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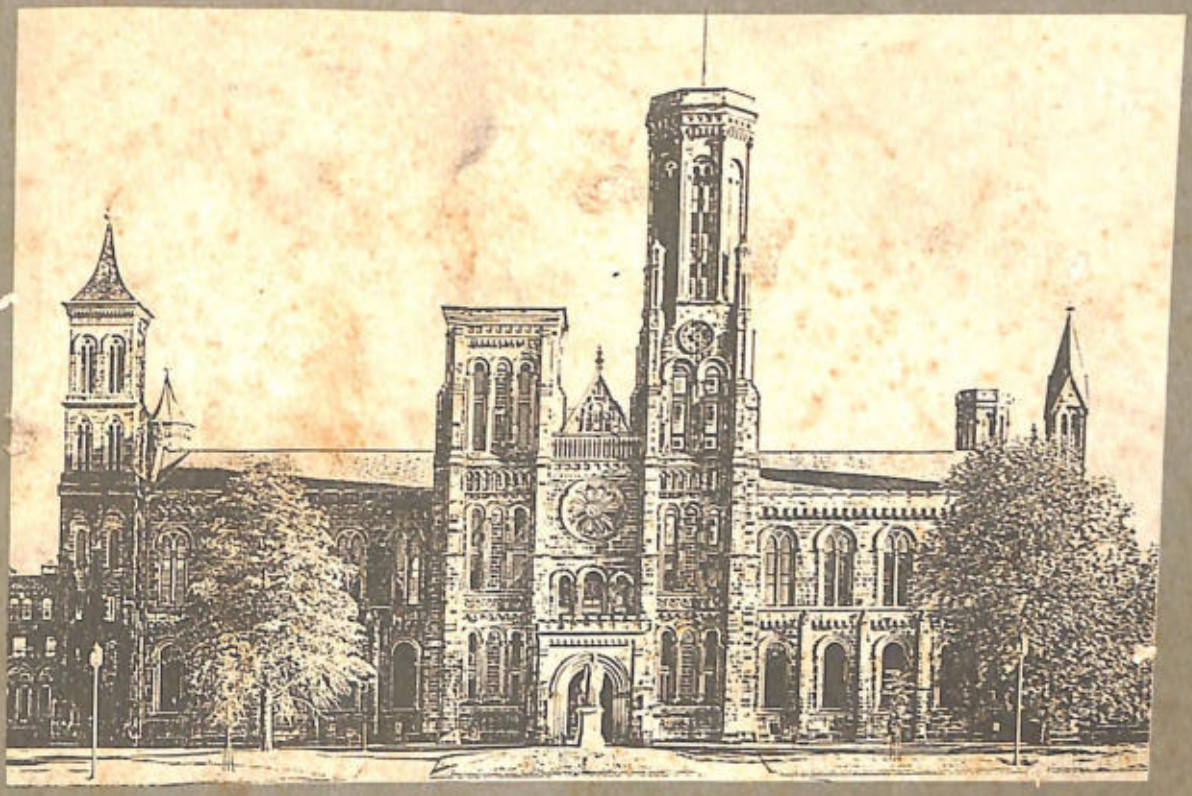

SMITHSONIAN YEAR 1968

Smithsonian Year 1968

ANNUAL REPORT OF
THE SMITHSONIAN INSTITUTION
FOR THE YEAR ENDED 30 JUNE 1968

BOOK NO.
569

SMITHSONIAN INSTITUTION
City of Washington 1968

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $2.75

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The Establishment

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Hubert H. Humphrey, Vice President of the United States
Earl Warren, Chief Justice of the United States
Dean Rusk, Secretary of State
Henry H. Fowler, Secretary of the Treasury
Clark Clifford, Secretary of Defense
Ramsey Clark, Attorney General
W. Marvin Watson, Postmaster General
Stewart L. Udall, Secretary of Interior
Orville L. Freeman, Secretary of Agriculture
C. R. Smith, Secretary of Commerce
W. Willard Wirtz, Secretary of Labor
Wilbur Cohen, Secretary of Health, Education, and Welfare
Robert C. Weaver, Secretary of Housing and Urban Development
Alan S. Boyd, Secretary of Transportation

Board of Regents and Secretary

30 June 1968

Presiding Officer ex officio	LYNDON B. JOHNSON, President of the United States
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Regents of the Institution	EARL WARREN, Chief Justice of the United States, Chancellor
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Statement by the Secretary

Statement by the Secretary

S. Dillon Ripley

In a year of convulsive impact on the people of America, one theme, I think, has been borne in upon the Smithsonian Institution. This theme is that the Institution has a moral responsibility to consider its exhibits for the effect that they may have upon all sorts and conditions of people. Many of our exhibits are directly involved with history—the history of people and their machines and their material culture. The teaching of history itself has changed radically in a generation. Traditionally most historians simply taught "the facts," whatever they were, attempting to relate them without bias, as best they understood them. Gradually this concept of history as factual chronicle has been shown to be in effect not rigidly and exactly true. At present history is coming to be thought of as social science. History indeed is now interpreted and is represented as a distillation of ideas. This change has been difficult, indeed painful, but it is here to stay.

The Museum of History and Technology is one of the first of its kind in the world. It is in effect a teaching museum. Most museums that present historical collections tend to be petrified. The reasons for this are various, but essentially revolve around people and money as might be expected. Historical collections have a strong personal bias. They have been brought together by individuals out of possessive love and the collector's passion. Such collections frequently are steeped in myth. The provenance of the objects is seldom called into question. Thus, the average historical museum or collection tends to have labels bearing information supplied by the donor and including his name. If the donor or the donor's family are anywhere around it seems tactless to put into question "the facts" as presented at the time of acquisition.

The second problem is money. Even if years later it becomes apparent that the information on the label is wrong, there is the expense of changing the label, or indeed of reordering the exhibit. Thus historical museums tend to become fossilized. Entrance into these "cemeteries" is considered by historians not only a bore but a trial. Sensible historians tend to shun museums in principle, for it is known that the exhibits are exhibits merely of objects presented as memorials of "the facts." They

cannot speak or tell anything, and besides the chances are that the information that they are intended to convey is faulty. In addition to all this the objects, having been collected in a random manner, probably do not even represent an ordered chronology.

The Museum of History and Technology should be a revelation for modern historians, though whether it is or not is another matter. In the first place, it is the only historical museum in this country with a staff of major proportions comprised of historians. This staff is the equivalent of a full-fledged university department of the history of science; it also includes historians in the fields of political, cultural, military, and social history. Thus there are ample resources in qualified people to interpret the exhibits. The staff is trained in research and is concerned with presenting "the facts" to the best of its ability. There is also an exhibits department which is probably the best in the Nation through which facts and ideas can be restated when research has shown the emphasis to be at fault. These two elements—continuing research on the objects and history itself, and a staff ready to shift or change the exhibits—go a long way toward creating what is an unique situation. This has resulted in a teaching museum in the best sense, geared to research and flexible about changing exhibits and exhibition objectives.

It has become apparent, however, that even such a wonderful museum as our own Museum of History and Technology might fall into the preservation trap. Even a curator trained as a research historian can become infected with a special virus which makes him prey to this trap. When objects are preserved they become shiny and new looking. They also become nice. Some might say "all gussied up." Everything becomes pretty and nice, and history itself becomes a storybook experience. In this country, everyone in history was romantic and dashing and lived in a genteel manner. A famous example of this perversion was the burning by a zealous librarian years ago of some of George Washington's off-color letters. Many exhibits pander to this myth that all our ancestors were upper middle-class Protestant whites who lived like ladies and gentlemen. The preservation trap is beautifully illustrated in the average historical restoration projects around the country. From the restoration of colonial cities on to the historic house with formal garden, there is an unfailing tendency for "the facts" to be tidied up, and everything to be restored to such a degree that reality and truth long since have flown out the window. Public taste accepts this for the most part and seems to appreciate the myth—witness the enormous popularity of towns and old houses or the awed visits to (preferably eighteenth century) restoration projects. The eighteenth century, being farther away, is even more genteel than the nineteenth.

This past year has demonstrated to us at the Smithsonian as never before the need to "tell it like it is." As the nation's museum of history, the Institution has a moral responsibility to do so. Inheritor of objects and charged with the obligation to perform research and to teach, to educate, it is the solemn responsibility of the Smithsonian to reveal the social history of our nation. More than ever before our exhibits have a potential value for education and it is our moral responsibility to see that they do educate.

The principal facts of the history of our nation revolve around the cultural pluralism of our people. We are not all as one and we are certainly not all nice and "gussied up," nor have we ever been. Our museums, among them the Museum of History and Technology, should be concerned with this theme of presenting truth in a social context. Far too little has been done to delineate the history of the ethnic minorities of our country or to single out and describe their achievements. In the preservation trap, it appears as if innovation and intellectual and technological achievement were either racially anonymous or were the prerogative of Anglo-Saxons from western Europe, essentially Protestant of course. American Indians, along with Chinese or Mexican Indians find their culture and their mode of life discussed in the Natural History Museum as curious subjects for anthropological research, related somehow to zoology and other parts of the world of nature. African history is similarly discussed and recorded in depth in the halls of African technology and anthropology. Here and there in the historical museum there may be a reference to slavery or to wars against the Indians, but for the most part our ethnic subcultures, our minority groups, come off very badly indeed. It is obvious that the Smithsonian as a whole has a splendid tradition of research into a multitude of scientific and cultural subjects, but it is also true that our exhibits policies have not delineated history as a social science, or as the distillation of ideas.

Part of the Smithsonian's problem has been lack of money. A generous Congress has awarded money for buildings, but the annual budgets for installation and research have not kept up with the obligations created by the buildings. Since the Museum of History and Technology was opened in January 1964, it has been on a near-starvation diet. In the ensuing years, wars and necessary domestic programs have swallowed up the federal dollar. The educational and research needs of the Smithsonian, the need to change exhibits and to improve their teaching quality and character, have received a low priority. The urgent needs to develop cultural and social history in our museums are hard to meet. But the need is there. We have failed to give the true historical

picture, to describe the whole panorama of our cultures. Young people representing Negroes, Indians, Spanish, Chinese, Japanese and other subcultures are not given the evidence that they are part of the stream of history of the United States with a noble past, a vital present, and an unlimited future. If our Institution is to play a valid role in the Bicentennial of the American Revolution in 1976, we should be prepared to correct what is in effect a series of oversights in history, the history of our country and of the multiplicity of our peoples.

One of the ways that we can do this is to emphasize in our exhibits the people and especially the ordinary, everyday people who built the railroads, sailed the ships and drove as well as created the machinery and instruments we exhibit. Many of these people, the very stuff of our basic concern, will be revealed to belong to a wide variety of subcultures and of ethnic minorities, quite as well as various sorts of poor whites. For these purposes we do not simply have museums of history, or of art, or of natural history so much as we have museums for and about men, either man's way of looking at the world of nature, or man's way of coping with the world of nature. And in some art museums we have a clue perhaps to the varieties of means by which man looks at himself.

This year of 1968 has marked the opening of a new museum in this Institution, the refurbished, revitalized National Collection of Fine Arts, for long the Institution's stepchild, and it has seen the final preparation for the opening of a second new museum, the National Portrait Gallery.

The opening of the National Collection in the remodeled old Patent Office building was a stunning success. Years of effort by David Scott and his devoted staff culminated on May third in a splendid evening event, graced by President and Mrs. Johnson and some 3,000 guests who roamed the elegant, sometimes classic, sometimes modern halls, the lower sculpture room reminiscent of an Egyptian catacomb, the third-floor Lincoln Gallery so sublimely cool, chaste, and immense with its tight arches, the touch of the iron strapwork, the marble columns restored to a nacreous sheen thanks to the efforts of our hero of the occasion, Mr. Royal Murphy, the marble restorer. For Washington, it was an evening to be remembered.

The National Portrait Gallery is essentially a trial balloon. There has never been a National Portrait Gallery in this nation, and it is still unclear to many what purpose such a gallery will serve. If the United States had thought it as worthwhile to develop a memorial collection of likenesses of great men and women as it delights in writing their biographies, there might by this date in history be a great national collection of portraits of the great and near great alike. No such thing

The Lincoln Gallery on the opening night of the National Collection of Fine Arts, 3 May 1968. (Photo: Ralph Crane, LIFE magazine.)

occurred, however, and thus there is no hope that our National Portrait Gallery can rival in quality or character, the elegant, charming, and beautifully furnished portrait galleries of the United Kingdom and Ireland. There is only one sensible way to look at the matter then, to recognize that our new National Portrait Gallery must turn its back on precedent and chart a new path.

The implication of a portrait gallery, by the very title, is that it will consist of a *galleria* full of elegant, solemn, and somnolent halls lined with splendid portraits of the great of America, makers and shakers all, who have found a secure niche in the Dictionary of American Biography for their accomplishments if not for their virtues, and preferably Horatio Alger heroes all—to whom oncoming generations, pausing in the corridors, can look up to with awe, on tiptoe as it were.

The fact is, of course, that lacking the impedimenta of a large finished collection of important portraits and sculpture, the Portrait Gallery must perforce delineate people rather than memorialize the dead. By seeking to re-create the world in which famous people lived through every device known to exhibits technicians including photographs, film strips, tapes, and various kinetic devices, and by surrounding these famous people with the flavors of the everyday people on whom they depended—soldiers, farmers, tradesmen, Indians, slaves, actors, gamblers, politicans and all the hurly-burly, the stuff of life—the Portrait Gallery might become a theater of history. It could be a pantomime of American doings which would convey a vital meaning to the visitor, unencumbered by the dust on the old oils and marble. May it be so and may this museum too, as well as the others, try to "tell it like it is, and was."

As James Reston commented recently, our political leaders today are overwhelmed by events beyond our ken—the culmination of years of relentless pressures decried only by Cassandras—by

> the fertility of the ordinary people, and the movement of the people into cities, and the fertility of the human and particularly the scientific mind, which is changing the world faster than the politicians in any country can change their societies. Look at Washington, or London, or Paris, or Moscow—all the so-called "great men" are overwhelmed by the convulsive events of the human mind and body.

One false panacea which has become pandemic is more education for everyone, but immediately education, as such, *en masse* defies the meaning of the word. The assumption is that everyone, in order to be "educated," must be educated in precisely similar ways, through books, drilled by rote to pass exams. Such antilogies are pronounced by professional persons who make entire careers as experts out of telling people what is good for them. Time is catching up with many of these learned sophists.

Convinced that objects are of basic importance to many people, even peradventure to modern-day historians, the Smithsonian has been experimenting with a neighborhood museum. Here is a chance to work with non-didactic museum tools geared to creating interest and excitement in minds not interested for the most part in books. Run-down urban areas are the single most important problem for human environmental study in the world today. To anyone interested in what I have called "social biology," the linking in a common cause for research of modern biologists, especially ecologists, and sociologists, the so-called

slums are the areas ripe for studies cut in a new fashion and tailored to new dimensions.

To a large extent people from run-down neighborhoods tend to stay there. They tend to be immobile, not to move much out of their district, except in a transient sense from slum to slum. Such people, referred to by slogan phrases like "disadvantaged," are likely never to go into any museum. Indeed such people, if badly dressed or ill at ease, may feel awkward going out of their district. They may easily feel lost wending their way along an unfamiliar sidewalk toward a vast, monumental marble palace. They may even feel hostile. In Washington, D.C., a city where 262,000 people, or about one-third of the total population, live just above subsistence level, it is hardly to be expected that large numbers of the poor can afford the bus fare for a trip to a museum, or the clothes either. In connection with a recent PTA program in Washington to sponsor trips for children and their parents to local attractions, a number of parents in one low-income neighborhood objected to the program. The parents, it was learned, felt that they did not have the proper clothing for such a venture; rather than face the possible humiliation of conceivably being denied admission to places they might want to visit, they preferred not taking part. If this is true, then the only solution is to bring the museum to them. For of all our people these are the ones who most deserve the fun of being in a museum. Should any museum director today not feel this way then he should speak up. Although private collectors may wish to keep their collections private, the person in charge of a museum, no matter how recondite or esoteric or aesthetically rarefied his collection, must occasionally have at least a twinge of educational *esprit,* the merest modicum of egalitarianism or desire to improve the lot of his fellowman.

It is obvious, however, that in the case of a museum in a rundown neighborhood, the bookmobile concept won't do. Involvement is what is wanted, and a bookmobile museum in a slum implies something for nothing from rich folks somewhere else, a kind of charity, a handout—largesse in white gloves. Involvement can be created only if it is *their* museum. It must be on the spot, participated in by the people who live there. This was our principle in 1966 when the Smithsonian started looking about for a neighborhood which might want its own museum. Our one guideline was that the area must have stability and not be too full of transients or of the migratory unemployed. We looked for a site, perhaps an abandoned movie theater or grocery store, preferably on the block with a laundromat—that symbol of daytime neighborhood involvement—rather than too many bars.

We found the district in Anacostia, one of the areas of Washington which had changed a good deal since the days of the distinguished Frederick Douglass. Consultations with the Southeast Neighborhood House in Anacostia revealed an instant enthusiasm on the part of the local residents. With their help we decided to try, and set out to rent an unoccupied theater which, by chance, was on the same street as a local school, and in the same block as a laundromat.

The auguries seemed good. A community advisory council was formed early in 1967, chaired by Mr. Alton Jones, chairman of the Greater Anacostia Peoples, Inc., Mr. Stanley Anderson, later to become one of the first members of the new City Council of Washington, Mrs. Marion Hope, Mr. Ben Davis, and a good number of willing volunteers, including a sergeant of the 11th Police Precinct, Andrew Salvas. My colleague, Charles Blitzer was active from the beginning and we depended heavily on the advice of Mrs. Caryl Marsh, who had worked with neighborhood social problems in Washington. Our Smithsonian exhibits department, led by John Anglim and Ben Lawless, was keen to rush in and remodel the small 400-seat movie theater, and Robert Shelton was assigned by them to draw up a design. Long and prayerful meetings (most of them in a local church) with the advisory council ensued before they decided the framework of the exhibits, their focus, and the degrees to which a variety of exhibits might appeal to local residents. By June 1967, we had selected a Director, Mr. John Kinard, a thirty-year-old, Washington-born youth worker who had worked in the Neighborhood Youth Corps and the Office of Economic Opportunity. Under John Kinard, who is vigorous and decisive, the exhibit plans were completed and the work began. The seats were removed and a flat floor was installed with two single steps at intervals to take care of the slope. Six modules were constructed along the sides of the seating area, two to a section of the floor, so that each single step marked the partition between the modules. The exhibits resulted from a vast number of suggestions, primarily from the advisory council, but also from Smithsonian guards and staff curators. A complete general store of the 1890s—just as it was in Anacostia—occupies one corner. In it there is a post office (for which we hope to get a license to operate), old metal toys, a butter churn, an ice-cream maker, a coffee grinder, and a water pump, all of which work, and any number of other objects of the period from kerosene lamps to flat irons, to posters and advertisements. There is another do-it-yourself area for plastic art, with, at present, class instruction by volunteers. There are skeletons of various kinds, some of which can be put together or disassembled. There is space for temporary art shows.

EXHIBITS

Entrance to the Anacostia Neighborhood Museum; below, a do-it-yourself art area and, right, Director John Kinard talking with Washington Mayor Walter Washington, Councilman Stanley Anderson, and Charles Blitzer of the Smithsonian in the general store and post office which occupies a corner of the museum.

There is a TV monitor system on the stage. One of the modules is occupied by a live zoo with green monkeys, a parrot, and a miscellany of animals on loan from the National Zoological Park. A great success is a shoe-box museum in an A-frame structure, filled with wooden shoe boxes containing bird skins (in celluloid tubes), mammal skins, shells, fossil specimens, and pictures. There are slide projectors for intensive handling and study. A behind-the-scenes museum exhibit of leaf-making,

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Smithsonian Secretary S. Dillon Ripley and friends with "Uncle Beazley," the dinosaur hero of the story, *The Enormous Egg*, who made a temporary visit to the Anacostia Neighborhood Museum. Below, nearby fence painted for the opening by a local group of Trail Blazers, and a classroom area in the museum.

silk-screen techniques, casting and modeling, gives an additional outlet for instruction. All this—to the tune of crashing hammers, scraping saws, and slapping paint brushes—took form in two and a half months.

The grand opening attended by an 84-piece band, two combos, and a block party with speeches and klieg lights took place on 15 September 1967. A local group of Trail Blazers had painted the nearby fence, which separates the museum from the next property, with a stylish "primitive" mural of African life. The desolate surrounding lots were spruced up, and one of them was decorated temporarily with "Uncle Beazley," the dinosaur hero of the story, *The Enormous Egg*. One of the striking by-products of the opening was the improvement in the appearance of the block. Several store fronts and houses were newly painted. The local utility company branch, with friendly and unexpected solicitude, was hastily painted and landscaped with shrubbery which greatly enhanced

the previously dreary-looking brick premises. The whole place began to look almost as smart as the swagged bunting draped on the old theater marquee, now rechristened as the Anacostia Neighborhood Museum.

The financing for all of this had to be raised from private sources, for the federal government is, presumably quite rightly, only rarely interested in innovations of a sociological nature. This was an experimental project; for a museum or for the sedate Smithsonian, it could be described as "off-beat." We estimated that for the first year we would need to raise between $60,000 and $75,000 and by the fall of 1967 we had about $75,000 in hand, mostly from three foundations, the Carnegie Corporation, the Anne S. Richardson Fund, and the Eugene and Agnes E. Meyer Foundation. When in early 1968 we realized that all this would cost more, we received a challenge grant from the Irwin S. Miller Foundation, and small private contributions from interested citizens have been slowly but steadily coming in. At this juncture my colleagues and I estimate that once it is under way a neighborhood museum can run on something under $125,000 a year, with a flexible staff of four full-time employees as well as volunteers and contract or volunteer work from exhibits specialists. Changing exhibits are of the first importance, for any new experience, such as a museum, tends to pall in time.

The results so far in mid-1968 are hard to assess. Anacostia has a known population of nearly 65,000 persons, 41 percent under eighteen, 78 percent non-white. The median family income compiled from census records is $3,430. In the first five and a half months some 25,000 visits had been clocked into the museum, a building about 100 feet long and 60 feet wide with a tiny mezzanine floor for offices in the former projection booth area. Obviously something is happening. School classes are being taught there. A local business man has donated a school bus to drive children over to the main Smithsonian buildings for Saturday morning classes. These are, of course, children who would never otherwise enter the vast marble mausolea on the Mall. Interestingly, at the Anacostia museum there has been no vandalism. Not a feather or a fossil has been stolen. And best of all there are no guards. What is the mystery of this equation: no guards = no losses and no vandalism? The only valid answer of course is, "because it is their museum, not ours, and they can be proud of it."

Public service has many forms. One of these has been the degree to which the Smithsonian can involve people in its activities. Through the Folk Festival, the second of which was held over the 1968 Fourth of July weekend, with a great outpouring of public interest and an attendance of over 500,000, to the other events which bid fair to become

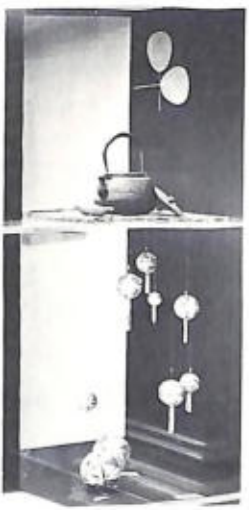
An all Charles Ives program by the Gregg Smith Singers received critical acclaim when it was presented on 24 October in the rotunda of the Arts and Industries Building for the Smithsonian Associates. At right, Bessie Jones and the Georgia Sea Island Singers performing at the Festival of American Folklife on the Mall.

annual ones, such as the April First party for the summer hours opening, the Mall is increasingly an involved and active place, full of vitality and, it might be said, joy. As one newspaper remarked after the first day of the Fourth of July Folk Festival, "it's such an unexpected pleasure to see 100,000 people gathered together in the middle of Washington, all smiling."

The Associates' activities continue to increase both in numbers and in enthusiasm and programs. By the end of June 1968, membership in the Associates stood at 7,000, representing around 15,000 persons. The variety of programs is tremendous, thanks to the heroic and dedicated work of Lisa Suter and her colleagues, ranging from field trips in fossils and archeology to Japanese drama (Kyogen and Noh), from fashion lectures to craft workshops in batik, mosaic, raku, from chamber music concerts to behind-the-scenes tours of paleobiology labs, as well as lectures, films, and art tours of various cities. The Ladies Committee of of the Associates, active in the Washington area, has a number of important programs of aid to constituent museums and in public affairs.

Particularly interesting has been the expansion of the Museum Shops under the imaginative direction of Carl Fox. Aside from books, pamphlets, and cards, Mr. Fox has been concerned to demonstrate the vitality of the folk art tradition, and to encourage museum visitors to realize that they themselves are part of a continuing tradition of crafts-

Smithsonian museum shops.



manship and craft work. Several special exhibits have been sponsored by the shops during the year ranging from "Childrens' Embroideries from Peru" to "19th-Century Japanese Prints and Drawings," from "Eskimo Sculptures and Prints," to "Traditional American Crafts," from "Toys around the World" to "Henry Evans Botanical Prints."

One of the bases on which this Institution stands is the exchange of information—the "diffusion" of knowledge. For a number of years,

the Smithsonian has pioneered in developing a Science Information Exchange, directed by Monroe Freeman, and supported principally by the National Science Foundation. More recently, we have been approaching our collections of things as if they were library books, seeking to encode and store information on them for instant retrieval. Without such ability the collections become meaningless. With such ability the collections may be used as tools, interwoven into the fabric of knowledge in such a way that specific questions may be asked of a philosophic, demographic, or biomedical nature which perhaps could not otherwise be answered. Much of the data buried in collections in the arts, social sciences, and sciences already found in our museum collections is of such a fundamental nature, that if we could collate it properly and ask the appropriate questions we could penetrate Sibylline mysteries and embark upon total environmental prediction including problems of food supply, stress, pollution, and population. Our new Division of Information Systems, under the direction of Nicholas Suszynski, is perhaps no oracle at present, but the seeds are there. In time, I am convinced that an evolved union catalogue of such diverse sorts as complete holdings in art across the country, of the assemblage of all aspects of marine biology, and other crucial resources may, when properly interpreted, teach us more than we presently know about ourselves and lead us to an objective form of wisdom out of which true planning for the future may emerge.*

In connection with our plans for mobilizing information in the Smithsonian, our library must occupy a paramount place. To a library-minded curator like myself, no single part of the Institution can yield primacy of place to our library and to our library-like resources which in essence are the collections. Since the days of Professor Charles Jewett, the Smithsonian library has grown slowly, largely presenting the accretions in books to the Library of Congress, an ideal scheme initially, but a course which lack of proper information retrieval-techniques rendered crippling to research within the Institution over the years. The appointment this year of Russell Shank to the post of Librarian of the Institution will go far toward remedying this gap, and we are all heartened by his bold and imaginative approach toward our problems.

In his design for the Institution, Joseph Henry elaborated schemes

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*Increasing interest in this problem is indicated by an important symposium at the 1967 (New York) meeting of the American Association for the Advancement of Science. "The Role of Museums in Modern Communication," summarized in *Science*, (9 August 1968), vol. 161, pp. 548–551.

both for what, today, would be called scholarly and popular publications. In respect to the former, he put the emphasis squarely on basic research. This has been adhered to in the serial reports which have flowed from the Smithsonian for 120 years without interruption. The mandate for popular publications was met more fitfully—the most vigorous effort being the *Smithsonian Scientific Series* begun in 1929. More recently, the immense popularity of the Smithsonian museums has led to the issue of a number of pamphlets and booklets which convey information about the museums and their exhibits. But the Smithsonian remained apart from the commercial book publishing industry, although in 1964 it became a member of the Association of American University Presses whose other members had, in the main, vigorously adopted the techniques of commercial publishers. In the past two years, under a new name and management, it has become an active producer and distributor of books. It is thus, now, a full-fledged university press, but different from any other university press by virtue of the variety of its output. The Smithsonian Institution Press publishes more special scholarship in our serials than do other presses, and in this we more resemble a museum publisher. On the other hand, no other university press publishes such popular items as our museum guides, pamphlets, and even juvenilia, for unlike our fellow academic publishers we are in daily contact with the lay masses. And, in the current fashion of university presses, we publish both scholarly monographs and semipopular works in the book trade with as much professional book-publishing expertise as we can apply.

While we give great emphasis to our imprint and continually seek to improve it, the Smithsonian is also alert to the possibilities of collaborating with commercial publishers. The *Smithsonian Library,* the new joint venture with American Heritage Publishing Company, is one of our greatest successes in the area of public education. The three books already published have avoided the fault common to popularizations of science—of being "all about" a subject, and overawing the lay reader with an array of incontestable facts which mislead him as to the nature of scholarly inquiry and thus widen the understanding gap. Instead, the authors have succeeded in communicating the hows and whys of research and development in science and technology. These volumes are *The Evolution of the Machine* by Ritchie Calder *The Forging of Our Continent* by Charlton Ogburn, Jr., and *The Evidence of Evolution* by Nicholas Hotton, III.

Although much of the activities in our museums has been severely hampered by curtailed funds, it is heartening to record that our staff has continued to produce more published research than in any previous

year. In the natural history areas, a discernible concern for the interpretive aspects of problems has begun to emerge. This is a welcome addition to descriptive science and the infusion of broad evolutionary principles in such study is always to be desired. In the realm of air and space, although construction for that museum is at present off our agenda, the development of research studies in this subject continues, notably monographs on the development of Professor Langley's engines of 1900–1903, a comprehensive history of the early years of air mail in the United States, studies on air pioneers like Glenn Curtiss, on the 19th-century rockets of Congreve and Hale, and on the National Air and Space Administration's contributions to modern rocketry and space flight. With aid from the Admiral DeWitt Ramsey Fund, research is proceeding on naval aviation during the post World War I decade.

During the past year the National Armed Forces Museum Advisory Board held a conference at Belmont, the Smithsonian's enormously useful conference center. Under the chairmanship of Regent John Nicholas Brown, the conference produced two recommendations approved by the Board of Regents at their January 1968 meeting. These included:

Early appointment of a senior scholar to serve as chairman of study center activities, responsible for establishing the nucleus of a staff and organizing initial programs. In addition, this scholar could assist in planning the role the museum and study center would play in commemorating the Bicentennial of the American Revolution.

Establishment of a committee of eminent scholars in the field of military history to provide a closer link between the Smithsonian and the academic world. Such a group would complement the functions of the Advisory Board by enlisting the active participation of the intellectual community.

In the law setting up the Armed Forces Museum and Board the Smithsonian has a unique opportunity to escape the constraining evolutionary patterns of the past. Rather than be cursed as many museums of today are by the possession of collections which tend to dominate whatever efforts are made to establish a meaningful *raison d'être* for the museum, the Armed Forces plan provides for separating museum and study center. The museum itself can be planned to contain only highly meaningful artifacts based on a reasoned intellectual objective. The Institution has an opportunity at present to study the problems of military historical collections throughout our bureaus with the purpose of achieving effective unity in their curation. The question of the

Belmont, the Smithsonian Institution's Conference Center near Elkridge, Maryland.

study center should probably be aligned with the subject of our academic programs.

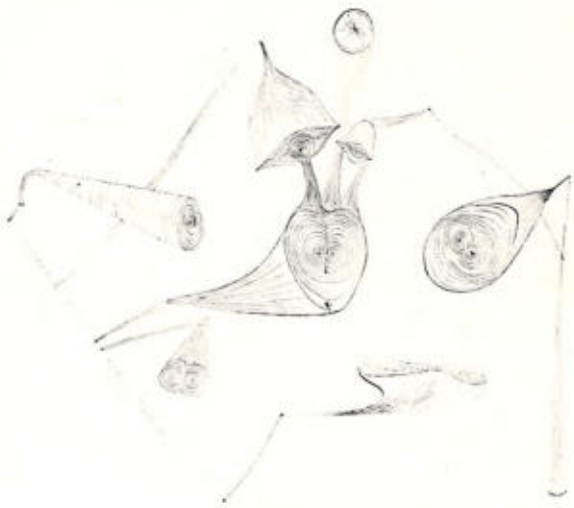
Charles Blitzer, who joined the Smithsonian as the first Director of the Office of Education and Training in July 1965, was named Assistant Secretary for History and Art in February 1968. In somewhat less than three years, he has demonstrated lasting accomplishments as an educator. Programs of visiting research appointments have been inaugurated, initially in the sciences in cooperation with the National Academy of Sciences, and then extended to include the fields of history and art, in cooperation with the American Council of Learned Societies. These programs have now grown to a level where thirty or more visiting scholars and scientists at the postdoctoral level come annually to the Institution for periods of six months to a year to pursue chosen research topics in consultation with members of the Smithsonian's professional staff. Through these and other programs, the Smithsonian has emerged as a national center of research training in the disciplines of primary interest to its staff. In a descriptive science such as systematic biology or anthropology the Ph.D. degree usually represents little more than an initial exposure to subject matter areas. Within the Smithsonian a young scholar may increase his mastery of their stubborn factualness and many subtleties with guidance and help from a mature investigator.

The Office of Education and Training inaugurated a program of fellowship awards to promising graduate students who pursue the research required for the award of the Ph.D. under the supervision of a

Smithsonian scientist or scholar. Fifty-three Ph.D.s, awarded by the students' home universities, were earned within the Smithsonian in the year under review, twenty-five of them at the Smithsonian Astrophysical Observatory which enjoys a close cooperative relationship with Harvard University. Indeed, the appointment of Fred L. Whipple as Phillips Professor of Astronomy at Harvard, coincident with new tenure appointments for Charles Whitney and Owen Gingerich, was welcome evidence of the strength of the bond which links these two institutions.

With the support of the National Humanities Endowment the Office of Education and Training inaugurated a program to train future museum scholars. With help from Eugene Wallen and Richard Woodbury, the Office sought and successfully obtained financial aid from the National Science Foundation for a program of summer research assistantships for outstanding undergraduates. Nathaniel R. Dixon, one of the most accomplished and innovative educators in the field of primary and secondary education, left his position as principal of Scott-Montgomery Elementary School in the District of Columbia to join the Office of Education and Training as Associate Director and head of a newly established Division of Primary and Secondary Education in July of 1967. Mr. Dixon succeeded in redesigning the duties of that division's staff of five instructors in a way that forged a most effective instrument for placing the resources of the Smithsonian at the disposal of the nation's schools. Through the efforts of the Institution's scholarly staff and with the help of its Office of Education and Training, the Bureau of Graduate Education proposed in 1901 for the Smithsonian by the predecessor of the Association of Land-Grant Colleges and by other prominent educators has at long last become a reality.

Our Office of Education and Training has been reconstituted as the Office of Academic Programs under Mr. Blitzer's successor, Philip C. Ritterbush. The change of name signifies the Smithsonian's desire to continue its development as an auxiliary of academic institutions at every level, while perhaps reminding us that education in its broad popular sense is a much more widely diffused function of the entire Institution in its public service role. The initial objective of the Office in its new guise is to expand formal instructional activity: seminars, survey courses, and tutorials. The President's Office of Science and Technology has proposed, in a very welcome series of recommendations which Mr. Ritterbush helped originally to formulate, that the unique research facilities of the federal government be made available to universities to the maximum practical extent. Expanded programs of visiting research appointments and further increases in our educational activities have been underscored as national policy objectives which



"The Familiars" by Paul Klee. This 1927 ink drawing was in an exhibition of biological imagery in modern art, about which subject Philip Ritterbush wrote a book-length essay entitled *The Art of Organic Forms.*

are most happily in concert with these recent trends in the Institution.

The Smithsonian Council met in October and April, serving admirably in its role as a forum for the discussion of the development of programs in higher education and research. One recommendation was that the Institution come to a full recognition of the professional value of teaching activities in its evaluation of the professional accomplishments of staff members. Another recommendation was that certain special exhibits, especially interdisciplinary or experimental exhibits, be regarded as illustrations or iconography for books that should be written at the same time. Not only would this result in a richer yield of books and exhibits, but it would permit exhibits to be reviewed as scholarly statements by our professional staff members. In response to this suggestion Mr. Ritterbush undertook to write a book-length essay about an exhibit which was mounted under his direction in the Museum of Natural History in June. A display of biological imagery in modern art, the exhibit evoked the esthetic dimension of the diversity of natural forms in the setting of a museum of natural history. The book, *The Art of Organic Forms,* was dedicated to our colleague, G. Evelyn Hutchinson, Sterling Professor of Zoology at Yale University and a member of the Smithsonian Council.

Signing of an agreement transferring administration of Cooper Union Museum to the Smithsonian Institution. To be known as the Cooper-Hewitt Museum, the name honors the founders, who were granddaughters of Peter Cooper and daughters of Abram S. Hewitt. Participating in the signing are, left to right, Henry F. duPont, chairman, and Albert Edelman, legal counsel, of the Cooper Union Museum Charitable Trust; Smithsonian Secretary S. Dillon Ripley; Dr. Richard F. Humphreys, president, and Daniel Maggin, chairman of the Board of Trustees, of Cooper Union; and Smithsonian legal counsel Peter Powers.

Another theme for discussion in meetings of the Council has been how best to organize our efforts in research and exhibition in order to take full advantage of interdisciplinary opportunities. The potential inherent in our collections can rarely be seen in entirety from the vantage point of a single discipline. Coins fascinate the metallurgist, the historian of economics and trade, and the student of social customs, as well as the specialized collector. The Council has conducted extensive discussions of the Anacostia Neighborhood Museum, of proposed programs in folklife and American studies, and of projects still in the planning stage, including the National Air and Space Museum and the National Armed Forces Museum. During the year Professor Elting Morison of Yale University, André Schiffrin of Pantheon Books, and Dr. Gordon Ray of the John Simon Guggenheim Memorial Foundation

accepted invitations to serve on the Council, where their advice will be greatly valued.

In this year the Smithsonian acquired a new museum, received contract authorization and an initial appropriation to construct a second, and acquired the largest collection of gold coins ever assembled by one person. The new museum is the Cooper-Hewitt Museum of Design in New York City, the first museum created to be entirely devoted to the decorative arts in this country. The continued existence of the museum had come into question in 1963 when the Trustees of its parent institution, Cooper Union, decided that the growing costs of providing free tuition to its schools of art, architecture, and engineering made it impossible to afford to retain the museum. A survey of the possibilities for the museum's future was undertaken by the American Association of Museums assisted by the New York State Council on the Arts. As a result, the Smithsonian Institution was suggested as the organization best suited by the nature of its founding philosophy to act to retain the very important collections of the museum intact and available to those interested in the study of all aspects of design in the human environment.

Shortly after the museum's future came into question a committee of citizens was formed, which is called the Committee To Save the Cooper Union Museum. The committee was extremely active in bringing about the present addition of the museum to the Smithsonian organization, and has pledged itself to the financial support of the museum. On 9 October an agreement was signed by Mr. Daniel Maggin, Chairman of the Board of Trustees of Cooper Union, and the Secretary of the Smithsonian Institution that administration of the museum would be transferred to the Smithsonian. On 14 May 1968 the Supreme Court of the State of New York ruled that this transfer could be accomplished and the museum is now legally an entity within the Smithsonian Institution.

The museum's collections include a large and outstanding group of design drawings—primarily French and Italian—from the sixteenth century to the present, textiles, wallpaper, ceramics and glass, metalwork, furniture and ephemera, as well as drawings by American and European artists. Richard Wunder as an Assistant Director of the National Collection of Fine Arts and a former curator at the Cooper Union, has been appointed the first Director, and a Board of Advisers has been formed under the Chairmanship of Henry F. du Pont who has been a primary supporter of the Cooper Union Museum for many years.

The Joseph H. Hirshhorn Museum and Sculpture Garden moved a step closer toward fulfillment with the enactment by the 90th Congress of the necessary legislation to guarantee its construction within the next

three years. Ground breaking for the new structure should take place in January 1969.

In its first Smithsonian year the Hirshhorn Museum, under Director Abram Lerner, moved with accelerated momentum toward three related goals: the acquisition of new paintings and sculptures, the development of plans and programs for the new museum on the Mall being designed by architect Gordon Bunshaft, and the continuation of its services to scholars and institutions involved in the history of modern American and European art. Mr. Hirshhorn's generosity led in 1968 to the acquisition of more than five hundred new paintings and sculptures, ranging historically from antiquity to the works of today's young creators. To its renowned group of European and American sculpture of the nineteenth and twentieth centuries, the collection in 1968 added significant works of Bourdelle, Chryssa, di Suvero, Dubuffet, Gabo, Lachaise, Lichtenstein, Miró, Pevsner, Rodin, Smith, and von Schlegell.

The collection's paintings focus on the twentieth century. From the works of precursors such as Thomas Eakins and Winslow Homer to the canvases of today, the course of painting in America is covered in depth. Complementing the American section is a strong selection of paintings by modern and contemporary European masters. Notable paintings added to the collection in 1968 included works by: Agam, Diller, Dubuffet, Ernst, Frankenthaler, Miró, Mondrian, Pollock, Ruscha, Still, Vasarely, and Zox.

For the past decade Mr. Hirshhorn has been known as one of the nation's most generous lenders and the collection is a major source for museums and art historians preparing retrospective exhibitions, biographies, and catalogues raisonnés of twentieth-century artists. In 1968 more than fifty queries were received weekly for research information, loans, photographs, or permission to view specific works. Although, due to limited physical facilities, only two hundred visiting scholars, artists, and officials could be greeted at the collection office and warehouse in New York, more than five hundred paintings and sculptures from the collection were loaned to museums and galleries throughout the world, notably to the Dada exhibition at New York, Chicago, and Los Angeles, to the de Kooning, Hooper, and Hepworth retrospectives, the Pittsburgh International, to three exhibits at the Smithsonian galleries in Washington, and to the Tovish Retrospective in New York.

The Josiah K. Lilly Collection of gold coins came to the Smithsonian as the result of bills introduced by Congressman William G. Bray (H.R. 12940) and Senator Birch Bayh (S. 2409) of Indiana, passed by the Congress and signed by the President on 4 June 1968. The collection

comprises some 6,125 coins valued at $5,534,808, and has been described as surpassing any other known hoard of gold coins amassed by one person. The United States section, in which the Smithsonian had been woefully deficient, is in itself of surpassing importance, being virtually complete. There is no museum in the Western World which has a comparable collection. Although the Lilly estate is paying a federal estate tax and an Indiana state tax on the collection, the preservation of the collection intact for the nation was deemed sufficiently important that congressional action was requested to sequester in this manner the Lilly coins which otherwise would have been dispersed. No provision under Mr. Lilly's will existed which could be invoked to keep intact his numismatic treasure. The lawyers of the Lilly estate deserve the greatest credit for their foresight in securing this collection for the nation.

This year has seen considerable expansion in the Institution's international activities which have passed under the direction of David Challinor. William Warner, first director of this office, has moved to become Acting Assistant Secretary for Public Service. In the four years that he has served in international activities, Mr. Warner has served the Smithsonian brilliantly; his prior knowledge gained from the Department of State and the Peace Corps has proved invaluable in reasserting the Smithsonian's traditional interest in international research services and specialized cultural exchange.

In this year the Smithsonian, in collaboration with the National Academy of Sciences has been able to be of some value to the Department of Defense in providing advice on the subject of the relative value of fragile and unique natural environments such as the island of Aldabra in the Indian Ocean. In addition, we have helped to work toward setting up a continuing *ad hoc* advisory committee on ecological change, an area historically of primary concern to the Institution. This century may see the inception of the largest, most critical experiment conducted by man in altering the environment, the trans-isthmian sea-level canal connecting the Caribbean and the Pacific Ocean. This is the reopening of a barrier closed for the last fifteen million years, with presently incalculable potential changes in marine and associated conditions around the Caribbean basin and the eastern Pacific. Although its resources are limited, the Smithsonian has not only initiated interest and concern in the problems throughout the biological community, but also has undertaken with the approval of the Atlantic-Pacific Interoceanic Canal Commission, the first studies in marine ecology, including sample hybridizing experiments at its Tropical Research Station in Panama.

President Bourguiba of Tunisia at the Smithsonian luncheon in his honor, 17 May 1968, with Secretary Ripley and Chancellor Earl Warren.

Under David Challinor's energetic leadership, the Office of International Activities has initiated preliminary scientific and cultural agreements with several countries, notably with Tunisia and Iran. In addition Mr. Challinor's special interests in forestry and conservation have enabled him to negotiate agreements with the United Fruit Company and the Organization for Tropical Studies for the development of the Lancetilla, Honduras, station of United Fruit Company, as an ecological research center, and to develop an agreement with the United States Bureau of Sport Fisheries and Wildlife for ecological research on St. Vincent Island off the west coast of Florida.

Tropical research already engages several of our bureaus. To these must be added the National Zoological Park which in this past year has developed increasing concern for the problems of the preservation of rare and endangered species. Working closely with the Survival Service Commission of the International Union for the Conservation of Nature (of which Assistant Director John Perry is a member) the Zoological Park has undertaken to initiate studies of the preservation and breeding of rare species. Aided by a much-valued grant from the National Geographic Society, the Director, Theodore H. Reed, will head an expedition to Kenya to study bongo antelope in the Aberdare mountains, and to attempt their capture and transport to the Zoo. The Zoo's resident scientist, John F. Eisenberg, has continued his work in Ceylon, aided by our veterinarian, Clinton Gray, working with the Ceylon government in immobilizing techniques with elephants, as part of a three-year study of the ecology of this threatened form.

As part of our mandate to develop research in the American tropics, the Smithsonian Tropical Research Institute continues its valuable studies under Martin Moynihan's perceptive direction. The central theme of these studies is to obtain information which will explain why tropical biotas and environments are different from those of other parts

of the world. We are still very far from answering this question, but the question is important and becoming urgent. The answers (and they will certainly be multiple) will not only be interesting from a theoretical scientific point of view, but should also provide base-line information for intelligent planning of human activities and for management of the environment in large parts of the world.

Gamma-ray astronomy is the observing of the effects of gamma radiation, which is the electromagnetic radion in the high-frequency range of the spectrum. Because of its high penetration through galactic and intergalactic matter, its direct and simple relationship to nuclear reactions that act as fundamental energy sources, and its direct relationship to high-energy electrons and protons, gamma radiation is a particularly important probe for cosmological studies. Measurement of the flux, energy spectra, and arrival direction of gamma rays can help us solve some of the fundamental problems of cosmology, such as the origin of cosmic rays, the density of cosmic radiation in the galaxy and in intergalactic space, the density and composition of galactic and intergalactic matters, the presence of antimatter in the universe, the hypothesis of the continuous creation of matter, and the strength of galactic and intergalactic magnetic fields.

The Smithsonian Astrophysical Observatory's large optical reflector for the detection of cosmic gamma-ray sources has been installed on Mount Hopkins in Arizona. This 34-foot-diameter, altitude-azimuth mounted instrument consists of 252 hexagonal mirrors focused on an array of photomultiplier tubes. The direct detection of cosmic gamma rays is generally not feasible. Now, however, electronic techniques allow the counting of light pulses, of very short duration and low intensity, that are created in our atmosphere by bombarding gamma rays. It is this indirect effect—called Cerenkov radiation—that is to be observed at Mount Hopkins with the large reflector.

The Observatory is operating at Mount Hopkins a new prototype laser satellite-tracking system. Correlated with the erection of this new instrument, the nearest Baker-Nunn satellite tracking camera has been moved from New Mexico, and a more advanced system installed at Mount Hopkins. The new system consists of a ruby laser that illuminates with high-energy light pulses retroreflector-equipped satellites. The reflected pulse is observed with a 20-inch telescope mounted on the same pointing pedestal and parallel with the laser. The time interval between laser firing and the receipt of the reflection provides a value of the range.

Depending upon the evaluation of this model, several other systems will be set up at selected Smithsonian astrophysical observing stations

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Installation of the new 84-foot radio antenna of the Smithsonian-Harvard observatories was completed early in 1968.

located around the world. These range observations, combined with photographic observations, will substantially increase the capability of the satellite-tracking network, thereby opening new horizons of investigation, particularly with respect to geophysical-dynamical processes within the earth. When applied to satellite geodesy, this new ranging technique should produce an accuracy in the measurement of continental distances to about one meter and eventually an accuracy sufficient for possible observations of continental drift.

Early in 1968, installation of the new 84-foot radio antenna at Agassiz station in Harvard, Massachusetts, was completed. The dish was acquired from the Army Materiels Command in Huntsville, Alabama. A joint undertaking of the Smithsonian and Harvard observatories, this facility provides a more accurate surface, larger area, and improved instrumentation over the dish previously available. The instrument already is being used for major investigations of atomic and molecular constituents in the interstellar medium.

A new analysis of observations by the observatory's Prairie Network shows that the mass flux of relatively large meteoroids exceeds, by several orders of magnitude, both that inferred from meteorite falls and that estimated from an extrapolation of small-meteor data. The

Classes conducted for members of the Smithsonian Associates give them first-hand knowledge of the materials and methods of science. Above, botany; right, oceanography.

earlier suggestion that this material is either fragile or of low density has been reinforced by recent observations.

Each year that passes brings us to a keener realization of the finite qualities of our earth and solar system and also the need for refining our observations and developing new criteria for critical measurements. To no men are given God-like powers. We do not as yet have the wisdom to observe every leaf that falls or to know the fate of every living organism. Rather we come to an increasing awareness of the continuing crudity of our measurements, and the need for continuing study, and for alertness to minute symptoms of environmental change. In this connection, using the facilities and interests of several of our member bureaus, a Center for the Study of Short-Lived Phenomena has been established by the Smithsonian Institution. Its purpose is to assist our scientists in their investigation of short-lived phenomena and to provide a reporting and information service for the scientific community. The Center is serving as a clearinghouse for the receipt and dissemination of information concerning rare natural events that might otherwise go unobserved or uninvestigated, such as remote volcanic eruptions and earthquakes, the birth of new islands, the fall of meteorites and large fireballs, and sudden changes in biological systems.

The Board of Regents of the Smithsonian recorded with deep sorrow the death on 28 November 1967 of Robert Vedder Fleming, Regent since 1947 and Chairman of the Executive Committee of the Board of Regents since November 1947.

Dr. Caryl P. Haskins was appointed Chairman *ad interim* of the Executive Committee (Permanent Committee). The present membership of the Board is given on page iii. The Board approved the appointment during the year of Charles Blitzer as Assistant Secretary for History and Art; William W. Warner as Acting Assistant Secretary for Public Service; Russell Shank as Director, Smithsonian Institution Libraries; T. Ames Wheeler as Treasurer; Leonard B. Pouliot as Director, Personnel Division; and Frederic M. Philips as Director, Office of Public Affairs.

For their confidence in the role of the Smithsonian, I as Secretary am deeply grateful to these men and their many colleagues. If the Institution is to succeed in its curious mission, to make relevant its collections, to delineate truths derived from them and to make clearer our arduous path upon this planet, then all must bind themselves in a common cause, for never has our task seemed more formidable, its horizons vaguer, its parameters less clear. We live in an uncertain world plagued by doubts, full of strident voices calling out. Which voices should we heed? Certainty is not measured by decibels, nor is certainty greatly aided by sight, for often black is white, white is black, and only gray remains. If sound and sight so betray us, there is at least a magic certainty in touch. Somehow in a time of change and convulsion we cling to objects, seeking in them a sense of continuity, a validation of the past and some support in thoughts upon the future.

THE BOARD OF REGENTS

The annual meeting of the Board of Regents was held on 25 January 1968 in the Fine Arts and Portrait Galleries Building at 9th and G Streets NW. The Board toured the restored building and previewed exhibitions being prepared for the formal opening of the building in May 1968. Dr. David Scott, Director of the National Collection of Fine Arts, and Charles Nagel, Director of the National Portrait Gallery, described their respective collections and galleries.

The spring meeting of the Board of Regents was held on 8 May 1968 on board the Presidential yacht *Honey Fitz* at the invitation of the Vice President.

SMITHSONIAN MEDALS

Dr. David E. Finley, first Director of the National Gallery of Art, on 19 July 1967 was awarded the Smithsonian's Henry Medal. Vice President Hubert H. Humphrey, who made the presentation at ceremonies in the Great Hall, cited him for his distinguished service to the city of Washington and the nation over thirty years as "an arbiter of taste, a moulder of form, and a conservator of all that is eclectic."

The Henry Medal—created in honor of Joseph Henry, distinguished for his discoveries in electromagnetism and first Secretary of the Institution (1846–1878)—was designed by William Barber, Engraver of the United States Mint, and his son, Charles E. Barber, following Secretary Henry's death. Dr. Finley is the first individual to be awarded the Medal by vote of the Regents of the Institution, though the first few struck were presented to Henry's friends and associates in 1879 on the first anniversary of his death.

The Henry Medal was also awarded to Frank A. Taylor, who has served the Smithsonian with distinction under five of its eight Secretaries. In making the presentation on 5 June 1968, Senator Claiborne Pell cited Taylor as—

> A man in whose breast the word "museum" has never struck terror, for forty-seven years a sturdy pillar of the Smithsonian, your persistence and imagination guided the Museum of History and Technology from drawing board to final completion against all odds, creating in the process the first evolutionary history museum with research programs and changing exhibits.

Vice President Humphrey, Smithsonian Secretary Ripley, and Dr. David E. Finley, first director of the National Gallery of Art at the July ceremonies during which the Vice President presented the Smithsonian's Henry Medal to Dr. Finley. Right, Senator Claiborne Pell presents the Henry Medal to Frank A. Taylor of the Smithsonian in June.

The Smithson Medal, the Smithsonian Institution's highest award, was presented by Secretary Ripley on 3 May 1968 to Edgar P. Richardson for helping "to shape the course of art scholarship in this country, interweaving the two streams of history and of men into effective unity."

Secretary Ripley termed Dr. Richardson—formerly Director of the Detroit Institute of Arts and the Henry Francis du Pont Winterthur Museum and Chairman of the Smithsonian Art Commission until the end of 1967—an "historian of American art without peer," and said: "Your contributions to the unravelling of the mysteries of the conduits, channels, bypasses and rivulets of the watershed of art history in its tangled skeins across the map of America have been fundamental to our understanding."

Dr. Richardson is the second Smithson Medal winner. Established in 1965, the medal was first awarded to the Royal Society of London during ceremonies marking the 200th anniversary of the birth of James Smithson.

FINANCES

The Institution derives its financial support from both federal and private sources. These include annual appropriations from Congress for operating expenses of the various Smithsonian museums, its educational and research centers, and its separate program of academic grants for overseas research projects financed from "excess" foreign currencies. Federal appropriations are also received for construction programs and, through the government of the District of Columbia, for support of the National Zoological Park. Substantial funding is received also from federal agencies and private institutions in the form of research grants and contracts, of which a large part goes to the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. Finally, private endowments and gifts support the Freer Gallery and numerous other specifically identified exhibition, educational, and research areas and provide relatively small but highly important added financing of new, innovative programs which have led to forward-looking improvements for the whole range of Smithsonian activities.

For the year ended 30 June 1968 financial support for Smithsonian operations was received as follows:

Federal appropriations:	
Salaries and expenses—normal activities	$24,535,000
Special foreign currency program	2,316,000
District of Columbia: operation of National Zoological Park	2,348,000
Research grants and contracts (federal and private)	11,303,000
Private funds:	
Gifts (excluding gifts to endowment funds)	469,000
Income from endowments and current fund investments	1,238,000
Total	$42,209,000

A federal appropriation of $3,082,000 was also made to the National Gallery of Art (a bureau of the Smithsonian Institution under a separate Board of Trustees) for operating salaries and expenses. Finances of the National Gallery of Art and the John F. Kennedy Center for the Performing Arts are discussed in their separate sections of *Smithsonian Year*.

Federal appropriations to finance construction projects were received as follows:

National Zoological Park	$400,000
Restoration and renovation of buildings	1,125,000
Toward construction of Joseph H. Hirshhorn Museum and Sculpture Garden	803,000
Total	$2,328,000

Additional information concerning the private funds of the Institution, including a statement of gifts received in the current fiscal year and the auditor's financial report, is shown in Appendix 1.

As outlined in these appended statements of private funds, Smithsonian endowments have a total year-end book value of about $24,750,000 (market value—$33,220,000). This was an increase during the fiscal year of $1,678,000 in book value (mainly $632,000 from gifts and $687,000 from gain realized on sale of securities); market value increased by $3,041,000. Roughly one-half of these endowment funds is dedicated to support of the Freer Gallery and another one-quarter is designated for support of other valuable endeavors in specific fields of research and education. The remaining quarter (about $6,200,000) is

unrestricted as to use of income; together with other investments in current fund accounts it produces about $350,000 of income annually.

These private funds permit the Smithsonian to introduce improvements in exhibit techniques, experimental museum programs, and modernizations such as the use of computer operations. Additional private funds are needed to expand these efforts beyond the necessarily limited steps which can be taken with federally appropriated monies. They would permit, for example, the development of information-retrieval systems for library and museum collections, added research studies in such newly developing fields as oceanography, ecology, and radiation biology, and added emphasis upon museum training and education. The results would be disseminated to the benefit of other museums and educational institutions throughout the nation.

Thus renewed attention will be given to the securing of additional private funds in order to make possible valuable specific projects of interest to contributors and to the Smithsonian. Such funds will support further innovation and add new strengths and vitality to established Smithsonian operations.

Office of Academic Programs

PHILIP C. RITTERBUSH, *Director*

THE BEST SIGN OF PROGRESS IN EDUCATION is change in the curricula of instruction, which must not be permitted to settle into final form. Patterns of knowledge constantly change and students discover relevance in differing ways. During this academic year the Smithsonian inaugurated a division of elementary and secondary education to draw upon collections, exhibits, audo-visual materials, and other Smithsonian resources to augment and improve curricula for the nation's schools. Under the learership of Nathaniel R. Dixon, Associate Director of the Office of Academic Programs (he was formerly principal of Scott-Montgomery Elementary School), the Institution has embarked upon a purposeful exploration of new kinds of educational experience for students at all levels of primary and secondary education.

Up to this year and continuing, we hope, for the future the Institution's principal services for schools have been escorted tours for schoolchildren, made possible by financial support and volunteer members from the Junior League of Washington, the Smithsonian Associates, and other organizations, who this year conducted visits for 30,352 children totaling 1,010 hours of instruction in Smithsonian museums and galleries. Throughout the week these ladies are to be found in the halls of the museums explaining the story of exhibits to enthralled groups of children. It is a pleasure to acknowledge the assistance of the chairman of Smithsonian volunteers, Mrs. George C. Gerber, and those members listed on page 38, who were presented certificates of accomplishment at a special recognition ceremony on 26 June.

Instructors from the Division staff help to train volunteer docents and they also write, for educational visits, guides which develop broad themes beyond the confines of any one exhibit hall. How cultural differences reveal different modes of adaptation to man's physical environment was the subject of one such guide developed this year for the Museum of Natural History, while in the Museum of History and Technology teaching guides were prepared on the war for American independence and the industrial revolution. Special new courses on Negro history and the relation of animal to human behavior were tested by instructors of the Division in summer 1968 under the guidance of

Mrs. Marjorie Halpin. The second annual holiday lectures for Washington area schoolchildren were given by Professor Vincent Scully of Yale University, a noted authority on the history of art and architecture and a compelling teacher. The public schools of the District of Columbia have cooperated enthusiastically, even assigning teachers to summer work at the Smithsonian, where they have written, for use in museums, special course materials on such topics as the biology of reproduction and the opening of the American west, as these may be studied through exhibits in the Museum of Natural History. An unusual exhibition—conceived in the days following the assassination of Martin Luther King—presented children's drawings of the civil disturbances which occurred, accompanied by their own words about the events of that trying period. The exhibit was prepared by the Division staff under the guidance of Michael Sands, a talented designer from the Education Development Center of Cambridge, Massachusetts, who captured something of the stark feeling of social conflict by mounting the drawings on a simple backdrop of cardboard cartons. The exhibit helped to demonstrate the value of engaging schoolchildren in confrontations with situations of social stress, from which the schools could not in any event have insulated them.

The Division also works to produce special audio-visual materials such as film strips, teaching films, and various kinds of kits and models. By producing exhibits for schools it may be possible to introduce into the classroom qualities of spontaneity and delight which inhere in the best exhibits. Much the same should be done for community colleges and other institutions of higher education, in ways which would involve cooperative undertakings uniting students, faculty, and Smithsonian staff. Such exhibits should embody changing features and content contributed by the host institution, in a setting conducive to the free exchange of ideas. In its relationship to academic institutions the museum can serve as an experimental theater of learning devoted to a wide variety of subjects.

PROGRAMS OF HIGHER EDUCATION AND RESEARCH TRAINING

The Office of Academic Programs awarded 138 fellowships and associateships in the course of the year to investigators conducting research in Smithsonian facilities. These appointments, listed in Appendix 6, are the basis for a wide variety of associated activities in higher education. The development of programs of higher education and research training, spanning the final years of graduate school and post-doctoral work directly following, is the responsibility of the Division of Fellow-

ships. In June Peter H. Wood joined the staff to supervise these activities. He has been associated with research enterprises in many contexts, including his own research on geography and environmental sciences, management experience with the Arctic Committee for the International Geophysical Year and the Arctic Institute of North America, and a study of the institutional structure of western European research organizations. Cooperation in higher education occurs within a complex institutional setting which requires constant study of university programs, especially in the Smithsonian's immediate geographical setting, the nation's capital, where since 1965 the Institution has conducted special studies of the relationships among institutions in research and higher education. As Assistant Director for Institutional Research Mr. Wood will oversee a wide range of surveys and special studies to guide planning for higher education within the Smithsonian. Appointments and associated instruction will be conducted in accord with nine programs of higher education and research training, whose activities for academic year 1967–1968 are summarized in the following sections:

In AMERICAN STUDIES, the program conducted by historians from the Museum of History and Technology, the National Portrait Gallery, and the National Armed Forces Museum Advisory Board, a total of 37 credit hours (equivalent) of instruction was offered. The graduate survey course in American material culture, conceived and designed by Wilcomb E. Washburn and Robert H. Walker, Professor of American Civilization at George Washington University, was offered for the third consecutive year with an enrollment of fourteen. Several students conducted their independent research assignments out in the field as projects in historic-site archeology, such as a survey of the Seneca quarry or a study of the early history of the Potomac canals. Six graduate students enrolled for graduate-level tutorials for academic credit, principally in military history and political history, and a total of seven Ph.D.s and one master's degree were earned under the supervision of Smithsonian historians. Three post-doctoral associates and three Ph.D. candidates held visiting appointments from the Office of Academic Programs, while three members of the Smithsonian staff held some form of university appointment.

In ANTHROPOLOGY AND CULTURAL STUDIES a total of 18 credit hours (equivalent) of instruction was offered, primarily as supervision of undergraduates. One post-doctoral associate held a visiting appointment from the Office of Academic Programs and one Ph.D was earned. Six members of the professional staff held some form of university appointment.

In Environmental Biology the Institution has a wide array of facilities and professional staff interests, including the Radiation Biology Laboratory, the Office of Oceanography and Limnology, the Office of Ecology with the Chesapeake Bay Center for Field Biology, and the National Zoological Park. Twenty credit hours (equivalent) of instruction was offered, including a twelve-week graduate-level survey course offered for the second consecutive year in cooperation with the D.C. Consortium of Universities. This year's topic, which drew an average evening attendance in excess of two hundred students, was the biology of developmental processes at the supra-molecular level. The Secretary conferred a special award upon Walter Shropshire for his imaginative work in developing this unusually successful survey course. One post-doctoral associate held a visiting appointment from the Office of Academic Programs. One master's degree and one Ph.D. were earned under the supervision of Smithsonian staff members, of whom seven in this field held some form of appointment at universities.

In Evolutionary and Behavioral Biology (Tropical Zones) the staff of the Smithsonian Tropical Research Institute maintained a high level of educational activity, 45 credit hours (equivalent) with a staff of seven. A weekly course on animal behavior was offered for graduate students and other resident investigators, of whom two post-doctoral associates and six Ph.D. candidates were on visiting appointments from the Office of Academic Programs. Seven Ph.D.s were earned and three members of the staff held appointments at universities.

In Evolutionary and Systematic Biology, comprising the biological research departments of the Museum of Natural History, the Smithsonian employs a professional staff of 74 investigators of whom 26 hold university appointments. One master's degree and twelve Ph.D.s were earned under their supervision in 1967–68. The total level of instruction offered, including such supervision and thirteen tutorials, was the equivalent of 74 credit hours. Seven post-doctoral associates and eight Ph.D. candidates held visiting appointments from the Office of Academic Programs.

In the History of Art no appointments were made by the Office of Academic Programs and no degrees were earned. The National Collection of Fine Arts is now established in adequate quarters and looks forward to participating in programs of higher education and research training as its staff expands. Members of the staff of the National Collection of Fine Arts participated in 8 credit hours (equivalent) of instruction, principally in supervising visiting students.

In the History of Science and Technology fourteen members of the Smithsonian staff offered 28 credit hours (equivalent) of instruc-

tion. Dr. Uta Merzbach spent the fall term and Edwin Battison the spring term teaching at the University of Pennsylvania under the cooperative program in this field. Three Ph.D.s were earned. Nathan Reingold, editor of the Joseph Henry Papers, conducted an informal seminar on nineteenth-century topics. Two post-doctoral associates and three Ph.D. candidates held appointments from the Office of Academic Programs.

In MUSEUM STUDIES six members of the Smithsonian staff offered 6 credit hours (equivalent) of instruction in museum techniques. Much additional training was offered, although not for academic credit. For some years students in the graduate program in art history at George Washington University have enrolled for additional practical museum experience under the supervision of Smithsonian staff members, after taking a prerequisite course on museum operations offered by Robert Stewart of the National Portrait Gallery. This pattern of cooperative studies will be extended in coming years to offer wider opportunities for the study of museum principles to qualified graduate students from universities both here and abroad.

In PHYSICAL SCIENCES, comprising the Department of Mineral Sciences of the Museum of Natural History and the Smithsonian Astrophysical Observatory, 79 credit hours (equivalent) of instruction was offered, almost entirely at the Astrophysical Observatory. Fred L. Whipple, its Director, was named Phillips Professor of Astronomy at Harvard this year, while Owen Gingerich and Charles Whitney both received tenure appointments, bringing to 42 the number of university appointments held by the Observatory staff. Two members of the staff of the Department of Mineral Sciences hold academic appointments at universities. Two post-doctoral associates and one Ph.D. candidate held visiting appointments from the Office of Academic Programs this year. Five master's degrees and 23 Ph.D.s were earned, while a total of 47 tutorials was offered.

PROGRAMS OF ADVANCED STUDIES

In May the noted British ecologist, Charles Elton, was named a Fellow of the Smithsonian Institution. This appointment enables him to conduct studies in animal ecology in Washington, but also at the special Area de Pesquisas Ecologicas do Guama field station near Belém, Brazil, operated with partial support from the Institution. Dr. Elton has retired as Director of the Bureau of Animal Population, which he founded in 1932, and has been Reader in Animal Ecology at the University of Oxford.

VOLUNTEER DOCENTS

Mrs. Ernest N. May, Jr., *Chairman, Volunteer Advisory Board*
Mrs. John F. Forstmann, *Assistant Chairman of Docents*

Mrs. Thomas A. Bradford, Jr.
Mrs. Warren E. Brockett
Mrs. Alfred Brummel
Mrs. Jonathon Bulkley
Mrs. Ernest Chase
Mrs. Colby A. Child
Mrs. Joseph D. Chisholm
Mrs. Donald B. Christman
Mrs. Norman Cole
Mrs. James L. Dooley
Mrs. W. Kent Ford, Jr.
Mrs. Rockwood H. Foster
Mrs. John J. Fox, Jr.
Mrs. George Fuller
Mrs. David Gibson
Mrs. Cary T. Grayson, Jr.
Mrs. Robert M. Griswold
Mrs. Francis L. Harmon
Mrs. John Hart
Mrs. Rutledge P. Hazzard
Mrs. Clyde E. Herring
Mrs. William A. Hessick, III
Mrs. John Hill
Mrs. Robert Hodges
Mrs. Edgar W. Holtz
Mrs. Daniel F. Johnson
Mrs. Ardon B. Judd
Mrs. Clyde V. Kelly, Jr.
Mrs. Robert M. Kimzey, Jr.
Mrs. Charles Klopf
Mrs. Joseph P. Lorenz
Mrs. Keith Magnus
Mrs. John A. Manfuso, Jr.
Mrs. Craig Mathews
Mrs. Robert J. McEachern
Mrs. John Munhall, III
Mrs. Frederick North, Jr.
Mrs. John E. Packard, III
Mrs. Steuart Pittman
Mrs. Barefoot Sanders
Mrs. Richard F. Shryock
Mrs. John A. Simmons
Mrs. Richard B. Smith
Mrs. John F. Snyder
Mrs. Edwin F. Stetson
Mrs. William R. Stratton
Mrs. Larry Temple
Mrs. Charles W. Turner
Mrs. David Wysong

Smithsonian Activities

Public Service and Information

Office of International Activities

DAVID CHALLINOR, *Acting Director*

EXPANDED ACTIVITY of this Office during the year reflects the growth in the Smithsonian's overall interests around the world. The primary role of the Office of International Activities remains one of coordinating and, where appropriate, initiating international programs and activities related to the interests of the Smithsonian.

Representative of the kinds of government agencies and public and private organizations concerned with international matters with which the Office, as the Smithsonian's point of liaison, regularly keeps in touch are the Organization of American States, some of the UNESCO bodies, and the Institute of International Education. The Acting Director continues to represent the Smithsonian formally or informally with such groups as the Department of State's Committee on International Education, the Southeast Asia Development Advisory Group, the American Subcommittee of the International Committee on Monuments, and similar groups.

In February 1968 William W. Warner, the first director, who had successfully organized and guided the Office's activities, was appointed the Smithsonian's Acting Assistant Secretary for Public Service. He is succeeded by Acting Director David Challinor, who had originally joined the Office as Mr. Warner's deputy.

Foreign Currency Program

At the end of the third year of operations for the Smithsonian Foreign Currency Program, more than one hundred research grants had been awarded, benefiting the research programs abroad of more than forty American institutions of higher learning. The Program also continued as a major source of support for the overseas work of the members of the Smithsonian's own scientific staff through grants to the Smithsonian Research Foundation. The Program's appropriation of United States-owned "excess currencies" abroad, arising from the sale of agricultural commodities under Public Law 480, remained at the level of the previous year, or $2,316,000 in foreign currencies. The countries where the Program continues to support research with foreign cur-

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rencies are: Burma, Ceylon, Egypt, Guinea, India, Israel, Pakistan, Poland, Tunisia, and Yugoslavia, with Morocco scheduled to be added in July 1968. Active projects are now going on in almost all of these countries and the lively interest of the American scientific community has resulted in the allocation of the entire appropriation to research grants.

The scholarly focus of the Program is on disciplines of interest to the Smithsonian, notably anthropology in all its major aspects (although the Program began originally, as successor to a similar program within the State Department's Bureau of Educational and Cultural Affairs, with authority to award grants in archeology only) and systematic and environmental biology, especially those aspects related to the International Biological Program (IBP). Together these disciplines comprise perhaps the broadest segment of the Smithsonian's institutional scientific interests. Under a broader authority from the Congress to award grants for "Museum Programs and Related Research," however, the Program has also begun making modest awards for work in other Smithsonian fields such as astrophysics, radiation biology, history, art, and museology. A major recommendation, by a policy committee convened to advise the Program, was that there be formed to decide on awards three new Advisory Councils patterned on the model of the Program's existing Advisory Council for Anthropology, which is composed of some of America's most distinguished scholars. These new panels would be composed of rotating members from the American scholarly community at large in the fields of earth and space science, the biological sciences, and history and art.

The major geographical focus continued to be Egypt, Tunisia, India, Yugoslavia, Ceylon, and Israel where major programs are in progress. A list of grants awarded is contained in Appendix 2. In Egypt, Smithsonian-funded work (including several archeological excavations and the epigraphic survey of the University of Chicago's Oriental Institute) was carried on despite the lack of diplomatic relations between the United States and the United Arab Republic. In Tunisia the Mediterranean Marine Sorting Center, under a new director, Neil C. Hulings, consolidated its operations as a major new factor in international cooperation in the marine sciences in the Mediterranean area.

The number of archeological excavations sponsored by the Program in Yugoslavia increased from one last year—a salvage archeology project in the Trebisnjica Basin—to five, including sites as interesting and diverse as a prehistoric site in Obre, Bosnia, and an excavation inside the ancient walls of the enormous villa of the Roman Emperor Diocletian at modern Split.

In Ceylon, the broad program sponsored by the Smithsonian's Office of Ecology was expanded to include botanical studies that will lead to a revision of Trimen's definitive *Flora of Ceylon.*

Israel—because of its unparalleled archeological riches and also because of its high degree of scientific competence—has accomplished significant research in a diversity of disciplines including both marine and terrestrial biology, radiation biology, archeology, and astrophysics.

India, where the largest amount of P.L. 480 funds exists, is now developing as the major country for research under the Program, which from the beginning has financed there in conjunction with the John D. Rockefeller III Fund an institute for research in art-history and archeology called the American Academy of Benares. Since then projects as diverse as studies of the flora of the Hassan District and of the marine animals of the Bay of Bengal have developed. In April 1968 Program Director Kennedy B. Schmertz spent several weeks in India establishing procedures for projects to be carried out; the pattern is one of joint Indo-American collaborative research, with the Indian collaborator responsible for securing Indian approvals of proposed research and the American collaborator responsible for bringing forward viable proposals for consideration by the Smithsonian Advisory Councils. This pattern, employed in a number of countries, was first developed on a cooperative project in paleontology, between Yale University's Peabody Museum and the Punjab University, that has already resulted in important discoveries bearing upon the ancestors of man.

While in South Asia the Program Director visited Pakistan, where previously only survey work had been accomplished, and there was encouraged to submit for review by the Pakistani government a pilot cooperative research proposal in marine biology involving the University of Karachi and the Smithsonian.

Secretary Ripley's visit to Tunisia in November, where he personally extended an invitation to President Bourguiba to visit the Smithsonian, led to a major step forward in extending the Program's scope in that country. During President Bourguiba's visit in June, Dr. Ripley announced the acceptance by the Smithsonian of its role in a Tunisian-American research agreement soon to be signed by their governments.

Foreign Visitor Program

An important task of the Office of International Activities is to coordinate the travel and research plans of foreign scholars visiting the Smithsonian. Among distinguished visitors received last year were museum directors from Uruguay, Honduras, Kenya, Sweden, Rumania, Ceylon,

India, and Peru; forestry and conservation officials from Ecuador, Peru, Bourguiba of Tunisia, during his visit here, at which the host was Chief of State's Office of Protocol, the Office arranged a luncheon for President Bourguiba of Tunisia during his visit here, at which the host was Chief Justice Warren, Chancellor of the Smithsonian.

Cooperative Programs

The Office served as coordinator in negotiations between the Department of Defense, the National Academy of Sciences, and the British Royal Society in establishing the Indian Ocean island of Aldabra as an international conservation area. Similarly, the Office worked out an agreement for long-term ecological research at the new wildlife refuge on St. Vincent Island, Florida, and cooperated with the Department of Commerce in planning for the Federal Building at Hemisfair in San Antonio, Texas.

This year also saw the fruition of almost two years of negotiations between the United Fruit Company, the Organization for Tropical Studies (a consortium of twenty-two universities and the Smithsonian), which resulted in the setting up of formal courses at the Lancetilla (Honduras) Botanical Gardens. A course in tropical forestry for twelve forestry faculty members was held there in January and February; this will be followed by regularly scheduled courses in tropical biology.

The Office contributed to the Smithsonian's participation in the work of the International Biological Program (IBP) both through Foreign Currency Program support for such IBP-sponsored projects as the conference on conservation of arid lands, held at Hammanet, Tunisia, in April 1968, and through the participation on the Interagency Committee for the IBP. It assisted in planning the United States role in the forthcoming UNESCO conference on the Biosphere, to be held in Paris in September 1968.

Smithsonian Institution Press

ANDERS RICHTER, *Director*

IN THE COURSE OF THE PAST YEAR, the Smithsonian Institution Press completed its formal development as a university press by concluding arrangements for a full marketing program in domestic and foreign areas. Under terms of a distribution contract executed with Random House, Inc., effective 1 January 1968, the Random House sales force has begun exclusive representation of Smithsonian books to the retail, library, and institutional trade in the United States and Canada. The backlist has been pared to 36 titles that justify commercial representation, and seven new titles were announced for the Spring 1968 season. In addition, the revised Press catalog of private publications for sale includes a number of softcover popular booklets and exhibit catalogs which are excluded from the Random House trade agreement but are sold directly by the Press to the Smithsonian Shops and other customers. A large part of the Press inventory of privately funded books was transferred to the Random House distribution center in Westminster, Maryland, where order fulfillment and shipping services are provided. The Press business office and warehouse has retained a portion of inventory from which to fill orders received from the Smithsonian Shops, Smithsonian employees, the Smithsonian Associates, and from foreign customers. On 7 March 1968, a contract was executed with Feffer and Simons, Inc., a foreign sales agency in New York City, for representation of Smithsonian publications in all foreign markets except Canada.

The Press supported these new sales arrangements with an expanded advertising and promotion program. Blanchard Associates of Washington, D.C., was commissioned as advertising agency, while the Press continued its own management of direct mail advertising. The year's largest campaign was a Christmas promotion of art books in a brochure mailed to 36,700 names. A total of 25 space advertisements appeared in the *New York Times Book Review, Washington Post, Choice, Entomological Society of America Bulletin, Art in America, Publisher's Weekly, Library Journal, Book World, Museum News, Centaur Guide to University Press Books, Smithsonian Journal of History,* and *Harness Horse*. As a result of the combined sales and advertising program, the

volume of publications sold increased to $100,678 from $41,563 in the previous year, a gain of 142 percent.

The titles of 151 publications issued under the Smithsonian imprint during fiscal 1968 are listed in Appendix 3. Production costs of 121 of these were funded by federal appropriation in the amount of $345,867; 25 were supported by Smithsonian private funds in the amount of $179,723; and 1 publication was subsidized by grant in the amount of $925. Press output has increased from 87 works published in fiscal 1966 to 130 in fiscal 1967 to 151 in the past year with no increase in Press staff (28 employees were on the roll on 30 June 1968, the same number as two years earlier). The growth in output will be arrested in the future, however, by the inadequacy of federal funds appropriated for Press expenditures. By the end of January 1968, the Press had obligated all of its federal funds allocated to printing expenses in fiscal 1968 and, for the succeeding three months, declared a moratorium on submission of new manuscripts for publication at government expense. On 1 May manuscripts were again accepted for editorial preparation, to be printed in the following fiscal year. At the close of the year, a backlog of 36 manuscripts totaling 7,500 pages was editorially in progress or on hand awaiting printing funds.

Included in the year's issues were works of major importance. With *São Paulo 9,* the Press inaugurated its publication of the two biennial series of catalogs produced for the Venice and São Paulo international art exhibitions, under the auspices of the National Collection of Fine Arts. The record of the United States representation in alternate years at these two preeminent exhibitions will be a chronicle of the development of modern American art. The Press also issued the long-awaited guide to the Museum of History and Technology as a service to visitors of the most popular Smithsonian museum. Among the research monographs and papers appearing in the Smithsonian series were two which epitomize the monumental character of scholarship which has repeatedly distinguished the imprint. Following publication of Volume 1, Part 5, of *A Monograph of the Existing Crinoids,* by Austin H. Clark and Ailsa McGown Clark, H. B. Fell of Harvard University wrote: "There can be no question that it is the one outstanding publication on echinoderms in 1967, and also it is obvious that it will be the standard work on the subject for at least the next hundred years." The appearance of this Part (Volume 2 remains uncompleted) terminates an undertaking initiated by A. H. Clark in 1915 and halted by his death in 1954. An even larger monument to scholarship was likewise concluded by publication of *Life Histories of North American Cardinals, Grosbeaks, Buntings, Towhees, Finches, Sparrows, and Allies,* in three parts. This publication completes

a series covering the life histories of all North American birds in 23 volumes. Conceived by Arthur Cleveland Bent in 1910, the first of these was published in 1919, and by the time of his death in 1954 at the age of 89, Bent had seen through the press 19 volumes, covering the life histories of diving birds, gulls, terns, petrels, pelicans, wild fowl, marsh birds, shore birds, Gallinaceous birds, birds of prey, woodpeckers, cuckoos, goatsuckers, hummingbirds, flycatchers, larks, swallows, jays, crows, titmice, nuthatches, wrens, thrashers, thrushes, kinglets, wagtails, shrikes, vireos, and wood warblers. His literary executor, Wendell Taber, carried the series through the twentieth volume, including blackbirds, orioles, tanagers, and allies, before he died in 1960. The mantle then descended on Oliver L. Austin, Jr. who, with extraordinary energy and judgment, has updated, corrected, and edited the manuscripts submitted by the several contributors to the final three volumes, and has given this magnificent work its fitting culmination.

In the course of the past year, the director and managers of the Press, believing that the older Smithsonian series no longer conform to the organizational structure and program strengths of the Institution, conferred at length with members of the major Bureaus involved in regard to reorganization of the serials. Recommendations were drawn, discussed with, and endorsed by the Editorial Policy Committee, and finally approved by the Secretary. It was determined to discontinue the *United States National Museum Bulletins* (inaugurated 1875), the *Proceedings of the United States National Museum* (inaugurated 1878), and the *Smithsonian Miscellaneous Collections* (inaugurated 1858). In their places will appear three new series: the *Smithsonian Contributions to Zoology*, the *Smithsonian Contributions to Paleobiology*, and the *Smithsonian Contributions to the Earth Sciences*. Finally, the existing subseries *Contributions from the United States National Herbarium* (inaugurated 1890) and *Contributions from the Museum of History and Technology* (inaugurated 1959) will be established as independent series under new titles: the *Smithsonian Contributions to Botany* and the *Smithsonian Studies in History and Technology*. The *Smithsonian Contributions to Astrophysics* (inaugurated 1956), and *Smithsonian Annals of Flight* (inaugurated 1964), and *Smithsonian Contributions to Anthropology* (inaugurated 1965) will continue unchanged.

The first two volumes of the *Smithsonian Library*, published by the American Heritage Publishing Company under a cooperative agreement with the Institution, appeared in early 1968. *The Evolution of the Machine* by Ritchie Calder and *The Forging of Our Continent* by Charlton Ogburn, Jr., carry out admirably, in their qualities of exposition and illustration, the objective of illuminating for the public at large

the process of the development of science. By the end of the year, eight other books were under contract and in preparation or production for the series.

Early in the fiscal year, over a period of several weeks, the business office and warehouse were moved to the second floor of 1242 Twenty-fourth Street, N.W., Washington, D.C. The integration of the office personnel and warehouse stock in a single location has improved the efficiency of distribution, but the warehouse space afforded is barely adequate for present needs and inadequate for future needs. Despite the difficulties of the move, followed by the completion of transferring stock to Random House, the business office and warehouse were able to distribute 308,972 publications during the year. Random House, in addition, distributed 8,773 books, for a grand total of 317,745.

The Press continues to administer a small branch of the Government Printing Office which exists to serve immediate printing needs. The print shop, with a staff of two journeymen, completed 868 jobs.

The director was again the Smithsonian's representative on the Inter-Agency Book Committee, and also served on the Education and Training Committee of the Association of American University Presses. As a result of his proposal to the AAUP Committee on Governmental and Foundation Programs that the Association give particular attention to the problems of scholarly publication in the fields of art and architecture, the Smithsonian was host at its Belmont Conference Center to a meeting, 4–6 April 1968, convened by the AAUP through a grant from the National Endowment for the Humanities. He attended the meeting in company with other university press directors and a contingent of prominent historians of art and architecture, whose frank appraisal of neglected areas of scholarly publication in these fields should furnish the Endowment with guidance for future action.

In May, the director appeared on the NBC television and radio panel series, "Georgetown Forum," in a program sponsored by Georgetown University entitled "Publishers, Who Needs Them?" The panel debated the professional and social roles of publishing.

Managing editor Roger Pineau completed his editing of the unpublished diary maintained by Commodore Matthew C. Perry during his Japan Expedition of 1852–1854. Pineau presented a number of illustrated lectures on the Perry Expedition and undertook the assembly of various objects for a future Smithsonian exhibit on the subject. He took leave in July-August 1967, on commission of *Reader's Digest*, for research in Japan on the Russo-Japanese War of 1904–1905.

W. H. Auden, detained by a blizzard, finally reaches Washington for the reception that followed the ceremony during which he was awarded the National Medal for Literature.

Managing designer Stephen Kraft taught a year's course in advanced graphic design techniques at The American University. On 11 June 1968, by invitation of the American Association of State and County Historical Societies, he conducted a seminar for its members on the design and production of printed materials at Nashville, Tennessee. Press designer Crimilda Pontes again achieved the signal honor of placing her work among the 25 best university press book designs of the year through selection by the AAUP jury of her design for *Swiss Drawings.*

Perhaps nothing better expressed recognition of the Institution's role as a publisher than the National Medal for Literature ceremony held at the Smithsonian on 30 November 1967. Following the Press director's informal offer of a Smithsonian site for the event, Secretary Ripley's invitation was accepted by the sponsoring National Book Committee. A buoyant group of publishers, literati, and government administrators beat its way to the Museum of History and Technology through a Washington blizzard to celebrate presentation by National Book Committee chairman William I. Nichols of the medal to W. H. Auden

for lifetime contributions to literature. Speeches were made by Smithsonian Secretary S. Dillon Ripley, by Secretary of Health, Education, and Welfare John W. Gardner, and by Deputy Librarian of Congress John Lorenz. Leo Rosten read the acceptance speech of Mr. Auden, who was detained by the weather but who appeared later in the evening at an enthusiastic reception. Mr. Ripley remarked, "We are not daunted by this occasion, though I know that some people today question whether all the muses are, or should be, welcome in a museum—the very institution that bears their name. I can think of no better place and no better time to state my belief that they most certainly do belong. The literary character of the Smithsonian was impressed on us by Joseph Henry, whose lively intellect translated the word 'diffusion' in our credo to 'publication.' The Institution was, in fact, begun as a publishing house as well as a center for advanced research, has continued as such without interruption, and remains so today through its Smithsonian Institution Press."

The following papers were published by the staff:

PINEAU, ROGER. "Okinawa." In volume 6, no. 12 (pp. 2549–2554) of *History of the Second World War*. London: Purnell and Sons, Ltd., 1968.

———. "Dr. Beishu Hara, A Living Cultural Treasure." *Japan Reader's Digest* (February 1968), p. 131.

Smithsonian Institution Libraries

RUSSELL SHANK, *Director*

OUTWARDLY, THE SMITHSONIAN INSTITUTION LIBRARIES performed much as in previous years, with no major changes in collections. With the appointment of a new Director in September 1967, however, the Libraries had taken a major step in the change of the library function within the Institution. Rather than passively responding to the demands of individual bureaus and divisions with disparate collections of literature, the library program aims to create an innovative and totally responsive integrated system of Libraries and services capable of serving the goals of the Institution directly through research, education, and service programs of its own, as well as secondarily through its support of the work of the Institution's professional staff.

The work of the office of the Director focused on a survey of the library activity within the Institution, and on an examination of decisions relating to their daily operations for relevance to the functioning of the Libraries as a system. By year's end a program statement was taking form that will describe, at least in a broad and general view, a modern, visible, serviceable, and creative library enterprise at the Smithsonian.

Library materials continue to be acquired at a rate too rapid to allow their processing completely according to the highest standards of intellectual analysis and bibliographical control. The Libraries concentrated on adding materials to the cataloged collections for which Library of Congress cards were readily available. The collection of uncataloged material, for which only a minimum inventory control is maintained, continues to grow. The net result is an increase in the average time required for an order for new library material to be converted to a book on the shelves fully ready for use.

A new concept of operation and related technology is required that will provide hierarchies of control for access to the collections, each tailored to different requirements for speed and precision of subject approach. Preliminary steps were taken to establish better control of access by users to new materials before they are completely cataloged. Late in the year, at the request of the Director of Libraries, the Information Systems Division developed a technique for creating a

frequent in-process report, using the computer-based records of purchased materials. That report, under test at the close of the year, will be an important device, both to notify the Smithsonian's professional staff of the status of the processing of books and journals they have had ordered for the Libraries, and to the Libraries' technical service staff for management control of the various stages of processing. The Libraries will be able to improve the quality of acquisitions services through the analysis of the same basic record in order, for example, to measure vendors' performance in terms of speed and cost of fulfillment of orders.

The amount of library material available for acquisition by research libraries has expanded in recent years far beyond the capacity of any research library to acquire it all, and thus to become self-sufficient. Cooperative acquisitions, shared cataloging on both a national and international basis, interlibrary lending, and the opening of otherwise restricted resources for reasonable use by all qualified scholars, are techniques that have assumed commanding importance in the management of research library enterprises. At the Smithsonian, for example, the circulation during the year of materials borrowed from other libraries increased at a greater rate than the circulation of the Libraries' own material. The Library of Congress remains the single most important outside source for these materials.

The informal networks that have been created among research libraries for interlibrary lending and shared cataloging have prospects of becoming more formal, and of increasing the power of their interactions through the recent development by the Library of Congress of a machine-readable format with which to distribute among libraries cataloging information on computer tapes. The first tapes to be distributed by the Library of Congress will be available in 1968. Because they will communicate information, at first only for a limited number of English language titles, for which the Smithsonian Institution Libraries now receive free printed Library of Congress cards, the Libraries have begun to examine carefully their service requirements in order to assess tradeoffs, while making administrative decisions with regard to the introduction of computer-based services.

Problems of developing and managing the library collection assumed early and high priority in the office of the Director. Hitherto, library materials have been acquired haphazardly in response to the immediate and urgent needs of individual professional staff members, and in response to the offerings of agencies and individuals throughout the world in exchange for Smithsonian publications. The Institution now faces the task of examining the basis for decisions on the selection of library materials, of coordinating the efforts of the scientists and curators in the selection processes, and of providing mechanisms to assure the

availability of comprehensive, basic, research collections in general areas of concern to the Smithsonian. Our goal is to give the Libraries the ability to respond quickly to specific program changes within the Institution, and to modifications of bureau and departmental organization.

Dialogues were begun in midyear with the librarians of several major branches to search for the fundamental issues that will serve as a basis for the subsequent preparation of policy statements on collection development. Miss Jean C. Smith, formerly assistant director of libraries, rejoined the staff to serve as a special assistant to the Director for biological science programs, with major emphasis on matters relating to the collections. Work was begun by a special task group on revitalizing the collections of the branch that serves the Office of Anthropology. Duplicates and material that is out of scope are being discarded. The whole collection will be integrated through recataloging according to the Library of Congress classification. This project is an outstanding demonstration of the manner in which the serviceability of the rest of the Institution's library facilities can be improved.

The Libraries have increased their service, both to other libraries and to the community of scholars, responding to more than 66,000 visitors, phone calls, and reference letters requesting information and publications, an increase of about five percent over the previous year. The potential for federal and related libraries to work together to serve their missions more fully continues to be enhanced by the work of the Federal Library Committee. The Smithsonian Institution Libraries increased their involvement with the Committee to include representation on task forces studying the role of libraries and information centers, and the problems of education for federal librarianship. The Committee's task force on library education, chaired by the Director, assisted the graduate library school at Catholic University in its sponsorship of an institute for library school faculty members on federal librarianship. The task force led the way for the establishment of a curriculum development study for training federal librarians. During National Library Week the Smithsonian served as the platform for a public forum on library service in urban slum areas. A children's art exhibit, prepared with the assistance of William Walker, librarian of the National Collection of Fine Arts/National Portrait Gallery branch library, was presented in the Arts and Industries building. Secretary Ripley was keynote speaker at the annual banquet.

Most large research libraries are conducting research and development in the application of computers to what is loosely called library automation. Computers will ultimately play a large role in supporting the information services of the Smithsonian's library system. Information science and technology, however, is far from being capable of sus-

taining the operation of any fully automated, large-scale, broad subject-based research library.

As resources become available, the Smithsonian Libraries will join the national movement among libraries to develop applications of computers to the intellectual aspects of library service. A major goal is the creation of literature-based information services that will be linked to the new data-processing systems being developed for the management and analysis of the collections of specimens and objects in the museums. Meanwhile, automation efforts aim at raising the level of quality and the economy of operation of basic housekeeping operations such as book ordering and accounting, process control, and serials inventory. Recent projects supporting this goal are mentioned elsewhere in this report.

The capability of the Libraries to capitalize on the new technologies affecting library service continues to be strengthened by the involvement of its staff in substantive activities of the library world in which the technologies are developing. The Director served during the year as vice president of the information science and automation division of the American Library Association, during which time the division established a new research journal on this subject and approved several national standards for computer-aided cataloging. Carol Raney, the head of the Libraries' cataloging division, was elected vice president and president-elect of the resources and technical services division of the American Library Association. That division developed the ALA cataloging code which serves as the basis for the Anglo-American rules for cataloging used by research libraries throughout the world. William Walker worked on the revision of the fine arts section of the Library of Congress classification system and assistant director Mary Huffer continued to lead the way in identifying processes in the libraries that were immediately amenable to automation.

The Libraries' year may thus be characterized as one of continued offerings of service at a higher level of output, of improving performance capability through an upgrading of automation effort, and of analysis of future directions for a modern museum research library enterprise.

The following papers were presented or published by the staff:

GOODWIN, J. "Current Bibliography in the History of Technology (1966)." *Technology and Culture*, vol. 9, pp. 277–327, 1968.

SHANK, R. *Regional Access to Scientific and Technical Information: A program for Action in the New York Metropolitan Area.* New York: New York Reference and Research Library Agency, 1968.

———. "The Smithsonian Institution Libraries." [Paper presented at a symposium on national library services to the public, Eastern College Librarians Conference, November 1967, Columbia University, New York, N.Y.]

WALKER. W. "Another Part of the Iceberg: Art Library Resources at the Smithsonian Institution." D.C. Libraries, vol. 38, pp. 70–75, 1967.

Information Systems Division

NICHOLAS J. SUSZYNSKI, JR., *Director*

IN ANNOUNCING THE OFFICIAL OPENING of the new Smithsonian Information Systems Division Computer Center, Secretary Ripley said:

> No product of modern technology has as much potential for social, economic and cultural benefits as does the digital computer. As an instrument of social change, the computer provides both the impetus behind the information explosion and it also offers the means for containing and recalling information when needed for the solutions of specific problems.
>
> The Information Systems Division serves as an interpreter and a diagnostician of information problems within the Smithsonian Institution, and to the extent that its resources permit, it provides automatic data processing and systems engineering expertise to the museum community in general.
>
> In its research role, the Information Systems Division engages in experimentation leading to better information retrieval techniques and better understanding of the man-machine interaction, particularly as applied to multicomputer tele-processing and multiprogramming environment.

By September 1968, the Smithsonian Information Systems Center, on the third floor of the Arts and Industry building's southwest court, will have:

A Honeywell-1250 computer with 131,000 positions of memory.
Six high-speed magnetic tape transports (devices for "writing" and "reading" of information on magnetic tapes, analogous to a tape recorder).
Five magnetic disc drives (with 45 million positions for directly accessible data storage.)
Card punch (for recording data on cards)
Card Reader (for transferring data from cards into a computer or to tape or to a printer)
High-speed printer (950 lines, or 100,000 characters, per minute)
Data plotter manufactured by the Electronic Associates Inc.

In addition to equipment, the Center will have a telecommunication access to the CDC–6400 computer at the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts (see *Year 1967*, p. 204). Also,

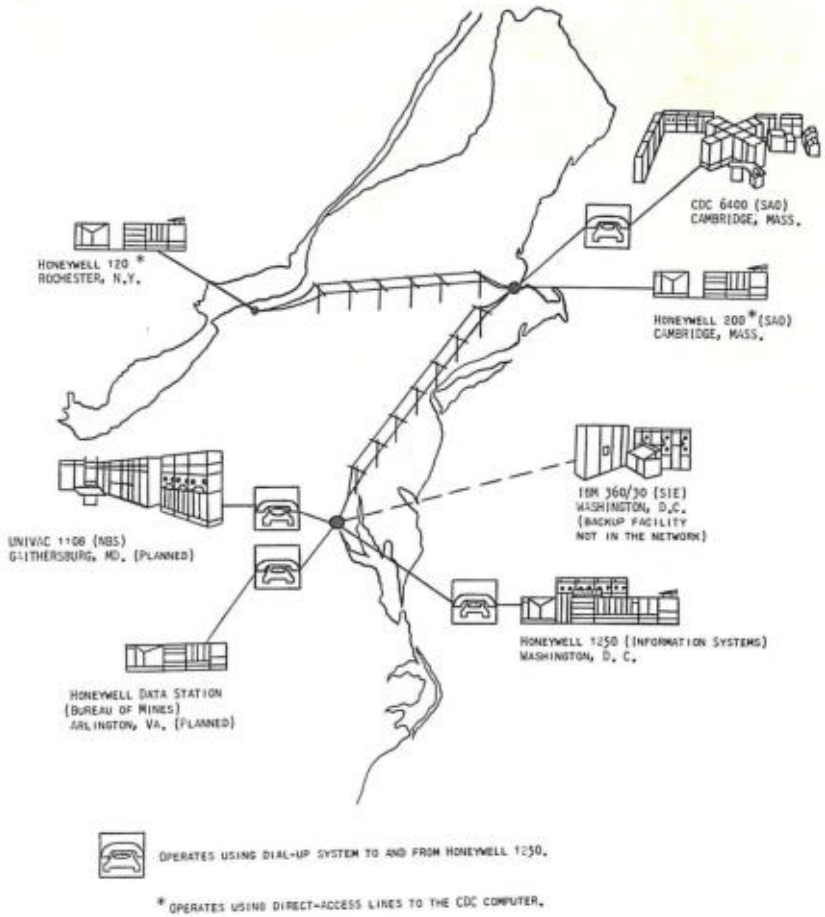
Honeywell–1250 computer installation in the Computer Center.

additional computing capabilities on an IBM 360/30 computer are available at the Smithsonian Science Information Exchange, in Washington, D.C., and on a UNIVAC 1108 at the Center for Computer Sciences and Technology at the National Bureau of Standards in Gaithersburg, Md.

The Honeywell–1250 computer operates continuously, on the basis of three eight-hour shifts daily, and as a part of its facilities, the Center offers daily data preparation, tabulating, and card punching services.

The Information Systems Center is comprised of an information retrieval section, a mathematical computation section, and a management systems section. The Center, in addition to providing systems analysis, programming, and computer time, has been established for the purpose of planning, coordinating and directing the preparation of systems, programs, and uses of automatic data processing equipment for the Institution. It is responsible for the overall review of automatic data processing (ADP) and source data automation requirements of the various Smithsonian activities and for recommending policies and programs to meet these requirements.

The information retrieval section is concerned with information systems used for indexing and data retrieval. A continuing program of research and development in these techniques is carried out to bring to the Institution a spectrum of indexing and retrieval systems that provide maximum capability and utility at minimum cost. Various techniques for randomizing, set theory recovery, hardware-independent



Smithsonian Institution computer-communications network.

query, synonymy rectification, coordinate indexing, concordance compilation, and dynamic significance redefinition, and for providing global reference denominators are made available to Smithsonian museums and, where possible, to the museum community in the United States and abroad. For example:

An information-retrieval system to cross-index any collection by 200 key categories was developed.

A concordance index containing up to one hundred chapters of key terms and providing cross-reference indexing to any collection of specimens, artifacts, or printed records was implemented. The system

indexes key-words and displays fragments of text (portraying context of use) in its index.

A digital code with associated procedures was developed that permitted phylogenetic sequencing of biological data as processed by a computer. The system solved problems associated with synonymy and is capable of hierarchical data retrieval.

The significance of data parameters often changes as preliminary computer output is reviewed. Research with the COBOL (Common Business Oriented Language) compilation system provided insight into techniques for dealing with this problem. As a result of this experimentation, a procedure was developed which permits dynamic redefinition of parameters of interest for query and is independent of parameters used in describing input data.

Several generic systems were developed for the storage and retrieval of data. They are flexible enough to be of specific utility to particular requirements and are general enough to have many applications throughout the Institution. The retrieval techniques vary with the requirements and with the structure, content, and orientation of the data file to be processed.

The mathematical computations section provides mathematical analysis and computer programming to aid Smithsonian scientists in presenting and interpreting their research data. The analysis ranges from simple correlation and regression analysis to complex multivariate statistical analysis, and from simple formula evaluation to the building of mathematical models to simulate biological phenomena. Systems design and computer programming are also provided to perform mathematical computations to process raw data, and to tabulate and graphically present the results. For example:

A common denominator code was devised to interrelate the disparate but traditional conventions used in expressing locations of the globe. Latitude-longitude coordinates, Marsden quadrangles, and political and geographic names are all transformed into a common code which facilitates retrieval of data.

Computer programs were developed to perform data reduction and statistical analysis dealing with neutron activation experiments (for the Conservation Analytical Laboratory) to determine the amount of trace elements present in the archeological artifacts, thereby establishing if the artifact is native to the area of discovery.

Statistical analysis employing distance coefficients, cluster analysis, and analysis of variance was performed for the Department of Paleobiology in the Museum of Natural History.

FORTRAN computer programs were implemented to perform time-series analysis of the prices of commodities in the trade-historical data for the Museum of History and Technology.

Computer programs were developed to read data from punched paper tape containing data quantifying the intensity of solar radiation over broad frequency bands. This data is edited for completeness and correctness, and then is reduced, plotted, and returned to the Radiation Biology Laboratory.

The management systems section provides support to the administrative, curatorial, and research activities that require automatic data processing of business or fiscal data. In addition, it provides maintenance support for business or accounting systems already in operation. During the year, systems were developed and initiated in a number of areas. For example, the Institution's accounting offices were provided with completely new accounting and reporting systems. A coordinated system was developed to handle all payrolls. A property management system was developed to satisfy the needs of both the supply division and the fiscal offices, and action was initiated to develop a research property system that will provide scientists with cataloged information as to the availability of research equipment. For the Smithsonian Oceanographic Sorting Center, a specimen inventory system was developed to provide an up-to-date inventory of specimens collected or distributed. For the Office of Public Affairs a consolidated central mailing system was developed to provide labels for mass mailings from the Institution.

The staff of the Information Systems Center contains experts in various areas of information processing who participate in symposia, technical panels, professional conferences and present papers as time permits. This group provides synergistic cross-fertilization which makes each individual stronger and more valuable than each would be alone. The recently developed "Global Reference Index" is an example of such collaboration, for the techniques used are not those usually associated with the natural sciences. To produce this index required a knowledge of Boolean Algebra, of algorithm structure, and of computer techniques combined with a knowledge of the traditional means of identifying a point on the globe.

During the year, the Center offered several training programs in computer programming, it provided self-study material for the scientific and curatorial staff, and established a library of statistical programs. Under preparation is a brooklet describing in detail the facilities of the Center and relating their capabilities to the activities and needs of the Institution.

At the symposium on Information Problems in Natural Sciences, held in Mexico City in December 1967, Creighton, Crockett, and Suszynski delivered papers, and Suszynski chaired one session. They also provided the symposium's films, as well as educational materials for its "Computer Theater."

Canadian, British, Mexican, and United States Museums and universities expressed interest in the technological aspects of data processing and information storage techniques developed at the Center. Technical information was provided to the following:

Canada: National Museum of Canada. *England:* Sedgwick Museum, The Royal College of Art, British Museum, H. M. Treasury, and Office for Scientific and Technical Information. *Mexico:* Centro de Calculo Electronico, Mexico, D.F. *Sweden:* Historiska Museet, Narvavagen, and Upsala Universitet. *United States:* The American Museum of Natural History, Colorado School of Mines, Museum Computer Network (a consortium of primarily New York City museums for the purpose of establishing a computerized information network), Systems Development Corporation, and U.S. Geological Survey.

Experts from the Center were requested to visit and consult with staff members of the National Museum of Canada and the Metropolitan Museum of Art, and the Royal College of Art in England (the last invitation had to be declined for lack of funds).

The following papers were presented by the staff:

CREIGHTON, REGINALD A. An Information Storage and Retrieval System for Biological and Geological Data, Design Consideration. Presented at the Symposium Sobre Problemas de Informacion en Ciencias Naturales, Mexico, D.F., December 1967.

AHUMADA, S., G. G. SHETLER, and JAMES J. CROCKETT. An Automated Bibliography for the Flora of North America. Presented at the Symposium Sobre Problemas de Informacion en Ciencias Naturales, Mexico, D.F. December 1967.

SUSZYNSKI, NICHOLAS J., JR. Telecommunication and On-line Access to Computers. Presented at the Symposium Sobre Problemas de Informacion en Ciencias Naturales, Mexico, D.F., December 1967.

———. Computer Installation Planning. Presented at the International Data Processing Management Association Conference in Washington, D.C., June 1968.

Science Information Exchange

MONROE E. FREEMAN, *Director*

REGISTRATION WITH THE SCIENCE INFORMATION EXCHANGE of current research projects from government and nongovernment research reached a total of over 97,000 during the year. Over 8,000 questions were answered for individual scientists. Over 300,000 copies of individual research summaries were made available to the national scientific community during the year.

A major innovation recently implemented by the SIE was the establishment of a randomly accessible data bank which contains all information pertinent to the research notices received by the Exchange. It represents another in a continuing series of steps to realize the benefits which the modern computer has made available and to provide a highly integrated man-plus-machine information system capable of expeditiously yet inexpensively fulfilling the SIE mission.

Many general improvements were provided with the initial version of the system. Previously the files of SIE had been updated twice monthly. Now they are updated daily and are thus able to provide more timely information. Internally the new system has reduced the elapsed time required for documents to flow through various stages of input processing. Capabilities for changing, adding, or deleting data fields have been improved. Input and indexing functions have been simplified and the keypunch operations have been significantly reduced. Three stages of input editing have been replaced by a single one which actually assures more accurate data on file. Finally the system provides the capacity to: (1) Input and store the full research abstract in machine-readable form, which will provide improved service to users of the Exchange; (2) provide online access to all SIE data through the use of video display units, an ultimate objective of the Exchange system; and (3) to quickly generate research catalogs from SIE data at significantly lower cost for federal agencies.

This improved system required some eight man-years of effort and was put into production within one month of the target date, predicted and scheduled over 18 months previously.

The Exchange will begin putting the full text of its research notices in machineable form in July 1968, via an IBM administrative terminal

Director Monroe Freeman of the Science Information Exchange presses the "start" button for the data bank's first run in May.

system. When all the information is in machineable form, SIE can provide full text records for government agencies and for the government-wide inter-agency Exchange.

The Exchange has continued to increase its coverage of research in urban planning. A compilation of current studies in urban planning provided to the Office of Intergovernmental Relations and Urban Programs Coordination was well received by urban specialists. It is hoped that increased registration of projects in this most important and timely area will be encouraged.

As the national cataloging center for water resources research, SIE prepared volume 3 of the *Water Resources Research Catalog* for the Office of Water Resources Research, Department of the Interior. *Outdoor Recreation Research—A Reference Catalog—1967* was also prepared for the Bureau of Outdoor Recreation, Department of the Interior.

A new concept for compiling and tabulating information about current research activity in broad research programs was designed and developed. The principle advantage is the display of condensed information in the form of distribution charts for the more convenient

inspection, review, and analysis of broad subject fields. Test models are now in the hands of industrial and government research program administrators and managers for their comments and suggestions. If favorable, the process can be highly automated and made widely available at nominal cost.

The following papers were presented or published by the staff.

FREEMAN, M. E. "Panel on The Role of Federal Government Programs." Presented before Conference on Technology Utilization and Economic Growth. Sponsored by Aerospace Research Applications Center at Indiana Memorial Union, Bloomington, Indiana, 31 July–4 August 1967.

———. "National Information Needs for Urban Transportation Management Decision Making." Presented before Engineering Foundation Research Conference, Proctor Academy, Andover, New Hampshire, 14–16 August. 1967.

———. "The Science Information Exchange: A Registry of Research in Progress." Presented at California Institute of Technology (sponsored by NASA–SBA), 12 October 1967.

———. "Information Strategy of Research Management." *Research Management*, vol. 11, no. 2 (March 1968).

———. "Science Information Exchange." Presented before the 52nd Conference for Eastern College Librarians, Harkness Theater, Butler Library, Columbia University, New York, New York, 25 November 1967.

———. "Scientific Information Storage and Retrieval System." Presented before National Council of University Research Administrators, Mayflower Hotel, Washington, D.C., 20 November 1967.

———. "SIE—A National Inventory of Research in Progress." Presented before First Annual ARISTOTLE Symposium sponsored by National Security Industrial Association, Washington, D.C., 7 December 1967.

———. "The Science Information Exchange as a Source of Information." *Special Libraries*, February 1968, pp. 86–88.

———. "Science Information Exchange." *Military Medicine*, vol. 133, no. 3 (March 1968), pp. 223–225.

———. "Scope and Objectives of the Science Information Exchange." Presented before members of Science and Technology Committee, Chamber of Commerce of the United States, Sheraton-Carlton Hotel, Washington, D.C., 25 January 1968.

———. "Science Information Exchange." Presented before Technology Utilization Conference at Miami University, Oxford, Ohio. Sponsored by representative Donald LuKens (Ohio) and arranged by NASA, 1 April 1968.

———. "Science Information Exchange of Smithsonian Institution Offers New Services to Navy Managers." *Navy-Management Review*, April-June 1968.

HERSEY, D. F. "Information Exchanges and the Research Community." Presented to the Information Retrieval Workshop, University of Wisconsin, Madison, Wisconsin, 21–22 September 1967.

———. "Chemistry of Viruses." Presented before the American Institute of Chemists Meeting of the D.C. Chapter, 16 January 1968.

———. "The Role of the Science Information Exchange in the Nuclear Technology Field." Presented before Conference on Technology Utilization, Seattle, Washington, 25 April 1968.

———. "Breaking the Information Barrier." Presented before the Small Business Administration Training Center, Small Business Administration, Silver Spring, Maryland, 19 June 1968.

LONG, BILL L. "A National Cataloging Center for Water Resources Research." *Journal American Water Works Association,* vol. 59, no. 8 (August 1967), pp. 930–934.

International Exchange Service

J. A. COLLINS, *Director*

TO FACILITATE THE DISTRIBUTION of Smithsonian publications in other countries, the Institution established the International Exchange Service. Agents were appointed in a number of countries to distribute Smithsonian publications and to receive in return publications from the foreign organizations for transmission to the Smithsonian Institution. This method proved so satisfactory that other non-profit organizations in the United States were permitted to utilize the Service, and later Congress designated the Smithsonian Institution as the agency through which the official United States publications would be exchanged for the official publications of other countries.

Libraries, scientific societies, educational institutions, and individuals in the United States wishing to exchange their publications with similar organizations in other countries, send addressed packages of publications to the Smithsonian Institution, where they are sorted according to countries of destination and are forwarded to one of the 37 exchange bureaus in other countries for distribution, or are sent directly to the addressees by mail. In return the Service receives addressed packages of publications from the foreign exchange bureaus for similar distribution in the United States.

Addressed packages of publications weighing 844,413 pounds were received during the year from more than 350 colleges, universities, learned societies, and other organizations in the United States for transmission to some 100 countries. In return 105,861 pounds of addressed packages of publications were received from the foreign bureaus for distribution in the United States.

Packages of publications were accepted for transmission to all countries except the mainland of China, North Korea, and North Viet-Nam.

During the year the United States official publications were sent to 105 organizations in other countries in exchange for their official documents. A partial set of United States publications is now being sent to the Central National Library, Seoul, Korea, in exchange for the official documents of Korea.

The daily issues of the Federal Register and the Congressional Record

were sent to 136 foreign libraries in exchange for their parliamentary journals.

The Service moved to new quarters during the year, and is now located at 1242 Twenty-Fourth Street, N.W., Washington, D.C. 20037.

PACKAGES RECEIVED FOR TRANSMISSION FROM FOREIGN AND DOMESTIC SOURCES, FISCAL YEAR 1968

Classification	*For transmission abroad by the Smithsonian*		*Received by the Smithsonian for distribution in the United States*	
	Number of packages	*Weight in pounds*	*Number of packages*	*Weight in pounds*
U.S. parliamentary documents received for transmission abroad	817, 236	373, 537	–	–
Publications received from foreign sources for U.S. parliamentary addressees	–	–	9, 389	10, 045
U.S. departmental documents received for transmission abroad	272, 552	254, 828	–	–
Publications received from foreign sources for U.S. departmental addressees	–	–	14, 118	17, 737
Miscellaneous scientific and literary publications received for transmission abroad	150, 081	216, 048	–	–
Miscellaneous scientific and literary publications received from abroad for distribution in the United States	–	–	45, 409	78, 079
Total	1, 239, 869	844, 413	68, 916	105, 861
Total packages received	1, 308, 785	–	–	–
Total pounds received	–	–	–	950, 274

Office of Public Affairs

FREDERIC M. PHILIPS, *Director*

THE OFFICE OF PUBLIC AFFAIRS, in its first year of existence as an organizational entity, devoted its energies to broadening and enriching the many channels of communication through which the Smithsonian serves both its visitors and the public at large.

The major operating premise of this Office is that a great and unique national institution such as the Smithsonian fully performs its function only when it broadly informs and communicates with the nation's public by all practical means. The Office is organized to this end.

With the cooperation of the Office of Public Affairs, television networks, local TV stations, USIA, Westinghouse Broadcasting Company, the British Broadcasting Corporation, Japan Broadcasting Company and others produced film reports concerned whole or in part with Smithsonian activities. NBC presented the documentary "Man, Beast and the Land" on the work of Smithsonian conservationists Marty and Lee Talbot—the ecology of East Africa—and on conservation of wildlife in the Serengeti plains. The NBC Children's Theater presented "The Enormous Egg," the story of a dinosaur who comes to the Smithsonian. Agreements were reached with producers for further documentary specials for television.

Radio activities were carried forward through such programs as "Master Control," twelve programs on Smithsonian activities for broadcast in the United States and foreign countries, prepared by the Radio Commission of the Southern Baptist Convention, the concert series "Music From the Smithsonian" on station WAMU, and broad participation in interviews, discussions, and panel shows.

Attendance at the Smithsonian Film Theater, which presents weekly educational films from October through May, increased more than fifty percent, with a total attendance of 18,100. The slides, slide lectures, and films available on loan to educational institutions, constantly in demand, continued to be fully booked far in advance. Special film shows were arranged throughout the year.

Inauguration of a TV film-clip service broadened the Office's news and photography programs. In more traditional news activities, 206

Public affairs activities. A: George Berklacy at teletype machine; B: Margaret Dress dispensing leaflets; C: Mary Krug working on the *Torch*, the Smithsonian employees newspaper; D: Fredric M. Philips and Mrs. Morris Cafritz with model of a Calder sculpture during presentation ceremony.

news releases, 11 in-depth news features, and 35 radio releases covering all areas of Smithsonian activities were issued. Major events requiring sustained effort included the first annual Folklife Festival in July, the opening of the Anacostia Neighborhood Museum in September, and the opening of the National Collection of Fine Arts in May. Nineteen press previews and conferences were held.

The *Torch* and the *Associate*, two monthly news publications, have a combined circulation of 10,000. The *Smithsonian Calendar of Events*, which now features a new and expanded press, is issued to more than 20,000 persons monthly.

William Grayson and Ann Rushforth, on left, screening a film; center, President Johnson, former Senator William Benton, and Secretary Ripley being greeted by Meredith Johnson, chief, special events; on right, Marilyn Danner and Mary Ann Friend posting a performance at the Smithsonian film theater.

Up-to-the-minute information on daily events and exhibits was provided to 60,250 callers on the recorded telephone service Dial-A-Museum. With information furnished by the Smithsonian Astrophysical Observatory, the Dial-A-Satellite service provided 135,250 individuals with information enabling them to view artificial satellites as well as other celestial bodies.

Smithsonian special events, another element of office responsibility, covered a wide area of presentations, lectures, openings, musical programs, conferences, movies and receptions. In all, a total of 624 special events were organized and conducted during the year. In addition Secretary Ripley was host to the diplomatic corps, co-host with Vice President Humphrey at a luncheon honoring the President of Iceland, and co-host with the Chief Justice at luncheon for the President of Tunisia. Smithsonian facilities are becoming increasingly popular for use by other government agencies for special activities that this year included official farewells to both Assistant Secretary of State Frankel and Secretary of Health, Education and Welfare Gardner in the Museum of History and Technology. Other diverse events included celebration of the 200th anniversary of the *Encyclopaedia Britannica*, in which President Johnson participated; presentation by the Italian Ambassador, for the City of Genoa, of a medal to the Vice President; induction of the officers of the Women's National Press Club; and presentation of the National Medal for Literature to Wystan Hugh Auden. Photographic coverage is provided for all special events.

In the field of visitor services, weekend tours of the Museum of History and Technology were organized through the generous cooperation of

the Junior League of Washington. Building guides and informative leaflets were provided to the Institution's millions of visitors. The process of computerizing the Institution's mailing lists to facilitate providing information to the public was advanced considerably. In addition, the Office responded to an average of 250 telephone inquiries a day.

Division of Performing Arts

JAMES MORRIS, *Director*

THE NEW DIVISION OF PERFORMING ARTS was formed on 1 July 1967 to manage and produce programs which increase the educational experience of the museum visitor. The "lively arts" are vitally important as means of cultural transmission, and the selection of presentations is largely determined by the need for illustrating both popular and little-known aspects of human expression. Such presentations contribute significantly to the greater understanding by American and foreign visitors of the esthetic traditions and developments of our national culture. The staff of the new division was drawn largely from members of the former museum services division.

The first annual Festival of American Folklife was developed and presented in July 1967. The initial program drew heavily on the accumulated field research and experience of Ralph Rinzler, Director of Field Programs for the Newport Foundation. It drew some 431,000 people to the Mall for a living exhibition of folk culture with demonstrations by craftsmen of pottery, basketry, toy making, carving, and weaving; and by live performances of traditional folk music and dance. Rinzler remained on the staff during much of the year and was responsible for developing new research programs in numerous areas of the United States, including exploration into several areas which had previously been ignored and unrecorded. During the year, he and Director James Morris were consulted regarding development of an international jazz festival in New Orleans, Louisiana, a folk culture center in Mt. View, Arkansas, and other programs in Virginia, North Carolina, Texas, Alaska, Washington State, and Pennsylvania. Extensive effort was devoted to the development of the second annual Festival of American Folklife with emphasis on little-known craft processes and Indian and Negro culture. Ten speakers, including members of the Smithsonian staff and scholars from abroad, were brought together for a 10-week course in American Folk Culture that was presented for members of the Smithsonian Associates in spring 1968.

During the fall and winter season several programs were developed and presented for the Smithsonian Associates. Among them was a concert by the Gregg Smith Singers presenting the vocal music of Charles

Scene from the Prague marionette theater, performed in the new Smithsonian puppet theater.

Ives, one of America's greatest, yet least-known, composers. It was hailed by local critics as one of the most significant musical events of the season. Other programs included traditional music, chamber music, a dramatized reading of the death of Socrates—featuring the renowned actor Walter Abel—and presentation of the Kyogen Theater of Japan on its visit to the United States. During the Christmas season, a production of Masques, Mimes and Miracles, a traditional English mummers play of 16th-century England, was offered as a means of understanding a past culture which ultimately manifested great influence on the English-speaking people of the new world.

Sound and Light, a production featuring the recreation of history by means of sounds, voices, and highly developed lighting techniques continued in its preproduction stages, with final presentation scheduled for 1969. Also offered as a means of enlivening the total environment of the museums and the surroundings were a variety of summer outdoor programs which included a series of Wednesday evening concerts, Friday evening barbershop singing, and such special events as a performance by the Fife and Drum Corps of Basel, Switzerland, and a modern dance program by the American choreographer Erick Hawkins. Two weeks of puppet theater, offered audiences an opportunity to experience the art of Jacques Chesnais Puppet Theater of Paris and the Czech Puppet Theater. The overwhelming popular success of these appearances encouraged the formation of the Smithsonian Puppet Theater, which offered daily performances all summer in a gaily colored tent theater on the Mall.

In March the division produced the second annual Rites of Spring, an occasion celebrating the opening of the museums during the evening and increased public service to the visitor. The program offered examples of the use of the outdoor environment for city parks and recreation centers and included balloon flights, exhibitions, demonstrations of poster painting and collage construction, music, carousel rides, and athletic

The Aylords, a rock-and-roll group, performing at the second annual Rites of Spring held on the Mall.

demonstrations. Congressman Andrew Jacobs of Indiana commented in the Congressional Record (2 April 1968) on the ". . . genuine sense of community, a thriving sense of involvement in the heart of this great city. The huge crowd was friendly and polite, reflecting an attitude which comes from sharing common pleasures. . . . The Institution seems to understand that culture is a total way of life of a people, not merely a treasure house for academicians or a plaything for the elite."

The cultural activities events of the National Park Service's "Summer In The Parks" program were also conceived and mounted by this division. Mobile art demonstrations, jazz and folk concerts, puppet theater, and a film theater were held in 20 parks during a 10-week period throughout Washington.

A total of 604,500 people attended the 26 Smithsonian productions of this year, and additional hundreds of thousands attended the "Summer In The Parks" programs.

Programs Presented

1–4 July	Festival of American Folklife
5 July	"Music on the Mall," Washington Ballet
7 July	Barbershop Concert, The Historyland Chorus and the Manassanaires

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Masques, Mimes, and Miracles, a mummers play of the Stuart Restoration period relating the story of St. George and the Dragon, was performed during the Christmas season.

12 July	"Music on the Mall," Jacob Barkin, soloist
14 July	Barbershop Concert, Arlingtones, and the Marylandaires
19 July	"Music on the Mall," Opera and Operatta
21 July	Annual Barbershop Chorus of the Potomac
23–28 July	Puppet Theater, Jacques Chesnais' "Comediens de Bois"
26 July	"Music on the Mall," The Summer Symphony Orchestra
28 July	Barbershop Concert, The Singing Capital Chorus
29 July–5 August	Puppet Theater, The Prague Marionette Theater
2 August	"Music on the Mall," Concerto Night
4 August	Barbershop Concert, The Counts
9 August	"Music on the Mall," Jazz Concert
9 August	Fife and Drum Hour, Olympia Society from Basel, Switzerland
18 August	Barbershop Concert, The Jubil-aires
26 August	Erick Hawkins Dance Company
15 September	Jazzmobile
24 October	Gregg Smith Singers
7 November	A concert of "Folksong and Style in Southeastern America"
27 December–6 January	Masques, Mimes and Miracles
27 February	Victory of Socrates—Walter Abel
1 March	Kyogen Japanese Comic Theater
26 March	Smith College Choir and Trinity College Glee Club
30–31 March	Rites of Spring
21 May	Chamber Music Concert

Smithsonian Associates

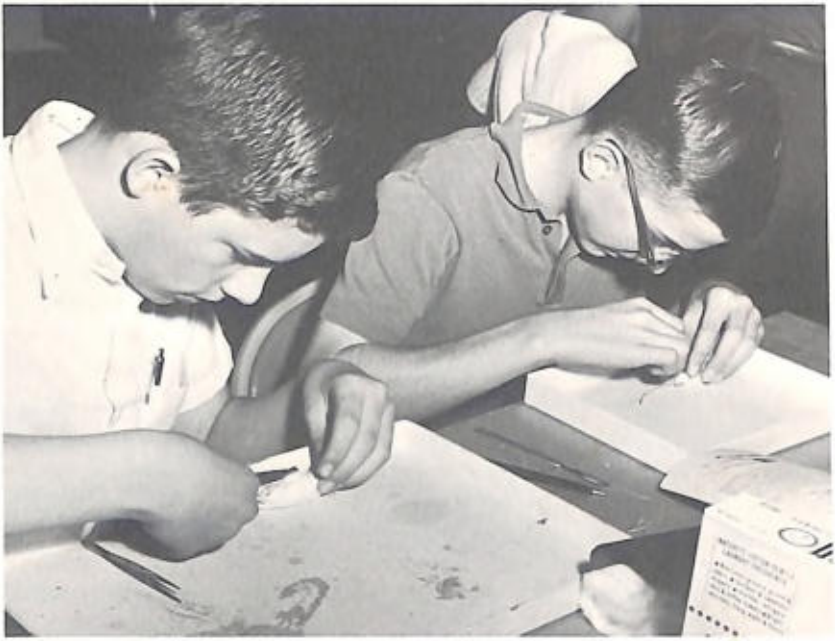
LISA SUTER, *Program Director*

ONE MEASURE OF THE SUCCESS of a museum is its ability to excite, delight, and involve its visitors. Through the Smithsonian Associates, the Institution has been able to transform spectators into participants and to reach the public in a new and personal way. During the past year 15,000 members (represented by 6,500 individual and family memberships) have participated regularly. Perhaps their enthusiasm for Smithsonian activities has been reflected best in their phenomenally high renewal rate of 89 percent.

The membership program was expanded in depth and breadth. A wide selection of activities were offered—dozens of lectures, demonstrations, choral, folk and chamber concerts, exhibition previews, films, drama, field trips, tours, mixed media, and other happenings. The Kite Carnival, the Zoo Night, and the Potomac Cruise were repeated by popular request. New Film and Producer, Young Composers, and Creative Persons series were established. Among many distinguished guests were Charles Eames, Constantinos Doxiadis, Walter Abel, and Pauline Trigere, who designed a garment for her spring collection on the stage. Lecture shows by Donald Brooks, Bill Blass, and Emanuel Ungaro were presented in cooperation with the Washington Fashion Group.

Highlights of the junior program were the "Pied Piper of Hamelin" and "Rapunzel" puppet shows by Rod Young; Chekov's *The Marriage Proposal* by the Garrick Players; brass, string, and woodwind concerts by The Dupont Circle Consortium; "An Introduction to Modern Dance" by the Washington Dance Theatre; a "chalk talk" by Robert Baldwin, creator of "Freddy"; "A Journey to the Planets" at the Rock Creek Nature Center, and a sketch-in at the Zoo. Experimental programs for tiny tots continued. Sea life workshops followed the popular Zoo Morning Talks on "What is a Reptile? A Bird? A Mammal?" Tickets for children's programs were regularly distributed to local orphanages.

More than 6,000 young people and adults were enrolled in Associates' seminars, lectures, and workshops, in which 168 courses were offered in 54 subjects, ranging from antiques to zoology. The curriculum was expanded to include creative arts workshops—drawing, painting, design, drama, photography, puppet-and-film making. Almost 500



Smithsonian Associates mammals workshop where members learn to prepare study skins.

scholarships were made available through the kindness of the Ladies Committee, the National Space Club, and members of the Smithsonian staff. The techniques of a variety of age-old crafts and their potential for contemporary use were demonstrated through "Ancient Crafts Revived" workshops on stained glass, bookbinding, raku, mosaic, and batik.

Two special week-end seminars were presented by former members of the Smithsonian staff—"Connoisseurship" by G. Carroll Lindsay of the New York State Museum and "The Inca State" by John V. Murra of Cornell University.

The Associates and the Japan-America Society of Washington brought twelve "national treasures" to this country for a Japanese Drama Festival, which featured an art exhibition, lectures, films and performances of Kyogen and Noh drama.

Over 2,300 members attended Luncheon Talks on the Arts, Sciences and Humanities and Tea Talks on American Arts and Ideas. The proceeds of these events were used to send Smithsonian speakers to hospitals, orphanages, and old-age homes and to provide senior citizens with transportation to programs here.

Smithsonian curator Paul Desautels lectures on minerals at an Associates luncheon.

The Associates and the Museum Shops co-sponsored an author's reception and eight sales exhibition previews. Members were invited to the grand opening of the National Collection of Fine Arts as well as a number of other exhibitions.

A modest travel program, in which 3,500 Associates participated, was started in fall with Walking Tours of Washington. These were followed by visits to significant museums, historic houses and private collections in Baltimore, Richmond, Annapolis, Winterthur, Philadelphia, Charlottesville, New York, and Boston. Guided tours were arranged of Hillwood, the Lindens, the Anacostia Neighborhood Museum and the Smithsonian buildings on the Mall. Also included were camping and field trips—mushroom, rock collecting and fossil hunts, shore strolls, insect, geology and botany walks, industrial and salvage archeology expeditions.

The Program Director presented three broadcasts on the Smithsonian over Voice of America, wrote an article, "A Museum in Transition," for the summer 1967 issue of *Museologist,* and talked on "The Concept of

a Living Museum" at the American Association of Museum meetings in New Orleans. For the latter, she directed and produced a short film on Associates activities.

Smithsonian Museum Shops

CARL FOX, *Director*

THE FIRST YEAR of the reorganized Smithsonian Museum Shop program saw the construction of a shop in the Museum of Natural History at the Constitution Avenue entrance and a book shop at the Mall entrance, the installation of a temporary display in the first floor rotunda of the Museum of History and Technology, and the completion of a book shop and sales exhibition gallery in the National Collection of Fine Arts. Plans were completed for redesign and construction of the Arts and Industries building shop and a book shop at the National Portrait Gallery for early summer and fall of 1968.

In addition to the customary presentation materials selected by the Director of Museum Shops, sales exhibitions were held in three buildings and on the Mall. Visitors to the Arts and Industries building saw molas by the Cuna Indians of San Blas Islands, Panama; 19th-century Japanese prints and drawings, children's embroideries from Peru, and Eskimo prints and sculpture.

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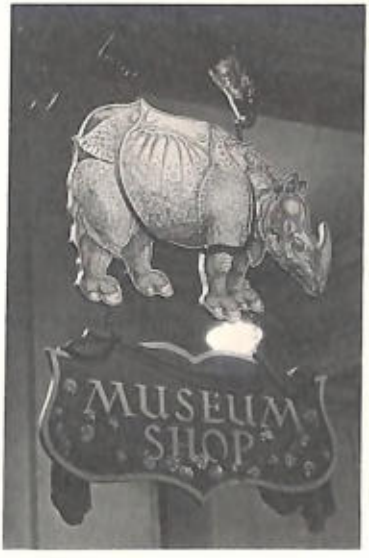


Opening of the new museum shop in the Arts and Industries building.

During the first annual Folklife Festival on the Mall traditional American crafts were offered from many parts of the nation.

At the Museum of History and Technology, special exhibitions included a Christmas showing of toys of the world, Appalachian crafts, *Track and Road: The American Trotting Horse* (publication by Peter Welsh), Botanical Prints of Henry Evans, Japanese arts and crafts, and publications by Howard Chapelle.

The first exhibition in the new galleries of the National Collection of Fine Arts was a collection of posters assembled by Mrs. Albert List.

Belmont Conference Center

DAVID B. CHASE, *Director*

THE CONFERENCE CENTER, which is now in its second year of operation, has been the setting for forty conferences sponsored by thirty private organizations and federal commissions and agencies. Requests for bookings during the more popular months exceeded the capacity of the center and a number of groups which were late in applying had to be turned down. With a large number of advance bookings already received, it appears likely that the center will be operating at capacity throughout most of the coming year.

Smithsonian groups which held conferences at Belmont include the Secretariat and Bureau Heads, the National Armed Forces Museum Advisory Board, the Smithsonian Council, and the Foreign Currency Advisory Council. Several groups of Smithsonian Associates visited Belmont on guided tours.

Belmont provides a facility which is unique in the Washington area. It affords an opportunity for small conference groups to enjoy exclusive occupancy of a comfortable and well-equipped center. The 340-acre property provides complete seclusion for the center in an attractive setting of rolling fields and woods. Only forty-five minutes by car from the center of Washington, Belmont is easily accessible from the city, and its situation close to Friendship International Airport makes it a convenient center for people coming from all parts of the country as well as from abroad.

Improvements to the center continue to be made. Additional air conditioning has been installed, and recording, slide projection, and duplicating equipment have been acquired. Plans have been completed for the installation of two new bathrooms and an additional bedroom in the main house during the coming year and for the renovation of two smaller houses on the property.

Smithsonian Activities

Special Museum Programs

Special Museum Programs

FRANK A. TAYLOR, *Director General of Museums*

TWO YEARS AGO CONGRESS PASSED the National Museum Act. Today, requests for assistance from museums in the United States and abroad have increased by more than 300 percent. The Smithsonian now responds to requests for advice and aid on museum projects and the training of museum personnel at the rate of more than 1500 a year. If, to this are added the requests for advice on preparing and conducting special exhibition programs and for the loan of exhibits, the total approaches 5,000 inquiries a year.

Many requests are from small museums which frequently are the only cultural activities in their communities. Others are from public spirited individuals seeking help to start museums to bring intellectual activities to their towns or inner-city neighborhoods. Many wish to enrich the education of their children through learning experiences beyond the classroom, or to give their senior citizens opportunities for intellectual, cultural, and social development through the continuing education programs which modern museums provide. Community colleges, for example, have sought advice on loan exhibits, on college museums, and on the content of museum technical courses, as well as on museum-based programs of service to their community.

By far the greatest rate of increase has been in requests from established museums, including some of the largest in the United States and abroad. They seek advice on new programs as well as consultation on cooperative solutions of continuing problems of administration, conservation, and collections management. These requests have been stimulated in part by the Museum Act, but they are much more the result of the favorable notice of the Smithsonian's successful experience in developing new museum opportunities. The Institution's pioneer experience with the Neighborhood Museum, its folklife programs of research and festivals, its traveling exhibition program, its leadership in studies of computerized cataloging and collections management, its Associates programs, including curator-conducted instruction for adults and children, its experiments with exhibits incorporating combinations of media appealing to all the senses, its programs of higher education and of cooperation with the schools, and its developing competence in the

preservation of art and museum objects, have attracted many requests for detailed advice, for the training of museum personnel, and for cooperative studies of opportunities and problems.

Universities have sought advice on the reorganization of their museums but even more basically on the experience of research museums in bringing students and scholars together with the reference materials required for their studies. They also are interested in the use of exhibitions to stimulate and demonstrate interdepartmental involvement with questions of national concern which call for university-wide attention. On the other hand, the large independent research museums which are affiliated with universities supplying teachers, facilities, essential collections, thesis supervision, and examination of candidates for advanced degrees, consult on how to convince foundations and granting agencies that, as institutions of higher education, they are equally entitled to direct financial support.

Smithsonian directors, curators, exhibits designers, conservators, education specialists, counsel, and administrative officers have responded to requests from practically every state and from more than a score of foreign countries. They have traveled to Georgia, California, New York, Michigan, Washington, West Virgina, Vermont, Texas, Kentucky, New Jersey, Virginia, Ohio, and many other states to consult with museum directors on their plans for museum development. Their advice has been sought by international organizations such as UNESCO and the International Council of Museums, and by governments or government institutions of such countries as Canada, the Republic of Korea, Thailand, the Republic of the Philippines, Okinawa, several African nations, Israel, Tunisia, and Ceylon. The subjects of the requests include advice and guidance on administering complexes of national museums, on planning the initial installations of large new museums, and for assistance in circulating significant collections of national treasures.

The needs of the museums for the services represented in these requests were recently reaffirmed by the conferees assembled to provide answers to the letter of 20 June 1967 addressed by President Johnson to Secretary Ripley as Chairman of the Federal Council on the Arts and Humanities (see 1967 Annual Report, pages 14–15). Of the needs identified by the museum directors and public conferees meeting for this purpose, all have been addressed at times to the Smithsonian. The study of all these needs and their solutions, as well as the financial support of training and conservation services, are embraced in the concept of the National Museum Act. The conferees urged that the Act be extended and substantially funded.

OFFICE OF EXHIBITS

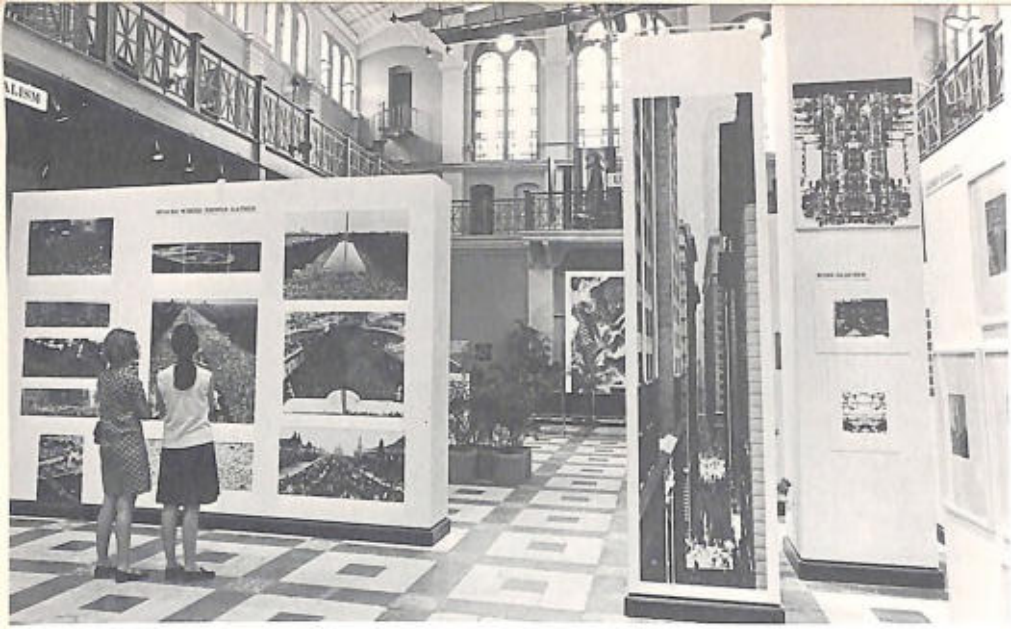
The Office of Exhibits—under the direction of chief of exhibits John E. Anglim and assistant chief Benjamin W. Lawless—developed new and diverse techniques in 1968 to present both the continuing and the dynamic new programs of the Smithsonian Institution.

In addition to acquitting its public-information and educational responsibilities to design, produce, and install permanent and special exhibitions, the Office responded to the needs of the Institution's growing scholarly programs by creating many-faceted exhibits supplements—notably in the audiovisual, motion-picture, and special-devices realms. For the most part, these new activities have been staffed from existing organizational units: Eugene F. Behlen has directed the audiovisual program; Karen Loveland, motion-picture production; Rolland O. Hower and James C. Nyce, special-devices research and development; and Carroll B. Lusk, lighting and special effects.

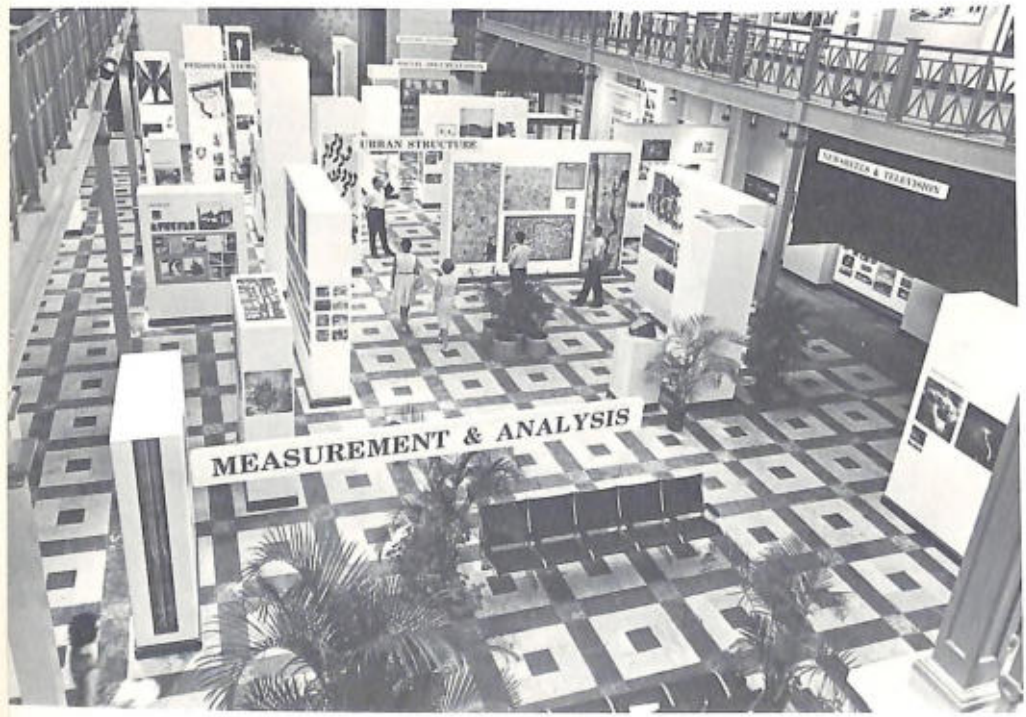
The Office completed 73 new units in 8 permanent exhibition halls and produced 42 special exhibitions, ranging from single-case presentations of specialized material to entire galleries. Among the special exhibitions that had international impact were "Peruvian Silver," "Colonial Art from Ecuador," "The Art of Organic Forms," and "Photography and the City: The Evolution of an Art and a Science." The latter—an extraordinary documentary on the development of the camera and its effects on society (especially urban life)—was designed by Charles Eames at the request of Vice President Hubert H. Humphrey and was produced jointly by the Eames staff and the exhibits staffs of the Museum of History and Technology and the Museum of Natural History. The great wealth of visual material in this exhibit, opened in May 1968, was appropriate to the facilities of the revitalized Arts and Industries building, which last year became the Institution's exposition hall for exhibits not specifically related either to natural history or to history and technology.

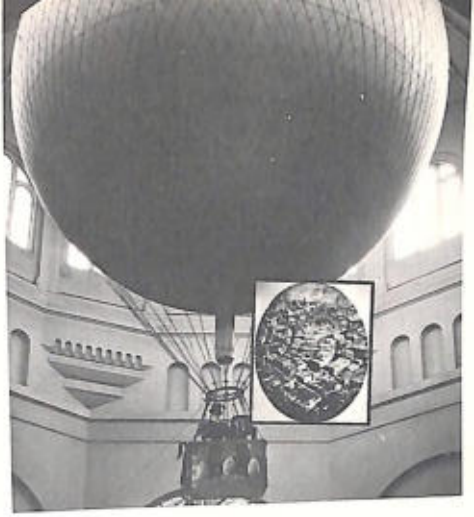
For the Traveling Exhibition Service the Office designed several traveling exhibits and edited and provided printed labels for 24 others. The Exhibits staffs also prepared exhibits requested by the Offices of Education and Training, of International Activities, and of Public Information, the Smithsonian Associates, Museum Shops, and the Smithsonian Institution Press. With industry, the Office of Exhibits also worked cooperatively, as for example, the special computer exhibit done jointly with International Business Machines Corporation.

In the many special operations within the Office—including the horticultural section, the conservation laboratories, the freeze-dry laboratory, the plastics shops, the model shops, and the silk-screen facili-



"Photography and the City: The Evolution of an Art and a Science," a major exhibit designed by Charles Eames, opened in the Arts and Industries building on 6 June. It depicts the development of the camera and its effects on society.





A focal point of the photography and the city exhibit was the 30-foot balloon in the rotunda of the Arts and Industries building, demonstrating how the first aerial photograph in the United States was taken. Nearby, the photograph of Boston, which was the first, is being rigged into position. Below, left: Charles Eames organizes photographic materials during the preparation stage; right, exhibits specialists Joan Nicholson and Frank Caldwell working with one of Charles Eames' designers.

ties—scores of persons were trained in techniques that could be adapted to their local needs. Many of these students were museum professionals. Among the foreign countries from which trainees came were Australia, Ceylon, Denmark, Ghana, Nepal, and Nigeria. The Office also worked extensively with disadvantaged young adults to help orient them to the business and professional worlds, and is continuing this program on an even broader scale.

Among the non-Smithsonian museums assisted by the Office of Exhibits last year was the Children's Museum and Planetarium of Charlestown, West Virginia, where a workshop seminar was conducted by designer Mrs. Deborah Bretzfelder, special projects supervisor Eugene F. Behlen, and exhibits specialist Frank Y. Caldwell.

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Assistance was also given to the orientation courses conducted by the Department of State for overseas exhibits coordinators, and to the design and installation of a foreign crafts fair at the Department of Commerce.

The exhibits editor's office, under its new chief, Mrs. Constance Minkin, in addition to its primary functions of editing exhibits labels and overseeing their typography and printing, participated in such exhibits-related activities as preparing the scripts for the audiovisual program, and prepared or assisted with such items for the visiting public as five exhibition brochures, a guide map to the Museum of Natural History, and a comprehensive Smithsonian-wide exhibits directory—all published last year—and completing the manuscript for a guidebook to the hall of philately. Also, work was begun on a guidebook for the Museum of Natural History. Of the 7,614 labels edited, 5,880 were printed for 90 exhibitions in 24 permanent and 66 temporary halls. The remainder awaits printing.

To other Smithsonian museums—the National Collection of Fine Arts, the National Portrait Gallery, the National Armed Forces Museum Advisory Board, the National Air and Space Museum, the John F. Kennedy Center for the Performing Arts—the Office contributed services ranging from consultation and advice to actual production assistance, as for the National Collection of Fine Arts, which opened in May its new galleries in the renovated Old Patent Office building.

The year's most significant and gratifying challenge was perhaps the development of the Anacostia Neighborhood Museum in Southeast Washington. Opening in September 1967, this very special museum was the outgrowth of Secretary Ripley's statement to museum directors, "We ought to try taking museums to the people." The Office of Education and Training, the curatorial staffs, and the Office of Exhibits joined with neighborhood leaders to provide appealing, learning exhibits to members of the Anacostia community, many of whom rarely participated in Smithsonian activities in downtown Washington. Designer James Gerald Shelton, created eight stimulating science and history exhibits calculated to appeal to the young residents of Anacostia.

Since the opening of the museum, many modifications have occurred both in methods of presentation and in the subject material exhibited, as both the community and the Exhibits Office learn how best to communicate exciting ideas and concepts in science and history. The Exhibits Office quickly discovered that what appealed to a typical museum visitor did not necessarily strike a responsive note in Anacostia and adjusted its approach to the requirements

of the neighborhood community. Included in the change of emphasis were a more personal participation and classes in such subjects as clay-modeling, painting, and casting. A pottery wheel was installed and instruction given in the field of ceramics. Plans are well along to instruct adults and children in gem stone cutting. The equipment for this operation has been already acquired, and classes will soon be started.

While these activities may not be considered standard museum approaches, they were initiated in response to the expressed desires of the community. Exhibits on art, history, and African culture continue the more typical aspects of a museum, and in the planning stage is a large and ambitious exhibit on Negro history in the United States.

The experiences in Anacostia may well serve as guideposts for other neighborhood museums to follow.

History and Technology Laboratory

The exhibits staff assigned to the Museum of History and Technology, under the direction of Benjamin W. Lawless, continued its work in the permanent-exhibition program, but diverted most of its manpower and resources in 1968 to a series of special exhibition and exhibits-related activities dealing with science, history, and technology.

Special exhibits rarely require more than four weeks to prepare and rarely last more than six weeks. These aspects—plus the fact that the exhibits can be mounted at relatively low cost per square foot of installed space—make special exhibits ideal experimental vehicles. They can return far more than their original investments in evaluating the teaching effectiveness of various types of presentations and in further understanding the special relationships of exhibit specimen, curator, designer, and museum public. Significant special exhibitions were "Three Centuries of Peruvian Silver" and "Copp Textiles," both designed by Robert B. Widder, coordinator of special exhibits. Prior to the former, little of the superb viceregal silverwork had been seen outside Peru. The work reflected Spanish hammering, etching, and chasing techniques, employed in traditional European forms but transmuted by native craftsmen into distinctively Peruvian designs. Religious, domestic, and equestrian pieces were displayed in settings suggesting the ornate cathedrals and the dark, cool interiors of well-to-do Peruvian homes. The Copp textiles, a vast collection of colonial and early 19th-century household furnishings retained by several generations of the Copp family of Stonington, Connecticut, ranged from furniture to

kitchen utensils. In settings reminiscent of colonial Connecticut white clapboard houses, the bedding, table linens, and handsome needlework were displayed. Among the magnificent fabrics in the exhibition was an indigo-dyed cotton coverlet, quilted in the traditional pineapple pattern.

Introductory exhibits were installed in the hall of musical instruments and in the nuclear energy area. Designed by the new chief designer Richard Virgo the musical instruments exhibition (open for special concerts and meetings) featured primarily 17th- and 18th-century instruments. An ancillary, but striking, feature was the use of stereophonic lounge chairs in which visitors could hear music recorded from the instruments on exhibit.

Alfred McAdams, also new to the design staff, developed several exhibit units that will ultimately become part of the permanent hall of nuclear energy.

Permanent exhibition halls in progress have continued to reflect experience gained from the special exhibits program. Six permanent halls were designed and—under the guidance of design-office manager and contracts supervisor John Brown—construction contracts were ready to be let for two of them.

Production facilities are under the direction of William M. Clark, assisted by Stanley M. Santoroski; Robert L. Klinger supervises the model shop.

SPECIAL EXHIBITS

Exhibit	*Location*	*Designer*
Copp Textiles	Museum of History	Robert Widder
Peruvian Silver	and Technology	Robert Widder
Masques, Mimes and Miracles	"	Eugene Behlen
Mexican Prints	"	Kenneth Young
Enrico Fermi	"	Alfred McAdams
Computers	"	Nadya Kayaloff
Chicago Architecture	"	Robert Widder
Political Cartoons	"	Kenneth Young
Tractor Jubilee	"	John Clendening
Presidential Pastimes	"	Barbara Fellows
Father Point's Paintings	"	Robert Widder
Excellence in Engineering	"	Benjamin Lawless
Scan-O-Groves	"	James Shelton
Comic Art	"	John Clendening
Bye Watercolors	"	Kenneth Young
Danish Glass	"	Kenneth Young
Celestial Globe	"	Nadya Kayaloff

Exhibit	*Location*	*Designer*
Honeywell-Emmett Computer	Museum of History and Technology	Nadya Kayaloff
Musical Instruments	"	Richard Virgo
Israel Philately	"	John Clendening
Historic Sewing Machines	"	James Shelton
American Medallic Art	"	Steve Makovenyi
Explorer's New Zealand	"	Kenneth Young
N.C.F.A. Opening	"	Robert Widder
"Golden Spike" Railroad Exhibit	"	Kenneth Young
Resolute Desk	"	Nadya Kayaloff
Recent Acquisitions, I	"	Robert Widder
Italian-American Show	"	
Baltimore Dental Collection	"	John Clendening
Folk Art (Cafeteria)	"	Benjamin Lawless
Halem Ceramics	"	Kenneth Young
Organ Making	"	Barbara Fellows
Appalachian Poverty	"	Benjamin Lawless
Recent Acquisitions, II	"	Kenneth Young
German Posters	Arts and Industries Building	Steve Makovenyi
Photos of Iran		Robert Widder and Kenneth Young
Erie Canal	"	Kenneth Young
Metal: Germany	"	Kenneth Young
NAFMAB Art	"	John Clendening
Children's Art	"	Barbara Fellows
Photography and the City	"	Charles Eames
Paintings by Tuculescu (Romanian)	"	Kenneth Young
Rhode Island Recreation	"	Barbara Fellows
Finnish Graphics	"	Kenneth Young
Hirshhorn Museum Model	Smithsonian Building	Kenneth Young
Brooks-Beason Exhibition	Old Senate Office Building	William Haase
World Craft Fair	Department of Commerce	Benjamin Lawless

PERMANENT EXHIBITS IN PROGRESS

Hall	*Location*	*Designer*
Autos and Coaches	Museum of History and Technology	John Clendening
Textiles	"	William Haase
Electricity, II	"	Nadja Kayaloff
Physics, II	"	John Clendening
Photography	"	James Shelton
Musical Instruments	"	Richard Virgo
Nuclear Energy	"	Alfred McAdams
Wood Technology	"	Benjamin Lawless

Museum of Natural History Laboratory

The Museum of Natural History Exhibits staff, under the direction of John E. Anglim, assisted by Gilbert A. Wright, completed the cultures of Africa and Asia hall, which was fully opened to the public in August 1967. Designed by Lucius Lomax, the final section of the hall included a Lundi life group depicted in an initiation dance; the realistic foreground was prepared by the models, dioramas, and accessories section under the supervision of John Babyak. Another fascinating, innovative feature was a life group in a kitchen setting—complete with kitchen scents facsimilated by the research and development section—under Rolland O. Hower's direction.

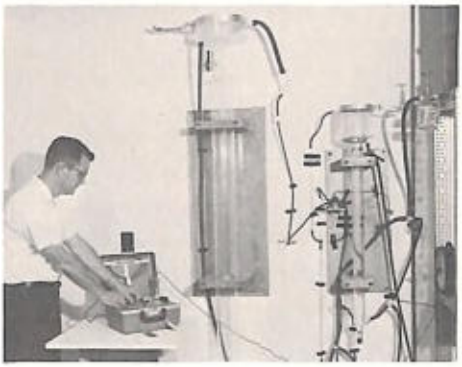
In the adjoining peoples of the Pacific and Asia hall, a new life group of New Guinea was installed. The background was developed by chief illustrator Christopher Reinecke, and the figures by John Weaver.

A newly acquired spectacular gold chalice was added to the gem hall (to be shown intermittently, by arrangement with the donor). A new complex of gem cases was planned by designer Dorothy Guthrie, and special exhibits were installed for the mammoth Lesotho diamond, twinned diamond crystals, a 31-carat heart-shaped blue diamond, and a collection of jade carvings. Nearly half of the exhibits have been completed for the hall of physical geology, designed by Mrs. Guthrie and produced and installed under the direction of Frank Nelms, chief of the production section, and assistant chief Charles W. Mickens.

Work continued in new sections of the cold-blooded vertebrates hall, designed by James Speight, and on the balcony of the dinosaur hall, where a large diorama depicting Cretaceous reptile life was completed by Jay Matternes. A new exhibit on restorations of the skull and soft parts of prehistoric *Zinjanthropus* was added to the hall of physical anthropology. For the future hall of Quaternary vertebrates, designed by Lucius E. Lomax, Vernon Rickman completed reduced-scale sculptures of two sloths, a mammoth, an American elk, and an American bison. A life-sized figure for the Cocapa Indian group, in the hall of American Indians, was also completed.

Peter Farb and designer Joseph Shannon have further developed the expanded concept of the discovery of natural history hall, which will be far more comprehensive than the originally planned insect hall, embracing basic biologic principles underlying the development of life on earth. Biologic films for the hall were made by Kjell Sandved during two months at the Smithsonian Tropical Research Institute on Barro Colorado Island.

Among the many dramatic special exhibitions produced by the Natural History Laboratory staff was "The Art of Organic Forms," de-



William Roberts employs a rapid sediment analyzer in his research in paleobiology. This instrument for scientific research was built in the plastics laboratory of the Office of Exhibits, Museum of Natural History.

signed by Lomax; an exhibition on the religious art of Ecuador, designed by Mrs. Guthrie; "Data-Processing in Systematic Zoology," designed by Speight; and "Artwork by School Children of Brasilia," which was prepared for the Anacostia Neighborhood Museum and later circulated in District of Columbia schools.

Much of the material was completed for the huge endangered species exhibit, which will open shortly in the foyer. Designed by Speight, the exhibit was coordinated by Joseph C. Britton, assistant to Richard S. Cowan, Director of the Museum of Natural History; Britton served for much of the year as the liaison between the exhibits staff and the curatorial and administrative staff.

The varied resources of the plastics laboratory section, supervised by John Widener, contributed importantly to the exhibits programs. Assisting other museums as well as serving the Museum of Natural History, this laboratory produced faithful replicas of irreplaceable museum specimens such as meteorites, plant fossils, and rare bones of prehistoric animals, as well as of intricately carved ivory chess sets; and fabricated intricate scientific instrumentation; and it made durable casts of sculptured sloths and of human forms (including manikins for the first ladies' hall in the Museum of History and Technology), and plaques of Assyrian bas-reliefs.

SPECIAL EXHIBITS

Exhibit	*Location*	*Designer*
Encyclopaedia Britannica	Museum of History and Technology	Commercial designer Stowe Myers, with assistance from Lucius Lomax
Early Religious Art of Mexico	Museum of Natural History	Dorothy Guthrie
Art of Organic Forms	"	Lucius Lomax

Exhibit	*Location*	*Designer*
Museum Data Processing	Baltimore Civic Center	James A. Speight
Using the Freeze-dry Technique for Museum Exhibition	University of Maryland	Rolland O. Hower
Art Work of School Children of Brasilia	Anacostia Neighborhood Museum	James A. Speight
Flora and Fauna of Chesapeake Bay	Chesapeake Bay Center for Field Biology	Morris Pearson

PERMANENT EXHIBITS

Hall	*Location*	*Designer*
African-Asian Ethnology (14 exhibits)	Museum of Natural History	Lucius Lomax
Pacific-Asian Ethnology	"	Lucius Lomax
Gems (4 exhibits)	"	Dorothy Guthrie
Life in the Sea (1 exhibit)	"	Lucius Lomax
Physical Anthropology (2 exhibits)	"	Joseph Shannon
North American Indians (1 exhibit)	"	Morris Pearson

TRAVELING EXHIBITION SERVICE

In 1968 the Smithsonian Institution Traveling Exhibition Service completed its seventeenth year of operation. From a beginning of touring exhibitions generally limited to the fine arts, it has gradually enlarged its scope to include design and crafts, photography, architecture, history, and science.

Exhibitions circulated by SITES are assembled from many sources in this country and abroad—from museums, institutions public and private, and collectors—and each year more of these lending sources accept SITES as a means of sharing their treasures with a wider public. At the same time, under the Director General of Museums, SITES is increasing its ability to aid public museums, community colleges, science museums, libraries and other educational institutions in developing programs for using their temporary exhibition space. One result of this has been that the current catalog lists 19 more exhibitions than were in last year's issue.

Notable among those requesting assistance are school systems project officers conducting educational exhibitions programs funded under Title III of the Elementary and Secondary Education Act of 1965. In Lock Haven, Pennsylvania, for example, SITES provided 13 exhibitions for periods of one to three months, to be circulated within the Title III area. These exhibitions, it is estimated, went to 40 schools and were

Two foreign exhibitions shown at the Smithsonian and later circulated by the Smithsonian Institution traveling exhibition service were, above, "140 Years of Danish Glass," and, below, "Metal: Germany," with Frank A. Taylor, Director General of Museums, Dorothy Van Arsdale, Chief of the Smithsonian Traveling Exhibition Service, and German Ambassador Heinrich Knappstein viewing a metal candelabra.

viewed by 90,000 students. And more and more the State Arts Councils are taking over the task of circulating exhibitions within their states.

The Council on Leaders and Specialists has referred many foreign museum specialists to SITES for briefings on its operation, and requests from these people for loans of exhibits prepared from Smithsonian collections represent a potential widening of the services now offered, provided funds could be obtained for preparing the exhibits. The requests

A special exhibit of the colonial art of Ecuador was opened on 15 April in the Museum of Natural History by the Smithsonian Institution traveling exhibition service in collaboration with the government of Ecuador. Entrance to the exhibition hall is shown on left.

predominantly seek science, history, and technological materials, demonstrating that areas of human endeavor and accomplishment other than fine arts play a major role in cultural exchange programs.

Increasing support from the Department of State and other federal agencies has been received in the form of consulting services, leader grants to visiting curators, and general liaison assistance. In return SITES has reciprocated by exhibiting the Tuculescu paintings from Romania at the Smithsonian and subsequently in Ohio and California, as called for in a cultural exchange agreement between Romania and USIA. Another exhibition, "Tapestries from Yugoslavia," is now circulating and the next will probably be of naive paintings from Yugoslavia, due in winter 1968; this latter is the third under a five-year proposal.

About a third of SITES' exhibitions are lent by foreign countries. Among them, "Art Treasures of Turkey," "Swiss Drawings," and "Henry Moore" were returned. "Tunisian Mosaics" continues for another year, and Ecuador has launched its first United States traveling exhibition, "Colonial Art from Ecuador." Other foreign exhibitions now circulating are "140 Years of Danish Glass," "Popular Art from Peru," and "Metal: Germany."

Dorothy Van Arsdale and program assistant Frances Smyth, were official guests of the governments of Switzerland, Romania, and Czechoslovakia for discussions of new exhibitions for the United States, and

Colonial art of Ecuador.

Donald McClelland of the National Collection of Fine Arts organized other exhibitions for SITES while traveling in Ceylon and India.

Cooperation with UNICEF in New York resulted in two exhibitions there, with a third scheduled for fall 1968, and cooperation with UNESCO in Paris resulted in one exhibition currently on tour and another scheduled for fall 1968. The two-year-old "Abu Simbel" exhibition will be updated and continued on tour.

Once again SITES was honored by the American University Presses; its catalog *Swiss Drawings,* produced by Frances Smyth and designed by Crimilda Pontes, was selected as one of the top 25 publications of the year. Other catalogs published this year are *Finnish Graphics Today,*

Colonial Art from Ecuador, 140 Years of Danish Glass, Graphic Art from Yugoslavia, and *Yugoslavian Tapestries.*

An increasing number of SITES shows open at Smithsonian Museums. This year they included "German Posters," "Finnish Graphics Today," "Metal: Germany," "Colonial Art from Ecuador," "140 Years of Danish Glass," and "The Explorer's New Zealand." Installation of all these shows was by the Office of Exhibits, under the direction of John E. Anglim. "Swiss Drawings" opened at the National Gallery of Art.

Carried over from prior years were 68 exhibitions; 29 were initiated, and 42 were dispersed. The 1968–1969 catalog, published in May 1968, lists 116 exhibitions.

Exhibitions Initiated in 1968

Painting and Sculpture

Radius 5; Colonial Art from Ecuador; The American Landscape: A Living Tradition; Eyewitness to Space, II; Contemporary Art of India and Iran; Isleta Pueblo Paintings; Swiss Drawings.

Drawings and Prints

Antique Maps; Contemporary American Drawings, III; Cross-section of Contemporary Graphics: American, European, and Japanese; Finnish Graphics Today; Master Prints of the 15th and 16th Centuries: Contemporary Mexican Prints; Ornamental Pen Drawings.

Architecture

The Grand Design; Ten Italian Architects; The Stencil Ornaments of Louis Sullivan.

Design and Crafts

Metal: Germany; 140 Years of Danish Glass; Wood Turnings from India; Kaleidoscope Orissa: Folk Art from India; Popular Art from Peru; Yugoslavian Tapestries.

History

The Carvings of Sanchi.

Children's Art

Paintings by Children of Many Lands, II; Tunisian Children's Art.

Natural History and Science

Transformation of Space.

Photography

A Photographer Looks at Africa; Australia: The Sunburnt Country; Laos: The Land and the People.

Exhibitions Continued from Prior Years

1966–1967: Islamic Art from the Collection of Edwin Binney 3rd; Henry Moore; Sources for Tomorrow: 50 Paintings from the Michener Collection; Naive Art from Haiti; Tunisian Mosaics; Italian Architectural Drawings; Graphic Art from Yugoslavia; Graphics '67; Albers: Interaction of Color; Cape Dorset: The Arts of an Eskimo Community; Empire Profile; Fiber, Fabric and Form; German Posters; Living with Wood; Victorian Needlework; Color and Light in Painting; The Explorer's New Zealand; The People's Choice; Les Enfants de Paris; Paintings by Children of Many Lands, I; Things and Other Things; Tokyo Children Look at the Olympic Games; Animal Behavior; Minerals Magnified; Prehistoric Paintings of France and Spain; Ten in Focus.

1965–1966: Eyewitness to Space; Action-Reaction; Contemporary Dutch Graphics; Polish Graphic Art; Six Danish Graphic Artists; Art in Urban Architecture; Early Chicago Architecture; Folk Toys from Japan; Jazz Posters; Posters from Denmark; Rugs from the McMullan Collection; Early Monuments and Architecture from Ireland; Danish Children Illustrate Hans Christian Andersen; Embroideries by Children of Chijnaya; Museum Impressions; The Preservation of Abu Simbel; New Names in Latin American Art.

1964–1965: Bridges, Tunnels and Waterworks; Eskimo Graphic Art III; Pier Luigi Nervi; American Costumes; American Furniture; The American Flag; Colors and Patterns in the Animal Kingdom; The Stonecrop Family: Variations on a Pattern; The Color of Water.

1963–1964: Alvar Aalto; Contemporary American Landscape Architecture; Birds of Asia; Hearts and Flowers; Religious Themes by Old Masters, I and II; Eero Saarinen; Swiss Posters.

1962–1963: Craftsmen of the City; Paintings by Young Africans.

1961–1962: Physics and Painting; UNESCO Watercolor Reproductions; Contemporary Italian Drawings; The Face of Viet Nam; Le Corbusier; Robert Capa: Images of War.

CONSERVATION-ANALYTICAL LABORATORY

The productive activities of the Conservation-Analytical Laboratory were directed toward both conservation and analysis in proportion to the manpower available.

Conservation consisted largely of providing information, advice, and tested materials to various departments engaged in safeguarding their own collections, together with emergency action in connection with special exhibitions.

One minor activity contributing to the welfare of the collections was surveillance of the relative humidity in various areas of the Museum of History and Technology by means of 25 continuously recording hygrothermographs. Close cooperation with the engineers responsible for air conditioning resulted in a reasonably stable environment at levels suited to the various materials.

Materials tested for compatibility with museum objects included paper, board, adhesives, and plastic foils intended for mounting graphic

art; paint for the decoration of rooms in which silver objects are stored; and insecticide for use in rooms containing metal objects.

Emergency action was taken to deal with wood borers and flying termites originating from exhibits in special exhibitions.

About 150 objects received various forms of treatment, and analysis was undertaken on some one hundred objects of wide variety, including ancient Chinese bronze ceremonial vessels and belt hooks, gold coins, slag from an archeological dig, and a corrosion product found to be hindering operation of one of the Museum's working models.

Most of these analyses were spectrographic, made on ten-milligram samples, and were semiquantitative in nature, but some of them were made with greater precision by x-ray fluorescence analysis. Identification of minerals that occur in the gesso on easel paintings, in artists' pigments, and as corrosion products on buried or sunken objects have been made by x-ray diffraction analysis. Artists' pigments have also been characterized by infrared absorption spectrophotometry which has served additionally to identify organic materials such as the adhesives used on commercial binding tapes suggested for use in mounting, the finish applied in earlier times to a celestial globe that was recently acquired, and the varnish found on political campaign buttons in the collection.

Another investigation, still in progress, was of the use of neutron-activation analysis for the characterization of sources of English and American pottery from the colonial period found here. A technique for the elemental analysis of small samples—less than 100 micrograms in weight—by use of the electron microprobe is being refined in conjunction with the division of meteorites. This method, applied to ink, may prove to be useful in investigations involving the attribution of old documents.

Aside from directly productive activity, the Laboratory was engaged in reorganization of its procedures and in filling minor gaps in equipment with a view to increasing its effectiveness in handling the many and varied tasks presented from six museums, each having different types of collections. As subsidiary gains, this reorganization is expected to facilitate access by other members of the Smithsonian staff to technical literature on conservation available in the laboratory and to the testing equipment that has been acquired for the purpose of monitoring and facilitating conservation treatments carried out in other laboratories in the Smithsonian museum complex.

OFFICE OF THE REGISTRAR

The energetic pursuits of the many branches and organizations under the Smithsonian have had their impact on the Office of the Registrar this year. Mail volume increased about forty percent over 1967, offering concrete evidence of increased staff activity and the heightened public awareness of the Institution and its varied programs. In the words of one correspondent, they are "unavoidably interested in . . . , send me ANY information."

Eight clerks handled more than 1,492,000 pieces of mail. Daily, approximately 800 deliveries are made in the four buildings on the Mall, and two truck deliveries service the seven buildings in other parts of the city.

A branch mail-shipping office was set up this year to service the newly opened Fine Arts-Portrait Gallery building and was amply justified by the timely service provided in receiving and shipping large exhibits in connection with the establishment and opening of the building. Total shipping activity, is shown below:

	Pieces	*Pounds*
Freight (surface and air)	15, 366	1, 740, 705
Express (surface and air)	1, 724	89, 829
Parcel Post (surface and air)	1, 184	10, 358

The nations of the Middle East and Africa, particularly North and East Africa, drew an increasing number of travelers. For all countries they totaled 297 and required the processing of 745 passports and other documents.

An important role played by the Office of the Registrar primarily for the benefit of the scientific and professional staff of the Museums of Natural History and of History and Technology is the recording of accessions to the collections and maintaining and searching the central files. The statistical tables showing the totals and distribution of specimens are given on pages 149 and 392–393.

Smithsonian Activities

History and Art

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American Studies Program

THE AMERICAN STUDIES PROGRAM of the Department of American Studies was carried on in cooperation with universities in the local area. For the third consecutive year an orientation seminar was given in the spring semester, this time organized around the theme of life in the period of the American Revolution. It was taught by staff members of various Smithsonian museums, with nine graduate students from George Washington University and four from the University of Maryland participating. In addition, two graduate students from George Washington University and three from the University of Maryland took individual reading courses with staff members of the Museum of History and Technology and the Museum of Natural History. Portions of comprehensive examinations were written and graded for three graduate students, and doctoral dissertation direction was carried out for two students.

The chairman prepared a paper on "Speech Communication and Politics" for an Interdisciplinary Colloquium on Speech Communication, in 10–12 October 1967, sponsored by the Speech Association of America and the United States Office of Education in cooperation with the Johnson Foundation. He participated in a conference at Austin, Texas, sponsored by the American Association of University Presses and the National Endowment for the Humanities, to identify areas in the history of exploration and discovery in need of support for research and publication. He also participated in meetings: the Commandant's Advisory Committee on Marine Corps History 22–27 July 1967; the Society for Historical Archaeology; the Organization of American Historians; and the International Commission for the History of Parliamentary and Representative Institutions.

Continuing his research in various areas of American history, he saw published during the year the following:

WASHBURN, WILCOMB E. "The Smithsonian's Graduate Program in American Civilization." *Smithsonian Journal of History,* vol. 2, No. 2 (Summer 1967), pp. 64–67.

———. "Indian Removal Policy: Administrative, Historical and Moral Criteria for Judging its Success or Failure." *Ethnohistory,* vol. 12, No. 3 (Summer 1965), pp. 274–278. [This issue of *Ethnohistory* did not appear in published form until 1967.]

———. "Joseph Henry's Conception of the Purpose of the Smithsonian Institution." Pages 106–166 in *A Cabinet of Curiosities: Five Episodes in the Evolution of American Museums.* Charlottesville: The University Press of Virginia, 1967.

The Amoskeag millyard, Manchester, New Hampshire. Aerial view made from a helicopter loaned by the state National Guard. Such views are of far greater value than conventional aerial photos which of necessity must be taken from much higher altitudes. Here, the relationship between the various mill buildings, the river, the power canal, and the corporation housing, is made clear in a way that would be possible by no other means. The Amoskeag complex expanded steadily from 1838 until construction of the last major mill in 1915.

Museum of History and Technology

ROBERT P. MULTHAUF, *Director*

WITHIN PRACTICALLY EVERY SUBJECT FIELD embraced by the Museum of History and Technology, beyond those of object and manuscript-material collection which conventionally occupy the professional staff, there are vast areas that could lend themselves to exploration by the curator. The most pressing of these, in terms of rapidly disappearing historical evidence is the area of physical remains. While of less importance and incidence in areas where the end objects themselves are small and easily collectible—coins, stamps, the artifacts of domestic and craft culture—most engineering and technological objects generated by man's ingenuity and construction are large, *un*collectible, and with few exceptions, not susceptible to a formalized preservation process except on their own foundations. Thus, it becomes the technological historian's obligation to devote as much energy to the direct study of the material remains of original structures in the field—the *primary documents*—as to the analysis of that development on the basis of essentially secondary, paper documents, for each provides understanding of the other. Acutely aware of this, historians in the Museum of History and Technology have turned their attention to industrial archeology.

INDUSTRIAL ARCHEOLOGY AT THE SMITHSONIAN

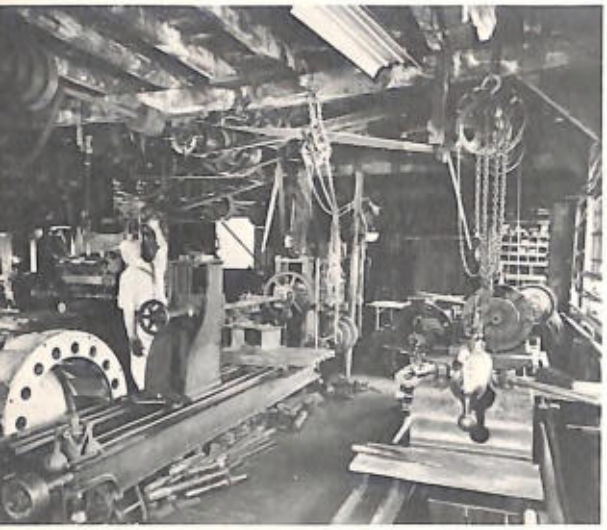
Because of its traditional orientation toward historical interpretation based almost wholly upon objects and documents that could conveniently be gathered within its walls, the Smithsonian's Museum of History and Technology has been relatively late in embracing the field of industrial archeology—the on-site investigation of physical remains of

it usually is, demolition is almost certain once it has become uneconomic. Thus, while a detailed graphic record may be a poor substitute for the object, it is better than no record at all.

Formal recording of industrial structures in the United States began in the Great Depression when the WPA established the Historic American Buildings Survey, under which unemployed architects were hired to make accurate measured drawings and photographs of a large group of significant buildings. Although established as a purely architectural project, HABS also recorded a number of bridges, small mills, and factories. Today it continues this work under the National Park Service, with an increasing attempt to document industrial remains.

About three years ago the Smithsonian's division of mechanical and civil engineering, aware that the rate of abandonment and demolition was increasing as a result of obsolescence, urban sprawl, highway construction, and other disruptive economical and physical factors, undertook a series of recording surveys to increase the breadth of this direct documentation of American industrial survivals. In the first survey, in July 1965, the C. P. Bradway Machine Works was thoroughly recorded. This small Connecticut factory had just ceased the manufacture of water turbines. Its buildings, production machinery, and—most importantly—its manufacturing methods were an unusual survival of a typical late-19th-century machine manufactory, for since its founding in 1889, few of its major physical or operational elements had been drastically altered. The three-man party that surveyed it in one week made complete measurements of the building and its contents. With a tape recorder and 35-mm. camera, they produced a step-by-step account of the entire turbine-manufacturing sequence as recounted by Mr. Bradway, the elderly owner and son of the firm's founder. It was virtually a craft process, and most of the dimensional and manufacturing information existed nowhere but in Mr. Bradway's memory, an extremely common method of record keeping in the early days of the turbine and other light, limited-production machine industries.

Summer 1966 saw a similar survey made of Dudley Shuttles, Inc., a small shop in Wilkinsonville, Massachusetts, which still manufactures wood shuttles for power looms. In 1900 this was an industry of perhaps thirty manufacturers, but today the bulk of the business is concentrated in the hands of two or three large firms, with the Dudley firm as the sole remaining small producer. The firm's significance lies in the fact that much of its production machinery was designed and built on the premises, some as early as 1885, and thus represents an unusual example of a manufacturer's own ingenuity being used to meet his requirements for a group of highly specialized, largely single-function machines.



C. P. Bradway Machine Works, West Stafford, Connecticut, employed a group of standard machine tools, some built or drastically modified on the premises and none made after 1900, to manufacture water turbines. Except for the lighting fixture and chain hoists, the scene is typical of any one of a dozen small late 19th-century shops in the industry. The works, now moribund, will probably be razed shortly.

factory-based manufacturing, processing, and extractive industries, the works of civil engineering, and the less-mobile structures of the mechanical engineer such as stationary power-producing machinery, canal locks, and the like, but excluding those objects and areas conventionally treated in and by museums. The industrial archeologist, because of the relative immobility of the structures in his domain and the fact that a few paper records have survived, is primarily a field investigator.

Interest in industrial archeology has existed in this country for about thirty years, primarily among a small group of dedicated buffs and on an organized level in the National Park Service. As a result of their efforts such significant industrial sites have been acquired and restored as the 18th–19th-century ironworking complex at Hopewell, Pennsylvania; more recently the Edison Laboratories in East Orange, New Jersey; and the right-of-way and remaining structures of the famed Allegheny Portage Railway.

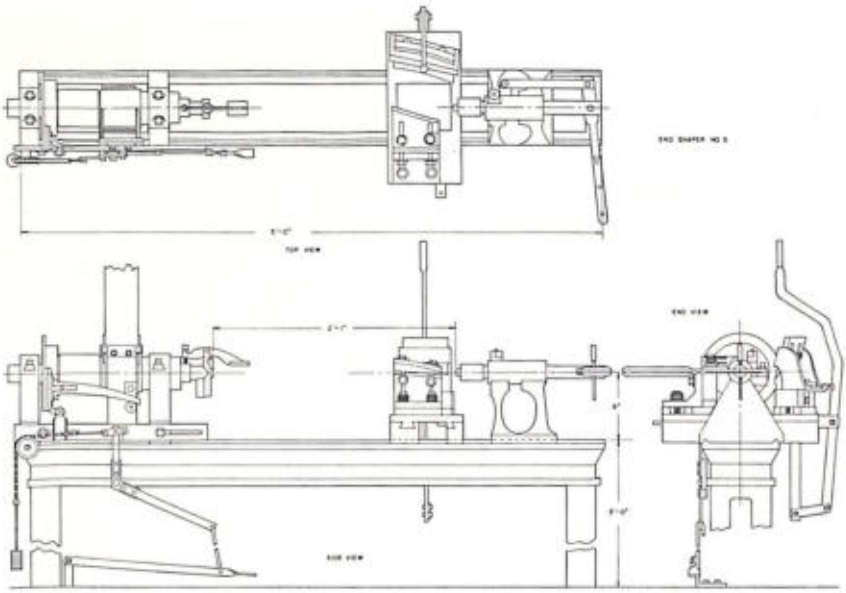
In this field the Smithsonian Institution, because of its organizational structure, for the present can best concentrate on the recording aspects of industrial archeology. This is an important contribution, however, because only a small portion of the finest and most important of industrial monuments stand a chance of being preserved. Unlike residential buildings, where adaptive use is feasible, it is only the rare industrial structure—bridge, canal, or mill building—that can easily be adapted for a purpose other than that for which it was originally intended, and if it occupies a valuable site or is large and expensive to maintain, which

it usually is, demolition is almost certain once it has become uneconomic. Thus, while a detailed graphic record may be a poor substitute for the object, it is better than no record at all.

Formal recording of industrial structures in the United States began in the Great Depression when the WPA established the Historic American Buildings Survey, under which unemployed architects were hired to make accurate measured drawings and photographs of a large group of significant buildings. Although established as a purely architectural project, HABS also recorded a number of bridges, small mills, and factories. Today it continues this work under the National Park Service, with an increasing attempt to document industrial remains.

About three years ago the Smithsonian's division of mechanical and civil engineering, aware that the rate of abandonment and demolition was increasing as a result of obsolescence, urban sprawl, highway construction, and other disruptive economical and physical factors, undertook a series of recording surveys to increase the breadth of this direct documentation of American industrial survivals. In the first survey, in July 1965, the C. P. Bradway Machine Works was thoroughly recorded. This small Connecticut factory had just ceased the manufacture of water turbines. Its buildings, production machinery, and—most importantly—its manufacturing methods were an unusual survival of a typical late-19th-century machine manufactory, for since its founding in 1889, few of its major physical or operational elements had been drastically altered. The three-man party that surveyed it in one week made complete measurements of the building and its contents. With a tape recorder and 35-mm. camera, they produced a step-by-step account of the entire turbine-manufacturing sequence as recounted by Mr. Bradway, the elderly owner and son of the firm's founder. It was virtually a craft process, and most of the dimensional and manufacturing information existed nowhere but in Mr. Bradway's memory, an extremely common method of record keeping in the early days of the turbine and other light, limited-production machine industries.

Summer 1966 saw a similar survey made of Dudley Shuttles, Inc., a small shop in Wilkinsonville, Massachusetts, which still manufactures wood shuttles for power looms. In 1900 this was an industry of perhaps thirty manufacturers, but today the bulk of the business is concentrated in the hands of two or three large firms, with the Dudley firm as the sole remaining small producer. The firm's significance lies in the fact that much of its production machinery was designed and built on the premises, some as early as 1885, and thus represents an unusual example of a manufacturer's own ingenuity being used to meet his requirements for a group of highly specialized, largely single-function machines.



Finished survey drawing of one of the specialized, "homemade," shuttle-manufacturing machines at Dudley Shuttles, Inc. The machine's function is to round off the ends of the rough shuttle blanks to permit smooth passage through the warp threads in the weaving process.

Here, as in the Bradway survey, it should be noted, is exhibited one of the basic principles for determining priorities in industrial archeology—the threat of extinction—for the advent of the high-speed, shuttleless loom, will in several decades make the shuttle largely obsolete.

In the Dudley survey, in which HABS cooperated, the buildings were fully measured. The greatest part of the work, however, was devoted to recording the unique production machinery and the manufacturing process. The Dudley-built machines were measured and fully photographed and the sequence of production photographed and described, from the raw persimmon-wood block to the finished shuttle—which is a deceptively simple looking but highly sophisticated device.

During this 1965–1966 period a number of minor surveys were also conducted by the division. Most of these covered a series of iron bridges of the era 1850–1875 when the development of shop-built, prefabricated iron railway and highway bridges was in its infancy. Of the thousands of those spans that once existed, very few remain, and, with one or two exceptions, these are in anything but secure positions.

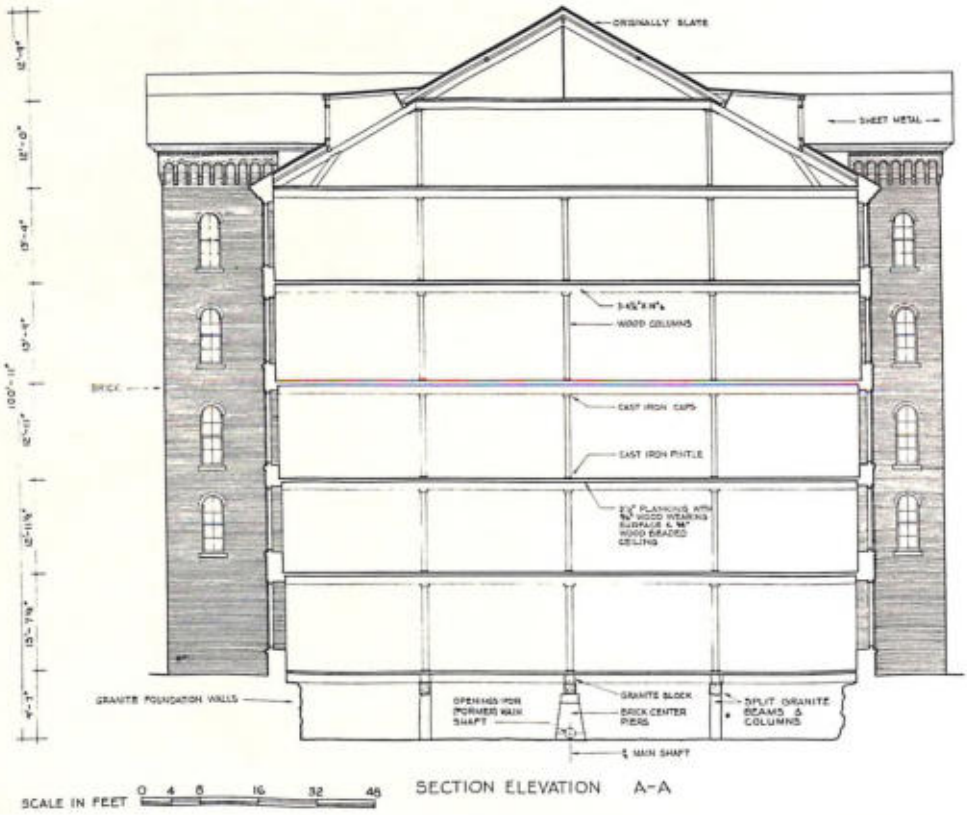
These beginning efforts culminated, in summer 1967, in the New England Textile Mill Survey, organized by the division of mechanical and

The Crown Mill, North Uxbridge, Massachusetts. A strikingly handsome building, built in 1823 during a period of enormous growth of the cotton textile industry in New England, it is diminutive in comparison to the huge brick mills in the urban textile centers like Lowell and Manchester. The Crown is typical of the hundreds built along the region's lesser rivers and streams, and is one of very few which have survived unaltered. The site is shared with a twin mill, the Eagle, built in 1827. As their fate at the moment is in doubt, the urgency of their recording by the New England Textile Mill Survey is clear.

civil engineering and co-sponsored by HABS and the Merrimack Valley Textile Museum of North Andover, Massachusetts. Goal of the survey was to produce a full-scale graphic record of a selected group of early textile-mill buildings in New England, the cradle of the industry in America.

As the first industry in this country to be systematically organized on the factory system—with all operations from raw material to finished product carried out under one roof—it seemed to be the logical starting point for a series of "industry" surveys, for while the machinery and operational aspects of the industry have been analyzed and the artifacts preserved, little has been done to determine how the physical plant that housed the machinery evolved from its late-18th-century beginnings to about 1900, by which time mill design had become practically standardized.

The survey team consisted of five architectural students, from universities around the country and as far away as Hawaii, who both measured



Sectional drawing through one of the Lawrence mills covered by the 1967 New England Textile Mill Survey project. The Pemberton, built in 1860–61 as a cotton mill, remains in use today as a plumbing supply warehouse, and has a fairly high probability of long life. A change in the economics of either the industry or the particular firm, however, could result in the building's obsolescence and demolition overnight.

the buildings and produced the finished drawings. One of the students also acted as photographer. Much of summer 1967 was devoted to recording a number of mills in the Manchester, New Hampshire, complex of the former Amoskeag Manufacturing Company, once the largest textile producer in the United States on a single site. Most of the Amoskeag buildings remain as they were at the time the company was liquidated in 1936, and are now occupied by a wide variety of other industries. The Amoskeag site, the earliest buildings of which date from 1838, is important as the only one of the half-dozen major New England

textile centers that remains largely intact. Others such as that at Lowell have been ravaged by urban renewal and highway projects which destroyed much of their value as total records, and even the Amoskeag complex is now threatened by an urban-renewal scheme—the main reason for beginning the survey there.

A group of large mills at Lawrence, Massachusetts, was similarly recorded, as were two small rural mills in Rhode Island and southeastern Massachusetts—a type fully as important in the development of the textile industry as the great mills clustered in the major centers. The 50 drawings and approximately 500 photographs produced by the 1967 survey have been permanently deposited in the HABS collections in the Library of Congress, where they are available for study and use.

In summer 1968 the survey is being continued among a group of mills remaining in the once-important textile cities of Fall River, Massachusetts, and Woonsocket, Rhode Island. These will be treated as individual structures rather than as parts of a unit complex, as was done at Manchester. In addition, it is planned to record as completely as possible the entire small mill village of Harrisville, New Hampshire, a remarkable survival of the company town, that peculiar American industrial-economic-social phenomenon which characterized a large segment of the textile industry in New England throughout most of its active history. Few remain as cohesive units, but in Harrisville, the woolen mill is still in operation, with most of the village dependent upon it. As in the previous summer's work, use will be made of such techniques as low-level aerial photography from a helicopter for recording interrelationships between buildings and site elements, and of aerial photography from higher flying planes where building details are inaccessible or complex.

With this documentation of the textile industry in hand it will be possible to achieve an overall view of a single class of structure which, regardless of the geographical location or time of construction, was designed to meet a specialized requirement, and by this means to observe changes in the relationship between the functions served and the structural solutions to the problems these changes presented.

As we noted, only a few states and private institutions are actively investigating industrial remains within their own provinces. It is a source of regret that interest in such activity is not more widespread, for the present effort is not enough to keep pace with the accelerating destruction of even the most important industrial monuments.

Some encouragement is to be found in the increasing number of graduate courses in material culture being offered by American universities,

A team of Smithsonian staff members, George Washington University graduate students, and "friends of the Museum" on a preliminary survey of the remains of the early 19th-century iron works at Principio Furnace, Maryland, in April 1968. A major survey is planned of 18th-century workings on the site in conjunction with the Museum's participation in historical studies connected with the Bicentennial of the American Revolution.

particularly in the Middle Atlantic States. In at least three universities—George Washington, Delaware, and Pennsylvania—these courses strongly emphasize fieldwork that can and often does include work in industrial archeology.

The Smithsonian, by means of its interdisciplinary-cooperative program with George Washington University, has been able to influence in this direction, a small but avid group of students who, over the past year or so, have taken part in several of our formal surveys and have conducted several of their own under Museum staff guidance, making it possible to record a number of sites and structures in the Washington area which otherwise could have been lost. It is in such methods that the greatest hope lies for interesting, encouraging, and training the coming generation of historians to have a proper perspective of the working relationship that should exist between the physical and paper documentation of American technology.

ROBERT M. VOGEL, *Curator*
Division of Mechanical and Civil Engineering

Research and Publications

OFFICE OF THE DIRECTOR

Robert P. Multhauf spent a part of the past year on sabbatical leave at Heidelberg where he continued his research on the history of the concept of specific gravity and on the development of industrial chemistry from 1750 to 1850.

A book-length history of early American navigational instruments, entitled *The Sign of the Quadrant,* by Silvio A. Bedini, was completed for the press. This is the first of a three-volume study in preparation on early American mathematical practitioners. During the past year several of his papers on scientific instruments and experiments with the measurement of time have appeared in American and Italian publications.

The research efforts of the section of mathematics this year were concentrated on the development of the modern computer. With the support of the American Federation of Information Processing Societies, the section, under Uta C. Merzbach's direction, intensified its efforts in this field, embarking on a long-range study with special emphasis on the period 1935 to 1955. This year's activities centered about the development of relay computers and mechanical differential analyzers.

Supplementing its overall research efforts in the history of mathematical instruments, the section greatly expanded its bibliographical reference file on mathematical instruments. A chronological file covering the period from 1890 to 1945 is now available to scholars.

SCIENCE AND TECHNOLOGY

Jon Eklund joined the staff as assistant curator of chemistry and Audrey Davis as assistant curator of medicine. Eklund is working on early 19th-century experimental techniques; Mrs. Davis is studying the development of medical chemistry in the 17th century. Deborah Warner was appointed assistant curator of astronomy and meteorology and is continuing her research on late-19th-century astrophysics. Assistant curator Sandra Herbert worked on new methods of presenting the history of science in exhibits.

The department's activities in graduate training this year reached a point at which the need for a somewhat more organized program became apparent. Hopefully this can be arranged without losing the in-

formality of curator-student relations in a matrix of course credits and organized seminars. In addition to having curators act as the principal academic advisers for graduate projects, the department sponsored a one-day Atlantic Coast conference, primarily for graduate students, organized by Bernard Finn; it was well received and will be repeated next year. The division of medical sciences will be host next year for the well-established mid-Atlantic seminar on the history of medicine. The American Academy of the History of Dentistry met here in October.

Our program of visiting professors at the University of Pennsylvania continues; Bernard Finn was in residence in Philadelphia during the fall semester, and Edwin Battison during the spring. Melvin Jackson and Sami Hamarneh will go to Pennsylvania next year. Several members of the staff participated in the teaching program in American Studies.

Both the history of theoretical science and the history of technology have aroused student interest, the former more especially with University of Pennsylvania students and the latter in the industrial archeological projects directed here by Robert Vogel. Any coordinated program will have to face the problem of whether these very different subjects can be put together meaningfully for students, or if indeed they should be.

A beginning, at least to the point of bringing the history of theory and experiment together, has been made in the division of electricity. Finn continued his experiments on the actual performance of historic telephone and radio equipment. John Miller spent the year as a predoctoral fellow studying the work of Henry Rowland, including tests on the Rowland apparatus here. This is a very distinct way, albeit a methodologically difficult one, in which Museum collections can offer areas of historical research which are not available to most university scholars. Several other curators are discussing similar possibilities in their subjects.

In the growing area of industrial archeology, several field projects were conducted or sponsored by the division of engineering. Vogel spent the summer of 1967 directing an architectural survey of a representative group of early New England textile mills, preparing graphic records which will survive the now rapid demolition of such buildings. Recording the material remains of a particular industry rather than those of a specific area is a relatively new practice in the United States. The survey was jointly sponsored and funded by the Smithsonian through its Research Foundation, by the Historic American Buildings Survey of the National Park Service, and by the Merrimack Valley Textile Museum of North Andover, Massachusetts. The survey will continue in the summer of 1968.

In winter the cutting building of an early quarry at Seneca, Maryland, was measured and documented by a group of students; the results have been deposited in the HABS archives at the Library of Congress. A student recorded a fine grist mill in the area. Several staff members made a preliminary survey of the Principio Furnace site in Cecil County, Maryland, preparatory to more extensive work. Vogel chaired sessions on industrial archeology at meetings of the Society of the History of Technology and the Society for Historical Archaeology; and in October he was appointed by Governor Spiro Agnew of Maryland to the Governor's Consulting Committee on Historic Landmarks. He is a consultant to American Heritage for their Smithsonian Series book on American bridges, canals, and tunnels.

An impressive scholarly publication is John White's *American Locomotives, An Engineering History 1830–1880,* being published by the Johns Hopkins Press. This large, handsome book (528 pages and 240 illustrations) is the climax of ten years of research by White and is the most comprehensive work on the subject yet published. Articles by Finn and Cannon in the *Smithsonian Journal of History* illustrate the breadth of our research interests in the history of the physical sciences.

Sami Hamarneh returned from a year of sabbatical leave during which he studied Arabic manuscripts on medicine and pharmacy, principally in Egypt. His paper delivered at the International Symposium on the History of Medical Education in Los Angeles offered a significant reinterpretation of the role of some major Islamic scientists.

The division of transportation has revised its railroad hall leaflet and produced a new vehicle hall leaflet. A recording of the sounds of the 1401 locomotive, made with the assistance of a grant from the Southern Railway, is available at the Museum Shops. The descriptive catalog of the automobile and truck collection was revised and expanded by Don Berkebile, and will soon be available to the public. Melvin Jackson is working with the Office of Exhibits on an educational film, "The Workings of the Wind Ships."

ARTS AND MANUFACTURES

Chairman Philip W. Bishop continued research into the distribution of economic resources in the United States prior to the Civil War as background to the development of manufacturing technology. An educational booklet was prepared to provide visitors to the hall of petroleum with a general context for the exhibits.

As a member of the government-industry committee organized by the Bureau of Mines to celebrate the centennial of the discovery of helium,

Demonstrations in the spinning area were an important part of the "Copp Family Textiles" exhibit which opened in March.

Bishop developed the design for a commemorative exhibit and organized the collection of material to be sealed into the time columns of the Amarillo memorial structure.

During the year, the research on "Living Historical Farms," conducted under a grant from Resources for the Future and in cooperation with the Department of Agriculture and the Department of the Interior, was completed by the professional research staff of the division of agriculture and forest products. A technical report, "The Past in Action," was prepared in November and an illustrated report will be published by the Smithsonian Institution Press in the coming year.

In October a gathering of scholars representing both the biological sciences and the humanities attended a three-day symposium at the Smithsonian to exchange information on the topic, "Eighteenth-Century Agriculture: Science, Technology, Life, Customs, and Politics." The symposium was jointly sponsored by the Smithsonian Institution, the Agricultural History Society, and the Accokeek Foundation. Scientists and historians from both the United States and Europe delivered papers dealing with a number of aspects of 18th-century agriculture. The symposium papers will be published in the coming year as a special issue of the *Agricultural History Journal.*

In cooperation with Clyde T. Lowe of the Department of Agriculture,

At the "Copp Family Textiles" exhibit, Mrs. Helene Bress, a local weaver, demonstrates how a blue and white check linen was made. At right, fringes and the implements used in their making.

the division is attempting to provide working plans of 19th-century agricultural implements that would be suitable for introduction into the more primitive agricultural areas of Thailand. This is an informal pilot project which the division hopes will pave the way for more ambitious projects in the future.

Research continues on a general history of American agriculture, 1607–1967. In anticipation of the Bicentennial of the American Revolution, the division is undertaking a major study of American agriculture during the period 1775–1783 with particular reference to the impact of the Revolution on American agriculture.

The professional staff of the division of ceramics and glass concentrated on several major research programs. Paul V. Gardner, curator, completed the manuscript for his biography of Frederick Carder, founder of the Steuben Glass Works. He spent six weeks in Europe studying ceramic and glass objects in museums and private collections, checking data on Carder's early life in England, and making preliminary arrangements for an exhibition of Carder glass at Pilkington's Glass Museum to coincide with the publication of the Carder biography. He spent a week in mid-December at the University of Wisconsin acting as advisor to graduate students in glass technology and ceramics.

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Associate curator J. Jefferson Miller II completed his research on ceramics from the 18th-century site of Fort Michilimackinac, Michigan.

Gardner and Miller continued work on the catalog and research on objects in the Hans Syz collection of 18th-century European porcelain. As board members of the Wedgwood International Seminar, both assisted in the 13th Wedgwood International Seminar held at Charlotte, North Carolina. They also chaired ceramic and glass sessions at Pennsbury Manor Americana Forum, Morrisville, Pennsylvania.

Elizabeth Harris, who had been a consultant in the division of graphic arts since 1966, was appointed assistant curator in November and has continued to work on a catalog of the photomechanical collection. In collaboration with museum technician James Spears, she has been studying the construction of old wooden printing presses and preparing the plans of a working model for a future exhibit.

On his return from a research trip to Lacock Abbey, England, ancestral home of William Henry Fox Talbot, curator of photography Eugene Ostroff began work on an illustrated catalog of the large Lacock Abbey collection of photographs and other items related to the work of Fox Talbot. He is also writing a monograph on this scientist and his photographic and photomechanical inventions. Under a Smithsonian Research Foundation grant, two special assistants worked full time with Ostroff on these extensive projects. He also continued his studies on the preservation and restoration of photographs, including the earliest processes, and summarized the care of all types of photographs in his article "Preservation of Photographs," in *The Photographic Journal.*

Associate curator of manufactures and heavy industries John N. Hoffman continued his research on the history of canal transportation in relation to the development of the coal industries of Pennsylvania, and the mechanization of the coal industry.

Associate curator of textiles Rita J. Adrosko continued her research on shawls and European folk origins of American coverlets with one month's official leave in England, Scotland, Belgium, Germany, and The Netherlands. She also examined important manuscripts on weaving and dyeing in Pennsylvania collections. Mrs. Grace R. Cooper, curator, examined numerous spinning wheels in New England collections in her research on the spinning wheel in America. She also initiated work on a second volume on the history of sewing machines; this one to continue the history from 1875 to 1925. Museum specialist Doris M. Bowman was on one month's official leave researching the collections and libraries of New England in her continuing study of lace and needlework.

CIVIL HISTORY

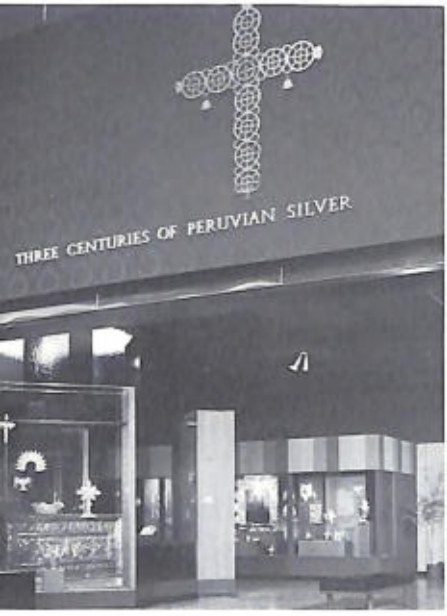
This year has been marked by the increasing integration of research, education, exhibition, and collecting. There has been a broadening, also, of such recently innovative research techniques as historical archeology and data-retrieval systems. Involvement with graduate-level education programs; development of improved methods of communicating to the public, such as by musical performances, television, radio, or film; and participation in social-action programs, such as the Anacostia Neighborhood Museum and activities on the Mall, have exemplified the Smithsonian's response to changing contemporary needs.

The advancement in April of Richard H. Howland to the position of Special Assistant to the Secretary left vacant the position of chairman. This had been filled on an acting basis by C. Malcolm Watkins, curator of cultural history.

Watkins returned from a sabbatical leave, during which he studied American folk pottery under a grant from the Smithsonian Research Foundation. In a collaborative project related to these studies, Mrs. Jacqueline Olin, research chemist in the conservation analytical laboratory, has been at the Brookhaven National Laboratory conducting neutron-activation analysis of sherds from certain historic sites.

Salvage archeology, continued in Alexandria, Virginia, by archeological aide Richard J. Muzzrole, has been extended to two sites in the District of Columbia—the Third Street freeway tunnel across the Mall and the area being excavated for the FBI building on Pennsylvania Avenue. The recovery in the latter site of a copper box revealed a minor historical event regarded as important in an earlier, more innocent Washington. The box, containing old newspapers and other documents, was bulldozed from the cornerstone of the long-forgotten Temperance Hall on E Street, NW., and retrieved by Muzzrole. Research by him and by students in the Smithsonian graduate program in American Studies has disclosed that the dedication of this cornerstone and its contents on 4 July 1843, was the occasion of parades, speeches, naval gun salutes, and the joining of white and free Negro associations in a great celebration. The recovery of the box exemplifies the archeologist's capacity to resurrect the immediacy and reality of the past in small fragments which can be joined together in a meaningful, historical mosaic.

Associate curator Richard E. Ahlborn conducted intensive studies in areas of Spanish-American cultural history. After collecting specimens in Peru for the exhibition, "Three Centuries of Peruvian Silver," he traveled to California and New Mexico to study Spanish colonial col-



Above left, entry to exhibition of "Three Centuries of Peruvian Silver" held in November; right, associate curator Richard Ahlborn of the Smithsonian, Sra. Sara de LaValle, curator of the Museo del Arte in Lima, and collector Sr. Constante Larco Hoyle of Peru unpack and catalog the more than 200 pieces for the exhibit. Below, a portion of the silver exhibit.

Museum technician Betty Walters posting cards on the Termatrex machine for a multi-index file, part of cultural history division's Termatrex data-retrieval system.

lections in museums and churches. His resources have been increased by Mrs. Otto Pike's generous gift of her card-file notes on the material culture of Puerto Rico.

Mrs. Betty Walters completed a manuscript on patented desks and other specialized office furniture made in the third quarter of the 19th century. The Termatrex data-retrieval program, which she has furthered, now covers more than 5,900 objects, permitting the use of this system to provide immediate information in many combinations.

Associate curator Rodris Roth continued her investigations of furniture shown at the Centennial Exhibition in Philadelphia, while collaborator Joan Pearson Watkins added many new photographs to her pictorial document of California vernacular architecture.

Curator Peter C. Welsh completed an introduction for David Macbride's 1778 essay "An Improved Method of Tanning Leather," which will be reprinted in *The Smithsonian Journal of History*. He continued his research on the subject of American folk art and on the Harry T. Peters lithography collection with special focus on the political prints of Henry Robinson. For the Cooperstown graduate program in history, museum training, and American folk culture, Welsh conducted a six-week course on "Material Aspects of Naïve Art." In August, Welsh was appointed editor of *The Smithsonian Journal of History*. He was a member of the program committee for the 1968 annual meeting of the American Association for State and Local History and served as a consultant for the Franklin Delano Roosevelt Warm Springs Museum and Little White House. In January he began a year's sabbatical leave.

Assistant curator Anne C. Golovin completed a paper "Daniel Trotter,

Eighteenth-Century Philadelphia Cabinetmaker," which has been accepted for publication in the *Winterthur Portfolio*. She continued her research on the Harral-Wheeler House of Bridgeport, Connecticut, and its gothic-revival furnishings.

Museum technician Anne Marie Serio pursued her study of the 1848 national convention of the Free Soil Party and related political caricatures in the Harry T. Peters lithography collection.

Associate curator Keith E. Melder continued research on women's status in the United States and on educational reform in the 19th century. His major investigations centered on events between 1765 and 1770 leading up to the American Revolution and on the general cultural and technical history of the Revolutionary period. Associate curator Margaret B. Klapthor did additional research on White House history, particularly on the study of china from all administrations. She and assistant curator Herbert R. Collins progressed in their joint research on presidential inaugurations. Collins continued his study of American political campaign bandannas and kerchiefs and began research on campaign headgear.

An important contribution to numismatic studies was made by curator V. Clain-Stefanelli, who completed research on the ancient gold coinages of Kallatis. The results of this project were read by associate curator Elvira Clain-Stefanelli in August to the International Numismatic Congress in Copenhagen. The paper will be published in *Museum Notes* of the American Numismatic Society.

In October Mrs. Clain-Stefanelli participated as United States representative in the 12th Congress of the International Federation of the Medal in Paris and arranged for an exhibit at the Paris Mint of medals engraved by 38 American artists in the period 1960–1967. Her proposal to publish "Medailles" as a bilingual periodical with French and English texts, thus contributing to a larger distribution in English-speaking countries, was adopted by the Congress. The first bilingual issue is in preparation.

John Fesperman, curator of musical instruments, produced an article describing the Smithsonian collections and musical program for the spring issue of *Current Musicology*. He is continuing his research on organs in Guanajuato and Mexico City, and on the four chamber organs of John Snetzler in the United States. Associate curator Cynthia A. Hoover is completing a paper on a trumpet battle at Niblo's Pleasure Gardens to be read at the national American Musicological Society meetings at Yale University in December 1968. Conservator Scott Odell

is working on a description of the restoration of the Stehlin harpsichord.

Carl H. Scheele, associate curator in charge of philately and postal history, continued research on devices for handling and processing developed and adopted by the Post Office Department, touching upon the pneumatic-tube service, the Chicago tunnel system, canceling machines, office-building mail chutes, and wagon and automobile services. In May he participated in Washington meetings held in connection with the fiftieth anniversary of the United States airmail system. During the winter he prepared a commentary based on original research for the President's Commission on Postal Organization.

Scheele was appointed chairman of the committee to select the best article to be published in the forthcoming *Thirty-Fourth American Philatelic Congress Book* for the Walter McCoy memorial award. He served as a juror for selecting the design of the 1968 migratory bird hunting stamp issued by the Department of the Interior, and lectured locally on rare stamps in the division's collection.

Assistant curator Reidar Norby continued his study of postal connections between the United States and Scandinavian countries during the 19th century and began research on the counterfeited Kansas and Nebraska overprinted United States postage stamps, in cooperation with the Bureau of Engraving and Printing.

Claudia B. Kidwell, assistant curator in charge of the section of American costume, pursued a study of 19th-century dressmaker's drafting tools as well as continuing her research on 19th-century costume accessories.

There has been increasing participation by research grantees and outside investigators. Frederick Fried, an authority on American folk sculpture in wood, provided a detailed report and analysis of folk carvings in the collections. Mrs. Maureen Cole, a member of the staff of the Henry Francis duPont Winterthur Museum, spent most of the year photographing and recording 18th-century objects for the Winterthur Museum's nationwide index of American decorative arts. Research fellow Carroll Greene participated in the research and exhibition program commemorating the American Revolution and collaborated in planning exhibits on Afro-American culture.

Associate curator Margaret B. Klapthor advised the White House on the design and production of the new Johnson White House china.

Many staff members participated in seminars and orientation lectures in the Smithsonian graduate program in American Studies, as well as counseling reading students in the program.

ARMED FORCES HISTORY

Research in underwater exploration techniques and documentation of historical underwater sites continued as the major project of chairman Mendel Peterson. Under a grant from the Explorers Research Corporation, an intensive electronic survey of Bermuda waters was made in cooperation with the government of Bermuda and Edward Tucker. Large areas of the outlying reefs and fringing coral reefs were swept with a late-model proton magnetometer.

On the south coast of the islands a new deposit of material from the *Virginia Merchant* was discovered. This ship, bound for the Virginia colony, was dashed on the rocks and sunk in 1660. The same search procedures were employed in Castle Harbor in a search for the *Warwick* which sank in a violent storm in 1619. After several days of sweeping, a strong impulse indicating deposits of iron was received from an area lying on the south shore of the harbor near the property of Clay Frick. Subsequent exploration of the site with the airlift proved that the *Warwick* remains had been found and that they lay in deep silt in twenty feet of water. A permit to explore the site was issued and it is hoped that funds will be forthcoming to explore the remains of the vessel in the fall of 1968.

Peterson continued research into the marking and decoration of muzzle-loading guns and other armament recovered from underwater sites. He completed two chapters for a book on marine archeology to be published by UNESCO in Paris, a chapter on marine archeology in a general work on oceanography to be published in the winter of 1968, and a chapter on early shipping in the New World for a book on man and his seafaring which is being edited by George Bass of the University of Pennsylvania.

Museum specialist Alan B. Albright continued his investigation of methods of preservation of materials recovered from underwater sites. The appointment of Joseph M. Young as laboratory assistant has aided this project.

Curator of military history Edgar M. Howell and museum specialist Donald E. Kloster of the division of military history continued work on a multivolume, descriptive, critical, and documentary catalog of United States Army dress to include uniforms, headgear, and footwear. The first volume of this project, *United States Army Headgear to 1854,* is scheduled for publication in September 1968. Much of the research and writing for the second and third volumes—*United States Army Uniforms to 1857* by Kloster and *United States Army Headgear, 1855 to Date* by Howell—is complete and work is continuing. This project is

Dana M. Wegner, a summer intern, taking the hull lines off a half-model of an unidentified monitor.

being performed in conjunction with a comprehensive recataloging and documenting of the uniform collections. It is a highly significant undertaking in that the uniform collections of the division are the most comprehensive in America. In connection with the project, Kloster performed research in the New York Historical Society and the Museum of the City of New York.

Howell continued his study of contemporary military graphics and completed an article on the combat art of Harvey Dunn for publication in *The Smithsonian Journal of History*.

Associate curator Craddock R. Goins, Jr., concentrated on the preparation of a detailed documentary catalog of patent models in the firearms collection, assembling patent drawings, specifications, affidavits, and other documentary material from the National Archives and the Patent Office.

In support of the American Studies Program, Howell lectured on the Revolutionary Army.

Naval curator Philip K. Lundeberg published an extended article in which he demonstrated that mine and submarine warfare during World War I exerted a crippling influence upon the Allies' peripheral strategy, frustrating Western efforts via the Dardanelles and the Baltic

to establish a common maritime front with Tsarist Russia. He also published a study on the United States response to tonnage warfare.

Museum specialist Howard P. Hoffman continued work on a superbly detailed model of the Continental gondola *Philadelphia,* plans of which will appear in a forthcoming publication on Benedict Arnold's Champlain squadron. Besides assisting the Japanese television industry in preparing footage for a centennial series commemorating the Mejii Restoration, the division of Naval History sponsored a lecture by Rear Admiral John D. Hayes on "Sea Power in the Civil War and Today: the Du Pont Letters," in cooperation with the Naval Historical Foundation and the American Military Institute.

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The Collections

CARE AND CONSERVATION—GIFTS AND ADDITIONS

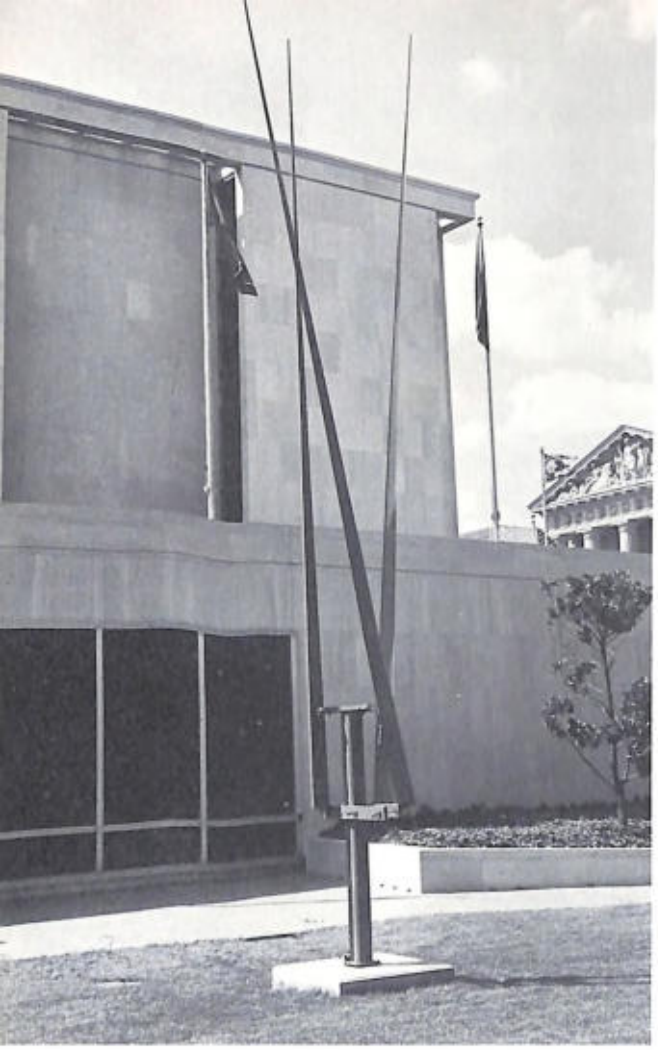
Mathematical items added to the collections, aside from miscellaneous single mathematical instruments, consisted mainly of documentary material related to digital computers. Among various individuals and corporations who donated materials, Grace Murray Hopper provided a variety of important items related to the history of programming, and the Rand Corporation contributed a large quantity of technical manuals and other descriptive materials.

Science and Technology

In medical sciences, new additions were: an early Julius H. Hess infant oxygen unit for premature infants; a rare Egyptian sacred amulet with multiple eyes (about 600 B.C.), gift from E. R. Squibb & Sons, Inc.; an original prototype dermatone for cutting skin grafts in the treatment of severe wounds and similar injuries, invented by George J. Hood in cooperation with Earl C. Padgett; a 1925 Tycos recording sphygmomanometer for measuring blood pressure in the arteries; an original stapling apparatus for small blood vessels invented by Dr. Julian A. Sterling; and about 45 Japanese medical, pharmaceutical, and dental antiques from the Tokugawa Shogunate period (1603–1867).

A handsome oil painting by J. Shreeve in about 1855, showing two firemen of the Northern Liberties Fire Company of Philadelphia, was given to the Museum for the division of transportation by the Society of Oldest Inhabitants of Washington, D.C. Reynolds Metals Company presented a fine scale model of an aluminum hopper car which illustrates the novel design and construction of the modern freight car. The marine collection was enriched by a half-model of the famous clipper ship *Flying Cloud,* a gift of Henry G. Currier.

Notable additions to the collections in engineering were: the Bathe Collection of steam-engine models, literature, and manuscript material; the Willans high-speed steam engine and generator, circa 1880, the first and most widely used engine for direct coupling to electric generators; 15 watercolors of American railroad stations by Ranulph Bye; an oil painting, "Harlequin," by Lili Rethi, showing the Verrazano-



Three Red Lines, by George Warren Rickey, at west end of the Museum of History and Technology. Kinetic sculpture of welded stainless steel, painted. The blades, 32 feet long, taper in width from 8 inches to ¾ inch. From the Joseph H. Hirshhorn Collection.

Narrows Bridge under construction; a 17th-century striking and alarm clock with Gothic decorative elements; a Massachusetts shelf clock by Aaron Willard; and a very unusual lighthouse clock patented by Simon Willard.

As the opening of the hall of electricity appeared to be drawing nearer, increased emphasis was placed on obtaining objects that would fill important gaps in the collections. Of particular note was a collection of tubes and notebooks from his early work received from television pioneer Philo T. Farnsworth. Another item was a 1939 Scott FM radio receiver from Charles A. Curtze which will be used in a demonstration to help illustrate, through actual operation, the relative merits of AM versus FM broadcasting at the time FM was introduced. In June, curator Finn made a field trip to Newfoundland to investigate the early telegraph equipment still extant in the Atlantic-cable landing stations.

Philo Farnsworth in about 1934, holding a dissector-multiplier tube like one in a group given to the Smithsonian.

Meggers infra-red spectrograph, from the Bureau of Standards.

Below, 18th-century British theodolite by J. Sisson. This probably documents a development toward smaller size for greater stability.

Eighteenth-century circumferentor by Thomas Wright, a standard British surveying instrument.

These stations have recently been taken out of service, and Western Union International has indicated its desire to make some of the equipment available to the Museum.

There were significant accessions in the physical sciences in the field of spectroscopy. The Meggers infrared spectroscope has just been retired to us by the Bureau of Standards. It is scheduled to be an impressive operating exhibit of the precision equipment used by a modern physicist. Two spectroscopes used by the pioneer American astrophysicist

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Charles A. Young in his studies of the sun were donated by the Princeton University Observatory. One, made by Alvan Clark and Sons in 1877, is equipped with a diffraction grating ruled on a Lewis M. Rutherford engine; the other, holding up to six prisms, was made by Grubb of London.

Two 18th-century English surveying instruments, a theodolite by J. Sisson, and a circumferentor by Thomas Wright, were acquired. It seems likely that study of the former will lead to significant results with respect to the development of basic surveying instruments.

The division of physical sciences is making a serious effort to acquire works of art related to science. Pride of place goes to the contemporary art form called "Astralite III" donated by the artist, Adam Peiperl, which features ever-changing colors floating in a globe. A number of 18th-century prints and engravings were also acquired.

Arts and Manufactures

John Deere Company of Moline, Illinois, presented a John Deere garden tractor. A 1908 Fitzhenry-Guptill power sprayer was given by the Department of Agriculture; a 1921 truck and 1921 tractor seat by Bostrom Corporation, Milwaukee, Wisconsin; a one-way disk plow by Francis Angell, Plains, Kansas; and a 1961 experimental gas-turbine tractor by the International Harvester Company, Chicago, Illinois.

To the ceramics and glass collections came 20 pieces of 18th-century European and Oriental porcelain from Dr. Hans Syz; especially noteworthy was a fine Chantilly bowl, circa 1740, decorated in Kakiemon style. Mrs. Florence E. Bushee donated 27 rare 19th-century European and American paperweights, and The Academy of Natural Sciences of Philadelphia donated a splendid collection of sixty 20th-century porcelain birds manufactured by Edward Marshall Boehm, Trenton, New Jersey. The latter collection, originally given to the Academy of Natural Sciences of Philadelphia by Mr. and Mrs. Morris Gastwirth, was transferred to the Smithsonian Institution with their kind permission.

From Mrs. Harold G. Duckworth came a unique collection of 720 19th-century American pressed-glass cup plates which comprise an index collection and are most important in documenting the history of the American glass industry. From Eugene D. Buchanan, five important 18th-century ceramics were received, including an extremely interesting Leeds cream-colored earthenware teapot; and from Mr. and Mrs. Edward M. Pflueger, five pieces of 18th-century European porcelain and faience. Outstanding in this gift is a Höchst porcelain, Italian comedy figure dating about 1755. From Mrs. Nathan Cummings came a most unusual English Jackfield jug, circa 1750, beautifully painted

English salt-glazed stoneware drinking vessel in the form of a bear, shown above. At right, English cream-colored earthenware figure of a musician, Neale & Company, about 1790.

with birds and flowers; from Dr. Lloyd E. Hawes, 16 pieces of English earthenware and stoneware dating from the 18th and early 19th centuries; from Dr. and Mrs. Laverne G. Wagner, five pieces of Carder Steuben glass; from Mrs. William A. Sutherland, 8 pieces of 18th-century English porcelain, including an especially fine Worcester pitcher painted with exotic birds; from Samuel L. Zeigen, a splendid pair of Meissen figures with baskets, circa 1740; from Marshall Zeigen, a very important set of three Bow vases, circa 1755; from Lyle N. Perkins, a fine, large reduction-fired slab pot.

A long-range program of cataloging and cross-referencing the print collection by subject matter was begun in the division of graphic arts.

Accessions included the Scan-A-Graver 559, one of the first electronic halftone engraving machines, the gift of Fairchild Graphic Equipment; and a set of printing-roller casting equipment dating from around 1900. Among additions to the print collection were 28 bound volumes of cartoons by Martin Branner, from the artist; some 300 original cartoon drawings by contemporary artists from the Newspaper Comics Council; prints by Saul Steinberg, Anders Zorn, John Sloan, Nalle Werner, Rune Pettersson, Jean-Henry Marlet, Gordon Grant, and Ralph Nankivell; and photoglyphic etchings by William Henry Fox Talbot.

Museum technician Horace Randolph operates a densitometer in order to determine if artificial aging has altered the transmission density of a photographic negative.

Notable additions to the history of photography collection included an autograph letter of 1852 from W. H. Fox Talbot to Abbe Moigno, defending his priority in the invention of paper photographic prints; and an autograph letter from the scientist Sir John Herschel to the photographer Julia Margaret Cameron, and a group of graphic arts prints and watercolors depicting early photography.

In England, Eugene Ostroff procured materials related to the life and work of W. H. Fox Talbot, for display in a reconstruction of Talbot's laboratory in the new hall of photography. These items include photographic apparatus, furniture, and a walking stick owned and used by Talbot.

Gifts of special interest were a tricolor "one-shot" Color-Scout camera from Fairchild Graphic Equipment; an early Ives Kromskop three-color stereoscopic viewer with a set of Kromogram color-separation slides, from Mrs. Herbert E. Ives; and four cameras built for specialized applications in high-speed photography, from their designer, a pioneer in the field of high-speed photography, J. S. Courtney-Pratt. The photographer Daniel Farber also donated a group of his dye-transfer color prints, and five prints were acquired from the photographer John Brook.

David Haberstich, museum specialist, continued his project of classifying and arranging the history of photography collection, recataloging specimens when necessary and performing background research in order to expand specimen records. He revised the classification and cross-indexing system for the collection, and produced a guide to cataloging and other aspects of the section's work in order to standardize procedures. With museum technician Horace Randolph, who joined

"Orpheus and the Animals" on linen damask napkin, shown above, with mythological scenes in border, was woven in Haarlem, Holland, about 1650. At right, 18th-century linen press.

the staff in 1967, Haberstich supervised the repair and restoration of apparatus specimens intended for the hall of photography. In addition, Randolph rearranged the section's apparatus storage areas to produce greater accessibility, and inventoried and rearranged all photographic items stored at the Silver Hill facility, and started making photographic records of previously unphotographed specimens, indexing with photographs and diagrams the location of all items.

A number of important textile items were located and acquired for exhibition in the new hall of textiles. Among these were a collection of 17th- and 18th-century damask napkins from the C. A. Burgers collection, weavers' pattern and account books, an 18th-century linen press, loom and weaving accessories from Deerfield, New Hampshire, 18th-century quilt and canvas embroidery, several excellent printed textiles of the 18th and 19th centuries, and a number of textile implements.

The staff continued the cleaning, repairing, and special mounting of textiles for both a special exhibit on Copp family textiles and the

Weaver's pattern book, early 19th century.

forthcoming permanent hall. Ellen Rae Best, an undergraduate research assistant completed the initial phase of a project on adhesives for mounting fragile textiles. The limitations of this type of mounting were clearly demonstrated in her study. Numerous requests for advice on these problems are answered by the staff each year.

The division of manufacturers and heavy industries received a fine full-scale reconstruction of "Lady Godiva," a small prompt-burst reactor which was developed at Los Alamos Scientific Laboratory of the University of California. This nuclear reactor is authentically unique, historically significant, and a comprehensive symbol of nuclear energy. Kiwi-A, the prototype of the nuclear engines being developed for space transportation, was presented for inclusion in the nuclear-energy collections. An important group of brewmaster instruments was received as well as a substantial library on the art of brewing. Engineering drawings representing anthracite mining activities in Pennsylvania, a gift from the trustees of the Tench Coxe estate, were added to the coal-mining reference collections. Also, several other small donations of coal-mining tools, safety lamps, and photographs were received.

Civil History

Important broadening of the scope of the collections has resulted from associate curator Richard E. Ahlborn's research in Spanish colonial areas. The gift by Mrs. Otto Pike of 47 religious figures by the Puerto Rican folk sculptor, Pedro de Arce, enriched a group of nearly 100 other Puerto Rican carved *santos* also acquired this year. From New Mexico came several examples of native religious sculptures and Penitente cult objects, including a 19th-century death cart used in Penitente ceremonies. Staff members of the Museum of New Mexico restored several retablos and a rare 18th-century Franciscan hide painting of San Antonio that has been in the Smithsonian collections for nearly a century. These additions and upgradings of our Spanish colonial materials are significant of the Smithsonian's increasing recognition of America's cultural diversity.

Mrs. Marjorie Merriweather Post's gift of a gold chalice encrusted with more than 1,350 diamonds, made in St. Petersburg by Iver Winfeldt Buch in 1791 for Catherine the Great, belongs among the Museum's most splendid rarities. In connection with curator C. Malcolm Watkins' research numerous examples of 19th-century American folk pottery, including many decorative stoneware pieces from New York State, were acquired for the collections by collaborator Joan Pearson Watkins. A group of contemporary baskets showing residual African culture traits, made at John's Island, South Carolina, was collected by research fellow Carroll Greene.

In November the false-front facade of a Victorian butcher shop in Olema, California, was acquired for future exhibit installation. The

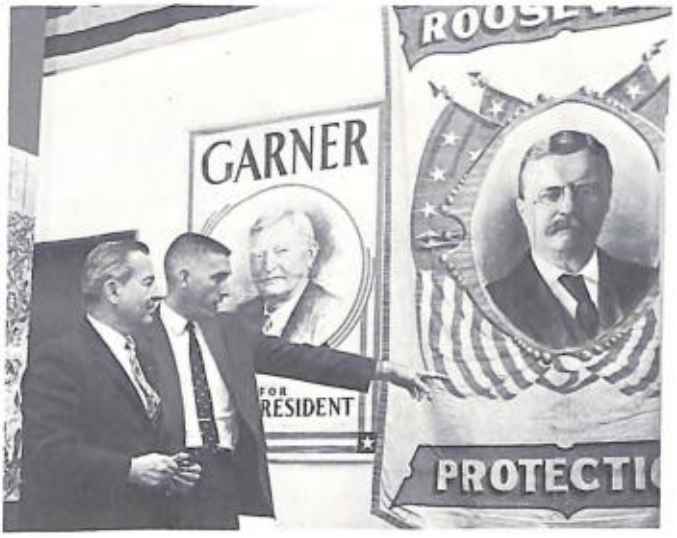
False-front facade of Victorian butcher shop in California before and during dismantling for future Smithsonian exhibit.

Archeological aide Richard Muzzrole completing the restoration of a Queen's ware pitcher of about 1800, one of many specimens recovered from salvage work in Alexandria, Virginia.

dismantling at the site was conducted by contractor George H. Watson and his carpenter Charles H. Rowell, under supervision of curator Watkins. The painstaking process of dismantling was filmed by the University of California Extension Media Film Unit, under the direction of Ernest Rose. In Washington, collaborator Joan Pearson Watkins working with the Smithsonian exhibits department's film unit, began filming the subsequent preparation and re-erection of the facade in the Museum. The completed film will demonstrate Watson's unique skills and the Smithsonian's standards of accurate restoration.

Archeological aide Richard E. Muzzrole advised "Ancient Pemaquid," an organization engaged in excavating the site of the 17th-century settlement of Pemaquid, Maine, in setting up an archeological laboratory, and conducted a training course at Pemaquid in the conservation and restoration of artifacts.

Among numerous items associated with the Wheeler family of Bridgeport, Connecticut, donated by Miss Ellen Wheeler, were nine important architectural drawings for the Harral-Wheeler House by the 19th-century architect Alexander Jackson Davis. Two side chairs and a sofa in the gothic-revival style from this house were given by Mrs. William P. Finney.



Ralph E. Becker and assistant curator Herbert R. Collins looking at a portion of the Ralph E. Becker collection of political Americana which Mr. Becker has been donating to the Smithsonian since 1960.

The collection of American costume was enhanced by the addition of 204 specimens, and work was begun on a project directed by assistant curator Claudia Kidwell to catalog and mount an extensive collection of 19th-century fashion plates.

Ralph E. Becker of Washington, D.C., continuing his generous contributions to the political-history collections, gave a gold pocket watch, tie chain, and poker chips used by Franklin D. Roosevelt. Other donations of Presidential memorabilia were a black woolen shawl worn by Abraham Lincoln, gift of Mrs. Shirley Wood; a book of trout flies used by Grover Cleveland, given by his son Richard Cleveland; and a cup and saucer used by William McKinley just before his assassination in 1901, gift of Mrs. Louis Antonsanti. From the Society of the Oldest Inhabitants of Washington, D.C., came an original 1819 desk used in the House of Representatives and a double desk of the House of Representatives designed by Thomas U. Walter in 1857. Other objects included a gold lorgnette and vanity case owned by Mary Todd Lincoln, gift of Lincoln Isham; a dress worn by Harriet Lane Johnston, niece and hostess for James Buchanan, 1857–1861, gift of the Misses Elizabeth Gray, Juliana Paca, and Margaret Beverly Taylor; and the brooch "Our Mineral Heritage," given by the executive committee of the 1967

National Gem and Mineral Show. A portrait of Emily Donelson, hostess for Andrew Jackson, by R. E. W. Earle, was lent by Mrs. Charlton Henry, and a portrait of Maria Monroe Gouverneur, daughter of James Monroe, by an unknown artist, was lent by Mr. and Mrs. Harris E. Kirk, Jr.

Portraits of James and Dolley Madison and of Mrs. Catherine Cropper were restored, and the recording of dresses of the First Ladies continued with the completion of patterns, muslin models, and sewing instructions for the dresses of Mrs. Ellen Wilson and Mrs. Edith Roosevelt.

Among important musical instruments acquired this year were an 18th-century English violin and bow made by John Marshall and John (Kew?) Dodd respectively, and a 19th-century Chickering square piano. A harpsichord by Benoist Stehlin, made in Paris and dated 1760, was restored by conservator Scott Odell with the help of museum specialist Robert Sheldon, and members of the restoration laboratory staff in the National Collection of Fine Arts, who assisted with cleaning the lid painting and case.

The restoration of a small church organ, made by Jacob Hilbus about 1811–12 for Christ Church, Alexandria, was completed in the shop of C. B. Fisk of Gloucester, Massachusetts. The first organ in the collections to be restored to playing condition, it is used periodically for concerts and informal demonstrations in the hall of musical instruments.

The continued interest of Willis H. duPont in the numismatic collections was generously expressed in his gift of an authoritative series of coins struck during the reign of Tsar Alexander II of Russia from 1855 to 1881. Significant additions to the section of ancient coins include a collection of 206 Greek bronze pieces from Asia Minor donated by the Messrs. Stack and three rare fractional silver coins from Lydia and Persia contributed by Harvey Stack, who also has acquired recent foreign issues for the collections. The Messrs. Stack also filled gaps in our modern foreign series through the gift of 1,609 pieces.

The receipt from Mr. Jon Holtzman of a hoard consisting of 1,502 early 15th-century Ottoman akchehs was one of the determining factors in establishing a special Islamic section with the help of Raymond Hebert.

Significant additions to the United States series included a collection of 109 Connecticut 18th-century cents (dated 1785–1788) donated by Theodore L. Craige. Mrs. F. C. C. Boyd gave a rare gold-assay ingot of Knight and Company, Marysville, California, bringing to three the number of American ingots in the Smithsonian collections.

Organ made by Jacob Hilbus of Washington, D.C., for Christ Church in Alexandria about 1811–12. Restored to playing condition in 1967.

J. B. Longacre's original design of 1861 for a double eagle with the motto, "Our Trust is in God," as well as other related documentation for the introduction of the motto, "In God We Trust," on our coinage, was a most important gift from the Messrs. Stack, as was an original artist's working model of a proposed design for the Washington-head quarter dated 1932. Harvey Stack presented trial impressions on cardboard of dies prepared by United States Mint engraver Charles E. Barber for commemorative gold dollars.

Mr. and Mrs. Mortimer Neinken donated 58 mostly very rare 19th-century treasury bills issued by German states and banking institutions as well as 112 notes which formerly circulated in German colonies and a specialized collection of 968 German post-World War I "pegged-value" currency issues, which are of great importance to students of financial history.

One of the earliest bank notes issued in the Western World, a Swedish

Embossed revenue stamp issued by the colonial government of Massachusetts, applied to a document on the first effective day of the act, 1 May 1755.

certificate of credit for 25 dalers in silver issued in 1666 by the Stockholm Bank, was given by Joseph B. Stack.

From the Library of Congress were obtained 685 medals and badges and 194 medals, and 511 dies were given by the Gorham Corporation, illustrating the contributions to American medallic art made during nearly one century by this company. The National Commemorative Society (Philadelphia) and the Société Commémorative de Femmes Celébres (Wynnwood) gave an impressive series of 18 platinum strikings of the medals issued by them. Through a donation received from Willis H. duPont, the series of Russian medals was increased by 287 silver and bronze pieces of the 19th and 20th centuries.

The tasks of identifying and cataloging numismatic material in the custody of the division continued as a matter of routine, although frequently interrupted by construction and installation of devices to improve security.

In the areas of philately and postal history, the Reverend Floyd S. Leach's collection of 1,454,604 stamps and covers was acquired as a bequest from the estate of Mrs. Harriett M. Leach. It includes three volumes of rare American Expeditionary Force covers from North Russian and Siberia, 1918–1920; a significant group of covers carried by balloons during the siege of Paris, 1870–1871, together with three rare "pellicules"—microfilm messages—carried by pigeons during the siege; and a very extensive collection of United States stamps and postal markings. John F. Rider, again enriching the European postal-history portion of the collections, donated a letter posted in Barcelona in 1344. An embossed revenue stamp issued by the colonial government of Massachusetts, applied to a document on the first effective date of the act—

1 May 1755—was a gift from the Milton A. Holmes Memorial Fund and E. M. Moore.

Assistant curator Reidar Norby, museum specialists Francis E. Welch and Victor H. Weill, and museum technician Frank Berek were all

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SPECIMEN TRANSACTIONS—FISCAL YEAR 1968

Departments	*Accessions (transactions) 1968 (new)*	*Received on loan*	*Exchanged with other institutions*	*Transferred to other Government agencies*	*Lent for study to investigators and other institutions*	*Specimens identified*
Science and Technology	120	1	69	0	181	3
Arts and Manufactures	195	80	0	0	56	3,205
Civil History	525	96	6	2	2,388	13,821
Armed Forces History	89	11	0	2	63	875
Total	929	188	75	4	2,688	17,904

SPECIMENS IN THE NATIONAL COLLECTIONS, 31 MAY 1968

DEPARTMENT OF SCIENCE AND TECHNOLOGY		105,865
Physical Sciences	4,732	
Mechanical and Civil Engineering	12,767	
Electricity	8,227	
Transportation	43,186	
Medical Sciences	36,953	
DEPARTMENT OF ARTS AND MANUFACTURES		157,150
Textiles	36,603	
Ceramics and Glass	19,253	
Graphic Arts	54,167	
Manufactures and Heavy Industries	36,436	
Agriculture and Forest Products	10,691	
DEPARTMENT OF CIVIL HISTORY		12,061,899
(Section of American Costume count separated from Political History this year)		
Political History	37,023	
Cultural History	26,604	
Philately and Postal History	11,658,056	
Musical Instruments	57	
Numismatics	327,121	
American Costume	13,038	
DEPARTMENT OF ARMED FORCES HISTORY		59,060
Military History	45,225	
Naval History	13,835	
TOTAL		12,383,974

engaged in reorganizing and cataloging the philatelic collections, so that the tremendously widespread interest of the public can be efficiently served.

Work continued on the information-retrieval system which is being developed for the United States cover collection. Improved security was provided for the reference-collection area.

Armed Forces History

The laboratory for the preservation of underwater finds continued treatment of materials from underwater sites. These processes included treatment of organic materials with polyethylene glycol, the direct-current reduction of iron artifacts, and reconstruction of ceramic vessels.

Most important accessions to the underwater collections were organic materials recovered from the sites of the *Warwick* and the *Virginia Merchant* in Bermuda.

An unusually comprehensive collection of shoulder-sleeve insignia were received from David N. Epstein. Also received were a rare Revolutionary-period cartridge box and an unusually fine example of a Brown Bess musket marked "29th Regt," elements of which unit participated in the "Boston Massacre."

Notable additions to the national collection of naval uniforms included a white service dress uniform, worn by Seaman Harry T. Bennett during the Civil War. Enlisted men's uniforms of the Spanish-American War era were received from Mrs. Caroline W. Budinger, Mrs. James E. Ross and Herbert L. Crook. Mrs. Ethel R. Edson donated the uniforms of Major General Merritt A. Edson, USMC.

The national collection of warship models was enriched by the donation of an original half-model (alternate lift style) of a *Passaic*-class monitor by Thomas A. Burdick and family.

Naval history continued restoration of navigation instruments in the Weems collection and prepared a series of uniforms for exhibit in the hall of the armed forces.

Educational Activities

The thrust of the Smithsonian in recent years has been toward involvement with a wider range of people in a wider area of activities. Specifically, this has brought the Smithsonian and the staffs of its museums into closer cooperation with the academic world, both teaching and student, and with the visiting public, principally Washington area residents and the Smithsonian Associates.

This activity has supplemented the ongoing program of lectures, symposiums, seminars, workshops, concerts, and recitals that have brought the public to the Museum, often during periods when it normally would have been closed.

Staff members have also been increasingly active in the presentation of lectures and scholarly papers to groups of their colleagues in cities and universities both in this country and abroad.

Listed below are some of the more important of these events and their participants.

ADROSKO, RITA J. "Early European and American Handlooms." The New England Weavers' Seminar, held on 10 July at the University of Massachusetts, Amherst, Massachusetts.

AHLBORN, RICHARD E. "Spanish New Mexican Crafts." Paper delivered in April at Third Annual Symposium for Historic Preservation (The Southern Frontier), co-sponsored by Houston Baptist College and National Trust for Historic Preservation.

———. "Ecclesiastic Silver of Colonial Mexico" and "Domestic Silver of Colonial Mexico." Two papers delivered in March at the Fourteenth Annual Winterthur Conference on Museum Operation and Connoisseurship.

———. "Silver in Colonial Peruvian Life." Paper delivered in January at the Museum of History and Technology on the occasion of the special exhibition, "Three Centuries of Peruvian Silver."

BATTISON, EDWIN A. "Repair *vs.* Restoration" Lecture delivered in June to the National Association of Watch and Clock Collectors, Philadelphia, Pennsylvania.

———. "Water Turbines and Machine Tools," consultant to New York State Council on the Arts and Jefferson County Historical Society. May 1968.

BROOKS, PHILIP C., JR. "Political Campaign Exhibits at Presidential Libraries and at the National Archives." Paper delivered in June at the Twelfth Annual Institute of Pennsylvania Life and Culture, Lancaster, Pennsylvania.

CANNON, WALTER F. "In Which Charles Lyell is Permitted to Speak for Himself." Paper delivered in September at the White Mountain Conference on the History of Geology.

———. "The Scientist and the New Civil Servant: John Herschel at the Mint, 1851–1854." Paper delivered in December at the History of Science Society annual meeting.

CHAPELLE, HOWARD I. "Colonial Ship Building." Paper delivered in July at the Munson Institute, Mystic, Connecticut.

———. "Maritime Museums." Paper delivered in February at the New Orleans Propeller Club.

———. "Small Sailing Craft on the Bay." Paper delivered at Washington Coast Guard, April; Maryland Historical Society, May; and Annapolis Yacht Club, May.

CLAIN-STEFANELLI, ELVIRA. "L'evolution artistique de la medaille dans les Etats Unis." Paper read 18 October in Paris, at the 12th International Congress of the "Federation Internationale de la Medaille."

CLAIN-STEFANELLI, VLADIMIR. "Ancient Gold Coinage of Kallatis." Paper read 29 August by Mrs. Clain-Stefanelli at the International Numismatic Congress, Copenhagen.

———. "Numismatics Re-Examined." Official address given in September at Canadian Numismatic Association Convention and Centennial Celebration, Ottawa.

———. "The Importance of the Study of Numismatics, Gold as a Coinage Metal, and the Josiah K. Lilly Collection of Gold Coins." Statement on 27 September before Subcommittee No. 2 of the House Committee on the Judiciary on H.R. 12941, and identical bills, "For the relief of the estate of Josiah K. Lilly." (A 32-page research paper.)

COLLINS, HERBERT R. "The Lust for Office—The Remains." Paper and seminar in June organized for the Twelfth Annual Institute of Pennsylvania Life and Culture, Lancaster, Pennsylvania.

HAMARNEH, SAMI. "Medical Education and Practice in Medieval Islam." Paper delivered 5 February at the International Symposium on the History of Medical Education, Los Angeles, California.

JACKSON, MELVIN H. Project 400 D. C. Education Department—a series of weekly lectures on marine history as part of the curriculum-enrichment program.

———. "Naval Arms and Armament of the Revolution." Lecture delivered in March for the American Studies program.

KLAPTHOR, MARGARET B. "The First Lady Image." Paper presented in May to the History Department, Mount Holyoke College.

MERZBACH, UTA C. "Leibniz and Nineteenth-Century Mathematics." Colloquium lecture presented in April at Yale University.

NORBY, REIDAR. "The Smithsonian Institution and its Role in Philately." Lecture delivered 17 July to the Philadelphia Scandinavian Collectors Club, Philadelphia, Pennsylvania.

———. "The Smithsonian Institution and its Role in Philately." Lecture delivered in October to the National Institutes of Health Stamp Club, Bethesda, Maryland.

———. "The Smithsonian's Philatelic Treasures." Lecture delivered 24 October to the Washington Scandinavian Collectors Club, Washington, D.C.

———. "Project Smithsonian." Lecture delivered 16 November to the North Jersey Scandinavian Collectors Club, Upper Montclair, New Jersey.

———. "The Smithsonian Institution and its Role in Philately." Illustrated lecture delivered 12 June to the Wilmington Stamp Club, Wilmington, Delaware.

OSTROFF, EUGENE. "The Invention of Photomechanical Reproduction." Paper presented 24 May at the American Association of Museums meeting, at New Orleans, Louisiana; scheduled for publication in *Museum News*.

———. "The Photomechanical Image and Its Origin." Paper presented 23 April to the Society of Photographic Scientists and Engineers, at Washington, D.C.

PETERSON, MENDEL L. "Techniques of Underwater Exploration and Research." Series of four lectures delivered in February under the sponsorship of the University of Texas at El Paso.

ROTH, RODRIS. "Centennial Taste: American Furniture at the 1876 Philadelphia Exposition." Paper delivered in September at Pennsbury Manor Americana Forum, Pennsbury Manor, Morrisville, Pennsylvania.

SCHEELE, CARL H. "The Post Office Department and Urban Congestion, 1893–1953." Paper presented in December at the Eighty-Second Annual Meeting of the American Historical Association, Toronto, Canada.

VOGEL, ROBERT M. The New England Textile Mill Survey. Paper delivered in July at the Manchester Rotary Club, Manchester, N.H.

———. "Prelude to Progress—Victorian Manchester and the Future." First session of series, November, sponsored by the Manchester Historic Association and the Currier Gallery of Art, "The Dark Satanic Mill," Manchester, New Hampshire.

———. "Industrial Archeology, the Off Side of the American Heritage." Paper delivered in November at the Society of Architectural Historians, Washington Chapter, Washington, D.C.

———. "The Place of Industrial Archeology." Paper delivered in January at the Society for Historical Archæology, Williamsburg, Virginia.

———. "Industrial Archeology: A New Field of History." Paper delivered in April at the Virginia History Federation, Fairfax, Virginia.

WELSH, PETER C. "A Century of Technological Change, 1750–1851." A series of lectures delivered at the 1967 Annual Seminars on American Culture sponsored by the New York State Historical Association.

WHITE, JOHN H. "Cincinnati Incline Planes and Hilltop Houses." Paper delivered in December before the Cincinnati Historical Society.

Musical Events

The division of musical instruments is distinguished uniquely from other units of the department in its ability to communicate aurally as well as visually. As in previous years, its musical performances and demonstrations of early instruments have added a dynamic dimension to the exhibit function. During the course of the year, the following concerts were performed:

Tower Music, weekly—July through August (evening performances on brass instruments from the crenelated roof of the main portico of the Smithsonian Building).

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Amsterdam Baroque Trio—14 July 1967.

Frans Brueggen, recorder—25 October 1967.

Baroque Players of New York—14 November 1967.

Alan Curtis, harpsichord—5 December 1967.

Jean Hakes, soprano; John Fesperman, organ—18 January 1968.

Sonya Monosoff, violin; James Weaver, harpsichord—12–13 February 1968.

Albert Fuller, harpsichord—16 April 1968.

Flore Wend, soprano; Frank Bowen, flute; James Weaver, harpsichord—14 May 1968.

Tower Music, weekly—3–24 June. Augmented by tympani.

Each concert, except for Tower Music, was preceded by a lecture relating to instruments, repertoire, and performance conventions heard in the performance.

Exhibits

A special mathematical exhibit on the development of the modern computer opened in late August. This opening was timed to coincide with the twentieth annual meeting of the Association of Computing Machinery, which convened in Washington, D.C. The exhibit featured representative historic items in the digital and analog field, as well as a "reading table" at which visitors were able to study at leisure codes and programs of the late 1940s and early 1950s.

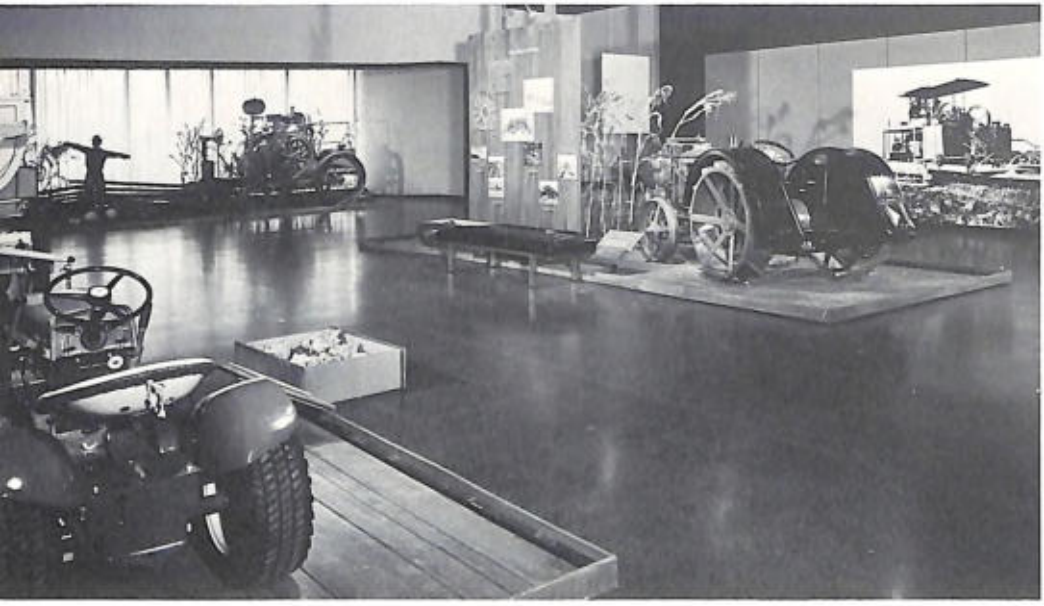
A special exhibit was shown between October and April on the telephone experiments of Alexander Graham Bell. This drew in large part on the researches published by curator Bernard Finn; the exhibit concentrated on the year 1876, showing the progress of the inventor through his experimental equipment, his notebook entries, and his later courtroom testimony.

In February, the division of engineering sponsored a showing of American artist Ranulph Bye's watercolors of 19th-century railroad stations. Mr. Bye has presented 15 of the paintings to the Museum. They are not only accurate architectural documents, but of great artistic merit as well. An outstanding spring event was the joint sponsorship by the division and the Society of Architectural Historians (Washington chapter) of a lecture: "Industrial Archeology—Whose Benefit, Whose Responsibility?" by Kenneth Hudson of the Bath University of Technology. The lecture was followed by a joint Smithsonian-Historic American Buildings Survey show of drawings and photographs titled "Recent Projects in Industrial Archeology."

Two special shows were completed during the year. The Nautical Research Guild's 25th-anniversary ship-model show was held in the hall of American merchant shipping. The Winton transcontinental automobile panel was installed in the front hall of the museum.

In cooperation with the committee on the history of dentistry of the American Dental Association, an exhibition on "Early American Dentistry" was installed at the medical gallery, featuring the original denture set of President George Washington, paintings, certificates, tools, and dental equipment from the collection of the University of Maryland, College of Dentistry, in Baltimore.

The 75th anniversary of the invention of the internal-combustion tractor was marked in 1967. A special exhibit, depicting the growth



A special exhibit marked the 75th anniversary of the invention of the internal-combustion tractor.

and technological changes in the internal-combustion tractor and the significance of the tractor to American agriculture, was displayed for six weeks in September and October.

From 2 March through 15 April the ceramics of Judith and Henry Halem—a talented husband-and-wife team of ceramists from Fredericksburg, Virginia—were shown in the Museum. From 12 April through 2 June the products of the Kastrup-Holmegaard Glassworks were displayed in an exhibition entitled "140 Years of Danish Glass." This exhibition featured the finest works of a major Scandinavian glass factory and documented the evolution of design and technique from traditional forms to advanced concepts in glassmaking.

Regular demonstrations of 19th-century hand printing have been started at the Columbian press in the hall of graphic arts. It is planned to expand the demonstrations to show printing at an 18th-century wooden press and a late-19th-century platen press.

A traveling exhibition of prints by Mexican artists had its inaugural showing in the graphic arts gallery from December 1967 to February 1968. Original cartoon drawings selected from the Newspaper Comics

Museum technician James Spears demonstrating hand printing at the 1865 Columbian press in the hall of graphic arts.

Council's gift to the Smithsonian were shown from November to December 1967.

Planning for the permanent hall of photography was greatly accelerated, and consequently no new temporary displays were scheduled during the year.

The section of photography assisted and advised Charles Eames in the preparation of the special exhibition "Photography and the City," which opened 5 June in the Arts and Industries Building. Numerous photographs, cameras, and other items from the photography collection were included in the display.

With the assistance of Alfred McAdams, the temporary exhibit of nuclear-energy equipment was modified to provide a better sample of some of the significant items. Work was commenced on the erection of the full-scale model, a part of CP–1, the first nuclear reactor developed by Enrico Fermi at Chicago in 1942.

"The Copp Family Textiles," a special six-month exhibition, was opened on 15 March. The collection from the Copp family of Stoning-

Mrs. Alice Roosevelt Longworth, daughter of President Theodore Roosevelt, and assistant curator Herbert R. Collins at the opening of the "Pastimes of the Presidents" exhibit, 15 September 1967. In the foreground is a Nile Lechwi, a type of antelope, brought down by Theodore Roosevelt during a Smithsonian expedition to Africa.

ton, Connecticut, was presented to the Museum in 1896, and includes a rare cross-section of the types of household and furnishing textiles used by one New England family from 1750–1850. Daily demonstrations of the processing of flax and wool fibers and of weaving checked-linen bed furnishings are given by Mrs. Helene Bress, a local craftsman, and Mrs. Lois Vann of the division staff.

A one-unit exhibit on "American Sewing Machines," a brief introduction to the Museum's collection, was opened in the first-floor rotunda in May.

Work with the designer on the layouts and graphics for the permanent hall of textiles continued, and the hall is scheduled to open in January 1970.

A notable special exhibition, "Three Centuries of Peruvian Silver," brought to the Smithsonian 210 pieces of ecclesiastic, domestic, and equestrian silver of the 17th, 18th, and 19th centuries never before seen in the United States. Opened on 19 December and continuing until 15 February, the exhibition was made possible through the cooperation of El Patronato del Peru, El Museo del Peru, and the Peruvian Embassy in Washington, Antonio Lulli, Minister Counselor.

Webb C. Hayes III, great-grandson of President Rutherford B. Hayes, Smithsonian Secretary S. Dillon Ripley, and William Howard Taft III, great-grandson of President William Howard Taft, at the opening of the "Resolute" desk exhibit, 16 November 1967. The desk was given to President Hayes in 1880 and deposited in the Smithsonian Institution by the White House.

In January a period room from Martha's Vineyard, Massachusetts, was installed under the direction of associate curator Rodris Roth in the hall of everyday life in the American past. Once the parlor of Edmund and Deliverance Crowell's house in Vineyard Haven, it bears the date of its construction, 1808, and features a remarkable primitive landscape painting built into the paneling over the fireplace mantel.

One of the exhibit highlights of the year was the "Pastimes of the Presidents," opened in September, which depicted leisure-time and recreational activities of the Presidents from George Washington to Lyndon B. Johnson. Using original associational objects, the content of the exhibit ranged from John Quincy Adams' original poetry, philatelic interests of Franklin D. Roosevelt, and horseback riding by several Presidents, to the strenuous sports indulged in by Abraham Lincoln, John F. Kennedy, and others. Portions of the "Pastimes" exhibit were later shown at the Anacostia Neighborhood Museum. The *Resolute* desk,

given by Queen Victoria to President Rutherford B. Hayes and last used by President John F. Kennedy, was placed on exhibition in November. Its deposit in the Smithsonian Institution as a historic object was authorized by President Lyndon B. Johnson.

Another in a series of special exhibits commemorating events leading up to the American Revolution and opened in June, was "The Glorious Cause of Liberty," dealing with American colonial resistance to the Townshend Acts in the years 1767–69, and featuring original documents and objects from the period.

In January an exhibit of photos and artifacts dealing with 18th- and 19th-century organbuilding was presented in conjunction with a concert and a lecture by Miss Barbara Owen. An experimental temporary exhibit representative of musical instruments from the collection marks the beginning of a docent program and of trials for several new exhibit techniques. These include the use of chairs equipped with stereophonic speakers through which concert tapes are played.

A radio series broadcast for 13 weeks over educational station WAMU–FM began on 4 June. These programs consist of tapes made during Smithsonian concerts.

The "Retrospective Exhibit of the American Medal," sponsored by the Medallic Art Company in New York, set up under the direction of Mrs. E. Clain-Stefanelli, marked the celebration of the 75th anniversary of the National Sculpture Society.

Ephraim Evron, Minister of the Embassy of Israel, and Moshe Cohen, Director of Philatelic Services in Jerusalem, participated in the formal opening of a one-month special exhibit of postage stamps on 20 May to commemorate the 20th anniversary of the founding of the State of Israel. Also, during the same month, the rare 24-cent United States airmail issue of 1918, with inverted vignette, together with certified proofs from the two plates which were used to produce that issue, were placed on special exhibition in the Arts and Industries Building during the week which marked the 50th anniversary of the United States airmail service.

Planning and design of the hall of armed forces history, 1865 to date, occupied the staff during the year. Particular emphasis was placed on two period rooms to be installed.

Exhibits specialist Donald Holst constructed five finely detailed military figures for the model of the Continental gondola *Philadelphia* being built by Howard P. Hoffman.

National Air and Space Museum

S. Paul Johnston, *Director*

Plans for optimum utilization of the authorized (1966) but as yet unbudgeted National Air and Space Museum are under constant review, and a special NASM Task Group meets periodically to assess programs for the education and inspiration of the American people concerning the past accomplishments, present attainments, and future potentials of flight.

In this respect, the Museum is now less concerned with displays of "famous firsts" in air and space than with the continuously changing presentations of the impact of man-flight on the cultural life of America, and is envisioned as part of a great public educational facility in which visitors may gain new knowledge of the world around them and clues as to what the future may hold.

For these reasons, planning for NASM during the past years has concentrated on two major areas: On the development of creative and stimulating exhibits which reveal to the layman and the specialist where we have been, why we are here, and where we are going in man's quest for mastery of the air and of space; and on pioneering in the history of flight, both as a branch of the history of science and technology and as a determinant in the history of man as a social animal. Despite current budgetary limitations and personnel restrictions, a number of programs were initiated or continued which are designed to provide firm foundations for future development in these areas.

Main reference files and indexes of photographic and film collections are readily available for researchers.

Great progress was made in the physical arrangements and the consequent utility of the museum's research center. A large backlog of unsorted material still exists, but the bulk of the most needed documentary and photographic material is shelved and readily retrievable.

Thousands of bound volumes include complete files of research and periodical aerospace technical and historical literature from all over the world.

Drawings, technical literature, photographs, and bibliographic files are maintained in readily available form.

Historical Research

Progress was made by curator Robert B. Meyer on his monograph on the development of Professor Langley's remarkable engines of 1900–1903, and by assistant director Paul E. Garber and George Conner on their comprehensive history of the early years of air mail in the United States. Curator Louis C. Casey continued his research on the contribu-

tions of Glenn Curtis to aviation, and assistant director Frederick C. Durant III his in-depth studies on NASM's contributions to modern rocketry and space flight and on the development of Congreve's and Hale's 19th-century rockets. The latter brought to the Museum copies of archival material on these two pioneers.

Research and editorial support was furnished to a number of authors whose books are scheduled for publication during 1968. Support was also rendered to others on such diverse research as 16th-century studies of rocketry and 19th-century lifesaving and whaling rockets.

As a result of participation in the organization of international symposiums on the history of rockets and astronautics, a series of thirteen memoirs, presented at Belgrade in 1967, are being edited by the astronautics department and prepared for publication by the Smithsonian Institution Press.

An in-depth study of naval aviation development during the first decade after World War I, focusing on the contributions of Admiral William Moffett and DeWitt C. Ramsey, is being undertaken by historian Richard K. Smith. This is the first historical research project to be supported by the Admiral DeWitt C. Ramsey memorial fund, which came to the National Air and Space Museum in the form of a substantial bequest from Mrs. Ramsey's estate.

The Guggenheim project, under a grant from Harry Guggenheim, was established in August. Guggenheim Fellow Alexis Doster is investigating the impact of the Guggenheim-founded aeronautical laboratories and schools during the 1920s and 1930s on the subsequent development of air and space technology.

Research files were established containing biographies of over six hundred graduates and faculty members of the seven schools founded by the Guggenheim Fund for the promotion of aeronautics. Of these, twenty who made outstanding contributions to the advancement of aeronautics and space technology were chosen as representative of those who have been influenced by the Guggenheim schools, and the contributions of each will be described and evaluated.

The oral history project of the NASM research center, under the direction of E. W. Robischon, added new tape recordings, bringing the total recordings to the tape bank to 180. Notable among those people recorded were Floyd L. Thompson, Director of the NASA Langley Laboratory; Admiral Edwin C. Parsons, USN, (Ret.), member of the Lafayette Escadrille in World War I; Arthur E. Raymond, designer of the Douglas DC–1 transport; and Waldo Waterman, an early aviation designer. A program of interviews on a nationwide scale was inaugurated to insure inclusion of all remaining pioneers who have made important contributions to aviation and space flight.

Paul Garber discussing kites after his lecture 11 March on the nationalities, types, practical uses, and the role of kites in the development of aircraft. Sponsored by the Smithsonian Associates, the lecture was followed later by a workshop, a prelude to the second annual Smithsonian kite carnival. Kite on left is a type used in Bermuda; center, a traditional newspaper kite; and, right, copy of an early American kite shown in a book printed in 1836.

Educational Activities

Assistant director Paul E. Garber made a major contribution to the education program through his lecture program to school groups and outside organizations, in which he gave 95 talks on aeronautical history and allied subjects to an estimated 12,500 persons.

The information and education department, working with the Federal Aviation Administration in its teacher workshop programs for elementary and secondary schools, is presently developing a new program for teacher education in which Louis S. Casey and Robert B. Meyer, Jr., have been active. A program for secondary school students is being developed at the NASM facility at Silver Hill, where students may have actual contact with significant air and space artifacts.

In conjunction with the Smithsonian Institution office of academic programs, a three-day tour and seminar was conducted for a group of fifteen students from St. Albans School. A docent educational program is planned for the near future.

At weekly lunch-box seminars, held in the NASM conference room,

staff members are apprised of information on subjects related to air and space technology by speakers from industry, private corporations, and other government agencies.

Local chapters of the following organizations met on a regular basis at the Historical Research Center (figures in parentheses indicate the number of meetings held): Antique Airplane Association (4), American Aviation Historical Society (9), International Plastic Modelers Society (3), Experimental Aircraft Association (1), Ninety-Niners (3). The Center staff served a total of 966 visitors and answered 5,760 telephone and letter requests during the year.

The Collections

EXHIBITS AND SPECIAL EVENTS

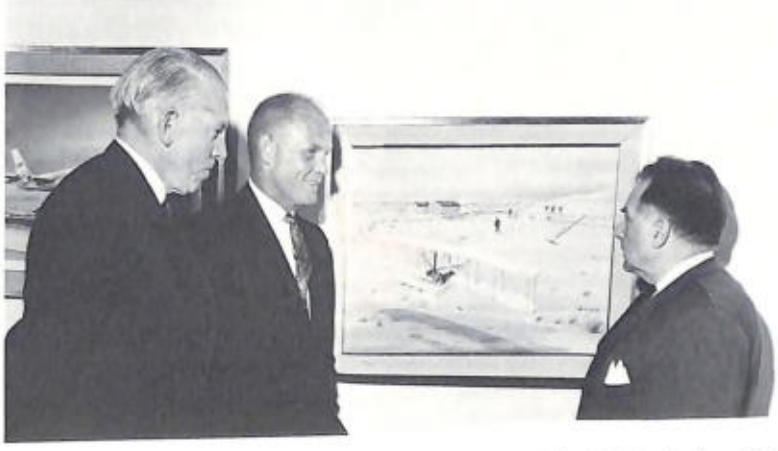
The following exhibits and special events took place at the Smithsonian (or elsewhere, as indicated) during the year:

Lockheed "Vega" aircraft used by Amelia Earhart, on the occasion of the 40th anniversary of her round-the-world flight (July).

Charles and Anne Lindbergh's "Sirius" (Dulles Airport, National Aviation Day, August).

Exhibit on Santos-Dumont; paintings by John McCoy, "Painting Aviation History"; DeHaviland DH–4 (Langley Research Center) and Langley aerodrome model (National Academy of Science) (September).

Installation of IBM and NASA "Gemini" exhibit, and "Paris Air Show" and NASA "Project Mercury" exhibits (October).



At the opening of a one-man show of John McCoy's historical painting, Paul Garber, right, discusses the original Wright flight at Kitty Hawk with the artist and Astronaut John Glenn.

Part of the growing collection of spacecraft and related material now in the museum's custody under an agreement with NASA. (Photo courtesy United Press International, Inc.)

Paintings by John Desatoff of TRW, Inc., "U.S. and Foreign Spacecraft"; and presentation of Kennedy family plane *Caroline* (November).
Huff-Daland crop duster aircraft (January).
"Bios II" satellite and paintings by Henry Farré, "Sky Fighters of France" (February).
Rocket motors from Aerojet General Corporation; McDonnell F–4A aircraft, Gemini 7 spacecraft, and Bell H–13 helicopter (on the Mall) (April).
Presentation of the Collier Trophy, ceremony for 50th Anniversary of the Air Mail, rebuilt DH–4 installed United States Air Force exhibit, F9F aircraft installed at Anacostia playground (May).
Scientific balloon payloads and Air Force exhibit (June).

The Silver Hill facility under the supervision of Donald K. Merchant, transported, relocated, or prepared for shipment to exhibitions in the United States and Europe some 25 full-size aircraft, spacecraft, or their major components.

The visual presentations division at the 24th Street facility, under the supervision of Harry Hart, completed the installation of photographic, silkscreen, and carpenter shops and supported more than 19 temporary exhibits and special activities.

CARE OF COLLECTIONS

A new warehouse was accepted by the NASM and designated for specimens of the astronautics department. The first installation of efficient, heavy-duty storage racks was completed. Specimens are being stored there on an instant-retrievability basis. On acceptance of the new building, NASM vacated two similar warehouses which have been assigned to other Smithsonian activities.

The preservation and restoration crew also handled several hundred

additions to the collections which were stored at Silver Hill. New specimens of all types received at Silver Hill totaled 229,136 pounds.

Museum specialist Winthrop S. Shaw, made great progress in identifying, cataloging, and warehousing specimens at the 24th Street facility. The model collection is now in good order and progress was made in organizing the artwork and memorabilia, medals, and miscellaneous artifacts.

ACCESSIONS

Implementation of the agreement on artifacts between the National Aeronautics and Space Administration and the museum brought to the latter title to and responsibility for preservation and exhibit of 15 Mercury and 8 Gemini spacecraft, as well as astronaut space suits and hundreds of significant space-related items. Some spacecraft were placed on long-term loan for display at NASA centers, others were exhibited for short periods in the United States and Europe. Still others are undergoing restoration and preparation for exhibit. Other spacecraft accessions include flight items and engineering mock-ups of Surveyor, Lunar, Orbiter, and Ranger. Liaison with NASA field centers continued, and the NASA contract covering this work was extended an additional year, with no increase in funds.

Additions to the collections received and recorded during the year totaled 636 specimens in 93 separate accessions, as listed below. Those from government departments are entered as transfers; others were received as gifts.

AEROJET GENERAL CORP.: Wyld rocket motor; paintings, "The Earth from Space" and "Portrait of T. von Karman" (NASM 1833). Liquid propellant rocket engines: 25 ALD World War II unit, LR 63–AJ–1 unit, Aerobee thrust chamber, Nike thrust chamber, YLR–63–AJ–3 and YLR–45–AJ–1 thrust chambers, 15 KS 1000 smokeless unit, 12 NS 250 Junior JATO unit, Genie motor, Delta with gimbal unit, F–86 unit propulsion tank, Apollo chamber and injector, first American JATO (Boushey flight), 14 AS 1000 unit, miscellaneous tubing (NASM 1940). Injectors from the Apollo service module engine (NASM 1871). Fuel turbopump rotating assembly (NASM 1952).

AIR FORCE, UNITED STATES: *Ballistic Missile Division:* Photo of earth and stars; Atlas missile (NASM 1837). *Hill AFB,* Ogden, Utah: Rocket engine assembly, experimental model (NASM 1847). *Hollman AFB,* New Mexico: Rocket sled (NASM 1813). Rocket sled and Tarzon bomb (NASM 1814). *Air Materiel* San Bernardino, California: Titan I first stage rocket engines (NASM 1805).

ARMY, UNITED STATES, *Ft. Meade,* Maryland: Jupiter propulsion system trainer (NASM 1843). Depot, Anniston, Alabama: Nike-Zeus target reentry vehicle (NASM 1804); Ft. Wingate, Gallup, New Mexico: Rocket sled (NASM 1815).

BEECH AIRCRAFT CORP.: Model Beechcraft King Air A 90 (NASM 1877).

BELL AEROSYSTEMS CO.: Minuteman II post-boost propulsion system (NASM 1949).

Pilot-constructor William Hackbarth turns over DH–4 mail plane "Old 247" to NASM director S. Paul Johnston at the fiftieth-anniversary ceremony of the United United States airmail service.

CLARK CO., DAVID: Astronauts' clothing patterns (NASM 1824 and NASM 1825).
CULVER, MRS. PAUL: Magnetic compass and map of D.C.–Norfolk, Virginia; used by Paul Culver in flying the mail, 1918 (NASM 1941).
DELTA AIRLINES: Huff-Daland aircraft (NASM 1839).
DE WELDON, FELIX: Bust of John Glenn (NASM 1927).
FORD MOTOR CO. Aeronutronic Division: Far side rocket (NASM 1811).
GENERAL ELECTRIC CO.: Biosatellite mock-up (NASM 1950). Model of Nimbus II, meteorological satellite (NASM 1834). Engine, cutaway, GE turbosupercharger, Type B–2 (NASM 1800).
GUGGENHEIM, HARRY: Collection of 174 aeronautical cartoons and prints (NASM 1827).
HACKBARTH, WILLIAM: Airplane, reproduction of DH–4 mailplane (NASM 1942).
HERCULES, INC.: Rocket motor assembly (X–259) (NASM 1844). Vanguard rocket motor (NASM 1951). Rocket engine mock-up of BE–3–B1 (NASM 1850).
KEN-AIR, INC.: Convair 240, John F. Kennedy's campaign aircraft *Caroline* (NASM 1840).
MACHADO, MRS. ANESIA PINHEIRO: Memorabilia of Santos Dumont (NASM 1836).
MALINA, FRANK J.: Kinetic painting, "Polaris I" (NASM 1830).
MARTIN CO.: Space tools (NASM 1820).
MCDONNELL DOUGLAS CORP.: Spacecraft batteries (NASM 1849). Miscellaneous hardware, Gemini program (NASM 1943 and NASM 1944). Apollo heat-shield, service module beams, barometric pressure indicator (NASM 1945). Digital elapsed time clock, manual data readout unit, attitude director indicator (NASM 1946). Mirror assembly for installation in GT–10 (NASM 1864). Heat-shield remains and storage batteries from Gemini 8 (NASM 1955). Storage batteries from Gemini 9 (NASM 1956). Log books for spacecrafts 9 and 10 (NASM 1948).
MEYER, ROBERT B., JR.: Aero engine, Continental A–40, series 4 (NASM 1873).
MIKESH, MAJOR ROBERT C.: Vietnamese birds kite (NASM 1841).
MINNESOTA MINING AND MANUFACTURING CO.: Paintings, "Tiros," "Mariner," and "Polaris" (NASM 1835).

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION: Static test module (NASM 1812). Accutron clock and whip antenna for Gemini 9 (NASM 1819). Digital computer (NASM 1821). Gemini crew station mock-up (NASM 1954). Spacecraft Gemini 10 (NASM 1857). Model of Surveyor spacecraft (NASM 1867). *Ellington AFB,* Texas: Spacecraft Mercury 17 and Mercury 19 (NASM 1947). *Langley Research Center,* Virginia: Spacecraft Mercury 18 (NASM 1851). *Manned Spacecraft Center,* Houston, Texas: Gemini hand controller (NASM 1832). Ventilation unit for space suit (NASM 1826). Mercury spacecraft 5 and chimpanzee couch, ballistic flight, "Ham" aboard (NASM 1854). Mercury spacecrafts 15B, 9, 10, 8 and 12B; Mercury spacecraft wiring mock-up, Mercury spacecraft "Big Joe"; instrument mock-up, static test article #2, drop test vehicle, adapter sections, storage tank, heatshield and retro package; Gemini parachute and couch parts (NASM 1845). Space suit and helmet of astronaut Collins (NASM 1865). Space suits and helmets of astronauts Cernan, Schirra, Stafford, Cooper, Lovell, Conrad, Armstrong, and Grissom (NASM 1866). Chimpanzee couches, Mercury retro rocket package, Gemini systems demonstrator, Mercury abort engine and nozzle, Mercury rendezvous and recovery section, decompression chamber, procedural trainer couch assemblies for astronauts Cooper, Shepard, Glenn, Slayton, and Carpenter (NASM 1859). Space helmet and suit of astronaut Young (NASM 1861). Gemini spacecraft 7, water gun, astronaut food, EVA gear, helmet of John Glenn, hatch cover and periscope cover from Friendship 7 (NASM 1858). Astronaut Borman's space suit, parachute, helmet, boots, visor cover and gloves (NASM 1818). Spacecraft hatches (NASM 1823). Personnel parachutes, nonflight (NASM 1855). *Marshall Space Flight Center,* Alabama: Internal combustion engine, Jupiter missile (NASM 1808). Rocket engines RL–10 and H–1 (NASM 1810). St. Louis Missouri: Orbit attitude and maneuvering system (NASM 1846). Gemini spacecraft 11 with tilting cradle (NASM 1848). Gemini spacecraft 6 and 12 (NASM 1853). Computer Gemini 8 (NASM 1852). Inertial maneuvering unit (NASM 1856). Indeterminate hardware, nonflight items (NASM 1862).

NAVY, UNITED STATES: Bat missile, Rigel missile, two Gorgon missiles and JATO bottle (NASM 1831). *Mechanicsburg Defense Depot,* Pennsylvania: Petrel missiles (NASM 1822). *Naval Air Development Center,* Johnsville, Pennsylvania: Human centrifuge, used in training astronauts (NASM 1869). *Naval Air Station,* Point Mugu, California: Terrier missile with rails (NASM 1953). *Navy Yard,* Washington, D.C.: Vanguard launch vehicle (NASM 1806). *USNCBC,* Port Hueneme, Calif.: Corporal missile (NASM 1809).

NORTH AMERICAN ROCKWELL CORP.: Apollo heatshield, service module beams, barometric pressure indicator (NASM 1945).

PAGE, MRS. STANLEY H.: Control wheel with column, lever and collection of spark plugs; from the Page Flying Boat, 1918–1923 (NASM 1870).

PENDRAY, G. EDWARD: Propellant valve, section of Shesta four-nozzle rocket; World War I helmets (NASM 1828).

PURDUE UNIVERSITY: Walter rocket engine (NASM 1801).

RODENBERRY, GENE: Pilot film of television program "Star Trek" (NASM 1838).

ROLLS-ROYCE, LTD.: Rolls-Royce RB-108 direct lift turbojet engine (NASM 1878).

ROYAL ARTILLERY INSTITUTE: Hale and Congreve rockets (NASM 1816).

SICARD, PIERRE: Painting "Départ du Missile" (NASM 1829).

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SMITHSONIAN INSTITUTION: *United States National Museum*: Bronze head of Charles A. Lindbergh (NASM 1872).
SPERRY WATCH CO.: Full-scale model of Sergeant missile (NASM 1802).
STEVENSON, GORDON: Letter and envelope from Hiram Maxim to Edward Hewitt dated 28 June 1892 (NASM 1842).
THIOKOL CHEMICAL CORP.: ARS test stand (NASM 1817).
UNITED AIRCRAFT CORPORATE SYSTEMS CENTER: Reentry vehicle (NASM 1807).
WATERS, COLONEL DON: Machine gun, Lewis .303 caliber, 1914 (NASM 1879).
WELSH, E. C.: Oil portrait of Edward Christy Welsh by Hoessein (NASM 1863).

The Museum's Historial Research Center was greatly enriched during the year with valuable research materials. The cooperation of the following persons and organizations in providing this material is gratefully acknowledged:

Aerospace Industries Association
Aero Publishers
Baldwin, Leonard
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Edelson, Burton I.
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Greer, R. D., Jr.
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Hartung, Walter M.
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Hickey, John E.
Hiller, Stanley, Sr.
Hirsch, R. S.
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Johnson, Jesse G.
Lech, Andrew F.
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Wilkinson, Paul H.
Zapelloni, Fererico

National Armed Forces Museum Advisory Board

Colonel JOHN H. MAGRUDER III, USMC, *Director*

CONGRESSIONAL ACTION IS PENDING on legislation which would authorize the Smithsonian Institution to acquire necessary land for the site of the proposed National Armed Forces Museum Park in the Fort Foote area of Prince George's County, Maryland. Pursuant to a recommendation by the Board of Regents on 25 January 1967, identical bills for this purpose—Senate Bill S. 2510 and House Bill H.R. 14853—were introduced, respectively, by Smithsonian Regents Senator Clinton Anderson (for himself and Senator J. William Fulbright) on 6 October 1967 and Representative Michael J. Kirwan on 25 January 1968.

Under the broad concept expressed in Public Law 87–186, the National Armed Forces Museum Park is to consist, in part, of a study center for scholarly research into the meaning of war and its effect on civilization. Addressing this subject, the Advisory Board during the year sought the advice of academicians and museologists in an effort to define objectives and programs of the study center and to determine its relationship with the museum proper. On 4–6 December 1967 the Board sponsored a conference of distinguished historians to consider and make specific recommendations regarding these matters. The group, which met at the Belmont Conference Center under the chairmanship of Smithsonian Regent John Nicholas Brown, permanent chairman of the Advisory Board, consisted of Philip A. Crowl, chairman, Department of History, University of Nebraska; Colonel Trevor N. Dupuy, USA (Ret.), president and executive director, Historical Evaluation and Research Organization; Archibald Hanna, Jr., curator, Yale Collection

General Leonard F. Chapman, Jr., Commandant of the United States Marine Corps, and Colonel John H. Magruder III, USMC, director of the Smithsonian's National Armed Forces Museum Advisory Board, view John Groth's painting "Stampeded" at the February opening of the art exhibition, "The Armed Forces of the United States as seen by the Contemporary Artist."

of Western Americana, Yale University; Richard M. Leighton, professor of national security affairs, Industrial College of the Armed Forces; Louis Morton, professor of history, Dartmouth College; Harold L. Peterson, chief curator, National Park Service, Department of the Interior; and Theodore Ropp, professor of history, Duke University.

The recommendations of the Belmont group, approved by the Advisory Board and the Board of Regents on 25 January 1968, called for—

Early appointment of a senior scholar to serve as chairman of study center activities, responsible for establishing the nucleus of a staff and organizing initial programs, and to assist in planning the role the museum and study center would play in commemorating the Bicentennial of the American Revolution, and

Establishment of a committee of eminent scholars in the field of military history to provide a closer link between the Smithsonian Institution and the academic world. Such a group would complement the functions of the Advisory Board by enlisting the active participation of the intellectual community.

From 2 February through 9 March 1968, in the rotunda and south hall of the Arts and Industries building, the Advisory Board—in cooperation with the Army, Marine Corps, Navy, Air Force, and Coast Guard—presented an exhibition of art entitled "The Armed Forces of

General surface view of dredging operations at the site of the sunken Civil War monitor USS *Tecumseh*, in Mobile Bay, Alabama, on 13 July 1967. A suction dredge removes mud and sand from around *Tecumseh*'s bow. Small diving barge in center foreground is moored to the monitor's stern. The dark pentagonal structure close to the beach is Fort Morgan, the batteries of which constituted a major obstacle to Rear Admiral David G. Farragut's entry into the bay on 5 August 1864.

the United States as Seen by the Contemporary Artist." The exhibition drew primarily upon the collections of the Armed Forces but also included selections from holdings of several Smithsonian bureaus and outside establishments such as the Library of Congress and the Libraries of Princeton and Yale universities. Comprised of 196 art works in almost all media, representing the work of 85 artists, and providing a kaleidoscopic view of Armed Forces activities present and past, the exhibition attracted much favorable comment, including a four-page pictorial presentation in *U.S. News and World Report* of 18 March 1968.

During July 1967 a team composed of staff members of the Advisory Board and of the Office of the Supervisor of Salvage, Department of the Navy, conducted an engineering examination of the Civil War monitor U.S.S. *Tecumseh,* lying capsized and almost wholly buried under mud and sand on the bottom of Mobile Bay, Alabama, where she was lost in battle in 1864. With the aid of a suction dredge, a considerable portion of *Tecumseh*'s hull was uncovered, enabling divers to remove samples of the iron plating. Subsequent laboratory analysis by the Navy established that the historic ship retains enough of her structural strength to permit her salvaging intact and, after restoration, her eventual display

in the proposed Armed Forces Museum Park. Artifacts recovered in the course of the examination include one of *Tecumseh*'s one-ton anchors and—brought out of a partially open wardroom hatch—several pieces of dinnerware, a bronze floor ventilator, and part of a pewter cruet holder.

Battle damage uncovered during the examination disposed of a century-old controversy regarding the circumstances of *Tecumseh*'s loss, namely, whether she was sunk by the explosion of an underwater "torpedo" (mine) or by gunfire from shore batteries as claimed by some Confederate eyewitnesses. Divers, inspecting the bottom of the hull directly beneath the turret, found an area of depressed plates about five feet wide by seven feet long. Here the explosion of a "torpedo" ruptured several seams and forced one plate inward, leaving an opening approximately two feet wide by three feet long—ample to send *Tecumseh* with almost all her crew beneath the waves in something like a minute.

Through the year, the Advisory Board staff acquired from various agencies of the Armed Forces, from the General Services Administration, and others, a wide variety of military and naval objects desired for the collections of the proposed National Armed Forces Museum Park. Two major components—the float and the Krupp-made gondola—of the bathyscaphe *Trieste I*, acquired from the Department of the Navy, arrived in the Washington, D.C., area (the gondola via Expo-67) from the Naval Electronics Laboratory, Point Loma, San Diego, California. As the year ended, plans were being made for temporary outdoor exhibition of the bathyscaphe in the vicinity of the Mall, preliminary to her eventual display in the Armed Forces Museum Park. In cooperation with the Smithsonian library, the Advisory Board staff continued to acquire from Armed Forces historical agencies and elsewhere military and naval historical publications for use in current studies and to serve as a nucleus of the study-center library of the Museum Park.

Freer Gallery of Art

JOHN A. POPE, *Director*

AS IN PAST YEARS, the Freer Gallery of Art, continues to function as a research center for the civilizations of Asia and to add objects of significant quality, whenever they become available, to its collection of Oriental art. The staff members are engaged in research projects which relate to the cultural origins of the objects in the collection. To further this, they travel at home and abroad to see collections and study related material and exchange views with colleagues working on similar projects. Established scholarship programs exist, and students of Oriental art are encouraged and assisted in working with objects in the collection.

Gifts and Grants

The Freer Gallery of Art received a grant from the Ford Foundation to assist in the publication of volume 1 of *The Freer Chinese Bronzes.* The Felix and Helen Juda Foundation contributed travel funds to be used in the technical research area. The Ellen Bayard Weedon Foundation provided a grant for library purchases. Kevorkian Foundation

Jade, Chinese, Chou dynasty (late Eastern). 5th–3rd century B.C. (68.38).

***Hu*, with cover, Chinese bronze, Han dynasty, 2nd–1st century B.C. (67.27).**

funds given in March 1967 were used again toward the purchase of Near Eastern art volumes.

The Collection

Among the many objects of exceptional quality added to the collection were, in Chinese art, a fine jade incised blade dating from the Late Eastern Chou dynasty (68.38), presented by Mrs. Eugene Meyer in accordance with the will of Charles Lang Freer, and a bronze *hu* of the Han dynasty (67.27). In Japanese art were added an unusual pair of paintings of mynah birds by the Nanga school artist Yosa Buson (1716–1783) (67.18–67.19) and a large, shallow dish, an exceptional example of Kutani ware, dating from the Edo period, 17th century (68.13); and in Near Eastern art, a rare pair of Persian bowls from Kashan, early 13th century, with representations of a king and queen (67.24–67.25).

Under the terms of paragraph 4 of the first codicil to the last will and testament of the late Charles Lang Freer, the following 40 objects were presented by Mrs. Eugene Meyer:

BRONZE

Chinese, Chou dynasty. *Kuei,* on high foot ring, two handles with rams' heads; greenish patina. (68.28)

Chinese, Chou dynasty. *Kuei,* on high foot ring, four handles with deer head masks; greenish patina with malachite crust. (68.29)

Mynah birds and plum tree. Japanese painting, Edo period, 18th century, Nanga School, by Yosa Buson (1716–1783). (67.18). One of a pair: 67.19.

Dish, Japanese pottery, Edo period, 17th century, Kutani (68.13).

Bowl, Persian pottery, Kashan, early 13th century A.D. (67.24). One of a pair: 67.25.

Chinese, Chou dynasty. *Hu,* with lid, on high foot ring; round body, tapering tall broad neck; decorated with abstract motifs (Changsha). (68.32)

Chinese, Chou dynasty. Bowl, on high foot ring, two mask handles holding loose rings. (68.33)

Chinese, Chou dynasty. Vessel, on three high legs, in form of a bear. (68.34)

Chinese, Chou dynasty. *Hu,* square, with lid, two mask handles. (68.35)

Chinese, Han dynasty. Expanding open-work foot of a *po-shan-lu* with dragons; gilded. (68.49)

JADE

Chinese, Shang dynasty. *Tsung,* plain, brownish black nephrite square with open cylindrical center. (68.24)

Chinese, Shang dynasty. Battle-axe *pi* disc, buff colored jade with darker mottling. (68.48)

Chinese, Chou dynasty. *Tsung,* brownish gray nephrite square with open cylindrical center. (68.30)

Chinese, Chou dynasty. *Tsung,* brownish buff patina, square body with open cylindrical center; corners notched. (68.36)

Chinese, Ch'ing dynasty. Form of stylized tiger, both sides identically engraved, reddish brown jade with translucent greenish spots. (68.37)

PAINTING

Chinese, T'ang style, attributed to Ho Chen. Winter landscape; two groups of figures, "Calling on a Friend with a Harp." Painted in polychrome on silk. (68.17)

Chinese, T'ang dynasty, by Wang Wei. Landscape after a snowfall. Mountainous background with large valley, hamlet, and flights of geese. On silk. (68.27)

Chinese, Sung dynasty, by Li Kung-lin. Scene depicting a tipsy monk with assistants. Ink and light colors on paper. (68.18)

Chinese, Sung dynasty, attributed to Li Kung-lin. Manifestation of the Arhats depicting seven mudras of Buddha and various Lohans and guardians. Painting on paper. (68.19)

Chinese, Sung dynasty, attributed to Li Kung-lin. Hunting scene. Ink on paper. (68.20)

Chinese, Sung dynasty, by Li Kung-lin. "Laotze Delivering His Canons." Ink on paper. (68.21)

Chinese, Sung dynasty, by Su Shih (Su Tung-p'o). Depicts bamboo. Ink on silk. (68.25)

Chinese, Sung dynasty, attributed to Li Kung-lin. "The Eighteen Lohans: Cho-Se Shih-Pa Lo-Han T'u." Ink and colors on paper. (68.26)

Chinese, Sung dynasty, by Ma Yüan. Mountainous landscape, rocks and trees. Painting on silk. (68.43)

Chinese, Sung dynasty, by Chü-jan. "T'ao Yüan-ming Returning to Secluded Life." Painting on silk. (68.47)

Chinese, Sung dynasty, attributed to Mi Fei. "Mist and Rain on the Ch'u River." Ink on silk. (68.52)

Chinese, Yüan dynasty. "Nymph of the Lo River." (Copy of early version, *cf.* Sung dynasty 14.53.) Ink on paper. (68.12)

Chinese, Ming dynasty. "Ladies in Concert." Ink and color on paper. (68.23)

Chinese, attributed to Chia Kue. Mountainous landscape on misty morning. Ink on silk. (68.44)

Chinese, attributed to Lu T'an-Wei. "The Return of Duke Wen of Chin to His Own State." Ink on paper. (68.22)

Chinese, copy of "Prince Tung Tan's Return to Tartary." Unsigned. Colophon by Ju Yen dated 1424. Painting on silk. (68.46)

Japanese, Edo period, 17th century. Embossed flower chariot under willow trees of gold leaf. Six-fold screen; one of a pair: 68.40. (68.39)

Japanese, Edo period, 17th century. Embossed flower chariot under willow trees on gold leaf. Six-fold screen; one of a pair: 68.39. (68.40)

POTTERY

Chinese, Wei dynasty. Terra-cotta flat brick, tomb lining; two men and unmounted horse; high relief. (68.55)

Chinese, T'ang dynasty. Standing warrior, head turned to right; one of a pair: 68.42. (68.41)

Chinese, T'ang dynasty. Standing warrior, head turned to left; one of a pair: 68.41. (68.42)

Chinese, Sung dynasty, Tz'u-chou ware. Jar; floral sprays, black gackground. (68.16)

Chinese, Sung dynasty, Tz'u-chou ware. Vase with ovoid body, short neck, everted lip rim. (68.31)

Chinese, Yüan dynasty, Tz'u-chou ware. Vase on expanding foot ring; high bulbous shoulder, short, wide neck; figures and floral decoration. (68.50)

STONE SCULPTURE

Chinese, Wei dynasty. Seated Buddha and two standing bodhisattvas; dragons, tigers, and men on side; high relief. (68.53)

Chinese, Wei dynasty. Standing Buddha and two bodhisattvas; floral motif; high relief. (68.54)

Chinese, Northern Ch'i dynasty. Standing bodhisattva, high crown, head raised, long-lobed ears, holding lotus bud; dark gray granite. (68.45)

TEXTILE

Chinese, Ch'ing dynasty. Jehol cut velvet hanging tapestry; swastikas, flowers and dragons, large peonies and foliage on blue ground; K'ang-hsi. (68.51)

Purchased for the collection were:

LACQUER

Chinese, Sung dynasty, 960–1280. Dish with round base and cavetto, flattened rim with small vertical lip of chrysanthemum shape, flat countersunk base; brownish red. (67.13)

Chinese, Sung dynasty, 960–1280. Dish with five-lobed base, cavetto, rim and foot; thin brass binding on lip; brownish black. (67.14)

Chinese, Sung dynasty, 960–1280. Shallow dish with six-lobed rim bound in metal, low foot; brownish red, dark brown inside foot and on base. (68.14)

METALWORK

Japanese, Kamakura, ca. 1300. Iron kettle with lid; Ashiya type; design of pine trees, shells, and beach. (67.20)

PAINTING

Japanese, Edo period, Ukiyoe school, by Hokusai, 1760–1849. Nobleman and party. "Hyakunin Isshu Ubaga Etoki" series poem by Ki-no-Tsurayuki. Ink on paper. (68.56)

Japanese, Edo period, Ukiyoe school, by Hokusai, 1760–1849. Workmen hauling tree through a gate. "Hyakunin Isshu Ubaga Etoki" series poem by Ise Taiyu. Ink on paper. (68.57)

Japanese, Fujiwara period, 900–1185. Buddhist sutra, the Kan Fugen Kyō. Gold and silver on paper. (68.60)

POTTERY

Chinese, Southern Sung dynasty, 1127–1280, Tz'u-chou ware. Deep cup-shaped bowl, low foot ring; gray stoneware, transparent glaze over white slip; vertical fluting two thirds of the way down. (67.28)

Chinese, Annamese type, 13th century. Bowl with compressed, thin, slightly flaring rim; flat, slightly concave base; fine grain, buff stoneware; thin yellowish green celadon glaze; crackle. (68.59)

Japanese, Momoyama period, 16th century, Shino ware. Water pot with arching handle, spout and cover; coarse gray stoneware fired reddish in spots; grayish semi-opaque glaze; crackle; trellis, ivy motif, ferns on cover. (67.16)

Japanese, Momoyama period, 16th century, Mino-Karatsu ware. Water jar; uneven cylindrical shape with turned-in lip, two horizontal loop handles; coarse dark brownish gray stoneware; unevenly mottled gray and tan glaze; willow and cherry trees in brown slip. (67.17)

Japanese, Momoyama period, 16th century, Oribe ware. Tray, square with vertical sides, arching diagonal handle, four loop feet; coarse buff stoneware; transparent white and green glaze; curtain design underglaze in brown and white slip. (67.21)

Japanese, Momoyama period, 16th century, Hagi ware. Shallow bowl with arching handle and high foot with two notches; coarse, buff stoneware fired reddish; opaque grayish white glaze; uneven crackle. (68.15)

Japanese, Edo period, 17th century, Kutani ware. Large, deep dish with wide, flaring rim; white porcelain; milky white glaze; overglaze enamels of "tortoise shell" pattern on rim, each scale framing an object, bird in landscape in octagonal frame in center, floral scrolls outside. (67.15)

Japanese, Edo period, 17th century, Banko ware. Dish with arching handle and everted foliate lip; buff stoneware fired reddish on foot rim; light tan glaze; crackled; overglaze enamels of bird on a hydrangea branch, red "dewdrop" pattern on rim, red lines and clouds on handle. (67.22)

Japanese, Edo period, 17th century, Kutani ware. Large, shallow dish with plain rim, flat brown lip; coarse whitish porcelain fired brownish; mustard yellow, green, aubergine, lavender glaze; chrysanthemums and bird on yellow ground, lavender foreground and brown scrolls inside. (67.23)

Japanese, Edo period, 18th century, Nabeshima ware. Dish on high foot, flattened rim; fine white porcelain; transparent glaze; underglaze blue and overglaze enamel colors; outside three "six-coin" groups, comb pattern on foot; rocks and peonies inside center. (68.58)

Persian, probably Gurgan, 13th century. Elephant with howdah and two figures; fine, buff-colored earthenware; clear turquoise glaze with silvery iridescent decay; painted in cobalt blue underglaze. (67.26)

The Gallery was able to acquire by purchase, and through the kind offer of Professor Alban G. Widgery of Winchester, Virginia, the following paintings from his collection:

Burmese, 18th century. Royal personage with four attendants. Painted in colors and gold on paper. Inscriptions in black nasta'līq script. (68.5)

Indian, set of 20 paintings mounted in glass. Signs of the zodiac and planets. Painted in colors on paper. Inscriptions in black. (68.1)

Indian, Deccani, late 18th century. Seated ruler with four attendants. Painted in colors and gold on paper. Inscription. (68.7)

Indian, Deccani, early 18th century. Lady with attendants on terrace. Painted in colors and gold on paper. Worn inscription in black. (68.9)

Indian, Mughal, 18th century. Ascension of the Prophet (on horseback) surrounded by angels. Painted in colors and gold on paper. Text and inscriptions in red and gold nasta'līq script. One of a pair: 68.3. (68.2)

Indian, Mughal, 18th century. The Higher Regions of Paradise and Heaven. Painted in colors and gold on paper. Text and inscriptions in red and gold nasta'līq script. One of a pair: 68.2. (68.3)

Indian, Mughal, 18th century. The Iranians under Rustan defeating the Turanians under Afrasiyab. Painted in colors and gold on paper. Text and inscriptions in black and gold nasta'līq script. (68.4)

Indian, Mughal, 18th century. The Virgin Mary and the Miracle of Changing Water into Wine. Painted in colors and gold on paper; European style. (68.10)

Indian, Mughal, 18th century. Amatory scene with three figures. Painted in color and gold on paper. Painting unfinished. (For reverse, see 68.11a.) (68.11b)

Indian, Rajput, early 18th century. Krishna with gopis. Painted in color and gold on paper. (68.6)

Persian, 17th century, style of 16th century. Shah Tahmasp I seated on rock, holding bottle and cup; a goat dancer in the background. Painted in gold and black on paper. (For reverse, see 68.11b.) (68.11a)

Turkish, 17th century. Abraham in the fire watched by Nimrud. Painted in colors and gold on paper. Calligraphy in gold, blue, and black. (68.8)

Care of the Collections

The technical laboratory examined, cleaned, and repaired, as necessary, 137 Freer objects. In addition, 20 objects under consideration for purchase were examined and 33 objects were examined or repaired for other museums and individuals.

Takashi Sugiura, the Gallery's mounter of oriental pictures, and an assistant, Mrs. Kumi Kinoshita, select a mounting cloth for a Japanese painting.

Ten Chinese and Japanese paintings and screens were restored, repaired, or remounted by Takashi Sugiura and his assistant Makoto Souta. Illustrator F. A. Haentschke remounted 22 Burmese, Persian, Indian, and Turkish paintings.

Museum specialist Martin Amt made 250 exhibition changes: 42 were American, 72 Chinese, 35 Christian, 85 Japanese, and 16 Near Eastern. All the necessary equipment for these changes was provided by the cabinet shop under the direction of building superintendent Russell C. Mielke, who has also maintained the building in its usual immaculate and sound condition.

Curatorial Activities

Director John A. Pope, in collaboration with Robert B. Fox, chief archeologist of the Philippine National Museum, organized the Manila Trade Pottery Seminar which took place in Manila 18–25 March 1968. Some thirty of the leading authorities on Chinese ceramics from America, Europe, China, and Japan were invited to participate and funds

were raised to transport them to Manila. The combined knowledge and experience of these scholars was brought to bear on the problem of identifying and classifying some 40,000 fragments and whole pieces of Chinese pottery that have been excavated in the Philippines over the last half century. Members of the seminar visited the Museum and the private collections in Manila and some of the archeological sites where this material had been found. Plans are underway to publish the proceedings.

Officials of the National Palace Museum in Taiwan invited members of the seminar to Taipei, where they took part in another seminar dealing with some of the problems relating to the Imperial wares in that collection. The opportunity to study such a wide variety of export wares and the finest existing collection of Imperial wares within a short period of time was a rare one, and all agreed that the two seminars together were a most worthwhile undertaking.

On the way to Manila, Pope visited the East African countries of Kenya and Tanzania. In medieval times their seacoasts were largely inhabited by Arabs who built large cities and mosques and imported great quantities of Chinese porcelains for decorative purposes and, also, apparently for daily use. Thousands of fragments of this porcelain and a few whole pieces have come to light in the past twenty years or so as British archeologists have excavated and reconstructed these early Arab cities. Most of the material is divided among the British Institute for History and Archaeology in East Africa at Nairobi, the Museum at Dar es Salaam, and Fort Jesus at Mombasa. The material studied in these places will form the basis of an important chapter in the history of the early trade in Chinese porcelain and also throw new light on the function of the Indian Ocean as an early trading area.

On the way home, Pope spent a month in Japan, continuing his study of the early history of Japanese porcelain and again visiting museums and private collections, as well as many of the early kiln sites in Saga Prefecture on the island of Kyushu.

Pope was appointed by the Trustees for Harvard University a member of the Board of Advisors of Dumbarton Oaks Research Library and Collection.

Assistant Director Harold P. Stern continued his work as a member of the United Nations Educational Scientific and Cultural Organization Expert Committee for the Preparation of an Exhibition and Album on Mutual Influences of Japanese and Western Art following his participation at the meeting in Paris in June 1967. The exhibition and publication will be a major attempt to show the cross-cultural art ex-

change between East and West and the project should reach fruition in 1968, the Meiji Centennial year.

From September until January Stern studied Japanese paintings and drawings in European and British collections and initiated a survey of early Japanese lacquer as utilized in European furniture. Special emphasis was given to the work of the Ukiyoe and Yamatoe schools and the artists Katsushika Hokusai and Kawanabe Gyōsai. (The Freer Gallery has the world's most extensive holdings of Hokusai.) In addition he attended the International Institute for Conservation of Historic and Artistic Works London Conference and assisted Takashi Sugiura, of the Freer staff, in presenting a session devoted to Far Eastern paper-conservation techniques.

Plans continued to move forward for the Master Prints of Japan Exhibition to be held at the University of California at Los Angeles in April 1969, sponsored by the Art Council. Stern was asked to organize the exhibition, select the prints, and write the book which will accompany it. The show will be the largest and most comprehensive early Japanese woodblock print exhibition ever held on the West Coast. He also was called upon in April by the Department of State to organize, for the delegates to the United States-Japan Conference on Cultural and Educational Interchange, an exhibition of Meiji period art to be displayed at the Smithsonian Institution Museum of History and Technology.

Progress was made on his study of the Gallery paintings of the Ukiyoe school, with their publication the object. In addition Stern was selected a trustee of the Japan-America Society of Washington and was asked to serve on the executive committee.

Head curator Rutherford J. Gettens of the technical laboratory devoted his major effort to the continued preparation of volume 2 of *The Freer Chinese Bronzes,* now in galley proof.

In July 1967, at the invitation of René Sneyers, deputy director of the Institut Royal du Patrimoine Artistique, he spent the summer in Brussels as "visiting specialist" observing practices in technical study and conservation in Belgium, and in writing and editing three articles on the identification of pigments, to be published in *Studies in Conservation.* He also gathered further material in Europe for the pigment identification series and participated in the one-week conference of International Council of Museums Committee on Conservation in Brussels. At the International Institute for Conservation of Historic and Artistic Works Conference on Museum Climatology, in London, he was honored as the Forbes Prize lecturer.

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In addition to being appointed coordinator of the working group on "reference materials" for the ICOM Committee on Conservation, Gettens was elected in March 1968 to a three-year term as president of the IIC.

Assistant conservator W. Thomas Chase of the technical laboratory continued to assist Rutherford J. Gettens in the preparation of the manuscript for the forthcoming publication on technical studies of Chinese bronze vessels and his manuscript on two Chinese bronze weapons with meteoritic iron blades. He also carried forward his investigation of Chinese bronze belt-hooks for a projected future publication.

Chase assisted Professor Oleg Grabar of the University of Michigan in organizing the Sassanian Silver Conference held at the Freer 28–29 February 1968.

Assistant curator of Chinese art Thomas Lawton was concerned with a complete reexamination of all objects in the Chinese collection. Colophons, seals, and inscriptions on paintings were studied and new information added to the Gallery's research materials. His organization of information and selection of representative objects from the collections for a Gallery handbook are now well under way.

Staff Changes

The Gallery regretfully announced, on 30 April 1968, the retirement of Rutherford J. Gettens as head of the technical laboratory after seventeen years at the Gallery. He will continue to serve as a consultant.

In August 1967 Donald Kelman and Yoshiaki Shimizu completed their summer intern studies at the Gallery.

William Trousdale resigned as associate curator of Chinese art in September 1967 to accept a position in the Office of Anthropology, Museum of Natural History. Thomas Lawton reported for duty as assistant curator of Chinese art.

In May 1968 Morris Rossabi reported for a one-year predoctoral research internship.

Library

Library acquisitions this year included 337 volumes, 2,338 photographs, and 2,928 slides.

A total of 296 scholars, students, and visitors used the library for research, and 10 graduate library students interviewed the librarian for information on the administration and organization of the library.

Through the generosity of the Weedon Foundation, the library was able to acquire additional material, among which were:

Toyozo Arakawa. *Shinō*. Osaka, 1967.
Idemitsu Bijutsu Sensho. Tokyo: Idemitsu Bijutsukan, 1966–1968.
Wang Shih-chieh (compiler). *Garland of Chinese Painting*. Hong Kong, 1967.

Books purchased from the Kevorkian Foundation grant included:

Louis Frederic. *Art of India: Temples and Sculptures.* New York, 1959.
Kanwar Lal. *Immortal Khajuraho.* Delhi, 1965.

Public Services

The Gallery was open to the public daily, except Christmas, from 9:00 a.m. to 4:30 p.m. A total of 169,533 individuals visited the exhibits (the August attendance of 28,652 was the highest of any month) of which 2,417 visited the office for general information, to submit objects for examination and inscriptions for translation, to consult with staff members, to take photographs or sketch in the galleries, to study in the library, and to examine objects in storage. Members of the staff examined 7,685 objects and 652 photographs, and translated 788 Oriental language inscriptions for individuals and institutions. Objects in storage were shown to 506 persons. By request, 45 groups, totaling 921 persons, were given docent tours through the exhibition galleries, and 8 groups of 105 individuals were given docent service in the storage areas. Among the visitors were 255 distinguished scholars in Far and Near Eastern art or persons holding official positions who came here to study museum administration and practices; of this number, 138 were from other countries.

On 26 October 1967, a ceremony celebrating the coronation of His Imperial Majesty Mohammad Reza Pahlavi, Shahanshah of Iran, and Her Imperial Majesty The Empress Farah Diba was held in the auditorium. Vice President Hubert H. Humphrey and Ambassador of Iran and Mrs. Ansary attended, along with many other distinguished guests. Following this, a special exhibition of Iranian art was opened in the galleries.

The auditorium was used by 12 outside organizations for 22 meetings with a total of 3,447 individuals attending.

The fifteenth annual series of illustrated lectures, held in the auditorium, included:

"Ceramic Wares of Siam." Dr. Charles N. Spinks, American University (October 1967).
"The Artistic Program of Ajanta." Professor Walter M. Spink, The University of Michigan (November 1967).
"A Newly Discovered Medieval City in the Syrian Desert." Professor Oleg Grabar, University of Michigan (January 1968).
"Musicial Instruments in Japanese Art." Professor David B. Waterhouse, University of Toronto (February 1968).
"Indian and Iranian Elements in Early Japanese Art." Professor Benjamin Rowland, Harvard University (March 1968).

The photographic laboratory, under the supervision of Raymond Schwartz, processed a total of 17,061 items during the year of both

Freer Gallery objects and those submitted from other sources; these included negatives, photographs, color slides, color-sheet films, polaroid prints, and album and registration prints.

The sales desk sold 113,154 items consisting of 5,353 publications and 107,801 reproductions (including postcards, slides, photographs, and reproductions in the round).

Publications

GETTENS, RUTHERFORD J. "Joining Methods in the Fabrication of Ancient Chinese Bronze Ceremonial Vessels." Pages 205–217 in *Proceedings of the Seminar on Application of Science in Examination of Works of Art.* Boston, September 1965.

GETTENS, RUTHERFORD J., HERMANN KUHN, AND W. T. CHASE. "Lead White." *Studies in Conservation,* vol. 12, no. 4, pp. 125–139, 1968.

LAWTON, THOMAS, AND CHU-TSING LI. "The New Chinese Landscape." *Art Journal,* vol. 27, no. 2 (Winter 1967–1968), pp. 142–150.

POPE, JOHN A., RUTHERFORD J. GETTENS, JAMES CAHILL, AND NOEL BARNARD. *The Freer Chinese Bronzes.* Vol. 1, catalogue. Washington: Freer Gallery of Art (Smithsonian Institution Publication 4706), 1967.

STERN, HAROLD P. *Moonlight Revelry. Text for a Springbok Puzzle.* Thompsonville, 1968.

———. "Traditional Japanese Art." *Asahi Evening News,* Tokyo., March 1968.

National Collection of Fine Arts

DAVID W. SCOTT, *Director*

THE NEW GALLERY OF THE National Collection of Fine Arts was opened in the belief that what it has to offer is profoundly needed at this time. It is both a resource and a force. As a resource it plays a vital role, never more important than during an age of rapid change and reassessment. When we are struck, as we are so vividly today, by the realization that change is of the essence, we tend to forget the opposite and equal truth that continuity, as well, is of the essence. One of the most profound maladies of our time is our emphasis on change itself, to the exclusion of continuity, as a life principle. This overvaluation strikes at the foundations of orderly growth and evolution. The arts record the spiritual voyage of our nation and tell us whence we have come and what values and beliefs have guided and sustained us, in short—who we are. As a major, continuing repository for significant American Art, the National Collection is thus a vitally important resource.

And the Collection is a force. In the terms of today's activists, it represents the march of the American spirit. It reflects our inquiry and our energy, our doubt and our affirmation. Enormous strength, courage, and faith emanate from the monumental building, from the paintings in its halls, from the sculpture in its court. Here we see process and creativity, discipline and imagination, the bridging from the past and from the present toward the future, the formulation of change, the confrontation with and embracing of the new.

And this action operates not only within the walls of the building—although works of art from all over the country and visitors from all over the world meet in this arena. The National Collection and the

President Lyndon B. Johnson dedicates the nation's newest, and oldest, museum, the National Collection of Fine Arts, on 3 May in the sculpture court of the renovated Old Patent Office Building. Below, the 8th and G Streets entrance ablaze with light for the 3,318 guests who attended the formal dedication ceremonies.

exhibits it assembles project their effects outward—to the schools of the District of Columbia, to the White House, to small libraries and community colleges throughout the land, and to the nation's largest museums. Throughout Latin America, Europe, Africa, and Asia the National Collection's International Art Program sends exhibits and curators, and it co-sponsors art workshops. The Collection communicates through lectures, slides, prints, publications, periodicals, radio, and television. It encourages scholarship and trains museum technicians. It is a lively part of that great national university, the Smithsonian Institution. Its aim is to project and to share the American experience as a fundamental part of the universal experience. Its faith is founded on a belief in the creative energies of man and the ultimate integrity of the human spirit.

Opening of the New Galleries

The dedication ceremony for the new galleries of the National Collection of Fine Arts took place at 9:30 p.m., 3 May. Seated under the elms in the courtyard on that warm spring evening were 3,318 guests. The Secretary, having recounted the history of the National Collection, introduced President Johnson, who characterized himself as feeling "very much like a proud uncle to the National Collection." He added, "If I will never be remembered as a patron of the arts, I should be delighted to be known as an uncle of the arts . . . one who doesn't visit often but likes his relatives to do well." Then the President and Mrs. Johnson were escorted through the galleries by the Secretary and Mrs. Ripley. The red-coated Marine Corps Band played for the moonlit courtyard ceremony, and, during the reception following the formal dedication, the New England String Quartet played in the assembly room.

On the following morning, a scholarly symposium was held on the topic, "Directions for the National Collection of Fine Arts." Charles Sawyer, Chairman of the Smithsonian Art Commission, served as moderator. The three principal speakers, all distinguished members of the Smithsonian Art Commission, were: Edgar P. Richardson, who commented on research in art history, Bartlett Hayes, Jr., on art education, and Lloyd Goodrich, on the subject of government encouragement of the arts. Discussants were Wayne Andrews of the Wayne State University, and John B. Hightower, executive director of the New York State Council of the Arts. A prepared statement was also read by Alfred Frankenstein, San Francisco art critic and art historian.

The new galleries—which display some 600 examples of American painting, graphic arts, and sculpture—opened to the public on Monday, 6 May. They have already enjoyed widespread popular and critical

success. The National Collection presents both continuing and changing exhibitions in some fourteen halls and galleries, with more exhibit areas to open subsequently. It shares with the National Portrait Gallery an extensive library and conservation laboratory established as centers for training and research.

Response to the opening has been most gratifying. Widespread Smithsonian support provided essential assistance and a boost to the morale of the Collection's staff. All the major national news and art periodicals, press services, and television information services covered the event, which was also carried by such media as special displays and a unique poster program sponsored by the List Foundation. Interest in the new museum brought ten thousand visitors in the first five days of operation.

Smithsonian Art Commission

At the forty-fifth annual meeting of the Smithsonian Art Commission, held in Washington on 5 December recommendations were made for the reappointment of Page Cross, Lloyd Goodrich, Walker Hancock, and Bartlett H. Hayes, Jr. for the usual four-year term. The following officers were elected: Charles H. Sawyer, chairman; Walker Hancock, vice-chairman; and S. Dillon Ripley, secretary. Appointed to the executive committee were: David E. Finley, chairman; Ogden M. Pleissner, Henry P. McIlhenny, Charles H. Sawyer (ex officio), Walker Hancock (ex officio), and S. Dillon Ripley (ex officio). The resignation of Gilmore D. Clarke was regretfully accepted.

Under provisions of the revised bylaws, which were approved by the Smithsonian Board of Regents in January, the following new members were announced at the spring meeting of the Commission on 3 May: William A. M. Burden, Regent of the Smithsonian Institution and art collector; Martin Friedman, Director of the Walker Art Center; Thomas Howe, Director Emeritus of the Palace of the Legion of Honor; Mrs. J. Lee Johnson, President of the Board of the Amon Carter Museum of Western Art; Samuel C. Johnson, business executive, collector, and patron; and Mrs. Otto L. Spaeth, writer, collector, and patron. The resignations of Paul Mellon and Stow Wengenroth were also announced at the special spring meeting.

At both the December and May meetings, Commission members reviewed works of art which had been submitted during the year and recommended their acceptance or rejection for the National Collection of Fine Arts.

The immediate past Chairman of the Commission, Edgar P. Richardson, was the honored recipient of the second Smithson Medal, formally

Survey of American Art exhibited in the Lincoln Gallery which served as a Civil War hospital and was the setting for President Lincoln's second inaugural ball and banquet.

presented 3 May at a ceremony in the great hall of the Smithsonian Institution building.

The Collections

An outstanding gift to the National Collection was that of Emil J. Arnold, which included works by Jacob Epstein, Louis Eilshemius, Karl Knaths, and Louise Nevelson. Orrin Wickersham June donated works by Bierstadt, Kroll, Kensett, and other artists. Following the death of William Zorach, the artist's children deposited with NCFA an important group of sculptures, paintings, and drawings by this artist as a nucleus by which his life work may be studied in depth.

Received as a transfer from the Harmon Foundation were more than eleven hundred paintings, watercolors, drawings, and prints by the Negro artist W. H. Johnson. These were cataloged and photographed under curator Adelyn D. Breeskin's direction. Fifty pieces were selected to be retained by NCFA as a nucleus of the artist's best works, and the principal Negro colleges and the Museum of African Art each selected a dozen of this artist's works for their art and educational programs.

The most important purchase of the year was the entire surviving contents of the studio—in Florence, Italy—of the eminent 19th-century American sculptor Hiram Powers. It comprises 160 pieces of sculpture and over six thousand letters between the artist and major British and American personalities—including three United States Presidents—on

Top, left: Hiram Powers (1805–1873), *Eve Tempted,* modeled 1839; purchased in memory of Ralph Cross Johnson. Top, right: Frederick MacMonnies (1863–1937), *Bacchante and Infant Faun,* bronze, 1894. Below, left: Alexander Archipenko (1887–1964), *King Solomon,* bronze, 1963; gift of Frances Archipenko. Below, right: Chaim Gross (1904——), *Judith,* rosewood, n.d.; gift of the artist.

the political, artistic, and literary scene. Included were two major marble statues, *Eve Tempted,* purchased in memory of Ralph Cross Johnson, and *The Last of the Tribe.* Other purchases include *Niagara Falls* (1820) by Alvan Fisher (1967.85), the second of a pair of paintings by this artist, and a bronze *Bacchante* by Frederick MacMonnies.

The Registrar reports that 1,425 works of art were submitted for accessioning, including 142 paintings, 278 pieces of sculpture (including 160 pieces by Hiram Powers), 989 prints and drawings, and 16 decorative arts objects. These works were given by 124 donors or partly purchased through NCFA funds. The museum sent out 337 items to other museums and institutions for exhibitions.

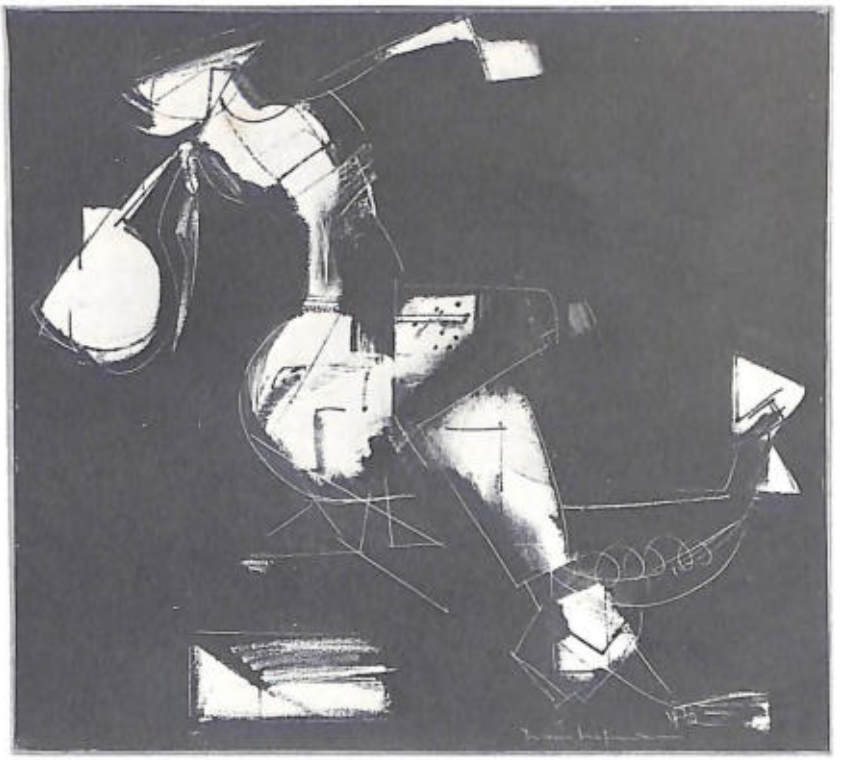
Four pieces of brass jewelry designed for his wife by Alexander Calder were donated by the artist; and Atelier Mourlot gave a number of prints. The following were also included in gifts received during the year:

PAINTINGS

Artist	*Title*	*Donor*
Romaine Brooks	(14 paintings)	The artist
Jasper F. Cropsey	Greenwood Lake	Ellen Wheeler
Gene Davis	Gothic Jab	The artist
Louis Eilshemius	Standing and Reclining Nymphs	Roy Neuberger
a/Ralph Earl	(pair of portraits of clockmaker and wife)	Orrin W. June
Helen Frankenthaler	Small's Paradise	George L. Erion
Thomas George	Painting #21	The artist
Cleve Gray	Ceres I	The artist
Hans Hofmann	Untitled	Harry Kreindler
Eugene Higgins	The Black Cloud	Ranger Fund
Lester Johnson	Three Graces	Martha Jackson Gallery
William H. Johnson	Flower to Teacher	The Harmon Institute
Alexander Liberman	Green Diagonal	The artist
George L. K. Morris	Industrial Landscape	Anonymous
Lowell Nesbitt	Ben Berns' Studio 1967	The artist
Henry Lyman Sayen	(14 paintings)	The artist
Maurice Sterne	Benares on the Ganges	Ranger Fund
Adja Yunkers	Aegean II	The artist

PRINTS, DRAWINGS, AND WATERCOLORS

Artist	*Title*	*Donor*
Romaine Brooks	(drawings, watercolors)	The artist
William Gropper	(5 drawings)	The artist
Chaim Gross	(19 drawings, watercolors, and prints)	The artist
Alfred Maurer	Portrait of a Girl	George P. Blundell



Hans Hoffman (1880–1966), untitled. Tempera on canvas, n.d. Gift of Harry E. Kreindler.

Artist	*Title*	*Donor*
Raphael Soyer	(10 drawings)	Emil J. Arnold
Abraham Walkowitz	(watercolor)	Emil J. Arnold
	SCULPTURE	
Alexander Calder	Nenuphar	The artist
Sue Fuller	String Composition #534	The artist
Charles Grafly	Meade Memorial	Dorothy Grafly
Chaim Gross	Three Acrobats on a Unicycle	Harris J. Klein
Alexander Liberman	Equipoise	The artist
Victor Millonzi	Mellow Yellow	Robert and Eleanor Millonzi Foundation
Bernard Rosenthal	The Smithsonian Column	The artist
Theodore Roszak	Construction in White	The artist

During the year the lending program of the National Collection organized a number of special exhibits for the White House, government agencies, and the District of Columbia schools. A limited

Henry Lyman Sayen (1875–1918), *Valley Falls.* Oil on canvas, 1915. Gift of H. Lyman Sayen.

George Bellows (1882–1925), *Mr. and Mrs. Philip Wase.* Oil on canvas, 1924. Gift of Paul Mellon.

number of loans were made to federal agencies and approved educational institutions. Approximately 900 works of art are on loan, including over 100 paintings and prints to the White House, most of which represent American art of this century. Also organized was the Third White House Fellows Seminar on American Art which was attended by the Fellows and members of the President's staff. Works of art were purchased for government agencies, and numerous private collections were inspected with reference to gifts for the collection. The Barney lending collection was reorganized and moved into new quarters under the supervision of Jean Lewton.

The conservation laboratory examined some 500 works in the collection, and by May more than 80 paintings had received treatment ranging from varnishing to cleaning and lining. During the year 32 pieces of sculpture were restored or cleaned. Rostislav Hlopoff, conservator for the Frick Collection in New York, came for six weeks to restore and clean six large works for the opening. Preventive conservation was given emphasis during the year, instruments were obtained to monitor relative humidity and light intensity, and increasing attention was given to safe handling and storage procedures.

Exhibitions

The last outpost of NCFA occupancy in the Museum of Natural History building was evacuated in January. As the new building was not to be opened to the public until May, the year's exhibitions were limited to a six-month period. They included the following:

Treasures from the Cooper Union Museum (13 July through 24 September 1967), which numbered 250 items—a small selection in relation to the scale and variety of the Cooper Union Museum's collection of fine and decorative arts. Objects displayed ranged from panels of wall paper to paintings by Winslow Homer, bird cages to brocades, Japanese sword fittings to jewelry. An extraordinary exhibition, it did honor to the Cooper Union, one of the great museums of America.

George Caleb Bingham: 1811–1879 (19 October 1967 through 1 January 1968), which brought together 35 portrait, genre, and narrative paintings and 51 drawings by one of America's foremost delineators of the life of her own people. Organized by NCFA, the exhibition was also presented at the Cleveland Museum of Art and the Art Galleries of the University of California at Los Angeles.

William Zorach: 1887–1966 (21 September through 5 November 1967), a selection of 57 sculptures, paintings, and drawings from a large group of the artist's work given to NCFA by his children.

The Graphic Art of Mary Cassatt (22 November 1967 through 7 January 1968), a definitive collection of Cassatt's etchings and lithographs.

Personal Impressions by Alice Pike Barney (19 October 1967 through 1 January 1968), a group of 12 pastel portraits.

In addition 50 examples of work done by children in art classes, provided by several American museums, were selected from exhibitions being sent abroad under sponsorship of NCFA's International Art Program and shown (14 July through 4 September 1967).

International Art Program

The principal activity in the earlier part of the year was the organization and preparation of the American exhibition at the IX São Paulo Bienal. This major show, containing a memorial exhibition of the works of Edward Hopper and a show of younger painters entitled "Environment USA," was both a popular and a critical success in São Paulo. One of the Bienal prizes went to American painter Jasper Johns. The International Art Program (IAP) prepared an extensive catalog, now on the commercial market, to accompany the exhibition.

In the fall of 1967, the IAP collaborated with the Pasadena Museum in preparing the American representation to the V Paris Biennial for Young Artists. The show was composed of four west-coast painters, one of whom, Llyn Foulkes, won the grand prize for painting.

One of the most successful ventures of the year was a traveling print workshop, organized by IAP and sent to Pakistan for a three-month period. Printmaker Michael Ponce de Leon received a Department of State grant in order to conduct the workshop. Enthusiastic reports from Karachi indicated that it made a significant contribution to the artistic life of Pakistan.

"Communication Through Art," an exhibition of contemporary graphic art, is now in India. Through Grey Foundation support, the Department of State provided a grant for New York City artist Clayton Pond to travel to East Africa with the exhibition and conduct the serigraph workshop. "New Expressions in American Printmaking," shown for eight months in Germany, was lauded as the best United States exhibition of its kind ever circulated there.

In February, the IAP sent a small collection of contemporary United States art to New Delhi as the official American entry to the First India Triennale of Contemporary World Art. A generous grant from the Ben and Abby Grey Foundation in St. Paul, Minnesota, made this possible. Here again, American artists received prizes, a gold medal in sculpture going to Joseph Cornell and honorable mention to Donald Judd. In

April, a collection of twenty contemporary prints was sent to the Third Print Biennial in Santiago, Chile. The American collection won the award as the best country entry, while Joseph Albers received a prize as the best individual printmaker. The year's activities culminated with the preparation and installation in Venice of the American exhibition at the XXXIV Venice Biennale. This show, organized in collaboration with the University of Nebraska, contains the works of ten artists and is built around the theme, "The Figurative Tradition in Recent American Art."

Library

The library's plan to develop a study center for American art in Washington comes closer to realization as a result of the year's events. The total number of 3400 reference uses made of the library represents an increase of 57 percent over the figure reported during the previous fiscal year. Notable additions to the library collections were received from Mrs. Adelyn D. Breeskin, Stefan Munsing, Dr. and Mrs. David Scott, Mr. and Mrs. Tessim Zorach, and the Washington Gallery of Modern Art.

Curatorial and Other Staff Activities

The activities of the department of painting and sculpture were reflected in the final selection of art works shown at the opening of the NCFA as well as in their documentation, conservation, photographing, and placement. Inspection of works of art brought in for identification and opinion, the solicitation of new objects to be added to the collections by gift and purchase, extending help and advice to researchers in American art, and the devising of new programs continued at a steadily accelerating rate.

Director David W. Scott participated as a juror in the Armed Forces Exhibition in Washington, D.C., and in the Ninth Annual Eight-State Exhibition of Painting and Sculpture in Oklahoma City. He served also as a judge in the third annual Arts and Crafts Festival sponsored by the St. Augustine Arts and Crafts Council in St. Augustine, Florida, and was a panel member in a workshop "to evaluate revival and development of Northwest Coast Indian Art" in Port Chilkoot-Haines, Alaska.

Curator of painting and sculpture Richard P. Wunder spent much of his time on the transfer of the Cooper Union Museum to the Smithsonian, which officially took place 30 June. The negotiation for the acquisition and eventual transfer to Washington of the Hiram Powers sculpture studio necessitated two trips to Italy. He also lectured before

the Third White House Fellows Seminar conducted by NCFA, the Material Culture Seminar conducted by the Department of American Studies, the Smithsonian Associates, and the Third Pennsbury Manor American Forum, Morrisville, Pennsylvania.

Curator of contemporary art Adelyn D. Breeskin collected 67 paintings and 42 sculptures, exclusive of the Johnson collection, from outside NCFA for the opening. She engaged in the organizing of the comprehensive exhibition of prints and drawings by Mary Cassatt, which traveling show will visit nine museums throughout the country, and she also conducted two all-day art tours to Philadelphia and to Baltimore, and taught a ten-week course on "The Art of Seeing," for Smithsonian Associates, as well as jurying shows in Norfolk, Alexandria, and Baltimore.

The curator of prints and drawings Jacob Kainen selected work representing high points in American art from the 18th century to the present, and new accessions were made with a view to filling historical gaps in the collection. He lectured on 18th-century artist Canaletto at the National Gallery of Art and at the Museum of History and Technology. He also delivered a series of lectures, "Art Without History," for the Smithsonian Associates.

The associate curator in charge of the lending program Donald R. McClelland, traveled to the Orient to select an exhibition of paintings by the Ceylonese artist Justin Daraniyagala and to develop an exhibition of Mogul art from Banaras, India. He delivered several lectures on American art in Japan, Ceylon, and India, as well as at The Little White House, Warm Springs, Georgia; High Museum, Atlanta, Georgia; the National Chapter of the Daughters of the American Revolution, Washington, D.C.; and at the White House Fellows Seminars. He juried shows at the Fairfax County Art Association, the Virginia Museum Show (Alexandria), and the Gunston Hall Art Fellowship.

Curator of exhibits Harry Lowe led an art tour for the Smithsonian Associates to Richmond, Virginia, and was host for the tour to the Valentine Museum and Virginia Museum of Fine Arts. He also served on the five-man committee appointed to select the art works comprising the Tennessee Painting Today collection; selected the exhibition for "Norio Azuma-Maltby Sykes: New Processes in Printmaking," for the Tennessee Fine Arts Center in Nashville; organized and conducted an art tour of New York City for the Smithsonian Associates; delivered the commencement address at the Memphis Academy of Art, "Destruction as a Positive Force"; and gave a lecture, "The Museum: Large or Small?" at the annual meeting of Telfair Academy of Arts and Sciences at Savannah, Georgia.

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Summer by Mrs. W. H. Holmes covered by an opaque bloom caused by a burst steam pipe; right, after cleaning and revarnishing in the conservation laboratory.

Above, left: Conservator Norvell Jones cleaning 8x10-foot glass-top hot table used for lining paintings; right, plaster head by Hiram Powers, showing cleaning, half finished. Below, left: assistant conservator Elizabeth McDonald working on "Il Penseroso" by Mozier; right, museum technician Alden Jackson applying gold leaf to a period frame in the museum's frame shop. (Photo by Peter Fink, New York City.)

Chief of the International Art Program Lois Bingham and assistant Betty Jo Abel traveled to Brazil twice, to install and to dismantle the American exhibition at the IX São Paulo Bienal. Miss Bingham made survey trips to Latin American countries to arrange for circulation of the exhibition, "The New Vein," and in Italy, with deputy chief Margaret Cogswell, she installed the American exhibition at the XXXIV Venice Biennale. In Czechoslovakia and Romania she arranged for the show, "The Disappearance and Re-Appearance of the Image," which was in Romania under the United States-Romanian Cultural Exchange Agreement for 1968. She also juried the annual exhibition of the Academy of Fine Arts in Easton, Maryland.

Head conservator Charles Olin gave slide lectures to a number of groups including the National Trust for Historic Preservation, the Jewish Community Center, and the 84th Congress Wives' Club. He spent three days at Dickinson College giving lectures and seminars on conservation, and was guest lecturer for the George Washington University museum training course.

Under Mrs. Mary Nell Sherman, special service activities focused on the NCFA opening and included a community relations program, under which the Director's preview tour for over thirty-five commercial neighbors resulted in twenty imaginative store windows honoring the opening. The plans for the opening provided for invitations, hostesses, a press room, establishing complete invitational lists, as well as a White House tour for major donors, and dinner parties at the Italian and Brazilian Embassies for out-of-town guests.

The volunteer staff for the opening included Miss Ruth Oviatt, a retired writer and editor who wrote the major part of the press kit; Mrs. John Durrell, who worked on community relations; Mrs. Huston Coiner III, who carried out a new liaison program with guidebooks, convention bureaus, USIS missions and map companies; Mrs. Ellis Lyons, who planned an extensive educational program for schools and libraries; Mrs. Robert Kintner, who organized pre-opening dinner parties for 350 out-of-town guests; and Mrs. Angel Byrne, who aided with the logistics of the opening. Two dozen additional volunteers, most from the Smithsonian Ladies Committee, accomplished vital work such as addressing invitations and mailing posters to museums.

The Office of Special Services programmed the openings for the George Caleb Bingham and Mary Cassatt exhibitions in the Musuem of Natural History; prepared press kits for the Biennials in São Paulo and Venice; arranged a four-part lecture series in cooperation with the Washington Print Club; planned a series of teas for Congressional and Ambassadorial wives; and prepared a continuing program of private tours for distinguished visitors.

The docent program was initiated during the year and has been greatly expanded. This first summer will see two tours daily during the week, and one tour each day on the weekend.

Research

A number of research projects were carried on despite the heavy demands of preparation for opening the museum. Mrs. Pamela Allara prepared a paper on the art career of the National Collection's first director, William Henry Holmes. Curator Adelyn D. Breeskin made important progress on her monumental study of Mary Cassatt and hopes to complete her "Catalogue Raisonée" by the end of the year. She also began intensive study of Milton Avery's paintings in preparation for next year's exhibition.

The department of painting and sculpture is working toward a final catalog of the National Collection's holdings of American painting and sculpture. Curator Richard Wunder has been transcribing and analyzing the correspondence of 19th-century sculptor Hiram Powers, preparatory to publishing a definitive monograph. Volunteers from the Junior League of Washington have assisted in transcribing the letters. Wunder is also gathering data on American expatriate artist Romaine Brooks in anticipation of the National Collection's exhibition of her paintings and publication of her memoirs, and on Emanuel Leutze for the NCFA exhibition planned for the summer of 1969.

Assistant curator William Truettner followed up his study of Frederic Edwin Church's 19th-century paintings of the Far North with an article, "The Genesis of Frederic Edwin Church's Aurora Borealis," to be published in the October *Art Quarterly*. He also completed research on Gilbert Stuart's 18th-century portraits of naval officers, and his article, "Portraits of Stephen Decatur After Gilbert Stuart," was submitted for publication.

Research assistant Robert Hunter worked extensively on paintings in the National Collection by early 19th-century landscape artists Alvan Fisher and Thomas Cole.

Curator of prints and drawings Jacob Kainen is nearing completion of a history of the Works Progress Administration graphic arts project in New York City, for an organization sponsored by the National Foundation of the Arts. Kainen also wrote forewords to various books and catalogs. Research assistant Caril Dreyfuss completed studies on the history of the Washington Workshop and the Color School which developed from it, and did preliminary research on American engraver Stanley William Hayter.

In addition, scholars were brought to the National Collection of Fine Arts for special projects. A study of exterior sculpture in the District of Columbia by Bruce Moore and Michael Richmann was carried to a conclusion. Professor William Gerdts made a study of the 19th-century American sculpture in the National Collection. Mrs. Selma Rein researched 19th- and 20th-century legislation on the planning, erecting, and maintaining of the Old Patent Office building, as source material for a small booklet on the monumental building which now houses the Collection.

Publications by the staff include the following:

BREESKIN, ADELYN D. *The Graphic Art of Mary Cassatt.* 111 pp. New York and Washington: The Museum of Graphic Art and Smithsonian Institution Press, 1967.

KAINEN, JACOB. [Foreword to] *Raphael Soyer—Fifty Years of Print Making 1917–1967.* Compiled and edited by Sylvan Cole, Jr. New York: Da Capo Press, 1967.

LOWE, HARRY. [Essay in] *Norio Azuma-Maltby Sykes: New Processes in Print Making.* Nashville, Tennessee: Tennessee Fine Arts Center, 1968.

MCCLELLAND, DONALD R. "Sudanese Perspective." *Mid-East—A Middle East-North African Review,* vol. 7, no. 9 (November 1967), pp. 14–18.

OLIN, CHARLES. "Conservation at the National Collection of Fine Arts." *Arts Magazine,* vol. 42, no. 8 (June/Summer 1968), pp. 67–68.

SCOTT, DAVID W. "New Home for the Nation's Oldest Collection." *Art Education, Journal of the National Art Education Association,* vol. 21, no. 5 (May 1968), pp. 10–13, 5 illustr.

———. "The National Collection." *The Art Gallery,* vol. 11, no. 8 (May 1968), pp. 21–30, 16 illustr.

WUNDER, RICHARD P. "Charles Michel-Ange Challe: A Study of His Life and Work." *Apollo,* vol. 87, no. 71 (January 1968), pp. 22–35.

———. "The Smithsonian Institution's National Collection of Fine Arts." *The Connoisseur,* vol. 168, no. 675 (May 1968), pp. 49–54.

Publications

Publications prepared under the auspices of the National Collection of Fine Arts as follows:

George Caleb Bingham 1811–1879. Text by E. Maurice Bloch. 99 pp., 36 illustr. Washington: Smithsonian Institution Press (publ. 4725), 1967.

Highlights of the National Collection of Fine Arts. Introd. by David W. Scott; essays by Richard P. Wunder, Adelyn Breeskin, and Jacob Kainen; descriptions by William Truettner and Caril Dreyfuss. 64 pp., 48 illustr. Washington: Smithsonian Institution Press (publ. 4737), 1968.

National Collection of Fine Arts-National Portrait Gallery [the story of the building]. Introd. by David W. Scott, remarks by Charles Nagel, architectural statement by Waldron Faulkner. 16 pp., 12 illustr. Washington: National Collection of Fine Arts, Smithsonian Institution Press, 1968.

National Collection of Fine Arts [Gallery plan, for free distribution]. 4 illustr., map. Washington: National Collection of Fine Arts, Smithsonian Institution Press, 1968.

São Paulo 9: United States of America—Edward Hopper—Environment U.S.A.: 1957–1967. Essays by Lloyd Goodrich and William C. Seitz. 165 pp., 75 illustr., text in English and Portuguese. Washington: Smithsonian Institution Press, 1967.

Venice 34, The Figurative Tradition in Recent American Art. By Norman A. Geske. 131 pp., 70 illustr. (Preceded by text in Italian, 59 pp.) Washington: Smithsonian Institution Press, 1968.

Treasures from the Cooper Union Museum [catalog of the exhibition]. Foreword by David W. Scott; introduction by Christian Rohlfing. 48 pp., 1 illustr. Washington: National Collection of Fine Arts, Smithsonian Institution Press, 1967.

William Zorach 1887–1966 [catalog of the exhibition]. Foreword by David W. Scott. 4 pp. Washington: National Collection of Fine Arts, Smithsonian Institution Press, 1967.

Four large reproductions and four postcards of paintings in the Collection were printed through the Kefauver memorial fund. Postcards from the S. C. Johnson & Sons gift collection were reprinted for the opening of NCFA.

National Portrait Gallery

CHARLES NAGEL, *Director*

HENRY INMAN, a 19th-century artist of note and himself an excellent painter of portraits, once prophesied: ". . . The time will come when the rage for portraits will give way to a higher and purer taste."

Whether a higher and purer taste is characteristic of our times is perhaps debatable, but the "rage for portraits" has given way to the point that few artists are still interested in the mastery of this long-esteemed skill. Today the creating of a portrait which is at the same time a work of art is not what it was in 18th- or even 19th-century America.

Among the duties of the National Portrait Gallery, the collection of likenesses of our country's great people is no doubt a primary one. Another should be to encourage the creation of outstanding likenesses by commissioning contemporary portraits of men and women who have been judged desirable subjects for Gallery collections. Such a program might well begin with portraits of our presidents, a matter of prime importance since that roster is by no means complete.

We have been fortunate in receiving from the artist Peter Hurd his impressive likeness of President Lyndon Baines Johnson. This generous gift is a singular stroke of good fortune for a gallery with extremely limited purchase funds, and we are greatly indebted to the artist for a fine addition which brings our presidential series up to date. There are still many gaps—fifteen to be exact—many of them, alas, among our earlier presidents. This points up the need for a special fund for presidential likenesses, one which would enable the Gallery to commission a portrait by an artist of its choice early in each administration.

***President Lyndon Baynes Johnson*, by Peter Hurd, contemporary American artist. Egg tempera. Gift of the artist. (NPG 68.14)**

Eventually, this might lead the way to the establishment of similar funds to be devoted to such special fields as the arts and letters, the stage, and science. It is discouraging to find how few people of note but not necessarily of means have sat for a fine portrait. And of the few that have been done, most are usually already owned by some other institution, and are available to us only for temporary showing. It should be our duty to ensure that this situation is corrected for the future.

The National Portrait Gallery affirms the continuing need for fine portraits in all media. It is our belief that artists who are skilled in producing distinguished likenesses deserve to be encouraged, and we are willing to take part in developing an American renascence of fine portraiture as soon as necessary funds become available.

By the time the Gallery opens we shall have been in the building twenty months. In this relatively short time our numerically limited staff has performed prodigiously.

The task of equipping the building has been formidable. We were fortunate, however, to have received some ten thousand dollars, contributed in his memory by friends and former clients of the late Victor Proetz. This sum enabled us to secure a number of 18th- and 19th-century antiques. These give a special air to the administrative suite which has been made a memorial to Mr. Proetz, who was its designer. Also, from drawings of furniture designed by him selections were made for manufacture by his cabinet maker of many "working pieces" for the commission room, the Reception Room, and the offices. Four handsome cases for large books—two high and two low—were willed to the Gallery and serve as theme pieces. These, from the hand of Mr. Proetz, for many years had graced his apartment. They now add greatly to the character of the reception room. For her help in securing both antique and contemporary pieces, we are much indebted to Miss Elinor Merrell of New York who was generous to us in every way in this felicitous achievement.

One early idea concerning the Gallery was that people should realize this country is a consolidation of the early holdings of many different lands. It therefore seemed appropriate to secure contemporary likenesses of the sovereigns of nations which had colonial interests in America. The Victor Proetz Fund has made it possible to obtain engravings of a number of these monarchs. These prints all hang on the third floor where they are presided over by the handsome marble effigy of William Pitt, Earl of Chatham, an early champion of the rights of our country. They contribute much to the Gallery's air of being primarily a museum of history. Similar efforts will continue, perhaps next with early explorers such as LaSalle, Sir Walter Raleigh, de Soto, Sebastian Cabot, and Verazzano.

Gradually the exhibition areas of the Gallery are being properly equipped under the direction of curator of exhibits Riddick Vann. Meanwhile, the collections have been slowly growing in size and significance by gift and purchase under the watchful eye of curator Robert G. Stewart, and his research assistant, Monroe Fabian. These holdings are being kept in prime condition with the help of conservator Charles Olin.

Personnel

During the six months of the past year that historian Daniel J. Reed was absent on leave as deputy director of the National Advisory Commission on Libraries, his duties were ably assumed by his assistant, Mrs. Virginia Purdy. She has since been made acting keeper of the catalogue and has rendered valiant service in the preparation of

material to be used in the catalogues for our opening exhibition. As the Gallery's administrative officer, Joseph A. Yakaitis has contributed much to its smooth and efficient day-to-day operation.

The Gallery may consider itself fortunate in having secured for a year, which began in September 1967, the services as Assistant Director of J. Benjamin Townsend, from the University of the State of New York at Buffalo. Toward the end of the year he assumed responsibility for the two catalogues being issued by the Smithsonian Institution Press for the opening exhibition, "This New Man: A Discourse in Portraits" and a "Catalogue of American Presidents." His seasoned judgment has been of inestimable value, and his intellectual qualities, wit, and good humor won the respect of the entire staff. His return to Buffalo after his year with us will be a major loss to the Gallery.

The permanent staff reached a total of twenty-three members with the addition of Jon Danning Freshour as research assistant in the Curator's office. The addition of a number of "700-hour" appointees has proved most valuable.

Nine volunteers have continued to help at various tasks in the Gallery and library: Mrs. Marian Carroll, Mrs. Helen Elder, Mrs. Helen Jones, Mrs. Cynthia McKelvie, Mrs. Charles Nagel, Miss Gabrielle Pirandoni, Mrs. Bryson Brennan Rash, Mrs. Tobie Savoie, and Mrs. Stuart Symington. It is hoped that this number of most welcome workers will be increased in the fall by a group of volunteer docents with whom preliminary orientation discussions have already begun.

Only one major change in our small staff has taken place: Mrs. Helen Maggs Fede, who, as keeper of the catalogue, came to the Gallery in November with a fine record of curatorial and research duties performed at Mt. Vernon, the Museum of History and Technology, and Blair House, after only two months on the staff, died suddenly, in February 1968, of a heart attack. It is seldom that one finds a person whose qualifications and duties coincide so completely and her loss is keenly felt.

National Portrait Gallery Commission

In the course of the year the makeup of the Commission has remained unchanged, those whose appointments expired having been reappointed.

MEMBERSHIP

John Nicholas Brown, Chairman
Mrs. Catherine Drinker Bowen
Julian P. Boyd
Lewis Deschler

President Benjamin Harrison, **on left, by Eastman Johnson (1824–1906). Drawing heightened with chalk, ca. 1889. (NPG 68.4) Right, *Henry Cabot Lodge,* by John Singer Sargent (1856–1925). Oil on canvas, 1890. Gift of the Honorable and Mrs. Henry Cabot Lodge, Jr. (NPG 68.58)**

David E. Finley
Wilmarth S. Lewis
E. P. Richardson
Richard H. Shryock
Frederick P. Todd, Colonel, USA (Ret.)

Ex-Officio

Chief Justice of the United States, Earl Warren
Director of the National Gallery of Art, John Walker
Secretary of the Smithsonian Institution, S. Dillon Ripley

The Collections

The fifty-one accessions for the year again show a variety of approaches to the making of a likeness: painting, sculpture, and drawing as well as a few scattered examples of other media. While space does not permit detailed consideration of all these, a few are worthy of special mention.

Four additions were made to the presidential series: Chester A. Arthur by O. H. P. Bolling was the gift of Margaret Garber Blue; Ulysses S. Grant, also by Bolling, was purchased through the Museum

***Gertrude Stein,* on left, by Jo Davidson (1883–1952). Terra-cotta. (NPG 68.8) Right, *Robert (King) Carter,* by unknown American artist, ca. 1701–1719. Oil on canvas. (NPG 68.18.)**

Fund; Benjamin Harrison is represented by one of the really fine drawings in the collection by Eastman Johnson and also came to us by purchase; and, finally, the portrait of President Johnson by Peter Hurd, which came as a gift of the artist, as previously mentioned.

A bust of the late Helen Keller, by Jo Davidson, was one of a series of fine likenesses purchased from the estate of the artist; Henry Cabot Lodge depicted by John Singer Sargent was an important gift from the grandson of the Senator and his wife, the Honorable and Mrs. Henry Cabot Lodge. Mrs. Alice Silliman Hawkes gave us a portrait of Benjamin Silliman, the distinguished early 19th-century scientist and nephew-in-law of John Trumbull, the painter of this small portrait. Finally, a painting of Daniel Webster by Chester Harding came to the collections as a most welcome gift from Mrs. Gerald Burwell Lambert.

David Finley has continued his interest in building up a collection of decorative arts to ornament our exhibition areas by presenting a pair of handsome Duncan Phyfe chairs to complement the card table he presented last year.

Conservator Charles H. Olin has been much occupied with readying the collections of the National Collection of Fine Arts for their opening last May, but he managed as well to take care of several portraits in the Gallery's collection. To have his conservation laboratory located in the building is a tremendous aid to the smooth operation of the Gallery.

The curatorial staff has spent most of the year establishing operational procedures for exhibitions and in locating portraits for the opening exhibition, and on Labor Day the entire collection was moved from the exhibition area in the Arts and Industries building, and from other Smithsonian storage areas, to the new Portrait Gallery.

In the course of the year, additions were made to the collections, and loans granted and accepted, as follows:

PAINTINGS ADDED TO THE COLLECTIONS

Subject	*Artist*	*Donor or Fund*
Adams, Franklin P.	Zoss Melik	Museum Fund
Alcott, Louisa May	Frank Edwin Elwell	Alcott Farrar Elwell
Arthur, Chester A.	Ole Peter Hansen Balling	Margaret Garber Blue
Auerbach-Levy, William	William Auerbach-Levy	Max Levy
Cannon, Joseph Gurney	Jo Davidson	Museum Fund
Carey, Henry C.	T. Henry Smith	Mr. and Mrs. Henry Lea Hudson
Carter, Robert	Unknown	Museum Fund
Darrow, Clarence	Jo Davidson	Museum Fund
Depew, Chauncey M.	Adolfo Muller-Ury	Jessica Dragonette
Eastman, George	Paul Nadar	George Eastman House
Emerson, Ralph Waldo	Daniel Chester French	Museum Fund
George, Henry	George DeForest Brush	Museum Fund
Gibbs, William Francis	Malvina Hoffman	Anonymous Donor
Goddard, Robert	Emily Burling Waite	Anonymous Donor
Godwin, Parke	Eastman Johnson	Museum Fund
Grant, Ulysses S.	Ole Peter Hansen Balling	Museum Fund
Hampden, Walter	William J. Glackens	Museum Fund
Harrison, Benjamin	Eastman Johnson	Museum Fund
Harrison, William Henry	Denison Kimberly and Oliver Pelton, after Albert Gallatin Hoit	Museum Fund
Hoover, Herbert	Douglas Chandor	Museum Fund
Hunt, Richard Morris	Karl Bitter	Museum Fund
James, Henry	Emile Blanche	Katherine Dexter McCormick
Johnson, Lyndon Baines	Peter Hurd	Peter Hurd
Jones, John Paul	J. E. Haid	Museum Fund
Joseph, Chief	Cyrenius Hall	Museum Fund
Keller, Helen	Jo Davidson	Museum Fund
Kennedy, John P.	Eastman Johnson	Museum Fund
Kent, James	Daniel Huntington	Museum Fund
Kent, Mrs. James	Daniel Huntington	Kennedy and Knoedler Galleries
Lewis, Sinclair	Jo Davidson	Museum Fund
Lindberg, Charles	Jo Davidson	Museum Fund

Subject	*Artist*	*Donor or Fund*
Lodge, Henry Cabot	John Singer Sargent	The Honorable and Mrs. Henry Cabot Lodge, Jr.
London, Jack	Finn Frolich	Irving Shepard
Millay, Edna St. Vincent	John Ellis	Norma Millay Ellis
O'Keeffe, Georgia	Una Hanbury	Museum Fund
O'Neill, Eugene	Zoss Melik	Museum Fund
Peabody, George	Unknown	Museum Fund
Pershing, John Joseph	William Orpen	International Business Machines Corporation
Phillips, Wendell	Martin Millmore	Museum Fund
Rogers, Will	Jo Davidson	Museum Fund
Sherwood, Robert E.	Zoss Melik	Museum Fund
Silliman, Benjamin	John Trumbull	Alice Silliman Hawkes
Stein, Gertrude	Jo Davidson	Museum Fund
Stowe, Harriet Beecher	Alanson Fisher	Kathryn and Gilbert Miller Fund
Toscanini, Arturo	Boris Lovet-Lorski	Anonymous donors
Webster, Daniel	Chester Harding	Mrs. Gerard Burwell Lambert
Wimar, Carl	Carl Wimar	Martin Kodner
Winthrop, Theodore	Samuel Rowse	Winslow Ames
Whitney, Gertrude Vanderbilt	Jo Davidson	Museum Fund
Wollcott, Alexander	Zoss Melik	Museum Fund
Young, Brigham	Hartwig Bornemann	The Church of Jesus Christ of Latter-Day Saints

DECORATIVE ARTS ADDED TO THE COLLECTIONS

Object	*Donor*
Pair of American Empire side chairs	David E. Finley
Pair of American Empire side chairs	Museum Fund
One blue and white delft vase; pair of bronze Egyptian-style girandoles with crystal arms and pendants; one 19th-century marble and bronze urn with lid	Elinor Merrell
Pair of Leeds plates with pierced rims	Mr. and Mrs. Charles Nagel
Smithsonian owl, stamp collage	Emily Milliken Wilson

WORKS OF ART ON LOAN TO THE GALLERY

Subject	*Artist*	*Owner*
Acheson, Dean	William Zorach	National Collection of Fine Arts
Adams, John	Thomas Spear	University of Michigan

Subject	*Artist*	*Owner*
Choate, Rufus	Attributed to Henry or William Willard	University of Michigan
Churchill, Winston	Unknown	Louis E. Shecter
Conway, William Augustus	James Herring	National Gallery of Art
Elliott, Charles Loring	William S. Mount	National Gallery of Art
Everett, Edward	Attributed to Bass Otis	University of Michigan
Forrest, Edwin	David Johnson	National Gallery of Art
Fremont, John Charles	Bass Otis	University of Michigan
Gompers, Samuel	Moses Wainer Dykaar	National Collection of Fine Arts
Greenwood, Grace	Attributed to Cephas Giovanni Thompson	University of Michigan
Hall, James	Daniel Huntington	National Gallery of Art
Harding, Chester	Chester Harding	National Gallery of Art
Harper, Joseph Wesley	Eastman Johnson	National Gallery of Art
Henry, Joseph	Herbert Adams	National Collection of Fine Arts
Henry, Joseph	Walter Ingalls	National Collection of Fine Arts
Henry, Joseph	Clark Mills	National Collection of Fine Arts
Henry, Joseph	Theodore Mills	National Collection of Fine Arts
Henry, Joseph	W. W. Story	National Collection of Fine Arts
Holbrook, John Edwards	Daniel Huntington	National Gallery of Art
Hunt, William Morris	Thomas B. Lawson	National Gallery of Art
Ives, Herbert E.	Chester Warner Slack	Mrs. Herbert E. Ives
Kemble, Gouverneur	Asher B. Durand	National Gallery of Art
Lincoln, Abraham	Frederick W. Halpin	Mrs. Robert McCormick
Lloyd, James	Gilbert Stuart	National Gallery of Art
Longfellow, Henry Wadsworth	Thomas Buchanan Read	Mrs. Thomas Curtis
Madison, James	Attributed to James Frothingham	University of Michigan
Morrill, Justin Smith	Preston Powers	National Collection of Fine Arts
Otis, Bass	Attributed to Bass Otis	University of Michigan
Pettigru, James	Thomas Spear	University of Michigan
Pickens, Andrew	Unknown	Colonel Francis Pickens Miller, USA (retired)
Poe, Edgar Allan	Edith Woodman Burroughs	Louis E. Shecter
Prescott, William	Attributed to James Harvey Young	University of Michigan
Ranson, Alexander	Attributed to Alexander Ranson	University of Michigan
Roosevelt, Franklin D.	Jo Davidson	Louis E. Shecter
Sothern, Julia Marlowe	Irving R. Wiles	National Gallery of Art

Subject	*Artist*	*Owner*
Sousa, Mr. and Mrs. John Philip	Harry Franklin Waltman	Mrs. Helen Sousa Abert
Tuckerman, Henry Theodore	Daniel Huntington	National Gallery of Art
Van Rensselaer, Stephen	Gilbert Stuart	National Gallery of Art
Washington, George	Gilbert Stuart	Erick Kauders
Wayland, Francis	Attributed to Thomas Spear	University of Michigan

WORKS OF ART LENT BY THE GALLERY

To	*Subject*	*Artist*
American Museum of Negro History	Bethune, Mary McLeod	Betsy Graves Reyneau
American Museum of Negro History	Drew, Charles	Betsy Graves Reyneau
American Museum of Negro History	DuBois, William	Laura Wheeler Waring
Blair House	Grant, Ulysses S.	Samuel Waugh
Anacostia Neighborhood Museum	Harmon Collection	
William Penn Memorial Museum	Helmuth, Justus Henry Christian	John Eckstein
American Museum of Negro History	Marshall, Thurgood	Betsy Graves Reyneau
Montreal Museum of Fine Arts	Pocahontas	Unknown
Deerfield Academy	Pope, John Russell	Augustus Vincent Tack
American Museum of Negro History	Robeson, Paul	Betsy Graves Reyneau
Deerfield Academy	Root, Elihu	Augustus Vincent Tack
National Collection of Fine Arts	Sherman, William T.	George Peter Alexander Healy
Saint Paul Art Center	Stevenson, Adlai E.	Edward Weiss

Other Activities

Preparations for the opening exhibition have constituted a major part of the work of the history department in the past year. Having selected for it the title, "This New Man: A Discourse in Portraits," the historians have worked with Mr. Townsend on the selection of sitters to develop the theme, and with Curator Robert G. Stewart on what portraits were available for the show. The catalogue, which is to be a beautiful book of lasting importance, has entailed considerable biographical research. Under the editorial supervision of Mr. Townsend, a caption for each sitter as well as introductory statements for each gallery and group of

galleries were written by the history department staff and a smaller catalogue of the thirty-five presidential portraits was also prepared.

The Catalogue of American Portraits, now housed in convenient storage units, is being used by the staffs of this Gallery and other Smithsonian bureaus as well as by occasional visiting scholars. In addition, the number of reference letters grows. Equipment has been installed to prepare the data in the Catalogue for computer processing. After the sudden death of Mrs. Fede, Mrs. Virginia C. Purdy became acting keeper. Mrs. Mona C. Dearborn, a permanent though part-time cataloguer of the Catalogue of American Portraits, has been assisted in her work by one volunteer, Mrs. McKelvie, and several able temporary employees.

Historian Daniel J. Reed returned from a year's leave of absence in January 1968. Offprints of his article, "The Catalogue of American Portraits," which appeared in the July 1967 issue of the *American Archivist*, were sent to the mailing lists of a number of groups as well as to many individuals. In addition, notes about it appeared in the National Trust's *Preservation News*, in *Picturescope*, and in the April 1968 issue of *American Notes and Queries*. The response has been splendid, and negotiations are in progress with county, state, and national historical organizations interested in undertaking portrait surveys in cooperation with the Catalogue of American Portraits. He also edited "Manuscripts on Microfilm," for the *Quarterly Journal* of the Library of Congress.

He is serving as chairman of the local arrangements committee for the 1968 convention of the American Association for State and Local History which meets in Washington in September 1968. He is also a member of the professional advisory committee of the Archives of American Art. He and Mrs. Purdy attended the Museum Computer Conference in April at the Metropolitan Museum of Art in New York City.

Curator Robert G. Stewart again taught his course in "Principles of Museum Work" at George Washington University, and an article by him on a recent bequest to the Gallery—the portrait of Noah Webster by James Herring—was accepted for future publication by the *Smithsonian Journal of History*. Monroe H. Fabian published an article, "Some Moravian Paintings in London," in *Pennsylvania Folklife* (vol. 17, No. 20, 1967–1968).

Mrs. Virginia Purdy was the author of "The Catalogue of American Portraits" published in *Picturescope* (vol. 15, 1967), and prepared a new edition of the general brochure on the Gallery. Director Charles

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Nagel served as a member of the Fine Arts Committee of Blair House during the year, and he and Townsend both delivered lectures on the Gallery to local groups.

The prints and photographs collection was augmented by prints, given to the National Portrait Gallery by the Library of Congress, from 4000 glass-plate negatives made by Harris and Ewing. Mrs. Genevieve Kennedy Stephenson incorporated these into the collection with the volunteer assistance of Mrs. Cynthia McKelvie, Mrs. Charles Nagel, and Mrs. Stuart Symington.

For performing the doubly onerous duties in connection with a large opening exhibition, we are indebted to all the staff, but particularly to registrar Thomas Girard, who has performed miracles of thoughtful and efficient service in the complicated task of assembling the opening exhibition, and to Lewis McInnis who has likewise functioned quietly and effectively behind the scenes in the performance of a multitude of tasks.

Library

The library enlarged its physical facilities considerably this year, replacing old and inadequate shelving with new wood and steel stacks and adding other basic equipment. The use of the library represents an increase of 57 percent over the figure previously reported. Additions to the collection came largely through donations: Mrs. Adelyn Breeskin, Stefan Munsing, Dr. David Scott, Mr. and Mrs. Tessrin Zorach, and the Washington Gallery of Modern Art. During the year, one publication exchange mailing consisting of five National Collection of Fine Arts publications and two National Portrait Gallery titles were sent to 248 institutions here and abroad.

Librarian William Walker gave six orientation lectures on various aspects of the Gallery and its library, both in the library and in Barney House.

Joseph H. Hirshhorn Museum and Sculpture Garden

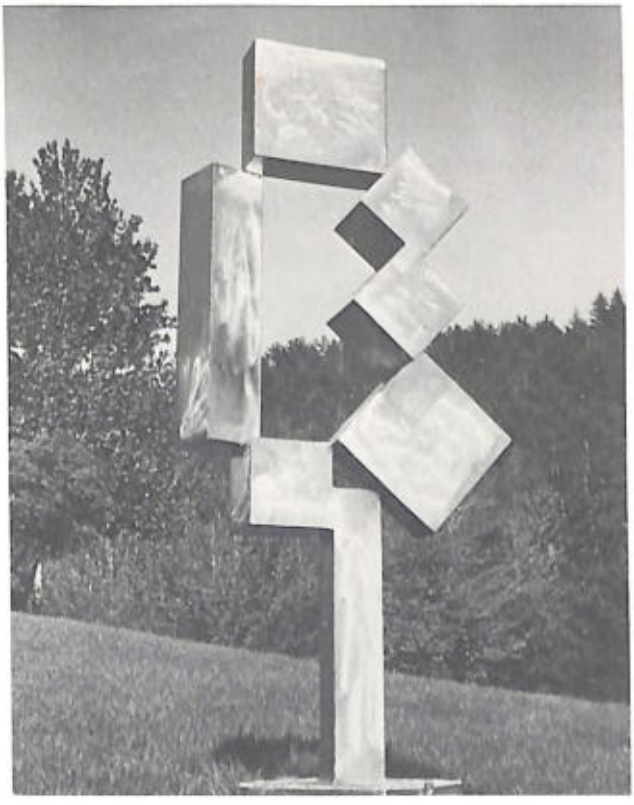
ABRAM LERNER, *Director*

THE JOSEPH H. HIRSHHORN MUSEUM, under Director Abram Lerner, moved with accelerated momentum toward three related goals: the acquisition of new paintings and sculptures, the development of plans and programs for the new Museum on the Mall being designed by architect Gordon Bunshaft, and the continuation of its services to scholars and institutions involved in the history of modern American and European art. Mr. Hirshhorn's generosity led to the acquisition this year of more than five hundred new paintings and sculptures, all of which were received and cataloged into the Collection. Assisting the Director was a staff of three: Frances Shapiro, executive secretary, Myron O'Higgins, registrar, and Cynthia Jaffee, assistant curator.

The Collection

Born of one man's unique passion for art, the Hirshhorn Collection is deeply concerned with major developments in the fields of contemporary painting and sculpture. Its 2,500 sculptures range historically from antiquity to the works of today's young creators. To its renowned group of European and American sculptures of the nineteenth and twentieth centuries, the Collection in 1968 added such significant works as:

Artist	*Title*
Bourdelle, Emile	Hommage à Daumier
Chryssa	Study for the "Gates" No. 15 (Flock of Morning Birds from *Iphigenia in Aulis* by Euripides)



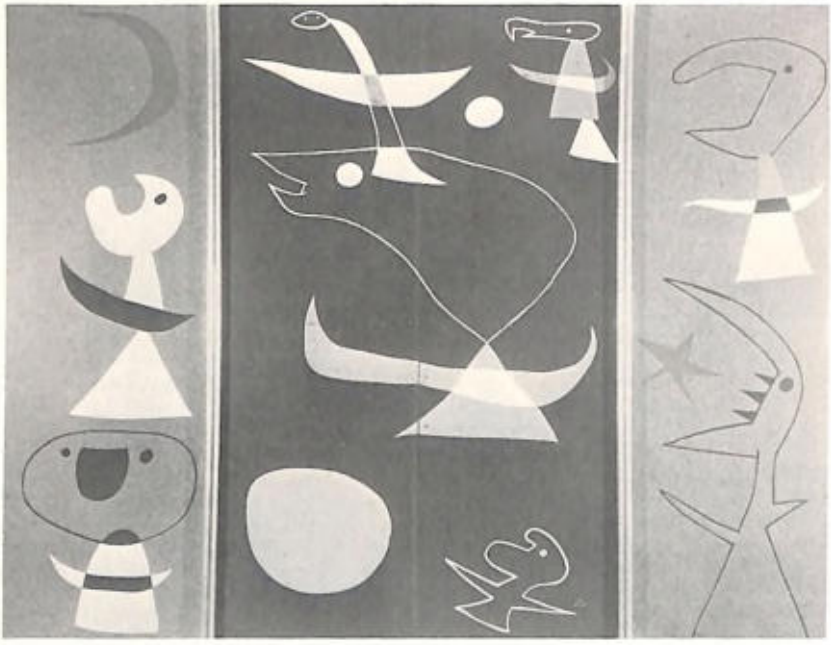
***Cubi XII*, by David Smith (American, 1906–1965). Stainless steel, 110 inches high, 1963.**

Artist	*Title*
Dubuffet, Jean	Le Verre d'Eau II
Gabo, Naum	Vertical Construction No. 1
Lachaise, Gaston	The King's Bride
Lichtenstein, Roy	Modern Sculpture with Black Shaft
Miró, Joan	Oiseau Lunaire
Pevsner, Antoine	Composition (Woman's Head)
Rodin, Auguste	Celle qui fut la Belle Heaulmière
von Schlegell, David	Leda
Smith, David	Cubi XII
di Suvero, Mark	The A Train

The Collection's paintings focus on the twentieth century. From the works of precursors such as Thomas Eakins and Winslow Homer to the canvases of today, the course of painting in America is covered in depth.

Le Verre d'eau II, by Jean Dubuffet (French, 1901——). Polyester, 94½ x 42⅛ x 4 inches, 1966.

Oiseau lunaire, by Joan Miró (Spanish, 1893——). Bronze, 92⅛ x 82¾ x 61½ inches, 1966.

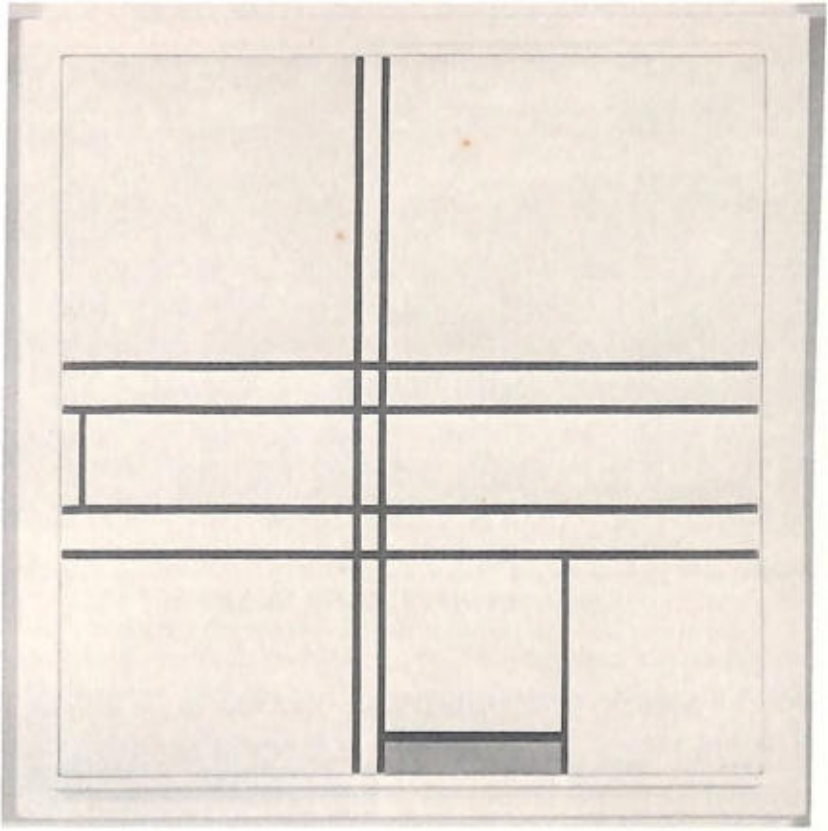


***Triptych*, by Joan Miró (Spanish, 1893——). Oil on masonite, 54 x 70 inches, 1937.**

Complementing the American section is a strong selection of paintings by modern European masters and young contemporaries. Notable paintings added to the Collection in 1968 include:

Artist	*Title*
Agam, Yaacov	Transparence of Rythmes II
Diller, Burgoyne	No. 2, First Theme
Dubuffet, Jean	Paysage au Caniche
Ernst, Max	Belle de Nuit
Frankenthaler, Helen	Indian Summer
Miró, Joan	The Circus Horse
Mondrian, Piet	Composition No. 2, Blue and Yellow
Pollock, Jackson	Number 3
Ruscha, Edward	Los Angeles County Museum on Fire
Still, Clyfford	Painting: January 1951
Vasarely, Victor	Mizzar
Zox, Larry	Trobriand

For the past decade Mr. Hirshhorn has been known as one of the nation's most generous lenders. The Collection is a major source for museums and art historians preparing retrospective exhibitions, biographies, or catalogues raisonnés of twentieth-century artists. In 1968 more



***Composition No. 2, Blue and Yellow,* by Piet Mondrian (Dutch, 1872–1944). Oil on canvas, 28¾ x 27½ inches, 1935.**

than fifty requests were received weekly for research information, loans, photographs, or permission to view specific works. Despite the limited physical facilities, more than three hundred visiting scholars, artists, and officials were greeted at the Collection office and warehouse in New York, and more than five hundred paintings and sculptures from the Collection were loaned to museums and galleries throughout the world. The following loans were representative:

Artists	*Works on Loan*	*To Exhibition or Recipient*
Giacometti; Magritte; Masson; Miró; Pollock	1 sculpture 4 paintings and drawings	"DADA, Surrealism & Their Heritage": Museum of Modern Art, New York; Los Angeles; Chicago

***Number 3*, by Jackson Pollock (American, 1912–1956). Oil and mixed media on canvas, 61 13/16 x 31 5/16 inches, 1949.**

Artists	*Works on Loan*	*To Exhibition or Recipient*
de Kooning, Willem	15 paintings and drawings	de Kooning Retrospective: Amsterdam; London; Museum of Modern Art, New York; Los Angeles; Chicago
Hepworth, Barbara	3 sculptures	Hepworth Retrospective: Tate Gallery, London
Hopper, Edward	3 paintings	Hopper Retrospective: IX São Paulo Bienal, Brazil; Brandeis University
Bacon; de Kooning; Hartley; Kokoschka; Munch; Rattner; Weber	8 paintings	"International Expressionism": Marlborough-Gerson Gallery, New York
Gorky, Arshile	1 painting	Opening Exhibition: National Collection of Fine Arts, Smithsonian Institution
Anuszkiewicz; Bontecou; Rauschenberg; Soto; Williams	3 paintings 2 sculptures	Pittsburgh International: Carnegie Institute Museum of Art
Calder; Giacometti; Man Ray; Masson; Miró	2 sculptures 3 paintings	"Space and Dream": M. Knoedler & Co., New York
Bauermeister; Matta	1 sculpture 1 painting	"The Art of Organic Forms": Smithsonian Institution
Bellows; Eilshemius; Luks; Walkowitz	4 paintings and drawings	"The Lower East Side: Portal to American Life (1870–1924)": Smithsonian Institution

Artists	*Works on Loan*	*To Exhibition or Recipient*
Tovish, Harold	5 sculptures 5 drawings	Tovish Retrospective: Solomon R. Guggenheim Museum, New York
Hopper, Edward	1 painting	United States Embassy, Paris

In 1968 the 130 monumental sculptures at the Hirshhorn Sculpture Garden in Greenwich, Conntecticut, were seen by 3,000 visitors who attended the 30 benefit tours scheduled for educational, cultural, and philanthropic organizations. The Garden Clubs of America and Channel 13 (National Educational Television) issued publications in conjunction with their visits.

The Museum

On 17 May 1966, the President requested that Congress enact legislation to authorize acceptance of the Hirshhorn Collection as a gift to the United States. By the Act of 7 November 1966 (P.L. 89–788, 89th Cong., S. 3389), Congress provided a site on the Mall, bounded by 7th and 9th Streets, Independence Avenue and Madison Drive, and provided statutory authority for the appropriation of construction and operating funds.

In 1968 the 90th Congress provided contract authority as well as an initial appropriation of $2,000,000 for construction of the Hirshhorn Museum and Sculpture Garden. Under architect Gordon Bunshaft, of Skidmore, Owings & Merrill, plans for the Museum neared completion. Construction on the site is scheduled for early 1969.

Staff Activities

Director Abram Lernér traveled to London, Rome, Venice, and Milan to confer with artists, gallery directors, and museum officials. He and Assistant Curator Cynthia Jaffee attended the Vernissage and Opening of the XXXIV Venice Biennale.

On 25 May, Mr. Lerner was interviewed by WCBS–TV News on "Art Collecting Today." In 1968, among other activities, he continued to serve on the New York Advisory Board of the Archives of American Art. Miss Jaffee served as a consultant to the New York State Council on the Arts. In April, all staff members attended the Museum Computer Conference at the Metropolitan Museum of Art.

Publications

LERNER, ABRAM. "Thomas Eakins" and "Edward Hopper." Essays in exhibition catalog, *From El Greco to Pollock*. Baltimore Museum of Art, 1968.

———. "The Hirshhorn Collection." *The Museum World: Arts Yearbook 9* (New York), pp. 62–66, 1967.

———. "The Joseph H. Hirshhorn Sculpture Garden." *The Garden Clubs of America Fifty-Fifth Annual Meeting*, 1968.

———. "Mr. Hirshhorn and his Collection." Foreword to *The Friends of Channel 13 Tour of the Hirshhorn Gardens*, 1968.

JAFFEE, CYNTHIA. "Reuben Nakian." Biographical note and bibliography in *Venice 34, The Figurative Tradition in Recent American Art.* Washington: Smithsonian Institution Press, 1968.

National Gallery of Art

JOHN WALKER, *Director*

SIR: Submitted herewith on behalf of the Board of Trustees is the report of the National Gallery of Art for the fiscal year ended 30 June 1968. This, the Gallery's thirty-first annual report, is made pursuant to the provisions of section 5(d) of Public Resolution No. 14, 75th Congress, 1st session, approved 24 March 1937 (50 Stat. 51; United States Code, title 20, sec. 75(d)).

Organization

The National Gallery of Art, although established as a bureau of the Smithsonian Institution, is an autonomous and separately administered organization and is governed by its own Board of Trustees. The statutory members of the Board are the Chief Justice of the United States, the Secretary of State, the Secretary of the Treasury, and the Secretary of the Smithsonian Institution, ex officio. The five general trustees continuing in office during the fiscal year ended 30 June 1968 were Paul Mellon, John Hay Whitney, Franklin D. Murphy, Lessing J. Rosenwald, and Stoddard M. Stevens. On 2 May 1968 Paul Mellon was reelected by the Board of Trustees to serve as President of the Gallery, and John Hay Whitney was reelected Vice President.

The executive officers of the Gallery as of 30 June 1968 were as follows:

Chief Justice of the United States, Earl Warren, Chairman.
Paul Mellon, President.
Ernest R. Feidler, Secretary and Treasurer.
John Walker, Director.
E. James Adams, Administrator.
Ernest R. Feidler, General Counsel.
Perry B. Cott, Chief Curator.
J. Carter Brown, Assistant Director.

The three standing committees of the Board, as constituted at the annual meeting on 2 May 1968 were as follows:

EXECUTIVE COMMITTEE

Chief Justice of the United States, Earl Warren, Chairman.
Paul Mellon, Vice Chairman.
Secretary of the Smithsonian Institution, S. Dillon Ripley.
John Hay Whitney.
Franklin D. Murphy.

FINANCE COMMITTEE

Secretary of the Treasury, Henry H. Fowler, Chairman.
Paul Mellon.
Secretary of the Smithsonian Institution, S. Dillon Ripley.
John Hay Whitney.
Stoddard M. Stevens.

ACQUISITIONS COMMITTEE

Paul Mellon, Chairman.
John Hay Whitney.
Lessing J. Rosenwald.
Franklin D. Murphy.
John Walker.

Personnel

At the close of fiscal year 1968, full-time Government employees on the permanent staff of the National Gallery of Art numbered 323. The United States Civil Service regulations govern the appointment of employees paid from appropriated funds.

Appropriations

For the fiscal year ended 30 June 1968 the Congress of the United States, in the regular annual appropriation, and in a supplemental appropriation required for pay increases, provided $3,082,000 to be used for salaries and expenses in the operation and upkeep of the National Gallery of Art, the protection and care of works of art acquired by the Board of Trustees, and all administrative expenses incident

***The Much Resounding Sea*, by Thomas Moran (American, 1837–1926). Canvas, 26 x 62 inches. Gift of the Avalon Foundation.**

thereto, as authorized by the basic statute establishing the National Gallery of Art, that is the Public Resolution No. 14, 75th Congress, 1st session, approved 24 March 1937 (50 Stat. 51; United States Code, title 20, secs. 71–75).

The following obligations were incurred:

Personnel compensation and benefits	$2,462,864.89
All other items	570,423.96
Total obligations	$3,033,288.85

Attendance

Visitors to the Gallery numbered 1,267,028 during the year. Average daily attendance was 3,500.

The Collections

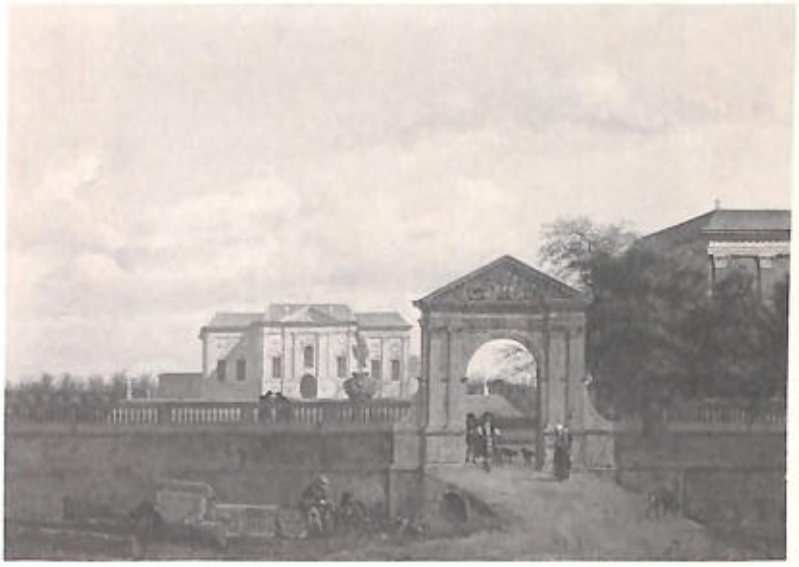
There were 1,878 accessions to the collections by the National Gallery of Art as gifts, loans, or deposits during the year. The following gifts or bequests were accepted by the Board of Trustees:

PAINTINGS

Donor	*Artist*	*Title*
Avalon Foundation	Moran	The Much Resounding Sea
Mrs. Julia Feininger	Feininger	Storm Brewing
Colonel and Mrs. Edgar W. Garbisch	G. W. Mark	The Swamp Fox

***Mrs. Metcalf Bowler*, by John Singleton Copley (American, 1738–1815). Canvas, 50 x 40¼ inches. Gift of Louise Alida Livingston. At right, *Portrait of a Woman*, artist unknown (American, painted about 1840). Canvas, 30 x 34 inches. Gift of Edgar William and Bernice Chrysler Garbisch.**

Donor	*Artist*	*Title*
Colonel and Mrs. Edgar W. Garbisch	F. R. Mullen	Confederate Blockade Runner and Union Man-of-War
"	Unknown	A City of Fantasy
"	"	Portrait of a Man
"	"	Portrait of a Woman
"	"	Still Life: Fruit and Painted Box on Table
"	"	Stylized Landscape
Louise Alida Livingston	Copley	Mrs. Metcalf Bowler
"	Sharples	John Bard
"	"	Mrs. John Bard
"	"	Dr. John Bard
G. Grant Mason, Jr.	Lawrence	Lady Hertford
"	"	Marquis of Hertford
Eugene and Agnes E. Meyer	Renoir	Nude
National Gallery of Art, Ailsa Mellon Bruce Fund	Jan van der Heyden	An Architectural Fantasy
"	Juan de Flandes	The Temptation of Christ
"	Panini	Interior of Saint Peter's, Rome



***An Architectural Fantasy*, by Jan van der Heyden (Dutch, 1637–1712). Wood, 18½ x 27½ inches. Ailsa Mellon Bruce Fund.**

Donor	*Artist*	*Title*
Mrs. Sigourney Thayer	Kensett	Landing at Sabbath Day Point
	SCULPTURE	
Avalon Foundation	Rimmer	Dying Centaur
Eugene and Agnes E. Meyer	Barye	Tiger Killing a Deer
"	Brancusi	Bird in Flight
"	"	Agnes E. Meyer
"	Despiau	Agnes E. Meyer
"	Rodin	The Sphinx
National Gallery of Art, Ailsa Mellon Bruce Fund	Maillol	Bather with Raised Arms
"	Prou	Charles, Duc de Berry
	GRAPHIC ARTS	
Frank Eyerly	Kuniyoshi	Bombed Out
"	Marin	The Sea, #3
Colonel and Mrs. Edgar W. Garbisch	Various	7 watercolors
The Heller Foundation	Beckmann	5 drypoints

***The Temptation of Christ,* by Juan de Flandes (Hispano-Flemish, active 1496–ca. 1519). Wood, 8¼ x 6¼ inches. Ailsa Mellon Bruce Fund.**

Donor	*Artist*	*Title*
Dr. and Mrs. George B. Green	Catesby	13 etchings
Louise Alida Livingston	Saint-Memin	Commodore Tingy
"	L'Aubin	Mrs. Tingy
Eugene and Agnes E. Meyer	Marin	5 watercolors
National Gallery of Art, Ailsa Mellon Bruce Fund	Haseltine	A Venetian Lagoon
National Gallery of Art, Andrew Mellon Fund	Various	22 prints and drawings
Mrs. Harold Ober	Marin	Quai d'Ivry
"	Meryon	The Old Gate of the Palace of Justice
"	"	The Admiralty
Mrs. Helen Haseltine Plowden	Haseltine	House in Venice
"	Haseltine	Mount Tacoma

Donor	*Artist*	*Title*
Mrs. Fred Rieth	Various	23 prints
Lessing J. Rosenwald	Claude Lorrain	Return of the Herds
"	Corot	40 prints
"	Géricault	Etudes de chevaux
"	Rembrandt	The Artist Drawing from a Model
"	"	A Woman Reading
"	"	The Goldweigher's Field
"	Various	4 prints (from proceeds of sale of duplicate prints)

WORKS OF ART ON LOAN TO THE GALLERY

The following works of art were received on loan, or were continued on loan:

Donor	*Artist*	*Title*
Nathan Cummings	Prendergast	Cove with Figures
Colonel and Mrs. Edgar W. Garbisch	Hicks	Peaceable Kingdom
Jerome Hill	Delacroix	Lion Devouring a Goat
Mr. and Mrs. David Lloyd Kreeger	Bonnard	After Lunch
"	Cézanne	Road near Auvers
"	Degas	Woman Brushing Her Hair
"	Gauguin	Landscape
"	Monet	The Seine near Giverny
"	Maillol	Pomona
Mr. and Mrs. Paul Mellon	Stubbs	Lion Attacking a Deer
"	Stubbs	Lion Attacking a Horse
"	Various French artists	68 paintings
"	Various English artists	137 drawings and water-colors
"	Prendergast	Salem Willows
"	Degas	13 wax sculptures
"	"	1 bronze sculpture

WORKS OF ART ON LOAN RETURNED

Donor	*Artist*	*Title*
Nathan Cummings	Prendergast	Cove with Figures
Colonel and Mrs. Edgar W. Garbisch	Hicks	Peaceable Kingdom
Mr. and Mrs. David Lloyd Kreeger	Bonnard	After Lunch
"	Cézanne	Road near Auvers
"	Degas	Woman Brushing Her Hair
"	Gauguin	Landscape
"	Monet	The Seine near Giverny
"	Maillol	Pomona

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WORKS OF ART LENT BY THE GALLERY

To	*Artist*	*Title*
Akron Art Institute	Demuth	Chimney and Water Tower
American Federation of Arts	Various	35 paintings
State of Arkansas	Catlin	18 paintings
Blair House	Various	6 paintings
The Brooklyn Museum	Homer	Hound and Hunter
"	Whistler	Head of a Girl
Art Institute of Chicago	Whistler	White Girl
California Palace of the Legion of Honor	Homer	Hound and Hunter
"	Whistler	Head of a Girl
Deerfield Academy	Tack	Charles Evans Hughes
Drury College	Various	4 paintings
Georgia Museum of Art	Various	14 paintings
State of Illinois	Stuart	Sir John Dick
"	Zeliff	The Barnyard
Joslyn Art Museum	Catlin	35 paintings
Lakeview Center for the Arts and Sciences	Catlin	28 paintings
Munson-Williams-Proctor Institute	Whistler	White Girl
University of Maryland	Cropsey	Autumn on the Hudson River
Mint Museum of Art	Copley	The Death of the Earl of Chatham
"	West	Self-Portrait
"	Various	17 paintings
National Art Museum of Sport, Inc.	Toole	Skating Scene
National Collection of Fine Arts	Quidor	The Return of Rip Van Winkle
National Society of Colonial Dames	Stuart	Betsey Hartigan
"	"	Unknown Man
National Portrait Gallery	Various	13 paintings
Norfolk Museum of Arts and Sciences	Various	7 paintings
Pennsylvania Academy of the Fine Arts	John	Joseph E. Widener
Portland Art Museum	Homer	Right and Left
Museum of Fine Arts, St. Petersburg, Fla.	Various	4 paintings
Smithsonian Institution	Various	5 paintings
State University College, Geneseo, New York	Church	Morning in the Tropics
Society of the Four Arts	Various	17 paintings
Tampa Bay Art Center	Various	6 paintings
Triton Museum of Art	Various	35 paintings
United States Capitol	Lambdin	Daniel Webster

To	*Artist*	*Title*
United States Capitol	Courter	Lincoln and His Son Tad
United States Department of Justice	Various	4 paintings
United States Department of State	Catlin	7 paintings
United States Supreme Court	Hesselius	Thomas Johnson
Virginia Museum of Fine Arts	Homer	Hound and Hunter
"	Whistler	Head of a Girl
The White House	Various	3 paintings
Whitney Gallery of Western Art	Catlin	72 paintings

Other Gifts

Gifts of money and securities were made by Avalon Foundation; Mrs. Angier Biddle Duke; J. I. Foundation, Inc.; Mrs. Ailsa Mellon Bruce; H. Arthur Klein; Samuel H. Kress Foundation; Medici Society, Ltd.; The A. W. Mellon Educational and Charitable Trust; Paul Mellon; Old Dominion Foundation; Lila Acheson Wallace Fund, Inc.; and others.

Exhibitions

The following exhibitions were held at the National Gallery of Art:

Fifteenth- and Sixteenth-Century German Prints (continued from the previous year through 3 August 1967).

Eighteenth-Century Drawings and Watercolors from the Collection of Rear Admiral and Mrs. H. W. Chanler (continued from the previous year through 9 October 1967).

Gilbert Stuart, Portraitist of the Young Republic (continued from the previous year through 20 August 1967).

French Nineteenth-Century Prints from the Rosenwald Collection (3 August through 7 December 1967).

Fifteenth- and Sixteenth-Century European Drawings (27 August through 24 September 1967).

Swiss Drawings: Masterpieces of Five Centuries (8 October through 29 October 1967).

Portraits from the Graphic Arts Collection of the National Gallery of Art (25 October 1967 through 8 February 1968).

Fifteenth-Century Engravings of Northern Europe from the Collection of the National Gallery of Art (3 December 1967 through 7 January 1968).

The Temptation of Christ by Juan de Flandes (14 December 1967 to continue into the next fiscal year).

Exhibition of Christmas Prints (7 December 1967 through 22 January 1968).

Renderings from the Index of American Design (22 January through 8 April 1968).

Painting in France 1900–1967 (18 February through 17 March 1968).

The Etchings of Charles Meryon (1 April through 28 April 1968).

Prints by Mark Catesby (1 April through 28 April 1968).

Paintings from the Albright-Knox Art Gallery, Buffalo, New York (19 May 1968 to continue into the next fiscal year).

Twentieth-Century French Prints and Drawings from the Rosenwald Collection, the Chester Dale Collection, and the Frank Crowninshield Collection (8 April through 25 June 1968).

Prints of the Danube School (25 June 1968 to continue into the next fiscal year).

Traveling Exhibitions

Graphic Arts from the National Gallery of Art collections were included in two traveling exhibitions, and special loans were made to 32 museums, universities, schools, and art centers in the United States and abroad.

Curatorial Activities

Under the direction of chief curator Perry B. Cott, the curatorial department accessioned 164 gifts to the Gallery. Advice was given with respect to 1,691 works of art brought to the Gallery for expert opinion, and 50 visits to collections were made by members of the staff in connection with offers of gifts.

The registrar's office issued 130 permits to copy and 70 permits to photograph. About 4,000 inquiries, many of them requiring research, were answered orally and by letter. There were about 350 visitors to the graphic arts study room, and permits for reproduction involving 100 photographs were issued.

Material in the Index of American Design was used during the year by 471 persons. Their interests included securing slides and exhibits, doing special research and designing, and gathering illustrations for publications.

Assistant chief curator William P. Campbell served as a member of the Special Fine Arts Committee of the Department of State; he judged one exhibition.

Curator of painting H. Lester Cooke was appointed consulting editor of *American Artist* magazine; he judged two exhibitions. A combat artist in Viet Nam, he continued as art consultant for NASA, visiting

***Interior of St. Peter's, Rome,* by Giovanni Paolo Panini (Italian, ca. 1692–1765/8). Canvas, 61 x 77½ inches. Ailsa Mellon Bruce Fund.**

Cape Kennedy with artists. He organized an art exhibit for NASA's tenth anniversary, and appeared on several television shows during the year.

David Rust, museum curator, judged three art exhibitions.

Assistant registrar Diane Russell taught two courses at The American University.

The Richter Archives received and cataloged 200 photographs on exchange from museums here and abroad; 1,176 photographs were purchased and about 2,000 reproductions were added to the Archives. 1,000 photographs were added to the Iconographic Index.

Restoration

Francis Sullivan, resident restorer of the Gallery, made regular and systematic inspection of all works of art in the Gallery and on loan to government buildings in Washington, periodically removing dust and bloom as required. He relined, cleaned, and restored ten paintings; gave special treatment to sixty-eight; and X-rayed eighteen as an aid in research. He continued experiments with synthetic materials as suggested by the National Gallery Fellowship at the Mellon Institute of Industrial Research, Pittsburgh, Pennsylvania. Technical advice was given in response to 237 telephone inquiries. Special treatment was given

to works of art belonging to government agencies including the United States Capitol and the Supreme Court. Sullivan appeared on the NBC television broadcast "The American Profile—The National Gallery of Art."

Publications

Katharine Shepard, assistant curator of graphic arts, contributed a book review to the *American Journal of Archaeology*. Hereward Lester Cooke wrote a book on *Painting Lessons from the Great Masters,* which won the Art Book of the Year award from the Art Publishers Guild. William P. Campbell edited the catalog of the Stuart exhibition. Perry B. Cott wrote the introduction to a book on Italian paintings in the National Gallery of Art.

Publications Service

The Publications Service placed on sale nine new publications: *Nicolas Poussin* by Sir Anthony Blunt, the A. W. Mellon Lectures in the Fine Arts for 1958; *Painting Lessons from the Great Masters* by Hereward Lester Cooke; *On Quality in Art* by Jakob Rosenberg, the A. W. Mellon Lectures in the Fine Arts for 1964; *Renaissance Medals from the Samuel H. Kress Collection* by G. F. Hill and Graham Pollard; the second book in the National Gallery of Art's Kress Foundation Studies in the History of European Art, *French Painting in the Time of Jean de Berry* (two volumes) by Millard Meiss; *Going Places with Children* (a guidebook to Washington, D.C.); *Art and the Spirit of Man* by René Huyghe, Kress Professor in Residence at the National Gallery of Art; *Historia Illustrada del Arte Occidental* by Erwin O. Christensen; *Bernini* by Howard Hibbard.

Six new catalogs of special exhibitions were placed on sale: *Gilbert Stuart (1755–1828), Portraitist of the Young Republic; Fifteenth- and Sixteenth-Century European Drawings; Swiss Drawings: Masterpieces of Five Centuries; Painting in France, 1900–1967; Paintings from the Albright-Knox Art Gallery; Fifteenth-Century Engravings of Northern Europe* by Alan Shestack, the second volume on graphic art in the collection of the National Gallery of Art.

A second edition of the catalog listing items sold by the Publications Service was published. A catalog with black-and-white illustrations of 48 Christmas cards, using reproductions of paintings, sculptures, and prints from Gallery collections was published, and 55,000 were distributed. Over 360,000 cards were sold.

The following new color reproductions were made available during the year: twelve subjects in the 22″ x 28″ format; fourteen subjects in 11″ x 14″ letterpress format; twenty-one subjects (for the first time)

in the 11″ x 14″ offset-lithography format; thirty-four color postcards; and seventy 2″ x 2″ color slides.

Number of customers served:

Over the counter	337, 012
By mail	14, 464
Total number of customers	351, 476

Educational Program

The program of the education department was carried out under the direction of Margaret Bouton, curator of education. Attendance figures for the series of lectures, tours, and special talks continued by the department are shown below.

Type of Tour	*1967*	*1968*
Introduction to the collection	22, 126	19, 384
Tour of the Week	9, 166	9, 711
Painting of the Week	13, 396	13, 836
Sunday lectures	15, 095	14, 533
Special appointments	22, 733	25, 325
Scheduled visits for area school children	74, 327	63, 674
Pre-school children	820	646
Total public response	157, 663	147, 109

Special appointments for tours, lectures, and conferences were made for groups from government agencies such as the Department of State, the Foreign Students Council, and the Armed Forces, and for club and study groups from all parts of the country.

The program of training volunteer docents continued, and volunteers from the Junior League of Washington, D.C., and the American Association of University Women conducted tours for children from public and private schools in the District of Columbia and surrounding counties of Maryland and Virginia. This year a Saturday program was inaugurated by the Junior League docents to provide tours for Scout groups and others.

The program for pre-school children, begun last year in connection with the cooperative nursery schools supervised by the District of Columbia Department of Recreation, continued; and fifteen volunteer docents (mothers who regularly help in the nursery schools) conducted tours of the Gallery for children from twenty-seven schools.

On Sunday afternoons fifty lectures with slides or films were given in the auditorium. There were thirty-five guest lecturers. Among these, the Andrew W. Mellon Lecturer in the Fine Arts, Stephen Spender, gave five lectures entitled "Imaginative Literature and Painting."

Seven lectures were given by members of the staff of the education department, two by other Gallery staff members, and there were two full-length film presentations.

The slide library now has a total of 51,567 slides in its permanent and lending collections. During the year 1,893 slides were borrowed by 446 persons, and it is estimated that the slides were seen by 26,769 viewers.

Education department staff members prepared texts for thirty-nine leaflets to accompany reproductions of the Painting of the Week sold in the Publications Rooms. Thirty-six radio talks were produced for broadcast during intermission periods at the National Gallery Sunday concerts. One new LecTour tape was recorded, and an Acoustiguide text was written and recorded for the exhibition of paintings from the Albright-Knox Gallery. Five pages of text were prepared for the Spanish-language Acoustiguide tour.

Dr. Bouton gave five lectures over the telephone to classrooms in schools in Arlington, Virginia, and in Youngstown, Ohio. Slides of Gallery paintings had been sent to the schools. Question and answer periods followed the telephone lectures.

A calendar of events listing National Gallery activities and mailed to approximately 11,800 names each month was prepared by the education department. In January this duty was transferred to the Public Information Office.

John Brooks taught art courses for the University of Maryland. John Hand delivered three lectures for the Virginia Museum and lectured on Oriental Art at the Graduate School, Department of Agriculture. Raymond S. Stites, Assistant to the Director for educational services, delivered twenty talks outside the Gallery. These included lectures at ten universities and colleges delivered in six states.

Extension Service

The Office of Extension Service circulates to the public traveling exhibitions, films, slides, and filmstrip lectures. These materials are lent free of charge except for shipping expenses. During the fiscal year this program reached approximately 2,176,000 persons—an increase of approximately 396,000 over last year.

Traveling exhibitions were viewed by an estimated 1,018,000. These figures include viewers of thirteen exhibits which are on loan to other organizations and are circulated by them. One hundred and forty-four prints of three films on the National Gallery of Art were circulated in 1,299 bookings and were seen by approximately 142,000 persons. This represents an increase in bookings of 576 (approximately 63,000

viewers) over last year when eighty prints of films were circulated.

A total of 2,403 slide lectures were circulated in 9,487 bookings and were seen by over 711,500 persons. This represents an increase in viewers of close to 81,500 over last year.

The special slide lecture project of placing sets of slides on long-term loan with school systems was, in this its second year, expanded and increased so that fifty additional slide sets were placed in thirty-two school systems, with nine state directors of art, and in five colleges. The total number of schools now included in this special project is fifty-six. An incomplete report from the schools (thirty-one schools reporting) shows 4,123 bookings with an estimated 309,225 viewers.

To increase the effectiveness of the Extension Service and to keep abreast of new developments in the audiovisual field, the curators, Grose Evans and George Kuebler, attended conferences and conventions in various states, speaking about the National Gallery of Art and displaying teaching materials available from the Gallery.

The National Gallery of Art again cooperated with the United States Office of Education and the George Washington University in a summer institute entitled "The Art Museum and the Teacher." Thirty-six teachers and supervisors from various parts of the country participated in this program, which was designed to strengthen their knowledge of art history and criticism and to develop new teaching techniques. The institute was held from 26 June to 11 August 1967.

Library

The library, under the direction of Anna M. Link, accessioned by gift, exchange, and purchase 1,723 books, pamphlets, and periodicals; processed 993 publications; filed 4,442 cards in the main catalog and shelf list; received by gift, exchange, or purchase 3,301 periodicals; charged to staff members 4,821 books; shelved 8,320 books; and borrowed through interlibrary loan facilities 569 books, of which 536 were borrowed from the Library of Congress.

Under the exchange program the library distributed 538 National Gallery of Art publications to foreign and domestic institutions and received 554 publications in exchange.

The library is the depository for black-and-white photographs of the works of art in the Gallery's collections. These are maintained for use in research by the staff, for exchange with other institutions, for reproduction in approved publications, and for sale to the public. Approximately 5,571 photographs were added to the stock in the library, and 1,323 orders for 6,046 photographs were filled, including 400 permits for reproduction of 906 subjects.

Index of American Design

The Index of American Design circulated 32 exhibitions in 74 bookings in 15 states and the District of Columbia. The Index also circulated 154 sets of color slides (7,636 slides) throughout the country; 735 photographs of Index subjects were used for exhibits, study, and for publication. The photograph file has been increased by 42 negatives and 192 prints. The Index received 471 visitors who studied the material for research purposes and to collect material for design and publication. Twenty-one permits were issued to reproduce Index subjects (354 subjects) for publication. All these categories showed an increase by use and activity over 1967.

One special exhibition was prepared for display in the Gallery, and a selection of Index watercolors was on view in certain areas of the Gallery during the entire year.

Two exhibits from the Index were circulated by the Smithsonian Institution and one was borrowed for a year by the National Foundation on the Arts and Humanities.

Operation and Maintenance Activities

The Gallery building, mechanical equipment, and grounds were maintained throughout the year at the established standards.

Alterations in the west wing corridor on the ground floor were completed; a large unfinished area was floored and prepared for occupancy by the Extension Service and the Index of American Design; additional general and art storage facilities were constructed; various improvements were made in the restoration studio, photographic laboratory, Constitution Avenue entrance, and greenhouse. Alterations necessary to provide more efficient facilities for the sale of publications were commenced.

The Gallery greenhouse produced flowering and foliage plants in sufficient quantities to meet all of the decorative needs of special openings, holiday periods, and the daily requirements of the garden courts.

Pre-Recorded Tours

The Gallery radio-tour system, LecTour, and Acoustiguide, a small tape-playback device offering a 45-minute highlight tour, were used by 44,707 visitors.

Music

Under the supervision of Richard H. Bales, Assistant to the Director in charge of music, thirty-seven concerts were given on Sundays in the east garden court. Thirty-two of these concerts were financed by funds

bequeathed to the Gallery by William Nelson Cromwell, and six of the seven programs in the twenty-fifth American Music Festival were provided by funds received from the J. I. Foundation, Inc.

The National Gallery Orchestra, conducted by Richard H. Bales, played ten of the concerts. Two programs were made possible in part by grants from the Music Performance Trust Fund of the Recording Industry. All the concerts were broadcast in their entirety by radio station WGMS. Music critics of the local newspapers continued coverage of the concerts.

The orchestra performed at special concerts, including a performance at the White House following a State dinner in honor of Chancellor of the Federal Republic of Germany and Mrs. Kiesinger, on 15 August 1967; and at the dedication of restored Ford's Theater on 21 January 1968.

Two one-hour color television concerts by the National Gallery Orchestra were telecast locally on WTOP on 28 November 1967 and 20 February 1968. The Gallery Orchestra and television station WTOP received an award from the Metropolitan Area Mass Media Commission of the American Association of University Women for these concerts.

Richard H. Bales was in residence at the University of Rochester for the summer as conductor of the Eastman Chamber Orchestra and as instructor in conducting at the Eastman School of Music. He also appeared as guest conductor of the Peninsula Symphony Orchestra in Newport News, Virginia; he lectured several times before clubs and music groups. A number of his compositions were performed during the season not only by the Gallery Orchestra but also by the Philadelphia Symphony Orchestra and by orchestras in other cities. This year marks his twenty-fifth year in charge of music activities at the Gallery, and as conductor of the National Gallery Orchestra. During this quarter century he has compiled a record of which the National Gallery of Art is justly proud.

Research Project

Generous grants from the Old Dominion and Avalon Foundations have made possible the continued long-range program of research on artists' materials sponsored by the National Gallery of Art at Carnegie-Mellon University's Mellon Institute in Pittsburgh. One phase of the present investigations concerns a broad spectrum of studies regarding the deteriorating effects of light on museum collections. Another phase, just initiated, concerns the application of nuclear methods to the characterization of materials.

The past year marked the completed development of a method that can provide an indication of the age of white lead in paintings, based on measurement of the equilibrium between the natural radioactive isotopes present in the lead, lead-210 and radium-226. In its latest development, the method permits estimation of the probability that the lead in pigment samples was refined in the twentieth century or in an earlier time. An article in *Science* describes new procedures which were devised to circumvent possible interference by impurities, and presents data demonstrating conclusively that modern white lead had been used in a number of paintings in the style of Vermeer and Hals which have generally been considered forgeries. Furthermore, data obtained regarding two questioned paintings, attributed to Vermeer, at the National Gallery of Art showed that the lead in these paintings was indeed old, thereby tending to confirm the attribution.

A new three-year project jointly financed by the Gallery and the Atomic Energy Commission will explore further applications of nuclear technology to problems in characterizing artists' materials. Chief among these will be the application of neutron activation analysis to establish concentration profiles of trace impurities in pigments used by major artists. Such data may establish what amounts to "fingerprints" of the artist, his studio, or contemporary locale which would be virtually impossible for any forger to duplicate.

To probe the various hazards of exposure to light, the Research Project has initiated studies of the rate at which certain traditional pigments may fade. Early in this investigation, special attention was given to the phenomenon of chalking, a lightening of the color of paints which may easily be mistaken for deterioration of pigment but which is caused instead by the deterioration of the vehicle. Although frequently encountered in accelerated testing, this form of deterioration can also occur in paintings on a gallery wall. Through analysis of the spectrophotometric reflectance curves of a paint before and after exposure, it has proved possible to distinguish chalking from true fading of the colorant.

Vermilion is a peculiar artists' pigment that darkens rather than fades upon exposure to light; in so doing it undergoes a physical change rather than a chemical one. In the examination of this problem, the Research Project has studied in detail the nearly forgotten writings and patents published by Alexander Eibner fifty years ago in which the causes of this transformation and directions for the preparation of lightfast pigment are presented. Laboratory experiments revealed that vermilion made according to Eibner's directions is more lightfast than many currently available varieties. The extent of conversion of the red to the black

form depends upon the amount of visible and near ultraviolet radiation that strikes the sample. As a consequence, the traditional technique of placing alizarin and carmine glazes over vermilion provides protection from darkening. Moreover, in watercolor and polymer-emulsion paints that scatter the light considerably, vermilion will not darken so much as it will in oil.

Illumination may also cause damage through heat. To monitor the temperature of paintings being photographed under high-intensity illumination, infrared-sensing thermometers have been introduced which operate at a distance and need not touch the object. A published report covering both the theoretical and practical aspects of the problem describes the beneficial effects of dichroic-reflector lamps, infrared-reflecting glass, and refrigerated air.

The research results have been shared widely through the publications in the attached list as well as through numerous lectures, including invited papers given in London and Siena in September 1967.

FELLER, R. L. "Barytes Found in Blanched Paint." *Bulletin of the American Group–IIC,* vol. 8, no. 1, p. 10, 1967.

———. "Felt-tipped Markers and the Need for Standards of Lightfastness for Artists' Colorants." *Bulletin of the American Group–IIC,* vol. 8, no. 1, pp. 24–26, 1967; *Inter-Society Color Council Newsletter,* no. 192 (January-February 1968), pp. 10–11.

———. "Solubility Parameter." *Bulletin of the American Group–IIC,* vol. 8, no. 2, pp. 20–24, 1968.

———. "Control of Deteriorating Effects of Light on Museum Objects: Heating Effects of Illumination by Incandescent Lamps." *Museum News,* vol. 46, no. 9 (May 1968), Technical Supplement.

JOHNSTON, R. M., and R. L. FELLER. "Optics of Paint Films: Glazes and Chalking." Pages 86–95 in *Application of Science in the Examination of Works of Art.* Boston: Museum of Fine Arts, 1967.

KEISCH, B. "Discriminating Radioactivity Measurements of Lead: New Tool for Authentication." *Curator,* vol. 10, no. 1, p. 41, 1968.

———. "Scientific Evidence in Art Authentication: Problems in Interpretation." *Lex et Scientia,* vol. 5, no. 2, p. 66, 1968.

———. "Dating Works of Art through Their Natural Radioactivity: Improvements and Applications." *Science,* vol. 160, p. 413, 1968.

Other Activities

The National Gallery of Art provided facilities for the ceremony held by the Post Office Department on 2 November 1967—the first day of issue of a postage stamp in the Fine Arts Series. The stamp is based on the painting by Thomas Eakins, *The Biglin Brothers Racing,* which was given to the Gallery by Mr. and Mrs. Cornelius Vanderbilt Whitney.

Henry Beville, head of the photographic laboratory, and his assistants processed 234,037 items including slides, negatives, prints, color transparencies, and color slides. This is a 90 percent increase over the activity in 1967.

Audit of Private Funds

An audit of the private funds of the Gallery will be made for the fiscal year ended 30 June 1968 by Price Waterhouse and Co., public accountants. A report of the audit will be forwarded to the Gallery.

John F. Kennedy Center for the Performing Arts

ROGER L. STEVENS
Chairman, Board of Trustees

THE KENNEDY CENTER'S STEEL SUPERSTRUCTURE, begun in September 1967, is now extravagantly visible. As of 30 June 1968 the steelwork was more than three-quarters complete. The drive up Rock Creek-Potomac Parkway now passes under the steel framework of the River Terrace. The skeletal outlines of the Concert Hall, the Opera, the Theater, the impressive Grand Foyer, and the twin Halls—The Hall of Nations and Hall of States—are clearly visible.

Equally important to the Center's progress, though less visually spectacular, were the appointments of William McCormick Blair, Jr., as General Director of the Kennedy Center and Julius Rudel as Music Advisor.

The Kennedy Center, which has long been a workable challenge for those close to it, is now becoming a physical reality. The building is expected to open for performances in 1970. As construction has progressed, so too has interest and curiosity about the Center. In addition to the customary "sidewalk superintendents," the Center was host to diverse groups of visitors, including Washington school children, 4–H honor students from Nebraska, architects from Italy and Greece, and engineering students from Sweden and the University of Virginia. The Trustees responded to this increased interest by approving a plan for an information center, a temporary structure to be located at the site.

Organization

Although it was the intent of the founders of the nation's capital that the city be both the political and cultural center of the United States, only in recent years was positive action taken to provide adequate facilities for the performing arts in Washington, D.C.

When compared with other major capital cities of the world, Washington has lagged far behind. The lack of a showplace in the city for the finest achievements in music, drama, dance, and cinema from this nation and from abroad has been a continuing embarrassment.

The establishment of a national center for the performing arts has had the active support of the last three Presidents, and the encouragement of three previous Presidents. President Eisenhower signed the legislation authorizing the National Cultural Center in 1958 (P.L. 85–874, 85th Cong., 2 September 1958). President Kennedy encouraged national support of the project and in 1963 signed amending legislation which extended the fund-raising deadline and increased the membership of the Board of Trustees to 45.

On 23 January 1964 President Johnson signed into law a bipartisan measure designating the National Cultural Center the sole official memorial in the nation's capital to President Kennedy, renaming it the John F. Kennedy Center for the Performing Arts (P.L. 88–260). The law also authorized $15.5 million in matching Federal funds, and granted the Trustees the authority to issue revenue bonds to the Secretary of the Treasury to a value not greater than $15.4 million. These funds were designated for construction of the 1600-car underground garage and are payable from the revenues accruing to the Board.

BOARD OF TRUSTEES

Pursuant to the John F. Kennedy Center Act, the Board of Trustees is made up of 15 members who serve ex-officio and 30 general Trustees.

During the past year, through resignations, membership in the Board has changed. Wilbur J. Cohen succeeded John W. Gardner as Secretary of Health, Education, and Welfare. Edward D. Re succeeded Charles Frankel as Assistant Secretary of State for Educational and Cultural Affairs. Walter E. Washington succeeded Walter N. Tobriner as Commissioner of the District of Columbia. William H. Thomas succeeded William H. Waters, Jr., as Chairman of the District of Columbia Recreation Board.

Vacancies in the Board of Trustees were created by the sudden deaths of Senator Robert F. Kennedy and Howard F. Ahmanson.

At the annual meeting of the Board of Trustees on 29 January 1968 the following officers were elected:

Roger L. Stevens, Chairman
Robert O. Anderson, Vice Chairman
Sol M. Linowitz, Vice Chairman
Ralph E. Becker, General Counsel
Robert C. Baker, Treasurer
K. LeMoyne Billings, Secretary
Philip J. Mullin, Assistant Secretary and Assistant Treasurer
Herbert D. Lawson, Assistant Treasurer
Kenneth Birgfeld, Assistant Treasurer
Paul J. Bisset, Assistant Treasurer
Henry C. Heine, Assistant Treasurer

Previous to the annual meeting Daniel W. Bell notified Mr. Stevens that he was retiring as Treasurer, a position Mr. Bell had held since the establishment of the Center. At the annual meeting, Mr. Bell was elected Treasurer Emeritus, an office created in recognition of his "dedication, counsel and tireless work since 1958." Mr. Bell was formerly Assistant Secretary of the Treasury and returned to private life to serve as president and chairman of the board of the American Security and Trust Company of Washington.

Under the bylaws the following officers continue to serve as members of the Executive Committee:

Roger L. Stevens, Chairman
Robert O. Anderson, Vice Chairman
Sol M. Linowitz, Vice Chairman
Ralph E. Becker, General Counsel
Robert C. Baker, Treasurer
K. LeMoyne Billings, Secretary

From the Board, the Chairman appointed to the Executive Committee the following persons, who are presently serving:

Mr. Justice Fortas
George B. Hartzog, Jr.
Mrs. John F. Kennedy
Mrs. Albert D. Lasker
Erich Leinsdorf
Edward D. Re
S. Dillon Ripley II
Arthur Schlesinger, Jr.
Mrs. Jouett Shouse
Mrs. Stephen E. Smith
Walter E. Washington
Jack Valenti

At the annual meeting Mrs. George A. Garrett, Mrs. Albert D. Lasker, and Mrs. Jouett Shouse, Trustees of the Center, were reappointed. to serve on the National Council of the Friends of the Kennedy Center.

The death of two individuals who had devoted their time and energies to the Kennedy Center was acknowledged by memorial resolu-

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tions adopted at the annual meeting. The two were: Murray Preston, executive vice president of the American Security and Trust Company, Washington, who had served as Treasurer of the Friends of the Kennedy Center; and Mrs. Ann Smolian Jacobson of Birmingham, Alabama, who was active in promoting the Kennedy Center both nationally and in Alabama.

At the close of the fiscal year the membership of the Board of Trustees of the John F. Kennedy Center was as follows:

Richard Adler
Floyd D. Akers
Robert O. Anderson
Ralph E. Becker
K. LeMoyne Billings
Mrs. Thomas W. Braden
Edgar M. Bronfman
Mrs. George R. Brown
Joseph S. Clark
Wilbur J. Cohen
Ralph W. Ellison
Mr. Justice Fortas
Peter H. B. Frelinghuysen
J. William Fulbright
Mrs. George A. Garrett
Leonard H. Goldenson
George B. Hartzog, Jr.
Harold Howe II
Mrs. Albert D. Lasker
Robert Lehman
Erich Leinsdorf
Sol M. Linowitz
George Meany
Robert I. Millonzi
L. Quincy Mumford
Edwin W. Pauley
Arthur Penn
Charles H. Percy
Edward D. Re
Frank H. Ricketson, Jr.
S. Dillon Ripley II
Richard Rodgers
Arthur Schlesinger, Jr.
Mrs. Jouett Shouse
Mrs. Stephen E. Smith
Roger L. Stevens
William H. Thomas
Frank Thompson, Jr.
Jack Valenti
William Walton
Walter E. Washington
Edwin L. Weisl, Sr.
James C. Wright, Jr.

Mrs. Lyndon B. Johnson, Mrs. John F. Kennedy, and Mrs. Dwight D. Eisenhower continue to serve as honorary co-chairmen of the Center.

On 31 January 1968 the Chairman announced the appointments of Ambassador William McC. Blair, Jr., as General Director and Julius Rudel as Music Advisor to the Center.

Mr. Blair, who assumed duties on 1 April, most recently served as United States Ambassador to the Philippines. As General Director, he is responsible for administration, including budget, congressional relations, promotion, fund-raising, and educational activities.

Mr. Rudel, who has been chief conductor and general conductor of the New York City Opera since 1957, will review the musical program for the Center and will be responsible for the final recommendations to the Trustees of the artistic groups that will appear in the concert hall and opera.

During his long association with the New York City Opera, Mr. Rudel has gained a reputation for championing contemporary works to a degree unique among operatic enterprises. The opera company is also known for its excellent Mozart repertoire.

The Kennedy Center lost one of its most dedicated and effective supporters in the tragic death on 6 June of Senator Robert F. Kennedy. Appointed to the Board of Trustees by President Johnson in 1964, Senator Kennedy took an active interest in the progress of the Center and had been a member of both the Executive Committee and the Development Committee.

The Kennedy Center suffered another grievous loss in the sudden death on 17 June of Howard F. Ahmanson, who was appointed a trustee in 1963 by President Kennedy. Mr. Ahmanson, a noted California financier, philanthropist, and art collector, was principal owner of the Los Angeles-based Home Savings and Loan Association.

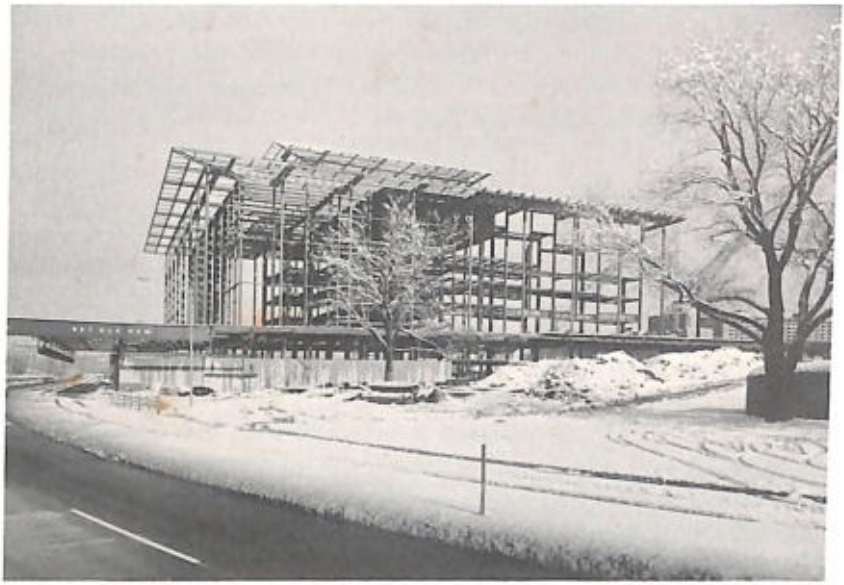
Construction Progress

At the end of fiscal year 1968 the steel superstructure was 92 percent complete and the Center, overall, stood 25 percent complete. At the end of the last fiscal year the general contract and seven subcontracts representing over $22 million (steel, electrical, mechanical, steel testing, reinforcing steel placement, marble fabricating and marble erection), had been awarded and about a third of the marble had arrived from Italy.

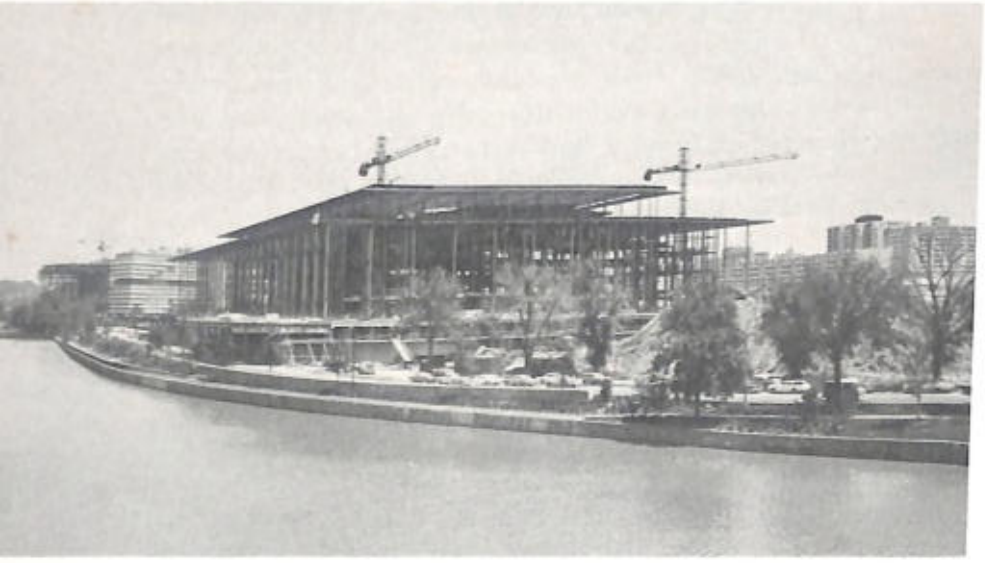
During the year subcontracts, amounting to nearly $9 million, were awarded. Total expenditures for architectural and construction work, representing approximately 25 percent of the total estimated cost, reached $15.7 million of which $14.6 million were federal funds.

Once the drilling for footings and caissons was finished, the joining of concrete and steel forming the sub- and superstructures progressed rapidly. Soon electrical and mechanical contractors were able to begin their work, and by June the more than 500 people regularly employed at the site represented all the building trades.

Shipments of marble continued from the Bufalini, Henraux, and Montecatini quarries near Carrara. The marble for the interior and exterior facing was shipped directly to Brandywine, Maryland, where it will be fabricated into blocks and then moved to the site for installation.



The first steel girders were put into place early in September 1967. By December the Center had begun to take shape, as can be seen from this view, looking up the Potomac toward Rock Creek Park.



At the end of June the steel framework of the Center was more than ninety percent complete. Up-river, the entrance to Rock Creek Park can be seen behind the nearby Watergate apartment complex, under construction.

All the marble, a gift of the people of Italy, is being shipped in American vessels. American Export-Isbrandtsen Lines transported over 1,600 tons of the approximate total of 3,500 tons without charge to the Center. The remaining tonnage is being carried to Baltimore by the Prudential and American President Lines, also as a contribution to the Center. The oceanic transportation of this fragile commodity, a most valued donation, undoubtedly set records, for breakage was held to between two and three percent of total weight compared to the usual five or more percent.

Subcontracts awarded during the year were:

Furnish and erect concrete plank—Anning-Johnson Co., of Alexandria, Virginia, $49,700.

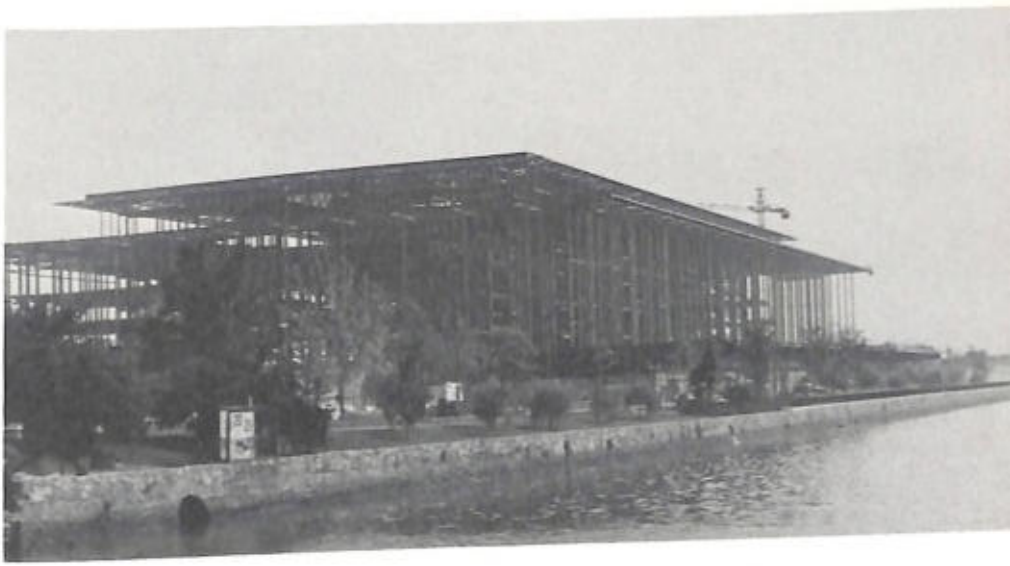
Dampproofing and elastomeric waterproofing—Prospect Associates, Inc., of Arlington, Virginia, $253,099.

Furnish and install 22 elevators and 6 escalators—Otis Elevator Company, of Washington, D.C., $913,500.

Unload, hoist, place, set, and tie reinforcing steel and mesh—M. J. Byorick, Inc., of Washington, D.C., $440,145.

Miscellaneous metal and wire mesh work—Potomac Iron Works, Inc., of Hyattsville, Maryland, $697,131.

Architectural metal work—Usona Manufacturing Co., of St. Louis, Missouri, $867,200.



Down river, toward the Roosevelt Island Bridge, the Center's River Terrace overhanging Rock Creek Potomac Parkway can be seen.

Marble, paving, interior and miscellaneous—Peter Bratti Assoc., Inc., of New York City, $490,000.

Metallic waterproofing—Washington Ply-Rite Co., of Washington, D.C., $19,592.

Furring, lathing, and plastering, acoustical plaster and fire protection—The Brazier Co., of East St. Louis, Illinois, $1,056,000.

Steel floor and roof deck—Inland Steel Products Co., of Baltimore, Maryland, $75,560.

Furnishing and delivering hollow metal—Firedoor Corp. of America, of New York City, $118,500.

Furnishing finish hardware—Webb Builders Hardware, Inc., of Arlington, Texas, $131,521.

Roof insulation, roofing system, sheet metal—Warren-Ehret-Linck Co., of Rockville, Maryland, $219,600.

Thermal insulation—Armstrong Contracting & Supply Co., of Washington, D.C., $238,500.

Masonry—Costello Company, Inc., of Cumberland, Maryland, $1,639,000.

Furnish and install acoustical units and sound insulation—Bilton Insulation & Supply, Inc., of Arlington, Virginia, $725,000.

Acoustical doors and frames—Overly Mfg. Co., of Greensburg, Pennsylvania, $413,350.

Furnish and install manually operated monorail system—E. L. Seward & Associates, Inc., of Baltimore, Maryland, $22,800.

Steel roll-up power operated doors—Capital Products, Inc., of Washington, D.C., $8,191.

Stage equipment—Joseph Vasconcellos, Inc., of West Babylon, New York, $506,960.

The Watergate Development applied for a permit to build its planned Building No. 1 of the complex last summer. As a result, the Center's Trustees reaffirmed their position that the height of this building, only 300 feet to the north of the Center, should be substantially reduced or that the building should not be constructed at all. Their views were presented before the District of Columbia's planning and zoning agencies in the fall and winter.

On 22 April, the Secretary of the Interior, who had moderated negotiations between Watergate and Kennedy Center officials, announced that a compromise had been reached. Based partially on the results of a study undertaken by the National Capital Planning Commission, the compromise solution called for rotating the proposed building to increase its distance from the Center, and for reducing its height and increasing its width. As of 30 June 1968 the amended plans were awaiting approval by the District's zoning agencies.

Friends of the Kennedy Center

The Friends of the Kennedy Center, a national auxiliary organization chartered by the Trustees in 1966, now has a founding membership of 1,115, representing 45 states.

The many visitors to the Kennedy Center construction site during the year included these third graders from LaSalle Elementary School in Washington, D.C., who were especially interested in the Center's Tom Sawyer fence-painting project.

Their second annual meeting was held in Washington on 8 and 9 May, opening with a buffet dinner at Ford's Theatre and attendance at a performance of "She Stoops to Conquer."

The next day's session at the Smithsonian Institution included a business meeting, speeches by William McC. Blair, Jr., and Miss Peggy Wood, and a panel discussion, "The Performing Arts and the Community." Members of the panel, which was chaired by Mr. Ralph Burgard, Director of Associated Council of the Arts, were Mrs. William Mitchell, Chairman of the Education Program of the Chicago Lyric Opera, Mrs. Agnew Hunter Bahnson, Jr., President of the North Carolina State Art Society, Miss Gladys Douglas-Longmore, Director of the Hospitalized Veterans Service of the Musicians Emergency Fund, and Miss Katherine Dunham, dancer and educator.

The Tom Sawyer Project, one of the Friends' programs, now includes on the fence surrounding the Center painted panels representing 27 foreign countries, 41 states, 5 United States territories and trusts, and the District of Columbia.

The Speakers Bureau, under the joint chairmanship of Mrs. Eugene Carusi and Mrs. Frederick Mascioli, fulfilled engagements to organizations not only in the District but as far away as Louisiana and North Carolina. A slide lecture was presented at a meeting of sixty foreign

Erich Leinsdorf, music director of the Boston Symphony Orchestra and a Trustee of the Center, spoke during the ceremony on 29 January celebrating completion of the steel framework of the Concert Hall. Left to right are Ralph E. Becker, General Counsel and a Trustee of the Center; Ambassador Arne Gunneng of Norway whose country has presented crystal chandeliers for the Concert Hall; Mrs. Polk Guest, chairman of the Friends of the Kennedy Center; Mr. Leinsdorf; and (partially hidden) Daniel W. Bell, Treasurer Emeritus of the Center.

drama professors, directors, and playwrights, with comments simultaneously translated in four languages, and another was given before a committee of architects and city officials from Italy.

On 21 May the Executive Committee of the Friends of the Kennedy Center met to elect new officers. They are:

Mrs. Polk Guest, Chairman
Mrs. Norris A. Dodson, Vice Chairman
Mr. Philip Bonsal, Treasurer

One major project of the Friends is the American College Theatre Festival to be held in Washington 27 April to 12 May 1969 at Ford's Theatre and at a theatre on the Mall. The Friends' participation as a co-sponsor with American Airlines and the Smithsonian Institution was undertaken at the suggestion of Mr. Stevens. It was felt that the Festival reflected both artistic and educational aspects and was an ideal pilot program for the Friends. A total of 192 colleges and universities have entered the contest.

Completion of the steel framework of the Center's Concert Hall was marked with the hoisting of a specially built bass viol, cut out in steel, to the high point of construction. The ceremony was held 29 January.

The Friends recently created two new membership categories: organizational membership, with annual dues of twenty-five dollars and annual membership, with dues of five dollars. Founder memberships will also remain renewable.

Special Events and Projects

A "topping out" ceremony was held at the construction site on 29 January 1968 to celebrate completion of steel construction of the Center's Concert Hall. Bethlehem Steel, the steel contractors, prepared an eleven-foot-long steel replica of a bass viol for the ceremony. Following remarks by the Chairman and Erich Leinsdorf, a Trustee and Music Director of the Boston Symphony Orchestra, the bass viol was hoisted

and welded to the steel framework near the high point of the Concert Hall. Among those attending the ceremony were major donors to the Concert Hall, Center officials, and representatives of General Services Administration and Bethlehem Steel.

Gifts and Memorials

The Center's seat endowment program provided an opportunity for various groups to honor great men of foreign nationalities. The Polish Veterans in Exile Association held its annual benefit ball in January with proceeds going to endow a chair to honor Ignacy J. Paderewski, Polish statesman and pianist. In May, the annual Gala Ball of the American Hungarian Cultural Center provided funds to endow a chair to honor Bela Bartok, Hungarian composer.

During a testimonial dinner held last January for Patrick Hayes, Washington impressario, it was announced that Mr. Hayes' friends had collected $2,500 to decorate in his honor the green room of the Concert Hall. The green room is a reception room near the stage placed at the disposal of guest artists.

Smithsonian Activities

Natural Sciences

Natural Sciences

THE SCIENTIFIC FACULTY OF THE SMITHSONIAN has traditionally been concerned with man's environment. The "natural history" of the early days included much of what is now called ecology, and the Institution's second Secretary, Spencer F. Baird, because of his interest in the biology of the sea and his pioneering efforts to establish long-term and far-ranging programs for study of the marine environment and its biological components, may be considered one of the first of our oceanographers. His work and that of his successors take on a special importance in light of today's urgent drive to exploit our environment, for it is basic to the fundamental research that must be continued and enlarged if destructive exploitation is to be avoided. Our constantly improving technology enables us, unfortunately, to make rapid and effective changes in the environment. Thus it is doubly important that any such disturbance be evaluated in advance, so that well-considered predictions can be made of the possible long-term effects.

It was to provide a basis for such prediction and evaluation, by coordinating the information gathered from our collections and from the research based on them, that the Smithsonian Institution established the Office of Ecology and the Office of Oceanography and Limnology. These offices work closely with our science faculty, and also with mission-oriented governmental agencies and industry, to insure that the most effective use of our research knowledge can be made with the minimum of delay.

Additional research being instituted among the scientific groups in the Smithsonian Institution includes a program for the use of satellites in the tracking of large migratory animals: the Smithsonian Astrophysical Observatory has examined the present state of the art in biotelemetry and has developed an inexpensive and feasible system which can be used with satellites following the appropriate orbit. Information gained by this tracking system will permit mammalogists and ornithologists to study in detail for the first time the day-to-day migrations and other movements of these animals.

A major problem besetting our mission, "to increase and diffuse knowledge among men," involves communications. During the current year, the Smithsonian has established a Council on Communication which serves the Secretary as well as the community as a whole in assess-

ing the impact of communications on societal problems. It seeks to establish broad perspectives on communication, including the rapidly advancing technology itself, and it attempts to identify the problems that must be resolved to facilitate communication among all sectors of the community.

Further evidence of the Smithsonian Institution's commitment for the enhancement of communications is our contractual association with the New York Academy of Sciences and its Interdisciplinary Communications Program. Under this program interdisciplinary conferences are convened to examine fundamental scientific problems that transcend individual disciplines and that require the cooperative efforts not only of scientists but also of humanists who can view the impact on society of scientific advances. Conference series on the following topics are in progress:

Information and Control Processes in Living Systems
Biology of Hard Tissues
Origins of Life
Population

SMITHSONIAN INSTITUTION
CENTER FOR SHORT-LIVED PHENOMENA

In January 1967, Dr. Sidney Galler, Assistant Secretary (Science) of the Smithsonian Institution, wrote a memo to Dr. Fred L. Whipple, Director, Smithsonian Astrophysical Observatory, in which he stated:

"There is a growing need for an international science mobilization center that would enable preselected teams of experts to fly into places where momentous but short-lived environmental changes are occurring. Volcanoes, both on land and underseas, earthquakes, tidal waves, cyclones, etc., offer unusual opportunities for gathering fundamental data if the scientist equipped with the measuring and collecting equipment can be brought to the scene while events are taking place."

In response to this need, the Smithsonian Institution Center for Short-Lived Phenomena was established on 1 January 1968 under the direction of Robert A. Citron.

The purposes of the Center are to assist Smithsonian scientists in their investigation of short-lived phenomena and to provide a reporting and information service for use by the general scientific community. The Center serves as a clearinghouse for the receipt and dissemination of information concerning rare natural events that might otherwise go unobserved or uninvestigated, such as remote volcanic eruptions and earthquakes, the birth of new islands, the fall of meteorites, and sudden changes in biological and ecological systems. The Smithsonian Institution hopes thus to effect major opportunities for research.

A group of Smithsonian Institution scientists representing a number of disciplines, including biology, astrophysics, ecology, oceanography, anthropology, archeology, and geology, are members of a scientific committee that determines policy for the Center. The Center itself is operated by an Administrative Office responsible for carrying out these policy decisions and for implementing its programs. The Administrative Office is located at the Astrophysical Observatory and utilizes the Observatory's communications, publications, operations, logistic, and administrative-support facilities to carry out the work of the Center.

Event reports are received from a number of sources, including news media, private citizens, individual scientists, and scientific observatories. These reports are immediately communicated to correspondents in selected disciplines around the world. The method of communication (telephone, cable, or airmail) depends on the nature of the event and and on the correspondent's ability to respond to the event. The Center has established communications with a network of people and organizations to be alerted when events occur. Ties have been established with scientific institutions and individual scientists interested in short-lived phenomena. The Center now has over 400 correspondents located in 71 countries, representing major disciplines that might involve short-lived phenomena. Correspondents include mission-oriented groups with rapid-response capabilities and individual scientists and organizations interested in developing portable instrument kits that will enable teams to make measurements in event areas while environmental changes are occurring. These scientists and organizations may be asked to cooperate with the Center by reporting events, obtaining additional information about events that occur in their areas, and providing assistance to research teams that might be sent to investigate events in their areas.

The Administrative Office maintains a log of events reported to the Center, notifies correspondents of these events and of significant developments in event areas, and issues periodic status reports on each active event and final reports when the activities close. In addition, the Center is seeking to determine areas of interest and investigation to which it might contribute or concerning which it might cooperate with or benefit from the work of other agencies; it is also making informal contacts in the countries and areas of the world where occurrences of particular phenomena are most frequent and is initiating informal public information programs designed to make the public conscious of the Center, its goals, accomplishments, and interests.

During its first six months, the Center was concerned with 18 geophysical, astrophysical, and biological events (see table) and collected information on 11 additional events. In each case the Center was in contact with observers in the event area, interviewed pertinent witnesses

and specialists, collected photographic and cinematographic documentation, issued event-notification reports to correspondents of the Center, maintained current status reports, and released information to those persons and organizations actively involved and interested in the phenomena.

Of the 18 events that the Center participated in between 1 January and 30 June 1968, there were five volcanic eruptions, four major earthquakes (greater than magnitude 7.0), four large fireballs, two major oil spills, and two important fish kills.

Birth of an island—Metis Shoal, Tonga Islands. Photograph (left) was taken 14 December 1967, the third day of the 27-day submarine volcanic eruption that built an island 700 meters long and 100 meters wide. It remained above the surface for 58 days before wave action eroded it below water level. Photographs, films, eyewitness reports, and fresh lavas were collected to document and describe this rare short-lived event in nature.

In addition, the Center coordinated activities for one field reconnaissance mission (to the Tonga Islands) and two scientific field expeditions (to the Mayon volcanic eruption, Philippines, and the Fernandina volcanic eruption, Galapagos Islands). The Center arranged transportation and coordinated logistics and communications for these missions.

The Center obtained Air Force transportation support for the Mayon expedition as well as systematic aerial photographic reconnaissance and motion picture camera team participation during the peak activities of the Mayon eruption.

The Center also obtained U.S. Air Force air transportation from Panama to the Galapagos Islands for a team of seven scientists to investigate the effects of the Fernandina eruption on the physical environment and the island ecosystem.

In addition, the Center assisted in dispatching scientific observers or investigation teams to four event areas while the events were still in progress. The Center published three final Event Reports, on the Metis Shoal and the Mount Mayon volcanic eruptions and on the Fernandina Caldera collapse, as well as preprints of scientific papers dealing with these three events. The Metis Shoal report represents a rare documentation of the birth and death of an island and the report on Fernandina documents the first observed caldera collapse in historic times.

EVENTS COVERED BY THE CENTER FOR SHORT-LIVED PHENOMENA

Number	*Name of event*	*Place*	*Date*
1–67	Deception Island eruption	Antarctica	6 December 1967
2–67	Metis Shoal eruption	Tonga	11 December 1967
1–68	Sicily earthquake	Sicily	15 January 1968
2–68	Polo fireball	Eastern U.S.	26 February 1968
3–68	Ocean Eagle spill	Puerto Rico	3 March 1968
4–68	Dayton fireball	Eastern U.S.	3 March 1968
5–68	Veracruz fireball	Mexico	27 March 1968
5A–68	Schenectady meteorite	(New York) U.S.	12 April 1968
6–68	Mount Mayon eruption	Philippines	20 April 1968
7–68	Tokachi-Oki earthquake	Japan	16 May 1968
8–68	Inangahua earthquake	New Zealand	23 May 1968
9–68	Fernandina Caldera collapse	Galapagos	11 June 1968
10–68	World Glory spill	South Africa	14 June 1968
11–68	Etna eruption	Sicily	15 June 1968
12–68	Moyobamba earthquake	Peru	19 June 1968
13–68	Florida fish kill	U.S.	20 June 1968
14–68	California fish kill	U.S.	28 June 1968
15–68	Huntington fireball	(Pennsylvania) U.S.	30 June 1968

Office of Oceanography and Limnology

I. Eugene Wallen, *Head*

The Office of Oceanography and Limnology acted to broaden the ability of the biological oceanographers of this country to respond to national needs.

Working closely with the National Commission on Marine Sciences, Engineering and Resources and with the National Council on Marine Resources and Engineering Development, the Office participated in many of their committees and panels. Responding to the requests of the Departments of the Interior, Navy, State, Army, Transportation, and Commerce, and to those of the National Science Foundation and the Atomic Energy Commission, the Office provided consultation and advice in regard to problems within their areas of responsibility.

The Office also served as a focal point for bringing the scientific expertise of the Smithsonian to bear on problems of estuarine pollution, the Great Lakes, environmental prediction, polar research, the National Buoy Program, Food from the Sea, the proposed international cooperative studies of the Mediterranean and Caribbean, data processing, the national programs of such countries as Iran, Taiwan, and the Philippines, and the President's proposed International Decade of Exploration.

Research Activities

Arrangements were made with the National Science Foundation to send a four-man team, consisting of Robert H. Gibbs, Jr., and Roland H. Brown (Smithsonian), Herbert E. Kumpf (National Aquarium), and Edward L. Foss (Southern Maine Vocational Technical Institute), on an *Eltanin* cruise from San Francisco to New Zealand, 13 November to 20 December 1967, to obtain midwater trawl and plankton samples for processing by the Smithsonian Oceanographic Sorting Center (SOSC) and for study by scientists.

The SOSC assistant supervisor for algae, Ernani G. Meñez, collected in the Philippines assemblages of plants and animals associated with two algal genera, *Eucheuma* and *Caulerpa*. Working with Maxwell S. Doty of Hawaii, Meñez brought the collections to SOSC for sorting, and the ecological information obtained will be used to increase production of these commercial species.

In December 1965 the Office of Oceanography received the 43-foot yawl *Ellida* as part of a package gift from a private donor. On request of the Smithsonian Ships Operations Committee, Smithsonian curator Richard H. Benson worked with *Ellida* from February through August 1966 to train sailing scientists and to test her capability for shallow water marine ecological, biogeographical, and sedimentological research. After a tryout cruise through Chesapeake Bay it was concluded that she was unsatisfactory for the uses proposed, and in November the vessel was returned to private ownership.

During February a research diving program was carried out in Tongue of the Ocean, Bahamas, by Smithsonian curator Clyde F. E. Roper and Richard E. Young (University of Miami), who made six dives (including one tethered dive) mostly along the cliff faces. Two or three species of snails were seen in their native but previously unknown habitats, and the abundance of midwater organisms observed at night was far greater than had been anticipated. Walter C. Starck (University of Miami) and Robert I. Wicklund (Bureau of Sport Fisheries and Wildlife) made the second series of nine dives. Along the steep cliffs, ledges and caves were numerous, and in the rich areas were an abundance of algae, sponges, hydroids, stony corals, alcyonareans, black corals, bryozoans, and crinoids. Starck and Wickland believe that they collected seven previously undescribed fish species, including one and possibly two new genera and three new records for the Bahamas. Giles W. Mead and Sylvia Earle Mead (Harvard University), a third team, made five dives between 20 February and 1 March. Observations of marine plants to depths of 600 feet and of depth distribution in fishes were recorded.

For the program Edwin A. Link contributed his time and that of his oceanographic ship *Sea Diver*. J. Seward Johnson contributed his time and his ship, *Ocean Pearl*, and Ocean Systems, Inc., loaned the *Deep Diver* vehicle. Support for the program also came from the Office of Naval Research, the National Geographic Society, and the agencies regularly employing the participating scientists.

On behalf of the Smithsonian, Joseph B. MacInnis of Ocean Systems, Inc., arranged for J. Seward Johnson to use *Ocean Pearl* in support of two diving projects in the Florida Atlantic University underseas habitat off West Palm Beach, Florida. These two dives permitted MacInnis, R. F. McAllister (Florida Atlantic University), Robert I. Wicklund, Alan R. Emery and Martin Gowan (graduate students in fishes, University of Miami), to observe the "reef effect" of *Hydrolab*, an underwater habitat that was established about six months ago in a biologically barren area and now has accumulated associated organisms including about 300 fishes.

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Vessels Used

For Oceanographic Research

National Science Foundation vessel *Eltanin* (1), in the edge of the Antarctic ice, served as a base for studies of midwater organisms by Robert H. Gibbs and associates.

Ocean Systems, Inc., *Deep Diver* (2), on Edwin A. Link's oceanographic yacht *Sea Diver* in the Bahamas, was used in underwater experiments by Clyde F. E. Roper and associates.

J. Seward Johnson's yacht *Ocean Pearl* (3), in the straits of Florida, was used as a diver support vessel with *Deep Diver* in underwater experiments of Clyde F. E. Roper and associates.

University of Maryland vessel *Orion* (4), in Chesapeake Bay, was used by Miss McLaughlin and associates for curatorial research in the Sorting Center.

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Grace Lines S.S. *Santa Sophia* (5), in the Atlantic, served as a base for collections by Kenneth M. Towe and Norman K. Sachs in electron microscope studies of Foraminifera.

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Bureau of Commercial Fisheries vessel *Alosa* (6), in Chesapeake Bay, served Martin A. Buzas and associates for collections of Foraminifera.

Smithsonian vessel *Phykos* (7), with University of Pennsylvania submersible *Asherah* on her deck, in New London, Connecticut. In 1968 *Phykos* was used as a training vessel by the Southern Maine Vocational Technical Institute.

Duke University vessel *Eastward* (8), in the Western Atlantic, was utilized by Jack W. Pierce and associates in studies of sedimentology.

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Department of Commerce Environmental Sciences Service Administration vessel *Oceanographer* (9), in the Atlantic. She was used in a sampling study by Richard E. Pieper and associates in the Indian Ocean.

Florida Atlantic University's underseas house *Hydro-Lab* (10), off West Palm Beach, was used by Robert I. Wicklund and associates in two experiments on behalf of the Smithsonian Institution.

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University of Rhode Island vessel *Trident* (11), off the Rhode Island coast, was utilized by Robert H. Gibbs, Clyde Roper, and associates for studies of the behavior of midwater organisms.

American Mail Line vessel S.S. *Washington Mail* (12), in the North Pacific

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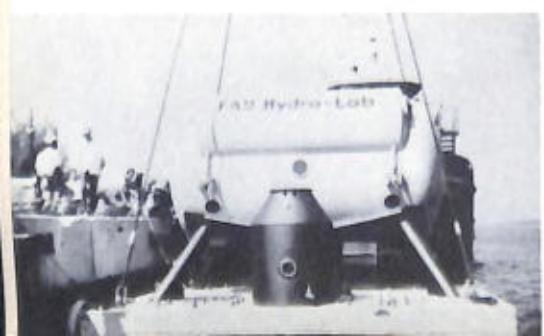

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Ocean, was used by George A. Anderson and associates in studies of phytoplankton productivity on behalf of the Smithsonian.

Department of Transportation Coast Guard vessel *Rockaway* (13), in the Atlantic, three two-week cruises for Daniel J. Stanley and Jack W. Pierce in studies of the geology of Wilmington Canyon.

The Smithsonian's *Sally-Anne* (14), in Chesapeake Bay, served in training staff members and students from the Smithsonian and cooperating local universities.

Mrs. Mariel King's yacht *Pele* (15), loading at a Polynesian port, served as a support ship for collections of mollusks by Harald A. Rehder.

Westinghouse submersible *Deep Star 4000* (16), on a demonstration dive, was made available by the Naval Oceanographic Office to Robert H. Gibbs and associates for familiarization and fisheries research dives in the Northwest Atlantic.

Edwin A. Link's oceanographic yacht *Sea Diver* (17), in the Bahamas, was used in a diving project involving about 20 scientists under the operational direction of I. E. Wallen.

University of Miami R/V *Pilsbury* (18), was used by H. Adair Fehlman and David M. Damkaer for plankton collection in June 1968. The Mote Marine Laboratory R/V *Rhincodon*, used for research on shark parasites, is shown on page 334.

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The Scientific Committee on Oceanic Research of the International Council of Scientific Unions and UNESCO established Working Group 23 (WG 23) on methods for preserving zooplankton samples for taxonomic study and for biomass determination. Consisting of A. Fleminger (for J. R. Beers, United States), G. J. Flügel (Germany), B. Kimor (Israel), H. F. Steedman (England), T. Tokioka (Japan), M. E. Vinogradov (Union of Soviet Socialist Republics), and V. K. Hansen (Chairman, Denmark), this committee met in closed sessions at the Smithsonian 25–30 March to discuss the state of preservation of plankton samples and to design experiments to be conducted on a worldwide basis. At the request of the UNESCO group, the Office of Oceanography and Limnology agreed to undertake "main responsibility for such tests and experiments proposed by WG 23" and to use as advisors during the curatorial research a coordinating group (Steedman, Beers, and Tokioka) from WG 23. For this study H. Adair Fehlmann and David M. Damkaer took a two-week cruise to the Caribbean to collect standard plankton samples.

As part of a Public Law 480 project, Deputy Head William I. Aron spent the period 10–15 March in Israel considering the movement of plants and animals through the Suez Canal. It has been found, as a result, in part, of about 60 recent field trips and from the more than 2,000 collections—including plankton, dredge hauls, grab samples, trawls, and Scuba collections in the eastern Mediterranean, Red Sea, and the Suez Canal—that more than 150 species occurring in the eastern Mediterranean are migrants from the Red Sea. One, and possibly two, species are found to be migrants in the reverse direction. Professor H. Steinitz of Israel visited the Smithsonian in May and presented a lecture detailing the most recent findings.

Aron, Gibbs, and Roper of the Smithsonian, William Krueger and Ted Napora of the University of Rhode Island, Brooke G. Farquhar of the Naval Oceanographic Office, and Charles L. Brown of the Navy Underwater Sound Laboratory, developed a joint project for intensive long-term studies of a selected ocean area—the "ocean acre." The main objective of these studies—expected to last for at least three to five years—is to bring together a detailed understanding of the biology and acoustical properties of the area. The acoustical studies will be undertaken by the Navy and the biological work will be conducted under the supervision of the Smithsonian Institution with the cooperation of the University of Rhode Island and Navy biologists. With funds from the Navy, at least 40 days of ship-time are anticipated to be spent each year and the necessary instrumentation and technical support will be procured. An area just north of Bermuda was tentatively selected as the

Summer trainee John Romack is given instructions in fish sorting by deputy supervisor Leslie W. Knapp at the Smithsonian Oceanographic Sorting Center.

study site, an exploratory cruise was taken in March, and the second starts about 1 July.

From Ocean Systems, Inc., the Office was awarded funds for a conference on underwater archeology in Boston on 29 December 1967. Co-chaired by Smithsonian curator Gus Van Beek and I. E. Wallen, it was attended by 32 representatives of universities, private institutions, government, museums, industry, and a professional society. There was general agreement that prehistoric town sites, which might include submerged buildings, were unlikely to be found at depths greater than 50 feet, but that maritime paleolithic habitats of ages up to 15,000 years may be available at depths of up to at least 350 feet in the ocean, probably located in caves fronting on what were once natural terraces with an ocean view. Archeologists showed a strong desire to take advantage of modern underseas vehicles and tools for their research, and the possibility of future archeological activities is being pursued.

Training is an important part of the activities of the Office. Annual programs in undergraduate research participation continue to involve 20–25 United States college students, ordinarily after their junior year. These work with marine scientists on individual projects in relation to the work of their supervisors in order to get some feeling for possible careers in the marine sciences. In another program, many new employees of the Oceanographic Sorting Center are selected from the Depart-

ment of Labor unemployed list and are given on-the-job training under close supervision. Many, after several weeks, become proficient in the required technical skills, and often are led to other positions for which the training has been useful preparation. Certificates of achievement were awarded by the Secretary in January to 54 sosc employees who had completed the minimum time in training.

The Army Corps of Engineers was asked to undertake a study of wastes-disposal sites located off New York Harbor, and the Coastal Engineering Research Center of the Corps, under instructions to "prepare a plan of study," turned to the Smithsonian Institution. With the help of Smithsonian curator M. Grant Gross, the Office convened a committee of eight scientists to examine the problem. The report submitted to the Corps listed the investigations needed to evaluate the oceanic conditions and the biology of the wastes-disposal areas, and indicated their priorities. Emphasis was placed on literature surveys and comparative studies of benthic communities, especially organisms and sediments in the areas affected by the disposals.

On invitation from the Navy and the British Royal Society, sosc supervisor H. A. Fehlmann and museum technician Charles F. Rhyne spent July and August on Diego García and Aldabra Islands making collections for the Smithsonian Institution.

On behalf of the Office, Smithsonian curator Kenneth M. Towe and Norman K. Sachs of the Geological Survey, spent January on board the Grace Line ship *Santa Sofia* cruising the Caribbean. This represented the first Smithsonian ships-of-opportunity cruise taking advantage of merchant ships on their normal trade runs. The main emphasis was on sampling radiolarians, both to study their distribution and to obtain materials of high quality for studies of microstructure. This arrangement was found to be highly practical by Towe and Sachs. The study involved the cooperation and support of the Naval Oceanographic Office, the Office of Naval Research, and the Grace Line.

As another Smithsonian-encouraged ships-of-opportunity program, George C. Anderson of the University of Washington completed a series of transects of the North Pacific in American Mail Line ships between Seattle and Yokohama early in March. Anderson collected seawater samples for phytoplankton and chemical analyses, pyroheliometer readings, and zooplankton, and examined the possibilities of employing the ship's officers in making these collections on subsequent cruises. Although Anderson found the officers cooperative and capable of taking the required observations, he felt that a technician should accompany the ship and be specifically charged with the sampling program.

While in Japan, Anderson also visited a number of laboratories to

assess Japanese interest in the program. There appears to be real potential for the development of an international program involving the Japanese and Canadian (specifically, T. R. Parsons' productivity group at the Fisheries Research Board of Canada Station in Nanaimo), and the United States, to be funded in part by the National Science Foundation via the Japan-United States Scientific Cooperative Treaty. In the meantime the Office of Naval Research provided support for Anderson to continue the work, and two additional ships were equipped—the S.S. *Philippine Mail* (departed Seattle 4 March) and the S.S. *Oregon Mail* (departed Seattle in late March).

Use of the Coast and Geodetic Survey vessel *Oceanographer* as a biological ship-of-opportunity was completed during this fiscal year and, with support from the Office of Naval Research, the samples are being studied by scientists.

The agreement with the Southern Maine Vocational Technical Institute for their operation of the Smithsonian research vessel *Phykos* was continued.

Smithsonian Oceanographic Sorting Center

Serving as a national referral service in biological oceanography, the Center is involved in all kinds of specimen-based activities, from field collecting to the deposition of identified species in permanent study museums. Staff members of the Center engaged in field collecting at Diego Garcia and Aldabra Islands in the Indian Ocean, on various Philippine Islands, during a trans-Pacific cruise to the Antarctic, during a trans-Caribbean cruise, on several cruises in the Mediterranean, and from vessels in the Chesapeake Bay. These collections were made to assist

H. Adair Fehlmann collected fish for the Smithsonian at Aldabra Island, off Madagascar.

specific research projects, with the expectation of adding substantial unique material to that already available to the 257 taxonomic specialists using the services of the Center.

An automatic data-processing system has been initiated for records of natural history specimens. Many of the manual operations of data processing—including preparation of labels, inventory cards, and invoices—have been automated. The same system provides labels and a record suitable for entry into a computerized data storage and retrieval system. Two high-speed automatic typewriters have been installed, each of which is programmed to code and punch the typed data onto a paper tape at the same time as labels and invoices are prepared. Data from the punched tape are accepted by another machine which stores the information as an inventory on the magnetic tape of a computer.

The inventory is designed to list, along with the taxa from the label, essential identifying and sampling data, such as vessels, collectors, station numbers, positions, dates, depths, and type of gear. Data retrieval can be made on one or any combination of these parameters. As taxa are shipped to specialists, invoices are prepared which are programmed to update the information on the location of the specimens. Similarly, provision has been made for entry of species names as specialists provide such identifications. The inventory provides a necessary record of the Center's activities and eventually will become a useful tool for studies of ecological communities and distribution of taxonomic groups.

Although programming is not complete, data from the basic programs have been entered to include nearly 10,000 records. Much of the impetus for the development of the records system resulted from fulfillment of contract obligations, to the National Science Foundation's Office of Antarctic Programs, which provide for compilation and maintenance of files of all collections taken from the Antarctic, both old and recent. Requirements of this project have made especially urgent the obtaining of accurate specimen files from throughout the United States.

During the past year the Center received 4,476 samples, coming from all oceans. From these and the other samples on hand, 3,475,283 specimens were sorted. Totals of 629,867 specimens and 4,422 unsorted lots were shipped to the 257 scientists from 27 countries presently being served by the Sorting Center. The principal function of the Center is the painstaking process of separating discrete units of the collections and sending these units to taxonomic specialists who identify the species, describing newly collected forms and publishing the taxonomic and related environmental data. Shipment to specialists continues to take place more slowly than sorting for many reasons, including the following:

A particular taxonomic unit should have a variety and relatively large number of individuals before being of critical size to justify attention by a specialist.

All shipments of specimens are made subject to prior arrangements with the specialist for acceptance and study.

All specialists must have had review of their qualifications by a Center advisory committee for related taxonomic groups.

Taxonomists are in short supply and those who meet our quality standards are busy, so that their handling of specimens from the Center must be correlated with that of specimens obtained from other sources.

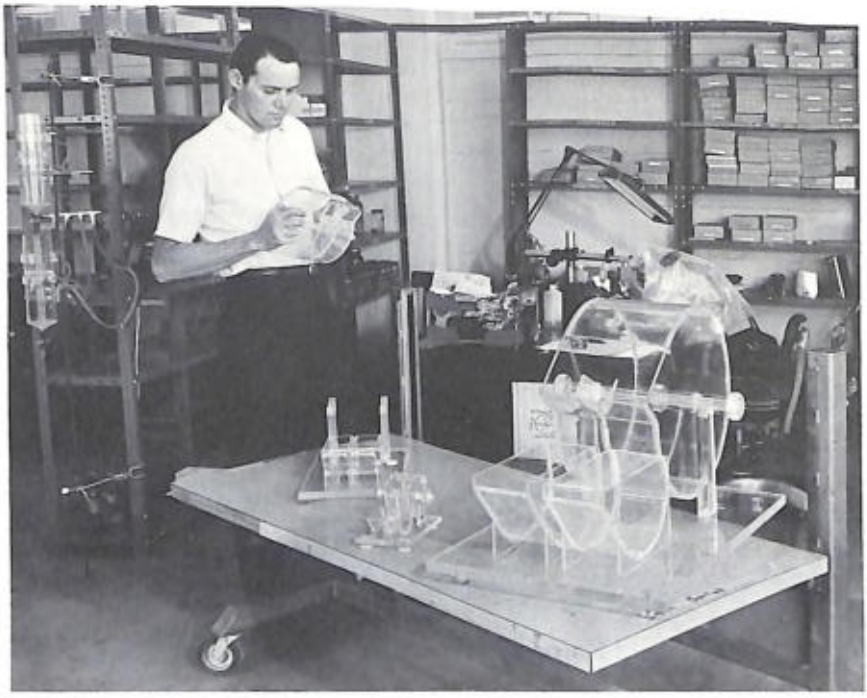
When a student requests specimens for use in meeting degree requirements, he or the Center must find an experienced taxonomist to serve as his sponsor and to accept responsibility for maintaining the condition of the collection.

After the specimens have been identified and returned the Center selects as a repository a suitable study museum, which must agree to keep them in good condition and to make them available for reference by qualified investigators.

Innovative concepts of the staff, its advisors, and any visitor to the facility are continually under review. Efforts to interest commercial suppliers in the developing of adequate containers and closures led to the manufacture of different-sized jars with uniform mouth openings, and of polypropylene closures to fit a variety of glass containers commonly used for other purposes in industry. Commercially available materials of an elementary nature which have been adapted for specific laboratory purposes include a square of black glass, which under the microscope stage provides a background against which organisms are more easily seen, and a special adhesive mixture used to seal vials and bottles before shipment, thus avoiding the problem of leakage common to many biological containers.

The Plastic Peel-a-Way Blood Sampler provides a quick and reasonably accurate method of obtaining, holding, and shipping aliquots of phytoplankton; and it eliminates contamination, and the chance of loss owing to breakage. Multipurpose biological trays were adopted for washing and rinsing marine macroscopic algae. Use of different mesh openings avoids the loss of minute filamentous algae formerly carried away in the water overflow.

For smaller marine animals, the use of a plastic tray with a numbered grid of 12x12-mm compartments to facilitate handling and sorting was found less cumbersome than the use of a larger maze of dividers. An enlarged version of the Folsom Plankton Splitter can handle the greater



Walter Sorrell of the Museum of Natural History plastics laboratory inspects one of the numerous plankton splitters fabricated by the Office of Exhibits for research at the Smithsonian Oceanographic Sorting Center. The production of such precision scientific instruments is an important contribution of the plastics laboratory to Smithsonian's research program.

volume of midwater-trawl specimens per sample. Small desk fans that direct a confined stream of air across the top of the sorting tray help to prevent the sorter's inhaling preservative fumes without causing a draft on him. Miniature egg boxes were used to facilitate storage of specimens in five-dram vials.

Several methods were experimented with to handle the most fragile specimens: thistle tubes with ultra-fine mesh netting were used to draw off fluid from samples without removing the microscopic organisms; a scoop-type device was developed to pick up fragile animals without injury, while for separating and sorting the use of fine, flexible forceps, Irwin loops, and broaches was found more satisfactory than the stiffer jeweler's forceps previously used.

Two devices adapted for more efficient record-keeping are the banks of multiple counters, which reduce hand movement in enumeration of animals by taxa, and a metal plate 1/50 the area of the sorting tray, used to estimate copepods when their numbers would cause prohibitive loss of time if an organism-by-organism count were made.

Use of various solutions in processing marine organisms at the time of collection and in the laboratory is a continuing concern. Experiments were conducted with formalin in natural sea water, artificial salt water, and fresh water to determine the most satisfactory solution for preservation of animals and for handling large numbers of specimens. For example, it was found that Ionol is useful in preserving color, but it causes organisms to stick together and makes sorting more difficult. Its use also resulted in the destruction of certain plastic containers in the laboratory.

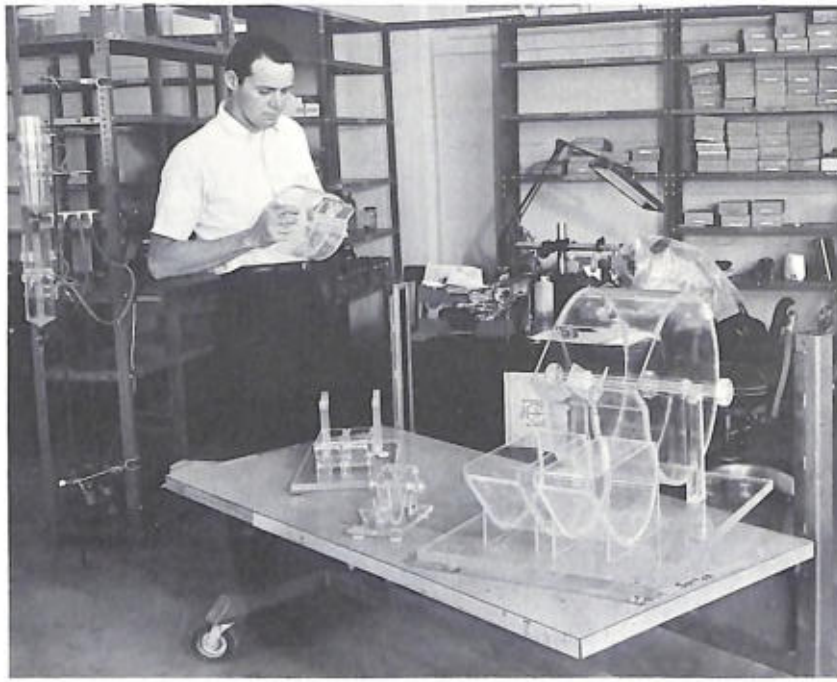
The use of mechanical sorting devices to speed tedious and time-consuming manual sorting is under investigation. A modified sorter based on the mechanical sorter (McGowan and Fraundorf, 1964), was designed and built to utilize the organisms' specific gravity in a given "sorting solution." When fully developed, it should substantially increase for certain groups of pelagic organisms the volume of material sorted per man-hour.

At the Center, geology this year has developed into a full partnership with biology; and although emphasis is placed on oceanic rocks, sediment samples also are accepted and processed, and bottom photographs are described and made available to scientists. A single, rapid tour of a few research laboratories established a user list of more than twenty scientists who needed access to various oceanic rocks to satisfy their research interests in the oceanic crust.

The Center plans to participate in collecting oceanic rocks, but much material can be accumulated by advertising the willingness to accept and distribute collections of others, for experience has shown that potential users often do not know about the activities of potential collectors.

Favorable reviews of this activity have resulted in joint support from the National Science Foundation, and by year's end the Center had in being a petrographic laboratory with equipment and supplies for rock identification, an automated rock inventory system, a staff trained for the tasks required, and continuing communication with requesters and suppliers of oceanic rocks and information.

During the year 583 negatives and 36 log sheets were received from *Eltanin* cruises. Primarily for scientific research, 2,854 black-and-white prints and 131 color slides were distributed and 190 black-and-white negatives were loaned. Data on photographic techniques, the camera, and the camera-to-bottom geometry were gathered to assist specialists in



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determining the size of objects which they study on the bottom photographs. Since the camera often points obliquely at the bottom, the scale of the resulting photograph may vary through the field of view. Assuming a horizontal sea floor and a vertical camera rig to be the ideal situation, criteria are being developed to recognize departure from this, and a grid now can be supplied to facilitate making measurements on oblique photography.

Mediterranean Marine Sorting Center

Established and maintained in Tunisia using Public Law 480 excess currency funds, the Mediterranean Marine Sorting Center (MMSC) is directed by an American (David M. Damkaer during its first year and Neil C. Hulings during its second year). Patterned after the Smithsonian Oceanographic Sorting Center, MMSC differs only by emphasizing Mediterranean samples and in giving first consideration to Mediterranean-based scientists wishing to work on the specimens. Recognizing the world shortage of taxonomists, MMSC coordinates its specialist list and advisory committees with other specimen centers, but develops both of these facilities to fit its own needs. It assists with all aspects of taxonomy, from the collecting of specimens through their processing for identification and their deposition in appropriate study museums. Emphasis during the year was on quality control and training. In this connection a total of 27 consultants from Tunisia, Italy, Yugoslavia, Austria, France, Algeria, the United States, and two United Nations Organizations (FAO and UNESCO) visited the Center and advised on specimen handling, while MMSC staff members visited Malta, Italy, Yugoslavia, Lebanon, Libya, Cyprus, England, Denmark, the United States, and Canada.

During the year MMSC received 1579 samples from Tunisia, Malta, Italy, France, Romania, Yugoslavia, and United States expeditions in the Mediterranean. From these 1,070,726 specimens were sorted and 135,840 were sent to 14 specialists from Tunisia, Italy, Yugoslavia, and the United States, representing seven institutions. Twenty-one specialists have formally requested material from among the nearly 400 who have expressed an interest in MMSC. A reference collection—mostly identified to species and now consisting of 507 specimens of marine benthos, algae, and fishes—has been developed at MMSC for assistance with training. Most of these museum specimens are from Tunisia. A series of 15 advisory committees, averaging four members each, are in the final process of being established to consider requests for specimens and to approve depositories for them.

Recording (left) and sorting of marine biological collections is done by Tunisians at the Mediterranean Marine Sorting Center.

At present the director, benthos supervisor Jose M. Stirn, and Mme. J. H. Heldt, permanent consultant, are training the technicians in all categories of sorting. Among the technicians recently employed are two who will fill supervisory positions. One, Mme, Hedia Baccar, earned a D.Sc. from University of Lausanne in 1967. The other, Mr. Abdeloud Ghanem, has a degree in the natural sciences from the University of Tunis. These two plus Mme. Fafani Ouachi, who also has a natural science degree from the University of Tunis, make it possible for three of the four supervisory positions at MMSC to be filled by Tunisians. Two Tunisians, Hassouni Zaoui and Mohamed Shili, are being trained to occupy subsupervisory positions.

Excellent relations have been established not only with INSTOP but also with the Faculty of Sciences of the University of Tunis, the biology faculty of which has aided MMSC in selecting employees.

In honoring requests by foreign scientists to provide specific collections of Tunisian marine organisms, MMSC depends upon and works directly with INSTOP, and when such collections are made, a representative number of specimens—identified and properly preserved—are always deposited with INSTOP.

Since MMSC is interested in the total marine environment, the Center has been involved in a wide variety of activities. Personnel and financial support were provided for a two-week Mediterranean Association of Marine Biology and Oceanology (MAMBO) course in marine biology fisheries. The countries represented and the number of participants were: Algeria 2, Cyprus 2, Italy 2, Lybia 1, Malta 1, Romania 2, Spain 2, Tunisia 7, Turkey 1, and Yugoslavia 2. In addition, Professor Stirn spent six full days lecturing, leading field trips, and directing

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laboratory work. Other organizations participating in the course included FAO, UNESCO, INSTOP, the Swedish International Development Association, and the University of Tunis.

The staff of MMSC participated in a number of conferences in the Mediterranean region, including the Third International Colloquium on Medical Oceanography in Nice, France; the General Fisheries Council for the Mediterranean in Split, Yugoslavia; the Sixth International Conference on Food from the Sea in Ponza, Italy; and the MAMBO training course in Malta. In addition, numerous conferences were held with representatives of many institutions regarding MMSC activities and future operations.

Publications

FEHLMANN, H. A. "Role of the Smithsonian Oceanographic Sorting Center in Antarctic Research." *Antarctic Journ. of the U.S.*, vol. 2, no. 5, pp. 205–206, 1967.

HULINGS, NEIL C. "A Review of Recent Marine Podocopid and Platycopid Ostracods of the Gulf of Mexico." *Contr. in Mar. Sci.*, vol. 12, pp. 80–100, July 1967.

———. "Marine Ostracoda from the Western North Atlantic Ocean: Labrador Sea, Gulf of St. Lawrence and off Nova Scotia." *Crustaceana*, vol. 13, pt. 3, pp. 310–328, 1 pl., 1967.

LANDRUM, BETTY J. "The Antarctic Records Program, 1966–1967." *Antarctic Journ. of the U.S.*, vol 2, no. 5, p. 206, 1967.

SIMKIN, TOM. "Flow Differentiation in the Picritic Sills of North Skye." Pages 64–69 in *Ultramafic and Related Rocks*, edit. P. J. Wyllie. New York: John Wiley & Sons, 1967.

———. "Zoned Olivines and the Cooling History of a Picritic Sill." *Geol. Soc. Amer. Spec. Paper*, no. 101, pp. 202–203, 1967.

———, and J. V. SMITH. "Minor Element Variation in Olivine." *Geol. Soc. Amer. Spec. Paper*, no. 101, p. 203, 1967.

WALLEN, I. E. "Smithsonian Institution Participation in *Eltanin* Cruises." *Antarctic Journ. of the U.S.*, vol. 2, no. 5, p. 202, 1967.

———. "Cooperative Systematic Studies in Antarctic Biology." *Antarctic Journ. of the U.S.*, vol. 2, no. 5, p. 203, 1967.

Smithsonian Office of Ecology

HELMUT K. BUECHNER, *Head*

PRIMARY GOAL OF THE OFFICE OF ECOLOGY is to contribute—through the promotion of research, through education, and through the communication of knowledge—to the development of a new science of man and his total environment: ecosystem ecology. In its traditional disciplinary sense, ecology is concerned mostly with the environmental relationships of the various components of relatively undisturbed natural ecosystems. The new emphasis is with interdisciplinary studies that advance the scientific understanding of how whole ecological systems are put together and how they work in nature with man as an integral component of the system.

Such are the complexities of man's contemporary ecological problems that not only the various disciplines of the natural sciences, but also those of the behavioral sciences and of the humanities must ultimately be brought to bear on them. Since the foundation of such studies lies partly in traditional ecology, the Office of Ecology supports research of this nature while it builds toward the new science. Fundamental to all ecological studies, of course, is systematic biology, and the Office also encourages and supports interdisciplinary studies among systematists and ecologists in order to expand and spread basic scientific knowledge about the living components of ecosystems involving man.

Development of a strong program of ecosystem ecology at the Smithsonian Institution, a principal center for the study of biosystematics, is particularly appropriate and important, for the Institution provides an ideal focal point from which to motivate, encourage, and develop biosystematics relevant to today's ecological problems.

Significant changes in the basic staff occurred during the year. Lee M. Talbot became deputy head of the Office of Ecology on 6 May, with special responsibility for the international program. As the Smithsonian field representative for international affairs in ecology and conservation, a title which he retains, Talbot has been on special assignment as the international field coordinator for the conservation section of the International Biological Program. In this capacity he has been instrumental in the establishment of various projects in Africa, Asia, Europe, and the

Americas involving biological research, survey, the establishment of field research stations and reserves, the organization of conferences and symposia, and the international exchange of scientific and conservation personnel. All programs and projects of the Office of Ecology supported from the Foreign Currency Program and other sources are now administered by Talbot.

Francis S. L. Williamson was appointed by Secretary Ripley as the new Director of the Chesapeake Bay Center for Field Biology, effective 1 July 1968. Director Williamson came to the Smithsonian with ten years of intensive ornithological research in Alaska where he was employed by the Public Health Service, Arctic Health Research Center, to investigate the ecology of Alaskan birds with special relationship to the epizootiology of animal-borne diseases. He also conducted extensive studies on the ecology, distribution, speciation, and faunal relationships of Alaskan birds, the results of which have been published in about 30 research papers.

INTERNATIONAL PROGRAM

The research program now under way in Ceylon, a study of the behavior and ecology of elephants, is in its second year, and a series of projects on primates has been started. It is under the direction of John F. Eisenberg, resident scientist of the National Zoological Park and associate ecologist of the Office of Ecology, who joined the field team in Ceylon

Elephants at Lahugula Tank (a former reservoir about 1000 years ago) in Ceylon. Photographed 5 November 1967.

in June to direct the projects and conduct ethological research for a year. Based on the weights and linear measurements of 21 female and 16 male elephants examined while they were assembled for the annual Kandy Perahera procession, a system for estimating ages of Ceylonese elephants was developed. This system provided a foundation both for Fred Kurt's post-doctoral research on individual and group behavior, population structure, and reproduction, and for George McKay's pre-doctoral research on food habits, relationships to vegetation, and energy flow. Suzanne Ripley joined the team to investigate the interrelationships between man and tame elephants, with special reference to the use of the elephant as a work animal and the role which the elephant plays in the Ceylonese culture. Knowledge of the cultural significance of the elephant will provide important background for a program of education and training to insure continued conservation of the Ceylonese elephant.

Two students at the University of Ceylon in Peradiniya, veterinarian A.P.W. Nettasinghe and zoologist Anil Jayasuriya, will use segments of this research on elephants for their M.S. degrees. In October, Clinton Gray, veterinarian of the National Zoological Park, determined the dosage of M99 for immobilizing the Ceylonese elephant, and with unqualified success captured, marked, and released three large male elephants in the wild, thus demonstrating a means by which the Ceylonese government can move elephants to new locations. During the month of January, Kurt, McKay, and Ripley journeyed to India for observations on the elephant round-up in the State of Mysore, an event known as a "keddah," which is held every ten years to capture wild elephants for domestic use. Valuable information was obtained on behavior during capture, on normal behavior (observed at 50-meter range from the backs of tame elephants), and on age structure of the wild population. The accomplishments proved so worthwhile that a second trip was made, this time with Nettasinghe and Jayasuriya. These trips also laid the foundation for the future development of a project on elephants in Mysore.

Dieter Mueller-Dombois, who is conducting botanical studies in Ceylon, intensified his cooperation with the elephant studies by establishing a series of vegetation transects in the Yala National Park, developing a vegetation classification system for relating the daily and seasonal behavior of elephants to vegetation types and for aiding in identifying plants utilized as food. Both Mueller-Dombois and the elephant team are gathering information on the relationship of buffalo, sambar deer, and axis deer to elephants through their influence on the vegetation, particularly at Yala where there is an overabundance of deer. By the close of

these studies next year a broad foundation will have been established for long-range action in the conservation of the Ceylonese elephant.

The primate studies initiated by Eisenberg include the macaque (two races), the gray langur (one race), and the purple-faced langur (four races). They involve comparisons between species and between races of the same species to elucidate the variations in individual morphology, social forms, and distribution in relationship to climate, diet, and habitat utilization. Cooperating investigators in these studies include Suzanne Ripley, whose doctoral dissertation was on the gray langur in Ceylon; Theodore I. Grand of the Oregon Regional Primate Research Center; and Claude M. Hladik of the University of Paris. The overall goal is to determine the modes of exploitation of the environment by the different species and races of primates, which is to be accomplished by relating data on ecology, sociology, energy budget, and form and function of the primates to relevant differences in the environment.

The survey of opportunities for overseas ecological research initiated last year with support from the Smithsonian Foreign Currency Program continued with promising results. A large portion of the survey activity was concentrated in India. Two post-doctoral students, Robert L. Fleming from Michigan State University and Robert H. Horwich from the University of Maryland, completed a year surveying the present state of ecological research in India. They also examined research opportunities and disseminated widely information on the Smithsonian research objectives. One immediate result of the survey was to prepare a trip to the United States for India's leading plant ecologist, Ramdeo Misra, professor of botany, Banaras Hindu University, to seek support and collaboration in studies of primary and secondary productivity of representative ecosystems in central India. George A. Petrides, professor of zoology at Michigan State University, formulated a well-conceived plan for ecological research in southern Nepal. With assistance from his university and from the Smithsonian, an interdisciplinary program is being developed, based on the Rapti Valley of Nepal, a relatively undisturbed area that is accessible to ecologists and students from many parts of the subcontinent.

Richard D. Taber, professor of forestry at the University of Montana, and post-doctoral student Mirza Beg, laid the groundwork for ecological research in Pakistan, project proposals for which are now being prepared, with emphasis on the population ecology of animals (such as the wild boar) that damage agricultural crops.

Lawrence B. Slobodkin, formerly professor of zoology at the University of Michigan and now chairman of the department of biological sciences at the State University of New York at Stony Brook, began a five-year

study of diversity, spacial distribution, and interspecific relationships of corals, and of the behavior and ecology of reef fishes, at the Eilat coral reef in Israel.

Frank B. Golley of the University of Georgia's Institute of Ecology visited Poland for the Smithsonian to develop a joint ecological research project, on the bioenergetics of small mammals, with Kazimierz Petrusewicz, the Director of the Polish Academy of Science's Institute of Ecology.

Lee M. Talbot made three trips to Tunisia, where he initiated a wide and promising research program on arid-land ecology in conjunction with the government of Tunisia. The principal study site will be that government's research station at Bou Hedma in southern Tunisia. This project is being developed as part of the International Biological Program, and it is envisioned that information from this study will find application in other North African nations.

Kai Curry-Lindahl and Walter Leuthold completed a highly successful survey of opportunities for limnological and terrestrial ecological research in the Republic of the Congo (Kinshasa). From the Congo Leuthold traveled to Kenya to gather information, contact government and university officials, and to prepare a long-term program of comparative studies on territoriality, reproduction, and ecology of several East African antelopes. This program is to be an expansion of the earlier research by Buechner and Leuthold on territorial behavior in the Uganda kob.

Elephants at Lahugula Tank. Two babies can be seen, one of which is nursing. Photographed 5 November 1967.

The ecological studies that have been supported for nearly two years by the Office of Ecology in the DMZ study area, which is contiguous with the demilitarized zone of Korea, were brought to a temporary standstill by the increased activities of infiltrators that threaten the lives of the investigators. A five-year plan was developed for a Korean Center for Environmental Studies, within which an integrated program of research and education in ecosystem ecology can be undertaken at some point in time when the military and political situation in Korea has eased and financial support becomes available.

In most regions of the world outside of the United States, ecosystem ecology is in its infancy, and it is important to make preliminary surveys in these areas to identify significant problems and to initiate effective plans to carry out research projects. Preliminary research usually can be accomplished on initial trips, and the Office of Ecology supports such introductory studies in ecosystem ecology and environmental physiology under a contract with the Air Force Office of Scientific Research. Since April 1967, some 40 scientists have been supported, many of whom have worked in Latin America at the Smithsonian Tropical Research Institute and at Belém, Brazil, where the Smithsonian cooperates in a research program with the Instituto des Pesquisas and Experimentação Agropecuarias do Norte 14 (IPEAN).

CHESAPEAKE BAY CENTER FOR FIELD BIOLOGY

Development of facilities for the Chesapeake Bay Center for Field Biology continues. The Center's headquarters with the assistance of a grant from the Old Dominion Foundation, was remodeled to provide offices, a small dormitory with dining facilities, a conference room, and a library. A maintenance vehicle and two small boats to be used in freshwater and estuarine research were acquired. All necessary road work was completed and a precise grid system for the location and recording of observations was established.

Three students began research for the summer at the Center in June 1968. Paul E. M. Fine initiated studies on avian blood parasites, William W. Wiggins started on intensive bird-banding project to determine the special distribution of birds in the mature forest, and Mary A. Feagin began studies of aquatic animals in Muddy Creek under the guidance of I. Eugene Wallen.

The Office of Ecology made available the 234-page manual, "An Ecologically Annotated Checklist of the Vascular Flora at the Chesapeake Bay Center for Field Biology, with Keys," by Daniel Higman. This checklist is backed by herbarium specimens collected at the Center since August 1965, and after the keys have been tested through use, it will be published.

EDUCATION

The efficacy of reorienting liberal education on an ecological basis to achieve greater contemporary relevance in higher education was discussed at a seminar organized by the Office of Ecology and held at the White Memorial Foundation, Litchfield, Connecticut, 28 September–1 October. This seminar, "The Quality of Man's Environment—A Challenge to Liberal Education," was jointly sponsored by the Office of Ecology, the Union for Research and Experimentation in Higher Education (UREHE), the United States Office of Education, and the White Memorial Foundation, with a supporting grant from the Esso Education Foundation.

As a result of this conference, the 10 liberal arts colleges of UREHE are developing interdisciplinary approaches for an educational program centered on man and his total environment.

"Man, Beast, and The Land," a color documentary film of research begun in 1959 in East Africa by Lee M. and Martha H. Talbot, appeared on NBC television, 16 May. The Nielsen rating of 33.5, representing nearly 30 million viewers, was remarkably high for a documentary and indicated keen public interest in the wildlife and ecology of the Serengeti-Mara plains of Tanzania and Kenya. The high quality of this film sets a standard for future films documenting research by Smithsonian scientists.

Charles Elton, who became the second Smithsonian Fellow, subsequent to his recent retirement from the Directorship of the Bureau of Animal Population, which he founded at Oxford University 35 years ago, arrived in Washington, 4 April. As Sir Alister Hardy said of Elton in his foreword to the commendatory issue of the *Journal of Animal Ecology* (February 1968): "Elton in fact set out to turn natural history into science, and that, of course, is what ecology is: the quantitative and experimental study of living organisms in relation to their environments. He blazed a pioneering trail in this new domain of terrestrial animal ecology. He had the courage to remain in university life, to sally forth from the laboratories into the field, and so was one of the very first to bring the principles of animal ecology, which he himself was largely making, into the academic world to influence future students."

The visit of Elton to the Smithsonian for a five-month period, initially sponsored by Philip S. Humphrey, will include two months of field research at the IPEAN rain forest, Belém, Brazil, where ecological research was organized in 1966 by Humphrey with financial support from the Office of Ecology. During an earlier brief visit to Belém, Elton was impressed by the scarcity of rain-forest animals; his recent research

has centered on population density and species diversity of the rainforest fauna, comparisons being made with the fauna at Oxford University's estate at Wytham Woods which he has studied intensively over the past 20 years.

The stimulation of Elton's visit, particularly through his informal talks, has led to the incorporation of some of his ideas, methodology, and guidelines—evolved at Wytham Woods—into the long-range program of the developing Chesapeake Bay Center for Field Biology.

Staff Papers Presented or Published

BARBEHENN, KYLE R. "The Effect of Community Organization on Estimating Small Mammal Populations." Paper presented at the 47th Annual Meeting of the American Society of Mammalogists, Nags Head, North Carolina, 1967.

———. "Host-Parasite Relationships and Species Diversity in Mammals: An Hypothesis." Paper presented at the Annual Meeting of the Ecological Society of America, University of Wisconsin, Madison, Wisconsin, 1968.

BUECHNER, HELMUT K., and FRANK B. GOLLEY. "Preliminary Estimates of Energy Flow in Uganda Kob." Pages 243–254, in vol. 1 of *Secondary Productivity of Terrestrial Ecosystems (Principles and Methods)*, edit. K. Petrusewicz. Warsaw: Polish Academy of Sciences, Institute of Ecology, International Biological Programme PT, 1967.

BUECHNER, HELMUT K., and HARLAND W. MOSSMAN. "The Opening Between the Allantoic Vesicle and the Uterine Cavity in the Uganda Kob Conceptus." Paper presented at the International Symposium, Biology of Reproduction in Mammals, University College Nairobi, Kenya, April 1968.

TALBOT, LEE M. "Background and Organization of the IBP." *Transactions of the Thirty-second North American Wildlife and Natural Resources Conference*, 1967. Volume 32, pp. 275–278.

———. "The Herbivore-Vegetation-Nomad Complex: Recent Research and Its Implications." Paper presented at the IBP–CT Technical Meeting, Hammamet, Tunisia, 24–29 March 1968.

———. "Wildlife in a Changing World: A Conservation Challenge." Keynote address, joint sectional meeting of American Society of Range Management, the Society of American Foresters, and the Soil Conservation Society of America, Utah State University, Logan, Utah, 1967.

———. "Ecology of East African Savanna." Lecture series, College of Natural Resources Conservation Week, Utah State University, Logan, Utah, 1967.

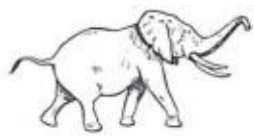
———. "Wildlife in Developing Countries." Pages 46–49 in *Wildlife Resources in a Changing World*. Washington, D.C.: The Conservation Foundation, 1968.

———. "Ecological Considerations in Water Development Projects in the Middle East." Paper presented at the Conference on the Middle East: Horizons in Science and Technology, The Middle East Institute, Washington, D.C., 1967.

TALBOT, LEE M., and MARTHA H. TALBOT, editors. *Conservation in Tropical Southeast Asia*. IUCN Publications, new series, no. 10, 550 pp. Morges, Switzerland: International Union for Conservation of Nature and Natural Resources, 1968.

Museum of Natural History

RICHARD S. COWAN, *Director*



LEARNING IS FUN! So say the hundreds of children who clamber over a life-size model of a prehistoric dinosaur Triceratops under the trees in front of the Museum, and then flock into the exhibit on dinosaurs in strikingly larger numbers than ever before. The same mood is expressed by the young and old who crowd informal classroom areas all over the Museum where scientific staff members teach Smithsonian Associates classes on many natural history subjects. This is learning at its best; but it does not stop there, for there is a burgeoning interest among the Museum staff to bridge the former gap between the Smithsonian and academic institutions across the country.

Some of the research scientists are actively involved in giving courses and seminars at nearby and distant universities, but many more are involved in cooperative research training with students who are working in the seven departments of the Museum under the direction and supervision of our professionals. Dissertations for advanced degrees are in progress or were completed in most of the natural history disciplines, and summer intern students undertook a wide variety of limited research projects in the departments. In addition, growing numbers of postdoctoral investigators are spending substantial periods of time in residence in the Museum.

The depth of interest and concern for educational matters by the scientific staff is well demonstrated by the number of them involved in teaching at all levels. The joint development of an almost unique curriculum for paleontology students at a local university by members of our department of paleobiology is an especially good example of the interest in higher education in the Washington area.

SUMMARY OF PUBLICATIONS BY THE STAFF
(INCLUDING HONORARY MEMBERS)

Department	*1964*	*1965*	*1966*	*1967*	*1968*
Anthropology	30	31	35	41	48
River Basin Surveys*	–	1	13	15	17
Botany	54	51	50	69	89
Entomology	38	25	30	55	53
Invertebrate Zoology†	67	39	35	68	60
Mineral Sciences	2	18	15	21	25
Paleobotany	13	29	39	41	103
Vertebrate Zoology†	–	28	56	60	81
TOTALS	204	222	273	370	476

*Prior to 1965 under Bureau of American Ethnology.

†Invertebrate and vertebrate zoology were one department through 1964. The figure for 1964 represents both.

The continuing annual increase in research papers represented by the tabulation opposite, has taken place despite an actual decrease in the size of the professional staff. This is most gratifying, for in addition, few national and international meetings occur in which Smithsonian scientists are not involved, often as contributors of papers reporting results of original research, and they also present lectures to their colleagues and to students in academic seminars. These represent an important part of the scholarly output of the staff, and are listed on page 397. From these impressive accomplishments, one may conclude that, research, as a form of learning, is one the staff finds most satisfying.

The increase in interdisciplinary projects implies effective communication between scientists who recognize the benefits of collaboration: A petrologist joins a specialist on Foraminifera to study the history of the mid-Atlantic sea-floor; a specialist on sharks and one on the parasitic micro-invertebrates pool their efforts to illuminate the evolutionary development of their respective groups; and a botanical systematist links his interests with those of an entomologist to understand the biological interrelationships between flowers and their pollinators. Notable as such collaborative efforts are, an even more important research development is appearing.

Because of the size and extent of the national collections of natural history objects and of the interests of the research staff, the Museum has always had a unique role of collecting, organizing, and synthesizing biological data to be presented in monographs and revisions of both fossil and Recent groups. This responsibility to the scientific community is still recognized and discharged, as it must always be, for such basic information is the foundation for the understanding we must acquire of the living world if man is to continue to live in harmony with it. There is evident, however, a new concern for the question, regularly addressed by researchers in the academic environment, of how this basic information relates to the development of our understanding of such biological processes as evolution and environmental relationships—the

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Although the learning process is not altogether understood, most of us agree that LEARNING IS FUN! The pleasure of learning, so evident in the faces of children, also motivates the graduate student and the professional scientist. Museums are, or should be, fun because they are places for learning, whether by clambering over a model dinosaur, assisting scientists as summer interns, or by researching the mysteries of the world about us. The Smithsonian Museum of Natural History, with things and ideas, exists to excite and encourage the fun of discovery. As the national museum of the United States and the largest museum complex in the world, the Smithsonian is constantly seeking new ways to carry out its historic mission of public enlightenment.

MALA
JUNG

Twenty exhibit halls in the Museum of Natural History are visited by millions of people each year, many of them school children. The efforts of artists, designers, model-makers, and other exhibits specialists catch the interest of young visitors. A Junior Natural Science Library is being organized as a tool for bringing learner and knowledge together in an environment that takes advantage of the excitement exhibits generate. Through experiments with new exhibition techniques, the Smithsonian discovers ever more effective ways to arouse interest and to facilitate the learning that is the hallmark of museums.

Behind the scenes, Smithsonian and visiting research scientists with their assistants, volunteer helpers, and students learn about the nature of man and his cultures, about the millions of living and fossil plants and animals, and about meteorites and the origin of our solar system. Young volunteer students are trained in skills that prepare them for a challenging career or an exciting lifelong avocation.

As the official caretaker of the Nation's collections of natural history, the Museum maintains and conducts studies of the more than 50 million specimens of plants, animals, rocks, gems, and human artifacts. The Smithsonian's vast collections have long constituted a kind of national referral center upon which biologists have learned to rely for the basic information they need for understanding the living world. By encouraging scientists, scholars, and students to pursue research among its collections and libraries, the Smithsonian contributes to the national effort to strengthen academic science and scholarship.

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interpretive aspects of systematic biology. This direction suggests that the research staff of the Museum will ultimately include three general, interdependent classes of scholars—those concerned solely (often necessarily by the nature of the group) with monographic studies, those who combine monographic with interpretive interests, and those who are largely interpreters, drawing on and collaborating with individuals and teams representing the first two classes. The result can be a highly stimulating, increasingly relevant environment in which the parts interact, each providing and receiving research direction not otherwise attainable to the same extent. Future staff growth will have this as its goal.

But research at any of these levels depends ultimately on the collections, a unique asset and, at the same time, a unique responsibility of the Smithsonian Institution. As the caretakers and users of the nation's natural history collections, the charge to make them available to any serious, reputable scientist elsewhere is not neglected in the emphasis on an increase in research productivity, both quantitatively and qualitatively. The move of the department of entomology back into the natural history building (started this year), coupled with an annual increase of about one million specimens, necessitates careful long-range planning to provide storage space for the collections. Space must be found outside the Museum for this purpose and two kinds of planning were initiated during the year: a policy to guide curators regarding what kinds of specimens are to be added to the national collections, and a statement of the requirements for an "off-campus" storage facility that will maintain the collections in an available-for-study status. Long-range plans were advanced for the use of recently acquired space in Alexandria, Virginia, and for the construction of new structures within a few minutes of the Mall. Adequate physical protection, space for visiting researchers, and sufficient curatorial assistance are assumed to be basic requirements of any collections-storage location outside the Museum.

Since the results of Museum actions with respect to both research and care of the collections are important to the scientific community generally, ad hoc advisory committees were convened during the year to assist the members of each of the seven departments and the Office of Systematics in an evaluation of past performance and future potentials. The assistance of these groups, composed of the most highly qualified scientists available, has been of inestimable importance and it is gratefully acknowledged.

The accompanying photographic essay illustrates some of the interests of the Museum of Natural History today. The reports of the most significant activities in each of the departments is the substance of past progress and the basis for an enormously optimistic future.

Research and Publication

OFFICE OF SYSTEMATICS

In June the second Summer Institute in Systematics, this one for botanical systematists, was initiated with the collaboration of the American Society of Plant Taxonomists and with support provided by the National Science Foundation and the Air Force Office of Scientific Research. Curator of plant anatomy Richard H. Eyde served as the director of the symposium with Mrs. Sally W. Yochelson as the administrative assistant.

From more than 100 applicants a Society selection committee chose 25 participants, all of whom are occupied during the year with both teaching and systematic research in colleges and universities across the country. Fifteen especially stimulating speakers, including one from overseas, provided the focus for extensive discussion each day and some individual participants presented their own research problems for discussion in the afternoons. Chemotaxonomy, numerical taxonomy, cytogenetics, systematics of cultivated plants, and floral biology were a few of the lecturers' topics. The Institute was attended not only by the participants but by botanists and zoologists of the metropolitan Washington area.

Because of financial stringencies, no new programs were initiated by the Office and ancillary support of miscellaneous, but important, research projects was necessarily reduced. The Office was able, however, to continue minimal support of the development of the program in primatology. This multifaceted program will fill critical gaps in our knowledge of primates generally, but it will be especially concerned with those of biomedical importance.

The federal Office of Science and Technology's Evironmental Quality Committee established in November a special panel on systematics and taxonomy. R. S. Cowan, Head of the Smithsonian Office of Systematics, was appointed the chairman to guide the efforts of representatives from all the federal agencies concerned with systematic biology. The purpose of the panel is to prepare a report that will identify the role of systematics in federal science, its present health and needs, as well as its future development and the requirements to meet anticipated involvement in national and international programs. A first draft of the report was completed at the end of the year and will be submitted early in the new fiscal period.

OFFICE OF ANTHROPOLOGY

The special programs initiated last year have continued to develop under the guidance of professor Sol Tax, special advisor to the Secretary for Anthropology. With assistance from program coordinator Sam Stanley and other staff members, Tax prepared a report outlining present and future program development for the Office of Anthropology and discussing the three major, current programs: urgent anthropology, *Handbook of North American Indians,* and ancient technology. In addition, a number of new concepts were proposed—establishment of a national archives of anthropology, a national library of anthropology, a worldwide teaching cooperative program, an anthropological information exchange, adjunct staff appointments, and planning for the eventual establishment of a museum of man.

One of the recommendations of an ad hoc committee of distinguished anthropologists that was convened during the year was that the programs be emphasized by the creation of a center for the study of human sciences. Professor Tax was asked by the Secretary to draw up plans for implementing this recommendation, and in June the creation of the Center for the Study of Man was announced. It will be the focus for a number of broad, interdisciplinary programs involving scientists from other departments and bureaus of the Smithsonian and from academic centers elsewhere.

Though William Sturtevant, editor of the *Handbook of North American Indians,* is spending the year in England, work on various phases of the *Handbook* continued under Stanley's direction. Most of the volumes have been tentatively planned and these outlines are being critically reviewed by colleagues outside the Institution. The appointment, as research associate, of William S. Willis, Jr., with his profound knowledge of the ethnohistory of the Southeastern United States, adds an important dimension to the program.

A number of colleagues on every continent assisted in carrying out exigent field research under the small grants program for urgent anthropology. This, as the words suggest, provides modest funds for conducting field studies of extreme urgency that can be carried out before scientifically important data are lost forever. The catalogue of urgent research projects was published in *Current Anthropology* for October.

In collaboration with the Smithsonian's division of performing arts, Stanley explored the development of a folklife studies program to systematically record rapidly disappearing American folk history. He distributed to a large number of concerned persons a questionnaire, the results of which will be discussed at a conference later next year.

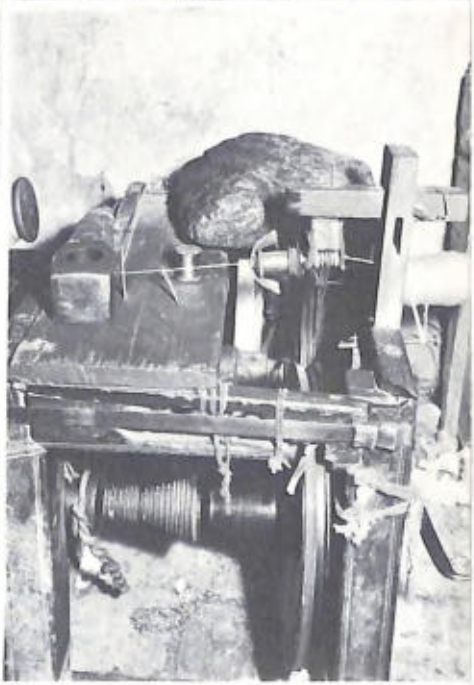
Under the co-direction of Clifford Evans and Gus W. Van Beek, the objectives of the ancient technology program were advanced with the study of several hundred additional pre-Columbian metal artifacts by means of metallographic and spectrochemical techniques under a special contract with Battelle Memorial Institute. A similar study was begun on southern Arabian specimens. Data from these metal studies, made on grave lots from the pre-Columbian culture of coastal Ecuador, will be collated with the other associated materials—pottery, stone, shell, wood, and textile artifacts—and programmed for cluster-analysis study on computers.

Research associate Theodore A. Wertime is conducting a pyrotechnical reconnaissance of Afghanistan, southern and western Iran, and Turkey as a follow-up of his study last year of the ancient technology of tin of Iran. The preliminary results of that work were published in a lead article in *Science* for 1 March.

The study of disappearing traditional crafts, industries, and technologies of South Asia continued, in collaboration with the University of New South Wales, Australia, under support from Public Law 480 and Smithsonian research funds. Professor Hans Wulff, accompanied by Donald Godden and Charles F. Walton, began field work in November in Pakistan. In December Dr. Wulff died of a cerebral hemorrhage in Khairpur, but Godden and Walton continued the expedition. These projects to gather collections and obtain data on the pre-industrial crafts of South Asia have been so successful that Chancellor Baxter of the University of New South Wales was asked to name Professor L. M. Haynes, who is head of the Department of Industrial Arts, as principal field investigator to carry out the long-range collaboration and fieldwork. Plans were developed for fieldwork in Ceylon by Professor Haynes, and in Pakistan by Godden and Walton on one team and by Smithsonian curator Eugene Knez on another.

With Hrdlicka fund support, J. Lawrence Angel extended his fieldwork in Turkey on the health, energy, fertility, and genetic patterns of the earliest farming peoples. He confirmed that their smaller body size and poorer dental health in contrast to those of the meat-eating successful hunters of latest Paleolithic times, was a consequence of chronic falciparum malaria (indicated by anemia-produced thickening of the skull vault) and their carbohydrate diet. Yet the farmers' greater certainty of food supply allowed a slight increase in longevity and in fecundity.

Donald J. Ortner's bone biology program has its current emphasis on the effects of aging on microstructural units, and the coordination of micromorphology with electron microprobe analysis of mineral concen-



First results of the long-range Ancient Technology Program were obtained by a team headed by the late professor Hans Wulff in Iran, where they located and recorded a variety of fast-disappearing crafts, such as drawing gold wire, shown here, and wrapping thread with gold leaf (lower right, opposite) for weaving gold brocade. Machines and tools were collected, along with samples of the products made on them. Other teams have been working in Pakistan and Ceylon.

tration. Ortner will shortly begin studying age-related changes in the organic fraction of single microstructural units. During the 1968–1969 academic year, he will complete the requirements for his doctorate at the University of Kansas under a Smithsonian graduate scholarship.

One application of both gross and microchemical changes in the physiological biography of each individual is identification of skeletons by the division of physical anthropology as consultant to the FBI, State medical examiners, and local police. The physical anthropologist looks for clues to physiological shift from the usual and for stress, injury, or trauma which may distort "norms." After cremation identification is much more difficult and here is where the anthropologist finds himself in court as an expert witness; in one such case a 5-cm piece of the back of the shinbone matched a hospital X-ray of the supposed victim taken when he had broken his ankle, and led to a conviction.

Senior physical anthropologist T. Dale Stewart, supervised Lawrence

G. Quade, from the University of Texas, one of the summer students accepted under the NSF undergradute research participation program, in a survey of frontal lesions in American Indian skulls. They presented a paper on the subject at the annual meeting of the American Association of Physical Anthropologists in Detroit.

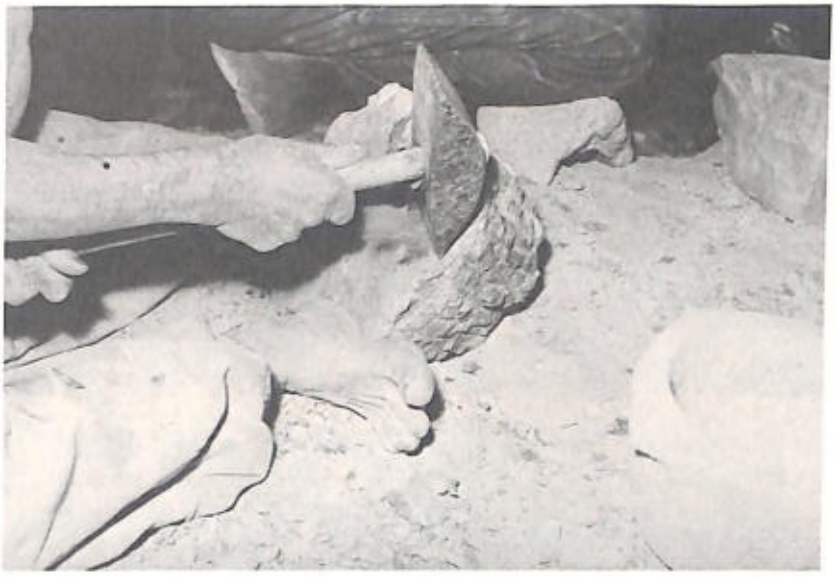
Stewart in December visited Trinity University, San Antonio, for the purpose of examining some newly recovered skeletal remains from a chimney-type cavern outside the city. These proved to be of interest mainly because they date back to the Archaic Period. In January he was in California representing the Committee on Research and Exploration of the National Geographic Society at a conference on L.S.B. Leakey's search for early man in the Calico Hills. It was determined that no satisfactory objective evidence for man's considerable antiquity here has yet been obtained.

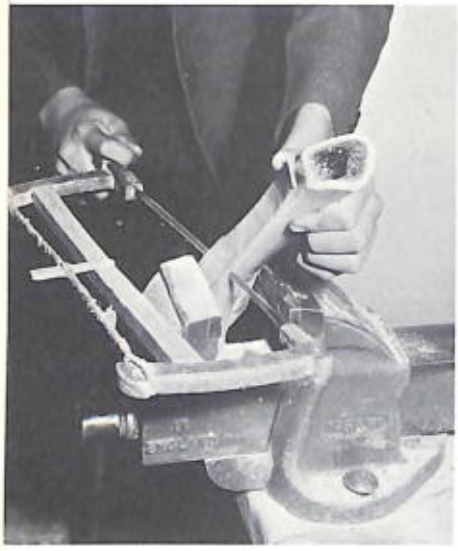
Senior archeologist Waldo R. Wedel, accompanied by museum specialist George Metcalf in June, began further excavations of ceremonial structures associated with certain early historic Indian village sites in central Kansas. Eight students from various educational institutions, including the state universities of Iowa, Kansas, and New Mexico, were employed as field helpers.

Operations were centered on two so-called council circles described last year. Located about a mile apart, they are believed to date from the very beginning of European contact between the natives and the Spanish under Coronado. At the Hayes council circle, previously tested in 1966, it was determined that the circle consisted of two concentric sets of native excavations. An inner set of oblong basins may have been the remains of semisubterranean houses. Three of these were cleared as completely as ground and weather conditions permitted. Then, owing in part to saturation of the ground by heavy and protracted rains, operations were transferred to the Paul Thompson council circle. Here the south half of a circle complex about 100 feet in diameter was opened. As at Hayes and Tobias, dug in 1940 and 1965, the circle of inner structures was surrounded by a ditch or a series of outer basins. The two opened basins had fireplaces in a line down the center, postmolds, storage pits, and much trash on the floor—clear evidence that they had been used as habitations. Much refuse of human occupation was collected from the pit fill, but there was no human bone, whole or fragmentary, in this circle.

The finding of some 12 to 15 human skeletons in the fill of one of the house pits at the Hayes site is of particular interest, because no burial grounds have been found with these village sites. Most of the skeletons had been carelessly interred, sometimes in very incomplete condition. Yet there was a surprising amount of cultural material scattered among

Ancient Technology Program: A steatite (soapstone) pot is roughed out and then shaped on a primitive lathe hand-powered in the manner of an Indian bow-drill. Wulff carefully recorded and photographed each step of these processes, which in a very few years will become lost skills, such is the impact of cheap imports from Japan and mainland China.





Pride of hand-craftsmanship is obvious in this series showing steps in the making of bone-inlay artifacts in Iran. The hundreds of tools and machines already collected by the Ancient Technology Program, with associated descriptions of their use and operation and of the processes involved, constitute a unique historical record of the beginnings of modern technology.

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the bones and in the fill immediately above. From this it is suspected that the skeletons represent hastily interred bodies of individuals belonging to the local community, who may have come to violent ends.

The trade relationships between these communities and the pueblo towns on the Rio Grande 500 miles to the southwest are manifested in the artifact inventory. Finally, sunset observations made on 21 June 1967, including photographs, show that the inferred alignment of the Thompson and Hayes circles with solstitial horizon points is a certainty.

Paul H. Voorhis completed for publication the revision of his doctoral dissertation on Kickapoo Indian grammar. Three brief papers, including native textual material, on Kickapoo subjects—whistle speech, standard orthography, and transcription problems—were also completed. In March he began a six-month field trip to the Mesquakie settlement near Tama, Iowa, to collect new data on the Mesquakie language, emphasizing the intonation system, unrecorded inflections, new vocabulary and texts, and to recheck differences between the Mesquakie and Kickapoo dialects.

Richard B. Woodbury completed a report on the prehistoric water-control systems in the Tehuacán Valley, Mexico, in collaboration with James A. Neely, University of Arizona, as part of the Tehuacán project of the R. S. Peabody Foundation, Andover, Massachusetts. He and Mrs. Woodbury, who is a research associate, in August and September initiated in the Zuni Valley, New Mexico, an intensive archeological reconnaissance designed to examine the ecology of prehistoric and recent use of land and resources.

William C. Sturtevant was on sabbatical leave as a Fulbright professor at the Institute of Social Anthropology, University of Oxford, for the current academic year. This afforded him opportunities for the study of collections of early eastern North American Indian specimens in public and private collections, and of archival material on American Indian history and culture, especially of the Southeast.

In July curator Clifford Evans and research associate Betty J. Meggers presented at the Second International Congress for the Study of Pre-Columbian Cultures in the Lesser Antilles, held at the Barbados Museum in Barbados, a contribution to the methodology of ceramic analysis and reported on their archeological work in 1966 on Dominica.

The archeological survey in Brazil under the direction of Evans and Meggers completed its third year of field work with funds from a Smithsonian research award and with the official collaboration of the Conselho Nacional de Pesquisas of Brazil. The eleven Brazilian archeologists involved are accumulating significant and extensive data, and a conference is scheduled for the end of the third year of field work to allow all participants and the principal investigators to correlate and synthesize the results into general period divisions and to reconstruct the movement of the aboriginal cultures.

Under the direction of Professor Ramiro Matos, and in collaboration with Evans and Meggers, three field parties commenced similar survey work in the coordinated archeological research training program for highland Peru. This was made possible by the generosity of Kaiser Jeep International, W. R. Grace and Company, and the Wenner-Gren Foundation for Anthropological Research.

Robert M. Laughlin brought two native informants to work for two months in Washington, to aid in the analysis of linguistic material previously gathered for his Tzotzil-English, English-Tzotzil dictionary,

Analysis of ethnological information and specimens collected in the course of fieldwork in Botswana and Southwest Africa in earlier years, and the comparative study of these data and published reports, occupied curator Gordon D. Gibson much of the year. He completed a narrated research film on the Himba, a pastoral, Bantu-speaking people of Southwest Africa, in which the motion picture record he made in 1960–1961 is reproduced in its entirety. Work was also begun on a shortened, edited version of the film intended for educational and general purposes.

Gibson continued the translation from the Portuguese of one volume of an important three-volume work on the enthnography of the southwestern Bantu, *Etnografia do Sudoeste de Angola* by Padre Carlos Estermann (Lisbon, 1957–1961). With partial support provided by an anonymous benefactor, translations of the other two volumes are also being obtained.

Gibson joined discussions to develop at the Smithsonian an archive for anthropological motion picture records and, in April, attended a conference at the Wenner-Gren Foundation in New York to explore with other anthropologists and interested educators some of the problems of developing a unified anthropological film program.

Upon his return in July from the previous year's fieldwork in the Caroline Islands, Saul H. Riesenberg assumed his duties as chairman of the Office of Anthropology. The study at Puluwat, centering around the maritime life of the natives, revealed the existence of a unique and

extremely complex set of methods of inter-island navigation. Successful graduates of the native navigation schools are required to memorize thousands of items of information, organized for mnemonic purposes by principles of logic different from those familiar to Western scientists. The complex of social and political activities and relationships which support the very important seafaring life was also studied. Since his return Riesenberg completed the revision of his monograph on the native polity of Ponape, and a paper on James F. O'Connell, a picaresque adventurer in the Pacific in the 1830s.

During the past year associate curator William Trousdale, who transferred from the Freer Gallery in August, was involved in preparing preliminary reports on the University of Michigan expedition, of which he is assistant director, to Qasr al-Hayr. This is the third season on the project, and three more seasons are projected. He worked in Syria for a period of three weeks in June, on an early Islamic palace and city, founded A.D. 728–729, in the Syrian desert about 70 miles northeast of Palmyra. During the last part of the year he collected information from the archives of several British institutions relative to archeological history of Sistan in Afghanistan and plans to visit there in the coming year for the purpose of continuing field surveys, and negotiating with Afghan officials for permission to conduct a larger expedition to this region. His other interests included the study of Chinese jade and the nomadic cultures of Central Asia and southern Siberia, especially with respect to material culture.

A selected and annotated bibliography of Korean anthropology, by Eugene I. Knez and Chang-su Swanson, now in press, emphasizes the contributions of Asian scholars to this subject and will facilitate the use of their publications by Western students. Another manuscript, "Korean People, Their Traditions and Language," compiled and edited by Knez, with translation assistance by Willie Song, is in preparation. Most of the scientific illustrations for the manuscript. "A Study of Korean Material Culture," by Knez, have been completed by Edward G. Schumacher of the staff.

The long-range project of archeological research at Carthage, planned by Gus W. Van Beek was canceled, owing to our inability to meet the Tunisian government's demands for a program of archeological restoration unrelated to the scientific objectives of the expedition. Following the conclusion of negotiations in Tunisia, Van Beek visited Ethiopia, Saudi Arabia, and Lebanon where he discussed with officials of the respective Departments of Antiquities the possibilities for archeological programs and visited archeological sites. This led to the development of a long-range archeological program in Saudi Arabia, of which the

Curator Eugene I. Knez examines specimens in the outstanding collection of Japanese artifacts assembled by General Horace Capron, former U.S. Commissioner of Agriculture, when he and a staff of 45 American economists and engineers were advisors to the Japanese Government, 1871–1875. One of Capron's responsibilities was the development of Hokkaido—the large northernmost island of Japan. This fall the Japanese will honor him as the "Father of Modern Farming" in a special television documentary film.

first fieldwork had already been initiated, involving an intensive archeological survey of the regions known as the 'Asir, Nejran, and the Tihamah, an area which has never been visited by an archeologist. The survey is expected to contribute to our understanding of its cultural history in pre-Islamic times and its political, economic, and cultural relations with the high cultures of ancient southern Arabia and the various cultures of the fertile crescent.

During the past year, Van Beek completed the manuscript of "Hajar Bin Humeid: Archeological Investigations at a Pre-Islamic Site in South Arabia." To be published by the Johns Hopkins Press for the Study of Man series, the volume presents a cross-section of a southern Arabian farming town and trading center during the first millennium B.C. and the early centuries A.D.

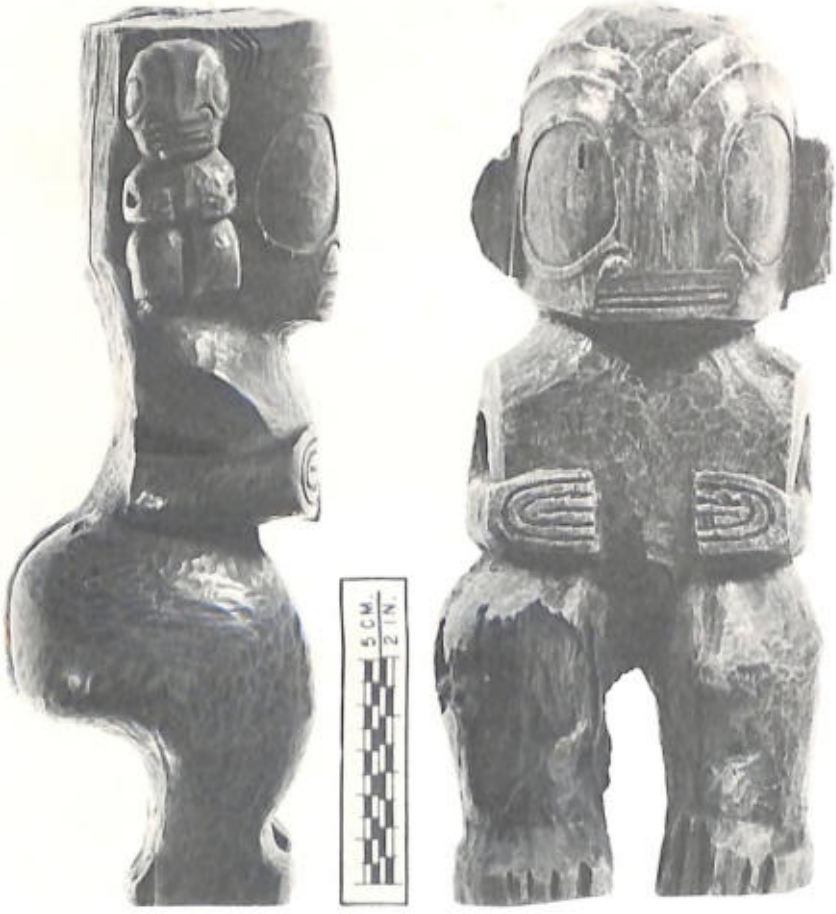
Senior ethnologist John C. Ewers completed for publication by the Smithsonian Press his "Jean Louis Berlandier's Indians of Texas in 1830," and gathered materials for an exhibit on the same subject. He also wrote an article on Thomas M. Easterly's pioneer daguerreotypes of Plains Indians in the collections of the Missouri Historical Society, St. Louis, and the Smithsonian Office of Anthropology. These daguerreotyes of prominent Iowa Indians, taken in 1846 or 1847, comprise the earliest known photographic portraits of Plains Indians.

During the year Ewers also began research for a book on the field drawings of Gustavus Sohon, a unique series of portraits of the Indian chiefs who signed the first treaties between their tribes and the United States in 1855, scenes of the treaty council proceedings, and the only on-the-spot sketches of actions in the Cayuse War of 1858, as well as other historically significant views of the construction of the Mullan Road, the first wagon road over the Northern Rockies.

Some of the North American Indian objects in the national collections may date back to the second decade of the 19th century, when Thomas L. McKenney, superintendent of the Office of Indian Trade in Georgetown, began to collect ethnological materials from Indian Factories in the field, and it is certain that there are a number of specimens collected by field officers of the Army Medical Corps in the Great Plains and Southwest during the Indian Wars of the 1860s. Retrieving a specimen record of the types of weapons and equipment employed by Indians in the dramatic Indian Wars of the American West during the post-Civil War years would be important to both ethnological and historical research. Therefore, a documentation-retrieval project was inaugurated to provide more precise and more detailed information on ethnological specimens in the collections of the Office of Anthropology which were transferred to the Smithsonian from the War Department and the Army Medical Museum. This project is under Ewers' direction, with the able assistance of William K. Jones, who holds a National Foundation for the Humanities Fellowship, and Herman Viola of The National Archives.

At the commencement ceremonies of his alma mater, Dartmouth College, in June, Ewers was awarded the honorary degree of Doctor of Science.

Donald Fowler, who held a National Research Council visiting postdoctoral associateship at the Smithsonian this past year and a grant from the National Endowment for the Humanities, worked on several research subjects, including editing the ethnographic notes and manuscripts on Great Basin Indians made in the 1870s and 1880s by John Wesley Powell, describing the available parts of the collections of ethnographic artifacts from the Great Basin gathered by Powell during the



Tikis in the recently acquired Henry collection. These unique carved wooden figurines from the Marquesas Islands date from the early 18th century.

same period, and gathering archival material toward a book on Powell and the beginnings of the Bureau of American Ethnology.

Research associate Olga Linares de Sapir has in press her complete analysis of the archeological material from the Casemance, Senegal, which she excavated in 1966. The results will be of much interest to West African specialists because the Casemance has been postulated as a secondary center for the indigenous domestication of cereal grains.

Museum specialist (supervisory) George Metcalf completed a paper on wooden scraper handles from the Great Plains, and is currently engaged in preparing a report on two Paiute burials with their associated grave goods which have been in the collections of the Museum for nearly a hundred years.

Staff Publications

(Papers, lectures, and seminars given by members of the staff are listed on page 397.)

ANGEL, J. LAWRENCE. "Porotic Hyperostosis or Osteoporosis Symmetrica." Chapter 29 in Don Brothwell and A. T. Sandison, eds., *Diseases in Antiquity.* Springfield, Illinois: Charles C. Thomas, xix + 766 pp., 1967.

———. "Ecological Aspects of Palaeodemography." Pages 263–270 in Don Brothwell, ed., *The Skeletal Biology of Earlier Human Populations.* Oxford: Pergamon Press, 1968.

CROCKER, WILLIAM H. "The Canela Messianic Movement: An Introduction." *Atas do Simpósio sôbre a Biota Amazônica,* Rio de Janeiro, vol. 2 (Antropologia), pp. 69–83, 1967.

———. "Ethnology: South America." *Handbook of Latin American Studies,* no. 29, Univ. of Florida Press, pp. 128–155, 1967.

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River Basin Surveys

Research and laboratory activities carried forward at the Lincoln, Nebraska, headquarters of the River Basin Surveys included the processing of specimens that now number in excess of one and three-quarters million. A program of microfilming, initiated during the year, will ultimately produce an indexed storage copy of all site records on the more than 3,700 sites to be processed. Staff archeologists concentrated upon the analysis of data from a number of major excavated sites, chiefly in the Dakotas, but also in Wyoming and the Hells Canyon district of the Northwest.

Four River Basin Surveys field operations were conducted during the 1967 season.

River Basin Surveys field camp, in the middle distance, near the site of the rock shelter excavation in the Cottonwood Springs Reservoir in the southern Black Hills, South Dakota. Below, excavation crew at work in Capes Cave in the Cottonwood Springs Reservoir area.

Archeologist Richard E. Jensen records data uncovered in a house excavation at the Medicine Creek Site in central South Dakota. Although a part of the remains have fallen into the Big Bend Reservoir as a result of erosion and slumping, the work produced a good sample of data.

1. A four-man survey party spent several days examining sites in the Garrison Diversion Project in North Dakota, but when it was learned that Bureau of Reclamation construction activities had been delayed a year, further archeological reconnaissance was deferred.

2. The same party made a survey of the Cottonwood Springs Reservoir and environs in the southern Black Hills. Thirty-six new sites were recorded and excavation conducted over a period of three weeks in a small rock shelter.

3. Another party examined two sites at the mouth of Medicine Creek in the Big Bend Reservoir in South Dakota. Evidence of three cultural horizons was uncovered, including a small form of the typical early long rectangular houses known from elsewhere in central South Dakota.

4. A third party returned to the South Cannonball Village in the upper Oahe Reservoir in North Dakota for a second season of excavation. Three of the thirty-four large, rectangular houses of the settlement were excavated and although the structures were generally like those at related villages, some important differences were noted which suggest strong ties with the Big Bend country 250 or more miles to the south.

Two Smithsonian undergraduate summer research assistants participated in the fieldwork, first with the Cottonwood Springs party then with the crew at Medicine Creek. At the close of the field season, they returned to the Lincoln facility of the River Basin Surveys and during the remaining three weeks of their assignment made an analysis of a site complex in South Dakota, including the compilation of a manuscript describing the site and its materials.

The following list includes all issues to date of *Publications in Salvage Archeology,* a series published in Lincoln, Nebraska, by the Smithsonian River Basin Surveys to provide a publication outlet for staff members and cooperators following the demise of the Bureau of American Ethnology and their publication of *River Basin Surveys Papers* in the *Bulletin* series of the Bureau.

1. The Fire Heart Creek Site, by D. J. Lehmer, 115 pp., 1966.
2. The Black Partizan Site, by W. W. Caldwell, 145 pp., 1966.
3. The Hitchell Site, by R. B. Johnston, 113 pp., 1967.
4. Molstad Village, by J. J. Hoffman, 123 pp., 1967.
5. Pony Creek Archeology, by L. A. Brown, 121 pp., 1967.
6. Hells Canyon Archeology, by W. W. Caldwell and O. L. Malloy, 153 pp., 1967.
7. Arikara Archeology: The Bad River Phase, by D. J. Lehmer, and D. T. Jones, 169 pp., 1968.
8. The Two Teeth Site, by C. S. Smith and A. E. Johnston, 84 pp., 1968.
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Staff Publications

(Staff publications for the years July 1964 through June 1967 are listed in the Appendix to the Separate of this report.)

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BOTANY

The main program of research in botany is the taxonomy of phanerogams in tropical America, the richest and least explored area for plant life in the world and one that has long been of interest to the Museum. A major project, now nearing completion, in this area is the revision of the Melastomataceae of Venezuela by curator John J. Wurdack. Curator Velva Rudd completed revisions of several large groups of legumes in Mexico, and senior botanist Lyman B. Smith continued his extensive program on the Bromeliaceae, in part with collaborative studies by associate curator Harold E. Robinson on stomatal structure. Smith also collaborated with research associate Floyd A. McClure in a revision of the bamboos of Santa Catarina, Brazil.

Field studies under the Bredin-Archbold-Smithsonian Biological Survey of Dominica have now largely been completed. Associate curators Dan H. Nicolson and Wallace R. Ernst have made substantial progress this year in labeling and organizing materials in preparation for compiling a flora of Dominica. Ernst also began a revision of the genus *Lamourouxia,* a small but distinctive group of western and tropical plants. He is analyzing development and variation in floral characters as part of a biosystematic approach. Nicolson continued work in the Araceae, readying a manuscript on *Aglaonema* and clarifying the status of several poorly known genera.

Associate curator Stanwyn G. Shetler continued development of the Flora of North America project. The accomplishments of the past year

include a computerized list of genera of North American plants taken from selected floras; trial computerization of dichotomous keys with the aid of a summer undergraduate participant, L. Morse; and preparation of a format for an automated bibliography with the assistance of research assistant P. Morisset.

Associate curator Thomas R. Soderstrom, in collaboration with research assistant C. Calderón, is extending our knowledge of the *Olyreae* grass related to bamboo, with emphasis on anatomical studies of embryos, leaves, and stems. Two new genera and several new species were discovered among Costa Rican collections made by Calderón.

Curator Conrad V. Morton published the first part of a basic series on fern types, utilizing literature, herbarium, and photographic studies in European herbaria. He also published a revision of the difficult fern genus *Grammitis* in Ecuador. Of particular interest, too, is his report on the history of the Red River Expedition of 1806. Associate curator David B. Lellinger completed study of his fern collections from Costa Rica with the aim of preparing an updated list that will include about 1,000 species.

Associate curator Richard H. Eyde published a comprehensive study of the flowers and fruits of the Alangiaceae and is now engaged in parallel research on the fossil record of this family. Associate curator Edward S. Ayensu has clarified by means of anatomical study the systematic position of several genera in the Bromeliaceae and Velloziaceae. Characteristics of vascular bundles in the leaves, which had never been adequately investigated, provide a reliable base for delimiting both families and genera in these groups. Ayensu made considerable progress on his studies of vasculature in the yam family.

Flora Neotropica is an international project to encourage and publish monographic work on Neotropical plant families or large genera. The Smithsonian Institution and the New York Botanical Garden are the organizational centers for this activity, with scientists from both institutions contributing to the program. The first monograph, issued by the Hafner Publishing Company, appeared in May, a study of the legume genus *Swartzia* by Richard S. Cowan. Research associate José Cuatrecasas completed a monograph on the Brunelliaceae and Lyman B. Smith is completing one on the pineapple family, the Bromeliaceae.

Research associate F. Raymond Fosberg, assisted by geologist Marie H. Sachet, coordinated ecological-systematic studies in Ceylon, with the cooperation of the University of Ceylon. A small team is working on the plants associated with behavior of the Ceylonese elephant, correlating these data with weather and soil information.

The Smithsonian Foreign Currency Program approved a five-year project on the flora of Ceylon with Fosberg as principal investigator.

Participating specialists in various plant families will be sent to Ceylon to make collections, to study those in the herbarium at Peradeniya, and to prepare family revisions for a new *Handbook of the Flora of Ceylon*, first published by Trimen in 1893. The first participant spent four months in Ceylon in 1968, and two more joined him in early June. Because many Linnaean types of widespread tropical plants are from Ceylon, it is hoped that the collections will help in clarifying their identity, besides being the basis of the revision of the Trimen *Handbook*.

As member of a Royal Society Expedition, Fosberg spent over two months in early 1968 on the raised coral island of Aldabra in the Indian Ocean. It is known for its relatively unaltered vegetation, with a flora including several endemic species, its endemic birds, and a large population of giant tortoises. Observations were made on the vegetation, effects of tortoises on it, tortoise food plants, and the origin of various geomorphological features influencing vegetation. Just over a thousand numbers of plants were collected, in large series of duplicates. Smaller collections were made also on the nearby islands of Astove and Cosmoledo, and in Kenya and Ceylon. Several manuscripts are in various stages of preparation and a card catalog of the flora is being completed.

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(Papers, lectures, and seminars given by members of the staff are listed on page 398.)

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ENTOMOLOGY

The most important event for the future of the department is that space in the Museum of Natural History was allocated for the collections and the combined Smithsonian and USDA staffs, and the move will take place during the next year. For increased security, the segregated collection of holotype specimens was moved during April to a temporary storage area in the Natural History building.

The department was host for two special events during the year. The first of these was a seminar, "Systematics in Relation to the Geographical Distribution of Insects in the Pacific," 4–8 December. Arranged under the United States-Japan Cooperative Science Program and supported in part by a grant from the National Science Foundation, it brought together 17 eminent American and Japanese participants and 9 observers from the United States, who reviewed and evaluated recent developments in the field of systematic entomology which have contribtued to an improved understanding of the zoogeography of insects in the Pacific area, and identified the more critical problems, of mutual interest to Japan and the United States, which still require solution. Seminar organizers were Karl V. Krombein (Smithsonian) and Paul Oman (Oregon State University) for the United States and Keizo Yasumatsu for Japan.

The second event was the nineteenth annual meeting of the Lepidopterists' Society, 15–18 June, at which the division of Lepidoptera and Diptera was host. Invitational addresses were presented by Dr. H. B. D. Kettlewell of Oxford, England, and by Dr. H. E. Hinton of

P. J. Spangler, netting elusive tiger beetles on sandy bank of Olifants River, Kruger National Park, Republic of South Africa.

Bristol, England. The program, under the direction of associate curator Donald R. Davis emphasized the phenomenon of polymorphism in Lepidoptera. In addition, an organizational meeting was held to discuss the possibility of initiating a synoptic catalog of New World Lepidoptera. About 70 specialists were in attendance, including the four lepidopterists on our staff.

Oscar L. Cartwright was in the final stages of preparing a revisional study of the American species of *Rhyparus,* a genus not previously known from the Western Hemisphere, and he also made considerable progress on a revision of the species of North American *Ataenius,* the first of a proposed series of papers covering the world fauna of this large aphodiine genus. Field study of this group was accomplished by a collecting trip to the Tall Timbers Research Station in Georgia and the Archbold Biological Station in Florida.

Paul J. Spangler's monograph of the hydrophilid water beetle genus *Tropisternus* neared completion with the recent addition of incorporated new information on types and distributional data on 4,800 specimens identified during the year. He also initiated a cooperative revisionary study of the waterpenny family Psephenidae with Chad Murvosh of Nevada Southern University, and a collaborative study with biochemists from the Department of Agriculture on the chemical constituents

Karl V. Krombein collecting in Malaise trap in coastal jungle south of Mombasa, Kenya.

of hormones produced from the prothoracic glands of several genera of dystiscid water beetles.

Curator Richard C. Froeschner directed most of his research effort toward completion of his manual of the lacebug genera of the world and studies of certain families of true bugs collected during the Bredin-Archbold-Smithsonian Biological Survey of Dominica. Treatments of about a third of the more than 250 genera of lacebugs were completed, as were about 175 dorsal habitus sketches to illustrate them. The Dominica studies completed the text of two papers covering four families, the cicadas, spittlebugs, treehoppers and lacebugs. The nineteen species treated, of which nine are new, show an affinity to tropical forms in Central and South America rather than to the geographically closer Greater Antilles.

Department chairman Karl V. Krombein collaborated with mammalogist Dale J. Osborn of the Field Museum of Natural History to complete a paper discussing habitats, flora, mammals, and wasps of the remote Gebel Uweinat in the Libyan Desert at the juncture of Egypt, Libya, and Sudan, an area which they explored in spring 1967. By year-end he had almost completed a revisional study of the Melanesian species of the wasp genus *Cerceris*, the species of which are predaceous on solitary bees and various kinds of beetles.

In his research on the biosystematics of solitary bees, assistant curator Gerald I. Stage placed principal emphasis on completion of his monograph of the genus *Hesperapis,* on a field and laboratory study of the pollinators and pollination of the loasaceous genera *Eucnide* and *Mentzelia,* and a survey of the bee fauna of Dominica. Assistance by graduate student W. L. Krinsky enabled Stage to initiate fieldwork on the pollinators of the primulaceous genus *Lysimachia.*

Research associate C. F. W. Muesebeck, in addition to continuing his valuable role as translation editor for the Russian journal *Entomological Review,* is bringing to completion an illustrated revision of the North American braconid genus *Orgilus,* an important group of caterpillar parasites. In it are more than 100 North American species, of which 80 will be described as new.

Senior entomologist J. F. Gates Clarke completed the manuscripts for volumes 7 and 8 of his monumental catalog of the Meyrick types of Microlepidoptera. Substantial progress also was made on his review of the Microlepidoptera of the Pacific Island of Rapa. With the aid of a Smithsonian Research Foundation grant, Clarke, with the assistance of his wife, continued his studies of the microlepidopterous fauna of selected Pacific Islands, by extended fieldwork for one month each on Nuku Hiva, Hiva Oa, and Fatu Hiva in the Marquesas Islands, French Polynesia, and for a brief period at Fangatau Island in the Tuomotus.

Donald R. Davis completed a systematic revision of the American moths of the family Carposinidae as well as a shorter revisionary study of the genus *Acanthopteroctetes.* A continuation of his Smithsonian Research Foundation grant enabled Davis to make very substantial progress on his monograph of the Nearctic Tineidae through the employment of an illustrator, Choon Y. Chung, who prepared a number of genitalic and head drawings. In connection with his tineid and incurvariine projects, he studied types in the Museum of Comparative Zoology, the American Museum of Natural History, and the Canadian National Collections.

Associate curator W. Donald Duckworth, continuing his long-term study of the Neotropical stenomid moths, completed a manuscript on the West Indian species for inclusion in the Bredin-Archbold-Smithsonian Biological Survey of Dominica series. A systematic study of the *Pelepoda* complex in the Oecophoridae, nearing completion, will fix the family assignment for this anomalous and heretofore poorly known group of moths.

Associate curator William D. Field whose revision of the butterfly genus *Phulia* and worldwide review of the genus *Vanessa* are near completion, continued work on his catalog of New World Lycaenidae, adding 7,300 new entries. With the assistance of Donald R. Frazier, a

Youth Opportunity Program employee, Field initiated a bibliography of Lepidoptera as a divisional working tool. More than 27,000 entries have been placed on cards, providing virtually complete coverage for the last three decades.

Curator Ralph E. Crabill, Jr., completed ten papers on systematics and evolution of centipedes. The most important of these was an analysis of the Himantariidae, utilizing the tracheation as a character of primary importance, the first time that this internal system has been so used. The other papers deal with evolution of the Oryidae and descriptions of new genera and species, a suprageneric revision of the Gonibregmatidae with proposal of a new subfamily, descriptions of new species of the schendylid genera *Mesoschendyla* and *Schendylurus,* revisions of the Neogeophilidae and of *Arenophilus* in the Geophilidae, description of a new himantariid, and descriptions of one new and one old species of the chilenophilid genus *Eurytion*. Other research projects in progress were aided by field collecting trips to western and southcentral New York and to southern Virginia and adjacent areas in North Carolina, and by the study of types in the Museum of Comparative Zoology.

In the division of neuropteroids, curator Oliver S. Flint, Jr., completed his third summer's fieldwork in Central America under NSF support, collecting primarily in Costa Rica and Panama. His collections there point up the distinctness and greater richness of the caddisfly fauna of southern Central America as compared to that of northern Central America and Mexico, areas which he has surveyed in earlier years. Manuscripts completed during the year included systematic studies of adult Trichoptera from Dominica for the Bredin-Archbold-Smithsonian survey and from Masatierra, Islas Juan Fernandez, and a study on the immature stages of a Neotropical *Barypenthus*.

Research associate K. C. Emerson completed studies of the Anoplura, or sucking lice, collected in Mozambique and Southwest Africa, and in the Democratic Republic of the Congo, and is currently studying collections of Anoplura and Mallophaga (bird lice) made in Nepal, Venezuela, southeast Asia, and Nigeria, Madagascar, Senegal, Pakistan, and Botswana.

Research associate Robert Traub and his associates from the University of Maryland Medical School continued to collaborate closely with the Smithsonian. They are studying the chigger mites and fleas collected in overseas programs on viral and rickettsial infections, while the host mammals are sent to the division of mammals.

The Southeast Asia Mosquito Project (SEAMP) under the direction of Botha de Meillon, a cooperative venture between the Smithsonian and the Department of the Army, continued work on the mosquitos of that critical area. Assistant investigator John E. Scanlon has nearly com-

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pleted his revisional study of the anopheline fauna of Thailand. Mercedes Delfinado, who left SEAMP in October for a position at the University of Hawaii, completed a study of the *powelli* group of *Tripteroides*.

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(Papers, lectures, and seminars given by members of the staff are listed on page 399.)

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INVERTEBRATE ZOOLOGY

J. Laurens Barnard completed his visit to Hawaii as Smithsonian Fellow in invertebrate zoology at the Bernice P. Bishop Museum, which provided partial support to him. While there he prepared a review of the shallow-water gammaridean Amphipoda of the Hawaiian Islands. He then spent six months in fieldwork in New Zealand in association with the New Zealand Oceanographic Institute. At year end he was in Perth, Western Australia, on the last leg of his two-year journey; while in Western Australia he will concentrate on making research collections from littoral habitats.

A report on relict populations of the copepods *Limnocalanus macrurus grimaldii* and *Drepanopus bungei* from Lake Tuborg and Disraeli Bay, Ellesmere Island, was prepared by Thomas E. Bowman and Austin Long, Radiation Biology Laboratory. They concluded that brackish water was widespread in the Arctic about 3,000 years ago, at which time Lake Tuborg was isolated from the sea by movement of a glacier. Bowman, with Rudolph Prins and Byron Morris, also completed an analysis of distribution patterns and biology of two species of the harpacticoid copepod *Attheyella* commensal with crayfishes.

In collaboration with Horton H. Hobbs, Jr., Fenner A. Chace, Jr., completed a study of the freshwater and terrestrial decapod crustaceans of the West Indies. He also finished the study of eight families for a review of the shallow-water shrimps of the West Indies, based on the collections made by four Smithsonian-Bredin Caribbean expeditions. In addition, he submitted the text for a chapter on shrimps in an illustrated guide to the shallow-water marine invertebrates of California.

Roger F. Cressey, Jr., made three study trips to the Mote Marine Laboratory, Sarasota, Florida, to continue his research on copepods parasitic on sharks from the west coast of Florida. A study in cooperation with Bruce Collette, Ichthyological Laboratory, Bureau of Commercial Fisheries, of the copepods parasitic on needlefishes has resulted in the recognition of several new species and has produced significant information on host specificity. He also completed a survey of the stomach contents of echineid fishes, in cooperation with Ernest Lachner, division of fishes, which demonstrated the role the echineids play as cleaner fishes of their shark hosts and other pelagic fishes. Cressey also assumed the duties of editor for the Biological Society of Washington.

John C. Harshbarger, Director of the Registery of Tumors in Lower Animals, a cooperative project with the National Cancer Institute, continued to broaden the scope of activities of the Registry. Numerous examples of tumors and suspected tumors from poikilothermic vertebrates

Roger F. Cressey and Perry Gilbert onboard R/V *Rhincodon* at Mote Marine Laboratory, Sarasota, Florida, where Cressey was engaged in research on shark parasites.

and invertebrates were processed by the Registry, including a tumor from an oyster, the first from an invertebrate sharing criteria with known mammalian tumors. In June 1968, the symposium "Neoplasia of Invertebrate and Primitive Vertebrate Animals," attended by over 100 specialists, was held in Washington under the sponsorship of the National Cancer Institute and the Smithsonian.

Consulting zoologist Robert P. Higgins, Wake Forest College, completed his analysis of kinorhynchs from the Indian Ocean and began the study of collections of kinorhynchs from Peru and Chile. Early in 1968 he was appointed acting resident systematist, under the systematics-ecology program of the Marine Biological Laboratory, Woods Hole. During the summer of 1967 he served as co-director of the Summer Institute in Systematics held at the Smithsonian with the support of the National Science Foundation and the U.S. Air Force Office of Scientific Research.

A manuscript dealing with the distribution and phylogeny of the genus *Cambarus,* with an appended generic revision, was prepared by Horton H. Hobbs, Jr., for a conference on the distributional history of the biota of the southern Appalachians. Fieldwork was conducted on Dominica, and approximately a month was spent collecting crayfishes in Alabama, Georgia, and Mississippi. Studies on entocytherid ostracods, in collaboration with Miss Margaret Walton, were continued at the Mountain Lake Biological Station. Hobbs, Percy C. Holt, and Miss Walton were the co-recipients of the J. Shelton Horsely Research Award of the Virginia Academy of Science, in recognition of their joint paper, "The crayfishes and their epizootic ostracod and branchiobdellid associates of the Mountain Lake, Virginia, region."

Research during the past year by W. Duane Hope has been predominantly on the fine structure of muscles of marine nematodes. He spent six months at the University of Toronto working with Kenneth A. Wright on the ultra-structure of ornamentation in the cuticle of a marine nematode. He was elected President of the American Society of Meiobenthologists at the AAAS meetings in December.

During the summer of 1967, Meredith L. Jones participated as instructor in the invertebrate course at the Marine Biological Laboratory, Woods Hole. While there he continued observations on *Magelona* and other polychaetous annelids and initiated a survey of the electrophoretic patterns of various polychaete tissue components. The latter program will be continued during the summer of 1968. Observations were also made on the systematics, morphology, and zoogeography of *Caobangia,* an aberrant freshwater polychaete of southeast Asia.

Myodocopid ostracods of the deeper waters of the Gulf of Mexico

are virtually unknown. Louis S. Kornicker described six new bathyal species from a small collection made by Texas A&M University. He also described a new genus comprising four new species from deeper waters of the Antarctic, Atlantic and Indian Oceans, based on materials collected by the Lamont Geological Observatory and the Woods Hole Oceanographic Institution. A report on ostracods found in Texas bays and lagoons was completed with Charles E. King of East Texas State University.

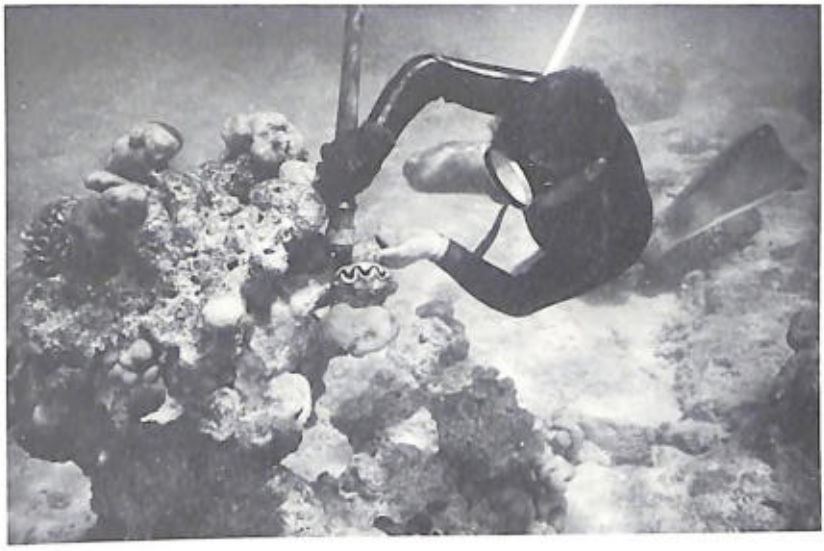
Raymond B. Manning continued his studies of stomatopod crustaceans; during the year particular emphasis was placed on working up small collections from the Indo-west Pacific region. He also completed reports on some species from the Gulf of Guinea and the eastern Pacific region. With L. B. Holthuis, Rijksmuseum van Natuurlijke Historie, Leiden, he completed a report on the porcellanid, hippid, and albuneid crabs collected in the Gulf of Guinea in 1964 and 1965 by R/V *Pillsbury*.

J. P. E. Morrison made collections from near Lima, Peru, and Rio de Janeiro, Brazil, in an extension of previous studies of brackish and fresh water mollusks from North America. In addition, he studied the species of *Donax* and *Hastula* from certain western Atlantic sand beaches.

David L. Pawson was engaged between April and January in teaching in the Zoology Department at Victoria University of Wellington, New Zealand. Some fieldwork was conducted at the Portobello Marine Laboratory, Dunedin, and at the Edward Percival Marine Laboratory, Kaikoura, and at museums in Sydney and Melbourne, Australia, were visited. A monograph of the New Zealand holothurians and papers on the holothurians of Macquarie Island and some ophiuroids from New Zealand were submitted for publication. A study of Chilean holothurians, based on collections made by the Lund University Chile Epedition 1948–49, was completed, and a monograph of Antarctic holothurians based on numerous "Operation Deepfreeze" and *Eltanin* collections, among others, is currently in preparation.

Marian H. Pettibone worked on a report on some species of errant polychaetes, including representatives of six families, collected by the *Siboga* Expedition, completing the study started by the late Hermann Augener. The study includes revisions of *Leocrates* (Hesionidae) and of *Gymnonereis* (Nereidae).

A long-term research project on Polynesian marine molluskus was continued by Harald A. Rehder who spent two months in the Marquesas Islands, the Tuamotu Islands, and at Pitcairn Island as scientific leader of the National Geographic-Smithsonian Institution-Bishop Museum Marquesas Expedition. Much important material in all groups of marine invertebrates was collected by dredging, diving, and shore collecting in



Barry R. Wilson of Western Australian Museum pries loose a *Tridacna* shell in the lagoon of Rangiroa Atoll, Tuamotus, on expedition led by Harold A. Rehder.

this, the first comprehensive survey ever made of the marine invertebrate fauna of the geographically-isolated Marquesas Islands.

Mary E. Rice worked at Isla Margarita, Venezuela, and Curaçao between September and December, collecting sipunculid worms and making laboratory observations on their development. Further observations on sipunculid development were made following her return to Washington, where she completed a manuscript on the comparative development of three species. In May she joined the *Atlantis II* of the Woods Hole Oceanographic Institution in Angola for a cruise to Senegal.

Studies on the cephalopods were extended by Clyde F. E. Roper who participated in the Ocean Acre Project, a long-term, cooperative effort designed to delineate the macrofauna of a selected oceanic area and to determine its daily and seasonal activities, relative abundance, bathymetric distributions, etc. The initial cruises were conducted in an area east of Bermuda in October and March. A series of dives aboard the research submersible *Deep Diver* was conducted in early February in Tongue of the Ocean, Bahamas. Cooperative studies on Antarctic and Atlantic cephalopods were continued at the Institute of Marine Sciences, University of Miami, in late January and February.

During March and April, Joseph Rosewater visited nine institutions in Europe where he studied primary type-specimens of littoral Indo-Pacific gastropods (Littorinidae) prior to completing the monographic

Klaus Ruetzler examining young sponge culture at Laboratory dock of Lerner Marine Laboratory, Bimini, Bahamas.

study and an annotated worldwide catalog of the family. Working with Kennth J. Boss, Museum of Comparative Zoology, and Florence A. Ruhoff, he helped to complete and submit for publication a catalog of the nearly 5,500 taxa described by William H. Dall.

Klaus Ruetzler continued his studies of sponges from the Caribbean and Adriatic Seas. During July and August, he worked on sponges at the Lerner Marine Laboratory, Bimini, Bahamas, at the invitation of the American Museum of Natural History. From January to July, Ruetzler was in Europe perfecting and testing equipment for measuring ecological parameters in marine microhabitats. The equipment was constructed at the Department of Zoology, University of Innsbruck, Austria, and at Bari, Italy. It was used to study the relationships between sponges and symbiotic algae by means of a study of light intensity and the process of photosynthesis. In collaboration with Helmut Forstner, he prepared a paper describing the construction and use of the equipment.

Zoologist emeritus Waldo L. Schmitt, with the help of Edward Davidson and Lucile McCain, continued his review of American pinnotherid crabs; a synonymy of pinnotherids was prepared for the *Crustaceorum Catalogus*. Schmitt also devoted much time to his duties as co-editor of the Antarctic Research Series.

In addition to the research activities of the staff and the research associates in residence at the Museum, the department was host to several visiting investigators during the year who materially broadened its overall research program. Three were in residence for parts of the year under the National Academy of Sciences-National Research Council fellowship program: Perry C. Holt, Virginia Polytechnic Institute, completed a review of the branchiobdellid worm genus *Pterodrilus,* as well as an analysis of the branchiobdellid fauna of the southern Appalachians; Alan J. Kohn, University of Washington, completed part 4 of a long-term study of the type specimens and identity of the described species of the gastropod genus *Conus,* and he also studied the application of objective, quantitative methods to the taxonomic study of the genus; Marvin C. Meyer, University of Maine, worked with the leech collections of the late J. Percy Moore, preparing them for permanent deposit, and he also completed a review of the taxa introduced by Moore.

Dr. Georgiana B. Deevey, Yale University, a Visiting Investigator in the Division of Crustacea, completed an account of six new species belonging to a new genus of halocyprid ostracod from the stomach contents of fish taken in deep water in the Gulf of Mexico. In addition, she has continued work on two other projects, the problem of the identity of the cladoceran *Bosmina* from the southern hemisphere and its seasonal cyclomorphosis, and a year-round qualitative and quantitative study of the plankton of the Sargasso Sea.

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(Papers, lectures, and seminars given by members of the staff are listed on page 399.)

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MINERAL SCIENCES

Highlight of the work of the division of meteorites has been a significant expansion of its international activities. While research on meteorites has always had a notably international flavor, because of the uniqueness of the material and its worldwide distribution, the division of meteorites is now in a strong position to promote international cooperation in this field, thanks to the expansion in its staff and facilities in recent years. Prominent among these activities are collaborative investigations in West Africa, Western Australia, Thailand, India, and Tanzania, and in Kinshasa, Paris, and Vienna.

Research work with meteorites was concentrated on the chemical and mineralogical composition of stony meteorites; this is a broad program with some 30 individual projects, much of it supported by grants and contracts from the National Aeronautics and Space Administration, the Air Force, and the Smithsonian Research Foundation.

Chemical studies by associate curator Roy S. Clarke, Jr., of meteorite specimens from Campo del Cielo, Argentina, were extended into a general investigation of meteorites in the hexahedrite-octahedrite transition range, including compositional and metallographic investigations, with particular emphasis on the occurrence of schreibersite and cohenite. Clarke is cooperating with John F. Wosinski of Corning Glass Works in experimental studies on the formation of metallic spherules, allied to those observed in tektites, in synthetic glass.

Curator Kurt Fredriksson worked mainly on the problem of phase equilibration in chrondritic meteorites. This has involved experimental work, together with the analysis and description of several meteorites. G. Arrhenius, A. Reid, and R. Fitzgerald of the University of California have cooperated on this project, and on the refinement of microprobe techniques. Fredriksson collected ash samples of varying age on Hawaii and on the new volcanic island Surtsey, in the North Atlantic, in order to search for silica-rich glass particles which could be related to the so-called microtektites; and a series of samples of ignimbritic rocks of approximately andesitic composition were collected in west Texas, for comparison with certain stony meteorites which they resemble texturally. Fredriksson and A. Dube from the Geological Survey of India made a preliminary study of Lonar Lake in India, and concluded that it is probably an astrobleme; i.e., caused by meteorite impact. Detailed

studies, including core drillings, are being planned in cooperation with the Geological Survey of India with financial support of the Smithsonian Foreign Currency Program.

Geochemist R. F. Fudali's research work was devoted to experimental studies at high temperatures and pressures on systems of significance in the study of rocks and meteorites. Approximately sixty experimental runs were made, some of extended duration, bearing on the following problems: (1) crystallization sequences of natural basalts and andesites, and chemical trends of the residual liquids; (2) the relations between divalent iron, trivalent iron, oxygen fugacity, and total chemical composition of a given rock; and (3) diffusion rates in nickel-iron meteorites, and in olivines. Curator Brian Mason continued his work on the phase composition of stony meteorites, giving special attention to the pyroxenes, which are almost ubiquitous in stony and stony-iron meteorites. The pyroxene group is complex, but the complexities, if they can be elucidated, will provide significant information on the temperatures, pressures, and chemical environments under which meteorites are formed. Work on meteoritic pyroxenes was complemented by investigations on comparable terrestrial pyroxenes. Mason with Edward P. Henderson also worked in Australia for three months investigating occurrences of tektites and meteorites.

Chemists E. Jarosewich and J. Nelen provided the quantitative analyses essential for the research program of the entire department. During the year complete analyses of 13 stony meteorites and partial analyses of 2 more were completed. Analyses of volcanic rocks from recent eruptions at Metis Shoal (Tonga Islands) and Mayon (Philippines) have been made, this work as part of a commitment to the Smithsonian Center for Short-Lived Phenomena. Other work completed includes complete analyses of 9 rocks, 4 garnets, 3 meteoritic olivines, 1 diopside, and partial analyses of 20 rocks. With the aid of a grant from the Smithsonian Research Foundation equipment for the determination of carbon at low levels has been obtained, and used for a study of carbon distribution in stony meteorites.

Research in petrology during the past year continued to focus on oceanic rocks, but in addition new and exciting research was undertaken in volcanology.

A suite of rocks, including previously unrecorded andraditic garnet-bearing rocks associated with hydrothermally altered peridotites (so-called rodingite rock suite), was described from lat. 43°N. on the mid-Atlantic Ridge. The results of this study, along with the related topographic, sedimentological, and paleontologic data on the region, are being published by associate curator William Melson in conjunc-

Volcano Eruption Studied

The eruption of Mount Mayon, Philippine Islands, 27 April 1968, was the subject of one of four expeditions coordinated by the Smithsonian Center for Short-Lived Phenomena (see page 266). The expedition included Air Force motion picture cameramen and volcanologists from the Smithsonian and the Geological Survey. The systematic aerial photographic reconnaissance provided unique documentation of critical aspects of eruption activity. Right, hot bouldery ash flows (nuées ardentes) rapidly advance down the slopes of the volcano. This rare, devastating type of eruption was studied by William G. Melson in May 1968.

tion with G. Thompson and V. T. Bowen of the Woods Hole Oceanographic Institution, and with Smithsonian paleontologist R. Cifelli. The region is of special interest, petrologically, because in addition to the occurrence of garnet-bearing rocks, it furnishes an opportunity to compare rocks from a small fracture zone (a fault zone along which the central valley of the ridge is displaced along east-west trending faults) with rocks from the adjoining undisturbed region. This comparison further supports the view, postulated in a number of papers previously published by Melson and his colleagues at Woods Hole, that plutonic rocks, mainly gabbros, peridotites, and serpentinites, are more abundant in fracture zones than along the undisrupted normal north-south trending portions of the ridge. Melson, in a paper presented at the 1968 meeting of the American Geophysical Union, found that this relationship is rather neatly explained by assuming that, during sea-floor spreading, the crust is essentially "opened" up along fracture zones, and eventually, faulting exposes the plutonic zone. The exposure of the deeper layers does not occur along the normal ridge because new crust is forming, and produces a nearly continuous upper volcanic zone which mainly conceals the lower or plutonic zone.

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A study of deep-sea carbonate sedimentary rocks, including limestones and dolomites, was completed. The study reports, for the first time, the presence of abundant and highly diverse carbonate rocks from a mid-ocean ridge (equatorial Atlantic). This study by Melson in conjunction with Woods Hole scientists and with Cifelli, found that these rocks range from mid-Tertiary to Pleistocene in age. These findings have important implications on the makeup of the upper oceanic crust. Specifically, it appears that the upper volcanic zone may contain a significant amount of carbonate rocks, implying that the total amount of combined carbon dioxide in the Earth's crust may be much larger than previously estimated, an estimation of importance in reconstruction of the evolution of the Earth's atmosphere. This discovery also raises the question of the true thickness and maximum age of the sedimentary record of oceanic crust. The thickness is normally estimated by geophysical methods, and is assumed equal to the thickness of the unconsolidated materials which cap the oceanic crust in most places. However, these methods cannot in some cases distinguish dense, well-lithified carbonate sedimentary rocks from volcanic rocks. Drilling in the sediments beneath the deep sea floor, which tentatively will begin in July 1968 under the joint oceanographic deep sea drilling program sponsored by the National Science Foundation (JOIDES program), will provide concrete information on this particular problem, as well as data bearing directly on the theory of sea floor spreading. Melson is one of the principal investigators in the JOIDES program.

The final of three papers on the volcanic and metamorphic rocks of the ridge at lat. 22°N. was completed by Melson, co-authored by G. Thompson of the Woods Hole Oceanographic Institution, Tjeerd H. van Andel, of the University of Washington at Corvallis, and Eugene Jarosewich. It records another large area characterized by the abundance of basaltic lavas of the oceanic tholeiite type. These oceanic tholeiites occur in three forms, all believed to be parts of voluminous fissure-type submarine lava flows: (1) Glassy pillow lavas, (2) massive nearly totally crystalline basalts, and (3) basaltic tuffs, formed mainly by the breaking up of the advancing flow margins, and by the accumulation and lithification of the still-hot fragments. Also recorded in this paper are data believed to argue against the widely accepted generalization that volcanic "emanations" are responsible for the formation of the manganese-rich nodules and encrustations on the mid-ocean ridge.

Thomas Simkin of the Smithsonian Oceanographic Sorting Center, a research associate in the division of petrology, began a study of the petrology of Cobb Seamount, a volcanic pinnacle in the northwestern Pacific, 270 miles west of Washington state. This study is aimed at reconstructing the development of the remarkable pinnacle and of the

Artist's rendering of Cobb Seamount, an extinct oceanic volcano which rises from a depth of 10,000 feet to within 110 feet of the sea surface. (Drawing courtesy of Dr. Thomas F. Budinger, Lawrence Radiation Laboratory, University of California, Berkeley.)

kinds of volcanic rocks which compose it. Simkin also continued his investigations of the way in which suspended crystals behave during flow of basaltic magma, essentially a study of the fluid mechanics of magmas.

Melson continued his studies of the iron-bearing basalts from Disko Island, West Greenland. There, plateau-forming basalts locally contain large masses to minute microscopic grains of metallic nickel-iron alloys. These alloys commonly contain inclusions of cohenite (iron carbide), and, more rarely, pyrrhotite (an iron sulfide). A study completed during the past year outlined some of the major metallurgical, mineralogical, and chemical features of these alloys and the associated cohenite. These data, combined with preliminary high-temperature reduction experiments, suggest that the metallic phases were produced by reaction of basaltic magma and carbonaceous sedimentary inclusions, one of the numerous previously suggested origins, and that the reduction proceeds in two sequential stages: first, by the production of a carbon-saturated nickel-iron melt, and second, after carbon is no longer available in the magma surrounding the metal phases, by reaction of the nickel-iron-carbon melt with the magma to produce more metallic iron and carbon monoxide and carbon dioxide gases. During this second stage, the loss of carbon causes crystallization of the metallic phases because, as the

carbon content of the nickel-iron alloy decreases, its melting point increases considerably above the temperature of the basaltic magma (around 1200°C.). In the Disko basalts, these two sequential stages have been interrupted by cooling and subsequent crystallization, and has thus preserved the reduction process in one or the other of the two stages.

Chemical analyses of the metallic phases by Jarosewich revealed strikingly high germanium contents compared to other high-germanium natural materials, such as iron meteorites. A maximum of 550 parts per million has so far been reported. The high germanium content is attributed to concentration of germanium in the metallic phases during the reduction process, the germanium coming from the basaltic magma and from the carbonaceous shale inclusions. Most carbonaceous shale and coal are considerably enriched in germanium compared to other substances.

Reduction by graphite or by carbonaceous material is speculated, on firm grounds, to have produced the metal phase in stony meteorites and to have produced Earth's core. The postulated stages involved in the production of the metallic phases in the Disko basalts provide a testable model of reduction of silicate melts in general, and preliminary experimental studies were designed to further describe the details of the reduction process, particularly how it is affected by temperature, total pressure, oxygen pressure, magma composition, and by cooling rates and length of experimental runs.

During the past year, three volcanic eruptions and their products were examined by Melson in cooperation with other scientists. These investigations involved the "jack-in-the-box" Metis Shoal eruption that produced an island which, after being built above sea level by eruptions of a pumiceous dacite, lasted two months and was then destroyed by wave erosion only a few days after the eruption ceased. The site was visited by Charles Lundquist of the Smithsonian Astrophysical Observatory, who, in addition to visiting the site, interviewed numerous people who witnessed the eruption. The chemical analyses, carried out by Jarosewich, are of special interest in that the rock has an unusually low alkali content for such a high silica content. An analysis of the glass matrix, from which the phenocrysts—calcic bytownite, hypersthene, and magnetite—had been removed, revealed an almost tektite-like composition. The high soda-to-potash ratio is the only major difference between this glass and certain tektite compositions.

With James G. Moore, a Geological Survey volcanologist, Melson studied the spring 1968 eruption of Mayon Volcano, southeastern Luzon, Philippines. The unusual opportunity to directly observe, map, and sample the deposits of a nuée ardente eruption led to Smithsonian par-

ticipation. The nuée ardente is a rare but extremely devastating type of eruption, consisting of an incandescent avalanche of hot, gas-emitting lava blocks, which generate billowing, hot ash-rich clouds all along the avalanche's course. The destruction of St. Pierre on Martinique in 1902 and the loss of 30,000 lives was the direct effect of an unusually large nuée ardente eruption from Mount Pelée. In this case and others, however, although excellent studies were subsequently carried out, few trained observers were at these sites during the eruption.

The study of Mayon Volcano will probably prove unique in the aerial photographic coverage rendered, mainly through the courtesy of the 13th Air Force, and in the on-the-ground observations and sampling during and immediately after the passage of numerous nuées ardentes.

During the past year a remarkable discovery was made by Chairman George Switzer and Melson during an examination of a suite of nodules (rounded rock inclusions) obtained by Switzer from the Roberts Victor Diamond Mine, South Africa. Nodules of kyanite eclogite, a rock formed only at extremely high pressures and composed mainly of the minerals kyanite, omphacite, and garnet, were found to contain fresh glass along grain boundaries. This suggested that these rocks had been partially melted. Partial melting refers to the incipient melting of an otherwise crystalline rock. This process, which will occur, for example, when a rock is heated to high temperature, or heated to moderate temperature at high pressures and then, holding temperature constant, releasing the pressure, is believed to be responsible for the generation of magmas deep in the Earth's mantle. These kyanite eclogites are viewed, therefore, as a rare, specialized, natural fusion of a mantle rock. The presence of a diamond in one specimen indicates an especially deep-seated origin, possibly from as deep as 100 kilometers. The partial melting strongly affected the omphacite, changing it to a fine-grained mixture of plagioclase, clinopyroxene, and possibly glass.

The data in hand suggest that the unusual features observed in these kyanite eclogite nodules resulted from a mantle-derived inclusion being emplaced into the crust by a rapidly ascending kimberlite magma, which first caused partial melting of the nodules, due to sudden release of pressure, and then quenching, due to rapid cooling in the rising and expanding gas-rich kimberlite magma.

Over summer 1967 the National Geographic Society supported a Smithsonian expedition to the Copper Mountain mining district, Prince of Wales Island, Alaska. Objectives of the principal investigators in the project, Switzer and research associate Peter Leavens, were to study the reaction rocks or skarns formed between the granites of the area and the marbles into which they were intruded.

The field party under the leadership of Leavens explored and collected as extensively as possible, but full scale operations in the torrential rains, on the steep slopes with heavy growth were out of the question. However, two small finds were made of the outstanding epidote crystals for which the district has been famous for more than sixty years. The mine workings were sound and accessible, but work therein produced relatively little. In the Green Monster Mountain area, a skarn containing the rare and interesting calcium silicate minerals monticellite and xasthophyllite was mapped and an extensive suite collected for detailed laboratory study. In addition, a complex pocket system containing many superb crystals of epidote was found.

Staff Publications

(Papers, lectures, and seminars given by members of the staff are listed on page 400.)

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PALEOBIOLOGY

Continuing emphasis on research in the department of paleobiology resulted in 54 publications by the curatorial staff during the year, totaling more than 1,200 printed pages. The research capability of the department was greatly enhanced by the appointment during the year of 15 research associates, in addition to 7 previous appointees. These appointments in most cases represent formal recognition of long-standing informal relationships. Of the 22 research associates, 15 are active or retired members of the paleontology and stratigraphy branch of the U.S. Geological Survey, reflecting the close interdependence of the two groups.

Two members of the scientific staff resigned during the year. In September Richard A. Robinson returned to the department of geology, University of Utah, where he continued his research on trilobites and resumed his teaching duties. In March David H. Dunkle assumed the curatorship of paleontology at the Natural Science Museum in Cleveland, Ohio, where he continued to pursue his long-standing interest in Devonian fishes and fish-like vertebrates.

In addition to his duties as chairman, Porter M. Kier continued his research on the Echinoidea. Accompanied by Thomas F. Phelan, he spent much of the month of December in New Zealand investigating the previously unknown living habits of a species of the order Cassiduloida. In March he left for Europe for six months of research as a Guggenheim Fellow. His primary objective there is study of the evolution of the jaw apparatus in echinoids, principally at the Sedgwick Museum in Cambridge, but he is also visiting other museums and conducting field work both in England and on the Continent.

Senior paleobiologist G. Arthur Cooper completed the photography of the Permian brachiopods to be illustrated in his Glass Mountains study, and has finished their arrangement into the more than 500 plates for publication. Preparation of the legends for the plates is now in progress.

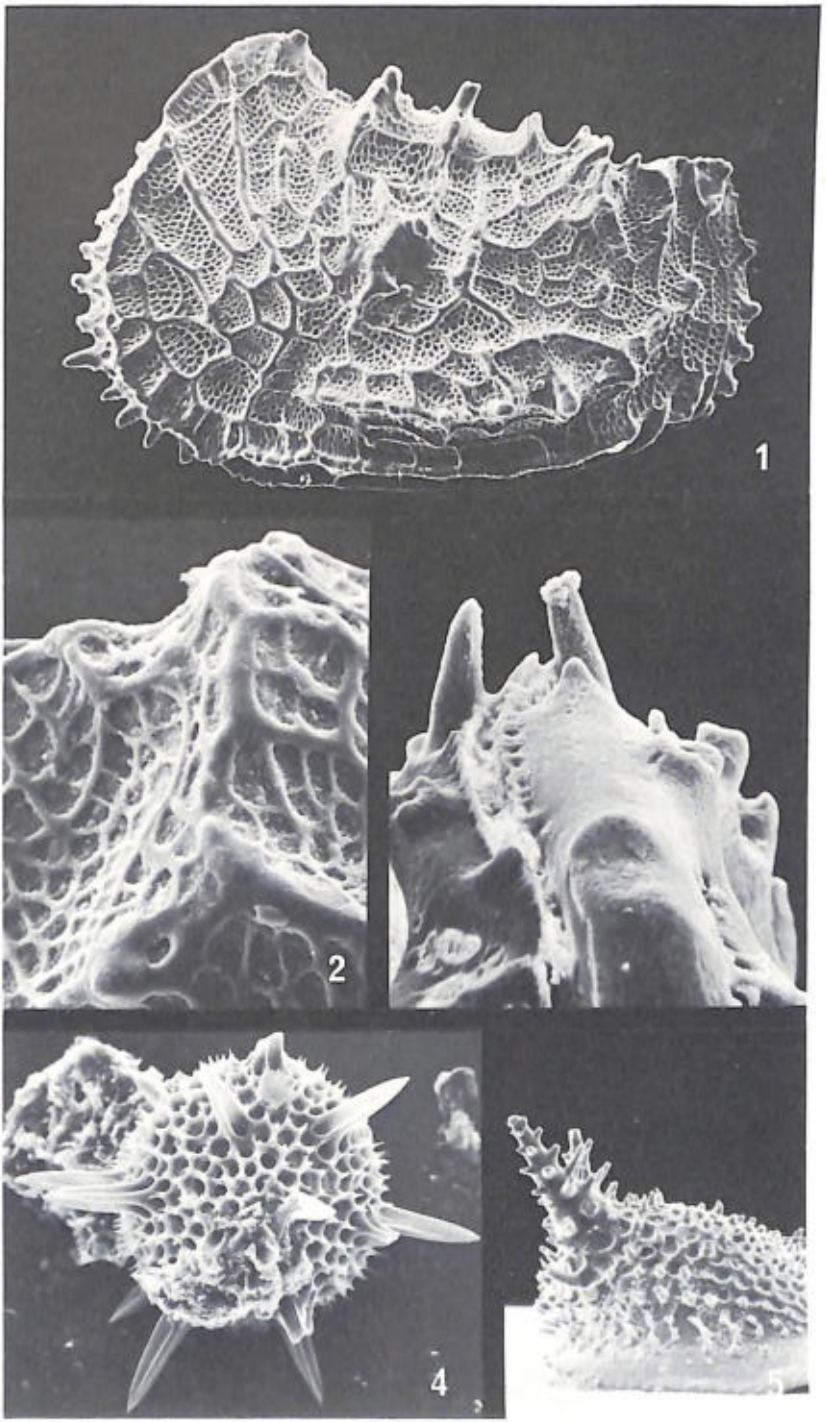
Curator Richard H. Benson is engaged in a long-term, worldwide study of deep sea and abyssal ostracodes. In the deep sea these animals are among the most abundant and oldest forms of life and their fossil remains reflect the history of this mysterious habitat. They have increased in size and have become bizarre in shape and ornamentation under low temperatures and great pressures, but beyond the achievement of a kind of grotesque aspect, their evolution seems to have been arrested. Forms which first developed during the time of the early history of the dinosaurs have remained unchanged and are still living. It is hoped that the present study of ostracodes will provide a basis for interpreting the deep ocean environment, and its history as well as giving some insight into the biologic processes of this extreme but widespread habitat, which has in part become a refuge for living fossils.

Scanning Electron Micrographs

The abyssal ostracode in figures 1–3 was found living at approximately 2000 meters depth in the western Indian Ocean. The closest known related group of ostracodes to this newly discovered species is a genus of Cretaceous cytheraceans which previously had been thought to be extinct since the end of the Mesozoic (60×16^6 years). These three views show the left side of one valve of the animal ($\times 88$), which contained in life its complex shrimp-like body, and detailed sections of the posterior and anterior margins of valve ornament ($\times 880$). Such views and photomicrographs of exceptional depth and clarity are not possible with conventional microscope optics.

The lower left figure (4) is of a radiolarian ($\times 880$), an ultramicroscopic protozoan, which was found attached to the inside of a dead ostracode valve and to which is adhered a yet smaller but identifiable fragment of a diatom.

The lower right figure (5) shows the highly spinose venter of a bathyal ostracode ($\times 88$) as seen from the front with the valve lying with the closure down. Such spinosity is typical of deep-sea ostracodes. Close examination shows two large Christmas-tree-like spines, one set behind the others, but both still in focus.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Through application of the scanning electron microscope (SEM), a very new and expensive instrument which promises expanded horizons in the study of microorganisms, Benson has examined and illustrated many fantastic features of ostracodes not previously accessible to study. He has conducted the study and illustration of his specimens during visits to the University of Leicester in England, where the SEM has been available to him. It is the only instrument which can reproduce great relief under high magnifications.

The major research effort of curator Richard S. Boardman during the year has been work on the production of a revision of the bryzoan chapter of the *Treatise on Invertebrate Paleontology*. He has been charged with organizing this effort with the help of associate curator Alan H. Cheetham, and he has completed the restudy of 62 of the approximately 175 genera for which he is responsible.

Cheetham continued his studies of adaptive morphology and evolutionary patterns of Tertiary cheilostome Bryozoa. A rich early Tertiary or late Cretaceous fauna from reeflike bryzoan mounds in southern Scandanavia is the basis for an investigation on the correlation of colony form with individual structure. The relationship of morphology to paleo-environment is being analyzed by principal component and clustering methods, using the time-share computer. Anatomy of fossil structural morphotypes, especially the relationship of skeletal and epithelial tissues, is being interpreted through study of wall structure and by analogy with Recent cheilostomes. Cheetham, J. B. Rucker of the U.S. Naval Oceanographic Office, and R. E. Carver of the University of Georgia have completed a study of wall structure and mineralogy of Recent species of the genus *Metrarabdotos* in which calcite and aragonite, secreted by the same epithelium, form segregated units having distinctive structural characteristics. They have studies underway on other cheilostome genera in which the walls show different patterns of development. Cheetham is also investigating the variation shown in single colonies of cheilostomes as a basis for calibrating population variation and identifying evolutionary trends. The taxonomic aspects of these studies are being incorporated in a revision of the order Cheilostomata for the *Treatise on Invertebrate Palentology*.

Analyses of data relating formaminiferal species densities to environmental variables in the Choptank River have been completed by associate curator Martin A. Buzas. The results indicate that the environmental variables are significant as a set, but none is individually. A study of the relative abundance-diversity of Foraminifera from the eastern continental shelf, Gulf of Mexico, and deep sea in the Recent, and from the Miocene and Pleistocene of the East Coast, is underway with

T. G. Gibson of the U.S. Geological Survey. This study utilizes the Shannon information function as a measure of diversity. This function and a measure of redundancy have been computed for several hundred samples to date.

Richard Cifelli and Roberta K. Smith in a nearly completed manuscript conclude that the uniqueness of the distributional patterns in the North Atlantic Current is explained by a hypothetical model of the dynamics of planktonic populations. Cifelli also has continued his studies of the age relationships of mid-Atlantic Ridge sediments by means of planktonic Foraminifera. A sediment of Paleocene age was recovered from a fracture zone in the mid-Equatorial Atlantic Ocean. This is the oldest sediment recorded from the Atlantic outside of the continental margin. Its occurrence is shown to be compatible with present concepts of sea-floor spreading.

Associate curator Erle G. Kauffman continued research in four major areas. In the first, systematic, evolutionary and biostratigraphic studies of the Bivalvia were concentrated on five important families; and major studies of Caribbean Inoceramidae, Cenozoic lineages of *Thyasia,* Paleocene *Astarte* and Crassatellidae, and Mesozoic-Cenozoic Ostreidae were completed and manuscripts prepared. In the second, a cooperative project to construct a biostratigraphic assemblage zonation for the Cretaceous of the Western Interior United States, utilizing all fossil groups studied within a radiometric matrix, was initiated and all basic data collated; the project is headed by Kauffman and involves twelve additional scientists from United States universities and other institutions. In the third, regional stratigraphic and basinal facies studies which have been conducted in the area of the Western Interior Cretaceous seaway during the past ten years culminated in the completion of a stratigraphic revision of the Colorado group in the central basin (with Donald E. Hattin of Indiana University); a similar revision of the Dakota group was initiated, with Karl M. Waage of Yale University, and three small papers naming new stratigraphic units in this area were completed and one published. In the fourth area, studies of Caribbean Cretaceous mollusks and stratigraphy progressed rapidly during the past year, with two papers on Caribbean bivalves (Inoceramidae) completed and the entire collection of Bivalvia cleaned, sorted, and readied for systematic research.

Associate curator Thomas R. Waller completed a major paper entitled, "The Evolution of the *Argopecten gibbus* Stock, with Emphasis on Tertiary and Quaternary Species of Eastern North America," and initiated a study of the living Pectinidae (Bivalvia) on the continental shelves of the Western Atlantic and Caribbean between Cape Cod and Recife, Brazil.

In January staff specialist Kenneth M. Towe, together with K. N. Sachs, Jr., of the U.S. Geological Survey, participated in a "Ships of Opportunity" cruise to the Caribbean aboard the Grace Line cruiseship SS *Santa Sofia*. Their purpose in the cruise was to collect and fix for electron miscroscopy living specimens of planktonic organisms, particularly Foraminifera and Radiolaria. Collaborating with Klaus Ruetzler of the Department of Invertebrate Zoology, Towe has discovered that certain keratose sponges are mineralized with small granules of lepidocrocite, an iron mineral known to occur in only one other organism, a marine chiton.

Activities of research associates in invertebrate paleontology were many and varied. Some are described below.

Anthony G. Coates continued the preparation and description of Caribbean Cretaceous corals, particularly those from Jamaica and Puerto Rico; he undertook a systematic study of the evolution of the families Montastreidae and Astrocoenidae, and he prepared a contribution on the relatively rare Cretaceous corals of the Western Interior for the biostratigraphic range chart being compiled under Erle G. Kauffman's leadership. During the past year J. Thomas Dutro, Jr., continued research on the Upper Devonian brachiopods of the southwest, with emphasis on the Sly Gap correlatives in Arizona and Nevada. This is an extension of a cooperative project with G. Arthur Cooper on the Devonian stratigraphy of New Mexico. Study of Late Devonian brachiopods in Idaho and Montana has added to the regional understanding of the Three Forks fauna and its correlatives.

A survey of the Great Barrier Reef of Australia was carried out by Harry S. Ladd during the spring at the request of the Queensland Department of Mines. A preliminary report dealing with the conservation and controlled exploitation of the reef is being prepared. A group of a dozen paleontologists organized by Ladd, including several of the Smithsonian staff, is currently engaged in study of an assemblage of late Eocene fossils obtained from the Island of Eua in Tonga. The material is the richest and most diversified fossil fauna and flora yet obtained from an island in the open Pacific.

Axel A. Olsson completed and submitted for publication studies on *Siphocypraea* and on aquarium specimens of *Oliva sayana*, recording feeding habits and for the first time the egg capsules and veliger of the latter. He has also completed his revision of the gastropod families Volutidae and Olividae for the *Treatise on Invertebrate Paleontology*, as well as continuing his studies of Recent and Tertiary mollusks from Florida, the West Indies, and Central and South America. M. Ruth Todd completed a report on a rich assemblage of smaller Foraminifera

of late Eocene age from Tonga, and with Doris Low nearly completed a report on the smaller Foraminifera from two deep drill holes in Midway Atoll that penetrated through Late Tertiary sediments to the basement rock.

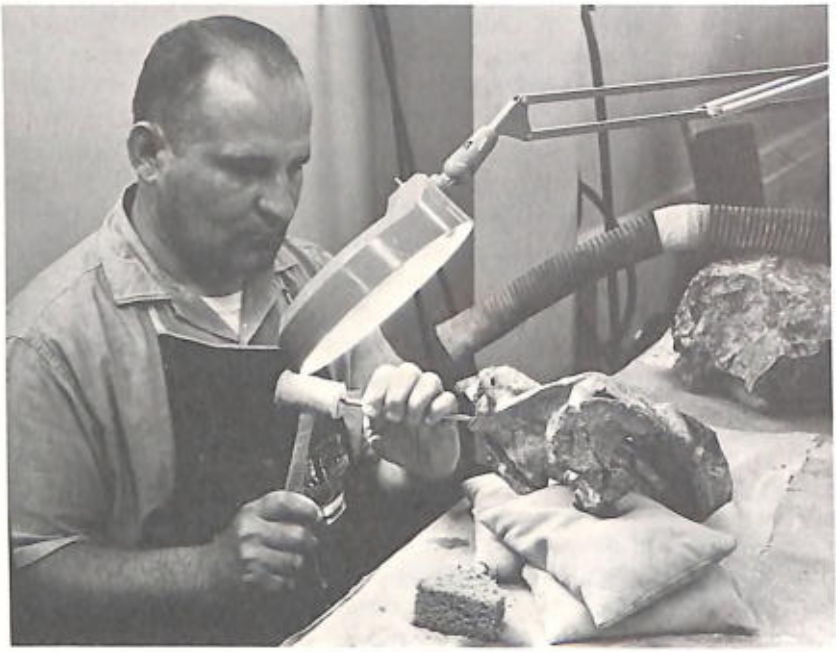
In September C. Lewis Gazin was appointed senior paleobiologist in order to devote a greater part of his time to research on early Tertiary mammals. In April he completed his monographic study of the Eocene condylarthran mammal *Hyopsodus* and submitted it for publication. Since then he has concentrated on identification of materials in two large collections of Paleocene mammals obtained during earlier field seasons from the classic sequence in the San Juan Basin of New Mexico, in preparation for further study of new Paleocene faunas from elsewhere in the Rocky Mountain region.

Nicholas Hotton III continued his study of functional morphology of dicynodont jaw musculature, with the consideration of two specialized genera, *Oudenodon* and *"Dicynodon" sollasi,* in progress. Taxonomic revision of the dicynodonts awaits the results of a study of osteological variation in the skulls of living lizards.

The work of research assistant Ruth O. Hotton, on the petrology of Beaufort sediments of South Africa, suggests a correspondence between the physical condition of heavy minerals and the stratigraphic position from which the samples were taken, which, it is hoped, will help in the interpretation of the depositional history of the Beaufort series.

Clayton E. Ray, who served as acting chairman in the absence of Porter M. Kier, completed studies of the fossil musk oxen of Illinois (with Donald L. Wills and John C. Palmquist), vertebrate remains from Indian sites on Antigua, West Indies (with Elizabeth S. Wing and Charles A. Hoffman, Jr.), and fossil vertebrates from the marine Pleistocene of southeastern Virginia (with Alexander Wetmore, David H. Dunkle, and Paul Drez). He continued work on the fossil musk oxen and on fossil walruses of Eastern North America.

Research associates Remington Kellogg and Frank C. Whitmore, Jr., devoted their attention to the nearby Miocene deposits. Kellogg completed manuscripts on two new Choptank Miocene whalebone whales and continued a review of the types of Miocene toothed whales described by E. D. Cope. Whitmore is cooperating with the Maryland Academy of Sciences in a stratigraphic and paleoecologic study at the Baltimore Gas and Electric Company site, at Calvert Cliffs on Chesapeake Bay. Detailed stratigraphic studies are being made in the Miocene Chesapeake group, and paleoecologic studies will be made by stripping bedding planes so that fossil organisms can be examined in place, in their relation to each other.

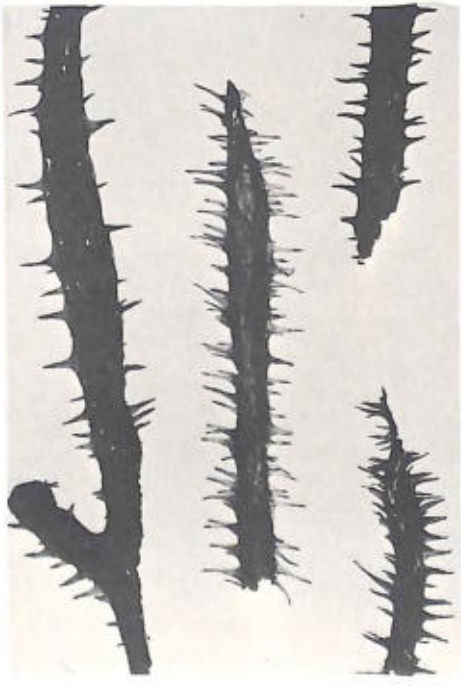


Preparation by Sigmund Sweda of the skull of a dicynodont tentatively identified as *Daptocephalus*, one of a large variety of plant-eating mammal-like reptiles from the late Permian of South Africa. These animals are being studied for their ecological role in the evolution of mammalian ancestors.

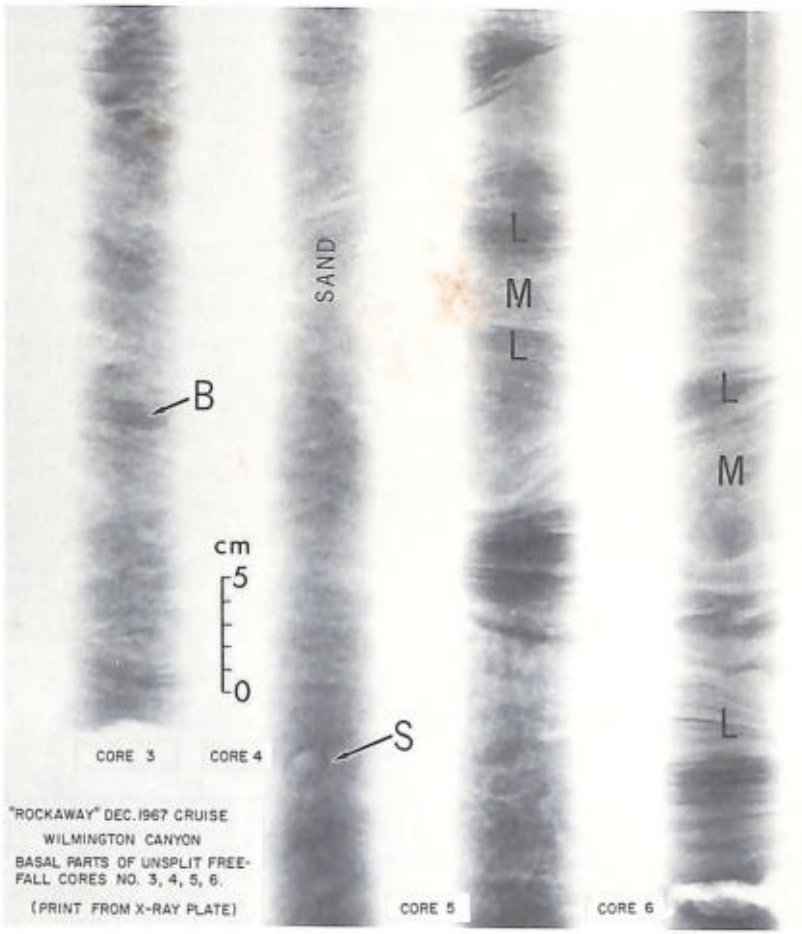
The installation of chemical fume hoods in the division of paleobotany made it possible for associate curator Francis M. Hueber to resume the use of chemical techniques important to the progress of his research on Early Devonian land plants. The isolation of nearly complete plant organs by means of acid maceration of the enclosing rock matrix is facilitating the study and reconstruction of several genera and species, of which some are new.

Research associate Sergius H. Mamay completed a report in collaboration with Michael Churkin, G. D. Eberlein, both of the U.S. Geological Survey, and Francis Hueber, dealing with land plants from a Lower Devonian graptolitic shale in southeastern Alaska. A sparse flora of simple vascular plants is associated with graptolites and other invertebrates, and comprises the oldest confirmed occurrence of land plants in this hemisphere.

M. Grant Gross has continued his research on the nature and rates of chemical processes in sediments and sedimentary environments, including various aspects of waste discharges and pollution. Working with T. John Conomos, a predoctoral intern, Gross investigated the radioactivity associated with suspended sediment from the Columbia River. In cooperation with the Maryland Department of Water Resources, Gross investigated abnormal sediment discharges and their effects on



Fossil remains (×2) of a land plant that flourished during the Lower Devonian nearly 400 million years ago. These specimens come from northern New Brunswick and Gaspé Bay, Quebec, Canada. Along with several others they have been dissolved free of their sandstone matrix with hydrofluoric acid and then mounted in plastic for study and exhibit. A study of these very early plants is in progress by Francis M. Hueber.



This print of an X-ray plate shows parts of unsplit cores of deep-sea sediments collected in the Wilmington submarine canyon off the east coast of the United States. This recently developed technique permits detection of subtle features otherwise not visible to the naked eye such as shell (S), mottling (M) and burrowing (B) by organisms, and lamination (L).

Maryland, especially that of the Potomac River, and developed laboratory procedures to be used in future studies of such problems. Working through the Office of Oceanography and Limnology, Gross assisted the Coastal Engineering Research Center, Corps of Engineers, to plan a study of the environmental impact of waste discharges in the coastal ocean off New York City. During the year, papers were completed on cores obtained from a drilling project on Midway Atoll and on the marine geology of Midway and Kure Atolls.

Coring and augur drilling along the North Carolina coast in July 1967 and January 1968 by Jack W. Pierce and D. J. Colquhoun of the University of South Carolina, suggest that this section of the coast has had a very complex history of development during the Holocene. This history does not seem to be analogous to that of the coast of Virgina to the north or South Carolina to the south. Additional drilling is planned for the summer of 1968 to delineate former shorelines in this previously unstudied section of the southeastern United States.

The origin and movement of sediment in probable submarine canyons and deep sea channel deposits in the French Maritime Alps and sectors of the Polish Carpathians are being examined by Daniel J. Stanley. As an outgrowth of these studies, Stanley has summarized sedimentological evidence pointing to the presence of a large emerged land mass in the Ligurian-Balearic Basin of the Mediterranean during the Paleocene. A series of studies was completed on the bottom morphology and origin, distribution, and dispersal of sediments on the continental margin off Nova Scotia, including a fjord-like inlet near Halifax, the Sable Island and Sable Island Bank region, and the Nova Scotian Shelf proper. Another group of studies made with D. J. P. Swift, Duke University, interprets the origin of the broad reef-front platform of Bermuda.

Staff Publications

(Papers, lectures, and seminars given by members of the staff are listed on page 400.)

AMSDEN, T. W., A. J. BOUCOT, and J. G. JOHNSON. "*Conchidium* and Its Separation from the Subfamily Pentamerinae." *Journ. Paleont.*, vol. 41, no. 4, pp. 861–867, 1 fig., 3 pls., 1967.

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VERTEBRATE ZOOLOGY

The department of vertebrate zoology has experienced some major changes in personnel this year. In August Philip S. Humphrey resigned as chairman to become Director of the Museum of Natural History and chairman of the department of zoology at the University of Kansas. He continues, however, as special advisor to the Director, and as principal investigator of the Pacific Ocean Biological Survey Program. Humphrey was replaced as chairman by George E. Watson, who in turn was replaced as supervisor of the division of birds by Richard L. Zusi.

The department was saddened by two deaths this year. Herbert G. Deignan, curator emeritus of birds, died in Switzerland while he was still working on manuscripts for the *Checklist of Birds of the World.* In May, curator Doris M. Cochran died just as her manuscript on Colombian frogs was in the final stages of editing and preparation for the printer.

The main orientation of research in the department is towards systematics, but the advanced state of our taxonomic knowledge of mammals, birds, reptiles, amphibians, and fishes also permits sophisticated ecological, biogeographic and behavioral approaches to systematic problems in these groups.

Accelerating intense interest in the evolution of man and in biomedical research with primates has led the department to initiate a primate biology program. Curator John R. Napier, formerly of the University of London, spent much of his first six months as the director

of the Smithsonian's primatology program traveling widely about the United States in order to make known the existence of the program, to determine the fields of research with which it should be concerned, and to explore the possibilities of cooperative projects with major universities. He visited five of the regional primate research centers, the major museums with large collections of primates and universities with special interest in primate biology. The results of these visits were incorporated in a major program statement, "Prospects in Primate Biology," published in April. Napier also spent two weeks in England in the spring negotiating for an academic affiliation of the London-based portion of the program. Between trips he continued his researches into the evolution of primate locomotion and, in collaboration with his wife, Prudence, into the feasibility of using reflectance spectrophotometry for studying the coat colors of monkeys. His *Handbook of Living Primates,* co-authored with Mrs. Napier, appeared late in 1967.

The main emphasis of field research in the department has been on large-scale ecological and faunal surveys of mammals, birds, and fishes in Latin America, Africa, the eastern Mediterranean, central Pacific Ocean, and off Bermuda. Some of these have had medical ramifications.

The collecting phase of the three-year-old biomedical survey of the mammals of Venezuela by curator Charles O. Handley, Jr., is almost complete. Two field parties concentrated efforts in the western part of the country, including the Mérida Andes, an area of local differentiation never before surveyed for mammals; the Sierra de Perijá; Páramo de Tamá; and the Maracaibo lowlands. Collation of ecological data of his earlier collections from Panama led to completion of a manuscript by his assistant, Theodore Fleming, on the distribution, ecology and population dynamics of the marsupials of the Canal Zone. Handley also spent six weeks in Belém, Brazil, in February and March studying the ecology and population dynamics of bats through high netting and banding in a freshwater swamp. About 700 bats marked in this period yielded enough recaptures to permit a reasonably reliable estimate of the vertical stratification of the bat fauna.

Field units of associate curator Henry W. Setzer's African mammal project collected specimens of vertebrate hosts and their parasites in Ghana, Togo, and Dahomey, and Setzer spent a month in South Africa to begin a survey of the Orange and Fish River basins in cooperation with the South African Institute for Medical Research and the Council for Scientific and Industrial Research.

George E. Watson's Palearctic migratory bird survey operated mainly in Cyprus after leaving Cairo last June. Under the field direction of John P. Hubbard, almost 14,000 birds were marked with British Trust for

Ornithology and other bands in the Middle East. Over 2,500 blood serum samples collected in the field have been analyzed in the virus laboratory at Yale University and active viremia of four different serotypes has been found in 42 blood samples from Egypt and Cyprus, mostly in fall-collected birds.

Field teams from the Pacific Ocean Biological Survey Program continued bird population and banding studies on the Hawaiian Islands, other central Pacific islands and islands off the western coast of Mexico, as well as sea observations on board EASTROPAC vessels in the eastern Pacific Ocean. Approximately 200,000 birds were banded and another 50,000 birds which had been previously banded were retrapped. Final programing and print-outs have been completed for processing data on pelagic bird observations; editing of the observations is almost finished and the majority of them are now on tape.

Two scientists are studying biogeographic faunal comparisons. Curator James A. Peters used time-share computer techniques in comparing large numbers of faunal samples from single localities or seine hauls to determine the degree of faunal similarity. First, each locality sample is compared with all other such samples to form a matrix of comparative values. Each set of comparisons for a single locality is ranked in a table according to coefficient value. Each rank is then simultaneously compared with all other rankings to give an indication of the degree of faunal identity between any two locality samples when compared against all other localities. The method and its underlying hypothesis were tested against data on fish collections from the eastern Pacific Ocean. The test proved so successful that the route of the ship could be predicted solely on the basis of the faunal similarity of samples. Tests were also run on fishes from an Atlantic Ocean transect cruise and on the herpetofauna of small islands off Puerto Rico.

Associate curator Paul Slud also was concerned with the theory of numerical or graphic comparisons of faunas. He concentrated on developing sampling procedures to compare the taxonomic and ecological distribution of neotropical birds. His one-month exploratory trip to the Amazon valley during February and March resulted in a tentative choice of two sites for comprehensive field studies next year.

Life history and behavioral information provides valuable characters to be used in systematic and ecological studies of vertebrates. Curator Ernest A. Lachner began a sabbatical year in April in the southeastern United States studying reproductive behavior patterns in stream minnows of the chub genus *Nocomis*. He co-authored with Robert E. Jenkins a systematic paper on the chubs of the southwestern Ohio River basin. Leonard Schultz continued field investigations and published pa-

pers on the biology of sea nettles in the Chesapeake and the life history of a nudibranch predator on jellyfish polyps.

Curator Victor G. Springer spent one and a half months in Taiwan collecting blennies for his extensive revisionary studies of blennoid fishes.

Curator Richard L. Zusi went to Churchill on Hudson's Bay in June and July to observe and photograph shorebirds as part of his anatomical studies of skull morphology of the Charadriiformes. He also spent another three weeks in Dominica studying the niche relationships of the Lesser Antillean forest trembler *Cinclocerthia ruficauda* as part of an anatomical study of the genus. He completed a manuscript with Joe T. Marshall, Jr., on the habits and anatomy of a sap-feeding woodpecker *Dendrocopos hyperythrus* from Thailand that proves to be convergent with North American sapsuckers.

Based on his many years of field work in the country, Alexander Wetmore completed the manuscript for a second volume in his four-volume account of *The Birds of the Republic of Panama.* The last three volumes of the multi-authored *Life Histories of North American Birds* covering the finches appeared 24 May, fittingly on the birthday of the editor, research associate Oliver L. Austin, Jr.

S. Dillon Ripley and his research assistant, Michel DesFayes, in collaboration with Salim Ali in Bombay, completed and sent to press volume 1 of the *Handbook of Indian Birds.*

Smithsonian identification manuals and catalogues of animals from little-known areas of the world stimulate further field research into natural history. Four major projects are underway in the department. Watson, J. Phillip Angle, and Peter C. Harper sent a first draft of the species section and maps for a manual on Antarctic birds to colleagues for criticism. James Peters, in collaboration with two Latin American herpetologists, Roberto Donoso-Barros of Chile and Braulio Orejas-Miranda of Uruguay, have nearly completed an IBP-sponsored project, the "Catalogue of Neotropical Squamata," which will facilitate identification of snakes and lizards in the field.

Units of the Navy concerned with the health of troops in Southeast Asia are attached to the department to produce field guides to the snakes and mammals of Vietnam. Simon Campden-Main is collaborating with Peters on the snake guide and Paul F. Ryan and Thomas J. McIntyre are at work in the division of mammals producing the mammal guide.

Henry Setzer has completed a key to the rodent genus *Acomys* for the *Preliminary Identification Manual for African Mammals,* a project of the International Biological Program centered at the Smithsonian, but with contributing authors from over the world.

Several other systematic studies of vertebrates are under way in the

department. Curators Stanley H. Weitzman and Robert H. Gibbs, Jr., and their collaborators have worked on stomiatoid fishes for several years and the results were published in several papers this year. Weitzman has almost completed a large manuscript on the interrelationships of the oceanic hatchetfishes Sternoptychidae and the oceanic lightfishes Gonostomatidae. Gibbs has completed manuscripts on the stomiatoids of transect cruises in the Indian Ocean and off Central America. He has also nearly finished the revision of the families Stomiatidae and Astronesthidae. Associate curator W. Ralph Taylor has in press his large revisionary monograph on the eastern North American catfish genus *Noturus* and is continuing studies of marine catfishes.

Setzer has almost completed work on the African rodent genus *Desmodilliscus* and continues work on the bats of Kenya with Bruce J. Hayward and Russell E. Mumford. Handley worked on the systematics and variation of the pocket gopher *Geomys pinetis* with Wilson Baker. Alphonse Hoge of Brazil worked in the division of reptiles and amphibians on a National Institutes of Health grant to conduct systematic research on venoms of vipers of Asia. Werner Bokermann, a Guggenheim fellow, studied Brazilian amphibians in the same division. Stewart Springer, Bureau of Commercial Fisheries, continued his long-range taxonomic studies of sharks of the family *Scyliorhinidae,* participating in a cruise of the *Oregon II* at the mouth of the Missouri River.

Staff Publications

(Papers, lectures, and seminars given by members of the staff are listed on page 401.)

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Conservation laboratory of the Office of Anthropology

The Collections

CARE AND CONSERVATION — GIFTS AND ADDITIONS

Anthropology

The outstanding anthropological acquisition of the year was the Terry collection on indefinite loan from the University of Washington School of Medicine in St. Louis, Missouri. Begun by Robert J. Terry and continued by his pupil and successor, Mildred Trotter, this unique collection includes over 1,500 skeletons of precisely known origin, many with cadaver measurements and face masks, collected over a period of two generations and actually spanning three generations (1840 to 1925), and serves as a base line for the physique of the less economically privileged sector of our population, most useful for comparative study.

A very important group of objects of Polynesian origin was presented by David Dunn Thomas, a descendant of John Williams Henry, early missionary to Tahiti. Collected by various members of the Henry and Thomas families at several periods and throughout the Polynesian area, some may have been collected in Tahiti before 1858 by the missionary Henry. The collection contains some particularly good specimens from the Marquesas.

In a ceremony at the Mexican Embassy on 27 October, President Gustavo Diaz Ordaz of the Republic of Mexico presented to the Smithsonian Institution an outstanding example of a Maya ceremonial incense burner in Palenque style, excavated in the state of Chiapas. The object is currently on display in the hall of Latin American archeology.

Less spectacular but scientifically valuable was the receipt of a documented collection from the Winslow site, Montgomery County, Maryland, from the Archeological Society of Maryland. The collection consists of approximately 20,000 objects of stone, bone, shell, and pottery, including several restored pots. It is the largest collection we have from the Piedmont-Tidewater area that has been excavated under controlled conditions, and it was presented with full documentation.

A collection of traditional arts and crafts, mostly from Iran, was received from Hans E. Wulff, University of New South Wales, Kensington, Australia. The 371 specimens represent a diversified craft economy, various stages of manufacture, and the raw materials employed. This collection with its documentation provides an essential dimension in the current research program in ancient technology.

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The anthropological conservation laboratory processed almost 2,000 specimens this year, about the same number as the preceding year. Museum specialist Bethune M. Gibson has significantly expanded her activities by training more volunteer workers, showing her conservation methods to visitors from all over the world (more than 95), and corresponding with other people desiring information. The photographic records (usually colored slides) of processed specimens have been greatly expanded, and the use of the airbrasive unit has been extended to include leather cleaning, basketry, and beadwork.

The archives of the Office of Anthropology, under the direction of archivist Margaret Blaker were moved from the north tower of the old Smithsonian building where they had been housed for more than fifty years, to newly constructed quarters in the Natural History building. Here greatly expanded stack areas and larger processing and study rooms make it possible to arrange the collections more efficiently and to provide improved study facilities for visitors.

Botany

Collecting activities by the staff added materials from unusual localities. A very significant series of marine algae was collected by museum technician Charles Rhyne on Aldabra and Diego Garcia Islands under the auspices of the Office of Oceanography and Limnology and the Royal Society of London, the first such extensive collections. Museum specialist D. Wasshausen accompanied an expedition of the New York Botanical Garden to Brazil, where he collected numerous specimens of Acanthaceae. D. H. Nicolson returned from a year in Nepal with a large representative set of specimens including many interesting new records. T. R. Soderstrom brought back a number of grass specimens from Java, and D. B. Lellinger collected many ferns in Costa Rica while acting as a consultant for a course given at the Organization for Tropical Studies at San José. Other materials collected for the Museum included 606 specimens from New Caledonia, 1,130 grasses from South and Central America collected by C. F. Calderón, and 223 phanerogams from Paraná, Brazil, collected by G. Hatschbach.

The exchange program by the department continues to bring in a significant portion of the materials that are accessioned. The most important collections received during the year were South American phanerogams from the New York Botanical Garden and Mexican materials from Stanford University. Some 1,835 specimens from Central America were sent by the Field Museum of Natural History in Chicago and 387 by the Missouri Botanical Garden.

Large sets of duplicates of North American plants were sent by the

University of Kansas, Southwestern Louisiana State University, and Vanderbilt University.

The Old World collections continue to grow. Lund University sent a large valuable set of 1,900 African specimens. As a gift the Forestry Department, British Solomon Islands, sent 1,339 plants of the Solomon Islands. Other important accessions of African, Pacific, or Asian plants were received from Suva, Fiji; Jardin Botanique, Brussels; Royal Botanic Gardens, Kew; and the British Museum, London.

Materials received as gifts for identification were especially rich. Of the cryptogams, a lot of 499 lichens from Rio de Janeiro collected by G. Eiten proved to contain many unusual records, and some 458 Venezuelan phanerogams collected by J. Steyermark have formed a valuable addition to the collections.

The department maintains an active program of loans and exchanges which demand detailed record keeping. A move was made during the year to simplify all records and to automate records on loan transactions in order to provide easy retrievability and print-outs with the computer. An extension of this activity has been the initiation of a program for a computerized type catalog, using the SCM Typetronic, which will eventually record data on our present holdings of about 60,000 types. This system will be expanded to include holdings of cooperating institutions as well and to provide plant taxonomists with the first comprehensive catalog of types.

Entomology

Several important collections made by staff members during field explorations connected with their research programs were accessioned: W. D. Duckworth collected 43,027 specimens in Central and South America, principally Lepidoptera; O. S. Flint, Jr., obtained 41,308 specimens, mostly neuropteroids, in southern Central America; P. J. Spangler collected 9,644 specimens, mostly Coleoptera, during a short stay in Panama and Costa Rica, and also donated 4,125 specimens from North America; K. V. Krombein obtained about 7,500 specimens during a brief stay at Gebel 'Uweinat in the Libyan Desert; 3,900 specimens of Lepidoptera were collected by D. R. Davis in the southwestern United States and California; and 711 Californian bees were obtained by G. I. Stage.

Spangler and Krombein traveled extensively in Africa in connection with exhibits work, improvement of the collections, and research projects. They worked together in Kenya for five weeks and in South Africa for two and a half weeks. While in Kenya, they worked principally at the National Museum in Nairobi, where they selected and packed for exchange shipment to Washington about 17,500 specimens

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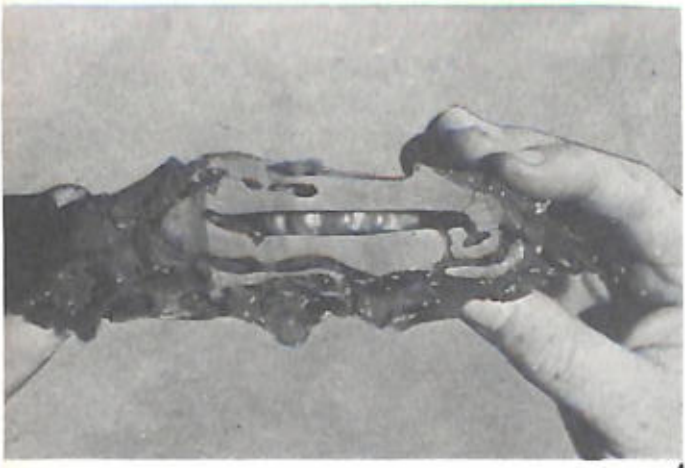

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Anatomy of a Termite Mound

Nest of the mound building termite *Macrotermes goliath* is excavated (1) by Karl V. Krombein and Paul J. Spangler during a n entomology-exhibits expedition to South Africa. Fungus chambers and fungus gardens (2) showing one of three earthen pots, originally placed by Bantu with openings level with surface of mound in order to capture swarming termites for food, that were gradually buried under several feet of earth by continued mound building. Close-up of a fungus comb (3) reveals the small white nodules used by termites for food. Thick-walled cell is sectioned (4) to show how queen termite is imprisoned and maintained to propagate the species. Queen is tended (5) by the king and numerous workers.

representing almost 9,000 species of African insects, principally in the orders Lepidoptera, Coleoptera, Odonata, and Orthoptera. It is estimated that about 75 percent of the species obtained in this exchange were not represented previously in the named collections. The principal project in South Africa was the excavation of nests of the mound-building termite *Macrotermes goliath* to obtain the queen, king, soldiers, workers, immature brood, fungus combs, earthern partitions and termite guests, to serve as the basis for an exhibit to be built in the forthcoming "hall of natural history." They operated Malaise traps full time and also made weekend field trips in both areas; these efforts netted about 30,000 additional specimens of African insects. After Krombein's departure, Spangler, assisted in part by an American Philosophical Society grant, collected 60,000 additional specimens in South Africa, Rhodesia, Malawi, Kenya, and Uganda during the ensuing eleven weeks.

The collection benefited also from the most generous donations of a number of other specialists. It is impossible to mention all of these specifically, but a few of the most important of these accessions were: 130,141 specimens collected by John W. Neal, Jr., in Iran and West Pakistan; 9,453 from N. L. H. Krauss, principally from the West Indies; 11,595 specimens of elaterid beetles from H. Lanchester; 10,206 specimens, mostly Venezuelan Lepidoptera from R. W. Poole; 500 species of Old World Odonata from M. A. Lieftinck, a particularly valuable acquisition because it added 318 species, 58 genera, and 2 families not represented previously; 4,236 specimens of American heliothine moths from R. R. McElvare; 4,107 North American insects from L. J. Bottimer, mostly Hemiptera, Coleoptera, and Lepidoptera; 4,000 specimens of North American Microlepidoptera from R. W. Hodges; type and ordinary specimens of Diplopoda from H. F. Loomis; 5,000 specimens of Panamanian Diptera from W. W. Wirth and F. S. Blanton; 244 paratypes of 114 species of New Guinea Psychodidae from L. W. Quate; 3,567 specimens of West Indian Lepidoptera from E. L. Todd; and 2,000 Diptera from L. Knutson.

Three important specialized collections were obtained by purchase, the Peña collection of 39,458 Chilean Tenebrionidae containing many paratypes, the Daguerre collection of 32,413 Argentinian Coleoptera and Neuroptera, and the Kormilev collection of 2,712 worldwide specimens of Aradidae, Phymatidae, and Vianaididae containing many primary and secondary types and nearly 250 species and 48 genera not represented previously in our collection.

The Department of Agriculture transferred 61,554 specimens of insects and their allies to the Smithsonian, of which many were of more than ordinary value or interest, representing as they did the choicest

materials submitted to the Department of Agriculture or to Museum specialists for identification. Many of the species were not represented previously in the national collections, and others bore associated host data, or consisted of reared series of immature and adult stages.

As a result of the Bredin-Archbold-Smithsonian Biological Survey of Dominica, we received 11,000 specimens collected by T. J. Spilman and D. M. Anderson of the USDA staff and by D. W. Bray of the University of Delaware.

We are also pleased to report the very welcome interest of two Peace Corps workers, Sharon Thomas and James H. Davis, who sent several most welcome lots of specimens from Malaysia and Nigeria, respectively.

Personnel assigned part time to the departmental preparators' team, Nancy B. Heath, Marc Roth, Ronald Faycik, and William Rowe, made substantial inroads both on the backlog of specimens awaiting accession or distribution and on newly received lots. Altogether they handled nearly 600,000 specimens, sorting and distributing them to the appropriate divisions. Of these about 150,000 specimens had been accessioned previously but not distributed; the remaining specimens constituted 54 new accessions. Divisional preparator Gloria House sorted 28,000 specimens of Coleoptera to family, mounted and labeled over 6,000 specimens, and transferred 26,000 specimens to Museum units.

R. E. Crabill continued to explore new and improved methods of whole-mounting of small arthropod specimens on glass slides. He believes that he has developed a better mountant than Hoyer's, having the outstanding advantage of similar superb optical qualities with far better permanence. He also attempted to find a more satisfactory ringing medium for cover slips.

In addition, Robert Traub donated 58 specimens of fleas, a particularly valuable acquisition because it consisted of primary and secondary types. K. C. Emerson added over 3,000 slides of Mallophaga and Anoplura from his personal collection and from Department of Defense sources. Dr. G. W. Rawson, a vounteer worker in the division of lepidoptera and diptera, undertook the incorporation of several separate collections of Nearctic butterflies including his own, and has virtually finished the family Pieridae.

Our scientific colleagues in the systematic entomology laboratory of USDA and the preparators assigned to it continued to provide much appreciated curatorial assistance in sections of the collection in their care. In addition, many thousands of insects were mounted under USDA contracts with several universities and individual workers.

The Southeast Asia Mosquito Project received 45 collections consisting of 14,080 mounted adult mosquitoes and 10,376 slide preparations

from 26 different sources. The bulk of the material came from the SEATO laboratories in Bangkok, Thailand, and S. Ramalingham.

Invertebrate Zoology

Perhaps the single most important acquisition during the year was the unparalleled collection of freshwater mollusks and crayfishes from the central United States assembled by Byron Leonard, his colleagues, and his students at the University of Kansas. The gift, from the Natural History Museum of the University of Kansas, greatly enhances our holdings of American mollusks and crayfishes.

With the support of the Office of Education, the Museum began a modest pilot project to study the application of automatic data retrieval methods to Museum collections, with particular emphasis on developing techniques for retrieval of specimen-associated data. In the department of invertebrate zoology, the collection of stomatopod crustaceans was selected as the first group to be processed under this experimental program. The collection, comprising about 2,000 lots, includes representatives of 4 families, 30 genera, and 230 species. Between September and June, through the efforts of Michael C. Ridge, 900 lots containing more than 10,000 specimens were documented, cataloged, and curated; specimen data on punched paper tape was converted to magnetic tape by a computer. In addition, Ridge organized the data on the stomatopod types so that a publishable type catalog, including original references, can be generated by the computer.

Cataloging of Crustacea is now based entirely on mechanical equipment with which label-typing simultaneously punches a paper tape which then can be used to produce data cards, neck labels for bottles, and, ultimately, printed catalogs. A master list of crustacean taxa is being compiled as the first step in converting all crustacean data records to magnetic tape and machine storage.

Museum specialist Henry B. Roberts assumed the major load of identifying decapods in response to outside requests, in addition to reorganizing the 15,000 type lots for greater accessibility. Major accessions in Crustacea included 6,300 specimens received through Harvey R. Bullis, Jr., Bureau of Commercial Fisheries, and 4,600 specimens of copepods from the Bahama Islands received from Arthur G. Humes, Boston University.

The addition of a large number of storage cases allowed reorganization of the dry collections of echinoderms and lower invertebrates. A catalog of the type-specimens of echinoids in this Museum and at the Museum of Comparative Zoology, Harvard, prepared by Maureen Downey, was published during the year. A similar catalog of ophiuroids

has been submitted for publication, and preparation of a catalog of asteroids is under way. These catalogs will be most useful reference sources for future work on the echinoderms.

An important addition was the extensive series of 2,900 freshwater sponges received from the estate of the late J. T. Penney. The collection, comprising materials from many localities around the world, has added materially to the division's holdings of this group.

Other echinoderm accessions during the year include a large collection of starfishes from the Gulf of Mexico received from Harvey R. Bullis, Jr., Bureau of Commercial Fisheries; a large collection of North Atlantic bryozoans from Frank J. S. Maturo, University of Florida; and a large series of lower invertebrates and echinoderms from the Smithsonian Oceanographic Sorting Center.

The collections of mollusks were enriched by the addition of 23,759 lots of freshwater mollusks from Thailand, collected by Rolf Brandt, of the SEATO medical research unit, in connection with his research on medically important mollusks. A small but significant addition consisted of 15 specimens of the interesting monoplacophoran genus *Neopilina*, including primary types of two species described by Robert J. Menzies, Florida State University. The division also received from Robert H. Stewart 1,350 marine mollusks of Payardi Island on the east coast of Panama, a relatively important and little-known region.

During the past year several projects were completed and a few begun which will improve the accessibility of the collections of mollusks. Among the valuable items received in a permanent loan collection from the New York State Museum some years ago was the Reigen collection of mollusks from Mazatlán. These were classified during the last century by P. P. Carpenter and other 19th-century workers. The type-specimens of freshwater mussels were rearranged, and a cross-referenced list of the Museum's holdings of this large group was prepared.

Under an agreement with the Agricultural Research Service, Walter J. Byas identified over 4,000 specimens of mollusks which had been intercepted at ports of entry to the United States.

In the division of worms, the most outstanding addition to the collection was the extensive series of branchiobdellid annelids collected by Perry C. Holt of the Virginia Polytechnic Institute. The approximately 700 slides deposited in the collection represent one of the largest holdings of branchiobdellids in the world.

Mineral Sciences

The meteorite and tektite collections have grown considerably during the past year. The University of Minnesota meteorite collection, contain-

ing specimens of almost 100 different meteorites, has been placed with us as an indefinite loan. Particularly noteworthy are a 125-pound Esterville (Iowa) specimen, a 65-pound Forest City (Iowa) stone, and several fine Richardton (North Dakota) stones.

The Australian expedition of Henderson and Mason provided material of several meteorites previously unrepresented in the collection, including the unique Mt. Egerton stony-iron. Tektite collections, when added to those obtained on previous expeditions, provide us with probably the finest collection of precisely localized Australian tektites in existence.

Three important new meteorite falls were added to the collection during the year. These are the Ankober (Ethiopia) fall of 7 July 1942, a 7-kg. stone obtained through the cooperation of Robert Citron of the Smithsonian Astrophysical Observatory; the Tathlith (Saudi Arabia) fall of 5 October 1967, obtained through Glen F. Brown of the United States Geological Survey; and the Denver meteorite, which penetrated a warehouse roof in July 1967 and was subsequently presented to the Museum by the warehouse owner, Nationwide Papers, Inc., of Denver, Colorado.

A large number of rock specimens were incorporated into the petrologic series, which has been arranged systematically and by geographic groupings, thus making this material more accessible to the researcher interested in obtaining samples of various rocks from specific localities.

Two particularly noteworthy acquisitions were from the Geological Survey—a collection of volcanic rocks from Truk Islands, described by J. T. Stark and R. C. Hay in *U.S. Geological Survey Professional Paper 409* (1963), and an extensive collection of ultrabasic nodules and inclusions from the Hawaiian Islands obtained through E. D. Jackson. Melson collected an extensive suite of rocks from the 1968 eruption of Mayon Volcano, Philippine Islands; the suite of rocks from the 1967–1968 eruption of Metis Shoal, Tonga Islands, collected by Charles Lundquist of the Smithsonian Astrophysical Observatory, were the only specimens collected at the site.

The division of petrology continued development of a format for entering specimen data into the Smithsonian's information storage and retrieval system.

Steady growth of the mineral and gem collections continued. Among important gifts by individual donors were a number of fine sapphires of several colors by Mr. and Mrs. James H. Clark, a very rare 5.34-carat taafeite by Mr. and Mrs. Fred C. Kennedy, a 336-carat mass of industrial diamond by Nathan Fink, and an antique diamond necklace with a magnificent blue sapphire weighing 98.57 carats, gift of Countess

Edward Bismarck. Several fine exhibition quality mineral specimens, including torbernite from the Congo and rose quartz from Brazil were donated by Lewis K. Land.

Through exchange an unusually large number of fine specimens were added to the mineral collections such as a 28-ounce gold nugget from Alaska, a large and extraordinary group of gem quality morganite crystals from California, two excellent epidote specimens from Austria, four proustite crystal groups from Chile, one of the very few remaining large emerald crystals from North Carolina measuring six inches long, and two, well-crystallized specimens of California gold.

Roebling fund purchases during the year were directed primarily toward acquiring new materials for the research collection. The Canfield fund was used to obtain several specimens of superior exhibition quality, such as a euclase specimen of very unusual habit, color, and quality from Brazil, and an apophyllite specimen from Virginia which is probably the finest for this species in the world.

Through the Chamberlain fund a 67-carat black star sapphire from Thailand and an unusually large faceted labradorite from Oregon weighing 23.77 carats were acquired.

Paleobiology

A new departmental preparation laboratory, under the direction of Lorenzo Ford, has been established with facilities for various thin-sectioning, polishing and embedding techniques as well as limited acid digestion, heavy mineral separation, and macro- and micro-sample washing. The laboratory supplements the crowded and more specialized preparation rooms which have been pressured by an increasing number of post-doctoral fellows, visiting scientists, and students. The equipment is available to any one associated with the department and, if necessary, Ford provides training in proper handling and maintenance of the equipment. It is expected that the facility will be especially useful for visitors as it will allow them access to equipment for extended periods without interrupting routines in the more specialized laboratories.

The division of invertebrate paleontology made several major changes in collection storage and laboratories. A new room was completed and dedicated as the Cushman room for foraminiferal studies. Located in the central storage area, the room contains desks, library, and optical equipment for visitor study needs, and it houses the Cushman collection of Foraminifera.

The post-Mesozoic mollusk collection, inventoried over the previous year, was reorganized in a geographic-stratigraphic arrangement. The

material, consisting of thousands of collections, is easily accessible for the first time since the move into the east wing quarters. A biologically arranged reference collection is now being developed.

Cataloging of newly received type-specimens was curtailed for part of the year by loss of cataloging personnel. Several thousand specimens were processed but the influx of new types has been much greater than could be handled.

A manuscript catalog of Mesozoic coelenterates is near completion and the conodont manuscript is being updated. Publication of these lists is expected soon; while the first of the division type catalogs, the Paleozoic cephalopods, was issued early in 1968. A new curatorial and cataloging procedure involves entering locality, biometric, and faunal information, as well as information concerning the location of species in the storage area, on IBM cards and magnetic tape.

The Walcott bequest provided funds enabling several large collections to be made by the staff. These included more than 12,000 specimens of Upper Cretaceous invertebrates from the Rocky Mountains and Lower Cretaceous and late Cenozoic mollusks from the Atlantic Coastal Plain, all collected by Erle G. Kauffman. Frederick J. Collier and Jesse Merida collected more than 4,000 specimens of Middle Devonian brachiopods, corals, trilobites, and bryozoans from localities in western New York and southern Ontario.

Other notable contributions include more than 5,000 Tertiary and Quaternary mollusks from an area between Isla de Margarita and Guajira Peninsula in Northern Venezuela collected by Thomas Waller, and some 2,000 specimens of a variety of Devonian invertebrates presented by Dr. and Mrs. G. A. Cooper. Cooper also made extensive collections in the Guadelupe Mountains in continuance of his Permian studies.

Transfers from the Geological Survey included many type-specimens described by the staff of the paleontology and stratigraphy branch. Outstanding among these were 167 specimens of Foraminifera recovered from Tertiary and Recent samples from the Island of Guam and described by Ruth Todd. Approximately 150 additional Recent specimens from Alaska were described and received from Miss Todd. Calymenid trilobites described by Reuben Ross, Permian Tethyan fusulinids from California described by R. C. Douglass, and a large collection of Jurassic ammonites described in *U.S. Geological Survey Professional Papers* 483D, 540, 573B by Ralph Imlay are indicative of the great diversity of specimens accessioned.

Summer field work in the Bridger Basin of the southwestern Wyoming by C. Lewis Gazin and Franklin L. Pearce, with support from the Wal-

Articulated skeleton of the early lemuroid primate *Smilodectes gracilis* being prepared by Franklin Pearce in the laboratory of vertebrate paleontology. The block of matrix containing the skeleton was excavated this past summer in the middle Eocene Bridger formation of southwestern Wyoming.

cott bequest, resulted in the collection of some 450 specimens of fossil mammals, principally from the middle Eocene Bridger formation. Outstanding among materials obtained was the greater part of an articulated skeleton of the primate *Smilodectes gracilis*. Remarkably good skulls of other Eocene mammals were discovered, including that of condylarth *Hyopsodus minusculus,* significant to the *Hyopsodus* study then underway.

Fossil marine mammals have long been a major interest of the Museum, particularly as a result of the tradition in their collection and study established and maintained by Remington Kellogg. The past year has been the most productive ever in terms of quantity and quality of acquisitions of marine mammals and other marine vertebrates. The major single accession of the year was that of the Douglas Emlong collection of fossil marine vertebrates, purchased through the Walcott fund. The collection consists mainly of remains of whales, porpoises, and sea lions, but includes as well desmostylians, birds, fishes, and turtles, virtually all collected by Mr. Emlong on the coast of Oregon. More than 500

Museum specialist John E. Ott preparing skull of the extinct crocodilian *Gavialosuchus* collected by him and Albert C. Myrick, Jr., in the Miocene Calvert formation near Wakefield, Virginia. In the foreground is the snout of an individual of the same genus from near Cove Point, Maryland, donated to the Museum by Carla Sanchez of Hyattsville, Maryland.

individual specimens, ranging from single isolated bones to complete skeletons, of Oligocene, Miocene, and Pliocene age, will ultimately serve to document critical stages in the evolution of various groups, in particular the Cetacea and Pinnipedia.

Again with support of the Walcott fund, Albert C. Myrick, Jr., and others made several collecting trips to the nearby marine Miocene deposits of Maryland and Virginia. The principal results of this work include one nearly complete baleen whale skeleton, one partial baleen whale skeleton with skull and jaws excellently preserved, more than 20 specimens of porpoises, several specimens of fishes, and an excellent skull with partial skeleton of the extinct crocodile *Gavialosuchus*.

Frank C. Whitmore, Jr. conducted field work on Cenozoic vertebrates of the Gulf coastal plain. With George M. Lamb and students of the University of South Alabama (Mobile) he collected from a site north of Mobile and south of Citronelle, which has yielded the first Pliocene land-mammal bones to be found between western Florida and the Texas Gulf coast. The bones occur in clay that is probably of paludal or lacustrine

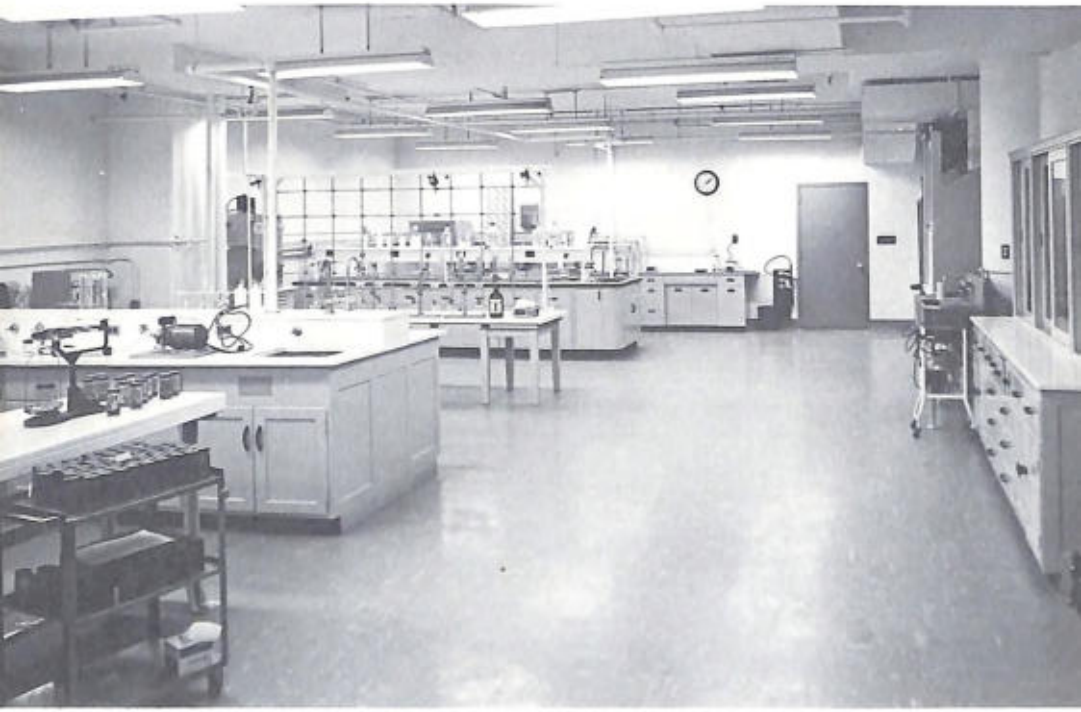
origin, as there are many leaves and large logs present. A particularly significant aspect of the fauna from the point of view of correlation is the association of the long-snouted dolphin *Pomatodelphia inaequalis* Allen with *Synthetoceras* sp., an extinct browsing ungulate characterized by peculiar horn-like growths on the skull, with the horse *Hipparion* cf. *H. plicatile,* and with a fairly large camel; a Hemphillian (middle Pliocene) age is indicated.

Through the courtesy of the Geological Survey, four Pleistocene peccary skeletons, collected by Warren I. Finch and John Sims of the Survey beneath 65 feet of loess in the Hickman quadrangle near Paducah, Kentucky, have been deposited in the Smithsonian. The skeletons were found articulated, in the position in which they died, all facing eastward, each animal apparently sheltered behind the next. They probably were overwhelmed by a dust storm.

Slides containing 52 figured specimens of fossil algae, including 9 new species, from the Buda Limestone and Pre-Buda Lower Cretaceous of Texas, were received from Professor J. Harlan Johnson of the Colorado School of Mines. The type-specimens of *Psilophyton forbesii* Andrews were received from the Department of Botany, University of Connecticut, through Professor Henry N. Andrews. Five slides containing type-specimens of fossil sporomorphs from the Walnut Shale of Oklahoma were received from Richard Hedlund of the Atlantic Richfield Company Dallas, Tex. The collections of Devonian land plants were broadened by the addition of 315 specimens representative of the Lower Devonian *Barawagnathia* flora of Victoria, Australia, specimens from Alkin, Germany, and mid and northern Scotland, and 135 from the Upper Devonian of Northern Queensland, Australia, All were obtained by Francis M. Hueber. A specimen establishing the second documented occurrence in the eastern United States of the Cretaceous fern *Tempskya* was received as a gift from Karl E. Rifenbark of Phoenix, Arizona.

The division of sedimentology now has responsibility for the entire collection of approximately 1,600 sediment samples, collected by the Geological Survey-Woods Hole Oceanographic Institute group on the Atlantic shelf of the United States. Also 1,455 core samples, collected by various ESSA ships, were received from the Coast and Geodetic Survey.

Part of the recently completed sedimentology laboratory, where samples are prepared for textural, mineralogical, and chemical analyses. Facilities for core preparation, X-radiography, geochemistry, petrography, X-ray diffraction analysis, and photography are available. The laboratory also houses the sediment collection, including deep-sea cores.



Vertebrate Zoology

A pilot project for automating the specimen catalog and data retrieval for seabirds is well underway in the division of birds and another project is just starting in the division of mammals. George E. Watson, Richard L. Zusi, Paul Slud, and Richard C. Banks, assisted by David Bridge, have produced a sequential list of birds of the world and codes for specimen data, as well as associated ecological and museum-accession information. A similar mammal program, which will include standard measurements, represents a cooperative effort by Henry Setzer, John Paradiso, and several colleagues outside the Museum.

The imminent return of the department of entomology to the Museum of Natural History has accelerated the move of the cetacean and pinniped collections to the new marine mammal center at Silver Hill, Maryland, and necessitated a temporary move of the large cases of marsupial, carnivore, and ungulate skins to Silver Hill. Remodeling in the new facility includes insulation, space heaters, and fluorescent light-

SPECIMEN TRANSACTIONS—FISCAL YEAR 1968

Departments	*Accessions (transactions) 1967 (new)*	*Received on loan*	*Exchanged with other institutions*	*Transferred to other government agencies*	*Lent for study to investigators and other institutions*	*Specimens identified*
Anthropology	96	40	21, 125	14	784	1, 885
Invertebrate Zoology	424	1, 083	3, 584	0	27, 319	32, 772
Vertebrate Zoology	223	4, 659	1, 426	0	13, 406	128, 859
Entomology	566	1, 965	2, 888	5	67, 853	55, 432
Botany	292	6, 107	22, 219	0	29, 545	11, 142
Paleobiology	164	1, 580	1, 424	0	13, 362	48, 405
Mineral Sciences	289	33	1, 281	62	411	230
Total	2, 054	15, 467	53, 947	81	152, 680	278, 725

SPECIMENS IN THE NATIONAL COLLECTION MAY 31, 1968

ANTHROPOLOGY		1, 042, 804
Archeology	811, 104	
Ethnology	193, 810	
Physical Anthropology	37, 890	
BOTANY		3, 338, 483
Phanerogams	2, 081, 106	
Plant Anatomy	48, 782	
Ferns	263, 222	
Grasses	401, 495	
Cryptogams	543, 878	

ing so that it may be used for processing, study, and storage of very large mammals, both Recent and fossil.

Accessions of mammals, totaling 32,464, were the largest in the history of the division. Outstanding accessions were 15,000 specimens from the African Project and 10,000 from the Venezuela Project; 500 West Pakistan mammals from the department of microbiology at the University of Maryland through Robert Traub, and holotypes of two new bats from the West Indies donated by Albert Schwartz.

Specimens of rare and extinct birds were safeguarded by moving them to locked cases similar to those used for type-specimens in the division. Case labels are being replaced with up-to-date ones based on the nomenclature newly developed for data processing. Among the more important accessions in the division of birds were a specimen of the new Colombian hummingbird *Eriocnemis mirabilis* described in 1967 by de Schauensee; three lots of egg shells of the extinct elephant bird of Madagascar, collected on a National Geographic expedition and received through Luis

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ENTOMOLOGY		18, 252, 017
Former Division of Insects Total, 1963 (Divisional totals are shown from this date)	15, 978, 513	
Coleoptera	558, 241	
Hemiptera and Hymenoptera	463, 090	
Lepidoptera and Diptera	441, 296	
Myriapoda and Arachnida	437, 182	
Neuropteroids	373, 695	
INVERTEBRATE ZOOLOGY		12, 428, 140
Crustacea	1, 570, 199	
Worms	672, 256	
Echinoderms	91, 960	
Mollusks	10, 093, 725	
MINERAL SCIENCES		472, 814
Mineralogy	162, 224	
Meteorites	11, 145	
Petrology	299, 445	
PALEOBIOLOGY		13, 456, 690
Invertebrate Paleontology	13, 396, 224	
Vertebrate Paleontology	53, 034	
Paleobotany	5, 524	
Sedimentology	1, 908	
VERTEBRATE ZOOLOGY		3, 170, 444
Mammals	385, 354	
Birds	528, 644	
Reptiles and Amphibians	170, 997	
Fishes	2, 085, 449	
TOTAL		52, 161, 392

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Marden and Alexander Wetmore; substantial collections from Panama, North America, and the central Pacific islands; two skeletons of *Streptoprocne semicollaris,* the largest known swift; and a collection of 238 bird skeletons from New Guinea.

Among the approximately 215,000 specimens added to the fish collection, the most significant accession was from Carl J. George of the American University of Beirut, Lebanon, who deposited a collection of 190,000 fishes from the eastern Mediterranean, the most extensive one in the Western Hemisphere. Other important accessions included specimens of pelagic, deep-sea fishes from the Pacific Ocean received through R. Rosenblatt, Scripps Institution of Oceanography; and 5,000 West African marine fishes from G. Bane, through Cornell University.

Particularly significant accessions of reptiles and amphibians came from South America, Africa, and Southeast Asia. Almost 1,000 specimens were collected by the African and Venezuelan mammal projects, including several new species; 446 specimens from Viet-Nam and 392 from Thailand were received through the Department of Defense and SEATO laboratory; Gaston de Witte of Belgium sent 155 frogs from the Congo, including 47 paratypes; Werner Bokermann gave 217 frogs from South America, including 15 paratypes; L. Hoevers sent 230 reptiles and amphibians from Surinam; John Visser of South Africa sent 44 carefully chosen reptiles; and David Jameson deposited large series of the specimens which formed the basis of his revision of various subspecies of *Hyla regilla.*

Exhibits

The African anthropological exhibits were formally opened to the public on 25 August 1967, culminating work on the hall begun about five years earlier by Curator Gordon D. Gibson. The 56 units displaying aspects of African culture make use of a wide variety of techniques (visual, auditory, and olfactory) to add interest and immediacy to the ethnographic specimens and descriptive texts.

Two permanent wall exhibits consisting of a Tibetan ritual apron incorporating human bones, and a linguistic map of Asia depicting the distribution of language families were installed. A simulated food offering was made in the models shop and placed on the altar in the Korean Buddha exhibit. The installations of the shadow puppets of Malaysia, and the display of textiles from India and Pakistan were improved and refurbished.

In the newly completed hall of the cultures of Africa and Asia, life-size costumed models (left) are positioned before a painted background to illustrate an episode in the boys' initiation rites of the Luvale people of Zambia and Angola. Below, daily activities in a camp of Bushman hunters of the northwestern Kalahari Desert in southern Africa.

A temporary exhibit was added to the section of a hall of physical anthropology dealing with the ancient varieties of man: In one of the standard free-standing cases adopted for use in the hall the skull of *Zinjanthropus,* found by L. S. B. Leakey in 1959, is shown as restored by the artist Jay Matternes. The skull is shown properly assembled for the first time alongside the fleshed head, also the work of Matternes. Both specimens slowly rotate synchronously so as to facilitate comparison. Also, a cast of *Zinjanthropus'* brain cavity is shown in comparison with that of a gorilla and of a modern man.

The opening of the new hall of meteorites in December 1966 was the culmination of several years of work by the staff of the division of meteorites in cooperation with other units of the Smithsonian; Robert F. Fudali has been drawing up plans for completing one small alcove, comprising three exhibition units.

Paul E. Desautels continued preparation of scripts and exhibit materials for the new hall of physical geology, and, under his supervision, the design and installation of exhibits in it was continued toward expected completion in 1969.

The laboratory of vertebrate paleontology, under the supervision of Franklin L. Pearce, continued to concentrate most of its effort upon preparation of specimens for exhibition, in particular for the hall of Quaternary vertebrates. A group of two dire wolves and a horse from Rancho La Brea, California, was completed by Albert C. Myrick, Jr. Other major exhibition preparations in progress include a second skeleton of the giant sloth *Eremotherium* by John E. Ott, a skeleton of the wooly mammoth *Mammuthus primigenius* by Leroy Glenn, Jr., two skeletons of glyptodonts by Gladwyn Sullivan, and a group of four peccary skeletons by Sigmund J. Sweda. Jay Matternes made significant progress toward completion of the first of four proposed murals for the Quaternary hall, a representation of the biota of the Snake River Valley near Hagerman, Idaho, near the beginning of Pleistocene time.

Papers Delivered, Lectures, and Seminars

ANTHROPOLOGY

ANGEL, J. LAWRENCE. "Paleodemography and Evolution." 66th Annual Meeting American Anthropological Association, Washington, D.C. December 1967.

———. "Prehistoric Anatolians and Falciparum Malaria." Philadelphia Anthropological Society, Philadelphia, Pennsylvania. February 1968.

———. "What Bones Tell You." Baltimore Association of Medical Assistants, Baltimore, Maryland. March 1968.

———. "The Bases of Paleodemography." 37th Annual Meeting of American Association of Physical Anthropologists, Wayne State University, Detroit, Michigan. April 1968.

———. "Ancient Disease and Civilization." Howard University Medical School, Washington, D.C. May 1968.

CALDWELL, WARREN W. (River Basin Surveys) "Formal Statement on Behalf of the Society for American Archaeology." Paper read at Department of the Interior Regional Conference on the National Historic Preservation Act, Omaha, Nebraska. 9 May 1967.

EVANS, CLIFFORD. "The New World Formative Period." Archeological Society of Maryland, Annapolis, Maryland. April 1968.

EWERS, JOHN C. "Jean Louis Berlandier: A French Scientist Among the Comanche Indians in 1828." Conference on Travelers on the Western Frontier, Southern Illinois University, Edwardsville, Illinois. February 1968.

ST. HOYME, LUCILE E. "Geographical Differences in Bone Pathology." 66th Annual Meeting American Anthropological Association, Washington, D.C. December 1967.

STEWART, T. DALE. "Evidence of Human Behavior in the Fossil Record." 75th Annual Meeting of American Psychological Association. September 1967.

———. "Man, the Unique Cultural Animal." Scientific Research Society of America, Hercules Research Center, Wilmington, Delaware. October 1967.

———. "Shanidar Neanderthals." Trinity University, San Antonio, Texas. December 1967.

———. "Two Million Years of Man." Trinity University, San Antonio, Texas. December 1967.

———. "Recent Developments Bearing on Hominid Taxonomy." Paleontological Society, Washington, D.C. January 1968.

———. "Deforming and Operating on the Human Head in Prehistoric Times." Howard University, Washington, D.C. April 1968.

———. "Prehistoric Human Behavior—The Fossil Record." International Association of Torch Clubs, Washington, D.C. June 1968.

STURTEVANT, WILLIAM C. "The Florida Seminole: Ethnonymy and Ethnogenesis." Wenner-Gren Foundation Symposium, Burg Wartenstein, Austria. August 1967.

STURTEVANT, WILLIAM C. "Iroquois Ritual." Versions read to seminars at Institute of Social Anthropology, University of Oxford (November 1967), School of Oriental and African Studies, University of London (November 1967), Department of Anthropology, University of Cambridge (February 1968), Department of Anthropology, University College, London (February 1968), Universities of Beregn, Oslo, Stockholm, Göteborg, and Copenhagen (May 1968).

———. "Semiology and Material Culture." Versions read to seminars at Department of Anthropology, University College, London (March 1968), Institute of Archaeology, University of Oxford (March 1968), London School of Economics (May 1968), Universities of Bergen, Oslo, Stockholm, and Copenhagen (May 1968).

———. "History and Ethnography of Some West Indian Starches." Institute of Archaeology, University of London. May 1968.

———. "Seneca Music." Ethnomusicology Panel, Royal Anthropological Institute, London. June 1968.

TROUSDALE, WILLIAM. "Archaeological Exploration of Afghanistan." Archaeological Institute of America, New York, Detroit, Toledo, Columbus, and Cincinnati. February 1968.

VAN BEEK, GUS W. "South Arabian Archeology." Institute of Archaeology, University of London, London, England. December 1967.

———. Co-chairman (with Dr. I. E. Wallen) Symposium on "Underwater Archeology." Annual Meeting, Archaeological Institute of America, Boston, Massachusetts. December 1967.

———. "South Arabian Archeology." Department of Antiquities Staff, Government of Saudi Arabia, Riyadh, Saudi Arabia. June 1968.

WEDEL, WALDO R. "1967 Smithsonian Investigations in Central Kansas." Twenty-Fifth Plains Conference, St. Paul, Minnesota. November 1967.

———. "Trends and Projections in Plains Archeology." Twenty-Fifth Plains Conference, St. Paul, Minnesota. November 1967.

———. "Central Plains—Southwestern Contacts in Light of Archeology." Thirty-Third Annual Meeting of Society for American Archaeology, Santa Fe, New Mexico. May 1968.

WOODBURY, RICHARD B. "The Potentials of Archaeological Paleoecology." Society for American Archaeology, Santa Fe, New Mexico. May 1968.

BOTANY

AYENSU, EDWARD S. "Smithsonian Institution." University of Ghana, Legon, Ghana. October 1967.

———. "Biology of the Velloziaceae." University of Ghana, Legon, Ghana. November 1967.

———. Complex Vasculature in the Dioscoreaceae." College of William & Mary, Williamsburg, Virginia. February 1968.

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National Zoological Park

THEODORE H. REED, *Director*

PRACTICING GOOD ANIMAL HUSBANDRY, the National Zoological Park has sought throughout the year to make even better the splendid collection of animals which it now houses. Every effort was made to obtain mates for solitary specimens, and the resultant breeding records have been gratifying. The research program has been broadened, and the educational facilities offered to the public have been increased. The grounds, which for several years were torn up by new construction, have now returned to a green and parklike loveliness. Although unsettled civic conditions existed throughout the spring months, there were no incidents at the Zoo and the number of visitors was only slightly less than last year.

The Animals

The collection grew through births, gifts, purchases, and exchanges. The aim of the Zoo is to present a wide diversity of fauna and at the same time to build up herds of rare and endangered species whenever possible.

The animal department has been reorganized and is now known as the department of living vertebrates.

BIRTHS

This has been a most important year for births of rare and seldom-bred animals. In August the black rhinoceroses, Tony and Thelma, produced a fine male baby. Named Dillon in honor of S. Dillon Ripley,

Secretary of the Smithsonian Institution, he has proved to be one of the most popular animals in the Zoo, both with the public and with the employees.

In May, a Père David's deer gave birth to a male fawn. This species is on the "rare and endangered list" of the International Union for the Conservation of Nature, and the Zoo hopes to build up a sizable herd of these animals, which have long been extinct in the wild. The golden marmosets, which are also on the IUCN list, produced another set of twins. Other notable births included giraffe, pygmy hippopotamus, Nile hippopotamus, black-footed cats, a Gambian pouched rat, bushbabies, Patas monkey, black and spotted leopards, a golden cat, and a California sea-lion (which is being hand-raised).

Efforts of the bird division to mate up pairs, try out new diets, and furnish acceptable nesting conditions have paid off. There was a notable increase in the number of species hatched, despite the disruption of the bird house, which underwent a complete replastering, re-roofing, and repainting job, making it necessary to move birds frequently from one cage to another.

STATUS OF THE COLLECTION

30 June 1968

Phylum: *Class*	*Orders*	*Families*	*Species or subspecies*	*Individuals*
Chordata: Mammals	14	48	210	601
: Birds	22	78	417	1, 254
: Reptiles	3	29	259	743
: Amphibians	2	12	35	116
: Fishes	5	8	31	189
Arthropoda: Insects	1	1	1	15
: Crustaceans	1	1	2	126
: Spiders	1	1	1	2
Mollusca: Snails	1	1	1	30
TOTALS	50	179	957	3, 076

NOTE: Certain tabulated, statistical, and other information formerly contained in the report of the National Zoological Park in *Smithsonian Year* now appears as appendices to the Separate of this Report (available on request from the Director of the National Zoological Park). This information includes:

Visitor statistics and other operational information.

Report of the Veterinarian, augmented by case histories and autopsy reports.

Complete lists of (a) animals in the collection on 30 June 1968; (b) all births and hatchings during the year; and (c) changes in the collection by gift, purchase, or exchange.

One-day-old Masai giraffe Donna and mother Marg. This baby was born 2 February and named for Mrs. Gilbert M. Grosvenor.

Two black-footed cats *(Felis nigripes)* hand-reared in the Zoo's animal hospital, at two months of age.

The first Père David deer birth at the National Zoo, was a male, born on 9 May.

Boat-billed herons hatched for the first time in the Zoo's history on 3, 7, and 9 April.

A young female patas monkey *(Erythrocebus patas)* born and reared during the year.

The hatching of 4 bare-throated tree partridges (*Arborophila brunneopectus*) is believed to be a "first" breeding record. In addition there were 4 kookaburras, continuing the seven-year breeding record for this species, as well as 32 crested green wood partridges (*Rollulus roulroul*), 3 boat-billed herons, 10 Hawaiian ducks, 10 hoopoes, and 11 black-necked swans.

A noteworthy birth in the reptile division was that of five tentacled snakes (*Erpeton tentaculatum*). Although none of the young lived longer than 14 days, this is believed to be the first record of the species being born in captivity.

GIFTS

A gift of nine kangaroos and a wallaby from the Australian government was formally presented to the National Zoological Park by Australian Ambassador John Keith Waller on 9 November. These kangaroos had been in the Australian pavilion at Expo 67 in Montreal. It is nearly ten years since the Zoo last exhibited the red kangaroo, and the "mob," as a group of kangaroos is called, makes a most attractive exhibit.

Also originating in Australia, was another gift, ten gray-headed fruit bats (*Pteropus poliocephalus*) from Knut Schmidt-Nielson of Duke University. These large, impressive bats are currently being housed in a glass-fronted cage in the small mammal house. Schmidt-Nielson also deposited a pair of echidnas at the Zoo.

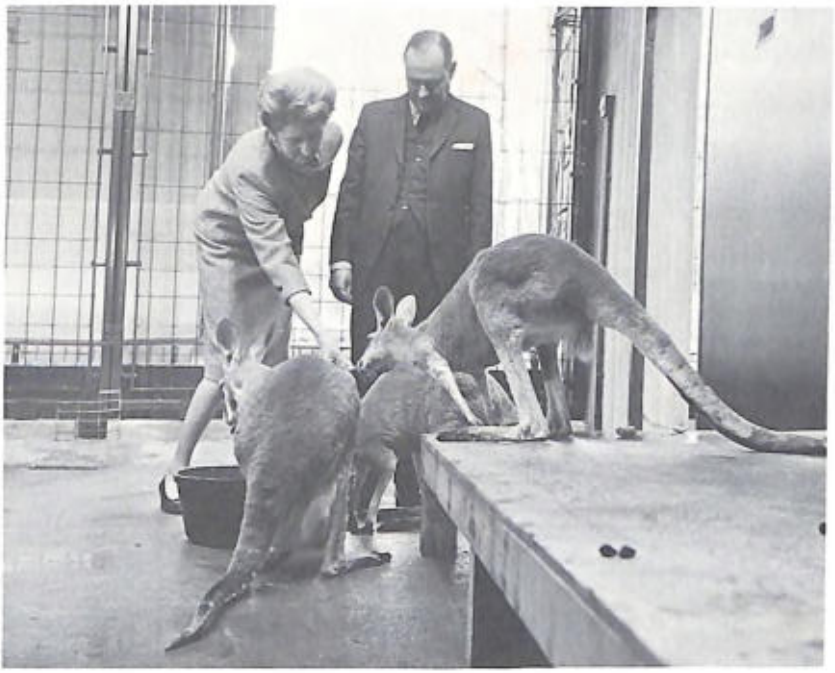
A colorful collection of finches and other small cage birds was received from Cornelius Zwenners of McLean, Virginia, and a contribution of $125 toward the animal purchase fund was gratefully received from *Reader's Digest*.

PURCHASES

When buildings were completed for delicate-hoofed stock, the Zoo began to add to its antelope collection, which had never been large because of lack of suitable quarters. With the acquisition of a female greater kudu, there is now a fine pair with excellent breeding prospects. Three Mrs. Gray's waterbuck were ordered, and while they were in the quarantine station at Clifton, New Jersey, one of the females produced a fawn—an unexpected bonus for the Zoo.

A trio of the rare and beautiful scimitar-horned oryx was acquired during the year. These animals, listed by the IUCN as rare and endangered species, are also in the new delicate hoofed-stock area.

Other purchases of note were four rare South American rodents called pacaranas, a pair of Geoffroy's cats, two linsangs, and six white-checked gibbons.



On 9 November the Ambassador from Australia John Keith Waller, C.B.E., formally presented a group of nine red kangaroos and one wallaby to the National Zoological Park, a gift to the people of the United States from the Commonwealth of Australia. Here, in the hoofed-stock building, Mrs. Waller offers a tidbit to one of the kangaroos while the Ambassador looks on.

Two of the Zoo's trio of scimitar-horned oryx *(Oryx tao)* graze contentedly in their outdoor paddock.

Photo by Mary M. Krug

A female cheetah was acquired to replace one that died last year, and the Zoo now has a pair of these beautiful, long-legged cats. Other purchases were a female caracal, male spectacled bear, bush dogs, and crab-eating fox. The so-called puma house had not displayed pumas for many years, but a young pair was obtained and the name of the building is now justified.

The bird collection was enriched by the purchase of macaroni penguins, hooded cranes, giant coots, a pair of resplendent quetzals, several species of hummingbirds, tawny frogmouths, and many others.

Purchases for the reptile division included a group of Old World vipers, a beaked snake, and Smyth's water snake.

EXCHANGES

In order to improve breeding potentials in the National Zoo and in other zoos throughout the country, animals are occasionally exchanged. The most interesting exchange this year was the gorilla – orangutan trade with Yerkes Regional Primate Research Center. The Zoo needed a female companion for young Atjeh, the first orang born in Washington. Yerkes wanted a young gorilla. Accordingly, Inaki, the third gorilla baby born at the National Zoo, was exchanged for Seriba, a delightful young female orang. The young animals involved all seem quite happy with this arrangement, and Seriba and Atjeh became friends at once.

An exchange with the zoo in Melbourne, Australia, netted the National Zoo four mainland wombats, three species of Australian lizards, and some Australian snakes, including the diamond python, amethystine python, and carpet python.

REMOVALS

Dennis, the pixyish young orangutan that was confiscated at Dulles Airport on 25 February 1967, under a Federal law prohibiting black market trade in wild animals, left on 27 September for his permanent home in the Henry Doorly Zoological Gardens in Omaha, Nebraska. The Omaha zoo was selected by the Wild Animal Propagation Trust as having suitable facilities for breeding these red-haired apes which are in danger of extinction in the wild. The Omaha zoo has four female orangs and needed a young male.

A Siberian white crane (*Grus leucogeranus*), which arrived in the Zoo as a young adult in 1906, was found in the bird house on 19 March with a compound fracture of the left leg. The leg was set, but the bird succumbed to shock and old age on 22 March. An autopsy showed that "Old Pops" as he was affectionately known, was a female. She had lived in captivity for 61 years, 8 months, and 25 days.

A sad event was the death of famous old "Pops" (left) the Asiatic white crane *(Grus leucogeranus)* on 22 March. This remarkable bird was received as a young adult on 26 June 1906 and lived at the National Zoological Park 61 years, 8 months and 25 days. As far as can be determined, Pops holds the world's longevity record for cranes in captivity. Right: Orang Atjeh, born here 2 April 1966, received a fine present a month before his second birthday—a companion and future mate, Seriba. Two months younger than Atjeh, Seriba was received from the Yerkes Regional Primate Research Center in exchange for Inaki, the third gorilla born at the National Zoo.

The Colombian red-eyed cowbird (*Tangavius armenti*) died on 28 December 1967, after 11 years and 15 days in captivity. At the time this bird was purchased from an animal dealer in Rockville, Maryland, this species had not been seen alive for a hundred years and was presumed to be extinct. As far as is known, there are no other specimens in captivity and no ornithologist has reported seeing them in Colombia.

Deaths occurred among animals that had been in the collection for so many years that they may have established longevity records. A female linsang that died in August had been in the collection for 9 years, 3 months and 27 days; this animal is so rare in collections that no longevity is recorded for it. Another old resident that died during the year was a slender-tailed cloud rat, which established a longevity record of 13 years, 8 months, 6 days. A Florida spiny softshell (*Trionyx ferox*) received 18 December 1930, died 15 September 1967, having been in the Zoo 36 years, 8 months, 28 days. A grison received 25 March 1958, died 24 July 1967, after 9 years, 4 months; and a cotton-top marmoset, received 26 November 1958, lived until 14 July 1967—8 years, 7 months, 17 days.

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ANIMAL-COLLECTING TRIPS

Three collecting trips were undertaken by members of the department of living vertebrates to various parts of the country. Kerry Muller, manager of the division of birds, went to Cold Bay, Alaska, to trap waterfowl in conjunction with the Fish and Wildlife Service in Alaska. Through their combined efforts, the Zoo obtained 10 Steller's eiders and it is believed that these may be the only ones at present in captivity, with the possible exception of some at Slimbridge Wildfowl Trust in England.

In March, Muller and headkeeper of birds Broderick McCrossin, participated in a duck-trapping program on Rhodes River adjacent to the Chesapeake Bay Biology Station at Java Farms. More than 700 ducks were trapped, the majority being banded for the Fish and Wildlife Service and released. Some desirable specimens were retained for the Zoo's collection, notably old squaw and bufflehead ducks.

During early April, four members of the animal department participated in a two-week reptile collecting trip to Florida. William Xanten, Jack Armstrong, Mario DePrato, and Lee Schmeltz collected over 170 specimens of reptiles and amphibians; they also visited several zoos, including Crandon Park, Miami Seaquarium, and Busch Gardens.

MIXED EXHIBITS

The department of living vertebrates continued to show mixed groups of animals. Among the more startling is a small group of cotton-top marmosets to be seen cavorting in branches suspended above the pygmy hippopotamus pools in the elephant house. They are allowed to roam the whole area unrestricted by bars, and leap gracefully from branch to branch. In the same building white cattle egrets wander among the rhinos in a natural relationship, just as they do in Africa. A mixed exhibit in the bird house has streaked tenrecs in the same cage as falconets and frogmouths. Blue spiny lizards are shown in the desert bird exhibit. These community groups have great interest for the public as well as for the keepers.

Research

Further diversification of the research program at the National Zoological Park has been made possible by the construction of an additional room in the basement of the lion house in which several caviomorph rodents are now housed, as well as the acquisition of additional cage facilities in one of the two rooms on the top floor of the reptile house.

During the first part of October, John Eisenberg flew to Ceylon for his quarterly inspection of the Smithsonian elephant project and to conduct for members of the Ceylonese Wildlife Management Department a three-week training course on the immobilization of wild elephants. Ths was a joint effort between Eisenberg and Zoo veterinarian C. W. Gray.

On 4 January, Dr. Paul Leyhausen of the Max Planck Institut at Wuppertal, Germany, arrived for a month's stay, during which he and Eisenberg conducted observations on the predatory behavior of several species of viverrids. In addition, films were made of the prey-catching behavior of the dasyurid marsupial *Dasyuroides byrnei.*

On 21 April, L. Collins, who had earlier joined the staff as animal keeper, was promoted to administrative assistant in order that he might assume responsibility for the department and continue the research projects when the resident scientist departed for Ceylon in June.

During the past year Eisenberg conducted seminars at the University of Michigan, Ann Arbor; University of Maryland, College Park; and Johns Hopkins University, Baltimore. He also presented papers at the American Association of Zoological Parks and Aquariums meeting in Tampa, Florida, and at the New York Academy of Sciences Conference in New York City. In addition, during the spring semester at the University of Maryland Graduate School he taught a course, entitled "A Review of Primate Ecology and Behavior Studies."

One of the Scientific Research Department's rarest species, a moon rat or Malayan gymnure, *Echinosorex gymnurus*. Since its arrival 10 July 1967 this insectivore has been thriving on a diet consisting of a mixture of horsemeat, vitamins, canned cat food, and egg, plus mice and fish fillets.

Several research projects are currently being undertaken at the Zoo in addition to the overseas projects in Ceylon.

Among the research projects currently underway are two, in Ceylon, of which the administrator and principal investigator is J. Eisenberg, who departed 10 June to begin a year's residency in that country. The first, initiated in January 1967, is a study of the behavior and ecology of the Ceylonese elephant. Working with Eisenberg on this project are H. K. Buechner, the co-principal investigator, and F. Kurt and G. McKay. The second project is an investigation of the comparative ecology and behavior of Ceylonese primates. Suzanne Ripley is co-principal investigator and G. Manley and N. Muckenhirn are presently working on it.

Other current research projects are:

1. Studies of predatory behavior of the Viverridae (with C. Wemmer).
2. Studies on the social behavior and on the ontogeny of behavior among selected species of caviomorph rodents (with N. Smythe).
3. Studies on the climbing ability of *Microgale* (with J. McAulay).
4. Studies on the hand raising and maturation of *Setifer* and *Tenrec* (with N. Muckenhirn).
5. Studies on the general behavior of *Macaca sylvana* (with W. Dittus).
6. Studies on the learning ability of *Microgale* (with M. Linnet).
7. Studies on the reproductive behavior in *Cannomys badius* (with A. Miller-Baker).
8. Studies on the predatory behavior of *Tenrec,* including filming of selected series (with E. Gould).
9. Studies on thermoregulation in tenrecs (with A. Underhill and B. Myton).
10. Studies on the reproduction and maturation in *Proechimys* (with E. Maliniak).
11. Studies on the reproductive behavior and maturation in the dasyurids (with L. Collins).
12. Studies on the gestation period in the Rodentia, Marsupialia, and Insectivora (with A. Miller-Baker, E. Maliniak, and L. Collins).
13. Studies on the reproductive behavior of *Solenodon paradoxus* (with E. Maliniak).

The following paper originating in the scientific research department was published:

EISENBERG, J. F. "A Comparative Study in Rodent Ethology with Emphasis on Evolution of Social Behavior, Part I." *Proceedings of the U.S. National Museum,* vol. 122, no. 3597, 51 pp.

Conservation

Wildlife conservation, with special emphasis on species threatened with extinction in the wild state, is a primary consideration in management of the Zoo's collection, in its scientific and educational programs, and in its commitments to national and international conservation activities.

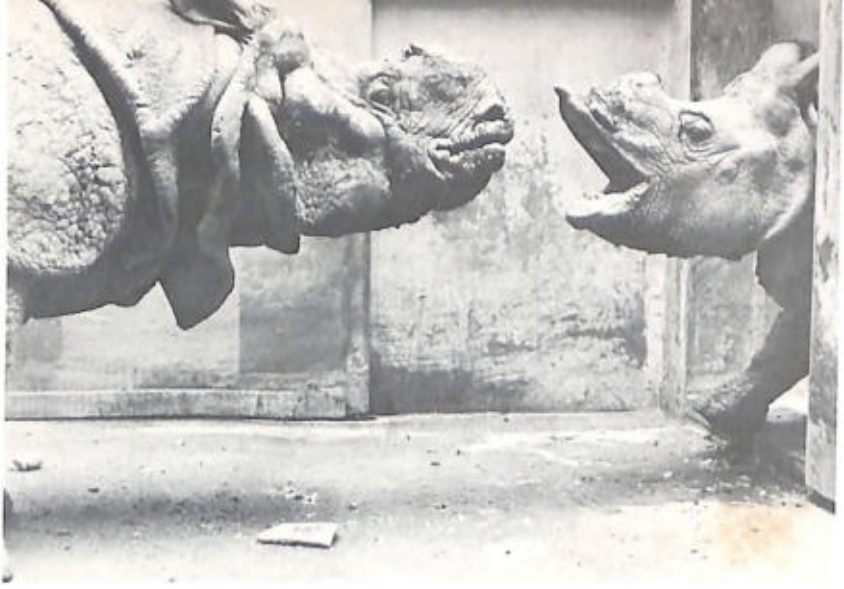
The director was re-elected president of the AAZPA's Wild Animal Propagation Trust, a group that promotes and coordinates the captive breeding of endangered species. Its principal aim is to allocate responsibilities for such species among qualified zoos in order to avoid duplication of effort and neglect of some species, and its specialist committees have had considerable success in arranging inter-zoo exchanges and loans of animals so as to bring pairs of breeding age together. Père David's deer and the golden marmoset are among the species for which the National Zoo has accepted responsibility. A series of cages have been redesigned to provide optimum conditions for an increasing number of the marmosets.

The Zoo has not been successful in obtaining funds to develop the available Smithsonian-owned land at Belmont as a breeding farm. During the year, a friend of the Zoo offered to make private land available for this purpose, providing the necessary facilities and support. A tentative agreement was reached, and it is hoped that the first animals will be transferred to this pilot project shortly.

For the third successive year, the Zoo conducted for the American Association of Zoological Parks and Aquariums the annual census of endangered species. It covers all North American animal collections and provides data essential to coordinated management of these species.

The assistant director was invited to membership in the Survival Service Commission of the International Union for the Conservation of Nature and Natural Resources. This international strategy group seeks to develop and apply specific plans benefiting individual endangered species, chiefly in their native habitats. It is frequently consulted by governments in the planning and administration of wildlife parks and preserves, and also advises the World Wildlife Fund in its grants for wildlife research and preservation. The assistant director met with the group in April at Bariloche, Argentina.

The assistant director continued as chairman of the AAZPA subcommittee on endangered species. One of the most promising developments of the year was Congressional consideration of the Lennon bill (H. R. 11618) which would enable the Secretary of the Interior to regulate importations of endangered wildlife species, as well as their hides and furs, and to regulate interstate traffic in native species protected by state laws. Hearings were held by the House Committee on Merchant



Although our Indian rhinos Tarun and Rajkumari had been living in adjoining cages almost since Raj's arrival as an 8-month-old calf in December 1963, it was felt that she was too young to be introduced to the mature male before this spring. As far as Rajkumari was concerned, it was definitely NOT love at first sight. . . .

. . . but after a week or two, Tarun was obviously transforming into a prince. (Photos courtesy *The Washington Post:* Top, Ken Feil, bottom, Arthur Ellis.)

Marine and Fisheries, at which Lee Talbot read a statement by Secretary Ripley endorsing the legislation. Zoo Director Reed also testified for the Wild Animal Propagation Trust, and submitted a statement by William G. Conway (then president of the AAZPA), favoring enactment.

Information and Education

During fiscal year 1968 the information-education section continued its signing and labeling program, as well as providing editorial and graphic arts services and assistance in planning special Zoo events. The section assisted with press, radio, and television coverage of Zoo activities on more than 77 occasions, and disseminated natural history and Park information by telephone and correspondence. For groups of handicapped children, visiting schools and colleges, personnel from other zoo's and museums, and special guests and dignitaries, 46 guided tours were conducted.

The section also cooperated with the Friends of the National Zoo in a number of projects, principally in training groups of volunteer docents or tour guides.

African black rhino Thelma keeps a watchful eye on her (and the Zoo's) first-born rhinoceros, Dillon, named for Smithsonian Secretary S. Dillon Ripley.

Friends of the National Zoo

This was another busy and productive year for the Friends of the National Zoo. Publication of the newsletter, *Spots and Stripes,* was continued, and the Friends assisted the Zoo in two "preg watches"—for Dillon the rhino and Donna the giraffe.

A children's art exhibit, commemorating the opening of the National Collection of Fine Arts, sponsored and organized by the Friends, consisting of 155 colorful and imaginative paintings on the theme "Animals and Zoos" was displayed in the hoofed-stock buildings.

The board of directors formed a permanent new scientific research committee to keep abreast of and support, wherever possible, Zoo research activities.

Under the supervision and guidance of the Zoo, an animal-feeding program was begun to permit visitors to purchase proper and nutritious food for the bears, monkeys, and sea lions.

The Friends' education committee revised their educational aid packets on the Zoo for elementary school teachers and in addition initiated their first docent program. Seventeen trained volunteers now offer guided tours of the Zoo to organized educational groups, and a second training program for tour leaders was begun on 20 June. An active drive during the year more than doubled membership to a total of over 1,000.

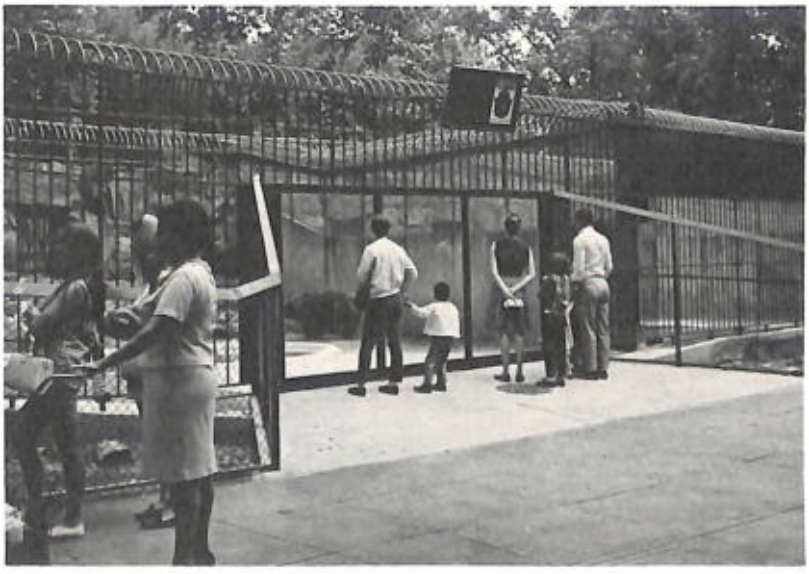
Construction and Improvements

On 12 October the new Harvard Street overpass was opened to pedestrian and vehicular traffic, thus completing a project the National Park Service began in 1962. It spans the bridle path, parking lot, Rock Creek, and the relocated boundary fence of the Zoo, and then joins the internal visitor road system of the Park. This was the final step in the work involved in relocating Beach Drive, which included the tunnel under Administration Hill and changing the course of Rock Creek. Gates are approximately at the Zoo boundary line, over the parkway property onto the Zoo property. It is esthetically pleasing and of modern design, and gives easy access and a pleasant approach to the Zoo from Harvard Street.

For a number of years the Forest Service had been encouraging school children to contribute their nickels and dimes to a fund to build a new home for Smokey Bear, internationally known symbol of forest-fire prevention. While Smokey remains in the same cage, there is a dramatic new front consisting of a crash-proof picture window of three panes, each 4 by 6 feet. These are laminated of two outer layers of ¼-inch

The new Harvard Street bridge spanning Rock Creek Parkway provides local traffic and pedestrians with easy access to the south end of the Zoo.

Smokey Bear's remodeled cage, completed 18 April 1968, has a wide expanse of heavy-duty glass (with plexiglas core) that enables visitors to view and photograph Smokey and Goldie with safety almost eyeball to eyeball.



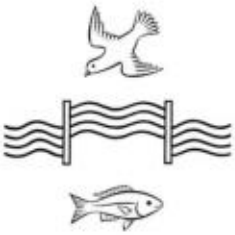
tempered plate glass, between which is a ¼-inch plexiglas panel. This is the only barrier between Smokey and his admirers, and in the Zoo's remodeling program this technique will be used in displaying many of the large carnivores, such as lions and tigers, as well as great apes.

Remodeling of the bird house was completed. With new planting and decoration it looks even lovelier than before.

Planning is continuing on the multi-climate house to be built between the site of the old antelope house, an 1898 structure demolished this year, and the small mammal house. Construction of the hospital-research center was started on 10 June under a 14-month contract.

Smithsonian Tropical Research Institute

MARTIN H. MOYNIHAN, *Director*



THE SMITHSONIAN TROPICAL RESEARCH INSTITUTE continued its work in the fields of research, education, and conservation with the ultimate objective of obtaining information that will explain why tropical biotas and environments are different from those of other regions. We are still very far from solving this problem, but the question is important. It also is becoming increasingly urgent. The answers (and they will certainly be multiple) not only will be interesting from a theoretical scientific point of view, but should provide baseline information for intelligent planning of human activities and for management of environments in large parts of the world.

The present phase of bureau activities began only a few years ago with a modest expansion of the scientific staff and facilities. It is gratifying to see that this is now producing accelerated results. The number of scientific papers and reports has increased substantially. The numbers of visiting scientists and students has grown, and it has become possible to design and initiate cooperative projects involving multiple investigations of a particular subject by different specialists using different techniques. Among these subjects are the effects and implications of seasonality and climatic fluctuations in the tropics, and the possible biological consequences of the construction of a sea-level canal between the Atlantic and Pacific Oceans in Panama or some adjacent country.

Simply because the expansion has been so successful, however, it also is necessary to "take stock" and to consider further developments in detail. Thus, the last twelve months have been a period of re-assessment of the past and planning for the future.

In this process, an ad hoc advisory committee of distinguished university scientists was invited to Panama to review the operations of the Institute. It endorsed past policies, and suggested that they be extended into new areas and problems as soon as opportunity permits.

Plans were drawn up to increase the administrative capability of the bureau. A new building is being acquired in Ancon, Canal Zone, where the administrative and support services for all the laboratory and field studies will be centralized. Operations in various parts of South America and the islands of the Caribbean will continue. The first investigations in the Old World Tropics will begin in July 1968 and will be concentrated in the Ivory Coast, Madagascar, India, and New Guinea.

Research

The research activities of the bureau include both the studies of staff scientists, interns, and fellows, and those of visiting investigators from other institutions. The following tabulation shows the number of visitors, roughly divided into academic categories, for whom the bureau provided appreciable support during the past fiscal year.

Senior scientists	137
Graduate students	74
Undergraduate students	44
Secondary school students	113
Amateur biologists and members of natural history groups	108
Nonscientific	91
Total	567

The scope of the research by visiting scientists was quite broad. Some examples are cited below.

As part of a long-term analysis of the accumulation of insecticide and other chlorinated hydrocarbon residues in marine environments, Robert W. Risebrough of the University of California measured the amounts of these substances present in the eggs of several species of seabirds nesting on islands in the Bay of Panama. The amounts were correlated with the breeding success of the species involved. Such data may facilitate prediction of the effects of common environmental pollutants upon other organisms.

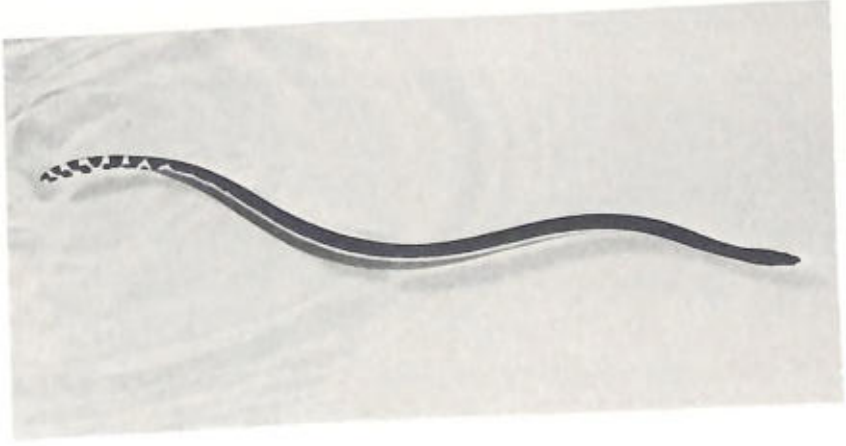
The factors regulating reproduction in lizards continued to be the subject of investigation by Owen J. Sexton, and his associates and students, from Washington University. Their studies indicate that many species are surprisingly "vulnerable." Tropical areas may have relatively stable temperature schedules, but variations in rainfall and other features

may impose severe stresses, with possibly catastrophic effects, upon some animal populations.

David Chivers of Cambridge University came to Barro Colorado Island to observe howler monkeys (*Alouatta*) and to develop new techniques which can be applied to the study of primates in Malaya and other areas of southeast Asia.

Through a cooperative program sponsored by the United States Air Force, the Institute was able to invite seven scientists to visit Panama, to determine the feasibility of new kinds of research in the Tropics and to initiate certain pilot projects. Robert J. Menzies of Florida State University transported a variety of marine invertebrates through the freshwaters of Gatún Lake, and proved that some of them survived rather better than might have been expected. He also obtained viable F_1 offspring from a cross between Atlantic and Pacific populations of a marine isopod *Limnoria*. Max Hecht of the City University of New York studied the ecology and behavior of the highly poisonous sea snake *Pelamis*. This animal represents a very distinctive adaptive type which is common in the Pacific but, as yet, absent in the Atlantic. Both Menzies' and Hecht's studies were highly relevant to the problems which may be posed by the proposed sea-level canal. Amyan MacFadyen of the University of Ulster made detailed analyses of the microfauna of the forest floor on Barro Colorado Island, and demonstrated that decomposition rates of organic matter are quite different in the Neotropics and the Temperate Palaearctic. Guy Bush of the University of Texas collected certain parasitic insects of economic importance for subsequent cyto-

The sea snake *Pelamis platurus* showing characteristic swimming movement in one of the concrete study tanks at Naos Island.



genetic analysis. Arturo Gomez Pompa from the University of Mexico compared the floras of northern and southern Central America. William Rand of the University of California has come to the Institute to assist in the development of mathematical techniques and models.

The staff has continued to concentrate on aspects of evolution, ecology, and behavior, combining experimental analysis in the laboratory with observations in the field under natural conditions. This is the most obvious, and still the most productive, method of tackling the major problems of tropical biology.

Moynihan continued studies of the evolution of social behavior among passerine birds and primates in Panama, Costa Rica, the Andes, and the upper Amazonian region. Special attention is being paid to communication systems and the factors regulating contacts and competition between species. It has become evident that many variations in social behavior are direct adaptations to certain geographic and ecological parameters of the areas inhabited.

Robert L. Dressler has made further progress in his investigations of the relations between orchid flowers and the euglossine bees which help to pollinate them. Working in collaboration with C. H. Dodson of the University of Miami, he has been able to identify some of the volatile substances produced by the flowers and to test their effects upon the bees in the field. This has facilitated analysis of the evolution of isolating mechanisms.

Peter W. Glynn pursued his studies of the ecology of coral reef communities in Puerto Rico and began similar work in Panama. He also analyzed seasonal and annual cycles of chitons in Panama and Puerto Rico, and growth rates in various littoral and benthic invertebrates in the same regions and along the coast of Venezuela. He has been particularly interested in the effects of the upwellings of cold water which are characteristic of some areas, such as the Bay of Panama, at certain periods of the year.

A. Stanley Rand made a detailed analysis of "colonial" nesting in a population of iguanas on Barro Colorado Island. This behavior is unusual among reptiles and may represent an early stage in the evolution of gregariousness. Work on vocal communication in the frog *Engystomops pustulosus* revealed that the males encode information about their position in different ways according to the proximity and number of potential rivals. This may help to explain several previously puzzling features of the calling behavior of other tropical Anura. Rand also attended the International Biological Program conference in Caracas, Venezuela.

Continuing his studies of predator-prey interactions, Michael Robinson found that the spider *Argiope argentata* can discriminate be-

One of Peter Glynn's study areas off southwest Puerto Rico showing the coral *Montastraea annulata.*

An unusual breeding aggregation of iguanas studied by Stanley Rand.

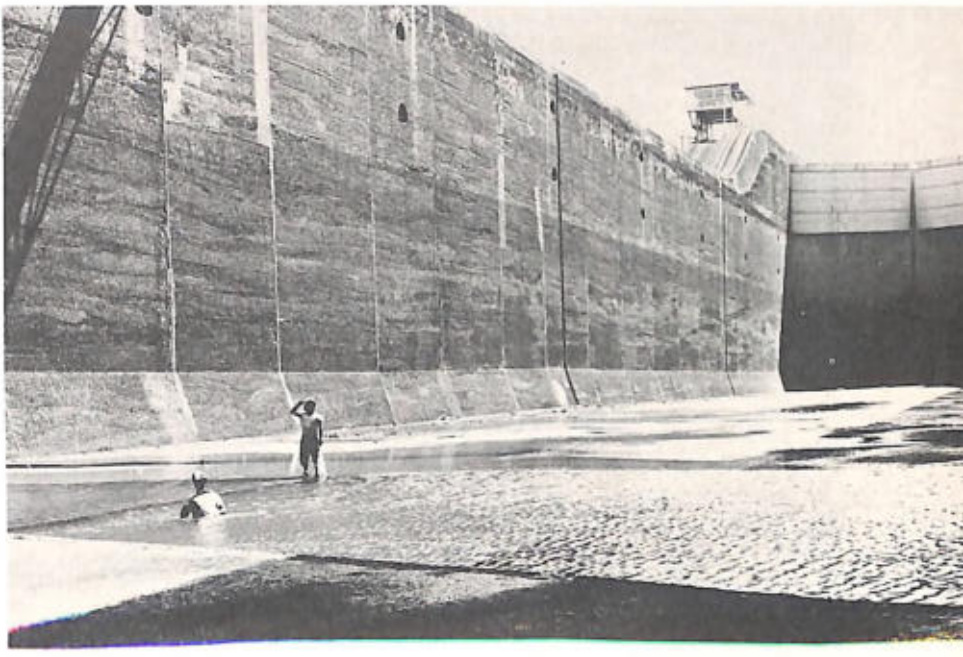
tween Lepidoptera (moths and butterflies) and other insects caught in its webs. Lepidoptera are restrained immediately by biting, while other insects are wrapped in silk. The discrimination seems to be based on the surface characteristics of the prey rather than on size, weight, or type of web vibration induced. This behavior is highly adaptive, as moths and butterflies are much more likely to escape from webs (by shedding the scales on their wings) than are other insects.

Ira and Roberta Rubinoff made a discovery which further emphasizes the fact that even the present (lock and freshwater) Panama Canal is not a complete barrier to the movement of marine organisms from one ocean to the other. They found that the Atlantic goby *Lophogobius cyprinoides* has successfully invaded a small area on the Pacific coast. The invasion may have been facilitated by special factors. The important point, however, is that the invading population is reproducing itself in its new environment. This seems to be a first record for the Panamanian region. The Rubinoffs also continued their studies of isolating mechanisms in fish and, with the help of research assistant Peter Delmonte, developed new techniques for culturing and raising the larvae of several marine gobies.

Neal G. Smith extended his studies of brood parasitism in birds. He is now investigating hormonal control of egg color and pattern in those species of parasites which are polymorphic for these features.

Three postdoctoral research associates were in residence last year. Howard W. Wright finished his studies of grapsoid crabs and the breeding of *Tylosurus* fishes. He was the first person to follow the complete course of embryological and larval development in these fishes. His data are of interest in connection with the evolution of the cleidoic egg. Christopher C. Smith measured the food assimilation rates and time and energy budgets of howler monkeys (*Alouatta*). It would appear that the characteristic social organization of these animals permits a significant reduction of certain motor activities, thus "freeing" more energy for assimilating difficult-to-digest foods such as leaves. Robert E. Ricklefs has compared the breeding strategies of temperate and tropical birds, relating seasonality of nesting to food availability and climate. He also discovered a previously unnoticed connection between variation in clutch size and nestling growth rates.

Jose Olazarri of Uruguay worked on Barro Colorado Island under the auspices of the joint Smithsonian-Organization of American States cooperative program. He collaborated with biologist Michael H. Robinson on studies of spider behavior, analyzed the social reactions of spiny rats (*Proechimys*), and completed a list of the species of mollusks occurring on the island.



The cleaning of the Gatun Locks of the Panama Canal enabled STRI scientists (left, foreground) to census the lock's marine fishes.

Working from a ladder with a long aluminum pole, Neal Smith was able to remove the nests of oropendolas and caciques, examine and manipulate their contents, and to replace the nests in the colony tree.

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One of M. Hladik's study animals, the tamarin *Saguinus geoffroyi*, manipulates food.

Visiting fellow Thomas Croat, of the Missouri Botanical Garden, has begun to prepare a new Flora of Barro Colorado Island. The need for this has become increasingly evident in recent years. Not only has the vegetation of the island changed since the last Flora was written, but nonbotanical scientists want to be able to identify from materials such as fruits and other vegetative structures of plants which were largely ignored in previous guides. The new version, which will be designed to permit this, is expected to be completed in three years.

Predoctoral interns and associates also conducted a variety of research projects.

Bruce Haines of Duke University studied the ecological effects of the leafcutting ant *Atta columbica* on tropical forests. Colonies of this ant throw out dead individuals and used leaf debris on special "dump heaps" that represent localized accumulations of mineral nutrients. It might be expected that these would also stimulate localized increases of plant growth, but this does not seem to be the case. Haines found that dumps show decreased rather than increased vegetation cover partly because of the inability of seedlings to cope with the dry season moisture stresses caused by the low water-holding capacity of dump soils, but more importantly because seedlings apparently cannot compete successfully with nearby adult trees whose roots quickly enter and preoccupy the dumps.

Robert Topp of Harvard University investigated ecological interactions among thirteen species of Pomacentrid fishes along both the Atlantic and Pacific coasts of Panama. He found a very considerable amount of food and habitat differentiation, and analyzed the adaptive significance of morphological modifications in food processing structures.

Several long-term projects were completed during the past year. Nicholas Smythe of the University of Maryland finished a two-year study of two large, ungulate-like, caviomorph rodents, the agouti *Dasyprocta punctata* and the paca *Agouti paca*. John R. Oppenheimer of the University of Illinois wrote his doctoral thesis on the behavior of the capuchin monkey *Cebus capucinus*. Some of the reactions of this species are particularly complex. Primates also were the subject of Claude Marcel Hladik of the Laboratoire d'Écologie of the Muséum National d'Histoire Naturelle in Paris. He correlated feeding habits with microstructures of the intestinal gut, and found that the intestinal mucosa adjusts, morphologically and histochemically, with surprising rapidity to changes in type of food consumed. Annette Hladik's studies of the flowering and fruiting times of the tree *Didymopanax morototoni*, a species whose fruits are favored by several monkeys, were a useful complement to her husband's work. Martin Naumann of the University of Kansas finished

BARRO COLORADO ISLAND, CANAL ZONE

ANNUAL RAINFALL 1925–1967

Year	Total inches	Station average	Year	Total inches	Station average
1925	104. 37		1947	77. 92	107. 49
1926	118. 22	113. 56	1948	83. 16	106. 43
1927	116. 36	114. 68	1949	114. 86	106. 76
1928	101. 52	111. 35	1950	114. 51	107. 07
1929	87. 84	106. 56	1951	112. 72	107. 28
1930	76. 57	101. 51	1952	97. 68	106. 94
1931	123. 30	104. 69	1953	104. 97	106. 87
1932	113. 52	105. 76	1954	105. 68	106. 82
1933	101. 73	105. 32	1955	114. 42	107. 09
1934	122. 42	107. 04	1956	114. 05	107. 30
1935	143. 42	110. 35	1957	97. 97	106. 98
1936	93. 88	108. 98	1958	100. 20	106. 70
1937	124. 13	110. 12	1959	94. 88	106. 48
1938	117. 09	110. 62	1960	140. 07	107. 41
1939	115. 47	110. 94	1961	100. 21	106. 95
1940	86. 51	109. 43	1962	100. 52	107. 07
1941	91. 82	108. 41	1963	108. 94	107. 10
1942	111. 10	108. 55	1964	113. 25	107. 28
1943	120. 29	109. 20	1965	92. 80	106. 91
1944	111. 96	109. 30	1966	111. 47	106. 80
1945	120. 42	109. 84	1967	85. 88	106. 40
1946	87. 38	108. 81			

COMPARISON OF 1966 AND 1967 RAINFALL

[In inches]

Month	Total		Station average	Years of record	1967 excess or deficiency	Accumulated excess or deficiency
	1966	1967				
January	3. 23	0. 49	2. 22	42	−2. 74	−2. 74
February	0. 15	0. 51	1. 26	42	+0. 36	−2. 38
March	0. 44	0. 52	1. 13	42	+0. 08	−2. 30
April	3. 20	4. 38	3. 50	43	+1. 18	−1. 12
May	6. 88	6. 28	10. 78	43	−0. 60	−1. 72
June	13. 65	13. 54	10. 96	43	−0. 11	−1. 83
July	9. 27	8. 74	11. 50	43	−0. 53	−2. 36
August	14. 17	10. 94	12. 44	43	−3. 23	−5. 59
September	9. 93	6. 98	10. 26	43	−2. 95	−8. 54
October	12. 81	11. 87	13. 63	43	−0. 94	−9. 48
November	23. 72	15. 15	18. 09	43	−8. 57	−18. 05
December	14. 02	6. 48	10. 50	43	−7. 54	−25. 59
Year	111. 47	85. 88	106. 40		−25. 59	−20. 52
Dry Season	7. 02	5. 90	8. 11		−1. 12	−2. 21
Wet Season	104. 45	79. 98	98. 16		−24. 47	−18. 18

the field part of his analysis of the behavior and ecology of wasps of the genus *Protopolybia*. This revealed several characters, including caste distinction and differential oöphagy, previously unknown in social wasps.

It should also be mentioned that graduate and undergradute summer assistants have worked, or are working, on such subjects as the social organization of the collared peccary (*Tayassu tajacu*), the development of "neurotic" behavior patterns in captive capuchin monkeys, and the distribution of nitrogen in marine invertebrates.

Education

The educational efforts of the Institute are not confined to helping and guiding university visitors and resident interns, assistants, and research fellows. Secondary school students from the Republic of Panama are encouraged to visit the bureau facilities, especially Barro Colorado, in the hope of stimulating this interest in natural history and conservation. Various forms of assistance have been lent to the University of Panama. The regular series of research seminars of the Institute are open to all interested persons from the local community. As an experimental innovation last year, Robinson organized an adult education course in animal behavior in which several members of the staff participated. This was highly successful and very well attended.

It certainly would be desirable to expand such activities. Unfortunately, however, the Institute has for the moment about reached its capacity in this area. Thus, it will be necessary to make a special effort to obtain more funds and equipment (and space) for additional educational programs in the near future.

Acknowledgment

The Smithsonian Tropical Research Institute can operate only with the excellent cooperation of the Canal Zone Government and the Panama Canal Company, the United States Army and Navy, and the government authorities of the Republic of Panama. Thanks are due especially to General Robert W. Porter, Jr., Commander United States Armed Forces, Southern Command; Executive Secretary of the Canal Zone Paul M. Runnestrand and his staff; Lieutenant Colonel Jack G. Null, Post Commander, Fort Amador, Canal Zone; the customs and immigration officials of the Canal Zone; the Dredging Division and Police Division of the Panama Canal Company; Commander James Cox, Commanding Officer, Naval Security Group; the United

States Army Maintenance Division; Dr. R. C. Pearson, Canal Zone Veterinary Hospital; the officials of the Cristobal High School; and C. C. Soper of Eastman Kodak Company.

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Radiation Biology Laboratory

WILLIAM H. KLEIN, *Director*

THE LIFE CYCLES OF ORGANISMS ARE intricately associated with the environmental signals which influence their morphological and physiological development mechanisms. Growth and development of higher plants are regulated and controlled by solar radiant energy, a major factor of the environment, in two general ways: by the conversion, as through photosynthesis, of large amounts of radiant energy to chemical energy; and by the activation of regulating systems such as reproduction, differentiation, and morphological development by means of small amounts of radiation. These radiation-sensitive regulatory systems may further be subdivided on the basis of the spectral characteristics into one group responsive mainly to the blue and ultraviolet portions of the electromagnetic spectrum; and another responsive mainly to the red and far-red portion of the spectrum.

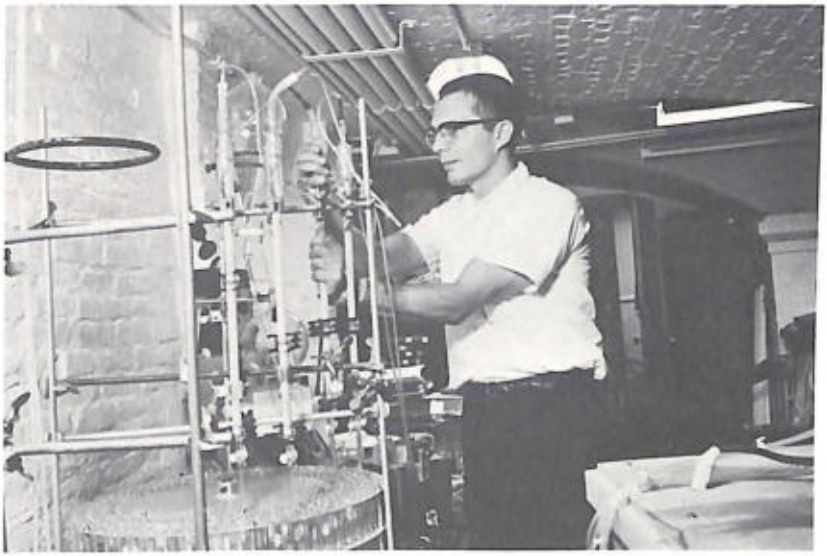
The research of the Radiation Biology Laboratory is directed toward understanding the cellular and subcellular mechanisms and processes by which organisms utilize this radiant energy from the sun for their growth and development. This research has been directed into four main areas: in regulatory biology, (1) the physiology and (2) the biochemical processes of developmental responses to light; (3) the measurement of solar radiation; and (4) carbon dating, measurements and research techniques.

Regulatory Biology—Physiology

The excised apex of the corn coleoptile has proved to be a favorable laboratory experimental object for the study of a phytochrome-mediated response. The growth rate in darkness at 25°C of coleoptile segments

floated on water is increased by about 50 percent following a brief (saturating) irradiation with red light in the wavelength of 660 nanometers (nm). This increased growth rate is established within a few minutes after the irradiation and persists unaltered for at least 24 hours. If the red irradiation is followed immediately by a few minutes of far-red (730 nm) irradiation very little enhancement follows; this is the operational criterion for involvement of the phytochrome system. Although the absolute growth rate of both irradiated and control coleoptiles may be increased or decreased by a large number of substances, the relative enhancement owing to red irradiation was not altered by most of the substances tested. Of a variety of sugars, plant growth regulators, amino acids, vitamins, inorganic ions, and other compounds only carbon dioxide has been found to influence the growth rate differentially. The growth rate of unirradiated coleoptile segments is about 50 percent greater in an atmosphere containing 200 mm (hg pressure) CO_2 plus 560 mm air than in air. A brief red irradiation does not further increase the CO_2-augmented rate. Hence the same result is achieved by the CO_2-enriched atmosphere as by a red irradiation. The effect of red light on growth is markedly temperature-dependent. At 45°C, the growth rate of unirradiated segments is only a small fraction of that at 25°C; the growth rate of segments which have received only a brief red irradiation is greatly diminished also. If the red irradiation is prolonged, however, for some time, the growth at 45°C is substantially equal to that at 25°C.

A multi-station interference-type monochromator system in a controlled environment has been used to study photomorphogenesis in *Arabidopsis thaliana*. Plants are cultured aseptically on mineral agar supplemented with 1 percent glucose in standard culture tubes with glass closures. Culture tubes are radially arranged in styrofoam blocks holding 40 tubes within a radius of 3 inches inside the uniform focused light beam. Equal energies of 100 microwatts cm^{-2} sec^{-1} at eight stations in the range 415–730 nm were used in an initial experiment. Control plants were subjected to continuous white light throughout the study; the treatment group was irradiated with 4 hours white light and 20 hours monochromatic light daily. Standard white light was from 300-watt incandescent lamps, passed through a water filter. Dissections were made during the 4-hour white-light period to detect the appearance of bud primordia. Floral induction occurred after 7.5–8 days of continuous white light radiation; after 11–12 days of 455-nm radiation; after 14–15 days of 415 or 500-nm radiation; after 20 days of 730-nm radiation; and after 27 days of 700-nm radiation. Plants supplemented for 20 hours daily with 550-, 600-, and 660-nm radiation, although vegetatively vigorous, showed no sign of floral induction at termination after



David L. Correll setting up a series of ion-exchange column chromatograms for the final step in the purification of phytochrome from rye seedlings.

32 days. It is postulated that phytochrome synthesis activated by blue light is required for floral induction, while phytochrome destruction is potentiated in red light.

Examination of light-controlled growth responses occurring in the apical cell of moss protonemata were continued. Action spectra obtained previously indicated that under continuous irradiation, growth required the simultaneous excitation of both the red (P_R) and the far-red (P_{FR}) absorbing forms of phytochrome.

Irradiating the filaments simultaneously with monochromatic red (660 nm) and far-red (730 nm) light, the peaks of absorption for the two forms of phytochrome, was more effective than any wavelength given singly in causing growth or tropic responses. Similar synergistic effects were given by ratios of red to far-red 3:1 to 1:3. Thus, cycling of phytochrome between the P_R and P_{FR} states rather than a particular steady state equilibrium seems to promote growth in this system.

Consistent with other studies, a locus of phytochrome receptors in juxtaposition to the cell wall has been inferred from experimentation with polarized light. But, contrary to other reports in the literature, all our present evidence indicates that there is no change in the orientation of photoreceptors upon conversion between P_R and P_{FR}.

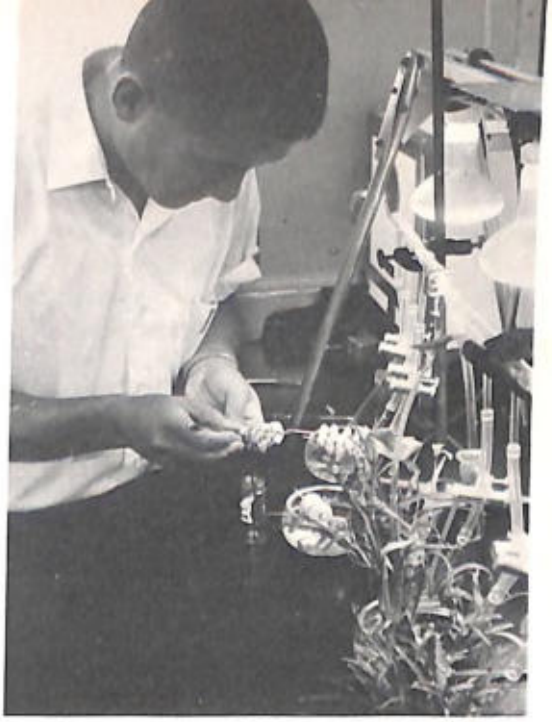
Further evidence for the juxtaposition of the pigment to the cell wall was given by experiments using microbeam irradiation. A strong tropic response may be elicited by a beam which only grazes the surface of the cell's apex; in this situation, however, maximal responsiveness is only obtained if a background of photosynthetically active irradiation is given simultaneously. Thus, a working hypothesis must include a role for photosynthesis as well as for phytochrome cycling.

Further studies on the effect of red and far-red light on pollen-tube elongation in *Tradescantia* revealed that the promoting effect of far-red light was reversible by subsequent treatment with red light. This indicated that the growth response was mediated by phytochrome. When pollen irradiated by far-red light was cultured on KOH- or NaOH-supplemented lactose agar medium, the elongation of the pollen tube was inhibited instead of being promoted, as would have happened in the regular culture medium. This inhibitory effect was also reversible by red light. The concentration of K and/or Na ions in the pollen tube may have played an important role on the action of phytochrome or on the state of the membrane and wall of the cell.

Concentrated glucose solutions (20 percent) receiving 0.5 Mrad of gamma rays (Co^{60}) were diluted to 2 percent and used to treat lateral roots of *Vicia* or adventitious roots of *Tradescantia*. Three series of experiments were carried out consecutively to determine the sensitive stage, dosage effect and the possible mechanism for breakage in the centromeres. Centromeric and secondary constrictional breaks were more prevalent than ordinary chromatid breaks in all experiments. Centromeric breaks which occurred in *Vicia* were almost exclusively found in metacentrics of the chromosome complement.

In *Vicia,* differential breakage rates from the fixations made at successive time intervals, following treatment of the mitotic cycle through a 24-hour period, indicated that the early interphase seemed to be more sensitive to the treatment than other stages. In *Vicia,* a 3-hour treatment caused a higher breakage rate than a 1-hour treatment when the low-dose (0.5 Mrad) irradiated glucose solution was used immediately after it had received gamma irradiation. *Vicia* roots treated with 96-hour-old, high-dose (2 Mrad) irradiated glucose solution for 6 hours had a relatively higher combined rate of breakage (centromeric, secondary constrictional, and chromatid breaks), but a lower rate of centromeric breaks than those treated with low-dose, freshly irradiated solution for shorter durations. The combined rate of breakage in controls of this experiment was also higher.

A comparative study on the centromeric breakage rates between *Vicia* and *Tradescantia* confirmed that the centromeric breaks occurred



Dr. Te-Hsiu Ma culturing bean roots for experiments to determine the effects of irradiated glucose solution on mitotic chromosomes.

preferentially in metacentric chromosomes. This may be the result of an artifact enhanced by the damaging effect of irradiated glucose solution. Control groups treated with nonirradiated glucose solution showed relatively lower rates of breakage, as compared with respective experimental groups, but higher rate of breakage than a baseline control group which received no treatment.

Regulatory Biology—Biochemical Processes

Studies of plastid protein synthesis *in vitro* have been continued. The amino acid incorporation of the chloroplast in the presence of ribonuclease is a function of the condition of the chloroplast membrane. Freshly isolated chloroplasts with intact membranes are impermeable to ribonuclease.

Crude preparations of etioplasts (plastids from etiolated leaves) incorporate amino acid into protein. The similarity of incorporation by etioplasts to that by chloroplasts indicates that etioplasts are the principal sites of incorporation in such preparations, as had already been shown with similar chloroplast preparations. When rates of incorporation per plastid are calculated, the etioplast preparations carry out incorporation at only one-fifth the rate of chloroplast preparations.

Both etioplasts and chloroplasts incorporate amino acid into the same proteins *in vitro* as *in vivo*, but the rates *in vitro* are much lower than

in vivo. Quantitative differences are found in the products formed by etioplasts and chloroplasts. Leaf Fraction I protein, however, is among the soluble protein products formed *in vitro* by both etioplasts and chloroplasts. At least a portion of the Fraction I protein formed by chloroplasts *in vitro* is ribulose diphosphate carboxylase. This shows that the informational RNA that acts as template for this chloroplast protein is present in chloroplasts, and leads to the possibility that a portion of the plastid DNA codes for this chloroplast protein.

Work has been continued on the micromorphology of red and blue-green algae, with emphasis on the localization of phycobiliproteins. The phycobiliproteins (phycocyanin and phycoerythrin, which are, respectively, blue and red) are present as accessory photosynthetic pigments in three groups of algae: Cyanophyta, Rhodophyta, and Cryptophyta. By trapping light energy in the green and orange regions of the visible spectrum and passing it to chlorophyll they greatly enhance photosynthesis.

From our previous work we knew that the phycobiliproteins are located at specific sites on the photosynthetic lamellae (see photograph) where they form aggregates. The pattern of the aggregates on the lamellae seems to be determined by the underlying photosynthetic lamellae, but the shape of the aggregates appears to be dependent on the predominant pigment. In *Porphyridium cruentum,* where phycoerythrin predominates, the aggregates, or phycobilisomes, are spherical; but in *P. aerugineum,* which has only phycocyanin, they are disk-shaped.

A major difference exists in the localization of phycobiliproteins in the different groups of algae. In the red and blue-green algae the phycobilisomes are located on the stroma side of the chloroplast lamellae with a periodicity of 400A; however, in the cryptophytes the phycobiliproteins are separated from the chloroplast stroma by being enclosed within flattened photosynthetic membrane sacks. The periodicity evidenced by the cryptophytes is about one-half that found in the red and blue-green algae.

Phycoerythrin, the red phycobiliprotein, was purified by butanol treatment and ammonium sulfate fractionation. Purity was determined by attainment of a ratio of optical density at 560:275 nm of 5 or better, disk-gel electrophoresis, crystallization, and electron microscopy. By negative staining with uranyl oxalate, or phosphotungstic acid and examination by electron microscopy, it was found that the minimal phycoerythrin unit is very tightly structured. It has a diameter of about 105 $\pm$ 5A, and an axial ratio of 1:2. There is no difference in the aggregation state in the pH range of 6 to 7 (pH 6.0, 6.6, 6.8, and 7.0). Aggregations occur by formation of stacks and contact along the 105A diameter faces. Aggregates have been stabilized with glutaraldehyde,

separated by disk-gel electrophoresis, and recovered for examination by electron microscopy.

Attempts have been made to compare the ultrastructure of the photosynthetic apparatus of blue-green algae grown under two different light regimes. It has been found that *Tolypothrix tenuis* under red light, produces almost exclusively phycocyanin and that under green light, phycoerythrin predominates, but there is still a considerable amount of phycocyanin. Thus far it has not been possible to distinguish whether this change in pigment ratio affects the phycobilisome shape .

Measurements of absorption changes of purified phytochrome indicate that multiple chromophores are present. Buffered aqueous solutions of pure phytochrome, when irradiated at 730 nm, had a main absorption band at about 660 nm and a shoulder or secondary band at 580–660

Electron micrograph of a red alga. The lamellate chloroplast occupies the major portion of the cell and contains the photosynthetic pigments. Phycocyanin is located as small particles on the lamellae in which the chlorophyll is located.

nm. When irradiated at 660 nm, these absorption bands bleached, and a pair of bands at 670 and 725–730 nm appeared. When samples irradiated at 660 nm were placed in the dark, the 730-nm absorption slowly bleached and the 670-nm absorption band shifted to 660 nm. The kinetics of the bleaching indicated that two populations of P_{FR} existed initially. These two populations decayed by first order kinetics with k's of 4.8×10^{-4} sec.$^{-1}$ and 3.1×10^{-5} sec.$^{-1}$ at 25°C. While the bleaching of P_{FR} was occurring, the appearance of the 660-nm and 580–600-nm absorption bands characteristic of P_R took place.

The kinetics of the increase in both absorption bands indicated that it was arising from two populations of reactants by two first-order reactions with k's of 6.4×10^{-4} sec.$^{-1}$ and 3.1×10^{-5} sec.$^{-1}$ at 25°C. When the sodium chloride concentration of the solvent was changed, the proportions of the kinetically different populations were altered. In some conditions, especially in the presence of air, reversible but nonreciprocal changes in the four absorption bands were observed. These effects were evident after the lapse of many hours in the dark. When native phytochrome was treated with sodium dodecyl sulfate all absorption bands but the 580–600-nm absorption band was bleached and photoreversibility was lost. When native phytochrome was treated with glutaraldehyde, the 730-nm absorption band was bleached but photoreversibility was retained. It was concluded that at least four species of chromophore exist in phytochrome with absorption maxima at 580, 660, 670, and 730 nm. Each chromophore is capable of being bleached by appropriate irradiation or in the dark by chemical reactions rather than photochemical reactions. The reactions are probably coupled redox reactions between the 580–660-nm pair and the 670–730-nm pair of chromophores. Discrepancies observed in the reciprocity of the absorption changes in these paired bands are probably due to various degrees of uncoupling and secondarily to the redox potential of the solvent when such uncoupling occurs.

Measurement of Solar Radiation

The data acquisition system was updated for better performance by the addition of a new solid-state digital clock and a dual punch unit. These two additions yield better reliability in time recording and longer running time without attendance to the paper tape. New Fortran programs were written for processing the data. The new program computes the solar secants and azimuths for each recorded event, the ratios between the different spectral bands, the energy content in each of the 100-nm bands and of the broad spectral bands. Besides the computations, the programs permit plotting of the data.

A further reduction of some normal incidence work done in 1966 showed a 16 percent decline in the incoming radiation since the years 1904–1907. This is an indication of accumulation of air pollutants.

New detectors are being developed at this time to expand the capability of the present system to very low levels of light.

Growth patterns for greenhouse-grown day-neutral Black Valentine Beans were studied for one complete year, consisting of 18 plantings, spaced at 3-week intervals and harvested when plants were 3 and 6 weeks old. The results indicate a similarity to the 1965 data in which an inverse relationship was noted between lower and upper internodes and between lower internodes and daylength. Differences in stem length ranging from 50 cm during short days to 90 cm during long days is due almost exclusively to elongation of the upper internodes. Flowering of this day-neutral plant continues throughout the year.

Biloxi soybean, a short-day plant, will produce flowers at this latitude if seeds are planted before 1 April and after mid-July. Plantings made during May, June, and early July remain vegetative and have longer stems due to an increase in number of internodes and elongation of the upper internodes. Also during this period there is some indication that the dry-weight ratio of leaf to stem changes slightly. It is notable that the second internode is similar in response to the first internode of Black Valentine bean.

In a previous report it has been stated that Wintex barley, a long-day plant, is sensitive to changing daylengths and light quality. Results indicate that barley flowers early in the year when far-red is a part of the light source and when light periods, though relatively short, are increasing daily. Plants grown under longer daylengths than these, but decreasing daily, remain vegetative. After collecting data for three years and obtaining similar results each year, it appeared reasonable that subsequent years would yield the same results. Data obtained during the spring of 1968, however, were not in accord. Plants remained vegetative under greenhouse conditions similar to those of previous years in temperature, humidity, nutrients, carbon dioxide level, and increasing daylengths. It is suspected that far-red energy and its relative proportions to the red wavelengths may have been the cause.

Carbon Dating

The output rate of the carbon dating laboratory increased during this year to about 15 carbon-14 analysis results and about 10 tritium determinations per month.

The tritium analyses were concentrated on the circulation study of Disraeli Fjord, northern Ellesmere Island, which has an ice shelf block-

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ing its mouth and restricting circulation on the upper 44 meters. Tritium analyses indicate that meltwater entering the fjord moves out along the 40-meter level and presumably, out to the Arctic Ocean at this level. The deeper, saline water in Disraeli Fjord has tritium values comparable to those in the Arctic Ocean. Thus circulation in deeper zones is apparently not hampered by a sill.

Two freshwater lakes on Ellesmere Island, Ekblaw (68 meters) and Rollrock (51 meters) had tritium values consistent with complete overturning during the summer of 1966.

Preliminary results on the carbon-14 content of eggshells indicate their carbonate may be good for dating in spite of birds using limestone pebbles for "scratch."

Staff Activities

A series of seminars in developmental biology was held in cooperation with the Consortium of Washington Area universities. The series of lectures was presented for graduate credit and approximately 150 persons attended each lecture. The speakers and their topics were:

"Supramolecular Biology of Development," Paul Weiss, Rockefeller University, New York.

"Changing Concepts of the Relations between DNA Synthesis and Differentiation," James D. Ebert, department of embryology, Carnegie Institution of Washington, Baltimore, Maryland.

"Reconstruction of Tissues from Dissociated Cells," Malcolm Steinberg, department of biology, Princeton University, Princeton, New Jersey.

"Formation of Patterns in Development," Heinrich Ursprung, Mergenthaler Laboratory for Biology, Johns Hopkins University, Baltimore, Maryland.

"Morphogenesis in the Cellular Slime Molds," John Tyler Bonner, department of biology, Princeton University, Princeton, New Jersey.

"Cell and Tissue Culture in Plants: Its Significance for Morphogenesis," F. C. Steward, Laboratory for Cell Physiology, Growth and Development, New York State College of Agriculture, Cornell University, Ithaca, New York.

"Problems of Growth and Regeneration in Hydra—The Acquisition and Mobility of the Differentiated State," Allison L. Burnett, Biological Laboratory, Western Reserve University, Cleveland, Ohio.

"The Role of the Nerve in Regeneration of Body Parts in the Vertebrate," Marcus Singer, department of anatomy, School of Medicine, Western Reserve University, Cleveland, Ohio.

"Hormones, Genes, and Metamorphosis," Carroll Williams, Biological Laboratories, Harvard University, Cambridge, Massachusetts.

"Fetal Hormones and Adaptive Growth in Mammalian Reproductive Systems," Dorothy Price, department of zoology, University of Chicago, Chicago, Illinois.

"Some Aspects of Neurogenesis," Viktor Hamburger, department of biology, Washington University, St. Louis, Missouri.

"Cell Death in Morphogenesis," John W. Saunders, Jr., department of biological sciences, State University of New York at Albany, Albany, New York.

During the year John A. M. Brown, visiting post-doctoral research associate from the University of Notre Dame, joined the staff to work with Director Klein on an action spectrum of floral induction in *Arabidopsis*. Plant physiologist Helga Drumm, from the University of Freiburg, Germany, is working with chemist Maurice M. Margulies on protein synthesis in etioplasts. Francesco Parenti completed his work with Margulies and accepted a position at Yale University. Plant physiologist Leonard Price began a sabbatical year working with Konstantinos Mitrakos at the Botanical Institute, University of Athens, Greece.

Members of the staff attended symposia, meetings of national scientific societies and international conferences; journeyed to universities to present seminars and to carry on joint research projects; participated in various panels and committees of scientific agencies and organizations; and attended science courses. Some of the special activities were:

In August, Austin Long delivered a paper at the Annual Convention in Kingston, Ontario of the Geological Association of Canada and the Mineralogical Association of Canada; and W. Klein presented a paper at the BIAC Symposium on bioinstrumentation in College Station, Texas.

In October, Robert L. Weintraub traveled to Kalamazoo College, Kalamazoo, Michigan, for consultation on joint research projects with M. Evans of their department of botany.

In November, M. Margulies presented a seminar to faculty and graduate students in the Department of Biology at the University of Akron, Ohio.

In December, at the Charles F. Kettering Research Labs in Yellow Springs, Ohio, W. Shropshire, Jr., presented a seminar.

In January, David L. Correll traveled to Tucson, Arizona, where he delivered a paper at the Second International Conference on Photosensitization in Solids, held at the University of Arizona.

In May, Elisabeth Gantt presented a seminar at the Iowa State University of Science and Technology in Ames.

In June, J. Brown attended meetings and delivered a paper in London, Ontario, to the Canadian Society of Plant Physiologists; also in June, Bernard Goldberg, with Director Klein, in Jerusalem, Israel, assisted with the initiation of a solar radiation measuring station, a cooperative effort between the Smithsonian Radiation Biology Laboratory and the National Physical Laboratory of Israel, and visited Athens, Greece, to discuss a joint research project with the Institute of General Botany in the University of Athens.

Staff Publications

CORRELL, DAVID L., JOHN L. EDWARDS, and VICENTE JULIO MEDINA. "Phytochrome in Etiolated Annual Rye, II: Distribution of Photoreversible Phytochrome in the Coleoptile and Primary Leaf." *Planta,* vol. 79, pp. 284–291, 1968.

CORRELL, DAVID L., and W. SHROPSHIRE, JR. "Phytochrome in Etiolated Anual Rye, I: Changes During Growth in the Amount of photoreversible Phytochrome in the Coleoptile and Primary Leaf." *Planta,* vol. 79, pp. 275–283, 1968.

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PARENTI, F., and M. M. MARGULIES. "*In Vitro* Protein Synthesis by Plastids of *Phaseolus vulgaris,* I: Localization of Activity in the Chloroplasts of a Chloroplast Containing Fraction from Bean Leaves." *Plant Physiol.,* vol. 42, pp. 1179–1186, 1967.

Smithsonian Astrophysical Observatory

FRED L. WHIPPLE, *Director*

IN THE MID-1880S SAMUEL PIERPONT LANGLEY, soon to become third secretary of the Smithsonian and founder of its Astrophysical Observatory, gave a series of popular lectures on "the new astronomy." By that term he meant the study of "the sun, moon, and stars for what they are in themselves, and in relation to ourselves." While that study has evolved to include all heavenly bodies and to encompass not only the present but also the past and the anticipated future, its primary concern has continued to be the relation between man and the universe.

The current research* of the Observatory reflects and is a part of that concern. Observatory scientists derive data for astrophysical study from a variety of sources—gamma-ray detectors, radio telescopes, optical instruments, and satellite observations and experiments, for example. Of the last, the Director, in an address this year to the 4th International Symposium on Bioastronautics and the Exploration of Space, noted: "The theoretician now has a local solar system in which the space program provides direct measurement of processes too complex for armchair prediction."

Observatory scientists use these data in investigations involving the structure, composition, and gravity field of the earth; the temperature, pressure, and other characteristics of the upper atmosphere; the history, orbits, and compositions of other bodies in the solar system; the nature of stellar processes; and the origin of the universe.

*Unless otherwise noted, research is supported from federal funds appropriated to the Smithsonian Institution. The Observatory, by paying scientists' salaries, shares in the support of all research. Support from outside sources is detailed in the notes on page 477.

The following short article by a member of the Observatory staff summarizes and examines recent findings in one of these areas of concern.

METEORITES AS PRIMITIVE PLANETARY MATERIAL

The origin of the earth is shrouded in mystery. We can talk with some confidence about the recent history of the earth's surface—the last 500 million years—because extensive beds and structures of rock formed during that time interval remain preserved and accessible to us. But as we attempt to probe further back, into the Precambrian eras, the record becomes increasingly blurred. Surviving rock units became progressively more scarce and less well preserved. The oldest rocks known were formed about 3500 million years ago, according to studies employing radioactive dating techniques. There the record closes.

But we know the earth is older than 3500 million years, because other members of the solar system are older: Meteorites, the lumps of rock and iron that the earth occasionally sweeps up from interplanetary space, often yield ages of about 4600 million years when the same radioactive dating techniques are applied to them. Our understanding, such as it is, of the origin of the solar system seems to require that all its members formed at the same time, give or take a few million years, so it appears that the first billion years (at least) of earth history is completely missing from the record.

It is not hard to see why. Contrary to the advertising literature of gravestone manufacturers, rock is not eternal nor "of the ages." On the surface of the earth, it is a highly perishable commodity. It is attacked and degraded by water, ice, wind, heat, cold, and soil acids; the debris produced is commonly swept away, compacted, and cemented into new generations of rock. Alternately, the slow churning and folding that goes on in the earth's crust (at a rate imperceptible to us) may carry rock down to great depths, where temperatures are so high that it melts, whereupon the hot liquid is injected into higher levels of the crust again. Generations of rock succeed one another, as if they were living organisms. The wonder is that any material at all has been preserved for 3500 million years in the earth's crust.

Nonetheless, one wishes that older material were available. Best of all would be to have samples of the original substance of the earth, still in the state it assumed when the earth first formed. This would truly be a scientific treasure. Its bulk composition would probably reflect the overall composition of the earth, something we can only conjecture about otherwise, because the thin crustal layer of the earth we have access to is

clearly nonrepresentative in composition, having been formed from the whole by processes that tend to favor some elements over others.

The texture and mineralogy of such a primitive material would spell out for us how the earth was born: whether from grains and particles (planetesimals) that agglomerated out of a primordial nebula, or conceivably as a molten, fiery mass that condensed directly from incandescent solar gases, as pictured some 50 years ago by Jeans and Jeffreys. The pattern of fission-produced and radiogenic nuclides it contained would establish the age of the earth and the time scale of star-forming events that preceded its creation. Its content of volatile substances would indicate for us the composition of the primeval earth's atmosphere and help us understand its subsequent evolution. It might contain carbonaceous compounds that could define the milieu out of which terrestrial life arose.

It seems futile to search for primitive material on the earth, because crustal rocks are exposed to the corrosive processes noted above. But perhaps somewhere else in the solar system? Geologic activity and corrosivity are fairly directly connected with a planet's size. A small planet could not retain internal heat effectively enough to support extensive igneous activity, nor would its gravitational field be potent enough to retain a corrosive atmosphere or bodies of water. Thus, if we could sample planets smaller than the earth, our chances of finding primitive materials would increase.

Venus, approximately equal in size to the earth, is not a good bet. Mars is smaller and somewhat better; the moon is better yet. Even the moon, however, seems to defeat us: chemical analyses performed by the recent Surveyor soft-landing missions to the moon have shown that much of the surface must be composed of material similar in composition to terrestrial basalts or gabbros—rock types that we are fairly certain are produced by complex processes of melting and chemical fractionation inside the earth, and that probably had a similar origin on the moon and do not represent unaffected primitive materials.

Of course, there are smaller bodies yet in the solar system—asteroids and the moons of Mars, Jupiter, and the outer planets. Spacecraft missions to these objects lie many years in the future, but fortunately we don't have to wait for them; a kind and accommodating nature has contrived to deliver samples of them to us gratis in the form of meteorites.

We are not really certain where the meteorites come from, but the process of elimination leaves little chance for any source except the asteroids. The character of their orbits eliminates a source outside the solar system; the composition of most of them does not match the Sur-

veyor composition of the lunar surface; the escape velocity from Mars is too high (it would be all but impossible for, say, an asteroid impact on the Martian surface to impart enough velocity to a surface fragment for it to escape without being pulverized or melted).

Asteroids are very small objects indeed. The largest, Ceres, is only 770 kilometers in diameter, about the dimension of France or Spain. Most asteroids are substantially smaller. To be sure, once there were probably larger asteroids than now; the present asteroids are for the most part only fragments of the primeval asteroids, the debris of collisions among them. But the total mass of asteroid fragments we see now is small nonetheless, only a few percent of the mass of the moon, so the parent asteroids cannot ever have been very large.

When we examine the meteorites, they seem the answer to our fondest hopes. About 85 percent of those seen to fall are members of a remarkably uniform class named *chondrites*. Chondrites are very old; in many cases we find they have been accumulating radiogenic argon-40 for 4500 or 4600 million years (the "age of meteorites" noted above). What this means physically is that they have literally been held in "cold storage" in space for 4500 million years. If they had been heated significantly (above a few hundred degrees centigrade) in that time or if they had experienced any significant geologic activity, their argon-40 would have been released and driven away.

Since the ages of a great many meteorites cluster about the value 4500 to 4600 million years, this has come to be accepted as the "age of the solar system." Initially, this conclusion was really quite unjustified. How do we know the solar system wasn't already 10 billion years old when the meteorites were formed? At first, we had no such assurance. But in recent years, evidence has appeared that the parent meteorites were still quite young when they cooled down to temperatures at which argon-40 began to accumulate. Some chondrites were found to contain anomalous amounts of the nuclide xenon-129, which can have been emplaced there only by the decay of radioactive iodine-129.

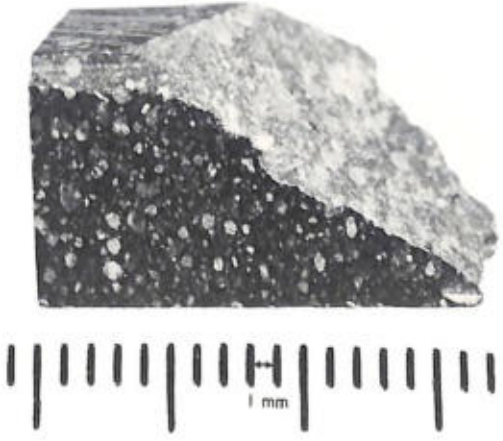
Iodine-129 has a relatively short half-life (16.4 million years), so the planets' stock of it—if they were endowed with any at the time the solar system was formed—must have dwindled away to effectively nothing in a very short time. Certainly the earth has none now. As iodine-129 decayed, it was transformed into the gas xenon-129. If the host rock in which it decayed was still hot, this gas would have been driven off and lost. Since some xenon-129 was retained by some meteorites, we can conclude that these meteorites had entered into the final "cold storage" phase of their histories before their initial stock of iodine-129 had dwindled away: within about 100 million years after freshly cre-

ated iodine-129 had been incorporated in the planets as they formed. Thus, the parent meteorite planets (and by inference the solar system) may be older than 4600 million years, but only a little bit older (relatively speaking)—100 million years or so.

The chemical composition of chondrites further encourages us to believe they are samples of primitive planetary material. Their content of the various metallic elements, relative to one another, is very similar to the proportions of these elements that we find (from spectrograms) in the surface of the sun. It is widely believed that the sun and planets formed from a single homogeneous cloud of gas and dust, so sun and primitive planets ought to be chemically similar, at least as far as the condensable, nonvolatile (metallic) elements are concerned. (As opposed to hydrogen, for example. We know the sun consists largely of hydrogen; but this, being a gas of very low boiling temperature (−253° C), could not possibly have condensed and contributed to the makeup of the small inner planets.)

Chondritic textures are indeed conglomeratic (figure 1). By studying their constituent grains and particles, we may be reaching out to the preplanetary stages, to a time when there were only gas and dust that were beginning to arrange themselves into a star and satellite planets. Further, the better preserved chondrites contain a great host of complex organic compounds; these compounds were probably produced by abiotic processes in the primordial nebula, though some workers are not wholly convinced that they might not be the debris of ancient, extraterrestrial, primitive life forms.

For all these reasons, chondrites are probably the most intriguing and enigmatic samples of planetary material we can study, princes among



1. A chondritic meteorite (from Beddgelert, Wales), with sawed faces, showing conglomeratic texture. Small light-colored spherules (chondrules) may be surviving planetesimals from the formative stage of the solar system. (From *Advances in the Astronautical Sciences*, vol. 19, pp. 99–118, 1965.)

rocks. And yet they do not answer the question raised at the beginning of this article. They are not samples of the primordial earth, but of planets formed two or three times farther out from the sun than is the earth. Things were probably not the same in both places. We know the planets vary in mass density with their distance from the sun:

Planet	*Distance from sun (relative to earth's distance)*	*Mean uncompressed density (approximate)*
Mercury	0. 39	5. 2
Venus	0. 72	4. 0
Earth	1. 00	4. 0
Mars	1. 52	3. 7
Asteroids/chondrites	2. 2 to 3. 2	3. 6
(Mesosiderites)	—	(4. 2)

Evidently the planets closer in contain a larger proportion of metallic nickel-iron, making them denser. Further, several workers have recently presented involved but convincing arguments, based on terrestrial heat flow and the absolute abundances and isotopic compositions of certain elements in the earth's crust, that the earth's bulk composition is not the same in detail as the composition of the chondrites. Primitive earth material must have been rather different from that of the chondrites.

2. Sawed face of a mesosiderite from Vaca Muerta, Chile. Light areas are nickel-iron metal; dark areas, gabbroic silicate minerals.

In this connection, one of the most obscure and little-studied classes of meteorites, the *mesosiderites* (only one percent of falls), begins to look interesting. Mesosiderites consist of about half basaltic or gabbroic minerals and half nickel-iron metal, intimately mingled together. It has usually been supposed that they are chance mechanical mixtures of earlier-formed iron meteorite material with igneous rock. And yet maybe not. There are practical difficulties in postulating a set of processes that would mix metal and rock in these proportions, with such intimacy, so as to yield such curious structures (figure 2). The mesosiderite content of potassium, uranium, rubidium, and metallic nickel-iron is closer to what the earth is believed to hold than is that of the chondrites.

The cooling history of mesosiderites, which can be derived with some confidence from a detailed study of the metal alloys they contain, seems to point to an origin in a planet whose overall heat budget was dominated by earth-like, not chondritic, proportions of potassium and uranium. Could it be that mesosiderites are another type of primitive material that is a fair approximation to the material from which the earth was formed? Could they be fragments of small planets that formed about as far from the sun as the earth is now and somehow escaped being swept up and added to the bulk of the earth? We may yet learn how the earth was formed.

JOHN A. WOOD

The Earth

The Observatory continued its investigation of the earth as a planet through an active program of satellite geodesy and atmospheric studies.[1]

The SAO network of 12 Baker-Nunn satellite-tracking cameras in 11 countries provided the basic observational data. In addition, the Observatory is deploying laser tracking systems. This year SAO moved its first laser satellite-ranging station from Organ Pass, New Mexico, to the Baker-Nunn site in Hawaii. A more advanced laser system was placed on Mount Hopkins, Arizona,[2] and a third unit began operating in Athens, Greece. The Observatory places considerable importance on the development and operation of laser ranging systems, under the supervision of Carlton G. Lehr. The greater accuracy of these systems over optical techniques promises major advances in geophysical research.

GEODESY

Using SAO satellite observational data, E. M. Gaposchkin, Walter Köhnlein, Yoshihide Kozai, Kurt Lambeck, Charles A. Lundquist, and George Veis have continued work on an improved calculation of geo-

detic parameters.[3] The principal results from a geodetic calculation are the coordinates of stations observing satellites and a mathematical representation of the earth's gravity field. The results calculated this year were published as Special Report 264, *Geodetic Satellite Results During 1967*.

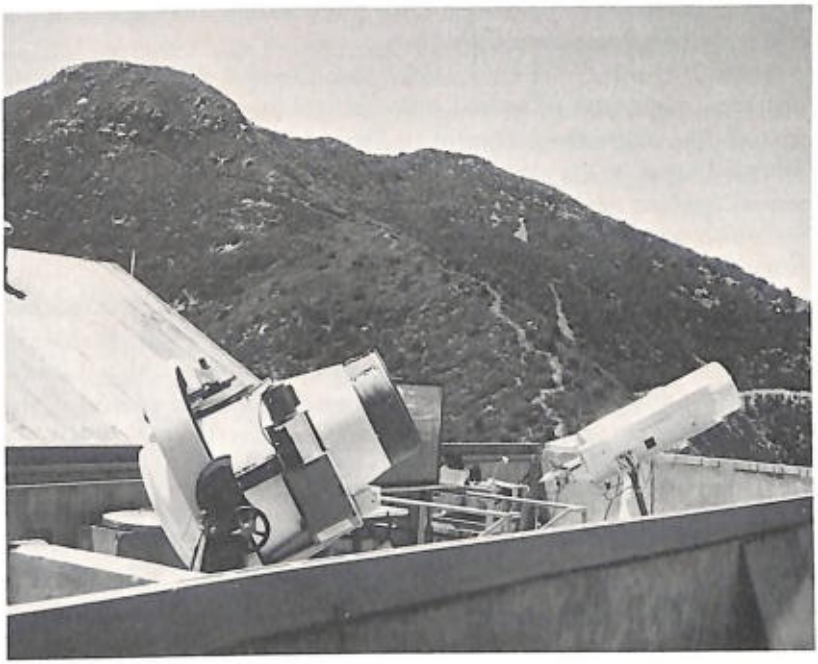
The previous major calculation, the 1966 Smithsonian Institution Standard Earth, involved data on 14 satellites observed from the 12 Baker-Nunn camera stations. The gravity field was represented with 121 parameters. The work for the 1968 Standard Earth will extend the theory to greater accuracy, increase the number of Baker-Nunn observations, and expand the analytic capability to include range and velocity observations. With this capability, tracking data from other systems, such as doppler and laser ranging, can now be used. Data from about 50 stations, including the SAO network, other U.S. satellite-tracking networks, and an international group of cooperating observatories throughout the world, will be included in the 1968 calculation. In further contrast to the 1966 Standard Earth, approximately 25 satellites will be used, almost 250 gravity-field parameters will be calculated, and the accuracy of the determination of fundamental observing sites should be improved to 5 to 10 meters.

The geodetic satellite Geos-1 was used extensively by SAO this year. This satellite, which has intense flash lamps for optical observing and retroreflectors for laser ranging, was a mainstay of the year's investigations. Geos-1 provided long-term data for Kozai's future zonal-harmonics calculations, intense short-period files for Gaposchkin's tesseral-harmonics determinations, and opportunities for simultaneous observations for Veis and Lambeck's geometric solution.[4]

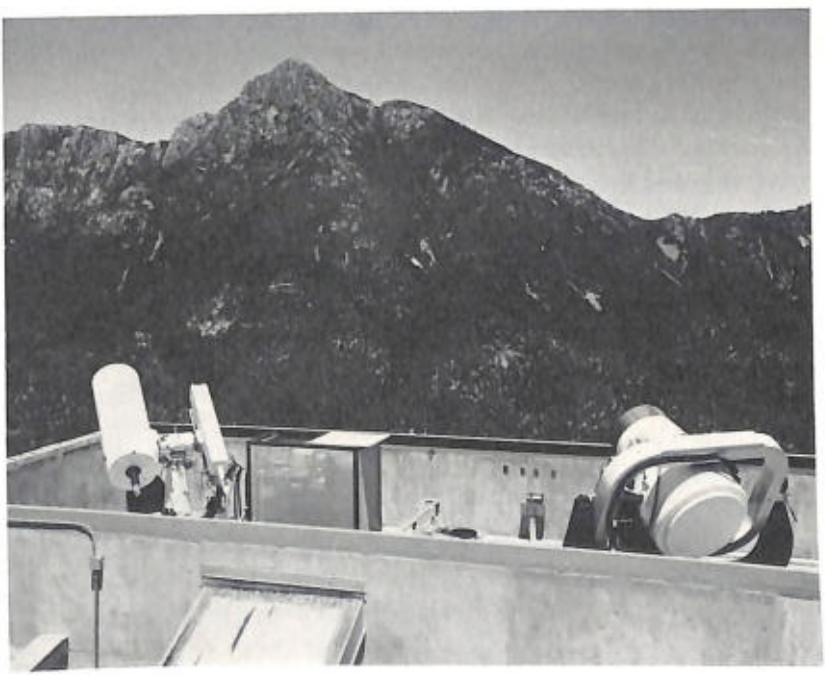
Giorgio E. O. Giacaglia and Lundquist developed for the gravitational potential of the earth an alternative mathematical representation that may be useful in the treatment of satellite altimetry data for geodetic investigations.[4]

Veis determined a new value for the radius of the earth, based on 1966 results together with more recent geodetic information and satellite laser-range data. Veis also established the procedures for a revised satellite triangulation program. This program can handle simultaneous directions and laser ranges.

Lambeck developed a new approach to the geometric solution for improving station coordinates and carried out theoretical investigations on the accuracy of the method. He is also developing a new technique that combines into a consistent solution the geometric and dynamic results of satellite geodesy as well as other forms of data. He has investigated film-reduction techniques and completed a study of the accuracy of the



The Baker-Nunn – laser installation at Mount Hopkins.



Baker-Nunn camera; included in this study was an investigation of the effect of atmospheric microturbulence.

Antanas Girnius, Lambeck, Veis, and Leonard H. Solomon completed a comparison of several different satellite-observing systems. As part of the comparison, Girnius performed geoid transformations for extended areas of the principal datums. Solomon combined data from several tracking systems to compute precise orbits for OGO–2, a satellite for which no one set of tracking data was sufficient to determine orbits to the accuracy required by the onboard experiments.

In conjunction with the geodetic work, Gaposchkin, Giuseppe Colombo, Barbara Kolaczek, and Jan Rolk continued an analysis of polar motion.[4] Knowledge of the position of the pole not only is a subject of geophysical interest but also is essential to the reduction of the coordinate system used in geodesy. Gaposchkin is developing a model that considers the liquid core of the earth as well as the elasticity of the mantle and the oceans in an attempt to resolve the disagreement between polar motion and the elasticity of the earth as determined from tides.

Colombo has investigated the Chandler wobble of the pole. The presence of two distinct peaks in the Chandler band of the power spectrum of the latitude variations has been tentatively interpreted as a beat phenomenon, suggesting that the classical model of a single elastic body with only one Chandler frequency may be inadequate. Colombo's new model consists of two nonlinear coupled components. Because of the complexity of the parametric study, a digital-computer simulation has not yet given significant results. A simulation on an analog computer is under study.

Kolaczek is investigating the possibility of determining polar motion by satellite observations. She has defined the optimum satellite area-to-mass ratio and the optimum semimajor axis of the satellite orbit for this purpose. She is estimating the magnitude of various perturbations due to satellite and orbit parameters in order to improve the accuracy of satellite-position determinations. She computed short-period perturbations due to solar radiation pressure, using Ladislav Sehnal's formula.

In another area of geophysics, Paul A. Mohr formulated a project using laser methods to measure dilation across the Ethiopian rift.[5] Refining the tectonic and volcanic maps of the African rift system, he also developed the concept that the rift zone marks a line of sinistral shear, with dilation and compression as secondary effects. This theory appears to solve a number of previously puzzling features of the African rift system such as the presence of great horsts rising from the rift floor, the peculiar restriction of volcanism to some areas of only moderate rifting, and the geometric difficulties with a hypothetical mantle-convection pattern in relation to the Indian Ocean ridge rift.

Together with Mohr, Ursula B. Marvin has begun an appraisal of geologically active zones in the earth's crust where continental drift may be tested by the techniques of satellite geodesy.[5]

Jacchia, Whipple, Veis, and several other staff members attended the annual COSPAR meeting held this spring in Tokyo. The Director presided over some of the sessions; the purpose of these meetings is to further international cooperation in geodetic and other studies.

THE UPPER ATMOSPHERE

Luigi G. Jacchia, assisted by Jack W. Slowey and I. G. Campbell, continued upper atmosphere investigations based on the drag analysis of artificial satellites.[1] To provide the necessary drag data, the Baker-Nunn cameras tracked nine satellites, including the two balloon satellites Explorers 19 and 24, which were launched for drag analysis by SAO and the Langley Research Center of NASA.

Theoretical models of the diurnal temperature variation, not intended to derive accurate predictions, but rather to further insight into the dynamics of the upper atmosphere, have been developed by Manfred Friedman, in collaboration with Jacchia. Friedman's models include such effects as solar radiational heating, interaction between the neutral and ionospheric constituents, and the possible existence of winds.

The semiannual density variation covering the interval from 1958 to 1966 was the object of a special investigation that included both the maximum and the minimum of solar activity. Data from six satellites were used, with perigee heights ranging from 250 to 658 kilometers. Jacchia found that, although somewhat variable from year to year, the semiannual variation is a vary stable feature that can be followed without any major change in phase throughout the eight years covered by the observations. The temperature curves obtained from each of the six satellites are strictly in phase and show the same amplitude, irrespective of perigee height; peculiarities of the variations, such as an unusually broad maximum or minimum, are easily recognizable in each of the individual satellite curves. This fact demonstrates that the semiannual variation is worldwide and that the observed density variations are the result of temperature variations at essentially the same atmospheric level as those arising from the solar-activity effect. Confirming previous results, the amplitude of the semiannual variation was found to vary with the solar cycle and to be proportional to the 10.7-centimeter solar flux. Jacchia has now undertaken a comprehensive study of the effect of solar activity on the upper atmosphere.

As new observational data on upper atmosphere density, temperature, and composition become available, atmospheric models must be improved to permit more accurate predictions. Jacchia worked on the revision of his "Static diffusion models with empirical temperature profiles" published in 1965 and later incorporated into the *U.S. Standard Atmosphere Supplements, 1966.*

Slowey has developed a method for taking into account the effect of solar radiation pressure in the computation of orbits of artificial satellites from optical observations.

THE MAGNETOSPHERE

A shortwave radio link was previously established by SAO and Argentine agencies between Jupiter, Florida, and Ushuaia, Argentina. The aim of this link was to probe the magnetosphere by measuring the time delay (and consequently the length) of propagation paths aligned with the earth's magnetic field along the magnetospheric shell. The two terminals of the line were synchronized by SAO's satellite-tracking timing system with an accuracy of better than 1 millisecond. Mario D. Grossi collected approximately 180 hours of data on analog tapes and is processing these data.

The Moon

Donald H. Menzel continued his studies of the rate of escape of the lunar atmosphere. More accurate atmosphere models are needed to account for the proved escape rate, which is slower than that predicted by Sir James Jeans. Lunar Orbiter photographs are continuing to be studied, to understand the processes of erosion that appear to have arisen from liquid flow, presumably water.

Winfield W. Salisbury is extending the study of induced currents in a conducting sphere to a two-layer system such as a body with a nonconducting surface and a conducting or partially conducting core. This work is being done to explain better the relation of the lack of induced-current magnetic shock waves near the moon to lunar structure and the electrical conductivity of the lunar lithosphere.

Salisbury and Yasushi Nozawa used the 1000-foot radio telescope at Arecibo, Puerto Rico, for various low-frequency radio-emission measures from the moon to investigate its internal structure and temperature. The data indicate that the temperature appears to go down with depth for at least a fraction of the moon's radius.

Edward L. Fireman, Ursula B. Marvin, and John A. Wood have set up laboratories for the isotopic,[6] mineralogical,[7] and petrological study[7] of lunar materials to be returned by the Apollo mission.

The Other Planets

David Morrison and Carl Sagan have analyzed the microwave phase effect of the planet Mercury and believe that the observations can be understood in terms of the combined solution of the one-dimensional equation of heat conduction and the equation of radiative transfer, provided that the eccentricity and the two-thirds spin of the Mercurian orbit are specifically taken into account.[8] They find a range in surface temperature from 700°K to 1000°K, with the thermal and electrical properties of the Mercurian subsurface similar to those for the moon.

Using the Harvard 61-inch telescope with a triple Fabry-Perot interferometric spectrometer, Nathaniel P. Carleton and Ashok Sharma searched for the 6300-Å emission line of atomic oxygen in the atmosphere of Venus. A preliminary upper limit of this line's intensity has now been set.[9]

The absorption spectrum of a variety of atmospheric constituents in the Venus atmosphere has been investigated by Egor Eberstein, Bishun Khare, and James Pollack in an attempt to derive transmission-averaged opacities for the construction of Venus greenhouse models.[8]

In a series of papers, Pollack, Sagan, Richard Wattson, and Arthur T. Wood, Jr., of the Harvard College Observatory, have investigated the compatibility of the Mariner 5 and Venera 4 space-vehicle results on the Venus atmosphere and their compatibility with ground-based passive and active microwave observations.[8] They find that a mean surface temperature of about 750°K, a mean surface pressure of about 90 atmospheres, and a mixing ratio of water of approximately 0.5 percent volume are consistent with all the data except the results of the Venera 4 radar altimeter.

The 61-inch telescope and associated interferometer were used by Carleton and Sharma to complete their analysis of CO_2 absorption in the spectrum of Mars.[9] An equation for the abundance of CO_2 in terms of Martian effective temperature and pressure was developed. They determined the surface pressure to be 6 to 9 millibars on the basis of an atmosphere containing 100 percent and 60 percent CO_2, respectively.

The determination of an effective temperature by usual techniques is not accurate, owing to variations with altitude, latitude, and longitude. Sharma is examining this problem by computing synthetic spectra of the CO_2 band for realistic polytropic models of the Martian atmosphere.

Sagan and Pollack have continued their investigations of a wind-blown dust model to explain the surface features and seasonal changes on Mars. They show that the particle sizes of the powder typical of

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dark and bright areas on Mars are those expected when aeolian transport of dust is dominant and where significant elevation differences exist.[8]

Clark Chapman, Pollack, and Sagan have performed a close analysis of the Mariner 4 photography of Mars.[8] The crater statistics are interpreted in terms of various populations of impacting objects and a variety of erosion mechanisms, including saturation bombardment by meteors. They find, among other conclusions, that the absence of such signs of water as river valleys in Mariner 4 photography is quite irrelevant to the question of the existence of water in early Martian history.

Douglas T. Pitman has made a detailed study of the dissociation vapor pressure curves for the minerals geothite ($HFeO_2$) and limonite ($HFeO_2 \cdot H_2O$); the data are compatible with a Martian model in which limonite and goethite make up a significant fraction of the Martian surface.[8]

The possibility of determining the temperature distribution of the Jovian atmosphere from the relative intensities of methane lines in the spectra of Jupiter is being explored by Sharma.[9] Preliminary laboratory observations indicate that a minimum path length of 150-meter atmospheres is required for extensive study of the 6200-Å methane band.

Fred A. Franklin and Allan F. Cook completed reduction of spectrograms of Saturn's satellites taken during the time of passage of the earth through the plane of the rings. This analysis made possible the setting of an upper limit on the density of a possible gaseous atmosphere enveloping the ring.

Franklin also continued with Colombo their study of the radial structure of Saturn's rings. With the help of an electronic computer that enabled them to include both the perturbations resulting from the inner satellite and the oblateness of Saturn, they determined the general field of perturbations throughout the ring. While the problem is by no means yet solved, they can show a notable correspondence in the motion of a ring particle with the radial dependence of the excluded regions produced by the above perturbations and the observed ring structure.

Comets and Meteors

At Prague in August 1967, the Director presented his detailed report of international research on comets, covering the 3-year interval 1964 to 1967, for publication in the International Astronomical Union (IAU) Report *The Physics of Comets* for Commission 15, of which he was President. He was also named President of Commission 6, Astronomical Telegrams. Several other staff members participated in the IAU Symposium.

Salah E. Hamid and the Director uncovered in ancient Chinese

records several possible references to periodic Comet Encke. Computer programs, which calculated the perturbing effects of the planets on the comet's orbit for a period extending 2500 years into the past, were used in the identification process.[1]

One of the problems in such an endeavor is the effect of unknown nongravitational forces that act on cometary orbits. Brian G. Marsden has found, from an exhaustive study of orbits of 18 short-period comets seen at three or more perihelion passages since 1925, that detectable nongravitational forces are the rule rather than the exception.[1] Studies such as this have provided supporting evidence for the Director's theory, first proposed in 1950, that these nongravitational variations are caused by the ejection of material from a rotating comet nucleus.

Hamid, Marsden, and the Director completed their calculations of the effects of a possible comet belt beyond Neptune on the motions of seven long-period comets. Comparison of the orbital elements of Halley's Comet, which is the most sensitive to such forces, as determined in 1835 and 1909, revealed, after allowance was made for all planetary perturbations, that there is no evidence of effects by a comet belt. This conclusion confirmed the earlier, preliminary results, which had established an upper limit for this belt of 1 earth mass out to 50 astronomical units from the sun.

James Wright studied the effects of general relativity on the calculation of periods of long-period comets. Comparisons of observational data with predicted behavior from rival gravitational theories are inconclusive because the observations are not sufficiently precise.[1]

A study of the sungrazing comet group by Marsden yielded virtually conclusive proof that Comets 1882 II and 1965 VIII were pieces of a single comet that had fragmented at the previous perihelion passage, probably in the first half of the 12th century, in the same manner that these comets themselves fragmented.[1]

Pitman is continuing investigations of the physical properties of icy systems, concentrating on the problem of thermal conductivity, in an effort to better understand Whipple's icy-conglomerate model of comet nuclei.[8]

Optical data from the observations of artificial meteoroids, carried out jointly with NASA's Langley Research Center, were analyzed by Richard E. McCrosky and Cheng-Yuan Shao.[10] From data on nine artificial meteoroids, they calculated improved values of the luminosity coefficient, which is essential for determining the mass of natural meteoroids.

Under the guidance of Richard B. Southworth and Salisbury, the meteor radar system was completely refurbished and calibrated during the year.[10]

Carl S. Nilsson has gathered and is now reducing data for a precise calibration of the Havana Radio Meteor Network.[10] Further improvements in the equipment are being made by Mario R. Schaffner, who completed construction of a new system for processing received signals in real time and for following several programs simultaneously.[10]

Giuseppe Forti used observations from the Radio Meteor Network to measure radial and two-dimensional horizontal winds in the upper atmosphere.[10]

Preliminary analysis of data from the Prairie Network indicates that the mass flux of large meteoroids entering the earth's atmosphere is one to two orders of magnitude larger than would have been expected from extrapolation from faint-meteoroid data.[11] Nevertheless, the structural characteristics of the large and small meteoroids appear to be identical.

Cook, who has been working on the physical theory of meteors, has explained that the inefficiency of radiational cooling for very small bodies at relatively low temperatures may cause extremely small meteoroids to vaporize in circumstances where they were previously thought to decelerate without significant mass loss.[10] He reviewed this work at the Symposium on the Physics and Dynamics of Meteors held in September in Tatranska Lomnica, Czechoslovakia. The Director and several other staff members also contributed to this symposium.

Zdeněk Ceplecha studied the problem of the beginning heights of meteoroids in an attempt to understand why two main levels, separated by about 10 kilometers, exist.[10] The meteoroids associated with these levels have different photometric-to-dynamic mass ratios. From several possible explanations of this phenomenon he concluded that only two, meteoroid composition and fragmentation or spraying, are significant.

Ceplecha also compared computed bulk densities for Příbram fireball with those for Prairie Network meteors and found that they were on the order of 0.1 in all cases. He concluded that progressive fragmentation was decisive for Příbram and could also be important for other bolides and meteorite fireballs.[10]

THE PRAIRIE NETWORK

The Prairie Network is a system of automatic photographic observing stations in the midwestern United States. Its purpose is to acquire orbital and trajectory data on extremely bright meteors. These events are rare, any single one of them being unlikely to be observable by a single

instrument in a year's time. The network, with 64 cameras patrolling an area of 1.5×10^6 km^2 in the meteor region (60-kilometer altitude), makes it possible for the first time to obtain a statistically significant number of observations in a reasonable time.

Four major problems are under attack: recovery of meteorites, ablation processes of high-velocity objects, the relationship between a meteor's brightness and its mass, and the distribution of meteoric material in the solar system. There was some expectation at the inception of the program that these problems were relatively independent and, furthermore, that nature would supply a variety of objects that, when adequately observed, would permit one to disentangle the dependent relationships. In particular, it has been generally believed that the material that produces meteors arises from two sources, the comets and the asteroids. Considerable data on cometary meteors are consistent with a fragile, and probably low-density, structure for this material. On the other hand, meteorites attributed to the asteroidal source are high-density and frequently high-strength material. One would expect to be able to differentiate between two bodies of such grossly different characteristics from their modes of ablation during flight through the atmosphere. The one will crumble easily, thus losing mass and velocity at a far greater rate than the other. Even if there is a continuum of structural characteristics spanning the range from cometary to asteroidal material (as we have defined them here), one should still expect to be able to extract the extreme cases from a large mass of data.

Another belief was important in the early considerations of the network. A meteorite fall, of course, is preceded by an extremely bright meteor event. Limited information on the heliocentric orbit of meteorites suggested that they bore a statistical resemblance to other meteoric objects, the bright fireballs. For this and even less compelling reasons, it was assumed that many fireballs were produced by asteroidal material. Since the fraction of recognizable asteroidal material among fainter meteors is extremelly small, the obvious extrapolation of the above facts suggests that the asteroidal source would become the predominant one if one observed meteors of sufficient brightness.

While it is disquieting, the Prairie Network and other fireball data do not support any of the preceding presumptions. We have numerous observations of fireballs for which we have measured the deceleration caused by atmospheric drag. The deceleration is a function of the body size and mass. If we accept as true our best present estimates on the relationship between the luminosity and the mass of the meteor, we can determine a mass independent of the drag and combine these two numbers to give a body size or density. The average value of the densities

is about 0.4 gram per cubic centimenter, and in no case have we observed a body with a well-determined density as high as 3.5 grams per cubic centimeter, which is the density of meteoritic stone. We also find that the terminal masses of the bodies are usually negligibly small; i.e., the ablation process has been near-catastrophic. In addition, we find that the total mass impinging on the earth's atmosphere in the form of these large bodies is several orders of magnitude larger than one would have expected on the basis of an extrapolation of the distribution of smaller particles of cometary origin. The mass influx is very much greater than that estimated from the apparent rate of fall of meteorites, even if the resulting meteorite represents only ten percent of the initial body. Also, we can be reasonably certain, after four years of observations, that the rate of meteorite falls is certainly less than our most optimistic estimates at the beginning of the program (one or two of 1 kilogram or larger) and may not be substantially higher than the most pessimistic estimate, 0.1 per year.

Even though our expectations were based on somewhat doubtful premises, the results are still sufficiently surprising to compel us to question all aspects of the theory used in their derivation. Such an investigation suggests either that the drag equation is very different for an ablating body than for those cases well studied by the classical aerodynamicist or that the production of luminosity in the visual region by the meteoric process is truly an exceptionally efficient process—more efficient, for example, than the best-designed hot-element devices commonly used for illumination. Both these prospects seem remote, and perhaps the present best guess of the meaning of these data is the simple explanation that most meteoric bodies are indeed low-density, fragile objects.

Such an explanation leaves unanswered—and with the present data, unanswerable—all questions concerning the frequency distribution and ablation processes of meteorites. The only clue to these problems that remains is the single example of a meteorite photographed in flight (Příbram), in Czechoslovakia in 1956. Because of the question raised by the Prairie Network data, we have been prompted to reanalyze the Příbram data. It, too, has always given paradoxical results, but these have often been attributed to the fact that the observations were unsatisfactory because of the extreme overexposure of an object 10^6 times brighter than the cameras were designed to observe. There is, however, no simple escape from the obvious facts of this event—that an extremely large body, of many tons, fragmented high in the atmosphere into a great number of pieces, of which remarkably few survived to the ground. One concept can embody all these observations. If most meteorites,

Příbram included, represent the small, high-density portion of meteoroids, we have both a source of meteorites and an explanation of the optical observations, but we do not understand how such a conglomerate could have formed in the solar system. Good photographic observation of the meteor event preceding a recoverable fall still remains a primary requirement in order that the Příbram result may be confirmed and meteor astronomy proceed toward an understanding of the nature of meteoroids.

R. E. McCrosky

Meteorites and Cosmic Dust

The Observatory is continuing its intensive investigation of extraterrestrial materials in the form of meteorites and dust particles.

Using the SAO high-sensitivity mass spectrometer, Fireman has analyzed separated phases of the Deelfontein iron meteorite. In the metal phase the rare gases are entirely due to cosmic-ray spallation, and the argon-36/chlorine-36 exposure age is about 400 million years. In the troilite phase there is a large xenon-129 excess due to extinct radioactivity. The time between nucleosynthesis and meteorite formation is less than 100 million years. The argon content of graphite indicates that primordial gas is concentrated in carbon and that the graphite was formed under a gas pressure containing about 0.001 atmosphere of argon.

Robert H. McCorkell and Fireman determined radioactive isotopes in the Hoba meteorite. They found that it landed less than 80,000 years ago. The cosmic-ray exposure age of Hoba was found to be about 260 million years. Activities of the cosmic-ray-produced radioisotopes in Hoba indicate that the surface that was sampled was shielded by about 40 centimeters of material when the meteorite was in space. Of this shielding, about one-third is accounted for by the weathering crust formed at the earth's surface; thus, very little ablation occurred from at least one side of the body as it passed through the atmosphere.

Fireman and McCorkell also continued their analysis of the samples of the 200-year-old Greenland ice.[12] This analysis has indicated that most of the extraterrestrial material arrives on the earth in the form of relatively large bodies, about ten centimeters in diameter. New satellite and balloon results have excluded a micrometeorite influx rate of more than 100,000 tons per year.

Marvin completed a mineralogical study of dust from the Greenland icecap. The mineralogy of the dust suggests that it is primarily wind-

blown material from North America. The dust did not show any presence of characteristically meteoritic minerals.

Using a newly developed laser-microprobe mass spectrometer, George H. Megrue has determined the location and isotopic abundances of primordial rare gases in the Fayetteville and Kapoeta meteorites. The consistently high abundance of helium, neon, and argon within these meteorites suggests that the fine-grained material, possibly cosmic dust, was collected on the surface of a parent body, either the moon or an asteroid, and was then introduced into the host body by brecciation caused by meteoritic impact.

Matthias F. Comerford had previously found that target ductility is an important parameter in erosion by high-velocity dust particles.[13] Since macroscopic projectiles cause higher erosion rates than microscopic dust, he has prepared single-crystal magnetite targets to test the hypothesis that larger particles have a higher probability of interacting with flaws in the target.

As a result of an effort to determine the orientation relationship between the crystal lattices of the carbide phase and the metal phase, a computer program to describe the crystallography of the carbide was written.

A careful study of phosphide morphology by Comerford revealed that extreme care must be exercised when attempts are made to use phosphides as a measure of the thermal history of meteorites.

A quantitative X-ray analysis of shock effects in several octahedrites performed by Comerford showed that these meteorites have mechanical and physical characteristics like those of deformed iron, but they do not show the plastic flow that characterizes the usual deformation process.

The study of the effects of a hydrostatic pressure of 30 kilobars on annealing kinetics in iron-silicon is continuing in collaboration with H. Posen of Air Force Cambridge Research Laboratories. The results to date suggest that hydrostatic pressure has very little effect on recovery kinetics, i.e., property changes that occur before recrystallization; but hydrostatic pressure may have a profound effect on recrystallization kinetics.

J. Wood has assembled a large number of meteorite samples that will be analyzed for nickel distribution in gamma nickel-iron grains by means of the newly acquired SAO electron microprobe. He will investigate the rate at which each meteorite cooled between about 550° C and 350° C. This cooling rate is of interest because it is indicative of the sizes of the host bodies and of the depths at which the meteorites resided. Although Wood had already obtained and published preliminary results of this

analysis, he is now using a larger number of samples in order to approach the problem statistically to determine preferred cooling rates corresponding to discrete source planets.

Wood is also using electron-microprobe techniques to study mesosiderites, an obscure class of stony-iron meteorite that may be primitive planetary material only partly degraded by heating and mechanical mixing.

Salisbury and Darrell L. Fernald continued experiments to test the Director's hypothesis concerning the formation of chondrules. Laplace nebula conditions partially duplicated with a hydrogen atmosphere and lightning discharges have produced 1- to 2-millimeter chondrule-like objects from granite dust. The experiment will be continued using dust from actual meteorites and a prepared Cameron cosmic mix consisting of 23 different elements in their measured solar and cosmic abundances.

Frances W. Wright has continued to collect, select, and prepare volcanic and meteoritic particles to be analyzed with the SAO electron microprobe. Volcanic particles were obtained from Bali, Surtsey, Vesuvius, and Tonga; and meteoritic particles, from the Henbury and Boxhole craters in Australia. Paul W. Hodge has compared satellite penetration studies, analyses using polar-ice sediments, and other investigations for determining the influx rate of meteoritic dust and micrometeorites. The latter have been identified chemically, and the former appears to be ablation products from very large meteoritic bodies. Using data collected from the guest experimenter on Gemini 12, F. Wright with Donald E. Brownlee, of the University of Washington, and Hodge determined a statistically probable value of an upper limit to the influx of particles.

Data from the OGO–2 micrometeoroid experiment have been completely analyzed by Nilsson.[14] He found only two impacts in over 1300 hours of data, and these may have been due to noise rather than to genuine impact. He therefore deduced that the average flux of micrometeoroids of mass greater than 10^{-2} gram must be less than 3×10^{-2} particle per square meter per second per 2π steradian. Nilsson, David S. Wilson, and F. Wright have analyzed over 1100 hours of data from the OGO–4 micrometeoroid experiment. They found no genuine impacts; this fact places an upper limit on the flux of particles of mass greater than 10^{-12} gram in the vicinity of the earth of 3×10^{-3} particle per square meter per second per 2π steradian.

Celestial Mechanics

In addition to those relevant investigations already noted, the Observatory carried on a variety of research in celestial mechanics.[1]

A highlight of the year was the approach of Icarus to the earth, an event that had long been awaited by scaremongers and members of certain "religious" sects (hippies), as well as by astronomers. Marsden kept track of its orbit as it approached and communicated information regarding it to the astronomical community.

Hamid developed a first-order planetary perturbation theory that makes available harmonic representations in mean anomalies of the perturbations.

The formulas for the effect of the moon's precession, nutation, and aberration on a selenocentric celestial coordinate system were developed by Kolaczek. Their general form enables the translation from one celestial coordinate system to another, e.g., from that of the earth to that of the moon or planets or of a space station.

Colombo, Cook, and Franklin are studying periodic orbits of restricted three-body problems to achieve a better understanding of the gaps of Saturn's rings and the asteroidal belts.

The Sun and Beyond

The Observatory's study of the sun, of the stars and other bodies, and of phenomena beyond the solar system can be considered under two headings: observational programs and theoretical investigations. The former include the detection of gamma rays from celestial sources,[15] Project Celescope,[16] most SAO research by means of radio telescopes, and the analysis of OSO–4 data; the latter, model stellar atmospheres, analysis of line radiation, stellar dynamics, cosmological models, and atomic and molecular physics. In fact, however, this division is largely for the sake of convenience, since no sharp distinction between the two areas can be made.

OBSERVATIONAL PROGRAMS

The Orbiting Solar Observatory (OSO–4) experiment, under the overall direction of Leo Goldberg, Director of the Harvard College Observatory, was the principal research area of Robert W. Noyes.[17] This experiment culminated in the successful launch (19 October 1967) and operation of an ultraviolet spectroheliometer to obtain monochromatic images of the sun in the light of coronal and chromospheric emission lines in the far ultraviolet.

The ultraviolet spectroheliometer, which operated successfully to 30 November 1967, sending back over 4000 pictures of the sun in 52 different wavelengths distributed over a wide range of temperatures and heights in the solar atmosphere. Most of the observations obtained are unique, in that they are the first to give spatial (depth) resolution on

the solar disk. George B. Rybicki developed a new correction for instrumental effects on observed spectra to extract more data from the observed spectroheliograms. Data on the Lyman continuum of hydrogen have already been used to investigate the temperature structure and departures from local thermodynamic equilibrium (LTE) in the chromosphere.

Together with Noyes and J. M. Beckers of the Sacramento Peak Solar Observatory, Jay M. Pasachoff continued the investigation of fine structures in the solar chromosphere. Both the dynamics and the radiation of the chromosphere were studied. Pasachoff and Joseph Silk considered the red shift of solar absorption lines and concluded that it is a general relativistic effect in which Compton scattering is insignificant.

Menzel continued his work on magnetohydrodynamics and problems of the solar atmosphere, including the structure and dynamics of sun spots, the corona, and most recently the theory of coronal helmets. He completed the analysis of observations, taken in Peru, of the polarization of the corona during the November 1966 eclipse.

The Observatory's effort to obtain accurate stellar spectral-energy distributions concentrated on instrument development for use on Mount Hopkins. A contract for the manufacture of a 60-inch telescope was signed. The site for this telescope was selected after a year of field-test observations under the direction of Noyes.[18]

David W. Latham modified the SAO spectrum scanner for use with a 12-inch telescope. A small building and dome were erected for this instrument, to obtain data and site experience on Mount Hopkins.[18]

Investigations commenced of possible configurations of a major optical reflector of a diameter equivalent to several hundred inches. It is hoped that this instrument will be installed on Mount Hopkins in three to five years.

The joint radio-optical monitoring of flares stars continued. Observations were expanded for 24-hour intervals coordinated by the Working Group on Flare Stars of the International Astronomical Union. The previous year's observations were reduced and correlated with radio data by Solomon.[19]

F. Wright and Hodge obtained two-color magnitudes of main-sequence stars and periods of variables in the Large Magellanic Cloud (LMC). Ages of 1200 clusters were determined. These results give a time sequence of cluster formation and a history of the LMC and contribute in general to our knowledge of the evolution of galaxies.

Other studies of galaxies by Hodge included detail structure and radial distribution of H II regions in spirals. The structure of all known members of the Fornax cluster of galaxies is now complete. Further studies of irregular and radio galaxies have begun.

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Other studies of galaxies by Hodge included detail structure and radial distribution of H II regions in spirals. The structure of all known members of the Fornax cluster of galaxies is now complete. Further studies of irregular and radio galaxies have begun.

Hodge also completed reductions of luminosity and color measures of NGC 147 and 205. The Population I component at the center of NGC 205 can probably be ascribed to a super-supernova or to some other short-lived burst of star formation. Studies of extragalactic stellar associations in nearby galaxies have begun, with the intent of extending the Bok-and-Bok relation to greater distances.

The Celescope experiment package has successfully completed the environmental acceptance tests at NASA and has been installed in the Orbiting Astronomical Observatory; current plans call for launching in the fall of 1968.[16]

Robert J. Davis devoted his time to planning the automatic analysis of data from the Celescope experiment. Computer programs have been completed for identifying and measuring the positions and brightnesses of stars in the television pictures from Celescope and for controlling and analyzing the operation of the Celescope experiment. William A. Deutschman and Davis completed a preliminary catalog of all astronomical objects that they expect to observe with the Celescope experiment. Nozawa developed a method for determining the optimal test duration for a space system that is the only available unit for flight.

The Director has been active on a committee of the National Academy of Sciences that is considering the possibility of a large space telescope.

The Observatory continued to study the mechanisms that produce cosmic gamma rays and to develop techniques to measure low-, medium-, and high-energy cosmic gamma radiation.

During September 1967, Giovanni G. Fazio, Henry F. Helmken, David Hearn, and Stephen Cavrak conducted a balloon flight from Palestine, Texas, with the vidicon spark-chamber detector to study gamma radiation in the range 100 million electron volts (Mev) to 5 billion electron volts (Bev). Failure of the high-voltage supply in the spark chamber prevented a search for cosmic gamma-ray sources; however, the scintillation counters and telemetry systems functioned well, and useful data were obtained for determining the operation of future detectors.[20] Preparations are being made for another balloon flight with the vidicon spark chamber in September 1968.

Helmken studied the design of gamma-ray detectors in the 0.2- to 10-Mev and 10- to 50-Mev ranges. These detectors will be flown on balloon flights near the geomagnetic equator as part of a joint experimental program with the Tata Institute of Fundamental Research in Bombay, India.[21] In March a preliminary balloon flight was made in India to test telemetry and to measure the background radiation.

In June the large optical reflector was installed at the Mount Hopkins Observatory and final acceptance tests were performed. This steer-

SAO's Helmken and Fazio cooperated with the Tata Institute of Bombay in launching an instrument package to measure the normal background level of secondary radiation caused by cosmic rays striking the upper atmosphere. Top, Indian workers fill the balloon with a quarter-million cubic feet of hydrogen; below the balloon readied for launch.

able 34-foot-diameter dish, consisting of a mosaic of 248 hexagonal mirrors, each 2 feet across, will detect gamma rays with energy greater than 10 Bev.

In preparation for the large optical reflector experiments, Fazio, Helmken, Trevor Weekes, and George Rieke conducted a pilot experiment at the Mount Hopkins Observatory. Using two 5-foot searchlight mirrors as reflectors, they achieved a gamma-ray energy threshold of 2000 Bev. Six months of observations resulted in new or improved upper limits on 18 suspected gamma-ray sources, including the Crab Nebula, M82, M87, and pulsating radio sources.

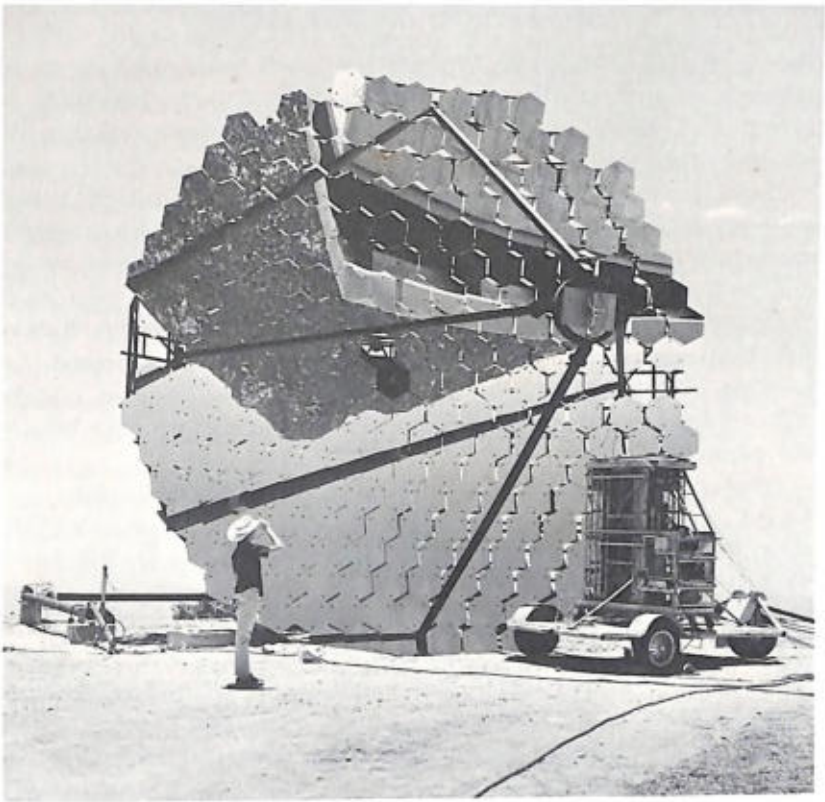
Working under Fazio, C. Cheng of Harvard College Observatory and Floyd Stecker conducted theoretical studies of cosmic gamma rays produced in interstellar and intergalactic cosmic-ray collisions and of the expected gamma-ray flux from the sun during solar flares.

This year marked successful completion of a project begun three years ago. Under the direction of A. Edward Lilley, the SAO-Harvard 84-foot-diameter precision paraboloid antenna was installed on an existing pedestal with an equatorial mounting and drive assembly at Harvard's George R. Agassiz Station. A new counterweight system was installed, a survey of the instrument's surface carried out, the system noise temperature measured, and the telescope placed on a regular operational basis. This radio telescope uses parametric amplifiers in a variety of research programs. Joseph F. Hayes has developed a small laboratory for constructing and testing parametric amplifiers.

The Observatory continued to participate in the study program of the Northeast Radio Observatory Corporation (NEROC), successor to the Cambridge Radio Observatory Committee (CAMROC).

Dale F. Dickinson has been working with M. Litvak of MIT Lincoln Laboratory and Ben Zuckerman of the SAO-Harvard radio-astronomy group on the problem of maser models to explain the anomalous OH signals. Excitation by ultraviolet light and excitation by near- and far-infrared radiation are three of the ideas most favored currently. Dickinson's work thus far indicates that the far-infrared processes play an important role, although they may not necessarily be the predominant exciter.

Sachiko Tsuruta has been investigating possible explanations of rapidly pulsating radio waves detected recently. Models involving both neutron stars and white dwarfs were studied. Study of various possibilities involving neutron stars, such as a combined model of oscillations plus rotations, the effect of stellar flares, magnetic fields, and atmospheric resonance, is proceeding. Analytic equations are being derived to explain the beta reaction rates in a shell of white dwarfs where URCA processes



At Mount Hopkins Observatory, Arizona: The large optical reflector.

(electron decay, positron decay, and electron capture) can take place. These equations will be useful for some of the white-dwarf models proposed to explain pulsars.

Carleton and Costas Papaliolios have made optical-photometric searches with the Harvard 61-inch telescope in the region containing one of these pulsating radio sources, CP1919. They have concluded that no object in this vicinity flashes in visible light in the same manner as do the radio pulses. The brightest star in the area defined by the radio observations is only of 19th visual magnitude. The observations could have detected a fluctuation of light equal to 0.4 percent of the light output of this star during the time between radio pulses if this fluctuation were concentrated in a time equal to the duration of the radio pulses. The possibility of the existence of other variations in light emission from the region is still being examined.

THEORETICAL INVESTIGATIONS

During the year Charles A. Whitney continued his research on stellar atmospheres and radiation gas dynamics. With Charles J. Bartlett, he investigated several problems of the structure of shock fronts in the presence of radiation.

Owen J. Gingerich performed the master calculations for a new reference solar model, the Bilderberg Continuum Atmosphere, and extended the ultraviolet calculations to include the carbon-absorption edge and the Lyman-alpha wings.

Duane Carbon, Gingerich, and Robert Kurucz studied the effect of line blanketing on the observed solar spectrum and hypothesized that existing observations of the "line-free" solar radiation field may be affected by a multitude of weak, unseen absorption lines, especially in the ultraviolet.

Stephen E. Strom, with Peter Conti of the Lick Observatory, continued studies of abundance anomalies in A stars and proposed that the class of Am stars be extended to higher effective temperatures.[22] S. Strom worked with Tom Greene, of the University of Washington, on the depth variation of turbulent velocities in atmospheres of K giants; their preliminary result is that velocity increases with depth.

Wolfgang Kalkofen and S. Strom continued their study of the continuum-formation layers in early-type stars.[22] Assuming detailed balancing in photoexcitation, they predict that, when radiative processes predominate over collisions, the population of the second hydrogen level is smaller, while those of the third level and the bound level of H^- are greater than populations prevailing in LTE.

Deane M. Peterson and S. Strom investigated non-LTE effects in the wings of Balmer lines; their predictions agree well with observations. Using their very accurate photoelectric profiles of H-alpha and H-gamma for Vega and Sirius, they showed that Griem's formulation of the Balmer-line Stark broadening is superior to that of Edmonds, Schlüter, and Wells.

Yvette Cuny showed that interpretations of the solar ultraviolet spectrum in the range 1500 to 1680 Å must consider non-LTE effects, and resolved discrepancies between computed and observed solar spectra by taking into account the resonance-broadening opacity of the Lyman-alpha wings.

Prompted by Cuny's discovery of the importance of Lyman-alpha absorption in the near ultraviolet, S. Strom and Karen M. Strom investigated the temperature structure of subdwarfs.[22] They found that subdwarf temperatures had previously been underestimated and that

consequently the helium content of these stars may be at least as high as 5 to 10 percent by mass. Studying Si I bound-free opacity, Strom and Strom showed that it plays an important role in the emergent flux of B7 to F0 stars. S. Strom investigated the determination of turbulent velocities from differential curves of growth and concluded that cases where metal-to-hydrogen ratios differ significantly between program and standard stars must be treated very cautiously.

Eugene H. Avrett investigated temperature and density variations and the inhomogeneities in the outer solar atmosphere by means of detailed theoretical analyses of spectral lines. He collaborated with Jeffrey L. Linsky, Pasachoff, and Eric Chipman of Harvard College Observatory in studies of the Ca II, Na I, Mg I, and H resonance lines. Their results suggest that the chromospheric temperature rise occurs at a greater height than was previously supposed and is accompanied by a sharp increase in turbulence.

Incorporating convection and better opacity calculations in their versatile computer program, Gingerich and collaborators Linsky, Carbon, and Latham have now achieved the coolest nongray stellar atmospheres ever computed.

Some of these and related results were reported at the third Harvard-Smithsonian Conference on Stellar Atmospheres.[23] This conference, dealing with the theory and observation of normal stellar atmospheres, was organized by Whitney and Gingerich and took place during the week of 8–12 April. Attending were 67 scientists from this country and abroad, as well as 29 staff members of SAO and the Harvard College Observatory.

Observatory scientists also investigated a variety of problems concerning nebulas, supernovas, interstellar space, and fundamental physical processes of the universe.

Rybicki computed emission lines of a simplified model of expanding planetary nebulas, formulating the scattering calculations to take differential motions into account. He demonstrated that such nebulae can show red-shifted emission lines, whereas many other investigators had expected that blue-shifted lines would occur.

Tsuruta, J. W. Truran and A. G. W. Cameron of Yeshiva University, and W. D. Arnett of the NASA Institute for Space Studies completed their detailed calculations of supernova element synthesis; confirming earlier analytical predictions, they showed that heavy elements are indeed produced under the conditions expected in expanding supernova envelopes. Tsuruta also investigated the URCA neutrino energy loss in nondegenerate and semidegenerate matter; her results will be useful in studies of the formation of white dwarfs or neutron stars.

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James P. Wright considered the role of rotation in general relativity, as well as the differences in the defined angular momentum in Newtonian theory and Einsteinian theory. He also found that, for determining instabilities and periods, the binding-energy methods are equivalent to the small-perturbation methods.

Menzel has nearly completed his calculations of high-level hydrogen lines in interstellar space. He also recomputed, by his more accurate formulas, the intensities of low-level hydrogen transitions.

Silk studied the effects of blackbody radiation on an initial spectrum of small-amplitude fluctuations in homogeneous and isotopically expanding cosmological models; he also investigated mechanisms that might explain the diffuse X-ray background observations.

Thornton L. Page continued his studies of the mass, structure, content, and evolution of galaxies. On two trips to Cordoba, Argentina, he obtained 60 spectra of southern galaxies and discovered one galaxy (NGC 3783) that is of the Seyfert type with broad emission lines. On another observing session, at Kitt Peak, he and H. J. Rood of Wesleyan University obtained 44 spectra of galaxies, mostly in the Coma Cluster, for a study of the dynamics and structure of that cluster.

Numerical experiments by Myron Lecar, with Carlos Cruz-Gonzales and Michel Henon, confirming previous estimates of the relaxation times of stellar systems, indicated that galaxies behave like a collisionless gas, while globular and galactic clusters are markedly influenced by stellar encounters.

Lecar worked with Leon Cohen of Hunter College to establish that relaxation by collective effects is sufficiently rapid to account for the symmetrical shapes of elliptic galaxies. Lecar established a group in stellar dynamics at Tel Aviv University in Israel; he collaborated with Shyke Goldstein and Sami Cuperman of that group on investigations of acceleration mechanisms in collisionless stellar systems, showing that a dense core surrounded by a tenuous halo is a common feature of such systems.[24]

In a comparison, sponsored by the International Astronomical Union, of direct numerical integrations of a particular 25-body collision-dominated problem performed at eight observatories, Lecar found this problem to be highly unstable and the results of numerical experiments to have only statistical value.

Henri E. Mitler completed his calculation of element formation during the "big bang," i.e., at the beginning of the universe. Even though it predicts appreciable amounts of elements heavier than helium from an initial state of only cold neutrons, his present model disagrees with observations. He also studied the coupling of matter and radiation in cosmology, deriving their rate of energy exchange via free-free absorp-

tions and emissions and calculating explicitly and accurately the matter and radiation temperatures through the decoupling region. His big-bang model produces residual ("fossil") radiation, but not enough to explain the observed 3°K background radiation.

This year SAO extended its program of theoretical research in atomic and molecular physics, to supplement its existing laboratory research. Observatory scientists study collision processes involving the interaction of radiation with electrons, atoms, and molecules taking place in the solar corona and in the interstellar medium as well as in the atmospheres of the planets.

Alex Dalgarno continued his fundamental studies on the quantum mechanics of many-body systems. Dalgarno and coworkers evaluated the thermal balance of the ionospheric regions of the earth's upper atmosphere in detail and demonstrated that the conversion of heat into luminosity by the collisional excitation of the fine-structure levels of oxygen atoms is the major mechanism for cooling the electron gas. Dalgarno and Gordon Drake explored processes by which long-lived metastable helium-like atoms ultimately decay.[25] They do so by the simultaneous emission of two photons. The resulting emission has been calculated and should be observable in the X-ray spectrum of the solar corona.

Arthur Allison calculated the viscosity and diffusion coefficients applicable to the study of the collision of a beam of hydrogen atoms with other hydrogen atoms. He is calculating photo-ionization and absorption coefficients governing Lyman emission by excited hydrogen molecules. Kenneth Sando and Allison studied the absorption spectrum of the helium molecule.

Papaliolios continued his laboratory studies of metastable states of atmospheric gases and directed the construction of a large-aperture ultraviolet spectrometer with moderate resolution, needed for this reseach.

The observational programs and theoretical investigations of SAO require new mathematical methods and elaborate general computer scattering process. Both Rybicki and Latham developed methods and programs. Rybicki studied ways to treat differential motions, horizontal inhomogeneities, and incomplete redistribution in the elementary atomic programs for automatic reduction of spectrograms, the former paying special attention to correcting observed spectra for instrumental effects. Kalkofen and Avrett developed further methods for the numerical solution of integral equations arising in the calculation of the radiation field of stellar atmospheres in statistical equilibrium. Peterson formulated an effective new procedure for temperature calculations at small optical depths in model atmospheres. The stellar-atmosphere program constructed by Gingerich and many coworkers has grown so uniquely useful

that investigators from other institutions come to SAO to use it. A line-profile program that Avrett and Rudolf Loeser continued to develop can accept atomic models of quite arbitrary complexity and many energy levels. Kurucz, working with S. Strom, has developed a very flexible and general model-atmosphere program that can be run on either CDC 6000, IBM 7000, or IBM 360 series computers.

Historical Astronomy

A grant was obtained from the National Geographic Society for the study of desert lines in Peru.[26] These lines are man-made circa A.D. 1; they extend, on the average, for about a mile on the desert pavement. A preliminary study shows that there may be up to a million lines and markings in the 1000-mile-long desert plateau. The interest of SAO is to ascertain whether or not these lines are (or were) directed to astronomical objects. Gerald S. Hawkins is expedition leader.

Using the CDC 6400 computer, Gingerich calculated a 300-year daily ephemeris based on the 13th-century *Alphonsine Tables;* it will serve as an aid for specialists in medieval astronomy. Also, a tabulation of moonrise and moonset in ancient Babylon was recomputed with the help of Barbara Welther. Gingerich's current study of the Persian astrolabist Abd al A'imma may shed some light on the curious fact that at least half of his astrolabes are incompetently constructed.

The first rough translation of Kepler's *Astronomia Nova* is now about 80 percent complete, largely through the efforts of William Walderman and Ann Wegner.

In April Gingerich attended a Copernicus Commission meeting in Warsaw to begin planning the 1973 half-millennium celebration of Copernicus' birth. At the International Astronomical Union Congress in Prague, Gingerich became Vice President of the Commission on History of Astronomy.

Central Bureaus

Gingerich retired as Director of the Central Bureau for Astronomical Telegrams on 31 December, his place being taken by Marsden, with the former continuing to serve as Associate Director. During the fiscal year, 59 circulars and 33 telegram books were issued. Far more than the normal number of supernovas (in other galaxies) were reported; news concerning six of them was disseminated by telegram during one 3-month period, and several other supernovas were announced by circular alone. Two naked-eye novas were reported, both discovered by G. E. D. Alcock in England, and the recurrent nova RS Ophiuchi also flared up to naked-eye brightness. Predictions and subsequently observations of

the occultation of an 8-magnitude star by Neptune were reported. A number of items concerning "pulsars" were issued. Four comet discoveries and seven recoveries were announced, four of the latter being made in one night (by K. Tomita at the Tokyo Observatory).

In April, Veis replaced Whipple as the Director of the Central Bureau for Satellite Geodesy. The Bureau [27] issued two regular publications this year as well as a special report submitted at the General Assembly of the International Union of Geodesy and Geophysics in Lucerne in 1967, which described the activities of the Central Bureau since its establishment in 1964. The Central Bureau made positive contributions to the increase of international scientific cooperation, especially in Africa, the Middle East, and the Far East. Rolff visited optical tracking stations in Poland, the Soviet Union, Greece, India, and Hawaii, and he represented the Bureau at international meetings on satellite geodesy held in London, Zakopane (Poland), Prague, and Tokyo.

The Observatory is now also headquarters of and supplies logistical and other support for the Smithsonian's newly established Center for Short-Lived Phenomena.

Staff Changes

The scientific staff of the Observatory welcomed, during the year, physicists Alex Dalgarno, Kenneth Sando, and Hiram Levy; astronomer Ladislav Sehnal; geodesist Kurt Lambeck; astrophysicists Yvette Cuny and Charles Bartlett; geologist Paul Mohr; and geophysicist Giorgio Giacaglia.

During the year, the Observatory continued its program of postdoctoral fellowships in cooperation with the National Academy of Sciences – National Research Council. Appointees during the year were Robin Reid, Gordon Drake, M. V. Krishna Apparao, Zdeněk Ceplecha, and Michel Henon. Allan Title and Thornton Page completed their fellowships with the Observatory; Title has taken an appointment with Harvard, and Page received an appointment as a Research Associate with the Smithsonian.

Resignations were received from David Tilles and Charles Bartlett and Leonard Solomon. Later during the year the Observatory was saddened to receive news of the untimely death of Dr. Tilles.

Jack Coffey was appointed Executive Officer of the Observatory, and Harry Albers was appointed Manager of the Satellite-Tracking and Data-Acquisition Department.

NOTES

(For explanations, see footnote, page 445.)

[1] Supported by NASA grant NsG–87.

[2] Supported by NASA contract NSR 09–015–039.

[3] Supported by NASA contract NSR 09–015–018.
[4] Supported by NASA contract NSR 09–015–054.
[5] Supported by NASA contract NSR 09–015–079.
[6] Supported by NASA contract NAS 9–8105.
[7] Supported by NASA contract NAS 9–8106.
[8] Supported by NASA grant NGR 09–015–023.
[9] Supported by NASA grant NGR 09–015–047.
[10] Supported by NASA contract NSR 09–015–033.
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Administrative and Management Services

Daily the forces of change in our society exert their profound pressures upon this nation's social and cultural institutions—upon its arts and sciences, and upon its people. Daily our traditions and norms are being challenged, and more than ever before, too, our organizations are being challenged to develop management policies that will enable them to evolve in response.

In its response to these pressures and challenges, the Smithsonian has endeavored to establish an organization that is adaptive to change and is experientially motivated—one with programs and structural modules predicated upon sociological interrelationships rather than upon compartmentalized bureaucratic boundaries, one in which individual as well as common goals can be achieved. Such an organizational environment helps to prevent isolation and to remove artificial restrictions, and thus it encourages individual achievement and the pursuit of excellence. The Smithsonian is committed, in short, to a program of administration and management that recognizes the importance of individual fulfillment within the framework of its larger objectives. The goal of this program is to establish a climate that encourages individual expression, releases creativity, ignites imagination, and fosters hope, trust, openness, and meaningful cooperation.

In achieving such a goal, an important function of management is that of nurturing the talents of the individual staff member, and of recognizing and responding to his needs, desires, and drives as a human being. The unique, multiversal nature of the Smithsonian and its staff makes this function a formidable and challenging opportunity to those charged with managerial responsibility. It requires a very special competence in social skills. Management's broadening role as the custodian of human resources is never more challenged than in synergizing the individual's drives into a program accomplishment without frustrating the individual or compromising the goal.

The standards of excellence the Smithsonian has set for itself, and the limitations circumstance has set upon its resources, place a premium on the innovative resolution of problems, on prescient program planning, and on cohesive teamwork. They force the Institution to accept management by programs and objectives as an organizational way of life.

In measuring its success in these respects, the Smithsonian can view with satisfaction the creative energy of its staff and the imaginative administration of its management. Through perceptive use of its great reservoir of talents, the Institution is showing itself able to respond to the forces of change while continuing, and expanding, its services to the cultural community and to the public.

Explicit in these contributions has been a firm recognition of the underlying value of the individual. For, in truth, the accomplishments of the Smithsonian Institution are but the sum of the achievements of the individuals which comprise it.

OFFICE OF PERSONNEL AND MANAGEMENT RESOURCES

The Office of Personnel and Management Resources has a responsibility to assist and advise all Smithsonian staff in creating an environment of administration and management that stimulates and promotes high achievement and the optimum use of resources.

The Office also administers a wide variety of programs affecting each employee from the time of recruitment through his career with the Smithsonian. This year the Office has worked to improve the direction and implementation of some fifteen substantive programs.

Responsive assistance to program directors and managers is a primary thrust of the Office's responsibility, which is that of acting as a consultant. In so doing, it serves as a catalyst, bringing to the attention of managers a knowledge of the organizational and behavioral sciences. And since stringent limitations have been placed on the Institution's manpower and financial resources, many management decisions must be considered for the effect they will have on all employees and on each individual's motivation for achievement. Consequently, a close consultant relationship between the professional staff of this Office and managers at all levels has been established, and the relationships of organizational structure and program to resources are being reviewed for improvement. The Staff of the Office has also participated in many lecture presentations, seminars, and teaching programs at other agencies, educational institutions, and professional societies.

To meet the Institution's growing responsibility to provide the public with a wider variety of learning opportunities, the Office has inaugurated additional training and employment programs for the physically handicapped, for young adults in need of summer employment, and for residents of the Metropolitan area in need of enhanced job opportunities. Participation in this year's Youth Opportunity Program, for example, was double that of last year, and this investment in special training that was afforded these deserving young citizens was repaid by hard work

and sincerity of purpose on their part. Also, the Smithsonian in 1965 was one of the first establishments in the nation's capital to participate in the Neighborhood Youth Corps program, and at that time, by agreement with the United Planning Organization, provided work stations for 40 enrollees. This year over 70 youths participated, and to date the Smithsonian has trained approximately 20 percent of all enrollees in the Washington area. As a result of their job training, an average of 30 percent of our enrollees have obtained federal employment, 10 percent have returned to school full time, and many of the remainder have obtained employment elsewhere.

For Smithsonian employees desiring to complete their high school education, or desiring to increase their job and personal qualifications in other occupational fields, a pioneering program of education and training was established. All career emplyees may now avail themselves of this program at no financial cost to themselves. Over 70 employees are already enrolled.

BUILDINGS MANAGEMENT DEPARTMENT

The Buildings Management Department operated, maintained, and protected the Smithsonian's more than three and one half million square feet of museum space, as well as its other research and service facilities in the Washington area. It provided security services for over 60 million objects of cultural, historical, scientific, and technological importance; and it provided information, directions, and other assistance to the 11,523,897 people who came to visit the Smithsonian museums and art galleries, and to attend its other presentations. In performing these duties, the Department supplied many different kinds of special mechanical services, as well as engineering, design, fabrication, repair, communication, transportation, and safety services, all of which supported the curatorial, research, administrative, education, and public-service activities of the Institution.

Expansion in the research, scientific, exhibition, and public-oriented activities of the Smithsonian, including those on the Mall, required greatly increased assistance from the Department. In addition, services were provided for 2,500 meetings, lectures, concerts, special exhibitions, seminars, and other special events, including those held on the Mall. Extensive alterations and modifications continued to be made to the Arts and Industries and other buildings. The Publications Distribution Section and the International Exchange Service were moved from the Arts and Industries buildings to the 24th Street building, and several offices were moved from the Smithsonian building in preparation for extensive renovation and restoration of that building. Increased empha-

RECORD OF VISITORS DURING FISCAL YEAR 1968

1 JULY 1967–30 JUNE 1968

1967	Smithsonian Building	Arts and Industries Building	Museum of Natural History	Air and Space Building	Freer Gallery of Art	Museum of History and Technology	Fine Arts and Portrait Galleries	Total
July	157, 780	273, 350	692, 284	238, 329	25, 955	936, 727	—	2, 324, 425
August	159, 016	274, 601	671, 279	239, 417	28, 652	835, 739	—	2, 208, 704
September	66, 324	90, 796	183, 334	67, 754	15, 203	300, 341	—	723, 752
October	58, 820	77, 568	197, 263	61, 059	12, 771	311, 751	—	719, 232
November	51, 908	81, 068	229, 594	66, 860	12, 171	301, 296	—	742, 897
December	37, 376	50, 454	124, 610	32, 505	7, 563	211, 085	—	463, 593
1968								
January	29, 664	46, 280	118, 567	31, 388	7, 315	160, 750	—	393, 964
February	45, 975	71, 500	165, 252	51, 675	9, 473	243, 751	—	587, 626
March	56, 289	87, 896	228, 318	87, 088	12, 757	354, 915	—	827, 263
April	71, 690	112, 250	245, 903	99, 194	14, 176	442, 998	—	986, 211
May	49, 401	86, 772	207, 529	71, 813	10, 592	340, 954	19, 849*	786, 910
June	62, 933	92, 087	194, 024	76, 616	12, 905	309, 716	11, 039	759, 320
TOTALS	847, 176	1, 344, 622	3, 257, 957	1, 123, 698	169, 533	4, 750, 023	30, 888	11, 523, 897

*National Collection of Fine Arts opened 3 May 1968.

The total of visitors this year to all parts of the Smithsonian complex was 17,615,949, a figure that includes 1,267,028 at the National Gallery of Art and an estimated 4,825,014 at the National Zoological Park. This total is somewhat over two million less than that of last year, as a result of the civil disturbances during the spring months.

sis on safety programming activities resulted in a reduction over the previous year of 12 percent in the frequency of disabling work injuries.

OTHER SERVICES

The Supply Division processed over 10,000 purchases. Through careful exercise of its responsibility for the distribution and utilization of government property it saved, on office furniture and equipment alone, which would have been otherwise purchased, in excess of one hundred thousand dollars. In addition, various objects from rockets to items of art, with acquisition costs in excess of $8,000,000, were obtained from other government agencies for use as museum specimens.

The Photographic Services Division produced 30,930 negatives, 16,267 color transparencies, 118,930 microframes, and 129,382 prints to meet research, exhibition, education and public service needs of the Institution. An eight-room photo laboratory was completed for servicing activities of the Smithsonian Oceanographic Sorting Center. This new unit, when staffed and equipped, will supply photographs such as photomacrographs of sampled plankton and enlargements of sea-bottom photographs to assist in ecological studies. Staff photographers will be assigned to participate in a variety of expeditions and cruises to take color and appearance photographs of newly captured specimens.

Appendix

1. FINANCIAL REPORT FOR THE YEAR ENDED 30 JUNE 1968
2. SMITHSONIAN FOREIGN CURRENCY PROGRAM GRANTS AWARDED, FISCAL YEAR 1968
3. PUBLICATIONS OF THE SMITHSONIAN INSTITUTION PRESS FOR THE YEAR ENDED 30 JUNE 1968
4. SMITHSONIAN ASSOCIATES
5. MEMBERS OF THE SMITHSONIAN COUNCIL, 30 JUNE 1968
6. RESEARCH PARTICIPATION PROGRAMS, APPOINTMENTS 1967–1968
7. STAFF OF THE SMITHSONIAN INSTITUTE, 30 JUNE 1968

1.

Financial Report

For the Year Ended 30 June 1968

The Smithsonian Institution gratefully acknowledges gifts and bequests received from the following:

$100,000 or more:

Carl F. Drake Estate (partial distribution)
Mrs. Marjorie Merriweather Post
Admiral and Mrs. Dewitt Clinton Ramsey Fund

$10,000 or more:

American Federation of Information Processing Society
Anonymous
Morris and Gwendolyn Cafritz Foundation
Carnegie Corporation of New York
Martin L. Ehrmann Company
Ford Foundation
Daniel and Florence Guggenheim Foundation
Junior League of the City of Washington, D.C.
L. E. Katzenbach
Samuel H. Kress Foundation
Lockheed Aircraft Corporation
National Geographic Society
Whitney Museum of Art

$1,000 or more:

AFL–CIO
American Philosophical Society
American Shop Producers Council
Anonymous
Archbold Foundation
Atlantic Richfield Company
Mrs. August Belmont, Sr.
The Louis and Henrietta Blaustein Foundation, Inc.
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The Link Foundation
Mrs. Vera G. List
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Mrs. Eugene Meyer
Robert and Eleanor Millonzi
National Academy of Sciences
National Home Library Foundation
Roy R. and Marie S. Neuberger Foundation
Richard E. Pieper
Mr. & Mrs. Robert C. Scull Foundation
The Sidney Printing and Publishing Company
Sport Fishing Institute
E. R. Squibb & Sons, Inc.
Philip M. Stern
Taconic Foundation, Inc.
Time, Inc.
Union Carbide Corporation
Ellen Bayard Weedon Foundation
Worthington Corporation

$500.00 or more:

Alaska Indian Arts, Inc.
American Council of Learned Society
Anacostia Business and Professional Association, Inc.
Bell & Howell Foundation
Braniff International
Explorers Research Corporation
Greenewood's Transfer, Inc.
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J. Seward Johnson
Felix and Helen Juda Foundation
John R. Kinard
Richard K. Mellon
Mrs. Isabelle P. Middendorf
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Philip Morris, Inc.
William Paley
Mrs. Josephine Pendleton
Photography in the Fine Arts
The Reader's Digest
Sidney N. Shure
Mrs. Robert D. Van Roijen
Thomas J. Watson, Jr.
Wenner-Gren Foundation

We also gratefully acknowledge other contributions in the amount of $10,820 received from 517 persons during 1967–68.

PEAT, MARWICK, MITCHELL & CO.
CERTIFIED PUBLIC ACCOUNTANTS
1140 CONNECTICUT AVENUE NW.
WASHINGTON, D.C. 20036

THE BOARD OF REGENTS,
SMITHSONIAN INSTITUTION:

We have examined the balance sheet of private funds of Smithsonian Institution as of June 30, 1968 and the related statement of changes in fund balances for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

As stated in note 1, the Institution changed its method of accounting to the accrual basis for that portion of the unrestricted funds relating to activities during the year. Physical inventories for such activities were not taken at June 30, 1967, and estimated figures have been used. Because such amounts enter materially into the determination of operating results of activities, we do not express an opinion on the current year's statement of changes in fund balances for that portion of unrestricted funds relating to activities.

In our opinion, the accompanying balance sheet of private funds of Smithsonian Institution presents fairly the financial position of Smithsonian Institution at June 30, 1968 and the related statement of changes in fund balances, except for that portion of the unrestricted funds relating to activities, for which no opinion is expressed, present fairly the results of its operations for the year then ended on the modified cash basis as explained in note 1 in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year, except for the effect on the balance sheet of current funds of the conversion of that portion of unrestricted funds relating to activities to the accrural basis, which we approve.

PEAT, MARWICK, MITCHELL & CO.

August 23, 1968

SMITHSONIAN

BALANCE SHEET OF PRIVATE

Assets

Current funds:		
Cash		$ 1,380,153
Receivables:		
Accounts	$ 90,359	
Advances-travel and other	142,059	
Reimbursements-grants and contracts	1,135,754	
		1,368,172
Inventories at net realizable value		610,388
Investments-stocks and bonds (market value $2,437,512)		2,507,586
Equipment-museum shops (less accumulated depreciation $4,944)		44,450
Total current funds assets		$ 5,910,749
Endowment and similar funds:		
Cash		$ 450,175
Notes receivable		240,254
Investments-stocks and bonds (market value $30,196,344)		21,726,554
Loan to U. S. Treasury in perpetuity		1,000,000
Real estate (at cost or appraised value at date of gift)		1,332,767
Total endowment and similar funds assets		$24,749,750

See accompanying notes to financial statements.

INSTITUTION

FUNDS, JUNE 30, 1968

Liabilities and Fund Balances

Current funds:		
Accounts payable		$ 379,624
Accrued liabilities		39,374
Unrestricted funds balances:		
General	$3,078,671	
Activities	7,482	3,086,153
Restricted funds balances:		
Gifts, grants, and contracts	1,526,607	
Unexpended income	878,991	2,405,598
Total current funds		$ 5,910,749
Endowment and similar funds:		
Endowment funds-income restricted		$18,553,392
Current funds reserved as an endowment-income unrestricted		6,196,358
Total endowment and similar funds		$24,749,750

Commitment (note 2).

SMITHSONIAN

Statement of Changes
Year Ended

	Total current funds	CURRENT Unrestricted funds	
		General	Activities
Balance at beginning of year	$ 6,001,407	$3,158,769	$ 67,607
Adjustment to accrual basis	236,334	. . . . .	236,334
Adjusted balance at beginning of year	6,237,741	3,158,769	303,941
Additions:			
Grants and contracts - net of refunds	11,303,377	. . . . .	. . . .
Investment income	1,224,117	354,465	. . . .
Gifts and bequests	469,013	26,507	. . . .
Gross profit on sales	278,604	. . . . .	278,604
Rental, dues, and fees	1,411,256	. . . . .	1,411,256
Reimbursement-grants and contracts	218,687	. . . . .	. . . . .
Other	205,533	73,287	15,906
Net gain on investments	13,498	13,498	. . . . .
Total additions	15,124,085	467,757	1,705,766
Deductions (additions):			
Expenditures:			
Salaries and benefits	8,468,149	1,736,414	809,131
Purchases for collection	317,037	12,716	. . . . .
Travel and transportation	906,591	68,248	86,912
Equipment and supplies	1,229,225	102,569	150,306
Contractual services	4,614,254	555,920	733,498
Depreciation	4,944	. . . . .	4,944
Administrative expenditures applicable to other funds	. . . . .	(2,076,347)	120,816
Total expenditures	15,540,200	399,520	1,905,607
Transfers to (from):			
Income added to principal	(55,276)	. . . . .	. . . . .
For designated purposes	(274,599)	(148,335)	(96,618)
Total transfers	(329,875	(148,335)	(96,618)
Balance at end of year	$ 5,491,751	$3,078,671	$ 7,482

INSTITUTION

in Fund Balances
June 30, 1968

FUNDS		ENDOWMENT AND SIMILAR FUNDS		
Restricted funds				
Gifts, Grants, and Contracts	Unexpended income	Total endowment and similar funds	Endowment funds	Current funds reserved as an endowment
$ 1,626,400	$1,148,631	$23,071,776	$17,239,870	$5,831,906
. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
1,626,400	1,148,631	23,071,776	17,239,870	5,831,906
11,303,377	. . . . .	. . . . .	. . . . .	. . . . .
. . . . .	869,652	. . . . .	. . . . .	. . . . .
442,506	. . . . .	631,673	631,663	10
. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
218,687	. . . . .	. . . . .	. . . . .	. . . . .
6,888	109,452	29,054	44	29,010
. . . . .	. . . . .	687,372	544,258	143,114
11,971,458	979,104	1,348,099	1,175,965	172,134
5,546,456	376,148	. . . . .	. . . . .	. . . . .
69,070	235,251	. . . . .	. . . . .	. . . . .
696,641	54,790	. . . . .	. . . . .	. . . . .
902,204	74,146	. . . . .	. . . . .	. . . . .
3,099,012	225,824	. . . . .	. . . . .	. . . . .
. . . . .	. . . . .	. . . . .	. . . . .	. . . . .
1,833,394	122,137	. . . . .	. . . . .	. . . . .
12,146,777	1,088,296	. . . . .	. . . . .	. . . . .
. . . . .	(55,276)	55,276	55,276	. . . . .
75,526	(105,172)	274,599	82,281	192,318
75,526	(160,448)	329,875	137,557	192,318
$ 1,526,607	$ 878,991	$24,749,750	$18,553,392	$6,196,358

SMITHSONIAN INSTITUTION
PRIVATE FUNDS

Notes to Financial Statements

June 30, 1968

(1) Basis of Accounting

Prior to July 1, 1967, the accounts of the Institution were maintained on the basis of cash receipts and disbursements except that the amounts due as reimbursements from grants and contracts were accrued and certain real estate was carried at cost or appraised value as explained below. During the year ended June 30, 1968, the accounts for that portion of unrestricted funds relating to activities were converted to the accrual basis of accounting resulting in an increase in the balance of this fund of $219,768. Since no physical inventories were taken at June 30, 1967, the amount thereof was estimated.

Except for certain real estate acquired by gift or purchased from proceeds of gifts which are valued at cost or appraised value at date of gift, land, buildings, furniture, equipment, works of art, living and other specimens, and certain other similar property are not included in the accounts of the Institution; the amounts of investments in such properties are not readily determinable. Current expenditures for such properties are included among expenses. The accompanying statements do not include the National Gallery of Art, the John F. Kennedy Center for the Performing Arts, nor other departments, bureaus and operations administered by the Institution under Federal appropriations.

(2) Commitment and Subsequent Event

Pursuant to an agreement, dated October 9, 1967, between the Institution and The Cooper Union for the Advancement of Science and Art, the Institution acquired, on July 1, 1968, all funds belonging to The Cooper Union for use exclusively for museum purposes and certain articles of tangible personal property as defined in the agreement.

The agreement provides, among other covenants, that the Institution will maintain a museum in New York City, and has pledges in excess of $800,000 for the support of such a museum.

SMITHSONIAN INSTITUTION

Summary of Grants and Contracts

Year Ended June 30, 1968

	Total	Grants	Contracts
Department of Defense	$ 1,334,983	$ 105,255	$1,229,728
National Aeronautics and Space Administration	7,293,539	4,816,637	2,476,902
National Science Foundation	2,354,715	181,300	2,173,415
Other	600,444	245,426	355,018
Total grants and contracts	$11,583,681	$5,348,618	$6,235,063

Summary of Endowment and Similar Funds Investments

Book Values at June 30, 1968

	Total	Consolidated Fund	Freer Fund
Short-term bonds	$ 1,009,119	$ 370,029	$ 630,090
Long-term bonds	10,252,817	3,781,828	6,470,989
Preferred stocks	710,241	324,717	385,524
Common stocks	9,740,993	4,778,596	4,962,397
	$21,713,170	$ 9,255,170	$12,458,000
Other stocks and bonds	13,384		
	$21,726,554		

2.

Smithsonian Foreign Currency Program Grants Awarded Fiscal Year 1968

Museum Programs and Related Research

ANTHROPOLOGY

AMERICAN INSTITUTE OF INDIAN STUDIES, Philadelphia, Pennsylvania. To continue (third year) support for the American Academy of Benares, India, an institution for research in archeology and art history.

AMERICAN INSTITUTE OF INDIAN STUDIES, Philadelphia, Pennsylvania. To support fifteen anthropological research projects in India.

AMERICAN RESEARCH CENTER IN EGYPT, Cambridge, Massachusetts. To continue support for a program of research and excavation in Egypt: (a) Excavation of the ancient city of Hierakonpolis. (b) Continutation of an epigraphic and architectural survey of Luxor. (c) Continuation of a field project of a stratified Pharonic site at Mendes. (d) Cephalometric and dental analysis of the Old Kingdom skeletal material from the Giza necropolis.

AMERICAN SCHOOLS OF ORIENTAL RESEARCH, Cambridge, Massachusetts. To support excavations at three sites in Israel.

AMERICAN UNIVERSITY IN CAIRO, New York City, New York. To survey and document the domed Mausolea of Mamluk, Cairo.

LAWRENCE RADIATION LABORATORY, UNIVERSITY OF CALIFORNIA, BERKELEY, CALIFORNIA. To continue the project utilizing cosmic rays for the discovery of unknown chambers in the pyramids of Egypt.

UNIVERSITY OF CALIFORNIA AT LOS ANGELES, LOS ANGELES, CALIFORNIA. To continue study of prehistoric community life through excavations at Obre in collaboration with Sarajevo Territorial Museum.

CARNEGIE MUSEUM, PITTSBURGH, PENNSYLVANIA. To test methods in underwater archeology and to search for the Ashdod harbor and the Ashdod wreck: an operation supplemental to excavations at Tel Ashdod, Israel.

DENISON UNIVERSITY, GRANVILLE, OHIO. To excavate the Roman imperial metropolis at Sirmium in collaboration with the Archeological Institute of Belgrade, Yugoslavia.

DUMBARTON OAKS CENTER, WASHINGTON, D.C. To support excavations leading to the publication of a corpus of ancient mosaics in Tunisia.

JERUSALEM SCHOOL OF ARCHEOLOGY OF HEBREW UNION COLLEGE, CINCINNATI, OHIO. To excavate an archeological site at Gezer, Israel, and to conduct a Summer Institute on Near Eastern civilizations (third year).

INSTITUTE FOR ADVANCED STUDY, PRINCETON UNIVERSITY, PRINCETON, NEW JERSEY. To initiate interdisciplinary research in the Bronze and early Iron Ages in northern Yugoslavia: excavations at the site of Sticna.

UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN. To continue (second year) a program of research and training in prehistoric archeology in Israel: excavations at the site of Tabun.

UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN. To continue (second year) a study of early neolithic cultures in Poland in collaboration with the University of Krakow.

UNIVERSITY OF MINNESOTA, MINNEAPOLIS, MINNESOTA. To excavate the Palace of Diocletian at Split, Yugoslavia, and study the development of the Palace from Roman through medieval times.

UNIVERSITY OF MISSOURI, COLUMBIA, MISSOURI. To excavate a Greek trade site in Israel.

UNIVERSITY MUSEUM, UNIVERSITY OF PENNSYLVANIA, PHILADELPHIA, PENNSYLVANIA. To study (second year) the inscriptions of the Dra Abu Naga Tombs in Egypt.

NORTHWESTERN UNIVERSITY, CHICAGO, ILLINOIS. To study the Pleistocene prehistory of the Slovenian Sub-Alpine Region in Yugoslavia.

SMITHSONIAN INSTITUTION, OFFICE OF ANTHROPOLOGY, WASHINGTON, D.C. To conduct a study of ancient urban technologies in Pakistan and Ceylon which will contribute to similar studies carried out in southern Asia.

SOUTHERN METHODIST UNIVERSITY, DALLAS, TEXAS. To study (third year) prehistory in the area around Sibaiya, Egypt.

STANFORD UNIVERSITY, PALO ALTO, CALIFORNIA. To conduct an urgent archeological investigation of the Trebisnjica Basin in collaboration with the Territorial Museum of Sarajevo, Yugoslavia.

UNIVERSITY OF WASHINGTON, SEATTLE, WASHINGTON. To study the kinship structure among the Veddas of Ceylon.

SYSTEMATIC AND ENVIRONMENTAL BIOLOGY

CARNEGIE MUSEUM, PITTSBURGH, PENNSYLVANIA. To study in Poland the interrelationships of North American and Asian Tertiary Lagomorpha.

UNIVERSITY OF COLORADO, BOULDER, COLORADO. Prehistoric paleontologic research in Tunisia.

UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN. To study (second year) the cytology of Indian mollusks.

UNIVERSITY OF MICHIGAN, ANN ARBOR, MICHIGAN. To study the ecology of an Eilat coral reef in Israel.

NATIONAL ACADEMY OF SCIENCES, WASHINGTON, D.C. To support research, training, and planning trips for International Biological Program personnel.

SMITHSONIAN INSTITUTION, WASHINGTON, D.C.

DEPARTMENT OF BOTANY. To study in India the comparative embryology and floral anatomy of the olyroid bambusoid grasses.

DIVISION OF BIRDS. To publish in India a handbook of Indian birds (second year).

DIVISION OF BIRDS. To conduct serological and ectoparasite survey of migratory birds in northeastern Africa.

OFFICE OF OCEANOGRAPHY AND LIMNOLOGY. To study in Israel (second year) biological interchanges between the eastern Mediterranean and the Red Sea through the Suez Canal.

OFFICE OF OCEANOGRAPHY AND LIMNOLOGY. To support (second year) the Mediterranean Marine Sorting Center at Salammbo, Tunisia.

OFFICE OF ECOLOGY. To revise Trimen's *Handbook to the Flora of Ceylon.*

OFFICE OF ECOLOGY. To hold a planning conference for the International Biological Program in Tunisia.

OFFICE OF ECOLOGY. Ecological research planning studies for the International Biological Program in Poland, Yugoslavia, Tunisia, Israel, and India.

NATIONAL ZOOLOGICAL PARK. To conduct comparative studies of the behavior and ecology of Ceylonese primates (Cercopithicidae).

NATIONAL ZOOLOGICAL PARK. To study the relationship of man and tame elephants in Ceylon.

NATIONAL ZOOLOGICAL PARK. To study (second year) the behavior and ecology of the Ceylonese elephant.

MUSEUM OF NATURAL HISTORY. To study the flora and vegetation of Ceylon.

ASTROPHYSICS

SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASSACHUSETTS. To study gamma rays through high-altitude balloon flights in south India.

SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASSACHUSETTS. To study in Israel the collective behavior of self-gravitating systems.

MUSEUM PROGRAMS

SMITHSONIAN INSTITUTION, NATIONAL COLLECTION OF FINE ARTS. To provide partial support for an American exhibit at the First World Triennale of Art in India.

SMITHSONIAN INSTITUTION. To send a conservator to Ceylon to repair damage done by vandals to the Sigiriya frescoes.

SMITHSONIAN INSTITUTION, TRAVELING EXHIBITION SERVICE. To transport an exhibit of Tunisian mosaics to the United States for exhibition in museums across the country.

3.

Publications of the Smithsonian Institution Press

For the Year Ended 30 June 1968

BOOKS

ADAMS, ROBERT MCC., and others. *The Fitness of Man's Environment.* Smithsonian Annual II. Introduction by the Right Honourable Jennie Lee; foreword by Hubert H. Humphrey; premise by S. Dillon Ripley. 250 pages. June 1968. $5.95.

Art Treasures of Turkey. Introductions by Richard Ettinghausen, Machteld Mellink, Paul A. Underwood, and Rodney S. Young. 218 pages, 128 illustrations. Publication 4663, originally issued 1966, reissued in cloth 30 November 1967. $10.00.

The Graphic Art of Mary Cassatt. Introduction by Adelyn Breeskin. Co-published with The Museum of Graphic Art. 112 pages, 80 illustrations. March 1968. $8.50.

ROTH, LOUIS M., and EDWIN R. WILLIS. *The Medical and Veterinary Importance of Cockroaches.* 147 pages, 7 plates. Publication 4299; Smithsonian Miscellaneous Collections, volume 134, number 10; originally published 1957, reissued in cloth November 1967. $5.00.

SHETLER, STANWYN G. *The Komarov Botanical Institute: 250 Years of Russian Research.* xiv+240 pages, 29 plates, 2 maps. Publication 4687. 30 December 1967. $5.95.

São Paulo 9: Edward Hopper/Environment U.S.A.: 1957–1967. Essays by William C. Seitz and Lloyd Goodrich. 189 pages, 75 illustrations. November 1967. Paper, $5.95; cloth, $10.00.

STANDLEY, PAUL C. *Trees and Shrubs of Mexico.* 2 volumes, 1,852 pages. Contributions from the United States National Herbarium, volume 23; originally published in 5 parts, 1920–1926, reissued in cloth September 1967. $25.00.

Swiss Drawings: Masterpieces of Five Centuries. Introduction and notes by Walter Hugelshofer; organized by the Pro Helvetia Foundation. 176 pages, 126 illustrations. Publication 4716. November 1967. $8.95.

WELSH, PETER C. *Track and Road: The American Trotting Horse.* 174 pages, 73 illustrations. Publication 4714. November 1967. $8.50.

BOOKLETS

BLOUGH, GLENN O., and PAUL E. GARBER. *Masters of the Air.* 31 pages, illustrated. 3rd edition. Publication 4183. December 1967. $ .75.

CANTOR, VERA M., and MURIEL F. LESSER. *Cal Rodgers and the Wonderful Flight of the Vin Fiz.* 24 pages, illustrated. Publication 4734. May 1968. $ .85.

CARPENTER, M. SCOTT. *Exploring Space and Sea.* 28 pages, 9 illustrations. Edwin A. Link Lecture Series. Publication 4726. December 1967. $ .50.

Exhibits in the Museum of History and Technology. 128 pages, illustrated. Publication 4720. 23 February 1968. $1.25.

Highlights of the National Collection of Fine Arts. Introduction by David W. Scott. vi + 58 pages, 49 illustrations. Publication 4737. May 1968. $1.50.

National Collection of Fine Arts/National Portrait Gallery: Museums of the Smithsonian Institution. Introduction by David W. Scott; remarks by Charles Nagel; architectural statement by Waldron Faulkner. 16 pages, 12 illustrations. 23 April 1968. $ .15.

SERIAL PUBLICATIONS

UNITED STATES NATIONAL MUSEUM BULLETINS

82. AUSTIN HOBART CLARK and AILSA MCGOWN CLARK. *A Monograph of the Existing Crinoids: The Comatulids, Suborders Oligophreta (Concluded) and Macrophreata.* Volume 1, part 5, xiv+860 pages. 30 August 1967.

237. ARTHUR CLEVELAND BENT and COLLABORATORS. *Life Histories of North American Cardinals, Grosbeaks, Buntings, Towhees, Finches, Sparrows, and Allies.* Compiled and edited by Oliver L. Austin, Jr. Parts 1–3 [bound individually and boxed], xxvii+xi+viii+1,889 pages, 78 plates, 3 color frontispieces. 4 June 1968.

247. REMINGTON KELLOG. *Fossil Marine Mammals from the Miocene Calvert Formation of Maryland and Virginia.* Parts 5–8, pages 103–201, figures 39–98. 12 June 1968.

248. MELBOURNE A. CARRIKER, JR. *Carriker on Mallophaga: Posthumous Papers, Catalog of Forms Described as New, and Bibliography.* Edited by K. C. Emerson. xi+150 pages, 100 figures, frontispiece. 20 September 1967.

257. A. DIAKONOFF. *Microlepidoptera of the Philippine Islands.* 484 pages, 846 figures. 31 January 1968.

259. JOHN R. HOLSINGER. *Systematics, Speciation, and Distribution of the Subterranean Amphipod Genus Stygonectes (Gammaridae)*. 176 pages, 36 figures, 6 tables. 14 July 1967.

260. J. LAURENS BARNARD. *Bathyal and Abyssal Gammaridean Amphipoda of Cedros Trench, Baja California*. 205 pages, 92 figures. 17 October 1967.

262. LOUIS PURNELL. *Catalog of the Type Specimens of Invertebrate Fossils*. iv+198 pages. 5 April 1968.

263. TOKUICHI SHIRAKI. *Fruit Flies of the Ryukyu Islands*. 104 pages, 35 plates. 17 April 1968.

264. MAUREEN E. DOWNEY. *Catalog of Recent Echinoid Type Specimens in the U.S. National Museum, Smithsonian Institution, and the Museum of Comparative Zoology, Harvard University*. vi+99 pages. 5 April 1968.

265. HERBERT FRIEDMANN. *The Evolutionary History of the Avian Genus Chrysococcyx*. viii+137 pages. 17 May 1968.

267. FLORENCE A. RUHOFF. *Bibliography and Index to Scientific Contributions of Carl J. Drake for the Years 1914–1967*. viii+81 pages. 28 March 1968.

268. HERMAN A. SCULLEN. *A Revision of the Genus Eucerceris Cresson (Hymenoptera: Sphecidae)*. 97 pages, 98 figures. 17 April 1968.

270. LUBOMIR MASNER and CARL F. W. MUESEBECK. *The Types of Proctotrupoidea (Hymenoptera) in the United States National Museum*. iv+143 pages. 17 May 1968.

278. JOHN C. MCCAIN. *The Caprellidae (Crustacea: Amphipoda) of the Western North Atlantic*. vi+147 pages. 28 June 1968.

CONTRIBUTIONS FROM THE MUSEUM OF HISTORY AND TECHNOLOGY

(Bulletin subseries issued as individual papers and bound volumes)

BULLETIN 240

(Whole volume)

Papers 34–44 on Science and Technology. viii+352 pages, illustrated. 19 September 1967.

BULLETIN 249

(Papers 52– on historical archeology)

54. C. MALCOLM WATKINS and IVOR NOËL HUME. "The 'Poor Potter' of Yorktown." 40 pages, 20 figures. 12 October 1967.

BULLETIN 250

(Papers 59– on cultural history)

59. Rodris Roth. "Floor Coverings in 18th-Century America." 64 pages, 28 figures. 2 August 1967.
60. John L. Nevinson. "Origin and Early History of the Fashion Plate." 28 pages, 34 figures. 2 August 1967.
62. Margaret Brown Klapthor. "White House China of the Lincoln Administration." 12 pages, 14 figures. 30 August 1967.

BULLETIN 252

(Papers 69– on technology)

71. Elizabeth M. Harris. "Sir William Congreve and His Compound-Plate Printing." 20 pages, 22 figures (14 color plates). 3 November 1967.

CONTRIBUTIONS FROM THE
UNITED STATES NATIONAL HERBARIUM

(Bulletin subseries with volumes numbered separately and issued in parts)

VOLUME 32

6. Velva E. Rudd. "A Résumé of *Ateleia* and *Cyathostegia* (Leguminosae)." Pages iii+385–411, 9 plates, 1 figure. 10 April 1968.

VOLUME 34

4. Thomas R. Soderstrom. "Taxonomic Study of Subgenus *Podosemum* and Section *Epicampes* of *Muhlenbergia* (Gramineae)." Pages 75–189, 14 plates, 9 figures. 19 July 1967.
5. Aaron Goldberg. "The Genus *Melochia* L. (Sterculiaceae)." Pages 191–363, 9 plates, 7 figures. 31 August 1967.
6. Richard W. Pippin. "Mexican 'Cacalioid' Genera Allied to *Senecio* (Compositae)." Pages 365–447, 10 plates, 4 figures. 17 May 1968.

VOLUME 37

4. George W. Gillett. "The Genus *Cyrtandra* in Fiji." Pages 107–159. 6 February 1968.

VOLUME 38

2. C. V. Morton. "Studies of Fern Types, I." Pages 29–83. 31 August 1967.
3. C. V. Morton. "The Genus *Grammitis* in Ecuador." Pages 85–123, 4 plates. 17 October 1967.

4. C. V. MORTON. "The Peruvian Species of *Besleria* (Gesneriaceae)." Pages 125–151. 28 March 1968.
5. C. V. MORTON. "The Genera, Subgenera, and Sections of the Hymemophyllaceae." Pages 153–214. 12 June 1968.

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM

VOLUME 122

3595. A. STANLEY RAND. "Ecology and Social Organization in the Iguanid Lizard *Anolis lineatopus*." 79 pages, 10 figures. 9 August 1967.

3597. JOHN F. EISENBERG. "A Comparative Study of Rodent Ethology with Emphasis on Evolution of Social Behavior, I." 51 pages, 9 figures. 19 July 1967.

3599. W. STEPHENSON and MAY REES. "Portunid Crabs from the International Indian Ocean Expedition in the Smithsonian Collections (Crustacea: Portunidae)." 34 pages, 2 figures. 12 July 1967.

VOLUME 123

3601. DAVID H. JOHNSON. "Neotropical Species of Genus *Triplax* Herbst and Review of Genus *Haematochiton* Gorham (Coleoptera: Erotylidae)." 25 pages, 10 figures. 28 July 1967.

3602. HORTON H. HOBBS, JR., PERRY C. HOLT, and MARGARET WALTON. "The Crayfishes and Their Epizoötic Ostracod and Branchiobdellid Associates of the Mountain Lake, Virginia, Region." 84 pages, 22 figures. 14 September 1967.

3604. DORIS H. BLAKE. "Revision of the Beetles of Genus *Glyptoscelis* (Coleoptera: Chrysomelidae)." 53 pages, 39 figures. 19 July 1967.

3605. FRANK B. GILL. "Observations on the Pelagic Distribution of Seabirds in the Western Indian Ocean." 33 pages, 2 figures. 9 August 1967.

3606. RAYMOND B. MANNING, "Review of the Genus *Odontodactylus* (Crustacea: Stomatopoda)." 35 pages, 9 figures. 28 July 1967.

3609. WARREN B. KING, GEORGE E. WATSON, and PATRICK J. GOULD. "An Application of Automatic Data Processing to the Study of Seabirds, I: Numerical Coding." 29 pages, 10 figures. 8 September 1967.

3610. ERNST KIRSTEUER. "Bredin-Archbold-Smithsonian Biological Survey of Dominica, 3: Marine Archiannelids from Dominica." 6 pages, 1 figure. 6 July 1967.

3611. William D. Field. "Butterflies of the New Genus *Calystryma* (Lycaenidae: Theclinae, Strymonini)." 31 pages, 23 figures, 3 plates. 9 August 1967.

3612. Clyde F. E. Roper and Richard E. Young. "A Review of the Valbyteuthidae and an Evaluation of Its Relationship with the Chiroteuthidae (Cephalopoda: Oegospida)." 9 pages, 1 figure, 4 plates. 4 August 1967.

3613. Thomas E. Bowman and Louis S. Kornicker. "Two New Crustaceans: The Parasitic Copepod *Sphaeronellopsis monothrix* (Choniostomatidae) and its Myodocopid Ostracod Host *Parasterope pollex* (Cylindroleberidae) from the Southern New England Coast." 28 pages, 7 figures, 1 plate. 28 July 1967.

3614. Richard C. Froeschner. "Revision of the Cactus Plant Bug Genus *Hesperolabops* Kirkaldy (Hemiptera: Miridae)." 11 pages, 30 figures. 19 July 1967.

3615. Harold Robinson. "Revision of the Genus *Harmstonia* (Diptera: Dolichopodidae)." 16 pages, 16 figures. 12 July 1967.

3616. Robert E. Woodruff and Oscar L. Cartwright. "A Review of the Genus *Euparixia* with Description of a New Species from Nests of Leaf-Cutting Ants in Louisiana (Coleoptera: Scarabaeidae)." 21 pages, 13 figures, 2 plates. 8 September 1967.

3617. Harry W. Allen. "Bredin-Archbold-Smithsonian Biological Survey of Dominica, 4: Two New Species of *Tiphia* from the West Indies (Hymenoptera: Tiphiidae)." 4 pages, 1 figure. 19 July 1967.

3618. Raymond B. Manning. "Notes on the *demanii* Section of Genus *Gonodactylus* Berthold with Descriptions of Three New Species (Crustacea: Stomatopoda)." 27 pages, 8 figures. 31 July 1967.

3619. Oliver S. Flint, Jr. "Studies of Neotropical Caddis Flies, V: Types of the Species Described by Banks and Hagen." 37 pages, 127 figures, 1 plate. 8 August 1967.

3620. W. Donald Duckworth. "Neotropical Microlepidoptera, XV: Review of Genus *Thioscelis* (Lepidoptera: Stenomidae). 11 pages, 12 figures, 1 map, 1 plate. 28 July 1967.

3621. Horton H. Hobbs, Jr. "A New Crayfish from Alabama Caves with Notes on the Origin of the Genera *Orconectes* and *Cambarus* (Decapoda: Astacidae)." 17 pages, 21 figures. 6 October 1967.

3622. Maurice T. James. "Bredin-Archbold-Smithsonian Biological Survey of Dominica, 5: Family Stratiomyidae (Diptera)." 23 pages, 18 figures. 15 November 1967.

3623. ROGER F. CRESSEY. *"Caritus,* a New Genus of Caligoid Copepod, with a Key to the Genera of Caliginae." 8 pages, 18 figures. 6 October 1967.

VOLUME 124

3624. BRIAN MASON and A. D. MAYNES. "The Composition of the Allegan, Bur-Gheluai, and Cynthiana Meteorites." 12 pages. 6 October 1967.

3625. JEAN WALKER FOX. "Liberian Strepsiptera in the Smithsonian Collection with Descriptions of Seven New Myrmecolicidae." 14 pages, 51 figures. 27 December 1967.

3626. WILLIS W. WIRTH and VERNON H. LEE. "New Species of *Culicoides* from High Altitudes in the Colombian Andes (Diptera: Ceratopogonidae)." 22 pages, 6 figures, 2 plates. 15 November 1967.

3627. J. LAURENS BARNARD. *"Echiniphimedia,* an Amphipod Genus from the Antarctic Ocean." 15 pages, 6 figures. 28 December 1967.

3628. ARTHUR G. HUMES. "Cyclopoid Copepods of the Genus *Paranthessius* Associated with Marine Pelecypods in Chile." 18 pages, 43 figures. 28 December 1967.

3629. SOEKARJA SOMADIKARTA. "A Recharacterization of *Collocalia papuensis* Rand, the Three-Toed Swiftlet." 8 pages, 2 figures. 28 December 1967.

3630. RICHARD L. HOFFMAN. "Revision of the Milliped Genus *Cleptoria* (Polydesmida: Xystodesmidae)." 27 pages, 23 figures. 27 December 1967.

3631. PERRY C. HOLT. "Status of Genera *Branchiobdella* and *Stephanodrilus* in North America with Description of a New Genus (Clitellata: Branchiobdellida)." 10 pages, 4 figures. 28 December 1967.

3632. OSCAR L. CARTWRIGHT. "Two New Species of *Cartwrightia* from Central and South America (Coleoptera: Scarabaeidae: Aphodiinae)." 8 pages, 3 plates. 27 December 1967.

3633. HERBERT FRIEDMANN. "Alloxenia in Three Sympatric African Species of *Cuculus.*" 14 pages. 28 December 1967.

3634. J. KNOX JONES, JR., and ALBERT SCHWARTZ. "Bredin-Archbold-Smithsonian Biological Survey of Dominica, 6: Synopsis of Bats of the Antillean Genus *Ardops.*" 13 pages, 3 figures. 27 December 1967.

3635. ALBERT SCHWARTZ and J. KNOX JONES, JR. "Bredin-Archbold-Smithsonian Biological Survey of Dominica, 7: Review of Bats of the Endemic Antillean Genus *Monophyllus.*" 20 pages, 1 figure. 27 December 1967.

3636. LEONARD P. SCHULTZ. "Four New Fishes of the Genus *Parapercis* with Notes on Other Species from the Indo-Pacific Area (Family Mugiloididae)." 16 pages, 4 plates. 24 January 1968.

3637. JOHN W. ALDRICH. "Population Characteristics and Nomenclature of the Hermit Thrust." 33 pages, 4 figures. 18 January 1968.

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3644. KARL V. KROMBEIN. "Studies in the Tiphiidae, X: *Hylomesa*, a New Genus of Myzinine Wasp Parasitic on Larvae of Longicorn Beetles." 22 pages, 5 figures, 1 plate. 24 January 1968.

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SMITHSONIAN CONTRIBUTIONS TO ANTHROPOLOGY

VOLUME 5
(Whole volume)

ESTHER S. GOLDFRANK. *The Artist of "Isleta Paintings" in Pueblo Society.* vi + 227 pages (including unnumbered plates of holograph facsimiles), 3 figures. 4 August 1967. $4.25.

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Smithsonian Contributions to Astrophysics

VOLUME 10

1. Luigi G. Jacchia, Franco Verniani, and Robert E. Briggs. "An Analysis of the Atmospheric Trajectories of 413 Precisely Reduced Photographic Meteors." Pages 1–139, 19 figures, 127 tables. 15 November 1967.
3. Franco Verniani. "Meteor Masses and Luminosity." Pages 181–196, 10 figures. 14 November 1967.
4. Gladys A. Harvey and Barbara Bell. "Some Additional Aspects of the Unequal Activity of the Northern and Southern Solar Hemispheres: Microwave Radio Bursts and SWFs." Pages 197–208, 1 figure, 5 tables. 28 March 1968.

VOLUME 11

(Whole volume)

Gerald S. Hawkins, editor. *Meteor Orbits and Dust.* 412 pages, 35 plates, 213 figures, 82 tables. July 1967.

Smithsonian Miscellaneous Collections

VOLUME 152

2. Porter M. Kier. "Revision of the Oligopygoid Echinoids." iii + 149 pages, 36 plates, 50 figures. Publication 4702. 13 October 1967.
4. Franco Rasetti. "Lower and Middle Cambrian Trilobite Faunas from the Taconic Sequence of New York." [iii]+111+[15] pages, 14 plates. Publication 4710. 29 August 1967.
6. C. G. Abbot. "Solar Magnetism and World Weather." 8 pages, 1 figure, 2 plates. Publication 4722. 20 December 1967.
7. Noel P. James and Daniel J. Stanley. "Sediment Transport on Sable Island, Nova Scotia." 33 + [4] pages, 18 figures, 2 plates. Publication 4723. 29 December 1967.
8. Martin A. Buzas. "Foraminifera from the Hadley Harbor Complex, Massachusetts." [ii] + 26 pages, 4 figures, 2 tables. Publication 4727, 16 February 1968.

VOLUME 153

1. Alan H. Cheetham. "Morphology and Systematics of the Bryozoan Genus *Metrarabdotos.*" viii+122+[37] pages, 24 figures, 18 plates, 16 tables. Publication 4733. 28 June 1968.

OTHER SERIAL PUBLICATIONS

(Editorial or production services by Smithsonian Institution Press)

Ars Orientalis: The Arts of Islam and the East. Volume 6, 247 pages, 295 illustrations. Publication 4675. November 1967. $16.00.

Freer Gallery of Art Occasional Papers. Volume 3, number 3: "Li Ti" by Richard Edwards, xii+50 pages, 33 plates. 15 August 1967.

Atoll Research Bulletin. No. 118: "Ecology of Aldabra Atoll, Indian Ocean," edited by David R. Stoddart, x+141 pages, 6 figures, 9 tables, 41 plates. No. 119: "Atoll News and Comments," 6 pages. [Two issues in one cover.] 15 November 1967.

CATALOGS

The Armed Forces of the United States as Seen by the Contemporary Artist. Foreword by John H. Magruder, III. vii+66 pages, 21 plates. Publication 4730. February 1968. $.65.

A Checklist of Keyboard Instruments at the Smithsonian Institution. Prepared by the Division of Musicial Instruments. viii+79 pages, 7 figures. September 1967.

George Caleb Bingham, 1811–1879. Introduction by David W. Scott. Essay by E. Maurice Block. v+99 pages, 10 plates, 25 figures. Publication 4725. November 1967. $.75.

Passing Symbols: Depots and Dwellings of Victorian America: Watercolors of Ranulph Bye. Prepared by Robert M. Vogel. Folder. February 1968.

Rubbings from Early American Stone Carvings Found in the Burying Grounds of New England by Ann Parker and Avon Neal. Leaflet. June 1968.

Treasures from the Cooper Union Museum. Foreword by David W. Scott. 48 pages. Publication 4715. 12 July 1967. $.25.

William Zorach, 1887–1966. Leaflet. September 1967.

INFORMATION LEAFLETS

Belmont: The Smithsonian Institution's Conference Center at Elkridge, Maryland. 8 pages, illustrated. Brochure. Publication 4703. Revised October 1967.

Cultures of Africa and Asia. Illustrated. Folder, hall guide. August 1967.

Growth of the United States. Illustrated. Folder, hall guide. October 1967.

The National Collection of Fine Arts. Illustrated. Folder, museum guide. April 1968.

National Portrait Gallery. Illustrated. Folder. Revised April 1968.

National Zoological Park. Illustrated. Folder, guide. June 1968.

PS 4 Pacific Type Locomotive: The Southern Railway's No. 1401. Illustrated. Information Leaflet 400. Revised January 1968.

Railroad Hall. Illustrated. Information Leaflet 455. January 1968.

SCHEELE, CARL H. *Owney, Mascot of the Railway Mail Service.* 6 pages, illustrated. Information Leaflet 506. November 1967.

STEEN, CHARLIE R. *The Citizen and Archeology.* Introduction by Richard B. Woodbury. 6 pages, illustrated. Information Leaflet 481. November 1967.

STURTEVANT, WILLIAM C. *Guide to Field Collecting of Ethnographic Specimens.* 41 pages+appendix. Information Leaflet 503. December 1967.

Vehicle Hall. Illustrated. Information Leaflet 508. January 1968.

WESSEL, THOMAS R. *The Honey Bee.* 14 pages, illustrated. Information Leaflet 482. November 1967.

ANNUAL REPORTS

Annual Report of the American Historical Association for the Year 1960. Volume 2: "Writings on American History 1958." xvi+736 pages. 16 November 1967.

Smithsonian Year 1967: Annual Report of the Smithsonian Institution for the Year Ended June 30, 1967, Including the Financial Report of the Executive Committee of the Board of Regents. vii+515 pages, illustrated. Publication 4729. 9 May 1968.

OFFICIAL PUBLICATIONS

Exhibits in the Museums and Galleries of the Smithsonian Institution. 38 pages. Publication 4731. February 1968.

Guard Manual and Regulations for the Guard Force. vi+81 pages. Revised August 1967.

Smithsonian Research Opportunities—Fine Arts, History, Science. vi+170 pages, 16 illustrations. Publication 4718. 1 September 1967.

4.

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WHITFIELD J. BELL, JR. Librarian, American Philosophical Society, 105 South Fifth Street, Philadelphia, Pennsylvania 19106. Born 1914. A.B. Dickinson College, Ph. D. University of Pennsylvania, 1947. Associated with Dickinson College 1937–1954; assistant and then associate editor of the Papers of Benjamin Franklin 1954–1961. Has been with the American Philosophical Society as associate librarian (1961–1966) and librarian since 1966. Editor of *Bibliography of the History of Medicine in the U.S. and Canada* (1948–1953) and *Mr. Franklin* (with L. W. Labaree) (1956). Author of *Needs and Opportunities for Research in the History of Early American Science* (1955); *John Morgan: Continental Doctor* (1965).

FRED R. EGGAN. Department of Anthropology, University of Chicago, 1126 East 59th Street, Chicago, Illinois 60601. Born 1906. Ph. B., University of Chicago, Ph. D. University of Chicago, 1933. Has been with the University of Chicago since 1934 (Chairman of the Department of Anthropology since 1961 and Director of the Philippine Studies Program since 1953). Has served as the official delegate to the Pacific Science Congresses in Manila (1953), Bang-

kok (1957), and Honolulu (1961). Research centers on the Indians of western United States and the tribes of the Philippines. Author of *Social Organization of the Western Pueblos* (1959). Editor of *Social Anthropology of North American Tribes* (1937 and 1955).

DONALD S. FARNER. Professor of Zoophysiology and Chairman, Department of Zoology, University of Washington, Seattle, Washington 98105. Born 1915. B.A. Hamline University, Ph. D. University of Wisconsin, 1941. Washington State University 1947–1966 (Dean of the Graduate School 1960–1966). President, International Union of Biological Sciences. Contributor to many scientific publications, mainly on avian physiology and control of annual cycles.

ANTHONY N. B. GARVAN. Chairman, Department of American Civilization, University of Pennsylvania, Philadelphia, Pennsylvania 19104. Born 1917. B.A. and M.A. Yale University, Ph. D. Yale University, 1948. Has been with the University of Pennsylvania since 1951, except three years (1957–1960) as Head Curator of the Department of Civil History at the Smithsonian Institution (Chairman of the Department of American Civilization since 1960). Editor of the *American Quarterly* 1951–1957. Author of *Architecture and Town Planning in Colonial Connecticut* (1951), *Index of American Cultures* (1953).

G. EVELYN HUTCHINSON. Sterling Professor of Zoology, Yale University, New Haven, Connecticut 06520. Born 1903. University of Cambridge. Has been at Yale since 1928. Author of *The Clear Mirror* (1936), *The Itinerant Ivory Tower* (1953), *A Treatise on Limnology, vol. I* (1957), *A Preliminary List of the Writings of Rebecca West* 1919–1951 (1957), *The Enchanted Voyage* (1962), *The Ecological Theater and the Evolutionary Play* (1965), and many scientific papers. Studies lie in the fields of oceanography and limnology, ecology, population biology, and biology in the development of literature and the fine arts.

JAN LARUE. Department of Music, Graduate School of Arts and Sciences, New York University, New York, New York 10003. Born 1918. S.B. Harvard, M.F.A. Princeton University, Ph. D. Harvard University, 1952. Taught at Wellesley College 1942–1943, 1946–1957 (Instructor to Associate Professor and Chairman of the Music Department), Professor of Music at New York University since 1957. President, American Musicological Society, 1967 and 1968. Editor, *Congress Report, International Musicological Society* (1961–1962); *Festschrift für Otto Erich Deutsch* (1963); *Aspects of Medieval and Renaissance Music* (1966). Author of numerous articles on 18th-century music, style analysis, computers and music, ethnomusicology, papyrology, and music bibliography.

CLIFFORD L. LORD. President, Hofstra University, Hempstead, Long Island, New York 11550. Born 1912. A.B. and A.M. Amherst College, Ph. D. Columbia University, 1943. Was Director of the New York State Historical Association 1941–1946; organized the Farmers' Museum, Cooperstown, New York, in 1942; Director, State Historical Society of Wisconsin, 1946–1958; Honorary Director of Circus World Museum since 1955; Vice President of the National Railroad Museum since 1956; Dean of the School of General Studies and Professor of History at Columbia University 1958–1964. Member of many historical associations. Author of *Atlas of Congressional Roll Calls* (1941), *Historical Atlas of the United States* (1943, 1954), *History of U.S. Naval Aviation* (1949), *Teaching History with Community Resources* (1964, 1967), *Clio's Servant* (1967).

CHARLES D. MICHENER. Watkins Distinguished Professor of Entomology, University of Kansas, Lawrence, Kansas 66044. Born 1918. B.S. University of California at Berkeley, Ph. D. University of California at Berkeley, 1941. Has been with the University of Kansas since 1948 (Watkins Distinguished Professor since 1959). Served as State entomologist 1949–1961. Author of *American Social Insects* (with Mary H. Michener) (1951), *Nest Architecture of the Sweat Bees* (with S. F. Sakagami) (1962), and approximately 200 technical works, mainly on bees. Work concerns social behavior and ecology (especially of bees), bee systematics, and principles of taxonomy.

PETER M. MILLMAN. National Research Council of Canada, Ottawa 7, Ontario, Canada. Born 1906. B.A. Toronto, Ph. D. Harvard University, 1932. Past-president of the Royal Astronomical Society of Canada. A meteoritic specialist whose studies include those of the upper atmosphere with planetary and space research; also interested in the culture of Japan and international exchanges.

ELTING E. MORISON. Acting Master, Ezra Stiles College, Yale University, New Haven, Connecticut 06520. Born 1909. A.B. Harvard University, M.A. Harvard University, 1937. Was a member of the faculty of Massachusetts Institute of Technology 1946–1966. Served as consultant to Houghton-Mifflin Company 1946–1951, and to Research and Development Board, Department of Defense 1946–1952. Author of *Admiral Sims and the Modern American Navy* (1942), and *A Study of the Life and Times of Henry L. Stimson* (1960). Editor of *The Letters of Theodore Roosevelt* (8 vols.) (1951–1954); *Cowboys and Kings* (1954); *The American Style* (1959).

ROBERT MOTHERWELL. 173 East 94th Street, New York, New York 10028. Born 1915. A.B. Stanford University, 1937. A well-known artist who has exhibited nationally and internationally and contributes to American and foreign magazines. Editor of *The Documents of Modern Art* 1944–1952.

NORMAN D. NEWELL. Curator of Fossil Invertebrates, American Museum of Natural History, New York, New York. Born 1909. B.S. and A.M. University of Kansas, Ph. D. Yale University, 1933. Since 1945 has been a professor at Columbia University as well as curator of invertebrate paleontology at the American Museum of Natural History. Author of *The Nature of the Fossil Record* (1959), *Organism Communities and Bottom Facies, Great Bahama Bank* (1959) and is the organizer of the pelecypod volume of the *Treatise on Paleontology*. Co-editor of the *Journal of Paleontology* (1939–1942). Has visited all parts of North America, Europe, Australia, and Asia in the study of the Permian of the world.

NORMAN HOLMES PEARSON. Professor of American Studies, Yale University, New Haven, Connecticut 06520. Born 1909. A.B. Yale University, Ph. D. Yale University, 1941. Has been with Yale University since 1941. Editor of *Complete Novels of Hawthorne* (1937), *The Oxford Anthology of American Literature* (with W. R. Benet) (1938), *Walden* (1948), *Poets of the English Language* (with W. H. Auden) (1950), and *The Pathfinder* (1952).

GORDON N. RAY. President, John Simon Guggenheim Memorial Foundation, 90 Park Avenue, New York, New York 10016. Born 1915. A.B. and A.M. Indiana University, A.M. (1938) and Ph. D. Harvard University, 1940. Taught at Harvard University, University of Illinois (Vice President and Provost), and New York University (Professor of English since 1962). Has been member of the United States Educational Commission in the United Kingdom, 1948–1949; adviser in literature to Houghton Mifflin Company since 1954; chairman, Committee on Institutional Cooperation of the Council of Ten Universities and the University of Chicago, 1958–1960; member of the Board of Trustees, John Simon Guggenheim Memorial Foundation Library Center, 1962–1968 (Chairman, 1965–1968); member of the Board of Trustees, Center for Applied Linguistics since 1965; and trustee of the Modern Language Association of America since 1966. Author of *The Buried Life* (1952); *Thackeray: the Uses of Adversity* (1955); *Thackeray: the Age of Wisdom* (1958); *Henry James and H. G. Wells* (with Leon Edel) (1958). Editor of *The Letters and Private Papers of William Makepeace Thackeray*, 4 vols. (1945–1946); Thackeray's

Rose and the Ring, History of Henry Esmond, and *Contributions to the "Morning Chronicle",* and Wells' *Desert Daisy* and *History of Mr. Polly.*

ANDRÉ SCHIFFRIN. Editorial Director, Pantheon Books, 437 Madison Avenue, New York, New York 10022. Born 1935. B.A. Yale University, 1957. Received degree from Cambridge 1959. Has been with Pantheon Books since 1962. Editor of Pantheon Studies in Social History, including Edward Thompson's *The Making of the English Working Class* and Michel Foucault's *Madness and Civilization.*

FEDERICK SEITZ. President, National Academy of Sciences, 2101 Constitution Avenue, NW., Washington, D.C. 20418. Born 1911. A.B. Leland Stanford Jr. University, Ph. D. Princeton University, 1934. Has taught physics at University of Rochester, University of Pennsylvania, Carnegie Institute of Technology, and University of Illinois (head of Department of Physics 1957–1964) (also dean of Graduate College and Vice President for Research 1964–1965). Was chairman of Governing Board of the American Institute of Physics 1954–1959. President, National Academy of Sciences since 1962. President, The Rockefeller University 1968– . Author of *Modern Theory of Solids* (1940), *The Physics of Metals* (1943).

CYRIL STANLEY SMITH. Institute Professor, Room 14N–321, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, Massachusetts 02139. Born 1903. B.S. University of Birmingham, Sc. D. Massachusetts Institute of Technology, 1926. Has been with American Brass Company, 1926–1943; the Los Alamos Scientific Laboratory, 1943–1946; the University of Chicago, 1946–1961; and M.I.T. as Institute Professor since 1961. Was a member of the President's Science Advisory Committee in 1959. Co-author of *The Pirotechnia of Vannuccio Biringuccio* (1942); *Structure and Properties of Solid Surfaces* (1953), *Réaumur's Memoirs on Steel and Iron* (1956); *Treatise on Divers Arts by Theophilus* (1963). Author of *A History of Metallography* (1960) and *Sources for the History of the Science of Steel* (1968). A primary interest is the historical interaction between science and technology, and he is a frequent consultant to the Freer Gallery of Art and the Smithsonian Office of Anthropology.

JOHN D. SPIKES. College of Letters and Science, University of Utah, Salt Lake City, Utah 84112. Born 1918. B.S. California Institute of Technology, Ph. D. California Institute of Technology, 1948. Has been with the University of Utah since 1948 (except for a period on leave as cell physiologist of the Division of Biology and Medicine

of the Atomic Energy Commission); dean of the College of Letters and Science, 1964–1968. Author of numerous publications in scientific journals, bulletins, etc. Major research is in biophysics, especially photobiology.

STEPHEN E. TOULMIN. Department of Philosophy, Brandeis University, Waltham, Massachuetts 02154. Born 1922. B.A. Cambridge University, Ph. D. Cambridge University, 1948. Has taught at Oxford, University of Melbourne, University of Leeds, New York University, Stanford University, and Columbia University, and from 1960–1965 was Director of the Nuffield Foundation Unit for History of Ideas. Author of *The Place of Reason in Ethics* (1950); *The Philosophy of Science, an Introduction* (1953); *Metaphysical Beliefs* (author of one of three essays) (1957); *The Uses of Argument* (1958); *Foresight and Understanding* (1961); "The Ancestry of Science": vol. 1 (*The Fabric of Heavens*) (1961), vol. 2 (*The Architecture of Matter*) (1962), vol. 3 (*The Discovery of Time*) (1965); *Night Sky at Rhodes* (1963).

WARREN H. WAGNER, JR. Botanical Gardens and Department of Botany, University of Michigan, Ann Arbor, Michigan 48105. Born 1920. A.B. University of Pennsylvania, Ph. D. University of California at Berkeley, 1950. Has been a member of the faculty of the University of Michigan since 1951, currently serving as Director of the Botanical Gardens. Vice President, Section G (Botanical Sciences), American Association for the Advancement of Science; and President, Michigan Botanical Club. Served as panelist in systematic biology for National Science Foundation (1962–65); and President of American Society of Plant Taxonomists (1966). Research centers on higher plants, origin and evolution of ferns, methods of accurate deduction of phylogenetic relationship of fossil and living plants.

6.

Research Participation Programs
Appointments 1967–1968
Post-Doctoral, Graduate, Undergraduate

POST-DOCTORAL RESEARCH ASSOCIATES

MARK M. BEACH, University of Wisconsin: The scientific lazzaroni and American higher education.

JOHN A. M. BROWN, Purdue University: Light quality, photoperiod, and meristem metabolism in floral morphogenesis.

MATTHEW D. DOWNEY, Princeton University: The tariff question, 1868–1892: the making of a political issue.

DON D. FOWLER, University of Pittsburgh: Edited and annotated in linguistic and ethnographic manuscripts of John Wesley Powell. Publication: "John Wesley Powell's Journal of His Second Trip Down the Colorado River 1871–72", *Smithsonian Journal of History* (in press).

MICHEL C. HENON, Université de Paris: Monte Carlo methods applied to the dynamics of star clusters.

LEO J. HICKEY, Princeton University: Systematic classification and description of the leaf architecture of each of the families of woody dicots.

PERRY C. HOLT, University of Virginia: Systematic studies of the annelid order Branchiobdellida.

EDWARD B. JELKS, University of Texas: Typology of European and American ceramics, A.D. 1600–1900.

AKIRA KATO, University of Tokyo: Descriptive studies of minerals. Publication (with Kunihiko Shinohara): "The Occurrence of Roquesite from the Akenobe Mine, Hyogo Prefecture, Japan;" *Mineralogical Journal* (Japan), vol. 5, no. 4, pp. 276–284, 1968.

GILBERT KELLING, Edinburgh University: Sedimentation in modern submarine canyons off the east coast of the United States and their Paleozoic analogues. Publications: (with M. G. Gross, J. W. Pierce, and D. J. Stanley) "A Review of Sedimentology in 1967," *Geotimes,* vol. 13, pp. 18–19; (with D. J. Stanley) "Sedimentation Patterns in the Wilmington Submarine Canyon Area," *Ocean Sciences and Engineering of the Atlantic Shelf Trans. National Symposium, Marine Technology Society,* pp. 127–142; "Submarine Channel and fan deposits, Silurian of Central Wales, U.K." (abstract), American Association of Petroleum Geologists, Oklahoma City, pp. 77–78; (with D. J. Stanley) (in press) "Neocurrent Trends and Structural Control of the Sedimentation in the Wilmington Submarine Canyon" (abstract), Geological Society of America, Mexico City Meeting, 1968.

ALAN J. KOHN, Yale University: Systematics of the Indo-West Pacific marine mollusks of the family Conidae.

AMBAT G. MENON, Madras University: A taxonomic version of the flat fishes of the genus *Cynoglossus* Hamilton; a revisional study of the freshwater fishes of the family Catostomidae (suckers).

MARVIN C. MEYER, University of Illinois: Further studies on the leeches (Hirudinea).

JOHN T. MICKEL, University of Michigan: A comparison of the pteridophyte floras of the Atlantic and Pacific slopes of Oaxaca, Mexico.

ROBERT W. READ, University of the West Indies (Jamacia): A study of the palms of the Caribbean region.

ROBERT E. RICKLEFS, University of Pennsylvania: Coexistence of two closely related bird species of the genus *Myiozetetes*.

CHRISTOPHER C. SMITH, University of Washington: Factors influencing the evolution of howling monkey social organization.

RESEARCH PARTICIPATION PROGRAMS—GRADUATE

(* denotes Predoctoral Internship)

SERGIO R. AHUMADA, University of Mexico: Bibliographic data retrieval system for Botany.

LEONARD P. ALBERSTADT,* University of Oklahoma: Comparative study of upper ordovician brachiopods with a detailed statistical analysis of several orthid genera.

TERRY M. ALDRICH, University of Texas: Series of cost-benefit analyses of collections in the USNM.

ROBERT G. BEAUCHAMP, George Washington University: Stratigraphy and environments of deposition of the Paleocene Sediments; Prince George's County, Maryland.

MARK H. BERNSTEIN, University of Pennsylvania: Development and function of abnormal behavior in caged cebus monkeys.

WILLIAM M. BIGEL, George Washington University: Assisted in preparation NPG Opening exhibition catalog by locating portraits and gathering information about the artists.

ROSEMARY BREEN, George Washington University: Research on the works of James Henry Moses (1854–1913) in preparation for catalog.

ROBERT C. BULLOCK, University of Maine: Study and identification the New World Members of the Genus *Latirus* (Mollusca: Fasciolariidae).

T. JOHN CONOMOS,* University of Washington: Chemical and mineral composition of suspended particulate matter transported by the Columbia River to the coastal waters of the Pacific Ocean.

NANCY M. CRAMER,* George Washington University: Spionidae of the Gulf and Caribbean.

FRANCES C. CROLEY, University of South Florida: Floristic study of the algae of the Content Keys, Florida.

ROBERT E. DIETZ, Cornell University: Generic revision of the genus *Horama*.

DONALD R. DOHRMAN, Yale University: Study of economic factors influencing the adoption of screw propulsion for steamships in the United States before the Civil War.

ANANDA DUBE, Patna University: Mineralogical and chemical investigations of some rare Indian meteorites.

CAROLYN FAWCETT, Oxford University: Continuation of work on the Smithsonian section of the international inventory of scientific instruments being compiled under the auspices of UNESCO.

THEODORE G. GAUTIER, University of Kansas: Restudied, illustrated and described ten genera to be published as part of a major revision of the *Treatise on Invertebrate Paleontology*.

KENNETH J. HAGAN,* Claremont Graduate School: Prelude to expansion: American naval diplomacy from the Civil War until Mahan.

BRUCE L. HAINES,* Duke University: Role of the leaf-cutting ant *Atta colombica tonsipes*, in the patterning of tropical forest vegetation.

DAVID R. HEARN, Harvard University: Data reduction of the results of SAO gamma-ray balloon flight; assisted in preparing the experimental package for a second balloon flight.

CLAUDE M. HLADIK,* University of Paris: Feeding behavior and diet of primates in respect to comparative histology and histochemistry of digestive system.

JOAN L. HOWARD, University of Kansas: Location and description of primary and secondary descriptions of objects in order to reconstruct the everyday life of a settler's family on the Great Plains in the decade following the Civil War.

PAUL R. HUEY, University of Pennsylvania: History of the saw in American technology.

BARBARA C. KAISER, Hunter College: Preparation of a catalogue raisonné on Mary Cassatt; research for catalog to accompany the retrospective exhibition of the works of Milton Avery.

JANET KAPLAN, Columbia University: Condition and location of each of 287 works in the White House painting, drawing, and sculpture collections.

JAMES R. KARR,* University of Illinois: Study of diversity in neotropical birds.

CAROLE N. KAUFMANN, University of California: Study of the slate and wooden pipes and the Haida argillite carvings in the collections in MNH.

THOMAS F. KELLY, Harvard University: Translation of sections on keyboard instruments of a treatise by Arnaut of Zwolle (d. 1466).

DONALD KELMAN, New York University: Traditional mounting and restoring techniques used in the conservation of Japanese and Chinese paintings.

DAVID W. KIRTLEY,* Florida State University: Continuation and expansion of the study of tube- and reef-building marine annelids of the family Sabellariidae.

CHARLES J. LARUE, University of Maryland: Variation and functional interrelations of the major components of the bird skull.

ROBERT E. MARTIN, Oklahoma State University: Systematics of three species of *Perognathus*.

JOHN D. MILLEU,* Oregon State University: Henry Augustus Rowland, electrical papers and apparatus.

BYRON F. MORRIS, California State College: Studies on the biology of *Attheyella pilosa* Chappuis.

AKIKO MURAKATA, George Washington University: Presents as a factor in the Perry Expedition to Japan 1853–1854.

JOHN J. MCCUSKER,* University of Pittsburgh and University College, London: The rum trade in the commerce of colonial America.

RITA G. NAPIER, American University: Compiled data for a modern ethnology of the Tlingit Indian village of Honnah, Alaska.

MARTIN G. NAUMANN,* University of Kansas: Biology of the social wasps of Central America.

ANN M. NIELSEN, University of Maine: Annotated bibliography of New Hampshire's early maritime history and related areas; Preliminary work for an eventual computerization of the National Watercraft collection.

ALBERT F. NOONAN, University of Tennessee: Compiled detailed information about the chemical and mineralogical composition of the Forest Vale meteorite.

OSBORNE B. NYE,* University of Cincinnati: Cyclostomatous Bryozoa included in the sub-order Cerioporina.

DONALD L. OBENDORF, University of California (Berkeley): Location, organization, and study of papers and correspondence of Samuel P. Langley, primarily the period 1867–1891.

WAYNE O'LEARY, Cooperstown Graduate Programs (New York): Investigation of merchant brigs and brigantines of the United States, with emphasis on those of the 19th century; travel registers and endowments of American pilot poats.

JOHN R. OPPENHEIMER,* University of Illinois: Ecology and behavior of the white-faced monkey *Cebus capucinus*.

JAY M. PASACHOFF, Harvard University: Spectral observations of spicules at two heights in the solar chromosphere.

GEORGE E. RADWIN,* George Washington University: Review of the Genus *Anachis* H&A Adams in the Western Atlantic.

ROLLIN D. REIMER, Tulane University: Survey of members of the simulans section of the genus *Procambarus;* clarified relationship of certain species of genus *Orconectes*.

MICHAEL T. RICHMAN, University of Pennsylvania: Organized and prepared curatorial files on 50 pieces of sculpture to be included in NCFA opening exhibition; continued research survey of all exterior sculpture in the city of Washington.

REGINALD J. SCOLARO,* Tulane University: Paleoecology and taxonomic revision of some tertiary and recent bryozoa.

ALAN E. SHAPIRO, Yale University: Scientific works of George Atwood.

YOSHIAKI SHIMIZU, University of Kansas: Translation of the early 19th-century records of and commentaries on the artists of the Late Edo period.

GORDON A. SINGER, University of Virginia: Interpret the historical significance and verify authenticity of over 1,000 medieval French feudal deniers discovered in North Italy; numismatic history of England during the reign of Edward II (1307–1327).

RAMAN J. SINGH, University of Cincinnati: Trepostomatous bryzoan fauna of the Bellevue Limestone of Ohio, Indiana, and Kentucky.

MERRITT R. Smith,* Pennsylvania State University: The Harpers Ferry Armory and the new American technology, 1794–1861.

NICHOLAS E. SMYTHE,* University of Maryland: Behavior and ecology and three neotropical caviomorph rodents.

TERRY G. SUMMONS, University of Maryland: Vitamins, hormones and antibiotics: A history of recent changes in animal nutrition.

DON S. THOMPSON, Syracuse University: Biometrical study of *Triarthrus* from the Ordovician of northeastern United States and Canada.

ROBERT W. TOPP,* Harvard University: Systematics, behavior and ecology of marine fishes.

JACQUELINE B. TUSA,* Pennsylvania State University: The liberal Republican movement of 1872.

JACQUELINE H. VERGIN,* George Washington University: The image of the Indian in popular culture.

JOSEPH F. VEVERKA, Harvard University: Thermal evolution of small bodies.

CATHERINE S. WIMSATT, University of Washington: Population analysis of a Virginia Indian cemetery from the standpoints of cultural customs, demography, disease, nutrition, and physical distinctiveness.

RICHARD H. ZANDER,* Duke University: Monograph of the genus *Leptodontium*

UNDERGRADUATE RESEARCH PARTICIPATION PROGRAM

JOHN C. BEAR, University of Pennsylvania: Restoration and descriptive study of skeletal material of Late Bronze of Early Iron Age, excavated at Ag-Kupruk cave site (Afghanistan).

ELLEN R. BEST, University of Maryland: Assisted in research concerning adhesives and their effect on antique textiles.

H. ANDREW BROOKS, Alleghany College: Preparation of a detailed index to Bishop's *History of American Manufacturers 1607–1860.*

JOHN BROWN, Glasgow University: Comprehensive study of the characteristics of meteor echoes.

MARTHA P. CONVERSE, Briarcliff College: Assisted in preparation of a publication on the Vinland Map Conference.

MALCOLM COULTER, Stanford University: Studied classification of habitats and distribution of several species of Central and South American birds.

LUCILLE A. CROSBY, Vassar College: Assisted in accessioning approximately 130 engines.

PETER J. DELMONTE, Swarthmore College: Survey to determine a method of rearing *Bathygobius* larvae.

RAYMOND J. DEMALLIE, University of Chicago: Documentation of Dakota photographs in the Office of Anthropology archives.

INGE DIETRICH, University of Michigan: Traced certain items of technology of a South Korean village through Chinese literature on agricultural technology.

JEFFREY L. ETHELL, King College: Conducted research on the Messerschimdt 163 B–1 Komet.

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AKIKO MURAKATA, George Washington University: Presents as a factor in the Perry Expedition to Japan 1853–1854.

JOHN J. MCCUSKER,* University of Pittsburgh and University College, London: The rum trade in the commerce of colonial America.

RITA G. NAPIER, American University: Compiled data for a modern ethnology of the Tlingit Indian village of Honnah, Alaska.

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TERRY G. SUMMONS, University of Maryland: Vitamins, hormones and antibiotics: A history of recent changes in animal nutrition.

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JOSEPH F. VEVERKA, Harvard University: Thermal evolution of small bodies.

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H. ANDREW BROOKS, Alleghany College: Preparation of a detailed index to Bishop's *History of American Manufacturers 1607–1860.*

JOHN BROWN, Glasgow University: Comprehensive study of the characteristics of meteor echoes.

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JEFFREY L. ETHELL, King College: Conducted research on the Messerschimdt 163 B–1 Komet.

315-997 O - 69 - 35

RODNEY C. EWING, Texas Christian University: Mineralogical comparison of the Baringer Hill and Rhode Ranch rare-earth-bearing pegmatites.

HENRY A. FELDMAN, Swarthmore College: Wrote programs for CEIR time-sharing computer, including the construction of clustergrams of biological specimen groups.

KA-HUNG FOGG, Massachusetts Institute of Technology: Experiments to find correlation between solar radiation and plant growth.

JAMES N. FOSTER, Earlham College: Faunal study of the northwest flank and core of one Danian bryozoan mound for comparison with a previously studied mound.

JANICE C. FOSTER, Purdue University: Morphology of United States species of *Ataenius* (Coleoptera, Scarabaeidae).

MARC S. GERSTEIN, Brandeis University: Identified 28 late 16th- and early 17th-century engravings by Theodore de Bry.

SHARON L. GIBBS, Colorado State University: Studied slide rules and related mathematical theory as well as history of the instruments themselves.

KATHLEEN L. GRANDI, College of the Holy Names: Autoradiographic studies on mitosis in *Tradescantia* pollen tubes.

PATRICIA M. GREENE, Manhattanville College of the Sacred Heart: prepared a biographical reference file for the engravers who contributed to the *National Portrait Gallery of Distinguished Americans*, edited by James Herring and James B. Longacre (New York 1834–1839).

FRANKLIN J. HARTE, University of Michigan: Identification of specimens in the USNM Japanese ethnology collection.

THOMAS J. HESTON, Gettysburg College: Conducted research on the technical and historical aspects of the Fw 190 F–8.

MARY G. HOLBACH, Dunbarton College: Integration of NCFA and NPG library holdings.

BARBARA E. HURWITZ, Bryn Mawr College: Studied the effect of different types of Versene and varying concentrations of sodium hydroxide on iron-silicate encrustations found on special types of pottery.

NORVELL M. JONES, Sweet Briar College: Learned techniques of documentation and basic conservation procedures.

WILLIAM L. KAHRL, Yale University: Research in the Library of Congress for the purpose of collecting material relating to Joseph Henry during the period 1825–1830.

KENNETH KARB, University of Virginia: Studied scale morphology of several genera of North American cyprinid fishes.

JOHN K. KELLY, Grove City College: Identified, cataloged, and described uniforms of the Regular Army of the United States for the period after 1872.

JONATHAN B. KOTCH, Columbia University: Studied techniques of archeological excavation at two sites in South Dakota.

WILLIAM L. KRINSKY, Yale University: Systematics and behavior of the insect pollinators of flowers within the genus *Lysimachia* (Primulaceae).

ANDREW D. LEEDS, Bard College: Study of American hand-painted political banners.

MARTHA S. LINET, Brandeis University: Studies concerned with the maintenance and behavior of tenrecs and marsupial rats under laboratory conditions.

ANITA M. MAJETICH, St. Joseph's College for Women: Compiled information on early American gun-styles.

MARYANN MEARS, Mt. Holyoke College: Assisted in preparing preliminary plans for National Portrait Gallery exhibits.

KATE MILLER, Smith College: Classification, identification, and location of USNM fruit collection.

LARRY E. MORSE, Michigan State College: Assisted with development of computerized key to plant families.

LINNEA PRUESS, Denison University: Assisted cataloging USNM petrology collection.

LARRY G. QUADE, University of Texas: Conducted research in paleopathology of the human skeleton.

RAYMOND ROBERTS-BROWN, George Washington University: Assisted in preparation of a research film.

BRUCE E. ROBERTSON, Syracuse University: Functional morphology, mode of life, and phylogeny of the Cambrian trilobite genus *Olenoides*.

JOAN M. RYAN, College of New Rochelle: Chemical determination of metallic iron in meteorites.

CHARLES E. SCHNELL, Grinnell College: Chromosome counts in various Melastomataceae species.

DONALD K. SERAFY,* Saint Petersburg Junior College: Identification of echinoderms of Project Hourglass, with emphasis on obtaining data concerned with ecological requirements.

ROBERT E. SHELL, Virginia Polytechnic Institute: Assisted in preparation of bibliography of published literature on Lepidoptera.

GEORGE F. SPRAGUE, North Carolina State University: Experiments with chloroplastic proteins to determine whether fractional protein is synthesized by the chloroplasts or by surrounding cytoplasm.

VESNA STEFANCIC, Vassar College: Experiments concerned with the localization of photosynthetic accessory pigments.

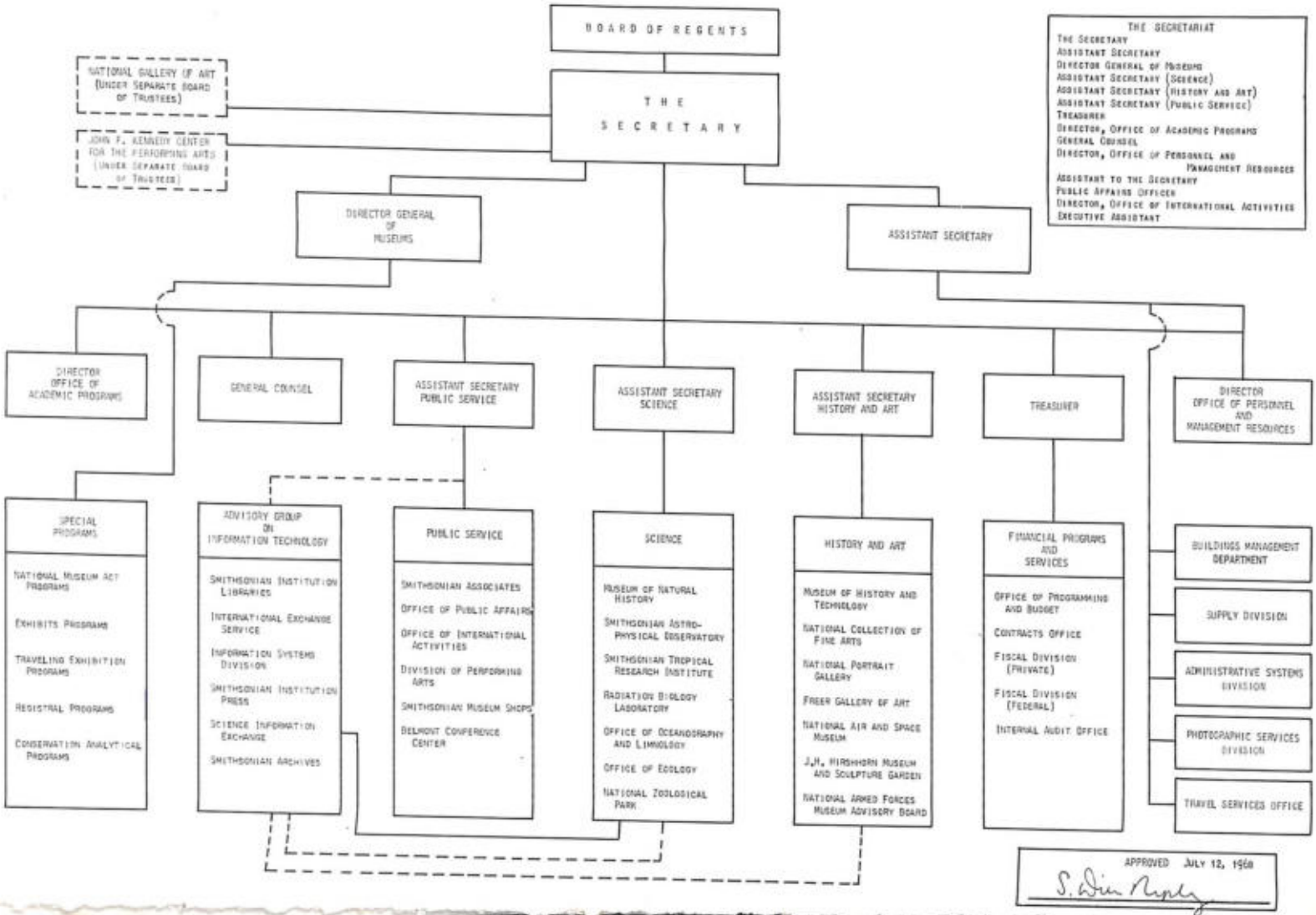
JAMES W. TYRRELL, Cornell University: Ecological study of the bird life in Poplar Island, Maryland.

ROGER B. VOGELFANGER, Cornell University: Distribution and relative abundance of several species of euryhaline fish in an estuarine shoreline.

ROBERT E. WEEMS, Randolph Macon College: Restoration and study of the remains of turtles representing twelve individuals from the Miocene Calvert formation.

STEPHEN R. ZWIRN, New York University: Collected bibliographical material on artists to be included in catalog for the IX São Paolo Bienal.

SMITHSONIAN INSTITUTION



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Staff of the Smithsonian Institution

30 June 1968

Secretary's Office and Related Activities

The Secretary	S. DILLON RIPLEY
Office of the Secretary	ROBERT W. MASON, Executive Assistant
	CHARLES CLAPP, Assistant to the Secretary
Assistant Secretary	JAMES BRADLEY
Office of the Assistant Secretary	ROBERT ENGLE, Special Assistant
	Mrs. DOROTHY ROSENBERG, Administrative Officer
Assistant Secretary (Science)	SIDNEY R. GALLER
Assistant Secretary (History and Art)	CHARLES BLITZER
Assistant Secretary (Public Service)	WILLIAM W. WARNER, Acting
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Office of Academic Programs	PHILIP C. RITTERBUSH, Director
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	PETER H. WOOD, Assistant Director for Institutional Research
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	LADD HAMILTON, Personnel Consultant to Science Faculty
	VINCE J. DOYLE, Personnel Consultant to History and Art Faculty
	JOSEPH P. EBERLY, Employee Relations and Training Officer
Special Projects, Office of the Secretary	RICHARD H. HOWLAND, Special Assistant to the Secretary
	JOSEPH A. KENNEDY, Equal Employment Opportunity Officer
	NATHAN REINGOLD, Editor, Joseph Henry Papers

Fiscal Division	Mrs. BETTY J. MORGAN, Assistant Treasurer (Private Funds)
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Contracts Office	ELBRIDGE O. HURLBUT, Contracting Officer
Administrative Systems Division	Mrs. ANN S. CAMPBELL, Chief
Buildings Management Department	ANDREW F. MICHAELS, Director
Supply Division	FRED G. BARWICK, Chief
Photographic Services Division	O. H. GREESON, Chief
Travel Services Office	Mrs. BETTY V. STRICKLER, Chief

Honorary	CHARLES G. ABBOT, Research Associate and Secretary Emeritus
	LEONARD CARMICHAEL, Research Associate and Secretary Emeritus
	JOHN A. GRAF, Honorary Fellow
	PAUL H. OEHSER, Research Associate
	ALEXANDER WETMORE, Research Associate and Secretary Emeritus

Natural Sciences

Assistant Secretary (Science)	SIDNEY R. GALLER
Office of the Assistant Secretary (Science)	Mrs. HELEN L. HAYES, Special Assistant
	HARRY HYMAN, Special Assistant
Office of Oceanography and Limnology	I. EUGENE WALLEN, Head
	WILLIAM I. ARON, Deputy Head
	H. ADAIR FEHLMANN, Supervisor, Smithsonian Oceanographic Sorting Center
	NEIL C. HULINGS, Director, Mediterranean Marine Sorting Center
Office of Ecology	HELMUT K. BUECHNER, Head
	LEE M. TALBOT, Deputy Head, Office of Ecology; International Field Representative, Ecology and Conservation
	FRANCIS S. L. WILLIAMSON, Director, Chesapeake Bay Center for Field Biology

MUSEUM OF NATURAL HISTORY

Director	RICHARD S. COWAN
Assistant Director	PAUL K. KNIERIM
Special Assistant for Tropical Biology	F. RAYMOND FOSBERG
Administrative Officers	Mrs. MABEL A. BYRD, JOHN J. PRENZEL
Special Assistant to the Director	JOSEPH C. BRITTON
Smithsonian Office of Anthropology	SAUL H. RIESENBERG, Chairman
	T. DALE STEWART, Senior Physical Anthropologist
	WALDO R. WEDEL, Senior Archeologist
	JOHN C. EWERS, Senior Ethnologist
	Mrs. M. BLAKER, Archivist
Latin American Anthropology	WILLIAM H. CROCKER, Supervisor and Associate Curator
	CLIFFORD EVANS, JR., Curator
	ROBERT M. LAUGHLIN, Associate Curator
Old World Anthropology	GORDON D. GIBSON, Supervisor and Curator
	EUGENE I. KNEZ, Associate Curator
	GUS W. VAN BEEK, Associate Curator
	WILLIAM B. TROUSDALE, Associate Curator
North American Anthropology	WILLIAM C. STURTEVANT, Supervisor and Curator
	RICHARD B. WOODBURY, Curator
	PAUL H. VOORHIS, Associate Curator

Physical Anthropology	J. Lawrence Angel, Supervisor and Curator
	Lucile E. St. Hoyme, Associate Curator
River Basin Surveys	Warren W. Caldwell, Director
	George H. Smith, Archeologist
	Richard B. Johnston, Archeologist
	Lionel A. Brown, Archeologist
	John J. Hoffman, Archeologist
	Wilfred M. Husted, Archeologist
	Richard E. Jensen, Archeologist
	Oscar L. Mallory, Archeologist
Botany	Mason E. Hale,[1] Chairman
	Lyman B. Smith, Senior Botanist
Phanerogams	John J. Wurdack,[2] Supervisor and Curator
	Dan H. Nicolson, Associate Curator
	Velva E. Rudd, Curator
	Stanwyn G. Shelter, Associate Curator
	Wallace R. Ernst, Associate Curator
Ferns	Conrad V. Morton, Supervisor and Curator
	David B. Lellinger, Associate Curator
Grasses	Thomas R. Soderstrom, Supervisor and Associate Curator
Cryptogams	Mason E. Hale, Jr.,[3] Supervisor and Curator
	Harold E. Robinson, Associate Curator
Plant Anatomy	Richard H. Eyde, Supervisor and Associate Curator
	Edward S. Ayensu, Associate Curator
Fungi [4]	Chester R. Benjamin, Research Associate
	John A. Stevenson, Research Associate
	Francis A. Uecker, Research Associate
	John L. Cunningham, Research Associate
	Paul Lewis Lentz, Research Associate
	Marie L. Farr, Research Associate
	Kent H. McKnight, Research Associate
	L. R. Batra, Research Associate
Entomology	Karl V. Krombein, Chairman
	J. F. Gates Clarke, Senior Entomologist
Neuropteroids	Oliver S. Flint, Jr., Supervisor and Curator
Lepidoptera and Diptera	W. Donald Duckworth,[5] Supervisor and Associate Curator
	Donald R. Davis, Associate Curator
	William D. Field, Associate Curator

[1] Appointment effective 1 July 1968.
[3] Replaced by Dan H. Nicholson, effective 1 July 1968.
[3] Replaced by Harold E. Robinson, effective 1 July 1968.
[4] National fungus collections are curated by Department of Agriculture staff.
[5] Replaced by William D. Field, effective 1 July 1968.

Coleoptera	PAUL J. SPANGLER, Supervisor and Associate Curator
	OSCAR L. CARTWRIGHT, Curator
Hemiptera and Hymenoptera	RICHARD C. FROESCHNER,[6] Supervisor and Associate Curator
	GERALD I. STAGE, Assistant Curator
Myriapoda and Arachnida	RALPH E. CRABILL, JR., Supervisor and Curator
Invertebrate Zoology	RAYMOND B. MANNING, Chairman
	FENNER A. CHACE, JR., Senior Zoologist
	HORTON H. HOBBS, JR., Senior Zoologist
	HARALD A. REHDER, Senior Zoologist
Crustacea	THOMAS E. BOWMAN, Supervisor and Curator
	J. LAURENS BARNARD, Curator
	LOUIS S. KORNICKER, Curator
	ROGER F. CRESSEY, Associate Curator
Echinoderms	DAVID L. PAWSON, Supervisor and Associate Curator
	KLAUS RUEZTLER, Associate Curator
Worms	MEREDITH L. JONES, Supervisor and Associate Curator
	MARIAN H. PETTIBONE, Curator
	W. DUANE HOPE, Associate Curator
	MARY E. RICE, Associate Curator
Mollusks	JOSEPH ROSEWATER,[7] Supervisor and Associate Curator
	JOSEPH P. E. MORRISON, Associate Curator
	CLYDE F. E. ROPER, Associate Curator
Mineral Sciences	GEORGE S. SWITZER, Chairman
Meteorites	KURT FREDRIKSSON, Supervisor and Curator
	ROY S. CLARKE, Associate Curator
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[6] Replaced by Gerald I. Stage, effective 1 July 1968.

[7] Replaced by F. E. Roper, effective 1 July 1968.

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