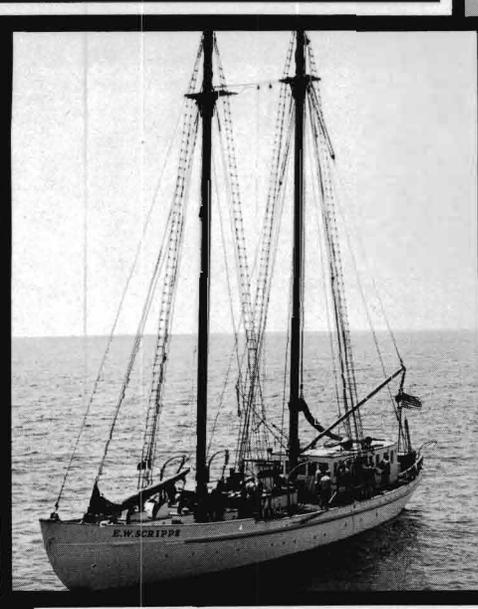
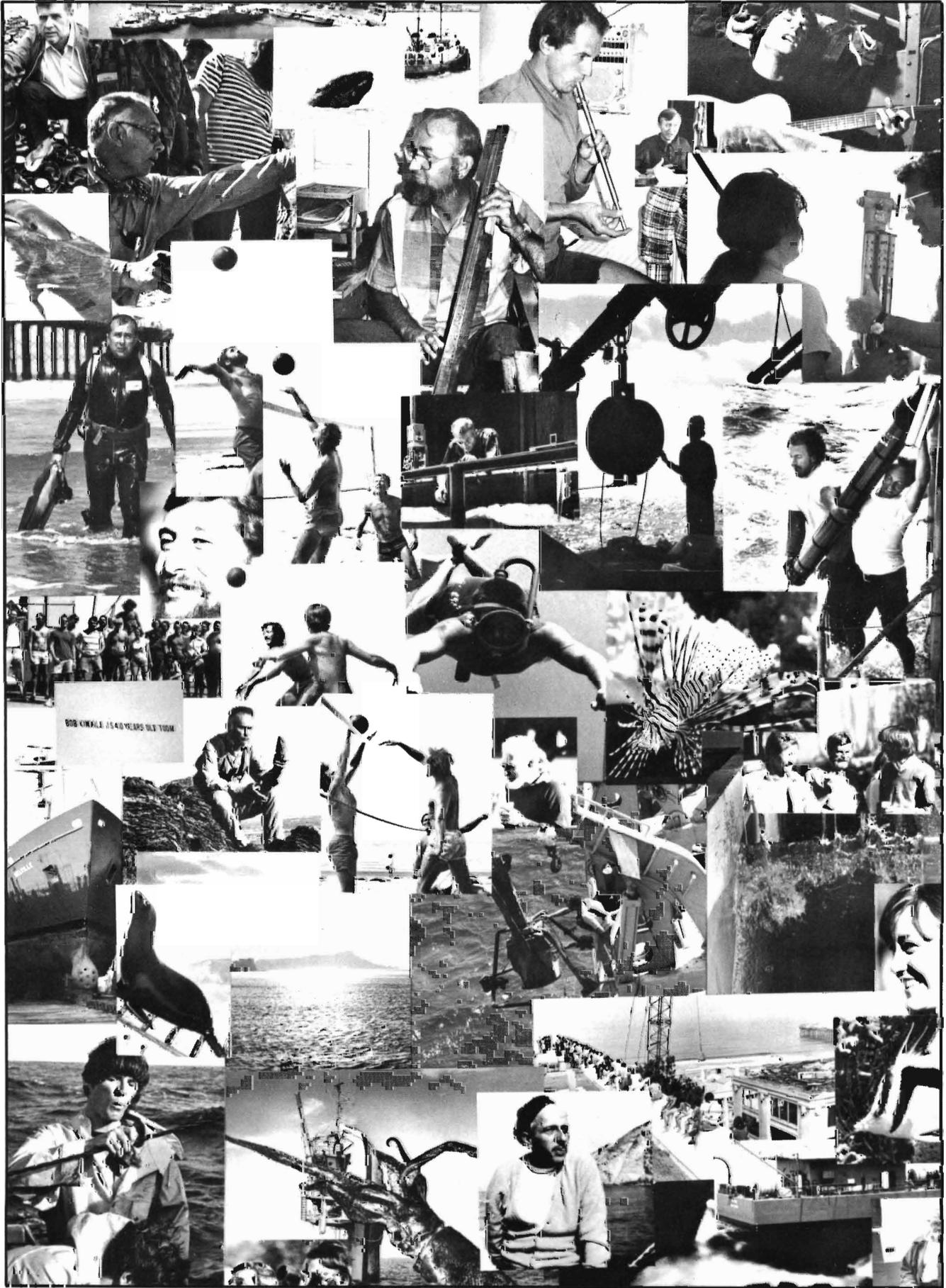


Scripps  
Institution of  
Oceanography



1903 — 1978



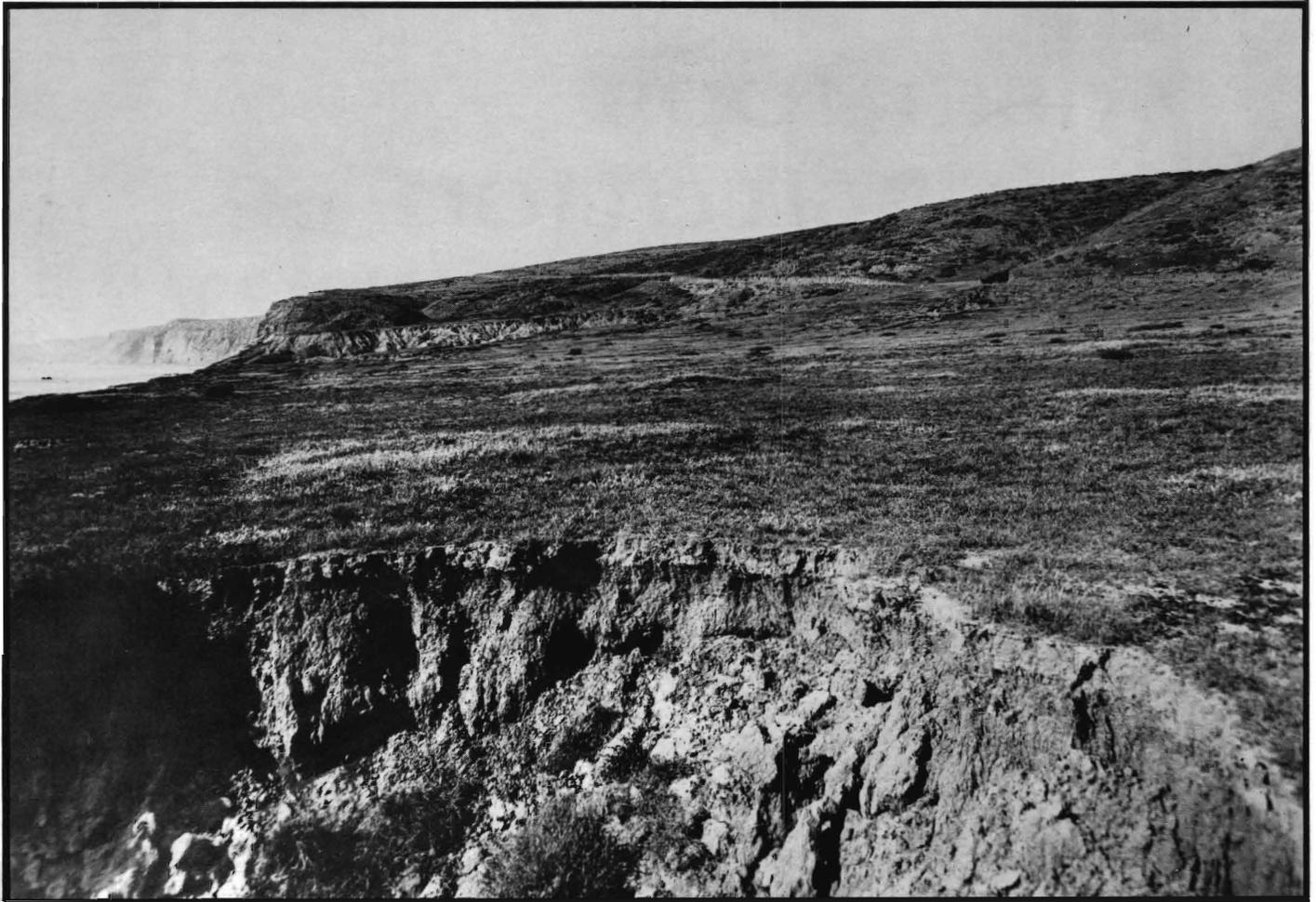
# scripps institution of oceanography

## 1903 — 1978

by  
Elizabeth Noble Shor  
June, 1978



*The Scripps campus about 1957.*



*The site of Scripps Institution in 1908.*

I would like to use this foreword to the brief history of the Scripps Institution to welcome the participants in this seventy-fifth year anniversary celebration of the Scripps Institution of Oceanography.

First, I greet the many distinguished alumni — those who have physically rejoined us, but also those who could not. We have to be very proud of our alumni — they can be found in high positions all over the world, including mainland China. It is largely to this distinguished group that SIO owes its reputation. By word and deed they have been ambassadors for their institution wherever they have gone.

Second, I greet the citizens of San Diego, whose predecessors had the wisdom and foresight to found this institution. The record shows that they fully appreciated the importance of their acts and the consequences. Further evidence of their wisdom was the transfer of the fledgling biological laboratory in 1912 to the University of California, which has nurtured the development of the institution since.

Third, I greet the citizens of the State of California, with whom we share their great University. The unprecedented phenomenon of California and its well-being are inextricably linked with the University and we have been

part of this relationship for the majority of the University's existence.

Fourth, I greet the people of the United States through the representatives of their agencies, who have joined with us. We have worked together in war and peace, and with our sister institutions have put the United States unquestionably in the lead of the scientific exploration of the world's oceans. We particularly greet the United States Navy, the National Science Foundation, the Department of Commerce, the Department of the Interior, the Department of State, the Department of Energy, the Environmental Protection Agency, the National Institutes of Health, and the National Oceanic and Atmospheric Agency.

Fifth, I greet our two former directors, Fred Spiess and Roger Revelle, who join us this year, and I pay tribute to the four others who preceded us in the upward development of the institution.

In short, I greet our neighbors, many friends, fellow world citizens, alumni, students, staff, and families, who join us in this celebration.

**William A. Nierenberg**  
June 1978  
La Jolla

*The Scripps campus in mid-1920's.*



*The Scripps campus in September 1977.*

Scripps Institution of Oceanography looks back proudly at seventy-five years of accomplishment. Its researchers have sailed to the equator and the poles, have rounded the Horn, have wrested rocks from the bottom of the sea, have gathered a host of bizarre creatures, and have talked—knowledgeably—about the weather. Its ships have circumnavigated the globe, have endured hurricanes and radiation, have hosted heads of state, and have visited the most beautiful islands in the world.

Scripps is the oldest and the largest institution in the United States devoted to oceanography. It has been called the foremost center of oceanographic research and instruction in the world. In three-quarters of a century it has enlarged its goal from conducting a biological and hydrographic survey of the coast of Southern California to exploring the entire Pacific Ocean basin to investigating all aspects of the oceans of the world.

### William E. Ritter and the Scripps

The beginnings of Scripps Institution were humble but visionary. In 1891 William E. Ritter became Instructor in Biology at the University of California at Berkeley, and almost immediately proposed to carry out “a biological survey of that part of the Pacific Ocean adjacent to the coast of California.” With \$200 provided by the Department of Zoology he purchased a tent and laboratory equipment, and conducted a summer course at Pacific Grove in 1892. For the next several years he and his colleagues and students made piecemeal excursions



William E. Ritter, founder and first director. Photo from Historical Collection, Title Insurance & Trust Co.

along the Pacific coast, carrying out biological studies while seeking a suitable site for a permanent summer station. Following an invitation from Fred Baker, a San Diego medical doctor and an able amateur conchologist whom Ritter had met on an earlier research trip to San Diego in 1891, Ritter agreed to carry out the summer program of 1903 in San Diego. Baker solicited \$1,250 for the summer's work and arranged for the use of a boat-house at Hotel del Coronado as a laboratory for the group of ten investigators.

Baker's enthusiastic efforts lined up support from a number of prominent San Diegans during and after that summer's program. As a result, on September 26, 1903, with thirty-four persons in attendance, the Marine Biological Association of San Diego was established. That date best represents the founding day of the present institution. The avowed purposes of the association were “to carry on a biological and hydrographic survey of the waters of the Pacific Ocean adjacent to the coast of Southern California; to build and maintain a public aquarium and museum; and to prosecute such other kindred undertakings as the Board of Trustees may from time to time deem it wise to enter upon.” The first officers of the association were: Homer H. Peters, president; Ellen B. Scripps, vice-president; William E. Ritter, scientific director; Fred Baker, secretary; Julius Wangenheim, treasurer; E.W. Scripps and James MacMullen, additional members of the board of directors. Peters left San Diego soon afterward to attend his business affairs elsewhere, and in 1906 Fred Baker became the president of the association.

The participation of E.W. Scripps and his half-sister Ellen Browning Scripps turned out to be a valuable addition to the venture. Newspaper owner E.W. Scripps provided business advice and financial support to the developing institution for many years, and provided the use of his own yachts for scientific trips. He took a great deal of interest in the research projects of the staff members and frequently contributed extra funds to specific ones. In 1907 he completed the transactions for acquiring from the city of San Diego the eighty hectares of land described as Pueblo Lot 1298, for which the Marine Biological Association paid \$1,000 as the sole bidder at public auction. E.W. Scripps also provided a great many trees and shrubs to cover the bleak hillside — plantings whose survival depended upon water carried by bucket and yoke. Ellen B. Scripps generously donated toward the annual operating expenses of the institution, provided major funds for constructing the Scripps Building, the Library-Museum (razed in 1977), the 305-meter-long pier, twenty-one of the original twenty-five residential cottages (of which eleven are still standing), and Ritter Hall (of which Miss Scripps's contribution was one-third of the total). She also established an endowment of \$400,000 for the institution.

From 1905 until 1910, the biological station was located in a small wooden building in La Jolla Cove park, built through individual donations totaling approximately \$900, collected by the La Jolla Improvement Society. In 1910 the first building was completed on Pueblo Lot 1298, the institution's present location. It was a laboratory building named George H. Scripps Memorial Laboratory at the request of Ellen B. Scripps, in memory of her deceased older brother.



The first home of the marine station from 1905-10, in La Jolla Cove Park (in center field, beyond the bath house).

### Transfer to the University of California

As had been the intention of the Marine Biological Association from the beginning, in 1912 the marine station was transferred to the University of California, which had accepted it after some reluctance. The university adopted the name Scripps Institution for Biological Research for its remote outpost. By then the institution had become a year-round facility, not solely a summer program. Dr. and Mrs. Ritter moved to La Jolla in 1910, and at first lived in the spacious second-floor rooms of Scripps Building. They moved into the wood-frame director's house as soon as it was completed in December 1913 (the house is now called T-16, located opposite the Aquarium-Museum). Most of the staff members and visiting investigators lived in the single-wall redwood cottages on campus (even though "the roofs leaked badly at every pore in the heavy rains, and the wind blew through the cracks"). Although the marine station was only four kilometers from central La Jolla, few had transportation to go back and forth, and the road into town was either a morass of mud or deep in dust. The isolation of the station led to its being called the "biological colony."

Ritter led the research projects of the institution for twenty years, from its founding in 1903 until his retirement in 1923. He was a prolific writer, acknowledged as an outstanding naturalist and biological philosopher, keenly interested in understanding the total organism. Although

their temperaments differed considerably, E. W. Scripps and W.E. Ritter worked together effectively and conversed long and often on points of mutual interest. Scripps often said of his and his sister's contributions: "We are not endowing an institution, we are endowing Ritter."

Research studies during the institution's early years were chiefly on nearshore marine animals and plants, with emphasis on classification, distribution, and the ocean environment. Short cruises were made on yachts owned by E.W. Scripps, and from 1907 to 1916 on the twenty-six meter **Alexander Agassiz**, built as a research ship for the institution from funds provided by Ellen B. Scripps. Intensive studies were undertaken on common marine organisms: chaetognaths, copepods, tunicates, diatoms, dinoflagellates, and annelids. Myrtle E. Johnson, who had earlier received her Ph.D. under Ritter at Berkeley, and Harry J. Snook, both biology teachers in Pasadena, were provided with space and facilities whenever they could arrange available time, and over several years compiled the first reliable handbook of Southern California marine life, *Sea Shore Animals of the Pacific*, published in 1927. In 1921 George F. McEwen summarized: "The major work of the institution has been of the type now generally known as Ecology."

Physicist McEwen had been added to the staff in 1908 because of Ritter's interest in relating the environment to the organism. McEwen began observing the physical



*Scripps Laboratory and the seawater tower, probably 1910. Photo from Historical Collection, Title Insurance & Trust Co.*

and chemical characteristics of the ocean, and he went on into physical oceanography and climate studies. For many years he provided seasonal rainfall forecasts, based on ocean temperatures, to a long list of farm advisers, chambers of commerce, and businesses.

An extensive study of the inheritance of acquired characters was undertaken in 1913 by Francis B. Sumner, who used generations of the deer-mouse *Peromyscus* for his researches. His program ended in the mid-1920's when the decision was made that the institution's research was to be entirely in marine studies. Sumner turned to studies on coloration of fishes, which had been one of his early fields of research.

## Toward the Ocean

When Ritter retired in 1923, Sumner was acting director for six months until the new director, T. Wayland Vaughan, could assume his duties in February 1924. The decision to focus the institution's research led to changing its name in 1925 from Scripps Institution for Biological Research to Scripps Institution of Oceanography.

Vaughan had been with the U.S. Geological Survey for most of his scientific career before becoming director of Scripps Institution. His research fields were fossil and living corals, coral reefs, and foraminifera, and he continued researches on those during his years as director. Through membership in national committees he encouraged the expansion of oceanography and led the institution into a larger role in studies of the oceanography of the Pacific. Vaughan's efforts derived oceanographic data from Navy ships, Coast and Geodetic Survey ships,

steamships, and from lighthouses for the institution. In addition, contributions to the research programs were acquired from many Southern California utilities companies.

Since 1916 the institution had not owned a research vessel, but Vaughan encouraged staff members to sail on ships of other agencies. In 1925 he arranged the purchase of a twenty-meter purse seiner, renamed the **Scripps**, for nearshore studies, and, with enthusiastic support of other Scripps staff members, he was planning an extensive program on the Carnegie Institution of Washington's research vessel, the **Carnegie**, before it was destroyed by explosion in 1929. The hoped-for gift of a large ship for the institution from Robert P. Scripps, son of E.W. Scripps, was thwarted by the financial depression. The economic situation affected the university's development also; budgets were lean, and donations less generous. A program that was of considerable benefit to Scripps Institution at that time, however, was the Works Progress Administration (and California's similar State Emergency Relief Administration), through which a number of workers were provided for such duties as painting buildings, paving roads, book-binding, library cataloging, typing, translating, and assisting in laboratories.

During Vaughan's tenure, the staff of the institution was increased somewhat, and programs were initiated in chemistry by Erik G. Moberg in 1925, in physiology by A. Haldane Gee for a brief period, followed in 1931 by Denis L. Fox, in bacteriology by Claude E. ZoBell in 1932, and

in sea-floor geology by Vaughan himself. The program in marine invertebrates that had ended with the death of C.O. Esterly in 1928 was reinstated by the addition of Martin W. Johnson to the staff in 1934. The second major laboratory building, Ritter Hall, was built in 1931, and a great deal more landscaping was done on the campus. The number of graduate students carrying out projects at Scripps varied from three to thirteen each year. (At that time the students registered at Berkeley.)

Vaughan retired in 1936 and returned to Washington, D.C. His successor as director was Harald U. Sverdrup, a Norwegian physical oceanographer, who had carried out arctic researches for Roald Amundsen and had participated in the first attempt to sail beneath polar ice in a submarine in 1931. His research interests specialized in ocean currents and the relationship of weather and the ocean, studies that he continued and expanded at Scripps.

When the boat **Scripps** burned in San Diego in the fall of 1936, Sverdrup discussed the institution's need with Robert P. Scripps, who in March 1937 purchased a luxurious thirty-meter sailing schooner in San Pedro for the institution. When conversion and outfitting for research had been completed, the ship, renamed **E.W. Scripps**, began taking monthly voyages to gather data on physical oceanography, chemistry, biology, and geology along the California coast. In 1939 she sailed on the institution's first "expedition" — a two-month voyage into the Gulf of California.

The reliance of the Scripps Institution on specific donations from members of the Scripps family was much re-

duced in the 1930's. E. W. Scripps had died in 1926, Ellen B. Scripps in 1932, and Robert P. Scripps in 1938. Sverdrup sought an increase in support from the university administration, and he encouraged cooperative programs by staff members with outside agencies, particularly a major study of fisheries with the U.S. Bureau of Fisheries. When Scripps Institution was incorporated into the Southern Section of the Academic Senate of the university in 1937, Sverdrup initiated a course in oceanography at the University of California, Los Angeles, which attracted new students to the institution.

## World War II

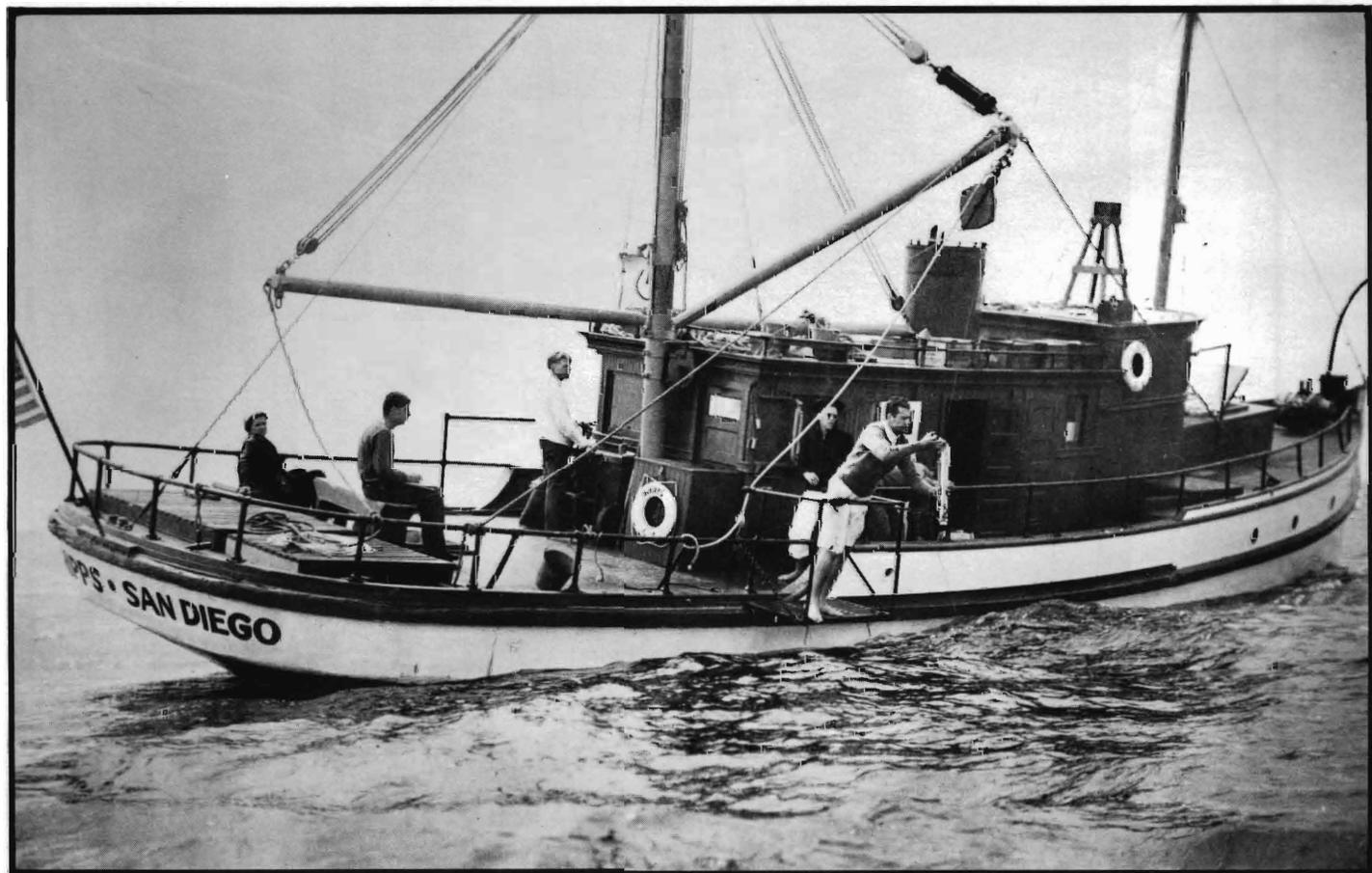
During the wartime years from 1941 to 1945, some Scripps staff members left for military service, and others were drawn into military research projects. Sverdrup and Walter H. Munk developed a methodology for predicting waves, surf, and swell, which were used by Allied amphibious forces from the invasion of North Africa until the end of the war. Courses in sea, swell, and surf forecasting were taught to more than 200 military officers at the institution.

Scripps researchers located at the University of California's Division of War Research (UCDWR) at Point Loma carried out pioneering studies on underwater sound for use in anti-submarine warfare, mapped the thermocline, found the deep scattering layer and proved it to be composed of living organisms. They also improved sonar equipment, prepared sonar charts of the Pacific and Indian oceans, and compiled sediment charts of Asian continental shelves.



*Dr. and Mrs. Ritter in the second-floor rooms of Scripps Laboratory, probably 1910.*

The **Alexander Agassiz**, built for Scripps Institution in 1907 and used for research until 1916. (The name was used again for another Scripps vessel acquired in 1962.)



The **Scripps**, purchased by the institution in 1925, and used for nearshore studies until 1936.

Martin W. Johnson, who had resolved the dilemma of the deep scattering layer, also determined that loud static-like noises that puzzled sonar operators were caused by snapping shrimp and so could be predicted in time and place. Researchers on the Scripps campus devised anti-fouling techniques, undertook studies on kelp and the red alga *Gelidium* for potential agar production, and prepared charts of the ocean currents in the Pacific. The institution's only ship, **E.W. Scripps**, was loaned to UCDWR throughout the war years.

"The war showed how oceanography could be applied," said Sverdrup in 1946, at which time the Scripps Institution was the only school in the United States that offered a graduate degree in oceanography. It also had produced, in 1942, the only textbook in English in the field: *The Oceans: Their Physics, Chemistry, and General Biology*, by Harald U. Sverdrup, Martin W. Johnson, and Richard H. Fleming. Students were eager to enter this new field, the Navy recognized the value of basic research in oceanography when it established the Office of Naval Research, and ships were available. In the fall of 1946, thirty-seven students registered for advanced studies at Scripps, a notable increase over the prewar numbers. From that point and throughout the 1950's Scripps Institution grew in staff, students, ships, and buildings. The "biological colony" disappeared, as the town, city, institution, and university grew. In its place was an internationally acknowledged research center, brimful of buildings, and not at all isolated. For some years it was diffuse, as space on the campus was limited, and many new projects began in temporary space in Navy buildings at Point Loma.

## Postwar Growth

Roger Revelle became prominent in the development of Scripps immediately after World War II. He had received his Ph.D. in 1936 from studies carried out at the institution, and during the war he served as an officer in the U.S. Naval Reserve, chiefly in Washington. In 1946 he was in charge of Operation Crossroads, to test the effects of atomic bombs on Navy vessels and to determine the environmental impact of the explosion, a joint military and scientific project that drew in most of the limited number of the nation's oceanographers.

Before his return to Scripps in 1948, as professor and associate director, Revelle helped negotiate for three ships for the institution from the Navy's available ones; these three — **Horizon**, **Crest**, and **Paolina-T** — joined the aging **E. W. Scripps** to create the first fleet of oceanographic research vessels owned by any institution. The ship's service unit, Marine Facilities, located then and since at Point Loma, was established at that time.

Revelle also helped arrange for the institution's first contract with the Office of Naval Research — an all-encompassing program in basic oceanographic studies. With Sverdrup he participated in a newly established multiagency state project in fisheries, begun early in 1948 as an effort to determine the cause of the decline of the California sardine. This program has continued as the California Cooperative Oceanic Fisheries Investigation, of which the Marine Life Research Group at Scripps is a unit.

Soon after seeing the cooperative fisheries program established in 1948, Sverdrup left Scripps Institution to return to Norway. Carl Eckart became the institution's



The chemistry laboratory on the second floor of Ritter Hall in the 1930's.

director, while continuing in the post that he already held as director of the Marine Physical Laboratory (MPL), a peacetime successor to the Division of War Research. Eckart served as director of Scripps until 1950, when Revelle was appointed acting director and, in 1951, director of Scripps. Revelle took the institution to sea, beginning in 1950 with the first major Scripps expedition, Mid-Pac, to the central Pacific Ocean.

Revelle felt that oceanographic researches could help solve such world problems as food and mineral shortages, contribute to national defense, and provide data basic to understanding the planet on which we live. In an era of expanding funds for scientific research he was able to encourage new programs and research units at Scripps.

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The first big, cooperative project, CCOFI or CalCOFI, led to a sudden spurt of growth from 1948. Through the years it has carried out the world's most intensive study of a major current, the California Current, the source of most of California's commercial fisheries. The Scripps portion of it, the Marine Life Research Group (MLRG), was assigned responsibility for gathering basic oceanographic data in the sardine's habitat. To do so, it established a training program for marine technicians and founded a system of handling large amounts of data rapidly. It also contributed extensively to the development of oceanographic equipment: the Isaacs-Kidd mid-water trawl, the first very successful device for gathering abyssal creatures; the bongo net, which can be opened and closed at any desired depth; and a host of free-vehicle instruments, including deep-sea cameras, fish traps, a sediment trap, and current meters. MLRG has accumulated "the greatest and most complete plankton collection of any area in the world." It has provided basic information on the commercially valuable

fishery resources of California. The sardine, MLRG researchers found, by analyzing fish scales in long sediment cores from anaerobic basins, was not usually the most abundant fish off California, but fluctuated through highs and lows. Long directed by John D. Isaacs, the Marine Life Research Group is currently directed by Joseph L. Reid, Jr.

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The Marine Physical Laboratory (MPL) became a research unit of Scripps Institution in 1948, when Eckart became the institution's director. Its researchers have pursued studies in underwater acoustics, pioneered in the development of signal processing, and conducted studies in marine geophysics. MPL engineers and physicists have devised and built remarkable marine vehicles, of which the most widely known is **FLIP**, the first successful floating instrument platform. Another of the laboratory's vehicles, **RUM**, can crawl along the floor of the ocean to set out and retrieve equipment on command from the surface. MPL researchers have developed and refined the technique of telemetering information from submerged instruments by way of a single conductor cable. Victor C. Anderson of MPL principally developed the digital multibeam steering system, DIMUS, which is the key component of signal processing in sonar systems. The Deep Tow system devised by the laboratory's researchers has been widely used for fine-scale studies of the sea floor at great depths. Fred N. Spiess has been director of the Marine Physical Laboratory since 1958.

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The Visibility Laboratory, headed by Seibert Q. Duntley until his retirement in 1977, transferred from the Massachusetts Institute of Technology to Scripps in 1951, to continue its researches into the optical properties of the ocean and the atmosphere. It has been located at Point Loma since its move to the west coast. The laboratory's



The **E.W. Scripps**, used as a research vessel by the institution from 1937 to 1955.

studies have been concerned with the propagation of light through the water and through the atmosphere, and with the limitations imposed by those media on man's ability to see. Its activities are presently directed by James L. Harris, Sr.

Also in 1951 began an intensive geological study at Scripps, API 51, funded by the American Petroleum Institute and directed by Francis P. Shepard, one of the first submarine geologists in the country. Long-time staff members Milton N. Bramlette and Fred B Phleger were early participants in API 51. The region of interest was the coastal waters of the Gulf of Mexico, and the project researchers provided a detailed description of the sedimentary patterns of the Gulf Coast area before turning their attentions to the Gulf of California. API 51 ended in 1962, but the basic researches that it began have continued, at Scripps and elsewhere.

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In 1954, with enthusiastic cooperation between representatives of commercial fisheries and university officials, the statewide Institute of Marine Resources was established, with headquarters on the Scripps campus, to foster research, education, and public service in all resources of the sea. Charles D. Wheelock was its first director; he was succeeded by Milner B. Schaefer, and in 1971, by John D. Isaacs. Programs within this university-wide institute have included: carrying out detailed studies of the giant kelp *Macrocystis*; establishing a SCUBA training program that is rated the safest in the world; conducting fisheries researches, particularly on

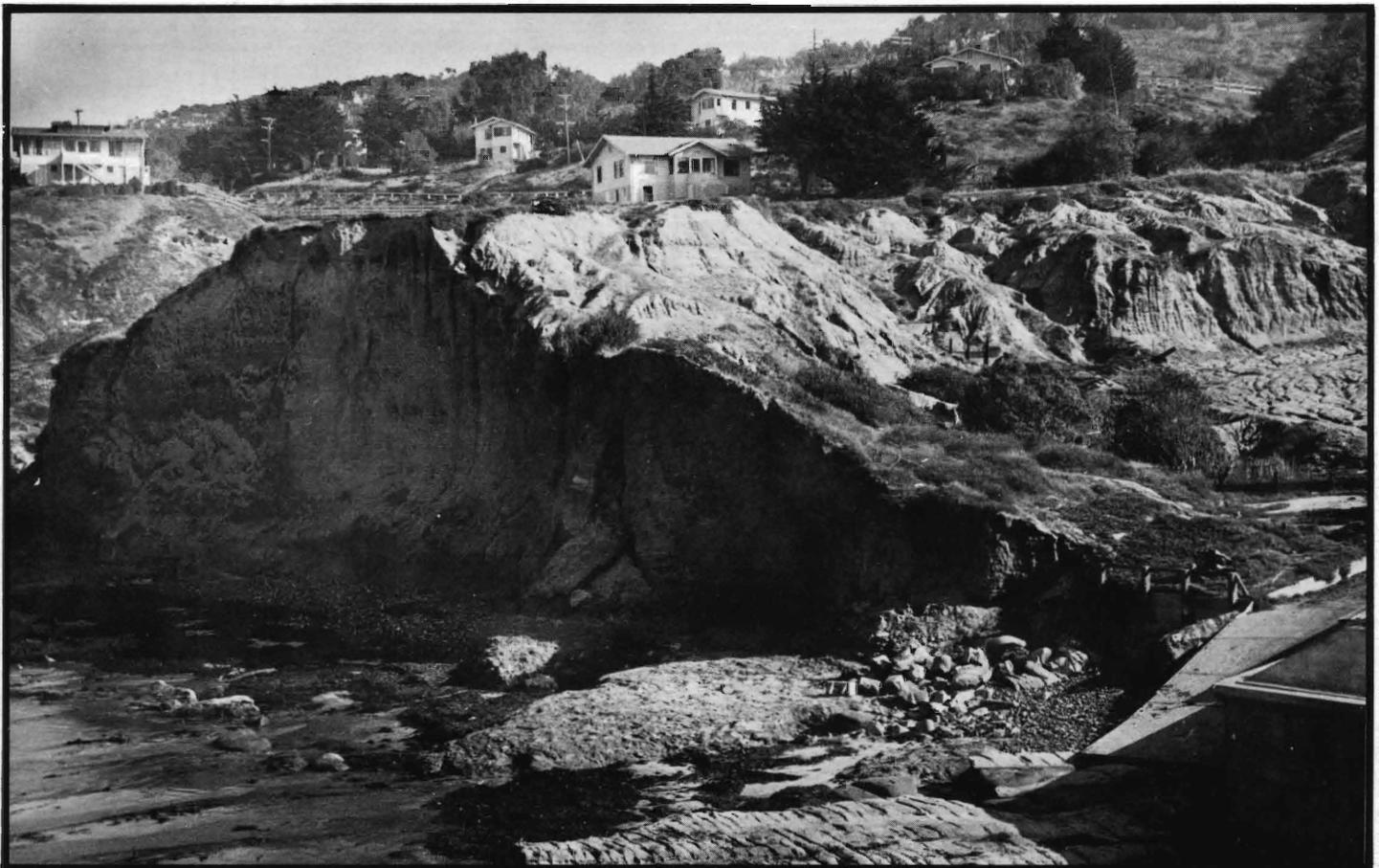
the several species of commercial tunas; researches on the food processing of marine products; analysis of the food chain of the sea; studies in sewage disposal and treatment; and resolving problems in beach and coastal erosion.

In 1971 the administration of the University of California's Sea Grant Program was placed within IMR. This large program, part of an extensive federal system, presently supports seventy-four projects on various California campuses, in research, education, and public service toward wise utilization of the resources of the sea.

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The La Jolla branch of the university's Institute of Geophysics and Planetary Physics was established in 1960, through the effort of Walter H. Munk. Its researches in land geophysics and ocean geophysics have included work on ocean waves, tides, and oscillations, on earthquakes, tsunamis, and microseisms, and on the internal constitution of the solid earth.

The Physiological Research Laboratory was begun in 1963, chiefly through the efforts of Per F. Scholander. Researchers there have undertaken studies on the physiology and behavior of marine and some non-marine vertebrates and on the physiology of transport mechanisms in a variety of organisms, both at the cellular and system level. Associated with the founding of this laboratory was a shipboard program, with the emphasis on physiological studies, aboard **Alpha Helix**, which has been counseled by a national advisory board and has drawn research participants from many nations on study locations from the Bering Sea to the Antarctic, the Amazon, and New Guinea.



The boat ramp alongside the pier, the "badlands" (now the service yard), and some of the cottages, in 1941.

## International Ventures

In the optimistic years of the 1950's began international cooperative programs to study the oceans, in which Scripps participated extensively. Norpac Expedition in 1955 was among the first. It was a synoptic survey of the Pacific Ocean north of 20°N, carried out by nineteen research ships from the United States, Japan, and Canada, three of them from Scripps. The International Geophysical Year followed in 1957-1958, and involved Scripps researchers in one geological-geophysical expedition and two other expeditions to study ocean currents. On one of these, Dolphin Expedition, John A. Knauss outlined the Cromwell Current, first noted in 1952 by Townsend Cromwell; this large subsurface current moves at speeds up to three knots eastward beneath the equator. Scripps personnel also directed an IGY program to record sea-level fluctuations and other oceanic data at sixteen island locations in the Pacific Ocean.

In 1959 the Scripps ship **Stranger** sailed on the two-year Naga Expedition in the waters near Thailand and Vietnam. This biological and fisheries survey included participants from many of the southeast Asian nations who worked and studied alongside Scripps scientists. In 1960 the Scripps ship **Argo** made the institution's first entry into the Indian Ocean, as part of the International Indian Ocean Expedition (IIOE), a collection of voyages by forty research ships during the five years of that international program. Three of the IIOE expeditions were carried out by Scripps and led to the institution's ships circumnavigating the globe for the first time. **Horizon** first, in 1962-63 on Lusiad Expedition, and **Argo** second, on the same expedition, circled the earth's oceans in opposite directions.

## Continuing Researches

Geologists and geophysicists found the decades of the 1950's and 1960's their most exciting era, as every oceanographic expedition brought in new knowledge of the configuration and structure of the sea floor and below it. By the latter 1960's the theories of sea-floor spreading and plate tectonics were well established, through observations gathered by many institutions. At Scripps, visitor Edward C. Bullard (who later became professor of geophysics at the institution) with Arthur E. Maxwell and James M. Snodgrass in 1949 constructed the first successful instrument for measuring the temperature gradient within the sediments of the sea floor, the heat probe, and in 1950 Maxwell and Snodgrass obtained the first conclusive measurements with it. Scripps expeditions in the early 1950's discovered the Mid-Pacific Mountains, that spread along the deep-sea floor for at least 2000 km, rising from it more than 4 km, but still submerged in a kilometer and a half of water. Other trips outlined a series of puzzling fracture zones on the sea floor off the Pacific coast.

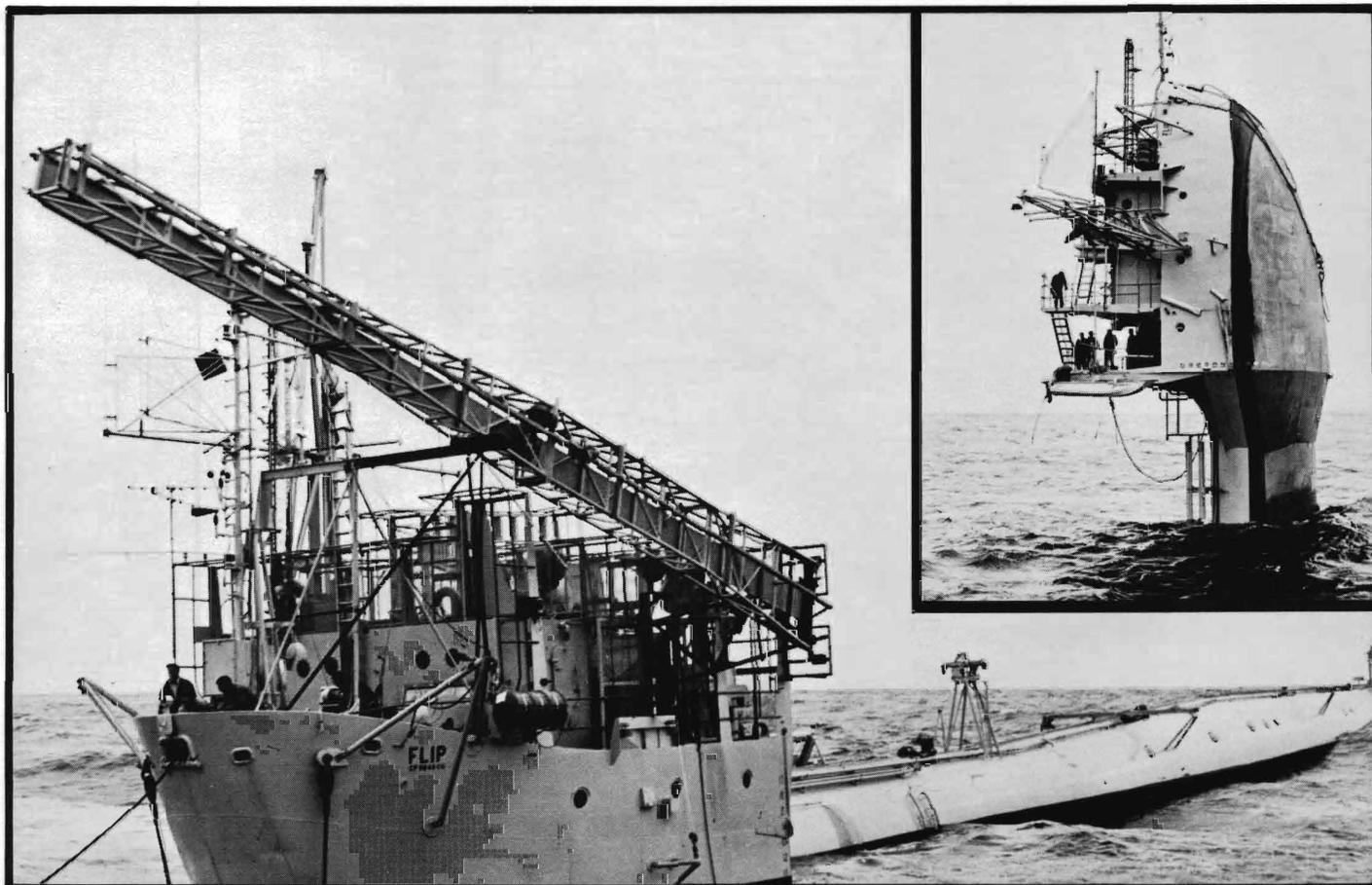
Pioneering work by Victor Vacquier, Ronald G. Mason, and Arthur D. Raff provided proof, through detailed measurements of the earth's magnetic field, that plates of the earth's crust had slipped past each other as much as 1,185 km. Several expeditions led by H. William Menard carried out thorough studies of the East Pacific Rise, which was soon found to be part of the globe-girdling rift from which new crust is created. The distribution of manganese nodules throughout large areas of the Pacific was outlined, and Scripps chemists Edward D. Goldberg and Gustaf Arrhenius analyzed samples of them.



Roger Reville (foreground) and Robert F. Dill handling the piston corer on Mid-Pac Expedition, 1950.



Bringing aboard the Isaacs-Kidd midwater trawl during Transpac Expedition, 1953.



**FLIP**, the first successful floating instrument platform, designed and developed by the Marine Physical Laboratory.

Robert L. Fisher, who has led many expeditions to survey deep-sea trenches, also determined the deepest spot in the world's oceans, 10,914 meters, in Challenger Deep of the Mariana Trench, later chosen for the world's deepest dive, in the Navy submersible **Trieste**. Scripps researchers helped plan the Mohole project, the bold vision of the late 1950's to drill a hole through the crust of the earth to the mantle. A shallow hole was drilled off the coast of Baja California, but the project was terminated because of increasing cost estimates and political complications.

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In these same decades Scripps biologists were pursuing a variety of marine studies, in addition to those of the Marine Life Research Group. Specimens of fishes collected on a number of expeditions swelled the Marine Vertebrates collection so that it has become the sixth largest, in total specimens, among collections in the United States and Canada.

In addition to doing considerable research on fishes, Carl L. Hubbs in the latter 1940's turned his attention to marine mammals; he observed and tallied the increasing numbers of gray whales, which had neared extinction before their international protection; he found the Guadalupe fur seal, long thought to be extinct, alive and well on Guadalupe Island in 1954; he recorded its increase in numbers, and the increase in population of the northern elephant seal there also.

Microbiologist Claude E. ZoBell, on the Danish research vessel **Galathea** in 1951, determined that bacteria lived at the ocean's greatest depths; samples of

mud from 10,000 meters in the Philippine Trench proved to have living bacteria, some of which survived in pressure chambers in ZoBell's laboratory for many years.

Biochemist Denis L. Fox undertook studies of animal pigments, unraveling the chemical structure of the pigment molecules in a wide variety of brightly colored marine organisms and in the brilliantly hued flamingos. Fox investigated fouling organisms also, and provided the advice to power companies that they periodically raise the temperature in sea-water cooling lines in order to clear them of marine growths.

Other biologists and biochemists began investigations, still continuing at Scripps, on photosynthesis in marine plants, the role of silicon in diatoms, circadian rhythms, waxes and fats in the minute but widespread copepods, the evolution of barnacles, the behavior of the organisms in the deep scattering layer, the distribution of nearshore marine communities, and the complexity of mid-ocean populations.

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Pursuing a range of studies in the nearshore zone from the 1950's has been Douglas L. Inman, who established the Shore Processes Laboratory. That group of researchers devised the first instrumentation, a wave-measuring device, that presented data in digital form for direct computer processing. Anthony J. Bowen, following a suggestion by Inman, in 1967 presented a technical description of the mechanisms that create rip currents. The transport of sand along the coast and the movement of sand within the wave zone have continued to be major research concerns of this group.



*Kelp project researchers on one of the buoy boats in 1956.*

In the latter 1950's James M. Snodgrass devised the technique that led to the development of the expendable bathythermograph, for recording ocean temperatures down to 200 meters from moving vessels. Throughout the 1960's and on, Margaret Robinson compiled a series of atlases of the temperature distributions of the world's oceans, a monumental task, based on hundreds of thousands of bathythermograph records. This work was aided by an automatic digitizer for BT records, designed by Jeffery D. Frautschy, Marston C. Sargent, and Phillip R. Mack in 1967.

Chemists at Scripps from the 1950's, beginning with Norris W. Rakestraw, have been analyzing sea water and air samples and sediment cores, using increasingly sophisticated techniques. In air samples taken well out to sea, Edward D. Goldberg found wind-borne dust from arid regions, and he also found talc derived from land-sprayed insecticides. Charles D. Keeling set up a program to monitor carbon dioxide in the atmosphere and the ocean, to see whether man's increasing use of fossil fuels might create global changes in climate — a phenomenon often referred to as the "greenhouse effect."

Among a number of Scripps researchers who participated in thermonuclear tests during the 1950's was Theodore R. Folsom, who traced the course of fission products through ocean waters for many years. Tsaihua J. Chow determined that lead was found in greater quantity than expected in sea water and in sediment cores, and concluded from its distribution that leaded gasoline was the major source. Hans E. Suess, who later transfer-

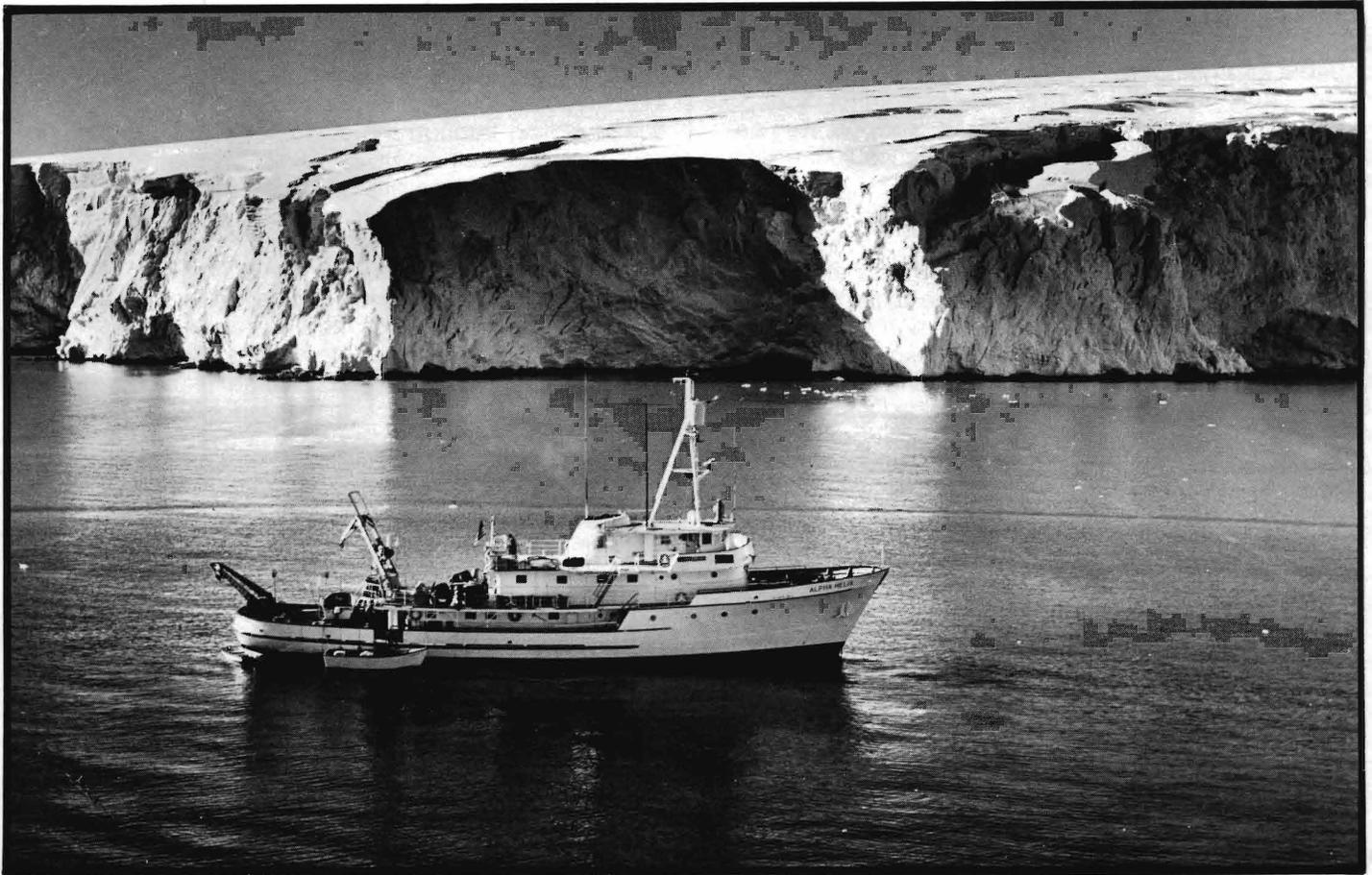
red to the chemistry department at UC San Diego, set up a radiocarbon laboratory as part of the Scripps program of the International Geophysical Year in 1957. It provided many closely defined dates of sea-level changes at coastal locations and the ages of aboriginal sites as part of a study of past climates.

### Founding a University

Throughout the years of its greatest growth, Scripps Institution was hard pressed to keep up with its own expansion. Gradually buildings were added to accommodate expanding programs. The peak year was 1960, when Sverdrup Hall, Sumner Auditorium, and a second addition to Ritter Hall were all completed. At that time the "new campus" was getting underway, first as a graduate School of Science and Engineering, and about 1960 as the University of California, San Diego (UCSD). The earliest appointments to the new campus were housed in buildings of the Scripps Institution. Upon the establishment of the new campus, Scripps Institution became a graduate school of UCSD.

Scripps staff members worked with the first arrivals of the new campus to ensure its successful founding. They suggested the name Revelle College for its first unit, to acknowledge the intensive efforts of Roger Revelle in the establishment of the university. The first dormitories were named for oceanographic ships, and the triton was adopted as the symbol of the first college.

With the founding of a full university campus that incorporated the already famous oceanographic institution, Revelle's vision of La Jolla as an intellectual center of the west was beginning to take shape.



**Alpha Helix** in the Antarctic, 1971. Photo by Edvard A. Hemmingsen.

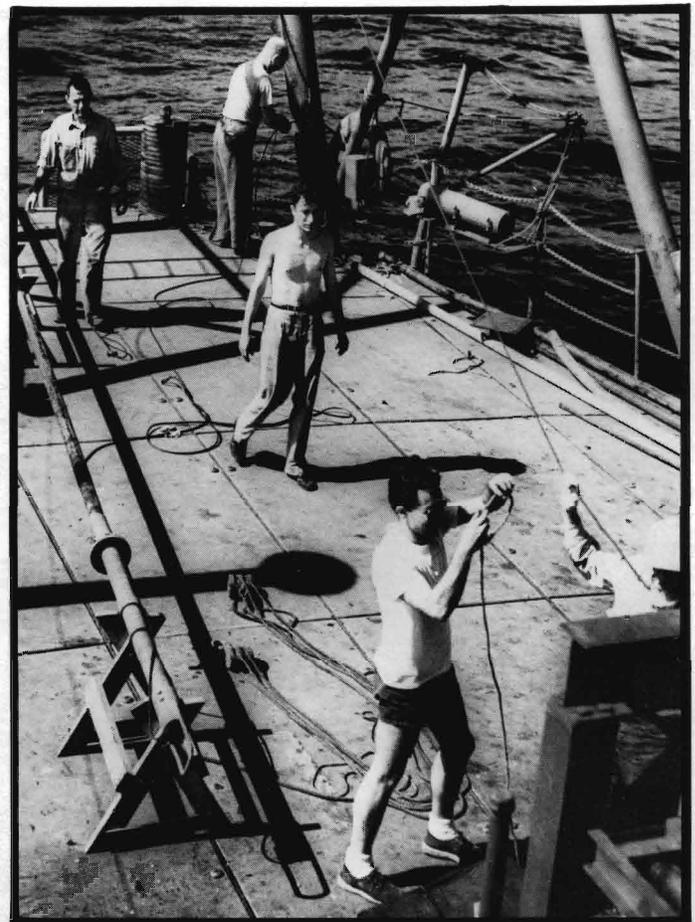
## The Recent Past

From 1961 to early 1963, while Revelle served as science adviser to Secretary of the Interior Stewart Udall, Fred N. Spiess was acting director of Scripps Institution. Revelle left Scripps in 1964, and Spiess became director of the institution for the following year.

In 1965 physicist William A. Nierenberg became the seventh director of Scripps Institution of Oceanography. Nierenberg received his Ph.D. from Columbia University in 1947, after having participated in Columbia's Manhattan Project during World War II, and became professor of physics at Berkeley in 1950. He established the Atomic Beam Laboratory on that campus and the Atomic Beam Research Group at Lawrence Radiation Laboratory.

Under Nierenberg's direction, the institution has emphasized major oceanographic projects, nationally and internationally sponsored. As the number of oceanographic projects, and their costs, have grown, the institution's operating budget has more than tripled since 1965. The campus facilities have also expanded; in the last few years have been added the Deep Sea Drilling Project building (1970), a new pier at Nimitz Marine Facility on Point Loma (1974), the Norpax Building (1975), the Carl Eckart Building to house the Scripps Library (1976), and the Marine Biology Building (1977).

In the mid-1960's the era of hand-me-down vessels ended as Scripps Institution began acquiring ships designed especially for oceanographic research, those that constitute the present fleet: **Thomas Washington**, **Ellen B. Scripps**, **Alpha Helix**, and **Melville**. Under construction, and scheduled for completion in mid-1978, is the 52-meter **New Horizon**, named in honor of the most



Coring from the **Spencer F. Baird** in mid-1950's.

widely known previous research vessel of Scripps. The ships are working vessels, comfortable but not luxurious, capable of coping with severe weather and handling heavy equipment. Since 1937, when the first Scripps vessel capable of long voyages, **E. W. Scripps**, was acquired, the institution's fleet has sailed almost four million nautical miles.

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Over the years, engineers and scientists at Scripps Institution have provided considerable expertise in the design of research ships. The basic design of most modern oceanographic vessels, with wide expanses of open deck, stems from studies by Scripps's longtime engineer, Maxwell Silverman, in cooperation with the Department of Naval Architecture at Berkeley. Scripps people have improved ship equipment also, such as devising the first large traction-drum oceanographic winch in the United States to handle great lengths of tapered cable; the three-strand hydrographic cable now used almost universally by oceanographers; and torque-balanced, high-strength steel oceanographic cable. The two largest Scripps vessels carry shipboard computers, which process ship's navigation, from satellite receivers and bridge data, compute underway data such as bathymetry and surface temperatures, and handle many individual research programs.

One of the largest projects with which Scripps Institution has been associated, the Deep Sea Drilling Project, began in the mid-1960's. DSDP is a unique effort to increase man's knowledge of the earth, the age, history

and processes of development of the ocean basins, and the structure and composition of the oceanic crust. It was established by several major oceanographic centers of the United States, who agreed to support a program of ocean drilling through the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). Fourteen institutions from six nations are now members of JOIDES. In 1966 Scripps Institution became the managing institution of DSDP, which commenced eighteen months of ocean-floor drilling in 1968, as soon as its drilling ship, **Glomar Challenger**, was constructed. The drilling project has been extended three times, and is presently carrying out Phase IV under the name International Phase of Ocean Drilling (IPOD). In its just-completed first decade the Deep Sea Drilling Project has drilled 679 holes at 446 sites throughout the world's oceans (to the end of leg 58 in January 1978) and has accumulated 52,413 meters of sediment cores. From these, geologists have determined that the ocean basins are young features chiefly because of the destruction of older sediments by sea-floor spreading. The very successful project has contributed enormously to our knowledge of the history of the earth.

### Into the Seventies

An interdisciplinary program instigated by Nierenberg was the Center for Marine Affairs, set up in 1970, first under the direction of Warren S. Wooster. The center's purpose was to involve specialists in the social sciences and government organizations in considering marine problems. A number of visitors were brought to Scripps in study teams and workshops to discuss such problems



Carl L. Hubbs greeting a bull elephant seal on Guadalupe Island in 1955. Photo by George E. Lindsay.

as restrictions on conducting marine research, global marine pollution, and to consider appropriate ways to develop the marine and coastal resources of Baja California, a program in cooperation with Mexican researchers.

GEOSECS, the Geochemical Ocean Sections Study, begun in 1971, was the first major program of the International Decade of Ocean Exploration, a research effort sponsored by the National Science Foundation. This multi-institutional study is attempting to determine the chemistry of the deep-ocean circulation, which requires simultaneous automated analysis for many elements and compounds from many samples throughout the water column. The GEOSECS Operations Group at Scripps is directed by Arnold E. Bainbridge. Harmon Craig is a member of the program's executive committee. On a GEOSECS-supported portion of Antipode Expedition in 1971, Craig and his co-workers discovered a major density discontinuity, the benthic front, in the South Pacific Ocean.

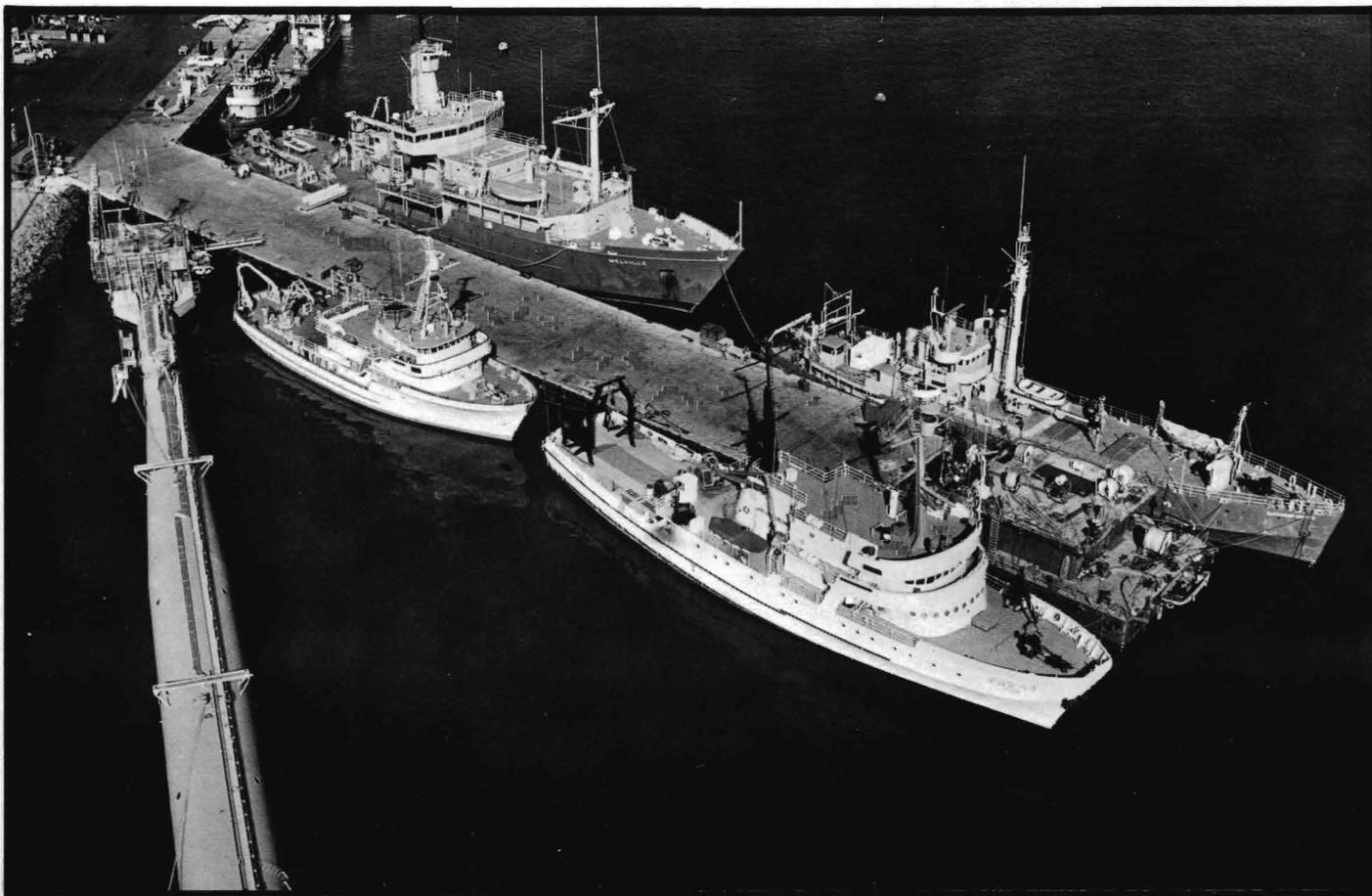
NORPAX, the North Pacific Experiment, was organized in 1972 and headquartered at Scripps. It arose from a project devised in the late 1960's by John D. Isaacs, the North Pacific Buoy Program, which monitored ocean temperatures, wave heights, and meteorological measurements from deep-moored buoys that telemetered information to shore continuously for many months. David L. Cutchin is the program administrator for NORPAX. Researchers in this interdisciplinary program are studying the large-scale fluctuations in the thermal structure of the

Pacific Ocean from 20° to 60°N and their relation to the overlying atmosphere. Their aim is long-term prediction of climate and weather in North America. Already the Climate Research Group under the direction of Jerome Namias has determined correlations between sea-surface temperatures, upper air wind patterns, and temperature anomalies over the United States. These have made it possible to predict seasonal trends in weather.

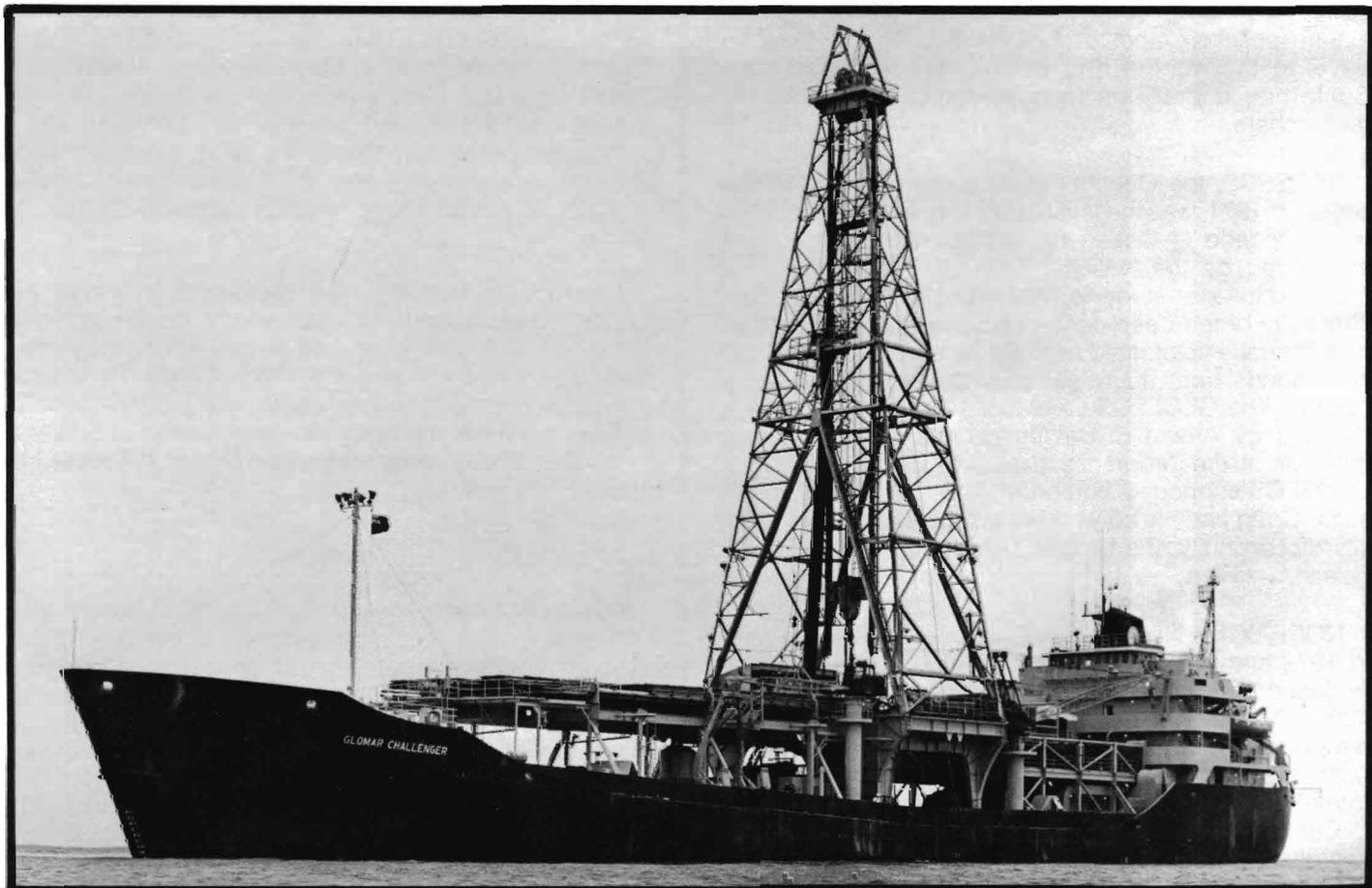
From the mid-1960's, the biological program at Scripps has expanded into researches in cell physiology, fertilization, embryology, and development of organisms. Partly in connection with the Physiological Research Laboratory and partly in connection with UCSD's School of Medicine, a Neurobiology Unit was formed at Scripps in the latter 1960's, under the leadership of Theodore H. Bullock.

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A little-heralded facet of Scripps Institution is the amount of time its researchers devote to advisory roles. For examples, Nierenberg served for five years as chairman of the National Advisory Committee for Oceans and Atmosphere — one of the most significant policy committees of the many on which he serves; H. William Menard served as technical assistant in oceanography for the White House Office of Science and Technology in 1965; Carl L. Hubbs served as a trustee of the San Diego Zoological Society from 1944 until 1971; Jeffery D. Fruitschy has served on the California Coastal Commis-



Most of the Scripps fleet (plus the **David Starr Jordan**) at Marine Facilities in 1974.



The **Glomar Challenger** of the Deep Sea Drilling Project.

sion since 1972. To the city of San Diego, to the state of California, to other cities and states, and to the federal government and other nations, dozens of Scripps scientists have provided advice and solutions in their fields of expertise. The Marine Life Research Group, the Institute of Marine Resources, and the Sea Grant Program were all established to disseminate knowledge to non-oceanographers, as well as to carry out basic researches.

### Scripps Today

Scripps Institution of Oceanography in 1978, when it is honoring its seventy-fifth anniversary, encompasses about 1,100 people, of whom 78 are faculty members (15 emeritus) and 190 are graduate students.

As the Department of the Scripps Institution of Oceanography of the University of California, San Diego, it offers seven curricular programs for its students: biological oceanography, marine biology, marine chemistry, geological sciences, geophysics, physical oceanography, and applied ocean sciences. Since 1919 a total of 365 students have received Ph.D. degrees from their researches carried out at Scripps Institution.

Faculty and staff of the institution are administratively located within three divisions — Geological Research, Marine Biology Research, and Ocean Research — and these research units: Marine Life Research Group, Marine Physical Laboratory, Neurobiology Unit, Physiological Research Laboratory, Visibility Laboratory,

Institute of Marine Resources (inter-campus), Institute of Geophysics and Planetary Physics (inter-campus), and Deep Sea Drilling Project (international).

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The popular Aquarium-Museum at Scripps, named in honor of T. Wayland Vaughan, welcomed 379,713 visitors during the fiscal year 1976-1977, including 59,598 school children in group tours. The institution has operated a public aquarium since its founding, first only as a few tanks set aside for special displays. The aquarium was located in a wooden building alongside Scripps Building from 1915 until 1950, when the present structure was built. A museum of oceanographic displays was set up in 1916 in the newly finished Library-Museum building and was hailed as the second oceanographic museum in the world (the first, in Monaco, was established in 1910). Percy S. Barnhart was curator of the aquarium and museum from 1914 until 1946, when he was succeeded by Sam D. Hinton. The present director of the Aquarium-Museum is Donald W. Wilkie, who has promoted a much enlarged program of tours for school groups.

Scripps maintains extensive collections of marine vertebrates, curated by Richard H. Rosenblatt; of planktonic invertebrates, curated by Abraham Fleminger; of benthic invertebrates, curated by William A. Newman; and of geological samples from coring and dredging, curated by William R. Riedel. The Geological Data Center, under the direction of Stuart M. Smith, processes and stores geological and geophysical data, and also publishes bathymetric charts and physiographic diagrams. Cores retrieved by the Deep Sea Drilling Project from the Pacific



*Visitors to the Scripps Aquarium-Museum entranced by a moray.*

and Indian oceans are stored at the Scripps facility of that project. The Scripps Institution Library, now a branch of the UCSD Library and directed by William J. Goff, holds one of the largest collections of oceanographic publications in the United States. All these uniquely oceanographic collections are extensively used by Scripps researchers and by many oceanographers elsewhere.

Special facilities for research maintained by the institution include machine shops, a diving locker and supplies, sophisticated equipment for various kinds of chemical analysis, an electron microprobe laboratory, an experimental aquarium building, a hydraulics laboratory, and a computer center. Scripps also operates radio station WWD, licensed to the National Marine Fisheries Service, to communicate with its research ships.

In the fiscal year that ended June 30, 1977, approximately eighty-one percent of the institution's financial support was derived from federal contracts and grants, fourteen percent from the state of California, and five percent from endowments, gifts, private grants and other sources. The total expenditures for that year were \$40,349,218.

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The dollar amount is vast. So is the scope of research at the oldest and largest oceanographic institution of the United States. Three-quarters of a century ago, a few days before the formal organization of the Marine Biological Association, E. W. Scripps said: "We are going to make this the biggest thing of its kind in the world."

Happy anniversary, Scripps!

Suggested references:

*For further reading about the early years of the institution, see Scripps Institution of Oceanography: First Fifty Years, by Helen Raitt and Beatrice Moulton, Los Angeles, Ward Ritchie Press, 1967.*

*For the later years see Scripps Institution of Oceanography: Probing the Oceans, 1936-1976, by Elizabeth Noble Shor, San Diego, Tofua Press, 1978.*

