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OCEANOGRAPHIC EXPEDITION
OF THE SHIP EXPLORER

by

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Director, U. S. Coast and Geodetic Survey

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The oceanographic program of the U. S. Coast and Geodetic Survey was highlighted by the voyage of the ship Explorer en route from Seattle to Washington, D. C. beginning 2 February 1960 and arriving at the national capital on 20 April. This 10,000-mile expedition which extended over a period of nearly three months establishes a landmark in recent oceanographic activities of the Survey. It is the modern counterpart of an historic voyage by the ship Hassler in 1872.

The old sailing ship, named for the first Superintendent of the Coast Survey, the great Swiss scientist and engineer, Ferdinand Rudolph Hassler, took ten months to sail from San Francisco around the Horn to Boston. The scientific operations of this cruise were under the direction of Professor Louis Agassiz, the Swiss naturalist who also immigrated to the United States from Switzerland.

The Explorer encountered many unique experiences that could occur only on a cruise of this type. One of the highlights of the cruise was a variety of investigations on and around Swan Islands. Substantial charting hydrography was accomplished in investigating the underwater shelf around the islands. Tides were observed there for six days and observations were also made at two magnetic stations. Plants, reptiles, and insects were collected for the U. S. National Museum of the Smithsonian Institution and 18 large land lizards, or iguanas five to six feet long, were captured alive for the National Zoological Park in Washington.

Almost 100 rock samples were collected and a reconnaissance geological study was made of Swan Islands for the U. S. Geological Survey. Oceanographers specially trained in scuba or skin-diving techniques donned diving gear to study and photograph the coral reefs around the islands. Nearly 1,000 feet of motion-picture film were exposed in a series of ten underwater dives. Due to the isolated area of these least known of the United States possessions, we enumerated for the Census Bureau the 28 inhabitants of the islands for the 1960 census. The Post Office Department authorized a special cancellation stamp

for philatelic mail and over 5,100 commemorative cancellations were made aboard the ship.

Transfer of the Explorer to the East Coast heralds an expansion of the Survey's oceanographic program in the Atlantic Ocean. Significant discoveries were made over the years with the Explorer pertinent to present-day accelerated interest in submarine topography. On many return trips from the working grounds to home port across the Gulf of Alaska, seamounts have been discovered by the Explorer and other ships of the Coast and Geodetic Survey fleet. Discovery was announced recently of a major seamount rising 1 1/2 miles to a surface depth of 3,984 feet. This latest discovery is the 20th peak of a chain extending along the floor of the Aleutian Trench for 600 miles from its terminus 110 miles east of Kodiak Island. Approximately 160 underwater mountains have been discovered by Coast and Geodetic Survey ships in this vast northwest Pacific area.

Reassignment of the Explorer to the East Coast resulted from the addition to the Coast Survey fleet of a fine new survey ship for West Coast and Alaskan operations. On 30 April 1960 the Surveyor was commissioned by the author at San Diego where she was built by the National Steel and Shipbuilding Corporation. The commissioning of the new ship was especially timely in view of national attention now being given oceanographic operations. This modern ship, among the finest of the specially built ocean survey ships in the world, now becomes the backbone of the Coast and Geodetic Survey fleet. The new ship of over 3,000 tons has a great range of navigational equipment on her bridge resulting from the electronic age. She also has the bell from the old ship formerly having the same name to perpetuate the honorable memory of her proud predecessor.

The oceanographic voyage of the Explorer embarks the Coast and Geodetic Survey on an intensified oceanographic program. In view of the part that the Survey will be expected to play in the new national program as a recognized world leader in physical oceanographic work, the Explorer's transfer was developed into a full-fledged expedition. Principal objectives were to examine oceanographic phenomena in collaboration with a dozen or more scientific agencies of the United States.

The National Science Foundation lent its support to the undertaking. Lack of information concerning the oceans or the science dealing with the earth's water mantle has never been more keenly felt than it is today. Knowledge must be acquired for effective cooperation with the oceans

to reap their bountiful harvest--a harvest of increased food supplies, better weather forecasts, and the future possibility of influencing our weather for the better.

The Weather Bureau of the United States Department of Commerce participated in the expedition by assignment of a meteorologist for the entire cruise. Extensive probes were made of the atmosphere with high-altitude meteorological balloons which were inflated in a special inflation shelter installed on the stern of the ship. The Weather Bureau scientist sat for hours in the ship's plotting room, working up the data that his balloon had radioed back from elevations as high as 130,000 feet above the surface of the ocean. Ultimately it is hoped to control or modify the weather through a more thorough understanding of oceanic phenomena and the interplay between the atmosphere and the oceans. In these and other ways the United States can and should lead the way for the benefit of all mankind.

Many individual research projects were carried out during the 79 days the Explorer was at sea. With the growing demand for information about the oceans an exceptional opportunity was presented for an intensive oceanographic investigation at a fraction of the cost of equipping an expedition of this magnitude under any other conditions. The Commanding Officer of the Explorer, Captain E. L. Jones, USC&GS, entered into this unique assignment with great enthusiasm and contributed effectively from his many years of sea duty with the Bureau. Dr. Harris B. Stewart, Jr., Chief Oceanographer of the Survey, directed the scientific phases of the expedition. The complement of 13 Coast and Geodetic Survey officers, 10 Bureau scientists including oceanographers and geophysicists, 5 guest scientists, and 72 crewmen actually worked around the clock gathering pertinent facts on the physics, chemistry, and biology of the ocean waters, the geology of the ocean bottom, and meteorological information on the atmosphere along the route.

The United States Navy contributed to the expedition through the Naval Electronic Laboratory at San Diego. The Laboratory made its deepsea camera available for most of the cruise and supplied an expert who operated the camera during the voyage. This equipment was used effectively in obtaining a great number of underwater photographs. Of special interest were the photographs that were obtained of rich deposits of manganese, nickel, and cobalt that occurred as manganese nodules on the ocean bottom more than two miles beneath the Explorer's keel.

Special nets made available by the Bureau of Commercial Fisheries of the United States Department of the Interior were towed from San Diego to Panama to obtain samples of small creatures that live in the upper layers of the ocean. The floor of the Caribbean and the Straits of Florida were dredged for bottom-dwelling organisms of interest to the Bureau of Commercial Fisheries. Some of the hauls brought up fantastic creatures of the deep.

An important phase of the oceanographic cruise was our drift-bottle operation. Almost 5,000 bottles were released at the rate of 10 every two hours throughout the entire voyage. These specially made bottles carried a message in four languages impregnated in bright colors in the glass. New facts are being sought concerning the pattern of ocean currents by the cards that were indicated for return to the Bureau by the finders of the bottles. The bottles were numbered and an accurate record retained of the point from which each was released. As the record of each bottle is received in the Washington office it will be compared with the point of release and these facts correlated to reveal a pattern of circulation for expert analysis.

South of Swan Island, 97 miles northeast of Honduras in the Caribbean, evidence was found of a drowned coral atoll. Investigation revealed a previously unknown undersea plateau rising from a depth of 6,000 feet to a least depth under the ship of 90 feet. With the echosounding equipment, magnetometer, and bottom-sampling equipment working together, the uncharted bank was found to be made up of dead coral with a core of magnetic rock which is probably volcanic in origin. Studies of this type reveal important facts concerning the geology of that region, but of more immediate importance, they indicate the presence of the uncharted bank, an obvious danger to submarine navigation.

Another unique phase of the oceanographic cruise was the completion of a profile of the water temperature beneath the ship for the entire trip. This profile comprised a continuous record which was highlighted by a unique discovery off the Pacific coast of Costa Rica. This discovery was an area of upwelling of cold water from the ocean floor, reaching to within 30 feet of the surface, rich in nutrients important as a food supply for the smaller forms of marine life.

Oceanographic stations were occupied at selected positions off the coast of Oregon, in cooperation with the Scripps Institution of Oceanography and Oregon

State College. At each station water samples were obtained for chemical analysis. These observations will reveal data of importance in determining the oceanographic regime or make-up off the coast of the Pacific Northwest states. In addition, surface water samples were obtained from which it is hoped that suspended-sediment analysis will help oceanographers learn what happens to Columbia River water after it enters the Pacific Ocean. The oceanographic stations occupied off the coast of Oregon have extended northward the network of similar stations occupied in connection with the marine-life research program of Scripps from Lower California to the California-Oregon border.

The Coast and Geodetic Survey has a long and historic interest in the Gulf Stream. Benjamin Franklin first recognized the existence of the Gulf Stream, and it is interesting to note that his grandson, Professor Alexander Dallas Bache, the second Superintendent of the Bureau, authorized the first scientific investigation of this mighty river of the sea. He assigned his brother, Captain George Bache, the task of making the first scientific investigation of the Gulf Stream in 1846 with the Coast Survey brig Washington. This expedition ended in disaster when the ship was demasted in a violent hurricane and Captain George Bache and ten of his men were swept overboard and lost. The scientific data collected during the season's work by the Washington was not lost, however. The crippled ship finally made port in Philadelphia with all of her records intact. These records are carefully preserved to this day in the archives of the Survey.

Interest in this phenomenon of nature has continued by the Coast Survey throughout the years. During the latter phase of the Explorer's expedition, a preliminary investigation was undertaken of the Gulf Stream off the Florida coast near Miami, and further detailed studies will be scheduled for future operations.

Final benefits accruing from the Explorer's 1960 voyage will not be realized until the huge mass of data has been processed. The record of the expedition includes about 9,000 miles of trackline hydrography, 50 detailed oceanographic stations, 754 salinity samples, 750 oxygen samples, 53 bottom-sediment cores, 684 bathythermograph observations, and other data in addition to the Swan Island developments.

It is expected that the Explorer's recent accomplishments will be followed by more comprehensive and enlarged programs. The wealth of scientific data

obtained on this cruise, supplemented by a constantly increasing flow of new data, should provide important contributions to many scientific studies in oceanography and related fields. As the oceanographic program is stepped up to new levels, the Survey's experience and background gained over more than fifteen decades of sustained effort should be of inestimable value in supplying some of the answers to the great oceanic riddles. The results of these continuing efforts should be of lasting benefit to the United States and, in fact, to all mankind.

