OCEANOGRAPHIC WORK OF THE HYDROGRAPHIC OFFICE AND THE UNITED STATES NAVY DURING THE YEAR 1932.

by

W. R. GHERARDI, HYDROGRAPHER.

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The activities of the Hydrographic Office, United States Navy Department, and of the United States Navy during the past year in the fields of oceanography were briefly as follows.

Naval surveys. — Under the direction of the Hydrographic Office three surveying vessels conducted surveys of the high seas and foreign coasts for the further benefit of the United States Navy and the merchant marine.

The U.S.S. *Nokomis* completed the surveying of the coasts and coastal waters of the Island of Cuba, originally begun in 1899. In addition to the general chart of Cuba, 21 coastal charts and 56 harbor or plan-charts have been published as the results of these surveys. These charts with the resulting revised Sailing Directions provide the mariner with accurate information of Cuban waters and coasts.

Due to the reported grounding of several vessels in the visinity of Mucaras Reef, Bahama Islands, and the apparent necessity of having better information as to the extent of shoal-water in that area and the circulation of waters between it and Cuba, the Hydrographic Office, with the consent of the British Government, directed the U.S.S. *Nokomis* to make investigations and surveys in those regions.

The triangulation was expanded from Lobos Cay, Great Bahama Bank, and Cayo Confites, Cuba, both main triangulation-stations of the Cuban survey.

The results of the survey place the reef about one mile farther south and three-quarters of a mile farther west than previously charted. A deep-sea development of an area of 70 square miles southward of the reef failed to disclose any detached shoals.

In the Gulf of Panama, the U.S.S. *Fulton*, U.S.S. *Hannibal* and U.S.S. *Nokomis* continued the survey of those waters, which was begun by the U.S.S. *Niagara* in 1928.

Aerial photography was employed in connection with all the surveys for detailed delineation of shore-lines and other topographic features.

Charts from United States Naval surveys. — Nine new Hydrographic Office charts have been published during the year 1932 based upon original United States Naval surveys. They are: 1810, Maturin Bar and Approaches to Rio San Juan, Gulf of Paria, Venezuela; 1811, Rio San Juan, Gulf of Paria, Venezuela; 1882, Puerto Gibara, North Coast of Cuba; 1970, Puerto Padre, North Coast of Cuba; 2145, Island of Cuba; 2628, Punta Maternillos to Punta Lucrecia, North Coast of Cuba; 5165, Bahia Manati and Nuevos Grandes, North Coast of Cuba; 5166, Bahia Jururo, Bahia Bariay and Bahia Vita, North Coast of Cuba; and 5167, Bahia Naranjo and Bahia Sama, North Coast of Cuba.

Sonic soundings obtained by United States Naval vessels. — A tabulated list of sonic soundings taken by United States Naval vessels from January 1, 1931 to December 31, 1932, follows:

U.S.S. *Concord, Cincinnati,* and *Omaha.* — While cruising over "Guardian Bank" obtained (by U.S.S. *Concord*) a shoal of 15 fathoms by lead in 9°39' N. at 87°18' W., and 170 sonic soundings crossing 8°31' N. in 86°55' W. and 9°45' N. in 87°30' W.

U.S.S. *Omaha.* — 22 sonic soundings obtained while searching for a rock (reported 1907) in 24°41' N and 116°10' W.

U.S.S. *Ramapo.* — Enroute San Pedro, California, to Manila, Philippine Islands, recorded 700 sonic soundings crossing 33°26' N. in 121°44' W., 26°55'30" N. in 179°09'30" W., and 17°37' N. in 134°16' E.

U.S.S. *Ramapo.* — 575 sonic soundings on return trip Manila, Philippine Islands, to San Pedro, California, crossing 21°07' N. in 124°30'30" E.; 30°00'00" N. in 174°02'30" E. and 38°16'00" N. in 136°11'00" W.

U.S.S. *Fulton.* — 1,500 sonic soundings obtained enroute Watling Island (San Salvador) crossing 24° N. in 74°30' W. to Cape Maysi Light (20°15' N., 74°45' W.).

U.S.S. *Chewink* and U.S. Sub. *S*-48. — On gravity-expedition in the West Indies and Caribbean Sea obtained 2,600 sonic and supersonic soundings crossing 19°50'N. in 75°10' W., 17°30' N. in 77°20' W., 19°15' N. in 81°00' W., 22°00' N. in 77°00' W., 25°00' N. in 77°40' W., and 26°40' N. in 79°30' W.

U.S.S. *Chaumont.* — 12 fathometer-soundings taken over unsurveyed area in San Bernardino Straits, Philippine Islands, in 12°48' N. and 124°31'45" E.

U.S.S. *Augusta, Chicago, Northampton, Pensacola, Chester,* and *Salt Lake City.* — While cruising over Guardian Bank obtained 320 sonic soundings in approximately 9° N. and 87° W.

U.S.S. *Hannibal.* — 231 sonic soundings taken enroute from Port of Spain, Trinidad, British West Indies, to Cristobal, Canal Zone, via Willemstad, Curaçao, crossing 10°47'30" N. in 61°54'15" W., 12°16'15" N. in 69°37'45" W. and 9°28'30" N. in 79°50'30" W.

U.S.S. *Ramapo.* — 207 sonic soundings obtained enroute San Pedro, California, to Manila, Philippine Islands, crossing 27°59'00" N. in 178°20'00" W., 20°54'00" N. in 159°46'00" E. and 15°18'00" N. in 145°40'00" E.

U.S.S. *Fulton.* — 55 supersonic soundings obtained enroute to the Gulf of Nicoya and passing over the area of obstructions reported south-west of Morro Puercos (Gulf of Panama) in approximately 7°12'26" N. and 80°17'04" W.

U.S.S. *Chaumont.* — 9 fathometer-soundings taken in San Bernardino Straits in 12°50'00" N. and 124°36'00" E.

U.S.S. *Marblehead.* — Reports a line of 58 supersonic soundings from Jicarita Light in 7°12'00" N. and 81°48'00" W.

U.S.S. *Marblehead.* — 70 sonic soundings taken south of the volcano lying near Punta Telmo (near Manzanillo) in 18°19'00" N. and 103°30'00" W. and off Punta de Campos Light in 19°01'15" N. and 104°21'00" W.

U.S.S. *Ramapo.* — Enroute Manila, Philippine Islands, to San Pedro, California, obtained 400 sonic soundings crossing 25°08'00" N. in 129°13'00" E., 38°36'00" N. in 159°56'00" E., 43°10'00" N. in 161°02'00" W., and 36°22'00" N. in 126°32'00" W.

U.S.S. *Fulton.* — While executing a new survey over the "Guardian Bank" obtained approximately 17,000 sonic soundings in 9°30' N. and 86°27' W.

U.S.S. *Sirius.* — 135 fathometer-soundings taken while in the "Alaska Expedition 1932", near Unimak Pass and northward including the Pribilof Islands in 56° N. and 170° W.

U.S.S. *Neches.* — 21 fathometer-soundings in vicinity of Uncle Sam Bank (25° N. and 113° W.), Lower California.

U.S.S. *Ramapo.* — 235 sonic soundings obtained enroute San Pedro, California, to Chefoo, China, crossing 30°29'30" N. in 177°48'45" E., 30°38'00" N. in 155°27'30" E. and 31°03'00" N. in 139°02'30" E.

U.S.S. *Ramapo.* — 324 sonic soundings obtained enroute Tsingtao, China, to San Pedro, California, crossing 32°53'04" N. in 140°16'30" E., 40°07'00" N. in 164°47'15" E., 41°00'00" N. in 178°58'00" W., and 41°01'00" N. in 143°54'30" W.

U.S.S. *Patoka.* — While enroute San Diego, California, to Gulf of Fonseca, Nicaragua, obtained 4 sonic soundings off Amapala Point, El Salvador, in 13°29' N. and 90°27' W.

U.S.S. *Hannibal.* — A line of 150 sonic soundings taken enroute to Cape Maysi, Cuba, crossing 31°30'00" N. in 76°25'00" W., 25°35'45" N. in 75°09'00" W., and 21°31'30" N. in 75°06'00" W.

U.S.S. *Nokomis.* — 200 sonic soundings taken off San Salvador (Watling Island) in 24°05' N. and 74°20'30" W.

U.S.S. *Hannibal.* — 45 sonic soundings obtained enroute Guantanamo Bay, Cuba, to Coco Solo, Canal Zone, crossing 17°44' N. in 75°58' W., 16°11'45" N. in 76°37'30" W. and 12°03'00" N. in 79°03'00" W.

U.S.S. *Nokomis.* — 450 sonic soundings taken enroute San Salvador to Port Sama, Cuba, crossing 24°03'45" N. in 74°21'00" W., 15°56'30" N. in 76°26'55" W., and 10°18'00" N. in 79°21'25" W.

Unsounded areas of the North Pacific Ocean. — While numerous soundings have already been taken in the North Pacific Ocean, many more are required for the delineation of the configuration of that Ocean with certainty.

The U.S.S. *Ramapo* from October 1929 to January 1932 made 25 passages across the North Pacific Ocean, 16 of which were made in 1932, taking in all 15,114 sonic soundings.

Mention may be made of the fact that correction-factors for some 900 of the sonic soundings obtained by the *Ramapo* have been received from the Carnegie Institution of

Washington, based upon the results obtained by the *Carnegie* of the specific gravity of those waters in which she took dynamical oceanographic soundings and in which the *Ramapo* also took sonic soundings.

As an illustration of the necessity of obtaining correction-factors to be applied to sonic soundings to obtain true depths, one of the uncorrected soundings of the *Ramapo* indicated a depth of 8,303 meters while the corrections gave a precise depth of 8,710 meters, a difference of 407 meters.

Bathymetrical chart of the North Pacific Ocean. — The results of soundings taken by vessels of the United States Government and those received from various other authentic sources and recorded by the Hydrographic Office on its charts have been embodied in a bathymetrical chart of the North Pacific Ocean, a copy of which is being prepared for publication in the usual manner, that is, by variation in blue color for each 500-fathom gradient.

Current-charts. — On the reverse sides of the Pilot Charts of the North Pacific Ocean for March, June and September 1932, and January 1933, respectively, current-charts covering the greater portion of the North Pacific Ocean for the four seasonal quarters were presented. These current-presentations, previously published in two sections for each quarter, as now simplified enable the mariner to have more readily at his disposal data regarding averaged current-expectancies. The traverse resultant-drifts in the one-degree quadrangles are being worked up and it is expected that they will appear shortly. These drifts will assist the mariner in making more expeditious voyages.

Oceanic temperatures. — The summarization of the observations by mariners of the temperatures of the surface-waters of the North Pacific Ocean observed during the years 1904-24, inclusive, has been completed and will be published shortly in the form of monthly charts showing the number of observations and the average temperature for each month in each one-degree quadrangle.

Mechanical extraction of oceanographic data. — The mechanical extraction of data relating to currents, temperatures, sea and swell, and concomitant phenomena was begun during the year 1932, in order that all such information relating to any given oceanic area might be quickly assembled and provide a ready means for analyzing the same. The data for January, February and March 1932 have been mechanically extracted. About 20,000 observations are being received monthly covering almost all oceanic portions of the globe.

Dynamic oceanographic surveys. — The necessity for obtaining precise values of specific gravity of the waters in which sonic soundings have been or may be taken by United States Naval and other vessels to reduce them to their true depths, and the lack of precision in the values of observations being taken relating to the temperatures of the waters observed with the consequent less of precision and assuredness in the resulting collations and depictions, influenced the Hydrographer to direct that the U.S.S. *Hannibal* be equipped for making dynamic oceanographic surveys of the waters in which she operates while surveying and while proceeding to and from her fields of operation. She was furnished with 2,000 fathoms of special sounding-wire, NANSEN and GREENE-BIGELOW water-bottles, protected and unprotected deep-sea thermometers, bottom-samplers, titration-appliances for titrating sea-water, and other necessary gear. On her passage from Philadelphia to the Canal Zone she occupied seven dynamic stations. In addition to these she has occupied nine dynamic stations to the southward of Cape Mala and Morro Puercos, and 86 in the Gulf and Bay of Panama. She is expected to also occupy other stations from Judas Point, Costa Rica, to Morro Puercos, Panama.

The data already in hand have not yet been analyzed, but they will provide a much-needed addition to our existing knowledge of the surface and sub-surface waters, and will aid in the establishment of the depths to which the thermocline reaches.

The leading oceanographical institutions of the country, including the SCRIPPS INSTITUTION OF OCEANOGRAPHY, the WOODS HOLE OCEANOGRAPHIC INSTITUTION and the CARNEGIE INSTITUTION of Washington, greatly aided the Hydrographic Office in making possible the inauguration of these dynamic oceanographic surveys by their advice relating to methods, their loan of equipment, and their encouragement.

R. H. FLEMING of the SCRIPPS INSTITUTION OF OCEANOGRAPHY was granted permission of the Navy Department to accompany the U.S.S. *Hannibal* while operating in the Gulf of Panama and along the Costa Rican and Panaman coasts, and to make observations relating to the chemical properties of the waters in those regions.

International Scientific Expedition to the West Indies. — The Hydrographic Office has always favored scientific projects in support of the advancement of geophysics and oceano-

graphy and gave most enthusiastic support to the 1932 INTERNATIONAL EXPEDITION TO THE WEST INDIES for measuring gravity at sea.

In this Expedition the Navy cooperated with PRINCETON UNIVERSITY. The results of this work and that of the 1928 expedition, in which the Navy cooperated with the CARNEGIE INSTITUTION of Washington, have added 103 new gravity sea-stations in this disturbed area. A chart has been printed by the Hydrographic Office showing all of the final values of these latest gravity anomalies.

F. A. Vening MEINESZ was in direct charge of all observations of both expeditions bringing with him his unique multiple-pendulum apparatus which when mounted on a submerged submarine is the only means which has been found adaptable for procuring precise oceanic-station values.

Navigators' Sailing Directions or Pilots. — During the year 1932 the Hydrographic Office placed on issue five revised volumes of Sailing Directions and published recapitulatory supplements to the other volumes of the series.

Navigational manuals. — In the exercise of its functions for the means of navigating with safety the vessels of the United States Navy and the American Merchant Marine, the Hydrographic Office has kept pace with the progress and development of the science of nautical astronomy by supplying the very latest methods in navigational tables and manuals for rapid position-finding at sea.

Magnetic charts. — From every available source, but principally from data supplied from the CARNEGIE INSTITUTION of Washington, this Office has been enabled to analyze material to produce its world magnetic charts of variation, dip, and horizontal intensity.

The destruction of the non-magnetic ship *Carnegie*, upon which the maritime world depended for securing values of the Earth's magnetic elements for correcting the latest magnetic charts, will necessitate, as time progresses, some degree of international co-operation and support in establishing another similar vessel with scientific personnel to continue to furnish this indispensable material for the common interest of transportation and navigation of the sea.