# Ocean Contains Three Kinds of Water

*Geophysics*

## Shotgun and Watch Serve as Sounding Device

THERE are three different kinds of water in the ocean, scientists of the Carnegie Institution of Washington, one of whom belonged to the staff of the ill-fated non-magnetic ship, Carnegie, reported to the American Geophysical Union.

Results of some of the deep sea determinations of the Carnegie, which was destroyed with the loss of Captain Ault and the cabin boy in Western Samoa last November, were commented on by H. W. Graham, biologist and chemist, in a paper presented by Dr. J. A. Fleming, as follows:

"These samples show that the waters may be divided into three general layers. An upper layer where an active plant and animal life is maintained, a middle layer in which a decomposition of organic remains is taking place, and a lower layer which represents water which has been conducted from polar regions. The upper layer shows high values of dissolved oxygen but low values of phosphates, silicates and hydrogen in concentration. The middle layer is low in oxygen but is high in phosphates and silicates and is relatively less alkaline. The lower layer tends toward conditions at the surface with again higher values of dissolved oxygen and lower of phosphates, silicates and hydrogen ion concentration."

How a shotgun and stop-watch were used to determine the distance to the bottom of the ocean when the sonic depth finding apparatus broke was told by Floyd M. Soule of the ship's staff of scientists, and C. C. Ennis. The depth finding apparatus, which was borrowed from the U. S. Navy, is an electrical device for accurately measuring the time it takes a sound to travel to the bottom of the ocean and return. Knowing the speed of sound in water, the scientists could then quickly calculate the depth of the ocean.

"A steel breech just long enough to hold a 16-gauge shotgun shell was screwed into one end of a length of brass pipe," the paper said. "The pipe acted as a holder and also as a guide for a heavy steel firing pin which was dropped into the upper end of the pipe, the shell end being held a foot or two below the surface. The hydrophones were used to pick up the echo and a stop-watch used to measure the elapsed time. Soundings were taken in this manner twice a day. These were only roughly approximate because of the inaccuracy of the stop-watch measurement and because of the uncertainty of the velocity of a sound set up by an explosion. However, it was a case of half a loaf being better than none, and the device materially assisted in the routine occupation of oceanographic stations."

Sound sent to the ocean's floor behaved strangely and in ways unaccountable by the scientists. Sometimes the reflection would be loud from depths and weak from shallows. Again loud echoes and faint echoes would come from places where all known conditions were similar and even where bottom samples were much alike. The echoes from five-mile soundings were stronger than those often heard from less than one mile.

In water sound travels nearly a mile every second, more than four times as fast as it does in air. On several occasions signals were picked up after traveling 25 miles back and forth between the bottom of the ocean and the surface, and once they had gone nearly 50 miles, having been reflected 15 times when last heard.

NON-MAGNETIC ships such as the Carnegie may no longer be needed to continue studies of the earth's magnetism.

Knowledge of terrestrial magnetism has been so increased by world cruises of the Carnegie and her predecessor, the Galilee, and navigators have learned so much about compensating for the magnetic effect of ordinary steel ships that the work can probably be continued on a vessel not especially constructed to eliminate magnetic effect. This is the thought of a paper presented by W. J. Peters, of the Carnegie Institution of Washington. Trials to substantiate this conclusion were suggested.

Knowledge of the secular variations of the compass is needed now to keep the magnetic charts up to date, it was pointed out. These are age-long changes in the earth's magnetism which are felt in practically all parts of the world. For example, in London the variation changed steadily from 11 degrees east in 1580 to zero degrees in 1659. In 1823 it was 24 degrees west and has now declined to about 14 degrees west.

If non-magnetic ships can be used, scientists will be able to follow these variations closely by taking occasional observations from ships of other expeditions without having to outfit vessels especially for magnetic cruises.

*Science News-Letter, May 10, 1930*

*The Answer Is*

### *In This Issue*

How does the *surface* water of the ocean differ from that below? p. 290—How fast is one *nebula* thought to be travelling *away* from us? p. 291—How can a *telephone* detect sunken *"duds"?* p. 291—How did an Assyrian king *anticipate* modern *agricultural* stations? p. 292—Is *St. Vitus* dance hereditary? p. 294—What has been the *increase* in *divorce* rate in 50 years? p. 294—What new *instrument* detects *heart* trouble? p. 296—What causes *carsickness?* p. 297—What types of sugar are poisonous? p. 300—What would it *cost* to *keep cool* on the sun? p. 300—For what are *flies* useful? p. 301.

SCIENCE NEWS-LETTER, The Weekly Summary of Current Science. Published by Science Service, Inc., the Institution for the Popularization of Science organized under the auspices of the National Academy of Sciences, the National Research Council and the American Association for the Advancement of Science.

Edited by Watson Davis.

Publication Office, 1918 Harford Ave., Baltimore, Md. Editorial and Executive Office, 21st and B Sts., N. W., Washington, D. C. Address all communications to Washington, D. C. Cable address: Scienserve, Washington.

Entered as second class matter October 1, 1926, at the postoffice at Baltimore, Md., under the act of March 3, 1879. Established in mimeographed form March 13, 1922. Title registered as trade-mark, U. S. Patent Office.

Subscription rate—$5.00 a year postpaid. 15 cents a copy. Ten or more copies to same address, 5 cents a copy. Special reduced subscription rates are available to members of the American Association for the Advancement of Science.

In requesting change of address, please give old as well as new address.

Advertising rates furnished on application.