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Geophysical Observations on Christmas Island

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During October and November of 1961, the Marine Physical Laboratory of the Scripps Institution of Oceanography, in cooperation with the British Atomic Weapons Research Establishment, sponsored a series of geophysical measurements on Christmas Island. Continuous recordings of the earth's magnetic field were made simultaneously at various points on the island under the direction of Ronald G. Mason [2/] and John Northrop of the Marine Physical Laboratory of the University of California, San Diego. In addition to these recordings, daily trips by land rover and small boat to various points on the island and in the lagoon were made for the purpose of completing gravity and magnetic measurements with portable equipment. These measurements show a sharp positive gravity anomaly near Motu Tabu, towards the north end of the island, indicating a shallow depth to basement in that area.

[1/] This work was partially supported by Contract Nonr 2216 (05) with the Office of Naval Research.

[2/] Also of Imperial College, London, England

At 1° 52.7' N/157° 23.9' W, an unusually hot lagoon 1/4 mile long was found to have a bottom temperature of 102° F and a surface temperature of 86° F. The surface layer, about 1/2 inch thick, has a specific gravity of 1.0 and the bottom water 1.4. Since this narrow lagoon is only about 3 feet deep, a marked inverse temperature gradient is present. At the suggestion of Walter Munk of Scripps Institution of Oceanography, the level of the lagoon surface was measured and found to be about one and one-half feet below sea level, and about 4 ft lower than the level of the lagoon to the S. W. about 100 yards away. There was clearly seepage of fresh water into our lagoon at the end--Philip Helfrich noticed an "oiliness" where the water was coming in. It is very likely therefore, that the effect exists only because of constant renewal by the incoming cold fresh water. We think that the effect probably dies out as one goes away from the end of the lagoon where we made our measurements. Thus, anomalous temperature structure is thought to be due to a very thin fresh water "blanket" that is renewed from seeps along the walls of the lagoon and prevents heat in the bottom layer from reradiating. To produce such a marked temperature change, this process must have been in operation for a good many years. Samples of this water have been sent to Philip Helfrich of the University of Hawaii for further analysis.