ECHO SOUNDINGS IN THE SOUTHERN OCEAN

by

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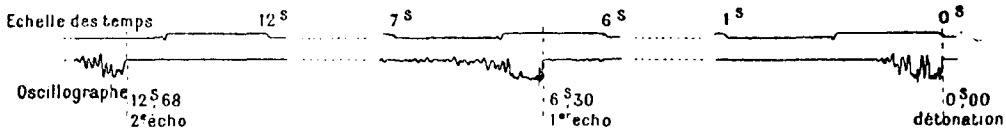
The sloop "Bougainville", commanded by Commander Fabre de la Ripelle, has just completed a cruise of 8,000 miles to the southward of Madagascar, in the Indian and Southern Oceans, between the meridians of Durban and the Islands of St. Paul and Amsterdam. Leaving Diego-Suarez on the 11th January 1939, the "Bougainville" called first at Durban, anchored at Marion and Crozet Islands, then steamed along the east and south coasts of the Kerguelen Islands, remained from the 7th to the 19th February on the east coast of this archipelago, and then anchored at Amsterdam and at St Paul, after which a return was made to Diego-Suarez on the 12th March 1939, with a stop at the Reunion and Mauritius Islands.

The "Bougainville" carried out regularly a series of echo soundings, at great depths, in the high seas and off the steep insular shelves, and other soundings with the ultra-sonic sounding apparatus, in shallow depths, on the insular shelves themselves.

1°) In the great depths, 219 soundings were obtained (one sounding, on an average, every 30 miles at sea). The procedure consisted in recording the detonation of a petard containing 135 grammes of melinite, and noting the time of the return of the echo from the bottom with the aid of a simple apparatus mounted on board the sloop before its departure from Madagascar. This comprised a microphone, an amplifier, oscillographs and a Boulite recording apparatus. Double echos were frequently obtained when the sea was not very rough, at depths greater than 4,000 metres. Figure 1 reproduces, to 1/2 size, the useful part of a sounding record of 4,785 metres, in which the second very distinct echo corresponds to a travel of the sound wave in the water of more than 19 kilometres.

Fig 1

Sondage de 4785 m entre St Paul et La Réunion, par 30°21' Sud - 62°29' Est.



Nota. - *Vitesse du son adoptée 1500 m d'après les tables de l'Amirauté britannique (Table I-14) La différence des temps d'écho 6,30 et 6,38 secondes est due au retard de l'éclatement du pétard qui se produisait à 1500 m. x 0,08 = 120 m à l'arrière du "Bougainville" en route*

Fig. 1. — Sounding of 4785 m. between St. Paul and the Reunion Islands, at 30°21' S. and 62°29' E.

NOTE: Velocity of sound adopted was 1500 metres in accordance with the British Admiralty Tables (1-14). The difference in the time of the echo 6.30 sec. and 6.38 seconds is due to the delay in the explosion of the petard which occurred at 1500 m. × 0.08 = 120 m. astern of the "Bougainville" underway.

The results of the bathymetric soundings of the "Bougainville" confirm and complement in detail those which had been obtained previously in this region and which are shown in the third edition of Sheet A'IV of the General Bathymetric Chart of the Oceans brought out by the International Hydrographic Bureau, Monte-Carlo. The delineation of the isobaths appears remarkably exact in the region covered. It will suffice to report here this particularly close agreement and some secondary modifications which should be noted (See Figure 2).

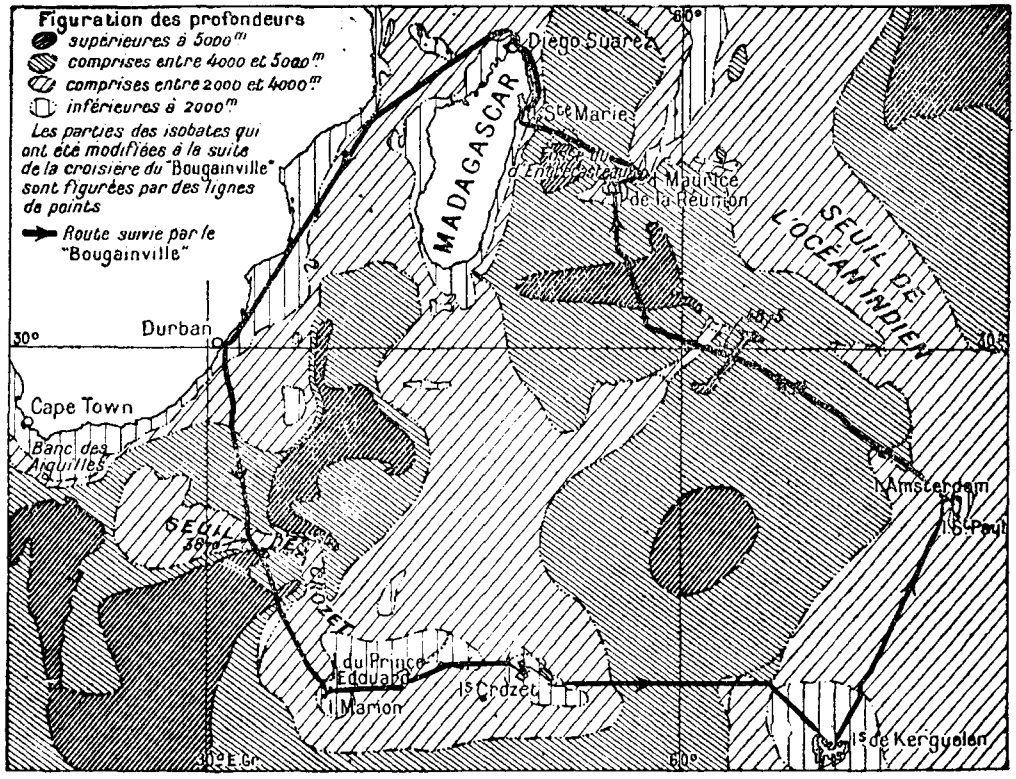


Fig. 2.

The "Bougainville" located, in its narrowest part, the ridge of the Crozet Archipelago, which extends from the Aiguilles Bank to the eastward of this archipelago, with a sounding of 3,870 metres obtained between two soundings of 4,160 and 5,465 metres respectively.

The depths of less than 2,000 metres extend to the westward of Marion Island somewhat further than is shown on the charts. On the parallel which was followed, an isobath of 2,000 metres was found, lying 400 miles from this island and at a distance of 110 miles only from the Crozet.

In the region between the Islands St Paul and Amsterdam, was found a narrow connecting ridge, the lowest point of which showed a depth of about 1,500 metres, which constitutes a particularly valuable aid to navigation in these waters where so much fog prevails.

Between two groups of soundings of more than 5,000 metres on the General Bathymetric Chart of the Oceans, comprising the sounding of 5,603 m. at 32° 00 S. and 60° 52' E., and the sounding of 5.250 m. at 29° 35' S. and 64° 20' E., the "Bougainville" obtained a sounding of 5,090 metres, which would tend to prove that there exists in this region a narrow deep of more than 5,000 metres depth.

To the northwest of the sounding of 5,090 metres, the "Bougainville" found a sounding of 3,710 metres. The ridge of less than 4,000 metres which is attached to the eastward, onto the Madagascar ridge and the Crozet ridge, should therefore be prolonged, in this region, to a group of soundings of less than 4,000 metres, one of which (3,556 metres) is located at 28°40' S. and 62°30' E.

From Mauritius Island to Sainte Marie, the "Bougainville" passed the edge of the deep of 5,000 metres, which was discovered by the cruiser "D'Entrecasteaux" in 1906, between the Mascareignes and Madagascar. No depth greater than 4,870 metres having been found, the deep extends a little less to the north than shown on the chart as drawn up from the soundings obtained by this cruiser. (1) Further, as a result of the conditions encountered, it is not impossible that the depths indicated by the "D'Entrecasteaux" might be slightly greater than the actual depths.

2°) On the insular shelves, the "Bougainville" made use of the ultra-sonic sounding apparatus of Langevin-Florisson, together with the Marti recording device.

The Crozet Islands rest on an insular submarine shelf which is generally rather flat in its north-western portion, and which extends, at an almost constant depth of 200 metres, to a distance of nearly 40 miles off the coast. But the soundings with the ultra-sonic apparatus have shown along the edge of this plateau, a series of submarine rock pinnacles rising abruptly from the bottom to 50 and 100 metres, analogous to the Islands of the Apostles which emerge to the southward. In accordance with the present state of research, the most elevated peak is covered by only 91 metres of water.

The insular shelf of the Kerguelen Islands is much more extended. In the north-west, it slopes gently towards the isobath of 500 metres which passes the archipelago at 120 miles distance, after which commences the change in the slope. In the north-east, it runs in a very gentle slope to the isobath of 200 metres which lies 80 miles off the coast and which marks the steep edge of the insular shelf.

At the approaches of Nosy Ahao Island (north-east coast of Madagascar) the continental plateau extends 12 miles from the coast. A sounding of 57 metres was found at 12° 43' S. — 49° 57' E.

(1) Annales Hydrographiques, 1907, page 19.