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EXPLORER BANK—A NEW DISCOVERY IN THE CARIBBEAN

Abstract: Scientists on the Coast and Geodetic Survey Ship EXPLORER discovered and investigated an "atoll-like" bank rising from nearly 1000 fms to 15 fms about 95 miles off the Caribbean coast of Honduras. A towed magnetometer showed that the primarily calcareous bank has a core of igneous origin.

During the 1960 oceanographic expedition of the Coast and Geodetic Survey Ship EXPLORER a previously uncharted bank, structurally comparable to the Pacific atolls, was discovered in the Caribbean Sea, and a reconnaissance survey was made. The feature lies 95 nautical miles off the coast of Honduras centered at 16° 55′ N, 83° 15′ W, and rises abruptly from general depths of nearly 1000 fathoms to a least depth of 15 fathoms (Fig. 1). It measures 5½ by 12 nautical miles within the 20-fathom contour and is essentially flat-topped except for a slight rim found on the two crossings of the eastern edge. A towed magnetometer belonging to the Scripps Institution of Oceanography revealed a core of igneous rock and indicated that the bulk of the feature is nonmagnetic. A cored rock sample from the crest was coralline and algal limestone. The bank is significant because there are few "atoll-like" structures in the Atlantic and because a magnetic survey could be made of this drowned feature.

The feature, tentatively called Explorer Bank, is an apparently isolated feature rising more than a mile above the sea floor 45 nautical miles southeast of the nearest land, the Swan

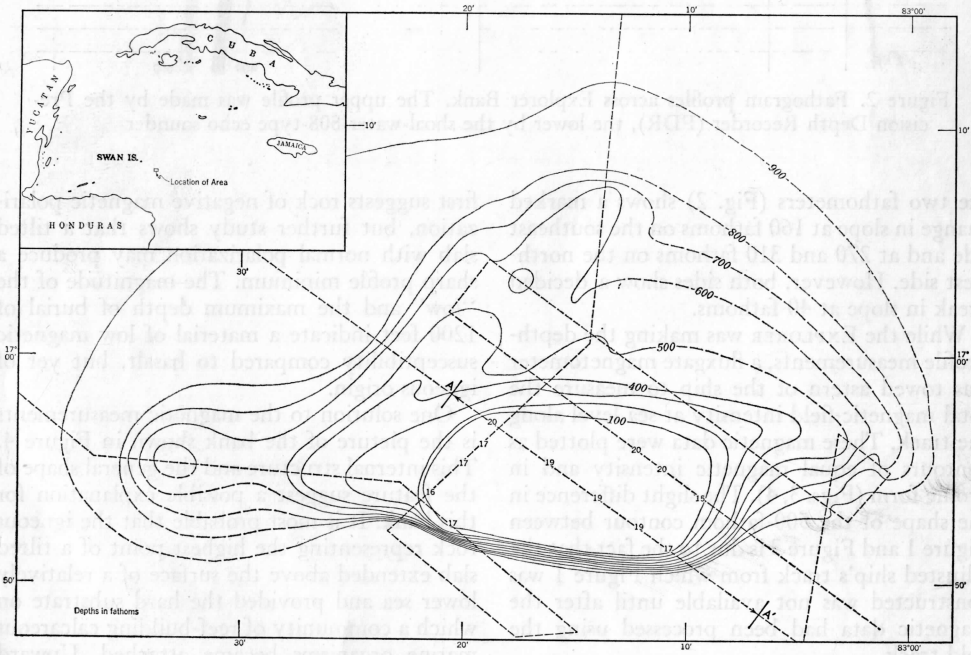

Figure 1. Reconnaissance bathymetric chart of Explorer Bank. A–A′ is the profile shown in Figure 2

Geological Society of America Bulletin, v. 72, p. 1271–1274, 4 figs., August 1961

Islands. The top of the feature is essentially rectangular, 5½ by 12 nautical miles, with the long axis oriented east-west (Fig. 1). The southern side has a measured lower slope of 31° which becomes 27° nearer the crest. To the north the slopes are gentle. The crest of the feature is nearly flat at depths of 19 to 20 fathoms. The two crossings of the eastern edge showed a narrow rim rising 2 to 5 fathoms above the general level of the flat top. The northwest-southeast profile across the bank as recorded on was the one sample recovered from the flat top. The sharp minimum in the magnetic profile locates a core of material of igneous origin and of shallow depth. This part of the magnetic profile is drawn as though smooth but actually is composed of small peaks and troughs. A study of these small features on the original record indicates that the highest part of the magnetic rock is less than 1200 feet deep, but probably deeper than 500 feet. The fact that the sharp feature of the magnetic profile is a "low" at

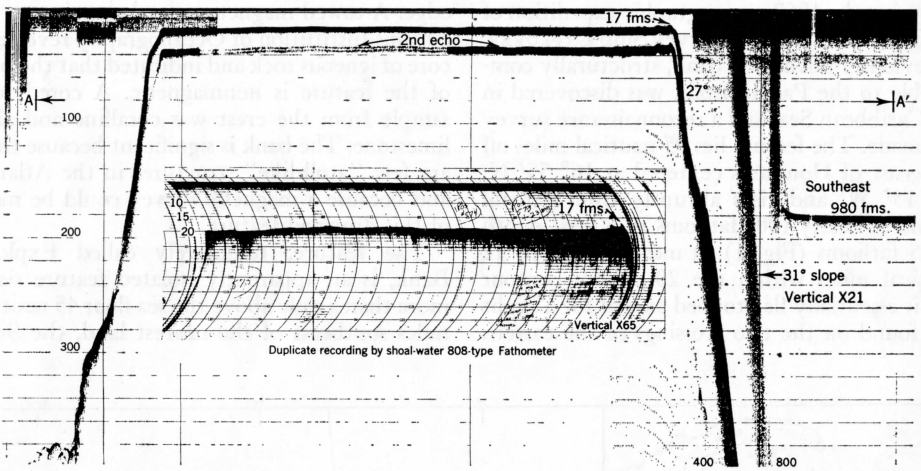

Figure 2. Fathogram profiles across Explorer Bank. The upper profile was made by the Precision Depth Recorder (PDR), the lower by the shoal-water 808-type echo sounder

the two fathometers (Fig. 2) shows a marked change in slope at 160 fathoms on the southeast side and at 270 and 310 fathoms on the northwest side. However, both sides show a decided break in slope at 40 fathoms.

While the EXPLORER was making the depth-profile measurements, a fluxgate magnetometer was towed astern of the ship to measure the total magnetic-field intensity at sea level along the track. These magnetic data were plotted as contours of equal magnetic intensity and in profile form (Figs. 3, 4). The slight difference in the shape of the 500-fathom contour between Figure 1 and Figure 3 is due to the fact that the adjusted ship's track from which Figure 1 was constructed was not available until after the magnetic data had been processed using the field track.

The magnetic-intensity contours and the profile indicate that the bulk of the feature is of nonmagnetic material, most likely limestone, as first suggests rock of negative magnetic polarization, but further study shows that a tilted slab with normal polarization may produce a sharp profile minimum. The magnitude of the "low" and the maximum depth of burial of 1200 feet indicate a material of low magnetic susceptibility compared to basalt, but yet of igneous origin.

One solution to the magnetic measurements is the picture of the bank shown in Figure 4. This internal structure and the general shape of the feature suggest a possible explanation for this bank. It is most probable that the igneous rock representing the highest point of a tilted slab extended above the surface of a relatively lower sea and provided the hard substrate on which a community of reef-building calcareous marine organisms became attached. Upward growth of the calcareous material continued and kept pace with a relative rise in sea level until the igneous material was covered. Relative se

level must have continued to rise with a concomitant upward growth of the calcareous material at least to its present extent of more than a mile high.

Possibly the flat top results from marine planation of the calcareous material that previously existed above sea level. However, the writers feel that it is more probable that this flat top represents the original surface of the living reef. In this case, the definite break in

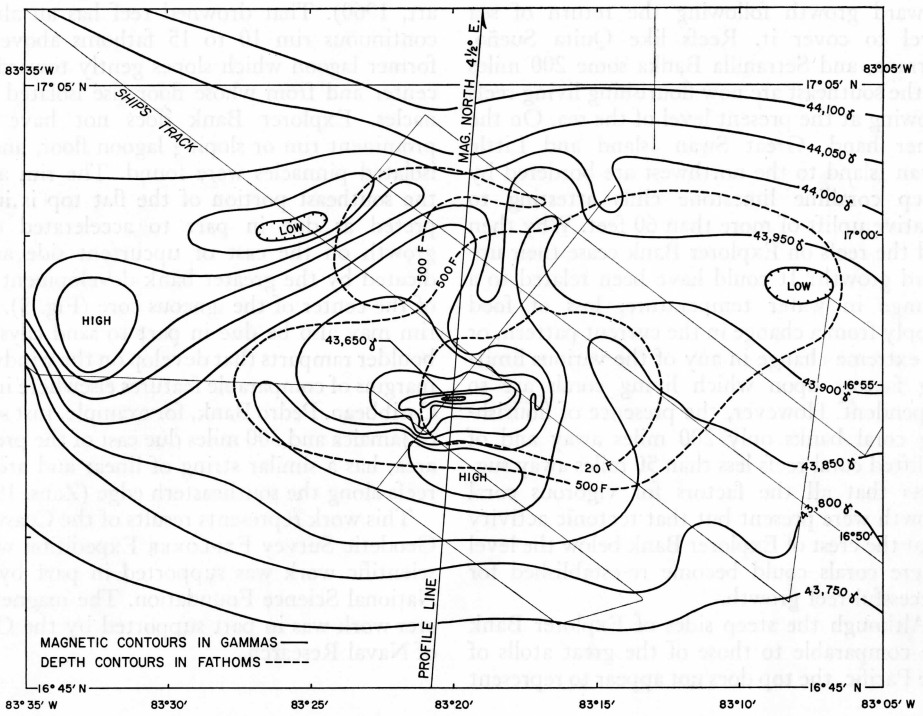

Figure 3. Magnetic field contour map of Explorer Bank

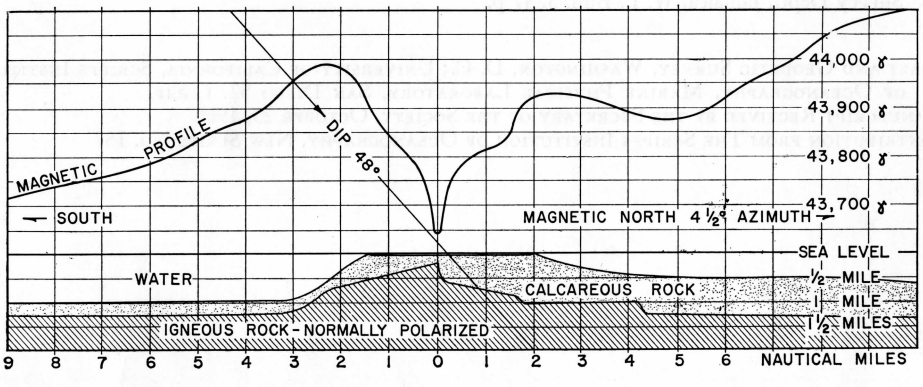

Figure 4. Profile of Explorer Bank with undistorted vertical scale

slope at 40 fathoms may be an indication of the effect of Pleistocene lowering of sea level which merely indented the sides rather than planing off the entire top of the reef. If the top of the reef was exposed above sea level, then surely it was killed by this exposure. The question then arises as to why this reef did not resume its upward growth following the return of sea level to cover it. Reefs like Quita Sueño, Serrana, and Serranilla Banka some 200 miles to the southeast are now flourishing living reefs growing at the present level of the sea. On the other hand, Great Swan Island and Little Swan Island to the northwest are bordered by steep coralline limestone cliffs attesting to relative uplift of more than 60 feet. Why then did the reefs on Explorer Bank cease their upward growth? It could have been related to a change in water temperature, loss of food supply from a change in the current pattern, or an extreme change in any of the various limiting factors upon which living corals are so dependent. However, the presence of flourishing coral banks only 200 miles away and of uplifted coral reefs less than 50 miles away suggests that all the factors for vigorous coral growth were present but that tectonic activity kept the crest of Explorer Bank below the level where corals could become re-established for successful reef growth.

Although the steep sides of Explorer Bank are comparable to those of the great atolls of the Pacific, the top does not appear to represent a true atoll. The narrow rim on the east side rises only 2 to 5 fathoms above a nearly flat top and was not found at the six other places where the edge of the reef was crossed. Alexa Bank north of the Fiji Islands in the Pacific is a true drowned atoll in which the original reef top is preserved at 20 fathoms (Fairbridge and Stewart, 1960). That drowned reef has an almost continuous rim 10 to 15 fathoms above the former lagoon which slopes gently toward the center and from whose floor rise isolated pinnacles. Explorer Bank does not have this prominent rim or sloping lagoon floor, and no isolated pinnacles were found. The rim along the southeast portion of the flat top is interpreted as due in part to accelerated coral growth on the east or upcurrent side as indicated by the greater bank development east of the center of the igneous core (Fig. 3). The rim may also be due in part to sand cays and boulder ramparts that develop on the windward margins of comparable features elsewhere in the Caribbean. Pedro Bank, for example, just south of Jamaica and 300 miles due east of the present area, has a similar string of linear and arcuate reefs along the southeastern edge (Zans, 1958).

This work represents results of the Coast and Geodetic Survey Explorer Expedition whose scientific work was supported in part by the National Science Foundation. The magnetometer work was in part supported by the Office of Naval Research.

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Manuscript Received by the Secretary of the Society, October 25, 1960
Contribution from The Scripps Institution of Oceanography, New Series No. 187