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Résumé de l'article

A diapiric structure was discovered on the Scotian Shelf at a point 45 km north-northeast of Sable Island, by means of continuous seismic-reflection techniques. The structure is dome-shaped, may contain an evaporitic core, and intrudes rocks considered to be of Cretaceous age. The area of structural disturbance is at least 10 km in diameter.

Reports

A Diapiric Structure Near Sable Island - Scotian Shelf*

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Abstract

A diapiric structure was discovered on the Scotian Shelf at a point 45 km north-northeast of Sable Island, by means of continuous seismic-reflection techniques. The structure is dome-shaped, may contain an evaporitic core, and intrudes rocks considered to be of Cretaceous age. The area of structural disturbance is at least 10 km in diameter.

Description of Structure

During AOL Cruise 69-016 on the CSS KAPUSKASING we obtained continuous seismic-reflection profiles across a structure near Sable Island which we interpreted as a diapir. The structure occurs at 44°23'N, 59°41.5'W, approximately 45 km (28 miles) north-northeast of the central part of Sable Island (Fig. 1). The location of seismic profiles in the area, the limits of the core of the intrusive body, and the limits of the structural disturbance are also indicated in Figure 1. The structure is dome-shaped and is approximately 10 km (6.2 miles) in diameter.

Photographs of seismic records across the structure are shown in Figures 2 and 3. Figure 2 is part of the profile running approximately north-south and Figure 3 represents the short profile running east-west across the structure. The records were obtained with a 10 cubic-inch marine profiler (Bolt Associates), which was fired at one-second intervals at a chamber pressure of 1500 psi.

In Figure 2 the intrusive body is shown between 5 and 7.5 km along the profile. The diapiric core is surrounded for the most part by a moat-like feature that is cut into the bedrock and filled with Pleistocene and Recent (possibly some Tertiary) sediment. These younger unconsolidated sediments are slightly folded in the area overlying the centre of the diapir and this suggests relatively recent movement of the intrusive body. The outer limits of the structure are defined by the upturned layers of bedrock that we believe to be of Cretaceous age. These beds have been traced along our seismic records to an area, 65 km (45 mi) to the northwest, where Cretaceous outcrop is known to occur (King et al, 1970; King and MacLean, 1970). The southern limb of the structure appears to protrude through the unconsolidated cover between 2.5 and 3.75 km along the profile (Fig. 2) and one might suspect from the record that bedrock is exposed at the seabed. During a recent submersible cruise over the Scotian Shelf we visited this site in the SHELF DIVER and made several traverses across the northern part of the structural knoll where the strong seismic reflector reaches the surface. Although we did not see outcrop, each time we traversed the small hummock associated with the strong reflector that presumably represents a well defined bed, we encountered blocks and boulders up to several metres in diameter. They varied in shape from large subangular blocks to tabular fragments, and in addition, small rounded fragments were present. No conclusive evidence was obtained during the dive to suggest either that the blocks and boulders had or had not been transported by the glaciers; however, the fact that they were found to be closely associated with the strong sub-bottom reflector provided some evidence to the effect that the fragments are more or less in situ.

During the submersible examination three small boulders were collected from the seabed and subsequent paleontological examination at the laboratory of Shell Canada Ltd., Calgary, revealed that the rocks are mid-Cretaceous in age.

Petrographic examination of these boulders shows that they consist of sideritic quartz sandstone and arenaceous sideritic carbonate rock very similar to samples of Cretaceous rock from the Scotian Shelf previously described by King et al (1970). One difference is that these rocks contain more calcite than those previously described and the calcite is partly replaced by siderite. X-ray examination of the sample revealed that the typical diffraction for pure siderite was not always obtained. There is apparently some distortion in the crystal lattice which may be due to substitution of Mn^{++} in place of the ferrous ion. The dominance of siderite in these samples suggests that sideritization of Cretaceous rocks has been fairly extensive on the

* Manuscript received March 24, 1970.

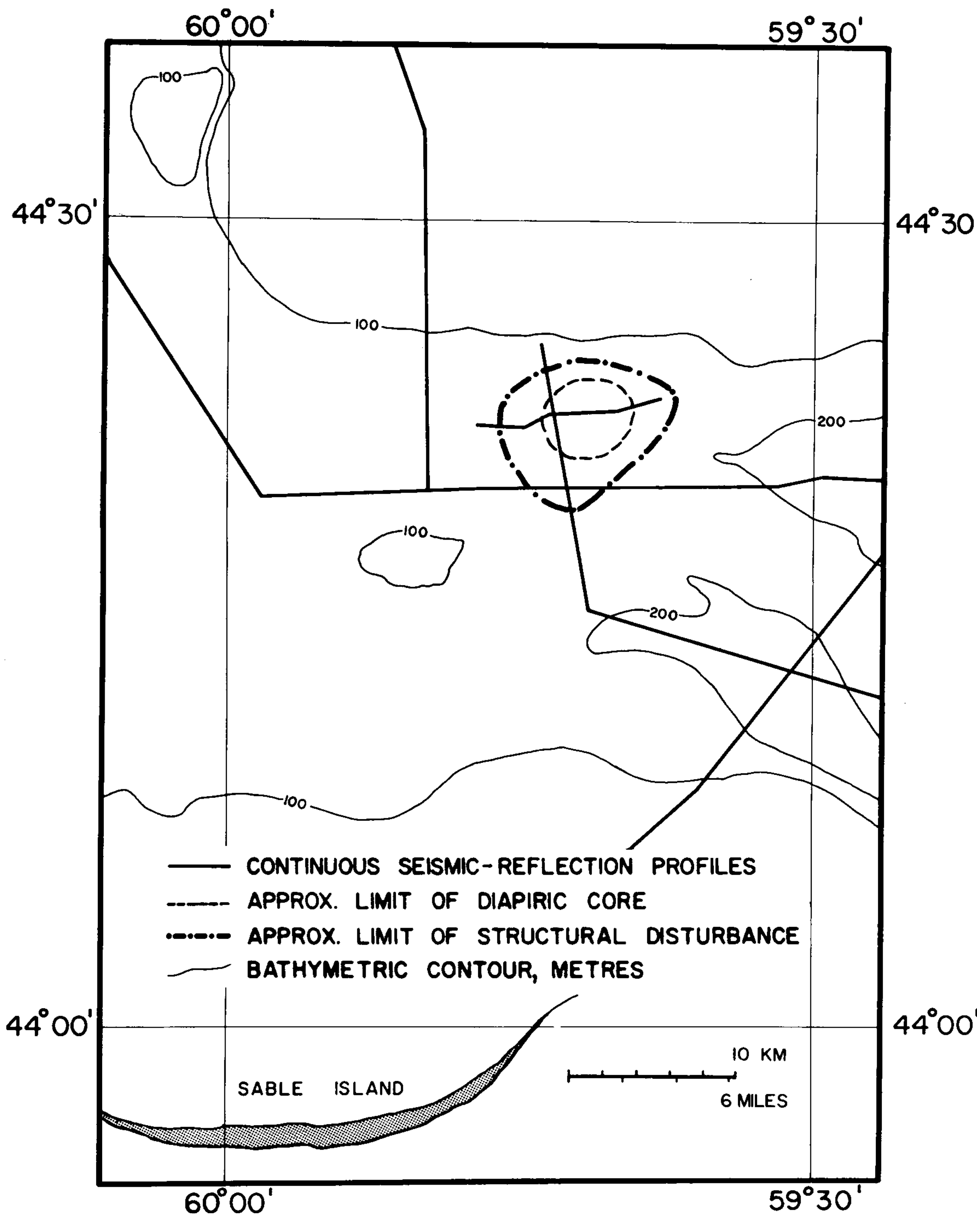

Figure 1 – Location of diapiric structure and extent of continuous seismic-reflection control in the area.

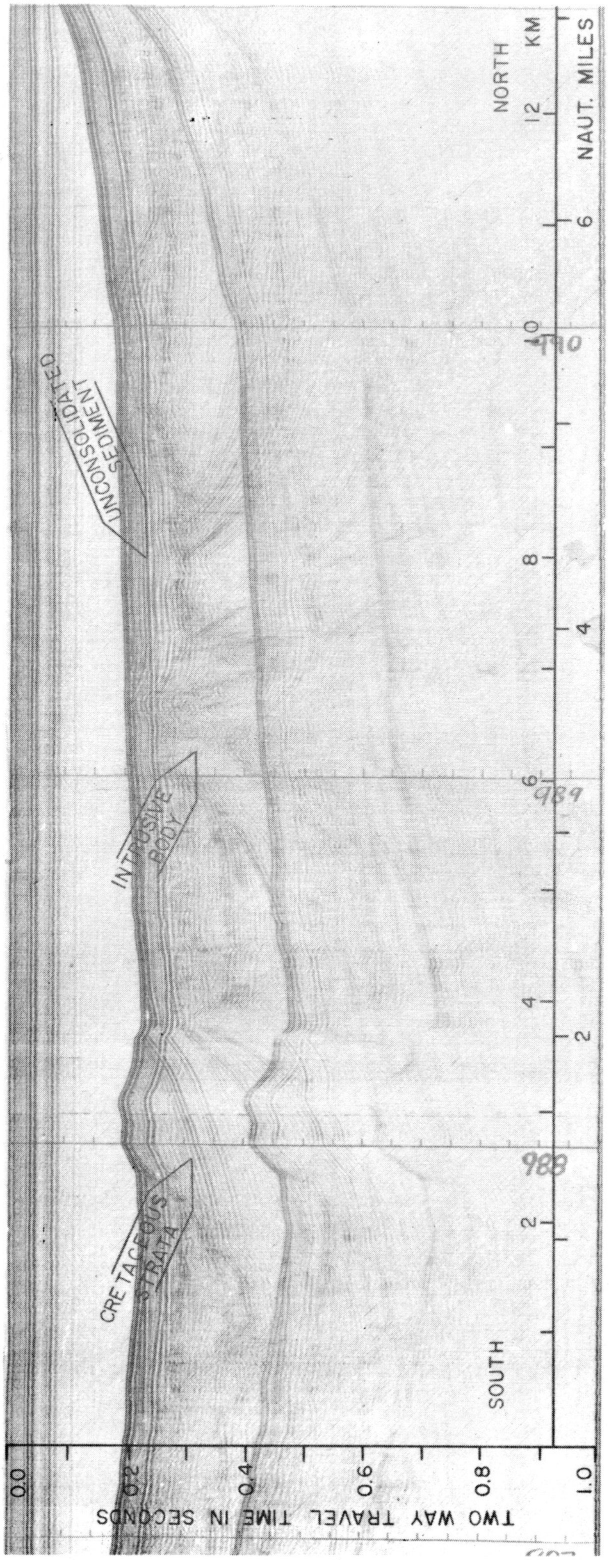

Figure 2 —Continuous seismic-reflection profile running north-south across the diapiric structure near Sable Island.

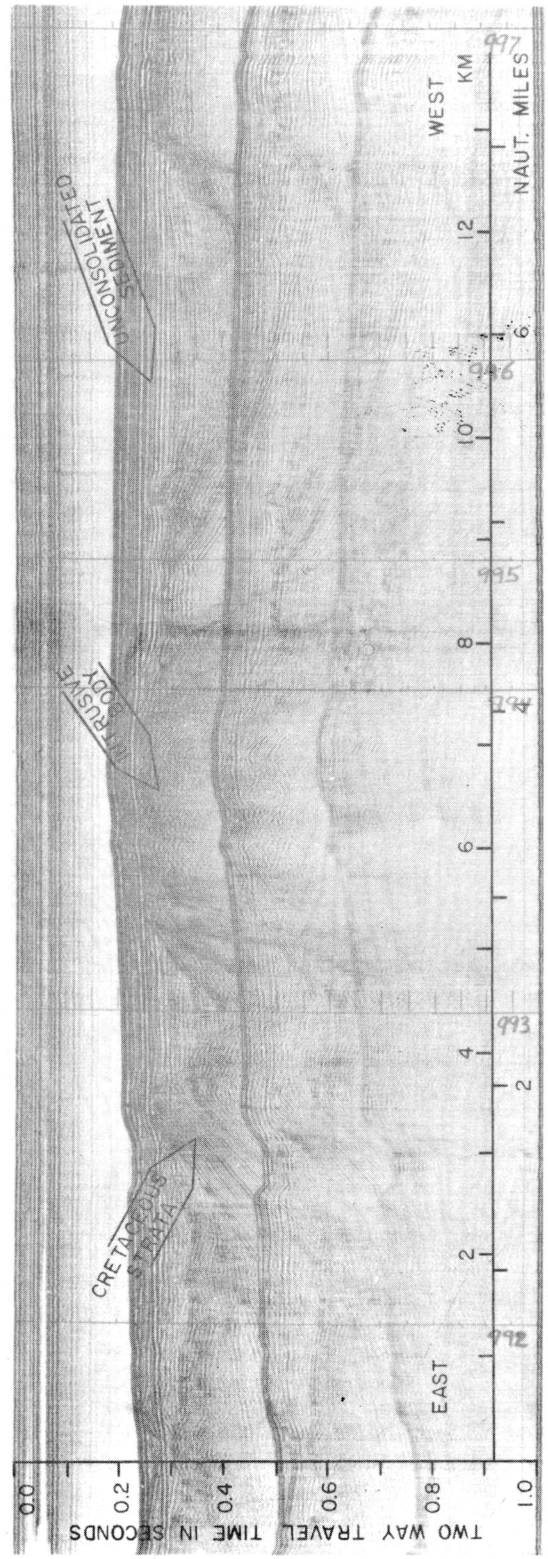

Figure 3 —Continuous seismic-reflection profile running east-west across the diapiric structure near Sable Island.

Scotian Shelf because these rocks occur approximately 900 m (3000 ft) stratigraphically above those previously sampled and found to be sideritic.

Figure 3 reveals the same basic structures as are shown in Figure 2, but this profile was obtained nearer the central part of the dome. A penetration of 0.75 sec (approximately 1.2 km) was obtained along the western part of this profile. The seabed shows a slight rise across the central part of the structure and this again suggests recent movement.

Interpretation of Structure

Additional geophysical measurements such as gravity and magnetics were not obtained across the structure. Because of the fact that it is difficult to distinguish between shale and salt diapirs on a seismic profile, such additional information is desirable. Nevertheless, there is some evidence to suggest that the intrusive body is salt. Evaporites occur in the Pan Am - IOE-A-1 Tors Cove W, D-52 well on the Grand Banks. Keen, Loncarevic, and Ewing (in press) report a diapiric structure from seismic-reflection studies across the Laurentian Channel and conclude on the basis of the Grand Banks well data that it is a salt dome. Their argument is strengthened because of the occurrence of negative gravity anomalies on gravity maps of the Grand Banks that they include in their report.

In view of the widespread occurrence of evaporites in Mississippian strata (Windsor Group) in the Atlantic Provinces, it is possible that evaporites on the continental shelf off Newfoundland and Nova Scotia are of the same age, but the possibility of a younger age cannot be ruled out. Schneider (1969) and Rona (1969) described deep-sea diapiric structures on the Cape Verde Rise west of Senegal and both suggested that these may be of salt composition because of the close association of these structures with known Triassic to Lower Cretaceous salt occurrences of North Africa. These workers postulated restricted conditions of sedimentation in the proto-Atlantic Ocean to explain the occurrence of deep-sea evaporites. Because the continental margin off the Atlantic Provinces bordered the same restricted basin (Bullard et al, 1965), evaporites underlying the Scotian Shelf and Grand Banks could also be Triassic to Lower Cretaceous in age.

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