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Eocene Deep Water Sediment from the Northeast Providence Channel, Bahamas*

CHARLES F. STEHMAN
Department of Geology, Dalhousie University, Halifax, N. S.

Introduction

The origin and age of the re-entrant channels that incise the Bahama Banks (such as Exuma Sound, Tongue of the Ocean, and the Providence Channels) are unknown, although several hypotheses concerning them have been proposed (Hess, 1933; Talwani, Worzel and Ewing, 1960; Lynts and Stehman, 1969). Little of the ancient history of these features is known for the sediments in them are deposited at quite a high rate and ordinary sampling techniques have not penetrated to depths sufficient to obtain answers to questions of age and origin. Little drilling in the Bahama area has been conducted and only two wells have been reported in the literature (Hess, 1933; Spencer, 1967). Geophysical studies over the re-entrants have been primarily restricted to gravity work and no deep seismic work over them is known to the author. Occasionally, ancient deep-water sediments are brought up from the re-entrants such as have been reported by Ericson et al. (1952) and Gibson and Schlee (1967). It is felt that the position and age of these older sediments should be noted as they may, in the future, aid in resolving questions about Bahamian history. This report concerns the discovery of another such deposit of older sediments in the Bahamas.

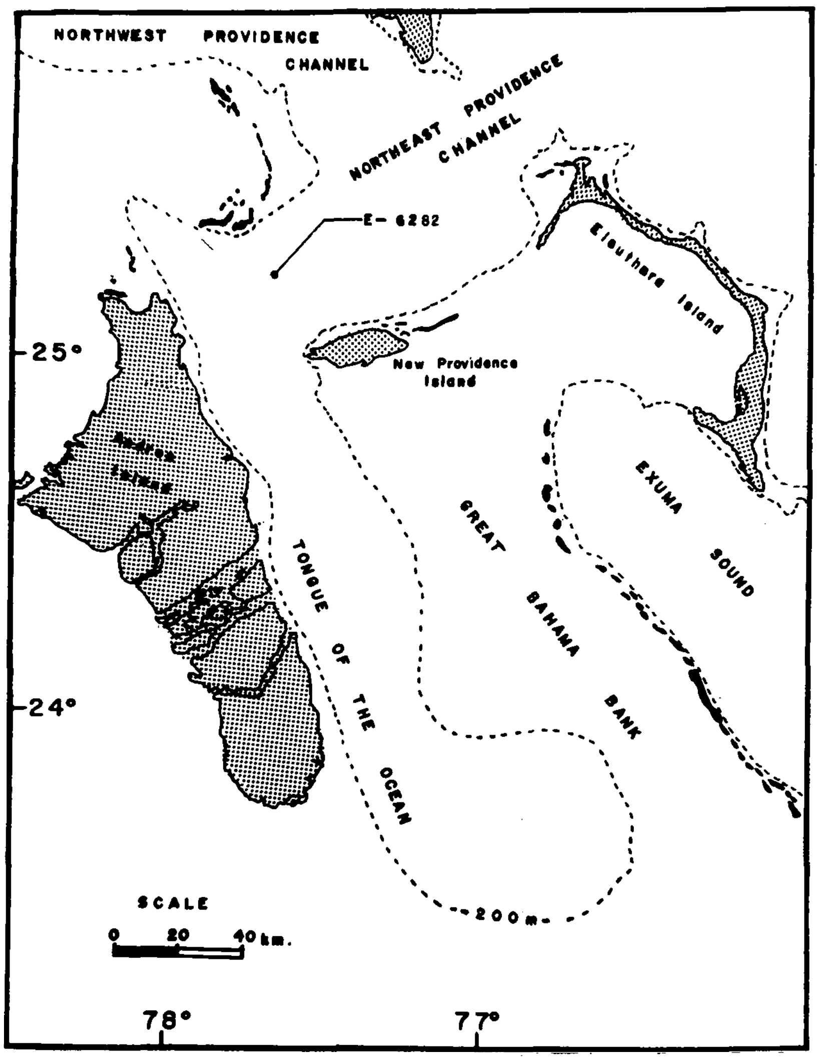

Figure 1 - Map of Northeast Providence Channel and Tongue of the Ocean, Bahamas, showing the location of core E-6282.

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Eocene Sediments

While examining a six-metre piston core raised by the R/V EASTWARD from the Northeast Providence Channel, Bahamas (Figure 1) a section of lower middle Eocene material corresponding to the *Globigerapsis kugleri* zone of Trinidad (Bolli, 1957a) was discovered in the bottom three metres of the core. The stratigraphic positioning of this material was based on identification of *Globigerapsis kugleri* Bolli, Loeblich and Tappan, and *Truncorotaloides topilensis* (Cushman) which evolved at the bottom of the zone, and *Globigerina boweri* Bolli, *Globorotalia aragonensis* Nuttal, and *Globorotalia broedermanni* Cushman and Bermudez which became extinct at the top of the *Globigerapsis kugleri* zone. With the exception of *Globigerina ampliapertura* Bolli, the whole planktonic foraminiferal assemblage of the Eocene fit well in the *Globigerapsis kugleri* zone described in the literature. Table 1 is a listing of the complete planktonic foraminiferal fauna found in the Eocene. The presence of the species *Globigerina ampliapertura* in the *Globigerapsis kugleri* zone is grounds for the extension of this species from the upper Priabonian of the Oligocene (Bolli, 1957b) down to the lower Lutetian of the Eocene.

Table 1 - Planktonic foraminifera found in the Eocene section of core E-6282.

Globigerapsis kugleri Bolli, Loeblich and Tappan, 1957
Globigerina ampliapertura Bolli, 1957
Globigerina boweri Bolli, 1957
Globigerina dissimilis Cushman and Bermudez 1937
Globigerina trilocularis d'Orbigny, 1826
Globigerinoides higginsi Bolli, 1957
Globorotalia apanthesma Loeblich and Tappan, 1957
Globorotalia aragonensis Nuttal, 1930
Globorotalia broedermanni Cushman and Bermudez, 1937
Globorotalia bullbrooki Bolli, 1957
Globorotalia spinulosa Cushman, 1927
Hantkenina alabamensis Cushman, 1927
Truncorotaloides topilensis (Cushman), 1925

The assemblage of planktonic foraminifera found in the Eocene section suggests that this section has lain undisturbed since deposition as there is no evidence of faunal mixing. The other micropaleontological constituents of the Eocene sediment consisted of radiolarians, spicules, a very few benthonic foraminifera, and undetermined forms of nannoplankton. The constituents of the microfaunal assemblage were essentially identical to that of a Recent deep-water assemblage. Thus, this section of Eocene sediment represents an undisturbed deep-water deposit from that time.

Resting unconformably upon the Eocene material was approximately a three-metre thickness of Pleistocene and Recent sediment displaying similar physical, mineralogical, and paleontological effects to those described by Busby (1962) for sediments from the Tongue of the Ocean, Bahamas. Pleistocene chronological zonation using planktonic foraminifera (Ericson et al., 1961) was attempted for this section. The results of this investigation showed little continuity from depth interval to depth interval, suggesting that this section of the core consists of a collection of discontinuous sedimentary sequences. The presence of the planktonic foraminiferal subspecies *Globorotalia cultrata flexulosa* (Koch), which became extinct during the last interstadial of the Wisconsin (Ericson et al., 1961), at a depth of 40 centimetres in the Pleistocene section of the core further attests to the interrupted nature of this upper section. Rates of sedimentation calculated from other, more continuous cores taken near the site of this core (Judd, 1969) are much higher than that needed to deposit only 40 centimetres of continuous sediment from the time of *Globorotalia cultrata flexulos's* extinction to the present.

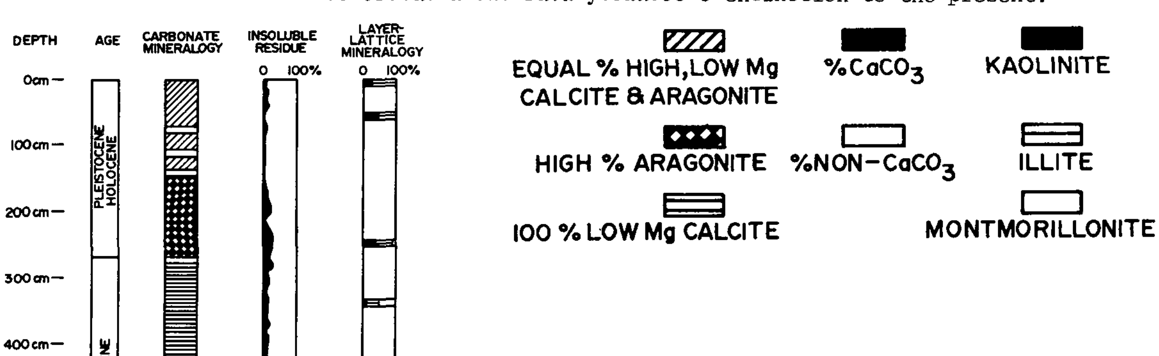

Figure 2 - Carbonate polymorph, insoluble residue, and layer-lattice silicate data derived from core E-6282.

Other aspects of the Eocene sediment that were investigated were carbonate mineralogy, layer-lattice mineralogy, and the carbonate content. Original size distribution information for the Eocene sediment investigated was obscured by partial lithification and thus no size distribution data is given here. The mineralogy information for both the Pleistocene-Holocene and the Eocene section of the core (Figure 2) is based on data obtained from the analysis of 10-centimetre interval subsamples taken from the core.

The Eocene was characterized by an increase in insoluble residue as compared to the overlying Pleistocene-Holocene sediment. The complete absence of any polymorph of calcium carbonate other than stable, low magnesium calcite in the Eocene is attributable to the age of the sample. An increase in the montmorillonite concentration was observed in the Eocene sediments relative to the overlying Pleistocene-Holocene sediments.

The unconformity in this core, the loss of a considerable stratigraphic section between the Eocene and Pleistocene, and the discontinuous section of Pleistocene material all indicate that the region from which this core was taken has undergone, and possibly is still undergoing, non-deposition or erosion or both. The presence of the Eocene material indicates that the Northeast Providence Channel and the Tongue of the Ocean which is contiguous with the Northeast Providence Channel are features that have existed since at lease the lower middle Eocene.

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References cited

BOLLI, H.M., 1957a, Planktonic foraminifera from the Eocene Navet and San Gernando Formations, Trinidad, B.W.I. U.S. Nat. Museum Bull., No. 215, p. 155-172.

__________, 1957b, Planktonic foraminifera from Oligocene-Miocene Cipero and Leugna Formations of Trinidad, B.W.I. U.S. Nat. Museum Bull., No. 215, p. 97-124.

BUSBY, R.F., 1962, Submarine geology of the Tongue of the Ocean, Bahamas. Navoceano Tech. Rept. 108, 81 pp.

ERICSON, D.B., EWING, M., and HEEZEN, B., 1952, Turbidity currents and sediments in the North Atlantic. Bull. Amer. Assoc. Petrol. Geol., Vol. 36, No. 3, p. 489-511.

____________________, WALLIN, G. and HEEZEN, B., 1961, Atlantic deep sea sediment cores. Geol. Soc. America Bull., Vol. 72, p. 193-286.

GIBSON, T.G. and SCHLEE, J., 1967, Sediments and fossiliferous rocks from the eastern side of the Tongue of the Ocean, Bahamas. Deep Sea Research, Vol. 14, p. 691-702.

HESS, H., 1933, Interpretations of geological and geophysical observations in Navy-Princeton Gravity Expedition to the West Indies, 1932, U.S. Hydrographic Office, p. 27-54.

JUDD, J.B., 1969, An analysis of the planktonic foraminiferal fauna from Core E-6278, Tongue of the Ocean, Bahamas, unpub. Masters thesis, Duke University.

LYNTS, G.W. and STEHMAN, C.F., 1969, Deep Sea Eocene in Northeast Providence Channel, origin of Bahamas and sea floor spreading. Abst. of the Annual Meeting of the Geological Society of America, 1969, Part 7, p. 281-282.

SPENCER, M., 1967, Bahamas deep test. American Association of Petroleum Geologists, Vol. 51, No. 2, p. 263-268.

TALWANI, M., WORZEL, J.L. and EWING, M., 1960, Gravity anomalies and structure of the Bahamas. Transactions of the Second Caribbean Geological Conference, p. 156-161.