Atlantic Geology

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Volume 4, numéro 3, december 1968

URI : https://id.erudit.org/iderudit/ageo04_3rep06

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Éditeur(s)

Maritime Sediments Editorial Board

ISSN

0843-5561 (imprimé)
1718-7885 (numérique)

Découvrir la revue

Citer cet article

Ramsay, A. T. (1968). A Preliminary Study of Some Barbados Ridge Cores. *Atlantic Geology*, *4*(3), 108–112.

# A Preliminary Study of Some Barbados Ridge Cores*

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## Introduction

The object of this communication is to describe and briefly discuss seven sediment cores collected along the crest of the Barbados Ridge which contain Quaternary and, in one instance Upper Tertiary sediments, together with a low background of reworked Upper and Lower Tertiary nannofossils. Location of cores shown in Figure 1.

The geographical area considered is such that a meaningful correlation between the cores could be established, and it is hoped, will provide a framework for detailed geochemical, sedimentological, palaeontological and palaeoclimatological analyses.

At present the sampling density on the Barbados Ridge is sufficient to establish only a broad picture of Quaternary sedimentation in the area.

## Biostratigraphy

In this account Recent sediments are included in the Quaternary. The biostratigraphy of the cores and the recognition of Quaternary in pelagic sediments is based on the interpretation of Banner and Blow (1965, 1967). Within the Quaternary vertical changes in the ratio of right and left coiling shells of *Globorotalia truncatulinoides* were used to establish a precise correlation between cores (in most samples ratios were determined from counts of over 100 tests). The usefulness of this technique in the correlation of late Quaternary sediments is already clearly demonstrated (Ericson, 1953; Ericson et al., 1954; Berggren et al., 1967). Ericson (1953) and Ericson et al. (1961) also demonstrate a relationship between short-duration reversals in the coiling direction of *G. truncatulinoides* and sudden changes in climate. The reasons for the variation in the direction of coiling of this species are however little understood, and although temperature has been suggested (Ericson and Wollin, 1966), a relationship between sea-surface temperature and coiling direction is not as clearly established for *G. truncatulinoides* as for the cold water species *Globigerina pachyderma* (Ericson, 1959).

## Core Descriptions

The lithological description of the cores is based mainly on visual observation, supplemented to a certain extent by the examination of balsam-mounted smear slides.

**Core G 5** 11°43.4'N, 60°24.2'W; depth 1408 m; core length 84.1 cm.
Remarks: Due to the inflow of sediment into the core-barrel no meaningful sequence was observed in this core. The sediment is Quaternary with a low background of reworked middle Eocene *Discoaster barbadiensis* and Upper Tertiary *D. brouweri*.

**Core G 6** 11°50'N, 60°11.5'W; depth 1756 m; core length 455 cm.
0 - 95 cm Gray-blue, foraminiferal lutite with a dark brownish layer at 95 cm. Abrupt contact with
95-120 cm light tan, foraminiferal lutite, has an abrupt contact with
120-280 cm grey-blue, foraminiferal lutite with narrow brownish layers between 120 and 160 cm. Abrupt transition to
280-315 cm light tan, foraminiferal lutite with a dark brown layer at 290 cm. Distinct contact with
315-455 cm grey-blue, foraminiferal lutite with a dark brown layer at 400 cm.
Sampling interval: Every 10 cm.
Remarks: The entire core is Quaternary with an admixture of Lower and Upper Tertiary species of Discoaster. Concentration of plant debris, which is distributed throughout the sequence, account for the narrow dark brown layers.

*Manuscript received March 11, 1969.

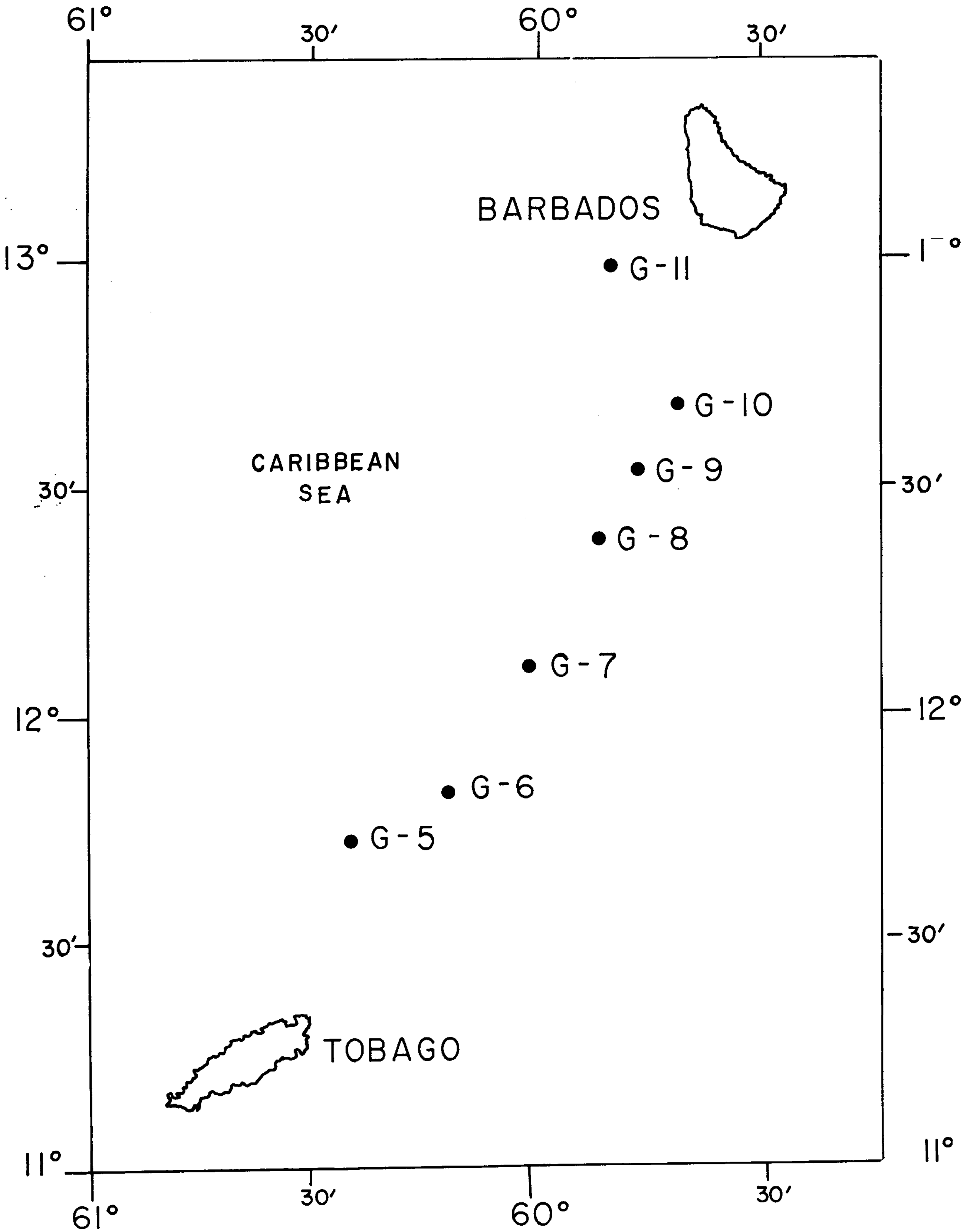


Fig. 1 - Location map of coring stations.

Core G 7 — $12^{\circ}07'N$, $60^{\circ}0'W$; depth 1609 m; core length 1207 cm.

0 - 90 cm — Light tan, foraminiferal lutite, merges with

90-1207 cm — grey-blue, unstratified, foraminiferal lutite with longitudinal streaking caused by the inflow of sediment into the core barrel.

Sampling interval: Upper 90 cm sampled every 10 cm.

Remarks: The interval sampled is Quaternary with an admixture of early and late Tertiary discoasters.

Core G 8 — $12^{\circ}23.5'N$, $59^{\circ}50.0'W$; depth 1280 m; core length 508 cm.

0 - 15 cm — Light tan, foraminiferal lutite with a gradual, mottled transition to

15-209 cm — blue-grey, foraminiferal lutite.

209-508 cm — A disturbed sequence of blue-grey, foraminiferal lutite.

Sampling interval: Upper 209 cm sampled every 10 cm.

Remarks: The Upper 0 - 2 cm is Quaternary; between 5 and 15 cm the fauna is predominantly Upper Miocene with a Quaternary admixture. Below 15 cm an Upper Miocene fauna of planktonic foraminifera corresponding to zone N 17 of Banner and Blow (1965, 1967) was recorded which includes Sphaeroidinella subdehiscens, Globorotalia tumida plesiotumida and Globigerina nepenthes. The presence of reworked Eocene throughout the core is indicated by the presence of Discoaster brouweri; the Upper Tertiary species D. brouweri, D. pentaradiatus and D. surculus were also recorded.

Core G 9 — $12^{\circ}32.7'N$, $59^{\circ}45.5'W$; depth 1520 m; core length 545 cm.

0 - 110 cm — Light tan, foraminiferal lutite with layers of foraminiferal lutite with layers of foraminiferal ooze at 35 cm and 80 cm; abrupt contact with

110-266 cm — dark grey-blue, foraminiferal lutite with narrow layers of foraminiferal ooze at 128 cm and 226 cm. Distinct contact with

225-330 cm — light tan, foraminiferal lutite with a layer of foraminiferal ooze between 290-298 cm. Merges gradually with

330-545 cm — dark grey-blue, foraminiferal lutite, disturbed below 380 cm.

Sampling interval: Every 10 cm.

Remarks: The entire core is Quaternary with an admixture of middle Eocene and Upper Tertiary species of Discoaster.

Core G 10 — $12^{\circ}41.5'N$, $59^{\circ}40.0'W$; depth 1170 m; core length 1125 cm.

0 - 40 cm — Light tan, foraminiferal lutite with a layer of foraminiferal ooze between 8 - 20 cm. Merges gradually with

40-130 cm — dark grey-blue, foraminiferal lutite. Merges with

130-190 cm — light tan, foraminiferal ooze becoming finer grained and merging with foraminiferal lutite below 170 cm. Merges gradually with

190-1125 cm — dark grey-blue, foraminiferal lutite.

Sampling interval: Every 10 cm.

Remarks: The entire core consists of Quaternary sediment with an admixture of reworked middle Eocene and Upper Tertiary discoasters.

Core G 11 — $12^{\circ}59.8'N$, $59^{\circ}49.7'W$; depth 1390 m; core length 500 cm.

0 - 30 cm — Light tank foraminiferal lutite in sharp contact with

30-80 cm — dark tan, foraminiferal lutite. Has an abrupt contact with

80-90 cm — light tan, foraminiferal ooze in sharp contact with

90-155 cm — light tan, foraminiferal lutite with layers of foraminiferal ooze at 110 and 130 cm. Distinct contact with

155-230 cm — dark grey-blue, foraminiferal lutite with a layer of foraminiferal ooze at 290 cm. Abrupt contact with

230-500 cm — light tan, calcareous clay with layers of foraminiferal ooze between 240-250 cm and 305-315 cm.

Sampling interval: Every 10 cm.

Remarks: The entire core consists of Quaternary sediments with a low background of reworked middle Eocene and Upper Tertiary discoasters.

## Discussion

### A. Quaternary

The correlation of the Quaternary sequences based on the coiling ratio curves of Globorotalia truncatulinoides (see Fig. 2) shows that sediment accumulation at stations G 6 and G 10 has been considerably more rapid than at stations G 9 and G 11. The presence of winnowed layers of foraminiferal ooze indicates that bottom scour may be responsible for the slower deposition at stations G 9 and G 11, and in the upper 180 cm at G10 is probably due to the infilling and levelling of a depression. The proximity of station G 6 to a terrigenous source, suggested by the high concentration of plant debris throughout the sequence, almost certainly accounts for the high rate of deposition at this locality.

The distinct colour banding of most sequences is probably related to vertical changes in the ferric (light tan lutite) ferrous (grey-blue lutite) and may be of diagenetic origin. Grey-blue lutites predominate in the sequence characterized by a high rate of sedimentation, and it is possible that a relationship exists between diagenesis and the rate of sediment accumulation. The light tan, oxidized lutite is probably associated with a slower rate of sedimentation.

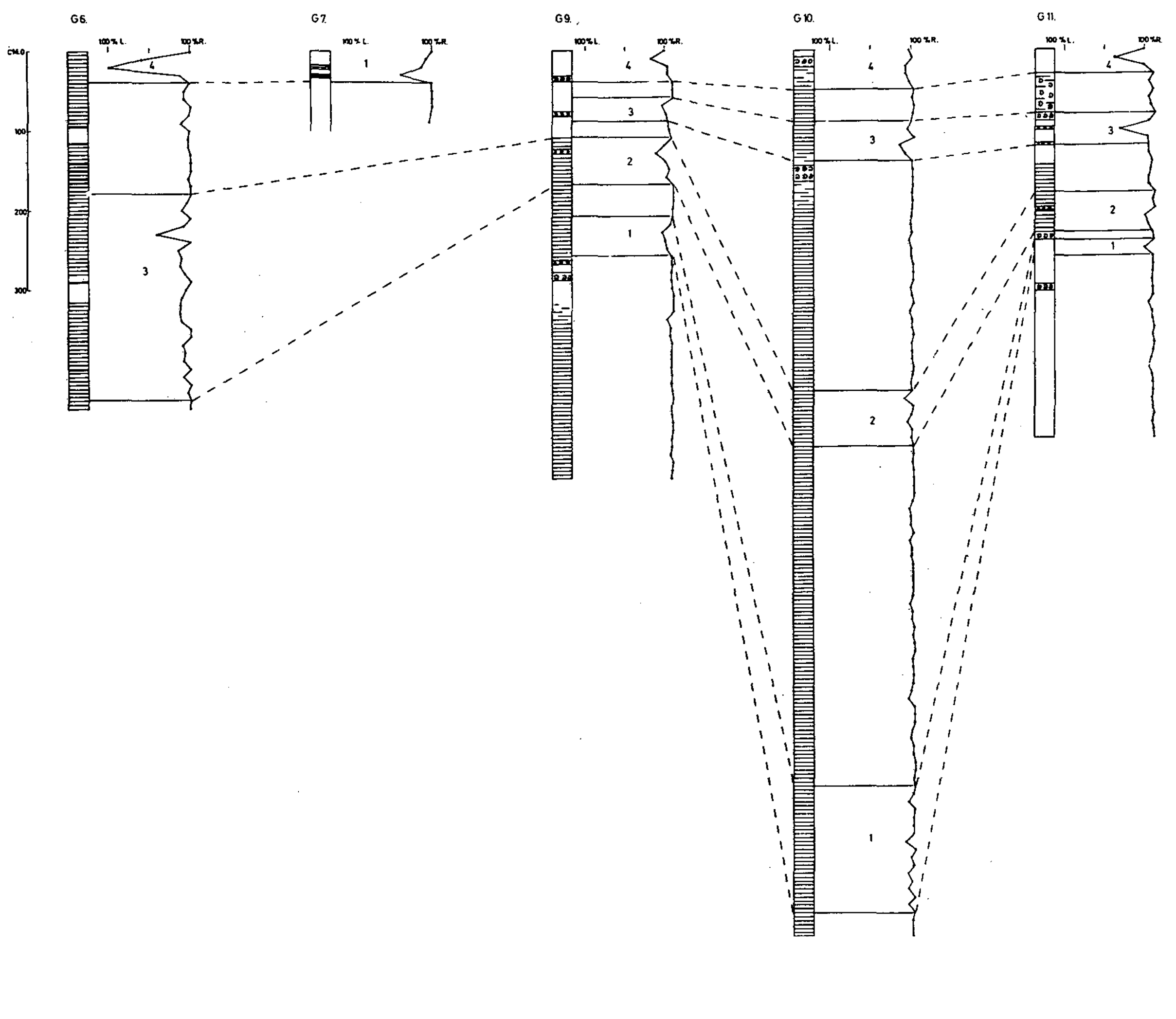


Fig. 2 - Correlation based on the ratio in percentage between right and left coiling tests of *Globorotalia truncatulinoides*. An open zone denotes light tan lutite; a lined zone denotes blue-grey lutite; interrupted lines denote transitional zones; coiled symbols indicate the presence of foraminiferal ooze.

It would be premature to relate major changes in the coiling ratio of G. truncatulinoides with the four "classic" Quaternary glaciations, without a more detailed floral and faunal analysis. Although it is reasonable to assume that marked deviations in coiling direction reflect changes in the environment, it would appear that more subtle changes than variations in surface temperature are involved. If surface temperature alone determined the distribution of sinistrally coiled forms, the 100% sinistrally coiling population at station G 6 would not be expected at such a low latitude.

B. Pre-Quaternary

The only in situ Tertiary sediments recorded are the Upper Miocene foraminiferal lutites at station G 8 which are unconformable with the overlying Quaternary lutites. The absence of Pliocene sediments at this locality is probably due to slumping.

The presence of a low background of a reworked middle Eocene species Discoaster barbadiensis throughout each sample sequence indicates that the sediments are derived, at least in parts, from the erosion of sediments of this age. There is however no indication as to whether the Eocene source is terrestrial or marine.

Acknowledgements

The assistance and encouragement of Dr. Bruno d'Anglejan and all other friends and colleagues at McGill is gratefully acknowledged. Thanks are also due to friends at the Bedford Institute and to the Captain and crew of the C. S. S. HUDSON for their assistance in the collection of the cores. The research was pursued during the author's visit as a research associate of the Marine Sciences Centre McGill University and was financed partly by McGill University and partly by a National Research Council of Canada research grant to Dr. B. d'Anglejan.

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