Tucholke, B.E., Sibuet, J.-C., and Klaus, A. (Eds.)
Proceedings of the Ocean Drilling Program, Scientific Results Volume 210

11. Data Report: Calcareous Nannofossil Biostratigraphy of Albian Sediments Recovered at Site 1276, Ocean Drilling Program Leg 210[1]

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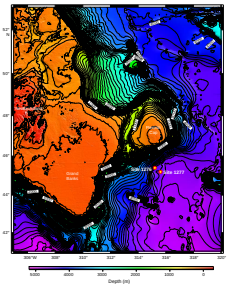
INTRODUCTION

Ocean Drilling Program (ODP) Leg 210 (Fig. **F1**) is one of very few deep-sea legs drilled along the eastern Canadian continental margin. Most other drilling on this margin has been carried out by the petroleum industry on the shallow-water regions of the Scotian shelf and the Grand Banks (see Doeven, 1983, for nannofossil studies). Deep Sea Drilling Project (DSDP) Leg 12 Site 111 and ODP Leg 105 Site 647 were drilled in the general vicinity of Leg 210 but recovered no appreciable Lower Cretaceous (Albian–Cenomanian) sediments. Site 111 yielded indurated limestones dated tentatively as late Albian–early Cenomanian, whereas Site 647 encountered no Albian–Cenomanian sediments.

Two sites (Sites 1276 and 1277) (Fig. **F1**) were drilled during Leg 210 in the Newfoundland Basin with the primary objective of recovering basement rocks to elucidate the rifting history of the North Atlantic Basin. The location for Leg 210 was selected because it is conjugate to the Iberia margin, which was drilled extensively during DSDP/ODP Legs 47B, 103, 149, and 173. A secondary but equally important objective was to recover the overlying sediments with the purpose of studying the postrift sedimentation history of this margin.

Sediment coring at Site 1276 began at 800 meters below seafloor (mbsf) in upper Eocene sediments, and a fairly continuous section was recovered through the lowermost Albian. Minor hiatuses resulted in the

F1. Leg 210 drill sites in the Newfoundland Basin, p. 6.



[1] Ladner, B.C., 2007. Data report: calcareous nannofossil biostratigraphy of Albian sediments recovered at Site 1276, Ocean Drilling Program Leg 210. *In* Tucholke, B.E., Sibuet, J.-C., and Klaus, A. (Eds.), *Proc. ODP, Sci. Results,* 210: College Station, TX (Ocean Drilling Program), 1–9. doi:10.2973/odp.proc.sr.210.113.2007
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Initial receipt: 4 March 2006
Acceptance: 23 August 2006
Web publication: 23 July 2007
Ms 210SR-113

omission of several nannofossil zones; however, one major hiatus spans the lowermost Campanian through the uppermost Turonian interval. The Lower Cretaceous (Albian) was encountered at ~1137 mbsf and persisted through 1719 mbsf, which represents an expanded section.

The unprecedented high recovery of 85%–100%, unusual for rotary coring, would normally allow for a very precise age model to be constructed; however, deposition of Lower Cretaceous sediments at Site 1276 occurred primarily below the carbonate compensation depth, resulting in many intervals that were either barren of carbonate or consisted of only impoverished, low-diversity calcareous nannofossil assemblages. These sediments consist mostly of dark gray to olive-black sediments with sandy to silty turbidites. Some turbidites contain thick tops of calcareous mudstone. Coccoliths were more persistent in this section than planktonic foraminifers; hence along with palynomorphs, nannofossils will be crucial for age control in this section. However, the low-diversity, low-abundance nannofossil assemblages are unlikely to provide robust or detailed paleoceanographic information.

Site 1277 was intended to core ~30 m of sediment immediately overlying basement but instead encountered basement rocks shallower than expected and did not yield any sediments containing calcareous nannofossils.

BACKGROUND

Because the primary objectives of Leg 210 are to investigate the conjugate to the Iberia margin, it is very important to relate any data collected to correlative sections on that margin. The Iberia margin was drilled during four previous legs: Legs 47B (Vigo Seamount), 103 (Galacia Bank), 149 (Iberia Abyssal Plain), and 173 (Iberia Abyssal Plain). Of those four, appreciable Albian sediments were recovered only during Legs 47B and 103. Therefore, only these two legs will be useful in relating the data collected during the present study.

Site 398 revealed an expanded Albian section that is nearly complete and rich in calcareous nannofossils (Blechschmidt, 1979), although the nannofossil biostratigraphic work performed was rudimentary from a modern perspective. Sites drilled during Leg 103 contained only lower Albian and uppermost Albian–lowermost Cenomanian sediments, although these are also rich in nannofossils (Applegate and Bergen, 1988).

METHODS

The nannofossil biostratigraphy presented here is based on examination of simple smear slides. Each sample was examined with a Zeiss Axioskop under 1600× magnification, using cross-polarized and phase contrast light. Several traverses of each slide were made, and relative abundance of individual species, overall abundance of nannofossils, and assemblage preservation were recorded directly into a Microsoft Excel spreadsheet for each sample. Bibliographic references for the species used in this paper can be found in Perch-Nielsen (1985) and Bown (1998). The zonation scheme of Roth (1973, 1983; NC zones), with subdivisions by Bralower et al. (1993), has been used for this study.

Abundances of individual taxa are represented by letter codes and were recorded according to the following definitions:

S = single (1 specimen observed).
R = rare (1 specimen/101–1000 fields of view).
F = few (1 specimen/11–100 fields of view).
C = common (1 specimen/2–10 fields of view).
A = abundant (1–10 specimens/field of view).
VA = very abundant (10–100 specimens/field of view).

The same definitions were used for estimates of total abundance in each sample, with an added definition:

B = barren of nannofossils.

The preservation of nannofossils varies significantly because of etching, dissolution, or calcite overgrowth. Finding pristine specimens in the same sample as specimens that are severely overgrown or etched is not uncommon. The state of preservation of the nannofossil assemblages in this paper was recorded as follows:

G = good (little or no evidence of dissolution and/or overgrowth, primary diagnostic features preserved, and specimens are identifiable to the species level).
F = fair (specimens exhibit some etching and/or overgrowth, primary diagnostic features somewhat altered, but most specimens are identifiable to the species level).
P = poor (specimens are severely etched or exhibit overgrowth, primary diagnostic features largely destroyed, fragmentation has occurred, and many specimens cannot be identified to the species and/or generic level).

SITE SUMMARY

Site 1276 was the only site during Leg 210 at which any of the sedimentary units above basement were recovered. The sediments recovered included an expanded Albian section (Table T1). The Albian sediments consist mostly of dark gray to olive-black sediments with sandy to silty turbidites. Some turbidites contain thick tops of calcareous mudstone. Calcareous nannofossils contained in these sediments were poorly to moderately well preserved, and assemblages range in abundance from barren to very abundant.

T1. Distribution of calcareous nannofossils, Hole 1276A, p. 8.

Corollithion kennedyi marks the top of Subzone NC10a and approximates the base of the Cenomanian for the purpose of this study. The first appearance datum (FAD) of *C. kennedyi* is found in Sample 210-1276A-37R-1, 102–103 cm (1137.42 mbsf). Uppermost Albian sediments, zoned as Subzone NC10a, were first encountered in Sample 210-1276A-37R-3, 96–97 cm (1140.12 mbsf), and persist through Sample 45R-3, 130–141 cm (1220.06 mbsf), based on the FAD of *Eiffellithus turriseiffelii*.

Samples 210-1276A-45R-5, 110–111 cm (1223.48 mbsf), through 53R-6, 46–47 cm (1300.47 mbsf), are placed in Subzone NC9b based on the FAD of *Eiffellithus monechiae* found in the latter sample. The FAD of *Axopodorhabdus albianus* marks the lower boundary of Subzone NC9a in Sample 210-1276A-60R-1, 99–100 cm (1356.42 mbsf). The interval between Samples 210-1276A-60R-3, 85–86 cm (1358.93 mbsf), and 77R-3, 51–52 cm (1521.65 mbsf), represents Subzone NC8c and is defined on the lower boundary by the FAD of *Tranolithus orionatus*.

The lower boundary of Subzone NC8b was difficult to define accurately because of a lack of consistent occurrences of *Hayesites albiensis*. Therefore, the lower boundary of Subzone NC8b was approximated by the FAD of *Cylindralithus nudus,* which occurs in Sample 210-1276A-87R-5, 91–92 cm (1634.33 mbsf).

Likewise, the lower boundary of Subzone NC8a is difficult to determine because of a paucity of fossils in the last few samples. It is possible that the FAD of *Prediscosphaera columnata* occurs in Sample 210-1276A-96R-5, 40–41 cm (1700.59 mbsf), and represents the base of the Albian. However, because the last two samples in the hole are impoverished, it is assumed that the samples examined in Core 210-1276A-97R are still Albian and that Aptian sediments were not penetrated during Leg 210.

AGE-DEPTH PLOT

Biostratigraphic datum levels from Table **T1** are summarized in Table **T2.** Age estimates for the datums were obtained from Bralower et al. (1997). The age-depth plot (Fig. **F2**) indicates a moderate rate of sedimentation (averaging 23 m/m.y.), between 97.6 and 107.3 Ma. The interval between 107.3 and 112.6 Ma indicates a much higher rate of sedimentation (69 m/m.y.). There were no indicated hiatuses in the Albian section of Hole 1276A, but this may result from the low number or reliable datums throughout this interval.

ACKNOWLEDGMENTS

This research used samples and/or data provided by the Ocean Drilling Program (ODP). ODP is sponsored by the U.S. National Science Foundation (NSF) and participating countries under management of Joint Oceanographic Institutions (JOI), Inc. This study was supported by United States Science Advisory Committee funds to Bryan C. Ladner. Laboratory facilities were provided by NSF grant no. DPP 94-22893.

T2. Age-depth plot data, Site 1276, p. 9.

F2. Age-depth plot for nannofossil datums, p. 7.

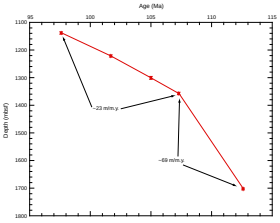

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Figure F1. Leg 210 drill sites in the Newfoundland Basin.

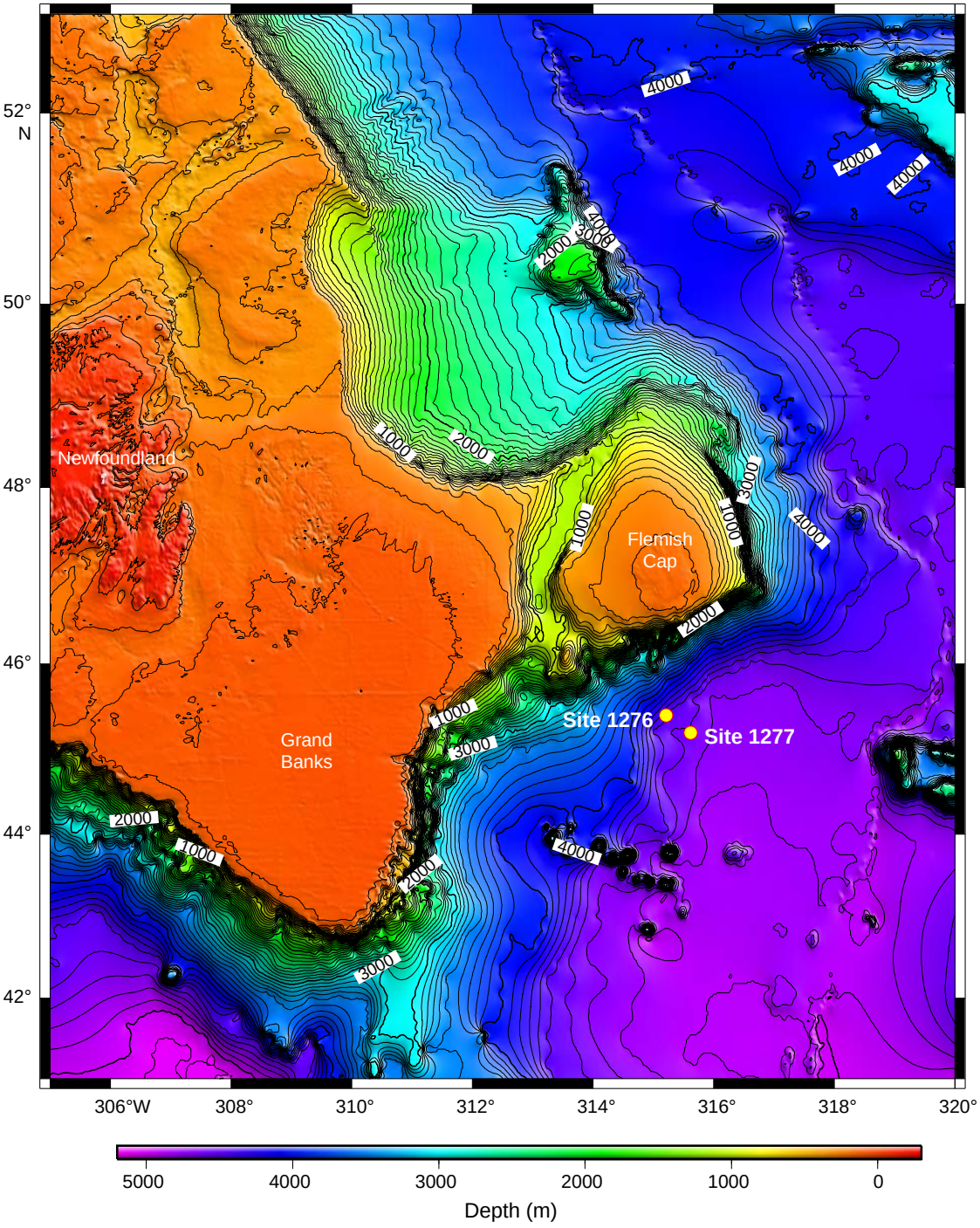

Figure F2. Age-depth plot for nannofossil datums.

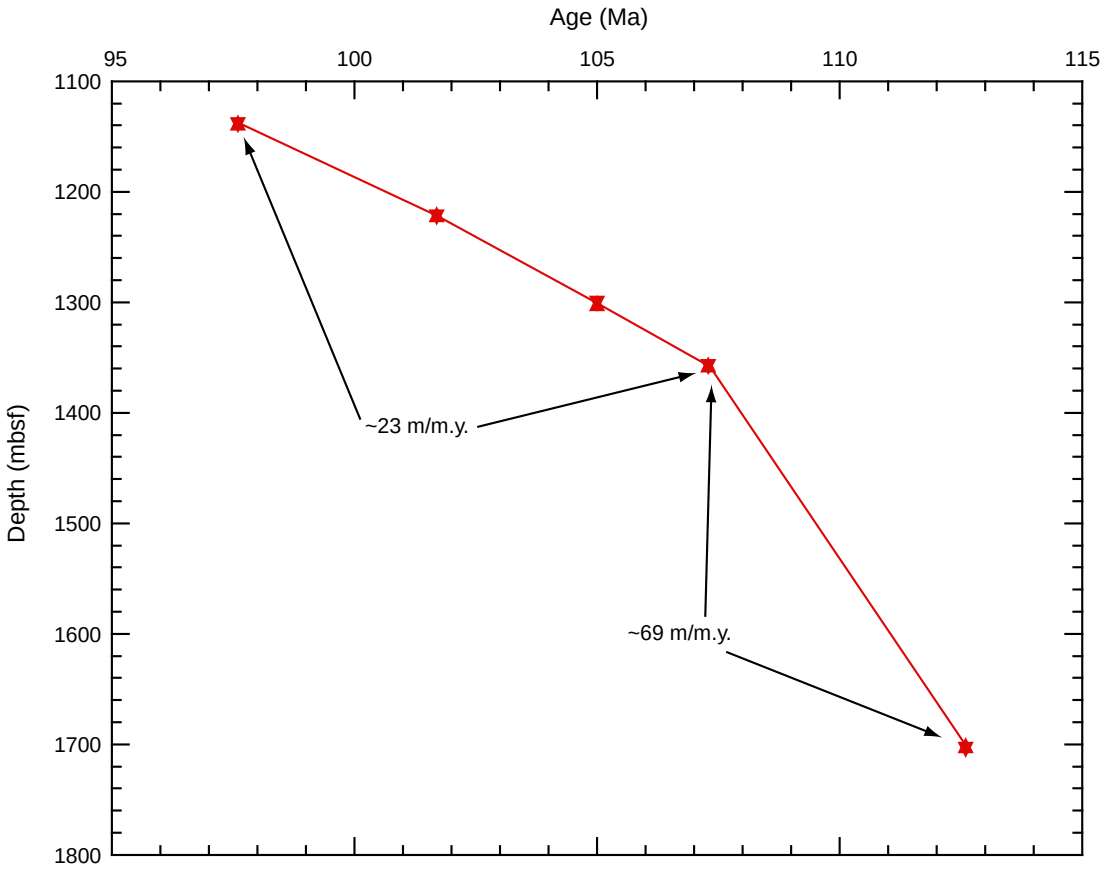

Table T1. Distribution of calcareous nannofossils, Hole 1276A. (This table is available in an **oversized format.**)

Table T2. Age-depth plot data, Site 1276.

Nannofossil datum	Datum type	Depth (mbsf)	Age (Ma)
Corollithion kennedyi	FAD	1137.42	97.60
Eiffellithus turriseiffelii	FAD	1220.06	101.70
Eiffellithus monechiae	FAD	1300.47	105.00
Axopodorhabdus albianus	FAD	1356.42	106.10
Tranolithus orionatus	FAD	1521.65	107.30
Prediscosphaera columnata	FAD	1700.59	112.60

Notes: All ages obtained from Roth (1973) and Bralower et al. (1997). FAD = first appearance datum.