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Comparisons of the late Cenomanian Foraminiferida from Goban Spur, Site 551, DSDP Leg 80 (Western Approaches) and Dover (SE England)

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The late Cenomanian foraminiferal assemblage from Site 551, DSDP Leg 80 (Goban Spur) shows many compositional features different to the coeval assemblage recovered from a typical onshore section in the AngloParis Basin (Dover). These are thought to be the result of deposition of the former in a deeper water facies.

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Introduction

Site 551, Deep Sea Drilling Project (DSDP) Leg 80 is located at lat. 48°54'.64"N long. 13°30'.09"W (Fig. 1), on Goban Spur, and was drilled to a depth of 3,887m. It penetrated a post-Aptian Mesozoic and Tertiary postrift drape over the en-echelon listric faulted basement of the eastern Atlantic passive margin (Graciansky et al. 1985). The oldest sediments recovered were 2.3m of late Cenomanian nannofossil chalk which rest unconformably on basaltic basement (Fig. 2). These are overlain by 4.1m of black, organic-rich, finely laminated shale (Graciansky et al. 1985), which are thought to be the local representation of the late Cenomanian Oceanic Anoxic Event (OAE) of Schlanger and Jenkyns (1976) (see Schlanger et al. 1987, for a recent review). The complete section has been used to assess the major microfaunal changes across the OAE (Hart 1985; Hart and Ball 1986; Leary 1987) but this study is only concerned with a comparison of the pre-OAE Foraminiferida. The presence of *Rotalipora cushmani* (Morrow) and *Rotalipora greenhornensis* (Morrow) in all samples (Fig. 2) (Graciansky et al. 1985) indicate the upper part of the *R. cushmani* T.R.Z. of Robazynski and Caron (1979).

The late Cenomanian chalks of Dover (SE England) (Fig. 3) are comprised of a sequence of poorly-developed chalk-marl rhythms (Abbots Cliff Formation) overlain by eight distinctive marl seams (Plenus Marl Formation) (Fig. 4). Recent detailed lithostratigraphic and sedimentological descriptions are available elsewhere (Robinson 1986; Jarvis et al. 1988). The OAE is represented at Dover from above the top of bed 1 Plenus Marls (Jarvis et al. 1988) and thus only the sediments from below this level will be treated here. The presence of *R. cushmani* (Morrow) in all samples and *R. greenhornensis* in some (including ABC 8 - Bed 1 Plenus Marls, Fig. 4) indicate the upper part of the *R. cushmani* T.R.Z. of Robaszynski and Caron (1979).

Goban Spur, Western Approaches

The abundances of foraminiferal tests recovered are high at between 750-900 specimens (Fig. 2) and the assemblages exhibit very high plan ktonic:benthonic (p:b) ratios (Fig. 2). P:b ratios may be utilised to make estimates of depth of deposition of sedimentary rocks (Grimsdale and Morkhoven 1955) and to map Cretaceous eustasy (Barr 1961; Diver 1968; Flexer and Starinsky 1970; Hart and Carter 1975; Bailey 1978; Hart 1980b) and possibly the distance from open ocean conditions (Murray 1976). Thus the consistently high p:b ratio can be taken to indicate a stable, deep water environment of deposition but well above the carbonate lysocline because of the rich well-preserved calcareous fauna.

The late Cenomanian planktonic foraminiferid assemblage may be subdivided into surface dwelling, thin-walled hedbergellids;

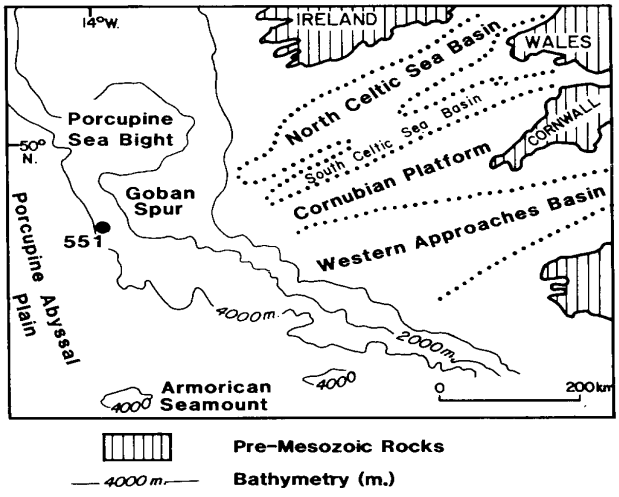

Figure 1. Locality map of Site 551, DSDP Leg 80, Goban Spur.

medium trochospired, partially keeled, intermediate depth praeglobotruncarids and deep water, low trochospired, well keeled rotaliporids (Bailey and Hart 1979; Hart 1980a; Wonders 1980; Caron 1983). The planktonic assemblage from Goban Spur is composed of at least 50% rotaliporids, 40% praeglobotruncarids/dicarinellids and <12% hedbergellids. Thus, the assemblage represents an unrestricted open ocean assemblage. In addition, it contains many specimens of the deepest water, low trochspired rotaliporids (*R. greenhornensis and R. deecki* (Franke)).

In contrast, the benthonic assemblage comprises a low diversity assemblage dominated by nodosariids and includes *Tritaxia macfadyeni* Cushman, *Arenobulimina advena* Cushman, *Eggerellina brevis* (d'Orbigny), *Marssonella trochus* (d'Orbigny), *Gavellinella intermedia* (Berthelin) and G. reussi (Khan) (Fig. 2). Within each group the gerontic specimens exhibit low size and morphological variability which is indicative of stable environmental conditions at the sediment water interface. The distribution pattern of benthonic foraminifera across Cretaceous shelves and the abyssal plain has been identified (Sliter and Baker 1982; Scheibnerova 1977; Nyong and Olsson 1983; Olsson and Nyong 1984; Koutsoukos 1985) which recognise species specific depth assemblages. The assemblage at Goban Spur, with a high proportion of nodosariids and a small number of agglutinated

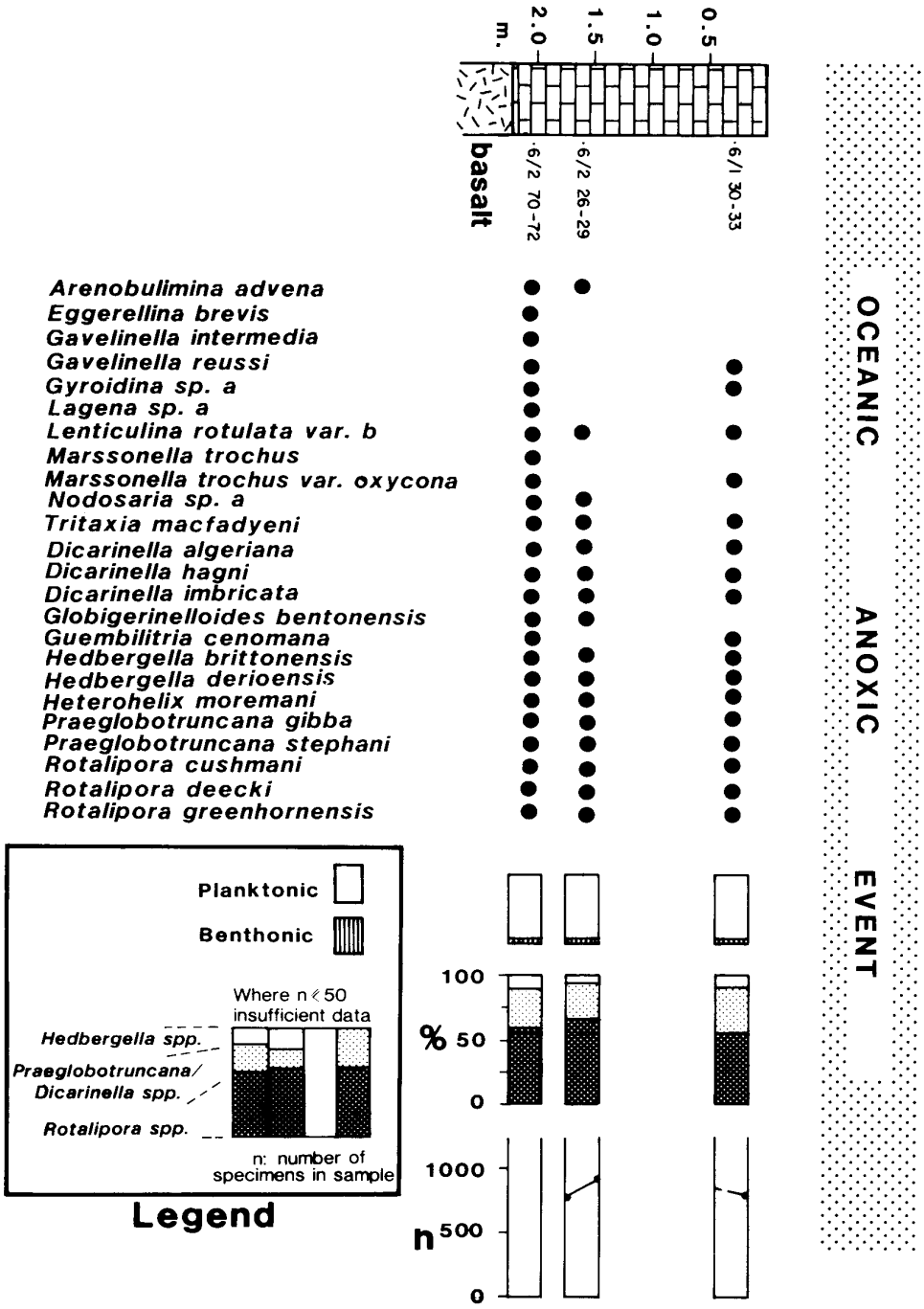

Figure 2. Foraminifera from Site 551, DSDP Leg 80, Goban Spur.

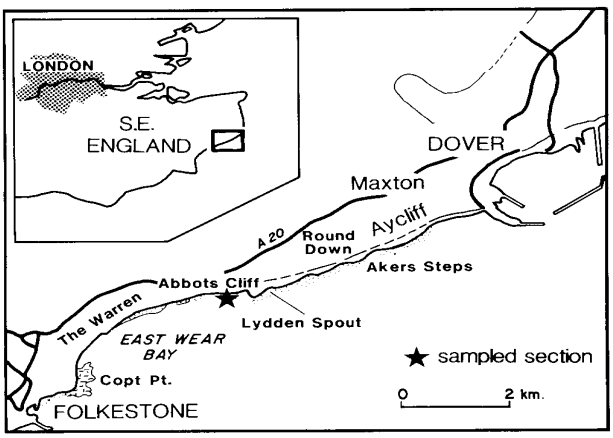

Figure 3. Locality map of Dover.

foraminifera, is consistent with the outer slope assemblage of Sliter and Baker (1972).

Dover, S.E. England

In contrast, the Foraminiferida from a coeval shallower water sequence from the Anglo-Paris Basin (Dover) exhibits many differences in terms of the relative influence of planktonic and benthonic foraminifera and their respective compositions (Fig. 4). Aspects of the late Cenomanian foraminifera have variously been described (Jefferies 1962; Carter and Hart 1977; Hart 1982; Hart 1985) and synthesised (Leary 1987; Hart and Leary, in press; Jarvis et al. 1988; Leary et al. in press). The abundances of foraminiferal tests is variable (Fig. 4), between around 300 to less than 50 which is a feature of samples from Cenomanian chalk-chalk marl rhythms. This may be a result of orbital forcing on the biota but a greater sample resolution would be required to confirm this supposition. The p:b ratio is much reduced, compared to Goban Spur, which reflects the higher diversity and abundance of the benthonic foraminifera and the lower planktonic diversity outlined below.

The planktonic assemblage has the same species composition as Goban Spur (Fig. 4) except it largely lacks the deepest water

rotaliporid species. *R. deecki* is absent and *R. greenhornensis* is only occasionally represented. In addition, *R. cushmani* forms a far smaller proportion of the total planktonic assemblage (usually under 25-30%) except for a marked increase in bed 1 of the Plenus Marls. This is a feature that may be picked out across the Anglo-Paris Basin and probably represents a marked deepening of water depth at the start of the deposition of this unit (Leary 1987; Jarvis et al. 1988).

The benthonic assemblage is diverse (36 species and varieties) and the assemblage displays much more intra-specific variability, in terms of specimen sizes and morphology, as exemplified by the nodosariids and marssonellids (Fig. 4). Most of the benthonic species found at Goban Spur are present at Dover but, significantly, within the nodosariid population the morphotypes possess a very high degree of ecophenotypic variation. In addition, the Dover assemblage contains species of the genera *Ataxophragmium, Pseudospiroplectinata, Gyroidinoides* and *Plectina* (Fig. 4). The assemblage is compatible with a middleinner shelf positioning according to Sliter and Baker (1972).

Conclusions

The late Cenomanian foraminifera of Goban Spur represent a much deeper water assemblage than the coeval assemblages from the on-shore sections of southern England, as exemplified by Dover (Table 1). The deeper water facies not only permitted the fuller representation of the deep water planktonic morphotypes

(*Rotalipora*) but exhibited a lower diversity benthonic assemblage with low ecophenotypic variation. This latter situation is in contrast to the modern benthonic foraminifera where abyssal plain assemblages are the most diverse (Murray, pers. comm.). The reverse situation in the chalf seas may well be a consequence of the higher extinction rates of deep water foraminifera during oceanic anoxic events and their low recolonisation rates. In this case the deeper water assemblage may not have fully recovered from the late Albian OAE. Placing absolute values on the depth of deposition of these two areas is problematical and it is thought by the writers best to maintain only the relative nature of the two depths.

Table 1. Comparison of the Late Cenomanian foraminifera from Goban Spur and Dover.

	Goban Spur	Dover
Planktonic Foraminifera	full late Cenomanian Assemblage containing abundant deeper water *Rotalipora greenhornensis* and *Rotalipora deecki* Rotaliporids comprise > 50% of planktonic assemblage	full late Cenomanian assemblage but with *R. deecki* absent and *R. greenhornensis Poorly represented* Rotaliporids from < 25% of planktonic assemblage (except for slight increase in bed 1 Plenus Marls)
Benthonic Foraminifera	Low diversity assemblage with little intraspecific test variation	High diversity assemblage coupled with a high degree of ecophenotypic variation
Depositional setting	At least outer shelf open ocean environment with stable deep water conditions	Middle-Inner shelf with limited depth. (Sea level rise in Bed 1 Plenus Marls)

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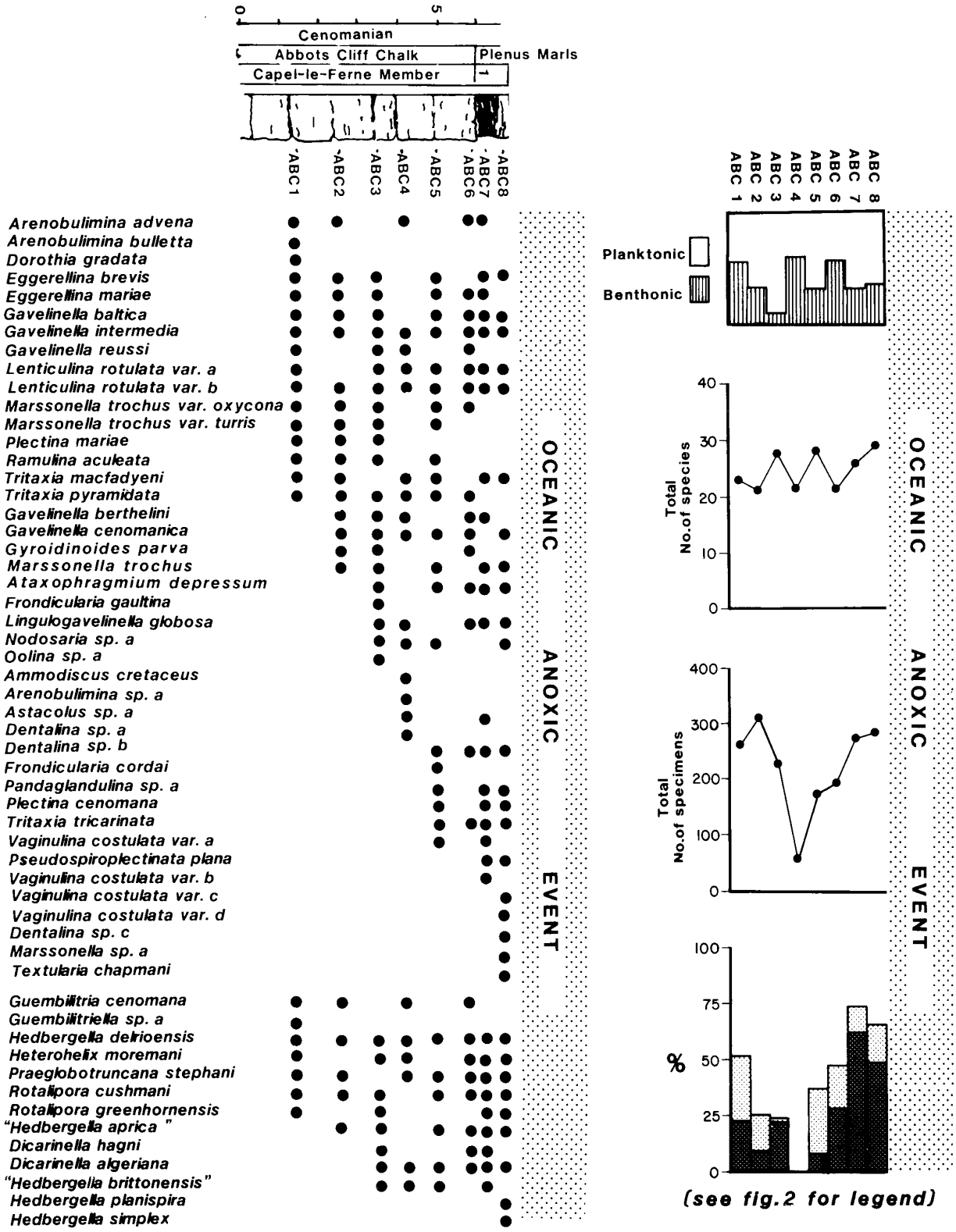

Figure 4. Foraminifera from Dover.

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