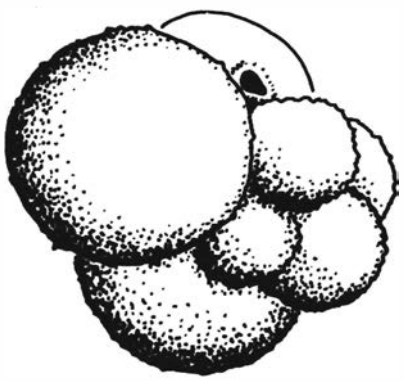

FORAMINIFERA IN THE LOWERMOST DANIAN OF DENMARK

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The faunal change in foraminifera at the Cretaceous/Danian boundary is well known. Among the benthic foraminifera, the disappearance of the genus *Stensioeina* and *Bolivinoides decorata* and *B. draco* groups is conspicuous.

The following list of species occurring in the Maastrichtian white chalk of Denmark and continuing into the Danian was given by Hofker (1966a):

Stilostomella spinosa Hofker
Neoflabellina numismalis (Wedekind)
Marssonella oxycona (Reuss)
Verneuilina limbata Cushman
Reusella cimbrica (Troelsen)
Bolivina (Tappanina) selmensis Cushman
Coleites reticulosus (Plummer)
Osangularia lens Brotzen
Gavelinonion nobilis (Brotzen)
Gavelinopsis involuta (Reuss)
Gavelinopsis bembix (Marsson)
Gaudryina supracretacea Hofker
Textularia agglutissima Hofker
Eponides frankei Brotzen
Bolivinoides paleocenica (Brotzen)
Cibicides beaumontianus (d'Orbigny)

To this may be added *Bolivinia* sp. and *Bolivinoides delicatula*, which continue to the middle Danian in certain facies.

Bolivinia basbeckensis gigantea Hofker, 1960, the very common *"Discorbis"* sp. 101 (Plate 1) and *Seabrookia* sp. can be regarded as guide fossils for the lowermost Danian.

The Danian limestones contain planktic foraminifera commonly in great quantities. They have been described from Stevns Klint by e.g. Hofker (1960, 1962b), Berggren (1962a) and Bang (1971). In the last mentioned paper, characteristic early forms of *Eoglobigerina* from Stevns Klint were described (e.g. *E. danica* (Bang) n. subsp. 1), which are now shown to be stratigraphically significant for the earliest Danian deposits of the whole region.

On the basis of a large number of sections in quarries and boreholes a lower Danian zone below the *Globoconusa daubjergensis* Zone can be established. This zone, the *Eoglobigerina danica* Zone, contains the very characteristic *E. danica* subspecies mentioned above as the only rotaliform globigerinacean. The upper boundary of the zone is defined by the first occurrence of *Globoconusa daubjergensis*.

In addition to the genus *Eoglobigerina*, the *E. danica* Zone is characterized by *Chiloguembelina* spp., *Woodringia* sp. and *Guembelitria* spp. Species of *Chiloguembelina* can be found at intervals throughout the Danian, but two species, at least, are restricted to the lower Danian. The genus *Guembelitria* is represented both in the Maastrichtian and in the Danian. Thus the very high-spired species *G. cretacea* Cushman seems to occur only in the Maastrichtian. Another very small *Guembelitria* sp. occurs also in the Maastrichtian. In the LM it resembles *Globoconusa daubjergensis*, but in SEM it can be distinguished on the basis of its bigger aperture, which always has a distinct lip. It may have given rise to Brotzen's comment (1959, p. 17) that *G. daubjergensis* appears in the uppermost part of the Maastrichtian of Sweden.

Besides the common occurrences around the Maastrichtian/Danian boundary, *Guembelitria* spp. tend to appear again in a special facies in the uppermost Danian. In this context it is interesting that Lutze & Pflauman (unpubl., paper read at the Plankt. Conf. Kiel 1974), in a faunal analysis of the Persian Gulf showed a *Guembelitria* to be the dominant gulf species, especially in shallow water. These workers compared the distribution with the results of Sliter (1972), who found Californian Cretaceous heterohelicids specially adapted to shelf sea conditions.

The environment of sedimentation is of special importance to foraminifera distribution as seen in the light of the theories advanced by Tappan (1968) and Worsley (1971) on the rise of the CCD at the end of the Cretaceous and it would be desirable to demonstrate the quantity of the planktic foraminifera in an attempt to elucidate the environment. The planktic foraminifera are very small, many below 50 µm, and only a few *Eoglobigerina* and a single species of *Chiloguembelina* reach 100 µm. This raises a practical obstacle for a planktic/benthic index. Instead, a scheme is given of the occurrence in some sections from northern Jylland (see Håkansson & Hansen, this volume).

NOTES ON DANIAN SECTIONS

Stevns Klint (see also Surlyk, this volume)

The Cerithium limestone at Højerup contains planktic foraminifera in most samples, but mostly diagenetically altered and in a very poor state of preservation. Owing to bioturbation it may be difficult to find an unmixed *E. danica* assemblage.

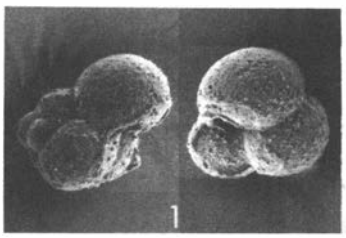
At the quarry of Boesdal (3 km SW of Højerup) a very rich planktic assemblage can be found in the lower Danian bryozoan limestone. The common Danian foraminifera *Globoconusa daubjergensis* (Bronniman), *Subbotina pseudobulloides* (Plummer), *S. trilobulinoides* (Plummer), *Eoglobigerina danica* (Bang) and *Planorotalia compressa* (Plummer) are accompanied by a number of other forms. Some of these have been described by Morozova from the Crimea as the *Eoglobigerina taurica* assemblage, comprising the following morphospecies: *Eoglobigerina eobulloides* Morozova, *E. tetragona* Morozova, *E. pentagona* Morozova, *E. hemisphaerica* Morozova, and *E. taurica* Morozova. She considered this assemblage to be older than the type Danian (*G. taurica* Zone, Morozova 1959, 1961).

A number of *Chiloguembelina* spp., *Woodringia* sp. and *Guembelitria* sp. from the lowermost zone still occur. This assemblage is here referred to the *E. eobulloides* Subzone of the earliest part of the *G. daubjergensis* Zone.

A well preserved fauna is also found within burrows at Højerup, dominated by *E. danica* subspp. and to a varying degree, elements of the *E. eobulloides* assemblage.

Pl. 1. *Eoglobigerina danica* Zone (lowermost Danian) x 300.

Fig. 1: *Guembelitria* sp. Figs 2, 3, 7, 8, 15: *Chiloguembelina* spp. Fig. 9: Juvenile *Woodringia* or *Chiloguembelitria* sp. Figs 4, 5, 10, 11, 13, 16: *Eoglobigerina danica* subsp. 1. Figs 6, 14: *'Discorbis'* sp. 101. Fig. 12: *Seabrookia* sp.
Figs 5 and 6 with micro-borings.
Figs 9, 10, 12, 15 from Kjølby Gaard sample KG 21. Fig. 14: Nye Kløv sample 4/8. Figs 1-6: Hanstholm well No. 10, lab.no. 293. Figs 8, 11, 13, 16: Hanstholm well No. 10, lab.no. 294. Fig. 7: Hanstholm well No. 3.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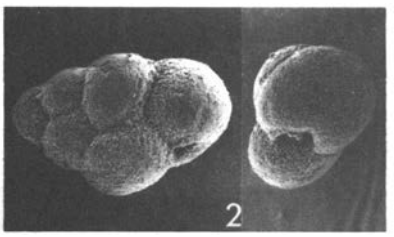
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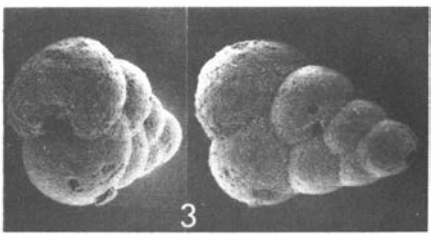
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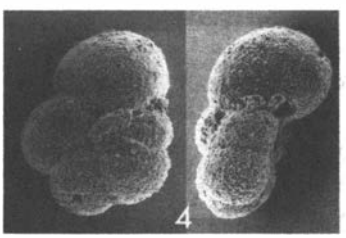
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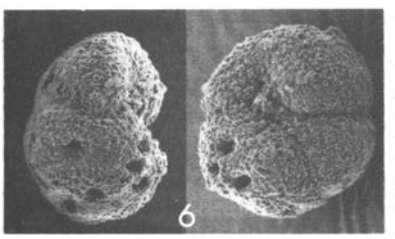
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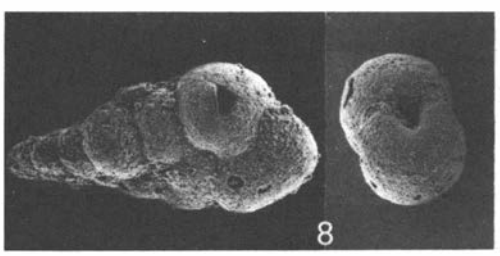
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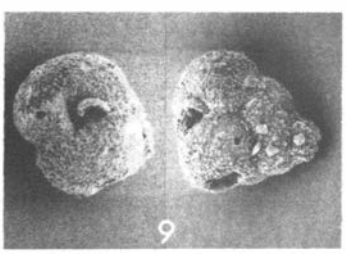
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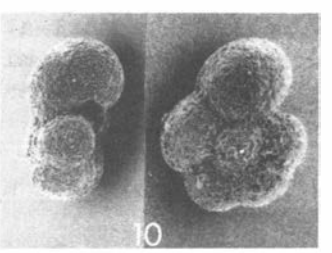
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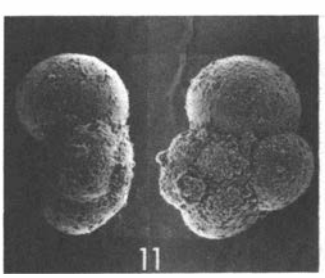
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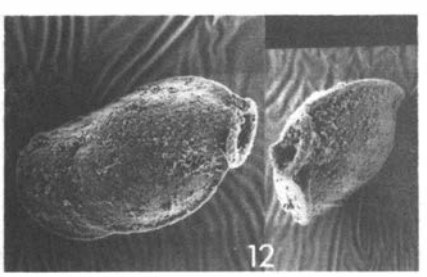
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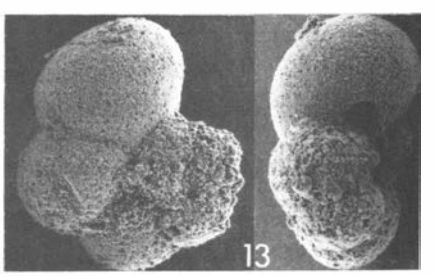
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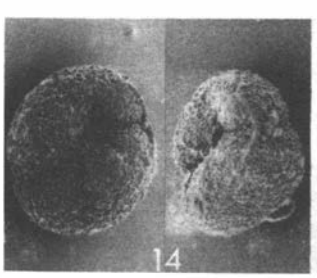
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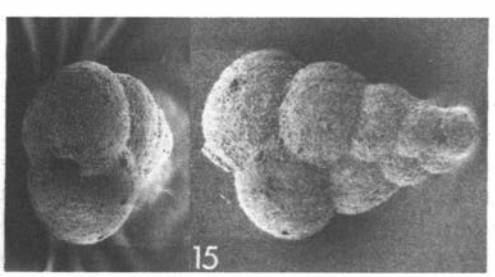
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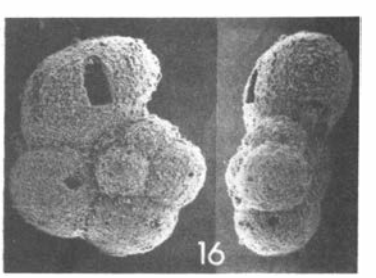
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Dania

Local structures (see Baartman Fig. 1 *in* Rasmussen, 1978) influence the section. In samples from the lowermost part of the Danian (see section in Håkansson & Hansen, this volume) large quantities of reworked Maastrichtian foraminifera occur together with very few foraminifera belonging to the *G. daubjergensis* Zone. Burrow fills within the hardground have shown a very well preserved fauna, dominated by large *Globoconusa daubjergensis*.

West of Dania, the lowermost Danian (*E. danica* Zone) has been found in the wells DGU file No. 33.406 and 39.393.

Eerslev and Legind

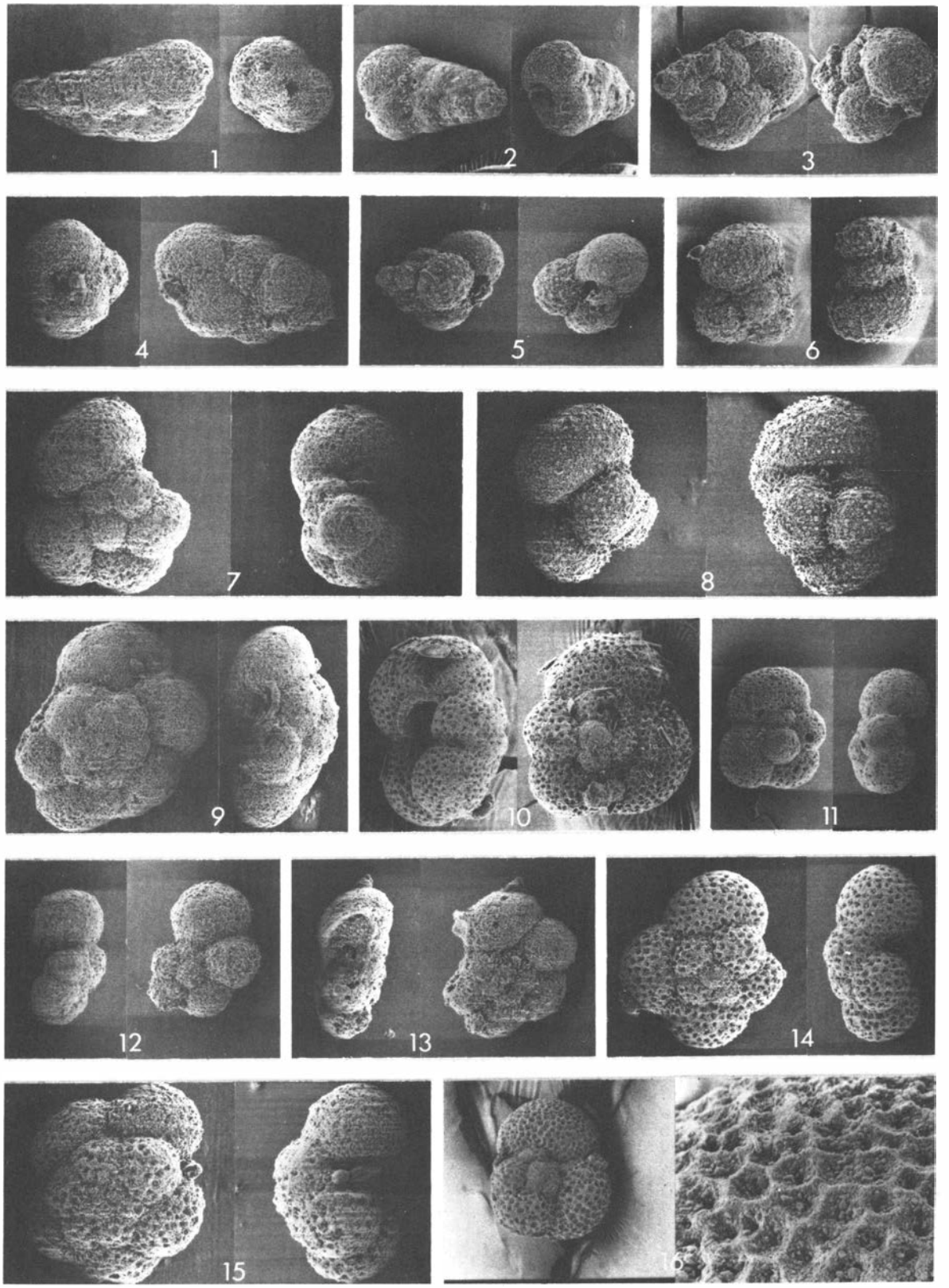
These quarries are influenced by their location on salt diapirs. In Legind the marl at the Maastrichtian/Danian boundary and the limestone above contain a mixture of Maastrichtian and Danian foraminifera (*E. danica* Zone and *G. daubjergensis* Zone).

Kjølby Gaard and Nye Kløv

The lowermost Danian is well developed in these sections. Data given in Håkansson & Hansen (this volume) show that the earliest samples from the Danian only contain reworked Maastrichtian planktic foraminifera (mostly *Heterohelix*) and above this the *E. danica* and *G. daubjergensis* Zones can be identified.

Pl. 2. *Eoglobigerina eobulloides* assemblage, Boesdal. (L. Danian). x 250, apart from Fig. 16: x 200, detail x 1000

Figs 1, 2, 3: *Chiloguembelina* spp. Fig. 4: *Woodringia* sp. Fig. 5: *Guembelitria* sp. Figs 6, 8: *Globoconusa daubjergensis*. Fig. 9: *Planorotalia* cf. *compressa*. Fig. 13: *Planorotalia compressa*. Fig. 11: *Eoglobigerina eobulloides*. Figs 7, 12: *Eoglobigerina danica* s.l. Figs 10, 16: *Subbotina triloculinoides*. Fig. 16 with detail of surface of last chamber. Fig. 14: *Subbotina pseudobulloides*. Fig. 15: *Eoglobigerina hemisphaerica*.
Figs 1, 4, 7, 8, 9, 13, 14, 15: sample Boesdal 77/8. Figs 2, 3, 5, 6, 10, 11, 12: sample Boesdal 77/4. Fig. 16: sample Boesdal 176.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North Sea

In the Danish part of the North Sea, the Danian and Upper Cretaceous have been examined in series of exploration drillings (Rasmussen, 1974, 1978). In all drillings the boundary has been determined by petrophysical logs, in this case Borehole Compensated Sonic Logs, at the log marking indicating base of "Tight Zone" (Lieberkind, 1977). So far the lowermost Danian has been found in Danish North Sea T-1x, while parts of the Danian sequence are missing in Danish North Sea E-2, M-1, and N-1.