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FORAMINIFERA FROM THE CRETACEOUS OF SOUTH-LIMBURG, NETHERLANDS. LIV.

SOME SMALL ROTALIIDS IN THE LOWER PALEOCENE ABOVE THE Md IN THE QUARRY CURFS, NEAR HOUTHEM, SOUTH-LIMBURG.

by J. HOFKER

In the more or less glauconitic limestone above the hard ground covering the Md in the Western part of the quarry Curfs, the first 2 m have a fauna which very much resembles that found in the holes in the hard ground underneath (Me); but above a hard layer with many macrofossils, the fauna abruptly changes; especially two species become dominant, which are described here.

In the Tuffeau de Ciply, covering the glauconitic limestone in many drill-holes and shafts more to the North West in South Limburg, a characteristic species is *Globorotalia pseudomenardii* Bolli. This sudden appearence of a keeled *Globorotalia* just above the lowest Paleocene glauconitic limestone with all characteristics of keeled Tertiary and Recent keeled features raises the surmise that in a time before that in which the base of the Tuffeau de Ciply (in which G. *pseudomenardii* already is very common) was sedimented, the first keeled *Globorotaliae* were already present. I believe that in the two upper meters of the glauconitic limestone such a primitive keeled *Globorotalia* is present.

Globorotalia praepseudomenardii nov. spec.

Test much compressed, with acute margin, slightly elongate, with lobulate periphery. Dorsal side with all chambers visible, slightly convex, later chambers slightly inflate; 6-7 chambers in the last formed whorl, sutures slightly depressed, slightly curved. Wall smooth or slightly rough, totally pierced by fine but distinct pores, just as they are found in *Globotruncana* and *Globorotalia*. Margin acute to slightly keeled, without pores in the keel. At the slightly more convex ventral side, 7 chambers are visible. Chambers here more strongly inflate, with distinctly depressed radial sutures, leaving a distinct umbilical cavity free in the centre. Walls pierced by the same kind of pores as found on the dorsal side. Near to the umbilical cavity the chambers show highly developed tena with

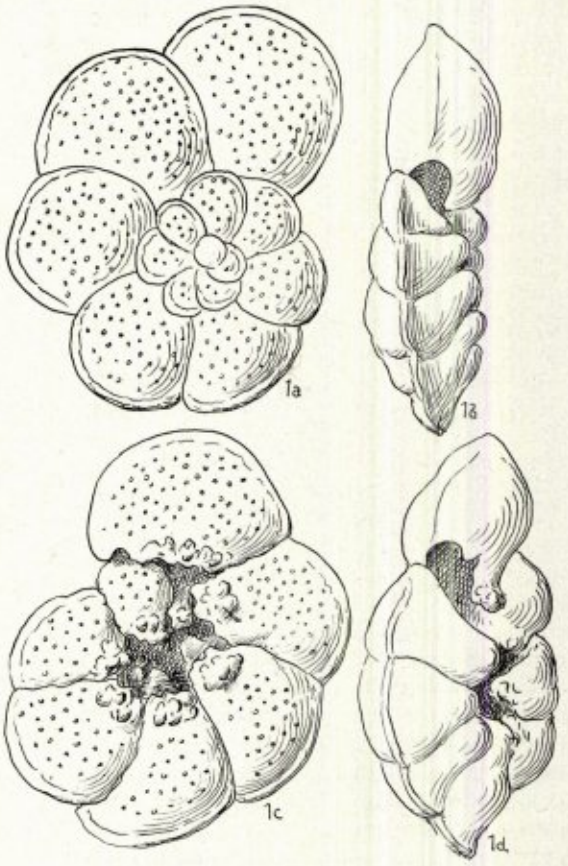

Fig. 1. *Globorotalia praepseudomenardii* nov. spec., from 2,00 m. above the top of the upper Md, quarry Curfs, near Houthem, South-Limburg. × 185. a: dorsal side; b: apertural view; c: ventral side; d: obliquely from aside to show the aperture and the raised tenon.

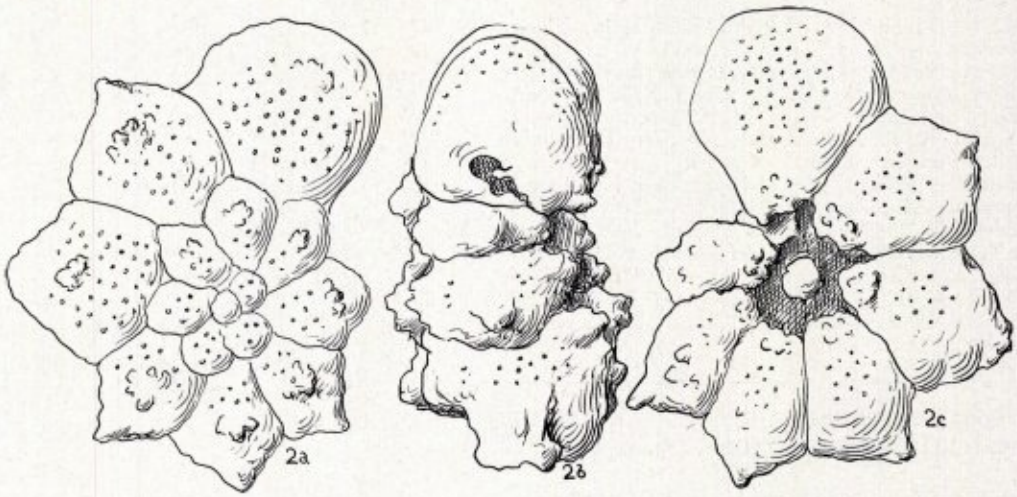

Fig. 2. *Pararotalia globigeriniformis* (Van Bellen), same locality and level. × 185. a: dorsal side; b: apertural face; c: ventral side.

strongly roughened surface. At the last formed chamber the deuteroforaminal more marginal and sutural part of the aperture is crescent-shaped; more to the proximal part of the chamber the distinctly raised roughened tenon is found, whereas the proximal part of the foramen compositum (the protoforaminal part) opens into the wide umbilical cavity. All older chambers opening with this proximal part of the foramen compositum into the umbilical cavity.

Lager diameter of tests about 0,3 mm, thickness about 0,08 mm.

This species thus shows characters which point strongly to *Globorotalia* of which the type-species, *G. tumida* Brady, shows similar pores, also a depressed keeled test, a much smaller but also open umbilical cavity, the foramen compositum with distinct tenon, etc. The only difference is the more open umbilicus and the tendency to form raised tena as they are found in many other early keeled *Globorotalia*, such as *G. velascoensis* and *G. lehneri*, where the umbilical cavity also is distrinct.

It is obvious that this part of the glauconitic limestone above the Md in the quarry Curfs has nothing to do with the Danian but must already be true Paleocene; keeled *Globorotalia* does not appear in the Danian. Moreover, only rare specimens of aberrant forms of *Globigerina daubjergensis* are found here which shows that this form already is disappearing.

Pararotalia globigeriniformis (Van Bellen).

Globorotalia globigeriniformis Van Bellen, 1946, Med. Geol. Stichting, C, V, 4, p. 71, pl. 10, fig. 10—12.

This species is abundant in the Tuffeau de Ciply and the Calcaire de Mons; it is a true *Pararotalia*. In the two meters of upper glauconitic limestone above the Md in the quarry Curfs it is one of the commoner species but occurs here only in a more primitive form, and as in most Foraminifera, in a much smaller size than in the later Tuffeau de Ciply.

Test somewhat elongate. At the dorsal side all chambers visible, 7-8 in the last formed whorl.

Most chambers somewhat pointed at the margin, often with distinct spine, so that the periphery often is star-like. At the dorsal side each chamber much inflated, with depressed sutures, the inflation often accentuated by spinous protuberances. Pores only distinct in the later chambers; they are rather fine but distinct, such as is the case in all *Pararotalia*. Margin strongly rounded, somewhat irregular by the spines. At the ventral side 7-8 chambers visible, with distinct radial depressed sutures. Each

chamber ending at the relatively large umbilical cavity by raised tubercules. In the centre of the umbilical cavity a more or less distinct irregular chalk knob which may be formed by older raised parts of chambers. Aperture areal with a connection toward the suture and a distinct dent (rest of toothplate) dividing the opening into two parts, as in all *Pararotalia*.

In the glauconitic limestone most specimens are small (greater length about 0,4 mm), in the Tuffeau de Ciply above they reach a much larger diameter. The abundancy in which this species suddenly appears above the hard fossiliferous layer in the glauconitic limestone strongly points to the age of the Tuffeau de Ciply which is already middle-Paleocene according to Foraminifera. So, to the belief of the author, there is no doubt as to the Lower Paleocene age of the glauconitic limestone above the 2 m of that limestone below the fossiliferous hard banc which was called by the author the Me and which, according to the fauna of the fillings of the hollows in the hard ground at its base, already is lowest Paleocene also, and not Danian (See no. LIII).

THE AGE OF THE Ma DEPOSITS

by R. G. BLEZARD

The age of the Ma deposits appears through anomalous zonal correlation to be prone to misinterpretation. From foraminiferal considerations, Hofker (1959) has proposed that it should be a contemporary deposit to the Danish Fiskeler. Whilst the foraminiferal comparison is not disputed, the lithology of the two deposits shows little resemblance (Blezard 1961) and the evidence of Belemnoids is not in keeping with the foraminiferal evidence.

Brotzen and Birkelund (1961) have suggested the presence of *Belemnella casimirovensis* (Skolozdrowna, 1932) as an indication of the Uppermost Maastrichtian beds, but although this belemnoid is present at Stevns Klint it is not found in the Maastricht tuff until the Md zone.

Both the Ma and Fiskeler contain derived foraminifera of the Pseudotextularia zone. Hofker (1959) has also shown the derived foraminifera to be in an identical orthogenetic state of development with a corresponding temporary cessation in development during the regression-transgression movement. It is, however, possible that the corresponding development states are fortuitous and are merely a result of climatic aclimatisation. The warmer conditions of the Limburg section of the Maastrichtian sea may have accelerated the development of foraminiferal species — whilst in the cooler and possibly deeper Stevns section a similar development stage may not appear until a later period.

Birkelund (1957) stated that it has not been possible to ascertain whether the lower boundary of horizons with *Pseudotextularia elegans* and the lower boundary of layers carrying *Belemnella casimirovensis* are in agreement.

The work of F. Schmid (1959) — who was in charge of the Belemnite revision for the International Commission studying the Maastrichtian stage — is of great importance in this respect. He found the presence of *Belemnitella junior* NOWAK in the coprolitic beds (Ma) Mb and Mc but in the upper beds of the tuff (Md) a new form is noted *Belemnitella* ex. gr. *junior* NOWAK — *Belemnella casimirovensis* (Skolozdr.) and variants — which characterise the Upper Maastrichtian.

From this it appears that the Ma deposit, when compared to the Stevns Klint and its belemnite distribution (Birkelund 1957), is a much older deposit. The Fiskeler of the Stevns region will approximate to the highest horizons of the Md, — and at these horizons the disappearance of Ammonites, Belemnites and Inocerami becomes apparent.

The true position of the Ma is not easy to place but one can anticipate strongly that further faunal correlation may place it as early Upper Maastrichtian — coinciding with Troelsen's zone IV ß (in the middle of the Upper Constrictus zone).

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