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

SOME FORAMINIFERA FROM THE LOWER PALEOCENE ABOVE THE MD IN THE QUARRY CURFS, NEAR HOUTHEM.

by J. HOFKER

In LIII and LIV, I gave the descriptions of several species of Foraminifera from the very rich fauna which is found in the holes of the hard ground covering the Md, and I will describe here some more forms, found in samples in the limestone above the Me in the quarry Curfs. They all point to early Paleocene with hints towards the Montian.

Discopulvinulina trinitatensis (Cushman and Renz). Test oval, strongly compressed; dorsal side slightly convex, ventral side nearly flat. Margin slightly keeled or rounded, with distinct poreless limbate border which continues in the spiral suture and often also forms limbate sutures between the chambers, the wall of which are slightly inflate. Walls with very fine pores. At the ventral side a more or less large umbilicus in the centre, sutures of the six chambers slightly curved, depressed. Aperture a sutural slit covered by an irregular lip; protoforamen inconspicuous. Around the umbilical cavity small pustules at the older chambers.

The species has been described by Brotzen as *Planulina limbata* Brotzen from the Lower Paleocene of Sweden (1948, geol. Sver. geol. Unders., C, 493, p. 85, pl. 13, fig. 7); since Cushman and Renz described it in 1942 (C.L.F.R.C., 18, p. 10, pl. 3, fig. 5), *Planulina limbata* is a synonym of *Discorbis midwayensis* Cushman var. *trinitatensis* Cushman and Renz. (Fig. 1).

Ruttenia geleenensis Van Bellen. Test at the dorsal side strongly convex, each chamber with a caliciform protuberance and many pustules roughening the surface. The walls of the chambers steeply bending towards the acute margin which also is covered by pustules and points. Distinct pores only visible in the walls of the last formed chambers, of which about 6 are visible. Ventral side flat, covered with small pustules directing towards the periphery. The chamberwalls leave a small umbilical cavity free; no distinct pores visible at the ventral side. Aperture sutural, near to the margin, with distinct bordering lip or neck.

This small species was described for the first time by Van Bellen from the Montian of Bunde (Med. geol. Stichting, C.V., No. 4, 1946, p. 76, pl. 11, fig. 13—15); his description and figures are rather bad, since he used badly preserved material. Bermudez (Bol. geol., 2, No. 4, 1952), when discussing the genus *Ruttenia* Pijpers, directed the attention to *Eponides tubulifera* (Heron Allen and Earland), also having those caliciform protuberances on the dorsal side; but this seems to be only a convergance, since the author proved (Siboga Rep., IVa, III, 1951, pp. 392—396) that that form belongs to *Alabamina*. Well preserved material from the Montian shows that Van Bellen's species is the same as that described here. The occurrence of the species already in the limestone above the Me strongly points to a Paleocene age of that limestone with tendences towards the type-Montian. (Fig. 2).

Reussella crassa (Brotzen). Test small, elongate. Chambers arranged triserially, each chamber with a small indentation at its basal suture. Angles rounded. Aperture more or less terminal, but showing a closed part towards the suture, mostly with distinct collar. The walls are hyaline, provided with two kinds of pores; there are some pores scattered near to the indentation, always with a distinct collar around them, and there are normal pores at the angle margin of each chamber, also distinct but without collar.

This species was described by Brotzen from the Paleocene of Sweden; he called it *Pyramidina crassa*, since Brotzen made for those *Reussellae* which show the tendency to get a terminal aperture a separate genus, *Pyramidina* (1948); the author proved that there is no reason to do so (1957, Geol. Jahrb., Beih. 27, p. 204). It occurs in the uppermost Danian in scattered specimens but becomes very abundant in the Lower Paleocene of Denmark and Sweden. It is common in the limestone above the Me. (Fig. 3).

Neoconorbina paleocenica nov. spec. Test small, rounded, with slightly lobulate periphery. At the convex dorsal side all chambers visible, 4—5 to a coil, with strongly curved slightly depressed or smooth sutures, apex rounded,

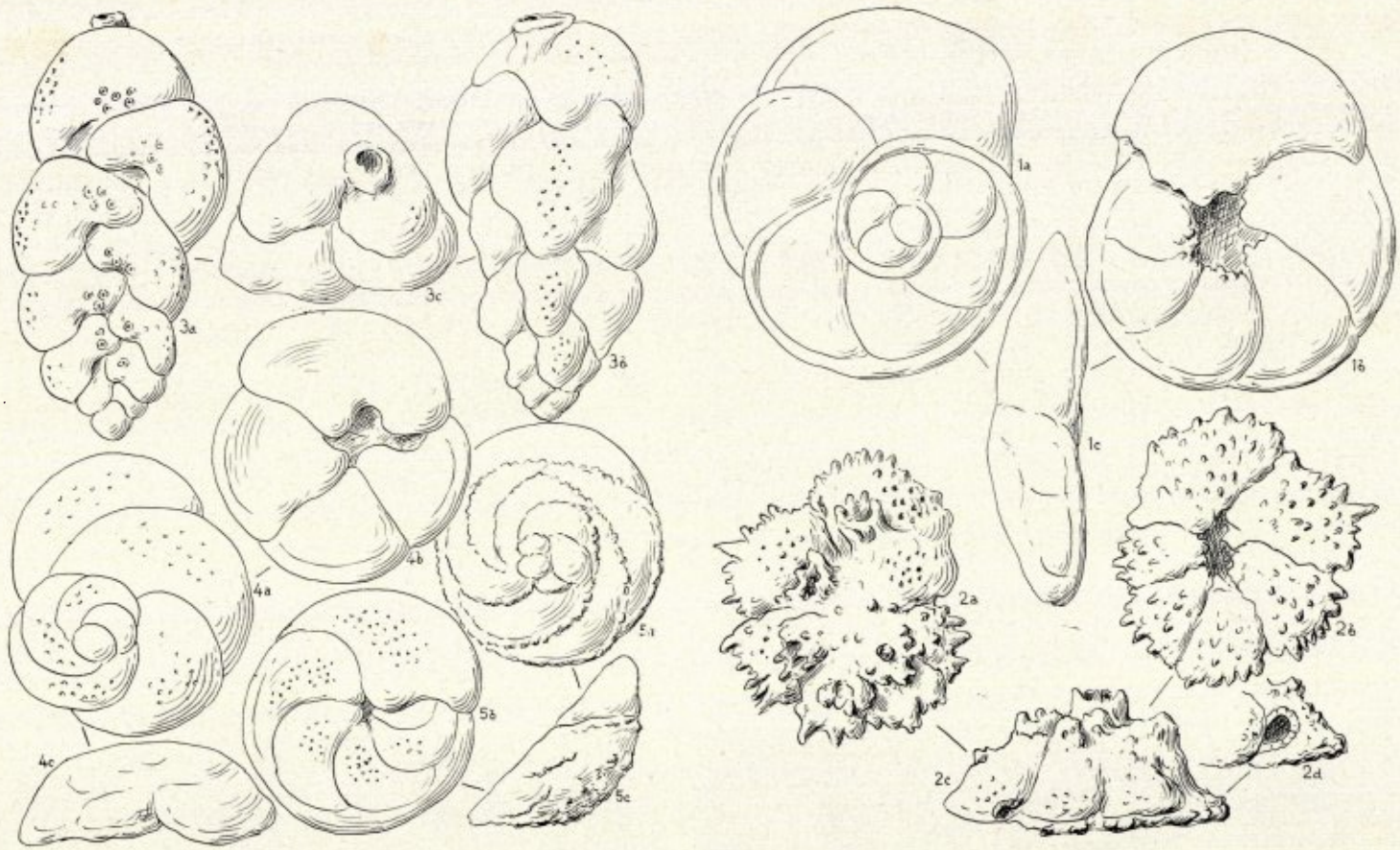

Fig. 1. *Discopulvinulina trinitatensis* (Cushman and Renz). Quarry Curfs, Lower Paleocene; × 185. a, dorsal side; b, ventral side; c, side view.
Fig. 2. *Ruttenia geleenensis* Van Bellen. Quarry Curfs, Lower Paleocene; × 185. a, dorsal side; b, ventral side; c, from aside; d, aperture.
Fig. 3. *Reussella crassa* (Brotzen). Quarry Curfs, Lower Paleocene; × 185. a, flat side; b, angular side; c, apertural face.
Fig. 4, 10. *Neoconorbina paleocenica* nov. spec. Quary Curfs, Lower Paleocene; × 185. a, dorsal side; b, ventral side; c, side view.
Fig. 5. *Rosalina crenulata* nov. spec. Quarry Curfs, Lower Paleocene; × 185. a, dorsal side; b, ventral side; c, side view.

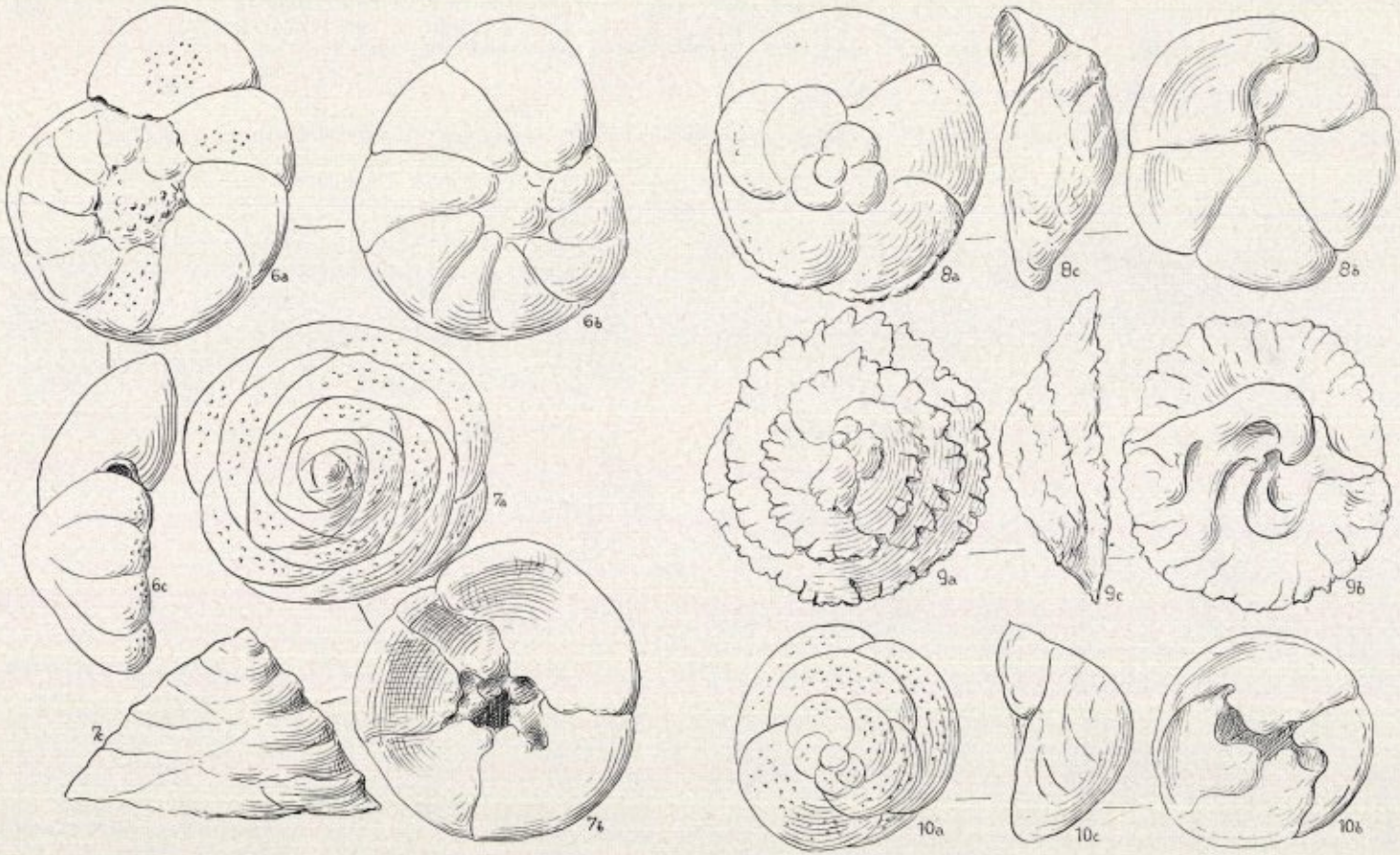

Fig. 6. *Gavelinopsis proprius* (Brotzen). Canal Albert, Belgium, near Vroenhoven. Lower Paleocene, sample Hofker 1172; × 185. a, ventral side; b. dorsal side; c,apartural face.
Fig. 7. *Neoconorbina pyramidata* nov. spec. Quarry Curfs, Lower Paleocene; × 185. a, dorsal side; b, ventral side; c, side view.
Fig. 8. *Trochammina* sp. Quarry Curfs. Lower Paleocene; × 185. a, dorsal side; b, ventral side; c, side view.
Fig. 9. *Discobolivina paleocenica* nov. spec. Quarry Curfs, Lower Paleocene. a, dorsal side; b, ventral side; c, side view; × 185.

margin acute. At the dorsal side only distinct pores in the walls. Ventral side flat or slightly concave, about 4 chambers visible, with slightly curved strongly depressed sutures. The last formed chamber shows a distinct tenon and a rather distinct indentation at the foramen, so that an umbilical hollow is left free in the centre. No pores at the ventral side.

Neoconorbina paleocenica differs from *Rosalina brotzeni* Hofker (Natuurhist. Maandblad, 50, 1961, p. 63, fig. 3) in having an acute margin, more distinct pores only at the dorsal side, whereas the chamberwalls at the dorsal side are not so inflated. The species is common in our samples and also occurs in the lower Paleocene of Denmark, above the Danian. (Fig. 4, 10).

Rosalina crenulata nov. spec. Test at the dorsal side convex, often slightly conical. Margin subacute. Ventral side flat or slightly concave. At the dorsal side the chambers are low and elongate with strongly curved sutures which are inflated and covered by small chalk buds (crenulate). At the ventral side about 5 chambers visible, with strongly curved slightly depressed sutures, leaving a very small umbilical hollow free. Last formed chamber with distinct tenon between the lobes. Only at the ventral side fine pores pierce the walls. Test rounded, small.

The species was found rarely in the limestone above the Me in the quarry Curfs and in the Paleocene of canal Albert, Belgium. (Fig. 5).

Gavelinopsis proprius (Brotzen). Test rounded to slightly elongate. Dorsal side convex, ventral one flattened, margin sub-acute. Aperture a crescent opening at the margin with a slit over the ventral suture. At the ventral side the first formed chambers often are covered by rough chalk and then invisible; sutures slightly depressed, slightly bent backward. Pores distinct, small in the Lower Paleocene. At the dorsal side the chambers are strongly overlapping, mostly leaving a distinct smooth centre free. Sutures here depressed, slightly curved. In the lower Paleocene no pores at the dorsal side, in Denmark in the higher Paleocene also pores in the dorsal walls of the last formed chambers.

This species begins its evolution in the Md, is very common in the Me and Lower Paleocene, and extinguishes in the Tuffeau de Ciply above. (Fig. 6).

Neoconorbina pyramidata nov. spec. Test on dorsal side conical, margin acute, ventral side strongly concave. At the dorsal side all chambers visible with indistinct sutures; the chambers are low, elongate; pores only in the dorsal walls, distinct, scattered. At the ventral side about 4-5 chambers visible, leaving a deep umbilical hollow free. Tenon small, pointed, and the chamber walls forming a strongly concave ventral side which gives the test a peculiar character when seen from that side.

The species was found in several specimes in the limestone above the Me in the quarry Curfs. (Fig. 7).

Trochammina sp. Test rounded, small, dorsal side convex, ventral side slightly concave, margin sub-acute. At the dorsal side all chambers visible, with strongly curved and slightly depressed sutures. At the ventral side about 5 chambers visible, without umbilical hollow. Last formed chamber forming a strongly curved suture with slitlike aperture ventrally. Walls finely agglutinated, without pores. The species is rare in the samples. (Fig. 8).

Discobolivina paleocenica nov. spec. Test rounded, flat-conical. At the dorsal side all chambers visible in the hyaline test with the typical insected sutures and margin. First chambers distinct, there is no spirilline first chamber. At the ventral side the strongly curved sutures of the last formed chambers with their protoforamen are clearly seen.

I described *Discobolivina* as having rotaline chambers from the beginning of the test (Foraminifera dentata, Spolia zool. Mus. Hauniensis, 15, pp. 170, pl. 25, fig. 25-29; pl. 26, fig. 1-3). So I bring this new species, with its hyaline poreless walls also to my genus *Discobolivina* and not to *Patellina*.

The species was figured as *Patellina* sp. by Brotzen (S.G.U., C. 493, p. 71, pl. 9, fig. 6). The specimens described by Cushman (C. C. L. F. R., 20, p. 45 1944) from the Midway and by Toulmin (Journ. Pal., vol. 15, p. 599) from the lower Wilcox all may belong to the same species, as Brotzen mentions already. *Patellina*-like forms are not found in the Tuff Chalk, nor in the Danian of Denmark. In the samples from Curfs it is not even rare. (Fig. 9).