het Mijngebied, Heerlen) in supplying the samples used in the investigation and to the various specialists who gave advice on the identification of the fossil fragments extracted.

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FORAMINIFERA FROM THE CRETACEOUS OF SOUTH LIMBURG, NETHERLANDS, LIII.

Some smaller Rotaliid species from the holes in the hard ground over the Md in the quarry Curfs, near Houthem, West-side.

by J. HOFKER

In a sample, taken by B. J. Romein from holes, about 1,50 m below the boundary between the Upper Md and the Lower Paleocene, an extremely well preserved fauna was discovered (Sample 2708 Geol. Bureau). Some of the species found are described here.

Rosalina ystadensis Brotzen. Fig. 1.

Test small, round. Dorsal side convex, somewhat conical, smoothly finished, with about three whorls of chambers with strongly oblique and curved sutures, with fine pores allover the surface. Margin acute. Ventral side flat and slightly concave in the centre, about 6 chambers visible, with strongly curved sutures which are distinctly depressed. Last formed chamber with protoforamen and slit-like deuteroforamen with a distinct thickened tenon between; the tena of older chambers form small distinct knobs in the umbilical depression in the centre. Pores fine, except for the tena which are poreless.

The species was described by Brotzen, 1948, p. 72, pl. 9, fig. 9. It is not found in the upper Danian beneath the Paleocene greensands in Denmark, where it is common.

Rosalina koeneni Brotzen. Fig. 2.

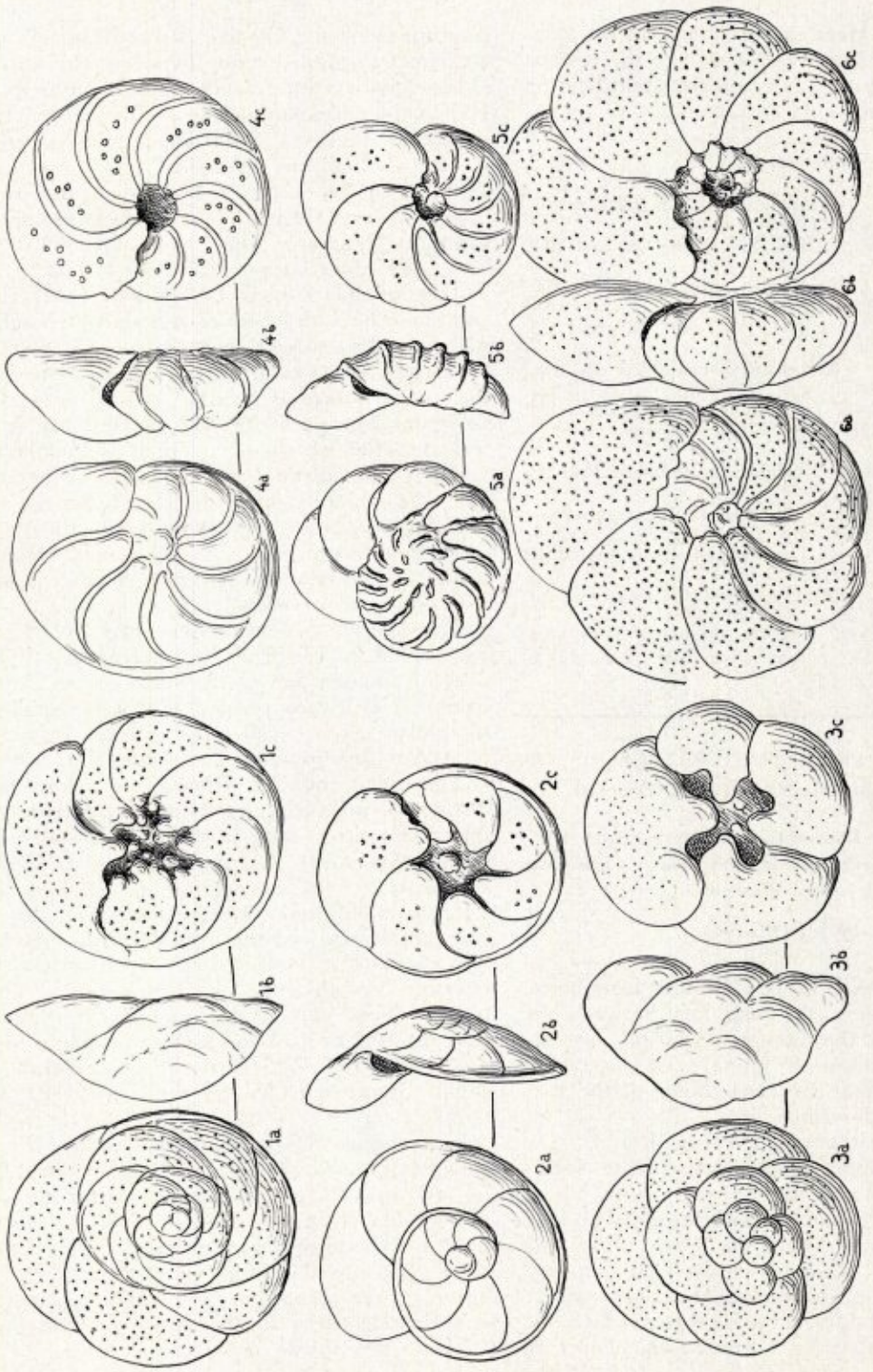
Test small, rounded. Dorsal side flatly conical, smooth, with about 2 whorls of chambers with slightly curved smooth sutures bending backward; no pores at the dorsal side; especially the spiral suture is distinct, all other sutures very thin. Margin acute, with poreless rim. Ventral side flat or concave, about 6-7 chambers visible, with distinct curved sutures bending backward, not reaching the centre. In the umbilical cavity a distinct chalk knob always visible. Few, distinct pores in the ventral chamber walls. Colour always brownish, as if the testwall consisted of aragonite.

The species has been described by Brotzen, 1948, p. 73, pl. 9, fig. 11 from the Paleocene of Sweden and is not found in the Danian below. It is a rare species, but occurred in the sample in several well-preserved specimens.

Rosalina brotzeni nov. spec. Fig. 3.

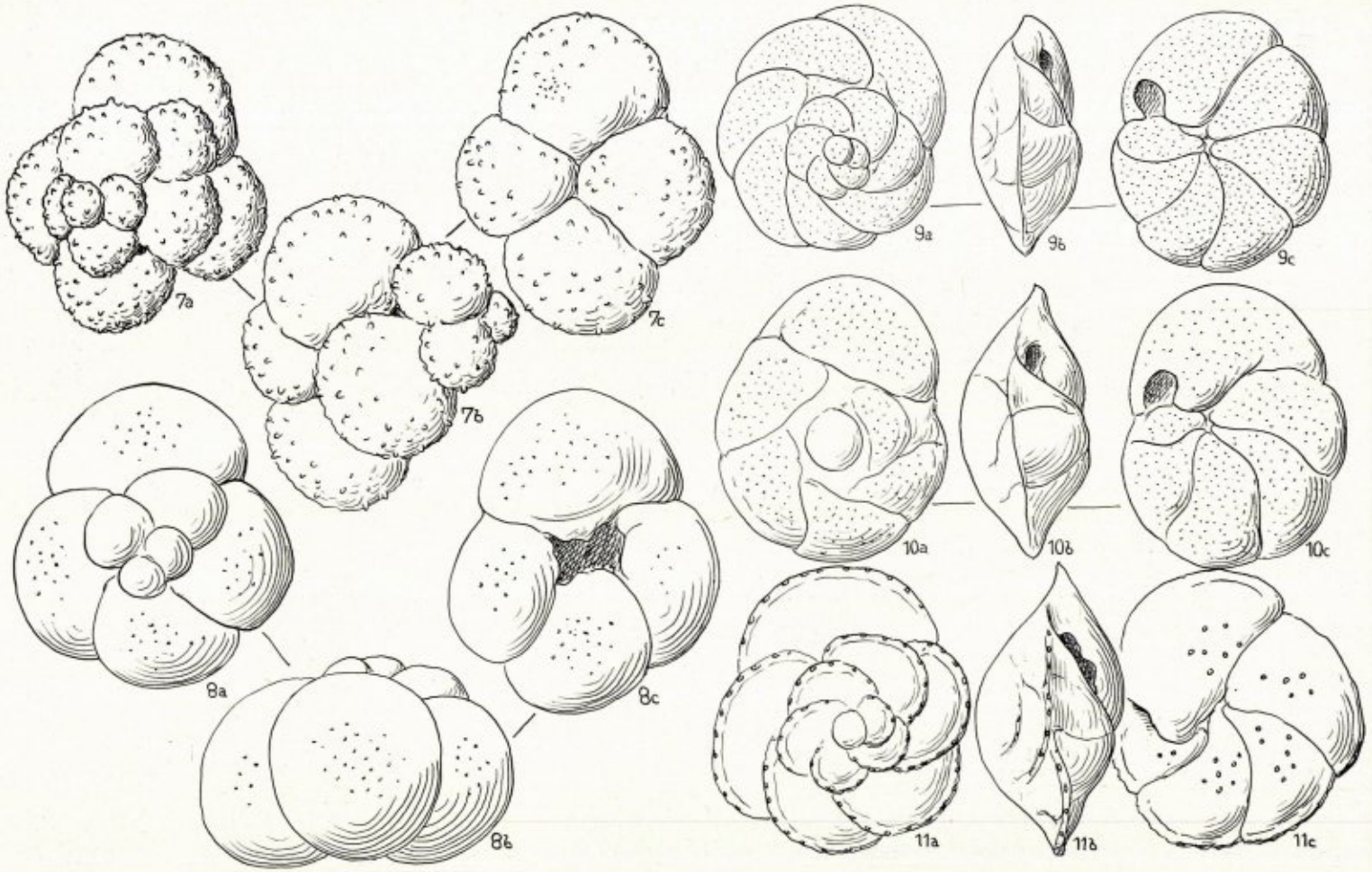
Test small, rounded. Dorsal side convex, with distinctly inflated chambers and depressed, rounded sutures, with very fine scattered pores in the thin walls. Margin rounded to slightly sub-acute. At the ventral side 4-5 chambers visible, with inflated chamber walls and depressed central parts of these walls, with open umbilicus. Each chamber forms a distinct tenon between proto-and deuteroforamen, which tenon covers part of the umbilical hollow, so that the free part of the umbilical hollow forms a star-like figure. Sutures at the ventral side radial, depressed. Walls with scattered fine pores.

The species has been mentioned by Brotzen as *Gavelinella*(?) sp., 1948, p. 76, pl. 9, fig. 10; in his specimen it seems that the very thin tena were partly broken away. It was typical for the lowest part of the Swedish Paleocene (greensands) and was refound by the author in the greensands at Hvallöse, Denmark. It does not occur in the upper Danian there. It is not rare in the sample studied.



1: *Rosalina ystadensis* Brotzen.
2: *Rosalina koeneni* Brotzen.
3: *Rosalina brotzeni* nov. spec.

4: *Gavelinella simplex* (Brotzen).
5: *Gavelinella sahlströmi* (Brotzen).
6: *Gavelinella umbilicata* (Brotzen).



7: *Globigerina daubjergensis* Brönnimann, *Catapsydrax*-form.
8: *Globigerina compacta* Hofker.
9; 10: *Pseudoparrella limburgensis* Visser; 9, microspheric; 10, megalospheric.
11: *Pulsiphonina elegans* Brotzen.

All specimens from sample 2708, Geologisch Bureau, Quarry Curfs, near Houthem, South-Limburg, Netherlands, in holes of the hard ground covering the uppermost Maestrichtian Tuff Chalk, from about 1,50 m below the boundary Md-glauconitic limestone.
a, dorsal side; b, sideview; c, ventral side. All figures × 185.

Gavelinella simplex Brotzen. Fig. 4.

Test small, hyaline, slightly oval in shape, strongly compressed. Dorsal side slightly convex, with marginal sides forming a trapezoid shape. Dorsal side with about eight chambers with distinct sutures curved backward, chambers overlapping most of the former whorls. Margin sub-acute. In the dorsal chamber walls no pores visible. Ventral side flat, with small but distinct open umbilicus. The lips at the ventral umbilical part of the apertures fuse, forming a sharp rim round the umbilical cavity. At the ventral side about 8 chambers visible, with strong, slightly inflate curved sutures. At the ventral side distinct scattered pores in the chamber walls. Aperture a slit at the ventral suture, near to the margin.

Brotzen described this species from the Paleocene of Sweden, 1948, as *Cibicides simplex,* p. 83, pl. 13, fig. 4. His Fig. 5, also named so, is not the same species. The species is a typical *Gavelinella,* since the septa are double, and the dorsal wall is without pores; only the lips around the ventral umbilicus are small and fused together into a rim. The species is fairly common in the Danish Paleocene, as well in the Swedish one, and may be found, in somewhat more primitive forms, in the Danian underneath. It is also found in the Tuff Chalk in Holland.

Gavelinella sahlströmi (Brotzen). Fig. 5.

Test small, slightly oval in shape, much compressed, hyaline. Dorsal side slightly convex, with distinctly raised hyaline sutures which are curved backward. The raised sutures in the centre of the dorsal side form typical ridges which can be seen very well in side-view. All chambers visible dorsally. Margin acute. Ventral side flat or slightly concave, with about 9 chambers visible, leaving a small distinct umbilical cavity. Sutures strongly curved at the sing together in a spiral rim around the umbilical cavity. Sutures strong by curved at the ventral side, flat or slightly depressed in the later chambers. Only at the ventral side with distinct scattered pores. Aperture a small ventral slit.

Brotzen described this species 1948, p. 85, pl. 17, fig. 1, as *Cibicides sahlströmi;* but it is a true *Gavelinella,* with double septal walls and pores only at the ventral side, though the lips at the umbilical parts of the apertures are nearly invisible. It is also found in the uppermost Danian in Sweden as well as in Denmark; it occurs rarely in the Md of the Tuff Chalk in Holland, and in the glauconitic limestone above.

Gavelinella umbilicata (Brotzen). Fig. 6.

Test much compressed, very hyaline. Dorsal side slightly convex, with about 8-9 chambers visible in the last formed whorl, which chambers are slightly overlapping the former whorl. Sutures distinctly curved backward, between the last formed chambers slightly depressed, between former chambers flat or even raised, and here thicker and hyaline. The whole dorsal wall pierced by fine distinct pores. Margin subacute, but mostly with pores, often slightly acute in large specimens and then without pores. At the flat or slightly concave side the chambers leave a large umbilical cavity free, in which the former whorls of chambers can be seen. The umbilical lips are fairly distinct in the last formed chambers but fuse into a spiral rim in the older ones. At the ventral side all walls pierced by the fine distinct pores except for the region at the umbilical lips, which are poreless.

Brotzen described this species 1948, p. 84, pl. 13, fig. 6, as *Cibicides umbilicata.* The septa, however, are double and it seems to me that the species is an offspring of *Gavelinella umbilicatiformis* Hofker from the Tuff Chalk in Holland; the latter species also is common in the Danian of Denmark; in the greensands above we find the typical *umbilicata.* Though the dorsal side also shows pores, the species may belong to *Gavelinella* rather than to *Cibicides.* It is a common species in the sample studied.

Globigerina daubjergensis Brönnimann. Fig. 7.

This species is common in the sample. Most specimens show the structure, described by me from the Paleocene above the Danian in Denmark as the *Catapsydrax*-form. These specimens do not show any more the ventral small aperture, but this is closed by the last formed chamber as in the "genus" *Catapsydrax.* This indicates that the age of the sample is not Danian any more, but already lower Paleocene (see: Hofker, Contr. Cushman Found, vol. 11, 1960, pp. 73-86).

Globigerina compacta Hofker. Fig. 8.

This species, common in certain samples from the Md and the Lower Paleocene above the Md, also was found in the sample in small specimens;

the wall is hyaline, the chambers are inflated, about 4 in the last formed whorl. At the ventral side there is an open umbilicus and the aperture is covered by a small lip. The pores are fine and scattered (see: Hofker, Natuurh. Maandblad, vol. 45, 1950, p. 53, fig. 16, 17, 21.

Pseudoparrella limburgensis Visser. Fig. 9, 10.

Test lenticular, compressed. Dorsal side convex, ventral one slightly more convex. Margin acute. At the dorsal side all chambers visible, with strongly oblique smooth sutures; in the megalospheric form only 1½ whorl visible, in the microspheric form 2 of them. At the ventral side each chamber slightly inflated with depressed sutures which are radial. Both sides with fine pores in the hyaline walls. Margin poreless. Aperture wide open, sutural, slightly loop-shaped, without any trace of tubercules, as they are found in *Pseudoparrella alata* (Marsson) which is so typical in the upper Tuff Chalk.

The megalospheric form shows about 5-6 chambers in the last formed whorl, and seems to have been described by Visser, 1950, p. 278, pl. 7, fig. 9 as *Pseudoparrella meeterenae;* the microspheric form has 6-8 chambers in the last-formed whorl, and has been described by Visser as *Pseudoparrella limburgensis*. The species is found in the whole Tuff Chalk of Holland, is also fairly common in the Danian of Denmark in some localities, and occurs abundantly in the Paleocene above the Md in South-Limburg. It continues in the Tuffeau de Ciply, as well in Holland as in the type-locality, Basin of Mons, Belgium, where it is very common. It seems to disappear in the Calcaire de Mons above the Tuffeau de Ciply.

Since Viser in 1950 first mentions *Pseudoparrella limburgensis* and since the microspheric form, when possible, has priority, the name of the species is *Pseudoparrella limburgensis* Visser. The type-specimens of *P. limburgensis,* collection Geol. Inst., Leiden, 18861, shows some badly preserved specimens of that species; but the type-slide labelled *P. meeterenae,* 18862, shows some small specimens of *Pseudoparrella alata* (Marsson).

Pulsiphonina elegans Brotzen. Fig. 11.

Test biconvex, often the ventral side slightly more convex than the dorsal one. Periphery rounded, lobulate. Margin acute. At the dorsal side all chambers visible, 5 in the last formed whorl, with strongly rounded and oblique sutures. Each margin of the chambers shows large pores running as a kind of canals through the marginal keel; no other pores are seen dorsally. At the ventral side the chambers are somewhat inflated with depressed curving sutures reaching the centre. The last formed chamber forms a slightly curved sutural ventral aperture, often in the middle with a tooth. So, this aperture is not marginal as Brotzen figured it, but always ventral, reaching the margin. There are distinct scattered pores only in the middle part of the ventral chamberwalls. Testwalls hyaline.

Brotzen described this species which is very close to *Pulsiphonina prima* (Plummer) from the Paleocene of Sweden, where it occurs already in the lowest formation, the greensands. It is very common in the sample.

The species described here only are some smaller rotaliid forms found in the sample K 2708 of the Geologic Bureau, Heerlen. There are many more of them, but they prove that this sample taken in the hollows of the Md-hard ground shows the fauna which also occurs in the Lower Paleocene of Denmark and Sweden and has nothing to do with the Danian; this in contradiction to the view of Meyer (1959, Bull. Cl. Sci. Acad. roy. Belgique, vol. 45, pp. 316-338) who believed that the glauconitic limestone above the Md in the quarry Curfs contains a Danian fauna; even the fillings of the hard ground underneath that limestone already are of Paleocene age, as this small part of the fauna proves. The excellent preservation of the specimens enabled me to give accurate descriptions and figures of Brotzen's and Visser's species mentioned here.

BOEKBESPREKING

Jaarboek 1960 van de Nederlandse Geologische Vereniging, afd. Limburg. 40 bladz.

Beter misschien nog dan de inleidende woorden van de Secretaris geeft naar mijn idee de indrukwekkende lijst van medewerkers aan dit met zo veel zorg samengestelde jaarboekje een idee van de geestdrift waarmee de leden van de afdeling Limburg hun liefhebberij, de geologie bedrijven. Maar er blijkt méér uit dit jaarboek. Er blijkt uit — voor enkele ingewijden niets nieuws meer overigens — dat de kwaliteit van het werk dat in deze vereniging wordt verzet nauwelijks nog toestaat van liefhebberij te spreken. Er wordt dan ook door vakmensen vaak een dankbaar gebruik gemaakt van de resultaten van het werk van de N.G.V. Te meer daar alle vondsten en vindplaatsen — zie de detailkaartjes in het jaarboek — op voorbeeldige wijze worden geregistreerd. Moge deze enkele woorden er toe