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

Polymorphinidae from the holes in the hard ground covering the Md in the quarry Curfs near Houthem, South-Limburg.

by J. HOFKER

The Polymorphinidae have been dealt with by the author in 1930, in so far they occurred in the Tuff Chalk of Maastricht (Natuurhist. Maandblad, vol. 19, in total 23 pages, and 36 figures in the text). Later the author once again described some Polymorphinidae with the last formed fistulose chamber, from the Tuff Chalk, in 1951 (Publ. Natuurhist. Genootschap, ser. 4, pp. 4-6, text fig. 5, 6).

Samples taken from the holes in the hard ground on top of the Tuff Chalk contain many species which are typical for the Paleocene; they are in an excellent state of preservation and numerous specimens were found with the last formed fistulose chamber which, as already has been stated in 1951, is as typical for each species as is the general form.

The author analysed a recent species with the fistulose chamber which was found with the protoplasm within the test, and which, after decalcifying, showed the inner structure by means of the protoplasm filling up the lumen of the chambers (Zoology of the Faroes, IIa, Foraminifera, Copenhagen, 1930, pp. 7-13, text figures 17-24), *Polymorphina acuta* Roemer. The study showed, that secondarily several openings in the test wall of the last formed chambers form the stolons which open into the fistulose chamber; the test wall of the fistulose chamber is thinner than that of the normal chambers.

Many instances are known to the author, in which the fistulose chamber was attached to a piece of molluscan shell; a very fine instance was detected in material from the E.N.C.I.-quarry of the Pietersberg, showing the fistulose chamber attached to both sides of a piece of shell. (Fig. 1). Another specimen shows the fistulose chamber attached wholly to one of the sides of a moluscan shell fragment, from the Lower Paleocene of Terblijt, South Limburg (Fig. 4) (both specimens belonging to *Globulina gibba* d'Orbigny). Yet another specimen has been figured by the author (1961, Ann. Soc. géol. Belgique, vol. 84, p. 569, Fig. 47), *Guttulina communis)* attached to the inside of a test of an Ostracod. A specimen of *Guttulina problema* from the hard ground holes of Curfs (Fig. 2) distinctly shows that the fistulose chamber was attached around a stem; the fistulose chambers of *Globulina rotundata* (Bornemann) in that Paleocene all show a flat distal base surrounded by very short stolons (Fig. 11); these too must have been attached to a flat surface. However, many other instances are known and figured here which do not show any trace of attachment, the stolons protruding towards all thinkable sides. It is possible that such forms were attached in the mud, or to soft surfaces on plants. It is obvious that the large chamber surrounding the attached test of *Webbinella* also is a fistulose chamber (Fig. 30), but in this case without detectable solons. The last formed chamber with only one terminal stolon of *Pyrulina extensa* (Cushman) also seems to be a fistulose chamber which covers the normal radiate terminal foramen (Fig. 30). No fistulose chambers have been found of any species of the genus *Sigmomorphina* (except in *S. lamarcki)*, and it is possible that also the forms with internal tube, gathered by Loeblich and Tappan into different new genera (*Esosyrinx, Siphoglobulina, Laryngosigma,* and *Globulotuba* Collins) have no fistulose chambers either.

In 1957, the author described the distribution of two allied species, *Sigmomorphina soluta* Brotzen and *Sigmomorphina brotzeni* Hofker; (Natuurhist. Maandblad, vol. 46, pp. 16-19, text figs. 1-27). It was shown that *S. soluta* occurs from the Cr4 below the Maestrichtian Tuff Chalk up to the Lower Paleocene just above that Tuff Chalk, whereas *S. brotzeni* appears for the first time in the Upper Md and ends in the Calcaire de Mons, the type-Montian. It is a remarkable fact, that in the Danian of Denmark, in the lower parts only *S. soluta* is found, and that there *S. brotzeni* appears in the uppermost Danian, continuing into the lower Seelandium; here the latest stages of the evolution of *S. soluta* also are found; in the middle part of the Seelandium, only *G. brotzeni* is found in the same evolution stage as is found in the Montian. This evolution of the two species

strongly points to a Danian age of the Maestrichtian Tuff Chalk.

From the Maestrichtian Tuff Chalk the author described the following species (1930, 1951):

Pyrulinella cylindroides (Roemer)
Guttulina communis d'Orbigny
Globulina gibba d'Orbigny
Globulina myristiformis Williamson
Pseudopolymorphina rudis Reuss
Pseudopolymorphina leopolitana (Reuss)
Pseudopolymorphina soldanii (d'Orbigny)
Guttulina adhaerens (Olszewski)
Sigmomorphina soluta Brotzen
Sigmoidella elegantissima (Parker and Jones)
Pseudopolymorphina digitata (d'Orbigny)

These names have been corrected in the way as has been pointed out on p. 23 of the separate paper, 1930.

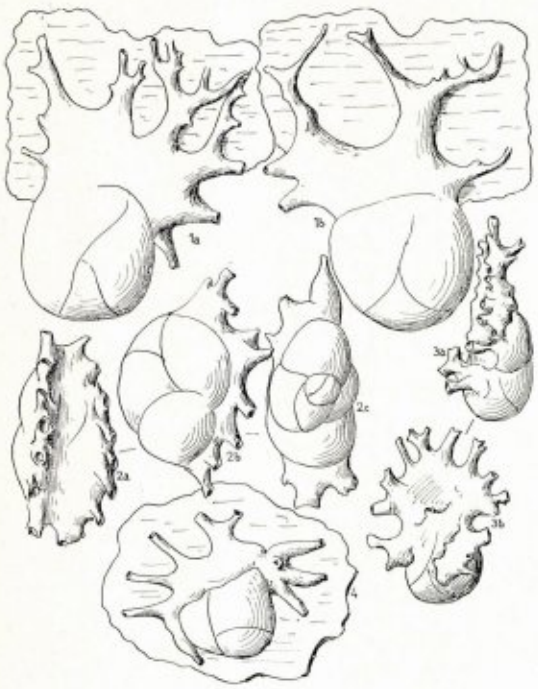
Visser (1950, Leidse Geol. Mededeel., vol. 16, pp. 236-249) described from the Maestrichtian Tuff Chalk the following species:

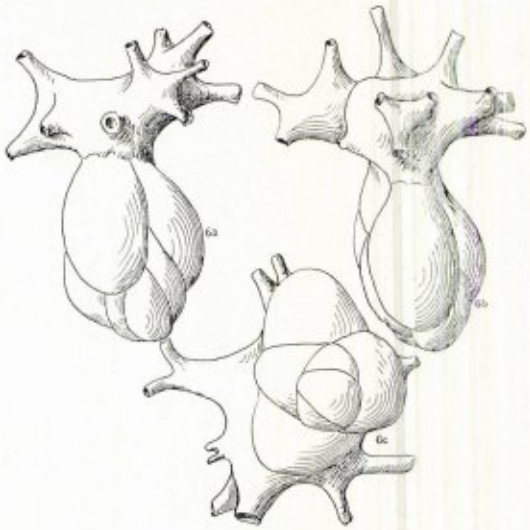
Quadrulina cf. *rhabdogonoides* (Chapman); coll. Leiden, G 11, 18770; is a broken *P. rudis*.
Guttulina adhaerens (Olszewski); coll. Leiden G. 10, 18750; one specimen is *S. elegantissima;* the other is indet.
Guttulina caudata (d'Orbigny); coll. Leiden B 11, 18753; is *S. soluta*.
Guttulina paalzowi Cushman and Ozawa.
Guttulina problema d'Orbigny; coll. Leiden K 1, 18748.
Guttulina trigonula (Reuss); coll. Leiden, 18752; is a new species, with very large diameter.
Guttulina uviformis (Reuss); coll. Leiden, G 1, 18773; is a broken specimen of *P. rudis*.
Globulina excerta (Berthelin); coll. Leiden 18756; is a young specimen of *P. soldanii*.
Globulina gravis; coll. Leiden, B 16, 18758.
Globulina lacrima Reuss; coll. Leiden K 1, 18754; is *Globulina gibba*.
Globulina lacrima Reuss cf. var. *horrida* Reuss; coll. Leiden S 14, 18897; is not a *Polymorphina*.
Globulina lacrima Reuss. var. *subsphaerica* (Berthelin); coll. Leiden, 18755.
Globulina lacrima Reuss, var II; is *Globulina acuticostata* Reuss.
Globulina prisca (Reuss); coll. Leiden B 27, 18749.
Globulina rotundata (Bornemann); coll. Leiden 18757; is *P. cylindroides*.
Pyrulina cylindroides (Remer); coll. Leiden G 13, 18768; is *Sygmomorphina brotzeni*.
Pseudopolymorphina digitata (d'Orbigny); coll. Leiden, K 2, 18761.
Pseudopolymorphina incerta (Egger); coll. Leiden, G 10, 18762; is a young specimen of *P. rudis*.
Pseudopolymorphina leopolitana (Reuss); coll. Leiden, B 6, 18759.
Pseudopolymorphina soldanii d'Orbigny; coll. Leiden, G 10, 18760.
Sigmomorphina kronenburgae Visser; coll. Leiden, 18762; small specimen of *S. brotzeni*.
Sigmomorphina semitecta (Reuss) var. *terqueminiana* (Fornasini); coll. Leiden, 18763; is not a *Polymorphina*.
Sigmomorphina soluta Brotzen; coll. Leiden B 1, 18764.
Sigmomorphina sp., pl. 3, fig. 2; is *S. brotzeni*.
Sigmoidella cf. *elegantissima* (Parker and Jones), coll. Leiden, G. 7, 18769.

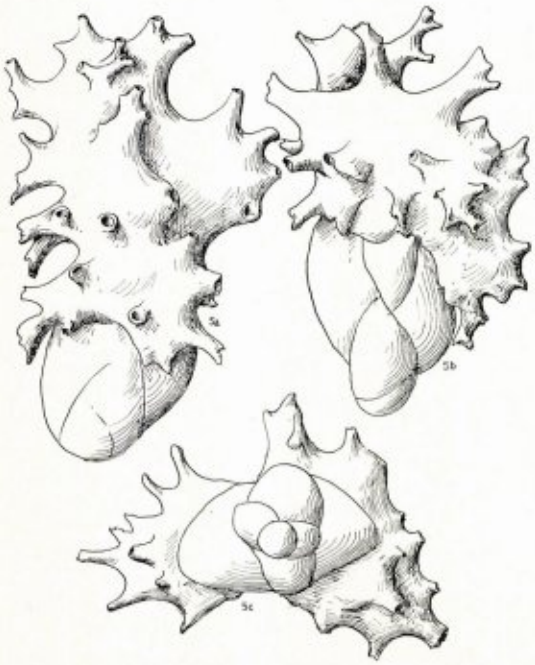
So we see, that the list given by Visser has to be reduced to a smaller number of species and only contains the forms, already described by Hofker.

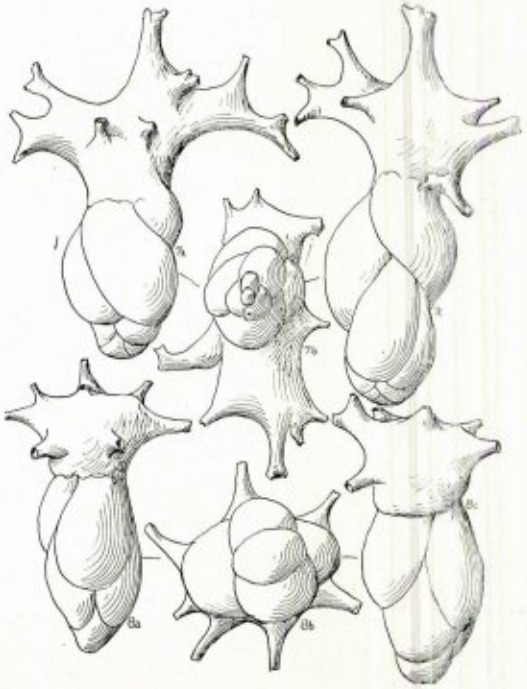
In the samples from holes in the hard ground on top of the Md, the following species could be found with certainty:

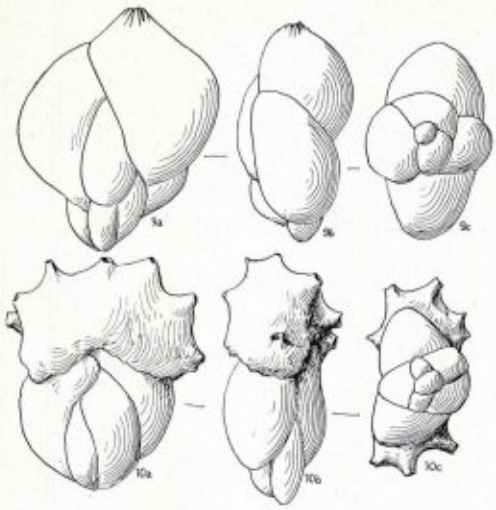
Guttulina problema d'Orbigny
Guttulina adhaerens (Olszewski)
Guttulina hantkeni Cushman and Ozawa
Guttulina wilcoxensis Cushman and Ponton
Guttulina communis d'Orbigny
Cuttulina trigonula (Reuss)
Globulina rotundata (Bornemann)
Globulina tuberculata d'Orbigny
Globulina caribbea d'Orbigny
Globulina globosa Münster
Globulina gravis (Karrer)
Globulina gibba d'Orbigny
Sigmomorphina frondea (Cushman)
Sigmomorphina soluta Brotzen

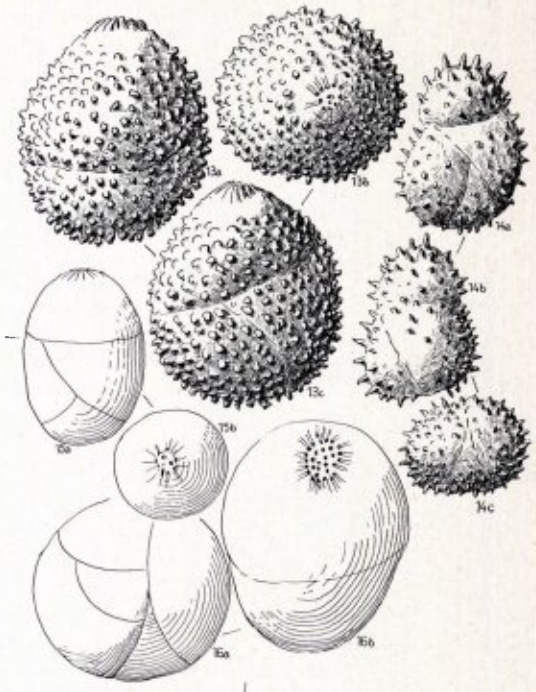


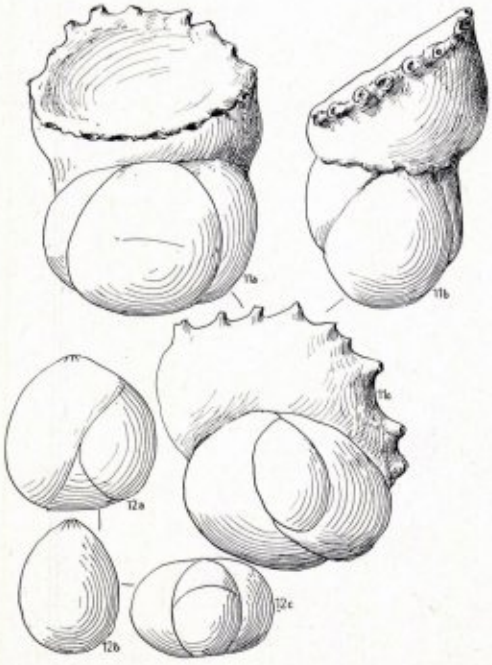


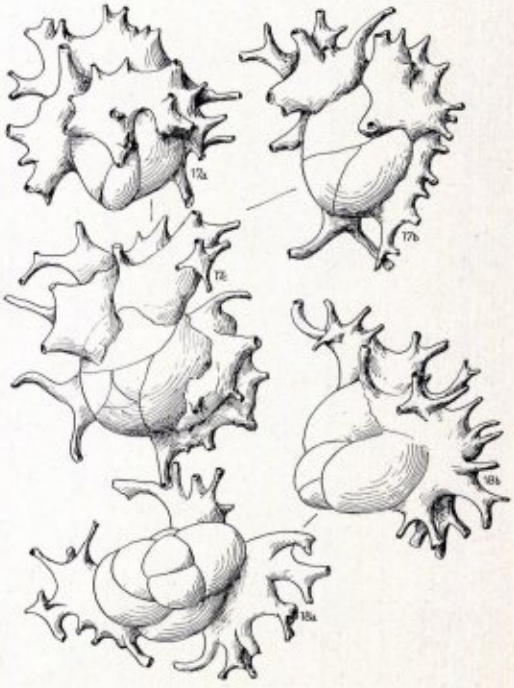


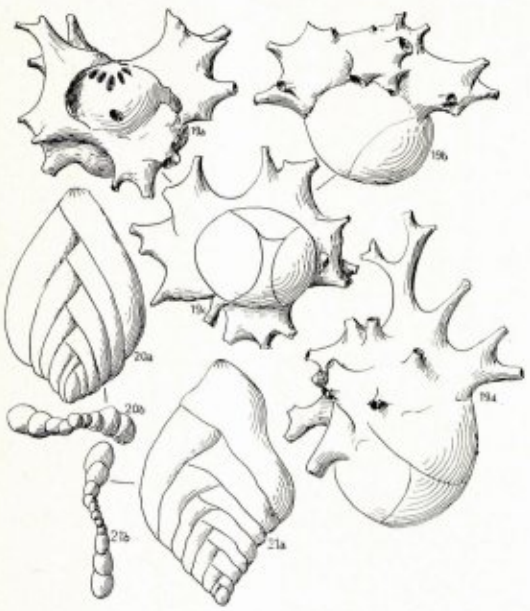








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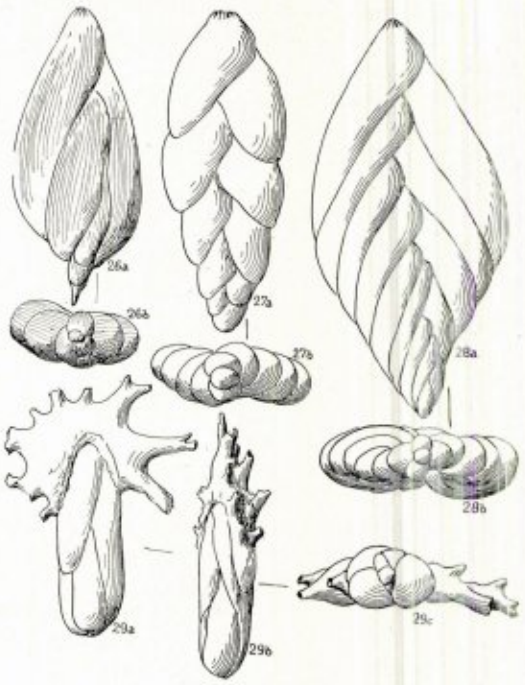
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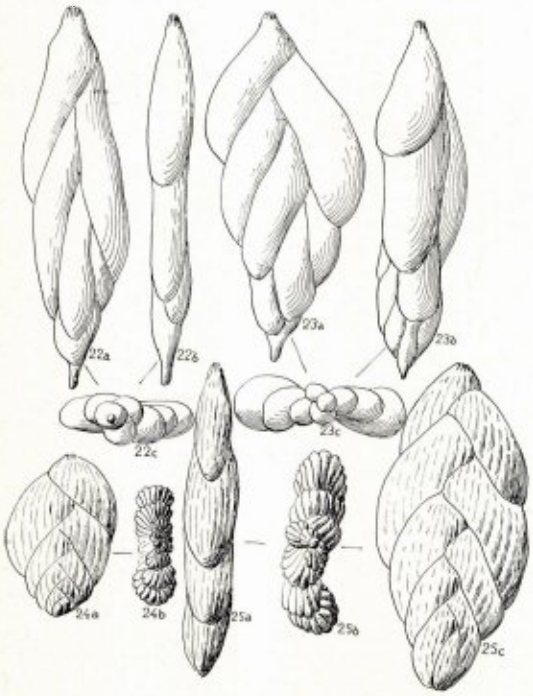
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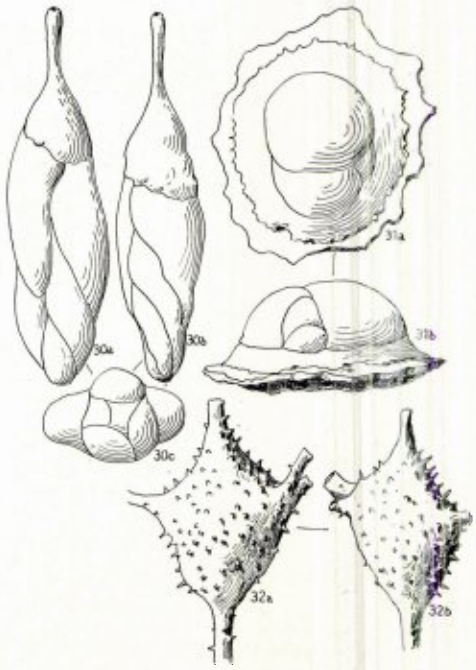
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Sigmomorphina brotzeni Hofker
Sigmomorphina longistriata Cushman and Ozawa
Sigmomorphina geyeri Brotzen
Sigmomorphina paleocenica Brotzen
Sigmomorphina pseudoregularis Cushman and Thomas
Sigmomorphina lamarcki Cushman and Ozawa
Pyrulinella extensa (Cushman)
Webbinella hemisphaerica Jones, Parker and Brady
Ramulina pulchra Bermudez

Comparing the list of species found in the Maestrichtian Tuff Chalk and that in the holes of the hard ground above it, there are remarkable differences. There are 4 species of *Pseudopolymorphina* in the Tuff Chalk whereas this genus is lacking in the holes; *Guttulina paalzowi* and *Globulina myristiformis* are missing in the holes; *Pyrulinella cylindroides* is lacking; *Sigmoidella elegantissima* is lacking; there are several species which are not found in the Tuff Chalk: *Guttulina wilcoxensis. Guttulina trigonula, Globulina tuberculata, Globulina globosa, Sigmomorphina geyeri, Sigmomorphina paleocenica, Sigmomorphina pseudoregularis, Pyrulinella extensa.*

All the species not found in the Tuff Chalk, are typical species for the Lower Paleocene; they do not occur in the type-Danian or are restricted to its utmost top.

Sigmororphina frondea and *Sigmomorphina longistriata* have been placed by Cushman and Ozawa (1930) in the genus *Polymorphina;* however, their initial part strongly suggests the typical sigmoid structure of *Sigmomorphina; S. paleocenia* has been placed by Brotzen (1948) in the genus *Pseudopolymorphina;* but here once again the whole structure is that of an elongate *Sigmomorphina.*

	Mb	Mc	Md	Me, fillings of holes	Lower Paleocene	Tuffeau de Ciply	Calcaire de Mons
Guttulina problema	X	X	X	X	X		X
Guttulina adhaerens	X	X	X	X	X	X	
Guttulina hantkeni	X	X	X	X	X	X	
* *Guttulina wilcoxensis*				X	X		
Guttulina communis	X		X	X	X	X	
Guttulina trigonula		X	X	X			
* *Globulina rotundata*				X			
* *Globulina tuberculata*				X			X
* *Globulina caribbea*				X	X		
Globulina globosa		X	X	X	X		
Globulina gravis				X	X	X	
Globulina gibba				X	X	X	X
Sigmomorphina frondea		X	X	X	X		
Sigmomorphina soluta	X	X	X	X	X		
Sigmomorphina brotzeni				X	X	X	X
Sigmomorphina longistriata		X	X	X	X		
* *Sigmomorphina geyeri*				X	X	X	
* *Sigmomorphina paleocenica*				X	X	X	
* *Sigmomorphina pseudoregularis*				X	X	X	
* *Sigmomorphina lamarcki*				X	X		
* *Pyrulinella extensa*				X	X		
Webbinella hemisphaerica			X	X			
* *Ramulina pulchra*				X	X		

Appearence of Polymorphinidae in the Maestrichtian Tuff Chalk and in the overlying Paleocene, compared with the species found in the holes of the hard ground at the top of the Tuff Chalk. * Species not found in the Tuff Chalk.

Fig. 1. Specimen of *Globulina gibba* d'Orbigny, attached to both sides of a piece of molluscan shell. E.N.C.I. quarry, Maastricht, Cr4, x 27. a and b from both sides.

Fig. 2. *Guttulina problema* d'Orbigny, obviously having been attached to a stem; a, fistulose chamber, hollow part which surrounded the stem; b, sideview, c, initial view; x 27. Holes of hard ground, quarry Curfs.

Fig. 3. *Guttulina problema* d'Orbigny, obviously having been attached to flat surface; from two sides; x27. Same locality.

Fig. 4. *Globulina gibba* d'Orbigny, attached to shell fragment. Lower Paleocene, Terblijt. x 13.

Fig. 5. *Guttulina adhaerens* (Olszewski). Holes of hard ground quarry Curfs. a, b, two side views; c, initial face. x 27.

Fig. 6. *Guttulina hantkeni* Cushman and Ozawa. Same locality. a, b, two side views; c, initial face. x 67.

Fig. 7. *Guttulina adhaerens* (Olszewski). Same locality. a, c, side views; b, initial face; x 27.

Fig. 8. *Guttulina wilcoxensis* Cushman and Ponton. Same locality. a, c, side views; b, initial face. x 27.

Fig. 9. *Guttulina communis* d'Orbigny. Same locality. a, b, side views; c, initial face. x 67.

Fig. 10. *Guttulina trigonula* (Reuss). Same locality. a, b, side views; initial face. x 67.

Fig. 11. *Globulina rotundata* (Bornemann). Same locality. a, b, side views, showing the flat attachement of the peculiar fistulose chamber; there were many

specimens which had identical fistulose chambers, so that this form seems characteristic for the species. x 67.

Fig. 12. *Guttulina rotundata* (Bornemann), without fistulose chamber, from three sides, x 27. Same locality.

Fig. 13. *Globulina tuberculata* d'Orbigny. a, c, side views; b, apertural view. Same locality. x 67. The species is characterised by the blunt spines allover the surface.

Fig. 14. *Globulina caribbaea* d'Orbigny. a, b, side views; c, initial face; same locality, x 200. The species is characterised by sharp spines, and mostly specimens were found in which the apertural face is covered by a globular chamber without any visible opening.

Fig. 15, 16. *Globulina globosa* Münster. Fig. 15, side view and apertural face of specimen from hard ground, quarry Curfs; fig. 16, side view and initial face of specimen from drill-hole Bunde I, 30-31 m, Calcaire de Mons. Both x 27. Peculiar are the numerous canals forming the aperture.

Fig. 17, 18. *Globulina gravis* (Karrer). Hard ground in quarry Curfs. 17a, b, side views; 17c, initial face; 18a, side view; b, initial face. x 27. The species is characterised by the many fine stolons of the fistulose chamber.

Fig. 19. *Globulina gibba* d'Orbigny. Same locality. a, view upon the fistulose chamber, opened, showing the enlarged radial canals of the aperture and a secondary opening; b, side view; c, initial face, x 27. d, another specimen, x 67.

Fig. 20, 21. *Sigmomorphina frondea* (Cushman). Same locality. 20,megalospheric; 21, microspheric (?). a, side views; b, initial faces, showing the sigmoid structure.

Fig. 22. *Sigmomorphina brotzeni* Hofker. Same locality, x 27. a, broad side, b, narrow side; c, initial face.

Fig. 23. *Sigmomorphina soluta* Brotzen. Same locality, x 27. Same indications.

Fig. 24, 25. *Sigmomorphina longistriata* (Cushman and Ozawa). x 67. 24: microspheric specimen, a, side view; b, initial face, showing the sigmoid structure. 25, a, narrow side, b, initial face, c, broad side, megalospheric. This species is one of the characteristic species of the Midway Formation of Texas.

Fig. 26. *Sigmomorphina geyeri* Brotzen. Same locality, x 27. a side view; b, initial face.

Fig. 27. *Sigmomorphina paleocenica* (Brotzen). Same locality. x 27. a, side view; b, initial face, showing the typical sigmoid structure, so that the species cannot belong to *Pseudopolymorphina*.

Fig. 28. *Sigmomorphina pseudoregularis* Cushman and Thomas. Same locality. x 27. a, side view; b, initial face.

Fig. 29. *Sigmomorphina lamarcki* Cushman and Ozawa. same locality. x 67. a, broad side; b, narrow side; c, initial face, showing that the sigmoid structure is not so apparent.

Fig. 30. *Pyrulinella extensa* (Cushman). Same locality. x 67. The tubiform chamber is a fistulose chamber. a, b, side views; c, initial face.

Fig. 31. *Webbinella hemisphaerica* Jones, Parker and Brady. x 67. a from above; b, side view. The surrounding chamber attaching the specimen to the molluscan shell particle is the fistulose chamber. Same locality.

Fig. 32. *Ramulina pulchra* Bermudez x 200. Specimen from two sides. Same locality.

MACROLEPIDOPTERA IN MIDDEN-LIMBURG (1964)

door
A. W. P. MAASSEN

Zoals reeds enkele jaren gebruikelijk wil ik u weer iets mededelen over mijn vangsten en waarnemingen van Macrolepidoptera in Midden-Limburg in 1964. De prachtige zomer is vooral gunstig geweest voor de dagvlinders, waarvan diverse soorten zeer goed gevlogen hebben:

Araschnia levana L. het bekende landkaartje, reeds jaren achtereen nog slechts sporadisch opgemerkt, vloog uitstekend in De Doort te Echt, vrij talrijk te Boukoul (Swalmen), terwijl ik van de heer Ottenheym veel ex. kreeg, gevangen te Arcen, *Papilio machaon* L., de koninginnepage, was gelukkig weer wat talrijker. *Colias hyale* L. vloog in mijn omgeving volop; ik noteerde meer dan 200 stuks, natuurlijk maar een klein gedeelte van wat er werkelijk geweest is. *Colias crocea* Fourcr. daarentegen was zeldzaam. *Polyommatus icarus* von Rott. vloog massaal in het Eschbroek te Annendaal. Een prachtig gezicht! *Maculinea nausithous* Bergstr. en *M. teleius* Bergstr., de Sanguisorba-blauwtjes. Hiervan heb ik helaas op de mij bekende vindplaatsen langs de Roer te Herkenbosch en Vlodrop nog nauwelijks één ex. gezien. De kunstmest doet de Pimpernel uit het weidebestand verdwijnen en daarmede verdwijnen deze prachtige blauwtjes.

De smeervangsten in de herfst vielen tegen. Wel waren praktisch alle specifieke herfstdieren aanwezig, maar in kleine aantallen. Slechts enkele soorten kwamen wat talrijker op de stroop af: *Agrochola macilenta* Hb., *Conistra vaccinii* L., *Allophyes oxyacanthae* L., *Cirrhia ocellaris* Bkh. was talrijker dan vorige jaren, vooral op de vanglamp te Putbroek.