Table I shows the distribution of the 56 species found in 1949—1952 in 16 localities all over the hill. Some earlier records are included; they are indicated by a +. The localities 1 and 16 are along the banks of the Meuse and the Jeker respectively, 2—6 are along the eastern slope, 2, 5, and 6 being woods, 7—12 are situated on the plateau along the Belgian frontier. and 13—15 on the western slope. Of these latter 13 and 15 are mainly open country, while 14 is a young artificial wood.

A number of samples from the soil of the localities 5, 6, 11, and 14 have been searched for the shells of land snails. The results are shown in Table II in which for each sample the total number of specimens is given and the percentages of this number belonging to the species found in the sample. These samples are not from equally large surfaces, and no distinction could be made between specimens which were alive when the sample was taken and those which were dead.

Special attention was paid to the occurrence of "sibling species". *Carychium minimum* and *C. tridentatum* do not inhabit the same localities in this area; they could always easily be distinguished. The same applies to *Vitrea crystallina* and *V. contracta*. *Cochlicopa lubricella* mainly inhabits dry slopes, but was also found in the young wood locality no. 14. It could not always easily be distinguished from the euryoekous *C. lubrica*, and an extensive biometrical study of Dutch populations of these forms seems necessary. Boettger's theory, that *Oxychilus draparnaldi* expels *O. cellarius* from the localities where it settles, seems to be confirmed by our results. It is, however, difficult to be sure that *O. cellarius* is absent in localities where *O. draparnaldi* lives, as young shells of the two species are very similar to each other. While *Cepaea hortensis* is abundant in the whole area, only one specimen of *C. nemoralis* was found on the Sint-Pietersberg. No hypothesis could be advanced to explain the almost complete absence of *C. nemoralis*.

Seventeen species known to occur in southern Limburg were not found on the Sint-Pietersberg. Of three of these no living specimens have as yet been found in this region. Of the other 14 species seven are inhabitants of banks and marshy localities, a category of biotopes poorly developed in the studied area. Two others are probably not autochthonous and their absence on the Sint-Pietersberg is, therefore, probably quite accidental. *Arion subfuscus* seems to be restricted to the southeastern part of southern Limburg. I cannot give an explanation of this peculiar distribution. *Limax cinereoniger* would seem to find suitable surroundings in the woods on the eastern slope of the Sint-Pietersberg. From the data at hand it seems possible that in the Netherlands *L. cinereoniger* does not stand where *L. maximus* settles. The absence of *L. cinereoniger* on the Sint-Pietersberg might, therefore, be due to a similar relation between this species and *L. maximus* as has been supposed by Boettger for *Oxychilus cellarius* and *O. draparnaldi*. *Milax rusticus* and *Helicella unifasciata* seem to be absent here because they need slopes exposed to the South for maintaining themselves in this region.

The proceeding removal of vast quantities of limestone will inevitably bring about great changes of the landscape and endanger the still very rich fauna of the Sint-Pietersberg. Although the most important localities (like the numbers 5, 6, 13, 14, and 15 of Table II) will be spared, it may be questioned if the changes in their surroundings will not spoil these sites too. Fortunately the only species occurring on the Sint-Pietersberg but not in the rest of southern Limburg, *Helicella caperata*, is not a very interesting species, as it was probably recently introduced into the area.

FORAMINIFERA FROM THE CRETACEOUS OF LIMBURG, NETHERLANDS. XXXV. ON THE INITIAL STAGES OF OMPHALOCYCLUS MACROPORUS (Lamarck).

by J. HOFKER

The author has given already many detailed structural data on *Omphalocyclus*: Die Foraminiferen aus dem Senon Limburgens, IV *Sporadotrema errantium* nov. spec., Natuurhist. Maandbl., vol. 15, 1926, pp. 62-65, fig. 1-20; Mém. Inst. Roy Sc. Nat. Belgique, No. 112, 1949, pp. 60-67, fig. 23, a-o.

The autor emphasised that the chamber thought to be the initial one in the large specimens (up to 7 mm diameter) had a size of about 60 μ and thus could not be the proloculus of a microspheric specimen. So the author

believed it to be the proloculus of an A_1-form. He gave as his opinion that the first set of chambers in these large specimens has the shape of an irregular clew.

Recently late **Hans Küpper** once again described a section through such a large form, and suggested that what he saw in the section was the proloculus followed by a set of biserially arranged chambers which once again was followed by ogivally arranged chambers, the normal chambers of the equatorial layer. But, when studying his figures, especially fig. 3 on p. 183, we find two outstanding peculiarities: the initial chamber, as given by **Küpper**, is not globular, and the size of that chamber is about 60 μ diameter, much too large for a microspheric proloculus. (**Küpper**, Notes on Upper Cretaceous larger Foraminifera, II, genera of the Subfamily Orbitoininae with remarks on the microspheric generation of *Orbitoides* and *Omphalocyclus;* Contr. Cushman Found. For. Res., vol. 5, 1954, pp. 179-184, pl. 33, 34; text-fig. 1-3).

This lead the author to restudy some specimens of this large generation of *Omphalocyclus macroporus* from the type-locality, Saint Pietersberg, Maastricht. He made therefore successive series of sections, grinding down horizontally and transversally the embryonic centre of tests.

The sections revealed that the initial set of chambers surrounding the proloculus which has a diameter of about 25-30 μ and is globular, form a clew, often arranged in two layers more or less, in total of lenticular shape and in most cases observed with its larger diameter not in the level of the equatorial chambers but forming an angle with it.

This first set of chambers surrounding the initial chamber, when seen in horizontal section not gowing through the proloculus, strongly suggest the structure of a *Gümbelina* like arrangement of chambers. But the „initial chamber" as described by **Küpper**, is not the initial one but one of the peripheral chambers of the clew. Since this clew often shows two layers of chambers or, better, is two layers thick, a not totally transverse section of it suggests an initial chamber (which, however, is not globular, since it is a peripheral chamber of the clew) followed by a set of biserially arranged chambers. Since in most cases observed the first clew of chambers is coiled in a plane forming an angle with the equatorial plane, it will be obvious that a horizontal section will not give any clear idea about the real structure of the initial part of the test. This also clears up the interpretation of the sections given by **Küpper**: in horizontal sections only than the real structure of the initial part in „microspheric" specimens is found when serial sections are made through the whole initial part; a single section hardly reaches the proloculus. With such a series at hand no real „*Gümbelina*-stage" is found. This also is the case in *Orbitoides* and *Lepidorbitoides* microspheric specimens, contrarily to **Küpper**'s idea.

The megalospheric (A_2) initial stage of *Omphalocyclus* also has been exhaustively analysed by the author; in most cases it consists of an embryonic apparatus with a smaller proloculus and a larger second chamber, flanked by two other chambers which may not be developed; there is a distinct thickened wall between this embryonic stage and the rest of the equatorial chambers; between the two to four chambers within this wall the walls are thin. So it is obvious that in that generation the embryonic part lived for some time (probably within the mother-test) before other chambers were added.

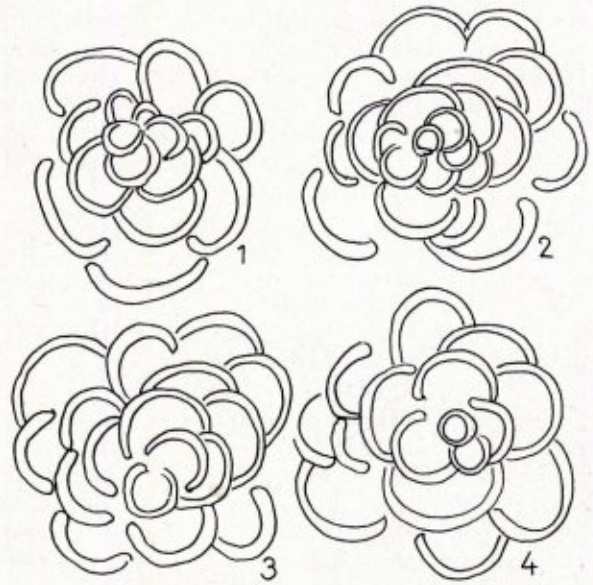
The structure of the embryonic parts of the two generations found in *Omphalocyclus* strongly remind us of the structure of these parts in *Monolepidorbis* **Astre**, as will be described in another paper; also the structure of the other parts of the tests of *Omphalocyclus* and *Monolepidorbis* are similar.

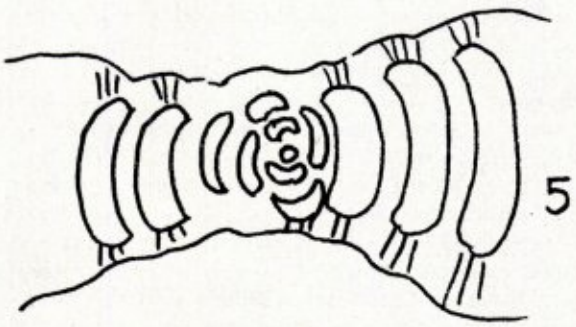
Since the embryonic apparatus of the megalospheric forms (which has been analysed in the author's paper 1949) often is consisting of only two chambers in the small forms with larger proloculus, and the walls between these two chambers are irregularly built, often stark waving, it will be obvious that transverse or horizontal sections may give quite different results, as is shown in my figures of series of sections here. Moreover, the sections of the rest of the chambers also may differ greatly, since these chambers, surrounding the embryonic apparatus, are simple but stretched highly towards both flat sides of the test, and, more advanced from the initial part, begin to divide into two parts with stolons between, as already fully described. Each chamber, however, shows only one aperture towards the next chamber, and the chambers surrounding the embryonic apparatus con-

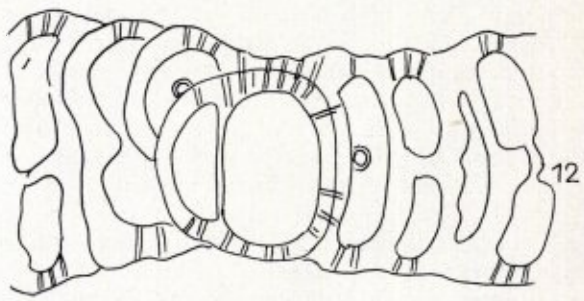
nect with that apparatus only by means of the coarse pores. Especially this peculiar structure also is found in *Monolepidorbis*, thus suggesting a close relation between these two genera.

The structure of the outer wall easily can be studied in specimens in oil. Than it is found that the septa between the chambers form at the outer wall thickened ridges and that between these ridges the pores of the outer walls can be seen: distinct and coarse pores. This structure reminds strongly that of *Sporodotrema* as do the stolons between the chamber-parts.

Omphalocyclus macroporus (Lamarck) is found only in the Md of the Maestrichttian Chalk Tuff, especially in the Upper Md. It also is found in the uppermost Maestrichtian of Navara, Spain, and in the Upper Maestrichtian of Lybia and the Middle-East.







Figures.

Fig. 1. *Omphalocyclus macroporus*, microspheric. Uppermost section through initial part; x 105. An irregular clew of central chambers.

Fig. 2. Section slightly more advanced, the proloculus is reached; x 105.

Fig. 3. Section once more slightly deeper cut; now the type of *Gümbelina*-arrangement, as figured by Küpper, is reached; x 105.

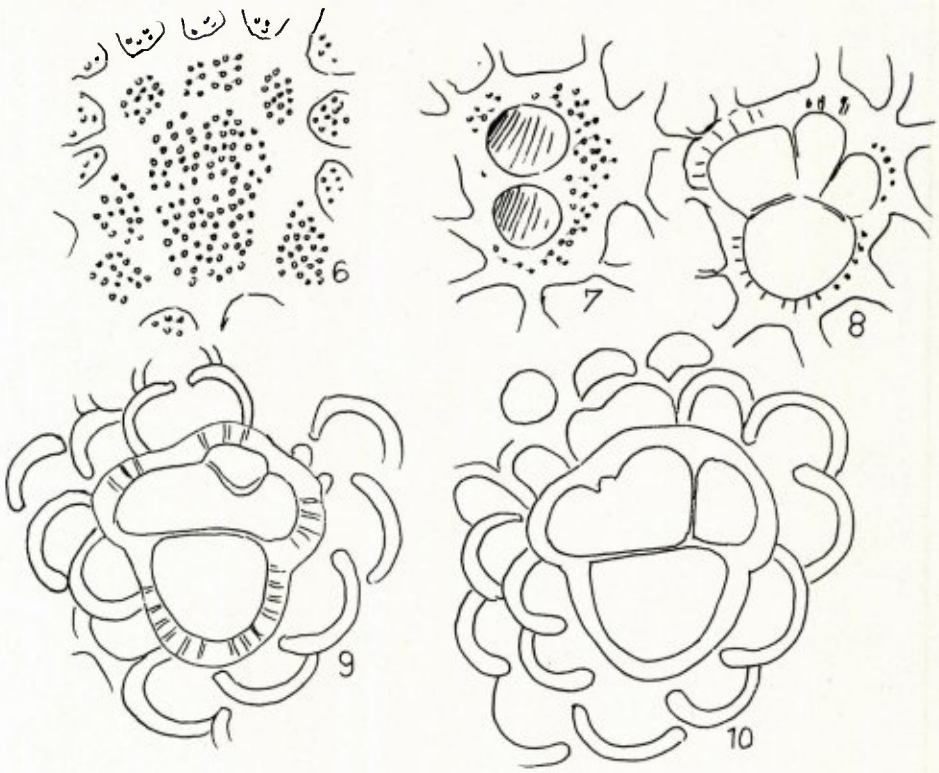
Fig. 4. Once more the section is ground deeper; it now resembles fig. 1.

Fig. 5. Schematic transverse section through microspheric test, showing the arrangement of the initial chambers; x 105.

Fig. 6. — fig. 10. Series of sections, horizontally through megalospheric initial apparatus of *Omphalocyclus macroporus;* in 6 the pores of the thick wall of the protoconch are reached; in 7 two parts of the waving surface are ground open; in 8 and 9 the apparatus more and more comes to sight; in 10 the section must be transverse. All x 105.

Fig. 11. Surface at the margin of small megalospheric specimens of *Omphalocyclus macroporus*, showing the coarse pores of the chamber walls and the higher sutures between. x 105.

Fig. 12. Transverse section of megalospheric central part of *Omphalocyclus macroporus*, showing the protoconch, one chamber not in the plane of the test (see microspheric apparatus) and some of the apertures towards other chambers. x 100.



FORAMINIFERA FROM THE CRETACEOUS OF LIMBURG, NETHERLANDS. XXXVI. THE EVOLUTION OF MISSISSIPPINA BINKHORSTI (REUSS).

by J. HOFKER

Rosalina binkhoristi **Reuss,** 1862, Stizber. k. Akad. Wiss. Wien. 44, p. 317, pl. 2, fig. 3.
Pulvinulina binkhorsti **(Reuss) Hofker,** 1927, Natuurhist. Maandbl., 16, p. 126-128.
Conorbina binkhoristi **(Reuss) Brotzen,** 1936, Sver. geol. Unders., C, 396, p. 145.
Discorbis binkhorsti **(Reuss) Brotzen,** 1940, Sver. geol. Unders., C, 435, p. 32.
Gavelinella binkhorsti **(Reuss) Visser,,** 1950, Thesis, Leyden, p. 265, pl. 5, fig. 6, pl. 10, fig. 12.
Discopulvinulina binkhorsti **(Reuss) Hofker,** 1951, Publ. Natuurhist. Genootschap, Limburg, IV, p. 20-22, figs. 22, 23.
Stromatorbina binkhorsti **(Reuss) Bermudez,** 1952, Bol. geol. ,Venezuela, 2, p. 36.

This well-known species has been mentioned under many generic names; yet in 1951 I suggested that it had to belong to *Discopulvinulina* rather than to *Mississippina*. Since, however, the genotype of *Mississippina, M. missouri* Howe, shows the same characters as those of *M. binkhorsti,* it has to be called *Mississippina;* the only difference with *Discopulvinulina* is found in the raised sutures and margin, which are secondarily covered by chalk.

In the Lower Mb, and even in the Ma, very small specimens are found which are flattened throughout. In the Upper Mb and the transgressional zone Mb-Mc the specimens become slightly more elevated at the dorsal side and the ornamentation by means of the secondary chalk is slightly more pronounced. In the Mc often very large specimens occur with this shape. Then, in the Md, especially in the Upper part of this layer, the ornamentation, especially on the dorsal side, becomes yet more prominent and the tests are strongly convex at the dorsal side. In the lower part of the overlying Mc the tests