

## NIEUWS UIT VENLO EN OMGEVING.

Door Pater M i l t e n b u r g O.E.S.A. is naar het Natuurhistorisch Museum te Maastricht opgezonden een kleine alk, *Plautus alle*. Het dier was dood gevonden te Tegelen, op 25 nov. 1959. Helaas kon het niet meer worden opgezet. De kleine alk is in Nederland een onregelmatige wintergast, die ook wel in het binnenland gezien wordt, vooral wanneer het gestormd heeft. Het dier van Tegelen was de eerste vermelding van deze soort in Limburg.

De heer L. W e y s schrijft: Naar men mij vertelde, en zoals ik gelezen heb in het Natuurhistorisch Maandblad 1959, p. 137, zijn in Lim-

burg tot nu toe slechts drie ex. waargenomen van de Mantelmeeuw. Het is daarom misschien wel interessant te weten dat ik op 28 januari van dit jaar in Venlo een Mantelmeeuw heb waargenomen. De vogel kwam uit noordelijke richting en volgde de Maas naar het zuiden. Daar hij verschillende malen in de lucht draaide en zwenkte, kon ik zijn zwarte rug en bovenvleugels zeer goed zien, zodat vergissing met een andere soort uitgesloten was, ook met de Kleine Mantelmeeuw, daar de vogel vleeskleurige in plaats van oranje-gele poten had. Bovendien viel hij, zoals de grotere meeuwen meer doen, een waterhoentje aan.

## FORAMINIFERA FROM THE CRETACEOUS OF SOUTH-LIMBURG, NETHERLANDS, XLVIII.

GLOBIGERINA DAUBJERGENSIS Brönnimann  
and the age of Me and Lower Paleocene above  
the upper Md in the quarry Curfs, near Houthem,  
and the age of the Cr 4 below the Ma.

by J. HOFKER

In 1959 the author took, together with B. J. R o m e i n, many sets of samples in the Danian and Paleocene of Denmark. In the Danian and lowest Paleocene samples planktonic Foraminifera were very abundant, especially *Globigerina daubjergensis* Brönnimann. The analysis of several thousands of specimens of that species revealed that during the Danian stage this species shows a true orthogenesis, from small specimens (0,07—0,10 mm larger diameter) in the lowest Danian without the characteristic dorsal small sutural openings (*Globigerina*-type), through larger specimens (diameter from 0,09 to 0,17 mm) with many specimens showing already the *Globigerinoides*-openings in the middle Danian, and yet larger specimens (diameter from 0,10 to 0,24 mm) among which more and more specimens with the dorsal openings in the upper Danian, to very large specimens with dorsal openings and larger diameters from 0,12 mm to 0,27 mm in the transitional

zone (zone V of W i n d ' s) and the greensand of the lower Paleocene above; these largest specimens often show end-chambers, often covering totally the umbilical part of the test (*Catapsydrax*-type). It was found that these orthogenetic data could be used as a time-indicator in Denmark.

In the Maestrichtian Tuff Chalk, already in the upper Mb (boundary Mb-Mc) small specimens were found by the author which belong to the *Gl. daubjergensis* group, without dorsal openings; the author has figured such a specimen as *G. hornibrooki* or *G. linaperta* (Natuurhist. Maandbl., vol. 45, 1956, fig. 10); in the lowest Md, more specimens of this group were found (*Gl. primitiva*, *ibid.*, vol. 46, p. 58, fig. 5); here they are already larger, but rare.

In the holes of the hard ground at the top of the Md, filled with material from the lowest Me (H o f k e r, *ibid.*, vol. 46, 1957, pp. 121—123), in the Me, a zone with thickness 1—2 m between that hard ground and a hard bank with many Paleocene molluscs, in many samples we find abundant and typical specimens of *Gl. daubjergensis*.

The analysis of these specimens of *G. daubjergensis* from the holes, the Me and the Paleocene gave following data:

	diameters	characteristics
holes	0,09—0,20 mm; average 0,15—0,16 mm	Chambers often voluminous, always dorsal openings ( <i>Globigerinoides</i> -type)
Me	0,10—0,24 mm; average 0,16—0,17 mm	Chambers voluminous, always dorsal openings ( <i>Globigerinoides</i> -type) and some <i>Catapsydrax</i> .
Paleocene	0,11—0,27 mm; average 0,17—0,18 mm	Voluminous; dorsal openings; several specimens with end chamber covering the umbilical hollow ( <i>Catapsydrax</i> ).



These results, compared with the results in Denmark (see Pl. 4), make it very probable, that:

1. Mb-Md were sedimented in the time of the Lower and Middle Danian; *G. daubjergensis* without dorsal openings is rare here, but it was found;
2. the lowest Me (holes) must be of the time of the zone IV of Wind's zonation, and the Foraminifera found in these holes do not disagree with this view;
3. The Me is comparable with the zone V in Denmark, or the highest level of zone IV; zone V may be the transitional zone between Danian and Paleocene.
4. the Paleocene above the hard fossiliferous bank is of the age of the Paleocene greensand or the zone V, possibly of the time just between those two zones. Since the Foraminifera found in this lowest Paleocene of Holland are more alike those found in the greensand above the Danian in Denmark, than those found in the highest Danian itself, there is strong indication that the lowest Paleocene in Holland is of the age of the greensand in Denmark, which always is identified as lowest Paleocene (Brotzen's Seelandium).

It is a very remarkable fact, that the specimens of *G. daubjergensis* from Holland show very few and smaller spinose outgrowths of the outer test wall than those found in Denmark; yet it was found, that this tendency also occurs at the end of the Danian and in the greensand in Denmark. Moreover, the test walls from Dutch specimens invariably are thinner than those of the Danish specimens.

Just as in the Danian, where in zone V and the overlying greensand *Gl. triloculinoides* nearly is absent, this species was rare in the zones studied here from Holland; also, in the uppermost layers in Denmark *G. pseudobulloides* is always rare; this also is the case in Me and Paleocene in Holland. On the other hand, *Gümbelitra marauciana* which is common in the whole Mc-Md and the overlying Me and Paleocene in Holland, in Denmark is found abundantly in the Lower Danian, but rarely in the

middle and Upper part of the Danian; this difference may be due to the different circumstances; in Holland the temperature of the water was tropical, and the sea was a shallow one; in Denmark the temperature of the water must have been moderate, and the amount of planktonic species, as well as the occurrence of many deep-sea forms of Ostracods, point to a much deeper sea.

The conclusion of this part of the investigation is:

The so-called Post Maestrichtian above the Md in Holland (Hofker's Me and Lowest Paleocene) is in time identical with the highest Danian (Wind's zone V) and the Paleocene greensands above the Danian in Denmark.

As already stated, in the Mb-Md, the Maestrichtian Tuff Chalk, scattered specimens, often more abundant in holes of hard banks and in clayish lenses, are found of *Globigerina pseudo-bulloides* Plummer and *Globigerina daubjergensis* Brönnimann, both in stages of development which also are found in the chalks of the Danian in Denmark, as will be fully analysed in another paper by the author; the primitive stages of *G. daubjergensis* lack the typical dorsal openings, and are found in the lower and middle Danian in Denmark; they have been mentioned by Brönnimann from samples from Hjerm and from Daubjerg, the first being lower Danian, the second middle Danian, as *Globigerina linaperta*, *Globigerina hornibrooki*, etc. (Brönnimann, 1952, Ecl. geol. Helvetiae, vol. 45, pp. 339—341). Hofker also found them in the Mb-Md of the Maestrichtian Tuff Chalk and the uppermost Cr 4 just beneath that chalk (Natuurhist. Maandblad, vol. 45, 1956, pp. 51—57; *ibid.*, vol. 46, 1957, pp. 57—58; *ibid.*, vol. 48, 1959, pp. 80—83).

In the mean time, Meyer published an account on planktonic Foraminifera in the Maestrichtian Tuff Chalk and the „Post-Maestrichtian"; from samples taken just beneath and just above the hard ground at the top of the Md, he concludes that in the Maestrichtian Tuff Chalk only typical Cretaceous Foraminifera are found, whereas above the hard ground typical *Globigerina daubjergensis* and *G. pseudobulloides* are found; so it seems to him, that the boundary between Cretaceous and Danian is found at that hard ground.

Meyer (1959, Bull. Acad. Roy. Belgique,



ser. 5, vol. 45, pp. 316—338) does not give any figures and does not mention Hofker's analysis on those „Cretaceous” species found in the Maestrichtian Tuff Chalk (Hofker, 1959, Natuurhist. Maandblad, vol. 48, pp. 89—95). Meyer calls typical specimens of *Globigerina cretacea* d'Orbigny, not distinguishable from the types of d'Orbigny's type-locality, the Craie blanche of Meudon, *Rugoglobigerina rugosa* Plummer; moreover, he states that *Globigerina compressa* Plummer does occur in the Maestrichtian Tuff Chalk, but vanishes just at the hard ground above the Md; but, at the boundary Danian-Paleocene in Denmark, *G. compressa* likewise disappears! Moreover he finds, that in the Post-Maestrichtian, no *Chilogümbelina* is found; he believes this to be of minor importance; yet the author stated, that *Chilogümbelina* is not found any more in the lowest Paleocene in Denmark, whereas it is very common in the Danian itself; in this way, its absence in the formation above the Md just is very important: it shows that that formation cannot be of Danian age. Meyer emphasizes that in the Maestrichtian Tuff Chalk, *Gümbelina striata* (Ehrenberg) is common; in reality, most specimens of this group from the Tuff Chalk show, when studied in oil and high magnification that they are not fresh, but eroded, filled up with material and that the walls are recrystallised; whereas just beneath the Ma, where the author thinks the boundary Cretaceous-Danian has to be found, all specimens of the same group are hyaline, fresh, thin-walled, air-filled. Quite similar specimens of this group are found abundantly during the whole Danian in Denmark also in reworked state; so the occurrence of this group, in reworked state, in the Danian and in the Maestrichtian Tuff Chalk, strongly points to the identity in time of these two formations. In this way, Meyer's arguments turn against his ideas about the age of Maestrichtian Tuff Chalk as well as of the Post-Maestrichtian in Holland.

So, we cannot use so-called „Cretaceous” planktonic species as found in the Maestrichtian Tuff Chalk for stratigraphic purpose. But we can use once again another identity: that of the top of the Cr 4 in Holland, found just beneath the lowest layer of the Maestrichtian Tuff Chalk, the Ma, and the uppermost part of the white chalk (*Pseudotextularia*-zone) just found

beneath the Fiskeler in Denmark; we will then see, that both tops have an identical planktonic fauna. Moreover we will find, that just the first stages of *Globigerina pseudobulloides* and of *Globigerina daubjergensis*, are found in those formations, and so we can, also by means of planktonic Foraminifera, establish with certainty the stratigraphic place of the Maestrichtian Tuff Chalk. For in both formations, top Cr 4 in Holland, and top white chalk in Denmark, two important planktonic species start their development series; both are found during the Maestrichtian Tuff Chalk in later stages of development, though rarely; and both are found, extremely commonly, in the deep-sea sediments of the Danian in Denmark, in just the same way continuing their evolution. At the end of their development, when *Globigerina pseudobulloides* reaches its honeycomb structure of the wall (see Hofker, 1959, Natuurhist. Maandblad, vol. 48, pp. 80—83) and when *Globigerina daubjergensis* reaches its stage of large diameter with *Catapsydrax* structure, at the top of the Danian and in the lowermost Paleocene (greensand) in Denmark, and in the Post-Maestrichtian in Holland, in both localities they are found abundantly, being both formations deeper sea formations.

A sample, taken by B. J. Romein, just beneath the Ma in the ENCI-quarry (sample 2.75—3.00 m of the lowest series taken; the Ma is found at 3.25 m) and a sample, taken by Hofker and Romein in Denmark, just below the Fiskeler in the white chalk at Vigsø-Bjerre, near Thisted, Jutland (No. 975), gave following very typical planktonic Foraminifera in abundance (see plates 1 and 2):

The sediments of these two localities of white

Holland: plate 1:

*Globigerina pseudobulloides* Plummer in its most primitive form; fig. A Cr. 4, sample Romein 2.75 m;  $\times 335$ ;

*Globigerina daubjergensis* Brönnimann, in its most primitive type, described by Brönnimann from the Danian as *G. linaperta* Finlay; fig. B, E sample Romein 2.75 m,  $\times 335$ ;

*Gümbelina* cf. *striata* (Ehrenberg); fig. C, same sample,  $\times 335$ ;

*Globigerina biforaminata* Hofker; same sample fig. D,  $\times 115$ ;

*Globigerina rugosa* Plummer; same sample, fig. F,  $\times 115$ .



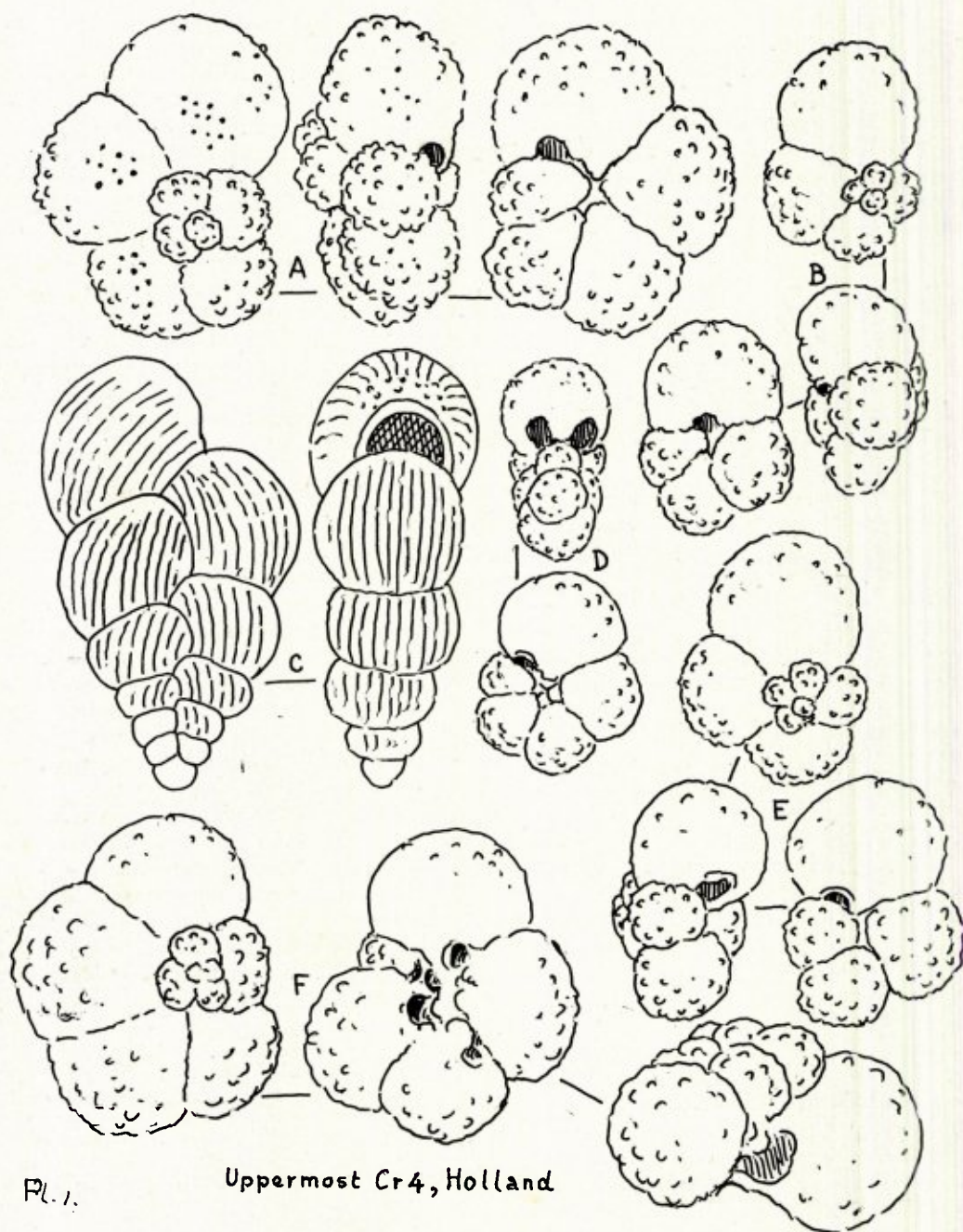


Plate 1. Planktonic Foraminifera of the uppermost Cr 4, just below the Maestrichtian Tuff Chalk, in Holland; see text.



chalk must, also seen from the side of planktonic Foraminifera, be identical in time.

It is very important to state here, that the faunal break of planktonic Foraminifera was not so abrupt a change as is often emphasised; already in the uppermost white chalk, in Holland as well in Denmark, the first forms of the Danian species *Globigerina pseudobulloides* and *Globigerina daubjergensis* appeared; this also was stated by Brotzen (1959, Sver. geol. Unders., ser. C, No. 571, p. 17: „In the Stevnian... in the uppermost part extremely small specimens of triloculine *Globigerinae*, with diameters less than 0,09 mm, occur"); the specimens of triloculine *Globigerina daubjergensis* in primitive form, found in Denmark as well in Holland (figs. B, B, E) measured 0,07—0,09 mm also. During the Danian this diameter gradually increases, as can be seen from the plate and then only young specimens are so small. So it is obvious, that at the end of the upper Maestrichtian (as Brotzen also calls this part of the white chalk, identical in time with our uppermost Cr 4) already the first forms of the Danian planktonic Foraminifera appeared.

This identity, in this way very accurately established, is once more emphasised by Backhaus by means of *Thecidium papillata* (Mitt. geol. Staatsinstitut, Hamburg, H. 28, 1959, p. 83), where this author says: „Hofker's Gleichsetzung des Ober-Maastrichtien von Stevns Klint mit dem Cr 4 und Ma Hollands könnte auf Grund des gemeinsamen Vorkommens von *Th. papillata* als berechtigt angesehen werden".

For more data about the identity in time of the Cr 4 with the *Pseudotextularia*-zone of Germany and of Denmark, read: Hofker, the Age of the Cr 4, Natuurhist. Maandblad, 1959, vol. 48, pp. 46—53.

Conclusion of this part of the investigation:

**The top of the Cr 4 in Holland, and the top of the white chalk in Denmark, are of the same age; the Cr 4 and the *Pseudotextularia*-zone both form the uppermost part of the Cretaceous; what is found above the Cr 4 in Holland (the Maestrichtian Tuff Chalk) and above the *Pseudotextularia*-zone of the white chalk in Denmark (the type-Danian) must be of absolutely comparable age.** For above these two formations, Maestrichtian Tuff Chalk and type-Danian, Globigerines are found which show the

end-stage of development, whereas just at the beginning of both formations, these planktonic species show the beginning of their development series (Brotzen, l.c. 1959, emphasizes that the Danian stage to his belief is the uppermost part of the Cretaceous; that also may be so, and in that case, the Maestrichtian Tuff Chalk also is the uppermost part of the Cretaceous, and the planktonic faunal break, by many stratigraphers indicated as the Cretaceous-Tertiary boundary, then would be found within, and not at the top, of the upper Cretaceous. The occurrence of so many typically Cretaceous fossils in the Maestrichtian Tuff Chalk also would point into the direction of Brotzen's idea which, as Brotzen mentions, was the idea of many older investigators. That in some localities the planktonic faunal break coincides with the Cretaceous-Tertiary boundary (Australia, Trinidad, Mexico) is due to a gap in the sedimentation; for in these localities the author stated that the Tertiary Globigerines following up the uppermost Cretaceous species, show the test wall structure of lower Paleocene and not of Danian forms; the real Danian is lacking in those localities. Such a gap also occurs in the Basin of Mons, Belgium; in the Tuffeau de Ciply (type-Montian) the planktonic fauna is that of Middle Paleocene, whereas the Tuffeau de Saint Symphorien below has the age of the Maestrichtian Tuff Chalk.

The latter is characterised by *Glob. daubjergensis*, and below that formation is found the Craie phosphatée de Ciply which is of the age of Dutch Cr3c and lowest Cr4. Often in this Basin the Tuffeau de Saint Symphorien is missing, and the Tuffeau de Ciply is overlying the Craie phosphatée; in that case the gap is even larger than in the localities mentioned above.

Denmark; plate 2:

*Globigerina pseudobulloides* Plummer in its most primitive form; fig. A white chalk, Vigsö-Bjerre, sample 975;  $\times 335$ ;

*Globigerina daubjergensis* Brönnimann, in its most primitive form; described by Brönnimann as *G. linaperta* Finlay; fig. B, sample 975;  $\times 335$ ;

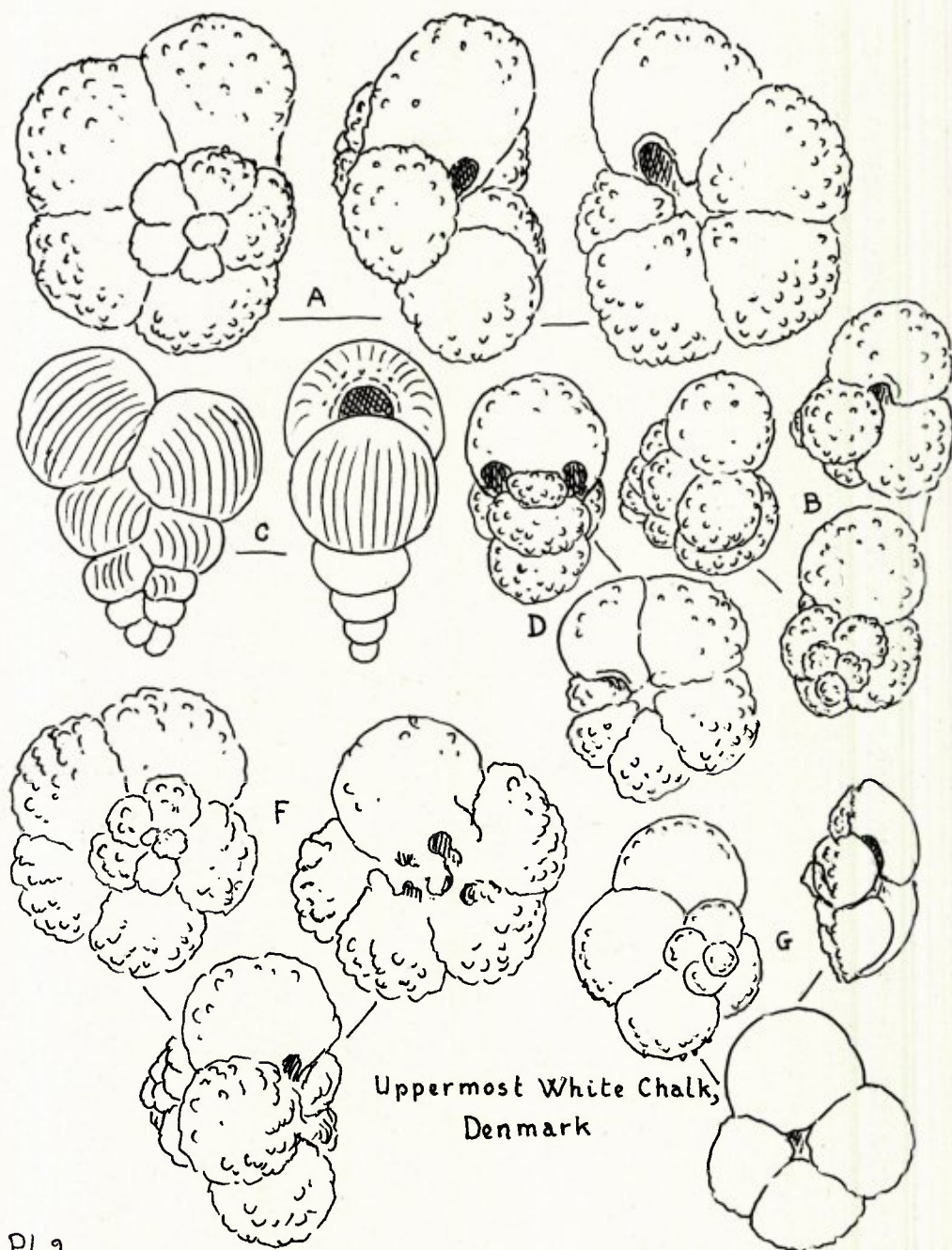
*Gümbelina* cf. *striata* (Ehrenberg); fig. C, same sample,  $\times 335$ ;

*Globigerina biforaminata* Hofker; same sample, fig. D,  $\times 115$ ;

*Globigerina rugosa* Plummer; same sample, fig. F,  $\times 115$ ;

*Globotruncana citae* Bolli; same sample, fig. G,  $\times 335$ ; this species was very rare in the Cr 4, since that formation is not sedimented in open sea.





Pl. 2

Plate 2. Planktonic Foraminifera of the uppermost white Chalk (*Pseudotextularia*-zone), just below the Fiskeler, in Denmark; see text.

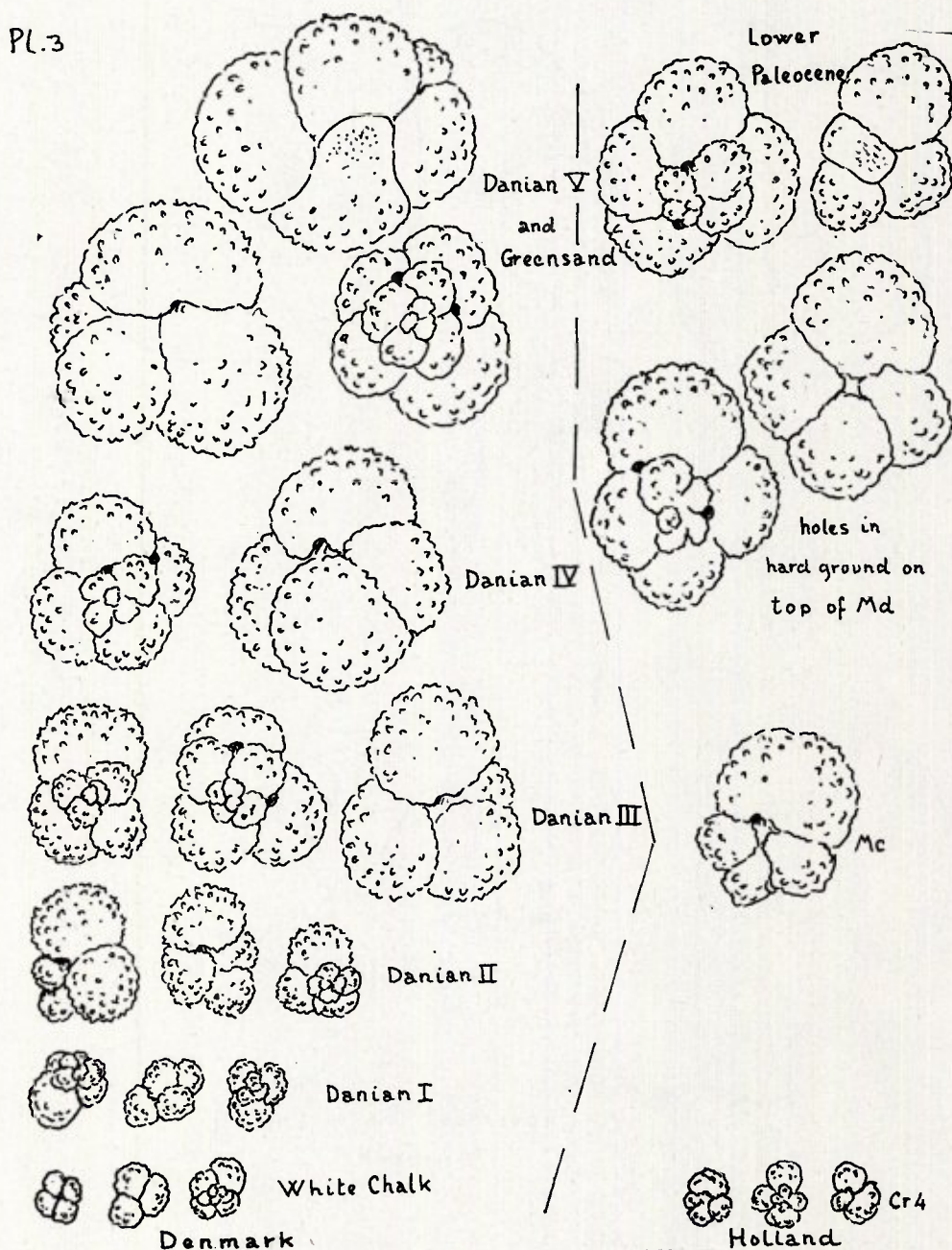


Plate 3. The development series of *Globigerina daubjergensis*, giving a continuous series in Denmark and a more scattered one in Holland; yet in Holland, Cr 4 and Me-Paleocene having been deeper sea sediments, both ends of the series can be analysed on a larger material. Begin and end of the series in both Denmark and Holland are the same.



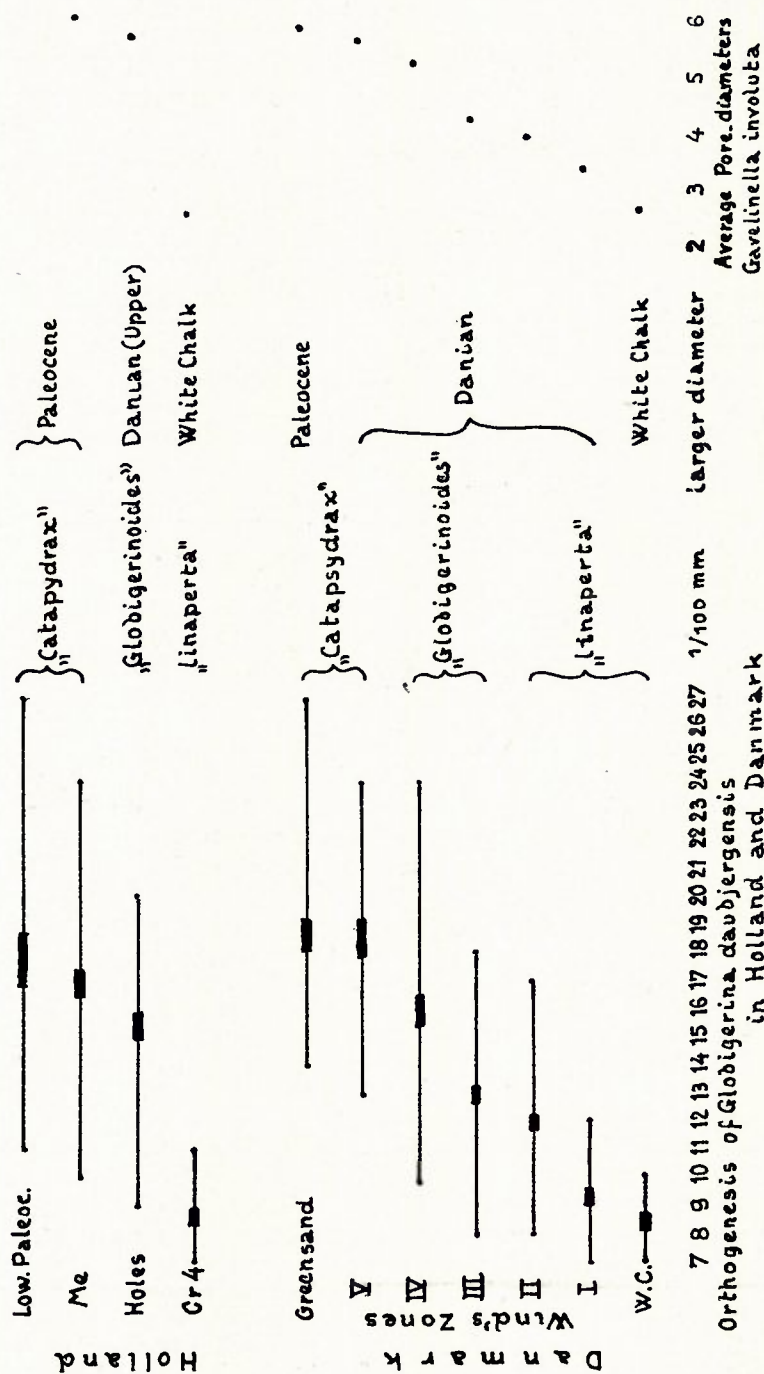


Plate 4. Diagram, showing the development of *Globigerina daubjergensis* in Denmark and in Holland, insofar the amount of specimens enabled statistic analysis. From all localities from which the samples were taken, also the average pore-diameter of *Gavelinopsis involuta* is given. These also are identical for Denmark and Holland, as are the whole faunae of Foraminifera.