cations in the river dunes on the right bank of the Meuse. In one spot they were trapped during spring migration towards their breeding places, in another spot they could be observed in their summer area.

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FORAMINIFERA FROM THE UPPER CRETACEOUS OF SOUTH-LIMBURG, NETHERLANDS LXXXIII

Tremastegina roestae (Visser)

by J. HOFKER

Cibicides roestae Visser, 1950, Leidse Geol. Mededelingen, vol. 16, p. 291, pl. 6, fig. 9.

Lockhartia roestae (Visser), Hofker, 1955, Natuurhist. Maandblad, vol. 44, pp. 4-5, fig. a-e.

Lockhartia roestae (Visser), Hofker, 1959, Congrès des Soc. Savantes, Dijon, pp. 289-290, fig. 95, 96.

This species only occurs in the Md in the Tuff Chalk of Maastricht, and was also found in the Campanian and Maestrichtian (Dordonian) in the Aquitaine Basin in France. The inner structure without any doubt excludes the genus *Cibicides;* a study of the genotype of *Lockhartia*, *L. haimei* (Davies) from the Laki Beds of Pakistan showed, that the species cannot belong to *Lockhartia* either: in *Lockhartia*, being an offspring of *Rotalia trochidiformis* Lamarck, the pores are very coarse, and each chamber is connected with the umbilical canal system by a peculiar opening, partly formed by a gutter-like toothplate which in *Rotalia* is straight, in *Lockhartia* more complicated; in *Lockhartia* no ventral secondary chamberlets are found, which are typical for the species found in the Campanian-Maestrichtian. These secondary chamberlets form the dome-shaped side of the small test, whereas the main chambers are situated at the flat side.

Each test has a nearly flat dorsal side with about 8 chambers in the last formed whorl; the last formed chambers show radial striae over their dorsal surface, which are poreless, with fine pores between in the furrows. The sutures

Fig. 1. *Trematostegina roestae* (Visser). Test from three sides; a, ventral side; b, side view; c. dorsal side, showing the primary chambers. High Md in Quarry Van der Zwaan, Jekerdal, St. Pietersberg near Maastricht. x 115.

Fig. 2. 3. Transverse axial sections, showing the primary chambers above, and the secondary chamberlets below, often distinctly separated by the tiny toothplate with its typical granular structure. x 115.

Fig. 4. Oblique section, dorsal side above, with the openings, formed by the granular toothplates from the main chambers towards the chamberlets. x 115.

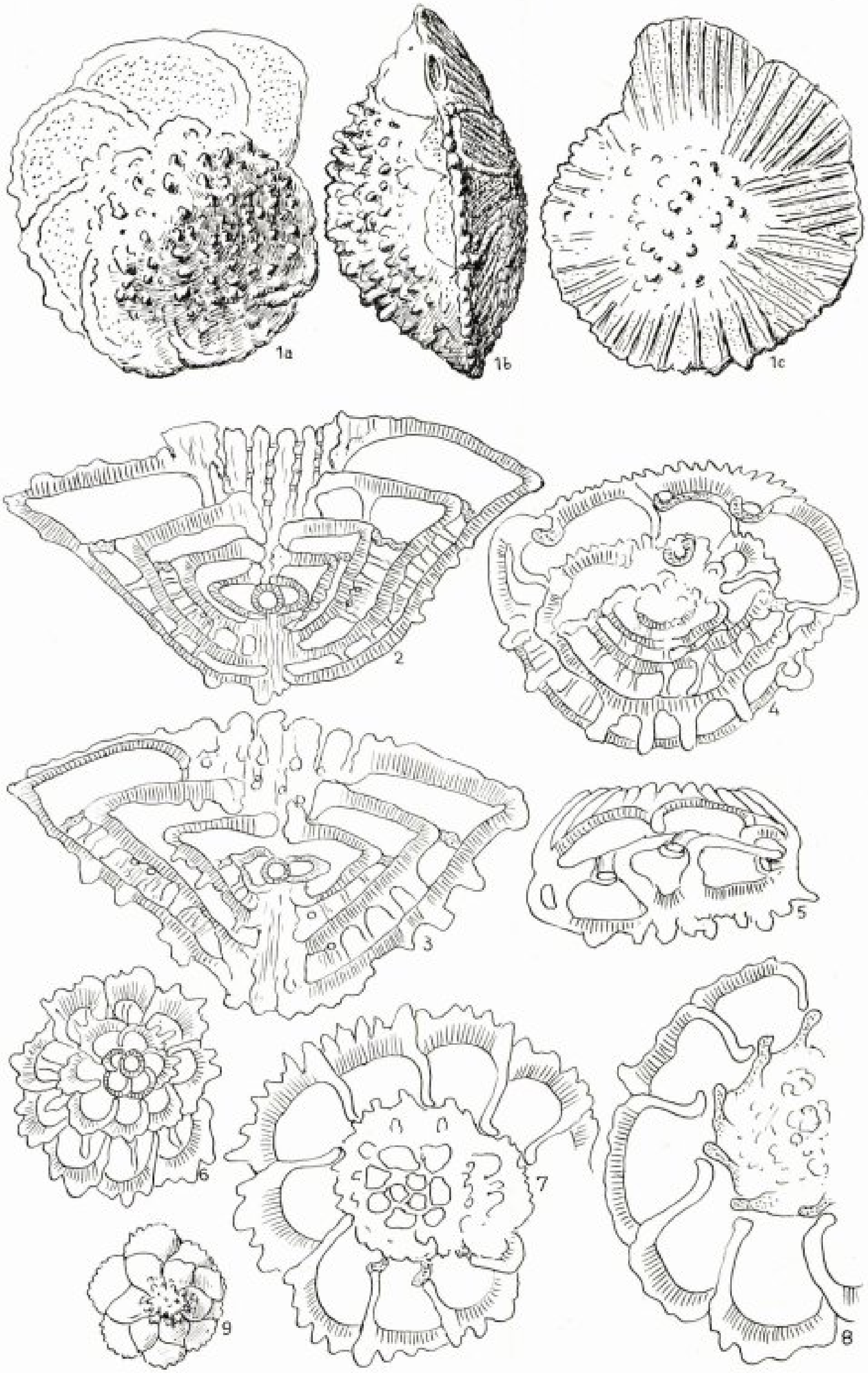
Fig. 5. Tangential axial section, showing above the main chambers and below the secondary chamberlets alternating with the main chambers, and the connecting foramina between. x 115.

Fig. 6. Horizontal section through a young specimen, through the proloculus. x 115.

Fig. 7. Horizontal section through the dorsal part of the test, with some main chambers, with their simple septa, and some toothplates; the middle part of the section transverses the dorsal pillars. x 115.

Fig. 8. Horizontal sections, somewhat more ventrally than given in fig. 7, showing the foramina between the main chambers and the more axially situated toothplates. x 115.

Fig. 9. Small test seen from the ventral side; the outer walls and most of the covering spinous surface eroded by acid. Clearly the ventral secondary chamberlets can be seen. x 50.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are difficult to observe and are radial. In the middle of this dorsal side and on the surface of the more initial chambers the striae fuse into an irregular texture of pustules.

The ventral side (which in my descriptions hitherto was taken as the dorsal one) is strongly dome-shaped. The last formed chambers here show a smooth surface with fine pores and the sutures of the chambers are slightly raised and towards the older chambers more and more ornamented by small pustules; these sutures are strongly rounded backward. The centre and sides of the ventral dome itself is covered by large pustules and short spines so that it is impossible to detect chambers. These chambers, however, can be seen when the spines of the dome-like side are eroded by an acid, and then it is found that from the sutures of the dorsal chambers a coil of ventral chambers emerge, chamberlets which are placed alternately with the dorsal chambers. Obviously we deal here with a species with ventral alternating chamberlets, just as they are found in *Asterigerina* and *Amphistegina*. Whereas in *Asterigerina* and *Amphistegina* only fine pustules appear at the ventral side of the aperture of the main chambers, here aspecially the surface of the chamberlets is covered by much more heavier spines, obscuring the surface of these chamberlets. The fine but distinct pores also are typical for *Asterigerina* or *Amphistegina*. The toothplates between the primary and secondary chambers are very small as in the case in *Amphistegina;* they form a rounded opening connecting the primary and secondary chambers. The toothplates can be seen also in some horizontal sections where they form small hooks proximally to the apertural openings of the primary chambers, just as is found in *Asterigerina* and just as can be seen in the horizontal sections given by Barker and Grimsdale (1936, Journ. Pal., vol. 10, pl. 34, „*Amphistegina*" *lopeztrigoi)* and by Brönnimann (1950, Ecl. geol. Helv., vol. 43, No. 2, fig. 6, *Tremastegina senni).* In oblique sections they can be seen, forming a funnel towards the secondary chamberlets. In some transverse sections the septal walls between the secondary chambers were observed; just as has been described by Brönnimann for *Tremastegina*, they show fine, rounded passages between the adjacent secondary chambers. Typical for the Cretaceous species are the spines formed on the ventral walls of the secondary chambers; they are so large, that the proximal walls of the secondary chambers of a next whorl could be laid down on the tops of these spines, in order that on transverse sections these chambers seem to be divided into small irregular parts. This phenomenon also can be seen in the transverse sections in Barker and Grimsdale, l.c., pl. 32, figs. 1-3 and in fig. 7,c, Brönnimann, l.c., p. 262. All these features strongly point to the genus *Tremastegina*, as scoped by Brönnimann. The septa between the primary as well as the secondary chambers are simple; this also is the case in *Asterigerina* as stated by the author (Paläont. Zeitschrift, vol. 33, fig. 3, 10a) and by Reiss (Geol. Survey of Israel, Bull. 35, 1963, p. 60); however, in the same paper Reiss stated, that *Amphistegina* had bilamellar septa (6. 62; p. 68); a thourough investigation of many horizontal sections revealed to the author that *Amphistegina* also has simple septa, so that also *Amphistegina* has to be placed in the neighbourhood of *Asterigerina*.

The finding of a true *Tremastegina* in the Upper Cretaceous is of special interest. Barker and Grimsdale showed, that the Lower Tertiary genus *Helicostegina* is but a more advanced group of species and must be derived from *Amphistegina* through *Tremastegina*. On p. 244, l.c., they give a supposed phylogeny of the Lepidocyclinidae, beginning with „*Amphistegina*" *lopeztrigoi*, which is a true *Tremastegina;* so the root of the Tertiary group of Lepidocyclinidae should be found in the Upper Cretaceous; till now, real Asterigerinids were unknown from the Upper Cretaceous. In the Treatise by Loeblich and Tappan (1964), Barker places the genus *Tremastegina* in the Amphisteginidae; in that family also *Eoconuloides* and *Boreloides* show these striking pillars in the ventral secondary chamberlets. In the type-species of *Amphistegina, A. vulgaris* (identical with *A. lessonii)*, pillar-like structures also are found.

The wall of the test of *T. roestae* (Visser) is, in well-preserved specimens, radial hyaline, as in *Asterigerina* and in *Amphistegina*. The primary chambers connect by a crescent-shaped opening near or slightly ventrally from the margin.