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## THE GENUS *BOLBOFORMA* VON DANIELS & SPIEGLER IN THE UPPER MIOCENE OF NORTHERN BELGIUM

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ABSTRACT. - Six species, belonging to the problematic genus *Bolboforma* VON DANIELS & SPIEGLER, 1974, have been described from three samples of the Upper Miocene of the Antwerpen and Kempen areas (Belgium).

ZUSAMMENFASSUNG. - Sechs Arten, gehörend zur problematische Gattung *Bolboforma* VON DANIELS & SPIEGLER, 1974, sind durch drei Proben aus dem Ober-Miozän der Antwerpener und Kempischen Gegenden (Belgien) beschrieben worden.

RESUME. - Six espèces de microfossiles problématiques, appartenant au genre *Bolboforma* VON DANIELS & SPIEGLER, 1974, ont été décrites à partir de trois échantillons du Miocène supérieur des régions d'Antwerpen et de Kempen (Belgique).

### INTRODUCTION.

C.H. VON DANIELS and D. SPIEGLER (1974) have described, from the Northwestern German Upper Tertiary strata, a group of eleven species of problematic microfossils for which the genus name *Bolboforma* has been introduced.

From three samples of late Miocene age (two samples from the Deurne Sands at the Borgerhout-Rivierenhof site, and one sample from the Dessel Sands in deepboring Lille 30W/294) problematic microfossils have been found, belonging to the genus *Bolboforma*.

The Deurne Sands are outcropping at the eastern part of the Antwerp city region. LAGA & DE MEUTER (1974) have described the Dessel Sands in deepborings of the Kempen area, east of Antwerp. The authors have stated a close relation with the Deurne Sands, regarding the presence and frequencies of both planktonic and benthonic foraminifera.

According to the litterature (LAGAAY, 1952) the Deurne Sands are considered of being of Upper Miocene age.

### DISCUSSION.

About 270 specimens belonging to the *Bolboforma* genus have been recorded from the three mentioned samples. The greater part of them (236 specimens) belongs to the species *Bolboforma metzmacheri*. Relatively frequent are *B. laevis* (17 specimens), *B. rotunda* (9 specimens) and *B. clodiusti* (5 specimens). One single specimen belonging to

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*B. reticulata* has been found and also one belonging to *B. spiralis*.

The abundant presence of *B. metzmacheri* in the Upper Miocene corresponds to the results of VON DANIELS & SPIEGLER (1974, fig. 2). *B. clodiusi*, *B. laevis* and *B. reticulata* are also Upper Miocene species.

The presence of *B. rotunda* and of *B. spiralis* in Upper Miocene samples has not been mentioned by VON DANIELS & SPIEGLER (1974) who have found those two species in Upper Oligocene and Lower Miocene samples.

ACKNOWLEDGEMENTS.

We wish to thank Dr. F. DE MEUTER (Laboratorium voor Paleontologie, K.U. Leuven, Belgium), who enabled us to examine the samples.

SYSTEMATICS.

genus *Bolboforma* VON DANIELS & SPIEGLER, 1974

*Bolboforma clodiusi* VON DANIELS & SPIEGLER, 1974

*Bolboforma clodiusi*, VON DANIELS & SPIEGLER, 1974, p. 63, pl. 7, fig. 4-6.

DIMENSIONS : see table 1

TABLE 1

Dimensions, in microns, of five *Bolboforma clodiusi* VON DANIELS & SPIEGLER, 1974, specimens from the Dessel Sands.

diameter	height	d/h
148	112	1.32
153	107	1.43
128	97	1.32
122	102	1.20
143	102	1.40

REMARKS : Only 5 specimens have been found in the sample of the Dessel Sands.

Their test is covered by many small; but large, spines. The aboral side is strongly flattened. The test has a pentagonal shape in longitudinal section.

*Bolboforma laevis* VON DANIELS & SPIEGLER, 1974

*Bolboforma laevis*, VON DANIELS & SPIEGLER, 1974, p. 64, pl. 7, fig. 7-9, pl. 10, fig. 6.

DIMENSIONS : see fig. 1

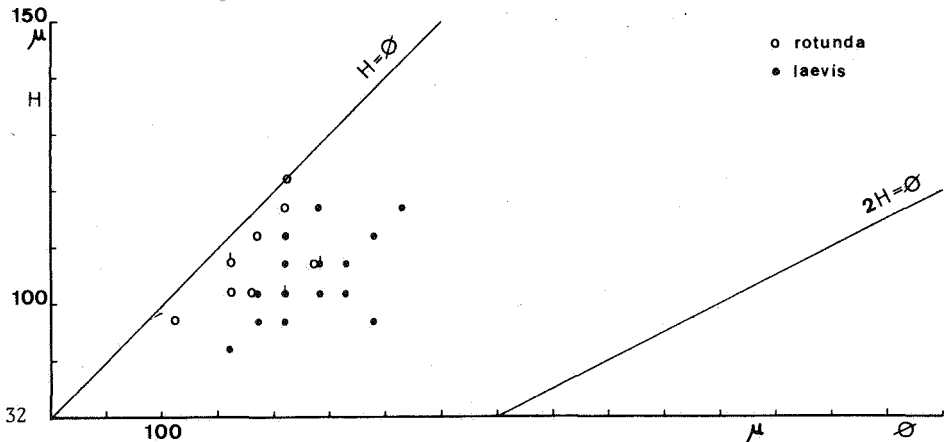


Fig. 1. - Diameter and height measurements of *Bolboforma laevis* VON DANIELS & SPIEGLER, 1974 and of *Bolboforma rotunda* VON DANIELS & SPIEGLER, 1974. The specimens are found in the Dessel Sands. Each dot represents one specimen. Dots with one or more streaks represent two or more specimens with identical dimensions.

REMARKS.

About 17 specimens have been recorded in the sample from the Dessel Sands. Nearly all tests are very smooth although some of them show slight traces of polygonal depressions. The specimens show a little variation in diameter height ratio (fig. 1). They may easily be distinguished from *Bolboforma rotunda* which has a higher and narrower test as expressed in figures 1, 2 and 7.

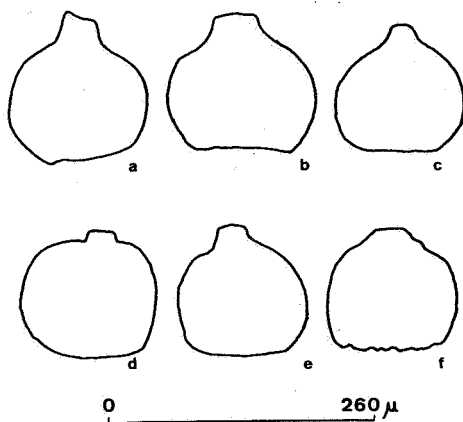


Fig. 2. - Variability in test shape of *Bolboforma laevis* VON DANIELS & SPIEGLER, 1974 specimens from the Dessel Sands.

*Bolboforma metzmacheri* (CLODIUS, 1922)

*Lagena metzmacheri*, CLODIUS, 1922, p. 108, pl. 1, fig. 21.

*Lagena metzmacheri*, CLODIUS, LANGER, 1969, p. 45, pl. 2, fig. 1, 2, 4.

*Bolboforma metzmacheri*, (CLODIUS), VON DANIELS & SPIEGLER, 1974, p. 62, pl. 7, fig. 1-3.

REMARKS.

About 218 specimens of *Bolboforma metzmacheri* (CLODIUS, 1922) have been found in the samples of the Deurne Sands and 18 have been found in the sample of the Dessel Sands.

All specimens show the characteristic polygonal depressions on the oral and lateral sides of the test although the degree of depression is quite variable; the aboral side is flat and without polygonal depressions in the centre; the oral aperture is surrounded by a smooth ring.

We have observed a great variability in the shape of the test and three main types have been distinguished (fig. 3) : a type with convex lateral sides (CX-type), a type with rather parallel lateral sides (PL-type) and a type with a conical test (CL-type). Furthermore some specimens possess a test which is pentagonal in longitudinal section and resembles the figure of CLODIUS as copied by LANGER (1969, pl. 2, fig. 4) but the aboral/lateral side is not so high. Transition specimens between the three main types are relatively frequent and distinction between PL-types and steep CL-types has not always been possible.

For every type we have found a great variability in diameter/height ratio (fig. 4.). Every type possesses flattened specimens and very high specimens with a main part of transitional specimens. The height of a specimen has been measured between the aboral flattened side and the chamber/neck transition which is in most cases very distinct. The diameter measured is the greatest diameter of the test.

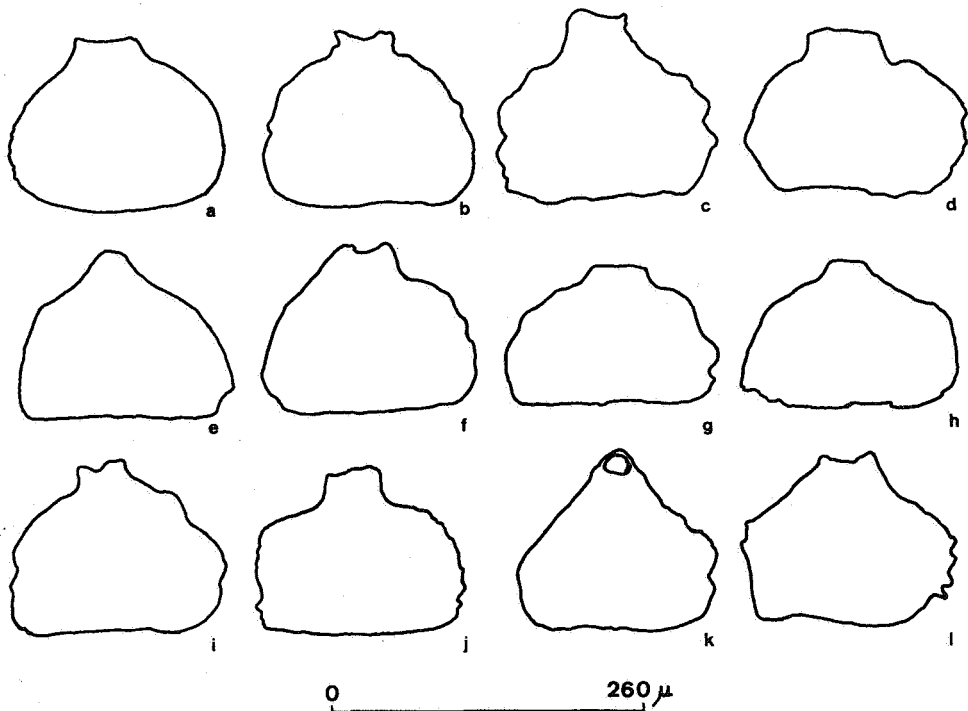


Fig. 3. - Variability in test shape of *Bolboforma metzmacheri* (CLODIUS, 1922) specimens from the Deurne Sands. a, b, c, d, : CX-type; e, f, g, h, : CL-type; i, j, : PL-type; k, l, : pentagonal type.

We also found a great variability in the shape of the aboral side (fig. 5). Most specimens possess a nearly round section but others have a rather ovale (fig. 5a), rhombic (fig. 5b) or even triangular (fig. 5c, 5d) section. The oral aperture is mostly eccentric. In some specimens we have observed an aperture in the aboral side of the test (Pl. 1, fig. c, d.). Such specimens are rather rare (about 5% of the recorded specimens). The aperture is probably an accidental feature although some aboral apertures are nearly in the centre of the aboral side and are fairly rounded (fig. 5c, 5d).

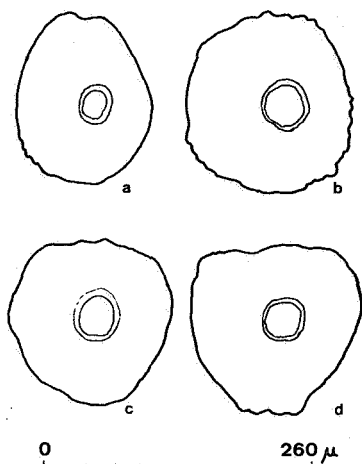
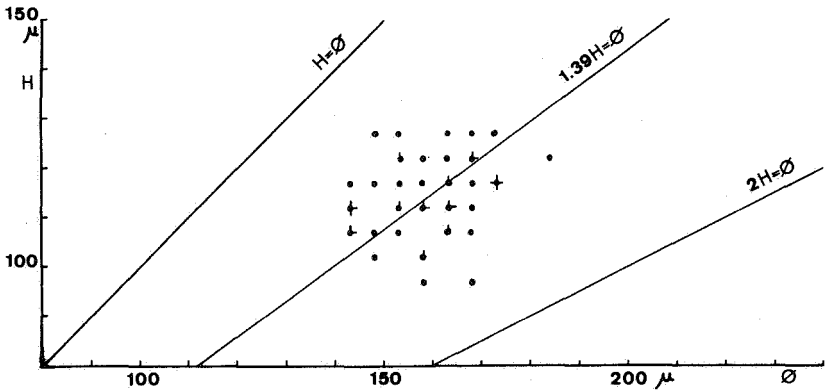


Fig. 5. - Variability in shape of the aboral side of *Bolboforma metzmacheri* (CLODIUS, 1922), specimens from the Deurne Sands.

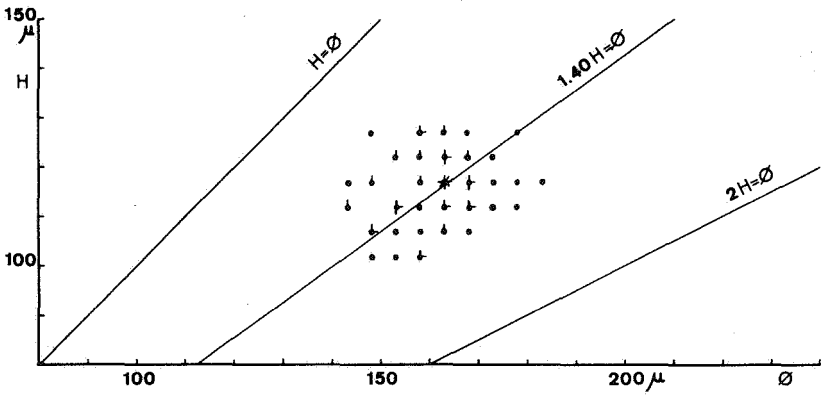
TABLE 2

Dimensions, in microns, of the pentagonal *Bolboforma metzmacheri* (CLODIUS, 1922) specimens from the Deurne Sands.

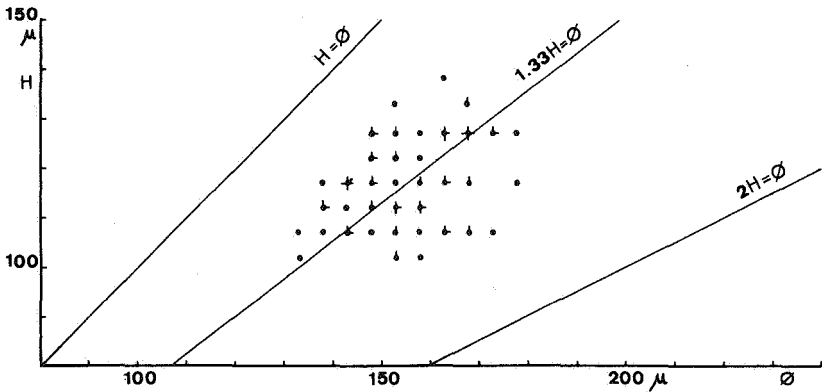
diameter	height	d/h
163	127	1.28
153	122	1.25
158	127	1.24
138	127	1.09



(a)



(b)



(c)

Fig.4. - Diameter and height measurements of *Bolboforma metamacheri* (CLODIUS, 1922) specimens from the Deurne Sands. a. PL-type; b. CL-type; c. CX-type. Each dot represents one specimen. Dots with one or more streaks represent two or more specimens with identical dimensions.

We have also noticed that one oral-lateral side is mostly more flattened than the other one (fig. 3d, 3e).

In table 2, the diameter, height and diameter/height ratio of the pentagonal *Bolboforma metzmacheri* specimens have been mentioned.

*Bolboforma reticulata* VON DANIELS & SPIEGLER, 1974

*Bolboforma reticulata*, VON DANIELS & SPIEGLER, 1974, p. 64 , pl.7, fig. 10-11.

DIMENSIONS :

Diameter : 152 microns; height : 153 microns; diameter/height ratio : 1.03.

REMARKS.

One single specimen from the sample of the Dessel Sands has been recorded. The test possesses a strongly reticulated ornamentation although the diameter of the polygonal depressions is smaller than those of the holotypes and paratypes as mentioned by VON DANIELS & SPIEGLER (1974, p. 64).

The aboral side is triangular in shape. The test possesses convex lateral sides and slightly concave oral/lateral sides.

*Bolboforma rotunda* VON DANIELS & SPIEGLER, 1974

*Bolboforma rotunda*, VON DANIELS & SPIEGLER, 1974, p. 67, pl. 8, fig. 10 pl.9, fig.1,2.

REMARKS.

The nine specimens, which have been recorded from the sample of the Dessel Sands, have a relatively high test, which is smooth.

The dimensions of the recorded specimens are not so variable as these of *Bolboforma laevis* (fig. 1) and a distinction between the two species seems to be easily possible by the diameter/height ratio (fig. 1) and by the flattened aboral side of *Bolboforma laevis* (fig. 2) and rounded aboral side of *B. rotunda* (fig. 6).

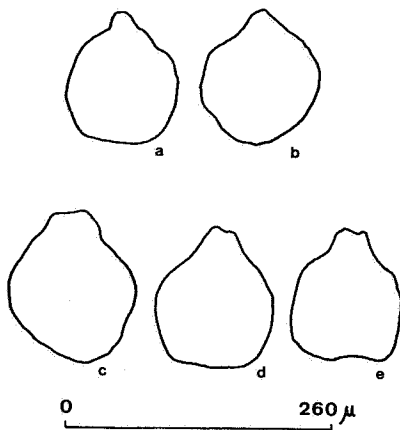
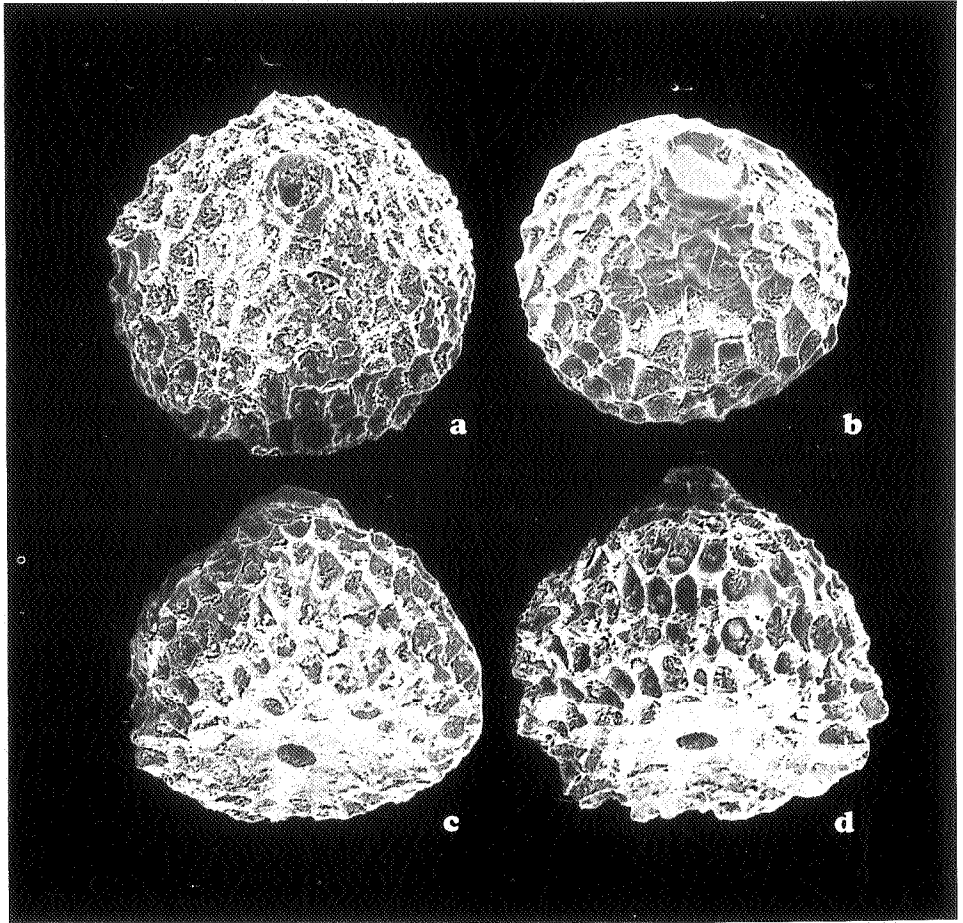


Fig. 6. - Variability in test shape of *Bolboforma rotunda* VON DANIELS & SPIEGLER, 1974 specimens from the Dessel Sands.



PL. I. - Scanning photographs of *Bolboforma metzmacheri* (CLODIUS, 1922) specimens from the Deurne Sands, showing the polygonal depressions and the smooth ring around the oral aperture (a, b) and an aboral aperture (c, d); a. x 432; b. x 444; c. x 421; d. x 378.

*Bolboforma spiralis*, VON DANIELS & SPIEGLER, 1974, p. 68, pl. 9, fig. 5-8, pl. 10, fig. 1-3.

DIMENSIONS.

Diameter : 128 microns; height: 102 microns; diameter/height ratio : 1.26.

REMARKS.

One single specimen has been recorded from the sample of the Dessel Sands. The test is glassy and transparent and shows three distinct keels.

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