FORAMINIFERA FROM THE CRETACEOUS OF SOUTHERN LIMBURG, NETHERLANDS. XIV.*)

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THE GENUS *ORBIGNYNA*.

In my paper on the Foraminifera from the Upper Cretaceous of North Western Germany and Holland in press, I pointed out that the genera *Ataxophragmium* and *Orbignyna* belong closely together and that in both genera the microspheric form is an *Arenobulimina*, where as in *Orbignyna* the A_1-generation is a form with a univerial stage, the A_2-generation an *Ataxophragmium*.

In the Upper Cretaceous of Holland four different species occur which show a different geological appearance.

ORBIGNYNA AQUISGRANENSIS (Beissel).

Lituola aquisgranensis Beissel, 1891, p. 12, pl. 3, figs. 1—16.

Lituola aquisgranensis Beissel, var. *conica* Beissel, 1891, p. 13, pl. 3, figs. 17—54.

Ataxophragmium beisseli Cushman 1936, p. 43, pl. 6, fig. 22.

Plectina ruthenica (Reuss) partim Cushman 1937, pl. 11, figs 12, 14.

This species in its three forms occurs typically in the Upper Cretaceous of Aachen. The coarse sand-grains, cemented with whitish chalk, and the more or less coarse surface are characteristic enough. The test may be very different in size. The species occurs in the whole profile at Lüneburg (Germany), especially in the lower samples, and is found in Holland in many samples of the Cr 3 *a* and Cr 3 b. It is characteristic for the Cr 3 a, where it is often very abundant. Some specimens show a somewhat finer texture and may belong to *Orbignyna variabilis*.

ORBIGNYNA OVATA Hagenow.

Orbignyna ovata Hagenow, 1842, p. 573, pl. 9, fig. 26.

Haplophragmium ovatum Reuss, 1861, p. 328, pl. 5, figs. 8, 9.

Lituola ovata Marsson, 1878, p. 171, pl. 5, fig. 40.

Spirolina inflata Reuss, 1851, p. 32, pl. 2, figs. 5, 6.

Ataxophragmium variabile authors partim.
Plectina ruthenica authors partim.

This species is characteristic in its A_2-generation, since that is compressed laterally; the agglutination always is much finer than that of *O. aquisgranensis* and the two other generations also show that texture, so that they show the characters of some *Ataxophragmium variabile* or an *Arenobulimina*, and *Plectina* in the full-grown B-generation.

The species is typical in Holland for the Upper parts of the Cr 3 *a*, the Cr 3 b, and is found also in the Cr 3 gamma and the Cr 3 c. In Germany it is typical for the upper parts of the Upper Campanian and the Lower Maestrichtian.

ORBIGNYNA RIMOSA (Marsson).

Bulimina rimosa Marsson, 1878, p. 153, pl. 3, fig. 2.

Bulimina ovata (Hag.) var. *ruegensis* Franke, Pomm. Kreide, 1925, p. 82, pl. 7, fig. 5.

In many descriptions and figures of *Ataxophragmium variabile*, some *Plectinae* and more *Arenobuliminae* from the Uppermost Cretaceous one observes tests in which the greater part of the agglutination is formed by fine calcareous spiculae. The study of the Dutch forms revealed that they belong together and form a species of *Orbignyna*.

B-generation. A slender form, in some cases with the aperture of an *Arenobulimina*, in most cases with the areal aperture of a *Plectina*. The initial end tapering and often pointed, in full-grown specimens the last formed chambers uniserial. Sutures indistinct, wall very smooth with conspicuous fine spiculae imbedded in the agglutination, mostly directed in the length of the test.

A_1-generation. The texture of the test is that of the B-form. Test elongate, consisting of an initial part which is closely coiled and two or three uniserial chambers. In most cases the initial part is strongly rounded the apertural part is as bluntly ending as the initial one.

A_2-generation. This generation looks like an *Ataxophragmium* and has been figured by Cushman, 1937, pl. 21, figs. 16—18 as *Ataxophragmium rimosum* (Marsson). When Cushman is right in his determination, the whole group of three different forms, all with the same texture with spicules in the test, should be recorded as *Orbignyna rimosa*. The generation shows the characters of *Ataxophragmium*, but, as Cushman points out already, its aperture often becomes areal. It was found in the uppermost Cretaceous of Rügen and reported by Franke (but I believe that his determination is doubtful) from Obershagen near Hannover.

This typical species, at once characterised by the spicules in the tests, is found in Holland in the Cr 4, the Ma and in some samples, very rarely, from the lowest Prae-Mb, in Belgium also in the middle Maestrichtian. In Germany and Denmark it occurs in the Uppermost Maestrichtian and the lowest Danian.

ORBIGNYNA FRANKEI (Brotzen).

Ataxophragmoides frankei Brotzen, 1948, p. 36, pl. 5, fig. 6.
Bulimina variabilis Franke, 1927, p. 11, pl. 1, fig. 7.
Plectina elava Marsson (?),1878, p. 160, pl. 3, fig. 29.

This species was described from the Lower Paleocene of Sweden, where it may have been reworked.

The characteristic feature of this species, of which the A_2-generation occurs only in the older parts of its development, is the texture of the test. Here fine grains are found forming the bulk of the walls, whereas much larger grains are found forming the bulk of the walls, whereas much larger grains, smoothly imbedded in the substance, are found especially in the region of the proximal sutures of the chambers. These larger grains, but not so conspicuous, also are found in *Plectina ruthenica*, which is a geologically older species.

B-generation. Mostly shaped as an *Arenobulimina (Arenobulimina ovoidea* Visser (non Marie), 1950, p. 218, pl. 8, fig. 2), in full-grown specimens as a *Plectina (Plectina ruthenica* Visser (non Reuss), 1950, p. 220, pl. 1, fig. 9). The texture of the walls always is consisting of fine grains in which larger grains are inbedded. The aperture is sutural or, in the *Plectina*-forms, areal.

A_1-generation. This generation is not so common as the former one. It has the shape of an *Orbignyna*, with bluntly rounded initial part followed by a series of 3 or 4 chambers of uniserial chambers at the end with areal aperture. The coarse grains between the fine agglutination are characteristic. *(Orbignyna aquisgranensis* Visser (non Beissel), 1950, p. 221, pl. 8, fig. 5).

A_2-generation. This generation is found in the first development of the species only. In younger samples it becomes very scarce. It shows the characters of an *Ataxophragmium*. Brotzen found that this form lacks the partition in the chambers and thus created a new genus for in, *Ataxophragmoides;* but I could show that most of the A_2-forms of *Orbignyna* and *Ataxophragmium* do not develop these partitions, so they cannot be regarded as a generic character.

This species seems to be trimorphic in its first development, where it is found in the Cr 4, up to the Ma and its equivalents in the Kunrade Chalk. In the uppermost layers of this Prae-Mb and in the whole Mb the species is not common and is found only in the B-generation with *Plectina*-form apogamic form).

This simplification of reproduction is found in many end-forms of foraminiferal groups as I could state in my paper in the Cretaceous of North Western Germany and Holland; in some layers of the uppermost Md, in which all indications are present of a much colder climate, this *Plectina*-form returns in some abundancy. It is found also in the Danian of Denmark.

These four species of *Orbignyna*, all very characteristic and easily recognisable, give beautiful guide-fossils for the Cr 3 a up to the Mb, since they are found in many samples. The range-chart gives their geological distribution.

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			Orbignyna aquisgranensis	*Orbignyna ovata*	*Orbignyna rimosa*	*Orbignyna frankei*	*Orbignyna frankei apogama*
Kunrade Chalk		Md					×
		Mc					× ?
Danian		Mb					×
		Ma + Prae-Mb			×	×	
Lower Middle Upper Maestrichtian		Cr 4			×	×	
		Cr 3 c		×	×		
		Cr 3 b		×			
		Cr 3 y	×	×			
		Cr 3 b	×	×			
Campanian		Cr 3 a	×	×			
		Hervian	×				

Range-Chart of the four (five) species of *Orbignyna* in Southern Limburg

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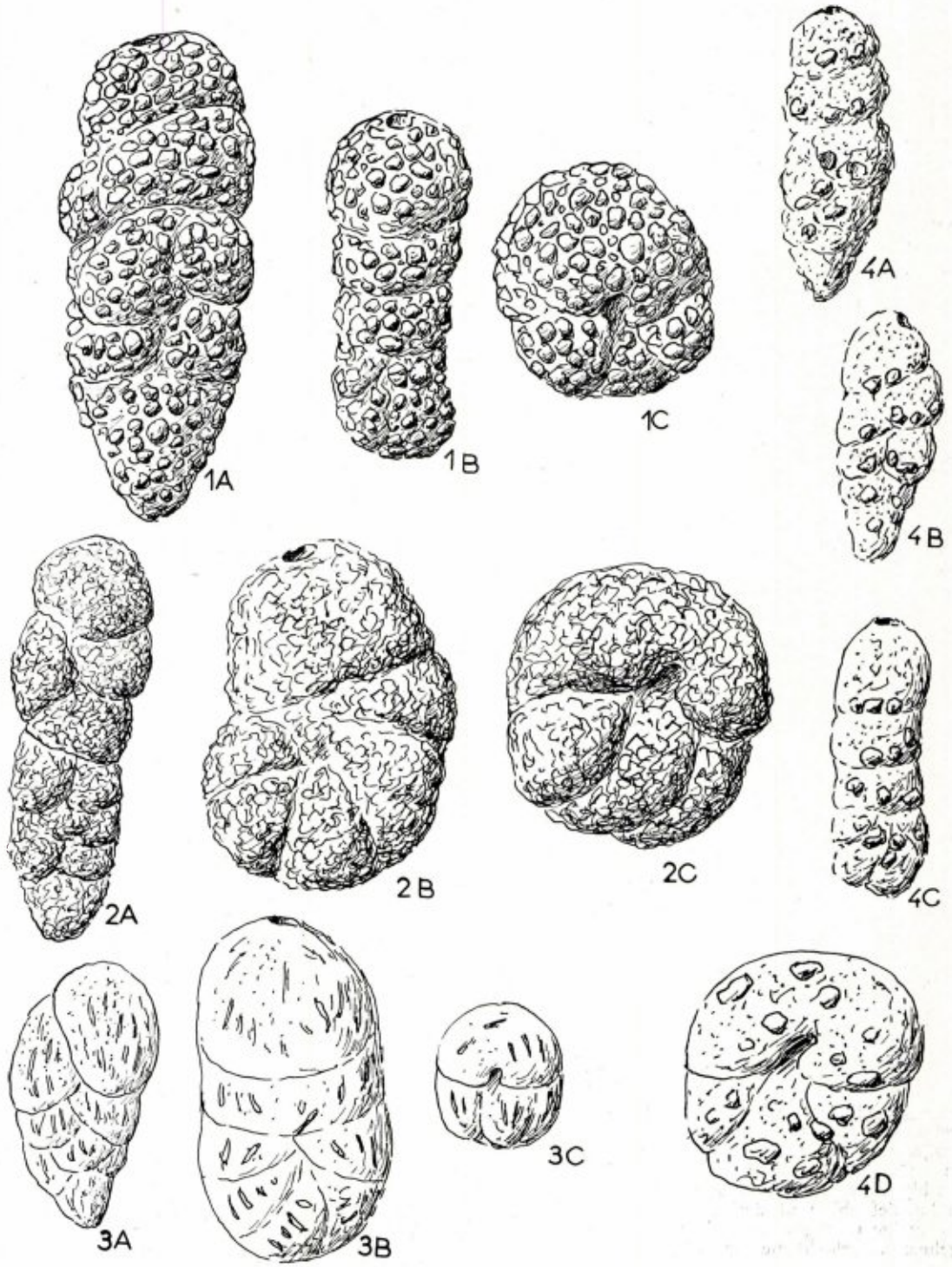
EXPLANATION OF THE FIGURES.

Fig. 1. *Orbignyna aquisgranensis*. a. *Plectina*-form; pit at Wahlwylre, 9 m. Cr 3 γ. b. *Orbignyna*-form; Bovenste Bos, coll. Kruit 606, Cr 3a. c. *Ataxophragmium*-form; Hollow way at Gulpen, Cr 3a.

Fig. 2. *Orbignyna ovata*. a: *Plectina*-form; Vijlen, 87, Cr 3 C. b: *Orbignyna*-form; Vijlen, 87, Cr 3 C. c: *Ataxophragmium*-form; Vijlen, 88, Cr 3 C.

Fig. 3. *Orbignyna rimosa*. a: *Arenobulimina*-form; coll. Kruit 552, Enci, Cr 4. b: *Orbignyna*-form; coll. Kruit 552, Enci, Cr. 4. c: *Ataxophragmium*-form; coll. Kruit 552, Enci, Cr 4.

Fig. 4. *Orbignyna frankei*. a: *Plectina*-form, Apogamic; Upper Md, quarry v. d. Zwaan, St. Pietersberg. b: *Arenobulimina*-form; coll. Kruit 469, Enci, prae-Mb. c: *Orbignyna*-form; coll. Kruit 461, Ma. d: *Ataxophragmium*-form; coll. Kruit 609, Simpelveld, prae-Mb.
All figures × 36.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