

## The stratigraphical position of the Edegem Sands Member (Berchem Formation, Miocene) in its type area at Wilrijk (N Belgium), based on planktonic foraminifera

H.J.F. Hooyberghs

*Instituut voor Aardwetenschappen, Afdeling Historische Geologie, Laboratorium voor Paleontologie, Redingenstraat 16, 3000 Leuven, Belgium*

Received 27 October 1994; accepted in revised form 1 April 1996

**Key words:** Early Miocene, Aquitanian, Biozone N4

### Abstract

The glauconitic and fossiliferous Edegem Sands Member of the Berchem Formation (Miocene) in northern Belgium contains 25 different taxa of planktonic foraminifera. The presence of *Globorotalia kugleri* and *Globigerinoides primordius* allows to assign an Aquitanian age (Early Miocene) to the member. More accurately, this presence allows a correlation with Biozone N4, defined in tropical regions by Blow (1969, 1979).

### Introduction

After the disappearance of some temporary outcrops of the Edegem Sands around Antwerp, the 'Belgische Vereniging voor Paleontologie' has dug a pit at Wilrijk (Figure 1). The Edegem Sands in this pit were sampled to study the planktonic foraminifera. This is of particular interest as the pit is situated in the type region of the Edegem Sands. A similar study has been made before by Hooyberghs (1983) at nearby Terhagen.

The samples have been washed on a 75  $\mu$  sieve. The dried residue was treated with CCl<sub>4</sub>, which allows to concentrate the microfossils. The specimens shown in Plates 1–5 are stored in the 'Instituut voor Aardwetenschappen' at Leuven.

### Lithostratigraphy

Figure 2 shows the lithological log of the studied section at Wilrijk. The Edegem Sands Member is a subdivision of the Berchem Formation, introduced by De Meuter & Laga (1976). Table 1 shows the lithostratigraphical subdivision of the Miocene around Antwerp, as well as the local biostratigraphical subdivision based on benthonic foraminifera, proposed by De Meuter (1980). At Wilrijk, the Edegem Sands overlie the Boom

Clay Member of the Rupel Formation (Oligocene). At the erosional top of the dark grey clay, calcareous septaria concretions occur. Such concretions are typical of the Boom Clay, and their presence reflects a hiatus between the Boom Clay and the Edegem Sands.

The Edegem Sands consist in the lower part of dark grey-greenish glauconitic and clayey sands. The sediment is rich in scattered molluscs. At 325 cm depth, a thin horizon occurs which is characterized by a high concentration of molluscs. The clay component in the Edegem Sands decreases upwards, which is explained by the decreasing depth of a regressing sea. The horizon rich in molluscs likewise is considered by De Meuter (1974) as a near-shore facies. The colour of the sand around this horizon is rather dark brown. In the upper part, at a depth of 190–306 cm, the sand is green-yellowish in colour. Most molluscs are strongly fragmented in this interval, probably because of the increasing turbulence in a shallowing sea. The Edegem Sands are overlain by Quaternary sediments.

### Biostratigraphy

The distribution of planktonic foraminifera in the Edegem Sands at Wilrijk is shown in Table 2. The distribution chart of Hooyberghs (1983) for Terhagen is

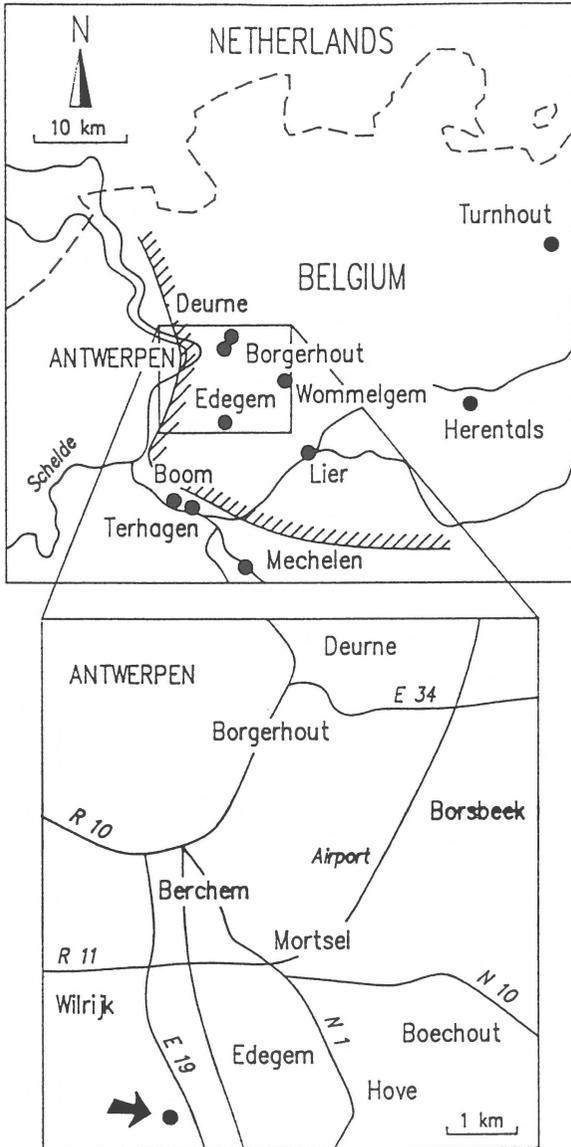


Figure 1. Arrow indicates studied section at Wilrijk ( $X = 51^{\circ} 07'$ ,  $Y = 4^{\circ} 26'$ ). Hachured line indicates erosional western boundary of Berchem Formation (after De Meuter 1980).

included in Table 3. Most of the taxa have an extended stratigraphical range and occur also in the underlying Boom Clay (Hooyberghs 1983).

A few species such as *Globigerina ampliapertura* Bolli 1957 and *Chiloguembelina cubensis* are clearly reworked from the Boom Clay. However, also at Wilrijk, the Edegem Sands contain individuals of a few other species: *Globorotalia zealandica incognita* Walthers 1965, *Globigerina edegemensis* Hooyberghs 1983 and *Globigerinoides primordius* Blow & Banner 1962.

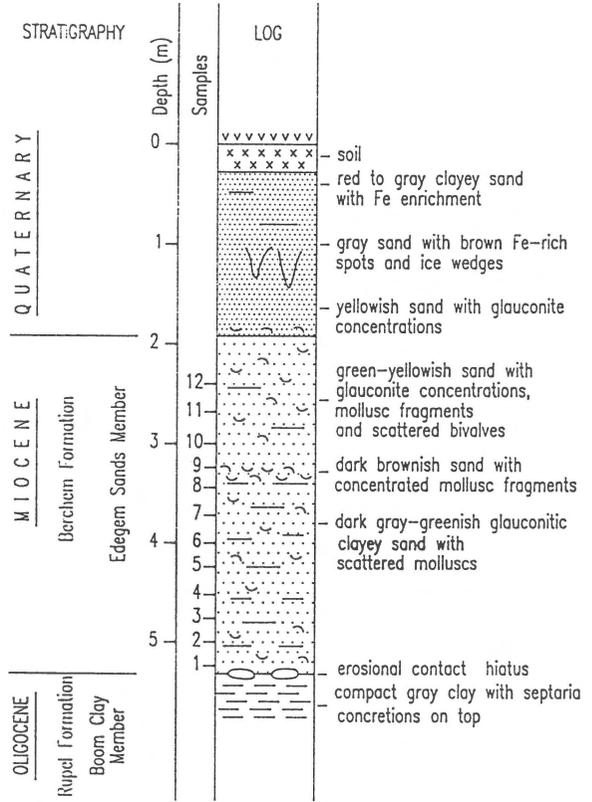


Figure 2. Lithological log of the studied section of the Edegem Sands Member (Berchem Formation) at Wilrijk (Figure 1).

In the North Sea Basin, *Globigerina edegemensis* is restricted to the Edegem Sands in Belgium. It was recorded also from Zone N4 in Central Tunisia (Hooyberghs et al. 1990). This species differs from *Globigerina ciperoensis* Bolli 1954 only in having six chambers in the last whorl instead of five.

Important in the Terhagen section is the presence of both *Globigerinoides primordius* and *Globorotalia kugleri* Bolli 1957. In view of the small distance (10 km) between the Terhagen and Wilrijk sections, we can assume that both sections are situated in the same biozone. Besides, the presence of planktonic foraminifera and the association of benthonic foraminifera (De Meuter 1980) indicate in both sections a shelf environment with an open connection to the deep sea.

The presence of *Globorotalia kugleri*, associated with *Globigerinoides primordius*, is important because it allows to situate the Edegem Sands in Biozone N4 of Blow (1969, 1979), even though *Globorotalia kugleri* was not found in the Wilrijk section. Biozone N4,

Table 1. Lithostratigraphical subdivision of the Miocene near Antwerp and biozonation of benthonic foraminifera (after De Meuter 1980).

Series	Lithostratigraphy		Biozonation Assemblage zones
	Formation	Member	
Miocene	Diest Fm. (partim)	Dessel Sands	<i>Uvigerina hosiusi deurnensis</i> –
		Deurne Sands	<i>Elphidium antoninum</i>
	Berchem Fm. (partim)	Zonderschot Sands	<i>Uvigerina tenuipustulata</i> –
Antwerpen Sands		<i>Elphidium inflatum</i>	
Berchem Fm. (partim)	Edegem Sands		<i>Trifarina gracilis rugulosa</i> –
			<i>Elphidium ungeri</i>

Table 2. Distribution of planktonic foraminifera in the type region of the Edegem Sands, Berchem Formation, at Wilrijk.

Berchem Formation, Edegem Sands												Lithostratigraphy
1	2	3	4	5	6	7	8	9	10	11	12	Samples
					•		•	•	•	•		<i>Globorotalia obesa</i> Bolli, 1957
		•									•	<i>Globorotalia opima nana</i> Bolli, 1957
							•		•	•	•	<i>Globorotalia siakensis</i> (Le Roy, 1939)
	•	•	•	•	•	•	•	•	•	•	•	<i>Globorotalia zealandica incognita</i> Walthers, 1965
•	•	•	•	•	•	•	•	•	•	•	•	<i>Globigerina angustumbilicata</i> Bolli, 1957
•	•	•	•	•	•	•	•	•	•	•	•	<i>Globigerina ciperoensis</i> Bolli, 1954
		•			•			•	•		•	<i>Globigerina edegemensis</i> Hooyberghs, 1983
	•											<i>Globigerina fariasi</i> Bermudez, 1961
	•	•	•	•	•	•	•	•	•			<i>Globigerina officinalis</i> Subbotina, 1953
•	•	•	•	•	•	•	•	•	•		•	<i>Globigerina ouachitaensis</i> Howe & Wallace, 1932
•	•	•	•	•	•	•	•	•	•	•	•	<i>Globigerina praebulloides leroyi</i> Blow & Banner, 1962
•	•	•	•	•	•	•	•	•	•	•	•	<i>Globigerina praebulloides occlusa</i> Blow & Banner, 1962
•	•	•	•	•	•	•	•	•	•	•	•	<i>Globigerina praebulloides praebulloides</i> Blow, 1959
											•	<i>Globigerina tripartita</i> Koch, 1926
		•	•		•							<i>Globigerina woodi connecta</i> Jenkins, 1964
	•	•	•	•	•	•	•		•			<i>Globigerinoides primordius</i> Blow & Banner, 1962
				•								<i>Globigerinoides cf. sacculifer</i> (Brady, 1877)
•	•	•	•	•	•	•	•	•	•	•	•	<i>Globorotaloides suteri</i> Bolli, 1957
<i>Globigerinoides primordius</i> N4												Biostratigraphy

the *Globigerinoides primordius* Zone of the biostratigraphical subdivision worked out in tropical regions, indicates an Aquitanian age (Blow 1969, 1979; Bolli & Saunders 1987).

Gradstein et al. (1994) note that, due to erosion, Lower Miocene deposits are missing in offshore oil wells in the North Sea Basin. They also note the absence of *Globigerinoides primordius*.

## Acknowledgements

The author is greatly indebted to K. Hoedemakers and R. Marquet of the 'Belgische Vereniging voor Paleontologie' for information concerning the section of the Edegem Sands at Wilrijk, and for the invitation to sample and to study the planktonic foraminifera. Sincere thanks are also due to K. Wouters (Koninklijk Belgisch Instituut voor Natuurwetenschappen, Brussels) for the facilities to make the SEM photographs.

Table 3. Distribution of planktonic foraminifera in the Edegem Sands at Terhagen (after Hooyberghs 1983).

1	2	3	4	5	6	7	Samples
•	•	•		•		•	<i>Globorotalia continuosa</i> Blow, 1959
		•					<i>Globorotalia kugleri</i> Bolli, 1957
						•	<i>Globorotalia obesa</i> Bolli, 1957
•	•		•				<i>Globorotalia opima nana</i> Bolli, 1957
		•				•	<i>Globorotalia pseudokugleri</i> Blow, 1969
•					•		<i>Globorotalia siakensis</i> (Le Roy, 1939)
•	•	•	•	•	•	•	<i>Globigerina angulituralis</i> Bolli, 1957
•	•	•	•		•	•	<i>Globigerina angustiumbilitata</i> Bolli, 1957
•	•			•	•	•	<i>Globigerina ciperoensis</i> Bolli, 1954
	•		•	•			<i>Globigerina edegemensis</i> Hooyberghs, 1983
•	•	•				•	<i>Globigerina euapertura</i> Jenkins, 1960
•	•	•			•		<i>Globigerina officinalis</i> Subbotina, 1953
•	•					•	<i>Globigerina ouachitaensis</i> Howe & Wallace, 1932
•	•	•		•	•	•	<i>Globigerina praebuloides leroyi</i> Blow & Banner, 1962
	•	•	•	•	•		<i>Globigerina praebuloides occlusa</i> Blow & Banner, 1962
						•	<i>Globigerina praebuloides praebuloides</i> Blow, 1959
•			•				<i>Globigerina tripartita</i> Koch, 1926
•	•	•			•	•	<i>Globigerina woodi connecta</i> Jenkins, 1964
		•					<i>Globigerina woodi woodi</i> Jenkins, 1960
	•				•	•	<i>Globigerinoides primordius</i> Blow & Banner, 1962
			•		•	•	<i>Globorotaloides suteri</i> Bolli, 1957
	•						<i>Globigerinita martini</i> Blow & Banner, 1962
Boom Clay	Burcht Gravel	Edegem Sands					Lithostratigraphy

## References

- Blow, W.H. 1969 Late Middle Eocene to Recent planktonic foraminiferal biostratigraphy – Proc. First Int. Conf. Plankt. Microfossils, Geneva 1967. Brill, Leiden, vol. I: 199–422
- Blow, W.H. 1979 The Cenozoic *Globigerinidae*. Brill, Leiden. Part I, 572 pp; Part II: 754–1413; Atlas: 264 pls
- Bolli, M.H. & J.B. Saunders 1987 Oligocene to Holocene low latitude planktonic foraminifera. In: H.M. Bolli, J.B. Saunders & K. Perch-Nielsen (eds.): Plankton Stratigraphy. Cambridge University Press, Cambridge: 155–262
- De Meuter, F.J. 1974 Bijdrage tot de systematiek en de paleoecologie van de benthonische foraminiferen uit het Mioceen van België – Thesis, Leuven, 31 + 202 + 108 pp
- De Meuter, F.J. 1980 Benthonic foraminifera from the Miocene of Belgium – Aardkundige Meded. Leuven 1: 1–170
- De Meuter, F.J. & P.G. Laga 1976 Lithostratigraphy and biostratigraphy based on benthonic foraminifera of the Neogene deposits of Northern Belgium – Bull. Soc. Belge Géol. 83(4): 133–152
- Gradstein, F.N., M.A. Kaminski, W.A. Berggren, I.L. Kristiansen & M.A. D'Iorio 1994 Cenozoic biostratigraphy of the North Sea and Labrador Shelf – Micropaleontology 40, supplement 1994: 1–152
- Hooyberghs, H.J.F. 1983 Contribution to the study of planktonic foraminifera in the Belgian Tertiary – Aardkundige Meded. Leuven 2: 1–131

- Hooyberghs, H.J.F., O. Ben Abdelkader & M.A. Ben Haj 1990 Foraminifères planctoniques de l'Oligo-Miocène en Tunisie Centrale – Notes Service Géol. Tunis 56: 19–40

## Plates

Plate 1. Planktonic foraminifera from the Edegem Sands at Wilrijk.

Figures 1–4. *Globorotalia obesa* Bolli 1957; 1, sample 6, umbilical view, × 60; 2, sample 11, lateral view, × 57; 3, sample 11, lateral view, × 50; 4, sample 11, spiral view, × 57.

Figures 5–7. *Globorotalia opima nana* Bolli 1957; 5, sample 3, umbilical view, × 50; 6, sample 12, spiral view, × 45; 7, sample 12, lateral view, × 43.

Figures 8–11. *Globorotalia siakensis* (Le Roy 1939); 8, sample 9, umbilical view, × 55; 9, sample 10, lateral view, × 82; 10, sample 9, spiral view, × 76; 11, sample 10, umbilical view, × 55.

Figure 12. *Globorotalia zealandica incognita* Walthers 1965; sample 9, umbilical view, × 58.

Plate 2. Planktonic foraminifera from the Edegem Sands at Wilrijk.

Figures 1, 2. *Globorotalia zealandica incognita* Walthers 1965; 1, sample 9, spiral view, × 64, 2, sample 9, umbilical view, × 55.

Figures 3–6. *Globigerina angustiumbilitata* Bolli 1957; 3, sample 9, umbilical view, × 70; 4, sample 9, lateral view, × 56; 5, sample 9, spiral view, × 55; 6, sample 9, umbilical view, × 55.

Figures 7–10. *Globigerina ciperoensis* Bolli 1954; 7, sample 9, umbilical view,  $\times 80$ ; 8, sample 9, spiral view,  $\times 66$ ; 9, sample 9, lateral view,  $\times 66$ ; 10, sample 9, umbilical view,  $\times 85$ .

Figure 11. *Globigerina fariasi* Bermudez 1961; sample 2, umbilical view,  $\times 93$ .

Figure 12. *Globigerina edegemensis* Hooyberghs 1983; sample 6, umbilical view,  $\times 70$ .

Plate 3. Planktonic foraminifera from the Edegem Sands at Wilrijk.

Figures 1–3. *Globigerina edegemensis* Hooyberghs 1983; 1, sample 6, spiral view,  $\times 70$ ; 2, sample 6, lateral view,  $\times 68$ ; 3, sample 6, umbilical view,  $\times 72$ .

Figures 4–7. *Globigerina officinalis* Subbotina 1953; 4, sample 10, umbilical view,  $\times 50$ ; 5, sample 9, lateral view,  $\times 51$ ; 6, sample 10, spiral view,  $\times 60$ ; 7, sample 10, umbilical view,  $\times 57$ .

Figures 8–10. *Globigerina ouachitaenses* Howe & Wallace 1932; 8, sample 10, umbilical view,  $\times 86$ ; 9, sample 10, lateral view,  $\times 85$ ; 10, sample 10, spiral view,  $\times 76$ .

Figures 11, 12. *Globigerina praebulloides leroyi* Blow & Banner 1962; 11, sample 10, umbilical view,  $\times 50$ ; 12, sample 10, lateral view,  $\times 51$ .

Plate 4. Planktonic foraminifera from the Edegem Sands at Wilrijk.

Figures 1, 2. *Globigerina praebulloides leroyi* Blow & Banner 1962; 1, sample 9, spiral view,  $\times 57$ ; 2, sample 9, umbilical view,  $\times 75$ .

Figures 3–6. *Globigerina praebulloides oclusa* Blow & Banner 1962; 3, sample 10, umbilical view,  $\times 71$ ; 4, sample 10, lateral view,  $\times 62$ ; 5, sample 10, spiral view,  $\times 58$ ; 6, sample 10, umbilical view,  $\times 70$ .

Figures 7–9. *Globigerina praebulloides praebulloides* Blow 1959; 7, sample 10, umbilical view,  $\times 75$ ; 8, sample 10, lateral view,  $\times 70$ ; 9, sample 10, spiral view,  $\times 77$ .

Figure 10. *Globigerina tripartita* Koch 1926; sample 10, umbilical view,  $\times 60$ .

Figures 11, 12. *Globigerina woodi connecta* Jenkins 1964; 11, sample 3, umbilical view,  $\times 60$ ; 12, sample 6, lateral view,  $\times 69$ .

Plate 5. Planktonic foraminifera from the Edegem Sands at Wilrijk.

Figures 1–3. *Globigerina woodi connecta* Jenkins 1964; 1, sample 6, spiral view,  $\times 74$ ; 2, sample 4, spiral view,  $\times 70$ ; 3, sample 6, umbilical view,  $\times 65$ .

Figures 4–6. *Globigerinoides primordius* Blow & Banner 1962; 4, sample 4, umbilical view,  $\times 62$ ; 5, sample 4, lateral view,  $\times 81$ ; 6, sample 5, spiral view,  $\times 63$ .

Figure 7. *Globigerinoides* cf. *sacculifer* Brady 1877; sample 5, umbilical view,  $\times 67$ .

Figures 8–11. *Globorotaloides suteri* Bolli 1957; 8, sample 11, umbilical view,  $\times 48$ ; 9, sample 11, lateral view,  $\times 52$ ; 10, sample 11, spiral view,  $\times 42$ ; 11, sample 11, umbilical view,  $\times 55$ .

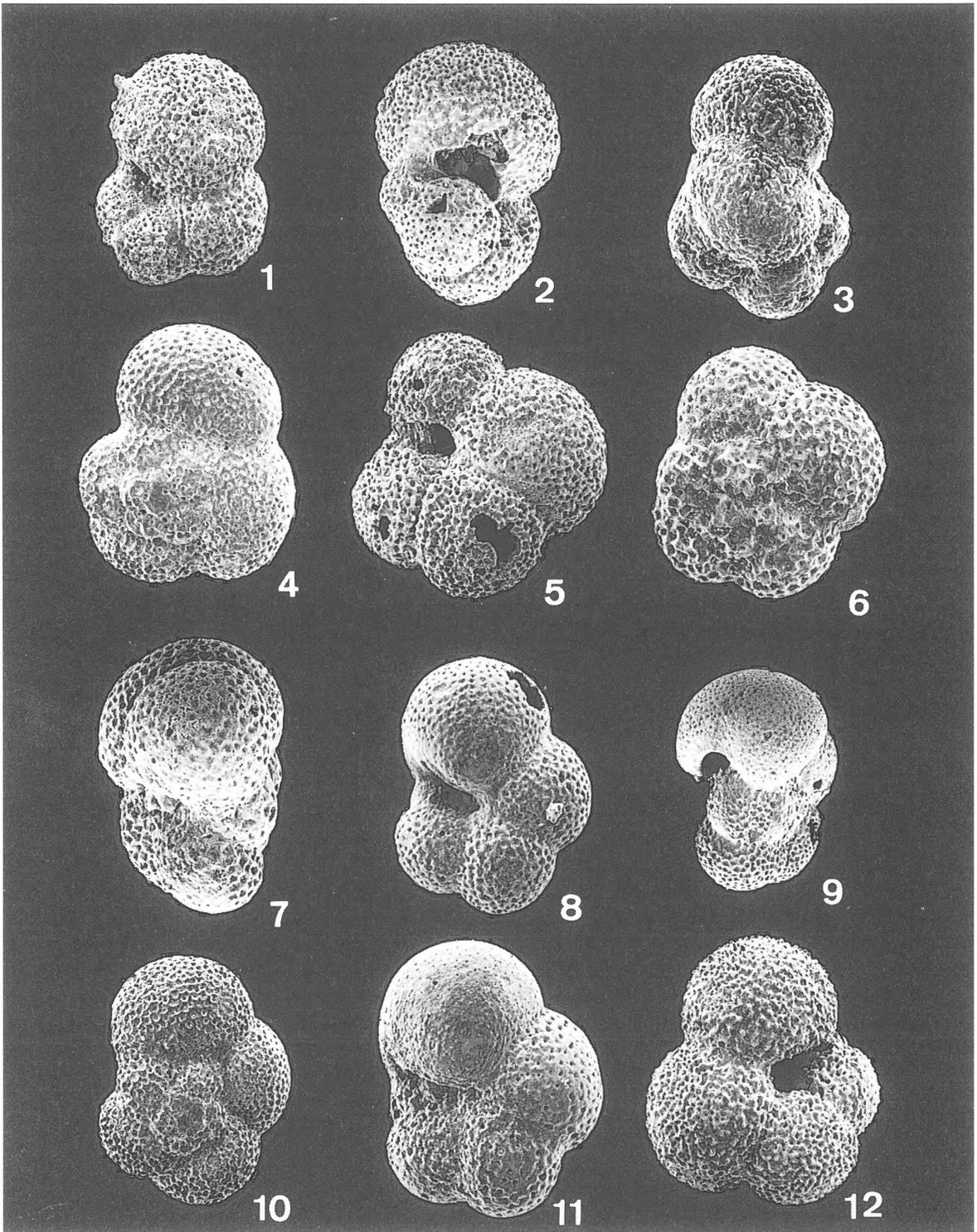


Plate 1. Planktonic foraminifera from the Edegem Sands at Wilrijk. For explanation see under 'Plates'.

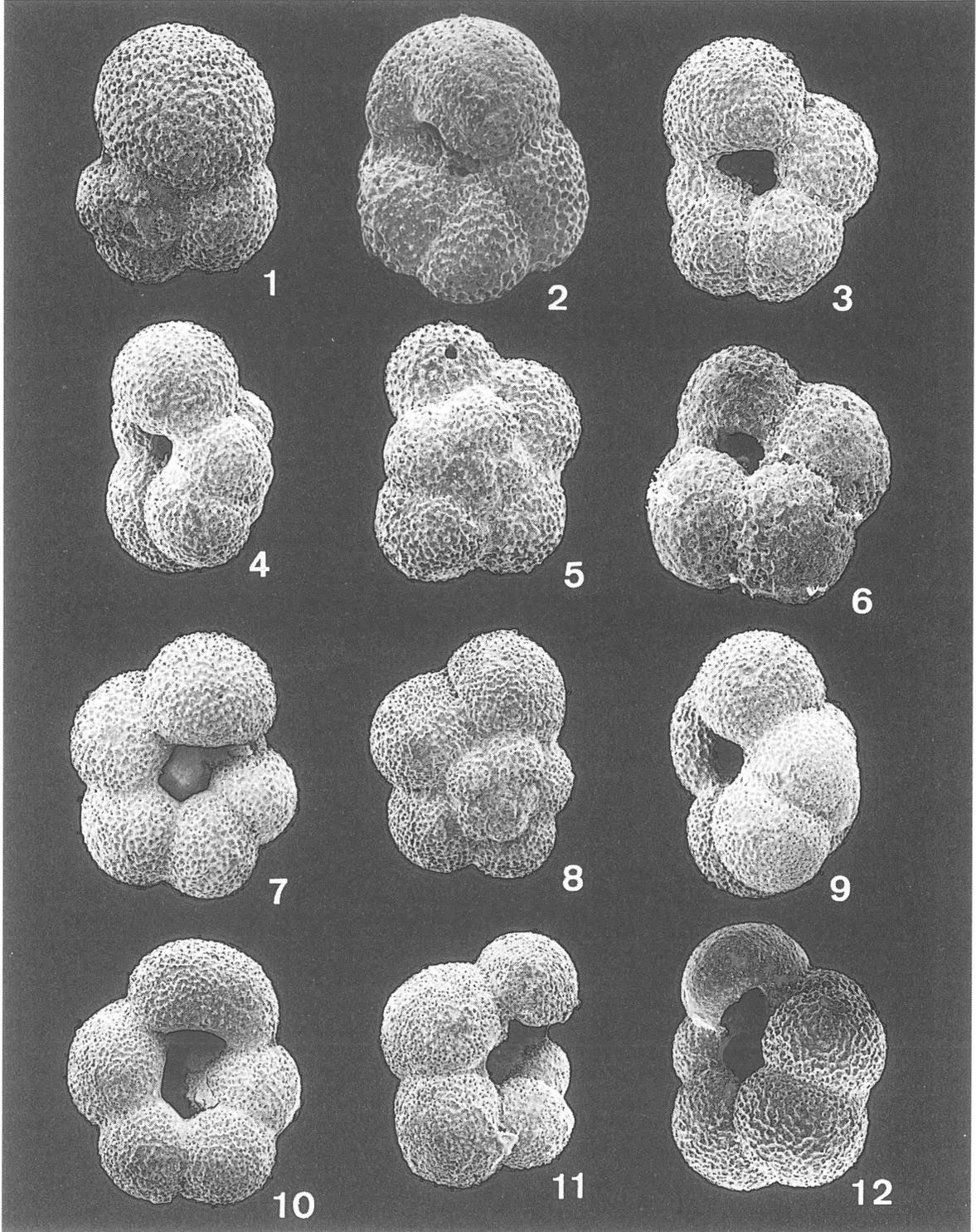


Plate 2. Planktonic foraminifera from the Edegem Sands at Wilrijk. For explanation see under 'Plates'.

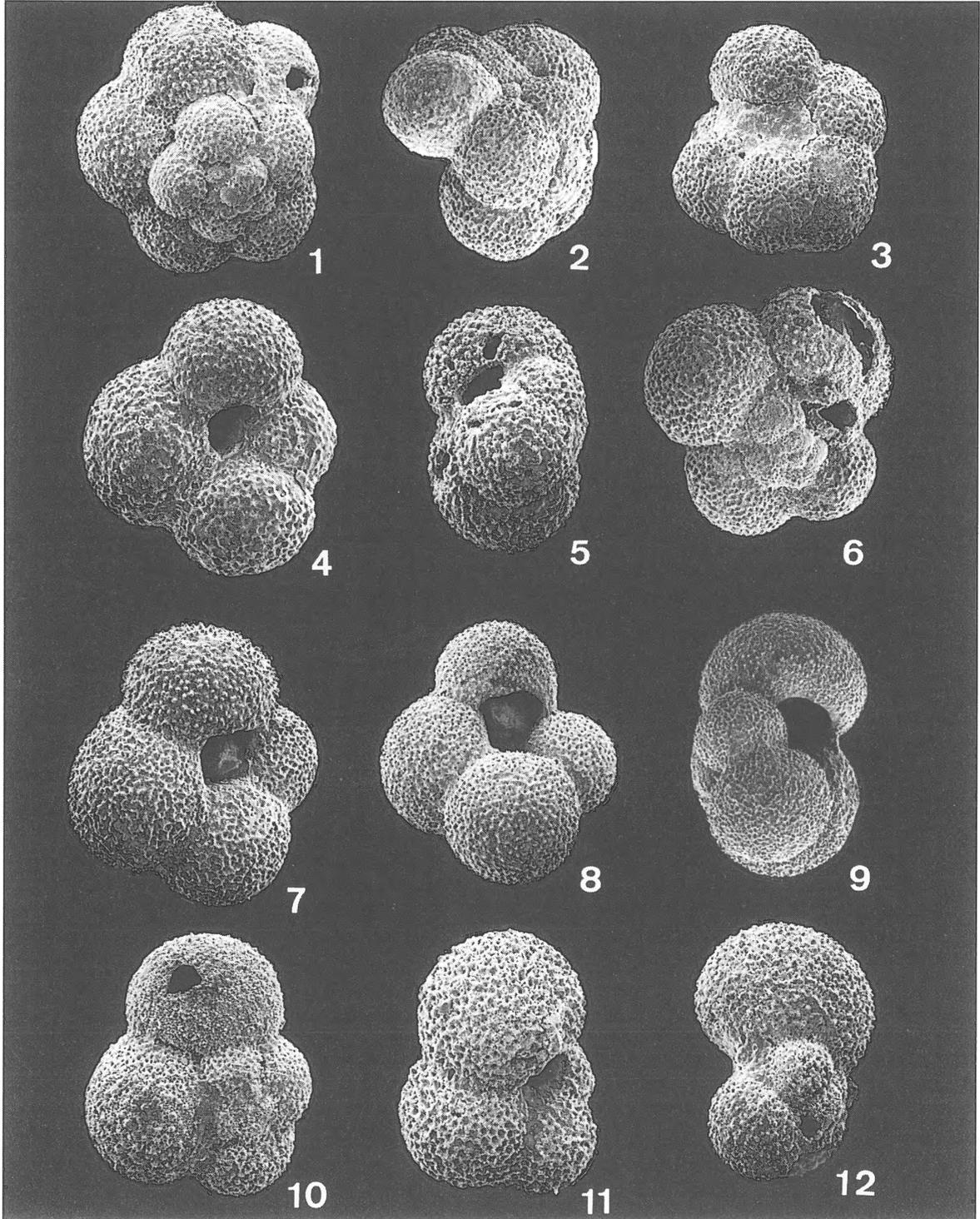


Plate 3. Planktonic foraminifera from the Edegem Sands at Wilrijk. For explanation see under 'Plates'.

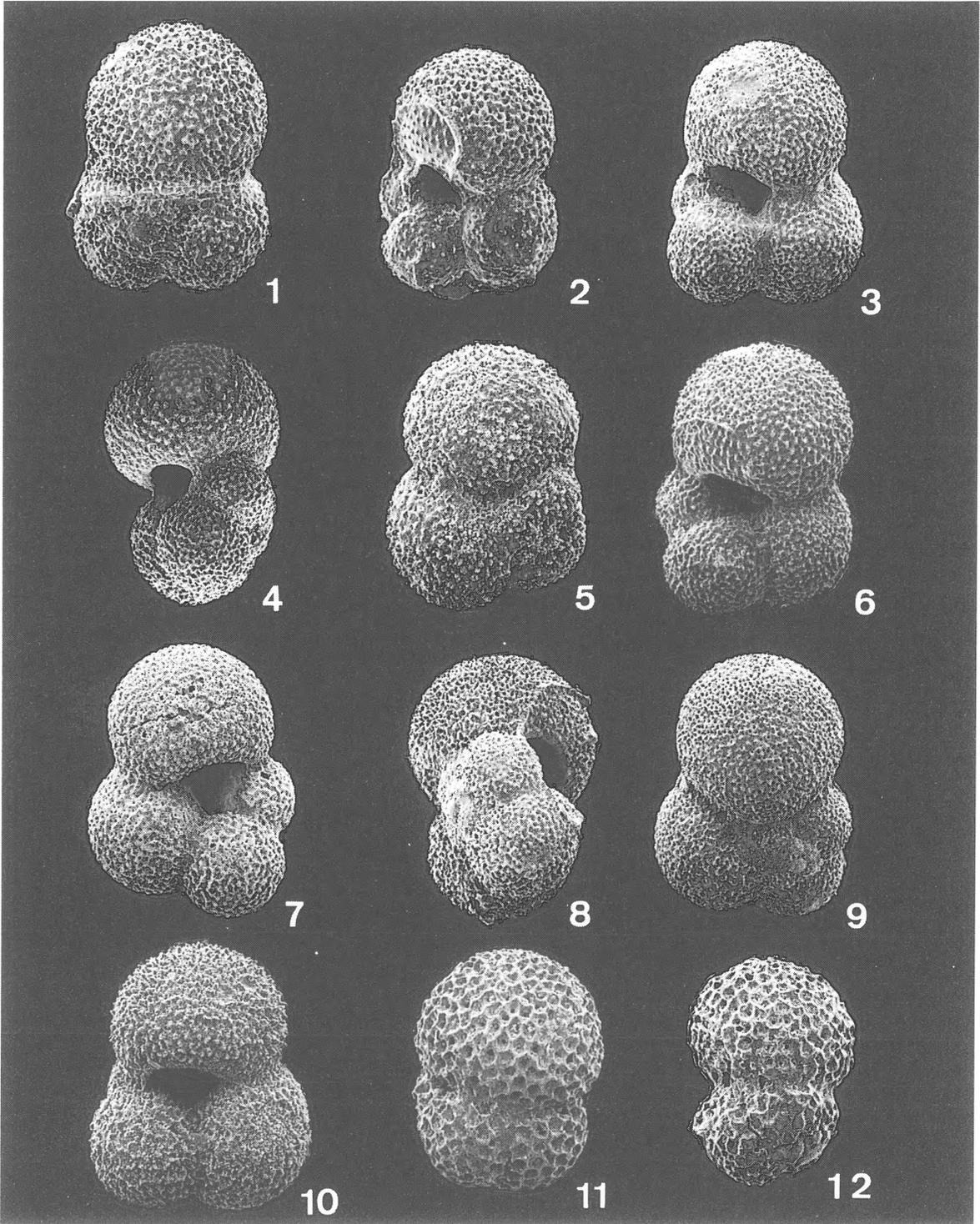


Plate 4. Planktonic foraminifera from the Edegem Sands at Wilrijk. For explanation see under 'Plates'.

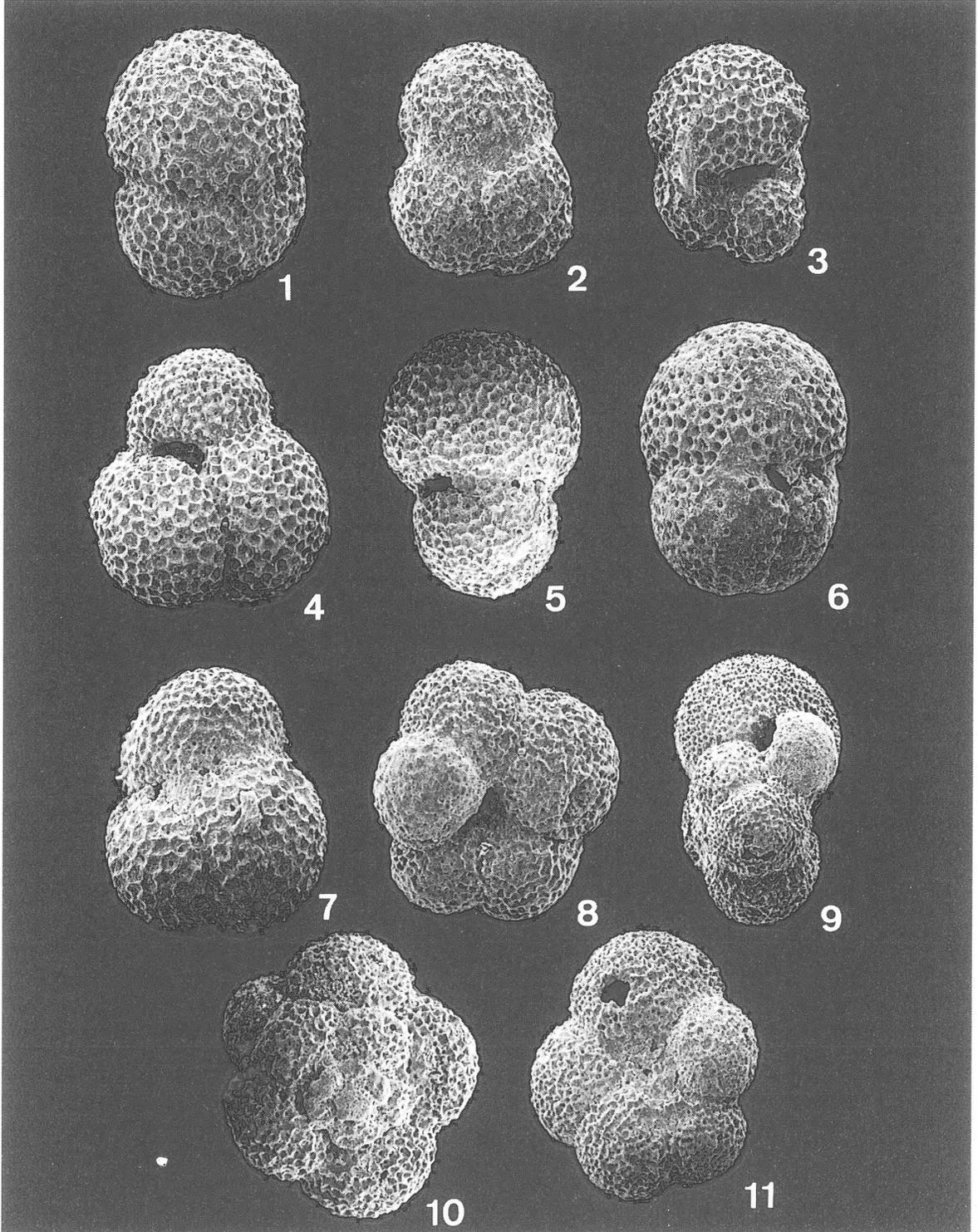


Plate 5. Planktonic foraminifera from the Edegem Sands at Wilrijk. For explanation see under 'Plates'.