

# IDENTIFICATION OF THE BENTHONIC FORAMINIFERA OF THE „BADENER TEGEL”, EARLY TORTONIAN, AT SOOSS NEAR BADEN, AUSTRIA, ILLUSTRATED BY SOME SCANNING ELECTRON MICROSCOPE PHOTOGRAPHS

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**SUMMARY** An identification of 118 benthonic species, subspecies and varieties of Foraminifera is given from three samples of the “Lagenidenzone, Unteres Torton, sensu Grill (1941)” of the “Badener Tegel (= marly clay of Baden) sensu Keferstein (1828, p. 425)” from the “Ziegelei” (= brick-yard) at Sooss near Baden, Austria, one of d’Orbigny’s (1846) very probable sampling localities. A frequency table is made based on 200 counted specimens of each sample. Scanning electron microscope photographs of some species are added.

## *Introduction*

An assemblage list (table 1) is made of 118 benthonic Foraminifera from three samples at Sooss of the “Badener Tegel” sensu KEFERSTEIN 1828 in d’Orbigny 1846 page xj foot-note 2 (= une argile marneuse gris-bleuâtre, plastique, et très imperméable à l’eau). A frequency table (table 2) is set up of 67 species based on 200 counted specimens.

In the nineteenth century some authors have studied Foraminifera of the Vienna Basin. Generally they mainly considered big specimens and rarely, except KARRER, they have given assemblage lists and never frequency tables of one layer at one locality have been made. At this time synonymy seldom was applied; each different specimen belonged to a different species or variety.

Sooss near Baden is one of the very probable sampling localities of d’Orbigny (1846), the first and excellent author of Foraminifera of the Vienna Basin; so we may suppose to have many topotypes of this author. d’Orbigny found in all 228 species in this Basin. After him CZIZEK (1848) added 25 new species and

one species first found at four localities. HÖRNES (1848) made fauna lists of 135 localities, under which Baden, based on d’ORBIGNY (1846) and CZIZEK (1848). REUSS (1850) added 66 new species found in the Vienna Basin at several localities under which Baden. KARRER (1862, 1863, 1865, 1867 and 1877) described many new species of this Basin and gave lists of some localities, under which Baden; exceptionally he mentioned the locality Sooss. MARKS (1951) has written a recent comprehensive revision of the smaller Foraminifera of the Miocene of the Vienna Basin based on samples of seven localities, under which Sooss; he described 6 new species and 3 new varieties; he has given the occurrence of the species and found 85 species and varieties at Sooss; from the latter we have found only 49 species and varieties; on the contrary at Sooss MARKS did not have 66 of our species and varieties.

## *Techniques*

The benthonic Foraminifera were sieved on a 125  $\mu\text{m}$  sieve. The samples have been split

by a sample-splitter (KENNARD and SMITH) and 200 specimens have been counted (table 2). The figured specimens were coated with a C-Au layer on a rotating table. After coating scanning electron microscope photographs have been made of some species by a Cambridge Stereoscan (plates I-IV).

The specimens, photographed or not, are kept in the collection of the "Laboratorium voor Paleontologie, Geologisch Instituut, Redingenstraat 16, Leuven, Belgium" of the University of Leuven catalogued under the numbers F1295 to F1708.

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#### Systematic part

For the systematic part the species have been arranged according to the classification of LOEBLICH and TAPPAN (1964).

##### *Spiroplectammina carinata*

(d'ORBIGNY, 1826)

Plate I, figure 1-2

*Textularia carinata* d'ORBIGNY, 1826, Tabl.

méth., p. 263, (nom. nud.); d'ORBIGNY, 1846, Foram. tert. Vienne, p. 247.

##### *Spiroplectammina pectinata*

(REUSS, 1850)

*Textularia pectinata* REUSS, 1850, N. Foram. österr. Tert., p. 381, pl. 49, figs. 2-3.

*Spiroplectammina pectinata* (REUSS) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 36.

##### *Spiroplectammina mariae*

(d'ORBIGNY, 1846)

Plate I, figure 3

*Textularia mariae* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 246, pl. 14, figs. 29-31.

*Spiroplectammina mariae* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 36.

##### *Textularia abbreviata*

d'ORBIGNY, 1846

*Textularia abbreviata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 249, pl. 15, figs. 7-12.

*Textularia hauerii* d'ORBIGNY, 1846, p. 250, pl. 15, figs. 13-15.

##### *Textularia* spp.

Several specimens of one sample (OE 12) are too coarsely arenaceous to be determined.

##### *Martiniotiella communis*

(d'ORBIGNY, 1826)

*Clavulina communis* d'ORBIGNY, 1826, Tabl. méth., p. 102, no. 4 (nom. nud.); d'ORBIGNY 1846, Foram. tert. Vienne, p. 196, pl. 12, figs. 1-2.

*Martiniotiella communis* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 37; LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C282, fig. 188: 10a-b.

##### *Spiroloculina canaliculata*

d'ORBIGNY, 1846

*Spiroloculina canaliculata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 269, pl. 16, figs. 10-12.

##### *Quinqueloculina akneriana*

d'ORBIGNY, 1846

Plate I, figure 4-5

*Quinqueloculina akneriana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 290-291, pl. 18, figs. 16-21; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 38.

*Quinqueloculina hauerina* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 286-287, pl. 17, figs. 25-27.

*Quinqueloculina mayeriana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 287, pl. 18, figs. 1-3.

*Quinqueloculina triangularis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 288-289, pl. 18, figs. 7-9.

*Quinqueloculina regularis* REUSS, 1850, N. Foram. österr. Tert., p. 384, pl. 50, fig. 1.

*Quinqueloculina concinna* REUSS, 1850, *ibid.*, p. 384, pl. 50, fig. 2.

We agree with MARKS' (1951, p. 38) synonymy list of this nominal species; all these specimens are present at Baden, Nussdorf or Grinzing in the Vienna Basin. *Quinqueloculina impressa* REUSS, 1851 (type locality Hermsdorf, Berlin in the "Septarienthon") may be synonymous; MARKS (1951, p. 39) has made it an actual synonym. As this author further writes "*Quinqueloculina akneriana* is a most common species in both the Tertiary and Recent, is somewhat variable in relative dimensions, and has been described under quite a number of different names", we also identify the species as *akneriana*. *Quinqueloculina seminula* (LINNAEUS, 1758) (= *Serpula*) may be synonymous but, as MARKS writes, LINNAEUS never published an adequate figure. We have found the same specimens in the "Saltzthon" of Wieliczka of Poland (type locality of *Q. regularis*).

*Quinqueloculina auberiana*  
d'ORBIGNY, 1839

*Quinqueloculina auberiana* d'ORBIGNY, 1839, Foram. Cuba, p. 193, pl. 12, figs. 1-3; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 38.

*Quinqueloculina ungeriana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 291, pl. 18, figs. 22-24.

*Quinqueloculina peregrina* d'ORBIGNY, 1846, *ibid.*, p. 292, pl. 19, figs. 1-3.

*Quinqueloculina boueana*  
d'ORBIGNY, 1846

*Quinqueloculina boueana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 293-294, pl. 19, figs. 7-9; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 39.

*Quinqueloculina nussdorfensis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 295, pl. 19, figs. 13-15.

*Quinqueloculina contorta*  
d'ORBIGNY, 1846

*Quinqueloculina contorta* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 298, pl. 20, figs. 4-6.

MARKS probably rightly grouped *Q. contorta*, *Q. juleana* d'ORBIGNY 1846, *Q. rodolphina* d'ORBIGNY 1846, *Q. badenensis* d'ORBIGNY 1846 and *Q. mariae* d'ORBIGNY 1846 under the name *Q. rugosa* d'ORBIGNY, 1826. There is not enough material available to prove that. Our specimens mostly resemble the *contorta* species.

*Quinqueloculina dutemplei*  
d'ORBIGNY, 1846

*Quinqueloculina dutemplei* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 294, pl. 19, figs. 10-12.

*Quinqueloculina josephina*  
d'ORBIGNY, 1846

*Quinqueloculina josephina* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 297, pl. 19, figs. 25-27.

*Quinqueloculina longirostra*  
d'ORBIGNY, 1826  
Plate I, figure 6-9

*Quinqueloculina longirostra* d'ORBIGNY, 1826, Tabl. méth., p. 303; d'ORBIGNY, 1846, Foram. tert. Vienne, p. 291-292, pl. 18, figs. 25-27; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 39, pl. 5, figs. 4a-6c; LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C458, figs. 349: 2-3.

*Adelosina laevigata* d'ORBIGNY, 1826, Tabl. méth., p. 304; d'ORBIGNY, 1846, Foram. tert. Vienne, p. 302, pl. 20, figs. 22-24.

As MARKS (1951, p. 39) and LOEBLICH and TAPPAN (1964, p. C458) have pointed out the "generic name" *Adelosina* is given for young macrospheric forms of *Quinqueloculina*, and in this case *A. laevigata* for *Q. longirostra*. In the sample OE 4 there are several adult, one young-adult and several young macrospheric specimens; in OE 12 there are some young-adult and adult specimens.

*Quinqueloculina pygmea* REUSS, 1850

Plate I, figure 10

*Quinqueloculina pygmea* REUSS, 1850, N. Foram. österr. Tert., p. 384, pl. 50, fig. 3; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 39.

Several specimens have a typical small tooth and one specimen lacks it.

*Quinqueloculina* sp. cf. *Q. badensis*  
d'ORBIGNY, 1846

*Quinqueloculina badensis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 299-300, pl. 20, figs. 10-12.

Our single specimen has a somewhat different costae pattern; it may be a synonym of *Quinqueloculina contorta* d'ORBIGNY, 1846.

*Quinqueloculina* sp. cf. *Q. bromniana*  
d'ORBIGNY, 1846

*Quinqueloculina bromniana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 287-288, pl. 18, figs. 4-6.

Only one broken specimen has been found.

*Quinqueloculina* sp. cf. *Q. haidingerii*  
d'ORBIGNY, 1846

*Quinqueloculina haidingerii* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 298-299, pl. 18, figs. 13-15.

Only one specimen does not have the clear transverse curved striations (... "ornée en travers de rides arquées" d'ORBIGNY, p. 290) of the original description and has a curious lateral spine. No variety or subspecies has been proposed. The other specimen is broken.

*Quinqueloculina* sp. 1

One somewhat irregular specimen has not been determined.

*Quinqueloculina* sp. 2

One somewhat irregular specimen has not been identified.

*Massilina* (?) sp.

Only three badly preserved specimens have been found.

*Pyrgo bulloides* (d'ORBIGNY, 1826)

*Biloculina bulloides* d'ORBIGNY, 1826, Tabl. méth., p. 297, pl. 16, figs. 1-4; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 41.

One specimen shows all the characters of *P. bulloides* but has many fine longitudinal striations.

*Pyrgo clypeata* (d'ORBIGNY, 1846)

*Biloculina clypeata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 263, pl. 15, figs. 19-21.

*Biloculina turgida* REUSS, 1851, Foram. Entom. Sept. Berlin, Zeitschr. d. geol. Ges., Bd. 3, p. 85, pl. 7, fig. 55.

*Pyrgo bulloides* (d'ORBIGNY, 1826) has a small long tooth in a circular aperture. This species has a clear bifid tooth in an oval aperture.

*Pyrgo rixatoria* (FRANZENAU, 1890)

*Biloculina rixatoria* FRANZENAU, 1890, Magyar Nemz. Muz. Term. Fü. Budapest, köt 13, p. 165, pl. 2, figs. 1a-c.

The specimens of the author are more oblong and widest in the middle; the simple tooth is the same as Franzenau's specimens. *Biloculina contraria* d'ORBIGNY, 1846 of the Badener Tegel at Baden does not have an individual tooth but as d'ORBIGNY wrote on p. 266 "l'ouverture est en demi-cercle très étroit, pourvue d'une dent demême forme que la bouche presque partout". The last but one chamber of the author's specimens is larger in lateral view.

*Sigmoilina tenuis* (CZJZEK, 1848)

Plate I, figure 11

*Quinqueloculina tenuis* CZJZEK, 1848, Foram. Wiener Beckens, p. 149, pl. 13, figs. 31-34; REUSS, 1850, N. Foram. österr. Tert., p. 385, pl. 50, figs. 8a-c.

*Sigmoilina tenuis* (CZJZEK) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 39-40, pl. 5, fig. 7.

*Sigmoilopsis celata* (COSTA, 1855)

Plate I, figure 12

*Spiroloculina celata* COSTA, 1855, Foram. foss. Vat., R. Acc. Sci. Napoli, Mem., vol. 2, p. 126, pl. 1, fig. 14.

*Sigmoilopsis celata* (COSTA) LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C466, fig. 353: 2c.

*Triloculina angularis* d'ORBIGNY, 1850

*Triloculina angularis* d'ORBIGNY, 1826, Tabl. méth., p. 299 (nom. nud.); d'ORBIGNY, 1850,

Podr. Paléont., vol. 2, Masson, Paris, p. 409; FORNASINI, 1905 (6), *Illustr. sp. orb. Miliol.*, Mem. R. Acc. Sci. Bologna, s. 6a, t. II, pl. 1, figs. 2-2a (dal disegno inedito di d'Orbigny).

*Triloculina consobrina*  
d'ORBIGNY, 1846

*Triloculina consobrina* d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 277-278, pl. 17, figs. 10-12; MARKS, 1951, *Rev. sm. Foram. Vienna Basin*, p. 40.

*Triloculina trigonula* (LAMARCK, 1804)  
Plate I, figure 13

*Trilobolites trigonula* LAMARCK, 1804, *Mém. foss. Paris, Mus. Nat. Hist. Nat., Ann.*, t. 5, p. 351; LAMARCK, 1807, *ibid.*, t. 9, pl. 17, fig. 4.

*Triloculina trigonula* (LAMARCK) MARKS, 1951, *Rev. sm. Foram. Vienna Basin*, p. 41; LOEBLICH and TAPPAN, 1964, *Sarcodina and Foram.*, p. C466, fig. 353: 4a-c.

*Triloculina gibba* d'ORBIGNY, 1826, *Tabl. méth.*, p. 299; d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 274, pl. 16, figs. 22-24.

*Triloculina austriaca* d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 275, pl. 16, figs. 25-27.

As MARKS (1951, p. 41) has written, we make *M. trigonula*, *T. gibba* and *T. austriaca* synonyms, because we found these three forms and their transition forms in one sample; in transverse section *T. gibba* is the most triangular, *T. austriaca* the most rounded and *T. trigonula* the intermediary form.

*Triloculina* sp. 1

The single specimen found looks like *Triloculina bipartita* d'ORBIGNY, 1846 but lacks the leaflike outgrowths of the chamber.

*Triloculina* sp. 2

The very few specimens found have a "cryptoquinqueloculine chamber arrangement" sensu Bogdanovich (1969), so that it is provisionally difficult to identify the specimens.

*Biloculinella depressa*  
(d'ORBIGNY, 1826)

*Biloculina depressa* d'ORBIGNY, 1826, *Tabl. méth.*, p. 298, mod. no. 91; PARKER, JONES and BRADY, 1871, *Ann. Mag. Nat.*

*Hist.*, s. 4a, vol. VIII, pl. 8, fig. 5, fig. after Soldani.

*Biloculina lunula* d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 264, pl. 15, figs. 22-24.

*B. depressa* was first found by d'ORBIGNY at Castellarquato (fossil) and at Rimini (recent) and *B. lunula* by the same author at Baden (fossil).

*Biloculinella grinzingensis*  
(KARRER, 1877)

*Biloculina grinzingensis* KARRER, 1877, *Geol. K.F.J. Hochquellen-Wasserl., K.K. Geol. Reichsanst., Abh.*, Bd. 9, p. 375, pl. 16a, fig. 8.

*Biloculinella ventruosa* (REUSS, 1867)

*Biloculina ventruosa* REUSS, 1867, *Foss. Fauna Steins. Wieliczka, K. Akad. Wiss. Mat.-Naturw. Cl., Sitzber.*, Bd. LV, Abt. I, p. 69, pl. 1, fig. 9.

*Nummoloculina contraria*  
(d'ORBIGNY, 1846)

*Biloculina contraria* d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 266, pl. 16, figs. 4-6; MARKS, 1951, *Rev. sm. Foram. Vienna Basin*, p. 40; LOEBLICH and TAPPAN, 1964, *Sarcodina and Foram.*, p. C468, fig. 355: 6-9.

*Borelis melo* (FICHTEL and MOLL, 1798)

Plate I, figure 14

*Nautilus melo* FICHTEL and MOLL, 1798 var.  $\beta$  FICHTEL and MOLL, 1798, *Test. micr. Comesina, Wien*, p. 123, pl. 24, figs. g-h.

*Nodosaria bronniiana* NEUGEBOREN, 1852

*Nodosaria bronniiana* NEUGEBOREN, 1852, *Foram. Ober-Lapugy, Siebenb. Ver. Naturw. Hermannstadt, Verh. Mitt.*, Jahrg. 3, no. 4, p. 52, pl. 1, figs. 33-35.

*Nodosaria hirsuta* d'ORBIGNY, 1826

*Nodosaria (Nodasaire) hirsuta* d'ORBIGNY, 1826, *Tabl. méth.*, p. 252; PARKER, JONES and BRADY, 1871, *Ann. Mag. Nat. Hist.*, s. 4a, vol. VIII, pl. 9, fig. 45, fig. after Soldani.

*Nodogenerina hirsuta* (SOLDANI) MARKS, 1951, *Rev. sm. Foram. Vienna Basin*, p. 56, pl. 7, fig. 7.

*Nodosaria hispida* d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 35, pl. 1, figs. 24-25.

- Nodosaria rudis* d'ORBIGNY, 1846  
Plate I, figure 15
- Nodosaria rudis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 33, pl. 1, figs. 17-19; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 45-46.
- Nodosaria* sp. cf. *N. affinis* d'ORBIGNY, 1846
- Nodosaria affinis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 39, pl. 1, figs. 36-39.  
The single specimen is broken.
- Nodosaria* cp. cf. *N. boueana* d'ORBIGNY, 1846
- Nodosaria boueana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 37, pl. 1, figs. 30-31.  
The four specimens are broken and look like *N. boueana*.
- Dentalina pauperata* d'ORBIGNY, 1846
- Dentalina pauperata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 46, pl. 1, figs. 57-58.
- Nodogenerina pauperata* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 56, pl. 7, fig. 6.  
The aperture of the specimens is broken so that we use the oldest genus name *Dentalina*.
- Dentalina scripta* d'ORBIGNY, 1846
- Dentalina scripta* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 51-52, pl. 2, figs. 21-23.
- Nodogenerina scripta* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 56.  
This species differs from *Dentalina pauperata* by the many fine longitudinal lines; the aperture is radiate so that this species belongs to *Dentalina* RISS, 1826.
- Lagena clavata* (d'ORBIGNY, 1846)
- Oolina clavata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 24, pl. 1, figs. 2-3.
- Lagena hexagona* (WILLIAMSON, 1848)  
Plate I, figure 16
- Entosolenia squamosa* (MONTAGU, 1803) var.  $\gamma$  hexagona WILLIAMSON 1848 [= *Vermiculium squamosum* MONTAGU, 1803] Rec. Brit. sp. *Lagena*, Ann. Mag. Nat. Hist. London, ser. 2, vol. 1, p. 20, pl. 2, fig. 23.
- Lagena hexagona* (WILLIAMSON) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 46.  
The specimens show or alternating, or not alternating or nearly alternating hexagones.
- Lagena striata* (MONTAGU, 1803) var. *semistriata* WILLIAMSON, 1848
- Lagena striata* (MONTAGU, 1803) var. *semistriata* WILLIAMSON, 1848 (= *Vermiculium striatum* MONTAGU, 1803] Rec. Brit. sp. *Lagena*, Ann. Mag. Nat. Hist. London, ser. 2, vol. 1, p. 14, pl. 1, figs. 9-10.
- Robulus inornatus* (d'ORBIGNY, 1846)
- Robulina inornata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 102, pl. 4, figs. 25-26.
- Robulina intermedia* d'ORBIGNY, 1846, *ibid.*, p. 104, pl. 5, figs. 3-4.
- Robulus intermedius* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 43, pl. 5, figs. 14a-b.
- Marginalina costata* (BATSCH, 1791)  
Plate II, figure 1a-b
- Nautilus* (*Orthoceras*) *costatus* BATSCH, 1791, Sechs Kupf. Conch. Sees., Jena Univ. Press, p. 1, 4, pl. 1, figs. 1a-g.
- Marginulina costata* (BATSCH) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 43.  
The length of the planspiral initial part is variable.
- Marginulina rugoso-costata* d'ORBIGNY, 1846
- Marginulina rugoso-costata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 70, pl. 3, figs. 19-21; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 44, pl. 5, figs. 12a-b.  
The specimens have variable characters.
- Marginulinopsis pedum* (d'ORBIGNY, 1846)
- Marginulina pedum* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 68, pl. 3, figs. 13-14.
- Marginulinopsis pedum* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 44, pl. 5, figs. 10a-11b.
- Orthomorphina longiscata* (d'ORBIGNY, 1846)  
Plate II, figure 2
- Nodosaria longiscata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 32, pl. 1, figs. 10-12; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 45.
- Plectofrondicularia semicosta* (KARRER, 1877)
- Frondicularia semicosta* KARRER, 1877, Geol.

- K.F.J. Hochquellen-Wasserl., K.K. Geol. Reichsanst., Abh., Bd. 9, p. 380, pl. 16b, fig. 26.
- Fronidularia raricosta* KARRER, 1877, *ibid.*, p. 381, pl. 16b, fig. 28.
- Plectofronidularia* sp. cf. *P. floridana* CUSHMAN, 1930
- Plectofronidularia floridana* CUSHMAN, 1930, Choctawhatchee form. Florida, Florida State Geol. Surv. Bull. no. 4, p. 41, pl. 8, fig. 1; LOEBLICH and TAPPAN, 1964, *Sarcodina* and *Foram.*, p. C525, fig. 411: 1a-b. The few specimens are broken.
- Globulina aequalis* d'ORBIGNY, 1846
- Globulina aequalis* d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 227, pl. 13, figs. 11-12.
- Glandulina laevigata* (d'ORBIGNY, 1826)
- Nodosaria (Glanduline) laevigata* d'ORBIGNY, 1826, *Tabl. méth.*, p. 252, pl. 10, figs. 1-3.
- Glandulina laevigata* (d'ORBIGNY) d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 29, pl. 10, figs. 1-3; MARKS, 1951, *Rev. sm. Foram. Vienna Basin*, p. 47.
- Glandulina* sp. 1
- Only two specimens found look like *Glandulina elliptica* REUSS, 1863 from the "Septarienthon" of Offenbach-Bieber, Germany but the first are more constricted.
- Glandulina* sp. 2
- The few specimens we have look like *Glandulina inflata* BORNEMANN, 1855 [= *Glandulina schlichti* FRANZENAU, 1894]; because our specimens are badly preserved we do not give them a species name.
- Fissurina compressa* (d'ORBIGNY, 1839)
- Oolina compressa* d'ORBIGNY, 1839, *Voy. Am. mér. Foram.*, t. V, 5e p., p. 18, pl. 5, figs. 1-2; d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 24, pl. 21, figs. 1-2.
- Buliminella* sp.
- The single broken specimen looks like *Buliminella multicamera* CUSHMAN and PARKER, 1938 of the Pliocene of Castellarquato, Italy.
- Sphaeroidina bulloides* d'ORBIGNY, 1826
- Sphaeroidina bulloides*, d'ORBIGNY, 1826, *Tabl. méth.*, p. 267, mod. no. 65; MARKS, 1951, *Rev. sm. Foram. Vienna Basin*, p. 70.
- The described species *Sphaeroidina austriaca* d'ORBIGNY, 1846 and *Sexloculina haueri* CZJZEK, 1848 of the Tertiary of the Vienna Basin are probable synonyms; MARKS, 1951 p. 70 has made them actual synonyms. The specimens have few to many chambers; that is a character pointed out by many later authors.
- Bolivina directa* CUSHMAN, 1936
- Bolivina directa* CUSHMAN, 1936, *Fam. Vern. and Valv.*, *Cushm. Lab. Foram. Res.*, *Spec. Publ. n. 6*, p. 54, pl. 7, fig. 22.
- Bolivina miocenica* (GIANOTTI, 1953)
- Bolivinoidea miocenicus* GIANOTTI, 1953, *Riv. Ital. Pal. Strat.*, vol. 59, n. 1, p. 38, pl. 5, figs. 10-13.
- That species is first described in the Tortonian of the Tortona area, Italy.
- Bolivina spathulata* (WILLIAMSON, 1858)
- Textularia variabilis* WILLIAMSON, 1858, var. *spathulata* WILLIAMSON, 1858, *Rec. Foram. Gt. Britain*, *Ray. Soc.*, p. 76, pl. 6, figs. 164-165.
- Bolivina spathulata* CUSHMAN, 1937, *Cushm. Lab. Foram. Res.*, *Spec. Publ. n. 9*, p. 162-164, pl. 15, figs. 20-24.
- Bolivina viennensis* MARKS, 1951
- Plate II, figure 3a-b
- Bolivina viennensis* MARKS, 1951, *Rev. sm. Foram. Vienna, Basin*, p. 60, pl. 7, figs. 1a-2b.
- Siphonodosaria adolphina* (d'ORBIGNY, 1846)
- Plate II, figure 4
- Dentalina adolphina* d'ORBIGNY, 1846, *Foram. tert. Vienne*, p. 51, pl. 2, figs. 18-20.
- Nodogenerina adolphina* (d'ORBIGNY) MARKS, 1951, *Rev. sm. Foram. Vienna Basin*, p. 54-55.
- The aperture clearly shows a tooth, so that this species is better classified under *Siphonodosaria* SILVESTRI, 1924 than under *Nodogenerina* CUSHMAN, 1927 [= *Stilotosmella* GUPPY, 1894]

*Bulimina costata* d'ORBIGNY, 1852

Plate II, figure 5

*Bulimina costata* d'ORBIGNY, 1826, Tabl. méth., p. 269 (nom. nud.); d'ORBIGNY, 1852, Podr. Paléont. Masson, Paris, p. 194; FORNASINI, 1901, Boll. Soc. Geol. Ital., vol. 20, p. 174, tf. 1.

MARKS (1951, p. 58) has placed in synonymy under *Bulimina striata* d'ORBIGNY [1826] 1846: *B. costata* and *B. buchiana* d'ORBIGNY, 1846. It is very evident that *B. costata* and *B. striata* are probable synonyms. We give the name *costata* because the nomen nudum *costata* came before *striata* in d'ORBIGNY, 1826, p. 269.

*Bulimina elongata* d'ORBIGNY, 1846

Plate II, figure 6

*Bulimina elongata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 187, pl. 11, figs. 19-20; CUSHMAN and PARKER, 1937, Cushm. Lab. Foram. Res., Contr., vol. 13, pt. 2, p. 49, pl. 7, figs. 1-3; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 57, pl. 7, fig. 12.

*Bulimina elongata* d'ORBIGNY, 1846 var. *lappa* CUSHMAN and PARKER, 1937

Plate II, figure 7

*Bulimina elongata* d'ORBIGNY, 1846 var. *lappa* CUSHMAN and PARKER, 1937, Contr. Cushm. Lab. Foram. Res., vol. 13, pt. 2, p. 51, pl. 7, fig. 8; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 57, pl. 7, fig. 14.

*Bulimina elongata* d'ORBIGNY, 1846 var. *subulata* CUSHMAN and PARKER, 1937

Plate II, figure 8

*Bulimina elongata* d'ORBIGNY, 1846 var. *subulata* CUSHMAN and PARKER, 1937, Contr. Cushm. Lab. Foram. Res., vol. 13, pt. 2, p. 51, pl. 7, figs. 6-7; CUSHMAN and PARKER, 1947, U.S. Dept. Int., Geol. Surv., Prof. Pap. 210-D, p. 109, pl. 26, figs. 1-2; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 57, pl. 7, figs. 13a-b.

*Bulimina ovula* d'ORBIGNY, 1839

Plate II, figure 9

*Bulimina ovula* d'ORBIGNY, 1839, Voy. Am. mér., Foram. T.V., 5<sup>o</sup> p., p. 51, pl. 1, figs. 10-11; CUSHMAN and PARKER, 1947, U.S. Dept. Int., Geol. Surv., Prof. Pap. 210-D, p. 122, pl. 28, figs. 20-22.

*Bulimina pyrula* d'ORBIGNY, 1846

Plate II, figure 10

*Bulimina pyrula* d'ORBIGNY, 1846, Foram. tert. Vienna, p. 184, pl. 11, figs. 9-10; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 58.

*Bulimina pyrula* d'ORBIGNY, 1846

var. *pseudospinescens* EMILIANI, 1949

Plate II, figure 11

*Bulimina pyrula* d'ORBIGNY, 1846 var. *pseudospinescens* EMILIANI, 1949, Riv. Ital. Pal. Strat., vol. 55, no. 1, p. 9, pl. 2, figs. 24-25. That variety was first found in the Calabrian, Forli Province, Italy.)

*Reussella spinulosa* (REUSS, 1850)

Plate II, figure 12-13

*Verneuilina spinulosa* REUSS, 1850, N. Foram. österr. Tert., p. 374, pl. 47, fig. 12.

*Reussella spinulosa* (REUSS) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 61.

MARKS (1951, p. 61) found the species *R. spinulosa* and the *Reussella spinulosa* (REUSS) var. *laevigata* CUSHMAN, 1945 (first found in the 'Miocene' of the Bordelais, France) at the same localities. Our specimens have in the same sample either all the characters of the "typical species" or all the characters of the variety, or only some characters of the typical and some of the variety. This is why only one species name is given.

*Uvigerina orbignyana* CZJZEK, 1848

*Uvigerina orbignyana* CZJZEK, 1848, Foram. Wiener Beckens, p. 147, pl. 13, figs. 16-17 (in plate explanation given as "*orbigniana*").

*Uvigerina aculeata* d'ORBIGNY, 1846 subsp. *orbignyana* PAPP and TURNOVSKY, 1953, Entw. Uvig. Vindobon. Wiener Beckens, Jb. geol. B.-A., Bd. XCVI, p. 127-128, Taf. V, Abb. A, fig. 11.

*Uvigerina asperula* CZJZEK, 1848 (of Baden, Vienna Basin) may be synonymous.

*Uvigerina pappi* MEULENKAMP, 1969

*Uvigerina pappi* MEULENKAMP, 1969, Strat. Neog. Rethymnon Prov. Crete, Utrecht Micropal. Bull., n. 2, p. 136-136, pl. 1, A, pl. 2, figs. 3-11.

This species differs from *Uvigerina bononiensis* FORNASINI, 1888 subsp. *compressa*



CUSHMAN — PAPP and TURNOVSKY, 1953 [= *Uvigerina compressa* CUSHMAN, 1925 of Perchtoldsdorf, Vienna Basin] by the presence of an uniserial chamber.

*Uvigerina urnula* d'ORBIGNY, 1846

Plate II, figure 14

Plate III, figure 1-2

*Uvigerina urnula* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 189, pl. 11, figs. 21-22; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 62.

*Uvigerina urnula* d'ORBIGNY, 1846 var. *semistriata* d'ORBIGNY, 1846 — MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 62.

*Uvigerina semiornata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 189-190, pl. 11, figs. 23-24.

*Uvigerina semiornata* d'ORBIGNY, 1846 subsp. *semiornata* d'ORBIGNY, 1846 — PAPP and TURNOVSKY, 1953, Jb. geol. B.-A., Bd. XCVI, p. 128-129, Taf. V, Abb. C, figs. 1, 3, 7.

*Uvigerina semiornata* d'ORBIGNY, 1846 subsp. *urnula* d'ORBIGNY, 1846 — PAPP and TURNOVSKY, *ibid.*, p. 129-130, Taf. V, Abb. C, figs. 2, 6.

There is much literature about the nominal species *U. urnula* and *U. semistriata*, the first coming from Baden and the latter from Nussdorf, on the outskirts of Vienna, a locality in the "Amphisteginenmergel", a layer above the "Badener Tegel". We do not agree with MARKS (1951) or PAPP and TURNOVSKY (1953) making varieties or subspecies in this case. In the sample OE 11 there are typical *urnula* specimens with only costae in the initial part, typical *semiornata* specimens with costae almost over the entire test and continuous transitional specimens. In the sample OE 4 there are only some *semiornata* specimens with costae covering the entire test and some specimens having a very slightly costate last chamber. Because of this transition we make *urnula* and *semiornata* synonyms.

*Uvigerina venusta* FRANZENAU, 1894

Plate III, figure 3

*Uvigerina venusta* FRANZENAU, 1894, Foss. Foram. Markusevec, Hrvat. Nar. Drustvo,

Glasnik, Zagreb, god. 6, broj 6, p. 284, pl. 6, fig. 60a-b (not 61a-b); MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 62.

*Uvigerina venusta* FRANZENAU, 1894, subsp. *venusta* PAPP and TURNOVSKY, 1953, Jb. geol. B.-A., Bd. XCVI, p. 125-126, Taf. V, Abb. B, figs. 8, 13.

The species "*Uvigerina cf. acuminata* HOSIUS, 1895" of PAPP and TURNOVSKY (1953, p. 124-125) and "*Uvigerina multicosata* LEROY, 1939" of MARKS (1951, p. 61-62) are probable synonyms of *U. venusta*. Our specimens have variable characters concerning the length of the costae and we do not make varieties or subspecies.

*Trifarina angulosa* (WILLIAMSON, 1858)

*Uvigerina angulosa* WILLIAMSON, 1858, Rec. Foram. Gr. Britain, Ray Soc., p. 67, pl. 5, fig. 140.

*Angulogerina angulosa* (WILLIAMSON) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 63, pl. 7, fig. 16.

*Trifarina angulosa* (WILLIAMSON) LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C571, fig. 450: 1-3.

*Rosalina globularis* d'ORBIGNY, 1826

*Rosalina globularis* d'ORBIGNY, 1826, Tabl. méth., p. 271, pl. 13, figs. 1-4; LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. 584-585, fig. 459: 1a-c.

*Cancris auricula* (FICHTEL and MOLL, 1798)

*Nautilus auricula* FICHTEL and MOLL, 1798, var.  $\alpha$  and var.  $\beta$ . FICHTEL and MOLL, 1798, Test. micr., Camesina, Wien, p. 108, pl. 20, figs. a-c (var.  $\alpha$ ), p. 110, pl. 20, figs. a-f (var.  $\beta$ ) ("*auricula*" was written as substantive)

*Cancris auriculus* (FICHTEL and MOLL) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 66.

*Rotalina scaphoidea* REUSS, 1950, N. Foram. österr. Tert., p. 372, pl. 47, fig. 3.

The last species comes from Möllersdorf, near Vienna, in "Tegel"; the author thinks this species is a probable topotype of *R. scaphoidea*.

*Valvulineria complanata*  
(d'ORBIGNY, 1846)

Plate III, figure 4a-b, 5, 6a-b

*Rosalina complanata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 175-176, pl. 10, figs. 13-15.

*Valvulineria complanata* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 64, pl. 6, figs. 13a-c.

*Valvulineria bradyana* (FORNASINI, 1900) [= *Discorbina*] of the Recent of the Ravenna coast, Italy, probably is the recent synonym.

*Asterigerina planorbis*  
d'ORBIGNY, 1846

Plate III, figure 7-8

*Asterigerina planorbis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 205, pl. 11, figs. 1-3; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 66-67, pl. 8, figs. 1a-c.

*Rotalia viennensis* (d'ORBIGNY, 1846)

*Rosalina viennensis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 177-178, pl. 10, figs. 22-24.

*Rotalia viennensis* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 65, pl. 8, figs. 7a-c.

*Rotalia* sp. cf. *R. aculeata*  
(d'ORBIGNY, 1846)

*Rotalina aculeata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 159, pl. 8, figs. 25-27.

The single specimen is broken and badly preserved.

*Ammonia beccarii* (LINNAEUS, 1758)  
Plate III, figure 9-10

*Nautilus beccarii* LINNAEUS, 1758, Syst. nat. Ed. 10, Holmiae, Suecia, t. 1, p. 710; PLANCUS, ?, Cornu Hammonis, Conch., t. 1; GUALTERI, ?, figs. H, H, I.

*Turbulina beccarii* (LINNAEUS) d'ORBIGNY, 1826, Tabl. méth., p. 275 (misspelled *becarii*)

*Ammonia beccarii* (LINNAEUS) LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C607, fig. 479: 2, 3.

*Elphidium aculeatum* (d'ORBIGNY, 1846)

*Polystomella aculeata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 131, pl. 6, figs. 27-28.

*Elphidium aculeatum* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 50-51, pl. 6, figs. 11a-b.

*Elphidium crispum* (LINNAEUS, 1758)  
Plate III, figure 11-12

*Nautilus crispus* LINNAEUS, 1758, Syst. nat. Ed. 10, Holmiae, Suecia, t. 1, p. 709, pl. 19, figs. a-d.

*Polystomella crispa* (LAMARCK, 1822) d'ORBIGNY, 1846, Foram. tert. Vienne, p. 125, pl. 6, figs. 9-14.

*Elphidium crispum* (LINNAEUS) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 51.

The umbilical boss is either clearly hyaline with more or less pores or hardly hyaline.

*Elphidium fichtellianum*  
(d'ORBIGNY, 1846)

Plate III, figure 13

*Polystomella fichtelliana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 125, pl. 6, figs. 7-8.

*Elphidium fichtellianum* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 52, pl. 6, figs. 12a-b.

*Elphidium flexuosum* (d'ORBIGNY, 1846)  
Plate III, figure 14

*Polystomella flexuosa* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 127, pl. 6, figs. 15-16; REUSS, 1850, N. Foram. österr. Tert., p. 370, pl. 48, figs. 3a-b.

*Elphidium flexuosum* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 52.

*Elphidium flexuosum* (d'ORBIGNY) var. *reussi* MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 52, pl. 6, figs. 7a-b.

A variety *reussi* has not been identified, because there are transitions in one sample. MARKS found the typical species at Sooss and the variety in other localities. We found at Sooss specimens with characters of the typical species and of the variety; they have more chambers than the variety, a small keen like the variety, narrow retral processes like the variety, a flush to prominent umbilical boss, the first a character of the typical and the latter of the variety. At Nussdorf ("Amphisteginenmergel") there are typical *flexuosum*, variety and transition specimens. The same feature we saw in the "sabbie gialle Astian" at Castellarquato, Italy.

*Heterostegina costata* d'ORBIGNY, 1846  
subsp. *costata* PAPP and KÜPPER, 1954

- Heterostegina costata* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 212 (pars), pl. 12, fig. 15 (not fig. 16).
- Heterostegina costata* d'ORBIGNY, 1846 subsp. *costata* PAPP and KÜPPER, 1954, Contr. Cushman. Found. Foram. Res., vol. 5, p. 116-117, text pl. 3, figs. 8-10, pl. 20, figs. 1-7, pl. 21, figs. 3-6.
- Heterostegina simplex* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 211, pl. 12, figs. 12-14.
- We agree with PAPP and KÜPPER (1954, p. 117) that the nominal species *H. simplex* is a juvenile *H. costata* and that d'ORBIGNY's plate 12, figure 16 is not a *H. costata* but a *H. granulotatesta* PAPP and KÜPPER, 1952.
- Eponides boueanus* (d'ORBIGNY, 1846)
- Rotalina boueana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 152-153, pl. 7, figs. 25-27.
- Eponides haidingerii* (d'ORBIGNY, 1846)
- Rotalina haidingerii* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 154, pl. 8, figs. 7-9.
- Eponides haidingerii* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 64-65, pl. 8, figs. 10a-c.
- d'ORBIGNY has miswritten *haidingerii*; many later authors wrote *haidingeri* after Haidinger. Because the original name was *haidingerii*, we write the species name as the latter.
- Eponides* sp.
- Only few specimens have been found.
- Amphistegina lessonii* d'ORBIGNY, 1826
- Amphistegina lessonii* d'ORBIGNY, 1826, Tabl. méth., p. 304, mod. no. 98; PARKER, JONES and BRADY, 1865, Ann. Mag. Nat. Hist., s. 3, vol. XVI, pl. 3, fig. 92; after d'ORBIGNY's modèle; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 67.
- Cibicidina boueana* (d'ORBIGNY, 1846)
- Truncatulina boueana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 169, pl. 9, figs. 24-25.
- Cibicides boueanus* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 72, pl. 8, figs. 9a-b.
- Cibicides haidingerii* (d'ORBIGNY, 1846)
- Plate IV, figure 1-2
- Rotalina haidingerii* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 154-155, pl. 8, figs. 7-9.
- Cibicides lobatulus* (WALKER and JACOB, 1798)
- Nautilus lobatulus* WALKER and JACOB, 1798, Adams Essays, Kanm. ed., p. 642, pl. 14, fig. 16.
- Truncatulina lobatula* d'ORBIGNY — d'ORBIGNY, 1846, Foram. tert. Vienne, p. 168-169, pl. 9, figs. 18-23.
- Cibicides lobatulus* (WALKER and JACOB) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 73.
- Cibicides pseudoungerianus* (CUSHMAN, 1922)
- Truncatulina ungeriana* BRADY, 1884 (not *Rotalina ungeriana* d'ORBIGNY, 1826) Rept. Challenger, pt. 22, vol. 9, p. 664, pl. 94, figs. 9a-c.
- Truncatulina speudoungeriana* CUSHMAN, 1922, Foram. Byram. calc. marl. Miss. U.S. Geol. Surv., Prof. Pap. 129-E, pl. 20, fig. 9.
- Cibicides ungerianus* (d'ORBIGNY, 1846)
- Plate IV, figure 3-4
- Rotalina ungeriana* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 157, pl. 8, figs. 16-18.
- Cibicides ungerianus* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 75, pl. 8, figs. 2a-b.
- Fursenkoina squamosa* (d'ORBIGNY, 1826)
- Virgulina squamosa* d'ORBIGNY, 1826, Tabl. méth., p. 267, mod. no. 64; PARKER, JONES and BRADY, 1865, Ann. Mag. Nat. Hist., s. 3, vol. XVI, pl. 2, fig. 66, figure after d'Orbigny's modèle;
- Fursenkoina squamosa* LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C731-732, fig. 600: 1-4.
- Hitherto only *Stainforthia schreibersiana* (CZIZEK, 1848) [= *Virgulina*] was described in the Vienna Basin by CZIZEK (1848), CUSHMAN (1937, p. 13-14), MARKS (1951, p. 59) or POKORNY (1963, p. 321-322). The single difference between the species *squamosa* and *schreibersiana* is the wall structure character; *schreibersiana* has a "radial wall structure" according to WOOD (1949, p. 243) and POKORNY (1963, p. 321-322); WOOD has further written on page 251 the term "gra-

nular" for the same species. WOOD and CUSHMAN have no figures of thin sections.

According to WOOD (1949, p. 251,) HOFKER (1956a, p. 908) and LOEBLICH and TAPPAN (1964, p. C731) *Fursenkoina squamosa* has a granular wall structure; our specimens show a probable granular structure in thin section. TOWE and CIFELLI (1967) contest the difference between "granular" and "radical" based on electron microscope research.

In that perspective the author thinks that *squamosa* and *schreibersiana* are probable synonyms. Young specimens show a highly twisted biserial arrangement.

*Loxostomum digitale* (d'ORBIGNY, 1846)

Plate IV, figure 5a-b

*Polymorphina digitalis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 235, pl. 14, figs. 1-4.

*Loxostoma digitale* (d'ORBIGNY) CUSHMAN, 1937, Cushm. Lab. Foram. Res., Spec. Publ. n. 9, p. 180-181, pl. 21, figs. 10-12.

*Loxostomum digitale* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 60-61.

*Cassidulina laevigata* (d'ORBIGNY, 1826)

*Cassidulina laevigata* d'ORBIGNY, 1826, Tabl. méth., p. 282, pl. 15, figs. 4, 5, 5bis; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 68; LOEBLICH and TAPPAN 1964, Sarcodina and Foram., p. C737-738, fig. 604: 1-2.

*Globocassidulina cruyssi* (MARKS, 1951)

*Cassidulina cruyssi* MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 68, pl. 8, figs. 3a-4c.

*Globocassidulina oblonga* (REUSS, 1850)

*Cassidulina oblonga* REUSS, 1850, N. Foram. österr. Tert., p. 376, pl. 48, figs. 5-6.

*Globocassidulina oblonga* (REUSS) LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C738, fig. 604: 7a-b.

*Chilostomella oviodea* REUSS, 1850

*Chilostomella ovoidea* REUSS, 1850, N. Foram. österr. Tert., p. 380, pl. 48, fig. 12; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 69; LOEBLICH and TAPPAN, 1964, p. C742-743, fig. 611: 1.

*Allomorphina trigona* REUSS, 1850

Plate IV, figure 6

*Allomorphina trigona* REUSS, 1850, N. Foram.

österr. Tert., p. 380, pl. 48, fig. 14; MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 69, pl. 7, figs. 11a-c; LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C743, fig. 611: 3.

*Nonion commune* (d'ORBIGNY, 1846)

Plate IV, figure 7

*Nonionina communis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 106-107, pl. 5, figs. 7-8.

*Nonion commune* (d'ORBIGNY) CUSHMAN, 1939, U.S. Geol. Surv., Prof. Pap. n. 191, p. 10-11, pl. 3, fig. 2.

*Nonion scaphum* (FICHTEL and MOLL, 1798) [= *Nautilus*] may be a probable synonym. MARKS (1951, p. 49) described *N. scaphum* with *N. commune* in synonymy.

*Nonion granosum* (d'ORBIGNY, 1846)

Plate IV, figure 8a-b

*Nonionina granosa* d'ORBIGNY, 1826, Tabl. méth., p. 294, no. 17 (nom. nud.); d'ORBIGNY, 1846, Foram. tert. Vienne, p. 110, pl. 5, figs. 19-20.

*Nonion granosum* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 48.

*Nonion pompilioides* (FICHTEL and MOLL, 1798)

Plate IV, figure 9

*Nautilus pompilioides* FICHTEL and MOLL, 1798, Test. micr., p. 31, pl. 2, figs. a-c.

*Nonion pompilioides* (FICHTEL and MOLL, MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 49.

*Nonion soldanii* (d'ORBIGNY, 1846) [= *Nonionina*] of the Vienna Basin has a narrow, curved aperture. Our specimens have a low aperture from almost umbilicus to umbilicus, a character typical for *N. pompilioides*.

*Astrononion italicum* CUSHMAN

and EDWARDS, 1937

*Astrononion italicum* CUSHMAN and EDWARDS, 1937, Contr. Cushm. Lab. Foram. Res. vol. 13, pl. 1, p. 35-36, pl. 3, figs. 19-20.

The *Astrononion italicum* specimens of MARKS (1951, p. 50, pl. 6, figs. 3a-b) are

better identified as *Astrononion sidebottomi* CUSHMAN and EDWARDS, 1937.

*Nonionella turgida* (WILLIAMSON, 1858)

*Rotalina turgida* WILLIAMSON, 1858, Rec. Foram. Gt. Britain, Ray Soc., p. 50, pl. 4, figs. 95-97.

*Pullenia bulloides* (d'ORBIGNY, 1826)

*Nonionina bulloides* d'ORBIGNY, 1826, Tabl. méth., p. 127, no. 2; d'ORBIGNY, 1846, Foram. tert. Vienne, p. 107, pl. 5, figs. 9-10.

*Pullenia bulloides* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 69.

*Pullenia quinqueloba* (REUSS, 1851)

Plate IV, figure 10

*Nonionina quinqueloba* REUSS, 1851, Foram. Entom. Sept. Berlin, Zeitschr. d. geol. Ges. Berlin, Gd. 3, p. 71, pl. 5, fig. 31.

*Pullenia quinqueloba* (REUSS) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 69-70, pl. 7, figs. 19a-b.

*Gyroidina orbicularis* d'ORBIGNY, 1826

*Gyroidina orbicularis* d'ORBIGNY, 1826, Tabl. méth., p. 278, mod. no. 13; PARKER, JONES and BRADY, 1865, Ann. Mag. Nat. Hist., vol. XVI, ser. 3, pl. 3, fig. 85, figure after d'Orbigny's modèle; LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C750, fig. 614: 5-6.

*Anomalina badenensis* d'ORBIGNY, 1846

Plate IV, figure 11-12

*Anomalina badenensis* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 171, pl. 10, figs. 1-3.

*Heterolepa dutemplei* (d'ORBIGNY, 1846)

Plate IV, figure 13-14

*Rotalina dutemplei* d'ORBIGNY, 1846, Foram. tert. Vienne, p. 157-158, pl. 8, figs. 19-21.

*Cibicides dutemplei* (d'ORBIGNY) MARKS, 1951, Rev. sm. Foram. Vienna Basin, p. 72.

*Heterolepa dutemplei* (d'ORBIGNY) LOEBLICH and TAPPAN, 1964, Sarcodina and Foram., p. C759-760, fig. 623: 3a-c.

Several young macrospheric and some microspheric young specimens have been found of this species; one to two whorls are present in this case; these specimens are typical by a big hyaline boss corresponding to the nucleus; the first whorl with the visible suture is involute in older specimens.

*Lamarckina scabra* (BRADY, 1884)

*Rotalina oblonga* (WILLIAMSON, 1858) var. *scabra* BRADY, 1884 [= *Pulvinulina*], Rept. Challenger, pt. 22, vol. 9, p. 689, pl. 106, fig. 8.

*Robertinoides bradyi* (CUSHMAN and PARKER, 1936)

*Bulimina subteres* BRADY, 1884 (not *Bulimina subteres* BRADY, 1881), Rept. Challenger, pt. 22, vol. 9, pl. 50, figs. 18a-b.

*Robertina bradyi* CUSHMAN and PARKER, 1936, Contr. Cushm. Lab. Foram. Res., vol. 12, pl. 4, p. 99, pl. 16, fig. 9.

*Robertinoides bradyi* (CUSHMAN and PARKER) HOFKER, 1956b, Foram. dentata, Spolia Zool. Mus. Haun. XV, Kobenhavn, p. 128-132, pl. XVIII, figs. 1-3, pl. XIX, figs. 1-7.

#### Occurrence

An alphabetic assemblage list of the 118 species of the studied samples is shown on table 1. Further remarks of this distribution are given in the frequency part (table 2).

It is noted which species are probable topotypes; probable is written because d'ORBIGNY chiefly described many new species from the locality Baden and its surroundings, and the locality Sooss, of the author, is at 2,5 km from Baden. We are not absolutely sure that d'ORBIGNY has taken samples at the brickyards of Sooss, but there are serious indications to conclude that this was the case (HÖRNES 1848, p. 11 and KARRER 1877, p. 379, 382). In all there are 36 probable topotypes in these samples.

The single real topotype *Bolivina viennensis* MARKS, 1951 is also noted on the list.

Of the 118 species marked on the list 64 species, after synonymy reduction, have been found by d'ORBIGNY (1846) in the Vienna Basin.

At Sooss 49 species of the author already have been found by MARKS (1951). MARKS described *Lagena striata* and the author has identified the variety *semistriata* of that species. Further the author thinks that MARKS'

*Virgulina schreibersiana* may be his *Fursenkoina squamosa*.

At least 11 new species have been found in the Vienna Basin by other authors (and identified by the author): CZJZEK 1848, REUSS 1850, KARRER 1877, PAPP and KÜPPER 1954.

### Frequency

In all 200 specimens have been counted and plotted on table 2. From the 118 species found (see Systematic Part) 40 species are present in sample OE 4, 50 species in OE 11 and 43 species in sample OE 12. In the three samples 23 species are present and 24 species are present in only one sample.

The most frequent species in the sample OE 4 is *Heterolepa dutemplei* (16 %), in OE 11 *Nonion commune* (11 %) and in OE 12 *Nonion commune* (17,5 %). There is no species which reach 10 % or 5 % in the three samples. There are 4 species which obtain to 2,5 % in the three studied samples: *Bulimina elongata*, *Bulimina elongata* var. *subulata*, *Uvigerina venusta* and *Valvulineria complanata*. There is 1 species which obtains to 10 % in two samples (OE 11, OE 12): *Nonion*

*commune*. There species obtain to 5 % in two samples (OE 11, OE 12): *Nonion commune*, *Asterigerina planorbis* and *Spiroplectammina carinata*.

In the sample OE 4 there are 4 species, with a frequency of minimum 5 %, which obtain together to 38 %: *Heterolepa dutemplei* (16 %), *Nonion pompilioides* (9,5 %), *Bulimina elongata* (7,5 %) and *Textularia abbreviata* (5 %). In the sample OE 11 there are 6 species, with a frequency of minimum 5 %, which obtain together to 40,5 %: *Nonion commune* (11 %), *Spiroplectammina carinata* (7 %), *Asterigerina planorbis* (6,5 %), *Bulimina elongata* var. *subulata* (6 %), *Bulimina elongata* (5 %) and *Uvigerina venusta* (5 %). In the sample OE 12 there are 4 species, with a frequency of minimum 5 %, which obtain together to 41 %: *Nonion commune* (17,5 %), *Asterigerina planorbis* (9,5 %), *Valvulineria complanata* (8 %) and *Spiroplectammina carinata* (6 %).

The conclusion may be made that there are many variations between the three studied samples. That may be a reasonable explanation of the differences between the assemblage list of MARKS (1951) and the author. Further investigations of the "Badener Tegel" are necessary to permit broader conclusions.

### Legend to the following tables

- |   |  |
|---|--|
| + | present  |
| - | not present  |
| × | probable topotype  |
| ⊗ | real topotype  |
| □ | species found by d'Orbigny (1846) in the Vienna Basin      |
| △ | species found by Marks (1951) at Sooss in the Vienna Basin |
| ▲ | new species found by other authors in the Vienna Basin     |

TABLE 1 *Alphabetic assemblage list of benthonic Foraminifera of the "Badener Tegel" at Sooss, near Baden, Austria.*

SAMPLE OE			Species			
4	11	12				
+	+	+			□	<i>abbreviata</i> Textularia
-	+	+			□	<i>aculeata</i> sp. cf. Rotalia
-	+	+	×		□	△ <i>aculeatum</i> Elphidium
+	+	-	×		□	△ <i>adolphina</i> Siphonodosaria
+	+	+			□	<i>aequalis</i> Globulina
+	-	-	×		□	<i>affinis</i> sp. cf. Nodosaria
+	+	+	×		□	△ <i>akneriana</i> Quinqueloculina
-	+	+				<i>angularis</i> Triloculina
-	+	-				<i>angulosa</i> Trifarina
-	-	+				△ <i>auberiana</i> Quinqueloculina
-	+	+				<i>auricula</i> Cancris
					□	<i>austriaca</i> Triloculina see <i>trigonula</i> Triloculina
+	+	-	×		□	<i>badenensis</i> Anomalina
-	-	+	×		□	<i>badenensis</i> sp. cf. Quinqueloculina
-	+	+				<i>beccarii</i> Ammonia
-	+	+			□	<i>boueana</i> Cibicidina
+	-	-			□	<i>boueana</i> sp. cf. Nodosaria
-	-	+			□	<i>boueana</i> Quinqueloculina
-	-	+	×		□	<i>boueanus</i> Eponides
+	-	-				<i>bradyi</i> Robertinoides
+	+	-				<i>bronniana</i> Nodosaria
-	-	+			□	<i>bronniana</i> sp. cf. Quinqueloculina
+	+	+			□	△ <i>bulloides</i> Pullenia
-	+	-				<i>bulloides</i> Pyrgo
+	-	-				△ <i>bulloides</i> Sphaeroidina
-	+	-	×		□	<i>canaliculata</i> Spiroloculina
+	+	+			□	△ <i>carinata</i> Spiroplectammina
+	+	+				<i>celata</i> Sigmorlopsis
+	-	-	×		□	<i>clavata</i> Lagena
+	-	-	×		□	<i>clypeata</i> Pyrgo
-	+	+			□	△ <i>commune</i> Nonion
+	+	+			□	△ <i>communis</i> Martinotiella
+	+	+			□	△ <i>complanata</i> Valvulinera
+	+	+			□	<i>compressa</i> Fissurina
					▲	<i>concinna</i> Quinqueloculina see <i>akneriana</i> Quinqueloculina
+	-	+			□	△ <i>consobrina</i> Triloculina
-	-	+			□	<i>contorta</i> Quinqueloculina
+	-	-			□	△ <i>contraria</i> Nummoloculina
-	-	+				△ <i>costata</i> Bulimina
+	+	-				△ <i>costata</i> Marginulina
					□	<i>costata</i> Heterostegina see <i>costata</i> subsp. <i>costata</i> Heterostegina
-	+	+			□	▲ <i>costata</i> subsp. <i>costata</i> Heterostegina
-	+	+			□	<i>crispum</i> Elphidium
+	-	+				<i>cruysi</i> Globocassidulina

SAMPLE OE					
4	11	12			
+	-	+			<i>depressa</i> <i>Biloculina</i>
+	+	+		□	<i>digitale</i> <i>Loxostomum</i>
+	+	+			<i>directa</i> <i>Bolivina</i>
+	+	+		□	<i>dutemplei</i> <i>Heterolepa</i>
-	-	+		□	<i>dutemplei</i> <i>Quinqueloculina</i>
+	+	+		□	<i>elongata</i> <i>Bulimina</i>
+	+	+		□	<i>elongata</i> var. <i>lappa</i> <i>Bulimina</i>
+	+	+	×	□	<i>elongata</i> var. <i>subulata</i> <i>Bulimina</i>
-	+	+		□	<i>fichtellianum</i> <i>Elphidium</i>
-	+	+	×	□	<i>flexuosum</i> <i>Elphidium</i>
+	-	+			<i>flexuosum</i> var. <i>reussi</i> <i>Elphidium</i> see <i>flexuosum</i> <i>Elphidium</i>
+	-	+		□	<i>floridana</i> sp. cf. <i>Plectofrondicularia</i>
+	+	+		□	<i>gibba</i> <i>Triloculina</i> see <i>trigonula</i> <i>Triloculina</i>
+	+	+		□	<i>globularis</i> <i>Rosalina</i>
+	-	-		□	<i>granosum</i> <i>Nonion</i>
+	+	+		□	<i>grinzingensis</i> <i>Biloculina</i>
-	+	+		□	<i>haidingerii</i> <i>Cibicides</i>
+	-	-	×	□	<i>haidingerii</i> <i>Eponides</i>
+	-	-	×	□	<i>haidingerii</i> sp. cf. <i>Quinqueloculina</i>
			×	□	<i>hauerii</i> <i>Textularia</i> see <i>abbreviata</i> <i>Textularia</i>
+	-	+		□	<i>hauerina</i> <i>Quinqueloculina</i> see <i>akneriana</i> <i>Quinqueloculina</i>
+	+	-		□	<i>hexagona</i> <i>Lagena</i>
			×	□	<i>hirsuta</i> <i>Nodosaria</i>
+	+	+	×	□	<i>hispida</i> <i>Nodosaria</i> see <i>hirsuta</i> <i>Nodosaria</i>
			×	□	<i>inornatus</i> <i>Robulus</i>
-	+	+		□	<i>intermedia</i> <i>Robulina</i> see <i>inornatus</i> <i>Robulus</i>
-	-	+		□	<i>italicum</i> <i>Astrononion</i>
				□	<i>josephina</i> <i>Quinqueloculina</i>
+	+	-		□	<i>laevigata</i> <i>Adelosina</i> see <i>longirostra</i> <i>Quinqueloculina</i>
+	-	-		□	<i>laevigata</i> <i>Cassidulina</i>
-	-	+		□	<i>laevigata</i> <i>Glandulina</i>
+	+	+		□	<i>lessonii</i> <i>Amphistegina</i>
+	+	+		□	<i>lobatulus</i> <i>Cibicides</i>
+	-	+		□	<i>longirostra</i> <i>Quinqueloculina</i>
+	+	+	×	□	<i>longiscata</i> <i>Orthomorpha</i>
			×	□	<i>lunula</i> <i>Biloculina</i> see <i>depressa</i> <i>Biloculina</i>
+	+	+	×	□	<i>mariae</i> <i>Spiroplectammina</i>
				□	<i>mayeriana</i> <i>Quinqueloculina</i> see <i>akneriana</i> <i>Quinqueloculina</i>
-	-	+			<i>melo</i> <i>Borelis</i>
+	-	+			<i>miocenica</i> <i>Bolivina</i>
				□	<i>nussdorfensis</i> <i>Quinqueloculina</i> see <i>boueana</i> <i>Quinqueloculina</i>
+	+	+			<i>oblonga</i> <i>Globocassidulina</i>
+	+	-			<i>orbicularis</i> <i>Gyroidina</i>
+	-	-	×		<i>orbignyana</i> <i>Uvigerina</i>
-	+	-			<i>ovoidea</i> <i>Chilostomella</i>
+	+	+			<i>ovula</i> <i>Bulimina</i>
-	-	+			<i>pappi</i> <i>Uvigerina</i>
+	-	-	×	□	<i>pauperata</i> <i>Dentalina</i>



SAMPLE OE			Species				
4	11	12					
+	+	+				△	<i>pectinata Spiroplectammina</i>
+	+	-	×	□		△	<i>pedum Marginulinopsis</i>
			×	□		△	<i>peregrina Quinqueloculina</i> see <i>auberiana Quinqueloculina</i>
-	+	+		□		△	<i>planorbis Asterigerina</i>
+	+	+				△	<i>pompilioides Nonion</i>
+	+	+				△	<i>pseudoungerianus Cibicides</i>
+	+	+				△	<i>pygmaea Quinqueloculina</i>
+	+	+	×	□		△	<i>pyrula Bulimina</i>
+	-	+					<i>pyrula</i> var. <i>pseudopsinescens Bulimina</i>
+	+	-				△	<i>quinqueloba Pullenia</i>
			×				▲ <i>raricosta Frondicularia</i> see <i>semicosta Plectofrondicularia</i>
							▲ <i>regularis Quinqueloculina</i> see <i>akneriana Quinqueloculina</i>
+	-	-					<i>rixatoria Pyrgo</i>
+	-	-	×	□		△	<i>rudis Nodosaria</i>
-	+	-		□		△	<i>rugoso-costata Marginulina</i>
-	+	-					<i>scabra Lamarckina</i>
			×				▲ <i>scaphoidea Rotalina</i> see <i>auricula Cancris</i>
+	+	+	×	□		△	<i>scripta Dentalina</i>
-	+	-	×				▲ <i>semicosta Plectofrondicularia</i>
				□			<i>semiornata Uvigerina</i> see <i>urnula Uvigerina</i>
				□			<i>simplex Heterostegina</i> see <i>costata</i> subsp. <i>costata Heterostegina</i>
-	-	+					<i>spathulata Bolivina</i>
-	+	+				△	▲ <i>spinulosa Reussella</i>
+	-	-				△	<i>squammosa Fursenkoina</i>
+	+	-				△	<i>striata</i> var. <i>semistriata Lagena</i>
-	-	+					sp. <i>Buliminella</i>
-	+	+					sp. <i>Eponides</i>
-	+	-					sp. 1 <i>Glandulina</i>
+	-	-					sp. 2 <i>Glandulina</i>
-	-	+					sp. <i>Massilina</i> (?)
+	-	-					sp. 1 <i>Quinqueloculina</i>
+	-	-					sp. 2 <i>Quinqueloculina</i>
+	-	-					sp. 1 <i>Triloculina</i>
-	+	+					sp. 2 <i>Triloculina</i>
+	+	+					spp. <i>Textularia</i>
+	+	+	×	□		△	▲ <i>tenuis Sigmoidina</i>
				□		△	<i>triangularis Quinqueloculina</i> see <i>akneriana Quinqueloculina</i>
+	+	+					<i>trigona Allomorphina</i>
+	-	+					<i>trigonula Triloculina</i>
+	-	-					<i>turgida Nonionella</i>
							<i>turgida Biloculina</i> see <i>clypeata Pyrgo</i>
			×	□		△	<i>ungeriana Quinqueloculina</i> see <i>auberiana Quinqueloculina</i>
+	+	+	×	□		△	<i>ungerianus Cibicides</i>
+	+	-	×	□		△	<i>urnula Uvigerina</i>
+	-	-					<i>ventruosa Biloculinella</i>
+	+	+				△	<i>venusta Uvigerina</i>
+	+	+		⊗		△	<i>viennensis Bolivina</i>
+	+	+	×	□			<i>viennensis Rotalia</i>

TABLE 2 *Frequency list of benthonic Foraminifera, in systematic sequence, of the "Badener Tegel" at Sooss, near Baden, Austria*

SAMPLE			Species
OE4	OE11	OE12	
	14	12	<i>Spiroplectammina carinata</i> (d'ORBIGNY, 1826)
7	4	2	<i>Spiroplectammina pectinata</i> (REUSS, 1850)
1	3	2	<i>Spiroplectammina mariae</i> (d'ORBIGNY, 1846)
10	5	4	<i>Textularia abbreviata</i> d'ORBIGNY, 1846
3	2	2	<i>Textularia</i> spp.
1	1		<i>Martinotiella communis</i> (d'ORBIGNY, 1826)
4	2	1	<i>Quinqueloculina akneriana</i> d'ORBIGNY, 1846
		2	<i>Quinqueloculina auberiana</i> d'ORBIGNY, 1839
2			<i>Quinqueloculina longirostra</i> d'ORBIGNY, 1826
3	1	2	<i>Quinqueloculina pygmaea</i> REUSS, 1850
1	1	4	<i>Sigmoilina tenuis</i> (CZIZEK, 1848)
2	4	4	<i>Sigmoilopsis celata</i> (COSTA, 1855)
	1		<i>Triloculina angularis</i> d'ORBIGNY, 1850
	1	1	<i>Triloculina</i> sp. 2
1			<i>Nummoloculina contraria</i> (d'ORBIGNY, 1846)
4			<i>Nodosaria bronniiana</i> NEUGEBOREN, 1852
1			<i>Dentalina pauperata</i> d'ORBIGNY, 1846
1	1	3	<i>Dentalina scripta</i> d'ORBIGNY, 1846
	1		<i>Lagena striata</i> (MONTAGU, 1803) var. <i>semistriata</i> WILLIAMSON
1	2	1	<i>Robulus inornatus</i> (d'ORBIGNY, 1846)
	1		<i>Orthomorphina longiscata</i> (d'ORBIGNY, 1846)
1			<i>Sphaeroidina bulloides</i> d'ORBIGNY, 1826
1	4	7	<i>Bolivina directa</i> CUSHMAN, 1936
1			<i>Bolivina miocenica</i> (GIANOTTI, 1953)
		5	<i>Bolivina spathulata</i> (WILLIAMSON, 1858)
22	1		<i>Bolivina viennensis</i> MARKS, 1951
2			<i>Siphonodosaria ADOLPHINA</i> (d'ORBIGNY, 1846)
9	10	8	<i>Bulimina elongata</i> d'ORBIGNY, 1846
	9	4	<i>Bulimina elongata</i> d'ORBIGNY, 1846 var. <i>lappa</i> CUSHMAN and PARKER
15	12	5	<i>Bulimina elongata</i> d'ORBIGNY, 1846 var. <i>subulata</i> CUSHMAN and PARKER
	1		<i>Bulimina ovula</i> d'ORBIGNY, 1839
1	1	1	<i>Bulimina pyrula</i> d'ORBIGNY, 1846
	4	3	<i>Reussella spinulosa</i> (REUSS, 1850)
		1	<i>Uvigerina pappi</i> MEULENKAMP, 1969
	1		<i>Uvigerina urnula</i> d'ORBIGNY, 1846
5	10	5	<i>Uvigerina venusta</i> FRANZENAU, 1894
	1		<i>Trifarina angulosa</i> (WILLIAMSON, 1858)
1			<i>Rosalina globularis</i> d'ORBIGNY, 1826
7	9	16	<i>Valvulineria complanata</i> (d'ORBIGNY, 1846)
	13	19	<i>Asterigerina planorbis</i> d'ORBIGNY, 1846
7	5	1	<i>Rotalia viennensis</i> (d'ORBIGNY, 1846)
	1		<i>Rotalia</i> sp. cf. <i>R. aculeata</i> (d'ORBIGNY, 1846)
	7	8	<i>Ammonia beccarii</i> (LINNAEUS, 1758)
	2	3	<i>Elphidium aculeatum</i> (d'ORBIGNY, 1846)
	1	1	<i>Elphidium crispum</i> (LINNAEUS, 1758)

SAMPLE			Species
OE4	OE11	OE12	
	2	1	<i>Elphidium flexuosum</i> (d'ORBIGNY, 1846)
	4	3	<i>Heterostegina costata</i> d'ORBIGNY, 1846 subsp. <i>costata</i> PAPP and KÜPPER
	2		<i>Eponides</i> sp.
		2	<i>Amphistegina lessonii</i> d'ORBIGNY, 1826
	1	1	<i>Cibicidina boueana</i> (d'ORBIGNY, 1846)
8	4	2	<i>Cibicides haidingerii</i> (d'ORBIGNY, 1846)
1	2	3	<i>Cibicides lobatulus</i> (WALKER and JACOB, 1798)
1		5	<i>Cibicides pseudoungerianus</i> (CUSHMAN, 1922)
2	2	2	<i>Cibicides ungerianus</i> (d'ORBIGNY, 1846)
2	7	7	<i>Fursenkoina squamosa</i> (d'ORBIGNY, 1826)
1			<i>Cassidulina laevigata</i> d'ORBIGNY, 1826
5		3	<i>Globocassidulina cruysi</i> (MARKS, 1951)
5	3		<i>Globocassidulina oblonga</i> (REUSS, 1850)
	22	35	<i>Nonion commune</i> (d'ORBIGNY, 1846)
	2	3	<i>Nonion granosum</i> (d'ORBIGNY, 1846)
19	3	2	<i>Nonion pompilioides</i> (FICHTEL and MOLL, 1798)
	1		<i>Astrononion italicum</i> CUSHMAN and EDWARDS, 1937
4		1	<i>Pullenia bulloides</i> (d'ORBIGNY, 1826)
	1		<i>Gyroidina orbicularis</i> d'ORBIGNY, 1826
5	1		<i>Anomalina badenensis</i> d'ORBIGNY, 1846
32	7	3	<i>Heterolepa dutemplei</i> (d'ORBIGNY, 1846)
1			<i>Robertinoides bradyi</i> (CUSHMAN and PARKER, 1936)
40	50	43	Species
200	200	200	Counted specimens

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## PLATE I

### Explanation

- fig. 1 *Spiroplectammina carinata* (d'ORBIGNY, 1826) 26 × (sample OE 11)
- fig. 2 *Spiroplectammina carinata* (d'ORBIGNY, 1826) 27 × (OE 12)
- fig. 3 *Spiroplectammina mariae* (d'ORBIGNY, 1846) 26 × (OE 4)
- fig. 4 *Quinqueloculina akneriana* d'ORBIGNY, 1846 40 × (OE 4) the 4-chambered side
- fig. 5 *Quinqueloculina akneriana* d'ORBIGNY, 1846 26 × (OE 4) the 3-chambered side of an other specimen
- fig. 6 *Quinqueloculina longirostra* d'ORBIGNY, 1846 24 × (OE 4) adult specimen
- fig. 7 *Quinqueloculina longirostra* d'ORBIGNY, 1826 55 × (OE 4) other side of an other adult specimen
- fig. 8 *Quinqueloculina longirostra* d'ORBIGNY, 1826 27 × (OE 12) young-adult specimen
- fig. 9 *Quinqueloculina longirostra* d'ORBIGNY, 1826 45 × (OE 4) young macrospheric specimen
- fig. 10 *Quinqueloculina pygmea* REUSS, 1850 59 × (OE 4) the 4-chambered side
- fig. 11 *Sigmoilina tenuis* (CZJZEK, 1848) 55 × (OE 12)
- fig. 12 *Sigmoilopsis celata* (COSTA, 1855) 39 × (OE 12)
- fig. 13 *Triloculina trigonula* (LAMARCK, 1804) 81 × (OE 12)
- fig. 14 *Borelis melo* (FICHEL and MOLL, 1798) 37 × (OE 12)
- fig. 15 *Nodosaria rudis* d'ORBIGNY, 1846 21 × (OE 4)
- fig. 16 *Lagena hexagona* (WILLIAMSON, 1848) 140 × (OE 4)

PLATE I



1



2



3



4



5



6



7



8



9



10



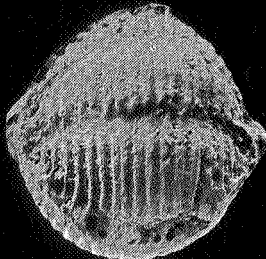
11



12



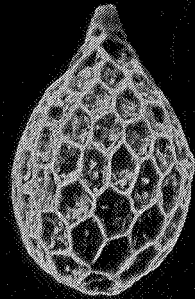
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14



15



16

## PLATE II

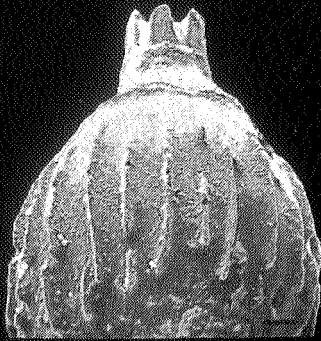
### Explanation

- fig. 1a *Marginulina costata* (BATSCH, 1791) 27 × (OE 11)  
fig. 1b Detail of the last chamber of the same specimen 97 ×  
fig. 2 *Orthomorphina longiscata* (d'ORBIGNY, 1846) 21 × (OE 4)  
fig. 3a *Bolivina viennensis* MARKS, 1951 55 × (OE 4)  
fig. 3b Detail of the central part of the same specimen 277 ×  
fig. 4 *Siphonodosaria adoplhina* (d'ORBIGNY, 1846) 27 × (OE 4)  
fig. 5 *Bulimina costata* d'ORBIGNY, 1852 77 × (OE 12)  
fig. 6 *Bulimina elongata* d'ORBIGNY, 1846 54 × (OE 4)  
fig. 7 *Bulimina elongata* var. *lappa* CUSHMAN and PARKER 87 × (OE 4)  
fig. 8 *Bulimina elongata* var. *subulata* CUSHMAN and PARKER 55 × (OE 4)  
fig. 9 *Bulimina ovula* d'ORBIGNY, 1839 56 × (OE 4)  
fig. 10 *Bulimina pyrula* d'ORBIGNY, 1846 56 × (OE 12)  
fig. 11 *Bulimina pyrula* var. *pseudospinescens* EMILIANI 46 × (OE 4)  
fig. 12 *Reussella spinulosa* (REUSS, 1850) 52 × (OE 12) specimen with acute spines  
fig. 13 *Reussella spinulosa* (REUSS, 1850) 85 × (OE 12) specimen without acute spines  
fig. 14 *Uvigerina urnula* d'ORBIGNY, 1846 42 × (OE 11) specimen with very fine costae





1a



1b



2



3a



3b



4



5



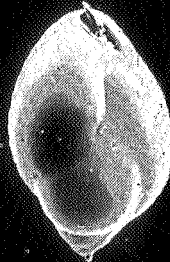
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7



8



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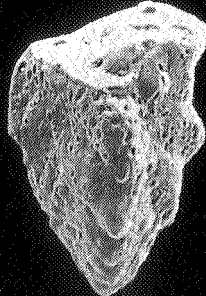
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11



12



13



14

### PLATE III

#### Explanation

- fig. 1 *Uvigerina urnula* d'ORBIGNY, 1846 45 × (OE 11) specimen with fine costae not reaching to the end  
fig. 2 *Uvigerina urnula* d'ORBIGNY, 1846 40 × (OE 11) specimen with costae over the entire test  
fig. 3 *Uvigerina venusta* FRANZENAU, 1894 35 × (OE 11)  
fig. 4a *Valvulineria complanata* d'ORBIGNY, 1846 78 × (OE 12) umbilical-peripheral side  
fig. 4b Detail of the chamber wall of the same specimen 570 ×  
fig. 5 *Valvulineria complanata* d'ORBIGNY, 1846 72 × (OE 12) umbilical side of an other specimen  
fig. 6a *Valvulineria complanata* d'ORBIGNY, 1846 80 × (OE 12) spiral side of an other specimen  
fig. 6b Detail of the chamber wall of the specimen of figure 6a. 582 ×  
fig. 7 *Asterigerina planorbis* d'ORBIGNY, 1846 70 × (OE 12) spiral side  
fig. 8 *Asterigerina planorbis* d'ORBIGNY, 1846 46 × (OE 12) umbilical side of an other specimen  
fig. 9 *Ammonia beccarii* (LINNAEUS, 1758) 50 × (OE 12) umbilical side  
fig. 10 *Ammonia beccarii* (LINNAEUS, 1758) 100 × (OE 12) spiral side of an other specimen  
fig. 11 *Elphidium crispum* (LINNAEUS, 1758) 50 × (OE 12) specimen with a hyaline boss with pores  
fig. 12 *Elphidium crispum* (LINNAEUS, 1758) 47 × (OE 12) specimen without hyaline boss  
fig. 13 *Elphidium fichtellianum* (d'ORBIGNY, 1846) 36 × (OE 12)  
fig. 14 *Elphidium flexuosum* (d'ORBIGNY, 1846) 77 × (OE 11)



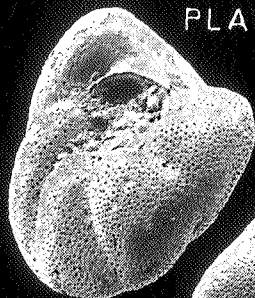
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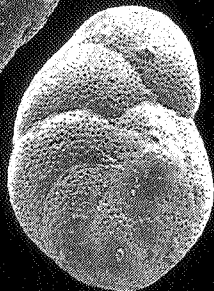
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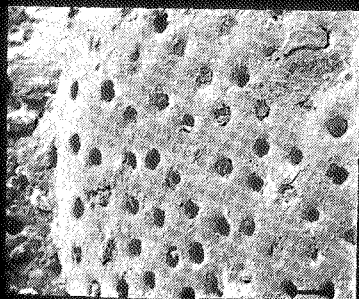
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4a



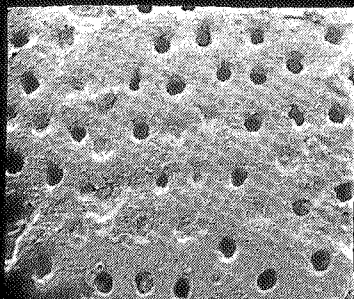
6a



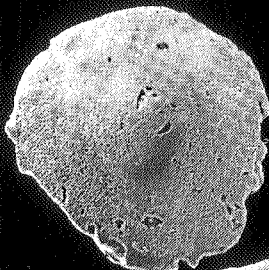
4b



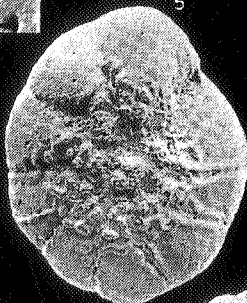
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6b



7



9



8



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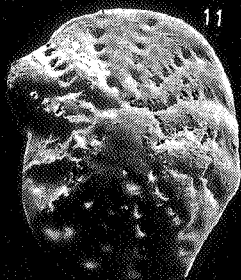
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12



13



14

## PLATE IV

### Explanation

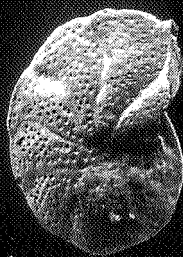
- fig. 1 *Cibicides haidingerii* (d'ORBIGNY, 1846) 37 × (OE 12) spiral side  
fig. 2 *Cibicides haidingerii* (d'ORBIGNY, 1846) 75 × (OE 12) other specimen showing the umbilical side  
fig. 3 *Cibicides ungerianus* (d'ORBIGNY, 1846) 48 × (OE 11) spiral side  
fig. 4 *Cibicides ungerianus* (d'ORBIGNY, 1846) 50 × (OE 11) other specimen showing the umbilical side  
fig. 5a *Loxostomum digitale* (d'ORBIGNY, 1846) 38 × (OE 12)  
fig. 5b Detail of the chamber wall of the same specimen 380 ×  
fig. 6 *Allomorphina trigona* REUSS, 1850 50 × (OE 4)  
fig. 7 *Nonion commune* (d'ORBIGNY, 1846) 36 × (OE 12)  
fig. 8a *Nonion granosum* (d'ORBIGNY, 1846) 60 × (OE 12)  
fig. 8b Detail of the central left part of the same specimen 312 ×  
fig. 9 *Nonion pompilioides* (FICHTEL and MOLL, 1798) 60 × (OE 4)  
fig. 10 *Pullenia quinqueloba* (REUSS, 1851) 72 × (OE 4)  
fig. 11 *Anomalina badenensis* d'ORBIGNY, 1846 36 × (OE 4) umbilical side  
fig. 12 *Anomalina badenensis* d'ORBIGNY, 1846 50 × (OE 4) other specimen showing the spiral side  
fig. 13 *Heterolepa dutemplei* (d'ORBIGNY, 1846) 44 × (OE 4) spiral side  
fig. 14 *Heterolepa dutemplei* (d'ORBIGNY, 1846) 62 × (OE 4) other specimen showing the umbilical side



1



2



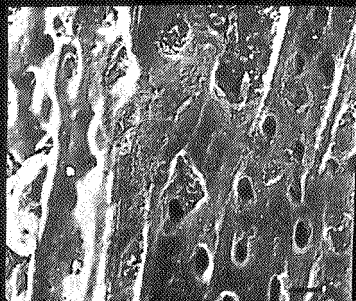
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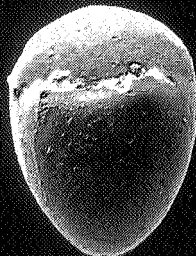
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5a



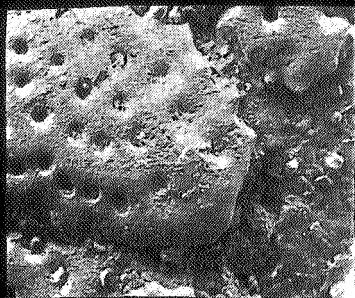
5b



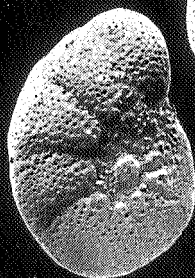
6



7



8b



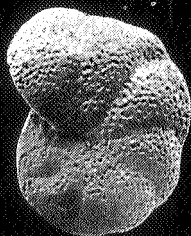
8a



9



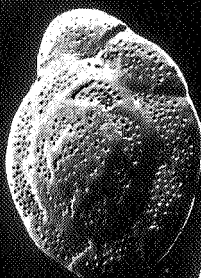
10



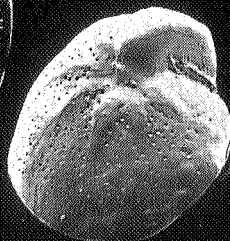
11



12



13



14