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Abh. Geol. B.-A.	ISSN 0378-0864 ISBN 3-900312-61-3	Band 41	S. 61–71	Wien, April 1988

AGGLUTINATED FORAMINIFERAL ASSEMBLAGES AS INDICATORS OF ENVIRONMENTAL CHANGES IN THE EARLY PANNONIAN (LATE MIOCENE) OF THE VIENNA BASIN

by

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With 2 figures and 3 plates

ZUSAMMENFASSUNG

An der Sarmatien/Pannonien-Grenze erlöschen in der Zentralen Paratethys (Wiener Becken, Pannonisches Becken) nahezu alle Foraminiferenarten infolge der fortschreitenden Aussüßung. Das Vorkommen von agglutinierenden Foraminiferen im untersten Pannonien wird durch reduzierendes Milieu sowie sinkende Salinität (oligohaline Bedingungen) beeinflußt.

Miliammina velatina VENGLINSKIJ, *Trochammina kibleri* VENGLINSKIJ und *Bathysiphon* sp. sind mit den Thekamöben *Silicoplacentina majzoni* KÖVARY und *Silicoplacentina irregularis* KÖVARY vergesellschaftet und treten nur im untersten Pannonien (Zone A und [?]B) im Zentralen Wiener Becken auf, wo vorwiegend dunkelgraue Tone zur Ablagerung kamen. Kümmerformen von *Ammonia beccarii* (LINNÉ) und *Nonion* sp. wurden gleichfalls in geringer Anzahl in Bohrungen der ÖMV-Aktiengesellschaft gefunden. Diese Formen sind als endemische Reliktfaunen des Sarmatien anzusehen. Ähnliche Reliktfaunen sind auch in Ungarn und in der ČSSR zu beobachten.

Das Auftreten obiger Sandschaler im untern Pannonien dürfte in der ganzen Zentralen Paratethys von stratigraphischer Bedeutung sein: Eine Korrelation mit der Zone A und (?)B (A. PAPP, 1951), die äquivalent mit der *Miliammina subvelatina– Trochammina kibleri*-Zone (JIRICEK & SVAGROVSKY, 1975) ist, scheint möglich.

ABSTRACT

The occurrence of agglutinated foraminifera in the lowermost Pannonian of the Central Paratethys is controlled by decreasing salinity and a local reducing environment. *Miliammina velatina* Venglinsky, *Trochammina kibleri* Venglinsky and *Bathysiphon* sp.in association with *Silicoplacentina majzoni* Kövary and *Silicoplacentina irregularis* Kövary, which are thecamoebians, occur in the lowermost Pannonian (zone A and ?B) as an endemic relict fauna of the Sarmatian.

INTRODUCTION

The Vienna Basin was an embayment of the Pannonian Basin. When the marine seaways were cut off from the SE part of the Mediterranean Sea, the basins became disconnected from the open sea. As a result, sediments of the Vienna Basin show a rapid change in facies from marine conditions in the Badenian (Middle Miocene) to brackish facies in the Sarmatian (Late Miocene) and finally to oligohaline facies in the Pannonian (Late Miocene), when the salinity decreased to 5-12‰.

Because of the oligohaline conditions in the Pannonian nearly all genera of foraminifera became extinct at the Sarmatian/Pannonian boundary.

Papp (1951, 1953) subdivided the Pannonian *s.l.* into 8 fossil zones (A-H). According to the decisions of the 6th CMNS Congress in Bratislava 1975, the 3

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MILLION YEARS	EPOCH		MEDITERRANEAN	CENTRAL PARATETHYS	SUBZONE	AGGLUTINATED FORAMINIFERA
5	PLIOCENE			Dacian		
	MIOCENE	Late	Messinian	Pontian	H G F	
8	MIOCENE	Late	Tortonian	Pontian	H G F	
	MIOCENE	Late	Tortonian	Pannonian	E D C B A	
11	MIOCENE	Late	Tortonian	Pannonian	E D C B A	+ + +
	MIOCENE	Middle	Serravallian	Sarmatian		+ +
15	MIOCENE	Middle	Serravallian	Badenian		
	MIOCENE	Middle	Langhian	Badenian		

Fig. 1.
Neogene stage systems of the Metditerranean and the Central Paratethys (Middle and Southern Europe).

last zones F, G, H form the Pontian (younger Late Miocene) so that the Pannonian includes zones A-E (figure 1). These biozones have been established with evolutionary lineages of endemic molluscs (*Congeria*). The progressive change to freshwater facies in the uppermost Pannonian and in the Pontian also caused the evolution of certain ostracod faunas.

THE EARLY PANNONIAN

The stratigraphic division after Papp (1951) designates zone A as the so-called "Zwischensand" (= interbedded sand), which is only known from deep drillings. The faunal content consists of small Limnocardiidae, ostracods and rare kummerform foraminifera.
Zone B contains clays with *Congeria ornithopsis* and *Melanopsis impressa posterior*.
Zone C contains clays with *Congeria hoernesi* and *Melanopsis fossilis* (Papp 1985).

The lithological development in the Early Pannonian shows local sand and silty clays and represents a short period of regression. During this period, gray and silty clays with *Congeria* are dominating. These deposits reveal a continuous sedimentation in the Central Basin, whereas the marginal area is covered with conglomerates and sand(stones), indicating the influence of large rivers. Pannonian sediments attain a thickness of about 1200 m in the Vienna Basin.

FAUNAL ASSOCIATIONS IN THE LOWERMOST PANNONIAN

The basal Pannonian is characterized biostratigraphically by the extinction of the typical brachyhaline faunas of the Sarmatian and the appearance of "kaspibrackish" species which are typical for decreasing water mineralization. In zone A there is the first appearance of the ostracods

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Erpetocypris, *Hungarocypris* and *Hemicytherea lörentheyi* (Méhes) and the thecamoebian *Silicoplacentina majzoni* Kövary (Schreiber, Fuchs and Kövary 1985).

Kummerforms of *Ammonia beccarii* (Linné) and *Nonion* sp. occur sporadically. Agglutinated foraminifera specimens of the genera *Miliammina*, *Trochammina* and *Bathysiphon* were found in some deep drillings of the ÖMV-Aktiengesellschaft (the Austrian national oil company) in the central part of the Vienna Basin as well as in the Seewinkel, the Austrian part of the Pannonian Basin (figure 2).

Zone A of the Czechoslovakian part of the Vienna Basin and zone A of the Slovakian Danube lowland also contain *Miliammina subvelatina* and *Trochammina kibleri* (Jiříček 1985a,b).

In Hungary some deep drillings, which penetrated the Sarmatian/Pannonian boundary, recovered *Trochammina kibleri* associated with *Nonion* and *Elphidium* in the earliest Pannonian. An example of such a well is Lajoskomarom-1, south of Lake Balaton, (Jambor *et al.* 1985). In the deep drilling Tengelic 2 (southern Hungary), the occurrence of abundant *Trochammina kibleri* in the basal Pannonian is remarkable (Széles 1980).

Because of persisting salinity in the Early Pannonian, some faunal elements of the Sarmatian survived in the Central Danube Basin in Yugoslavia (near Beograd) (Stevanovic and Papp 1985). For example, *Nubecularia*, which is abundant in the Sarmatian of the Central Paratethys, is reported from the Early Pannonian of Croatia (Yugoslavia) by Sokac (1985). In the Ukrainian Vyshkovo region (USSR), *Trochammina kibleri* is common in the Middle Sarmatian, but is also known from the Early Pannonian of the Carpathian foreland (Venglinskij 1975).

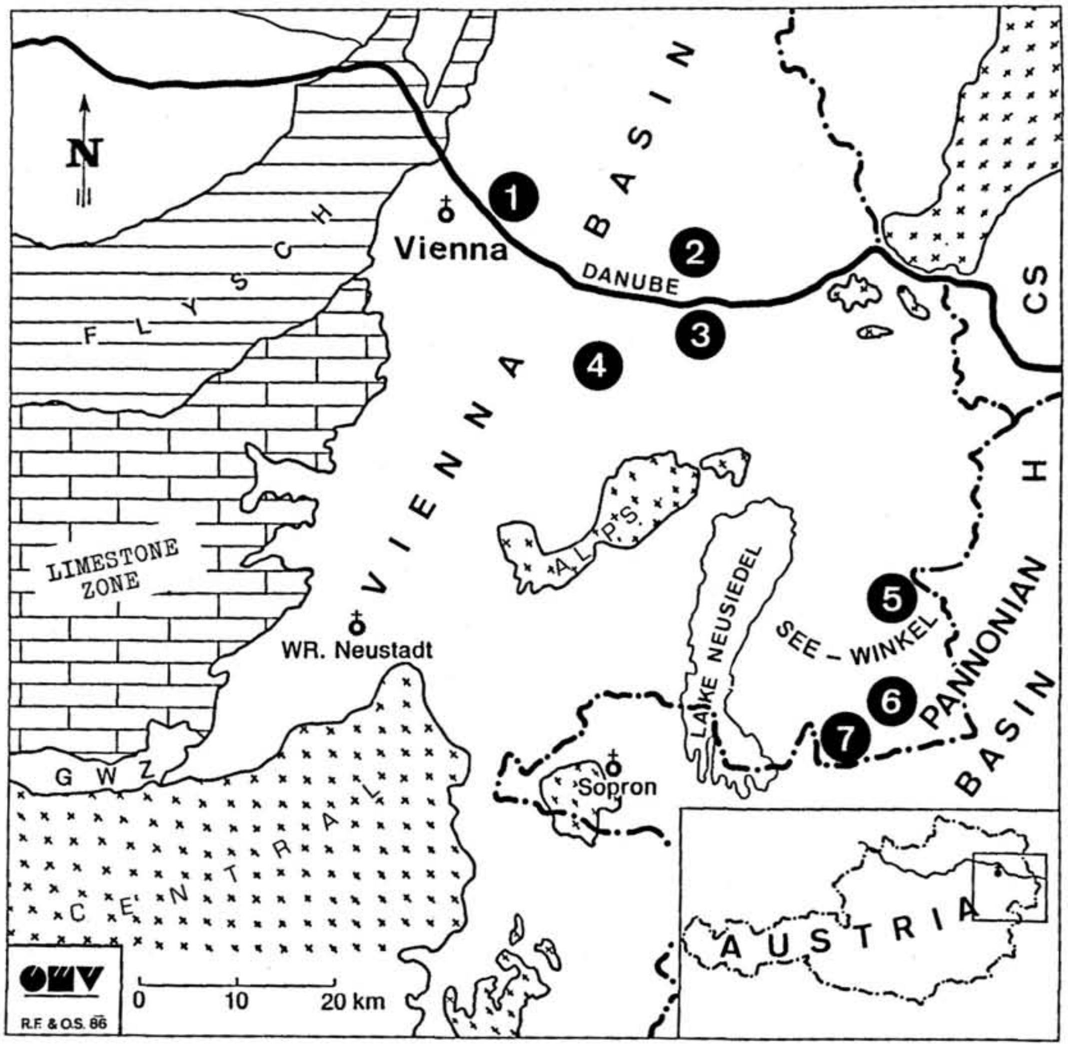

Fig. 2.
Map of the investigated area.
Boreholes: 1 = Kagran 9; 2 = Mannsdorf T1; 3 = Maria Ellend 1; 4 = Wienerherberg 5; 5 = Halbturn 2; 6 = Tadten 1; 7 = Pamhagen 1.
GWZ = Graywacke Zone. "Seewinkel" is the Austrian part of the Pannonian Basin.

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PALEOECOLOGY

High percentages of agglutinating foraminifera are reported from brackish water, deep cold water and some localities on continental shelves (Bandy and Arnal 1960). According to Moorkens (1975), the above-mentioned environments have a common parameter responsible for the occurrence of agglutinating foraminifera. Physico-chemical conditions of the surface layers of the sediment and of the deepest bottom waters (pH, Eh and high organic carbon content) are the principal controlling factors of the "agglutinated-foraminifera-facies" but not salinity, bathymetry or temperature. According to Moorkens (1975), sediments deposited under these conditions are usually a dark clay or mud, rich in organic matter and pyrite.

Moorkens (1975) also reports that potential source rocks are often characterized by the occurrence of this "agglutinated-foraminifera-facies", as agglutinating foraminifera tolerate a reducing environment, which is also favorable for the preservation of organic matter.

According to Matthes (1956), *Miliammina* prefers cold shallow water. Phleger (1960) describes *Miliammina fusca* (Brady), *Trochammina inflata* (Montagne), *Trochammina macrescens* (Brady) as well as thecamoebian species from marsh and estuary environments in the Gulf of Mexico, where a reduced salinity is observed.

The five niches in the modern marine environment of the NW Atlantic, where foraminiferal assemblages relatively rich in agglutinated taxa occur, are described by Scott *et al.* (1983): These are marsh, estuary, continental shelf, slope rise and deep ocean. The absence of carbonate abyssal and marsh environments leads to 100% agglutinated faunas.

The occurrence of agglutinated taxa in the Hungarian Lower Pannonian is connected with a certain type of sediment, *i.e.* shales ("Zalaer Mergel") with intercalation of light layers (Korecz-Laky 1985). Shales are dark and rich in organic material with primitive agglutinated taxa (*Miliammina*, *Ammomarginulina*, and *Ammobaculites*). According to Korecz-Laky, these associations live in the shallow muddy water of lagoons. The Zalaer shales and their associated agglutinated foraminifera have not been found in all wells.

The occurrence of agglutinated taxa in the Pannonian of the Vienna Basin is also remarkable. Species are only found in the Central Vienna Basin, where mainly dark shales were deposited (figure 2). Sedimentation seems to be continuous during the Late Sarmatian/Early Pannonian in the Central Vienna Basin as well as in some regions of the Pannonian Basin, particularly in the Seewinkel, the Austrian part of the Pannonian Basin (Fuchs and Schreiber 1985).

The thecamoebian genus *Silicoplacentina* is associated with the agglutinates. Pokorny (1958) reports that modern thecamoebids mainly live in shallow freshwater, on waterplants, some are also euryhaline or adapted to brackish conditions. Their common occurrence with agglutinated taxa in the Early Pannonian may therefore reflect the influx of freshwater from nearby rivers.

CONCLUSION

The occurrence of agglutinated foraminifera in the lowermost Pannonian of the Central Paratethys is controlled by decreasing salinity and a local reducing environment. *Miliammina velatina* Venglinsky, *Trochammina kibleri* Venglinsky and *Bathysiphon* sp.in association with *Silicoplacentina majzoni* Kövary and *Silicoplacentina irregularis* Kövary, which are thecamoebians, occur in the lowermost Pannonian (zone A and ?B) as an endemic relict fauna of the Sarmatian.

SYSTEMATIC DESCRIPTION OF AGGLUTINANTS

Family: Rzehakinidae Cushman, 1933
Genus: *Miliammina* Heron-Allen and Earland, 1930
Miliammina velatina Venglinsky, 1961
Plate 1, figure 1, 3-7.

Agglutinated thin-walled test, consisting of fine grains, surface smooth, quinqueloculine coiling, aperture is visible as a round or oval opening. Most of the specimens are deformed by sediment pressure. According to Venglinsky (1961), *Miliammina velatina* is the valid name; a partition into two different species because of varying length/breadth-ratio needs further investigations.
Frequency: relatively common.
Length: 0.3-0.7 mm, Breadth: 0.2-0.4 mm.

Miliammina sp.
Plate 1, figures 2, 8-9.

Test like *Miliammina velatina*, but not as broad; aperture on a distinct neck, sutures not depressed.
Frequency: rare.
Length: 0.2-0.7mm, Breadth: 0.1-0.3 mm.

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Family: Trochamminidae Schwager, 1877
Genus: *Trochammina* Parker and Jones, 1859
Trochammina kibleri Venglinsky, 1961
Plate 2, figures 1-3, 5-6.

Coarsely-grained agglutinated wall, surface rough, trochoid coiled, chambers increasing gradually in size, 6-8 chambers in the last whorl, sutures depressed, indistinct; the aperture is generally poorly visible, specimens sometimes deformed.
Frequency: rare.
Diameter: 0.45-0.70 mm.

Trochammina sp.
Plate 2, figure 4; plate 3, figure 1.

Small test, low trochospiral, coarsely agglutinated wall, chambers increasing slowly as added, 6½ in the last whorl, sutures distinct, depressed, straight, deep umbilicus.
Frequency: rare
Diameter: 0.2-0.2 mm

Family: Astrorhizidae Brady, 1881
Genus: *Bathysiphon* M. Sars, 1872
Bathysiphon sp.
Plate 3, figures 2-3

Test large, elongate, tubular, compressed, wall coarsely agglutinated, surface rough, aperture on open end of tube.
Frequency: rare
Length: 0.4-0.8 mm, Breadth: 0.5 mm.

ACKNOWLEDGEMENTS

Dr. H. Stradner (Geological Survey Vienna) kindly made the SEM photographs. We also thank Ing. R. Kouril (ÖMV-Aktiengesellschaft) for reprinting our negatives.

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PLATE 1

SM = scanning microscope LM = light microscope

Figure 1a,b,c	*Miliammina velatina* Venglinskij, borehole Tadten 1, 2075 m a = LM, transmitted light b = LM c = SM, same view as 1 a.
Figure 2a,b	*Miliammina* sp., borehole Tadten 1, 2075 m comparable with *Miliammina* sp., table 1, figure 5 in Venglinskij (1961) a = SM b = LM, same specimen.
Figure 3	*Miliammina velatina* Venglinskij, borehole Kagran 9, 915 m, schematic drawing with aperture view.
Figures 4-5	*Miliammina velatina* borehole Tadten 1, 1200 m, SM, compressed specimens.
Figures 6-7	*Miliammina velatina* Venglinskij, borehole Kagran 9, core: 910-916 m, SM. From this material, Turnovsky (1985) described the first agglutinated foraminifera from the Pannonian of the Vienna Basin.
Figure 8a,b,c	*Miliammina* sp., borehole Tadten 1, 2010 m. a = LM, side view b = LM c = LM, transmitted light, same view as 8b.
Figure 9a,b	*Miliammina* sp., borehole Tadten 1, 2070 m a = SM b = LM, side view.

scalebar = 200μ

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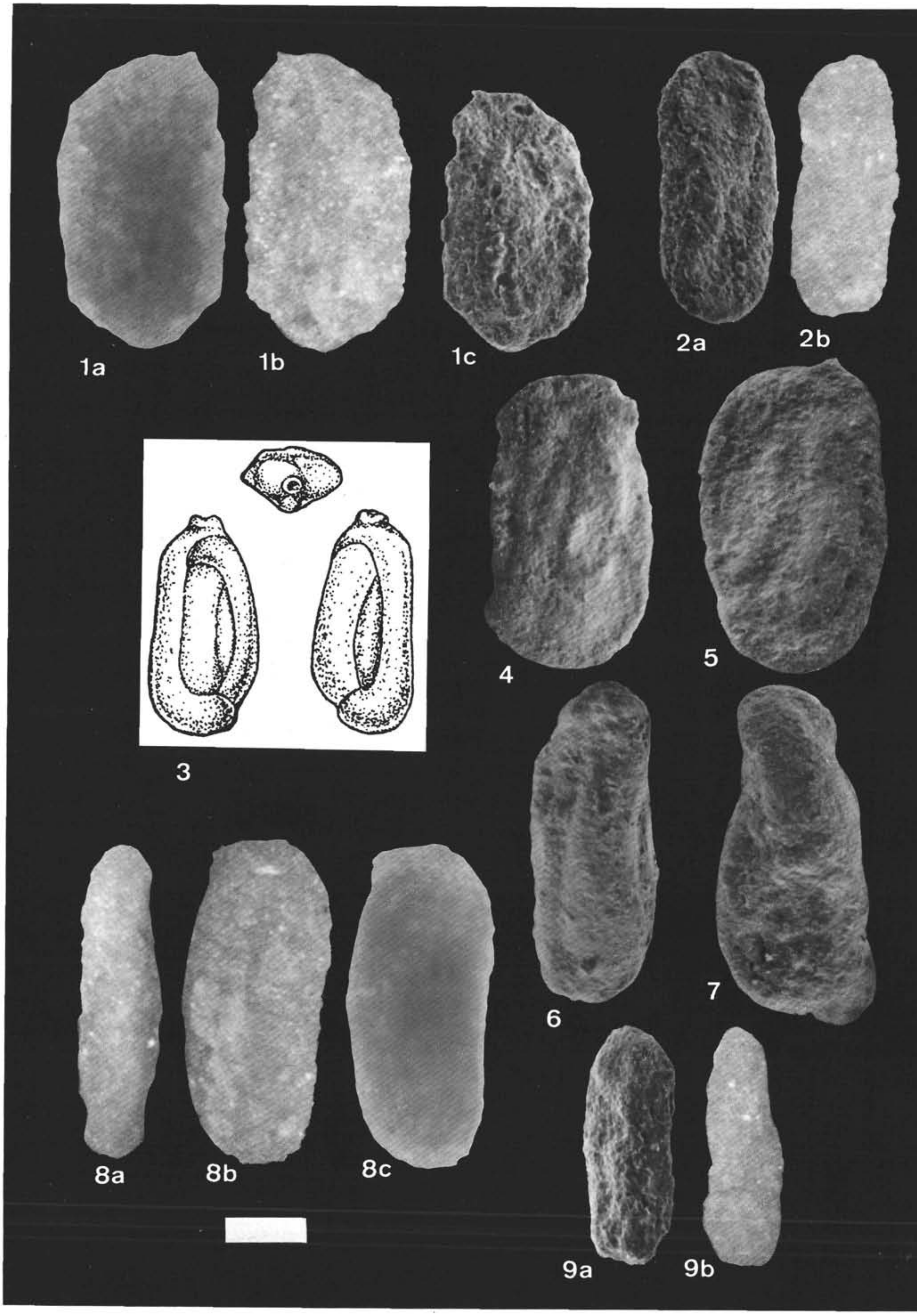

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PLATE 2

SM = scanning microscope LM = light microscope

Figure 1a,b,c	*Trochammina kibleri* Venglinskij, borehole Tadten 1, 2070 m a = LM, transmitted light, umbilical view b = LM, transmitted light, apical view c = SM, same view as 1 a, somewhat upset.
Figure 2a,b,c	*Trochammina kibleri* Venglinskij, borehole Tadten 1, 2080 m a = LM, transmitted light, umbilical view b = SM, same as 2 a, magnification somewhat lower c = LM, same as 2 a d = LM, apical view.
Figure 3a,b,c,d,e	*Trochammina kibleri* Venglinskij, borehole Tadten 1, 2010 m a,b = LM, transmitted light c,d = LM, same view as a,b e = SM, same view as 3a,c, apical.
Figure 4a,b,c	*Trochammina* sp. borehole Tadten 1, 2080 m a = LM, transmitted light b,c = LM.
Figure 5	*Trochammina kibleri* Venglinskij, borehole Tadten 1, 2080 m.
Figure 6	*Trochammina kibleri* Venglinskij, borehole Tadten 1, 2010 m.

scalebar = 200μ

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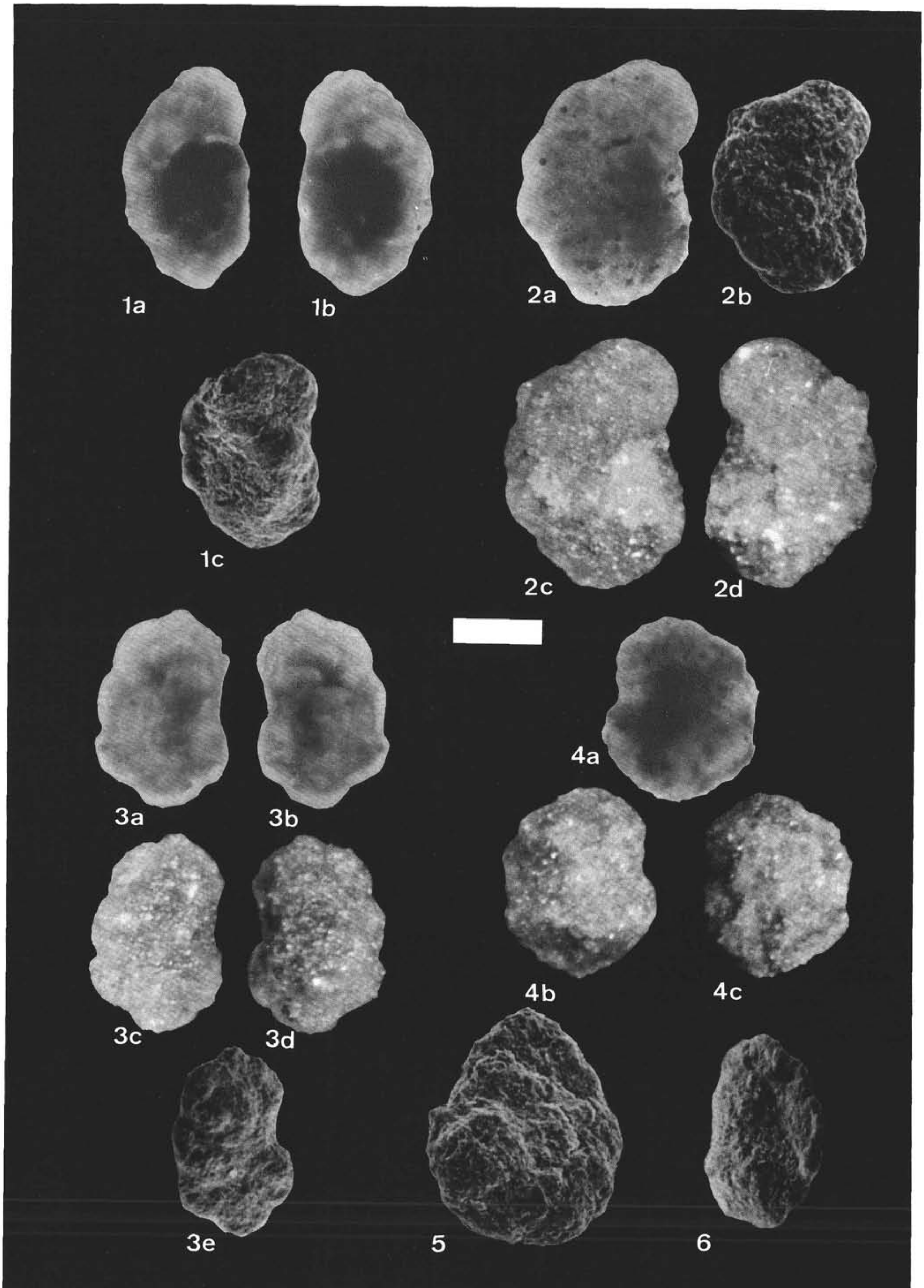

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PLATE 3

All photographs except figure 3 by scanning microscope

Figure 1 *Trochammina* sp., borehole Pamhagen 1, core: 1400-1407 m.
Figure 2 *Bathysiphon* sp., borehole Pamhagen 1, core:1200-1205 m.
Figure 3 *Bathysiphon* sp., borehole Kagran 9, core: 910-918 m, light microscope.
Figure 4 *Silicoplacentina majzoni* Kövary, borehole Pamhagen 1. 1570 m.
Figure 5 *Silicoplacentina irregularis* Kövary, borehole Tadten 1, 1740 m, magnification of the aperture.
Figure 6 *Silicoplacentina irregularis* Kövary, borehole Pamhagen 1, 1570 m.
Figure 7 *Silicoplacentina majzoni* Kövary, borehole Halbturn 1, 1100 m.

scalebars: figures 1 -4, 6-7 = 200µ
figure 5 = 50 µ.

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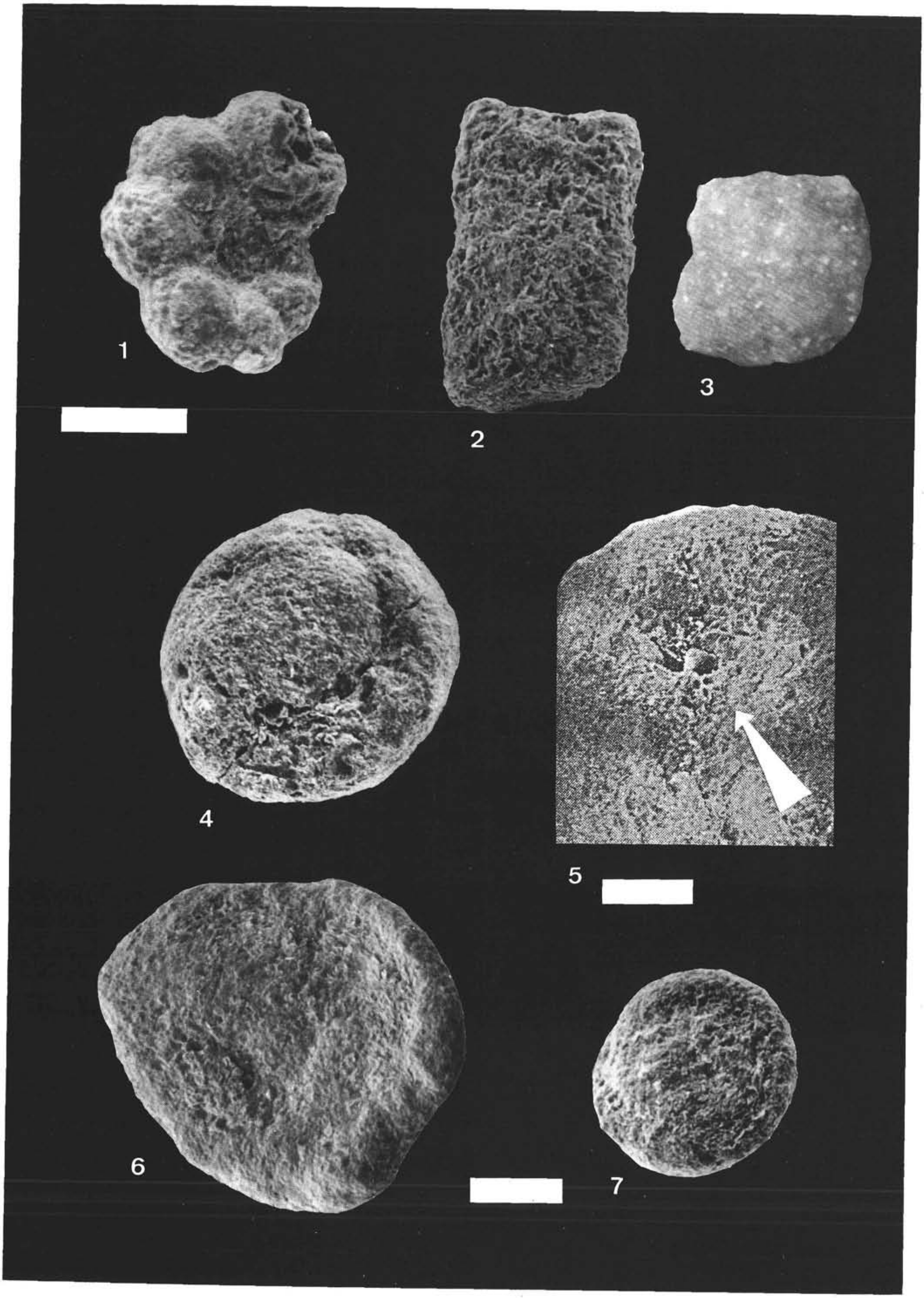

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Zeitschrift/Journal: Abhandlungen der Geologischen Bundesanstalt in Wien

Jahr/Year: 1988

Band/Volume: 41

Autor(en)/Author(s): Fuchs Reinhard, Schreiber Otto Stanislav

Artikel/Article: Agglutinated Foraminiferal Assemblages as Indicators of Environmental Changes in the Early Pannonian (Late Miocene) of the Vienna Basin 61-71