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Calcareous nannofossil biostratigraphy of the Mühlbach section (Gaindorf Formation, Lower Badenian), Lower Austria

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(With 1 textfigure, 1 table and 1 plate)

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Abstract

Calcareous nannoplankton was studied in 8 samples from the Mühlbach outcrop (Gaindorf Formation). The quantitative study of the nannoflora enables these deposits to be specified as the biozone *Sphenolithus heteromorphus* (NN5) of MARTINI (Lower Badenian).

Method

Smear slides were prepared for all samples and analysed using a light microscope (1000 x magnification) at normal and crossed nicols to identify calcareous nannofossils. For observations with a light microscope samples were treated ultrasonically for a few seconds. Approximately 300 specimens were counted from each sample.

Biostratigraphy

Samples M1 and M2 contain similar, middle to well preserved nannoplankton (Pl. 1). They include dominant *Coccolithus pelagicus* together with *Coronocyclus nitescens*, *Helicosphaera carteri*, *H. vedderi*, *H. waltrans*, *Reticulofenestra minuta, R. haqii, R. pseudoumbilica, Sphenolithus heteromorphus, Sph. moriformis, Syracosphaera histrica, S. pulchra, Thoracosphaera heimii* (Tab. 1a).

Sample M3 is barren by calcareous nannofossils. Sample M4 was taken from the middle part of the section, and contains a rather rare, but very well preserved nannoplankton assemblage dominated by *C. pelagicus*. The accompanying taxa are *Coronocyclus nitescens, Helicosphaera carteri, Pontosphaera multipora, Reticulofenestra minuta, R. gelida, R. haqii, Sphenolithus moriformis, Syracosphaera pulchra, Thoracosphaera heimii*, and *Thoracosphaera saxea.* Four samples (M5 – M8) were taken from the lower part of the section, but only sediments from samples M5 and M6 contain nannoplankton assemblages very similar to the higher levels. The stratigraphically very important species *Sphenolithus heteromorphus* is very scarce but present in the sample M5.

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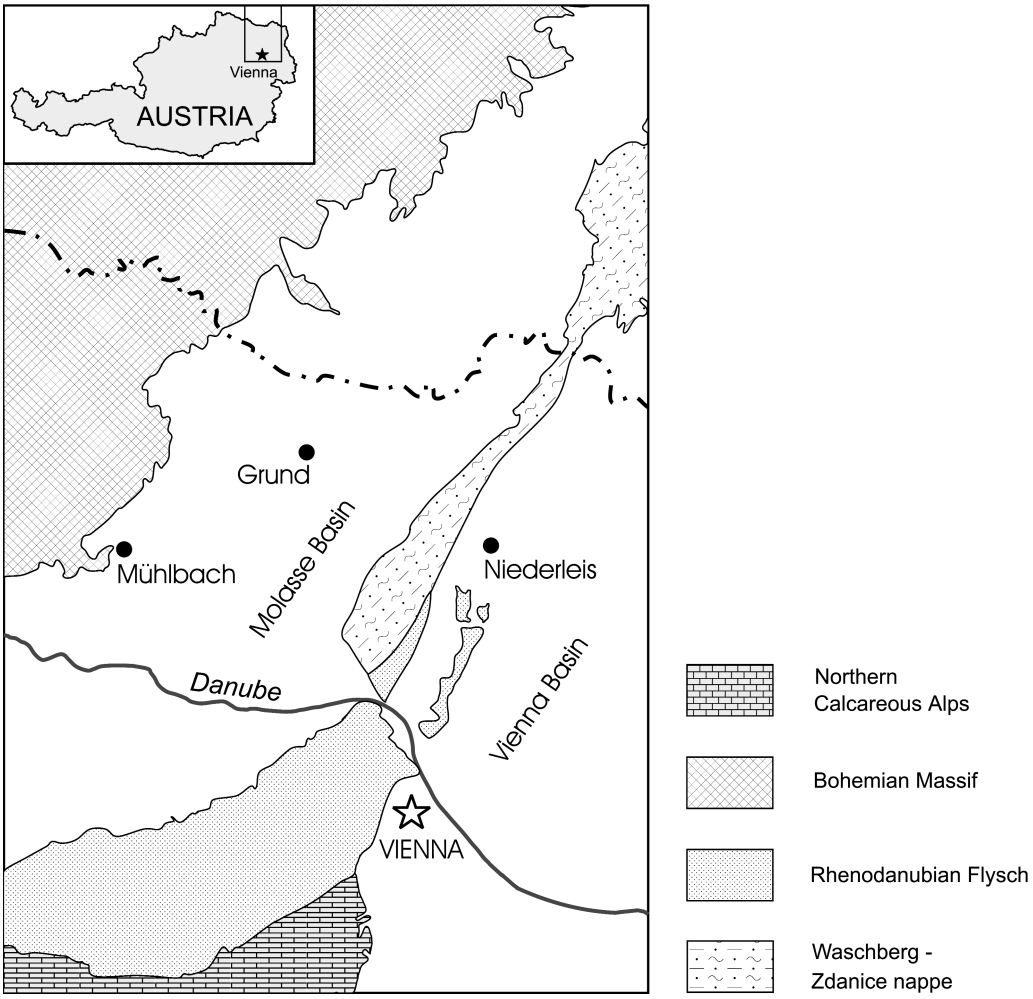

Reworked specimens are a common component of the total nannoplankton assemblage observed in the Mühlbach samples (Tab. 1b). In samples M1 and M2 *Helicosphaera ampliaperta* occurs very scarcely, reworked from older levels. The most abundant reworked cretaceous forms are *Watznaueria barnesae* and *Micula decussata.*

The Karpatian-Badenian transition was studied in detail at the old brickyard Wagna south of Leibnitz (Styrian Basin) and in the cement quarry of Retznei (RÖGL et al. 2002). The nannofossil assemblages have been examined by means of quantitative methods and yielded important biostratigraphic and palaeoecologic results, which can be very useful for regional correlations. In both sections *H. waltrans* occurs only in the nannoplankton Zone NN 5 above the last occurrence of *H. ampliaperta.* FORNACIARI et al. (1996) investigated the distribution patterns of selected calcareous nannofossils in Miocene sediments of the Mediterranean region. *Helicosphaera waltrans* occurs in the middle part of the *Sphenolithus heteromorphus* Partial-range Zone MNN 5, which corresponds to the nannofossil Zone NN5 of MARTINI (1971).

Tab. 1: Nannofossils distribution in samples from Mühlbach section (a = *in situ* species, b = reworked species)

1a

Sample Nr.	*Calcidiscus tropicus*	*Coccolithus pelagicus*	*Coronocyclus nitescens*	*Cyclicargolithus floridanus*	*Discoaster deflandrei*	*Discoaster variabilis*	*Discoaster* sp.	*Geminilithella rotula*	*Helicosphaera carteri*	*Helicosphaera euphratis*	*Helicosphaera granulata*	*Helicosphaera vedderi*	*Helicosphaera waltrans*	*Helicosphaera* sp.	*Pontosphaera multipora*	*Pontosphaera* sp.	*Reticulofenestra gelida*	*Reticulofenestra haqii*	*Reticulofenestra minuta*	*Reticulofenestra pseudoumbilicus* 5-7μ	*Reticulofenestra* sp.	*Sphenolithus heteromorphus*	*Sphenolithus moriformis*	*Syracosphaera hystrica*	*Syracosphaera pulchra*	*Thoracosphaera heimii*	*Thoracosphaera saxea*	*Thoracosphaera* sp.	*Umbilicosphaera jafari*	
1		139	1	1		1			9			1	2			1	1	31	113	8	1	2		3	16	1			1	332
2		126	2		1				22		1		2					47	79	1		1		1	23	1		1		308
4		255	3				1		2	1					1		2	2	18	1			1		11	3	3			304
5	1	229	1	1				1	10				1		1		1	3	22				3	7	11	9	6		1	307
6		185	1	1					9					1			10	5	61	2	1	1	4		23		3	2		309
3																														
7																														
8																														

1b

Sample Nr.	*Arkhangelskiella cymbiformis*	*Arkhangelskiella* sp.	*Biscutum melaniae*	*Broinsonia enormis*	*Calculites obscurus*	*Discoaster multiradiatus*	*Eiffellithus eximius*	*Eiffellithus gorkae*	*Eiffellithus* sp.	*Helicosphaera ampliaperta*	*Helicosphaera scissura*	*Microrhabdulus decoratus*	*Micula decussata*	*Neococcolithes protenus*	*Percivalia fenestrata*	*Prediscosphaera* sp.	*Quadrum* sp.	*Reticulofenestra bisecta*	*Toweius* sp.	*Triquetrorhabdulus carinatus*	*Watznaueria barnesae*	*Zeugrhabdotus* sp.	*Zygodiscus* sp.	*Zygrhabilithus bijugatus*
1	1	1							1	1	1		3			3	1	1	5		6		1	
2			1						1	1					1						2			
4	1		1	1	1		1						6	1		2		1			18	1		1
5	4					1	1	1	3				1	2		1		1	1		28	1	2	
6	2								4			1	3			3		1	2	1	14			1
3																								
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SVABENICKA & CTYROKA (1999) investigated the Karpatian-Badenian transition in the Carpatian Foredeep and in the Austrian Molasse. Based on foraminifera and nannoplankton they suggested the subdivision of this transition into four intervals. The second interval includes the lower part of Grund Fm. and contains *H. ampliaperta, H. walbersdorfensis*, and *H. waltrans*, and thus was placed in the upper part of Karpatian.

The co-occurrence of *H. ampliaperta* (not in situ) and *H. waltrans* (in situ) in sediments from the Mühlbach section is assumed to be result of reworking. Sediments from the Mühlbach outcrop can thus be positioned within the nannofossil Zone NN 5.

Palaeoecology

Nannofossil assemblages from the Mühlbach outcrop are strongly dominated by high percentages of species *Coccolithus pelagicus* (up to 83% of the entire assemblage in sample M4) and *Reticulofenestra minuta* (6 – 34%). *Coccolithus pelagicus* is well known as an indicator for cold water and nutrient enrichment of the surface ocean waters. OKADA & MCINTYRE (1979) found that the optimal growth conditions for this species are at temperatures ranging from 2 to 12°C. Recent palaeoecological studies (CACHAO & MOITA, 2000) on its distribution patterns in the water column of the western coast of the Iberian Peninsula confirmed these results. *Coccolithus pelagicus* is common in upwelling systems as well as close to river mouths.

Species of the genus *Discoaster* considered as warm water indicator are very scarce in nannofossil assemblages of the investigated samples. *Discoaster variabilis* is present only in the upper part of the Mühlbach section. The typical warm water species *Sphenolithus heteromorphus* occurs also very sporadically in these sediments.

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Plate 1

Light microscope photographs of nannofossils from Sample Nr. 1 from Mühlbach section

Fig. 1, 2: ***Helicosphaera ampliaperta*** **Bramlette & Wilcoxon, 1967**

Fig. 3: ***Cyclicargolithus floridanus*** **(Roth & Hay, 1967) Bukry, 1971**

Fig. 4: ***Helicosphaera carteri*** **(Wallich, 1877) Kamptner 1954**

Fig. 5: ***Umbilicosphaera jafari*** **Müller, 1974**

Fig. 6: ***Reticulofenestra pseudoumbilicus*** **(Gartner, 1967) Gartner, 1969**

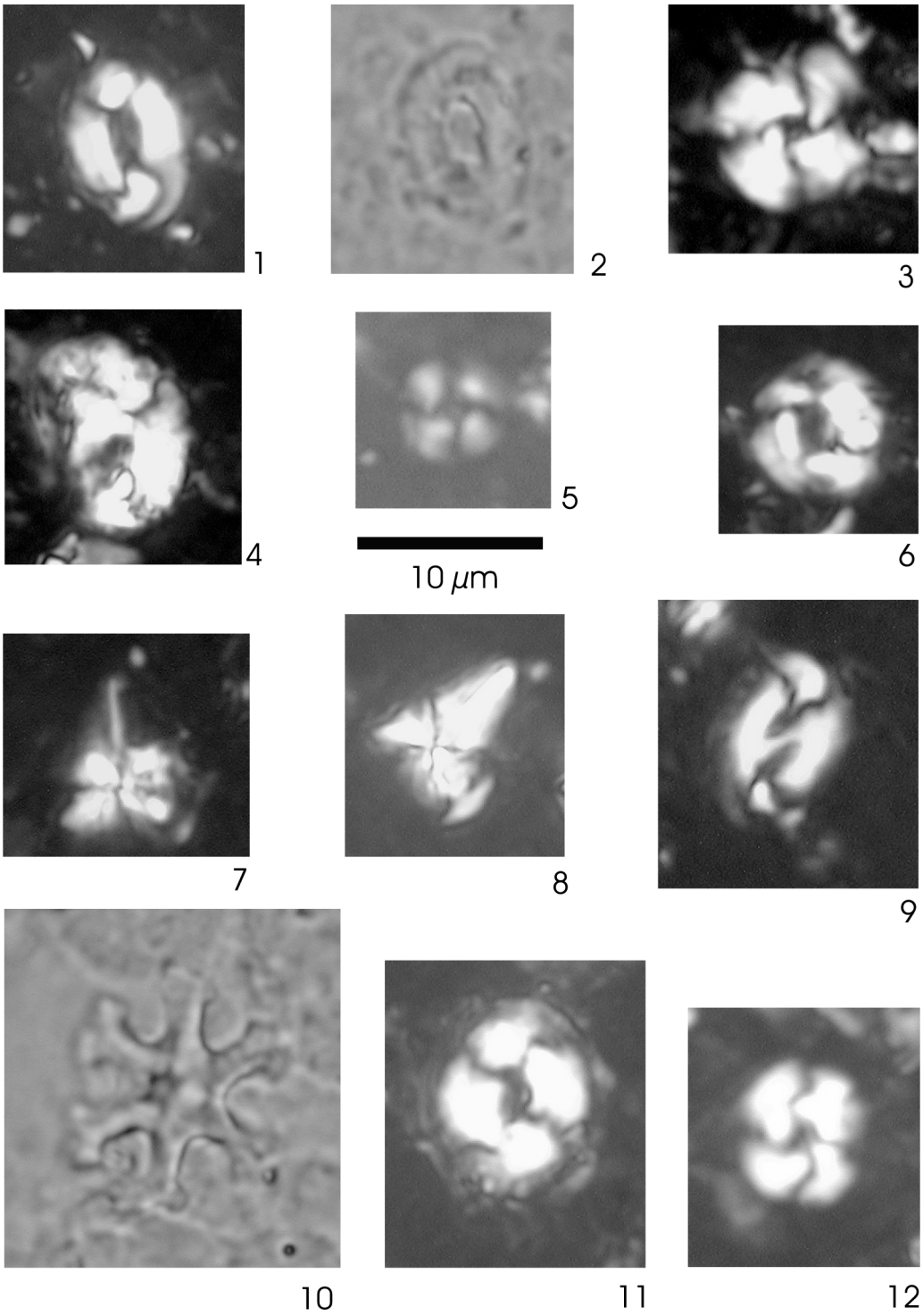
Fig. 7, 8: ***Sphenolithus heteromorphus*** **Deflandre, 1953**

Fig. 9: ***Helicosphaera waltrans*** **Theodoridis, 1984**

Fig. 10: ***Discoaster variabilis*** **Martini & Bramlette, 1963**

Fig. 11: ***Coccolithus pelagicus*** **(Wallich, 1871) Schiller, 1930**

Fig. 12: ***Reticulofenestra gelida*** **(Geitzenauer, 1972) Backman, 1978**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