Quantitative analysis of Middle Miocene calcareous nannofossils from the scientific drilling at Baden-Sooss (Austria, Central Paratethys)

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Quantitative analyses on calcareous nannofossils were carried out on 102 Middle Miocene samples from the drilling at Baden-Sooss (Vienna Basin) for scientific investigations. All samples can be assigned to nannoplankton Zone NN5 (Martini, 1971). The low concentration of *Helicosphaera walbersdorfensis* Müller, 1974 allows correlation with the Mediterranean nannoplankton Subzone MNN5a (*S. heteromorphus - H. walbersdorfensis* Interval Subzone of Fornaciari *et al*., 1996).

Typical near-shore forms, such as small reticulofenestrids, accompanied by smaller numbers of *Umbilicosphaera jafari* Müller, 1974, *Reticulofenestra haqii* Backman, 1978, *Coccolithus pelagicus* (Wallich, 1871) Schiller, 1930, and *Reticulofenestra pseudoumbilicus* (Gartner, 1967) Gartner, 1969 dominate the calcareous nannoplankton assemblages. Inter-species correlations and correlations to stable isotopes and magnetic susceptibility, together with multivariate statistical methods (Cluster analysis, Indicator values method, Nonmetric Multidimensional Scaling) enabled the reconstruction of trends in the palaeoenvironment of the upper water mass during this part of the Badenian.

The following calcareous nannoplankton species were analyzed for palaeoecological interpretation: *C. pelagicus*, discoasterids, helicoliths, reticulofenestrids (*R. minuta*, *R. pseudoumbilicus*), sphenoliths (*S. heteromorphus*, *S. moriformis*), *U. jafarii*, and the contribution of reworked nannoplankton from older strata (see figure).

Coccolithus pelagicus is negatively correlated with magnetic susceptibility, thus higher percentages of this form coincide with lower values of magnetic susceptibility and suggest lower water temperature. *Vice versa*, lower percentages of *C. pelagicus* can be correlated with peaks of magnetic susceptibility. These periods suggest warmer water due to the higher insolation. Periods of colder, non-stratified water containing higher proportions of *C. pelagicus* are interpreted in the deeper core between -77 and -71m, then this taxon was replaced in the following interval by stratified, higher-salinity and warmer water. A slight, but continuous, temperature decrease, starting from -50m core-depth upwards, resulted in an abundance increase of *C. pelagicus* indicating also an eutrophication trend.

Small reticulofenestrids, which occupy marine environments along continental margins, dominate the nannoplankton assemblages in the core. Abundance oscillations could indicate changes in temperature, inferring warmer, stratified waters and lower salinity.

Sphenolithids can also be used as temperature indicators. Therefore, higher percentages of *Sphenolithus heteromorphus* Deflandre, 1953 and *S. moriformis* (Brönnimann & Stradner, 1960) Bramlette & Wilcoxon, 1967 coincide with increased magnetic susceptibility and can be used as indicators for increased water temperature. *Umbilicosphaera jafarii* is common in shallow environments; the abundance peaks reflect a slight increase in salinity. The transition from a community with abundant *C. pelagicus* to *U. jafarii* needs a slight temperature increase; these transitions are often found in the core. Transitions from communities with abundant *U. jafarii* to communities where *R. minuta* dominates are discontinuous, needing larger and abrupt environmental changes.

The higher erosion rate on the continent is documented by high percentages of reworked calcareous nannoplankton. This can be correlated with the intensified input of magnetic particles, as documented by magnetic susceptibility.

Low percentages of discoasterids point to a sedimentation environment close to the shoreline.

Low variations in abundance of ecological sensitive species suggest relatively low fluctuating environments. The deeper part of the core (-102 to -40m) shows opposite oscillating trends (with long periods) in salinity and temperature. Around -70m, the salinity maximum is combined with a temperature minimum and, *vice versa*, a salinity minimum and temperature maximum can be found around -50m. Trends in the upper core are more discontinuous, possibly due to gaps in the sedimentation record as caused by intensified tectonics. Generally, a linear trend towards slightly increasing salinity, eutrophication and lowered temperatures can be documented for the upper core.

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References

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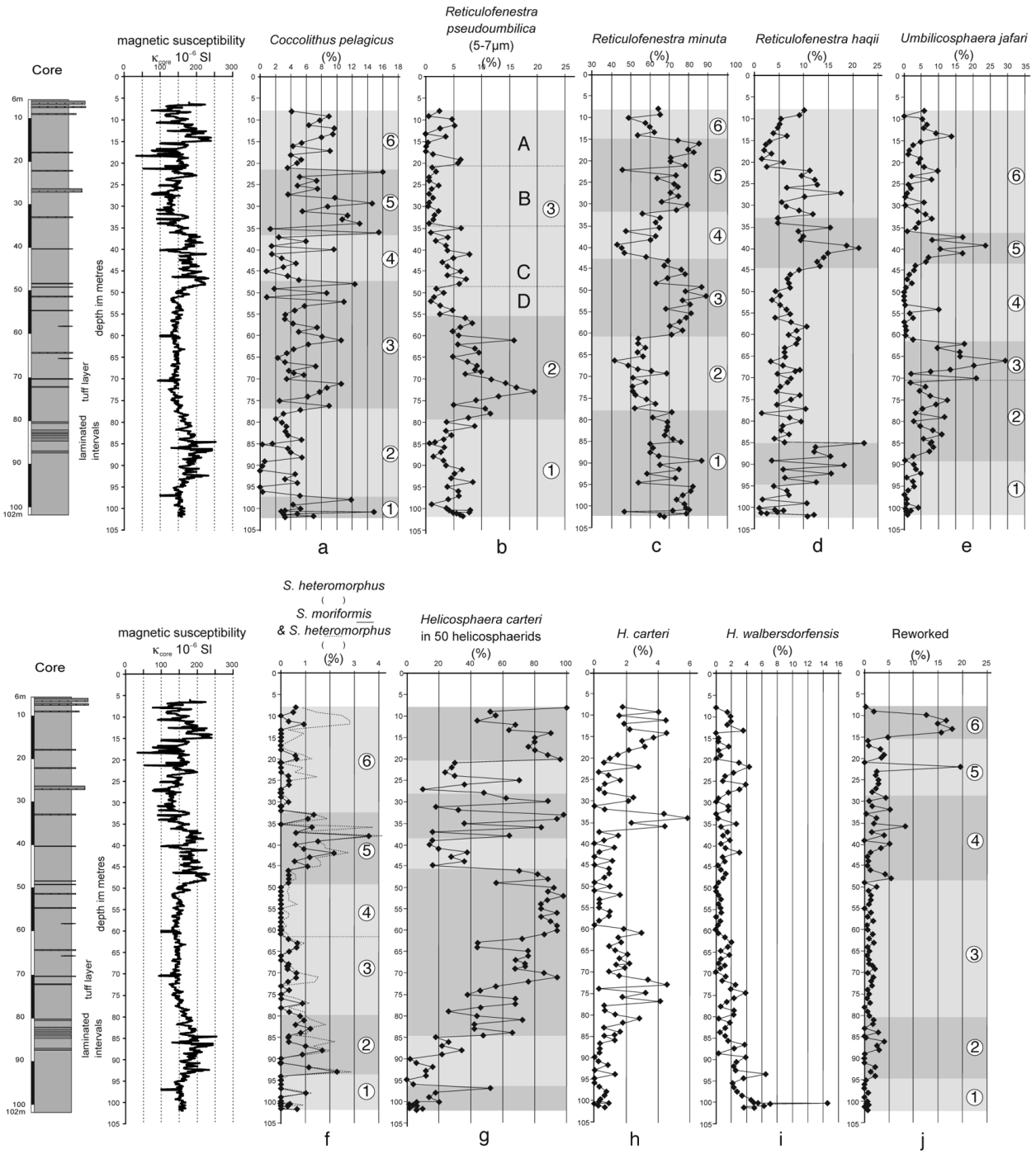
Core
magnetic susceptibility
κcore 10-6 SI
Coccolithus pelagicus
(%)
Reticulofenestra pseudoumbilica
(5-7µm)
(%)
Reticulofenestra minuta
(%)
Reticulofenestra haqii
(%)
Umbilicosphaera jafari
(%)
depth im metres
tuff layer
laminated intervals
6m
102m
A
B
C
D
a
b
c
d
e
S. heteromorphus
S. moriformis
& S. heteromorphus
(%)
Helicosphaera carteri
in 50 helicosphaerids
(%)
H. carteri
(%)
H. walbersdorfensis
(%)
Reworked
(%)
f
g
h
i
j
Intervals with higher content of analyzed taxa
Intervals with lower content of analysed taxa