Decline and recovery of foraminifera at the northern Tethyan margin during the Cenomanian-Turonian OAE-2

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The Oceanic Anoxic Event-2 at the Cenomanian-Turonian boundary is one of the major paleoceanographic events during the Cretaceous. We present the results and interpretations of foraminiferal assemblage-curves across OAE-2 from a key section studied at the northern Tethyan margin (Fehlsheggebraten, Unterhelvetik Zone, Austria, Fig. 1). The section investigated is the only known nearly complete boundary section encasing black shale layers in the Eastern Alps. OAE-excursions of C/O-ratios were measured for calcareous and organic matter of bitumens, marls and nearly carbonates free black shales (Fig. 2).

Planktic foraminifera (Fig. 2) are particularly frequent in the Late Cenomanian (>30000 individuals/g dry sediment, ind/g). Their number decreases to 1.3 ind/g during the OAE, and even 0.5 ind/g immediately after the black shale deposition in the basal Turonian (Fig. 4, 5). Their number increased to about 12000 ind/g in the Early Turonian (Fig. 4).

About 10-30% of the Cenomanian assemblages are Hedbergellids (Muricohedbergella spp.). Their percentage decreases during the OAE and varies between 10 and 50% in the Early Turonian. The fraction of Heterohelcids decreases already during the Late Cenomanian from 15 to 2%, is low during the OAE and varies strongly in the Early Turonian (2-15%).

Whiteinella occurs with 4 to 18% in Late Cenomanian samples, varies between 3 and 30% during the OAE and continues with about 30% in the Turonian. "Broad" species (e.g., W. baltica) have their highest fractions (19%) during the late OAE and the basal Turonian. Percentages of Praglobotruncana are low during Late Cenomanian (1-5%) and the C/O (0-4%) and increase noticeably in the Turonian (5-10%). Retaploides occurs with 0.7 to 2.5% in Late Cenomanian samples.

Frequency of benthic foraminifera (Fig. 6) varies between 0.5 ind/g during the OAE and more than 1500 ind/g in the late Cenomanian. The majority (number) of benthics is part of the 0.063 to 0.125 mm fraction (about 95%), Fig. 7. Benthic foraminiferal recovery after OAE-2 appears to be slow and the frequency remains less than 500 ind/g during the W. echinocavernosus-Zone. Pre-OAE levels are reached during the W. helvetica-Zone. The Turonian assemblages show a higher percentage those from the Cenomanian (Fig. 8).

Well developed K-selected Late Cenomanian assemblages with abundant Rotalipora (although dominated by Hedbergellids) are replaced by n-kelated assemblages with low total numbers and relatively high fractions of Schackoina and W. baltica. Recovery of the planktic ecosystem is represented by increasing numbers of larger and partly lysed species of the genera Praglobotruncana, Whiteinella, Spiroplectammina and Helvetoglobotruncana. We interpret the drastic decline, slow recovery and final return to pre-OAE levels as direct consequences of changes in the oceanic environment. Our data point to a collapse of stable nutrient supply and subsequent food chains together with a rise in and intensification of the oxygen minimum zone, resulting in the observed foraminiferal assemblages in the northern Tethyan Ocean.