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Quantitative faunal composition of estuarine and shallow marine Upper Burdigalian deposits of the Korneuburg Basin in Lower Austria

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In the course of highway constructions (Wiener Außenring-Schnellstraße (S1)) a detailed sedimentological transect of 1.8 km length was logged in deposits of the Central Paratethys near the village of Stetten, N of Korneuburg in Lower Austria. A total of 324 sediment- and 118 molluscan samples was studied. The siliciclastic succession consists of pelitic and sandy sediments and sandstones and is rich in fossils. The fossil remains consist of sponges, corals, serpulids, molluscs, balanids, echinoderms, fish and micromammals. Quantitatively the molluscs dominate and have been studied in detail. 139 species were determined from more than 11000 shells. Two gastropod species, *Agapilia pachii* und *Granulolabium bicinctum* make up more than 53 % of the assemblage. Another 11 species (*Nassarius edlaueri*, *Bittium spina*, *Loripes dujardini*, *Hydrobia* spp., *Paphia subcarinata*, *Cyllenina ternodosa*, *Turritella gradata*, *Corbula gibba*, *Cerastoderma praeaplicata*, *Striarca lactea*, *Sandbergeria perpusilla*) each contributes more than 1 % to the total molluscan composition, but all other 126 species are quantitatively unimportant. A conspicuous alternation between intertidal and shallow subtidal mollusc associations is evident. The intertidal is dominated by the superabundant *Agapilia pachii* and *Granulolabium plicatum*, whereas the heavily bioturbated fully marine subtidal is characterized by a more diverse assemblage including *Turritella gradata*, *Nassarius edlaueri*, *Anadara diluvii* and various venerids. Additionally, layers with large fragments of *Crassostrea*

and thin coal deposits with *Terebralia bidentata* are quite abundant in the section. Washed in land snails (e.g., Planorbidae) and river snails (Melanopsidae) occur occasionally. This faunal composition, along with its typical alternation points to a vivid dynamic within this Lower Miocene, subtropical ecosystem in the paleo-estuary of the southern Korneuburg basin.

Sm-Nd dating of hydrothermal carbonate formation - the case of the Breitenau magnesite deposit

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Traditional genetic models for „Veitsch Type“ sparry magnesite mineralizations in Palaeozoic series of the Eastern Alps (Styria, Austria) assume either a syngenetic (sedimentary) origin or an epigenetic formation by metasomatic replacement in Eoalpine times (WEBER 1997, VAVTAR 1976). More recently, PROCHASKA (2000) proposed a model of magnesite formation by metasomatic replacement of Palaeozoic limestones due to infiltrating residual brines in Mesozoic times. Essential for a verification of one of these models is to obtain an appropriate age of magnesite formation. However, absolute age determinations are missing. We investigated the potential of the Breitenau magnesite deposit, situated in the very-low grade Laufnitzdorf nappe within the Graz Palaeozoic nappe complex (e.g., RANTITSCH et al. 2005), for Sm-Nd dating. Chemical analysis of fluids obtained by crush-leach experiments on the Breitenau magnesites yields high Br concentrations with low molar Cl/Br and Na/Br typical for residual brines whose composition is controlled by halite fractionation (e.g., PROCHASKA & HENJES-KUNST 2008). Mg isotope investigations also point to a dominant evaporitic component in the magnesites (HENJES-KUNST & BUHL unpubl. results).

Bulk magnesite samples from the Breitenau deposit are characterized by very low amounts of dolomite but contain in part appreciable amounts of disseminated organic matter and clay minerals („matrix“). Magnesite and matrix were chemically separated and then analysed separately for trace-element composition by ICP-MS and Sm-Nd isotope composition by conventional TIMS technique. Magnesite yields consistent chondrite-normalized REE patterns with variable light-REE depletion (Sm/Nd between 0.33-0.82), slightly negative anomalies for Eu and in part also Ce. Nd concentrations are <3 ppm. Matrix material is enriched in the light REE (Sm/Nd 0.07-0.17) and in total REE (Nd up to several hundred ppm), but also displays slightly negative chondrite-normalized Eu and Ce anomalies. Sm-Nd isotope data for magnesite (14 samples) and matrix material (10 samples) yields an errochron (MSWD 7.7) with an age of 223.6±6.5 (2σ) Ma and an initial ¹⁴³Nd/¹⁴⁴Nd of 0.511903±0.000011 corresponding to ε_{Nd}-8.7. An isochron calculation based on the magnesite data only

yields less scatter (MSWD 3.1) but otherwise within error identical results (222.5 ± 9.8 Ma; 0.511905 ± 0.000022).

„Internal“ isochron calculation for magnesite and matrix material from individual samples, mostly involving replicate analyses of sample pairs with large spread in Sm/Nd, yields consistent ages for 8 samples ranging from 236 ± 15 Ma to 222.6 ± 8.2 Ma ($^{143}\text{Nd}/^{144}\text{Nd}_i$ 0.511871-0.511915) with a well defined mean value of 229.3 ± 2.4 Ma (MSWD 0.65). Only two samples yield discordant and slightly younger internal ages of 208 ± 19 Ma and 193.5 ± 8.4 Ma. While the first age value is not well defined (low spread in Sm/Nd; no repetition of analysis), the second age is better defined due to a larger spread in Sm/Nd and replicate analyses of both, magnesite and matrix.

The results of the isochron calculations both in terms of age and of $^{143}\text{Nd}/^{144}\text{Nd}_i$ strongly argue for an Nd isotope equilibration in the Upper Triassic on a local scale (hand specimen) and also, with somewhat larger degree of geological scatter, on a regional scale (Breitenau magnesite deposit) probably due to a pervasive flux of the REE. The well defined mean age of 229.3 ± 2.4 Ma of the internal isochron calculations can then be regarded as the best age to date this event. In combination with the high salinity of the fluids and the „evaporitic“ Mg isotope composition, the results of the Sm-Nd isotope investigation are interpreted to date formation of the Breitenau magnesite deposit by metasomatic replacement due to infiltrating residual brines. Remarkably similar fluid compositions and now also Rb-Sr mineral ages (MELCHER et al. this volume) can be observed for the Bleiberg Pb-Zn deposit suggesting a possible link in the chemical evolution of the mineralizing fluids and the timing of mineralization of the Breitenau magnesite deposit and the Bleiberg Pb-Zn deposit in the Eastern Alps.

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Accessory Ti and Zr-bearing phases as petrogenetic (T , $X\text{CO}_2$, $f\text{O}_2$) indicators in the metarodingites of Burgum (Upper Schieferhülle, South-Tyrol, Italy)

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The focus of this investigation is on the petrology of the metarodingites of Burgum in the Pfitsch-Valley, South-Tyrol, Italy. Geologically, these rocks are part of the Pennine Upper Schieferhülle (Bündnerschiefer) of the Tauern Window. The samples were collected from heaps of rock debris located next to the Sterzingerhütte at an altitude of 2344 m. Although this site is known by mineral collectors for its large, idiomorphic crystals of zircon, apatite, diopside, vesuvianite, and titanite, almost no petrological data exist so far. Therefore this study represents the first mineralogical-petrological investigation involving Ti and Zr-bearing phases in order to deduce the T - $X\text{CO}_2$ conditions of their formation. The metarodingites contain the mineral assemblage garnet (andradite-grossular), vesuvianite, clinopyroxene (diopside-hedenbergite), chlorite, ilmenite, magnetite, perovskite, calcite, dolomite, titanoclinohumite. In most samples corona-like reaction textures involving Ti-bearing phases can be found. In the center of these reaction textures ilmenite + magnetite occur. This assemblage is enclosed by a rim of perovskite, which is rimmed by titanite. The matrix shows the assemblage diopside + garnet + chlorite. Electron microprobe analysis shows that ilmenite contains a significant geikielite component (4.1-5.8 wt.% MgO). Perovskite is very close to end-member composition and titanite contains only minor amounts of F and Al (0-0.07 wt.% F, 0.48-1.03 wt.% Al_2O_3). Garnet is essentially a grossular-andradite solid solution with minor amounts of Ti (2.49-5.61 wt.% TiO_2). Schreinemakers analysis of the phase relations in the systems $\text{CaO-TiO}_2\text{-MgO-SiO}_2\text{-H}_2\text{O-CO}_2$ and $\text{CaO-TiO}_2\text{-FeO-SiO}_2\text{-H}_2\text{O-O}_2$ involving the phase components geikielite, perovskite, titanite, magnetite, hedenbergite, andradite, calcite, SiO_2 yield invariant points in a T - $X\text{CO}_2$ and a T - $f\text{O}_2$ diagram. The assemblage geikielite + quartz + calcite is restricted to high $X\text{CO}_2$, whereas perovskite requires low $X\text{CO}_2$ at high T in a T - $f\text{O}_2$ diagram, periclase requires high T and low $f\text{O}_2$, whereas titanite requires high $f\text{O}_2$ and low T . Titanite is stable at low T and high $a\text{SiO}_2$ and thus forms most likely during retrogression. Therefore this mineralogical sequence can be interpreted as being the result of lowering $X\text{CO}_2$ during the prograde path (perovskite formation) and a decrease in T contemporaneous with an increase in $f\text{O}_2$ and $a\text{SiO}_2$ during the retrograde path (titanite formation).

Electron microprobe analyses also revealed the presence of accessory Zr-phases, such as zircon, zirconolite ($\text{CaZrTi}_2\text{O}_7$), calzirtite ($\text{Ca}_2\text{Zr}_5\text{Ti}_2\text{O}_{16}$) and baddeleyite (ZrO_2). Zr-bearing phases are rare and occur in direct contact with or close to magnetites. Zirconolite occurs as single crystals with growth zoning or as part of mineral aggregates together with baddeleyite. Calzirtine crystals are very rare and also occur with magnetite. Zircon is frequently observed, but no clear textural relations to the other Zr-bearing phases could be discerned. Zirconolite shows compositional variations involving Ca (5-17 wt.% CaO), Ti (33-45 wt.% TiO_2), Zr (29-37 wt.% ZrO_2). This crystallization sequence is also in agreement with increasing $a\text{SiO}_2$ during the metamorphic evolution of these rocks. The presence of these minerals indicates high