Downstream of spring emergence, because the solubility of ironIII(hydr)oxides is practically nil, and because dissolved Fe^{2+} extremely inhibits calcium-carbonate precipitation, removal of ferrous iron by precipitation of Fe^{3+} compounds is prerequisite to enable calcium-carbonate deposition farther downstream.

Cool springs precipitating aragonite and magnesian calcite, Eastern Alps: significance of Mg/Ca ratio

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On the Silvretta metamorphic basement near the city of Landeck (Eastern Alps), aragonite and magnesian calcite precipitate from 'cool' or 'ambient' (non-thermal, <20 °C) limestone-depositing springs. The Silvretta basement is part of the Austroalpine structural unit of the Eastern Alps; in the considered area, the basement consists of a monotonous series of quartz phyllite overthrust by more variegated series composed mainly of schists with albite blasts, garnet mica schist, gneiss, and amphibolite. In the recharge area of the springs, the basement hosts copper-iron sulphide deposits with Mg-Ca-Fe carbonates as gangue minerals. Limestone deposit A is situated between 800 to 910 m a.s.l. and consists of, both, fossil spring limestones and actively-forming limestones; present mean annual temperature (MAT) at site is about 8 °C. Spring-limestone deposit B extends from 1680 m to 1800 m a.s.l., and is entirely fossil; $^{234}U/^{230}Th$ dating of a sample of aragonitic cementstone yielded an age of 8.9±0.3 ka. At deposit B, present MAT is below zero °C. The fossil spring limestones at both locations, and the actively-forming limestones at location A, are dominated by aragonite and magnesian calcite. Fossil spring-associated limestones are represented by phytoclastic tufas, intraclastic tufas, moss tufas, and slope breccias. Wood fragments, grass shoots, and moss tufts are locally permineralized by calcium carbonate; in addition, calcified pellets are common. At location A, precipitation of aragonite and magnesian calcite takes place in three moss-tufa deposystems. The springs shed an uncommon type of Mg-(Ca)-HCO_3^- waters with Mg/Ca ratios between about 2.6 to 5. We suspect that these spring waters were produced by oxidation of metal-sulphide mineralizations and associated dissolution of Mg-Ca-Fe carbonate gangue minerals. Precipitation of aragonite and magnesian calcite from these cool springs results mainly from elevated Mg/Ca ratio. Comparison of our data with carbonate precipitation in diverse other depositional environments underscores that carbonate mineralogy and polymorphy are primarily steered by Mg/Ca ratio.

Geochemical fingerprinting of Coltan ores by machine learning on uneven datasets

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Columbite (niobium rich)-tantalite (tantalum-rich) ore concentrates (Coltan) have been identified as one of several raw materials that were used to finance the civil wars in Central Africa. The term „Blood Coltan“ was coined in the Congolese civil war as the sale of such minerals powered the fighting, especially in the eastern provinces of the Democratic Republic of the Congo (DRC). The United Nations took the initiative and an expert group proposed that measures should be taken to certify tantalum-bearing mineral products along their trade chain (United Nations Security Council 2006). Therefore, Coltan ores were obtained from the Ta-Nb-Sn provinces in Africa (DRC, Rwanda, Burundi, Uganda, Mozambique, Ethiopia, Ghana, Nigeria and Namibia) and analyzed geochemically (Melcher et al. 2008, 2009, this volume). Preliminary results demonstrate that the major and trace element concentration patterns, mineral assemblages in the ore concentrates, and zoning characteristics in the different pegmatite provinces from Africa distinctly differ from each other (Melcher et al. 2008, 2009, this volume), thus geochemical fingerprinting may be applied to distinguish mineral matter produced within regions affected by the civil war from other sources.

Two modern machine learning techniques, Boosting and Support Vector Machines are introduced and applied to a data set, describing the geochemical composition of Coltan ores from the NE margin of the Congo Craton and the adjacent Kibaran Belt in Central Africa. Soft margin Linear Programming Boosting and soft margin Support Vector Machines respect the nonparametric properties of geochemical data. To respect the presence of uneven datasets, a parameterized performance measure λ together with common methods for its optimization is considered. Optimization of the classification function threshold improves the performance as class importance is shifted towards one of those classes. The optimization of their learning parameters results in an accuracy of up to c. 90 %, if spot measurements are assessed to estimate the provenance of ore samples originating from two mining districts. The average performance of the Support Vector Machines is significantly better or at least equal compared to that of Linear Programming Boosting.

The study demonstrates that methods from machine learning can be applied successfully to estimate the provenance of Coltan ores with unknown origin. As an important implication, the classifier can be adapted on the specific decision consequences, recorded by the confusion matrices of different λ values. Although our experiments are restricted to a specific geochemical data set, we believe that the application of such modern learning methods is a promising approach and deserves further attention.

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Drilling predation from the Early and Middle Miocene marine fossil record of the Central Paratethys

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Drilling predation is among the most studied biotic interactions in the fossil record, and its overall patterns are well established on Cenozoic molluscs from North America. Few studies have examined such predation in Europe. This study aims to evaluate molluscan drilling intensities from the Burdigalian, Langhian and Serravallian of the Central Paratethys. Using drill frequency (DF) and prey effectiveness (PE), a measure of prey's ability to survive predatory attacks, we examine taxonomic and environmental effects on drilling predation, evaluate local and regional spatial variation, and compare Central Paratethys values to other contemporaneous basins using >38500 whole shells from 162 Karpatian (Upper Burdigalian) and Badenian (Langhian and Lower Serravallian) bulk samples from Austria and Slovakia.

DF and PE were slightly higher in bivalves than gastropods, and DF could vary drastically within single environments at single localities (maximum at Immendorf: mean = 10.9 %, standard deviation = 12.9 %). Both DF and PE were more variable in the Karpatian than Badenian. Higher overall DFs, but lower PEs were seen in the Badenian than in the Karpatian. A similar pattern was observed between intertidal and sublittoral deposits.

We interpret the increase in predation from the Lower to Middle Miocene to reflect environmental shifts from restricted estuarine to deeper, normal marine conditions. Regional predation intensities from the Central Paratethys are distinctly lower than those of other Miocene seas, potentially due to lower predator abundance, differences in faunal composition, and/or fluctuating salinities typical of inland seas.

The Zottachkopf Formation: A new formation in the Lower Permian Rattendorf Group (Carnic Alps, Austria)

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Sedimentological study of the Lower Permian succession at Zweikofel, Trogkofel and Zottachkopf in the Carnic Alps showed that a well-bedded succession underlying the unbedded Trogkofel Limestone of Trogkofel and Zottachkopf differs significantly from the Zweikofel Formation at Zweikofel and Garnitzenbach (as defined by Krainer 1995). The bedded succession was originally termed „Oberer Schwagerinenkalk“ by Kahler & Kahler (1937); it is characterized by dark gray, thin- to medium-bedded limestone rich in small oncoids and, in its lower part, by siltite intercalations and reddish limestones rich in crinoid fragments. In addition, algal mounds are present, particularly along the southern flank of Trogkofel.

This bedded facies is not an equivalent of the Zweikofel Fm, but is younger and differs significantly in facies. We herein introduce the term Zottachkopf Formation (of the Rattendorf Group), as the section along the northern slope of Zottachkopf was originally regarded as the type section for the „Oberer Schwagerinenkalk“ by Kahler & Kahler (1937).

The new type section of the Zottachkopf Fm is located in the basal part of the northern cliff of Trogkofel, and may be up to approximately 120 meters in thickness; there, the basal part of the Zottachkopf Fm starts with a bed of reddish to grey, karstified limestone, overlain by a package of well-bedded, red-coloured limestones and two intervals of calcareous siltstone are intercalated. Sedimentary structures, such as festooned cross-lamination, ripple drift cross-lamination, cross-bedding, parallel-laminated siltites with interspersed quartz grains up to 2 cm in size are common, and record deposition in shoreface environment. These intervals are overlain by wavy- to evenly-bedded packstones to rudstones rich in echinoderms, fusulinids and/or oncoids. Thick-bedded oncolithic pack- to wackestones represent the top of this package. The described package is separated by an E-W trending, south-dipping fault from grey well-bedded limestones of the remainder of the Zottachkopf Fm in the lower part of the northern Trogkofel cliff. The section on the northern side of Trogkofel attains 90 m in thickness, and is characterized by alternating thin- to thick-bedded limestones, locally showing cross-bedding. Five small, laterally arrayed mounds with thin-bedded intermound facies are intercalated. Oncolithic floatstones are overlain by bioclastic pack- to grainstones and oncolithic packstones. Our preliminary biostratigraphic data from fusulinids of the north-facing Trogkofel cliff indicate an Artinskian age for the Zottachkopf Fm. From reddish limestones exposed at Rudnigsattel east of the Trogkofel massif, Forke (1995) and Schönlaub & Forke (2007) described a conodont fauna of Late Sakmarian to Early Artinskian age; these limestones may correlate in age with the lower part of the Zottachkopf Fm in the northern cliff.