Eozän vertikal nach oben bis in die Puchkirchen-Formation und Hall-Formation migriert ist. Die „bakteriellen" Gase der letztgenannten Formationen beinhalten daher zumindest Zumischungen von thermischem(?) Gas. Effektive Migration aus stratigraphisch tieferen Horizonten wird auch durch das Auftreten von Leichtöl/Kondensat in der Puchkirchen-Formation und den Chemismus von Formationswässern unterstützt.

Hebung der Molassezone: Ein junges Hebungsereignis der Molassezone ist evident (z. B. starke Heraushebung und Erosion des Hausruck). Besonders stark herausgehoben wurde aber der Ostteil der oberösterreichischen Molasse. Die resultierende Druckentlastung hat Einfluss auf die Zusammensetzung der Kohlenwasserstoffe.

Interpretation von Störungssystemen des Mesozoikums der Molassezone am Beispiel des Ölfeldes Trattnach

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Das Ölfeld Trattnach befindet sich im oberösterreichischen Teil der Molassezone. Seit 1975 wird aus den Cenoman-Sandsteinen (Oberkreide) Öl produziert. Die ältesten mesozoischen Schichten in der oberösterreichischen Molasse werden durch fluviatile bis flachmarine Sandsteine mit vereinzelten geringmächtigen Kohlelagen des mittleren Jura (Bajocium, Bathonium) repräsentiert. Diese werden von Karbonaten (Jura) überlagert. Eine lokale Diskordanz kennzeichnet das Top der jurassischen Sedimente. Die Unterkreide wird von Hebungsphasen, Erosion, tektonischer Aktivität und Verkarstung dominiert. Grobkörnige Sandsteine (Schutzfelsschichten), die teilweise den jurassischen Karst verfüllen, werden in der Oberkreide abgelagert. Im späten Cenoman kommt es zu einer N-gerichteten marinen Transgression und zur Sedimentation von sturmdominierten, flachmarinen glaukonitischen Sandsteinen. Darüber folgen Tone und Tonsteine (Turonium, Campanium) des äußeren Schelfs. Nordwestlich der Zentralen Schwellenzone werden flachmarine Sandsteine abgelagert, deren Liefergebiet die Böhmische Masse war. Das Top der kretazischen Ablagerungen ist von einer regionalen Diskordanz gekennzeichnet (Nachtmann & Wagner 1987).

Unter Verwendung von 3D Seismikdaten des Trattnachfeldes werden die im Mesozoikum auftretenden Störungsmuster kartiert und interpretiert, um mögliche Rückschlüsse auf das Paläostressregime zu ziehen. Die Daten wurden der Montanuniversität Leoben von der RAG zu Forschungszwecken zur Verfügung gestellt. Mithilfe der in PETREL bestehenden Software-Tools, vor allem dem AntTracking, können bereits in einer frühen Phase der Interpretation Störungsmuster dreidimensional dargestellt werden. Diese extrahierten Muster weisen, zumindest im größeren räumlichen Maßstab, eine gute Übereinstimmung mit konventionell interpretierten Störungen auf. So entstandene „Sub-Cubes" bieten sich als Unterstützung und Ausgangspunkt für eine detaillierte Interpretation an. Ausgehend von dieser Basis wurden Hauptstörungsrichtungen kartiert, Bewegungssinne interpretiert, die Störungssysteme in einen zeitlichen Rahmen gesetzt und Paläostressbedingungen analysiert. Zwei Hauptstörungsrichtungen wurden erkannt, eine NNW-SSE verlaufende ältere Aufschiebung und E-W gerichtete jüngere Abschiebungen. Sowie ein bisher im Molassebecken noch nicht bekanntes E-W-gerichtetes kompressives Ereignis während der jüngeren Kreide.

Nachtmann, W. & Wagner, L. (1987): Mesozoic and Early Tertiary evolution of the Alpine foreland in Upper Austria and Salzburg, Austria. - Tectonophysics, **137**: 61-76, (Elsevier) Amsterdam.

Mineralogically zoned, iron oxide/calcium-carbonate precipitating springs (Eastern Alps)

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At Obladis and Laas (Eastern Alps), downstream, oxygen-deficient circumneutral springs show a consistent mineralogical zonation of deposition of iron(hydr)oxide upstream/ahead of spring-associated limestones; this zonation results from stringent geochemical controls, and is representative for similar spring-associated deposystems.

The Obladis spring emerges from the telescoped frame zone of the Engadine tectonic window. The spring sheds dysoxic water charged with dissolved Fe^{2+}. Immediately downstream of spring emergence, upon oxygenation of the water, precipitation of iron(hydr)oxide is mediated mainly by the iron bacterium *Gallionella ferruginea*. Precipitation of fibrous calcite starts about one meter downstream of spring emergence, at the surface of and within tufts formed by the macro-alga *Vaucheria* and by Oscillatoriales. Significant deposition of calcium carbonate, to result in a limestone deposit, starts only about 1.5-2 m below spring emergence, where deposition of iron(hydr)oxide had faded. The spring at Laas emerges from sheared gneiss in the metamorphic basement of the Eastern Alps. Downstream of spring emergence, the lateral distribution of iron(hydr)oxide and limestone, as well as the iron-bacterial assemblage dominated by *G. ferruginea*, are basically identical to Obladis. The Laas spring supplies a waterfall tufa of fibrous calcite; the calcite forms mainly in association with a cyanobacterial assemblage, in fabrics including (a) laminated springstones, and (b) 'microspherulithic' limestones. The microbes themselves may leave little or no trace in the final carbonate fabric.

Conditions to form iron-oxide/calcium-carbonate depositing spring (IC spring) include: (a) dysoxia to anoxia in the groundwater, to dissolve Fe^{2+}, and (b) rise of Ca^{2+} and alkalinity, to achieve circumneutral conditions.

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