Metamorphic evolution of the Wadi Feiran-Solaf Core Complex, Sinai, Egypt

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The Wadi Feiran-Solaf belt lies in the northwestern part of the exposed hard rocks of Sinai Peninsula, Egypt, which is the northern segment of the Arabian-Nubian shield. This shield and the entire East African Orogeny were assembled during the Neoproterozoic and now constitute a pile of thin skinned Pan African low grade nappes overlying a high grade metamorphic basement. This basement is exposed in a series of windows in the Eastern Desert of Egypt, where they have been interpreted as metamorphic core complexes. The Wadi Feiran-Solaf belt is one of several metamorphic belts in Sinai and was metamorphosed at upper-amphibolite facies and locally to granulite facies conditions. In this project we study if this belt can also be interpreted as a core complex and if it is related to those known in the Eastern Desert. These rocks of the Feiran-Solf belt are arranged in form of two doubly plunging overturned antiforms, which are separated by a synform and high angle thrust fault. In the eastern and western margins of this core complex, the granitoids intruded along pre-existing structural features. These structural features are northwest trending sinistral strike-slip faults, while the southern margin of the core was identified by granitic intrusions intruded perpendicular to the main metamorphic foliations and along normal faults. There are three regional foliations (S_1, S_2 and S_3), defined mainly by low-pressure - high-temperature metamorphic phases. Five phases of deformation are identified in the Feiran-Solaf core complex. D_1 and D_2 are interpreted to be related to the arc-arc accretions and the closing of Mozambique Ocean. D_3 and D_4 are related to the escape tectonics exhuming the complex. The D_5 characterizes by brittle structural features. The absence of the ortho-pyroxene and the present of the liquid phase indicate that the peak assemblage is below the ortho-pyroxene-in reactions and above the liquid-in reactions at about 700-750°C and 4-7 kbar. The selected samples show nearly isothermal decompression path close to the solidus, following the maximum pressure until pressure (4.5 kbar). At lower pressure the P-T path becomes as isobaric cooling path.

Native polycyclic aromatic hydrocarbons (PAHs) in hard coals

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A variety of environmental polycyclic aromatic hydrocarbons (PAH) sources have been reported in the literature, however, unburnt coal is rarely considered.
Hard coals can carry diagenetic PAH concentrations up to hundreds, in some cases thousands of mg/kg (Willsch & Radke 1995). Hard coal is a mass product and has been mined as an energy source on a global scale for centuries. Worldwide hard coal production has increased from less than 1 to 4.96 billon tons from 1900 to 2005 (Thielemann et al. 2007). Unburnt coal particles can be released by open pit mining, spills during coal loading, and transport or accidents, or erosion of naturally outcropping seams into freshwater or marine systems (French 1998, Pies et al. 2007). On industrial sites, coal is stored on stockpiles for the production of coke, gas or steam and is subject to erosion. Apart from coke and coal tar, the particles occur at manufactured gas plant sites (Stout & Wasielewski 2004).
Physical effects of coal particles on organisms have been studied, however, the function of chemical constituents as environmental pollutants (Ahrens & Morrisey 2005, Yang et al. 2008) has hardly ever been in focus. Not much is known about the forensic characterization of coal in sediments.
Our study focuses on understanding the function of hard coal particles in soils and sediments in an environmental context. The objectives of the investigations are 1. environmental forensic characterization of international hard coals, 2. identification of often occurring toxic PAHs depending on origin and rank of the coal and 3. clarification of their bioavailability. First results of the analysis of 50 international hard coal samples show EPA-PAH concentrations mostly in the range of 50-100 mg/kg but some up to about 300 mg/kg. Total PAH concentrations are often in the range of a few hundreds of mg/kg. For the first time, dibenzopyrenes were detected in coals. Results of the current study will be presented.

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Magnetotelluric measurements at the eastern border of the Alps (Styria and Burgenland)

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In year 2005, 10 magnetotelluric measurements were performed along an about N-S striking line between Güssing and Kobersdorf (Bgld). Another 33 soundings were carried out in 2006 along a more or less SE-NW line, from Güssing to Gaming, along the seismic profile CEL-07, in the continuation of the Hungarian part of the profile, where MT measurements were carried out in 2003. The aim of the measurements was to supplement deep seismic experiments, carried out at the same and adjacent areas (e.g. Guterch et al. 2003).
The preliminary results about Austria have been reported by Novak et al. (2007) and Adam et al. (2008). Along the SE-NW line, MT instruments of GFZ Potsdam, equipped with induction coils, were used, which allowed a broadband registration in the frequency range of 0.001Hz to 1000Hz. However good and reliable results are above 0.01Hz and make the investigation of the subsurface possible down to a depth of about 20km. Along the N-S line induction coils, fluxgate and torsion drift magnetometers were used. (The latter are long period instruments that can be used to investigate down to the mantle.) In the alpine region of the SE-NW profile the magnetotelluric signal was disturbed by very intense artificial noise. In order to make remote correlation

possible, at least two instruments were placed at different stations.
The S-N line - due to the low number of stations (10) and the great distance between them - the measurements could be interpreted only as 1-d. 6 locations were used for long term („long-period") measurements, and the thickness of the lithosphere was found more then 100 km at the beginning and at the end of the profile, and about 50 km in the middle part. (These interpretations are very much affected by near surface inhomogeneities and the result may contain large errors.) The longer SE-NW line could be interpreted as a 2-d section. Reliable results were obtained down to a depth of more than 10 km. The Graz basin with a depth down to 3 km and the transition from Northern Limestone Alps to Flysch as low resistivity zones can be clearly distinguished from the high resistive zones in the inner Alpine part of the profile. Further a low resistive dyke in between the alpine part is visible.
The measurements gave some very interesting qualitative results, but are not sufficient to construct a conductivity model of that region. For that purpose some hundreds of measurements with 3-d interpretation must be performed.
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Palustrine limestone in the sedimentary succession of the Cenozoic Thakhola-Mustang Graben (central Nepal)

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Located at the northern side of the Dhaulagiri and Annapurna Ranges and South of Yarlung Tsangpo Suture Zone, the Thakhola-Mustang Graben of central Nepal represents the Cenozoic extensional tectonic phase of the Tibetan Plateau and the whole Himalaya. The graben is an asymmetrical basin containing thick (more than 850 m) continental debris. Stratigraphically, the graben sediments are divided into four formations, namely the Tetang Formation, the Thakkhola Formation, the Sammargaon Formation and the Marpha Formation. The oldest sedimentary units are the Tetang and Thakkhola formations (Miocene) while the Sammargaon and the Marpha formations lying disconformably above these formations represent younger units (Plio-Pleistocene). Although the stratigraphy of the area is well established, the paleoclimatic evolution and the depositional environments of this graben are still largely unrevealed.
We tried to identify the depositional environment and the paleoelevation by studying palustrine limestones from different levels of the succession. Mapping, construction of columnar sections and sampling of limestone were carried out in the field while measurement of $CaCO_3$ concentration, $\delta^{18}O$ and $\delta^{13}C$ of micritic limestone and paleosoil limestone and thin section analysis of limestone were done in the lab. Pelletal, charophytic algae, oncolitic algal micritic palustrine limestones are present in the Thakkhola Formation whereas the Tetang Formation consists of micritic limestones with ostracodes, micritic mudstone with root and tuffaceous limestone. The percentage of $CaCO_3$ of the limestones from different horizons of these formations ranges from 24-95. The values of $\delta^{18}O$ (‰) (V-PDB) of limestone are very negative and range from -13.53 to -24.96 while the values of $\delta^{13}C$ (‰) (V-PDB) ranges between1.58 to 11.08.
The presence of discontinuous growth of oncolites with minimum quartz grain content suggests that they are developed a considerable distance away from the mouth of a river in agitated water. Algal mats and charophyte algae cemented by sparite are also present in shallow water Limestones. Spherical pellets, 25 to 40µm in diameter with irregular structures, are present in micritic limestones of deeper part of the lake system Ostracodes in dark micritic mudstone indicate quite and calm water condition.. Although the thickness of the graben is high, these microfabrics suggest that they are deposited in flat and shallow lacustrine environments. The $\delta^{18}O$ value of the limestones of the Thakkhola Graben reflects meteoric water values (Garzione et. al. 2000) similar to the modern value indicating that the Thakkhola-Mustang Graben attained the current elevation level prior to the east-west extension of the Himalaya. The relatively high $\delta^{13}C$ values of the carbonates suggest that the orthographic barrier (Himalaya) to moisture existed during the Miocene period.

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Outcrop analogue study and isotope geochemistry of Middle Triassic dolomites (Vienna Basin, Austria)

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The basement below the Neogene Vienna Basin of Austria (so-called „First Floor" of exploration) consists of the thrust units of the Alpine-Carpathian nappes including units of the Northern Calcareous Alps. Within these, Middle and Upper Triassic carbonates and especially dolomites form the most important reservoir rocks, as the dolomites frequently are characterized by intensive jointing and comparably high fracture porosity. Several dolomitic intervals have been drilled; most prominent are Middle Triassic dolomites of the Wetterstein carbonate platform and Upper Triassic Hauptdolomit. The extent and genesis of dolomitisation has been investigated by applying outcrop analogue studies and isotope geochemical methods.
An outcrop analogue study was performed at the southwestern margin of the Vienna Basin, in the Helenental-Lindkogel area. Here, a transition from bedded into massive Wetterstein dolomite is exposed. Inside the bedded dolomites sometimes fine laminations of light and dark grey layer can be recognized. Two different kinds of breccias are present: the first one is a tectonic breccia occurring along extensional faults; the second one is a sedimentary breccia that is not linked to faults and appears in patches inside the dolomite. Data from porosity measurements show that on average the bedded dolomite has higher porosities (up to 7%) than the massive dolomites (1-3%). Dolomite types of these outcrops could be correlated into the well Schönfeld 1, where similar bedded types and breccias are present.
Stable isotope values of the dolomites range around 3 permil $\delta^{13}C$ VPDB and -1 permil $\delta^{18}O$ VPDB. Thus, carbon isotope values are near sea water values for the Middle Triassic and similar to coeval limestones. $\delta^{18}O$ isotope ratios indicate diagenetic