## Petrographic and geochemical studies of impact breccia from the Eyreville drill core, Chesapeake Bay impact structure, USA.

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The Chesapeake Bay impact structure, 35.5 Ma old and 85 km in diameter, is one of the largest and best preserved impact structures on Earth. It was drilled in the central part in 2005-2006 by ICDP (International Continental Scientific Drilling Program) and USGS (United States Geological Survey) [1]. At Eyreville, the crater fill comprises sediment-clast breccia and sedimentary megablocks of the Exmore Beds, a granitic and an amphibolitic megablock, gravelly sand, suevitic impact breccia (a polymict, melt-bearing breccia), and granite/pegmatite and mica schist (Gohn et al. 2006). We performed petrographic and geochemical investigations of 43 samples of suevite, impact melt rock, polymict lithic impact breccia, cataclastic gneiss, and clasts in suevite, from the impact breccia section of the depth interval 1397-1551 m of the Eyreville B drill core. The impact breccia consists mainly of suevite. The suevite displays a grayish matrix with various mineral and lithic clasts (including metamorphic, igneous, and sedimentary lithologies) and melt particles. The amount of melt particles generally decreases with increasing depth. The suevite contains two intercalations of impact melt rock in the upper part and abundant large blocks of cataclastic gneiss in the lower part. Various shock metamorphic and related features have been observed in suevite, including abundant planar fractures (PFs) and planar deformation features (PDFs) in quartz, toasted appearance of quartz, ballen quartz, rare kink-banding in mica, and extremely rare PDFs in feldspar. Evidence of hydrothermal alteration, as the presence of smectite and secondary carbonate veins, was observed especially in the lower parts of the impact breccia section. Chemical composition does not vary much in the upper part of the impact breccia section (above ~1450 m), whereas in the lower part, larger differences occur, which is in agreement with decreasing homogeneity (in terms of increasing clast-size) with increasing depth. The impact breccias show a decrease in the content of $SiO_2$ combined with a slight increase of the abundances of $TiO_2$, $Al_2O_3$, and $Fe_2O_3$ with increasing depth, which might be caused by an increase of the gneiss/schist component with depth. Concentrations of siderophile elements (e.g., Co, Ni) are lower in the suevite than in the basement schists and do not suggest presence of a meteoritic component.

Acknowledgment: This work was supported by the Austrian Science Foundation FWF, grant P18862-N10 (to C.K.).

Gohn, G. S., Koeberl, C., Miller, K. G., Reimold, W. U., Cockell, C. S., Horton, J.W., Jr., Sanford, W.E. & Voytek, M.A. (2006): Chesapeake Bay impact structure drilled. - EOS, Transactions American Geophysical Union, **87**: 349, 355.

## Surface soil moisture on global, regional and local scale from satellite data

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Soil moisture is a key element in the global hydrologic, energy and carbon cycle. Knowledge about the location specific sensitivity of radar backscatter can be used for operational determination of relative surface soil moisture over large regions (Wagner et al. 2007). This approach has been developed for C-Band scatterometer (50-25 km, global, ERS1, ERS2 and ASCAT) and transferred to C-Band ScanSAR (1km regional, ENVISAT ASAR) and is operational on both scales. This method relies on a high number of acquisitions in order to get a realistic estimate of a dry and a wet reference value and thus sensitivity. The performance of L-Band SAR (12.5-100 m, ALOS PALSAR) is tested for applications on local scale.

The ASCAT (Advanced SCATterometer) instrument onboard MetOp (Meteorological operational) satellite series is a real-aperture radar operating at 5.255 GHz (C-band) with high radiometric resolution and stability. It has been launched in October 2006. The ASCAT succeeds the scatterometers flown on the ERS-1 and ERS-2 satellites. The spatial resolution improved from 50 km to 25 km. The ASCAT provides near global coverage within 24 hours, surface soil moisture product in near real time via EUMETCAST and mission continuity for a minimum of 14 years (a series of three MetOp satellites is planned by EUMETSAT). The long term availability of the ASCAT data together with the already existing ERS datasets provide a valuable tool for monitoring of extreme events. Anomalies can be identified globally which relate to hazards such as droughts and floods.

ENVISAT ScanSAR data in ASAR Global Mode are less frequently acquired but provide up to weekly samples on 1km resolution since December 2004. Current databases cover Sub-Saharan Africa and Australia. These data are also suitable to derive scaling parameters (Wagner et al. 2008) which allow downscaling of the coarser resolution data from scatterometer.

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## Linking ore deposit mineral assemblages with metamorphism: a case study from the Pb-Zn ore deposit of St. Martin, Schneeberg (South-Tyrol, Italy)

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The deposit at Schneeberg has been one of the major Pb-Zn mining districts throughout the K.u.K dynasty. The Schneeberg is the highest deposit of Europe as well as the largest mining region in Tyrol whereas the peak of mining activities has been in the 15.-16 century, also known as the „argentic tyrolian age“, when thousands of miners work in the mines at St. Martin, Schneeberg (South-Tyrol, Italy). In the course of the special research project HiMAT (history of Mining in Tyrol and the adjacent areas), a thorough investigation, concerning the relation between metamorphism and selected ore deposits from the western part of the Eastern Alps is currently underway.

Geologically the Pb-Zn-Cu ore deposits are mainly stratabound, layerbound, cleavage concordant as well as disconcordant within the pre-Variscian metasediments (paragneises and mica schists) acid and basic metavolcanics (augengneisses and amphibolites) of the Ötztal Complex. At the foot wall the ore deposit is surrounded by the „Variegated-Series" of the Schneeberg Complex containing garnet micaschists, amphibolites, and paragneisses. The hanging wall consists of metamorphic verrucano and fragments of the Brenner Mesozoic. The ore-hosting rocks strike with 60°-70° ENE-WSW and dip with 30-35°NNW. Although the area around Schneeberg is a polymetamorphic crystalline complex, with at least two (Variscan, Eo-Alpine) main episodes of metamorphism, in the ore deposits, only one metamorphic event, Eo-Alpine metamorphic overprint, was detected so far.

The ore paragenesis of the Schneeberg is highly variable and includes native elements such as Au, Ag and Bi, as well as Pb-, Zn-, Cu-, Fe-sulphides such as galena, sphalerite, pyrrhotite, chalkopyrite, sulfosalts as boulangerite, bounonite, pyrargyrite and Ag-tetraedrite, and mainly Fe-oxides like magnetite. The gangue is composed of quartz, calcite, siderite, andradite, manganophyllite, Antigorite as well as biotite and grossular. In the course of this investigation, it is planned to perform a detailed mineral chemical survey of the ore minerals with the electron microprobe analyser.

The a-b transformation lamellae in chalcopyrite are an evidence for minimum temperatures of 547° ±5°C. Another evidence for a high-$T$ hydrothermal formation are star-shaped sphalerite exsolutions in chalcopyrite indicating a temperature of 500°C ±10°C. These T-estimates are in agreement with Eo-Alpine T-estimates from the southern ÖC and the adjacent Schneeberg Complex, indicating a strong remobilisation as well as recrystallization during the Eo-Alpine metamorphic event.

## Poisson's ratio of the crust and Moho structure from shear wave analyses in the Eastern Alps and their surroundings

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The knowledge of shear (transversal) wave velocities is of high importance for geological interpretations of geophysical models. Detailed information on shear wave velocities allows restricting the manifold of geological models which are usually obtained from longitudinal wave velocities and/or supplementary geophysical data (e.g. density, conductivity). However, shear wave velocities one crustal scale are rarely well known due to relatively elaborate measuring conditions.

Between 1997 and 2003, several large seismic 3D wide angle and reflection experiments were launched in Central Europe to explore the lithospheric structure. Seismic waves from shot points in boreholes (average charge 300 kg TNT) were recorded on a net of arbitrary oriented seismic profiles, thus enabling to identify inline and crossline wave arrivals (refractions and reflections from the crust and uppermost mantle). Despite that only vertical component geophones were used, good quality shear waves are also regularly observed in the seismic sections, in particular refractions (Sg) from the crust and reflections (SmS) from the Moho. We focus on a data subset from the CELEBRATION 2000, ALP 2002 and SUDETES 2003 experiments, which covers the area of the Eastern Alps and their transition to the surrounding tectonic provinces (Bohemian Massif, Southern Alps/Dinarides, Pannonian Domain).

A 3D seismic shear-wave velocity model of the crust based on Sg waves is presented. The middle and even lower crust of the Bohemian Massif are covered well by the model. In some parts of the orogens (Eastern / Southern Alps) the energy loss due to the complicated tectonic structure allows for interpretation of the upper crust only. Based on this and previously determined P-wave velocities, the 3D distribution of Poisson's ratio is calculated. S-wave velocities and Poisson's ratio show significant patterns and are related to the geological and tectonic structure.

The evaluation of reflected waves from the Moho (SmS) provides a large-scale image of the crust-mantle boundary. The results support the recently proposed model of three plates or plate fragments in the centre of the Eastern Alps. The border of the south-dipping European Moho follows the shape of the Alpine and Carpathian Arcs. In the south, the crust-mantle boundary is separated into a deep Adriatic and a shallow Pannonian Moho along the crest of the External Dinarides. The European Moho collides with the Adriatic Moho west of the southeastern edge of the Tauern Window and underthrusts the Pannonian Moho in the East.

## A new Moho map for the European Alpine collision zone

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We present a map illustrating the depth of the Moho discontinuity for the European Alpine collision zone compiled from two data sets covering the Western and the Eastern Alps, respectively. While extensive information on crustal structure and Moho depth in the area of the Western Alps has been gathered and presented in previous years, recent seismic refraction experiments focusing on the Eastern Alps now allow to establish a complete map of the Moho depth for the Alpine arc and its surroundings.

Both data sets derive the Moho depth from seismic refraction and reflection data only, but use different methodological approaches to obtain a 3-D image of the interface. With a consistent methodology and quantitative error assignment we control that the two data sets meet the same quality criteria. In the newly compiled map the Moho is represented by the smoothest possible surface passing through the data and their error bars. Vertical offsets are introduced when the curvature of the surface exceeds a certain threshold or where it is strongly indicated by individual data.

The image of the crust-mantle boundary in the Alpine collision zone shows four separate Moho interfaces, namely the European, Adriatic, Pannonian, and Ligurian Moho. Their generation and present-day configuration clearly reflect collision and escape tectonic in the past and reveal the complex geodynamical processes that formed the Alpine Arc. While the Moho structure in the Western Alps mainly reflects the collision of Adriatic and European plate, the situation in the Eastern Alps exhibits both collision and lateral escape characteristics.

## Das Lassee Segment der Wiener Becken - Störung als Quelle für das Erdbeben von *Carnuntum* (4. Jhdt. n. Chr.)

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