measured parallel and perpendicular to the exposed W-E striking wall and nearby a major fault structure by using different transmitter antennas of 20, 40 & 80 MHz. The precise geographical position of the GPR sections was recorded with a differential global positioning system (DGPS). Finally, in order to construct a high precision 3D structural model, the datas were integrated in a combined 3D model (Gocad).
A complex three-dimensional structural model includes surface and shallow subsurface geological data. A 3D model is based on: (i) GPR recording of coulisse sections (processed radargrams imported in 3D model); (ii) DGPS recording of the GPR sections (iii) Terrestrial laser scanning of an outcrop wall and (iv) Field mapping of the outcrop. In addition, a 3D multi-sourced structural model is supported with the ArcGIS geo-database of wider region of an investigated area. The integrated 3D structural model can be further analyzed by calculating and contouring geometric parameters like curvatures, fault dip and displacement magnitude and gradients.

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Fernüberwachung der Messwertequalität am Beispiel von Pegelmessungen

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Wasserstandsmessungen gehören zu den wichtigsten Messungen im Bereich hydrologischer Untersuchungen. Kommen dabei Insitu Messgeräte zum Einsatz, ist die gängigste Messmethode die der Differenzdruckmessung. Die dabei verwendeten piezoresistiven Sensorelemente liefern zwar ausreichend genaue Messergebnisse, es können jedoch verschiedene Fehler durch Probleme mit der Druckausgleichskapillare, starke Sedimentführung von Oberflächengerinnen bei Hochwässern, Vereisung und Grundeis, sowie Alterungseffekte des Sensormaterials, auftreten. Im Rahmen der Messstellenbetreuung werden daher auch derzeit manuelle Kontrollmessungen durchgeführt, um eine Qualitätssicherung des In-situ Messsystems zu ermöglichen.
Das in Zusammenarbeit von Joanneum Research und Fachhochschule Technikum-Wien entwickelte System ermöglicht eine automatisierte Kontrollwertgenerierung durch digitale Bildverarbeitung und Mustererkennung. Die Messwerte und die Kontrollwerte des Pegelstandes werden in nahezu Echtzeit über ein Satellitensystem an einen zentralen Server übertragen. Dort stehen sie zur weiteren Verarbeitung, aber auch zur Visualisierung im WWW zur Verfügung. Dieses System zur Qualitätssicherung von Wasserstandsmessungen hilft die Ausfallzeiten der Messsysteme durch optimierte und bedarfsorientierte Betreuung deutlich zu reduzieren.
Durch dieses Übertragungssystem sind ohne terrestrischer Infrastruktur Messdatenübertragungen auch aus engsten Gebirgstälern möglich. Aufgrund des niedrigen Orbits der Satelliten werden keine hohen Anforderungen an Antennen und Stromversorgungssysteme gestellt. Einfache Stabantennen und Solaranlagen mit 25 bis 50 W Leistung sind für eine Standardinstrumentierung bei Übertragungsintervallen von 15 Minuten durchaus ausreichend.
Das System zu digitalen Pegelerkennung arbeitet mit einer intelligenten Kamera, in der die gesamte Bildbearbeitung durchgeführt wird. Diese Kamera bildet mit der Pegellatte eine konstruktive Einheit. Nach dem Einbau erfolgt vor jeder Messung eine Kalibration zur Helligkeitskorrektur. Damit ist gewährleistet, dass die Kamera auch bei unterschiedlichen Lichtverhältnissen und bei Kondensation von Wasserdampf am Objektiv noch auswertbare Bilder liefert. Die Erkennung des Wasserspiegels an der Pegellatte, erfolgt in einem mehrstufigen Verfahren. Dabei wird zuerst eine Groberkennung mit 2 cm Auflösung durchgeführt und anschließend im entsprechenden Bereich mit Millimetergenauigkeit der Wasserspiegel detektiert und ein Messwert generiert, dem Datensammler übergeben und mit den anderen Messwerten über das Satellitensystem übertragen.
Als weitere Entwicklungen sind die Übertragung der Pegelbilder und die Entwicklung von Algorithmen und Messmethoden zur berührungslosen Wasserstandsmessung ohne Pegellatten geplant.

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Geodetic control networks for the geodynamics of the Eastern Alps 1992-2008

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Since the late seventies of the 20th century GNSS techniques for positioning are used in Austria. From the beginning the intention was to monitor the movements of the Eastern Alps and their forelands. The network AGREF (Austrian Geodynamic Reference) was established and measured 1990-1992 for the first time. Containing about 100 special markers in Austria and the neighbour countries it covers the whole region plus a densification in Carinthia to find the Periadriatic Lineament. In 1996 civil engineers added 250 points on conventional triangulation markers (AREF, Austrian Reference). Both, AGREF and AREF form now a second order control network which is superseded by the 80 permanent GNSS stations APOS (Austrian Positioning System). Those networks are analysed concerning their geokinematic behaviour by the international analysis centre OLG according to the international guidelines. Due to lack of manpower AGREF/AREF was re-measured at only random occasions whereas the permanent stations are analysed at a weekly basis. Therefore station velocities are available of almost all permanent stations, but not from the secondary network, where only few stations with local movements of more than 10 mm/year have been detected (gliding slopes). A real geokinematic analysis of AGREF/AREF is still missing because manpower is needed for a homogenous reprocessing and partial re-measurement. Applications for research funds have not been successful until now.
The station velocities of the permanent sites can be presently estimated with a precision of 1 mm/year lateral and 3 mm/year vertical. From the results the region of the Eastern Alps shows different regional movements at the level of 1-3 mm/year. Considering the Eurasian Plate as „stable“ the Bohemian Massif

and the Northern Alpine Forelands are stable too. In the Southeast a region is moving from the Adriatic Sea to the Pannonian Basin with 2-3 mm/year. A smaller movement of 1-2 mm/year is recognized along the Danube valley towards the Pannonian Basin. More uncertain, because of only few stations, is the 1-2 mm/year eastern movement in the region where the Tauern Window is usually placed. The value increases from West to East. Unfortunately 2-3 stations of this region seem to have local movements of 4-7 mm/year which are clearly not representative. The analysis centre OLG does not only consider the Eastern Alps; but also the surrounding regions. The Central European Geodynamic Research Project (CERGOP) maintains a network (spacing about 100 km) which is observed since 1994. Additionally a permanent analysis of the GNSS stations in the Eastern Mediterranean and around the Arabian Plate tries to refine the location of the plate boundaries between Eurasia, Anatolia, Arabia, India, Nubia and Somalia plus their transition zones. All these results should contribute to a future European Velocity field.

The Moslavacka Gora Massif in Croatia

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The Moslavaèka Gora Massif is located about 50 km east-southeast of Zagreb and represents one of the major outcrops of crystalline basement within the Tertiary sediments of the Pannonian basin (Pamic et al. 2002). The central part of the massif is built up of fine grained, mostly undeformed granite (Pleterac granite). The peripheral parts are dominated by metamorphic rocks. They include coarse and fine grained migmatitic metagranites (Jelen-grad, Gariæ-grad metagranite) as well as minor occurrences of amphibolites and metapelites.

The Moslavaèka Gora Massif has been considered as a major outcrop of Variscan crystalline basement of the south Tisia block. However, electron-microprobe-based Th-U-Pb dating on monazites from the granitic as well as the metamorphic rocks provide almost exclusively Cretaceous ages. Just in one sample of a metapelite, relics of monazites with a Permian age were found (Starijaš et al. 2006). LA-ICP-MS U-Pb dating of zircons gave Lower Ordovician formation ages for the metagranitic rocks (Gariæ-grad metagranite: 486 ± 6 Ma, 483 ± 6 Ma; Jelen-grad metagranite: 491 ± 2 Ma). For the Pleterac granite, a Cretaceous formation age of 82 ± 1 Ma was obtained.

The Cretaceous metamorphism in the Moslavacka Gora Massif was of the low-pressure type and reached, at least in places, granulite facies conditions (700-750°C, 3-4 kbar). According to the available monazite ages, high-grade metamorphism occurred in the mid Cretaceous. A retrograde metamorphic event, which may be related to the intrusion of the Pleterac granite, occurred under conditions of ca. 550°C and 3 kbar.

Based on the new geochronological data, a correlation of the Moslavaèka Gora Massif with the Banatite magmatic belt of south-eastern Europe may be possible. According to Neubauer (2002) the Banatite belt may have formed as a consequence of post-collisional slab break-off, representing a long but narrow zone with increased heat input from the asthenospheric mantle. The high T/ low P metamorphism recorded within the Moslavaèka Gora Massif would be compatible with such a model. Chemical data indicate that the Pleterac granite is most likely derived from a crustal source and not from a mantle source, as most magmas of the Banatite belt are. However, the Pleterac granite may have formed as secondary magma in the contact aureole of hot mafic mantle melts ponding at the base of the crust.

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Minor element chemistry of the Cu-deposit of the Kelchalm near Kitzbühel (N-Tyrol, Austria)

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The Cu-deposit from the Kelchalm lies in the western Greywacke Zone. The western Greywacke Zone is important for the investigation in the framework of the special research project HiMAT (history of mining activities in Tyrol and adjacent regions) and it's between northern Kalkalps and Central-alps. It can be subdivided in four nappes: Alpach Unit, Hohe Salve Unit, Jochberg Unit and Langeck Unit. The investigation area lies in the Jochberg Unit (= Glemmtal Unit), which is characterized by a mighty siliziclastical progression. This progression is named as „Wildschönauer Schiefer“ and they are the main rocks in the Kitzbühl Alps and can be subdivide because of the age into two groups (the lower Wildschönau Schists and the higher Wildschönau Schists). We can distinguish between three types of rocks: sedimentary rocks, acid and alkaline volkanites and tuffs. The Jochberg-unit is characterised by numerous syngenetic Cu-deposits of the Lahn-Dill Typ.

These deposits are connected with the mafic volcanism in the Wildschönau Schists. The gangue consists of quartz, ankerite and dolomite. The primary ore assemblage mostly consists of chalcopyrite and pyrite. The secondary assemblage mostly consists of goethite replacing pyrite and chalcopyrite, and subordinately covelline, markasite and azurite.

In order to characterize the ore assemblage chemically for further provenance studies, 21 elements were analysed and counted for 50 seconds by WDS EMPA analyses on ca. 300 spots on pyrite and chalcopyrite, as well as NAA was performed on selected hand specimen. The data show significant differences to the ores from the largest Cu-deposits in the Eastern Alps namely the „Mitterberg-Mühlbachl-Larzenbach district“in the eastern continuation of the Jochberg Unit, hosted in the Pinzgau Phyllites. In the Kelchalm, Co (5,5-155 ppm) and Ni (48-749 ppm) are lower then in Mitterberg (Co: 241-1088 ppm, Ni: 838-1479 ppm). As on the other hand is much higher in Mitterberg (839-3039 ppm) than in the Kelchalm (4-240 ppm). Se (40-145 ppm) and Ag (4-25 ppm) are higher in Kelchalm than in Mitterberg (Se: 20-40 ppm, Ag: 5-10 ppm). It is the aim of this SFB project to create a large minor and trace element database for different Cu-ore deposits from North- and South-Tyrol, as well as from Vorarlberg and Salzburg for provenance studies concerning historical trade routes of pre-historic artefacts.