Phase diagrams for the eclogites from Koralpe

BRUAND, E.[1], STÜWE, K.[1], PROYER, A.[1] & POWELL, R.[2]

[1]Institut für Erdwissenschaften, Universität Graz, Heinrichstr. 26, A-8010 Graz, Austria; [2]School of Earth Sciences, University of Melbourne, Melbourne, Vic. 3010, Australia; emilie.bruand@uni-graz.at, kurt.stuewe@uni-graz.at, alexander.proyer@uni-graz.at, rp1405@gmail.com

In the Kor- and Saualpe of the Eastern Alps several eclogite bodies occur within metapelitic gneisses. The bodies are between 1 meter and several hundreds of meters in size and some of them were defined by HAÜY (1822) as the type locality for the rock type „eclogite“. A growing body of petrological work has documented the metamorphic evolution of the metapelites surrounding the eclogites, including studies of the *PT* paths, studies of the evolution of water content and geochronological work documenting the cooling and heating rates. Moreover, there are many petrological, geochemical and geochronological studies on eclogites, but very little work has been done on phase diagrams for the eclogite bodies themselves. Here we use recently available activity models for amphiboles to present new thermodynamic pseudosections for the Koralpe eclogites that can be used to constrain their *P-T* path and general metamorphic evolution.

We study eclogites with both basaltic and gabbroic precursors. Specifically we have selected samples from (i) the Bärofen Gabbro (a type-2 eclogite as defined in earlier studies), (ii) the Gressenberg (a type-1 eclogite) exposure and (iii) the metabasalt at Hohl (a type-3 eclogite). From the Hohl occurrence, we have investigated the sample with different states of hydration, in order to maximize the P-T-aH_2O information.

Modelling these rocks using with THERMOCALC, results in estimates for the conditions of metamorphism that are consistent with earlier studies which used conventional thermobarometers. Interpretation of the metamorphic evolution using *PT* and P-M_{H2O} pseudosections indicates that the *PT* path of the eclogites provides additional information on the prograde and high pressure evolution. The comparison between eclogite and the gneissic host can permit to integrate these to the tectonic evolution of the Eastern Alps.

Crustal structure and its relation to active tectonics in the Eastern Alps and surrounding tectonic provinces

BRÜCKL, E.[1], BEHM, M.[1], DECKER, K.[2], GRAD, M.[3], GUTERCH, A.[4], KELLER, G.R.[5] & THYBO, H.[6]

[1]Institute of Geodesy and Geophysics, Vienna University of Technology, Gusshausstrasse 27-29, 1040 Vienna, Austria; [2]Department of Geodynamics and Sedimentology, Center for Earth Sciences, University of Vienna, Althanstrasse 14, 1090 Vienna, Austria; [3]Institute of Geophysics, Faculty of Physics, University of Warsaw, Pasteura 7, 02-093, Warsaw, Poland; [4]Institute of Geophysics, Polish Academy of Sciences, Ksiecia Janusza 64, 01-452, Warsaw, Poland; [5]College of Earth and Energy, School of Geology and Geophysics, University of Oklahoma, 100 East Boyd Street Suite 810, Norman, OK 73019, Oklahoma, USA; [6]Institute of Geography & Geology University of Copenhagen, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark; ebrueckl@mail.tuwien.ac.at, mbehm@mail.tuwien.ac.at, kurt.decker@univie.ac.at, mgrad@mimuw.edu.pl, aguterech@igf.edu.pl, grkeller@ou.edu, thybo@geo.ku.dk

We consider the Alps east of the Brenner fault and their surrounding major tectonic units (Molasse, Bohemian Massif, Vienna and Pannonian basins, Dinarides, and Adriatic foreland). Processes still imprinting active tectonics have been the collision between the European plate and the Adriatic micro-plate, and the lateral extrusion of Eastern Alpine crust to the Pannonian basin. The Moho structure revealed by 3-D interpretations of the CELEBRATION 2000 and ALP 2002 seismic wide-angle data by the application of stacking techniques and tomographic methods indicates a fragmentation of crust and upper mantle into the European plate, the Adriatic micro-plate, and the newly interpreted Pannonian fragment. 2-D modelling using interactive ray-tracing techniques along main profiles of the ALP 2002 experiment and steep angle reflection profiles (TRANSALP, NE-Styria) supply additional support. Elastic plate modelling was applied to locate and characterize the boundaries between the crustal blocks.

The boundary of European and Adriatic Moho is located south of the TW, near the PAL. Crustal structure indicates that NS convergence has been compensated mainly by thrusting and up-folding of the TW over the Subtauern Ramp (SR), by thickening of the Adriatic middle or lower crust, and by backthrusting of the South Alpine sedimentary layers. East of the TW the Moho boundary divides into two branches. One extends first to NE and then to E, near the Mur-Mürz fault. The other branch follows the strike of the Dinarides in the vicinity of the Idria fault. These two branches separate the Pannonian fragment from the EU and AD plates. Gravimetric data supports the general pattern of plate boundaries and the assumption that the Subtauern Ramp exists under the whole TW. At its northern and south-eastern boundary the Pannonian fragment belongs to the Alpine and Dinaric orogens. A distinct transition zone represents the continuation to the much shallower Moho in the Pannonian basin. Tectonic escape and gravitational collapse find their expression in this structure. To the south the Pannonian fragment meets the Tisza unit.

Seismic activity correlates well with thrust and strike-slip faults in our investigation area. However, also the deep crustal structure and the inferred fragmentation of the Moho are in excellent correlation with the spatial distribution of foci. This pattern, displacement vectors derived from GPS campaigns, and results from levelling may be well explained by a continuing NS convergence between EU and AD and an ENE movement of the Pannonian fragment. In this model the Pannonian fragment has been merged with the Tisza unit to one „soft“ micro-plate, and the PAL lost its significance as a dominant active strike-slip fault.

The geodetic-seismological field-laboratory at the mass movement Gradenbach

BRÜCKL, E.[1], BRUNNER, F.K.[2], MERTL, S.[1] & WOSCHITZ, H.[2]

[1]Institute of Geodesy and Geophysics, Vienna University of Technology, Gusshausstrasse 27-29, 1040 Wien; [2]Institute of Engineering Geodesy and Measurement Systems, Graz University of Technology, Steyrergasse 30/II, 8010 Graz; ebrueckl@mail.tuwien.ac.at, smertl@mail.tuwien.ac.at, Fritz.Brunner@tugraz.at, Helmut.Woschitz@tugraz.at

The mass movement Gradenbach (GB) is a typical example of deep-seated gravitational creep affecting the slope of an alpine valley. It is located in the crystalline nappes of the Schober mountain range near the confluence of the Graden creek and the Möll river, Carinthia, and covers an area of about 1.7 km^2. GB accelerated in 1965 and 1966 and triggered catastrophic debris flows. Since this time GB attracted the interest of scientists and practitioners. However, the reliable short and long time prediction of creep rates and hazard estimates is still an unsolved problem. Our combined geodetic-seismological research at GB is dedicated to a deeper understanding of the processes at work and to improve prediction.

Geodetic observations of displacement rates by GPS started in 1999 (BRUNNER et al. 2003). The depth to the basal sliding surface and the internal structure of GB was explored by a combination of seismic refraction and tomography (Brückl & Brückl 2006). The evaluation of aerial photographs of the years 1962 and 1996 resulted in two digital terrain models, a map of elevation differences between the two epochs, and displacement vectors. A kinematic model of GB was derived from this data, which indicates that GB has developed from creep to block movement and sliding at the basal shear zone (Brückl et al. 2006). The average velocity of GB for the period 1962-1996 was 0.6 m/year.

A closer look at the temporal development of the displacements reveals that the movement of GB is far from continuous and it may be characterized as „episodic creep“. This behaviour imposes fundamental problems on its prediction, and motivated us to expand our activities at GB to the level of a field-laboratory. A detailed geological survey was carried out. To gain information on the spatio-temporal distribution of brittle deformation and friction controlled sliding, a seismic network was installed which monitors the micro-earthquakes produced by these processes (Brückl & Mertl 2006). Furthermore, a large scale strain rosette working on fibre-optical principles was embedded (5 m arm length), which yields information on strain and stress build-up and release with high temporal resolution (Brunner et al. 2007). We will use this new information together with GPS and hydrological data to develop a model for the geophysics of the intermittent motion of GB in order to reliable predict the GB mass movement. Since the intermittent motion pattern is frequently associated with mass movements, we will study generalisation of the geophysical model.

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ALPASS - Teleseismic tomography of the Eastern Alps

Brückl, E., Lippitsch, R., Mitterbauer, U. & ALPASS Working Groups

(1) Institute of Geodesy and Geophysics, Vienna University of Technology, Austria; Gusshausstr. 27-29, 1090 Wien;
ebrueckl@mail.tuwien.ac.at, lippitsch@mail.tuwien.ac.at, umitterb@mail.tuwien.ac.at

The Eastern Alps were formed by the north-south directed collision of the Adriatic (African) and European plates and a subsequent tectonic escape of crustal fragments to the unconstrained margin in the east, represented by the Pannonian Basin. Recent controlled source seismic experiments (TRANSALP, CELEBRATION 2000, and ALP 2002) revealed significant internal structures of the crust and the Moho topography. However, deeper plate tectonic structures (e.g. subducting slab) are still under debate. ALPASS is a passive seismic monitoring project aiming to reveal lower lithosphere and upper mantle beneath the wider Eastern Alpine region, and to contribute to a better understanding of the geodynamic processes at work. By cooperation of Austria, Croatia, Finland, Hungary, Poland, and USA 57 temporary seismic recording stations were deployed from May 2005 until May 2006. The layout was designed to extend the efforts of earlier experiments (e.g. TRANSALP) and to support two other passive seismic experiments (BOHEMA, Carpathian Basin Project), which are overlapping in the investigation area. Additionally, data from permanent networks was collected to improve coverage of the investigation area. 83 events (50% with M > 5.6) from epicentre distances between 30° and 100° were selected for teleseismic inversion. Travel time picking of P-wave arrivals has been done by a semi-automatic correlation technique. Crustal corrections benefit from the high resolution velocity model of the crust and the new Moho map derived from CELEBRATION 2000 and ALP 2002 data. First results of teleseismic inversion will be presented and discussed with respect to crustal structures revealed by the controlled source experiments, tomographic models generated during earlier studies, and their consequences for the conception of plate tectonics in the Eastern Alps.

Zur thermischen Geschichte des Westabschnittes der Mürzalpendecke auf der Basis neuer Conodont Colour Alteration Index (CAI) Untersuchungen

Bryda, G.[1], Gawlick, H.-J.[2], Kreuss, O.[1], Lein, R.[3], Moser, M.[1] & Pavlik, W.[1]

[1]Geologische Bundesanstalt, Neulinggasse 38, 1030 Wien, gerhard.bryda@geologie.ac.at; [2]Department Angewandte Geowissenschaften und Geophysik, Prospektion und Angewandte Sedimentologie, Montanuniversität Leoben Peter-Tunner-Strasse 5, 8700 Leoben, hans-juergen.gawlick@mu-leoben.at; [3]Department für Geodynamik und Sedimentologie, Universität Wien, Althanstrasse 14, A-1090 Wien, richard.lein@univie.ac.at

In Verbindung mit Neuaufnahmen im Rahmen der geologischen Landesaufnahme auf den Kartenblättern ÖK 101 Eisenerz und ÖK 102 Aflenz wurde das bestehende CAI-Probennetz (Gawlick et. al. 1994, Lein & Gawlick 2000) bedeutend verdichtet, so dass für diesen Abschnitt der Mürzalpen-Decke nunmehr eine noch fundiertere Aussage über deren thermische Prägung gemacht werden kann. Die Auswertung von fast 150 neuen Conodonten Proben aus unterschiedlichen lithostratigraphischen Einheiten der Mürzalpen-Decke ergab bei fast allen Proben (141) sehr hohe CAI-Werte im Bereich zwischen CAI 5,5 und 6,0 und liegen damit im Trende der bisher bekannten Werte. Vier Proben zeigten mit Werten größer CAI 6,0 bis maximal CAI 7,0 eine noch höhere Temperaturbeeinflussung an. Nur fünf Proben fallen mit (scheinbar) niedrigen CAI Werten zwischen CAI 2,0 bis 3,0 aus dem Rahmen. Davon enthielt eine Probe bei stratigraphisch einheitlicher Einstufung sowohl Conodonten mit CAI-Werten zwischen CAI 2,5 bis 3,0 als auch CAI 5,5 bis 6,0. In unmittelbarer Nachbarschaft der Proben mit niedrigen CAI-Werten wurden innerhalb des gleichen Schichtgliedes auch hohe CAI-Werte (5,5-6,0) beobachtet. Alle Conodonten mit (scheinbar) niedrigen CAI-Werten stammen entweder aus der „Sonderfazies“ im Wettersteinkalk (Piros et al. 2001) oder aus dem basalen Anteil der Reifling Formation (Knollenkalk Member). Beide Schichtglieder sind dunkelgrau bis schwarz gefärbte Bank- oder Knollenkalke mit untergeordneter bis hoher Verkieselung (Hornsteine) und könnten über eine weitere gemeinsame Eigenschaft(-ten) verfügen, die unter bestimmten Bedingungen (= reich an organischen Bestandteilen) zur beobachteten scheinbar heterogenen Verteilung der CAI-Werte führt. Hier können in Zukunft nur Messungen der Apatitkristallitkorngröße klare Daten/Aussagen zu diesen „Ausreißern“ innerhalb der sonst sehr homogenen und relativ einheitlichen CAI-Verteilung mit CAI-Werten um CAI 6,0 liefern. Aus dem Bereich der nördlich vorgelagerten Göller-Decke (Tirolikum) liegt aus faziellen Gründen (Plattformkarbonate) leider nur eine neue Conodonten Probe aus einer Spatkalk Linse im lagunären