Eastern Alpine geomorphic setting with strong neotectonic overprint: a multimethod approach

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To reveal the short and long-term characteristics of the tectono-geomorphic evolution of the Eastern Alps, a multimethod study was carried out combining classic geological, thermo-chronological, and DEM-evaluation techniques, including data of recent crustal movements, Pleistocene glaciation and crustal thickness.

Digital geomorphic parameters have been computed for the Eastern Alps and have been evaluated by statistical methods based on a mid-resolution Digital Elevation Model. Results prove that glaciation-induced relief enhancement took place in most of the area: highly increased sediment evacuation, increase in valley spacing and valley deepening are traceable in the formerly glaciated areas by sediment budget calculations and applying numerical methods. The isostatic equilibrium seems to be not yet attained: recent vertical crustal movements (up to 1.5 mm/a uplift) strongly correlate with the area of glaciation. In certain parts of the Eastern Alps remnants of paleosurfaces (recognized in the last century) suggest that parts of the Northern Calcareous Alps and the Gurktal Alps were less affected by the relief enhancement, while the Hohe and Niedere Tauern and the westernmost Eastern Alps can be characterised by isostatically-enhanced strong surface uplift in combination with the orogeny-dictated rock uplift background.

The Last Glacial Maximum (LGM) nunatak pattern was also evaluated to delineate regions which were already mountainous in pre-LGM times. They are separable from those which have been strongly modified by the glaciation. Although the relief enhancement modified considerably the ruggedness of the elevated areas, the geomorphic domains (outlined by the slope angle distribution) correlate rather with the long-term uplift pattern (derived from apatite fission track geo-chronology) than the local lithology and the glaciation.

Based on these observations we conclude that (1) the long-term (>100 ka) behaviour is largely determined by the orogenic processes (uplift attains 0.3 mm/a), and (2) the glaciation increased the effectiveness of the orogenic forces by postponing the effect of the trend: during and after the short deglaciation period this delay starts to compensate by isostatic rebound caused by the melting ice and the increased volume of evacuated sediments.

U-Pb-SHRIMP-Datierungen an Zirkonen von leukokraten Gneisen und eines Metabasits aus dem Bayerischen Wald (westliche Böhmische Masse)

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Es wurden U-Pb-Einzelzirkondatierungen mit der Ionensonde SHRIMP II an der Curtin University, Perth (Australien) durchgeführt. Datiert wurden 3 leukokrate Gneise (Metamagmatite) aus dem Gebiet um Hauzenberg und Untergriesbach. Ferner wurde ein Eklogitamphibolit bei Hermannsried, N Oberviechtach, und ein undeformierter Metasomatit (Kalifeldspatgestein) aus Bodenmais datiert.

Leukokrate Granat-Biotit-Gneise vom Aubach, S Hauzenberg, führen Disthen und werden als ehemalige Granulite angesehen (Felber 1987, Ritter 1951). Die Internstruktur der Zirkone ist gekennzeichnet durch komplexe Kern- und Randbereiche mit Sektorzonierung. Die Randsäume weisen konkordante Alterswerte auf. Für die Kristallisation der Randsäume ergibt sich ein Alter von 338 ± 8 Ma.

In der Donauleite östlich von Passau kommen helle Gneise gemeinsam mit Paragneisen (Perlgneisen), Amphiboliten und untergeordneten Marmoren in langgestreckten Zügen vor. Es wurde ein fein- bis mittelkörniger, porphyroklastischer Biotit-Muskovit-führender Quarz-Kalifeldspat-Gneis, NW des Jochenstein-Kraftwerks und ein fein- bis mittelkörniger, porphyroklastischer Biotit-Plagioklas-führender Kalifeldspat-Gneis, W Obernzell, datiert. Die Zirkone zeigen teilweise mehrere Kern- und Randbereiche. Die Randsäume zeigen hohe Kathodolumineszenz und eine stark verblasste oszillierende Zonierung, die als ausgeheilte, magmatische Bänderung interpretiert wird. Die Randsäume weisen konkordante mittlere Alter mit 345 ± 11 Ma bzw. 338 ± 7 Ma auf.

Ein undeformierter Metasomatit (Kalifeldspatgestein) aus dem Kontakt zwischen der Sulfidvererzung und dem metamorphen Nebengestein in der Sulfid-Lagerstätte Silberberg bei Bodenmais weist ein konkordantes mittleres Alter von 324 ± 5 Ma auf. Dieses Alter wird auch als Bildungsalter der Sulfidvererzung interpretiert.
Die hier untersuchten leukokraten Gesteine haben ähnliche Verteilungen der Kernalter: konkordante Kernalter liegen zwischen 380 und 660 Ma, diskordante Analysen weisen auf 1,8 and 2,5 Ga.

Der Eklogitamphibolit aus Hermannsried ist gekennzeichnet durch Zirkone mit oszillierender Zonierung und mit relativ einfachen Internstrukturen ohne ererbte, alte Komponenten. Mit dem konkordanten mittleren Alter von 481 ± 8 Ma wird die magmatische Bildung des basaltischen Ausgangsgesteins datiert.

Strength Reversal of Porphyroblasts. A Potential Tool for Estimating Strain Rate

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The Plattengneiss shear zone in the Eastern Alps contains two textural features that may be interpreted of its strain rate: 1.) The rock contains porphyroblasts of (a) K-feldspar, (b) plagioclase, (c) aggregates of plagioclase and quartz. 2.) The decompression reaction of muscovite to biotite is preferentially located in pressure shadows behind garnet. Here we explore the rheological implications of different porphyroblast phases in the rock. The fact that three different porphyroblasts occur in the gneiss implies that all three phases or aggregates are of similar rheology. We show that they only may be of similar rheology (i.e. near conditions of strength reversal) if they are strongly non-linear viscous and if the stress exponents of the three phases have considerably different values. Differences in activation energy and pre-exponent constant of the flow law play a subordinate role. We explore both the strain rates at which this may occur (using rheological constants from the literature) and the rheological constants that allow strength reversal (using assumed strain rates).

Shallow high-resolution seismics along the TRANSALP profile in southern Bavaria

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A high-resolution reflection seismic survey was carried out in the southern part of the Bavarian Molasse basin in 1998 and 1999. The survey aimed at investigating the near-surface structure of the complicated transition from the unfolded Foreland Molasse to the Folded Molasse, and the Folded Molasse to the internally complicated thrust systems of Helveticum, Ultrahelveticum and Rhenodanubian Flysch. The study is linked to the TRANSALP seismic project, and results contribute to fill the gap between surface and upper 300 to 500 ms two-way traveltime, typical of deep-reflection seismic experiments.

The contact zones are covered totally by Quaternary sediments. During the survey the acquisition parameters of geophone spread, spacing and frequency range were particularly adjusted to reflectors which are expected to dip steeply southwards. A high-frequency vibrator was used designed for shallow reflection surveys.

The common problem of the Quaternary cover with glacial deposits complicates the data processing to a large extent. To this the complicated geological/tectonical conditions and the unfortunate circumstances for energy distribution are added. The consequences are that in most cases evaluation of reflection hyperbolic functions is not possible in raw data. Only after a time-demanding pre-stack processing, reflections with travel-times up to 300 ms TWT can be interpreted in unstacked sections. This affords a sensitive combination of air blast attenuation, spectral balancing, bandpass filtering and amplitude scaling. This combination proved to work successfully when permanently adjusted to the quickly changing data quality along the profile. The muting zone has to be estimated for each vibration location separately, so that in addition, small spatial and near-surface velocity variations could be taken into account.