Complete solid solutions between muscovite and Ba-rich white micas were observed since Ba contents range from 0.07 wt.% up to 13.38 wt.% BaO. The micro-Raman spectra of the Ba-rich white micas correspond well with the standard muscovite pattern. The comparison between micas with lower (0.07- 0.26 apfu) and higher (0.29-0.37 apfu) Ba contents yielded that the peaks at 265 $cm^{-1}$ and 396 $cm^{-1}$ show a distinct shift as a function of the Ba content of the micas.

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## Major, minor and trace element variations of apatite and tourmaline as a function of metamorphic grade in the contact aureole of the Lienz/Edenwald tonalite

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The distribution of major and trace elements in accessory minerals can provide important information on the metamorphic evolution of rocks. The aim of this investigation is to evaluate the influence of increasing temperature on the chemical composition of apatite and tourmaline using samples along a well defined profile within the contact aureole of the Oligocene Lienz/Edenwald tonalite. Minor element variations in apatites do not seem to vary systematically, but a distinct increase towards the contact was observed in Mn, Cl and ΣREE + Y. The increasing incorporation of REE + Y can be described by the coupled substitution $(REE + Y)^{3+} + Na^{+1} = Ca^{2+}_{-2}$. The major anion constituents, F and OH, show a systematic variation with respect to the metamorphic grade. On the other hand Cl does not vary consistently, although an overall increase towards the contact was observed. The elevated Cl contents in the innermost part of the aureole closest to the pluton probably results from the circulation of hydrothermal fluids associated with the intrusion process.

In contrast to apatites, tourmalines from this contact aureole are characterized by complex textural zoning, which is also reflected in strong chemical zoning. This zoning pattern displays at least two main growth events, where the inner rim shows higher Al[T], Ca and Ti contents and lower Si, Mg[Y] Al[Y] contents compared to the composition of the core and outer rim. With increasing metamorphic grade the tschermak-substitution becomes more significant (Henry & Dutrow 1996), which results in higher amounts of Al and lower Si and Mg contents. The chemical zoning of the investigated tourmalines can thus be interpreted as a prograde growth sequence from the core (probably Variscan metamorphism) to the inner rim and growth during decreasing metamorphic grades from the inner rim to the outer rim. This chemical trend can be observed in all contact metamorphic samples throughout the contact aureole.

This study shows that accessory minerals do provide important information concerning 1.) the extent of a thermal overprint, 2.) the polymetamorphic nature (tourmaline) of rock samples as well as 3.) evidence of episodes of localized fluid/rock interactions (apatite).

## Cracked pebbles - a gauge to constrain overburden

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Brittle, radially fractured pebbles from unconsolidated sediments were investigated in a gravel pit south of St. Margarethen (Burgenland, Austria). The outcrop is located in the Neogene Eisenstadt-Sopron Basin, which is a subbasin on the SE border of the Vienna Basin. The sediments, which were deposited during the Sarmartian and Pannonian (12.7-7.2 Ma), represent a succession of deltaic gravels with intercalations of shallow-marine calcareous sands. Extensional tectonics in these sediments resulted in the generation of conjugate sets of predominately WNW- and subordinate ESE-dipping normal faults (shear deformation bands). These faults were primarily localized in meter-thick gravel layers and, with increasing displacement, eventually crosscut other lithologies.

The gravel layers contain a significant number of cracked pebbles. Detailed structural mapping of the distribution of cracked pebbles revealed their preferential occurrence in the vicinity of the normal faults and, in these, within zones of roughly uniform-sized pebbles. The findings indicated a strong relation to the mechanics of faulting within the sediment. To find the controlling factors for the localization of pebble fracturing, the grain-size distribution and shape and the number of point contacts of the pebbles were statistically measured. The results were then used as input parameters for numerical modelling.

The Discrete Element Method was applied to simulate the effect of overburden on a certain volume of particles (i.e. the pebbles). The magnitude and the distribution of contact forces between the particles were observed and compared with the fracture resistance of natural pebbles, determined by point load testing in the laboratory.

Results from numerical modelling indicate that a maximum estimated overburden of a few tens of meters would not have been able to generate contact forces high enough to crack the significant number of pebbles that have been observed in some parts of the outcrop. We therefore conclude that cracking was related to faulting by force

jamming due to pebble reorganization and/or by contact force concentrations due to boundary effects of layering.

## Ein Rückblick über 23 Jahre Absolutgravimetrie mit dem Absolutgravimeter JILAg-6 in Österreich und der Wechsel zum Typ FG5

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Das BEV betreibt seit 1987 in der Abteilung Grundlagen (V1) das Absolutgravimeter JILAg-6, das im für die Neubestimmung und regelmäßige Überprüfung von Fundamentalpunkten der Schwere im In- und Ausland eingesetzt wird. Einige dieser Stationen sind Bestandteil internationaler Projekte wie z. B. UNIGRACE[(i)] und ECGN[(ii)].
In der Vermessung hat die hochgenaue Schwerebestimmung (Schweremonitoring) auf Satellitenreferenz-Stationen große Bedeutung, um daraus geodynamische Signale ableiten zu können. Aus beobachteten Schwereänderungen am Boden lassen sich direkte Rückschlüsse auf Massenverlagerungen im Untergrund bzw. in der Umgebung ziehen. Darüber hinaus wird das Gerät im Eichwesen als Normal für die Schwerebestimmung verwendet. All diese Anwendungen erfordern ein Höchstmaß an Messgenauigkeit und Mess-Sicherheit, die nur durch modernste Gerätetechnik und internationale Messvergleiche gewährleistet werden kann.
Das österreichische Absolutgravimeter JILAg-6 wurde im Jahre 1986 unter der Beteiligung von mehreren österreichischen Instituten (Universität Wien, TU-Graz, Montanuniversität Leoben, ZAMG[(iii)], ÖAW) angekauft und seither vom BEV betreut und betrieben.
Mit dem Absolutgravimeter JILAg-6 wurde das Niveau des Österreichischen Schweregrundnetzes (ÖSGN) definiert, dem mittlerweile 38 Absolutschwerepunkte in Österreich angehören. Einige dieser Stationen wurden in einem regelmäßigen Zyklus übermessen. Diese Stationen waren von Beginn an die Stationen Wien - Hohe Warte und Obergurgl und ab dem Jahre 2000 die ECGN Stationen Graz, Traflberg und Pfänder, womit Zeitreihen bis zu 23 Jahren zur Interpretation zur Verfügung stehen.
Im Jahre 1995 wurde die „Hochkar Calibration Line" (HCL), die 1982 mit einem Schwereunterschied von 198 Milligal zur Kalibrierung von Relativgravimetern entstand, mit dem Absolutgravimeter überprüft und somit neu kalibriert. Darüber beteiligte sich das BEV an vielen nationalen und internationalen Projekten, wie z. B. die Projekte Wr. Becken (1990), Karawanken (1996) und UNIGRACE (2000-2002). Zahlreiche weitere Messungen wurden entweder für Forschung oder als Grundlage für Referenznetze im europäischen Ausland durchgeführt.
Um die hohe Messgenauigkeit und Mess-Sicherheit zu überprüfen werden internationale Messvergleiche durchgeführt, die seit 1981 am BIPM in Sévres/Paris insgesamt acht Mal im Abstand von vier Jahren stattfanden. Das österreichische Absolutgravimeter JILAg-6 nahm an diesen internationalen Vergleichskampagnen seit 1989 insgesamt sechsmal teil.
Mit zunehmendem Alter des Messgerätes wurde der technische Betrieb des Absolutgravimeters schwieriger, bedingt durch vermehrt auftretende elektronische Störungen und mechanischem Verschleiß. Deshalb wird 2010 ein neues Absolutgravimeter der Type FG-5 des Herstellers Micro-g LaCoste angeschafft, um die Arbeiten im BEV zur Qualitätssicherung des Schwerebezugsrahmens sowie zur Erforschung des Schwerkraftfeldes der Erde weiterhin sicherstellen zu können. Die Beschaffung erfolgt in Kooperation mit der Zentralanstalt für Meteorologie und Geodynamik, mit dem Ziel, auch das supraleitende Erdgezeiten-Gravimeter am Conrad Observatorium Traflberg regelmäßig zu kalibrieren.

[(i)] Unification of Gravity Systems of Central and Eastern Europe
[(ii)] European Combined Geodetic Network
[(iii)] Zentralanstalt für Meteorologie und Geodynamik

## Mineralogical-petrological investigations of the Pb-Zn ore deposit in the Pflersch Valley (South Tyrol, Italy)

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The Pb-Zn ore deposits of the Pflersch Valley are situated in the northern part of South-Tyrol, between the Pflersch- and the Passeier Valley. Geologically, these ore mineralizations are part of the polymetamorphic Ötztal Complex. The aim of this study is the detailed field mapping of an area in the Pflersch- and Lazzach Valley, with special emphasis on the contact between the ore horizons and the surrounding country rocks. The Pb-Zn ore deposit of the Pflersch Valley occurs as strata-bound intercalations in the metamorphosed pelitic sediments of the Ötztal Complex. The ores are often associated with graphitic schists. The main ore mineral assemblage is sphalerite, galena, pyrrhotite and chalcopyrite. The gangue of the metalliferous lodes are muscovite-rich, albite-bearing schists. The sulfides are often accompanied with a garnet rich assemblage, showing garnet + biotite + muscovite + feldspar + quartz ± rutile. Electron microprobe analysis (EMPA) allowed the identification of accessory minerals such as fahlore, and native bismuth (Bi).
In order to directly obtain *T* of formation of the ore deposit, micro Raman thermometry of carbonaceous material coexisting with ore minerals was applied and yielded temperatures between 400 and 550 °C (BEYSSAC et al. 2002). Geobarometric investigations using the sphalerite geobarometer (BARTON & TOULMIN 1966) yielded pressures between 0.5-1 GPa at temperatures of 400-550 °C. This indicates that most of the ore mineral assemblage formed