Geochemistry of Granitoids in the eastern part of the Seckau Mountains (Eastern Alps, Austria)

PFINGSTL, S., KURZ, W. & HAUZENBERGER, C.
Institute of Earth Sciences, University of Graz, Heinrichstrasse 26, 8010 Graz, Austria.

The massif of the Seckau mountains (Seckauer Tauern) is mainly built up of Granitoids as part of a batholith with a Variscan protolith age, overprinted by Eoalpine (Cretaceous) deformation during nappe stacking and subsequent extension, and greenschist facies metamorphism. In this study, a suite of granitods was geochemically analysed by X-ray fluorescence (Bruker Pioneer S4) in order to derive the processes of magmatic evolution and differentiation. In general, three types of magmatites can be distinguished: granites, granodiorites and quartz-monzodiorites. The first two form the majority, whereas the intermediate quartz-monzodiorites are only locally exposed.
Following the A/CNK discrimination diagramm a clear distinction beween S- and I- Type granitoids can be established. The S- type granites are mainly localised along structurally the higher parts of the massif and are covered by Permisn to Mesozoic metasedimentary sequences of the Rannach Formation.
Within the AFM diagram all granitodis are characterized by a calcalcaline trend. This suggests that the related melts were formed during a subduction process. Within the R1-R2 digram, the granitoids are related to both pre-plate collision, syn-collision and post-collision uplift settings.
We therefore suggest that the granitoids of the eastern Seckau massif are part of an intrusion sequence during distinct stages of a plate tectonic cycle, i.e. from pre- to post collision, and that the related magmas differentiated from intermediate (quartz-monzodiorites) I-type to acidic (granites, granodiorites) S-type.

Characterization of a fault network in a Miocene oyster reef (Korneuburg Basin, Austria)

PILGORE, H.[1,2] & EXNER, U.[2,3]
[1] Ecole Normale Superieure De Lyon, France
[2] Department for Geodynamics and Sedimentology, University of Vienna, Austria
[3] Natural History Museum Vienna, Austria

The oyster reef excavated at the “Fossilienwelt Stetten” in the Korneuburg Basin is affected by a network of normal faults. The mass occurrence of Crassostrea gryphoides is embedded in a succession of sandstone and clay layers. The outcrop is particularly impressive by its size (300 m2), by the size of the oysters (up to 80 cm in length) and the high quantity of faults registered. The oysters serve as ideal linear markers for the determination of displacement vectors and indicate normal displacements along the NW-SE striking faults. The faults are 10 to 20 m long but they do not show large displacements: vertically about 5 cm and up to 18 cm and in some areas additional sinistral displacement of max. 7 cm. The relation between the length and maximal displacement for these faults indicates that the brittle deformation is confined in the sand layer containing the oyster horizon and more distributed in the underlying and overlying clay and silt layers. The faults are not continuous, but show frequent linkage between initial fault segments and relay zones to neighboring faults. Moreover the long faults are composed of several smaller segments on which we notice different degree of linkage.

Koralmtunnel lots KAT1 and KAT2: The Neogene of the Styrian Basin

PISCHINGER, G.,[1,2] WURZWALLER, S., [1,] FASCHING, F., [1], PACK , G., [1] & HARER, G.,[3]
[1] 3G Gruppe Geotechnik Graz ZT GmbH, Elisabethstraße 22, 8010 Graz, Austria
[2] Institute of Applied Geosciences, Graz University of Technology, Rechbauerstrasse 12, 8010 Graz, Austria
[3] ÖBB-Infrastruktur AG, Projektleitung Koralmbahn 3, Griesgasse 11/2. Stock, 8020 Graz

The easternmost part of the Koralmtunnel (KAT) crosses for a length of approximately 4.0 km the Neogene sediments of the Western Styrian Basin. These sedimentary units are assigned to the Badenian -Florianer Beds, which are commonly regarded as stratified lagoonal deposits (“Bay of St. Florian”). The westernmost boundary of those sedimentary rocks is formed by methamorphic rocks of the Koralpe. The alignment of the KAT (lots KAT1 and eastern part KAT2) is dominated by partly carbonatic siltstone with intercalated sandstone and by poorly cemented sandstone to well compacted sand, all of which are predominantly free of macro-fossils. Prior to excavation single faults were known for lot KAT2 from the exploratory tunnel Leibenfeld, but none for lot KAT1.

Tunnel heading largely confirmed the geological model as previously investigated. Large sandstone bodies indicate NNW-SSE trending fluvial or tidal channels. Several normal faults were encountered during excavation, but caused no severe geotechnical challenges. The fault pattern reveals a “Horst-Graben”-structure with extension mainly in WSW to ENE direction. Geotechnical challenges of the two lots were mainly linked to two areas with low overburden, which were successfully crossed with the help of grouted pipe umbrellas. Additional challenges were posed by water-bearing sandstone layers, especially in the descending tunnel heading of lot KAT2.

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Geological characterization and genetic aspects of the Mafengzhen magnesite deposit (Haicheng , Liaoning Province, NE China)

PLUCH, H., MALI, H. & EBNER, F.
Montanuniversität Leoben, Department Angewandte Geowissenschaften und Geophysik, Peter Tunnerstr. 5, A- 8700 Leoben

The Mafengzhen magnesite deposit near Haicheng (Liaoning Province, NE China) is part of the Yingke magnesite ore belt with numerous giant magnesite and talc deposits. This ore belt consists of early Proterozoic metamorphic rock series of Mg-rich carbonate formations which occure stratabound in the upper part of the Dashiqiao Formation of the Liaohe Group. The magnesite ore bodies are distributed in a large area, with extensions over 100 km in length and a width of 4 km in the eastern Liaoning Province. In case of the Mafengzhen deposit the ore body trends mostly towards NE. It is underlain by micaschists and concordantly alternating with thinly bedded dolomitic marble host rocks. The ore display metasomatic transitions and intergrowths with the dolomite host rocks and sometimes the ore is interbedded with siliceous green marble. In the late Jurassic lamprophyre dyke swarms intruded the magnesite deposit. Further the deposit is crosscut by faults including evidently younger magnesite sinter. The typical ore minerals of this deposit are magnesite and associated talc, Mg-chlorite, diopside, pyrite, graphite and others. The average geochemistry of the selective mined magnesite is MgO 46.89 wt. %, CaO 0.93 wt. %, SiO_2 0.99 wt. %, Fe_2O_3 (total) 0,44 wt. % and the LOI 50.78 wt. %.
A detailed geological and geochemical study was conducted of the Mafengzhen magnesite deposit to elucidate the genesis of the magnesite in the Yingke ore belt. The observed features and geochemistry indicate a multiply sedimentary to diagenetic magnesite formation.

Deep geo(hydro)thermal potential in Vorarlberg

POMELLA , H.,[1] ORTNER, H., [1] ZERLAUTH, M.,[1,2] & FÜGENSCHUH, B.[1]
[1] Institut für Geologie und Paläontologiw, Universität Innsbruck; Innrain 52, 6020 Innsbruck
[2] alpS GmbH; Grabenweg 68, 6020 Innsbruck

In the context of the planned Energy Autonomy of Vorarlberg and in collaboration with the Illwerke-Alternativenergie GmbH and the alpS GmbH Centre for Climate Change Adaptation Technologies, the geothermal potential of Vorarlberg is investigated. In the following the two most promising geological settings are discussed.
In the Alpine foreland of westernmost Austria, near Lake Constance, the autochthonous Mesozoic sediments are situated in an attainable depth of 4 to 4.5 km below the ground surface. As the limestone occurs in a distal facies and no intense karstification is known (Jodocy and Stober, 2009), the best prospects for a considerable permeability are expected in the damage zone of major fault structures. Near Bregenz a favourable structure has been detected in seismic sections. The most promising approach to determine the exact position and orientation of the structure, as well as for further characterization of the damage zone is 3D seismics, as has been recently shown by the nearby project run by the city of St. Gallen.
According to seismic data in southern Vorarlberg, the base of the Helvetic nappe stack is located at ~4.5 km below the ground surface. Within the Helvetic nappes, several formations have a high hydrothermal potential, especially when fractured due to folding or faulting. The Cretaceous Helvetic units are characterised by folding