permeability system.
(1) Fractured matrix is characterized by analyzing small-scale fractures and joints, which carry most of the fracture volume of the reservoir. Quantitative and semi-quantitative empirical classifications are used for measuring the total joint surface in a volume of rock (P32 expressed in m² per m³ rock), which is related to fracture porosity. Data shows an exponential increase of porosity and permeability with increasing fracture density.
(2) Cataclastic faults form marked discontinuities in the fractured host rock characterized by damage zones of strongly fractured wall rock or dilatation breccia and different types of cataclasite in the fault core. Fault rocks form about 7.5 % of the rock mass. Cataclasites show relatively high porosity (up to 6,5 %) but very low to low permeability (kGas 0.3-5.4 md). For extensional breccias samples indicate both higher porosity (4.5-8.5 %) and permeability (5-13 md). Data therefore support a complex fault model with high-porosity / low-permeability cataclasite in the fault core sandwiched by fault-parallel high-porosity / high-permeability zones formed by fractured wall rock and/or dilatation breccia. Quantitative fault mapping shows that Miocene NNE- to NE-striking sinistral faults and E-W-directed normal faults are by far the most important structures. About 78 % of the total fault population formed during Middle to Late Miocene deformation (sinistral faults: 50 %; normal faults: 28 %). The third group of abundant faults includes Pliocene to Quaternary NE-directed normal faults (11 %). Faults are very closely spaced with average distances between individual faults of a particular set of about 5 to 30 m. Intersecting faults therefore delimit blocks of wall rock with diameters ranging from less than 5 m to about 20 m.
The observed complex fault properties (low-permeability fault cores and high-permeability damage zones) and the existence of mutually cross-cutting faults related to distinct deformation events are regarded as the key features controlling the general reservoir properties. First, the closely-spaced high permeability streaks corresponding to fault damage zones appear extremely efficient in draining the fractured matrix blocks between faults. Second, abundant cross-cutting faults form a well-connected 3D network of damage zones allowing to bypass the low-permeability cataclasite, which otherwise would act as a fault seal.

Tectonometamorphic evolution of the Texel Complex, Southern Tyrol, Italy

Desch, A.[1], Flöss, D.[1], Speckbacher, R.[1], Fügenschuh, B.[1], Tropper, P.[2] & Mair, V.[3]

[1]Institute of Geology and Paleontology, University of Innsbruck, Innrain 52, A-6020 Innsbruck, Austria; [2]Institute of Mineralogy & Petrography, University of Innsbruck, Innrain 52, A-6020 Innsbruck, Austria; [3]Amt für Geologie und Baustoffprüfung, Eggentalerstrasse 48, I-39053 Kardaun (BZ), Südtirol/Italien; Angelika.Desch@student.uibk.ac.at, David.Floess@student.uibk.ac.at, Romed.Speckbacher@student.uibk.ac.at, Bernhard.Fuegenschuh@uibk.ac.at, Peter.Tropper@uibk.ac.at

The Upper Austroalpine Ötztal-Stubai basement complex (Schmid et al. 2004) is separated from the high-pressure rocks of the Texel complex by the NW-dipping Schneeberg complex. Sölva et al., 2001 termed this contact Schneeberg normal fault, which was described as a top to the NW normal fault allowing for the extrusion/exhumation of the Texel complex from high grade to near surface conditions. Based on the concept and the defined deformation sequence of Sölva et al. (2001) and Habler et al. (2006) the current project investigates the prolongation of the Schneeberg normal fault towards the SW.
Structural mapping revealed a spectacular km-scale antiform-synform pair refolding the main foliation around steeply (W)NW-dipping fold axes. NW-SE trending stretching lineations and top-NW shear sense indicators are related to the earlier main foliation and are thus refolded as well.
This refolded composite foliation traces the continuation of the SNFZ towards the W(SW) and thus delimits the area of possible Cretaceous high-P relics. As already proposed by Schmid & Haas (1989) the SNFZ can be linked with the Vinschgau Shear Zone (VSZ) along the folded mylonites.
The near-surface expression along the Schlinig fault can be continuously traced along the Vinschgau shear zone into the Schneeberg fault zone, thus extending this intra-basement shear zone (Schmid & Haas 1989) further towards the east.
The present-day NW-dip of the Schneeberg fault zone is due to post-Cretaceous folding and overturning.
Zoning patterns of hornblende-bearing gneisses reveal the polymetamorphic evolution of these rocks. Garnet and plagioclase show discontinuous zoning, most likely associated with the strong Eo-Alpine metamorphic overprint known in this area (e.g. Habler et al. 2006). P-T estimates, using coexisting rim compositions, yield 520-580°C and 0.72-0.92 GPa, interpreted to represent the decompression stage following peak metamorphic conditions.

Habler, G., Thöni, M. & Sölva, H. (2006): Tracing the high-pressure stage in the polymetamorphic Texel Complex (Austroalpine basement unit, Eastern Alps): P-T-t-d constraints. - Mineralogy Petrology, **88**: 269-296.
Schmid, S., Fügenschuh, B., Kissling, E. & Schuster, R. (2004): Tectonic map and overall architecture of the Alpine orogen. - Eclog. Geol. Helv., **97**: 93-117.
Sölva, H., Grasemann, B., Thöni, M., Tiede, R.C. & Habler, G. (2005): The Schneeberg normal fault zone: normal faulting associated with Cretaceous SE-directed extrusion in the Eastern Alps (Italy/Austria). - Tectonophysics, **401**: 143-166.

Recognizing different brittle tectonic events based on the different deformation mechanism of deformation bands and typical frictional faults

Draganits, E.[1], Grasemann, B.[2], Wiesmayr, G.[3] & Hager, C.[4]

[1]Institute for Engineering Geology, Vienna University of Technology, A-1040 Vienna, Austria; [2]Department of Geodynamics and Sedimentology, University of Vienna, A-1090 Vienna, Austria; [3]Rohöl-Aufsuchungs AG, Schwarzenbergplatz 16, A-1015 Wien, Austria; [4]Department of Geology, University of Kansas, Lawrence, KS 66045-7613, USA; Erich.Draganits@tuwien.ac.at, Bernhard.Grasemann@univie.ac.at, Gerhard.Wiesmayr@rohoel.at; hager@ku.edu

The interpretation of frictional faults suffers from the fact that these structures are difficult or often impossible to date by geochronological methods and therefore they are mainly dated by cross-cutting relationships. We have investigated deformation bands and zones of deformation bands from the quartzites of the Lower Devonian Muth Formation in the Pin Valley, NW Himalayas (Draganits et al. 2005). Thin section analyses show that the deformation bands in the Muth Formation formed early in the diagenetic history before porosity was lost. Deformation mechanisms involved cataclasis, translation, rotation of quartz grains and effective porosity reduction. Maximum conditions of about 80°C and 60 MPa lithostatic pressure are estimated from the amount of overburden during the middle Cretaceous. Because genetically unrelated, the orientations of the deformation bands cannot be reasonably grouped with the orientations of faults related to Himalayan deformation in the Pin Valley. Additionally the deformation bands are superposed by Eo-Himalayan (Eocene)