Porosity values of fractured rocks show an exponential increase with increasing fracture densities, with an average effective porosity of 5 % for intensely fractured rocks. Fault rocks such as cataclasites show variable values of effective porosity (2% -6%) due to differences in their micro-structural fabric. The analytical methods provide an insight on deformation processes and features such as grain size reduction, cementation and recrystallization, and point out porosity and permeability differences due to deformation mechanisms and cementation events.

2D thermo-mechanical modeling of basement-cover deformation with application to the Western Alps

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The external crystalline massifs of Western Alps and the Helvetic sedimentary nappe stack result from the deformation of the European passive margin during the Alpine collision. This area has been studied extensively for the past hundred years. However although the geometry and tectonic structures are well documented, the mechanical behavior of the rocks during nappe stacking and basin inversion is still highly debated. The aim of this study is to reproduce the first order tectonic structures of the Western external Alps. We use a 2-D thermo-mechanical finite element model with visco-elasto-plastic rheology formulation to simulate the deformation of half-graben structures during collision. We systematically investigate the control of (1) the rheology, i.e. ductile vs brittle; linear vs power-law viscous rheology, and (2) the boundary condition, i.e. pure shear vs simple shear. Geometry and finite deformation patterns in both basement and sediments are then compared to cross-sections, finite strain ellipses and cleavage orientation from published field data. Orientation and distribution of plastic shear bands in the model are compared to fault distribution from field data and sand box analogue models.

Alpine evolution of the central Aar-massif (Grimsel section)

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The Aar-massif represents a polycyclic basement window representing a part of the inverted former European continental margin. The exhumation and cooling history of the Aar-massif have been already intensively discussed in the literature using fission track and U-Th/He data. However, the thermal and structural situations in the Aar massif in its adjacent tectonic units (e.g., Gotthard unit in the south, Helvetic nappes in the north) during Alpine peak metamorphic conditions (Tmax) are less clear. The maximal temperatures in the Aar massif are similar in age and level as in direct south oriented Gotthard unit and the trend can be followed towards the South into the Lepontine dome (i.e. in Oligocene-Miocene Barrovian metamorphism), a situation which is fundamentally different to other external massifs of the Western Alps (e.g., Aiguille Rouge-, Mont Blanc-, Pelvoux-massifs).

Several problems exist for the reconstruction of Tmax in such basement units: (1) the lithologies (mainly granitoids) are not ideal for P-T estimates based on conventional mineral assemblages, and (2) the timing of mineral equilibration is not clear (mixing of pre-Alpine and