

Structural Make-Up of Brittle Fault Zones in the Eastern Aar Massif, Switzerland

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Increased tunnelling activity in the central part of the Swiss Alps has raised concerns with respect to geotechnically difficult zones which are to be encountered. In the eastern Aar massif, where parts of the new Gotthard-Basis tunnel will be constructed, these zones correspond to steeply inclined brittle fault zones which contain deeply fissured material. A key objective to several of our ongoing research projects is therefore to establish the mechanical and hydrogeological behaviour of such brittle fault zones. To do this, an initial examination of the structural make-up has been performed on a metre to decametre scale.

Extensive field mapping in the eastern Aar massif and core logging of newly drilled research boreholes in granite and gneiss bodies along the Gotthard road tunnel have revealed structural characteristics of brittle fault zones that can generally be described by a symmetric succession of brittle fault rocks. Spanning over several metres, this sequence contains the undeformed host rock, a strongly foliated and fractured zone, a cataclastic zone (cohesive fault breccia, cohesive cataclasites and mm-thick fault gouge of small subsidiary faults) and a central zone (cohesionless cataclasites and fault gouge). Within this succession the intensity of fragmentation of rocks and minerals increases towards the central zone. The thickness and the internal structure of the units can show large variations both along strike and dip, even over short distances of several metres. Furthermore, substantial variations among different fault zones occur due to differences in the bulk rock composition and original structure of the host rock.