Tectonics and Neotectonics in the Prealpes and Molasse Basin of Western Switzerland. Part 2 Paleostress

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In an ongoing study we examine the tectonic and neotectonic structures of the Molasse Basin and the Prealpes of the Canton Fribourg and adjacent areas in western Switzerland. Extensive field work allows us to determine the type and spread of structures, as well as the style and grade of deformation observed in the outcrops.

Within the Sandstones, mudstones and scarce conglomerates of the Lower Freshwater and Upper Marine Molasse (USM and OMM) of the Plateau and Subalpine Molasse we observed the following brittle structures: joints and fractures, slickensides, deformation bands in sandstones and pitted/fractured pebbles in conglomerates. The brittle deformation is of regional extent but the structures are not uniformly distributed. Areas of undisturbed rock are present, separated by strongly fractured areas with well developed fault zones containing cataclasites and fault gauge. In the limestones, marls and shales of the Prealpes Klippen and the sandstones of the Gurnigel nappe a whole suite of brittle tectonic features are exposed: joints and fractures, slickensides and vein arrays, as well as stylolites. Moreover, we observed strongly deformed shear zones with curved foliations and sharp boundaries to the adjacent rocks indicating the shear sense.

Paleostress was reconstructed from slickenside data, axis orientation of pebble solution pits and stylolites and were correlated to different fracture families distinguished by crosscutting relations of veins and deformation bands.

The stress field within the Plateau Molasse was found to be heterogeneous with the maximum horizontal compressive stress being mostly identical to $\sigma 1$ but with a scatter in azimuth. While most of the pressure directions are NW-SE orientated, some are between WNW-ESE and WSW-ENE as well as NNW-SSE to NNE-SSW. They were deduced from fault orientations quite similar to those reflecting NW-SE compression but with the opposite sense of shear. Within the Subalpine Molasse paleostress was found to be overall NW-SE directed but often with a stress ellipsoid characterising thrust tectonics. In the Prealpes, field data of several structural features reveal a complex history of several overprinted events. An initial bedding parallel compression shortening is followed by folding and thrusting associated with extension parallel to the fold axis (SW-NE). Subsequently a strike-slip regime with two major fault orientations - a left lateral NNW-SSE and a right lateral WNW-ESE striking shear zone – prevails. These two fault families are possibly linked to a common conjugate fault system. Comparison of fault patterns in the Molasse Basin and Prealpes Klippen show striking similarities in fault and stress orientation but the connection of these is still part of discussions.

The neotectonic and recent state of stress shows a NW-SE compression in a strike slip regime. In the Plateau Molasse the paleostress history started in the lower Miocene, probably with NNE-SSW compression, which then switched to NW-SE compression most likely in Serravallian times along with the formation of the Jura Mountains.