



Initiation and growth of strike-slip faults within effectively intact metagranitoid (Neves area, Eastern Alps, Italy)

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The geometry and progressive development of segmented strike-slip faults developed within effectively intact metagranitoid was studied in the Neves area of the Tauern Window (Eastern Alps, Italy). The currently exhumed faults formed in the lower brittle crust under hydrous conditions, as shown by the pervasive presence of chlorite, epidote and quartz along the faults and within associated veins. The numerous pre-Alpine leucocratic and basic dykes, as well as earlier Alpine high temperature shear zones and veins (Pennacchioni and Mancktelow, 2007), provide passive markers useful for estimating the strike-slip offset along the different parts of the brittle faults. The faults initiated as segmented fractures (on scales ranging from millimeters to hundred meters) arranged in an en-echelon pattern within shear bands, locally trending sub-parallel to the inferred direction of shortening (around N-S). Initial (cm-dm) slip accumulation on the fault segments was accommodated by more distributed fracturing at contractional stepovers and especially by slip on a dominant set of antithetic faults in the stepover. This was probably associated with a component of out-of-plane (vertical) movement, as slip on the antithetic faults does not fully account for the overall decrease in slip along the bounding faults towards their tips. This mechanism of slip accommodation was only effective for a relatively small fault slip. Further slip resulted in the development of synthetic, sigmoidal by-pass faults crosscutting the earlier antithetic fault set within the relay ramp and connecting the overstepped master faults. The total in-plane (horizontal) slip along the secondary faults within the stepover accounts for almost all of the net slip decrease towards the tips of the overstepping faults. However, the lack of distortion of the overstepping fault segments implies that a component of vertical slip also occurred. This second stage of evolution is documented in a main stepover of the sinistral NNE-SSW-trending Mesule fault (the major fault in the area), which has a current maximum offset of about 10 m. Hard linkage allowed the propagation of seismic fractures, as recorded by pseudotachylyte localized at by-pass contractional bends.

References

Pennacchioni, G., Mancktelow, N.S., 2007. Nucleation and initial growth of a shear zone network within compositionally and structurally heterogeneous granitoids under amphibolite facies conditions. *Journal of Structural Geology* 29, 1757-1780. doi: 10.1016/j.jsg.2007.06.002