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Fluid flow through fault zones in granite exhumed from seismogenic depths

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Faults within crystalline rock are potentially the primary conduits for fluid flow and play an important role within many hydrothermal deposits, yet how fluid can move, interact and affect fault rock properties and the evolution of faults is poorly understood.

The Monte Rosa nappe (N.Italy) is composed of late Hercynian granitoids which underwent a complex evolution during the Alpine orogeny including greenschist facies regional metamorphism. The Metagranites are cut by a variety of fracture systems that post-date Alpine metamorphism and several contain signatures of flow of different low temperature fluids. By integrating detailed structural, mineralogical and geochemical analysis it is possible to understand more about the role of fluids during fault growth and the possible feedback mechanisms.

Within the Passo Moro area of Monte Rosa two adjacent fault systems have been mapped in detail. Both faults are sinistral strike-slip with a maximum off-set of 1m. The faults have similar orientations yet show evidence for very different fluid flow histories. Key areas were mapped on a cm scale with core, damage zone and host rock sampled. Fault zone architectural profiles are constructed perpendicular to the fault plane and combined with the detailed mineralogical analysis of the various fault components by petrographic and scanning electron microscopes. Also by observing the various reaction fronts (e.g. Biotite-Chlorite) and stable isotopic variations of O

and H across the fault, it will be possible to monitor how the architectural components exchange material. By carrying out this type of detailed analysis on various locations along strike comparisons can be made between tip regions and the centre of faults allowing an aspect of evolution of fault development to be deciphered.

This research will provide valuable knowledge for numerous industries such as oil and nuclear waste disposal to name only a few.