



Structural and mechanical characterisation of natural hydrofractures: example from the mines of Panasqueira, Portugal

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Hydrofractures are mostly tensile fractures created by relatively high pore fluid pressures but under relatively low differential stresses and may originate barren joints and mineral veins. They can retain significant porosity at geological time-scales, providing preferential pathways for crustal fluids and often host mineral deposits. The mines of Panasqueira, central Portugal, represent the largest W-Sn deposit currently mined in western Europe and constitutes a fossil record of natural hydrofracturing at presumably high levels of pore pressure in the upper crust. The ore deposit comprises an extensive sub-horizontal quartz vein network hosted by a regional metasedimentary sequence of Palaeozoic age, which was previously folded, foliated and metamorphosed to greenschist facies during the Hercynian Orogeny. The vein system is connected to a greisenized cupola of the underlying granitic intrusion, evidenced by the pronounced contact metamorphism.

The extensive network of underground excavations allows for exceptional exposure of the geological structures, and gives the possibility to use the mines of Panasqueira as a natural laboratory to understand the mechanisms pertaining to natural hydrofracture. Paleostress analyses using vein data, complemented by fluid inclusion and geothermometry studies were conducted. Preliminary results of vein attitudes indicate a cluster distribution of the poles with σ_3 vertical, as expected. The other stress axes were oriented NW-SE (σ_1) and NE-SW (σ_2), respectively. Microthermometry of fluid inclusions in quartz related to the main opening stages of the vein structures indicates the occurrence of a low salinity fluid belonging to the system H_2O -NaCl- CO_2 -(CH₄)-(N₂). Contemporaneous arsenopyrite indicates compositional average results of 33,5–34,0 atomic % As. The further achievement of new data will permit the calculation of the “full” stress state associated to the formation of the quartz veins.