Geophysical Research Abstracts
Vol. 16, EGU2014-3537, 2014
EGU General Assembly 2014

A structural analysis of the Minas da Panasqueira vein network and related fracture generations

Dominique Jacques (1), Romeu Vieira (2), Philippe Muchez (1), and Manuel Sintubin (1)

(1) KU Leuven, Department of Earth and Environmental Sciences, Leuven, Belgium (dominique.jacques@ees.kuleuven.be), (2) Sojitz Beralt Tin & Wolfram (Portugal) S.A., Geology Department, Barroca Grande, Portugal

The Minas da Panasqueira is a world-class W-Cu-Sn vein-type deposit, situated within the Central Iberian Zone of the Palaeozoic Iberian Massif (Portugal). The deposit consists of a network of subhorizontal, sill-like massive quartz veins situated above the southwestern extremity of a greisen cupola, within regionally metamorphosed, isoclinally folded, lower-greenschist slates and greywackes. The greisen cupola is part of a larger intrusive complex, emplaced during the late- to post-tectonic stage of the Variscan orogeny. The late-Variscan granitoid(s) underlying the Panasqueira deposit is considered to have served as a major metal source.

The structure of the network of subhorizontal extension veins, consists of numerous planar vein lobes that are separated by host-rock bridges and merge at branch-points. A structural analysis demonstrates that not only within the Panasqueira mine, but also on a more regional scale, one or more generations of flat-lying fractures are present. The veins clearly exploited these pre-existing discontinuities, as confirmed by (1) the vein geometry being directly influenced by variations in the orientation of the initial fracture sets and (2) the geometry of the rock bridges and overlapping vein morphologies, consistently showing straight-line propagating crack tips. If veining is governed by a preferential, strongly developed anisotropy in the host rock, the hypothesis of vein lobes and rock bridges forming during propagation of the parent crack by tip-line bifurcation and confinement processes (Foxford et al., 2000) does not seem plausible. Instead, we propose that the rock bridges formed from several, initially separate and small veinlets that eventually overlapped in an en echelon arrangement during progressive propagation and inflation. Bending of the rock bridges and incipient vein rotation indicate that veining occurred near the brittle-ductile transition.

Using a quantitative analysis of bridge orientations, vein aspect ratios and tip lines, we try to sort out if a dominant σ_2 propagation direction, typical for hydrofractures, exists within the vein network. By doing so, we can evaluate whether the subhorizontal vein network formed under a compressive stress regime, or was mainly dictated by the strength anisotropy of the rocks under near-isotropic stress conditions of $\sigma_{hmax} \approx \sigma_{hmin}$.

The regional dominance of subhorizontal aplites, pegmatites and hydrothermal veins, exploiting subhorizontal fracture networks, occurs over a wide area of more than 100 km^2 along the Serra de Estrela granitic massif (Derré et al., 1986). This orientation contrasts with the more common vertical attitude of granite-related hydrothermal veins, observed throughout the Iberian massif. A detailed orientation analysis of the fracture sets should allow to explore the possible causes of this particular late orogenic, flat-lying fracture network related to the granitic intrusion.

References

Derré, C., Lecolle, M., Roger, G., Tavares de Freitas Carvalho, J., 1986. Tectonics, magmatism, hydrothermalism and sets of flat joints locally filled by Sn-W, aplite-pegmatite and quartz veins, southeastern border of the Serra de Estrela granitic massif (Beira Baixa, Portugal). Ore Geology Reviews 1, 43-56.

Foxford, K. A., Nicholson, R., Polya, D. A., and Hebblethwaite, R. P. B., 2000. Extensional failure and hydraulic valving at Minas da Panasqueira, Portugal; evidence from vein spatial distributions, displacements and geometries. Journal of Structural Geology 22, 1065–1086.