First structural approach to the SE Sardinia mafic dyke swarm

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We present a tectonic study of a NNW-SSE trending mafic dyke swarm intruded into granitoids of the late Variscan Sàrrabus pluton in SE Sardinia (Italy). Porphyritic to lamprophyric dykes show a predominant calc-alkaline affinity and they were emplaced during the Lower Permian at about 290-270 Ma (Vaccaro et al., 1991).

The circular scanlines method of Mauldon (2001) was applied to aerial photographs along the coastal exposures to measure fracture frequency tendencies. This, together with field measurements, allowed us to determine the dyke pattern and the joint network present in the granitoid rocks and in the dykes. The subvertical dykes have a $\sim$N135^o $\sim$N165^o mean trend, with a secondary set at $\sim$N10^o which mainly corresponds to a previous intrusive pulse. The joint network has a wider range of orientations, with multiple joint sets present both in the host rocks and in the dykes. A clear distinction cannot be established in terms of orientation between fractures pre-dating and post-dating dykes.

Using dyke orientations from field data, we applied the Bussell (1989) method to deduce the mean dilation direction of the dykes (246/02), and then, we performed a paleostress analysis (Jolly and Sanderson 1997) to get the principal stress axes compatibles with dyke emplacement (σ_1: 135/77; σ_2: 335/13; σ_3: 244/05). σ_3 is sub-parallel to the obtained sub-horizontal mean dyke opening direction, both being normal to the mean trend of the dyke swarm. During the dyke intrusion, the magmatic pressure (P_m) was lower than σ_2. These results allowed us to construct the Mohr circle and to get the driving pressure ratio (R'=0.132) and the stress ratio (Φ=0.327). It is inferred that dykes intruded into extensional fractures at relatively low fluid pressure conditions in comparison with the relatively higher regional differential stresses. Dyke emplacement was likely taking place under an ENE–WSW extensional regime (without considering the effect of post-intrusion crustal block rotations). Further work is needed in order to fully understand the emplacement of the SE Sardinia dyke swarm and to correlate it with other neighboring dyke provinces of the European Variscides in Permian times, such as the Aiguablava lamprophyre dyke swarm (NE Spain).

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