

SCALING ANALYSIS OF FRACTURE PATTERNS ADJOINING THE VILARIÇA STRIKE-SLIP FAULT ZONE, NE PORTUGAL: A GEOMETRIC APPROACH TO FAULT NUCLEATION AND GROWTH MODELLING.

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The Vilariça strike-slip fault is one of the main sinistral structures of the late-Variscan fracture network in the Iberian Peninsula. The fault zone, nearly 250 km long, NNE-SSW, has nucleated in the D₃ Moncorvo-Vila Real granitic batholith of intra-westphalian age, and did propagate on both directions during the Stephanian - Early Permian. In the Quinta da Terrincha area, an important fault segment within the nucleation sector, the granitic rocks exhibit prominent fracturing. Fracture density is very heterogeneous and comprises subparallel structures, with and without slip, striking N20W to N25E and generally subvertical. Their length is quite variable ($L > 2$ cm), and steps between adjacent fractures are usually less than 3-5 cm. Fractures longer than 20 cm show frequently a sinuous trace and are sealed with quartz and/or hydrous-phyllosilicates; in fractures with measurable slip these mineral fillings are deformed. The magnitude of the displacement associated with these fractures is commonly of the order of a few millimeters and rarely exceeds 2-3 cm; the sense is invariably left-lateral. Evidence of crack branching was only detected in restricted sectors adjacent to the Vilariça fault zone. The number-fracture length distribution follows a well defined power law, $N = L^{-n}$, which is similar to some well known fractal distributions; therefore n is the fractal dimension of fracture length distribution. The renormalisation group approach and the relation between fractal dimension and the critical fragile probability enable the following conclusions: (1) preexisting planes of weakness in granitic rocks, where fracture nucleation seems to be privileged, exist on all scales; (2) late shear accommodation in such fractures may be common in fault nucleation processes; (3) the mechanisms involved in fault growth are probably dependent on the nature and scale of those earlier heterogeneities