MULTI-SCALE FRACTURE ORGANIZATION IN GRANITES

Genter A.,1 and C. Castaing1. 1 BRGM, 3 avenue Claude Guillemin, BP6009, F-45060 Orléans Cedex 2, France

In order to understand the scale effects of fracture organization for modelling fluid flow in crystalline rocks, a multi-scale analysis of fractures was carried out in two granite massifs.In Saudi Arabia, systematic continuous measurement of the spacing joints shows irregular fracture clusters alternating with poorly fractured zones. The cumulative distribution of the fracture spacings is power law with a slope of -0.58. The maximum measured spacing was 123 m, whereas the extrapolated theoretical curve gives values of about 1000 m. At a larger scale, the spacing distribution of fracture zones is lognormal and displays a more periodic organization with a mode of about 400 m and a maximum extrapolated spacing of about 1000 m.In the Soultz granite (France), penetrated by a deep borehole, about 3000 fracture spacings were measured on core scale. They show a power law distribution with a slope of -0.90. The maximum spacing is 64 m, whereas the extrapolated theoretical curve gives a value of about 500 m. Normal faults within the borehole induce fracture zones defining a rather periodic distribution with an average spacing of about 500 m. Although each of the two granites has a different geodynamic history, the fracture patterns evolves in a similar way at each scale. At outcrop or core scale, the fracture spacing shows a power law distribution suggesting a fractal organization. At massif scale, the self-similar organization disappears and gives a more periodic image of the structure spacing which follows a lognormal law.