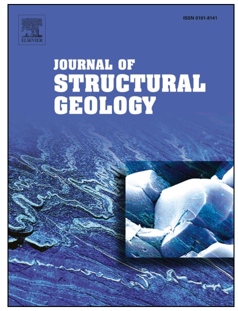
Accepted Manuscript



A km-scale "triaxial experiment" reveals the extreme mechanical weakness and anisotropy of mica-schists (Grandes Rousses Massif, France)

Francesca Bolognesi, Andrea Bistacchi

PII: S0191-8141(17)30279-1

DOI: 10.1016/j.jsg.2017.12.001

Reference: SG 3568

To appear in: *Journal of Structural Geology*

Received Date: 22 July 2017

Revised Date: 19 October 2017

Accepted Date: 1 December 2017

Please cite this article as: Bolognesi, F., Bistacchi, A., A km-scale "triaxial experiment" reveals the extreme mechanical weakness and anisotropy of mica-schists (Grandes Rousses Massif, France), *Journal of Structural Geology* (2018), doi: 10.1016/j.jsg.2017.12.001.

A km-scale "triaxial experiment" reveals the extreme mechanical weakness and anisotropy of mica-schists (Grandes Rousses Massif, France)

Francesca Bolognesi and Andrea Bistacchi

Department of Earth and Environmental Sciences, Università degli Studi di Milano Bicocca, Italy

Abstract

The development of Andersonian faults is predicted, according to theory and experiments, for brittle/frictional deformation occurring in a homogeneous medium. In contrast, in an anisotropic medium it is possible to observe fault nucleation and propagation that is non-Andersonian in geometry and kinematics. Here, we consider post-metamorphic brittle/frictional deformation in the mechanically anisotropic mylonitic mica-schists of the Grandes Rousse Massif (France). The role of the mylonitic foliation (and of any other source of mechanical anisotropy) in brittle/frictional deformation is a function of orientation and friction angle. According to the relative orientation of principal stress axes and foliation, a foliation characterized by a certain coefficient of friction will be utilized or not for the nucleation and propagation of brittle/frictional fractures and faults. If the foliation is not utilized, the rock behaves as if it was isotropic and Andersonian geometry and kinematics can be observed. If the foliation is utilized, the deviatoric stress magnitude is buffered and Andersonian faults/fractures cannot develop. In a narrow transition regime, both Andersonian and non-Andersonian structures can be observed. We apply stress inversion and slip tendency analysis to determine the critical angle for failure of the metamorphic foliation of the Grandes Rousses schists, defined as the limit angle between the foliation and principal stress axes for which the foliation was brittlely reactivated. This allows defining the ratio of the coefficient of internal friction for failure along the mylonitic foliation to the isotropic coefficient of friction. Thus, the study area can be seen as a km-scale triaxial experiment that allows measuring the degree of mechanical anisotropy of the mylonitic mica-schists. In this way, we infer a coefficient of friction $\mu_{weak} = 0.14$ for brittle-frictional failure of the foliation, or 20% of the isotropic coefficient of internal friction.