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

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1 A km-scale “triaxial experiment” reveals the extreme
2 mechanical weakness and anisotropy of mica-schists
3 (Grandes Rousses Massif, France)

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7 **Abstract**

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

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