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Along fault friction and fluid pressure effects on the spatial distribution of fault-related fractures

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Abstract

Whatever the processes involved in the natural fracture development in the subsurface, fracture patterns are often affected by the local stress field during propagation. This homogeneous or heterogeneous local stress field can be of mechanical and/or tectonic origin. In this contribution, we focus on the fracture-pattern development where active faults perturb the stress field, and are affected by fluid pressure and sliding friction along the faults. We analyse and geomechanically model two fractured outcrops in UK (Nash Point) and in France (Les Matelles). We demonstrate that the observed local radial joint pattern is best explained by local fluid pressure along the faults and that observed fracture pattern can only be reproduced when fault friction is very low ($\mu < 0.2$). Additionally, in the case of sub-vertical faults, we emphasize that the far field horizontal stress ratio does not affect stress trajectories, or fracture patterns, unless fault normal displacement (dilation or contraction) is relatively large.

Keywords: faults, fractures, geomechanics, stress, friction, fluid pressure