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STRESS RELAXATION IN FAULT ZONE CAUSED BY LIQUID FILTRATION

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The pore fluid that is in the preparation zone of an earthquake certainly affects the process of stress accumulation and relaxation. However, the filtering effect of the fluid on the relaxation process is almost unknown. The paper deals with the crack located in a saturated permeable medium under the action of dual dipole and bulk compression. In terms of the classical theory of elasticity, the problem of determining the stress-strain state in such cracks is reduced to solving the equilibrium equation with boundary conditions on the sides of the crack and at the infinity. A force couple with some moment is applied to the sides of the crack, whereas at the infinity there is a bulk compression and a force couple of opposite moment, the so-called earthquake model with dual dipole [1]. Solution of this problem provides an opportunity to evaluate the rupture stress on the crack spike. However, the classical model does not take into account the flow of fluid from the area of higher pressure to the area of lower pressure due to filtration. The saturated porous medium is described by a common system of equations of motion and filtering

$$(\lambda+\mu)\,\frac{\partial^2 u_k}{\partial u_i \partial u_k} - \frac{\partial p}{\partial u_i} + \mu \Delta u_i = -f_i;$$

$$\Delta p - \frac{c\,\eta}{kK}\frac{\partial p}{\partial t} = 0,$$

with the same boundary conditions , which are mentioned above. Solution of this problem shows that rupture stresses depend not only on the size of the force couple, but on its rate of growth as well. With a rapid increase of forces due to viscosity the fluid has no time to flow. With a slow increase of the force couple the fluid flows between areas with different environmental hydrostatic pressures, therefore there is relaxation of the shear stress, and the likelihood of a damaging stress decreases.

REFERENCE

1. KASAHARA K. Earthquake mechanics. Cambridge University Press, 1981, 264 p.