Geophysical Research Abstracts, Vol. 7, 03759, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03759

Using striation data to understand the mechanics of faulting in heterogeneous stress fields

J.O. Kaven (1), L. Maerten (2) and D.D. Pollard (1)

(1) Department of Geological and Environmental Sciences, Stanford University, Stanford, USA, (2) IGEOSS, Montpellier, France (kaven@pangea.stanford.edu / Fax:+1 (650)725-0979)

Methods for stress inversion from striation data on single or multiple faults are based on two fundamental assumptions: 1) the remote stress tensor is spatially uniform for the rock mass containing the faults and temporally constant over the history of faulting in that region; and 2) the slip on each fault surface has the same direction and sense as the maximum shear stress resolved on each surface from the remote stress tensor. More than ten years ago it was demonstrated, using an analytical solution to the linear elastic boundary value problem, that the second assumption is faulty: slip and maximum shear stress directions differ because of anisotropy in fault compliance (caused by tipline geometry), anisotropy in fault friction (caused by surface corrugations), heterogeneity in host rock stiffness (caused by Earth's surface, sedimentary layering, etc.), and perturbation of the local stress field (caused by the mechanical interaction of adjacent faults). It is an open question, however, whether the errors introduced by ignoring these natural heterogeneities of Earth's crust lead to significant errors in the stress inversion for particular data sets. We review the published accounts that test the validity of inversions and add to these tests for a number of common fault geometries. The steady progress in the development of numerical methods has supplied the structural geologists with the tools to investigate the influence of the natural heterogeneities and these methods are employed here. Systematic forward models help to better define criteria that can be used to choose appropriate analysis tools for field data. A field example from Chimney Rock, Utah, is used to examine the effect of different faulting mechanisms and the temporal development of the four sets of faults on striation direction.