Estimation of apparent elastic strain of fault-rock

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Elastic deformation is defined that deformation rebounds to its original shape completely when stress is removed, and estimating the elastic strain after stress release is one of unanswerable question. The elastic strain can be found with modulus of elasticity and loading stress. The rocks is composed various mineral grains. If some weak grains deform plasticly with applied stress during elastic deformation, they will become micro stress gauge within apparent elastic body. The obtained stress and elastic modules can estimate the elastic strain.

A calcite is weak mineral, undergo intracrystalline planar dislocation of twinning response to an applied stress, and this twin density has been used for paleo-stress indicator for pure-calcite rock during plastic deformation (e.g. Jamison and Spang, 1976; Rowe and Rutter, 1990; Ferrill, 1998). However it was thought that it was difficult to apply this technique to mixed rock with elastic deformation. It was believed that inner-stress field between pure-calcite rock (plastic deformation) and mixed rock (elastic deformation) differs very much, and later would be too complicated for prediction (Burkhard, 1993). We compared inner-stress field of them using computer simulation model and found the increases of calcite-twin density within mixed rock by tri-axial experiment.

In any cases of computer simulation model, inner-stress fields are complicated even if pure-calcite rock (plastic) not to mention what is mixed rock of rigid grains (elastic). Mean value of multi-points stress is in response to loading stress of whole rock. Tri-axial compression experiment was done using sandstone sample including calcite grains, and the mean value of calcite twin density was proportional to loading stress, except for case of much higher stress after yielding. This multi- point analysis of calcite twin density can be used for stress indicator in mixed grain rock, and obtained stress and elastic modules of the rock can estimate apparent elastic strain.

References

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