Geophysical Research Abstracts, Vol. 8, 02239, 2006
SRef-ID: 1607-7962/gra/EGU06-A-02239

Mechanical anisotropy: a negligible parameter for single layer folding?

T. Kocher (1), S. M. Schmalholz (1), N. S. Mancktelow (1)
(1) Geological Institute, ETH Zurich, 8092 Zurich, Switzerland (kocher@erdw.ethz.ch)

Single layer folds are often formed in a matrix with a pronounced schistosity or a fine layering, which implies a mechanical anisotropy. The infinitesimal and finite stages of folding of a nonlinear viscous layer embedded in a matrix with a layer-parallel anisotropy were investigated using numerical finite element and analytical methods. Anisotropy was found to have a first-order effect on growth rate and wavelength selection, even if anisotropy values are small (normal viscosity/shear viscosity $<$10) and lie within the range of values estimated from natural examples (Bayly, 1970; Hara and Shimamoto, 1984). The effect of anisotropy therefore must be considered when deducing viscosity contrasts from wavelength to thickness ratios of natural folds. Growth rates of single layer folds were found to increase and subsequently decrease during progressive deformation. This is due to interference between the single layer folds and chevron folds that form in the matrix as a result of instability caused by the anisotropic material behaviour. The wavelength of the chevron folds in the matrix is determined by the wavelength of the folded single layer. This overprinting provides an explanation for high wavelength to thickness ratios that are occasionally found in multilayer sequences (Ramsay, 1974). A comparison of the modelled finite fold geometries with natural samples reveals strong similarities in the fold patterns, supporting the conclusion that anisotropy is indeed an important parameter that must be considered in fold analysis. Numerical models including anisotropic material properties provide a method for investigating the behaviour of multilayer sequences without the need for resolution on the scale of individual layers. This is particularly important for large-scale models of layered lithosphere.

References:

Bayly, M. B., 1970. Viscosity and anisotropy estimates from measurements on chevron folds. Tectonophysics 9, 459.

Ramsay, J. G., 1974. Development of chevron folds. Geological Society of America Bulletin 85, 1741-1754.

Hara, I., Shimamoto, T., 1984. Folds and folding. Geological structures. Wiley, Chichester.