

# Deformation Mechanisms, Rheology and Tectonics: Current Status and Future Perspectives

Joe White

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ing with the Paleogene geology of the North Atlantic region. It will be of greatest use to explorationists working in the Faroe-Shetland Basin region. There are several useful papers here for readers wishing to understand some general features of the North Atlantic Igneous Province. However, most papers will only appeal to those with specific interests (for example, dinoflagellates of pre-volcanic strata in West Greenland, genesis of Erland Volcano, emplacement of Faroe-Shetland sill complexes, sediment dispersal patterns in Foinaven Sub-basin, etc). Such readers would be better served by requesting reprints from the individual authors.

## Deformation Mechanisms, Rheology and Tectonics: Current Status and Future Perspectives

Edited by S. de Meer, M.R. Drury, J.H.P. de Bresser and G.M. Pennock

*The Geological Society of London Special Publication No. 200, 2002, 416 p.*  
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Reviewed by Joe White  
*University of New Brunswick*

“The motion and deformation of rocks are processes of fundamental importance in shaping the Earth, from the outer crustal layers to the deep mantle.” This opening sentence sums up the philosophy behind the collection of papers from this, the 25<sup>th</sup> anniversary volume of a series of meetings initiated at a seminal meeting in Leiden, the Netherlands. The *Deformation, Rheology and Tectonics* symposia are held in alternate years and serve to bring together researchers working both at a range of scales (atom to mantle) and with a variety of approaches (experimental deformation, numerical and analogue modeling, textural analysis, field studies) in a single forum. In turn, the related conference volumes have become signposts for the state of integrated process-related deformation research.

Publications resulting from DRT symposia are, of necessity, partial records of the meeting, which reflect those attendees who submit their work. Despite this constraint, the editorial

group has produced a volume that represents the high quality of presentation and discussion typical of these conferences. The volume is prefaced by an excellent review by the editors on the state of research which incorporates the submitted papers and an extensive bibliography. Twenty-two papers are grouped into four contextual sections - the effect of fluids, microstructures and textures, deformation mechanisms and rheology and tectonics. The groupings are wholly appropriate but one can imagine that there were difficulties in deciding the final organization, as the interdisciplinary nature of the contributions makes different combinations equally feasible; for example, alternative ordering by approach or process would have been feasible, each grouping contains papers comprising experiments, numerical models and field/lab studies of naturally deformed material.

Papers addressing the effects of fluids on deformation emphasize interfacial processes that control dissolution, compaction and creep, including the interaction of porosity, permeability and deformation. Neimeijer and Spiers relate the absence of enhanced pressure solution of phyllosilicate-bearing sandstone, contrary to expectation from natural systems, while Gundersen et al. construct numerical models that examine the same problem. Den Brok et al. develop a method for in situ deformation and observation of stressed interfaces and Zhang et al. examine calcite compaction at varying stress and fluid chemistry conditions. Syndeformational chemical effects on vein formation are described for large strains and locally derived fluids (Le Hebel et al.) and basin-wide fluid flow events (Elburg et al.). The complexity of porosity-permeability relationships inherent in the latter regimes is addressed in compaction studies by Zhu et al.

Microstructural studies are weighted toward the understanding of the dynamic evolution and changes in textures through numerical simulations (Jessell and Bons, Piazzolo et al.) or sequential treatment of deformed samples (Heilbronner and Tullis). The importance of textural analysis to interpretation of naturally deformed rocks is reflected in papers by Stipp et al., (quartzites), Liess et al., (amphibolites) and Zucali et al., (glaucofanite).

Laboratory methods in this group of papers include image analysis, electron-backscattered diffraction and X-ray and neutron diffraction.

The ultimate aim of understanding deformation processes is to incorporate them into interpretations of earth rheology. Comparison of experimental and theoretical constraints with observed earth behaviour during subduction is examined by Stockhert; and Burg and Vigneresse review non-linear rheological feedback in partially molten deforming systems. Contributions by Renner and Evans, de Bresser et al., question the general applicability of standard steady-state flow laws to natural conditions and the utilization of simple textural models during the accumulation of large strain (Ter Heege et al.). Analogue modeling of continental lithosphere is presented by Brun, while Wiesmayer et al. describe strain accommodation in Bhutan by progressive fault rotation and Handy and Stünitz propose strain localization by reaction weakening as a method of initiating exhumation of subcontinental mantle.

The Special Publication series of the Geological Society has become a common publication vehicle for structural geology collections including several DRT volumes. The usual high quality of presentation is maintained in this volume. Text and both black-and-white and colour figure reproduction is excellent. The latter reflects the editorial care taken to ensure appropriate graphical representation of such a wide range of research. A presumed perk for the editors was creation from microstructure images of the “fun” synoptic subduction zone that comprises the book cover figure.

This volume, or aspects of it, will appeal to researchers in structural geology, tectonics, geodynamics and materials-oriented geoscientists. In addition to the research, graduate students should find the bibliographic components useful in that they exist in the context of the research i.e., references are not simply a down load of title related to key words. The volume is essential for libraries and will be a standard reference for researchers in the field of deformation processes.