DUCTILE SHEAR ZONES

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Ductile Shear Zones

From Micro- to Macro-scales

Edited by

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Introduction

Kinematics of ductile shear zones is a fundamental aspect of structural geology (e.g. Ramsay 1980; Regenauer-Lieb and Yuen 2003; Mandal et al. 2004; Carreras et al. 2005; Passchier and Trouw 2005; Mukherjee 2011, 2012, 2013, 2014a; Koyi et al. 2013; Mukherjee and Mulchrone 2013; Mukherjee and Biswas 2014; and many others). This edited volume compiles a total of 17 research papers related to various aspects of ductile shear zones.

In the first section "Theoretical Advances and New Methods", **Vitale and Mazzoli** describe an inverse method to deduce the incremental strain path in heterogeneous ductile shear zones, and have applied the method in a wrench zone hosted in pre-Alpine batholiths. Field studies, analog and numerical modeling presented by **Dasgupta et al.** strongly indicate that volume reduction augments transpression in ductile shear zones. In addition, two parameters that control shortening perpendicular to shear zones are defined. **Mulchrone et al.** analytically model steady state and oblique foliation development in shear zones and present the possibility of estimating: (i) the relative strength of foliation destroying processes, (ii) the relative competency of the grains, and (iii) the kinematic vorticity number. **Schrank et al.** analytically model the deformation of inclusions with a hyperelastoviscoplastic rheology under ductile lithosphere conditions, and predict the evolution of the shape of the inclusion. **Mukherjee and Biswas** presented kinematics of layered curved simple shear zones. Considering Newtonian viscous rheology of the litho-layers, they explain how aspect ratios of inactive initially circular markers keep changing.

In the second section "Examples from Regional Aspects", **Boutonnet and Leloup** discuss Quartz strain-rate-metry from shear zones at Ailao Shan–Red River (China) and Karakoram (India) and strain rate variation within these zones. They decipher high slip rates of the order of cm per year from both these zones. Applying Titanium-in-quartz thermobarometry on Scandinavian Caledonides, **Wolfowicz et al.** deduce a geothermal gradient and support a critical taper mechanism of deformation. **Pace et al.** study brittle-ductile shear zones from the Central–Northern Apennines related to frontal and oblique ramps and deduced structural inheritance of extensional faults. **Sengupta and Chatterjee** deduce lower amphibolites facies metamorphism in the Phulad Shear Zone (India). Antithetically oriented clasts indicate a general shear deformation; however, the method of vorticity analysis applied was found unsuitable since the deformation was heterogeneous and the shear zone contains a number of phases of folds. **Chattopadhyay et al.** describe how ductile shear altered the mineralogy, chemistry and texture of rocks from the South Purulia Shear Zone (India). Using phase diagrams, they also constrain the temperature of metasomatism. In a study of ductile shear zones in the Khariar basin (India), **Bhadra and Gupta** decipher two movement phases along the Terrane Boundary Shear Zone. **Mukherjee et al.** review morphology and genesis of intrafolial folds and deduce their Class 1C and Class 2 morphologies from Zanskar Shear Zone from Kashmir Himalaya according to Ramsay's scheme. **Pamplona et al.** classify the Malpica Lamego Ductile Shear Zone into sectors of different deformation patterns, such as sinistral or dextral shear and flattening. Pseudosection studies by **Delpino et al.** for ductile shear zone in the Pringles Metamorphic Complex (Argentina) yield thermal curves. **Kanjanapayont** reviews ductile shear zones in Thailand, presents structural details, and constrains and correlates when they were active. **Takahashi** studies the Nihonkoku Mylonite Zone (Japan) and found that its mylonitization during 55–60 Ma correlates with deformation in the Tanagura Tectonic Line. Flanking structures (Passchier 2001; Mukherjee and Koyi 2009; Mukherjee 2014b, etc.) has recently been of great interest in the context of ductile shear zones. **Goswami et al.** describe the geometry of flanking structures from Arunachal Pradesh, Higher Himalaya, India and use contractional flanking structures to deduce shear sense.

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