EGU2020-10427
https://doi.org/10.5194/egusphere-egu2020-10427
EGU General Assembly 2020

Advances in understanding localised variations in deformation experiments using numerical models

Sebastian Cionoiu[1], **Lucie Tajčmanová**[1], and Lyudmila Khakimova[2]
[1]Universität Heidelberg, Institut für Geowissenschaften, Heidelberg, Germany (sebastian.cionoiu@geow.uni-heidelberg.de)
[2]Skolkovo Institute of Science and Technology, Moscow, Russia

Phase transitions affect the physical properties of rocks (e.g. rheology) and control geodynamic processes at different spatial and time scales. However, the influence of deformation on phase transitions and their coupling is not well understood.
Previous experiments, with both assembly-induced and additionally placed mechanical heterogeneities, have shown patterns in the phase transition distribution. Numerical modelling (2D, viscous finite difference models) have been used to correlate the experimental observations with the mechanic stress state. The locally increased mean stress in the models shows the best correlation with the formation of high-pressure polymorphs in experiments (Cionoiu et al. 2019).
Besides the distribution of polymorphs, grain-size and deformation patterns also vary across the samples due to stress, strain and pressure variations. To better understand the mechanisms contributing to these variations, we used advanced numerical models (3D, viscoelastic) to calculate the local distribution of first order parameters as pressure, stress and strain. The modelled stress and strain patterns are compared to the experimentally produced phase transformation distribution and previous (2D) modelling results. The 2D and 3D models differ partially regarding the quantification of local stresses – an effect that mainly depends on sample geometry (coaxial vs. general-shear). However, the qualitative fit between experiments, 2D and 3D models persists (i.e. the localisation of increased stresses or strain).
This contribution shows how numerical models, that closely represent the sample, can further improve the understanding of processes occurring in deformation experiments. Our new results emphasize that mechanically-induced stress-variations influence the grain-size and mineralogy of rocks which feeds back on their rheology.

References:
Cionoiu, S., Moulas, E. & Tajčmanová, L. Impact of interseismic deformation on phase transformations and rock properties in subduction zones. Sci Rep 9, 19561 (2019)