EGU22-3252
https://doi.org/10.5194/egusphere-egu22-3252
EGU General Assembly 2022

Fold and thrust belts in an intraplate setting- An interplay between rheology and inherited deep structures.

Tasca Santimano and Russell Pysklywec
University of Toronto, Department of Earth Sciences, Toronto, Canada (tasca.santimano@utoronto.ca)

Fold and thrust belts and prominent orogens are found primarily along continental plate boundaries. Our knowledge of how these orogens are formed is based on the deformation of the upper crust. However, continental interiors also exhibit fold and thrust belts that may not be related to plate boundary collision. In these intraplate settings, structural heterogeneities in the deep lithosphere have been identified as an important factor in the formation of these belts. Particularly, inherited deep zones of weakness may initiate orogenesis in continent interiors. Aside from structural heterogeneity, the rheological strength of the lithosphere also has a primary role affecting the kinematics of deformation in the lithosphere. To investigate the interplay of rheology and pre-existing structures, we designed a set of physical scaled analogue experiments in a convergent setting that tests (a) the presence and absence of a pre-existing weak zone in the lithospheric mantle and (b) the effects of the rheological strength of the lithospheric mantle. The tectonic evolution of the model is recorded to acquire a time series data set of the velocity field, strain in the model, and the development of structures in the upper crust. Results show that a weak zone in the lithospheric mantle allows deformation to be accommodated by displacement along this zone and is transferred into the overlying lower and upper crust, regardless of lithosphere strength. In contrast, a model absent of a weak zone accommodates deformation by folding and thickening of the viscous layers. The viscous lithosphere in models with a strong lithospheric mantle tends to buckle creating a sequence of brittle faults in the upper crust. Specifically, the rheology of the lithosphere dictates the distribution of strain. Our results are further used to interpret the genetic formation of an intracontinental fold and thrust belt found on Ellesmere Island in the Canadian Arctic Archipelago.