Modeling the dynamics of basin subsidence following the lateral accretion of cratons

K Kublik[a]

[a] *Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton AB, Canada*

Despite being a major source of the world's gold, uranium, and diamonds, the formation of cratonic basins early in the history of craton evolution is poorly understood. Subsidence in these Neoarchean to Paleoproterozoic basins, typically prolonged over 100's of millions of years, is thought to begin shortly after cratonization – the lateral assembly of cratonic nuclei into larger cratonic masses. Regardless of how cratons form, the dynamic processes involved likely determine the details of basin development.

In our 2D thermal-mechanical numerical models (using SOPALE), a block of lithospheric material representing depleted peridotite, more buoyant and stronger than the rest of the mantle lithosphere, is thickened during compressional tectonics to simulate craton formation. Preliminary results show that widespread topographic subsidence, lasting at least 500 Myr, is possible after this compressional event. However, small changes to the rheology of the lithosphere can significantly alter geometries observed at the end of the 50 Myr compression phase. In the thickened block of cratonic lithosphere, a central platform above the chemically depleted lithosphere is resistant to surface deformation, and most of the shortening is accommodated by weaker surrounding lithosphere. This effect is amplified if the density of the depleted lithosphere is lower than the sublithospheric mantle. Shortening that is more evenly accommodated across the entire model width is observed in scenarios with increased crustal strength. The potential for subsequent basin subsidence is likely sensitive to these variations in the post-compression geodynamic environment. We are searching for models that lead to 4-8 km subsidence in basins at least 1000 km wide, similar to preserved Neoarchean and Paleoproterozoic cratonic basins.

Corresponding author: kkublik@ualberta.ca