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3D Modeling of Crust-Mantle Dynamics on Cratonic Regions: Implications for the Deformation of North China Craton

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A number of geological, geochemical and seismological studies suggest that cratonic lithospheres may be associated with thinning and destruction. For such unique plate configurations, the most well-known example is the North China craton. Geological studies suggest that during the Mesozoic era (120-80 Ma), a surge of magmatism occurred across the North China Craton as a response to the removal of the portions of the lithosphere beneath it. However, the question of which processes control lithospheric thinning/removal is yet to be understood. The one that is the subject of this study is the deformation controlled by gravitational instabilities (convective removal), that develop because of density variations between the lithosphere and the underlying sub-lithospheric (asthenospheric) mantle.

In accordance with numerical model predictions conceptual geological hypotheses are inferred to invoke the phase transitions in the lower crust and densification of this layer through the transformation of the basalt to eclogite during late Jurassic where Pacific flat-slab subduction led to shortening in the continental back arc (e.g Andean type tectonics). The removal event possibly occurred following the plate shortening during Early Cretaceous and various surface geological features, for instance, normal faulting/extension and pull apart basins and are interpreted in the context of coupled crust-mantle dynamics. This research aims to facilitate new 3D modelling strategies to further explain how large-scale plate geodynamics may account for the geological-geophysical fingerprints of destruction at North China Craton. The problem of deformation of the North China Craton will be approached on a much broader aspect including the extensional events that took place in Cretaceous. The overarching goal of this work is to explain the first order geodynamic mechanism that possibly constrain the craton destructions not only under North China but also other areas where such mechanism has been postulated (e.g North America, South Africa).