Geophysical Research Abstracts
Vol. 16, EGU2014-11218, 2014
EGU General Assembly 2014

Evidence for formation of metamorphic core complexes without pre-thickened crust in North China Craton

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Initially thickened orogenic crust is often regarded as a crucial precondition for formation of metamorphic core complexes (MCCs). However, numerous doubts are raised on applicability of this scenario to the formation of MCCs within normal crust during Mesozoic to early Cenozoic in North China Craton (NCC). In eastern NCC, no high pressure metamorphism has been reported before and during formation of the MCCs, and no trace of any suture zone following the trend of the extension zone has been described. In the meantime, widespread syn-tectonic plutons and still unclear mechanisms of cratonic destruction make the tectonic setting of NCC quite enigmatic. Recently, different multi-disciplinary researches have largely contributed to build a database on structural and lithological constrains, together with rheological and paleo-thermal state that provide an opportunity to extend the survey region. We therefore implement 2-D numerical thermo-mechanical modelling approach to investigate the possibility, as well as first-order controlling parameters for formation of MCC in normal crust. In the experiments, we set the initial Moho depth to a normal value of 35km and consider low lithospheric extension rates (< 1cm/y) corresponding to the observed highly limited lithospheric stretching in Late Mesozoic. Considering Moho temperatures derived from the surface heat flux recorded by vitrinite reflectance, we test three different thermal profiles and explore the influence of rheological structure on lower crust and lithospheric mantle deformation. The experiments demonstrate the possibility of MCC development under "hot" conditions of normal crust in case of slow extension rates. Due to the low Péclet numbers characterizing this specific situation, the predicted PT paths are quite different from those inferred for other known MCCs, just confirming the particularity of the NCC case. We show that the synthetic model data are in good correlation with the geological field observations, cooling history based on thermochronology data and with Moho geometry derived from gravity data. This model provides insights on the mechanisms and process of large scale continental extension and cratonic destruction.