



Formation mechanisms of the Songliao basin, China and its relationships to the exhumation of an Upper Jurassic to Lower Cretaceous metamorphic core complex

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Based on the finding of major low-grade metamorphic ductile strike-slip and low-angle normal shear zones along the western margin of the Songliao basin (NE China), representing part of an exhumed metamorphic core complex, we propose a new model of formation mechanisms of the Songliao basin, namely, a coupled Late Jurassic to Early Cretaceous Cordilleran-style metamorphic core complex (MCC) and Songliao basin origin of this system. New $^{40}\text{Ar}/^{39}\text{Ar}$ biotite and muscovite ages from the shear zones range from 144.06 ± 0.55 Ma to 117.37 ± 0.43 Ma and are contemporaneous with the syn-rift phase of basin. These ages indicated two main stages exhumation-related shearing, which were separated by a ~ 130 Ma-strike-slip shearing stage. The syn-rift basin fill starts with Upper Jurassic acidic volcanic rocks, which responded to the early uplift of MCC. The bimodal basaltic/acidic volcanic successions, above an asymmetrically located asthenospheric dome beneath the southeastern Songliao basin, terminated the rift stage and started the thermal subsidence stage, which is uniform with second exhumation stage. Combined with published reflection seismic and other geophysical data, we recognize a series of halfgrabens, basically E-dipping normal faults merging to a master detachment, which is exposed to the west, which also led to thinning of the entire crust beneath the present-day Songliao basin.

We investigated a few of low-grade metamorphic ductile strike-slip and low-angle normal shear zones along the western margin of the Songliao basin (NE China), representing part of an exhumed metamorphic core complex. We propose an origin of the coupled Cordilleran-type metamorphic core complex/Songliao basin system during the Late Jurassic to Early Cretaceous leading to the formation of Songliao basin and easternmost Da Xing'an Mountains and a series of halfgrabens confined by E-dipping normal faults merging to a master detachment at depth. The extensional system also led to asymmetric thinning of the entire crust beneath the present-day Songliao basin, even beneath the whole East China. The strong extension event affected entire NE China and Far east SE Siberia and occurred during Late Jurassic to Early Cretaceous, and originated in a subduction process of Paleo-Pacific plate.

The study was funded by the NSFC (Grant 40739905), Research Fund for Doctor Education of China Education Ministry (Grant 200801830041), Strategic Research Center of Oil & Gas Resources (Grant 2009GYXQ12), and China Scholarship Council (Grant 2008617114).