Geophysical Research Abstracts
Vol. 14, EGU2012-7775-1, 2012
EGU General Assembly 2012

Early Cretaceous extension in northern Asia and Paleo-Pacific plate kinematics

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Structural studies of three representative objects in eastern Mongolia outline different deformation modes that operated during the late Mesozoic large-scale extensional event in northeastern Asia: (1) ductile crust exhumation through metamorphic core complex formation, (2) emplacement of syn-thinning granitic intrusions in the middle-upper crust, and (3) horst and graben system development in uppermost parts of the crust. Recent 40Ar/39Ar and U-Pb geochronological data suggest that extension started at least at ca. 138 Ma. Numerous models have interpreted the late Mesozoic extension in northeastern Asia in terms of gravitational collapse of a previously tectonically thickened lithosphere. The main feature that may suggest pre-extensional crustal thickening in the region is the Mongol-Okhotsk suture zone that extends from central Mongolia to the Sea of Okhotsk in Far East Russia and that was interpreted as the trace of an oceanic domain closed at the Jurassic-Cretaceous transition. However, no field evidence of crustal thickening is observed and documented throughout eastern Mongolia. Moreover, horst and graben structures, together with the occurrence of extensional deformations both north and south of the Mongol-Okhotsk suture zone argue against interpretations in terms of post-thickening collapse. On the other hand, the onset of late Mesozoic extension in northeastern Asia may be discussed in the light of the closure of the Mongol-Okhotsk ocean and of major changes in kinematics of the paleo-Pacific domain, in particular a change in the subduction direction of the Izanagi oceanic plate from quasi orthogonal to the eastern Asia margin to strongly oblique, around 155-140 Ma. These major kinematic changes might have increased the sinistral wrenching components with respect to thrusting ones along the subduction zone, a feature that might have favoured slab roll-back. We propose that late Mesozoic extension in northeastern Asia might result from a drop in compressive stresses at the boundary of a hot continental lithosphere.