Geophysical Research Abstracts
Vol. 13, EGU2011-13627-1, 2011
EGU General Assembly 2011

Models of orogeny in Tibet and Pamir

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Despite of significant achievements in modeling of the orogeny in Tibet, clearly lacking are the models employing realistic composition and rheology of the lithosphere without kinematically predefined motion of mantle. In order to fill this gap at least partially and in search for an appropriate model setup and optimal technique for further modeling in the framework of the TIPAGE project, we have performed a number of numerical tests focusing at the following questions:

- What should be the structure of lithosphere of greater India to fulfill new paleomagnetic data suggesting about 1500 km of shortening of India during 50-55 Mln years of collision, together with seismic images suggesting less than 1000 km of understrusted Indian lithosphere beneath Asia?
- Which view on timing of Tibet uplift is more plausible from modeling perspective, view that Tibet was uplifted during the last 20 Mln years due to delamination of mantle lithosphere, or more recent idea of early (>40 Mln years old) high plateau expanding to the North and South?
- What is the reason of strong heating and partial melting of the crust of Tibet and Pamir and why domes are more common in Pamir than in Tibet?
- What is the force that is required to drive orogeny in Tibet?

We perform a 2D thermomechanical modeling using two different numerical techniques based on explicit (LAPEX) and implicit (SLIM) integration algorithms. In both methods we use same visco-elasto-plastic temperature- and stress-dependant rheological models, constrained by published laboratory data.

Modeling suggests that about 500-700 km of outer part of Greater India had relatively thin (<120 km) and not much depleted (similar to oceanic harzburgites) lithosphere. This lithosphere likely broke off from the thicker and more depleted inner part of Greater India that presently underthrusts Asia. All models support early formation of high plateau and suggest that force required to build Tibet is at least 2 times larger than recently published estimates.

We will also present models and discuss issues of crustal heating and doming in the crust of Tibet and Pamir.