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# First results of 2D Thermo-mechanical modelling of Cenozoic lithospheric deformation in the Himalaya-Tibet-Pamir-Tien Shan orogen

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Earth's most impressive and frequently studied orogeny, which was induced by the ongoing continent-continent collision of India and Eurasia, is the Himalayan orogeny. The collision, starting at around $55$ Ma gave rise to the Tibetan plateau, the largest highest plateau of the world, with an average elevation exceeding $5000$ m.

One of the mountain ranges of the Himalayan-Tibet orogenic belt is the Pamir-Tien Shan, which accumulates the largest strain of the entire orogenic system and hosts the Earth's most important active intra-continental subduction zone. The Tien Shan and Pamir collision zones are studied by a series of geophysical experiments within the framework of the multi-disciplinary *Tien Shan - Pamir Geodynamic Program*.

As participants of the program, our aim is to find controlling factors for continent-continent collisions with the help of 2D (and later on 3D) thermo-mechanical models and to integrate the geologic-geophysical work of TIPAGE. For this approach the finite-element code SLIM3D (Popov and Sobolev, 2008) is used, which allows coupled thermo-mechanical treatment of deformation processes and is capable of highly non-linear visco-elasto-plastic rheology, allowing self-consistent generation of faults as well.

We hereby present our current model setup which is used to study the initiation of intra-continental subduction. The size of the model is $3000$ km N-S and $400$ km in depth with a resolution of $5$ km. Given that our experiments are starting at $45$ Ma and the postcollision shortening within Asia is well beyond $1000$ km, we are using the "moving window" technique which has been used before in (Sobolev and Babeyko, 2006) to follow the center of collision, while the Indian plate is advancing.

The Indian plate in our model consists of a strong central part, plus a postulated northern extension which is weaker and already subducted in present time.

We will be running different model setups for N-S cross sections in the Pamir region of Eurasia, including sections through the major tectonic features, the Tajik basin and the strong archean Tarim block. The latter one will be studied in several section with different versions of size, growing larger from west to east.

Boundary condition for the left side are dynamic-velocity values taken from paleoreconstructions in (Molnar and Stock, 2009) while the right side is closed and free slip condition is applied. The bottom of the model has been left open and true free surface is applied on top.

We also implemented gabbro-eclogite, coesite-stishovite phase transitions which are playing an important role in the lower crust of the upper plate and in the crust of the subducting plate, respectively. We also applied a realistic rheology which is constantly adjusted to recent research results.

The experiments are performed at the moment and their results will be presented at the EGU.

In future another major aim is to include erosion and sedimentation routines in the model, given that climate has a profound effect on tectonics which seem to be generally underestimated. This will be done with the help of a new 2D-erosioncode which is currently in development as part of the Theme (II) (CRP-collaborative research project 6) inside TIPAGE.