Modeling subduction of the continental crust at the Andean type convergent margin

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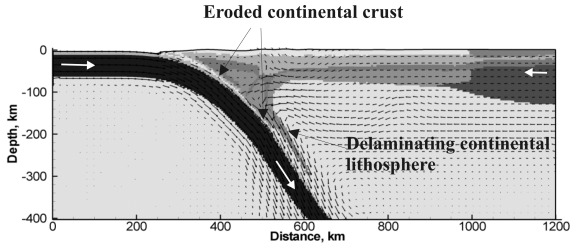
Andean-type orogenic belts are commonly considered as accretion orogens, i.e. regions where the continental crust is added rather than subtracted. However it is not true for the high central Andes, where it is known that more than 200 km of the continental margin has disappeared since Jurassic times, and where most of mafic lower crust and mantle lithosphere is missing under the Altiplano and Puna plateaus [1].

Using thermomechanical, numerical modelling of the dynamic interaction between subducting and overriding plates that replicates well the tectonic evolution of the Central Andes [2], we consider processes leading to the subduction of the continental crust and discuss their consequences.

One of those processes is subduction erosion, which strongly modifies structure of the upper-plate margin. We show that about half of eroded felsic crust is subducted to and accumulated at a depth up to 100 km (see Figure). Part of this crust is then diapirically uplifted to the middle-crust depths. The model-predicted structure is consistent with reflection seismic data [3] and seismic tomography [4].

Another process is delamination of the lower crust and mantle lithosphere, driven by gabbro-eclogite transformation in the thickening lower crust (see Figure). The delaminating lithosphere interacts with subduction-zone corner flow, influencing both the rate of tectonic shortening and magmatic-arc productivity causing an anti-correlation between those two processes. The related model-predicted structure is also consistent with seismic tomography [4].



References

[1] Yuan, X., Sobolev, S.V., and Kind, R. (2002) *Earth Planet. Sci. Lett.* **199**, 389-402.

[2] Sobolev, S.V. and Babeyko, A.Y. (2005) *Geology* **33**, 617–620.

[3] Oncken, O. et al. (1999) *Nature* **397**, 341-344.

[4] Koulakov, I, Sobolev, S.V. and Asch, G. *Geophys. J. In*t, in press.