Geophysical Research Abstracts
Vol. 19, EGU2017-10287, 2017
EGU General Assembly 2017

Impact of the overriding plate rheology on convergence zone dynamics.

Solenn Hertgen (1,2), Philippe Yamato (1,2), Benjamin Guillaume (1,2), and Jeroen van Hunen (3)
(1) Université de Rennes 1, Géosciences Rennes, Rennes, France , (2) CNRS, UMR 6118, Rennes Cedex 35042, France, (3) Department of Earth Sciences, Durham University, Science Labs, Durham DH1 3LE, UK

Most of deformation at the Earth's surface is localized at plate boundaries. This deformation can be accommodated in very different ways depending on the tectonic setting. In the case of convergence zones, the deformation is typically simplified and classified as follows:
- intra-oceanic convergence, when convergence involves two oceanic lithospheres, which generally leads to the subduction/obduction initiation and to the formation of an island arc;
- convergence between an oceanic and a continental lithosphere, which is mainly accommodated by subduction and can lead to the formation of a mountain range at the plate boundary;
- convergence involving two continental lithospheres, which is accommodated by collision and leads to the formation of a mountain range produced by the stacking of crustal slices.
Different materials are thus involved (i.e. oceanic crust, continental crust, sediments). Depending on the context (oceanic or continental subduction), they can form contrasted structures in terms of units size, morphology and metamorphism (e.g., Alps vs. Andes/Altiplano-Puna). Moreover, some convergent zones with apparently similar tectonic settings (e.g., continent/continent convergence) show very different patterns of deformation with either very localized deformation (e.g., the Alps) or, at the opposite, deformation distributed over thousands of kilometers (e.g, Himalayas/Tibet). Finally, other convergent zones from different tectonic settings seem to show similar structures (e.g., Tibet plateau and Altiplano-Puna plateaus).

Although the mechanism of plate convergence appears to be the same in each case, the structures obtained at the surface seem to be unique. Rheology of both the subducting plate and of the plate interface is known to influence the convergence zones dynamics. However, very few studies have addressed the role of the overriding plate rheology in details, while it may also exert a large control on the deformation style at plate boundaries.

In this study, we therefore focus on the influence of the overriding plate rheology on the convergence zones dynamics. For this, we use both 2D and 3D thermo-mechanical numerical models, in which the rheological properties of both the lithosphere and the crust of the overriding plate are tested vertically but also laterally. This complementary approach allows us to test the effects of numerous parameters controlling the rheological structure (i.e. nature of the material, thickness, convergence velocity, initial thermal structure) on the convergence zone dynamics and on the deformation style occurring at plate boundaries.