Geophysical Research Abstracts
Vol. 19, EGU2017-14817, 2017
EGU General Assembly 2017

Subduction starts by stripping slabs

Mathieu Soret (1), Philippe Agard (1), Benoît Dubacq (1), Cécile Prigent (2), Alexis Plunder (3), Philippe Yamato (4), and Stéphane Guillot (2)

(1) Sorbonne Universites, UPMC Univ. Paris 06, CNRS, Institut des Sciences de la Terre de Paris (ISTeP), 4 place Jussieu, 75005 Paris, France, (2) Univ. Grenoble Alpes, CNRS, ISTerre, F-38000 Grenoble, France, (3) Department of Earth Sciences, Utrecht University, Heidelbeglaan2, 3584CS Utrecht, The Netherlands, (4) Geosciences Rennes, Universite de Rennes 1, CNRS UMR 6118, F-35042 Rennes Cedex, France

Metamorphic soles correspond to tectonic slices welded beneath most large-scale ophiolites. These slivers of oceanic crust metamorphosed up to granulite facies conditions are interpreted as having formed during the first My of intra-oceanic subduction from heat transfer from the incipient mantle wedge towards the top of the subducting plate.

Our study reappraises the formation of metamorphic sole through detailed field and petrological work on three classical key sections across the Semail ophiolite (Oman and United Arab Emirates). Geothermobarometry and thermodynamic modelling show that metamorphic soles do not record a continuous temperature gradient, as expected from simple heating by the upper plate or by shear heating and proposed by previous studies. The upper, high-temperature metamorphic sole is subdivided in at least two units, testifying to the stepwise formation, detachment and accretion of successive slices from the downgoing slab to the mylonitic base of the ophiolite. Estimated peak pressure-temperature conditions through the metamorphic sole are, from top to bottom, 850˚C – 1GPa, 725°C – 0.8 GPa and 530°C – 0.5 GPa. These estimates appear constant within each unit but separated by a gap of 100 to 200˚C and $\sim$0.2 GPa. Despite being separated by hundreds of kilometres below the Semail ophiolite and having contrasting locations with respect to the ophiolite ridge axis, metamorphic soles show no evidence for significant petrological variations along strike.

These constraints allow to refine the tectonic-petrological model for the genesis of metamorphic soles, formed through the stepwise stacking of several homogeneous slivers of oceanic crust and its sedimentary cover. Metamorphic soles do not so much result from downward heat transfer (ironing effect) but rather from progressive metamorphism during strain localization and cooling of the plate interface. The successive thrusts are the result of rheological contrasts between the sole (initially at the subducting slab) and the peridotite above as the plate interface progressively cools down. These findings have implications for the thickness, the scale and the coupling state at the plate interface during the early history of subduction/obduction systems.