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First pressure- and temperature estimates of the metamorphic sole of the Pinarbasi ophiolite, central Turkey

Kalijn Peters (1), Douwe van Hinsbergen (2), Herman van Roermund (3), Fraukje Brouwer (4), and Martyn Drury (5)

(1) Utrecht University, Utrecht, Netherlands (M.K.Peters@uu.nl), (2) Utrecht University, Utrecht, Netherlands (D.J.J.vanHinsbergen@uu.nl), (3) Utrecht University, Utrecht, Netherlands (H.L.M.vanRoermund@uu.nl), (4) VU University Amsterdam, Amsterdam, Netherlands (fraukje.brouwer@vu.nl), (5) Utrecht University, Utrecht, Netherlands (M.R.Drury@uu.nl)

Ophiolites are interpreted as remnants of oceanic lithosphere. Many have a so-called supra-subduction zone (SSZ) geochemical signature, suggestive of formation at a spreading ridge overlying a subduction zone. Supra-subduction zone ophiolites frequently have a several-hundred-meter thick sequence of metamorphic rocks below their mantle section: the metamorphic sole. These dominantly mafic and generally heavily sheared metamorphic rocks have been shown to preserve an inverted metamorphic gradient with the highest pressures and temperatures at the top of the sole, decreasing downwards. Pressure estimates from rocks found at the top of metamorphic soles may be as much as 10-15 kbar with temperature estimates up to 875°C. The metamorphic grade varies from greenschist near the base, up to granulite facies at the top, with the bulk comprising of amphibolite facies rocks. At some locations a blueschist overprint of the amphibolite facies mineral assemblages has been described. The relative high pressures preserved in the metamorphic sole cannot simply result from overburden pressure of the currently overlying ophiolite, which is a long-standing problem.
This raises the question of what process(es) can explain pressures up to 10-15 kbar in the top of metamorphic soles, in relation to the approximately synchronous formation of the SSZ oceanic lithosphere above the sole.

One of the places to study the formation of SSZ ophiolites and their metamorphic soles is the Neotethyan Suture zone. Remnants of Neotethyan lithosphere are preserved as ophiolites that are discontinuously exposed from the Mediterranean region through the Himalaya to SE Asia. Supra-subduction zone ophiolites are particularly widespread in Turkey. The Pinarbaşi ophiolite is located in the SE of Central Anatolia, and overlies the Tauride fold-and-thrust belt that formed since the Late Cretaceous. It comprises mantle tectonites consisting of serpentinized harzburgite and dunite with remnants of gabbro to the top, cross-cut by felsic dikes. The mantle tectonites are highly brecciated at the bottom, near the contact with the metamorphic sole. The ophiolite is less than 3 km thick.
A well-preserved metamorphic sole structurally underlies the mantle tectonites and consists in ascending order of non-metamorphic rocks, sheared and foliated greenschists, amphibolites, and garnet-amphibolites. The greenschist facies rocks are foliated and folded. The amphibolite is well foliated and has asymmetric isoclinal folds and a lineation defined by amphibole crystals. It is fine-grained at the bottom and coarser at structurally higher levels with up to 8 mm garnet porphyroblasts near the contact with the mantle tectonite. The lower-grade rocks at the base of the sole are predominantly metasediments, whilst the (garnet-) amphibolites mostly appear to be of magmatic origin. The sole is between 200 and 300 meters thick and is laterally discontinuous, at least in part due to late brittle faulting. The metamorphic sole overlies a tectonic mélange that separates the ophiolite and the sole from Tauride carbonate platform rocks.
In this presentation we will show preliminary results constraining the PT-conditions for the different levels in the metamorphic sole underneath the Pinarbaşi ophiolite to define the formation mechanism of the sole in relation to the overlying SSZ ophiolite.