Two-layered Neo-Tethyan oceanic lithospheric mantle in a Tibetan ophiolite, China

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Closure of the Neo-Tethyan ocean between India and Asia built the >2000 km-long Indus-Yarlung Zangbo suture (IYS) in S. Tibet (China), including a series of large spinel-facies peridotite massifs. The discoveries of natural ultrahigh-pressure and super-reduced (UHP-SuR) phases in the massifs suggest unusual geodynamics in the Neo-Tethyan mantle [1]. Here, we report results from systematic petrological, mineral composition and Sr-Nd-Hf isotopic investigations of the Zedang peridotite massif in the IYS.

Petrographic mapping shows that the Zedang peridotite massif mainly contains lherzolites in the west and harzburgites in the east. The lherzolites display strong plastic deformation and exsolution within pyroxenes, while the harzburgites are relatively undeformed. Whole-rock and mineral chemistry suggests a dichotomy between the fertile lherzolites and depleted harzburgites (spinel Cr# = 0.17-0.30 *versus* 0.33-0.62). Temperature estimates show that porphyroblasts in lherzolites equilibrated at temperatures (up to 1260 °C) ~200-300 °C higher than those in harzburgites. Trace-element compositions of the harzburgitic minerals suggest metasomatism by pervasive melts with local channelized melts, while the lherzolites do not. These lines of evidence indicate that the harzburgites formed earlier and were cooled in the Neo-Tethyan basin, before the lherzolites underplated the harzburgites. Nd-Hf isotopes constrain the time of lherzolite accretion and melt metasomatism to ~120 Ma, consistent with the regional intrusion of mafic dykes into the Yarlung Zangbo ophiolites. The enrichment of fluid-mobile elements, radiogenic Sr ratios and similar cooling processes in both lherzolites and harzburgites imply they were finally emplaced together onto the continental margins.

The two-layered Neo-Tethyan lithospheric mantle identified in this study for the first time has important implications for the origins and preservation of UHP-SuR phases in the Yarlung Zangbo ophiolites.

[1] McGowan et al. (2015) *Geology* **43**, 179-182.