Episodic subduction of Tethyan slabs recorded in a Tibetan ophiolite

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The Yarlung Zangbo (YZ) ophiolites in south Tibet (China) provide rare examples to investigate the upper mantle down to ~410-660 km. However, diverse debates remain on their origin, upper-mantle processes and related tectonics in the Neo-Tethyan Ocean. Here, we present a substantial investigation of a representative ophiolite (Zedang) in the eastern YZ suture, combining petrological, microstructural and geochemical data of systematically sampled ultramafic-mafic rocks[1,2].

The Zedang ultramafic body comprises a lherzolite domain in the northwest and a harzburgite domain with enclosed dolerite dykes and dunite-chromitite pods in the southeast. Petrographic and thermal characteristics and geochemical compositions of whole rocks and minerals indicate that the harzburgite domain is depleted, colder and experienced melt metasomatism related to the intrusion of dolerite dykes at ~130-120 Ma, while the lherzolite domain is fertile, hotter, lacks such metasomatism, and represents the melting residue complementary to the mafic intrusions. Microstructural and chemical features of high- and low-Cr chromitites and dunites in the harzburgite domain suggest that some high-Cr chromitites with exsolved needles of diopside were exhumed from the Mantle Transition Zone to lithosphere in a mature supra-subduction zone (likely Jurassic), accompanied by the generation of other high-Cr chromitites in the shallow part of this subduction system. The low-Cr chromitites and dunites formed by rapid interaction between forearc basaltic magmas and the harzburgite domain in a dynamically extended, incipient forearc during the early Cretaceous, together with the lherzolite subcretion, melt metasomatism and mafic-magma intrusion in the Jurassic-accreted harzburgite lithosphere.

This study illustrates a two-stage lithospheric accretion process resulted from episodic subduction of Tethyan slabs, different from previous models: either as one-stage accretion in mid-ocean ridges or subduction-related spreading centers, or two stages from a mid-ocean ridge to a subduction system.

[1]Xiong et al. (2016) *EPSL* 438, 57-65. [2]Xiong et al. (2017) *G-cubed*, 18, doi:10.1002/2016GC006681.