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How to identify the Chapman-type oceanic lithosphere in ophiolites?

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Unlike fast-spreading ocean ridges, low magma supply at at slow- to ultraslow spreading ridges is conducive to the development of detachment faults, leading to the formation of oceanic lithosphere that is distinctly different from the well-accepted Penrose model of crustal structure. Such kinds of ocean lithosphere have been termed as Chapman-type and are characterized by formation of oceanic core complexes, occurrence of tectonized and heterogeneous lithosphere, extensive exposure of gabbro and serpentinized mantle, and formation of featured hydrothermal and ecological systems [1]. How to identify the Chapman-type ocean lithosphere in the ophiolites remains unclear. Different methods have been ulitized, including structural geology, paleomagnetism, petrology and geochemistry. In the past decade, our group have conducted petrological studies on the mantle rocks and gabbros outcropped in the Yarlung-Tsangpo ophiolite, Tibet. Gabbronorite veins in the mantle peridotites were derived from parental magmas formed through partial melting of serpentinized mantle [2]. Moreover, lower crustal gabbros show rhythmic variations in geochemical compositions [3], resembling the phenomena discovered in the drilled gabbros from the Atlantis Bank ocean core complex. These petrological evidences supports that the Yarlung-Tsangpo ophiolites are Chapman-type ophiolites, which were formed at slow- to ultraslow spreading ridges.

[1] Escartin & Canales, 2010, EOS; [2] Liu et al., 2014, Lithos; [3] Liu et al., 2021, Journal of Geological Society