Origin and evolution of Yarlung Zangbo ophiolites: evidence from HSE abundances and Re-Os isotopes of ophiolitic peridotites

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The ophiolites occurring along the Yarlung Zangbo suture zone (YZSZ) have been widely believed as the remnants of Neo-Tethyan oceanic lithosphere [1]. However, the detailed processes from birth to death of the Neo-Tethys ocean remain unclear. In an attempt to reconstruct the Neo-Tethyan history, we utilized highly siderophile element (HSE) abundances and Re-Os isotopes to study more than 70 ophiolitic mantle peridotites from 4 localities ranging from the west (Purang) to the east (Langxian) of the YZSZ. Combined with petrological and other geochemical data of the ophiolitic peridotites (including those from another 4 localities reported in literature), the primitive upper mantle-normalized HSE patterns of all these rocks are essentially similar to global abyssal peridotites, implying that the Yarlung Zangbo opholites (YZO) most likely formed from the Neo-Tethyan spreading centers. Nevertheless, the Os isotopic compositions suggest that both eastern and western YZO contain a significant additonal portion of ancient mantle materials (T_{RD} > 1.5 Ga up to 3.5 Ga), which are rarely observed in the central YZO. Such discrepancies might not be simply explained by the Os isotopic heterogeneity of oceanic lithospheric mantle. There are two probable models proposed to interpret these old mantle relics: (1) by incorporating sub-continental lithospheric mantle (SCLM) fragments from Gondwana supercontinent when the Neo-Tethys ocean opened; (2) by capturing SCLM materials from the Lhasa terrane during the emplacement of YZO. Considering that the second model can be achieved by strong mixing or mingling in subduction channel processes which are not yet found in YZO, we tend to agrue that the break-up of Gondwana primarily led to the opening of the Neo-Tethys ocean and brought in some ancient mantle materials to these ophiolites before they obducted to the southern margin of Eurasia continent, which is consistent with the origin of Luobusa chromitites [2] and the discovery of diamonds and ultrahigh-pressure minerals in YZO [3].

References: [1] Hébert et al., 2012. Gond. Res. 22, 377-397. [2] Shi et al., 2012. Geol. Rev. 58, 643-652. [3] Yang et al., 2007. Geology 35, 875-878.