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Ocean-continent Transition to Suprasubduction Zone Origin of the Western Yarlung Zangbo Ophiolites in SW Tibet, China: Multi-stage, Transient Evolution of the Neotethyan Oceanic Lithosphere

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1 Abstract

The ophiolites that crop out discontinuously along the ~2000 km Yarlung Zangbo Suture zone (YZSZ) between the Nanga Parbat and Namche Barwa syntaxes in southern Tibet represent the remnants of Neotethyan oceanic lithosphere (Fig. 1a). We have investigated the internal structure and the geochemical makeup of mafic-ultramafic rock assemblages that are exposed in the westernmost segment of the YZSZ where the suture zone architecture displays two distinct sub-belts of ophiolitic and mélange units separated by a continental Zhongba terrane (Fig. 1b). These two sub-belts include the Daba – Xiugugabu in the south (Southern sub-belt, SSB) and the Dajiweng – Saga in the north (Northern sub-belt, NSB). We present new structural, geochemical, geochronological data from upper mantle peridotites and mafic dike intrusions occurring in these two sub-belts and discuss their tectonomagmatic origin.

In-situ analysis of zircon grains obtained from mafic dikes within the Baer, Cuobuzha and Jianabeng massifs in the NSB, and within the Dongbo, Purang, Xiugugabu, Zhaga and Zhongba in the SSB have yielded crystallization ages ranging between130 and 122 Ma. Dike rocks in both sub-belts show N-MORB REE patterns and negative Nb, Ta and Ti anomalies, reminiscent of those documented from SSZ ophiolites. Harzburgitic host rocks of the mafic dike intrusions mainly display geochemical compositions of abyssal peridotites (Fig. 2), with the exception of the Dajiweng harzburgites, which show the geochemical signatures of forearc peridotites (Lian et al., 2016). Extrusive rocks that are spatially associated with these peridotite massifs in both sub-belts also have varying compositional and geochemical features. Tithonian to Valanginian (150 – 135 Ma) basaltic rocks in the Dongbo massif have OIB-like geochemistry and 138 Ma basaltic lavas in the Purang massif have EMORB-like geochemistry (Liu et al., 2015). Tuffaceous rocks in the Dajiweng massif are 140 Ma in age and show OIB-like geochemistry. We interpret these age and geochemical data to reflect a rifted continental margin origin of the extrusive rock units in both sub-belts.

These data and structural observations show that the western Yarluang Zangbo ophiolites represent fragments of an Ocean-Continent Transition (OCT) peridotites altered by fluids in an initial supersubduction setting. We infer that mafic-ultramafic rock assemblages exposed in the SSB and NSB initially formed in an ocean – continent transition zone (OCTZ) during the late Jurassic, and that they were subsequently emplaced in the forearc setting of an intraoceanic subduction zone within a Neotethyan seaway during 130 to 122 Ma. The NSB and SSB are hence part of a single, S-directed nappe sheet derived from a Neotethyan seaway located north of the Zhongba terrane.

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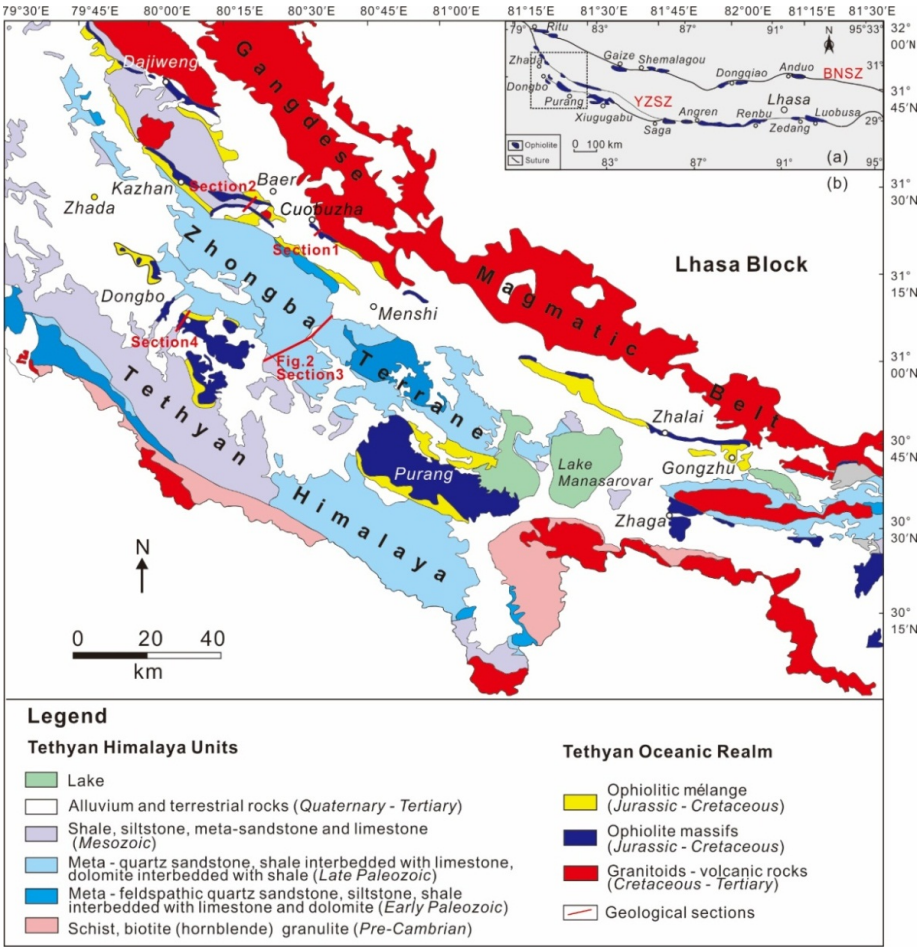

Fig. 1. Simplified geological map of the western Yarlung Zangbo Suture zone (YZSZ), showing the geological sections locations and main tectonic units from north to south, consisting of Gangdese arc, North ophiolitic sub-belt, Zhongba terrane, South ophiolitic sub-belt and Tethys Himalaya.

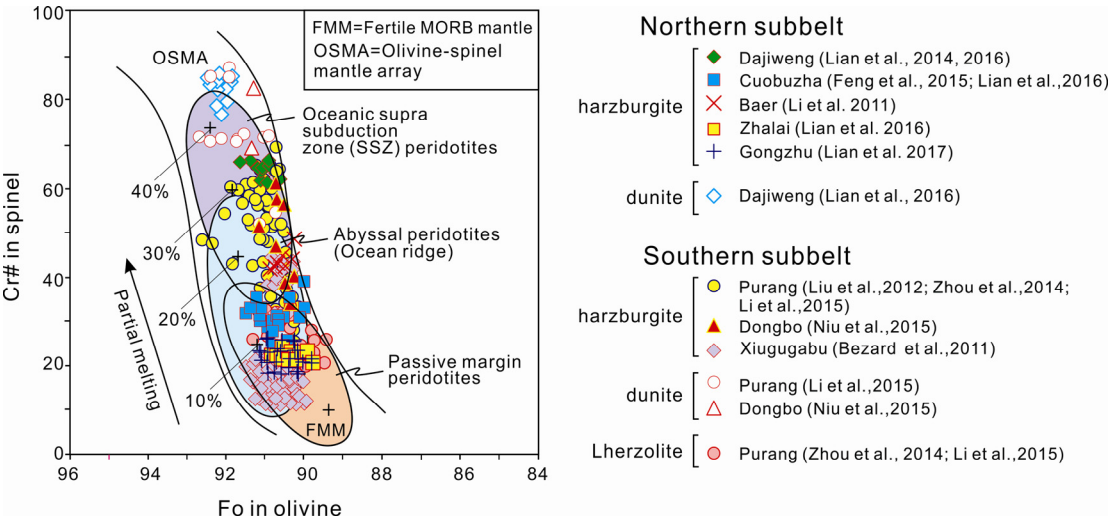

Fig. 2. Compositional variations of Fo in olivine versus Cr# in spinel diagram from the western Yarlung Zangbo peridotites. The abyssal peridotite, oceanic supra subduction zone peridotite field and passive continental margin field from (Pearce et al., 2000 and references therein).