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Subduction Initiation and Generation of the Xigaze Ophiolite, Southern Tibet

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The Cretaceous Xigaze ophiolite is best exposed at the central Yarlung Zangbo Suture Zone (YZSZ, Tibet) which also includes the Gangdese arc and the Xigaze forearc basin. This study reports new geochronological and geochemical data for this ophiolite to revisit its geodynamic and petrogenetic evolution. The Xigaze peridotites have low CaO and Al_2O_3 contents and U-shaped Rare Earth Element (REE) patterns, suggesting that they are residues after moderate to high degrees of partial melting and were modified by infiltration of Light Rare Earth Element (LREE)-enriched boninitic melts. The Xigaze crustal rocks belong to two groups: Mid-Ocean-Ridge-Basalt (MORB)-like rocks and boninitic rocks showing a uniform LREE depletion and flat to LREE enrichment on chondrite-normalized patterns, respectively. Geochemically, both groups show the influence of subducting oceanic slab-derived fluids. LA-ICPMS zircon U-Pb and Lu-Hf analyses from dolerite and quartz diorite dikes, which intruded into the mantle peridotite, and dolerite sheeted sills show that they were generated between 127–124 Ma. The zircons possess positive $\varepsilon_{Hf}(t)$ values ranging from +7.5 to +17.3. Taking into account the geological and geochronological characteristics of the central-western YZSZ, we propose that ophiolites in this region formed in a forearc spreading setting through rapid slab rollback during subduction initiation between 130–120 Ma. Following this stage of spreading, the forearc was stabilized and the zone of melting migrated beneath the Gangdese arc producing the voluminous Late Cretaceous granitoids displaying depleted mantle-type Hf isotopic compositions. Our model provides a new explanation for the generation and evolution of forearc-type ophiolites.

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