Southern Tibetan ophiolites display a geological – geochemical record of plume-influenced rift – drift magmatism in Neotethys

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Ophiolites, historically interpreted as ancient analogues for modern oceanic lithosphere, display major variations in their internal structure, geochemical fingerprints, and petrological evolution. They also show compositional and geochemical heterogeneities at different scales that are not consistent with steady-state magmatic accretion at a spreading center. We report here on the internal structure, geochemistry and petrology of the Yarlung-Zangbo suture zone (YZSZ) ophiolites (southern Tibet), which have been previously interpreted as the manifestations of mid-ocean ridge or suprasubduction zone (SSZ) magmatic processes. These early Cretaceous ophiolites consist mainly of peridotites, rare gabbros, mafic dikes and volcanic – sedimentary rocks. Extrusive sequences comprise pillowed lavas, massive lava flows and hyaloclastites, and commonly overlie serpentinized peridotites along unconformities or faults; they are interlayered with or overlain by mudstone, silty shale, radiolarian chert, and siliceous limestones. These volcanic rocks characterize E-MORB and OIB-like basalts with high TiO_2 contents (2.05 – 3.27 wt.%); doleritic dikes with REE and trace element patterns also bear chemical resemblance to those of modern OIB rocks. The low HREE contents, strongly fractionated REE patterns, low Y and high Ti/Y ratios point to garnet as a residual phase in the melt sources of all these crustal rocks. The Sr-Nd-Pb isotopic data suggest an enriched alkaline mantle source for their origin. We hence interpret the OIB and E-MORB mafic-ultramafic rock sequences along the YZSZ as the products of plume-influenced rift-drift assemblages that developed during the initial stages of the genesis of the Neotethyan oceanic lithosphere. Some of the YZSZ ophiolites were subsequently affected and modified by slab-driven fluids and related processes in a SSZ setting.