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Multiple melt extraction in Neo-Tethyan mantle and the Supercontinent heritage: insights from geochemical signatures of mantle peridotites from Naga Hills ophiolite, Indo-Myanmar ranges

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The Naga Hills Ophiolite (NHO) exposed on the northeastern margin of India, represents a thrusted section of Neo-Tethyan oceanic lithosphere comprising distinct crustal and upper mantle lithologies accreted onto continental margins at Indo-Myanmar ranges during late Cretaceous-Eocene collision between Indian and Eurasian Plates. This study focuses on the whole-rock geochemistry and Re-Os isotopic compositions of the mantle peridotites from NHO to address the implications on the upper mantle heterogeneity and thermo-tectonic evolution of Neo-Tethyan oceanic lithosphere through time. The chondrite normalized REE patterns, and low Re/Os, suggests that, these are mantle residues resulting from ~5–20% of melt extraction from a spinel peridotite source. The refractory characters of the studied mantle peridotites from NHO are further complemented by relatively enriched concentrations of transition elements like Cr, Ni and Co with respect to primitive mantle composition. PGE modeling from melt fractionation indices [$(Pt/Ir)_N$ and $(Pd/Ir)_N$] and depletion index (Al_2O_3) corroborates discernible melt depletion trends. Isotopically, these mantle peridotites are subchondritic with $^{187}Os/^{188}Os$ (0.1218-0.1266) and γ_{Os} (gamma osmium) values of -3.73 to -0.09 comparable with depleted MORB mantle source. LILE-LREE enrichment, HFSE depletion, and U-shaped chondrite-normalized REE patterns, distinct S-undersaturated trend and Re addition suggest multistage petrogenetic processes including refertilization of pre-existing depleted, refractory mantle wedge by subduction-derived fluids and instantaneous fractional melts operative in an intraoceanic fore-arc environment. Re-Os isotopic plots reflect the role of ancient depleted Subcontinental lithospheric mantle (SCLM) and the large variations in γ_{Os} values attest to involvement of both SCLM and depleted MORB component thereby contributing to pronounced Os isotopic heterogeneities in the upper mantle that in turn manifest inputs of discrete depleted and enriched mantle components during opening and closure of ocean basins synchronized with assembly and dispersal of continental blocks. The model ages (T_{MA}) for the mantle peridotites reveals a wide spectrum of ages ranging from 1142 Ma – 145 Ma suggesting multiple episodes of melt extraction events prior to the opening of Neo-Tethys (~250Ma) and encapsulation of ancient SCLM fragments correlatable with Gondwana Supercontinent amalgamation and disintegration coupled with closure and opening of the

Tethyan ocean basins.