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Evidence of back arc basin magmatism in basalts and dolerites of Nidar ophiolite, Neo-Tethys Himalyas, India.

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The Nidar Ophiolite Complex (NOC) along the Indus-Yarlung Tsangpo Suture Zone preserves critical evidence of Early Cretaceous Neo-Tethyan oceanic lithosphere formation (ca. 140-132 Ma). Previous interpretations have consistently characterised NOC basalts and dolerites either as intra oceanic island-arc tholeiites. However, our integrated mineral chemistry, whole-rock geochemistry, and quantitative trace-element modelling show a back-arc basin setting with moderate-degree melting of depleted mantle.

Both Basalt and dolerite exhibit primary igneous assemblage of clinopyroxene and plagioclase. Clinopyroxenes range from augite to diopside (basalts) and augite to ferroaugite (dolerites), while plagioclase compositions are predominantly albitic (An_{1-8}) in both the rock types. Clinopyroxene crystallisation conditions has been constrained to be 1180-1240°C at 1-5.5 kbar for the basalts and 1030-1210°C at 1-5.4 kbar for the dolerites based on Clinopyroxene thermometry. Geochemically, basalts exhibit flat to slightly LREE-depleted chondrite-normalised patterns [$(La/Sm)_N$ = 0.52-0.80] with unfractionated HREE [$(Gd/Yb)_N$ = 0.99-1.32], minimal Eu anomalies (Eu/Eu* = 0.83-1.19), and moderate to high Mg# values (57-77), while dolerites show similar patterns [$(La/Sm)_N$ = 0.70-0.90; $(Gd/Yb)_N$ = 0.90-1.28; Eu/Eu* = 0.98-1.13] with moderate Mg# values (54-63).

Non-modal batch modelling demonstrates 8-15% melting of spinel lherzolite source for generation of these rocks. The flat HREE patterns preclude garnet involvement, constraining melting to shallow spinel-facies depths. N-MORB-normalised patterns show characteristic subduction signatures (LILE enrichment, HFSE depletion), but limited compared to typical arc settings. Multiple tectonic discrimination diagrams (Hf-Th-Nb, Th/Yb vs. Nb/Yb, Y/15-La/10-Nb/8, V vs. Ti/1000, Th_N vs. Nb_N) consistently position NOC samples in transitional N-MORB to back-arc basin basalt fields, distinct from island-arc tholeiites.