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Magmatic and post-magmatic processes in Andaman Ophiolite: Insights from Volcanics and Gabbros

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Andaman Islands are related in formation to the ongoing subduction of the Indian plate beneath Sunda plate and are a part of Indo-Burma accretionary complex. Dismembered ophiolites containing both crustal and upper mantle sections of Cretaceous age found in these islands were litho-stratigraphically grouped into the Ophiolite Group. We aim to understand the petrogenesis and later hydrothermal processes that affected the volcanics and gabbros of the ophiolite suite by combining geochemical data from this study with that from the literature.

SiO_2, MgO, Al_2O_3, CaO and Total Alkali (Na_2O+K_2O) contents of the volcanic rocks and gabbros vary between 42-60 wt%, 2-20 wt%, 10-22 wt%, 0.6-23 wt% and 0.17-10.24 wt% respectively. Negatively correlated SiO_2 and Al_2O_3 and positively correlated MgO, CaO & total alkali concentrations of basalts with LOI, negatively correlated SiO_2 and CaO and positively correlated total alkali contents of gabbros with LOI respectively indicate post magmatic hydrothermal alteration of these rocks. This is also evident from the carbonate veins in gabbros and basalts, both in outcrop and photomicrographs. On chondrite normalized REE plot, basalts show a variable LREE enrichment and depletion (La_N/Sm_N: 0.87-2.84). Negative Nb anomaly and Nb-Ta fractionation on primitive mantle normalized spider diagram indicates a metasomatized mantle source for these rocks. Trace element modelling suggests that the parent magma for the basalts can be generated by up to 20% partial melting of a metasomatized mantle source of spinel lherzolite composition. Fractional crystallization of the parent magma starting with 0.55Plg+0.35Cpx+0.1Ol to 0.55Plg+0.45Cpx up to 70% can explain REE variations of gabbros with the residual melt patterns matching the basalts. On various tectonic discrimination diagrams, the data falls between MORB and IAT fields implying a supra-subduction zone origin for these rocks.

$^{87}Sr/^{86}Sr_i$ of basalts and gabbros show a large variation between 0.703395 to 0.706267 and 0.703224 to 0.705835 while $^{143}Nd/^{144}Nd_i$ values show a narrow range from 0.512840 to 0.512998 and 0.512898 to 0.512928 respectively. On $f_{Sm/Nd}$ vs ε_{Nd} plot, these rocks show a closed system evolution, indicating that post crystallisation, the Sr isotopic compositions of these rocks were altered by a seawater like fluid while Nd isotopes remained relatively unchanged.