Geochemical characteristics of mafic and felsic igneous rocks (1.9-1.75 Ga) in the Lesser Himalaya: Regional variation and its implications for tectonic setting

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The major and trace element and Nd-Hf isotopic compositions of Proterozoic meta-igneous rocks from the lower part of Lesser Himalayan sequence provide insights into the nature of their source mantle and its tectonic setting. We observed bimodal (basaltic and rhyolitic) magmatic feature in these rocks; this type of volcanism generally occurs in areas of extensional tectonics, particularly rifts. Two types of mafic rocks are identified: within-plate-type (OIB or more specially E-MORB like) rocks and Nb-Ta-depleted, continental arc like rocks. Within-plate type mafic rocks are dominated in the eastern Nepal, but similar rocks are also found in the western Nepal. Although models for the tectonic setting of these igneous rocks remain controversial (e.g., passive margin, continental arc, continental rift with possible hotspot), our new geochemical data supports the rift model associated with mantle plume activity, which evolved to the passive margin. The Nb-Ta depleted, arc-like rocks have lower εNd (t) and εHf (t) than within-plate type rocks; we consider that this type of magmas formed by interaction of mantle-derived magmas with crustal components. The felsic rocks have similar or slightly lower εNd (t) and εHf (t) values relative to arc-like mafic rocks, suggesting relatively limited crustal interaction. They are derived from juvenile crust of underplated mafic magmas. Most of felsic rocks have remarkably low Nb/Ta ratios (<5), suggesting modification on their chemical composition by intensive sub-solidus magmatic-hydrothermal alteration.