Early Cretaceous Sung Valley Ultramafic-alkaline-carbonatite Complex, Shillong Plateau: a Case of Primary Carbonatite Melt

RAJESH K. SRIVASTAVA AND ANUP K. SINHA
Igneous Petrology Laboratory, Department of Geology, Banaras Hindu University, Varanasi 221 005
(e-mail: rajeshgeolbhu@yahoo.com)

The Shillong Plateau of northeastern India experienced at least four early Cretaceous (105-115 Ma) ultramafic-mafic-alkaline-carbonatite (UMAC) complexes. The Sung Valley ultramafic-alkaline-carbonatite complex is one of them. This complex is emplaced slightly before or during the India-Antarctica break-up and thought to be spatially and temporally related to the Kerguelen plume activity. It is formed by ultramafic rocks (dunites, wehrlites, clinopyroxenites, uncompahgrites), mafic rocks (ijolites "s.l."), felsic rocks (nepheline syenites) and carbonatites. Field-relationships, petrological, mineralogical and geochemical data and Rb-Sr and Sm-Nd isotope systamatics of different rock types do not suggest any genetic relationship between them. The chemical composition of the mafic minerals indicates the expected enrichment in iron towards the felsic rocks. On the other hand, carbonatites feature very Mg-rich minerals, often Cr-rich, indicating that their genesis is completely unrelated to that of intermediate and felsic rocks (ijolites and nepheline syenites). The parageneses indicate that this complex was formed by primitive magmas with distinct magmatic affinity (olivine melilitites and olivine nephelinites, basanites, and maybe also carbonatites) which evolved independently, generating the observed spectrum of intrusive rocks. Clinopyroxenites have interstitial alkali feldspar and titanite, indicating that they formed from evolved feldspar-normative magmas (phonotephrites, tephriphonolites). It was studied also by means of LAM-ICP-MS analyses of the coexisting phases in a few particularly interesting petrographic sites. Carbonatites of the Sung valley clearly suggest that they are derived from a primary magma generated through low-degree partial melting of a deep-seated carbonated mantle peridotite. Radioisotope data also suggest a mantle origin for the carbonatite samples but associated silicate rocks are derived from an enriched mantle reservoir. Sr and Nd isotopic compositions ($^{87}Sr/^{86}Sr_{initial}$ between 0.706523 and 0.708891 and $^{143}Nd/^{144}Nd_{initial}$ between 0.512258 and 0.512464) suggest that silicate rocks were derived from a mixing of HIMU (mantle with high U/Pb ratio) and EM (enriched mantle) components, which show isotopic composition similar to FOZO. Lherzolite mantle was metasomatized into an alkaline wehrlite by CO_2, released by low-degree melting of a carbonated mantle peridotite. Melting of such a metasomatized mantle source may produce ultrabasic alkaline silicate magma, from which the different rock units of the Sung Valley complex were crystallized.