Kimberlites vs. ocean-island basalts: comparison as an indicator for volatiles and some other elements in deep mantle

ICHIRO KANEOKA

EARTHQUAKE RESEARCH INSTITUTE, UNIVERSITY OF TOKYO, BUNKYO-KU, TOKYO 113-0032, JAPAN; IKANEOKA@AOL.COM

In order to get information on the chemical state of the Earth's deep interior, mid-ocean ridge basalt(MORB) and ocean-island basalt(OIB) have been generally used. MORB magma sources are commonly regarded to be located in the upper mantle and OIB magma sources in the lower part than MORB magmas implying the lower mantle.

As a possible candidate to get information on deep mantle, the author has proposed kimberlites and its validity [1]. Based on high $^{3}He/^{4}He$ ratios observed in olivine separates from fresh kimberlites from Greenland, we have revealed that kimberlite magmas have a source similar to OIB magmas [2]. This has been supported by finding of OIB-like signatures of Ne isotopes in olivine separates from Udachinaya kimberlites [3]. Thus, noble gas isotope signatures of kimberlites are similar to those of OIBs, including the occurrence of excess ^{129}Xe. However, noble gas abundances in olivines are much more abundant in kimberlites than those in OIBs. Kimberlites are known to contain abundant volatiles such as H_2O, CO_2 and even halogen elements. Although such signatures may be partly attributed to a small degree of partial melting as genesis of kimberlite magmas, it would also suggest the properties of sources. Furthermore, group-1 kimberlites show relatively concentraged ranges of solid isotope signatures which are close to the inferred bulk Earth values, while OIBs show much more variations. In addition, although chondrite-normalized PGE patterns for MORBs and OIBs are largely fractionated, those of kimberlites are relatively unfractionated. This requires existence of PGE carriers in kimberlite magmas, possibly sulfides. Such sulfides are surely observed in kimberlites. OIB magmas might have lost such sulfides due to oxidation at a shallow depth during a slow magma ascent. Kimberlite magmas would keep them due to a rapid ascent from below the continental lithosphere to the surface without chemical reaction. Thus, kimberlites might keep more primary signatures than OIBs and suitable for investigating the chemical state of the Earth's deep interior.

References

[1] Kaneoka, I. (2004) GCA **68(11S),** A565.

[2] Tachibana, Y., Kaneoka, I., Gaffney, A. and Upton, B. (2006) Geology **34(4),** 273-276.

[3] Sumino, H., Kaneoka, I., Matsufuji, K. and Sobolev, A.V. (2006) This volume.