5.1.P06

Li-Sr-Nd isotopic compositions of Polynesian OIBs: Implications for the origin of HIMU source

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To investigate the origin of the HIMU reservoir in the mantle, we have measured Li-Sr-Nd isotopic compositions of several oceanic island basalts (OIBs) from the Polynesian region, using MC-ICP-MS technique [1,2]. The measured whole rock δ^7Li values ($\delta^7Li = [[^7Li/^6Li]_{sample} / [^7Li/^6Li]_{L\text{-}SVEC\ standard} - 1] \times 1000$) of the HIMU OIBs (Mangaia, Tubuai, and Rurutu) range from +5.0‰ to +7.4‰, which are higher than those of fresh N-MORB glasses (ca. +3‰). The $^{87}Sr/^{86}Sr$ ratios data, however, suggest a possibility that the measured δ^7Li values of HIMU OIBs may be increased by the post eruption alteration. In this case, from observed Li-Sr isotopic array of the HIMU OIBs, it is roughly estimated that δ^7Li value of pristine HIMU end-member is about +4‰ that is approximately equal to those of fresh N-MORB glasses. Consequently, even if measured δ^7Li value of HIMU OIBs are affected by the secondary alteration, the δ^7Li value of the HIMU end-member is never lower than those of fresh N-MORB glasses. Among the numerous models for the origin of the HIMU source, the most widely accepted model is that it involves subducted (dehydrated) oceanic crust. For this model, our Li isotopic results give a constraint that the HIMU source originates from the less altered basalt, as represented by the deeper part of subducted oceanic crust. Because it has been predicted that the δ^7Li value of subducted highly altered MORB would be extremely low compared to that of fresh MORB, due to the preferential loss of heavier Li (higher δ^7Li) from the subducted slab during dehydration at low temperatures (close to trench) [2,3]. Since the apparent sensitivity of Li isotopic composition to the alteration profile of subducted MORB, they may provide complementary information to Sr, Nd, and Pb isotopic compositions regarding the source of OIB magma.

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5.1.P07

The "Koolau" component: An ephemeral feature of Hawaiian volcanism

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The Ko'olau Scientific Drilling Project (KSDP) has been initiated in order to evaluate the long-term evolution of Ko'olau volcano and obtain information about the Hawaiian mantle plume. High precision Pb triple spike data on KSDP and Honolulu Volcanic Series (HVS) lavas are reported and reveal compositional source variations during Ko'olau growth.

Variations in $^{206}Pb/^{204}Pb$ ratios occur throughout the 300 m drill core, with an increase until about 450 m depth, followed by a decrease. Superimposed on this trend, $^{206}Pb/^{204}Pb$ ratios oscillate at depth intervals of about 25 m. Despite a small total range in Pb isotope ratios, KSDP and Honolulu lavas form two distinct linear arrays in Pb isotope space, requiring the presence of three Pb endmembers in Koolau. The two arrays intersect at the radiogenic end, implying that post erosional and shield stage lavas share a common Pb source with a high-μ signature. The unradiogenic Pb endmembers differ by their $^{208}Pb/^{204}Pb$ ratios and ε_{Nd} values. The high $^{208}Pb/^{204}Pb$-low ε_{Nd} endmember is present in subaerial and main-shield stage Koolau lavas and corresponds to the "Koolau" component of Hawaiian shields lavas which has EM1 type features. While it is a predominant component in subaerial lavas, its contribution during the main shield stage has significantly oscillated. These results demonstrate that the "Koolau" component is a short-lived, but recurrent feature of Hawaiian volcanism. The second unradiogenic endmember, so far only sampled by Honololu lavas, has by comparison, lower $^{208}Pb/^{204}Pb$ but higher ε_{Nd}, and its characteristics are similar to those of a depleted mantle.

It has been suggested that the Cretaceous Pacific lithosphere under Hawaii was involved in the generation of Hawaiian post erosional lavas. However, comparison of HVS with EPR MORB [1], thought to be representative of the recent Pacific lithosphere, seems to be inconsistent with this view. We suggest, instead, that the mantle source of HVS consists of a mixture of a Hawaiian plume component, similar to that sampled during the shield building stage, and a component derived from a secondary melting region within the ascending plume, sampled only during the rejuvenated stage. This interpretation is consistent with the dynamical model of Hawaiian volcanism by Ribe and Christensen [2].

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