

# Sr and Nd Isotopic Systematics of HIMU by Analyses of Clinopyroxene Phenocrysts

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HIMU is one of the important components in the Earth's mantle. Several processes have been proposed to explain the unique character of extremely high Pb isotope ratios of HIMU such as recycled oceanic crust, sediment and metasomatically enriched subcontinental lithosphere. Recent studies applying oxygen, osmium and helium isotopes provide more constraints on the origin of HIMU. However, the fact that HIMU plots away from the mantle array in the Sr - Nd isotope diagram has not yet been well explained. This study provides Sr and Nd isotopic data of HIMU and EM in the Polynesian region by precise isotopic measurement of both clinopyroxene (cpx) phenocryst and whole rock samples to clarify the Sr-Nd isotopic systematics and to provide further constraints on the origin of HIMU.

Ten HIMU samples were chosen from Mangaia, Rurutu and Tubuai Islands in the Cook-Austral Archipelago and four samples were obtained from Rarotonga Island (EM) for comparison. Most of the samples are olivine and cpx phyric alkali basalts. The details of sample preparation and acid leaching procedure are given in Hanyu and Nakamura (2000) together with analytical methods.

Measured  $^{87}\text{Sr}/^{86}\text{Sr}$  and  $^{143}\text{Nd}/^{144}\text{Nd}$  ratios of HIMU samples are similar to those previously reported and they all plot below the so-called mantle array (Fig. 1). Unleached whole rock samples always have higher  $^{87}\text{Sr}/^{86}\text{Sr}$  than leached ones. This result indicates that whole rocks are contaminated by seawater with high  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio ( $\sim 0.709$ ), and this component is mainly removed by acid leaching. In contrast, cpx samples from HIMU islands have very uniform  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios ( $0.70274 \pm 0.00003$ ),

which represent the lowest recorded ratios for HIMU. This result suggests that even leached whole rock samples inherit secondary contamination which cannot be totally removed by acid leaching. The fact that cpx appears to be free from subsolidus contamination suggests that cpx retains more original isotopic information and is therefore more suitable for precise measurement of isotopes, especially, when dealing with oceanic island samples.

Based only on the cpx analyses, HIMU form a vertical linear trend in the Sr-Nd isotope diagram with a significant variation in  $\epsilon_{\text{Nd}}$  (+3.3~+5.5) and constant  $^{87}\text{Sr}/^{86}\text{Sr}$ . This trend is explained by a mixing of the HIMU end-member and the MORB source. Consequently,  $\epsilon_{\text{Nd}}$  of the HIMU end-member is constrained to be less than +3.3. The vertical linear trend of the HIMU samples in the Sr-Nd isotope diagram indicates that time-integrated Rb/Sr of the HIMU source is similar to that of the MORB source or Sr/Nd of the HIMU source is much less than that of the MORB source. These observations are consistent with the model that the HIMU source was derived from dehydrated subducted materials. However, an important implication of the new Nd isotope data is that the HIMU source cannot be formed by only recycled oceanic crust and must include a time-integrated LREE enriched component, i.e. subducted sediments. More detailed discussion on the origin of HIMU may be found in Hanyu and Nakamura (2000).

Hanyu T & Nakamura E, *Earth Planets Space*, **52**, 61-70, (2000).

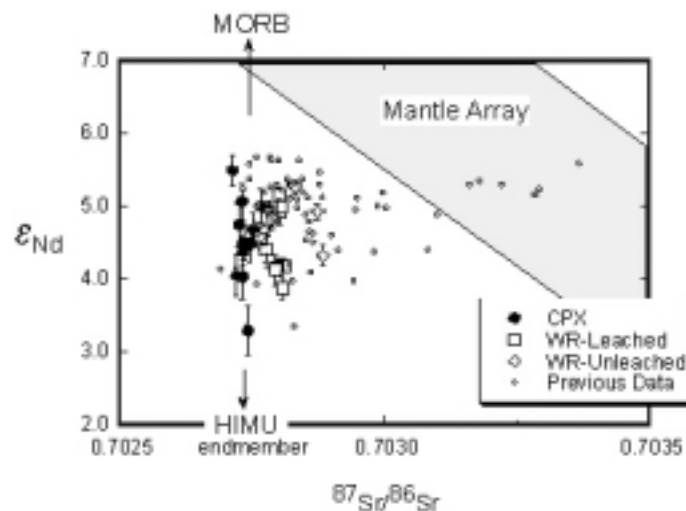


Figure 1: Sr and Nd isotope data of HIMU from this study and previous studies.