C104-010 **Room: 301A** **Time: May 29 14:10-14:23**

Is a high 3He/4He derived from the depleted mantle? - constraint from kimberlites

Ichiro Kaneoka[1]

[1] ERI, Univ. Tokyo

MORBs(mid-atlantic oceanic basalts) and OIBs (oceanic island basalts) have systematically different noble gas isotope ratios and they show 3He/4He ratios of about 8Ra (1Ra: the 3He/4He ratio of the atmospheric value) and 5~40Ra, respectively. Since alpha-decay of U and Th produces radiogenic 4He, old continental crusts enriched in U and Th show 3He/4He ratios lower than those of MORBs. Low 3He/4He ratios observed in OIBs are regarded to have been affected by recycled slabs into the mantle. However, high 3He/4He ratios observed in OIBs should represent a magma source with an averaged 3He/(U+(Th)) higher than that of MORBs through geologic time. In that case, there are two possibilities about the source that the primordial 3He remained relatively abundant or depleted in U and Th. In the latter case, however, there should be a phase where U is more depleted than He. Since OIBs are more abundant than MORBs in U, it is generally regarded taht the OIB magma source is less degassed.

On the other hand, if a reservoir is resided in a convective mantle, it seems hard to remain primordial noble gases in it. Hence, those who prefer a model of whole mantle convection to the other models have a serious problem to explainthwe occurrence of a reservoir where 3He remains. To explain it, it has been argued that a depleted phase with low U would retain 3He and ancient olivines composed of the mantle is a candidate. If noble gases were not lost during olivine formation in magma at an ancient time, olivines kept higher 3He/U ratios than that of the original source due to their partition coefficients and show a high 3He/4He ratio at present. In such a case, however, the amount of He remained in olivines is less than 1% and even 0.01% of that of the original source. Since the magma source of OIBs is regarded to be located in the lower mantle,if the 3He content is low in the original magma source, it seems difficult to keep a high 3He/4He ratio due to contamination at a shallow depth during a rise of a magma or plume. Furthermore, the MORB source shows more depleted character of solid element isotope signatures (e.g., 87Sr/86Sr, 143Nd/144Nd, etc.) than the OIB source.

It has been reported that the magma source of kimberlites has a 3He/4He ratio of more than 26Ra and the solid element isotopes cluster around the value of Bulk Earth. Hence, it is not resonable to assign a depleted character to the kimberlite magma source. Based on the Nd-Hf isotope systematics, it has been suggested that kimberlite magma source would have been affected by a component which is originated from a reservoir produced by ancient E-type MORBs of more than 2Ga located in a non-convective mantle. In such a reservoir, radiogenic 4He with the amount of 10E(-3~-4)cc/g has been produced. To show a 3He/4He ratio of more than 26Ra in a kimberlite magma affected by such a component, the 3He with the amount of about 10E-7cc is required. Since the highest concentration of 3He observed in a terrestrial rock is about 10E(-9~-10)cc/g in popping rocks, the above estimate indicates that kimberlite magma source should retain abundant 3He. Thsu, based on information of kimberlites, it is inferred taht a reservoir with high 3He/4He magma source is not depleted in incompatible elements and contain relatively abundant 3He. Hence, it should be less degassed and less fractionated part located in a deep non-convective mantle.