High $^{3}He/^{4}He$ detected in kimberlites from southern West Greenland

YURIKA TACHIBANA[1], ICHIRO KANEOKA[1], AMY GAFFNEY[2] AND BRIAN UPTON[3]

[1]Earthquake Reseach Institute, University of Tokyo, 1-1-1,Yayoi, Bunkyo-ku, Tokyo 113-0032, JAPAN (yurika@eri.u-tokyo.ac.jp, kaneoka@eri.u-tokyo.ac.jp)
[2]Department of Earth and Space Sciences, University of Washington, Seattle, WA 98195-1310, USA (agaffney@u.washington.edu)
[3]Department of Geology and Geophysics, Grant Institute, University of Edinburgh, Edinburgh EH93JW, UK (Brian.Upton@glg.ed.uk)

About the source materials of kimberlites, which are known to transport diamonds to the surface, there have been several hypotheses such as the asthenosphere, the lower part of the upper mantle, the lower mantle, etc.. Further, it has been reported that kimberlites are divided into two groups based on Sr-Nd isotopic ratios. In the $^{143}Nd/^{144}Nd$-$^{87}Sr/^{86}Sr$ diagrams, Group 1 kimberlites are located at an area close to the "bulk-Earth", whereas Group 2 kimberlites show the ralatively high $^{87}Sr/^{86}Sr$ and the low $^{143}Nd/^{144}Nd$, located in a field where enriched mantle components are assigned. To clarify their source materials and occurrence of primordial components, we have performed noble gas studies for kimberlites.

Since kimberlites are found to have been weathered and/or altered generally and difficult to get suitable phase for noble gas analysis, no noble gas data have been reported so far. Kimberlites we used for our noble gas study had been collected from Pyramidefjeld, south western Greenland, erupted around 200Ma and from Sarfartoq, western Greenland, erupted around 600Ma. These kimberlites are unexceptionably fresh and include fresh large olivines (>0.5mm). We separated olivines by hand pickking, and after acid treatment, measured noble gases in these olivines degassed by the crushing method.

Four western Greenland samples (W.GR.KIM1, 6, 9, 12) among five show high $^{3}He/^{4}He$ ratios (>17 R_A), while two south western Greenland samples (SW.GR.101423a, b) show $^{3}He/^{4}He$ ratios of 4.7 and 9.1R_A. Among them, W.GR.KIM9 shows the highest value of 25.6R_A. Such high $^{3}He/^{4}He$ ratios are similar to those found in Hawaii and Iceland areas. Samples show $^{40}Ar/^{36}Ar$ ratios ranging from 870 to about 9000, and W.GR.KIM9 shows the lowest $^{40}Ar/^{36}Ar$ ratio. Excess ^{129}Xe of more than 7% compared to atmospheric Xe is also observed for W.GR.KIM1. Present results support a conjecture that kimberlites are derived from the source materials similar to those of mantle plumes from Hawaii and Iceland, at least for those from western Greenland. It is intended to investegate them further by applying the heating method and getting other imformation to clarify the cause of variation among isotopic signatures.