Lithium, boron and lead isotope systematics on glass inclusions in olivine phenocrysts from Hawaiian lavas

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Lithium (Li) and boron (B) isotopes are belived as powerful tracer to understand the geochemical evolution of the Earth associate with mantle-crust recycling through the subduction (e.g., Ishikawa and Nakamura, 1994, Moriguti and Nakamura, 1998, Zack *et al.*, 2003), which should be one of the major mechanisms for producing geochemical heterogenity in the mantle. Here, we present new ion probe data of Li, B and lead isotopes ($^{207}Pb/^{206}Pb$ and $^{208}Pb/^{206}Pb$) together with major and trace elements concentrations in glass inclusions of olivine phenocrysts from Hawaiian basaltic lavas to examine the source heterogenity of the Hawaiian mantle plume.

Olivine phenocrysts were separated from selected five basaltic lavas. These rocks approximately cover the whole Sr-Nd-Pb isotopic variation of Hawaiian volcanics, which was defined as KEA–EMK-DMK isotopically distinct end-members (Tanaka *et al.*, 2002). These olivines were mounted in acrylic resin discs and polished for the ion probe isotope analyses by High Resolution Secondary Ion Mass Spectrometer, Cameca ims-1270, equipped with multi-collection system. Synthetic basaltic glass standards were applied to calibrate the mass discrimination on the ion probe isotope analyses and trace concentration analyses using ims-1270 and ims-5f.

The observed Li-B-Pb isotopic compositions of glass inclusions show wider variations than these of whole rock analyses. These results suggest that the analysed Hawaiian basaltiic lavas are mixing product of melts derived from isotopically different sources, and the glass inclusions keep more primitive informations of the source heterogeneity. For example, glass inclusions from fresh picritic lavas, K89-6, Oahu North-a, which has the typical EMK signature (see in detail, Tanaka *et al.*, 2002), show the lightest δLi variation (+2 ~ -10.2, n=6). This result indicates that the EMK end-member is extremely light Li reservoir, which may contain recycled oceanic crust suffered dehydration processes during subduction.

References

Ishikawa, T. and Nakamura, E., (1994), *Nature*, 370, 205-208.

Moriguti, T. and Nakamura, E., (1998), *Earth Planet, Sci. lett*., 163, 167-174.

Tanaka, R. *et al.*, (2002), *Hawaiian Volcanoes: AGU Geoph. Monograph 128, eds. Takahashi, E. et al.*, 311-332.

Zack *et al.*, (2003), *Earth Planet, Sci. lett*., 208, 279-290.

Formation of complex precursors of bioorganic compounds from possible interstellar media

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Complex organic compounds have been discovered in extraterrestrial environments such as in comets, which suggested that they were possible sources of the terrestrial biosphere. It has been hypothesised that cometary and meteoritic organic compounds were first formed in interstellar dust particles (ISDs). Recently amino acid precursors have been reported to form in simulated ISD environments by proton (Kasamatsu et al., 1997) or UV of simulated ISD ice mantles. Here we discuss nature of bioorganic compounds formed in simulated ISD environments.

Carbon monoxide, methanol, ammonia and water were among possible interstellar media. When a mixture of methanol, ammonia and water was irradiated with gamma rays or UV light at 77K, 293K or 353K, amino acids were detected in each hydrolysate. The G-value (energy yield) of glycine was *ca*. 0.01, which was independent from the temperature or the phase (solid, liquid or gas). These results suggest that amino acid precursors can be formed in ISD environments quite effectively even if the materials were frozen in low temperature.

A Mixture of carbon monoxide, ammonia and water was irradiated with high-energy protons, gamma rays or UV light. All of hydrolysate of the products also gave a wide variety of amino acids, together with uracil and cytosine. The products themselves are proved to be quite complex organic compounds whose molecular weights were thousands.

Finding of enantiomeric excess of amino acids in carboncesous chondrites (Cronin and Pizzarello, 1997) suggests that the origin of biological chirality may have initiated in extraterrestrial environments. A possible scenario of the generation of enantiomeric excess of amino acids will be presented.

According to these results, it is very likely that extraterrestrial organic compounds delivered to the Earth had important roles in generation of life on the Earth.

References

Kasamatsu T. et al., (1997), *Bull. Chem. Soc. Jpn*. **70**, 1021-1026.

Cronin J.R. and Pizzarello S., (1997), *Science* **275**, 951-955.