Chemical composition of the mantle under the Ryohaku mountains

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Introduction

The volcanoes in Central Japan are located about 150km to 300km above the inclined Wadati-Benioff Zone (WBZ) (e.g., Umino et al., 2002). Especially, the Ryohaku mountains are located about 300km above the inclined WBZ. The purpose of this study is to constrain the subduction zone magmatism (dehydration from slab, interaction between fluid from the slab and mantle wedge, subsequent melting) in such an unusual area, based on petrology and chemistry of the volcanic rocks.

Procedure

In order to discuss the generation of magmas in the upper mantle, it is common to use the most primitive volcanic rocks. However, such primitive rocks are rare in the Ryohaku mountains. Here, we tried to constrain the source mantle composition, using primitive to fractionated volcanic rocks upon estimation of trace element abundance of the source mantle. In the model, batch melting in the mantle and subsequent fractional crystallization are assumed. Consider two trace elements to behave as incompatible elements during the relevant processes (e.g., melting, crystallization). It has been found that the ratio of concetrations of the two incompatible elements in the volcanic rock as the end product of the processes and the source rock can be expressed by a relatively simple equation.

Results and Discussion

Model calculation shows that the abundance ratios of the incompatible elements in volcanic rocks preserve a trend as those of the source rocks, within the parameter ranges that the bulk partition coefficients (D) are between 0.001 to 0.5, the degree of melting (E) from 0 % to 20 % and the fraction of crystallized solid (F) from 0 % to about 70 %. The method used in this study is useful to estimate the source mantle for volcanoes without primitive rocks, but only with fractionated rocks, assuming that the conditions discussed above are satisfied. The model calculation also shows that the estimated trace element concentrations in the source mantle are different between the Ryohaku mountains and Northeast Japan. The estimated source mantle abundance of the Ryohaku mountains is about 0.3 times smaller than that of Northeast Japan in Y and is about 1.4 times larger in K and about 2.2 times larger in Rb, assuming the same abundance of Zr in the source rock. It is suggested that the difference reflects the initial concetration in the additional fluid from subducting slab between the Ryohaku mounatins and Northeast Japan, possibly due to deeper dehydration or longer path of fluid ascent for the Ryohaku mountains.

Hollow Organic Globules in the Tagish Lake Meteorite as Possible Products of Primitive Organic Reactions

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We reported in the Tagish Lake carbonaceous chondrite the first *in-situ* observation of hollow organic globules in any extraterrestrial material [1](Fig.1). The data from analytical TEM, Raman and micro-FTIR spectroscopies indicate that the globules consist of aliphatic and oxygenated functions. The hollow spherical morphologies are strikingly similar to the material produced by the laboratory simulation of UV photolysis of interstellar ice analogs and subsequent aqueous processing [2], suggesting that the organic globules in Tagish Lake may be extremely primitive organic material that formed before or during the formation of the solar system. The FTIR organic signatures also show strong similarities to the membrane-like products formed from hydrothermal reaction of an OH-bearing amino acid in the presence of hydrous minerals [3]. The survival of the structures in Tagish Lake indicates that primitive meteorites must have delivered these structures to the early Earth as a possible precursor to life.

We review the nature of the organic globules in Tagish Lake and report the extended study of the micro-sampling FTIR analysis and the *in situ* step heating experiments: which can allow us to place 1) significant constraints on the organic functionality in Tagish Lake; 2) the thermal stability of the organics; and 3) thermal history of the meteorite and its parent body.

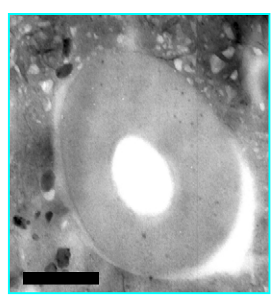

Fig.1: An organic globule in TL3B6 matrix, surrounded by fine-grained crystals of saponite with entangled ribbon-like structure. Scale bar equals 200nm.

References

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