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Chemical composition of halogen in kimberlites from Greenland, China and South Africa

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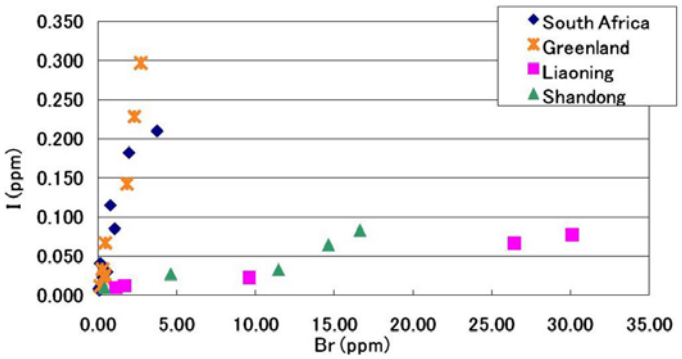

Kimberlite is an igneous rock whose magma is of mantle origin. Volatile components such as water and carbon dioxide are abundant, though it is a ultra-basic rock. Because kimberlites are known to contain diamonds, it has been generally thought that their magma sources are located at a depth of more than 150km (e.g., Dawson, 1980; Ringwood et al., 1992). Furthermore, it has been reported that some diamonds contain mineral inclusions which might have been originated in the lower mantle based on their mineralogical and chemical characteristics (e.g., Harte and Harris, 1994). Kimberlites erupt explosively through ancient continental crust (Archean cratons). It is expected that studies on the isotope and element compositions in kimberlites will provide important information to estimate chemical environment of the Earth's mantle. However, data about chemical compositions of kimberlites are still lacking, because its distribution is quite limited. Especially, data of halogen elements are very little. Halogen elements are thought to be almost negligible in the mantle, because most of these elements have been degassed from the Earth's interior when the Earth was formed. However, studies of noble gas isotopes imply that primordial noble gases still remain in the Earth's interior (e.g, Craig and Lupton, 1976; Kaneoka et al., 1978). Therefore, the other volatile elements might also be retained in the Earth's interior. Consequently, there is a possibility to obtain information on the distribution of halogen elements in the Earth's mantle by analyzing kimberlites and xenoliths. In this study, we analyzed concentrations of halogen elements in kimberlites and their inclusions from three regions, and considered the characteristics and their origin of each area.

Samples analyzed are 28 kimberlites, 1 eclogite and 1 garnet peridotite collected from South Africa, China and Greenland. For the determination of volatile elements such as I and Br, we used the pyrohydrolysis method combined with ICP-MS (Muramatsu and Wedepohl, 1998).

The results show that concentrations of I and Br in kimberlite samples are higher than those in common ultra-mafic rocks. Iodine concentrations in some kimberlite samples of South Africa and Greenland are relatively high (>0.1ppm), while some Chinese kimberlite samples show markedly high Br concentrations (>10ppm). The I/Br in kimberlites obtained for South Africa and Greenland are relatively high and very similar, whereas the I/Br of Chinese kimberlite samples are significantly low (Fig.1). Considering our previous results on the chemical and the isotope compositions (e.g., REE pattern, Sr-Nd systematics), the above-mentioned difference in the I/Br does not correspond to the degree of the influence of water and the crust material. There is a

possibility that the I/Br in kimberlites could show the characteristics of the mantle where kimberlite magmas were formed.

Keywords: kimberlite, halogen, Iodine, Bromine, mantle