

**DEPTH PROFILE OF HALOGEN CONCENTRATION IN ANTARCTIC AND NON-ANTARCTIC CHONDRITES.** Y. Yamamoto and Y. Muramatsu, Department of Chemistry, Faculty of Science, Gakushuin University, Mejiro, Toshima-ku, Tokyo 171-8588, JAPAN (yukio.yamamoto@gakushuin.ac.jp).

**Introduction:** Halogen studies provide clues on aqueous alteration histories of primitive solar system materials (e.g. [1]). Halogens have long been recognized as valuable indicators not only because of their high volatilities but also because their cosmochemical behavior is strongly dominated by partitioning into fluid phase. Fegley and Lewis (1980) [2] pointed out that halogens behaved as moderately volatile elements during condensation process in the early solar system. However, condensation behaviors of bromine and iodine were not fully described. Furthermore, understanding of iodine distributions in the early solar system is important in terms of I-Xe chronology.

The studies of the cosmochemical behaviors of halogen elements are limited by the difficulty of the analytical techniques for halogen analysis. Anomalous overabundance of halogen elements was found in Antarctic meteorites (e.g. [3]). Overabundances of halogens confirmed in other Antarctic chondrites that degree of overabundance decreases with depth from the surface ([4] and [5]). Among all halogen elements, iodine shows especially high concentration and small excess of chlorine was also observed [5]. Compared with halogen concentrations in Antarctic meteorites, those of non-Antarctic meteorites have no correlation with depth from surface [6]. The overabundance was interpreted that biogenic iodine compound influences the iodine content of Antarctic meteorites and rocks [5].

In this study, in order to elucidate the mechanism of halogen overabundance in Antarctic meteorites, Antarctic and non-Antarctic chondrites were analyzed for Cl, Br and I. The correlations between concentrations of halogen and depth from surface of Antarctic and non-Antarctic meteorites were discussed.

**Experimental procedure:** In this study, we used two Antarctic chondrites: ALH 77230 (L4) and Y 74354 (L6), and two chondrites from hot desert: NWA 1794 (LL5) and NWA 4001 (L4). All four samples were divided into three parts: fusion crust, subsurface and inner part. Parts of Fusion crust are about 1 mm surface layer. Depth of subsurface parts is from 1 mm to 3 mm. Inner parts of samples are deeper portion than 3 mm. Weights of samples were about 200mg,

400mg and >600mg for fusion crust, subsurface and inner part, respectively.

We used prompt gamma-ray analysis (PGA) for determined Cl concentration and pyrohydrolysis for Br and I concentrations in this study. Powdered samples were pressed into disks and were wrapped in FEP film for PGA irradiation to measured Cl contents. After PGA, samples were further digested by pyrohydrolysis methods. Due to the high homogeneity and well availability, two well analyzed powder formed reference samples, JB-2, basalt standard, and JR-1, rhyolite standard, issued by Geological Survey of Japan (GSJ), were prepared for standards. Furthermore a chemical reagent,  $\text{NH}_4\text{Cl}$ , was irradiated for validating obtained by JB-2 and JR-1 for PGA.

The PGA were performed using the prompt gamma-ray analyzing system installed at the neutron beam tube attached to the JRR-3M at Japan Atomic Energy Agency (JAEA). Detailed configuration of PGA is described in Yonezawa et al. (1993) [7].

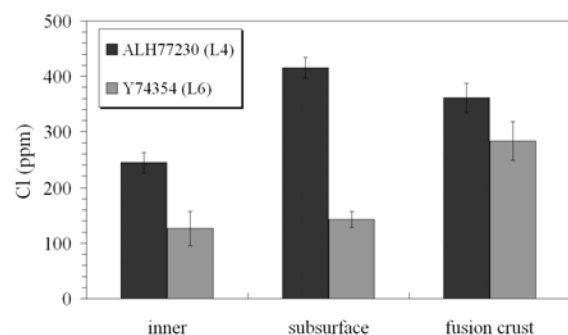
The pyrohydrolysis technique has been used for the release of bromine and iodine from chondrite samples. Detailed description of the sample digestion procedure is published elsewhere [8]. After PGA analyses, radio activities of the samples were lowered under environmental level by about 1-month cooling. About 200mg samples were added into a combustion boat that were heated to 1100°C in advance to remove bromine and iodine contained in it. After samples were mixed with  $\text{V}_2\text{O}_5$  in the boat, the boat was placed into a quartz tube and heated 1000°C for about 30 minutes. Bromine and iodine were evaporated out with hot and wet oxygen gases and trapped into and  $\text{Na}_2\text{SO}_3$  and tetramethylammonium hydroxide (TMAH) mixed solution. Bromine and iodine concentrations in solutions were subsequently determined with ICP-MS (Agilent 7500a, YOKOGAWA analytical systems, Japan).

**Results and discussion:** Chlorine concentrations in each part of chondrites differed among chondrites. Depth profiles of Cl concentrations of Antarctic chondrites measured in this study are shown in Fig. 1. Concentrations of Cl in parts of fusion crust and subsurface are comparable to those in ordinary chondrites published in Langenauer and Krähenbühl (1993) [6]. On the other hand, those in inner parts of

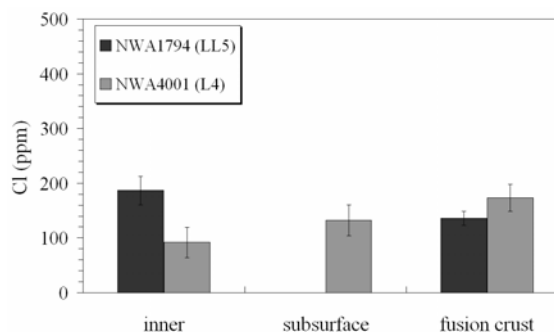
ALH 77230 are higher than those in other Antarctic ordinary chondrites [6]. Enrichment factors of Cl concentration in fusion crust compared to inner part are 1.5 and 2.2 for ALH 77230 and Y 74354, respectively. Those in subsurface to inner part are 1.7 and 1.1 for ALH 77230 and Y 74354, respectively. These values are in the range of other Antarctic ordinary chondrites [6]. Overabundances of Cl concentrations in surface parts (fusion crust + subsurface) compared to inner part were found in Antarctic chondrites investigated in this study.

In comparison to Cl concentrations in Antarctic chondrites, those in non-Antarctic chondrites are variable between chondrites. Fig. 2 shows Cl concentration in individual parts of non-Antarctic chondrites. Chlorine concentrations in inner parts of non-Antarctic chondrites are in the range of non-Antarctic ordinary chondrites reported in Langenauer and Krähenbühl (1993) [6]. Chlorine concentrations in fusion crust and subsurface of non-Antarctic chondrites are lower than those of Antarctic chondrites whereas those in inner part of Antarctic and non-Antarctic chondrites are comparable. Chlorine concentration in NWA 4001 decreases with depth from surface increases. On the other hand, that in the fusion crust of NWA 1794 is lower than that in the inner part. This variation of Cl concentration is found in non-Antarctic L6 chondrite Holbrook [6]. These results suggest that the degree of surface enrichment of Cl in non-Antarctic meteorites would vary in individual meteorites.

The detailed Br and I concentrations and differences of halogen concentrations between Antarctic and non-Antarctic meteorites will be discussed in the meeting.



**Fig. 1.** Depth profile of Cl concentrations in Antarctic chondrites. Errors in each concentration are  $1\sigma$ .



**Fig. 2.** Depth profile of Cl concentrations in non-Antarctic chondrites. Concentration of Cl in subsurface part of NWA 1794 is not measured. Errors in each concentration are  $1\sigma$ .

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