The 461st Geodynamics Seminar

Fluorine and chlorine fractionation during magma ocean solidification: Implications for the abundance and origin of terrestrial halogens

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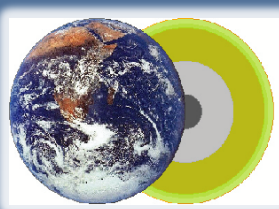

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Abstract

Previous geochemical studies on terrestrial volatiles have shown that the isotopic compositions of Earth's volatiles (i.e., H, C, N, and Cl) are very similar to that of CI chondrites, but the abundance pattern of Earth's volatiles (e.g., H/N, F/Cl, and Ar/Xe) is not chondritic (e.g., Alexander et al., 2012; Marty, 2012; Halliday, 2013). These observations indicate that most of Earth's volatiles has been delivered and fractionated during the main accretion phase. Elucidating the fractional processes of volatiles in terrestrial planets is therefore key for understanding the origin of Earth's volatiles.

In this study, we focus on the super-chondritic F/Cl ratio of the Earth. Previous studies have shown that fluorine and chlorine are moderately to highly lithophile elements under high pressure-temperature conditions (e.g., Mungall and Brenan, 2003; Sharp and Draper, 2013; Kuwahara et al., in prep), suggesting that these elements would have been mainly partitioned into mantle during core-mantle differentiation. Thus, the super-chondritic F/Cl ratio of the Earth cannot be explained by core formation process. Here we investigate fluorine and chlorine fractionation during magma ocean solidification. More specifically, we conduct high-pressure experiments using multi-anvil press in order to determine fluorine and chlorine partitioning between silicate minerals and melts at the transition zone and lower mantle conditions. In this seminar, we show the preliminary results of high-pressure experiments on fluorine and chlorine partitioning between silicate minerals and melts, and discuss the origin of super-chondritic F/Cl ratio of the Earth.

詳細は当センターホームページ: http://www.grc.ehime-u.ac.jp/をご覧ください
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