The 413th Geodynamics Seminar

Contribution of volatile rich material to Earth accretion

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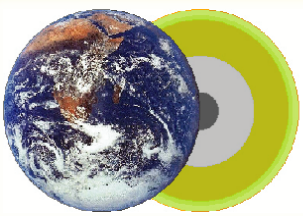

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Abstract

The planetary formation processes such as accretion and differentiation might have drastically modified the composition of Earth from the building blocks from the orginal so-called chondritic Earth model, especially on the elemental and isotopic compositions of the volatile elements. Recently, heterogeneous accretion model that describes that growth and evolution of Earth in two different stages from volatile-depleted and volatile-rich material was revised based on isotope geochemical studies (e.g. Nudds et al., 2010). However, the exact percentage and the time sequence of this volatile-rich material accretion need to be constrained. For example, models with ~2% carbonaceous chondrite (CI-CM) material added to a dry proto-Earth will result in estimation of carbon content of Earth to be over 500ppm, which could not be explained by the current silicate mantle composition of Earth. In addition, the modeling result needs to be consistent with the siderophile elements concentration in Earth mantle and the oxidation state of Earth mantle changes through the accretion process.

Therefore, we performed experimental studied on Tagish Lake chondrite (CI-CM), a new type of volatile rich carbonaceous chondrite at different pressure and temperature conditions. Our target is to explore the possible effect of the volatile component on Earth composition through the time sequence of Earth growth, the water budge of Earth at different accretion sequences, and other possible later impact.

Our melting experiment at 12GPa shows that the measured solidus temperature of Tagish Lake meteorite is much lower than CV3 meteorite because the existence of the large amount of volatile components; however, the measured liquid temperature is very close to that of CV3 meteorite, indicating the lost of volatile component through higher temperature (2000K) heating process. The experimental method we used works well to keep the volatile components (Carbon and Hydrogen) inside the meteorite sample during heating experiments with temperature lower than 2000K. Whether does the proto-core have carbon or other volatile element will rely on further experiments at higher pressure.

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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