Survey of D-rich organic matters in NWA801 CR2 chondrite

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Deuterium-rich organic matters have been reported in CR chondrites. The delta-D vaules of bulk CR chondrites are ˜644 per mill {1}. Insoluble organic matters (IOMs) in CR chondrites are enriched in D (delta-D of ˜3000 per mill in average), and the maximum D-rich domain of IOMs has a value of 19,400 per mill in delta-D {2}. The highly D enrichments are believed to have formed in molecular clouds or protoplanetaly disk. Hence, the H isotopic anomalies suggest that primitive organic matters are preserved in CR chondrites. In this study, we developed hydrogen isotopography to search for D-rich materials and to understand their in situ distribution in chondrite matrix.

The sample used in this study is a polished thin section of NWA801 CR2 chondrite.

Hydrogen isotope images (isotopography) were obtained by isotope microscope (Cameca ims-1270 + SCAPS) in Hokkaido University {3}. We used a large and intense primary beam to obtain high precision D/H isotopography. Secondary negative ion images of H, D, H and C-12 were acquired in this order. We used positive Cs primary ion beam (˜1nA, 35 micrometers in diameter). Total analysis time for one region was about an hour.

Hydrogen isotopic ratios of matrix were used for normalization. The selection criteria for distinguishing D-rich materials are that one of their isotopic ratios is 2sigma away from the 3sigma of distribution of isotopically normal matrix.

Thirteen matrix regions of total area about 0.02 square millimeters were analyzed. We discovered three D-rich particles in these regions. Hydrogen isotopic compositions of these particles are 700 per mill, 2400 per mill, 2600 per mill, respectively. Because all particles include C as a major component, they are likely organic matters. The D-enrichments of these particles are smaller than those of organic matters from other CR chondrites reported. We will apply the technique developed in this study to various chondrites in order to evaluate textual relationship between D-rich organic matters and isotopically normal organic matters which would have formed in the solar system.

Reference :
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