Thermal history of insoluble organic matter from Allende meteorite revealed by pyrolyses

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Insoluble organic matter (IOM) is isolated from chondrites as the major part of organic materials. IOM provides us useful information on the chemical evolution of chondrites, especially thermal history on the parent asteroids. To study the thermal history, isotopic analysis [1], IR spectroscopic analysis [2], and Raman spectroscopic analysis [3] have been carried out. We tried to find a new method for researching thermal history of IOM and showed that the pyrolysis study is useful for the research [4]. We report a possible thermal history of IOM from Allende (CV2) meteorite revealed by the pyrolysis.

We performed stepwise and gradual pyrolyses of Allende IOM up to 800ºC in the same way as [4]. Pyrolysates were analysed by GC-MS and residues were analysed by IRMS and EA.

Pyrolysates from Allende IOM contained H_2S, CS_2, OCS, H_2O, CO, and CO_2 as major components. In these compounds, sulfur-bearing materials, H_2S, CS_2, and OCS, were degassed in low temperature range (below 350ºC). These compounds were generated by dissociation of sulfo groups and sulphide linkages, which weakly combined with the IOM as labile parts. However, the pyrolysates scarcely contained aliphatic and aromatic hydrocarbons, which were mainly released from Murchison IOM by pyrolysis below 500ºC. The absence of aliphatics and aromatics in the pyrolysates shows Allende IOM has a refractory structure resulted from higher metamorphism than Murchison IOM. Hydrogen gas was degassed in high temperature range (550-800ºC), indicating that Allende IOM has not experienced over 550ºC. These results suggest that Allende IOM experienced the alteration below 350ºC causing the addition of sulfur-bearing materials, after the thermal metamorphism below 550ºC resulting in the release of aliphatics and aromatics.

[1] Alexander et al. (2007) *Geochim. Cosmochim. Acta* **71**, 4380-4403. [2] Kebukawa et al. (2011) *Geochim. Cosmochim. Acta* **75**, 3530-3541. [3] Homma et al. (2015) *J. Miner. Petrol. Sci.* **110**, 276-282. [4] Okumura and Mimura (2011) *Geochim. Cosmochim. Acta* **75**, 7063-7080.