Evaporation metamorphism of interstellar organic materials

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Experiments on the evaporation metamorphism of model interstellar organic materials have been performed from 297 to 773K under vacuum. Elemental composition and mass of the residues were analyzed. It was found that most of the interstellar organic material existed outside 2.3 AU in the primordial solar nebula. We compared the elemental compositions of the residues with those of organic materials in carbonaceous chondrites. We concluded that elemental compositions of the carbonaceous chondrites could not be explained by thermal metamorphism of the interstellar organic materials. But if carbonaceous particles are took into account, we will be able to explain the elemental compositions of the carbonaceous chondrites.

Interstellar dusts in molecular clouds consist of mineral, organic material and ice. The organic materials are classified into two groups. One is formed by ultraviolet photoprocessing in molecular clouds and another is modified in the diffuse clouds. Because these dusts were the materials of the solar system, they were metamorphosed inevitably when the primordial solar nebula has been formed. It is thus important to investigate the evaporation metamorphism of the interstellar grains to discuss the contribution of the interstellar grains to materials of planets.
We performed the experiments on the evaporation metamorphism of model interstellar organic materials and discussed the distribution of interstellar organic materials in the primordial solar nebula. Furthermore, we compared elemental compositions of residues, with those of organic materials in carbonaceous chondrites.
The model interstellar organic materials were based on Greenberg (1997) and some analitical data(Briggs et al. 1992,Mendoza-Gomez et al. 1992,Greenberg et al. 1999).
The sample (30mg) was put into a quartz glass vessel in the vaccum chamber(10E-6Torr) and was heated from 297 to 733K (1K/min).
The long time heated experiments(80hours) were performed because it is necessary to apply the experimental results to the phenomena which was occurred in the primordial solar nebula. After heating elemental compositions and mass of residues were measured.
We found that organic materials formed in molecular clouds were evaporated until 353K and those modified in the diffuse clouds until 433K in the primordial solar nebula. If we convert these temperatures to distances from the sun, we concluded following: Most of the interstellar organic materials evaporated inside 2.3AU, organic materials modified in the diffuse clouds were existed between 2.3 and 2.7 AU, and most of organic materials formed in the molecular clouds were existed outside 2.7 AU.
We compared elemental compositions of residues with those of carbonaceous chondrites on the basis of the assumption that carbonaceous chondrites were formed from thermal metamorphosed interstellar grains. We concluded that the C, N contents of the carbonaceous chondrites could not be explained by the thermal metamorphism of interstellar grains. It is considered that some of small carbonaceous particles were trapped in the ice in molecular clouds when ice grew(Greenberg 1999). If the carbonaceous particles are took into

account, we will be able to explain the C,N contents of carbonaceous chondrites.