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TITLE: Distribution and compositional change of organic materials with the evolution or a protoplanetary disk

ABSTRACT BODY:

Abstract Body: A protoplanetary disk evolves dynamically, which changes the physical and chemical conditions temporally and spatially. Evolution of organic materials derived from the previous molecular cloud has been extensively studied by chemical network calculation assuming chemical reaction on the surface of grains. Such surface reaction would have played important roles at the very early stage of disk evolution or low temperature outer region; however, thermal processes should have been the dominant reaction at later or high temperature (~above the melting point of water ice) regions. Those organics should have been incorporated into planetesimals that would be a precursor material of life.

We have developed a protoplanetary disk evolution model by combining fluid dynamics and chemical change of organics with the molecular cloud origin. On the basis of calculation, we discuss the temporal and spatial change of organics within the inner region of the disk. The organics initially has a composition of cometary organics, which is assume not to change up to T~250K, becomes rich in C up to T~400K, and changed into almost pure C at T>500K. At the early stage of disk evolution (t<105 years), a significant fraction of refractory organics (enriched in C and depleted in H, O, and N) is present in the asteroid belt, and the primitive (max T< 250K) organics are distributed beyond several AU, whereas, the primitive organics reached at the inner edge of the asteroid belt. Primitive organics are not present at ~1AU through the disk evolution.

The results strongly suggests that the Earth does not contain primitive organics if all the embryos that formed the Earth were derived within ~2AU. On the other hand, some fraction of organics in the asteroid belt would be primitive that retain primitive nature originated in the molecular cloud with heavy isotope enrichments. If the disk was heavy and the high temperature region extended to outer regions, organics supplied to the steroidal belt should be thermally processed and depleted in H, O, and N compared to cometary organics.

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