# Evolution of the protosolar disk and planetesimal compositions

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Undifferentiated chondrites and differentiated meteorites are the remnants of protoplanets and their origin should be understood in connection with the evolution of the disk. Despite numerous work on disk evolution and metorite comopositions, their relationship has not bee fully discussed yet. In order to clarify the temporal and spatial relationship between the protosolar disk and meteorites, we have carried out quantitative evaluation of chemical evolution of the disk by modifying the particle-tracking-model by Ciesla [1,2].

The basic of the model is a radial advection-diffusion equation for the proto-solar disk, which includes drift and dispersion by turbulence with stochastic diffusion term calculated by the Monte Carlo method and which shows the diffusivity by the viscosity of the disk. We (1) trace the *R-T-P* (*R*: heliocentric distance from the porto-Sun, *T*: temperature, *P*: pressure) trajectory of individual grains, (2) count the number of grains remained in the disk as a function of *R* and *t* (time), and (3) count the number of grains that experienced high temperature (1000K and 1400K), which were mostly from the inner region and which was transported outward by diffusion, and convection with lesser amount of grains originating from the outer region and going back and forth .

The present work shows how radial mixing in the proto-solar disk proceed as a function of distance from the proto-sun and time. The mixing ratio of materials from the inner and outer regions is almost unity at the early stage but the fraction of materials from the outer regions increases with time. Combining the information about the maximum temperature that the particles experienced, we can constrain that early differentiated planetesimals such as the parent body of angrites and planetesimals with refractory-rich compositions such as CV chondrites were formed at the current asteroid belt in $\sim 10^5$ yrs. This is consisting with very old chronological data of some iron meteorites, which were formed by total melting with the presence of abundant $^{26}$Al. On the other hand, planetesimals for other carbonaceous chondrites and ordinary chondrites that are not so enriched in refratories were formed later, possibly at $\sim 10^6$ yrs.

[1] Ciesla, F. (2010) *Icarus* **208**, 455. [2] Ciesla, F. (2011) *ApJ* **740**, 1.