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The spatial distribution of carbon dust in the early solar nebula and the carbon content of planetesimals.

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A high fraction of carbon bound in solid carbonaceous material is observed to exist in bodies formed in the cold outskirts of the solar nebula, while bodies in the terrestrial planets region contain nearly none. We study the fate of the carbonaceous material during solar nebula evolution. From observational data on the composition of the dust component in comets and interplanetary dust particles, and from data on pyrolysis experiments, we construct a model for the composition of the pristine carbonaceous material in the outer parts of the solar nebula. We study the pyrolysis of the refractory and volatile organic component and the concomitant release of high-molecular-weight hydrocarbons both under quiescent conditions of disk evolution where matter migrates inwards, and by violent flash heating events thought to be responsible for the formation of chondrules. It is found that the dominant complex hydrocarbon components are removed from the solid disk matter at temperatures between 250 and 400 K, while the minor amorphous carbon component survives up to 1200 K. Without efficient carbon destruction during flash-heating associated with chondrule formation the carbon abundance of terrestrial planets, except for Mercury, would be not as low as it is found in cosmochemical studies. Chondrule formation seems to be key for the carbon-poor composition of the material of terrestrial planets.

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