CALCIUM-ALUMINIUM INCLUSION IN THE KABA METEORITE AND ITS APPLICATION TO ASTROMINERALOGY

Arnold Gucsi1, Hirotsugu Nishido2, kiyotaka ninagawa1, Szaniszlo Berczi4, Szabolcs Nagy4, Peter Abraham5, Ildiko Gyollai6, Akira Tsuchiyama1, Irakli Simonia7, Peter Rozsa8, Daniel Apai9, Krisztian Mihalyi8, Mihaly Nagy10, Jozsef Posta11

GUCSIK, Arnold1, NISHIDO, Hirotsugu2, NINAGAWA, kiyotaka3, Szaniszlo Berczi4, Szabolcs Nagy4, Peter Abraham5, Ildiko Gyollai6, Akira Tsuchiyama1, Irakli Simonia7, Peter Rozsa8, Daniel Apai9, Krisztian Mihalyi8, Mihaly Nagy10, Jozsef Posta11

1Department of Earth and Planetary Sciences, Graduate School of Science, Osaka University, 2Research Institute of Natural Sciences, Okayama University of Science, Okayama, Japan, 3Department of Applied Physics, Okayama University of Science, Okayama, Japa, 4Institute of Physics, Department of Material Physics, Eotvos University, Budapest, Hungary, 5Konkoly Observatory of Hungarian Academy of Sciences, Budapest, 6Department of Lithospheric Research Center for Earth Sciences, University of Vienna, Austria, 7Graduate Studies of Ilia State University, Tbilisi, Georgia, 8University of Debrecen, Debrecen, Hungary, 9Lunar and Planetary Laboratory, Department of Planetary Sciences, The Arizona University, 10Reformed College of Debrecen, Debrecen, Hungary, 11Debrecen University, Dept Chemistry

1Department of Earth and Planetary Sciences, Graduate School of Science, Osaka University, 2Research Institute of Natural Sciences, Okayama University of Science, Okayama, Japan, 3Department of Applied Physics, Okayama University of Science, Okayama, Japa, 4Institute of Physics, Department of Material Physics, Eotvos University, Budapest, Hungary, 5Konkoly Observatory of Hungarian Academy of Sciences, Budapest, 6Department of Lithospheric Research Center for Earth Sciences, University of Vienna, Austria, 7Graduate Studies of Ilia State University, Tbilisi, Georgia, 8University of Debrecen, Debrecen, Hungary, 9Lunar and Planetary Laboratory, Department of Planetary Sciences, The Arizona University, 10Reformed College of Debrecen, Debrecen, Hungary, 11Debrecen University, Dept Chemistry

CAI of the Kaba meteorite has a complex texture and consists of spinel, anorthite and augite (fassaite), where spinel grains (up to 10 micron in size) are surrounded by anorthite and augite grains. CAIs are observed and maximum 1.8-2.0 mm in size. The composition of anorthite is An95.6Ab4.4Or0. Augite has a composition of En45.5-55.1Wo44.0-53.9Fs0.6-0.9.

The age of Kaba as determined from Mn-Cr dating is thought to be between 4,562 and 4,563 Ma (Hua et al. 2005). It is instructive to attempt to place the formation and properties of Kaba in the context of protoplanetary disk evolution as observed around some stars. Any such comparison relies on the zero points of the astronomical and cosmochemical timescales, i.e. the time of the protostellar collapse and the time of the CAI formation. While these zero points are likely to be slightly shifted, detailed comparisons of protoplanetary disk evolution and events in the proto-solar nebula suggest that they could not differ by more than 1 Myr, if the proto-solar nebula was a typical disk (Pascucci & Tachibana 2010). Consistent with the above description we assume that CAIs have formed at the time of or very shortly after the protostellar collapse.

In contrast, the younger disks in Cha I and Taurus frequently display disks with flaring geometry (disk opening angle increasing with radius), e.g., Szczygielski et al. 2010, Ciesla and Dullemond 2010). These disks also commonly display sharp and prominent crystalline silicate peaks, revealing the presence of sub-micron-sized forsterite and enstatite grains (e.g., Apai et al. 2005) with a few disks showing amorphous silicate emission features. The observed evolution of the small, initially amorphous dust grains into larger, crystalline grains is poorly understood, but it is often thought that grain-grain collisions and destructive planetesimals collisions will replenish and gradually replace the dust population. In this context, Kaba grains could provide an insight into the dust population of a disk halfway between a young protoplanetary disk and a debris disk: if so, a substantial amount of the building blocks of Kaba may have been recycled material from previous generation of small bodies. Furthermore, a systematic Micro-Raman spectral study (as future work) of an interaction between the organic compounds and CAIs in Kaba meteorite can provide us better understanding of the evolution of organic matter in the early Solar System.

References


キーワード: meteorite, Early Solar System, CAI, astromineralogy
Keywords: meteorite, Early Solar System, CAI, astromineralogy