MINERALOGY AND BULK CHEMISTRY OF CAIs FROM EFREMOVKA AND NWA 3118 CV CHONDRITES

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Introduction: The bulk compositions of CAIs record the cumulative effects of multiple high-temperature and largely volatility-controlled processes during the first 1–2 million years of solar system history [1, 2]. Yet precise CAI bulk composition data remain sparse. We are conducting correlated investigations on a new suite of large CV CAIs (~0.5 to 2 cm), from Efremovka and from NWA 3118. We report here preliminary SEM and EPMA results for 7 of these CAIs. In particular, we used full-spectrum high-resolution x-ray imaging of the whole CAIs in order to obtain bulk compositions. All inclusions are very pristine and contain very minor secondary minerals, mainly nepheline, so their bulk compositions are accurate representations of their primary bulk compositions.

Results: The studied CAIs ("E" and "N" denote Efremovka and NWA 3118, respectively) include three compact Type A (CTA), (*16N*, *21bE*, *9bN*), one Type B1 (*27cE*), one fine-grained spinel-rich CAI (*27aE*), and two complex objects (*27bE*, *7N*) that are not easily classified. The CTA CAIs *16N*, *21bE*, and *9bN* are typical in all respects, and their bulk compositions lie squarely within the Type A field on the Ca_2SiO_4-Al_2O_3-Mg_2SiO_4 phase diagram [3]. The Type B1 CAI *27cE* is somewhat more melilite-rich that is typical for Type B1 CAIs, and its composition is intermediate between Types A and B. The bulk composition of the fine-grained spinel-rich *27aE* is like that of similar objects that have been studied [4], and overlaps also with those of some Al-rich chondrules [3].

CAI *7N* is mainly a CTA inclusion whose core consists almost exclusively of a nearly-pure and densely-crystalline melilite. The core is overlain by two very different successive mantles: (*i*) directly on the melilite is a thick fine-grained assemblage of polygonal-granular melilite + spinel + anorthite, and (*ii*) the outermost zone, present on one part of the CAI only and truncating the fine-grained inner mantle, is what appears to be a fragment of another CAI that consists of very coarse-grained spinel and fine-grained melilite and pyroxene. The bulk composition of the core is typical of Type As, the porous mantle lies in the field of Type Bs, and the outermost zone lies in the field of Type C CAIs.

CAI *27bE* is very heterogeneous and may be composite; its bulk composition is intermediate between Types B and C.

Collectively our new bulk CAI composition data indicate that (1) the "fields" defined by different CAI types probably do overlap considerably and the boundaries are not well-defined; and (2) it continues to be true that the overall trend of Types B and C CAI bulk compositions deviates systematically from the trend defined by equilibrium condensation of a gas of solar composition [e.g., 5].

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