CY chondrite: A tentative classification criteria

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Introduction: CY chondrites experienced secondary heating after aqueous alteration. Such heated chondrites were first reported from the NIPR meteorite collections (Tomeoka et al., 1989a; Ikeda, 1991; Bischoff and Metzler, 1991). Later, similar chondrites have been abundantly reported (e.g., Kimura and Ikeda, 1992; Tonui et al., 2002). In these chondrites, phyllosilicate was partly to completely decomposed to form mainly olivine with Fe-Ni metal, sulfide, and other phases. However, these chondrites still preserve similar textures to CM or CI chondrites. Ikeda (1992) proposed to call them CYs after the Yamato meteorites. The characteristic feature that distinguishes CYs from other chondrites is their oxygen isotopic compositions. All CYs are most depleted in ^{16}O among all chondrites. On the other hand, the thermal histories and genetic relationships among CY and between CY and other C chondrites are not yet clarified. Here, we focus on the classification of CYs.

Results and Discussion: There seem to be two types of CY chondrites: heated CM-like and CI-like. CM-like CYs are Y-86720 (e.g., Tomeoka et al., 1989a) and B-7904 (e.g., Kimura and Ikeda, 1992). Only three CI-like CYs have been notified. The representative is Y-82162 (e.g., Tomeoka et al., 1989b). CM-like CYs evidently contain chondrules, including its relict or pseudomorph. CI-like CYs have no chondrule pseudomorph but consist of fine-grained clasts, like CIs. Following the petrologic type criteria for C chondrites, here we tentatively classify CM-like and CI-like CYs into CY2 and CY1, respectively. Lipschutz et al. (1999) and Tonui et al. (2014) suggested that some CY chondrites are depleted in highly volatile elements, such as Cs and Te. However, it is noted that the bulk major compositions, such as Al and Mn, of CY2 and CY1 are consistent with those of CM and CI, respectively (after Choe et al., 2010; Braukmüller et al., 2018). King et al. (2021) suggested that all CY were derived from the same starting materials. King et al. (2019) suggested that the precursor materials of CY were different from those of CM because of the high modal abundance of Fe-sulfide in CY. However, the bulk S contents, 2.4-3.6 wt.% (Braukmüller et al., 2018) and 2.1-6.2 (Ivanova et al., 2010) of CM and CY, respectively, are overlapped to each other. This is inconsistent with the sulfide abundances of these chondrites. Recently Greenwood et al. (2022) suggested that B-7904 (CY2) has different oxygen isotopic compositions from Y-82162 and Y-980115 (CY1). The latter two have oxygen isotopic compositions that are close to those of CI. However, B-7904 has the different composition. They suggested that all CY are not derived from a single parent body. Thus, the relationships between the precursor materials of CY, CI, and CM are open problems. We suggest that systematic studies, including chemical and isotopic measurements and petrography, of CY1 and CY2 are necessary to clarify the relationships and precursor materials of all these chondrites.

References:

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