METASOMATIC ALTERATION AND OXYGEN ISOTOPIC COMPOSITIONS OF IGNEOUS CAIs FROM CK3 CHONDrites

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We describe the mineralogy and O-isotope compositions of primary and secondary minerals in coarse-grained igneous CAIs from CK3 carbonaceous chondrites measured in situ with the UH Cameca ims-1280 SIMS.

**Compact Type A CAI** from NWA 4964 (CK3.8) consists of grossmanite (18-20 wt% TiO₂), louisfuchsite [Ca₂(Mg₄Ti₂)(Al₄Si₂)O₂0], spinel, hibonite, gehlenite, perovskite, and secondary Fe±Ti-bearing grossular, Fe±Ti-bearing Al-diopside, clinohomite, spinel, forsteritic olivine, anorthitic plagioclase, wadutil, titanite, and ilmenite. Primary spinel, hibonite, louisfuchsite, and a grossmanite inclusion inside spinel are 16O-rich (D₁⁷O ~ -24±2‰). Grossmanite enclosing spinel and melilit enclosing hibonite are 16O-depleted (D₁⁷O ~ -6 to -4‰). Secondary grossular, Al-diopside, olivine, and plagioclase have D₁⁷O of -3.9±1.8‰ (Fig. 1a).

**Type B CAI** from NWA 5343 (CK3.7) consists of fassaite (6-16 wt% TiO₂), spinel, anorthite, and secondary Fe±Ti-bearing grossular, Fe±Ti-bearing Al-diopside, forsteritic olivine, spinel, anorthitic plagioclase, clinohomite, titanite, and ilmenite. Primary spinel is 16O-rich (D₁⁷O = -23±0.3‰). Fassaites containing ~6-8 wt% TiO₂ and poikilitically enclosing spinel are slightly 16O-depleted (D₁⁷O = -21±1.3‰). Spinel-free fassaites containing ~10-16 wt% TiO₂ are 16O-depleted: D₁⁷O range from ~ -10 to ~ -3‰. Primary anorthite is 16O-poor (D₁⁷O ~ -4‰). Secondary grossular, Al-diopside, olivine, and plagioclase have D₁⁷O of -3.5±1.8‰ (Fig. 1b).

The NWA 5343 forsterite-bearing Type B CAI consists of fassaite (2-10 wt% TiO₂), spinel, and forsterite, and secondary ferroan olivine (Fa₃₅) and CaₙNa-plagioclase of variable composition (An₉₀Ab₁₈ and An₃₉Ab₇₉₈₅). Spinel and forsterite are 16O-rich (D₁⁷O = -23±0.7‰); fassaite shows large variations in D₁⁷O (from -23 to -3‰) which correlate with TiO₂. Secondary olivine and plagioclase have D₁⁷O of -2.7±1.1‰ (Fig. 1c).

We conclude that coarse-grained igneous CAIs from CK3.7−3.8s experienced an open-system multistage metasomatic alteration in the presence of an aqueous fluid with D₁⁷O of ~ -4‰. The metasomatic alteration of these CAIs is more advanced and occurred under higher oxygen fugacity than that of the Allende (CV3.6) CAIs. Like in the Allende CAIs, melilit, anorthite, and Ti-rich pyroxenes experienced O-isotope exchange with the fluid; hibonite, spinel, forsterite, and louisfuchsite retained their original 16O-rich compositions.