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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% TiO_2), louisfuchsite [$Ca_2(Mg_4Ti_2)(Al_4Si_2)O_{20}$], spinel, hibonite, gehlenite, perovskite, and secondary Fe±Ti-bearing grossular, Fe±Ti-bearing Al-diopside, clintonite, spinel, forsteritic olivine, anorthitic plagioclase, wadalite, titanite, and ilmenite. Primary spinel, hibonite, louisfuchsite, and a grossmanite inclusion inside spinel are ^{16}O-rich ($D^{17}O$ ~ -24±2‰). Grossmanite enclosing spinel and melilite enclosing hibonite are ^{16}O-depleted ($D^{17}O$ ~ -6 to -4‰). Secondary grossular, Al-diopside, olivine, and plagioclase have $D^{17}O$ of -3.9±1.8‰ (Fig. 1a).

Type B CAI from NWA 5343 (CK3.7) consists of fassaite (6-16 wt% TiO_2), spinel, anorthite, and secondary Fe±Ti-bearing grossular, Fe±Ti-bearing Al-diopside, forsteritic olivine, spinel, anorthitic plagioclase, clintonite, titanite, and ilmenite. Primary spinel is ^{16}O-rich ($D^{17}O$ = -23±0.3‰). Fassaites containing ~6-8 wt% TiO_2 and poikilitically enclosing spinel are slightly ^{16}O-depleted ($D^{17}O$ = -21±1.3‰). Spinel-free fassaites containing ~10-16 wt% TiO_2 are ^{16}O-depleted: $D^{17}O$ range from ~ -10 to ~ -3‰. Primary anorthite is ^{16}O-poor ($D^{17}O$ ~ -4‰). Secondary grossular, Al-diopside, olivine, and plagioclase have $D^{17}O$ of -3.5±1.8‰ (Fig. 1b).

The NWA 5343 **forsterite-bearing Type B CAI** consists of fassaite (2-10 wt% TiO_2), spinel, and forsterite, and secondary ferroan olivine ($Fa_{\sim 35}$) and Ca,Na-plagioclase of variable composition ($An_{90-99}Ab_{1-8}$ and $An_{13-19}Ab_{79-85}$). Spinel and forsterite are ^{16}O-rich ($D^{17}O$ = -23±0.7‰); fassaite shows large variations in $D^{17}O$ (from -23 to -3‰) which correlate with TiO_2. Secondary olivine and plagioclase have $D^{17}O$ 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 $D^{17}O$ 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, melilite, anorthite, and Ti-rich pyroxenes experienced O-isotope exchange with the fluid; hibonite, spinel, forsterite, and louisfuchsite retained their original ^{16}O-rich compositions.