Ca AND Ti ISOTOPES IN PLATY HIBONITE CRYSTALS SUPPORT THE EXISTENCE OF AN ^{16}O-DEPLETED RESERVOIR IN THE EARLY SOLAR SYSTEM.

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Introduction: PLAty hibonite Crystals (PLACs) preserve large nucleosynthetic anomalies in Ca and Ti isotopes and may be among the first materials that formed in the Solar System [1]. Recently, significant Δ^{17}O variations were reported in PLAC-like CAIs [2], which suggest that in the earliest stages of Solar System history, heterogeneity existed not only in the most refractory elements, but also in O, an abundant element present in both the gas and dust phases over a wide range of nebular temperatures [e.g., 3]. To investigate the relationships, we have measured the Ca and Ti isotopic compositions in samples which have already been studied for O isotopes (25 PLAC-like CAIs and several other types of hibonite-bearing inclusions, including 3 FUN CAIs [2]) with the Cameca ims-1280 at UH Mānoa and conditions similar to [4].

Results and discussion: The PLAC-like CAIs have large anomalies in ^{48}Ca and ^{50}Ti (ranges of approximately –60 to +80 ‰ and –70 to +170 ‰, when normalized to ^{40}Ca/^{44}Ca and ^{46}Ti/^{48}Ti, respectively). Nuclear effects in other Ca and Ti isotopes are mostly unresolved. Therefore, when normalized to ^{49}Ti/^{47}Ti, the PLAC-like CAIs clearly deviate from the correlation between ^{46}Ti and ^{50}Ti observable in CV CAIs and other meteoritic materials [5]. Similar to PLACs studied in [1], ^{48}Ca and ^{50}Ti anomalies are correlated, but not perfectly, which is consistent with a common origin of these isotopes, but not with a simple mixture of a well-defined presolar carrier phase into a chemically homogeneous solar reservoir.

In contrast to previous studies, the PLAC-like and FUN CAIs studied here show a clear relationship between O isotopes and the magnitude of nucleosynthetic anomalies in ^{48}Ca and ^{50}Ti. The most ^{16}O-rich samples (Δ^{17}O as low as that inferred for the Sun [6]) have no or barely resolved anomalies, while the most ^{16}O-depleted samples (Δ^{17}O of ~ –18‰) have the largest effects in ^{48}Ca and ^{50}Ti. Since ^{16}O-depletions (relative to the Sun) are associated with both large depletions and enrichments in ^{48}Ca and ^{50}Ti, it seems unlikely that the presolar carrier(s) of Ca and Ti anomalies is also responsible for ^{16}O depletions. Similarly, we do not expect unidirectional photochemical processes to result in the observed relationship between O isotopes and nucleosynthetic anomalies. Instead, it appears that the PLAC-like CAIs sampled varying amounts of a ^{16}O-depleted reservoir with heterogeneous Ca and Ti isotopes. Since Ca and Ti are highly refractory elements, this reservoir was likely primitive dust [3].

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