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An in-situ O isotopic study of aqueous alteration products in the Alais CI chondrite

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CI chondrites represent highly aqueously altered solar system material, having experienced near-complete hydration. This study investigates the details of this alteration by examining the petrology and O isotopic composition of alteration products in 3 polished sections of the CI chondrite Alais, on loan from the Field Museum of Natural History. Using backscattered electron and energy-dispersive x-ray mapping, we identified carbonate and magnetite to target for in-situ oxygen isotopic analysis by secondary ion mass spectrometry (SIMS). To date, there have been few in-situ O isotopic studies of CI chondrites [1-3]. This study represents the first published in-situ oxygen isotopic measurements performed on the Alais meteorite and of CI magnetite.

Carbonate phases identified include dolomite and magnesite, lack calcite, and exhibit a variety of morphologies and compositions, some of which have been previously described [4]. Dolomite represents the dominant carbonate phase and is present as single grains isolated within the matrix, as rounded blebs surrounded by magnetite (Fe_3O_4), replacing primary inclusions, and as veins up to 600 µm in length. Some dolomite is associated with Ca-sulfate veins. EDS analyses of dolomite indicate chemical diversity, containing 2-4 mol% Fe and 1-6 mol % Mn. Magnetite is also present in a variety of morphologies which include stacks of plaquettes, isolated radiating spherules, framboidal clusters, and interstitially between dolomite blebs. Rare forsterite grains were also found within the matrix.

The 3 oxygen isotopic composition of individual dolomite and magnetite phases will be measured using the CAMECA ims-1290 secondary ion mass spectrometer at UCLA. Large dolomite phases were measured using an 800 pA Cs^+ beam with a precision of $\delta^{17}O$ ± 0.5 ‰ and $\delta^{18}O$ ± 0.5 ‰. Smaller dolomites, forsterite, and magnetite will be measured using a 40 pA Cs^+ beam with a precision of $\delta^{17}O$ ± 1.0 ‰ and $\delta^{18}O$ ± 1.6 ‰ (2SD).

[1] Piralla, M. et al. (2020), *Geochim. et Cosmochim. Acta* 269, 451-464 [2] Leshin, L.A. et al. (1997), *Geochim. et Cosmochim. Acta* 61, 835-845 [3] Zito, K. L. et al. (1998), *Metorit. Planet. Sci*. 33 #4, A171 [4] Endreß, M. and Bischoff, A. (1996) *Geochim. et Cosmochim. Acta* 60, 489-507