MORE EVIDENCE FOR UNIQUE AQUEOUS ALTERATION ON THE L-CHONDRITE PARENT BODY

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Introduction: Northwest Africa 12380 (NWA 12380) is an L3 chondrite containing a clast with a unique assemblage of minerals produced by pre-terestrial aqueous alteration [1]. Although the host meteorite has experienced significant terrestrial weathering (W3) [2], preliminary petrography and mineral-chemical analysis suggested that the clast originated as an especially wet L3 chondrite lithology prior to incorporation in the host [1].

Results: Major, minor, and trace element data were obtained using ICPMS on both host and clast (Fig. 1). Given the strong similarity between the host and clast siderophile abundances, we conclude that the host and clast are from the same chemical group. Bulk compositions resemble those in L- or LL-chondrites (Fig. 1), consistent with probable L group membership for both [2]. Both clast and (especially) host show the chemical effects of terrestrial weathering, but only the clast is significantly depleted in soluble alkali elements Na, Rb, and Cs (Fig. 1), consistent with the low amount of feldspathic material in the clast [1] and suggesting break-down of feldspathic glass and open-system removal of alkali elements from the clast by pre-terrestrial and pre-brecciation aqueous alteration. The oxygen isotopic composition of clasr aliquots form a mass-dependent trend from an average L-chondrite value, different from the mass-independent trend shown for the host (Fig. 2), which can be explained by dominant aqueous alteration in the clast, and a shift to higher $\delta^{18}O$ and lower $\Delta^{17}O$ caused by terrestrial weathering in a warm climate for the host.

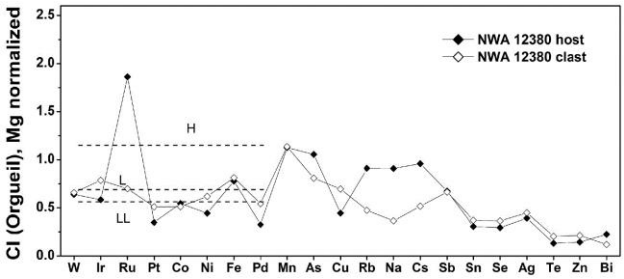


Figure 1. ICPMS data for NWA 12380 host and clast

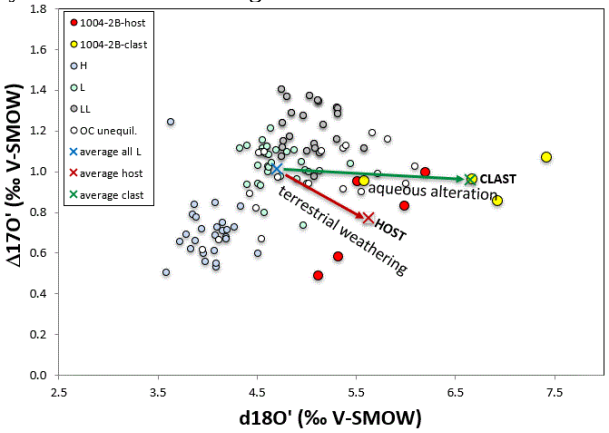
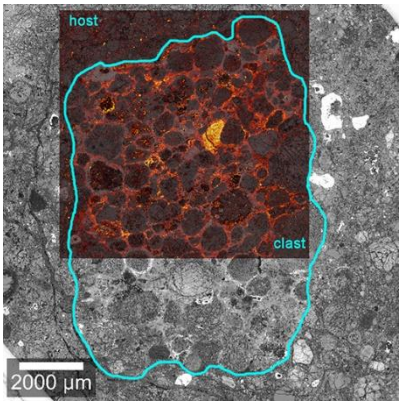


Figure 2. Oxygen isotope data for NWA 12380 compared to O-chondrite



Raman spectroscopy confirms the presence [1] in the clast of a saponite/montmorillonite mixture, jarosite, and cronstedtite, with additional identification of laihunite, hematite, goethite, and abundant macromolecular carbon (MMC) distinct from a few flecks of MMC in the host. The occasional flecks of MMC in the host are found only between chondrules. Two forms of MMC appear to be disseminated throughout the clast, both within and between chondrules. Additionally, a fine-grained MMC-rich lump (Fig. 3) appears to be an exogenous clast.

Figure 3. Reflected light image of clast with surrounding host, with an overlay showing the distribution of MMC, showing that MMC is enhanced in the clast relative to the host, and that the clast contains an MMC-rich lump.

Conclusion: A unique clast in NWA 12380 was aqueously-altered on the L-chondrite parent body prior to becoming incorporated in the host. The source for water could have been also a source of macromolecular carbon.

References: [1] Hutson, M. L. et al. (2019) *50th LPSC*, Abstract #1764. [2] Gattacceca J. et al. 2020. *Meteoritics & Planetary Science* 55:1146-1150.