

## LAP02342: Evidence for Chemical Variation During Hydrous Alteration

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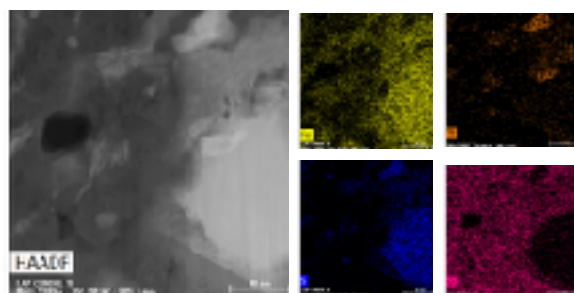
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LAP02342 was recovered from the La Paz icefield of Antarctica in the 2002-2003 season. It has been classified as a Renazzo-type carbonaceous chondrite, with an alteration subtype of 2 and a weathering stage A/B. Several preliminary studies have tried to characterize this enigmatic stone (e.g. [1-5]). Here are reported observations showing that LAP02342 contains multiple alteration levels, ranging from low levels to moderately altered.

Two FIB sections were characterized using the Nion aberration-corrected dedicated STEM at NRL. The first section has two components of chondrule rim from a type I porphyritic olivine chondrule, with component A bordering on the chondrule and component B bordering on the matrix. This is a well-formed S-rich rim, similar to those rims described in primary accretionary textures, seeming to contradict the findings of [3]. EDS mapping shows that this section has sustained moderate levels of aqueous alteration, demonstrated by the total conversion of FeNi metal grains into regions rich in Fe, Ni, S and O, compatible with the formation of the Fe-oxysulphide, tochilinite (see figure 1). This is similar to the elemental redistribution reported by [6-7]. Numerous patches of incipient crystallites were also observed, with lattice spacings of ~0.7nm, consistent with the formation of chrysotile [8].

The second section is a portion of matrix. This section shows less alteration, similar to that reported by [4-5]. Many areas remain amorphous Mg,Fe-rich silicate. However, FeNi metal grains are absent, probably replaced by the abundant FeNi-oxide grains. Interestingly, there are several high-Z grains which have cores of oxide surrounded by S-rich material. Could this indicate that more than one period of alteration occurred, the first O-rich followed by a S-rich fluid? Alternatively, could this indicate a



changing fluid composition mid-way through a single alteration event?

**Figure 1.** HAADF image and elemental maps showing high Z grain is a mixture of Fe, Ni, S and O, consistent with it being tochilinite.

**References:** [1] Wasson J. T. and Rubin A. E. 2009 GCA v73 #5 p1436-1460; [2] Pizzarello S. et al. 2010 GCA v74 #21 p6206-6217; [3] Wasson J. T. and Rubin A. E. M&PS 2014 v49 #2 p245-260; [4] Moyano-Camero C. E. et al. 2016 LPSC v47 #1903 p2537; [5] Stroud R. M. et al. 2016 MetSoc v 9 #1921 id#6360; [6] Burger P. V. and Brearley A. J. 2005 LPSC v36 abs#2288; [7] Brearley A. J. and Burger P. V. 2009 MetSoc v72

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p5148; [8] Chizmadia L. J. and Brearley A. J. 2008 GCA v72 #2  
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