Abundant Water in Ordinary Chondrites: Evidence from a Clast with Unique Alteration Assemblage in the Northwest Africa (NWA) 12380 (L3) Chondrite

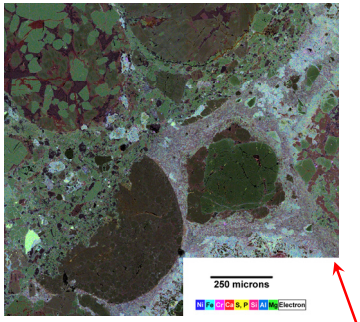
M. L. Hutson[1], A. M. Ruzicka[1], and S. Tutorow[2], [1]Cascadia Meteorite Laboratory, Dept. of Geology, Portland State University, P.O. Box 751, Portland OR 97207-0751, [2]eegoblago meteorites, Tucson, AZ 85705.

Summary

Clast is texturally distinct from host, with fully hydrated matrix, and partial replacement of chondrule interiors. Clast has unique assemblage.

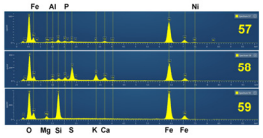
Pre-terrestrial alteration

clast/host contact is irregular, but sharp. Different host and clast matrix compositions.



Cronstedtite and Jarosite

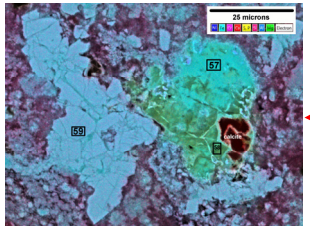
Clusters of cronstedtite crystals are common in matrix, along with small patches of a jarosite/Fe hydroxide intergrowth



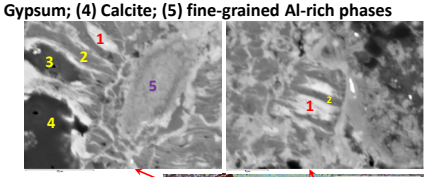
Fe/OH phase

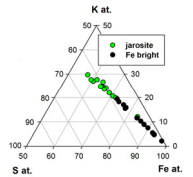
Jarosite

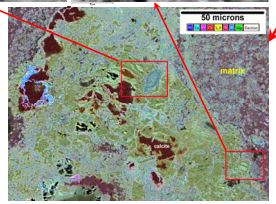
Cronstedtite



Interlayered and variable Jarosite (2) and Fe/OH phase (1) (3) Gypsum; (4) Calcite; (5) fine-grained Al-rich phases

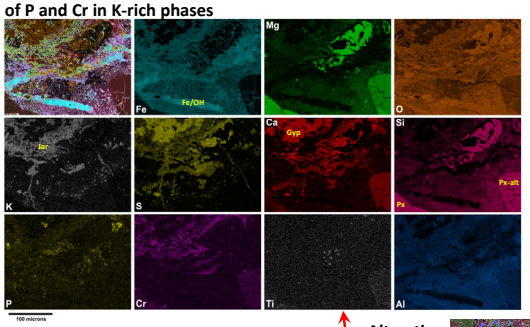






Complex sulfate intergrowths

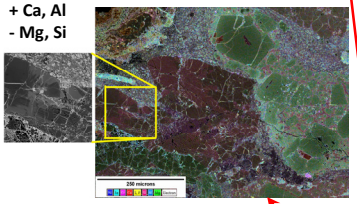
Some discrete sulfur-rich patches contain a zoned assemblage of gypsum (Gyp), jarosite (Jar), and Fe/OH phase. See enhancements of P and Cr in K-rich phases



Note zone of Mg and Si enhancement in matrix surrounding altered pyroxene (Px-alt)

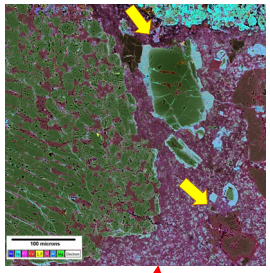
Pyroxene alteration

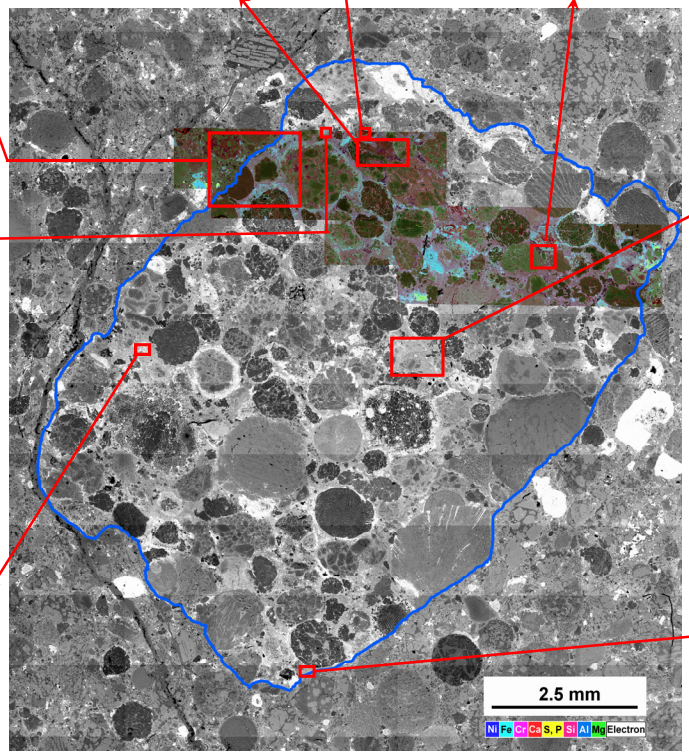
+ Ca, Al
- Mg, Si



Intraclast brecciation following alteration

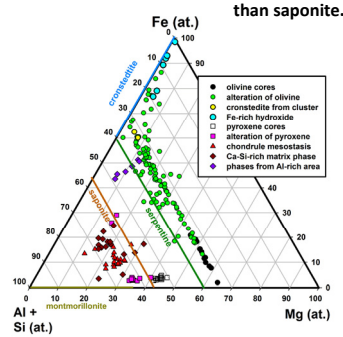
Alteration around grains truncated before final clast formation





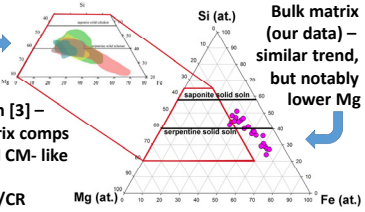
Silicate compositions

Alteration assemblage both similar to and distinct from those previously reported (e.g., [1]). Do not see phases populating ternary space between serpentine and saponite (e.g., [2]). See "smectites" with Al+Si > than saponite.

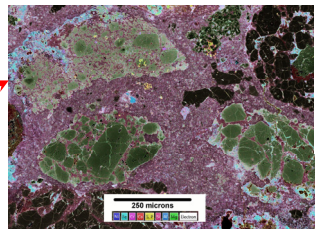


Unique matrix composition

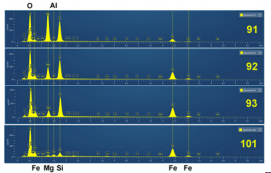
Data from [3] – bulk matrix comps of CI- and CM- like clasts in O/CH/CB/CR chondrites, HEDs, ureilites



Bulk matrix (our data) – similar trend, but notably lower Mg



Olivine alteration

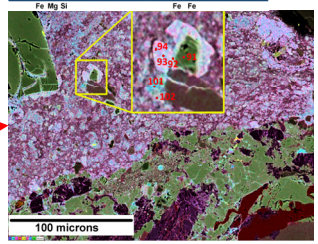


Mg-ol core

Fe-ol (+Fe, -Mg)

Serpentine or Cronstedtite

Fe/OH phase



Clast-host contact – irregular, but sharply defined

References: [1] Brearley A.J. (2006), in MESS II; [2] Brearley A.J. (1995), GCA 59. 2291-2317; [3] Patzek M. et al. (2019) Meteoritics & Planet. Sci. 53, 2519-2540.

Support: This work was funded entirely by donations from the public to Cascadia Meteorite Laboratory. Special thanks to S. Tutorow for providing generous sample for study.

Portland State UNIVERSITY