Possible clues of sulfide volatilization in Al Haggounia 001. **P. Manzari[1], G. Agrosì[2], D. Mele[2], G. Tempesta[2].**
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Introduction: In the frame of a broader study on impact effects on meteorites' microstructures and mineralogy, we have begun to study the Al Haggounia 001 meteorite using the combination of 3D techniques supported by chemical characterization. Al Haggounia 001 is a very interesting EL3 impact melt [1,2]. Different samples were found of this meteorite showing different looking. Among them, some show a strong porosity. Due to lack of expected metal and sulfide abundances, lack of well-defined chondrules and the presence of vesicles, this meteorite has also a complex classification history before the last classification as EL impact melt. This meteorite suffered shock by impact [1]. In particular, according to Rubin [1], the occurrence of vesicles could be explained as sulfide evaporation during impact shock. In this abstract we show some preliminary findings of our investigations.

Sample and Methods: Two porous samples were investigated: one thin section and a slab section. The latter was investigated by X-ray µ-CT and SEM analyses, which included the study of morphological features of the samples by SE imaging, EDS chemical characterization and X-ray elemental maps.

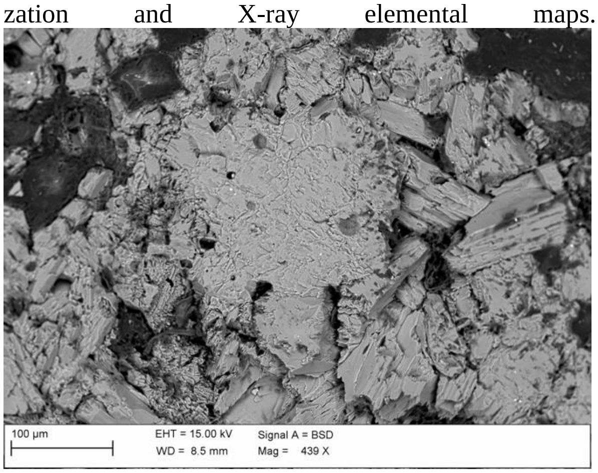

Figure 1 BSD image of two rounded vesicles in Al Haggounia 001.

Results: By SEM-EDS analyses and elemental maps, we found enstatite, Na-plagioclase/mesostasis, Ca-sulfide, Fe-sulfide, a N, Si-bearing phase, Fe, Cr(Fe)sulfide, graphite, halite, jarosite, and a Ca-Ti silicate. The latter is not common in enstatite chondrite and needs to be deeply investigated.

Images by SEM and X-ray µ-CT show that vesicles are present across all the samples (Fig.1). The vesicles constitute both an open and closed porosity [3]. The first µ-CT measurements show a porosity of about 13% that consists mostly of open pores (10.5 %), likely related to severe weathering processes whereas closed pores are 2.5 %.

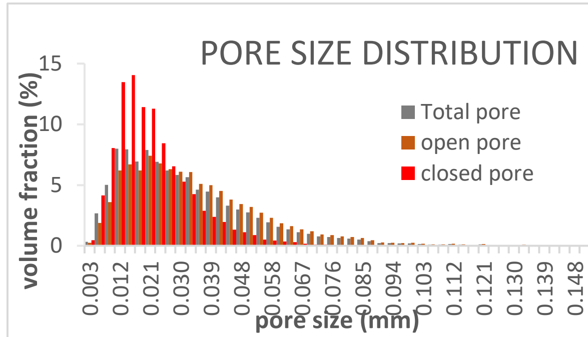

Figure 2 Statistics of pore size distribution

The average size of pores is 35 µm and 21.8 µm for open and closed pores, respectively (fig. 2).

The vesicle shape is rounded and with smooth internal surface.

Furthermore, the presence of small vesicles was noted on sulfides.

In particular, Cr, Fe, Mn sulfides were the biggest sulfide grains in the slab, and on these grains we observed vesicles (Fig 2).

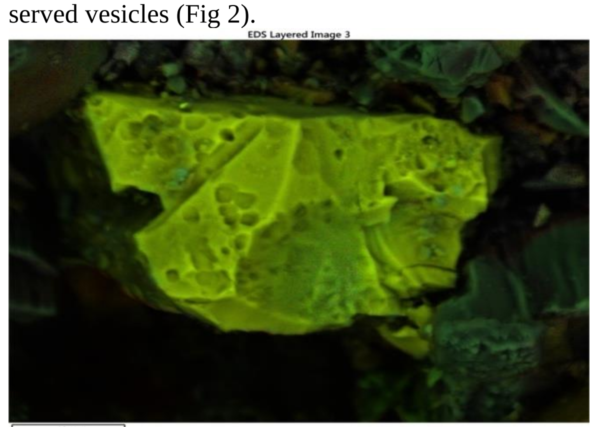

Figure 3 Popped bubbles look on the surface of a Cr-sulfide grain

Moreover, the statistics of pore size and high density phases let think about a possible correlation between them.

Discussion and preliminary outcomes: If vesicles were related only to secondary processes, due to the time of Al Hag 001 long staying on Earth, it would be difficult to explain the closed pores. Closed pores could be bubbles of S2 evaporating from sulfide phases, during the impact melting event, as suggested by Rubin (2016). Our findings of sulfide grains with surface morphology resembling bubble pops could support this theory. In the upcoming work we will focus on the correlation of sulfide grain size and closed pores size. The results of these investigations could have implications on the study of terrestrial and extraterrestrial impactites.

References:

[1] Rubin, 2016, Meteoritics & Planetary Science 51, Nr 9, 1576–1587 (2016), doi: 10.1111/maps.12679.

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[3] Manzari et al., (2020) EPSC2020-814 Presentation.