LaPaz 031117: A New Primitive CO3 Carbonaceous Chondrite. L. J. Chizmadia and E. Cabret-Lebrón, Department of Geology, University of Puerto Rico, PO Box 9017, Mayagüez, PR 00681 USA lysa@uprm.edu.

Introduction: The CO3 carbonaceous chondrites demonstrate a linear metamorphic sequence [1] and many have been assigned petrologic subtypes according to the extent of hydrothermal alteration. The subtypes originally ranged from 3.0 to 3.7, similar to the ordinary chondrites, on the basis of the systematic Fe-enrichment of olivine and low-Ca pyroxene in type I porphyritic chondrules [2]. A subsequent study of amoeboid olivine inclusions (AOIs) demonstrated that they are more sensitive to parent body hydrothermal alteration in the CO3 chondrites [3]. This modified scale has been independently verified by the studies of [4-6]. [3] expanded the range of subtypes to 3.8 in order to make room for a hypothetical 3.1. Meteorites belonging to the 3.1 subtype are expected to show signs of the incipient stage of alteration [3]. Recently a study of Cr_2O_3 in CO3 chondrule olivine confirmed the existence of a gap between 3.0 and 3.2 in existing datasets [6]. In 2006 two separate groups discovered CO3 chondrites which have the predicted characteristics of CO3.1 chondrites: DOM03283 [7] and A-881632 [8].

To date there are over 200 CO3 chondrites in our collections and yet only ~30 have been assigned petrologic subtypes [3-4,6,7-8]. This study is a continuation of the determination of the levels of hydrothermal alteration.

Methods: A petrographic thin section of the Lap031117 CO3 carbonaceous chondrite was obtained from a loan from the Smithsonian Antarctic Meteorite Collection (section #0). The thin section was carbon-coated and mapped with back-scattered electrons on a JEOL JSM5900 LV scanning electron microscope (SEM) in the Biology Department at the University of Puerto Rico, Mayagüez. Five AOIs were identified in the thin section. The constituent phases (olivine, diopside, anorthite, spinel, Fe-Ni metal, sulphides and phosphates) were analyzed on the Cameca SX50 electron microprobe (EMP) in the Geology Department of the University of Puerto Rico, Mayagüez for 14 elements using 3 crystal spectrometers, natural mineral and synthetic standards, ~20 second counting times, PAP corrections, a sample current of ~20 nA and an acceleration voltage of 15 kV.

Results: The coarse objects (e.g. chondrules and CAIs) in the thin section A-881632,55 are enclosed in fine-grained rims and the section appears to have a primary accretionary texture, such as that described by [9]. Type I porphyritic chondrules show no signs of Fe-enrichment in BSE images and FeNi is abundant, similar to the 3.0s reported by [2].

The type I porphyritic chondrules show no signs of Fe-enrichment in BSE images and FeNi is abundant, similar to the 3.0s reported by [2]. Lap03117 does show sporadic terrestrial alteration veins which cut through both coarse-grained objects (e.g. chondrules) and fine-grained matrix. However, the terretrial alteration tends to be locatlized and areas showing no obvious signs of terrestrial alteration can be found easily.

As the CO3 chondrites were altered on their parent body asteroids, the forsteritic olivine crystals in the AOIs ($<Fa_1$) are cut by ferroan olivine veins ($Fa_{35\text{-}40}$). The ferroan olivine veins widen systematically as the level of alteration increases, eventually replace all of the Mg-rich olivine. Petrologic subtypes are assigned primarily on the basis of the distribution of fayalite content in the olivine of the AOIs. The olivine in AOIs in Lap031117 is very uniform and dark in BSE imaging. We found no indication of incipient veining such as that seen in CO3.1s [7-8]. Upon analysis, the olivine in the AOIs of Lap031117 was very uniform (Fig.1), ranging from $Fa_{0.28}$ to $Fa_{1.2}$ (Fig.2). The average fayalite content of the olivine is 0.56% with a standard deviation of 0.21.

Discussion: Although the mol%Fa range in the Lap03117 AOIs is somewhat higher than the Fa in other CO3.0 chondrites, it is more consistent with the CO3.0s than with the CO3.1s (Fig.2 and Table 1). The likely explanation for the slightly higher values is probably due to small Fe-rich veins of terrestrial alteration, as described by [10].

In addition, the wt%Cr_2O_3 contents of the olivine in Type II chondrules was used to verify the subtype, as per [6]. The average wt% Cr_2O_3 content is 0.39 and the standard deviation is 0.12. The distribution of Cr_2O_3 in type II chondrules is more consistent with it being a 3.0 rather than a 3.1 (Fig. 3).

Subtype	Meteorites	Avg %Fa	SD %Fa
3.0	ALHA77307	0.4	0.3
	Y-81020		
	Lap031117	0.39	0.12
3.1	A-881632	1.14	1.46
	DOM03283		
3.2	Kainsaz	4.29	4.71
	Y-82050		

Table 1. The average mol% Fa values for Lap03117 compared to the CO3.0s ALHA77307 and Y-81020, the CO3.1s A-881632 and DOM03283, and

the CO3.2s Kainsaz and Y-82050. Note the similarity of the values for Lap03117 and those of the CO3.0s.

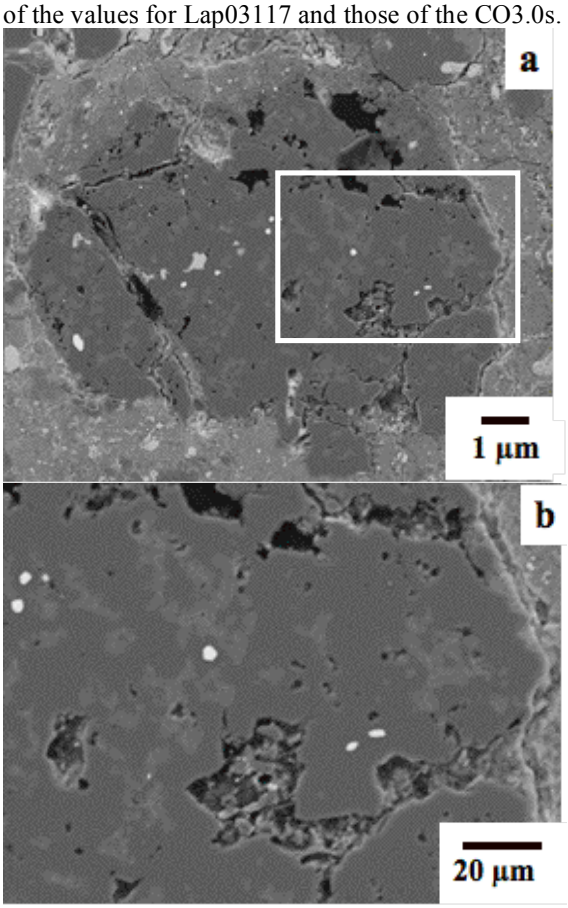
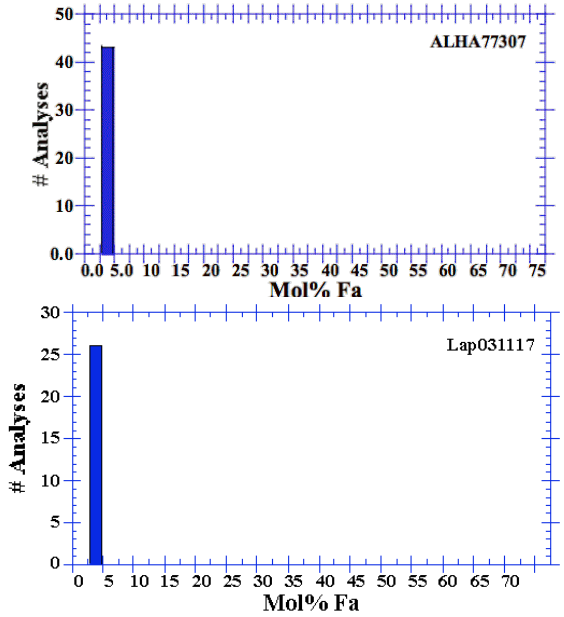


Figure 1. BSE images of a typical AOI in Lap031117, image (b) is from the white box in image (a). Note the olivine is dark, indicating a low average atomic number (Z). No ferroan olivine has been identified in the AOIs of Lap031117.



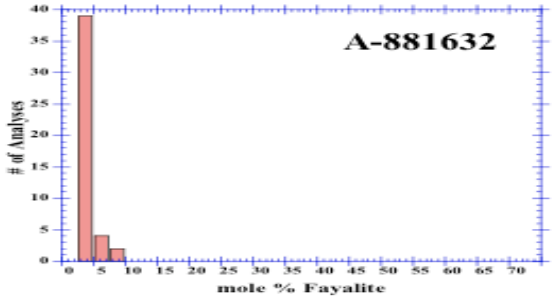


Figure 2. Histograms showing the distribution of the fayalite content of AOIs in Lap031117 compared to the CO3.0 ALHA77307 [3] and the CO3.1 A-881632 [8]. Note that distribution of the fayalite in the AOIs in Lap031117 is more similar to the CO3.0 ALHA77307 and to the CO3.1 A-881632.

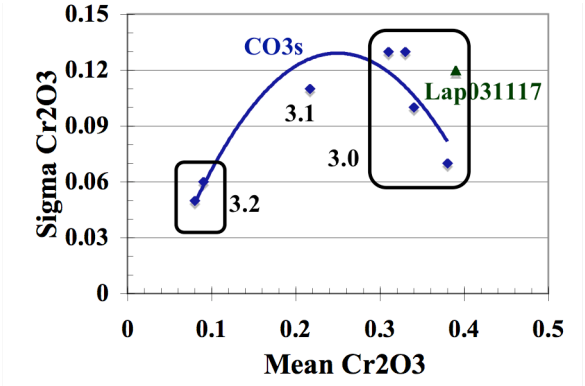


Figure 3. Average wt% Cr_2O_3 vs. the standad deviation of wt% Cr_2O_3 in Type II chondrules in CO3 chondrites (CO3s) and Lap031117, modified from [6].

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