ALLAN HILLS 77307 AND OTHER CO CARBONACEOUS CHONDRITES: INVESTIGATING THE LATE ACCRETION AND LITHIFICATION OF THE FIRST PLANETESIMALS. M. Martínez-Jiménez[1] and J.M. Trigo-Rodríguez[1]. [1]Meteorites, Minor Bodies, and Planetary Sciences Group, Institute of Space Sciences (CSIC-IEEC). Campus UAB, Fac. Sciences, C5-p2, 08193 Bellaterra (Barcelona), Spain. trigo@ice.csic.es

Introduction: It has been invoked that certain chondritic meteorites are samples arrived from second-generation parent bodies that re-accreted after the collisional destruction of the first planetesimals formed in our solar system [1-3]. Comprehensive reviews of the processes leading to shock and brecciation of these materials have been already published [see e.g. 4-5]. A significant number of chondritic meteorites have been found to be breccias exhibiting distinctive multiple lithologies [4-6]. Curiosly, among the carbonaceous chondrites (hereafter CCs), only a few CO3 chondrites are breccias, even although these meteorites are among the most pristine chondrites. We focus here in CO chondrites in order to look for additional clues in that regard. Escaped COs from collisional processing and mixing with other projectiles in some protoplanetary disk region? COs are unequilibrated chondrites usually formed by small, closely-sized chondrules and CAIs with about 200-300 µm in size that are set in a dry, olivine-rich matrix. Aqueous alteration has been not described except for some dark inclusions (clasts) found in Kainsaz, Ornans, Lance and Warrenton [7]. Finally, as a by-product of our mineralogical study we discuss the effect of terrestrial alteration in some of the studied chondrites.

Technical procedure: Three sections of Antarctic CO chondrites were used for this study (Table 1) and compared with the widely available Kainsaz fall. We selected COs with different petrologic subtypes to better understand the effect of thermal metamorphism in changing mineralogy. Two high-resolution mosaics of the sections were created from separate 50X images taken with a Zeiss Scope petrographic microscope. The mosaics allowed us to establish target features to be characterized by SEM+EDS, polarizing petrographic microscope, and micro-Raman techniques.

Name	Petrologic subtype	TKW (kg)	Fall / find (year)
ALHA77307	CO3.0	0.18	Find(1977/8)
Kainsaz	CO3.2	~200	Fall (1937)
ALH82101	CO3.4	0.03	Find (1982)
ALH77003	CO3.6	0.78	Find (1977)

Table 1. List of CO chondrites studied here.

SEM-EDS techniques. We used a FEI Quanta 650 FEG working in low vacuum BSED mode. The EDS detector used to perform elemental analyses is an Inca 250 SSD XMax20 with Peltier cooling with an active area of 20 mm^2. Some selected areas were explored at different magnification, and SEM elemental mapping together with EDS spectra were obtained.

Results and discussion: ALHA77307 has been identified as one of the most pristine carbonaceous chondrites with fine-grained amorphous dust and highly unequilibrated minerals [6]. A similar picture can be envisioned for other COs, but thermal metamorphism has participated in significant mineral changes and chemical homogeneization. Some details on the petrology and mafic phases: forsteritic to fayalitic alteration of silicates due to thermal metamorphism.

As a clear example of the diversity of materials forming COs we include in Fig. 1 a EDS elemental mapping of a ~1 mm^2 region forming ALHA77307. The main components of this region are a chondrule of an intergrowth of anothite into forsterite, with a rim of fayalite and, around it, some iron oxide grains. Besides, it can be seen spinel grains, schriebersite, troilite, and some forsterite chondrules have magnetite inclusions due to its high porosity. It is particularly interesting the chondrule/matrix complementarity that is only partially altered by thermal metamorphism [8]. Probably that complementarity is indicating that the CO formed from materials constrained to a local region of the protoplanetary disk in relatively short timescales. Being in the inner disk, their forming-minerals accreted dry, and only low velocity collisions fragmented some of the largest components to form the matrix.

In some of the highest petrologic types studied, it has been found terrestrial alteration which is a consequence of the geomorphology and the meteorological conditions. The main processes are iron oxidation in Fe-Ni metal, troilite, maphic silicates (topotactic replacement of olivine), chondrule border corrosions, formation of by-products like serpentine (hydrated minerals), and referred to the matrix, dissolution and creation of siltstone.

Conclusions: We have started a petrologic study of several CO chondrites in order to better understand accretionary processes in the protoplanetary disk [6]. We envision a formation model in which the CO parent body accreted from a constrained region of the disk in wich their forming materials were subjected to moderately low collisional processing. This fact could explain the relative absence of breccias and the matrix chemical complementarity. The highest petrological subtypes (ALH82101 and ALHA77003) have been significantly altered by water in Antarctica.

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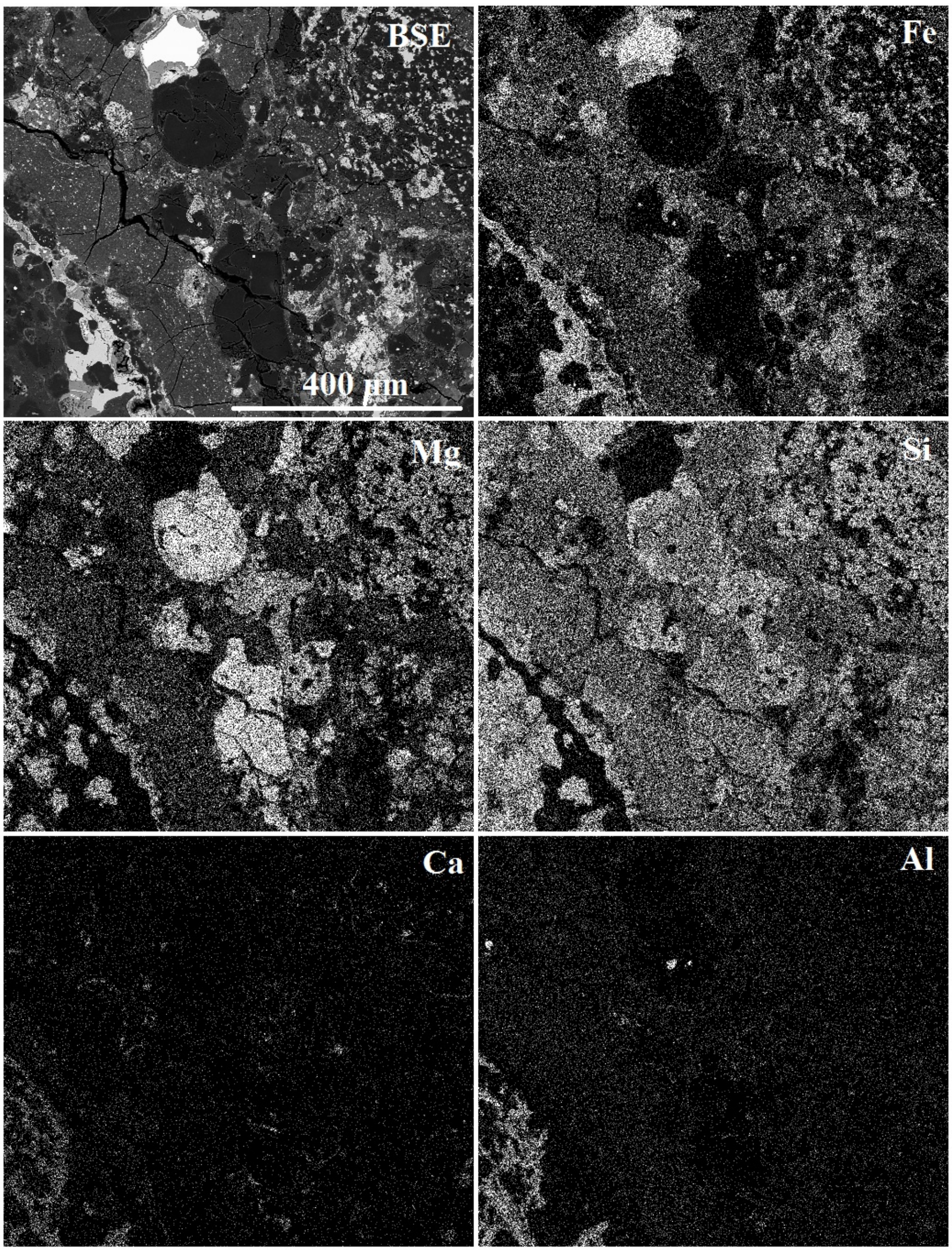

Figure 1. EDS elemental mapping of K6b region of ALHA77307 thin section surrounding a chondrule.