NON DESTRUCTIVE METHOD FOR BULK CHEMICAL CHARACTERIZATION OF BARRED OLIVINE CHONDRULES . M. A. Montoya[1], K. E. Cervantes-de la Cruz[2] and J. L. Ruvalcaba-Sil[3] [1]Facultad de Ciencias, Universidad Nacional Autonoma de Mexico, UNAM (karina-cervantes@ciencias.unam.mx), [2]Instituto de Ciencias Nucleares, UNAM, [3]Instituto de Fisica, UNAM.

Introduction: Ever since asteroids were discovered, they've been seen as remains of planetary formation [1], because they registered the processes that occurred in the origin of the Solar System in the same way that Earth's history is studied from geological registry. Chondrites represent unique study objects because the materials conserved in them were formed during the early stages of the Solar System [2]. The purpose of this work is to develop a bulk chemical characterization of 11 barred olivine chondrules in four Allende chondrite thin sections based on the X-ray fluorescence (XRF) analysis using the SANDRA portable equipment [3] at the National Research and Conservation Science Laboratory of Cultural Heritage (LANCIC-IF) in Mexico City.

Procedure: The SANDRA portable equipment was run at a voltage of 35 kV and a current of 0.3 mA. No vacuum was used. Each chondrule in the thin sections was scanned three times using a 500 µm diameter X-ray beam for 120 seconds.

The raw spectra were then transferred to the AXIL software. Using AXIL, the area under the peak was calculated. We calculated the average of the areas to find one value per element per sample.

To build a standard. We selected one of the chondrules with a matrix/olivine proportion that was average to the chondrule's sample. Punctual analysis with Electron Micro Probe Analyzer (EMPA) in matrix and olivine of the selected chondrule used to create a standard.

We calculate the elemental composition of all chondrules comparing the X-ray spectrum of the standard with spectrum of each one of them.

We distinguish the total iron in kamacite (FeNi) from the iron in troilite (FeS) and ferrous oxide (FeO) using the percent in weight to Ni and S. We calculated the magnesian oxide (MgO) percent wight in the same way.

Results: We estimated magnesium number (#Mg) for each chondrule with their MgO and FeO concentrations (Table 1). These values range from 80.2 to 94.8, very close to values of 93.0 [4] and 94.8 [5] previously reported. These values represent a poorly evolved olivine.

Final Thoughts:

Basic analysis with SANDRA portable equipment allowed to measure magnesium values very close to the ones reported before. Deeper future analysis may solve the variations showed in some calculations in this work.

Table 1. Magnesium number of each chondrule.

Sample	FeO (%Wt)	MgO (%Wt)	#Mg
Standard	3.984	36.219	90.09
C.BO.A*			93.0
C.BO.A**			94.8
Chondrule 1	3.308	61.336	94.88
Chondrule 2	4.039	38.403	90.48
Chondrule 3	4.622	62.064	93.07
Chondrule 4	3.475	97.919	96.57
Chondrule 5	4.409	29.849	87.13
Chondrule 6	3.625	68.252	94.96
Chondrule 7	5.864	23.843	80.26
Chondrule 8	3.984	36.219	90.09
Chondrule 9	4.068	60.608	93.71
Chondrule 10	4.524	75.532	94.35
Chondrule 11	4.032	70.436	94.58

#Mg = 100 x (MgO / MgO + FeO).

C.BO.A* : #Mg values calculated for Allende's barred olivine chondrules by Simon and Haggerty [4].

C.BO.A**: #Mg values calculated for Allende's barred olivine chondrules by Rubin and Wasson [5].

Even though this technique cannot yet substitute more advanced ones, it will be a quick and simple non invasive way to analyze the chemical bulk composition. Therefore, this technique represents an excellent opportunity to the study and conservation of very important materials in the meteorite field and planetary sciences.

References:

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