Geochemical and petrochemical study of type 3 ordinary chondrites.

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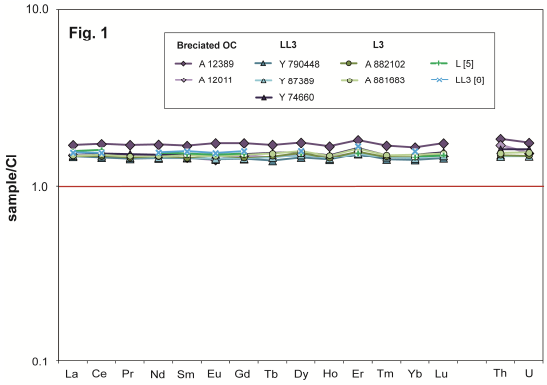
Introduction: Chondrites are the most primitive objects in the Solar System. The study of this kind of meteorite gives information to constrain the initial compositions and evolution of the Solar System. Chondrites are subdivided in three major class: carbonaceous, ordinary and enstatite chondrites. Chondritic meteorites are divided in 6 different petrological types. Type 3 chondrites are the least altered chondrites (unequilibrated) whereas types 1-2 are hydrothermally altered chondrites. Type 4-6 chondrites were affected by thermal metamorphism. The purpose of this study is a systematic bulk and mineral analyses of REEs, minor and trace elements for each different type to evaluate the impact of secondary process like metamorphism. We choose to analyzed the ordinary chondrites clan due to the large range in metamorphism degree (type 3-6) represented in this group.

For the first part of this study, we particularly analyzed type 3 OC. Five type 3 samples in the NIPR Antarctic meteorite collection were selected: three of them are diffined like LL3 (Yamato (Y-) 790448; Y-87319; Y-74660) and the two other are L3 type (Asuka (A-) 882102; A-881683). Two brecciated LL ordinary chondrites are also analyzed (A-12389 and A-12011) [1]. Allende carbonaceous chondrites were also analysed like standard. This abstract present the preliminary results obtained for the bulk composition of REEs, Th, U and some trace and minor elements. Petrological study are also conducted to redefined the subtype of each sample.

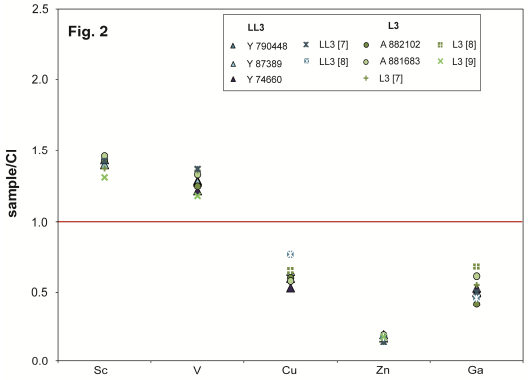
Analytical method: About 15 mg of each powder OC sample and the Smithsonian Institution (SI) Allende meteorite powder sample was dissolved an $HF/HClO_4/HNO_3$ mixture (2:1:1) followed by a step in concentrated $HClO_4$ and s step in concentrated HCl. After complete dissolution, all samples solutions are stock in 1N HNO_3 as mother solution. An enriched isotope ^{149}Sm was added before the dissolutions of samples to control the sample loss during the chemical preparation. The value of Sm was determined by both isotope dilution and external calibration method. For the other elements, external calibration method was used. The difference of Sm values between isotope dilution and external calibration methods gave the recovery for each sample. The data for other elements were corrected for losses during preparation of solution by applying chemical recoveries obtained from Sm. In, Tl and Bi was added in sample and standard solutions as internal standard. ICP-MS measurements were performed by Element XR at NIPR. Several tests were performed with SI Allende meteorite powder samples to define an appropriate dilution factor to obtain accurate data of REE, Th and U. Other trace elements (Y, Cs, Ba and Pb) were analyzed in low resolution with a dilution factor of 3,000. For Sc, V, Cu, Zn, Ga and Sr, medium resolution was used with a 80,000 of dilution factor.



Several minor elements were also analyzed for those samples. Figure 2 show the abundance of Sc, V, Cu, Zn and Ga. All data are presented normalized to CI. We also ploted data of LL3 and L3 chondrites from literatures [4-6].Our results show that our data are consistent with these previous data.

Result and discussion:

Figure 1 shows the REEs, Th and U pattern of our samples normalized to CI. All the samples present a flat pattern enriched compared to CI. Results are also consistent with the values of ordinary chondrites from the literatures [2,3]. Only the brecciate sample A 12389 shows a slightly higher enrichment compare to theother samples.



Conclusion and Perspective: Preliminary results obtained on OC samples show similar composition for the LL3 and L3 REE pattern and five minor elements analyzed in this study. These samples are considered to be the most primitive composition of OCs. Previous study showed that distribution of Cr in Fe-rich olivine in Type II chondrule of OC vary with the petrologic sub-type [7]. Based on this, we plan to analyse several olivines in this type of chondrule already selected by SEM imagies to defined precisely the subtype of our five OC samples.

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2767, [5] Binz C.M. et al. (1976) GCA 40, 59-71, [6] Kong P. and Ebihara M. (1996) GCA 60, 2667-2680, [7] Grossman J. N. and Brearley A. J. (2005) MAPS 40, 87-122