

## MINERALOGICAL STUDY OF A WHITE CLAST FROM MURCHISON (CM2): COMPARISON WITH R-CHONDRITES

I. Kerraouch<sup>1</sup>, M. E. Zolensky<sup>2</sup>, A. Bischoff<sup>3</sup>, L. Le<sup>4</sup>, D. Belhaï<sup>1</sup>, M. Patzek<sup>3</sup>, and S. Ebert<sup>3</sup>, <sup>1</sup>Planetology research team, University of Science and Technology Houari Boumediene (USTHB), Alger, Algeria. E-mail: [kerrimene@gmail.com](mailto:kerrimene@gmail.com). <sup>2</sup>NASA Johnson Space Center, Houston TX, USA. <sup>3</sup>Institut für Planetologie, Wilhelm-Klemm-Str. 10, D-48149 Münster, Germany. <sup>4</sup>Jacobs ESCG, Houston, TX 77058 USA.

**Introduction:** R-chondrites share some properties with ordinary chondrites (OC) and carbonaceous chondrites (CC). The proportions of the textural types of chondrule from R chondrites and their FeO/(FeO+MgO) ratios are similar to those of OC, but the high matrix abundance in R chondrites more closely resembles that of CC (matrix abundances: OC ~12 vol% vs. CC 34→60 vol%; [1-5]). In this study, we characterize the mineralogy of a white clast from Murchison (CM2), which was earlier considered to be a R-chondrite [6]. First, all the petrographic and mineralogical characteristics will be described and compared with those of R-chondrites [7,8]. Finally, all data will be considered in order to test, whether this clast is a real R-chondrite or a unique recrystallized chondrite?

**Analytical methods:** A polished thick section of Murchison was used for this study. Backscattered electron (BSE) imaging was performed with scanning electron microscope. Mineral compositions were measured using an electron microprobe. The modal abundances of the clast, were determined on the thick section using the open source image processing program “ImageJ” [9]. Each component was precisely thresholded based on its grey value on BSE images and the corresponding area% measured. Bulk compositions were determined using modal recombination following the protocol of [10,11].

**Petrography and mineralogy:** The studied section with the white clast comprised two areas with a granular texture: (a) a coarse-grained (grain size: ~200 μm) and (b) a fine-grained area (grain-size: ~20 μm). Both areas show a well-recrystallized chondritic texture. The olivine and Ca-pyroxene grains are equilibrated in the whole clast, while the plagioclase and sulfides do show some variations within the two domains (Fig. A).

The dominant phase is olivine (~Fa<sub>38</sub>; ~54 vol%). Ca-rich pyroxene (diopside, ~Fs<sub>10</sub>Wo<sub>50</sub>; 16 vol%), plagioclases (14 vol%), and sulfides (~13 vol%) are also abundant. The plagioclases are somewhat unequilibrated ~An<sub>32-45</sub>. Some nepheline has been analyzed. As sulfides pyrrhotite (or troilite), monosulfide solid solution and pentlandite were found. In the coarse-grained areas mainly Fe-rich sulfides occur, while the dominant sulfides within the fine-grained areas are rich in Fe, Ni, and S. Cr-spinel (2 vol.%) are the only oxides and one grain of amphibole (Fe#=0.57) was detected. No metals are found.

**Discussion and conclusions:** Based on the mineralogy it is unlikely that the white clast is a R-chondritic fragment as suggested by [6], because:

(1) The clast contains olivine with low NiO (~0.1 wt%); this clearly is below the normal value for equilibrated R-chondrites (>0.3 wt%). (2) The fragment contains abundant diopside, unlike normal R chondrites (Fig. B). (3) Plagioclases are unequilibrated and often An>30, which is not consistent with typical plagioclase from R-chondrites [7]. (4) Oxygen isotope analyses clearly show that the clast is not related to R chondrites [12]. Additionally, the clast is of high petrologic type and appears relatively unshocked. Probably, it was thermally metamorphosed in a different environment prior to incorporation into the Murchison parent body. According to [6] it was – if at all – only slightly affected by alteration on the Murchison parent body.

**References:** [1] McSween H. Y. (1977a,b) *Geochim. Cosmochim. Acta* 41: 1777–1790 and 41:447–491. [2] Huss G. R. et al. (1981) *Geochim. Cosmochim. Acta* 45:33–51. [3] Rubin A. E. and Kallemeyn G. W. (1989) *Geochim. Cosmochim. Acta* 53:3035–3044. [4] Weisberg M. K. et al. (1993) *Geochim. Cosmochim. Acta* 57:1567–1586. [5] Wasson J. T. (2008) *Icarus* 195:895–907. [6] Isa J. et al. (2014) *Geochim. Cosmochim. Acta* 124:131-151. [7] Bischoff A. et al. (2011) *Chemie der Erde-Geochemistry* 71:101-133 [8] Schulze H. et al. (1994) *Meteoritics* 29:275-286. [9] Schneider C.A. et al. (2012) *Nat. Methods* 9:671–675. [10] Hezel, D.C. et al. (2010) *Comput. Geosci.* 36:1097–1099. [11] Berlin, J., et al. (2008) *37th Lunar Planet. Sci.* # 2370.. [12] Bischoff et al. (2018) *Meteoritics & Planet. Sci.* (this issue).

