IMPROVING THE EXTRACTION OF INSOLUBLE ORGANIC MATTER FROM PRIMITIVE CHONDRITES: A COMPARISON OF THREE PROTOCOLS

L. Flandinet[1], E. Quirico[1], C.M.O'D. Alexander[2], L. Bonal[1], P. Beck[1], F-R.Orthous-Daunay[1]. [1]University Grenoble1/CNRS, IPAG, Domaine Universitaire BP 53 38041 Grenoble France. E-mail: laurene.flandinet@obs.ujf-grenoble.fr [2] DTM, Carnegie Institution of Washington, 5251 Broad Branch Rd NW, Washington DC, 20015, USA.

Introduction: Insoluble Organic Matter (IOM) found in primitive meteorites formed either in the interstellar medium or the early Solar System and was subsequently processed in the parent asteroids. IOM composition and structure may provide valuable clues to the thermal processes and aqueous alterations that happened in the parent bodies, such as long duration radiogenic thermal metamorphism, short duration thermal processes triggered by asteroidal collisions and possibly solar heating for those asteroids that approach close the Sun [1-3]. FTIR spectroscopy provides information on IOM chemical composition, and therefore on the extent and nature of thermal processes of low intensity [4, 5]. This technique requires, however, highly purified IOM, in order to avoid scattering artifacts that blur the absorption signal in the spectra and to concentrate the organic matter and improve the sensitivity of the technique. For several years, we have been performing a systematic survey of IOM composition by FTIR for series of chondrites. However, highly purified IOM from CM chondrites are still difficult to obtain with our conventional HCl/HF demineralization. To tackle this issue, we have performed a comparison between three extraction protocols: the standard HF/HCl protocol widely used to demineralize terrestrial rocks and sediments as well as chondrites [5], (2) an improved protocol designed to optimize sulfide dissolution [6], and (3) a protocol specifically adapted to chondrites, based on the combined use of CsF and dioxane [8]. Protocols (1) & (2) have been optimized to operate with 10-50 mg bulk sample with the future objective to extract IOM from micrometeorites. The third protocol was performed with much bigger samples, typically about 1g.

Results and discussion: IOM extracted with the protocols (1) & (2) at IPAG/Grenoble [1, 2] and protocol (3) at DTM Carnegie were analyzed with a HYPERION 3000 BRUKER microscope. IOM from protocol (1) produced IR spectra of low quality for most of CM chondrites. We typically observed an intense scattering continuum and faint absorption features along with intense water bands that could not be removed even at 300 °C. SEM analysis revealed that water was hosted by Mg-rich fluorides. Protocol (2) based on the $CrCl_2$ oxidant did not improve the quality of the spectra, but sulfides are not likely to be the main source of scattering artifacts. Moreover, it was not possible to fully remove the chromium introduced during the treatment, and this contamination blurred IR spectra. Protocol (3) provided infrared spectra without minerals hosting water.

Strategies for avoiding Mg-rich sulfides will be presented, as well as optimized protocols adapted for small samples.

References: [1] Bonal L. et al. 2003 *Geochim. Cosmochim. Acta* [2] Tonui E. et al. 2014 *Geochim. Cosmochim. Acta* 126: 284-306 [3] Cody and Alexander CMO'D 2005 *Geochim. Cosmochim. Acta* 69: 1085-1097 [4] Kebukawa Y. et al. 2011 *Geochim. Cosmochim. Acta* 75: 3530-3541 [5] Orthous-Daunay et al. 2013 *Icarus* 223:534-543 [6] Gardinier A. et al. 2000 *Earth Planet. Sci.* 184: 9-21 [7] Acholla F.V. and Orr W.L. 1993 *Energy&Fuels* 7:406-410