OLIVINE ANNEALING IN MOLTEN IRON-SULFIDE. A TOOL TO INTERPRET THE ORIGIN OF PALLASITES.

G. F. D. Solferino[1,2], S. L. Muir[1] [1]Earth Science Department, Mount Royal University, Calgary (AB, Canada). [2]Institute of Mineralogy and Petrology, ETH Zurich (Switzerland) E-mail: gsolferino@mtroyal.ca.

Pallasite meteorites are mixtures of olivine and Fe-Ni-(S) alloy in various proportions. The texture of this type of meteorites present a form of dualism, with rounded grains or angular fragments of olivine (e.g., Brenham and Eagle Station, respectively) surrounded by an Fe-Ni matrix, which bears various amounts of sulphur. Pallasites with uniquely or prevalently rounded olivine are thought to have formed inside a terrestrial planetesimal, which had not experienced complete separation of a silicate mantle and a metal core (e.g., [1], [2]) or after prolonged annealing in a body generated by the injection of the core of an impactor into the mantle of a proto-planet [3], after a catastrophic collision between planetesimals.

Several studies, aimed at determine the thermal history of pallasites, are based on annealing of olivine into Fe-Ni matrix (e.g., [1], [4]), or investigation of metal textures in actual meteorites (e.g., [2]). The authors of [1] express a need for investigation of olivine growth in sulphur-bearing metal alloy. In [4] a grain growth law for olivine was computed. However, employing the grain growth rate obatined in [4], the time required to achieve olivine grain size found in actual pallasites (up to 15-20 mm) would be enormous (i.e., > 1 Ga), which is implausible since maximum life span of the original pallasite body must have been less than 10-20 Ma (e.g., [3]).

The current study encompasses a series of annealing experiments of olivine plus Fe-S at 1100-1430 °C and 1 GPa (at which conditions iron-sulfide is molten) performed in a piston cylinder press. Digital analyses of BSE images of the run products was employed to determine the growth mechanism and growth rate of olivine, and finally to calculate a grain growth law for olivine in molten Fe-S. The most relevant finding is an olivine growth rate orders of magnitude larger than those of olivine in solid Ni [3], which allows reaching of a grain size of 20 mm within ~5 ka to 1 Ma for annealing temperatures of 1400 and 1000 °C, respectively.

[1] Saiki K et al. 2003. *Meteoritics & Planetary Science* 38, pp. 427-444. [2] Yang J. et al. 2010. *Geochimica et Cosmochimica Acta* 74, pp. 4471-4492. [3] Tarduno J. A. et al. 2012. *Science* 338, pp. 939-942. [4] Guignard J., Bystricky M., Toplis M. J. 2012. *Physics of the Earth and Planetary Interior* 204-205, pp. 37-51.