

### First meteoritic occurrence of Sidorovite (Fe<sub>3</sub>Pt) in the Smara 002 carbonaceous chondrite

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**Introduction:** Sidorovite Fe<sub>3</sub>Pt is a new mineral recently discovered in the Snegovaya River Placer, Koryak Highlands, Russia and approved by the I.M.A. CNMNC [1,2]. It has been found associated to other PtFe alloys and PGM minerals as inclusions within or as a rim on the main alloy phases [2]. Detailed analyses performed on the carbonaceous chondrite Smara 002, recently approved as a new meteorite by the Nomenclature Committee of the Meteoritical Society allowed to enucleate the presence of a sidorovite grain as a metal nugget dispersed in the matrix. Smara 002 is a meteorite consisting of several fragments totally weighing 805 grams recovered by Bachikh Mouloud in 2021 during a meteorite search in the El-Aasli area, west of Es Smara, Morocco. A cut surface reveals large chondrules and large Calcium Aluminum Inclusions (CAIs) set in a dark, fine grained matrix [3]. The type specimen is deposited at the Museo di Storia Naturale-SMA of the University of Firenze, Italy (Inv. # I-3710).

**Instruments and methods:** Optical microscopy was performed at the Dipartimento di Scienze della Terra, Università di Firenze, Italy, using a Zeiss Axioplan-2 microscope equipped with Axiocam-HR camera. The SEM-BSE images have been obtained both at the Scientific Research center of the Ibn Zohr University, Agadir, and at the Centro di Servizi di Microscopia Elettronica e Microanalisi (MEMA) of the University of Firenze with a Zeiss EVO-40. EMPA-WDS analyses have been performed at the Firenze laboratories of the IGG – CNR (National Council of Research) with a JEOL-JXA 8230 microprobe [4]. EBSD analyses have been performed at Caltech using a ZEISS 1550VP Field Emission SEM equipped with Oxford HKL EBSD detector.

**Textural features:** A polished section of the meteorite shows a chondritic texture with relatively large, well-formed chondrules (400 – 1500 μm in size) of porphyritic olivine-pyroxene (POP) and porphyritic olivine (PO) types, set in a fine grained, dominant (75 vol.%) silicate matrix. Large CAIs range in size from 400 to 800 μm and mainly consist of melilite and spinel. PO and POP chondrules consist mainly of compositionally homogeneous Fe-rich olivine and Fs-rich orthopyroxene, while the matrix shows Fa-rich olivine with scattered iron oxides. Magnetite is the main opaque phase, but small pentlandite blebs inside chondrules are observed. Very rare awaruite grains and single sidorovite grain of an intermetallic phase, consisting of Pt, Ir, Fe and Ni have been detected. Detailed EMPA and EBSD analyses performed on this grain allowed to determine the elemental composition and the structure. The following major elements have been detected: (in wt.%): Pt=44.1, Ni=16.8, Co=0.5, Fe=28.27 Ir=9.8, corresponding to a (Fe<sub>46.4</sub>,Co<sub>0.8</sub>Ni<sub>26.1</sub>)<sub>Σ=73.3</sub>(Pt<sub>20.7</sub>,Ir<sub>4.7</sub>)<sub>Σ=25.2</sub> atomic formula. The EBSD pattern can be indexed with a cubic *Pm3m* Fe<sub>3</sub>Pt structure, that perfectly matches with that of sidorovite (Fig. 1).

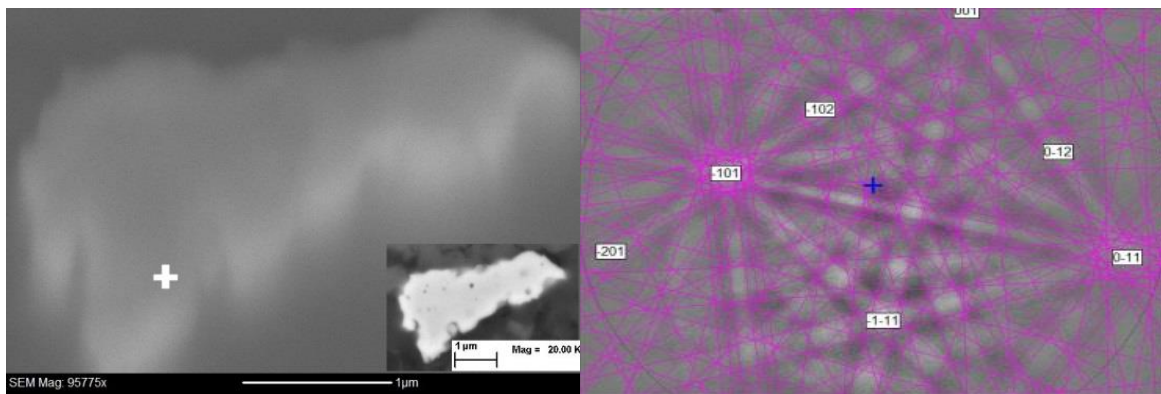


Figure 1: a) SEM-BSE image of the sidorovite grain in Smara 002; b) Its EBSD pattern indexed with the *Pm3m* cubic structure

**Discussion and conclusions:** The occurrence of sidorovite has been reported only in terrestrial samples. The grain identified in Smara 002, although being slightly different in composition, is therefore the first known occurrence of sidorovite in an extraterrestrial sample [1,2,4].

**References:** [1] Kutyrev, A. V. et al. 2022, CNMNC Newsletter 70, Eur. J. Mineral., 34; [2] Kutyrev, A. et al. 2023, The Canadian Journal of Mineralogy and Petrology: 61 (in press), [3] Grady M.M., Pratesi G., Moggi Cecchi V. 2014. Atlas of Meteorites. Cambridge University Press, Cambridge, p. 384; [4] Moggi Cecchi et al. 2023, 54<sup>th</sup> LPSC, Abs. 2859.