

A NEW IRON-NICKEL PHOSPHIDE FROM THE NORTHWEST AFRICA 1054 METEORITE. V. Moggi-Cecchi¹, L. Bindi², and G. Pratesi^{2,3}, ¹Museo di Scienze Planetarie, Provincia di Prato, Via Galcianese, 20/h, I-59100 Prato, Italy, e-mail: v.moggi@pratoricerche.it, ²Museo di Storia Naturale, Università degli Studi di Firenze, I-50121 Firenze, Italy, ³Dipartimento di Scienze della Terra, Università di Firenze, Via La Pira, 4, I-50121, Florence, Italy, e-mail: gpratesi@unifi.it

Introduction: NWA 1054 is a primitive achondrite (acapulcoite) with a main mass weighing 86 g. The thin section displays a granular texture with olivine and low-Ca pyroxene as major phases and high Ca-pyroxene and plagioclase as minor; major non-silicate phases are metal and troilite. Accessory phases include merrillite, a Mg-rich chromite and two iron-nickel phosphides. Terrestrial weathering grade is low (W1) as well as shock stage (S1). The Museo di Scienze Planetarie of Prato (MSP) owns the type specimen (MSP2366) [1].

Description: Six natural phosphides are known: schreibersite, $(\text{Fe,Ni})_3\text{P}$, nickelposphide $(\text{Ni,Fe})_3\text{P}$ [2], barringerite $(\text{Fe,Ni})_2\text{P}$ [3], allabogdanite $(\text{Fe,Ni})_2\text{P}$ [4], florenskyite FeTiP [5] and perryite, $(\text{Ni,Fe})_8(\text{Si,P})_3$ [6]. In the course of a study on some acapulcoites a new rather common iron-nickel phosphide was discovered in the NWA 1052 and 1054 acapulcoites [7]. The chemical composition of the new phase, determined by EMPA, is $(\text{Ni}_{2.30}\text{Fe}_{1.64}\text{Co}_{0.01})_{\Sigma=3.95}\text{P}_{1.05}$, pointing to a 4:1 metal/phosphorous ratio. It occurs as anhedral grains up to 100 μm either associated with kamacite (Fig. 1A) or with nickelposphide (Fig. 1B). Micro-indentation measurements provided a value (447 kg/mm^2) lower than nickelposphide. In reflected light, the new phase is cream-yellowish, non pleochroic, isotropic, and shows no bireflectance, without internal reflections. Reflectance values are 60.56, 50.44, 52.51 and 55.94 % at 471.1, 548.3, 586.6, and 652.3 nm, respectively. A single-crystal X-ray diffraction study, carried out on a small crystal fragment, indicates a cubic lattice with $a = 6.025 \pm 0.001$ and points to a space group $P2_13$ with $Z = 4$. Both the coordination-number (12) and the density (7.882 g/cc) are the highest ever reported for phosphorus and iron-nickel phosphides, respectively.

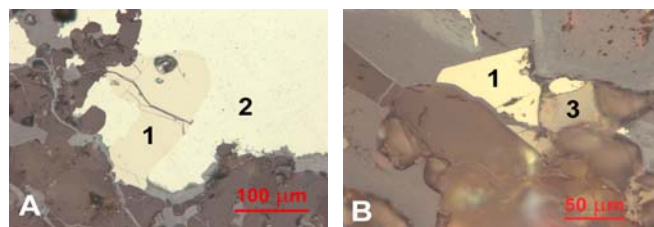


FIG. 1 Reflected light photographs displaying (A) the new phosphide (1) associated with kamacite (2) and (B) with nickelposphide (3).

Conclusions: The structure and the physical properties suggest that the new iron nickel phosphide could play an important role for Earth's core mineralogy. Due to the presence of this phase NWA 1054 acapulcoite seems to be a really peculiar acapulcoite if compared with literature data [8-9].

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