NWA 7620 AND 7766: TWO NEW ENSTATITE CHONDRITES FROM NORTHWEST AFRICA. V. Moggi-Cecchi[1,2], S.Caporali[3], G.Pratesi[4,1], [1]Museo di Storia Naturale, Via G. La Pira 4, I-50123, Firenze, Università degli Studi di Firenze, Italy, e-mail: vanni.moggicecchi@unifi.it, [2]Museo di Scienze Planetarie, Via Galcianese 20/h, I-59100 Prato, Italy, [3]Dipartimento di Chimica, Università degli Studi di Firenze, Via della Lastruccia 3, 50019, Sesto Fiorentino, [4]Dipartimento di Scienze della Terra, Via G. La Pira 4, I-50123, Firenze, Università degli Studi di Firenze, Italy, e-mail: g.pratesi@unifi.it.

Introduction

Two single pieces with no fusion crust were purchased by the meteorite collector Nicola Castellano from a single seller at the Torino Mineral Show in 2011. The meteorites have been collected by the seller in the same site although displaying slight differences. The larger piece (NWA 7620) is a single dark brown 148 g piece with no fusion crust and traces of moderate staining. The smaller stone (NWA 7766) is also dark brown, weighs 71.9 g, lacks fusion crust and shows a more marked staining. Both have been approved in 2013 by the Nomenclature Committee of the Meteoritical Society with the names NWA 7620 and 7766, respectively [1]. The cut surfaces of both meteorites don't show clearly visible chondritic textures, displaying several oxide veins and metal spots in a dark matrix. Nicola Castellano owns both the main masses. The Museum of Planetary Sciences of Prato (MSP) owns both the type specimens, weighing 21 and 14 g, respectively, as well as polished thin sections of each meteorite (inventory #s MSP 5218 and 5234)

Instruments and methods

Optical microscopy and image analysis was undertaken at the laboratories of the Museum of Planetary Sciences of Prato, Italy, using an Axioplan-2 polarizing optical microscope equipped with Axiocam-HR camera. EMPA-WDS analyses have been performed at the Padova laboratories of the IGG – CNR (National Council of Research) with a Cameca Camebax Microbeam microprobe.

Experimental results

The thin sections of NWA 7620 and NWA 7766 show a weakly visible chondritic texture, characterized by very rare relic chondrules, set in a fine-grained silicate matrix mainly consisting of pyroxene, with minor plagioclase (Figure 1).

Relic chondrules have dimensions ranging from 400 to 800 µm. Chondrules predominantly display radial pyroxene (RP) textures, with minor granular pyroxene (GP) types. The silicate matrix is mainly composed of enstatite, accounting for about 85 % vol., with rare plagioclase and olivine grains.

Opaque phases are mainly kamacite and troilite, almost completely weathered to iron oxides. Iron oxides and hydroxides are the most common alteration products (Figure 2). Schreibersite and daubreelite can be found as accessory phases. The former is associated to kamacite, while the latter can be found as blades intergrown with troilite grains.

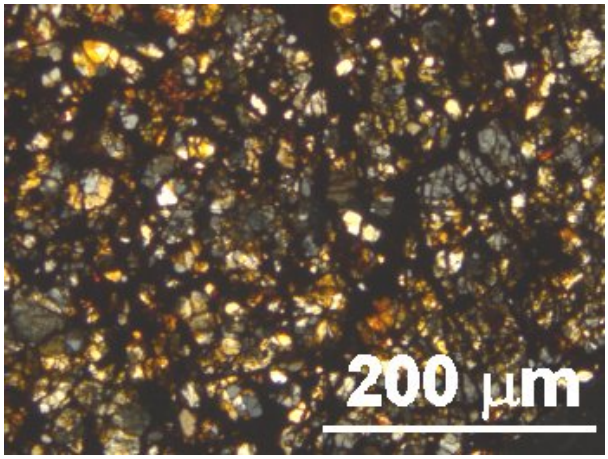

Figure 1: polarizing optical microscope image of a thin section of the enstatite chondrite NWA 7766. Cream-grey areas are enstatite, black areas are metal and troilite; transmitted light, crossed polars.

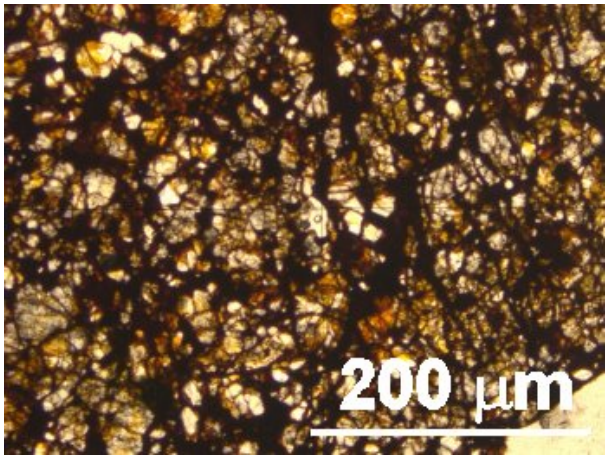

Figure 2: polarizing optical microscope image of a thin section of the enstatite chondrite NWA 7766.Yellow-creamy areas are enstatite, dark brown to black areas are metal and troilite; transmitted light, plane polars.

Multiple thin subparallel and anastomozing veinlets, with a maximum width of 180 μm for NWA 7620 and 160 μm for NWA 7766, filled with iron oxides and hydroxides can be easily observed both in transmitted light and in SEM-SE images (Figures 2 and 3).

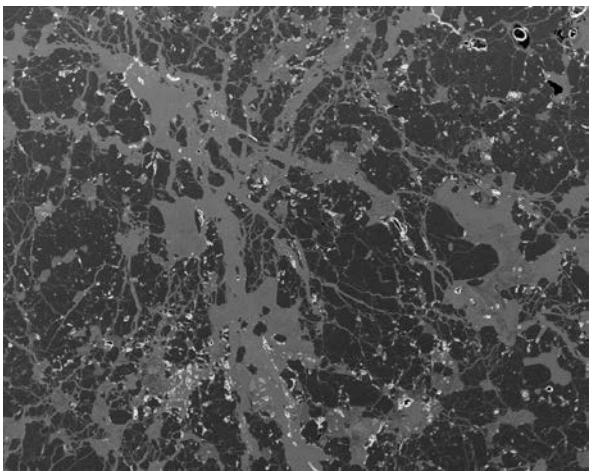

Figure 3: SEM-SE image of NWA 7620; dark grey areas are silicates; pale grey areas are kamacite and troilite; thin pale grey veins are oxidation products (iron oxides/hydroxides); f.o.v. = 420 μm;

Weathering and shock features display the major differences between these two meteorites: terrestrial weathering grade is moderately high (W4) for NWA 7766, as can be seen in Figure 2, and slightly lower (W3) in NWA 7620, as shown in Figure 3. The rare olivine grains display undulose extinction for NWA 7620, indicating that the meteorite is moderately shocked (S2), while signs of a higher shock stage (S3), like mosaicism of olivine crystals, can be observed for NWA 7766. The remarkable matrix-chondrules integration suggests a high petrologic type for both meteorites.

EMPA analyses of both samples revealed that orthopyroxene in the matrix is rather homogeneous and has a markedly enstatitic composition, ($Fs_{1.0}En_{97.7}Wo_{1.3}$ for NWA 7620 and $Fs_{0.6}En_{97.9}Wo_{1.4}$ for NWA 7766); plagioclase crystal fragments show a slightly more variable composition, ranging from a mean value of $An_{13.9}Or_{4.2}$ for NWA 7620 and a mean of $An_{12.9}Or_{3.8}$ for NWA 7766.

Among opaque phases kamacite displays, for both meteorites, a rather low Si content (0.8 wt. % and 0.7 wt. % for NWA 7620 and 7766, respectively), while sulphides are mainly represented by troilite and daubreelite, the former presenting in both cases a relatively high Ti content (6.1 wt. % and 5.9 wt. % for for NWA 7620 and 7766, respectively). Rare alabandite [(Mn,Fe)S] grains have also been detected in both meteorites.

Discussion and conclusions

The set of data collected on these enstatite chondrites point to a classification as EL6 chondrites for both meteorites. The chondrules-matrix ratios suggest a high petrologic type, while the predominance of enstatite and the presence of plagioclase among silicate phases, as well as of schreibersite and daubreelite among opaque phases [2] are distinctive for enstatite chondrites. Other minerochemical characteristics such as the Si amount of kamacite, the Ti content of troilite and the presence of alabandite have been previously suggested as being distinctive of the L-group [3].

References: [1] Garvie, L.A.J. (2013) *MAPS*, **49**, in preparation; [2] Rubin (1997) *MAPS*, **32**, 231–247. [3] Lin Y. and El Goresy A. (2002) *MAPS*, **37**, 577-599