Northwest Africa 10319 and 10320: two new cumulate eucrites from Sahara. V. Moggi-Cecchi[1], G.Pratesi[1,2], S.Caporali[3], M.Zoppi[1], I.A.Franchi[4], R.C.Greenwood[4], [1]Museo di Storia Naturale, Università degli Studi di Firenze, Via G. La Pira 4, I-50121, Firenze, Italy, e-mail: vanni.moggicecchi@unifi.it, [2]Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Via G. La Pira 4, I-50121, Firenze, Italy, [3]Dipartimento di Chimica, Università degli Studi di Firenze, Via della Lastruccia 3, 50019, Sesto Fiorentino (FI), Italy, [4]Planetary and Space Sciences Research Institute, The Open University, Walton Hall, Milton Keynes, MK7 6AA United Kingdom

Introduction

These two meteorites were purchased in 2006 at the Bologna Mineral Show by Romano Serra, from a Moroccan dealer. The main masses, weighing 7 and 73.2 g, respectively, display no fusion crust. The latter is partially covered by a dark brown desert varnish which simulates fusion crust (figure 1). The sawn surface of both samples shows a homogeneously fine grained texture but small rusty spots are visible on the surface of the smaller sample. Both meteorites have been approved by the Nomenclature Committee of the Meteoritical Society with the names NWA 10319 and 10320, respectively [1]. The Museo del Cielo e della Terra of S. Giovanni in Persiceto owns both the main masses. The type specimens, weighing 1.4 and 14.6g, respectively, and two thin sections are on deposit at the Museo di Storia Naturale dell'Università di Firenze (sample N° RI-3223 and RI-3224).

Figure 1: Hand size image of the main mass of the meteorite NWA 10320; f.o.v.= 7 cm

Instruments and methods

Optical microscopy was undertaken at the laboratories of the Dipartimento di Scienze della Terra, Università di Firenze, Italy, using an Axioplan-2 polarizing optical microscope equipped with Axiocam-HR camera. SEM-BSE imaging has been performed at the Dipartimento di Chimica, Università degli Studi di Firenze laboratories by means of a Hitachi SEM. Micro-Raman analyses were carried out at the Museo di Storia Naturale, Università di Firenze laboratories with a Horiba/Jobin-Yvon microscope equipped with a 1800 g/mm single holographic grating and coupled to a He-Ne laser with a spot of 3 μm^2 and a source emitting at 632.8 nm (red-light region). EMPA-WDS analyses have been performed at the Firenze laboratories of the IGG – CNR (National Council of Research) with a Jeol Microbeam microprobe. Oxygen isotope analysis was undertaken at the Open University.

Experimental results

Both meteorites were investigated by means of optical microscopy, SEM, EMPA and Micro-Raman techniques. A thin section of each sample was analyzed. Both thin sections display a cumulate texture consisting of large orthopyroxene crystals, 150-200 μm in width for NWA 10319 and 200-250 μm for NWA 10320, with minor clinopyroxene and anorthitic plagioclase (Figure 2) set in a homogeneous matrix consisting of the same phases (mean grain size 40 μm). Orthopyroxene crystals occasionally display very fine (1-2 μm width for NWA 10319) to fine (3-5 μm wide for NWA 10320) pigeonite exsolution lamellae. Minor phases include ilmenite, troilite, chromite, and, for NWA 10319, Fe-Ni metal.

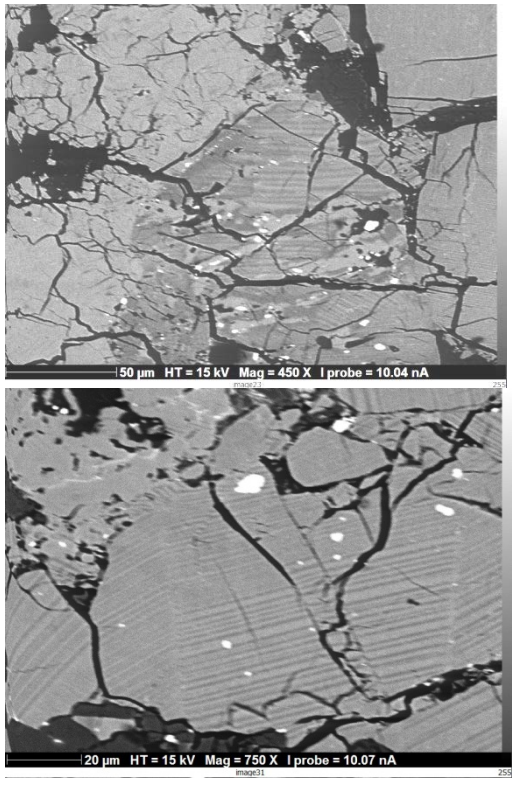

Figure 2: SEM-BSE images of NWA 10319 (up) and NWA 10320 (down); dark grey is Ca-rich pyroxene; pale grey is low-Ca pyroxene; exsolution lamellae are visible in both samples.

Both thin sections dispay a moderate weathering and a low shock stage.

NWA 10319 displays an area containing a high amount of Fe-Ni metal (Figure 3). Microscopic and SEM analyses performed on selected phases of this area excluded any possible chondritic affinity of the inclusion.

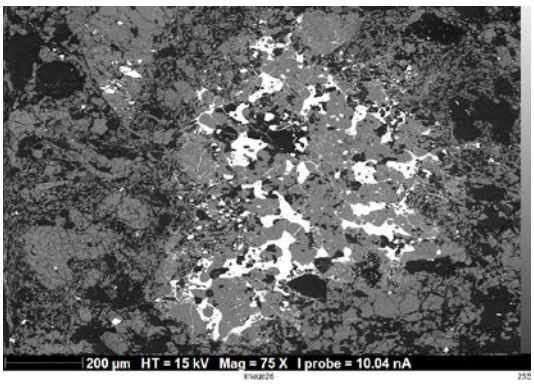

Figure 3: SEM-BSE image of a metal-rich area in NWA 10319 white areas are Fe-Ni alloys; grey areas are silicates;

EMPA analysis of individual grains was performed in order to determine the general minerochemical features of the matrix and of single crystals for classification purposes. Both samples display a calcic plagioclase ($An_{90.1}Or_{0.5}$, for NWA 10319 and $An_{88.7}Or_{0.5}$ for NWA 10320), low-Ca pyroxene ($Fs_{59.5}En_{36.7}Wo_{3.8}$, Fe/Mn=36.98, and $Fs_{54.3}En_{43.3}Wo_{2.4}$, Fe/Mn=47.03, respectively), pigeonite ($Fs_{49.8}En_{34.4}Wo_{15.8}$, Fe/Mn=34.63, and $Fs_{51.2}En_{40.0}Wo_{8.8}$, Fe/Mn=34.99, respectively), pigeonite exsolution lamellae in low-Ca pyroxene ($Fs_{47.1}En_{33.8}Wo_{19.1}$, Fe/Mn = 35.90 and ($Fs_{40.6}En_{38.1}Wo_{21.3}$, Fe/Mn = 39.41, respectively).

Micro-Raman analyses have been performed on selected phases and confirmed EMPA data.

Figure 4 presents the spectrum of an augite crystal compared with the reference spectrum.

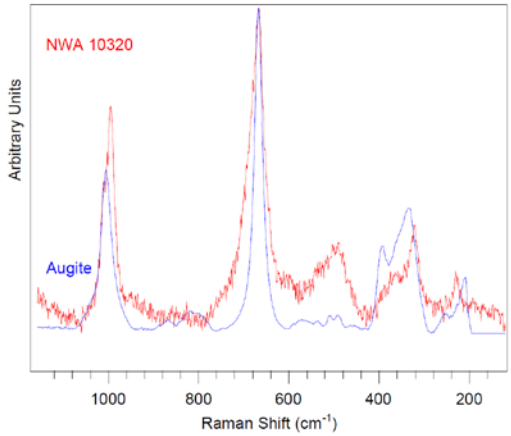

Figure 4: Micro-Raman spectrum of an augite crystal of NWA 10320 compared with the reference spectrum;

Oxygen isotope analyses performed on both samples provided the following results: $\delta^{17}O$ = 1.84 ‰, $\delta^{18}O$ = 3.96 ‰, $\Delta^{17}O$ = -0.22 ‰ for NWA 10319 and $\delta^{17}O$ = 1.81‰, $\delta^{18}O$ = 3.88‰, $\Delta^{17}O$ = -0.21‰ for NWA 10320.

Discussion and conclusions:

The textural and minerochemical data are distinctive and point to a classification as cumulate eucrite [1,2]. Oxygen isotope data confirm this hypothesis [3].

References: [1] Bouvier, A. et al. (2016) *MAPS*, in press; [2] Grady M. et al. (2014), *Atlas of Meteorites*, 1st ed., CUP, Cambridge, pp.350; [3] Scott, E.R.D. et al. (2009), GCA, 73, 5835-5853.