NORTHWEST AFRICA 11708 AND 12252: TWO NEW UNEQUILIBRATED CHONDRITES FROM SAHARA.

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Introduction: Two meteorites were found by anonymous finders in Western Sahara. One was purchased in 2016 at the Erfoud market by Hichame Mimaghador and the other one was purchased by Nicola Castellano at the Genova Mineral Fair in May 2017 from a Moroccan dealer. The main masses, weighing 1104 and 752 g, respectively, are markedly different from each since the first one is almost completely covered by black fusion crust and show cracks on the outer surface and the second instead has only small traces of fusion crust. The sawn surface of both show a chondritic texture, the first one almost without metal, the second with several metal spots. Both meteorites have been approved by the Nomenclature Committee of the Meteoritical Society with the names Northwest Africa 11708 and Northwest Africa 12252, respectively [1]. Both the main masses are with owners. The type specimens, weighing 24 and 41 g, respectively, and one thin section are on deposit at the Museo di Storia Naturale dell'Università di Firenze.

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-SE images have been performed at the MEMA center of the Università degli Studi di Firenze laboratories by means of a ZEISS EVO MA 15 SEM. 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 of NWA 11708 was undertaken at the Open University.

Experimental results: Both meteorites were investigated by means of optical microscopy, SEM and EMPA techniques. A thin section of each sample was analyzed. The thin section of the first one (NWA 11708) shows a texture composed of separated, well-formed chondrules (ranging in diameter from 300 to 600 μm) of different types, in a fine-grained matrix consisting of Fe-rich olivine, coarse grained Fe-rich olivine fragments and scattered opaque phases. Chondrule types are mainly PO, with minor POP and PP types. Main minerals are olivine, orthopyroxene, Ca-rich plagioclase and clinopyroxene. Opaques mainly consist of troilite and magnetite, with minor altered kamacite. The thin secton of the second meteorite (NWA 12252) shows a chondritic texture, with scattered GO, GOP, PO and POP chondrules, ranging in size from 400 to 800 μm, in a fine grained matrix. GOP chondrules are poikilitic, with olivine grains embedded in twinned clinopyroxene. POP chondrules display olivine grains and elongated pyroxene grains in a glassy mesostasis. Plagioclase is Na and K-rich. Opaque phases consist of Fe,Ni alloys and troilite as individual grains scattered in the matrix or rimming chondrules. An armoured chondrule is visible.

EMPA analyses of selected grains were performed in order to determine the general minerochemical features of the matrix and of chondrules for classification purposes. As concerns NWA 11708, olivine in PO and POP chondrules is remarkably forsteritic ($Fa_{1.7\pm0.2}$, Fe/Mn = 11.4±1.1, N = 6), while olivine in mineral fragments is fayalitic ($Fa_{38.9\pm5.3}$, Fe/Mn = 101.7±10.1, N = 10); orthopyroxene in chondrules is enstatitic ($Fs_{2.5\pm0.2}Wo_{2.1\pm0.1}$, Fe/Mn = 11.5±1.2, N = 15), while a fassaite-rich fragment has been observed ($Fs_{4.4\pm0.4}En_{56.6\pm0.3}Wo_{39.0\pm0.9}$, Al_2O_3 = 6.0 Wt.%, N = 5). Feldspar is anorthitic ($An_{95.7}Or_{0.1}$). For NWA 12252 olivine is homogeneous both in chondrules and in the matrix ($Fa_{17.4\pm6.2}Fo_{82.7\pm5.9}$; Fe/Mn = 41.2, n=25); orthopyroxene in chondrules is inhomogeneous, with a core-rim variability ($Fs_{18.3\pm0.5}En_{79.9\pm0.5}Wo_{1.8\pm0.1}$, in chondrules' grains rims and in matrix Fe/Mn = 24.1, n=13); low-Ca px in grains cores ($Fs_{7.9\pm4.2}En_{91.6\pm3.9}Wo_{0.5\pm0.1}$, Fe/Mn = 15.1, n=7), high-Ca pyroxene ($Fs_{2.1\pm2.0}En_{52.4\pm5.3}Wo_{45.5\pm4.5}$, n=7); plagioclase is Na and K-rich ($An_{33.7}Or_{33.4}$). Weathering is moderate for NWA 11708 and high for NWA 12252 (W4). Shock stage is low for the second one.

Oxygen isotope analyses performed on NWA 11708 provided the following results: $\delta^{17}O$ = - 4.75 ‰, $\delta^{18}O$ = -1.14 ‰, $\Delta^{17}O$ = - 4.15 ‰.

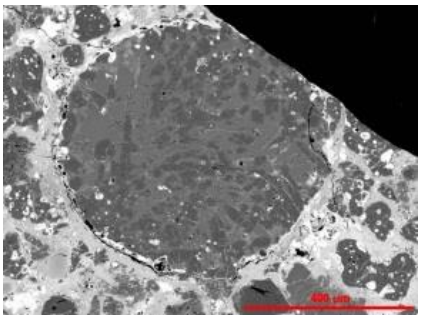

Figure 1: SEM-BSE image of a PO chondrule of NWA 11708; pale gray is olivine; white areas are iron oxides

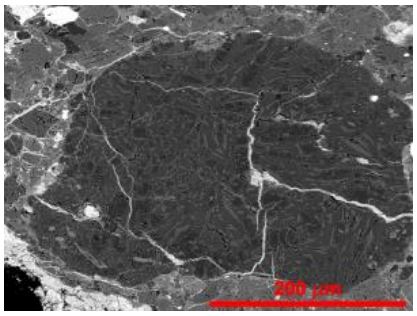

Figure 2: SEM-BSE image of a POP chondrule of NWA 12252; pale grey is olivine; dark grey is orthopyroxene;

Discussion and conclusions:

The textural and minerochemical data are distinctive and point to a classification as CK3 for NWA 11708 and as H3.6 for NWA 12252 [1,2]. Oxygen isotope data confirm this hypothesis for NWA 11708 [3].

References: [1] Gattacceca J., et al. (2019) Meteorit. Planet. Sci. 54 in press.; [2] Grady M. et al. (2014), *Atlas of Meteorites*, 1st ed., CUP, Cambridge, pp.350; [3] Greenwood R.C. et al. (2010). Geochim. Cosmochim. Acta 74, 1684-1705.