Minerochemical and textural features of Northwest Africa 14897 a new highly equilibrated chondrite from Sahara.

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Introduction:

This meteorite was purchased in 2017 at Erfoud, Morocco, by Abdeltif Mechaguen. The main mass, weighing 262 g and currently owned by the purchaser, is covered by a dark brown fusion crust. A dark brown, homogeneous interior with no visible chondrules can be observed on a cut surface. On the same surface no metal spots are visible, probably due to the marked alteration. The meteorite has been submitted to the NomCom of the Meteoritical Society and approved under the name of Northwest Africa 14897. The type specimen, weighing 36 g, and one polished thin section are on deposit at MSN-Fi (Inv.# I3690); one polished section is at the Università di Bari.

Instruments and methods:

Optical microscopy was performed at the Earth and Geoenvironmental Sciences Department of University of Bari and at the Università di Firenze Earth Sciences Department by means of a Zeiss Axioplan II optical microscope. Electron Dispersive X-ray Spectrometry (EDS) microanalyses, elemental mapping and modal mineralogy were undertaken at the using a Zeiss EVO MA15 SEM. Mineral chemistry analyses were also performed at the MEMA laboratories of the University of Firenze [4].

Textural features:

The thin section of the meteorite appears as a cataclastic breccia consisting of equilibrated chondritic clasts (mean size 1300 µm) composed of olivine and orthopyroxene set within a very fine similar matrix. No chondrules were detected in the section. Recrystallized plagioclase grains are diffuse throughout the section, with a mean grain size of 150 µm (n=25). Scattered augite grains have been observed. Among opaque phases, iron oxides are the most common, although a Ti-rich chromite has been also detected. Accessory phases include tetrataenite, troilite, chlorapatite and merrillite. No kamacite nor taenite were detected probably due a marked secondary alteration. Several calcite subparallel veins are visible due to secondary reprecipitation. A modal estimate performed by means of SEM-Rx maps on a wide area of the thin section (figure 1) provided the following results: 48% olivine, 25% low-ca pyroxene, 9% ca-pyroxene, 11% sodic plagioclase, 3% Fe-oxides, 0.6% chromite, 0.4 Cl-apatite, 3% calcite.

Minerochemical features:

EMPA analyses performed on selected phases allowed to determine a higly homogeneous composition of either-olivine and orthopyroxene, both in the clasts and in the fine grained matrix ($Fa_{31.5\pm0.3}$, N = 8: Fe/Mn = 64.3), Opx ($Fs_{23.4\pm0.3}Wo_{3.3\pm0.1}$, N = 4; Fe/Mn = 30.4). Augite displays a high content of chromium ($Fs_{11.0\pm0.5}Wo_{40.7\pm1.2}$, N = 11; Cr_2O_3 = 1.2 wt.%), while plagiocalase appears albitic ($Ab_{82.3}An_{15.6}Or_{2.1}$, N = 3). Shock stage is low (S1), while the weathering is marked (W4).

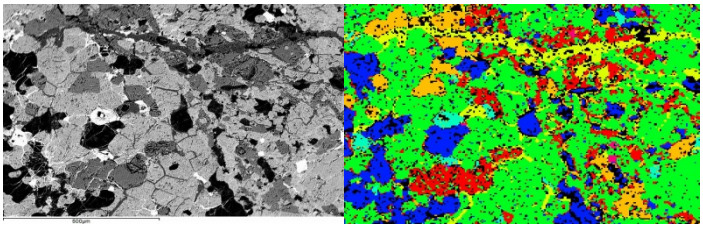

Figure 1: a) SEM-BSE image of an area of NWA 14897; Ol = pale gray;Opx and Cpx = dark gray; white areas are oxides; b) X-ray map of the same area: Plag = blue, Ol = green, Opx = red, Cpx = Orange, Fe oxides = pale blue; Calcite = yellow

Discussion and conclusions:

According to the textural features and to the high abundance of recrystallized plagioclase, the meteorite appears to be a highly equilibrated chondrite, as confirmed by the absolute absence of chondrules. The presence of clasts in a similar matrix suggest it may be a cataclastic breccia. Minerochemical features suggest a classification as LL7 ordinary chondrite [1,2,3].

References: [1] Y. Li, A. E. Rubin, W. Hsu, K. Ziegler 2020 Early Impact Events on Chondritic Parent Bodies: Insights From NWA 11004, Reclassified as an LL7 Breccia; JGR, Vol. 125, 5, pp. 1-16; [2] Friedrich, J.M., Perrotta, G.C., Kimura M. 2014 Compositions, geochemistry, and shock histories of recrystallized LL chondrites; GCA. 139, pp. 83–97; [3] Grady M.M., Pratesi G., Moggi Cecchi V. 2014. Atlas of Meteorites. Cambridge University Press, Cambridge, p. 384.