Northwest Africa 12721, 12847 and 12850: three new carbonaceous chondrites from Sahara. V.Moggi Cecchi, G.Pratesi, S.Caporali, Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Via G. La Pira 4, I-50121, Firenze, Italy, e-mail: vanni.moggi@unifi.it; Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Via G. La Pira 4, I-50121, Firenze, Italy; Consiglio Nazionale delle Ricerche, Istituto dei Sistemi Complessi, Via Madonna del Piano 10, 50019 Sesto Fiorentino (FI), Italy, Dipartimento Ingegneria Industriale, Università degli Studi di Firenze, Via S. Marta 3, 50139 Firenze, Italy;

Introduction

Here are presented the mineralogical and textural features of three new carbonaceous chondrites from Sahara classified in 2019 at the Museo di Storia Naturale-SMA dell’Università di Firenze, Italy. All specimens were collected by nomads in Western Sahara. The first one, weighing 105 g, was purchased in March 2018 by Hichame Mimaghador at Erfoud. CAIs are visible on the hand specimen cut surface. A total of 25 g specimen (inventory N° I3372) is on deposit at Museo di Storia Naturale dell’Università di Firenze-SMA. Mimaghador holds the main mass.

The second one, a single small piece without fusion crust and weighing 15 g with CAIs visible on the cut surface, was purchased by Romano Serra at the Bologna Mineral Show in March 2017. A total of 3.2 g specimen (inventory N° I3555) is on deposit at Museo di Storia Naturale dell’Università di Firenze-SMA. The Museo del Cielo e della Terra di San Giovanni in Persiceto (Bologna, Italy) holds the main mass.

The third one, a single piece weighing 42 g displaying chondrules and without fusion crust, was purchased by Mario Di Martino at the Torino Mineral Show in October 2017. The cut surface displays scattered CAIs. A total of 8.6 g specimen (inventory N° I3446) is on deposit at Museo di Storia Naturale dell’Università di Firenze-SMA. Di Martino holds the main mass.

The three meteorites have been submitted for classification and officially approved by the Nomenclature Committee of the Meteoritical Society under the names Northwest Africa 12721, 12847 and 12850, respectively [1].

Instruments and methods

BSE images and EMPA-WDS analyses were undertaken at the Firenze IGG – CNR laboratories with a Jeol microprobe.

Experimental results

Textural features

The thin section of NWA 12721 displays a marked chondritic texture, with GO, BO, PO and POP chondrules ranging from 800 to 1200 µm prevailing over matrix; a chondrules-matrix ratio of 1.2 can be estimated; no CAIs are visible in the thin section due to the small dimensions of the sampled area; olivine in PO chondrules is Fa-poor and displays a core-rim zoning; olivine in BO chondrules is Fa-rich while orthopyroxene in POP chondrules is Mg-rich; an Al-rich pigeonite and rare augite is present in BO chondrules; a Ca-rich plagioclase is present in POP chondrules; matrix is fine-grained and consists of Fa-rich olivine and orthopyroxene with diffuse altered opaque phases (iron-oxides) and magnetite (figure 1). The weathering grade is moderate while the shock stage is medium.

Figure 1: SEM-BSE image of an area of NWA 12721 displaying a POP chondrule; pale grey is glass, dark grey is Fe-poor olivine; white rounded blebs are magnetite.

The thin section of NWA 12847 displays a chondritic texture, with PO, POP and BO chondrules ranging from 750 to 1300 µm in a fine grained matrix (figure 2). PO and POP chondrules display zoned, Mg-rich olivine crystals and elongated pyroxene grains.

Orthopyroxene in chondrules is rather homogeneous. Iron oxides are prevailing among opaque phases; Fe-Ni alloys and troilite can also be observed as individual grains in the matrix or rimming chondrule. The weathering grade is moderate (W2) as well as the shock stage (W2).

In the thin section of NWA 12850 a chondritic texture consisting of PO and POP chondrules ranging from 600 to 1500 µm in a fine grained matrix is visible (figure 3).
PO chondrules display zoned olivine crystals. Olivine in PO and POP chondrules is markedly inhomogeneous with Mg-rich cores, while is more Fe-rich in the matrix. Orthopyroxene in chondrules is homogeneous. Iron oxides, Fe-Ni alloys and troilite are the most common opaque phases, present as individual grains scattered in the matrix or rimming chondrules. Rounded metal aggregates are visible in some chondrules. The weathering grade is rather high (W3), while the shock stage is low (S1).

Minerochemical features
As concerns NWA 12847 and 12850, SEM and EMPA analyses show that olivine is inhomogeneous for both meteorites and ranges, for NWA 12847, from Fa$_{1,1}$ mol. % (Fe/Mn = 6.8, N = 12) for PO chondrules to Fa$_{32,5}$ mol. % (Fe/Mn = 63.5, N = 11) for matrix and, for NWA 12850, from Fa$_{1,6}$ mol. % (Fe/Mn = 13.4, N = 11) for PO chondrules to Fa$_{34,9}$ mol. % (Fe/Mn = 66.6, N = 15) for matrix; low-Ca pyroxene is Fe-poor for both meteorites (Fs$_{1,4}$Wo$_{1,4}$ mol. % for NWA 12847; Fs$_{1,3}$Wo$_{0,8}$ mol. % for NWA 12850).

Discussion and conclusions:
Textural and compositional data suggest a classification as CV3 for all meteorites [1;2;3;4;5;6]

References:

As concerns NWA 12721, SEM and EMPA analyses show that olivine is markedly inhomogeneous and ranges from Fa$_{1,7}$Wo$_{0,2}$ mol. % (Fe/Mn = 12.9, N = 10) in PO and POP chondrules to Fa$_{29,9}$Wo$_{4,2}$ mol. % (Fe/Mn = 94.5, N = 6) in BO chondrules, while low-Ca pyroxene displays a wide compositional variation, ranging from Fs$_{1,0}$Wo$_{0,8}$ mol. % (Fe/Mn = 6.9, n=9) in orthopyroxene of OPO chondrules to Fs$_{35,7}$En$_{30,4}$Wo$_{33,9}$ mol. % (Fe/Mn = 60.6, n=6) in diopside of BO chondrules. Feldspar is anorthitic (An$_{97,7}$Or$_{0,1}$).