Textural and minerochemical features of NWA 1807 and 2180, two new CV3 chondrites from northwest Africa

Conference or Workshop Item

TEXTURAL AND MINEROCHEMICAL FEATURES OF NWA 1807 AND 2180, TWO NEW CV3 CHONDRITES FROM NORTHWEST AFRICA. V.Moggi-Cecchi[1], G.Pratesi[2], A.Salvadori[1], I.A.Franchi[3], R.C. Greenwood[3], [1]Museo di Scienze Planetarie, Via Galcianese 20/h, I-59100 Prato, Italy, e-mail: v.moggi@pratoricerche.it, [2]Dipartimento di Scienze della Terra dell'Università degli Studi di Firenze, Via G.La Pira 4, I-50123 Firenze, Italy, e-mail: g.pratesi@unifi.it, [3]Planetary and Space Sciences Research Institute, Open University, Walton Hall, Milton Keynes, MK7 6AA United Kingdom.

Introduction

NWA 1807: A single stone of 274 g was bought in Erfoud (Morocco) by M. Chinellato. The main mass, now weighing 54.5 g, has no fusion crust. A total of 20.5 g of sample and one polished thin section are on deposit at the Museo di Scienze Planetarie of Prato, Italy, while Mr. M. Chinellato holds the main mass. A cut surface on the type specimen reveals the presence of large chondrules and small white areas set in a dark green matrix

NWA 2180: A number of stones, weighing a total of 369.3 g, were bought in Erfoud (Morocco) by an anonymous buyer. The buyer holds the main mass, which weighs 51.4 g and has very small portions of a dark brown fusion crust. A total of 20.7 g of sample and one polished thin section are on deposit at the Museo di Scienze Planetarie of Prato, Italy. A cut surface on the type specimen shows a chondritic texture very similar to that of NWA 1807.

Instruments and methods

EMPA[rl]-WDS analyses on both meteorites have been performed at the Firenze laboratories of the IGG – CNR (National Council of Research) with a JEOL JXA-8600 microprobe. Oxygen isotope measurements were undertaken at the Planetary and Space Sciences Research Institute Laboratories of the Open University.

Experimental results

A textural study has been carried out on both the NWA 1807 and 2180 chondrites in order to determine sizes and typologies of their chondrules and the relative abundances of their main mineralogical phases, as well as the presence of minor and accessory minerals. In addition a combined mineralogical and geochemical study has been performed on these meteorites to determine the major element compositions for selected mineral phases. We report here the results of the textural and minerochemical study on both meteorites. The description of chondrule typologies and of their relative abundances follows the terminology defined by [2].

Textural features: The thin sections of both these meteorites display typical chondritic textures with several rather large chondrules set in a dark microcristalline matrix (figures 1 and 2).

Both meteorites have a chondrule/matrix ratio of 1.5 has been calculated for both meteorites. Chondrule dimensions of NWA 1807 range from 130 to 1400 µm with a mean value of 630 µm as determined on 60 chondrules, while in NWA 2180 the range is 90 to 1600 µm with a mean value of 530 µm as determined on 140 chondrules. Few chondrule types can be distinguished in both meteorites: a modal analysis performed on 40 chondrules showed in both cases an almost equal distribution of chondrules among granular olivine/granular olivine with a poikilitic texture (GO/GO-pk) and porphyritic olivine (PO) types with a minor amount of barred olivine (BO) type.

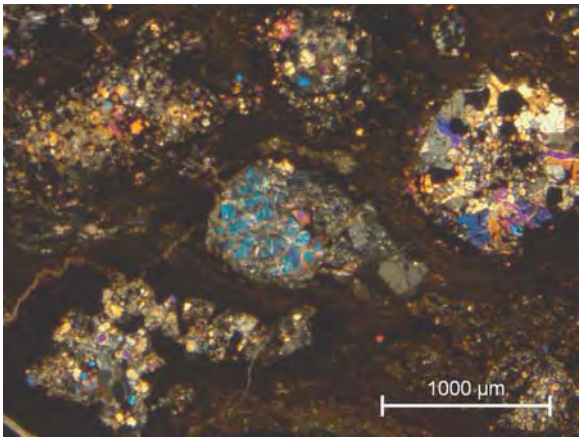

Figure 1: polarizing optical microscope image of a thin section of the NWA 1807 meteorite. Blue and pink grains are olivine, black areas are magnetite; transmitted light, crossed polars.

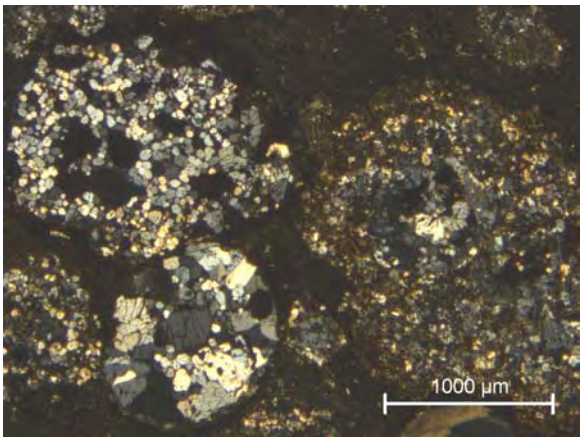

Figure 2: polarizing optical microscope image of a thin section of the NWA 2180 meteorite; transmitted light, crossed polars.

The relative percentages for both meteorites are indicated in figure 3. Radial pyroxene type are extremely rare. Both type-A and type-B CAIs are a minor constituent in both meteorites, with a slight predominance of the second type. A-type CAIs, mostly composed by melilite, spinel and perovskite, can be defined "fluffy" according to the classification of [3]. B-type, consisting of fassaite, anorthite, spinel and melilite, comprise both B1 and B2 subtypes [4].

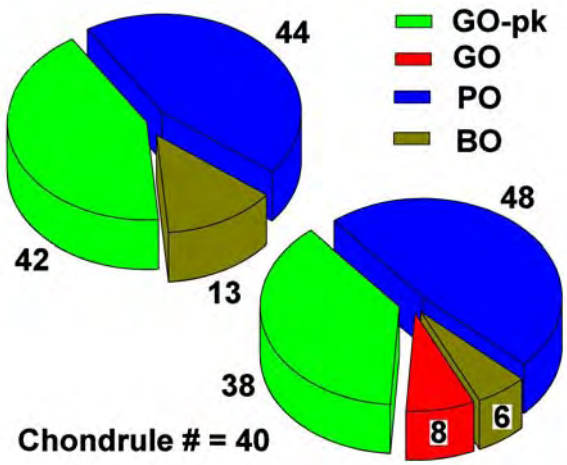

Figure 3: chondrule types distributions for NWA 1807 and 2180; values are in percentage

Non-silicate phases are mainly represented by magnetite occurring as subrounded grains inside chondrules. Rare metal (kamacite and awaruite) and sulphide (mainly pyrrhotite) grains can be occasionally found. Apatite occurs as an accessory phase. For both meteorites the terrestrial weathering grade is minor and the sharp extinction of olivine indicates a low shock stage (S1).

Mineralogical and chemical features: EMPA analyses revealed that olivine in chondrules of NWA 1807 has a markedly forsteritic composition (Fo = 95-99 mol %), while olivine in the matrix is Fo-poor (Fo = 50 mol %); low-Ca pyroxene is homogeneous and shows a marked enstatitic composition (En = 98, Wo = 1 mol %). High Ca-pyroxene is rather rare and can be found in porphyritic chondrules. It displays an augitic composition (Fs = 16-29, En = 25-37, Wo = 46-47 mol %). Chondrule glass is anorthitic (An = 85 mol %).

For NWA 2180 olivine in the chondrules has a slightly wider range of composition (Fo = 91-99 mol %); olivine in the matrix has a more variable composition (Fo = 31-56 mol %); low-Ca pyroxene is homogeneous, with an enstatitic composition (En = 98, Wo = 1 mol %). High Ca-pyroxene displays a pigeonitic composition (Fs = 0-1, En = 60-93, Wo = 6-40 mol %). Chondrule glass is anorthitic (An = 90 mol %).

Oxygen isotope concentrations plot within the oxidized CV-field for both meteorites ($\delta^{17}O$ = -1.64 ‰, $\delta^{18}O$ = 2.52 ‰, $\Delta^{17}O$ = -2.95 ‰ for NWA 1807 ---- $\delta^{17}O$ = -0.72 ‰; $\delta^{18}O$ = 4.03 ‰; $\Delta^{17}O$ = -2.82 ‰ for NWA 2180).

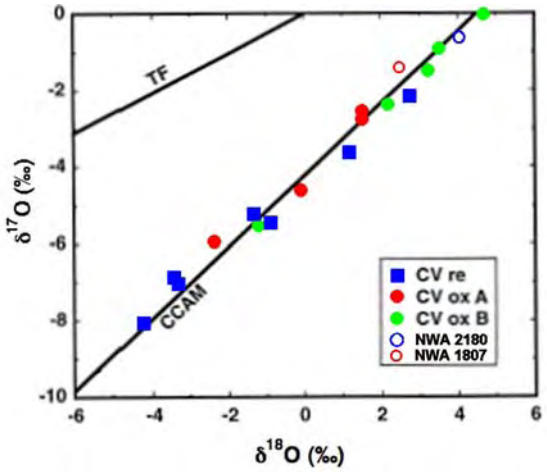

Figure 4: oxygen isotope data for NWA 1807 and 2180 compared with literature data (modified from [5]).

Discussion and conclusions

The set of data collected on these carbonaceous chondrite points, in both cases, to a classification as CV3 chondrites. Oxygen isotope data plot in the field of oxidized-CV chondrites (figure 4). Even the chondrules-matrix ratios, as well as the equal distribution of GO/GO-pk types [2], the ranges of chondrule sizes and the low amount of metal [6] are indicative of oxidized-CV3 chondrites. Other minerochemical characteristics such as olivine compositional ranges and the presence of magnetite as the dominant opaque phase have been previously suggested as indicative of oxidized-CV3 chondrites. The sharp definition of chondrules and the presence of intrachondrules glass indicate that this meteorite is petrologic type 3.

References: [1] Moggi Cecchi V. and Pratesi G. (2007), *MAPS,* **42**, in press; [2] Moggi-Cecchi et al. (2006), *Per. Min.*, **75**, 217-232; [3] MacPherson G. J. and Grossmann L. (1979), *MAPS*, **14**, 479-480, [4] Wark D.A. and Lovering J. F. (1982), *GCA*, **46**, 2581-2594; [5] Clayton R.N. (1999), GCA, **63**, 2089-2104; [6] Mc Sween H. Y. Jr (1977), *GCA*, **41**, 1777-1790.