NWA 4419: A new R chondrite from Northwest Africa

Conference or Workshop Item

NWA 4419: A NEW R CHONDRITE FROM NORTHWEST AFRICA. S.Caporali[1], G.Pratesi[2], V.Moggi-Cecchi[3], I.A.Franchi[4], R.C.Greenwood[4], [1]Dipartimento di Chimica dell'Università degli Studi di Firenze, Via della Lastruccia 3, I-50019 Sesto Fiorentino, Firenze, Italy; [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]Museo di Scienze Planetarie, Via Galcianese 20/h, I-59100 Prato, Italy, e-mail: v.moggi@pratoricerche.it, [4]Planetary and Space Sciences Research Institute, Open University, Walton Hall, Milton Keynes, GB-MK7 6AA United Kingdom

Introduction

A single stone weighing 103,1 g was purchased in 2006 at the Erfoud market. The outer surface of the main mass displays a small portion of a black fusion crust. A cut surface reveals a chondritic texture, with tiny metal spots and chondrules set in a silicate matrix. Matteo Chinellato owns the main mass, while the type specimen, weighing 20,8 g, as well as a polished thin section [1] are on deposit at the Museum of Planetary Sciences (MSP) of Prato, Italy (inventory number MSP 5045).

Instruments and methods

SEM images and EDS analyses have been performed at the MEMA center of the Earth Sciences Department of the University of Florence by means of a Zeiss EVO-MA15 SEM. EMPA-WDS analyses have been performed at the Padova laboratories of the IGG – CNR (National Council of Research) with a Cameca Camebax Microbeam microprobe. Oxygen isotope measurements have been perfomed at the Planetary and Space Sciences Research Institute Laboratories of the Open University by Richard Greenwood and Ian Franchi.

Experimental results

The thin section of NWA 4419 shows a marked chondritic texture consisting of well-defined, small (up to 1 mm) chondrules as well as chondrule and mineral fragments set in a slightly recrystallized matrix of silicates and sulfides (Figures 1 and 2). Chondrules account for about 50 % of the section by area and are of various textural types, the most common being porphyritic olivine, porphyritic olivine-pyroxene and poikilitic pyroxene, while radial pyroxene are rarer (Figure 3). Most chondrules are rimmed by tiny metal grains mainly consisting of troilite and pentlandite. Silicate phases, both in the matrix and among fragments, are mainly represented by olivine, orthopyroxene and plagioclase. Opaque phases, mainly consisting of Fe,Ni alloys, troilite and pentlandite, form globular aggregates about 250 μm in size or small (~ 50 μm) continuous rims around chondrules (Figures 4 and 5). The meteorite appears unbrecciated in the thin section studied, and the matrix-chondrules

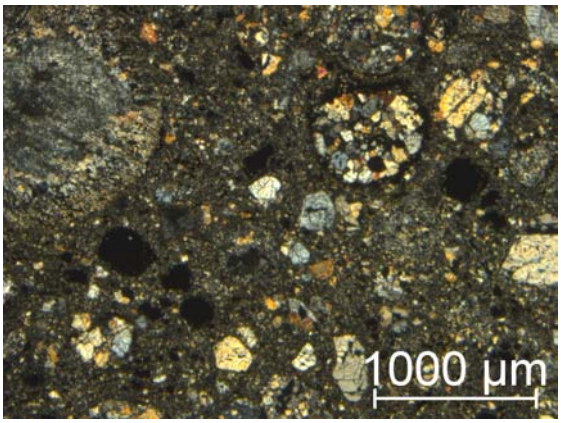

Figure 1: polarizing optical microscope image of a thin section of the mesosiderite NWA 4419 (sample MSP 5045); transmitted light, crossed polars.

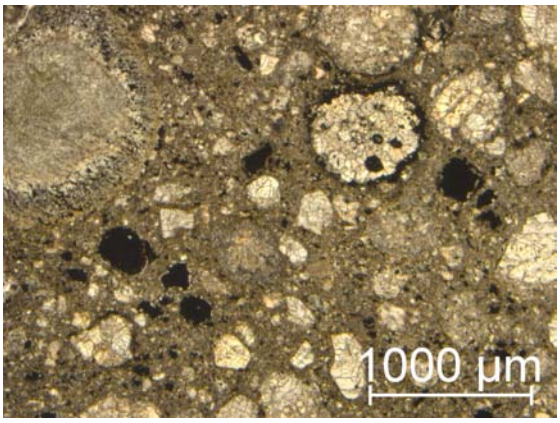

Figure 2: polarizing optical microscope image of a thin polished section of the martian meteorite NWA 4419 (sample MSP 5045); transmitted light, plane polars.

integration is rather high, thus suggesting a petrologic type 4. Both shock and weathering features are not marked, pointing to a low shock stage (S2) and weathering grade (W2).

SEM and EMPA analyses show that olivine is rather homogeneous and markedly fayalitic ($Fa_{39,8}$), while low-Ca pyroxene displays a wide compositional variation, ranging from $Fs_{13,9}$ mol. % to $Fs_{29,1}$ mol. % (mean $Fs_{22.8}$). Oxygen isotope analyses (I.A.Franchi and R.C.Greenwood, *OU*) confirm textural and compositional data and are consistent with a

classification as R chondrite: $\delta^{17}O$ = 5.469 ‰, $\delta^{18}O$ = 6.031 ‰, $\Delta^{17}O$ = +2.333 ‰.

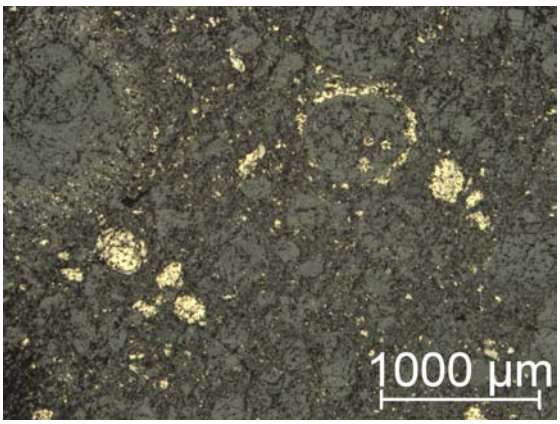

Figure 3: polarizing optical microscope image of a thin polished section of the martian meteorite NWA 4419 (sample MSP 5045); reflected light, plane polars.

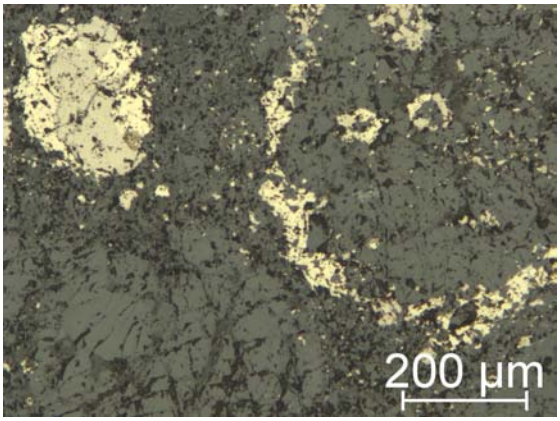

Figure 4: polarizing optical microscope image of a thin polished section of the mesosiderite NWA 4419 (sample MSP 5045). Detail of a metal-pentlandite aggregate and of a chondrule rim; reflected light, crossed polars.

Discussion and conclusions

Textural and compositional data, as well as oxygen isotope data, plotting in the R-chondrites field [2], and the similarities with other R chondrites [3],[4] point to a classification of this meteorite as R4.

References: [1] Weisberg, M.K. et al. (2008) *MAPS,* **43**, 9, 1555; [2] Greenwood R.C., et al. (2000) *GCA*, **64**, 3897-3911; [3] Schulze H. et al. (1994) *MAPS,* **29***,* 275-286; [4] Weisberg M.K. et al. (1991) *GCA,* **55***,* 2657–2669;