NWA 4418: A NEW MESOSIDERITE FROM NORTHWEST AFRICA. G.Pratesi[1], V.Moggi-Cecchi[2], I.A.Franchi[3], R.C.Greenwood[3], [1]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, [2]Museo di Scienze Planetarie, Via Galcianese 20/h, I-59100 Prato, Italy, e-mail: v.moggi@pratoricerche.it, [3]Planetary and Space Sciences Research Institute, Open University, Walton Hall, Milton Keynes, GB-MK7 6AA United Kingdom

Introduction

A single stone weighing 103,8 g was purchased in 2006 at the Erfoud market. The outer surface of the main mass is partially covered with a black fusion crust. A cut surface reveals a complex texture, with large metal areas set in a black, rocky matrix. Matteo Chinellato owns the main mass, while the type specimen, weighing 20,1 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 5044).

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 4418 shows a disomogeneous texture with large metal areas embedded in a silicate matrix (Figures 1 and 2). Metal accounts for 30 % of the total surface, with kamacite prevailing over taenite (Figure 3). Schreibersite is accessory. Silicate portion is formed by a microbreccia consisting of minute (not larger than ~ 40 µm) olivine, orthopyroxene and plagioclase grains and various clasts, mainly represented by orthopyroxene olivine (up to 200 µm) and plagioclase (up to 100 µm). Orthopyroxene clasts show very small (1 µm) exsolution lamellae (Figure 4), Clinopyroxene clasts are rather rare. Tiny oxide grains dispersed in the silicate matrix and probably deriving from altered metal or troilite can be occasionally observed (Figure 3 and 5). In the matrix orthopyroxene is prevailing over plagioclase thus indicating class B. Shock features are almost absent, suggesting a low shock stage. The sample displays minor oxidation of metal, pointing to a moderate weathering. Textural features like diffuse melting indicate that NWA 4418 may belong to subgroup 3 [2],[3].

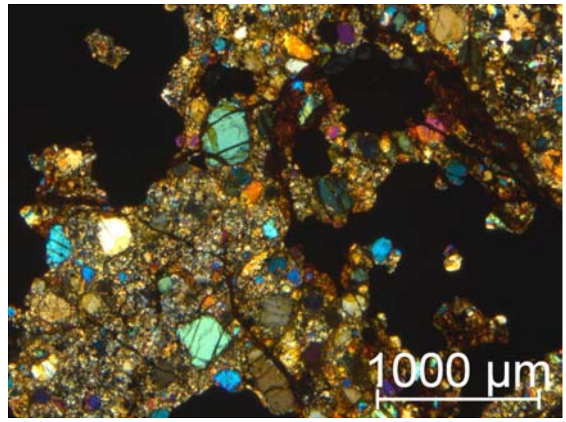

Figure 1: polarizing optical microscope image of a thin section of the mesosiderite NWA 4418 (sample MSP 5044); transmitted light, crossed polars.

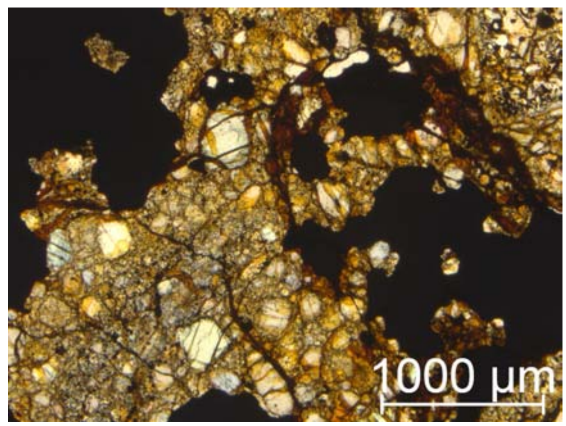

Figure 2: polarizing optical microscope image of a thin polished section of the martian meteorite NWA 4418 (sample MSP 5044); transmitted light, plane polars.

SEM and EMPA analyses revealed that orthopyroxene is pigeonitic ($Fs_{29,6}En_{67,3}Wo_{3,1}$, with a FeO/MnO ratio ranging from 26.3 to 37.0). Clinopyroxene ($Fs_{14,0}En_{43,9}Wo_{42,0}$) and exsolution lamellae ($Fs_{21,6}En_{49,8}Wo_{28,6}$) are instead diopsidic; Plagioclase is anorthitic ($An_{90,6}Or_{0,6}$). Oxygen isotope analyses (I.A.Franchi and R.C.Greenwood, *OU*) confirm textural and compositional data and are consistent with a classification as mesosiderite: $\delta^{17}O$ = 2.145 ‰, $\delta^{18}O$ = 4.524 ‰, $\Delta^{17}O$ = - 0.207 ‰.

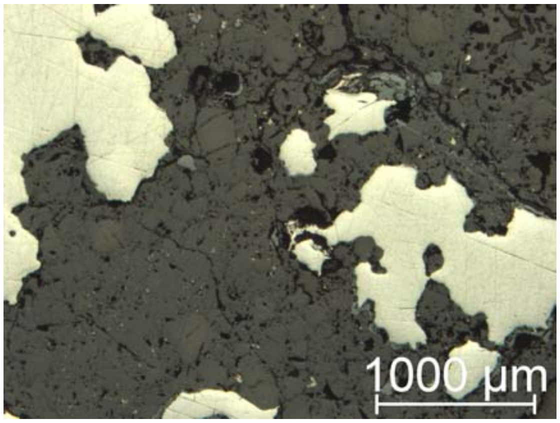

Figure 3: polarizing optical microscope image of a thin polished section of the martian meteorite NWA 4418 (sample MSP 5044); reflected light, plane polars.

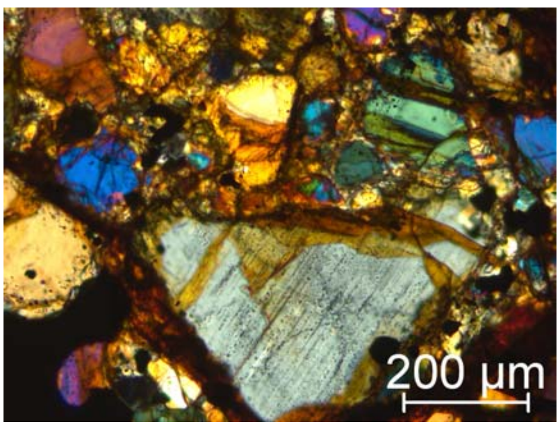

Figure 4: polarizing optical microscope image of a thin polished section of the mesosiderite NWA 4418 (sample MSP 5044). Detail of the silicate matrix with a large pyroxene crystal displaying exsolution lamellae; transmitted light, crossed polars.

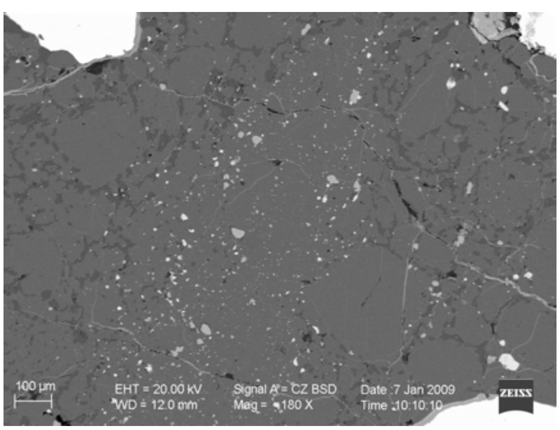

Figure 5: SEM-EDS image of a thin polished section of the mesosiderite NWA 4418 (sample MSP 5044). White areas are metal, tiny pale grey spots in the silicate matrix are iron oxides.

Discussion and conclusions

The set of data collected on this stony-iron meteorite point to a classification as mesosiderite. Oxygen isotope data plot in the mesosiderite field [4]. Textural and compositional data, as well as similarities with other mesosiderites from Northwest Africa point to a classification as subgroup 3B.

References: [1] Weisberg, M.K. et al. (2008) *MAPS,* **43**, 9, 1555; [2] Hewins R.H. (1984) *JGR,* **89**, C289-C297; [3] Powell B.N. (1971) *GCA*, **35**, 5-34; [4] Greenwood R.C., et al. (2006) *LPSC*, **37**, abs. 1768.