

A NEW CH CARBONACEOUS CHONDRITE FROM ACFER, ALGERIA. V. Moggi-Cecchi¹, A.Salvadori¹, G.Pratesi², I.Franchi³, R.Greenwood³, ¹Museo di Scienze Planetarie, Via Galcianese 20/h, I-59100 Prato, Italy, e-mail: v.moggi@pratoricerche.it, ²Dipartimento 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, ³Planetary and Space Sciences Research Institute, Open University, Walton Hall, Milton Keynes, GB-MK7 6AA United Kingdom

Introduction

A single stones weighing 1456 g was found in November 2002 in the Acfer area by Filiberto Ercolani, one of the best meteorite dealers ever lived in Italy, dead in 2004 in a car accident. The coordinates of the find are the following: 27°36.56 N - 03°56.14 E. The provisional name Acfer 366 has been assigned to this meteorite by the Meteoritical Society's nomenclature committee. The outer surface of the main mass presents a small portion of fusion crust. A cut surface reveals a chondritic texture with several visible metal spots in a dark matrix. The Museum of Planetary Sciences of Prato (MSP) owns both the main mass (MSP 2273), weighing 1410 g, and the type specimen, weighing 30 g as well as a polished thin section [1].

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 Philips 515 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 performed 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 Acfer 366 shows a chondritic texture, with chondrules dimensions ranging from 30 to 300 μm with a ponderate mean value of 91 μm on 150 chondrules. Chondrule types are variable, with a predominance of cryptocrystalline type (C, 77 out of 133), lower amounts of granular olivine/olivine-pyroxene (GO/GOP, 29) as well as of porphyritic olivine (PO, 23) and few barred olivine type (BO, 4). Chondrules abundances are also variable with dimensions: among large chondrules GO-GOP types are prevalent. From a textural point of view Acfer 366 is composed mainly of chondrules' fragments (accounting for about 70% of the total volume), minor chondrules (15-20 vol. %) and non-silicate phases (20-25 vol. %, Figure 1). Interchondrules (or interfragments) matrix is rather uncommon (5 vol. %). Non-silicate phases are mainly represented by Fe-Ni alloys (mostly kamacite) with very small amounts of

sulphides (1-5 % total vol.). Metal and sulphide grains, ranging in dimensions from 10 to 100 μm , are homogeneously distributed and have rounded or irregular contours. Metal is also present as small droplets inside chondrules, mostly in GO. Terrestrial weathering grade is moderately high (W2) as can be seen in Figure 2 and 3. Sharp extinction of olivine indicates that the meteorite is weakly or not shocked (S1).

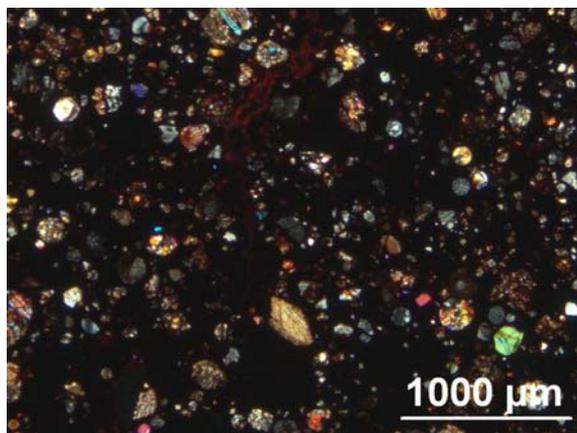


Figure 1: polarizing optical microscope image of a thin section of the CH chondrite sample MSP2273. Blue, green and pink grains are olivine, black areas are metal and troilite; transmitted light, crossed polars.

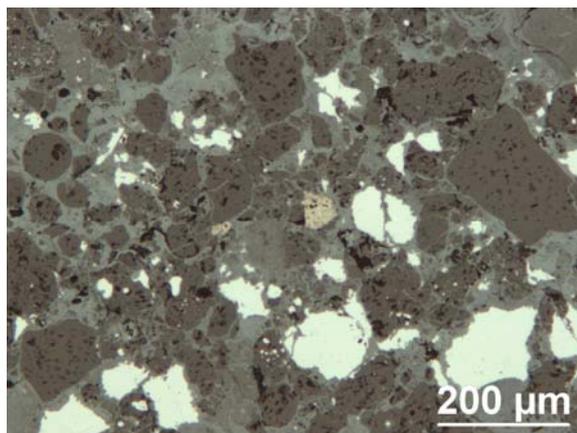


Figure 2: polarizing optical microscope image of a thin polished section of the CH chondrite sample MSP2273. White grains are Fe,Ni alloy, brown areas are troilite, grey areas are silicates; reflected light, plane polars.

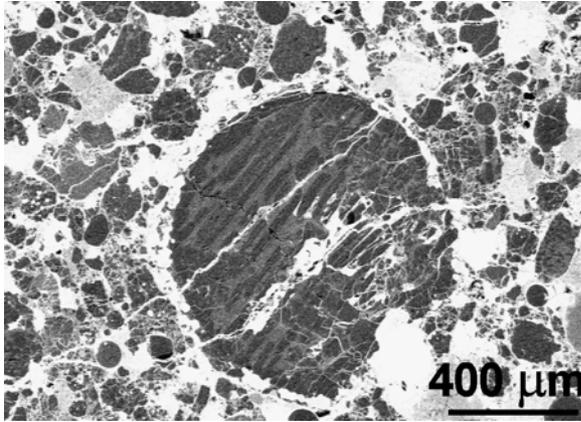


Figure 3: SEM-BSE image of the CH chondrite sample MSP2273, displaying a very large BO chondrule. White areas are Fe,Ni alloy and sulphides; grey areas are silicates.

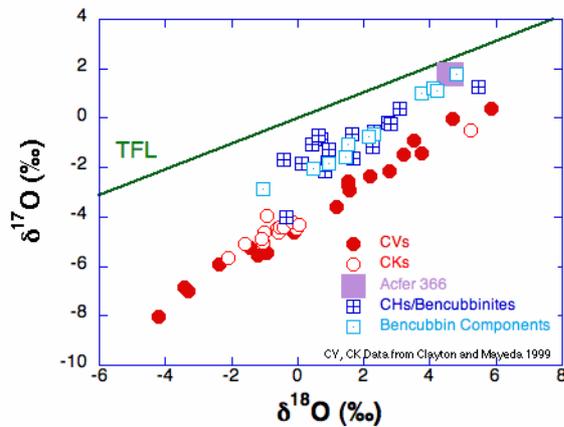


Figure 4: Oxygen isotopes diagram displaying sample MSP2273 OI data compared with literature data

SEM and EMPA analyses revealed that olivine in chondrule is rather homogeneous and has a markedly forsteritic composition, ($Fa = 0-3$ mol %); olivine in fragments has a more variable composition ($Fa = 1-20$ mol. %), with Fo-rich terms prevailing; low-Ca pyroxene, both in chondrules and in fragments, is homogeneous, too, with an enstatitic-bronzitic composition ($En = 90-100$, $Wo = 1-6$ mol %). High Ca-pyroxene is rather rare and can be found in porphyritic chondrules. It displays a rather markedly augitic composition ($Fs = 23.76$, $En = 44.32$, $Wo = 31.92$ mol. %). Plagioclase can be found as crystals within chondrules or as crystal fragments with a composition ranging from An_0 to An_{10} . Non-silicate phases include kamacite with a high Ni content (5-9 wt. %). Sulphides are mainly represented by Ni-rich troilite (1-2 wt.% Ni) but Ni-enriched sulphides (up to 11 wt.%), suggesting the presence of pyrrhotite, have

been detected, too. Oxygen isotope concentrations plot within the CH chondrite fields ($\delta^{17}O = 1.781\text{‰}$; $\delta^{18}O = 4.610\text{‰}$; $\Delta^{17}O = -0.616\text{‰}$; I.Franchi, R.Greenwood, *Open University*).

Discussion and conclusions

The set of data collected on this carbonaceous chondrite point to a classification as CH chondrite. Oxygen isotope data plot in the CV, CH and CK field, but a narrow affinity with CH chondrites can be observed (Figure 4). Even the chondrules-matrix ratio, as well as the predominance of C chondrule type [2], the distribution of type vs dimensions [3], the presence of several chondrule fragments and the total amount of metal [4] are distinctive for CH chondrites, as already indicated by these authors. Other minerochemical characteristics such as olivine composition [2] and the Ni amount of kamacite and troilite [3], as well as the presence and the distribution of Ni-rich sulphides [5], have been previously indicated as distinctive for this kind of carbonaceous chondrites. The sharp definition of chondrules, some of which poikilitic or granular and containing clinoenstatite, and the presence of intrachondrules glass suggest for this meteorite a petrologic type 3.

References: [1] Pratesi G. and Moggi Cecchi V. (2006) *MAPS*, **41**, in press. [2] Weisberg M. K. et al. (1988) *EPSL*, **91**, 19–32. [3] Bischoff A. et al. (1992) *GCA*, **57**, 2631–2648. [4] Gooding J.L. et al. (1981) *MAPS*, **16**, 17–43. [5] Grossman J. N. et al. (1988) *LPSC*, **19**, 433–434.