**A NEW CK CARBONACEOUS CHONDRITE FROM HAMMADA AL HAMRA, LIBYA.** G.Pratesi[1], A.Salvadori[2], V. Moggi-Cecchi[2], I.Franchi[3], R.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 198 g was found in February 2001 in the Hammadah al Hamra region of Lybia by Giovanni Pratesi during a joint scientific expedition for desert meteorites' recovery (Museum of Planetary Sciences of the Province of Prato and Museum of Natural History of the University of Florence). The coordinates of the find are the following: 29°00.00 N - 12°07.40 E. The provisional name HaH337 has been assigned to this meteorite by the Meteoritical Society's nomenclature committee. The main mass, weighing 174 g, has a dark brown external surface, with small fusion crust areas. A small cut surface displays a chondritic texture, with chondrules set in a dark green matrix and very large CAIs (up to 1 mm). The main mass, the type specimen (24 g) and 2 thin sections are at the Museum of Planetary Sciences of the Province of Prato (MSP 1592).

**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 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 the meteorite displays a rather peculiar texture since it contains few chondrules set in a devitrified matrix mainly composed by olivine crystals. Chondrules are weakly defined and sometimes altered. They have a mean size of 700 µm (on 25 chondrules). A gaussian fit on the sample provided a center value of 600 µm. Among chondrule types granular olivine (GO) are prevailing (16 out of 21 chondrules), with minor porphyritic-olivine/ porphyritic-olivine-pyroxene (2) and granular olivine-pyroxene (2). A poikilitic texture is evident in most GO chondrules. The matrix is coarse grained and is formed by devitrified crystals and a mesostasis of plagioclase composition. The matrix is prevailing over chondrules: a matrix/chondrules ratio of about 0.75 has been determined (Figure 1). Very rare and extremely altered AOIs, accounting for about 2% of the total volume, are also present, while very large CAIs, up to 1 mm in dimensions, are rather common.

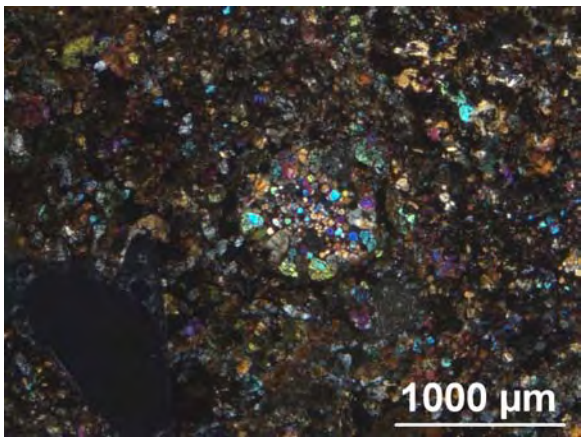


Figure 1: polarizing optical microscope image of a thin section of the CK chondrite sample MSP1592. Blue, green and pink grains are olivine, black areas are metal and troilite; transmitted light, crossed polars.

Metal alloys are absent (less than 0.01 vol. %), while magnetite is abundant and accounts for about 8 vol. %. This phase is present as rounded blebs inside chondrules or as more irregular grains outside chondrules.

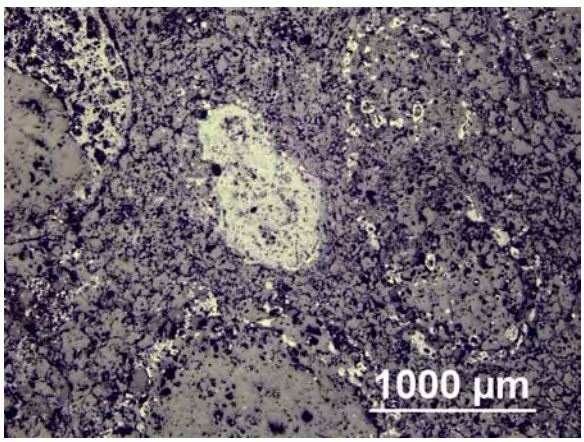


Figure 2: polarizing optical microscope image of a thin polished section of the CK chondrite sample MSP1592. Light-grey areas are magnetite; reflected light, plane polars.

Sulphides are rather rare (they account for about 1-5 vol. %) and mainly diffused outside chondrules. Rare occurences of Te-minerals have been found. Terrestrial weathering grade is rather high (W4). Sharp extinction of olivine indicates that the meteorite is weakly or not shocked (S1).

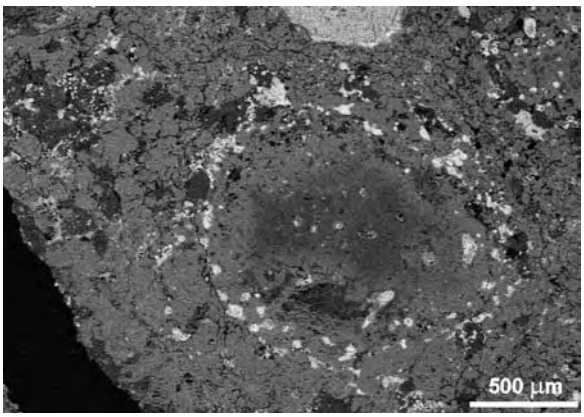


Figure 3: SEM-BSE image of the CK chondrite sample MSP1592, displaying a very large BO chondrule. White areas are magnetite and sulphides; grey areas are silicates.

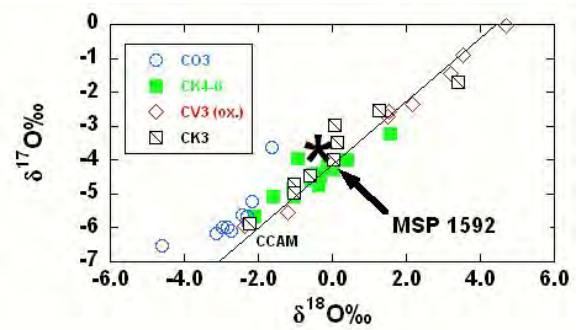


Figure 4: Oxygen isotopes diagram displaying sample MSP 2283 OI data compared with literature data for CO, CK and CV-ox chondrites.

SEM and EMPA analyses revealed a markedly homogeneous olivine composition, with Fa values ranging from 25 to 32 mol. % (PMD = 25). Zoned olivine crystals, with a core-to-rim composition ranging from Fa 6.75 to Fa 32, have been detected in PO chondrules (figure 3). Pyroxene composition is homogeneous, too, with En values ranging from 90 to 100 mol. % for low-Ca pyroxenes in GO and GOP chondrules. High-Ca pyroxenes in PO and POP chondrules have acicular forms and display an augitic composition ($Wo_{50}En_{50-60}Fs_{0-10}$). Plagioclase have albitic compositions, with An values ranging from 25 to 50 mol. %. As can be seen in fig. 2, magnetite is the predominant opaque phase, with rather high Cr contents (2-3 wt. %). Sulphides are mainly represented by troilite, which diplays rather high Ni contents (1-2 wt. %). The very rare kamacite grains have a low Ni content. Oxygen isotope concentrations plot within the CV and CK fields ($\delta^{17}O = -3.668‰$; $\delta^{18}O = -0.369‰$; $\Delta^{17}O = -3.496‰$, I. Franchi, R.Greenwood, OU).

**Discussion and conclusions:**

Petrographic features such as mean chondrules' dimensions, the coarse grained matrix and the presence of AOIs and CAIs, as well as of clinoenstatite in poikilitic chondrules, point to a classification as CK carbonaceous chondrite, in agreement with [2],[3],[4],[5] and [6]. Oxygen isotope data confirm this hypothesis (Figure 4). The homogeneous composition of olivine, its high Fa values, and pyroxene composition are compatible, according to literature data, with this classification, as well as the predominance of magnetite among opaque phases [7] and the presence of Te-minerals [3]. Chondrules-matrix integration and compositional data suggest a petrologic type 4.

**References:** [1] Pratesi G. and Moggi Cecchi V. (2006) *MAPS,* **41**, in press; [2] Rubin A. E. (1991) *Am. Min.,* **76**, 1856–1862. [3] Brearley A.J. and Jones R.H., (1998) in *Planetary Materials* (Papike J. J., ed) [4] Kallemein G. et al. (1991) *GCA,* **55**, 881–892. [5] Noguchi P. (1993) *NIPR,* **6**, 204-233. [6] Nakamura T. et al. (1993) NIPR, 6, 171-185.[7] Rubin A.E. (1993) MAPS 28, 130-135