A new HED achondrite from Ksar Jdid, Errachidia, Morocco: mineralogical and compositional data

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History: On September 1st, 2023, three meteorite fragments for a total mass of 1.25 kg were found by the meteorite hunter Mr. Ali Lamghari during a routinary meteorite searching in a location between Erfoud and Errachidia about 10 km far from the village Ksar Jdid, Moroccan Sahara. The main mass is partially covered by a black, shiny fusion crust (Figure 1). A cut surface revealed a pale grey achondritic brecciated texture, with large holocristalline diogenitic aggregates set in a fine-grained eucritic groundmass. The type specimen, weighing 21 g (Inv. # I-3741), and one thin section are deposited at the Museo "La Specola"- SMA, University of Florence, Italy; one polished thin section and a 43-g chip are deposited at the University Museum of Meteorites, Agadir, Morocco. Ali Lamghari owns the main mass. The meteorite has been submitted for approval to the Nomenclature Committee of the Meteoritical Society under the name Errachidia 009 [1].

Analytical techniques and instruments: Optical microscopy was performed at the Dipartimento di Scienze della Terra, University of Florence, Italy, using a Zeiss Axioplan-2 microscope equipped with Axiocam-HR camera. The scanning electron microscope - backscattered electrons (SEM-BSE) images and the energy dispersive X-ray (EDX)-SEM analyses have been obtained both at the Scientific Research Center of the Ibn Zohr University, Agadir, Morocco, and at the Centro di Servizi di Microscopia Elettronica e Microanalisi (MEMA), University of Florence, with a Zeiss EVO-40.

Textural, mineralogical and compositional features:.The SEM-BSE image of the thin section (Figure 2) shows a polymict breccia with two distinct lithologies: a basaltic lithology and an orthopyroxene-rich lithology with minor olivine and mineral fragments set into a fine-grained clastic matrix. One of the fragments consists of a very fine intergrowth of olivine, silica and plagioclase. Large orthopyroxene and diopside crystals, ranging in width from 500 to 900 µm are common. Very large (400-800 µm) aggregates of elongated diopside-orthopyroxene crystals are present, as well as minor olivine crystals, zoned core to rim. Scattered low-Ca pyroxene crystals of 300-700 µm in size, with very fine (5-11 µm) pigeonite exsolution lamellae are also visible. Minor phases are FeNi metal and troilite, with rare ilmenite and chromite grains. EDX-SEM analyses performed on the main mineralogical phases provided the following results: olivine in Ol/silica intergrowth: $Fa_{75.4\pm1.3}Fs_{24.6\pm1.3}$; n=6; Fe/Mn = 40.1±0.2; olivine in crystals (mean values $Fa_{58.2\pm1.3}Fs_{41.8\pm1.1}$; n=6; Fe/Mn = 45.5±0.2); low-Ca pyroxene crystals: $Fs_{29.8\pm0.2}En_{66.0\pm0.6}Wo_{4.2\pm0.2}$; n=8; Fe/Mn = 28.7±0.2): low-Ca lamellae in exsolved orthopyroxene: $Fs_{55.9\pm1.2}En_{40.0\pm1.3}Wo_{4.1\pm0.2}$; n=5; Fe/Mn = 32.0±0.3; diopside euhedral crystals: $Fs_{28.2\pm1.3}En_{32.7\pm0.8}Wo_{39.1\pm1.3}$; n=6; Fe/Mn = 27.1±0.3); plagioclase: $An_{86.8\pm0.6}Or_{0.7\pm0.4}$, n=7. According to textural and compositional data a classification as howardite has been proposed [2,3].

Figure 1: image of the mais mass of Errachidia 009 on the recovery site.

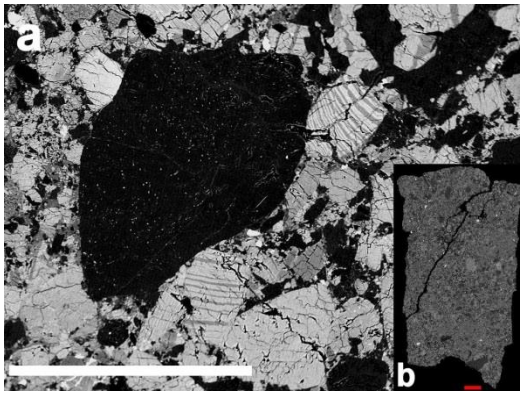

Figure 2: SEM-BSE images displaying:
a) exsolution lamellae in pyroxene (sc.bar = 300 µm);
b) an overall BSE map of the section (sc.bar = 1 mm)

References: [1] Gattacceca, J. et al. (2024) MAPS, in press; [2] Grady M. et al. (2014), Atlas of Meteorites, 1st ed., CUP, Cambridge, pp.350; [3] Scott, E.R.D. et al. (2009), GCA, 73, 5835-5853.