

Compositional and textural features of a new orthopyroxene-rich HED diogenite from Boujdour, Saguia el Hamra, Sahara

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History: On 10 June 2023, in the vicinity of the rural commune of Lamssid, approximately 80 km north of Boujdour province, within the Laâyoune-Boujdour-Saguia El Hamra region, Morocco, Mr. Ali Lamghari discovered a meteorite with a total weight of 4.5 kg in a flat stony area (Figure 1). A further systematic search conducted in the same area on 27 and 28 September 2024 by A. Ibhi, L. Ouknine and G.S. Senesi, allowed the recovery of an additional fragment weighing 270 g (Figure 1, top right). Both fragments show only small traces of a dark-brown fusion crust and display a partially altered external red-brown surface characterized by a coarse-grained crystalline texture, with euhedral green and brown crystals, and scattered black ones, presumably oxides. A cut surface revealed a pale grey achondritic texture, with large holocrystalline diogenitic aggregates set in a fine-grained groundmass. The type specimen, weighing 33 g (Inv. # MSNFi 3744-I), and one thin section are deposited at the Museo “La Specola”- SMA, University of Florence, Italy; one polished thin section and a 240-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 Boujdour 002 [1]

Analytical techniques and instruments: Optical microscopy was performed at the Dipartimento di Scienze della Terra, University of Florence, Italy, using a Zeiss Axioscope 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 a polished section of the meteorite shows a granular holocrystalline texture mostly consisting (90%) of very large euhedral orthopyroxene and plagioclase crystals ranging in width from 800 to 1600 μm (Figure 2, top right). Few medium grained aggregates, accounting for 10% of the area and consisting of plagioclase, orthopyroxene and diopside crystals, are also visible (Figure 2). Opaque phases are mainly consisting of iron-oxides and chromite grains (up to 700 μm), with rare troilite small grains. EDX-SEM analyses performed on the main mineralogical phases provided the following results: low-Ca pyroxene crystals: $\text{Fs}_{24.6 \pm 1.4} \text{En}_{72.1 \pm 1.2} \text{Wo}_{3.3 \pm 0.3}$; $n=14$; $\text{Fe/Mn} = 27.9 \pm 0.3$; diopside euhedral crystals: $\text{Fs}_{10.0 \pm 1.6} \text{En}_{46.4 \pm 1.3} \text{Wo}_{43.6 \pm 2.3}$; $n=13$; $\text{Fe/Mn} = 20.6 \pm 0.2$; calcic plagioclase: $\text{An}_{93.2 \pm 0.7} \text{Or}_{7.0 \pm 0.3}$, $n=5$. Chromite: $\text{Cr}_2\text{O}_3=49.3$, $\text{Fe}_2\text{O}_3=26.3$, $\text{Al}_2\text{O}_3=15.5$, $\text{MgO}=5.6$, $\text{TiO}_2=1.6$, $\text{V}_2\text{O}_5=0.5$, all in Wt.%. According to textural and compositional data a classification as diogenite has been proposed [2,3].



Figure 1: image of the main mass of Boujdour 002 on the recovery site. In the corner the image of the smaller fragment

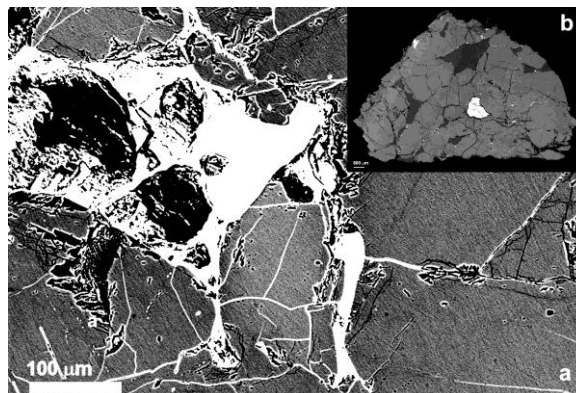


Figure 2: SEM-BSE images displaying:
a) a diopside-orthopyroxene aggregate;
b) an overall BSE map of the section (sc.bar = 800 μm)

References: [1] Gattacceca, J. et al. (2025) 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.