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Compositional and textural data of a new ungrouped iron meteorite from Oglat Sidi Ali, Morocco

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Abstract

In the present paper compositional and textural data on a recently found iron meteorite are provided. The meteorite was recovered near the locality of Oglat Sidi Ali, Maatarka, Morocco, in 2013 by Hassane Nachit during an expedition for meteorite recovery. Field data on the recovered samples suggest that the meteorite might be part of a strewn field produced by a single body that broke up in the lower atmosphere. Analytical data performed on an etched and polished section suggest a classification as ungrouped iron meteorite.

1. Introduction

About thirty small pieces from 3 to tens of grams each of an iron meteorite, totally weighing 240 grams, were recovered by Hassane Nachit, IZU in april 2013 during two expeditions of exploration fieldwork for meteorite recovery in the Maatarka region (Eastern Highlands) of Morocco (coordinates 33°31'45' N 02°37'01" W). Many other pieces, including a 190 kg piece, are reported to have been picked up by nomads in the area and sold to meteorite merchants but no certain information of the relationship with this meteorite is available. The coordinates of the recovered specimens plot in an ellipsoidal area that may describe a strewn field. The main mass, weighing 70 g, is moderately weathered (figure 1) and is on deposit at Ibn Zohr University. Three small pieces, totally weighing 30 g, are on deposit at the Museo di Storia Naturale dell'Università di Firenze, Italy. The type specimen, totally weighing 14.5 g, including an etched and polished piece is on deposit at Museo di Scienze Planetarie of Prato, Italy. The meteorite has been submitted to the Meteoritical Society for approval.

2. Experimental results

A cut surface of a hand size specimen of the meteorite displays no traces of staining. The etched surface shows exsolution lamellae with 3 prominent directions, at 60° intersection angles, displaying a distinctive Widmanstätten pattern (figure 2). The lamellae have an average bandwidth of 0.2±0.1 mm, pointing to a very fine octahedrite [1]. Scanning electron microscope analyses performed at the Dipartimento di Chimica dell'Università di Firenze allowed to determine a much finer scale pattern of these lamellae consisting of multiple tiny kamacite spindles roughly parallel to each other and ranging in width from 30 to 80 μm, separated by thin, Ni-rich taenitic spindles both forming a plessitic octahedrite arrangement (figure 3). SEM-EDX analyses performed on the Ni-rich phase allowed to determine a mean Ni content of 14.7 ± 0.2 wt.%, with a maximum Ni content of 45.2 ± 0.3 wt. % at spindle border, while the Ni-poor phase has a mean Ni content of 6.7 ± 0.1 wt.%. In order to determine the minor and trace elements contents of the meteorite, ICP-MS analyses have been performed at the Department of Earth and Atmospheric Sciences, University of Alberta laboratories. The analyses allowed to determine remarkably high Ni, Ga, Ru, Pd and Pt, and relatively low Ir contents. Table 1 reports the reliable values obtained for all the elements analyzed.

3. Figures

Figure 1: Field image of the main mass of Maatarka.

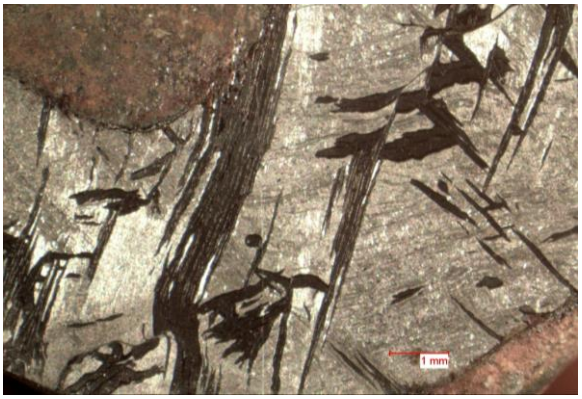

Figure 2: Image of the cut and etched surface of a hand size specimen.

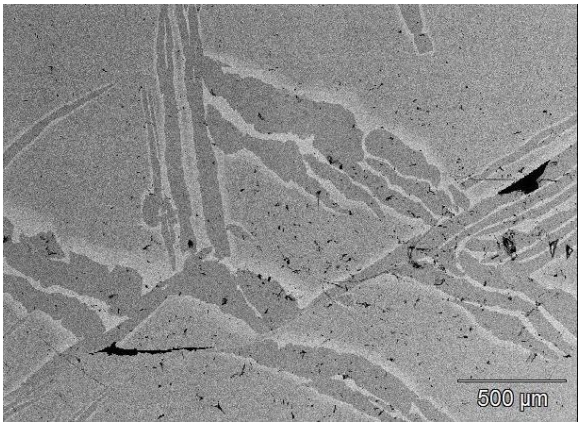

Figure 3: SEM-BSE image of an area of a polished sample; dark grey is kamacite; pale grey is taenite.

4. Tables

Table 1: Trace elements contents of Maatarka bulk.

Element	Amount (µg/g)	Amount (mg/g)
Ni	-	140.7
Co	-	11.7
Cu	249.4	
Ga	79.1	
As	10.0	
Ru	53.2	
Pd	8.8	
W	5.8	
Re	0.3	
Ir	2.5	
Pt	43.9	

5. Summary and Conclusions

Although textural data suggest similarities of this meteorite with plessitic octahedrites, pointing to a classification as IIC ([2], [3], [4]), compositional data do not support this hypothesis, due to the high Ni, Ga, Ru, Pd, Pt, and relatively low Ir contents. These data are outside the limits for the IIC group, therefore suggesting a classification as ungrouped, plessitic octahedrite. Further field research and the recovery of other specimens will provide more detailed topographic information about the scattering of the fragments and the characteristics of the fall (direction, fragmentation altitude etc.), allowing to fully determine the physical parameters of the supposed strewn field.

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