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## NWA 4537: A new Aubrite from northwest Africa

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**NWA 4537: A NEW AUBRITE FROM NORTHWEST AFRICA.** G. Pratesi<sup>1</sup>, V. Moggi-Cecchi<sup>2</sup>, I.A. Franchi<sup>3</sup>, R.C. Greenwood<sup>3</sup>, <sup>1</sup>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](mailto:g.pratesi@unifi.it), <sup>2</sup>Museo di Scienze Planetarie, Via Galcianese 20/h, I-59100 Prato, Italy, e-mail: [v.moggi@pratoricerche.it](mailto:v.moggi@pratoricerche.it), <sup>3</sup>Planetary and Space Sciences Research Institute, The Open University, Walton Hall, Milton Keynes, MK7 6AA United Kingdom

### Introduction

A complete single, green coloured stone lacking fusion crust was purchased in 2006 by Matteo Chinellato from a Moroccan dealer in Erfoud. The exterior displays minute spots of yellow-orange staining and larger dark brown areas. A cut surface on the type specimen displays a green colour and a homogeneous texture, with rare metal spots [1]. The main mass, weighing a total of 261 g, is on deposit at the *Museo di Storia Naturale dell'Università di Firenze*. The type specimen, one polished thin section and one block are on deposit at the *Museo di Scienze Planetarie di Prato* (inventory number MSP 5048).

### Instruments and methods

Optical microscopy and imaging have been performed at the laboratories of the Museum of Planetary Sciences of Prato by means of a Axioplan-2 polarizing optical microscope equipped with Axiocam-HR camera. 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 were undertaken at the Open University by laser-assisted fluorination [2]

### Experimental results

The thin section of NWA 4537 shows a uniform very fine-grained equigranular texture consisting of bladed grains of enstatite with sporadic clasts of enstatite, up to 0.7 mm across (Figure 1). The size of enstatite grains is variable from 80 to 210  $\mu\text{m}$  in width and up to 270  $\mu\text{m}$  in length. Relatively few enstatite grains exhibit lamellar twinning. Plagioclase is the only other silicate phase detected. Opaque phases are mainly characterized by blades of daubreelite up to 50  $\mu\text{m}$  in width, and very small (up to 50  $\mu\text{m}$ ) and rare rounded grains of troilite, Fe,Ni alloys and schreibersite. Kamacite and troilite are sometimes altered to oxides or hydroxides (Figure 2). Thin veinlets, consisting of iron oxides and hydroxides are visible in reflected light (Figure 3). Terrestrial weathering grade is not marked in the thin section and is essentially limited to troilite, although alteration is visible on the external surface of the type specimen.

EMPA analyses of NWA 4537 revealed that orthopyroxene is homogeneous and has a markedly enstatitic composition ( $\text{En}_{98}\text{Wo}_2$ ;  $\text{Al}_2\text{O}_3 = 0.19 \text{ wt}\%$ );

plagioclase can be found as crystal fragments with homogeneous composition ( $\text{An}_{14}\text{Or}_4$ ). Kamacite has a homogeneous and low Ni content (2 wt. %). Sulphides are mainly represented by Ti-rich troilite (2 wt. %) and daubreelite. Schreibersite grains have also been detected. The oxygen isotope composition of NWA 4537:  $\delta^{17}\text{O} = 2.65\text{‰}$ ;  $\delta^{18}\text{O} = 5.02\text{‰}$ ;  $\Delta^{17}\text{O} = 0.04\text{‰}$ , plots within the aubrite field of [3].

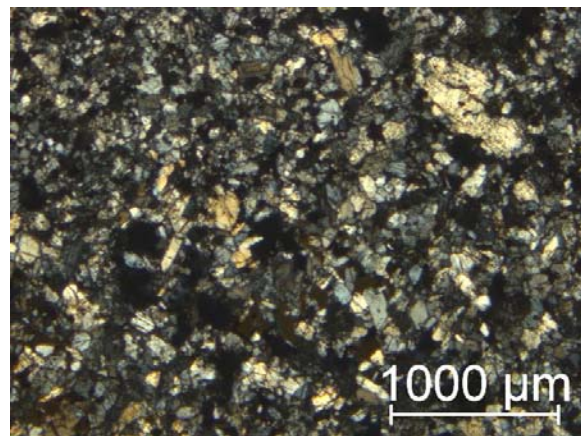


Figure 1: polarizing optical microscope image of a thin section of NWA 4537. cream-grey areas are enstatite, black areas are metal and troilite; transmitted light, crossed polars.

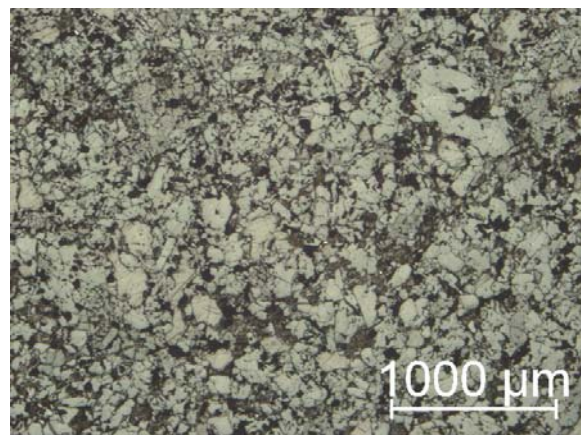


Figure 2: polarizing optical microscope image of a thin section of NWA 4537. Grey areas are silicates, pale-grey areas are iron oxides/hydroxides; reflected light, plane polars.

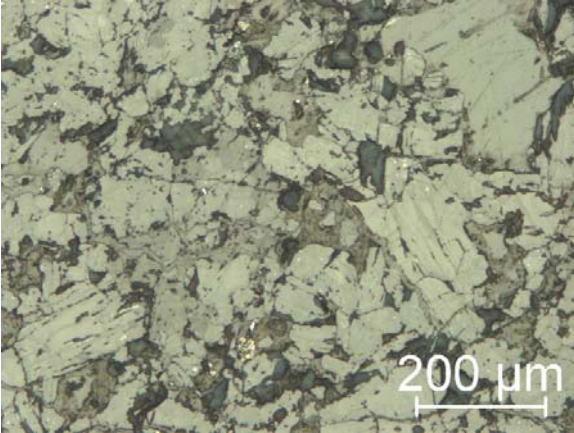


Figure 3: polarizing optical microscope image of a thin section of NWA 4537. Cream-yellow spots are kamacite and troilite, grey areas are silicates, pale-gray veins are iron oxides/hydroxides; reflected light, plane polars.

### Discussion and conclusions

The set of data collected on this achondrite point to its classification as an aubrite. The oxygen isotope data is consistent with it being an aubrite. The homogeneous texture, the predominance of enstatite and the presence of plagioclase among silicate phases, as well as of daubreelite among opaque phases are characteristic of aubrites [4]. Other minerochemical features such as the Ti-enriched composition of troilite and the Ni amount of kamacite, previously indicated as distinctive for aubrites, support this hypothesis [5].

**References:** [1] Pratesi G. and Moggi Cecchi V. (2008) *MAPS*, **43**, 1558; [2] Miller M.F. et al. (2000) *Rapid Commun. Mass Spectrom.* **13**, 1211-1217 ; [3] Newton J. et al. (2000) *MAPS*, **35**, 689-698. [4] Watters and Prinz (1979) *LPSC*, **10**, 1073–1093. [5] Easton (1986) *MAPS* **21**, 79-93