NWA4269: ANOMALOUS EUCRITE WITH HIGH METAL CONTENT FROM ALGERIAN SAHARA

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Introduction: NWA4269 was found in september 2004 in Hamada du Draa, South West of Algeria. It is a single, complete, fusion crusted stone weighing 54 g and is classified as a monomict eucrite.

Petrography: NWA 4269 presents three differents textures with various lithologies. The first is a relict of a magmatic sub-ophitic texture with big lath-shaped plagioclase (An_{85}) grains and equant ferro-pigeonites exsolved in ferro-augite ($En_{26-27}Wo_{34-41}$) and ferro-hypersthene ($En_{29-30}Wo_{6-5}$). The Fe/Mn atomic ratio in pyroxenes ranges from 27 to 42. Laths of plagioclase were sheared during shock. The two others textures are coarse-grained and fine-grained (granulitic). The later displays slightly a different lithology with plagioclase and low- and high-Ca pyroxenes recristallization associated with silica (quartz α), Ca-phosphates, iron metal (Ni%<0.1), troilite, spinel (Fe-rich chromite, Cr#=0.91) and ilmenite. Individual augite ($En_{26}Wo_{40}$) grains occur in the matrix. The metal is extremely abundant in the fine-grained lithology (up to 2%), it can reachs millimetric grain size. Silica (quartz α) is always in relationship with metal and troilite.
Mapping of crystallographic orientation in iron metal using the EBSD technique, displays evidences of plastic deformation as elongated subgrains [1].

Discusion: The exsolved pigeonites have homogeneous composition. NWA4269 shows petrographic evidence of secondary subsolidus reheating events. This monomict eucrite is a type 5 according to the metamorphic sequence of Takeda and Graham (1991) [2]. Pyroxenes are equilibrated between 800 to 900°C, suggesting that NWA4269 experienced sub-solidus annealing. The granulitic association is the result of a recristallisation after a reheating by simple burial and impact metamorphism [3].

All eucrites contain at least some metal (<0.5%), which formed either during crystallization or later metamorphism [4]. Metal in NWA4269 have very low Ni contents (Ni%<0.1), that exclude an origin from an impactor [5]. NWA4269 have a high metal content, which we interpret to origin from reduction of FeO and FeS like in the Camel Donga eucrite [6]. Silica (quartz α) is always in relationship with metal and troilite as a result of reduction of pyroxenes (Fig.1).

The total Fe in NWA 4269 is 23,18%, what is higher than Camel Donga (18.6%) and other known eucrites. Pyroxenes are iron-richer than Camel Donga pyroxenes and those from other known eucrites (Fig.2). Camel Donga contains about 2% (5 to 20µm) metallic iron [6]; NWA4269 contains more than 2% and can reachs millimetric size. All these features make NWA4269 exceptional.

This achondrite also has an atypic $\Delta^{17}O$ (0.136), $\delta^{18}O$=3.27, $\delta^{17}O$=1.84, that suggests it is a basaltic achondrite different from the HED group [7] or NWA4269 has a same origin as Ibitira, from a differentiated but not well-mixed material, that was buried and metamorphosed by lava flows that have reached the surface of HED parent body [8].

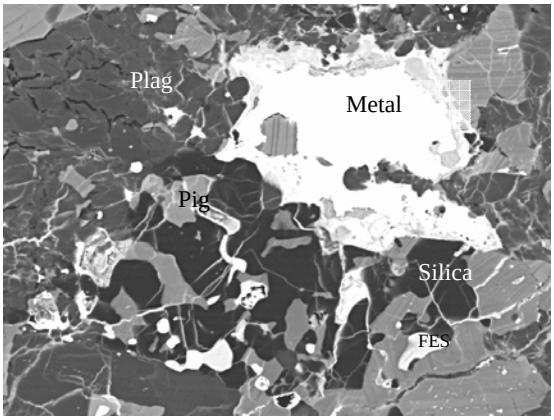

Fig.1 Silica systematically appears associated with metal and troilite (FeS) in NWA4269.

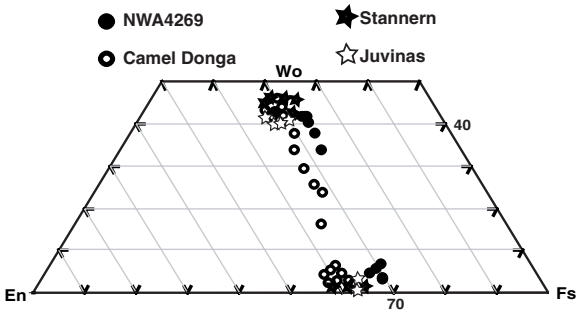

Fig.1 Pyroxene compositions of NWA4269, Stannern and Juvinas [9], Camel Donga [6].

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