AL HAGGOUNIA 001: A WEATHERED EL6 CHONDRITE

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Introduction: Al Haggounia (AHa) 001 is a significant find (several tons), the strewnfield of which extends over nearly 50 km [1]. The fall was dated 23 ka B.P. by ^{14}C; therefore it is not a fossil meteorite as confirmed by field evidences [1]. Its classification is however controversial: AHa 001 was classified as an aubrite [2] but paired stones were classified as EL3, EL6, EL7, enstatite achondrite and aubrite [2, 3]. One obvious reason for this disagreement resides in its severely weathered state and possibly in the variability among such a large number of stones of varied sizes. This can be illustrated in its magnetic susceptibility ($\log(\chi)$), which varies from 2.8 –an aubrite like value - up to 4.9 as for a slightly weathered enstatite chondrite (fresh 5.5±0.2). The present study is based on the observation of a large number of hand specimens, five polished sections and one thin section. Two types of rocks are typical: (1) brownish, heavily rusted samples with fractures filled of iron oxide-hydroxides and (2) bluish samples or remnant cores of several cm to dm surrounded by variable amounts of brownish material and limited by oxide-hydroxide filled fractures.

Results: Faint chondrules about 1 mm in size are quite rare (less than 0.2 per cm^2 on the average) and therefore not found in every section. Bulk chemical composition is of no help to discriminate between E chondrite and aubrite, as metal and sulfide have been heavily weathered when not leached away. The blue-grey sections in particular exhibit a porosity of about 40% as a result of leaching of all sulfides and metal. Brownish fractions however have some preserved sulfide and metal cores. Minor components in sulfides are useful in determining the type and metamorphic grade [4]. This approach however in hampered by the small size of preserved relict crystals. The Si content of kamacite (1 wt %) favors an EL type. The organization degree of carbon as obtained from Raman spectra has been used in order to characterize EH3 and EL3 [5]. As proposed by [6] we used the width of the G band as a reliable parameter of graphitization and not the classical ID/IG affected by polishing artifacts [6]. In AHa the carbon component is well ordered since its FMWH G (19 cm^{-1}) is close to the canonical graphite value. In contrast matrix carbon in type 3 exhibits a broad G band (FMWH-G > 60 cm^{-1}) and well developed D1 and D2 defect bands characteristic of a still disordered carbon [5]. It follows that all matrix carbon in AHa was subject to a significant metamorphism.

Conclusions: From the texture and carbon cristallinity the metamorphic grade is as high as a type 6. According to the presence of ghost chondrules, an aubrite classification is not justified. Search for preserved sulfides will help confirming this diagnosis.

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