A CLASSIFICATION TABLE FOR ACHONDRITES

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The classification of chondrites is obtained from their mineral compositions, their textural characteristics and magnetic susceptibility following especially [1- 3]. Devoid of chondrules, achondrites are essentially formed by varying proportions of silicates, oxides, sulfides and accessory minerals. According to their bulk chemical compositions, they derive from differentiated parents bodies and constitute meteorite classes most comparable to terrestrial igneous rocks. Identifying achondrite finds is particularly difficult because of these three parameters: non observation of the fall, frequent absence of fusion crust (due to terrestrial weathering) and for most classes, a non discriminating magnetic susceptibility relative to terrestrial rocks.

In order to simplify achondrite classification, we tried to develop a "grid", based on simple and robust criteria, according to recent petrographic and geochemical studies [4]. The different types of differentiated meteorites are concerned: Acapulcoites, Angrites, Aubrites, Brachinites, Lodranites, Ureilites, HED (Howardites, Eucrites, and Diogenites), lunar meteorites, Martian meteorites (Shergottite, Chassignites, Nakhlites…) and other grouplets. The following approach is suggested, based on four items: Field criteria, Optical observations, Geochemical criteria, Additional criteria.

1. Field criteria: From the magnetic susceptibility, a type group with log(χ) exceeding 4 can be separated [3]: Acapulcoites, Lodranites, Ureilites, winonaites in addition to mesosiderites and pallasites, the silicate fraction of which is achondritic like. These are typically more magnetic than comparable terrestrial rocks

2. Optical observations: 21. Fundamental criteria of petrology. Major minerals. Texture and mode. 22. Fundamental criteria of mineralogy. Accessory symptomatic minerals. 23. Additional criteria. Among accessory minerals, some are not symptomatic but complement the characterization. Examination with a SEM is more sophisticated but follows the same approach.

3. Geochemical criteria: These are more sophisticated as they require analyses. 31. EMP Analyses of major and accessory phases (e.g. Fa in olivine, En:Fs:Wo of pyroxene; Fe/Mn in olivine and pyroxene; Ab:An:Or in plagioclase) 32. bulk rock analysis (major and minor elements) is not performed routinely but this may change very soon. 33. Sophisticated analyses: oxygen isotopes [5]. Trace element analysis is a powerful tool requiring heavy equipment.

4. Additional criteria

Conclusions: This classification grid aims at helping classifiers. It could be inserted in the Meteorite Database of the Meteoritical Society as a guide of important criteria to meet before achondrite classification and as such should serve as an easy reference.

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