A CLASSIFICATION TABLE FOR ACHONDRITES (2) H. Chennaoui-Aoudjehane[1], N. Larouci[1], A. Jambon[2], D. W. Mittlefehldt[3], [1]Hassan II University Casablanca, Faculty of Sciences, BP 5366 Maârif Casablanca Morocco (e-mail: chennaoui_h@yahoo.fr), [2]UPMC-Paris 6 ISTEP, Case 110, 4 place Jussieu, 75252 Paris France, [3]Astromaterials Research Office, NASA Johnson Space Center, Houston, USA.

Classifying chondrites is relatively easy and the criteria are well documented [1- 3]. It is based on mineral compositions, textural characteristics and more recently, magnetic susceptibility. It can be more difficult to classify achondrites, especially those that are very similar to terrestrial igneous rocks, because mineralogical, textural and compositional properties can be quite variable. Achondrites contain essentially olivine, pyroxenes, plagioclases, oxides, sulphides and accessory minerals. Their origin is attributed to differentiated parents bodies: large asteroids (Vesta); planets (Mars); a satellite (the Moon); and numerous asteroids of unknown size. In most cases, achondrites are not eye witnessed falls and some do not have fusion crust. Because of the mineralogical and magnetic susceptibility similarity with terrestrial igneous rocks for some achondrites, it can be difficult for classifiers to confirm their extra-terrestrial origin.

We –as classifiers of meteorites- are confronted with this problem with every suspected achondrite we receive for identification. We are developing a “grid” of classification to provide an easier approach for initial classification [4]. We use simple but reproducible criteria based on mineralogical, petrological and geochemical studies [5]. In [4], we presented the classes: acapulcoites, lodranites, winonaites and Martian meteorites (shergottite, chassignites, nakhlites). In this work we are completing the classification table by including the groups: angrites, aubrites, brachinites, ureilites, HED (howardites, eucrites, and diogenites), lunar meteorites, pallasites and mesosiderites. Iron meteorites are not presented in this abstract.

The classification steps are:

1- Field criteria including the physical appearance of the rock, and its magnetic susceptibility that can help separate more magnetic achondrite classes with log(χ) exceeding 4 [3].
2- Optical/textural observations on an optical microscope or SEM: based on the observation of major minerals, texture, size, mode, and accessory symptomatic minerals.
3- Geochemical analysis: including EMP analysis 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) and oxygen isotopes [6]. Bulk rock analysis and trace elements are not performed systematically, but can be very helpful.
4- Additional criteria
5- Representative samples and important references for each group

Conclusions: This classification grid aims to aid classifiers. It will be detailed group by group following a branching tree model, inserting images of representative samples and the optical minerals, figures and more recent references. 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.

References: [1] Keil, K. and Fredriksson, K., 1964, J. Geophys. Res. 69, 3487–3515. [2] Brearley A.J. and Jones R.H., 1998, Planetary Materials Min. Soc. Amer., pp. 3.38-46 and 3.217-220. [3] Rochette P. et al, 2003 Meteoritics and Planetary Science 38, Nr 2, 1-18. [4] Chennaoui Aoudjehane, H. et al, 2010, 73rd Annual Meteoritical Society Meeting #5257. [5] Papike J. J., 1998, Planetary materials,Reviews in Mineralogy Vol 36, Min. Soc. Amer. [6] Clayton, R. N. 2003, Treatise on Geochemistry, Volume 1. pp. 711. Elsevier, 2003, p.129-142.