ALMAHATA SITTA MAGNETIC SUSCEPTIBILITY DATABASE – UPDATE OF THE ENSTATITE CHONDRITIC LITHOLOGIES. V.H. Hoffmann[1,2], K. Wimmer[3], R. Hochleitner[4], M. Kaliwoda[4], M. Funaki[5]; M. Torii[6]; S. Decker[7]. [1]Faculty Geosciences, Dep. Geo- and Environmental Sciences, Univ. Munich, [2]Dep. Geosciences, Univ. Tübingen, Germany; [3]Ries Crater Museum, Nördlingen, Germany; [4]Mineralogical State Collection, Munich, Germany; [5]Tokyo/Japan; [6]Okayama/Japan; [7]Oberwesel/Germany, www.meteorite-museum.de.

We have developed a database on the magnetic susceptibility (MagSus, and other magnetic parameters) of all so far by us investigated Almahata Sitta individuals and samples. Three sample sets are discriminated, details are found in earlier contributions [1-5]: AS (AHS), MS and MS-MU. Recently, we have extended our database of the MagSus values incorporating now all investigated individuals/samples of the Almahata Sitta fall of 2008, focusing on the above mentioned sample sets.

In the meantime, we have significantly extended our database on the magnetic susceptibility (MagSus, and other magnetic parameters) [1,2]. Since some time, MagSus is fully accepted and incorporated in the Meteoritical Bulletin as an independent parameter for the classification of stony meteorites.

Here we focus on the enstatite chondrite lithologies of the Almahata Sitta fall: 36 of all reported 143 individuals [1-3], see figs. 1 and 2. It should be mentioned that also 2 enstatite achondrite lithologies have been classified in the AS sample set: both are characterized by an extremely high metal (kamacite) content which discriminates these individuals from the “normal” enstatite achondrites (aubrites) (MS-MU 019 and 036). Recent investigations reported 63 additional Almahata Sitta stones/ individuals, stored at Univ. of Khartoum (sample set AhS) [4, 20]. Presently we cannot include this sample set as long as neither sample material for own investigations nor precise (magnetic) classification (eg MagSus) data are available.

We decided to treat the AS enstatite chondrites in more detail and to also include all published MagSus data of enstatite chondrite falls. Enstatite chondrites are highly reduced meteorites and Fe is only present in metallic iron phases (kamacite, taenite) or Fe-bearing sulphides (eg troilite) [5-13]. Therefore enstatite chondrites are extremely sensitive to terrestrial weathering effects, consequently only falls can be included in any substantiated MagSus database. The presently accepted enstatite chondrite classification scheme discriminates two groups depending on the bulk iron content: the EH group with ~30% total iron and the EL group with ~25%. A further discrimination between the two subgroups is made by the Si content of the metal: the EH subgroup has a higher Si content in kamacite (EH: 1.9–3.8 wt% vs. EL: 0.3–2.1 wt%).

However, it was shown already by Macke [4] that the two groups do not significantly differ in their iron content, and that they are indistinguishable in physical parameters such as density, porosity, and specifically in magnetic susceptibility.

Recently a new classification scheme was proposed by [18]. A new set of Almahata Sitta individuals was classified by [19] whereby 3 enstatite chondrites have been described and classified based on the new scheme.

We can summarize the main results as follows:

- For the first time, by incorporating AS E-C individuals, all petrographic types could be covered now for both E groups.
- Please note that in our contribution we do not apply the newly proposed E-C classification system, mainly as many data of the AS individuals are still missing.
- All MagSus values represent average values of 3 databases and several samples each, respectively. So we can consider the MagSus values as representative.
- The influence of local variations in Fe metal concentrations (eg veins) can be neglected: this was shown on Neuschwanstein 2 (EL 6) whereby a full profile across the main mass was sampled and investigated and no significant variations in MagSus could be found [15-17].
- It is evident that MagSus values of the AS E-C are generally lower, in case of both groups. This is specifically significant in the case of the EL 6.
- The Macke [14] findings can be confirmed – in our study only falls are taken into account.
- MagSus values do not provide a clear picture concerning grouping of E-C into high- and low-iron, respectively.
- E-H: we find a minor trend between MagSus and petrographic type – increase of MagSus with petrographic type, or degree of equilibration. The significance of the trend will have to be discussed
- E-L: we can not find any trend between MagSus and petrographic type, so the degree of equilibration seems not to play a major role in case of E-L.

- Consequently, bulk or total iron does not allow a clear classification into different E-C groups
- Further, taking into account the Si content of metal as a classification parameter is questionable.

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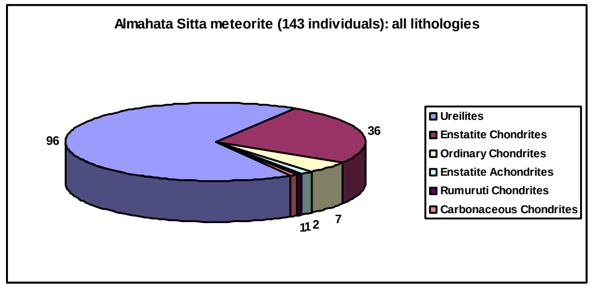

Figure 1: Statistical overview of the lithologies of all known AS individuals (see details concerning sample sets in text).

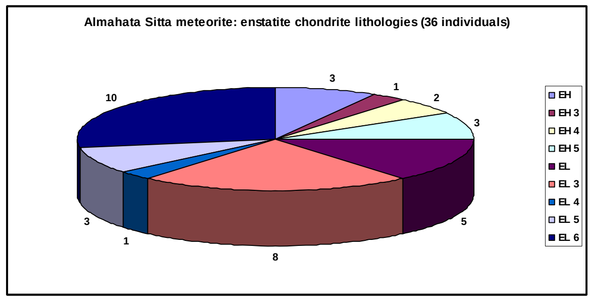

Figure 2: Statistical overview of all known individuals of the Almahata Sitta meteorite fall classified as enstatite chondrites (1 / 2019). Please note that „intermediate“ members are included within the lower petrographic group (eg EH 4/5 is placed in EH 4). EH and EL means all E chondrites which do not clearly fit in a specific petrographic group, such as IMR (impact melt rocks) or breccias.

E–L group members are clearly dominating, and here specifically the EL 6 lithologies. MS 179 should be noted as this individual represents a complex EL 3-5 breccia.