MAGNETIC SIGNATURE OF THE MILLER RANGE (MIL) NAKHLITES.

V.H. Hoffmann[1,2], M. Funaki[3], M. Torii[4]. [1]Faculty Geosciences, Dep. Geo- and Environmental Sciences, Univ. Munich, [2]Dep. Geosciences, Univ. Tübingen, Germany; [3]Tokyo, Japan; [4]Okayama, Japan.

General: In recent years a large number of new Martian meteorites have been reported [1] which significantly widened our knowledge concerning Martian geology, mineralogy, petrogenesis and formation/chronology. Nevertheless, the hypothesized existence of a strong Martian dipole magnetic field during very early periods of time, < 4 Gyrs, and the basic physical processes behind the strong crustal anomalies of the southern hemisphere are still a mystery. Is it generally accepted that a strong magnetic dipole field represents the most important condition for the formation of a stable atmosphere on a planet over longer period of times, and based on that the existence of liquid water on a planets surface, here Mars. The search for traces of live or prebiotic structures on the Mars surface was without any success so far. Future planed sample return missions are mainly focused in this direction [3].

Presently (5/2018) about 110 Martian meteorites are reported, several more still under investigation (classification process pending), details are found in [1, 2]. In our contribution we will focus on a specific group of Martian meteorites, the nakhlites - named after the famous Nakhla fall. In terms of petrogenesis, nakhlites are clinopyroxenites with some content of olivines, for details see [1,2] and are interpreted as shallow mantle rocks, related to chassignites (dunites).

In this contribution we will focus on the magnetic and mineralogical signature of the four reported Miller Range nakhlites: MIL03346, MIL 090030, MIL 090032 and MIL 090136. We received 2 samples of each MIL stone, one interior and one exterior (near surface but without FC) chip, all about 0.3 gr in mass. The homogeneity of the magnetic signature was investigated by systematical investigation a 3D array sampled along slices cut across the main mass of MIL 090032, all together 16 sub-samples (27 individual fragments). A large range of (paleo-) magnetic, mineralogical and Raman Spectroscopic parameters have been studied, here we will focus only on selected magnetic parameters and magnetic phase composition (magneto-mineralogy), [MagSus: specific magnetic susceptibility, classification parameter]:

Results:

1. Comparison between the 4 MIL stones: MIL 03346 int/ext shows slightly different MagSus values (lower), the MagSus values of other 3 stones lay within a very narrow range (int. 3.73-3.84, ext 3.69-3.80, respect.).
2. MagSus comparison 4 MIL stones int-ext: ext MagSus values are in the range of 0.92-0.98 of the int values, so slightly lower: the effect is due to terrestrial alteration even under Antarctic (cold desert) conditions: the int/ext difference in MagSus of individual meteorites depends significantly on terrestrial age, mineralogy / phase composition, but also on the cover-degree / thickness of the fusion crust.
3. Trends of other magnetic parameters (magnetic remanences such as NRM, several IRM's) and related parameters will be shown in our poster.
4. The magnetic phases in MIL stones have been investigated within a large temperature range including space conditions (low-T.) in our experiments (Raman data will be reported elsewhere): the dominating phases are (Ti-) bearing magnetite (low Ti content in general), and minor Ilmenite, traces of Fe-sulfides (pyrrhotite?).
5. Comparison with the other nakhlites (10 reported [1]): an update of earlier and existing models concerning burial depth [4-6] will be shown in our poster.
6. MIL sample array (MIL 090032): a very homogenous distribution of MagSus was detected.

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References:

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