GEBEL KAMIL IRON METEORITE: ^{57}Fe MÖSSBAUER SPECTROSCOPY AND MAGNETIC PROPERTIES DATA

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Gebel Kamil is an ungrouped iron meteorite, Ni-rich (~ 20 wt%) ataxite, found in 2009 close to Kamil impact crater in Egypt. Investigation of its microstructure indicates that Gebel Kamil meteoroid suffered preterrestrial-impact shock pressures between 35 and 60 GPa [1]. Usually, only optical/electronic microscopy are applied to study thermal/shock processes in meteorites. Nevertheless, it has been recently shown that magnetic properties measurements are sensitive proxies to the thermal/shock history of meteorites [2]. Indeed, the magnetic properties of iron-bearing meteorites are strongly dependent on the presence or absence of tetrataenite, a mineral that may be disordered into taenite during shock/thermal events. Thus, in this work, we present magnetic properties data along with mineralogical characterization by ^{57}Fe Mössbauer spectroscopy for a shrapnel of Gebel Kamil meteorite, in order to evaluate the thermal/shock history revealed by these techniques. ^{57}Fe Mössbauer spectroscopy, in standard transmission geometry using a 25 mCi ^{57}Co/Rh radioactive source in sinusoidal mode, was performed at room temperature (RT). Spectra were recorded for 24 h in a 512 channels spectrometer and the calibration was taken at RT with α-Fe foil. The error in source velocity is less than 1 %. The NORMOS code was used for Mössbauer spectra analyses. For magnetic measurements, a Princeton Micromag vibrating sample magnetometer (VSM) with a noise level of about 1 nAm^2 and a maximum applied field of 1 T was used to obtain hysteresis properties, isothermal remanent magnetization (IRM) acquisition curves.

Mössbauer spectrum for Gebel Kamil arises from the overlapping of three phases: two magnetic sextets identified as kamacite and disordered ferromagnetic taenite and, a single line attributed to antitaenite [3]. No tetrataenite was detected. Calculated from hysteresis loops and back-field experiments, the ratios remanent to saturation magnetization and coercivity of remanence to coercivity for Gebel Kamil are 0.09 and 1.07, respectively. Although low coercivity ratios are associated to tetrataenite, it seems this phase is not present in Gebel Kamil. Furthermore, the discrimination of coercivity components from IRM curves exhibits kamacite as the main phase. Nevertheless, in order to investigate if the observed magnetic properties is only a result of multi domain kamacite, more work is in progress. The absence of tetrataenite is indicative of high (> several 1000 °C/Myr) initial cooling rates below 400 °C and/or a successive transient thermal/shock event. The presence of antitaenite however indicates slow initial cooling which should have led to the formation of tetrataenite. Therefore the observed magnetic properties point to the transformation of tetrataenite to disordered taenite during a transient event, likely a shock-induced thermal excursion.

References: [1] D'Orazio et al. *Meteoritics and Planetary Science* 46: 1179-1196 (2011). [2] Gattacceca et al. *Meteoritics and Planetary Science* 49: 652 - 676 (2014). [3] Rancourt and Scorzelli. Journal of Magnetism and Magnetic Materials 150: 30 – 36 (1995).