New Results of Micro Raman Spectroscopy and Magnetism on Martian Meteorites.

V. H. Hoffmann[1,2], M. Funaki[3], M. Torii[4], Y. Yamamoto[5], K. Kodama[5], R. Hochleitner[6], M. Kaliwoda[6], T. Mikouchi[7]; [1]Dept. Geosciences, Univ. Tuebingen, Hölderlinstr. 15, 72074 Tuebingen, Germany; [2]Dept. Geo.-Env. Sciences, Univ. Munich, Germany; [3]NIPR, Tokyo, Japan; [4]Dept. Geosph.-Biosph.-Syst. Sci., Okayama Univ. Sci., Japan; [5]CMCR/KCC, Univ. Kochi, Japan; [6]Mineralogical State Collection, Munich, Germany; [7]Dept. Earth Planet. Sci., Univ. Tokyo, Japan. Email: hoffmann.vh@web.de.

General:

Raman spectroscopy is known to be a powerful tool for investigating mineral phase composition in a non-destructive manner. Detailed mapping allows to even catch (very) low-concentration phases in small particles sizes. Moreover polytype-/polymorph structures/phases can be distinguished. Recently a series of new Martian meteorites have been studied [1-9]. The intention of this study is to extend the existing databases of Raman spectroscopy and magnetic properties by adding data of a set of newly classified and investigated Martian meteorites.

Samples and techniques:

A series of Martian meteorites which have been found during the last years have been investigated by LASER Micro Raman Spectroscopy. Amongst them are Tissint, an olivine-phyric shergottite (witnessed fall from 2011) and the basaltic shergottites KG 002, Los Angeles and NWA 2800. Micro Raman Spectroscopy was performed with a Horiba XPLORA system using 3 different LASER frequencies (532nm, 638nm and 785nm).
Results of the following magnetic experiments have been added to our database: Natural Remanent Magnetization (NRM), Isothermal Remanent Magnetization (laboratory) and stability, magnetic susceptibility and anisotropy, IRM low-temperature experiments, thermomagnetic experiments up to 800°C (vacuum). Additionally we performed optical microscopy (polarized light), SEM/EDX (qualitative) and Electron Microprobe Analysis (quantitative).

Results and interpretation:

Raman spectra were obtained on all important phases of the Martian meteorites under investigation, major focus was on plagioclase/maskylenite, see fig. 1. The shock degree of KG 002, LA 001/002, NWA 2800 and Tissint was determined by Micro Raman Spectroscopy using the method of [7]. Maskylenite spectra of KG 002, LA 001/002, NWA 2800 are basically identical and in good agreement with the findings of [7] from Los Angeles and Tissint [8,9] revealing a shock degree of 40-45 GPa.

The results of the mineral phase analyses including Raman spectroscopy generally agree well with the data obtained on the magnetic signature.

The magnetic phase composition and behaviour of all three basaltic shergottites, KG 002, LA 001/002 and NWA 2800 is nearly identical and at odds to the other basaltic shergottites. The Tissint magnetic signature is dominated by nearly stoichiometric magnetite and minor pyrrhotite. We favour two models for the origin of the magnetite, oxyexolution of originally homogenous Ti-rich titano-magnetite (magnetite–ilmenite intergrowth) or the presence of nano-particles of magnetite in the olivines.

More and new results obtained on a set of shergottites and nakhlites will be reported in our poster.

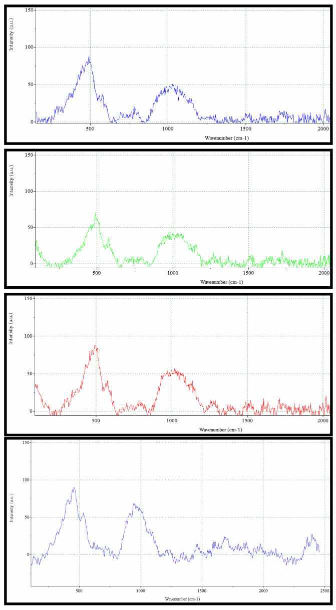

Fig. 1: Raman spectra of maskylenite as obtained on KG 002, LA 002, NWA 2800 and Tissint for determination of the shock degree (after [7]).

References:

[1] Hoffmann V. et al., 2012. ACM Niigata, #6344.
[2] Hoffmann V. et al., 2012. 75th Metsoc Conf., #5227.
[3] Roszjar J. et al., 2012. 43rd LPSC, #1780.
[4] Hoffmann V. et al., 2012. 75th Metsoc Conf., #5107.
[5] Bunch T.E., et al., 2008. 39th LPSC, #1953.
[6] Mikouchi T., 2001. Antarct. Meteor. Res., 14, 1-20.
[7] Fritz J. et al., 2005. Antarct. Meteor. Res., 18, 96-116.
[8] Hoffmann V.H. et al., 2012. Paneth Kolloquium, #2365.
[9] Hoffmann V.H. et al., 2012. Paneth Kolloquium, #2367.
[10] Hoffmann V. et al., Meteoritics & Planet. Sci., 46/2011, 1551-1564.