Raman spectroscopy as an important tool for the petrological study of different meteorite samples

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Spectroscopic methods with their capability to gain information on different rocks and minerals as well as on fluids and other types of inclusions are becoming more and more relevant in earth sciences in order to open up new fields of research and providing solutions to problems in various scientific disciplines.

Raman spectroscopy represents a fast and at the same time precise method to characterize materials in different types of environments. Furthermore, Raman spectroscopy can be an important tool to investigate extraterrestrial bodies, because the measurements are more or less independent of the surrounding environmental effects including the temperatures. Therefore, it will be an important goal to gain as much experience as possible by Raman measurements of meteorites in order to be able to apply this experience to extraterrestrial bodies.

At the mineralogical state collection Munich (MSM) Raman spectroscopy is used to characterize different meteorites, with main focus to mars, moon and vesta, in order to find out the composition of the various minerals, the high pressure phases, the possible glass components and the inclusions. All the measured phases are collected in an in-house Raman database (Kaliwoda et al. 2013, 2021; Drozdovsky et al. 2020).

Raman spectroscopy make it possible to gain more information about the mineral composition and the original pressure and temperature conditions on these extraterrestrial bodies. In addition, it is possible to draw parallels to the composition and to the formation history of the early earth. In another Raman study we aim at getting more detailed information about the earth mantle and investigate therefore mantle-xenoliths and ophiolitic mantle sections.

One examples of our research targets is NWA11266 meteorite, discovered in 2017, that has already been classified as lunar feldspar breccia (Gattacceca et al., 2019). In the MSM we did further investigations with Raman spectroscopy. The main minerals are mafic olivines and pyroxenes, beside anorthitic feldspar minor graphite and tiny little glass patches. Furthermore, metallic components and accessory phases like apatite and zircon could be identified. In addition, we like to compare brecciated meteorites with other terrestrial Breccias, like those from the Nördlinger Ries.

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