THE SPECTRAL CHARACTERIZATION OF THE RIBBECK AUBRITE AS MERCURY ANALOG.
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**Introduction:** The MERCury Radiometer and Thermal Infrared Spectrometer (MERTIS) of the BepiColombo mission has as main goal to characterize the Hermean surface mineralogy by measuring the spectral emissivity of Mercury’s surface with a spatial resolution of at least 500 mpp \cite{1}. To prepare for the upcoming remote sensing measurements of MERTIS, analogue materials to simulate the expected mineralogy were selected and studied for its microscopical and spectral properties in our facilities at the German Aerospace Center (DLR) and the Museum für Naturkunde (MfN) in Berlin. To simulate the Mercury surface, the recently fallen Aubrite meteorite “Ribbeck” was selected, as this enstatite-rich material is highly reduced such as expected for the planet \cite{2}. In this study, spectral analyses on a broad spectral range (VIS-VNIR-MIR) were performed on a fresh piece of Ribbeck. IR bulk and point-localized reflectance spectra were measured and compared to terrestrial mineral end-members. These results will be used as a baseline for understanding the lab and remote sensing spectra once the BepiColombo spacecraft reaches Mercury and MERTIS operates.

**Materials and Methodology:** For this study Aubrite samples of the recent January 21st 2024 meteorite fall BX-1 “Ribbeck” were selected for microscopical and spectral analysis at our laboratory facilities of the German Aerospace Center (DLR) and the Museum für Naturkunde (MfN) in Berlin. Measurements were performed on a 4.7 g Ribbeck hand specimen, revealing both its exposed face and fusion crust. Non-destructive methods were preferred for the material characterization, to preserve this fresh and rare sample as much as possible. For the microscopical analysis, an optical polarized microscope and a scanning electron microscope (SEM/EDS) JEOL JSM-6610LV were used for the general mineralogical characterization of the sample. Spectral analyses consisted in point-localized IR reflectance measurements and bulk IR hemispherical reflectance measurements of the exposed face and fusion crust to assess the absorbance features and derive the general mineralogy of the sample. The point-localized reflectance measurements (NA = 0.4, FoV = 50 \(\mu\)m) consisted of 1000 scans at an optical magnification of 15x and a resolution of 4cm\(^{-1}\). They were acquired with the Hyperspectral Bruker Hyperion 2000 Micro-FTIR in the VNIR (0.7 – 2 \(\mu\)m) and MIR (1 – 20 \(\mu\)m) spectral range. Bulk hemispherical reflectance measurements (aperture = 4 mm) were acquired with the Bruker FTIR VERTEX 80V spectrometer in the VIS (0.4 – 1 \(\mu\)m), VNIR (0.7 – 2 \(\mu\)m) and MIR (1 – 20 \(\mu\)m) spectral range. All hemispherical measurements consisted of 1000 with a spectral resolution of 4 cm\(^{-1}\).

**Results and Discussion:** Point-localized and bulk IR reflectance measurements on the Ribbeck hand-specimen showed distinct absorption features around 2.7 and 5 \(\mu\)m and emission bands between 8-13 \(\mu\)m. The data revealed that the absorption bands in the MIR are highly attenuated in the fusion crust compared to the freshly exposed interior, including the strong reduction of the OH-band. Most spectral features are a good match to those expected in an Aubrite, such as the identification of enstatite and sulfides (including oldhamite, CaS) within our analyzed sample \cite{3}. The reduced mineralogy of nearly FeO-free primary minerals (e.g. enstatite), and abundance in exotic sulfides (e.g. alabandite) characteristic of the Ribbeck aubrite meteorite, can be expected on other planetary bodies such as Mercury \cite{2}. The MERTIS instrument on the BepiColombo spacecraft, is designed to measure Mercury’s surface composition over a wavelength range of 7 - 14 \(\mu\)m \cite{1}. Most of the absorption features of the meteorite Ribbeck fall into the MERTIS spectral range, including that the low iron content of Mercury will not be an issue for MERTIS to map the planet’s surface mineralogy. MERTIS will therefore help us to clarify the possible link between the composition and geochemistry of Mercury and the Aubrites.