Non-destructive characterization of chondrules by CT-scanning

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The texture and mineralogical composition of chondrules is usually characterized using optical microscopy and SEM-BSE-EDS analyses on thin sections. These methods require the samples to be cut, polished and/or coated for surface analyses, causing a reduction of the available sample size for further geochemical measurements. For certain isotope analy-ses of individual chondrules, the amount of available material is a limiting factor due to the relatively small chondrule size [1]. Furthermore, the contamination of the surfaces may obscure the isotope signature to be analyzed. Non-destructive high-resolution CT-scanning (X-ray tomography) enables the study of the interior of geological samples [2] and in particular to determine the internal structure of chondrules. These in turn can be used to distinguish between Type I and Type II chondrules (different textures and mineralogical compositions). It is also possible to identify the presence of metal and sulphide phases, which is important for creating representative aliquots for different types of isotope analysis. For large chondrite fragments, the knowledge of the internal structure including the distribution of cracks and voids facilitates the mechanical separation of individual chondrules.

We scanned several chondrules and chondrule fragments that were separated from the ordinary chondrites Tieschitz (H/L3.6), Hedjaz (L3.7) and Parnallee (LL3.6) using a vltomelx 240L (GE Sensing & Inspection Technologies Phoenix Xlray) at the Muséum National d'Histoire Naturelle, Paris. We used a 240 kV acceleration voltage and 135 μA current. X-ray transmission was recorded on a 2024^2 pixel detector panel (pixel size 200x200 μm). The scans resulted in a stack of 2000 slices per acquisition with 6.6 μm resolution.

Using these parameters, we were able to discern the texture, chemical zonations and mineral abundances in single chondrules. On the basis of these observations, further isotope analyses can be prepared and later interpreted in the context of the petrology of the chondrules.

[1] Friedrich et al. (2014) *Chemie der Erde, in press* [2] Ketcham (2005) *J. of Structural Geology* **27**, 1217-1228 [3] Elangovan et al. (2012) *Computers & Geosciences* **48**, 323-329.