FINDING SHATTER CONES IN METEORITES FROM THE NATURAL HISTORY MUSEUM VIENNA COLLECTION.

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Introduction: In 2012, the meteorite display of the Natural History Museum in Vienna (the world's largest) was renovated, allowing us to manipulate and reorganize a large part of the meteorites from our collection. Some of the meteorites from the NHM-Vienna collection are historically and scientifically unique, including, for example, the original platelets of the iron meteorite Hraschina on which Alois Widmanstätten described the figures that are now named after him, the iron meteorite samples and sections in which Carl Schreibers first described the mineral schreibersite, or the thin sections of the Shergotty meteorite in which Gustav Tschermak first reported on the plagioclase feldspar glass phase that he named maskelynite.

Here we present new findings on samples from our collection, especially the discovery of shatter cones in a few meteorite samples and other impact metamorphism features, such as extremely large shock veins that are currently subject to further characterization using analytical electron microscopy techniques.

Results and Discussion: Most meteorites display signs of impact metamorphism, including macroscopic features such as brecciation and shock veins and/or microscopic features, for instance twinning, mosaicism, and planar deformation features in minerals. Recently, McHone et al. [1] described two NWA meteorite samples displaying shatter cones. We report here on the occurrence of well-developed shatter cones (i.e., conical striated fracture surfaces), in at least two more meteorites, in Ybbsitz (Find; H4) and in Zavid (Fall; L6; S4). They are several centimeters in size and are visible on broken surfaces. Our new findings of shatter cones support previous observations [1] and confirm that shatter cones do actually occur in meteorites (i.e., that the features noted by [1] are not ventifacts that might have developed in the desert). Shatter cones are the only meso- to macro-scale distinctive shock-deformation feature that can be used on Earth to confirm an impact origin of a crater structure (reported to date for more than half of the confirmed impact structures [2]). Even though their formation mechanism is still not completely resolved, it is generally accepted that they form at relatively low shock pressures; their occurrence in moderately to highly shocked meteorites records hypervelocity collisions in the solar system. In fact one could argue that shatter cones in meteorites should have been discovered long ago, as they are likely to be common on asteroids.

Other interesting impact metamorphism features, including large (>1 cm wide) shock veins, were observed in a few meteorites, especially in Mocs. Their detailed characterization at the macro- to micro-scale may help to better understand impact metamorphism processes on their parent body.

References: [1] McHone J. F. et al. 2012. Abstract #2359. 43rd Lunar & Planetary Science Conference. [2] Ferrière L. and Osinski G. R. 2010. Abstract #1392. 41st Lunar & Planetary Science Conference.