SHOCK-INDUCED PLANAR FEATURES IN PLAGIOCLASE: A PROJECT ON MEASUREMENTS AND INVESTIGATIONS ON THEIR OCCURRENCE IN RELATION WITH THE AN CONTENT.

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Introduction: Plagioclase, like quartz, may develop planar fractures (PF) and planar deformation features (PDF) as a response to shock [1]. Nevertheless, shocked plagioclase is commonly found as maskelynite (after transformation to an amorphous state), especially in shocked meteorites [e.g., 2-3], whereas planar features, including shock-induced micro-twinning, are mostly observed in shocked rocks from terrestrial impact structures [e.g., 4, 5]. Surprisingly, the occurrence of planar features seems related the An content, as PDFs have been observed only in albitic to intermediate (andesitic) compositions of plagioclase [1]. The common method to index PDFs is based on U-stage measurements [1], which becomes challenging in plagioclase due to its low crystal symmetry and the variable 2V depending on An content.

Here we propose a method for indexing shock planar features in plagioclase by using the U-stage for determining the orientation of PDFs and of some characteristic crystal features, such as crystal faces, twin planes, and cleavage planes, and using electron back-scattered diffraction (EBSD) for characterizing the complete crystallographic orientation of the investigated grain. The complete indexation of shock-induced planar features in plagioclase will be derived by combining the measurements from the two techniques with some crystallographic assumptions based on the crystal symmetry and on the known orientation of the measured crystal features (e.g., cleavage).

Method: A polished thin (35 μm thick) section from the suevite of the El'gygytgyn impact structure, described in [6], containing planar features in plagioclase, was selected for both U-stage and EBSD measurements, to be performed at the University of Vienna. The software OIM Data Collection and Analysis 7.3.0 will be used for EBSD data processing and orientation prediction of planar features. This information will be exported as polar coordinates, to be plotted together with the U-stage measurements on the stereographic projection in [1], with the aid of the software Stereo32 that includes specific correction for the U-stage. A polished thin section from the shocked target rock from the Charlevoix impact structure, containing micro-twinning in plagioclase, will be also measured for checking the correctness of the stereographic assumptions between the U-stage and the EBSD data set, as twinning planes are well known in the mineralogical literature and can be statistically determined by EBSD analysis [e.g., 7].

Expected results: The proposed method should allow a more systematic study of the preferred orientation of shock planar features in plagioclase. The preferred occurrence of PFs and PDFs in low to mid An content in plagioclase will be discussed in terms of lattice response to shock pressure and temperature along specific crystal directions. The relation between the An content of plagioclase and the shock pressure required for the transformation into maskelynite has been already demonstrated [8]. The higher shock pressure required for isotropization of albitic plagioclase than for anorthite might imply accommodation of shock through other processes, such as micro-twinning and formation of localized planar features. Even though the orientation of PDFs in plagioclase has not been strictly correlated with shock pressure, as was done for quartz, understanding the relation between shock-induced planar features and the crystal lattice might help to better constrain the shock response of plagioclase.

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