Geophysical Research Abstracts
Vol. 15, EGU2013-10538-2, 2013
EGU General Assembly 2013
© Author(s) 2013. CC Attribution 3.0 License.

Insights to Meteorites and Impact Processes provided by Advanced EBSD Analysis

Laurie Palasse (1), Jana Berlin (1), Daniel Goran (1), Roald Tagle (1), Maartje Hamers (2), Vera Assis Fernandes (3), Alexander Deutsch (4), Peter Schulte (5), and Tobias Salge (1)

(1) Bruker Nano GmbH, Berlin, Germany (Laurie.Palasse@bruker-nano.de), (2) Faculteit Geowetenschappen, Utrecht University, The Netherlands, (3) Museum für Naturkunde, Berlin, Germany, (4) Institut für Planetologie, WWU Münster, Germany, (5) AF-Consult Baden, Switzerland

Electron backscatter diffraction (EBSD) is a powerful analytical technique for assessing the petrographic texture of rocks and the crystallographic orientation of minerals therein using a scanning electron microscope (SEM). Innovations in EBSD technology include colour-coded forescattered electron (FSE) images, high resolution and highly sensitive EBSD detectors, together with advanced EDS integration. It allows to accurately identify and discriminate different phases, and to investigate microstructures related to shock metamorphism. As an example, shocked carbonates and shocked quartz reveal a complex thermal history during post-shock cooling.
(A) EBSD studies of calcite ejecta particles from the Chicxulub impact event, at the K-Pg boundary of El Guayal, Mexico ($\sim$520 km SW of the Chicxulub crater centre) display various microstructures [1] and spherulitic calcite ejecta particles reveal a fibre texture of elongated crystals with a preferred orientation. This indicates the presence of carbonate melts which were ejected at T>1240°C and P>40 bar from upper target lithologies and crystallized at cooling rates of $\sim$100′s °C/s [2]. The calcite particles of El Guayal and the K/Pg boundary of La Lajilla ($\sim$1000 km W of the crater centre) show distinct microstructures represented by unoriented, equiaxed crystals with random orientation distribution. It documents recrystallization upon impact induced thermal stress at T>550°C during prolonged atmospheric transport.
(B) Combined EBSD, FSE and cathodoluminescence (CL) studies of semi-amorphous shocked quartz of Chicxulub, Ries and Popigai impactites, reveal various microstructures. Colour-coded FSE imaging reveal recrystallized/deformed bands in Ries and Popigai samples indicative of planar deformation features. EBSD studies of Popigai allow to distinguish twinned Qz, α-Qz and α-cristobalite along the transition zone between shocked gneiss clast and impact melt. Recrystallized Qz grains are associated with amorphous SiO_2. For Chicxulub, the brecciated impact melt rock from borehole Yaxcopoil-1 (Unit 5, 861.72 m) [3] reveals that the ballen microstructure is only semi-amorphous and cross cuts a fine grained recrystallised microstructure.
(C) CB chondrite Gujba: EDS and EBSD data were acquired simultaneously to study chemical and physical interactions between preexisting metal particles and the invading silicate-rich impact melt matrix. Metal particles appear to have different thermal histories. Some of them consist of many small grains (average diameter $\sim$10 μm), which have a similar orientation when they are surrounded by arcuate Fe,Cr-sulfides. [4].

Acknowledgements: P. Claeys, R.H. Jones, ICDP and the Museum of Natural History Berlin for providing samples.

References: [1] T. Salge (2007) PhD thesis, Humboldt Universität zu Berlin, 130p. [2] A. P. Jones et al. (2000) Lect. Notes in Earth Sciences 91: 343-361. [3] M. J. Nelson et al. (2012) GCA 86: 1-20. [4]. J. Berlin et al. (2013) 44th LPSC # 2439