Geophysical Research Abstracts
Vol. 15, EGU2013-11023, 2013
EGU General Assembly 2013

Particle Size Distrbution in an Experimental Hypervelocity Impact on Dry Sandstone.

Elmar Buhl (1,2), Michael H. Poelchau (2), Alex Deutsch (3), Thomas Kenkmann (2), and Georg Dresen (1)

(1) German Research Centre for Geosciences - GFZ Potsdam, Germany , (2) Institute for Earth and Environmental Sciences, Albert-Ludwig- Universität Freiburg, Germany, (3) Institute of Planetology, Westfälische Wilhelms-Universität Münster, Germany

The particle size distribution (PSD) is a frequently used parameter to describe the deformation-induced fragmentation of fault rocks. It has been shown that resulting particle sizes may be described by a power law (fractal) size distribution:

$$N(d) \sim d^D$$

where $N(d)$ is the number of particles larger than diameter d, and $D$is the D-value. PSDs reported for impact deformation are still very few. D-values for natural and experimental impacts have been reported to range between 1.2-1.8 and 1.4-1.7, respectively. Here we show the systematic distribution of the PSD in the subsurface of an experimental impact crater. The investigated experiment was performed in the framework of the MEMIN project [1]. A 20 cm cube of quartz-rich sandstone (*Seeberger Sandstein*) was impacted by a 2.5 mm steel sphere at 4.8 km/s, producing a crater of 5.76 cm diameter and 11.0 mm depth [2]. For sample preparation the crater was impregnated with epoxy and the block was bisected. Thin sections were prepared from the crater sub-surface. Backscattered electron (BSE) micro-analysis was conducted by means of a Zeiss Leo 1525 Scanning Electron Microscope. A succession of 20 images (400x magnification) with increasing distance from the crater floor was analyzed. The image analysis software JMicrovision was used for automated object extraction. Area and perimeter of all detected particles were exported and used for PSD analysis. The obtained PSD were fit with a linear function in a log-log plot over at least one order of magnitude in diameter indicating that the PSD follows a power law relationship $N(d) \sim d^D$.

The distinct modes of deformation in the crater sub-surface [3] are closely linked to the fracture pattern and thus with the D-value. As expected, comminution was most effective closest to the crater floor. The highest D-value of 1.74 was found at a depth of 0.26-1.07 mm beneath the crater floor. Thus the largest fraction of fine material is situated in there. With growing distance the D-values drop steadily to ~0.84.

We suggest that the D-value is a good parameter to describe impact induced fragmentation. Our results for the first time show a spatial resolution of D-values for an impact event. Comparison with the reported data from natural and experimental impacts shows that our results cover almost all of the reported values but show systematic changes with distance from the crater floor. A detailed and spatially resolved analysis of the D-values of the ejected material from this experiment is planned. This will improve our understanding of ejecta emplacement and size distribution of space debris.

[1] Kenkmann T. et al. (2011) *M&PS,* 46, 890-902 [2] Poelchau M. H. et al. (2013) *M&PS,* (48), in press [3] Buhl E. et al. (2013) *M&PS,* (48), in press.