Geophysical Research Abstracts
Vol. 20, EGU2018-13255, 2018
EGU General Assembly 2018

Feather feature orientations in shocked granitic rocks of Chicxulub's peak ring

Matthias Ebert, Michael H. Poelchau, Thomas Kenkmann, and Oguzcan Karagöz
University of Freiburg, Geology, Freiburg im Breisgau, Germany (matthias.ebert@geologie.uni-freiburg.de)

In April to May 2016, a joint effort by IODP and ICDP drilled the Chicxulub peak ring offshore during Expedition 364 at site M0077A [1]. The core consists of felsic basement rocks between 748 and 1334.7 mbsf that were intruded by pre-impact mafic and felsic igneous dikes as well as impact-generated dikes [2]. The so far most striking observations of shock related features and rock modifications are the very high abundance of planar fractures (PFs) and feather features (FFs) in quartz grains [3]. FFs are crystallographically orientated microstructures in quartz that consist of a PF and a set of straight to slightly curved lamellae that emanate in one direction from the PF. In [4] it was proposed that these lamellae are tensile fractures that point in the σ_1 direction thereby indicating the orientation of the attenuated shock front. In our study, we used this FF model in order to see if a consistent or interrelated FF orientation occurs throughout the Chicxulub peak ring core. So far, 26 polished thin sections from different depths (below $\sim$748 mbsf) within the granitic section of the core were prepared and examined with a polarizing microscope. We have found that in individual thin sections, the majority of the FF lamellae emanate from the PFs in the same direction. A lower number of FFs point to the opposite direction of the main orientation. Subordinately, 1 to 2 additional FF orientations beside the main one also occur. However, the most important result is that we could not find an interrelated trend between the different thin sections. Only in a few cases, where the distance between the thin sections was $<$ 25 m, the FF orientations show a similar trend. We see two possible explanations for this: (i) The shock wave front scatters strongly in relatively small regions due to the heterogeneity within the felsic basement rocks, which leads to an irregular FF orientation pattern. (ii) The peak ring itself experienced extreme deformation that shows a wide range of structures, including hairline fractures, brittle shear faults, mm- to cm-thick zones of cataclasis, striated shear planes and dm-thick zones of foliated and crenulated mineral fabrics. The combination of all these deformation processes induces to a large number of small-scale rotational movements in the peak ring units, which is reflected by the varying FF orientations. We intend to perform additional microscope analyses of further core samples in order to cover a larger area of the drill core.

[1] Morgan J. V. et al. (2016) Science, 354:878–882, [2] Poelchau M. H. et al. (2017) 48th LPSC, Abstract #1924, [3] Ferrière L. et al (2017) 48th LPSC, Abstract #1600, [4] Poelchau M. H. & Kenkmann T. (2011), JGR Solid Earth, 116(B2).