SHOCK METAMORPHISM AND IMPACT MELTING IN SMALL IMPACT CRATERS ON EARTH: EVIDENCE FROM KAMIL CRATER, EGYPT. A. Fazio[1], L. Folco[1], M. D'Orazio[1], M. L. Frezzotti[2], C. Cordier[3] [1]Dipartimento di Scienze della Terra, Università di Pisa, Italy. E-mail: agnesefazio@dst.unipi.it. [2]DISAT, Univerità di Milano Bicocca, Italy [3]ISTerre, Grenoble, France.

Introduction: The generally poor state of preservation of small impact craters (<1.5-km-diameter) on Earth has determined that shock metamorphism and impact melting processes occurring during these events are still not adequately documented. Kamil Crater (45-m-diameter) is an exception among small craters for its pristine state of preservation. It was generated by the hypervelocity impact of the Gebel Kamil iron meteorite on subhorizontal-bedded sedimentary rocks (quartzarenite to wacke with siltstone levels), likely <5000 yr ago [1-3].

Samples and Analytical Methods: In order to investigate shock features occurring at Kamil Crater we carried out a petrographic (optical and SEM), geochemical (EPMA) and mineralogical (U-stage and μRaman) study of representative crater wall and ejecta samples collected during the first Italian-Egyptian geophysical campaign in 2010.

Results: Samples from crater wall are unshocked. Shock features were found only in sandstone fragments from the ejecta. Sandstone fragments show an almost complete set of shock metamorphic features including fracturing, planar deformation features (PDFs) in quartz, SiO_2 polymorphs, diamond, pseudotachylite veins and melt in poorly developed shatter cones. Some of these features have never been reported before from craters of comparable size. Impact melt lapilli and bombs also occur in the ejecta.

Discussion: Shock features were divided into two categories: 1- pervasive shock features: fracturing, PDFs on quartz, and impact melt lapilli and bombs; and 2- localized shock features: high-pressure phases and localized impact melts occurring as intergranular melt, pseudotachylite veins and melt films in poorly developed shatter cones. Pervasive shock features allow to establish which shock pressure suffered the studied samples. Impact melt lapilli and bombs indicate that highest shock pressure suffered by Kamil Crater target rocks was between 50 and 60 GPa, due to the initial low porosity of the topmost layers of the target [4]. Using the planar impact approximation we calculate a vertical component of the impact velocity of at least of 5.0 km s^{-1}. Pores and heterogeneities of the target rocks cause local enhancement of shock pressure and temperature [e.g., 5] determining the formation of localized shock features.

Conclusion: The almost complete set and freshness of the shock features make Kamil Crater a natural laboratory for studying impact cratering and shock deformation processes in small impact structures.

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