PLANAR DEFORMATION FEATURES IN QUARTZ FROM THE XIUYAN CRATER, CHINA.

M. Chen[1], C. Koeberl[2], W. Xiao[1], X. Xie[1] and D. Tan[1]. [1]Guangzhou Inst. Geochem., Chinese Academy of Sciences, Guangzhou 510640, China. E-mail: mchen@gig.ac.cn. [2]Depart. Lithos. Res., Univ. Vienna, Althanstrasse 14, A-1090 Vienna, Austria.

Introduction: The 1.8-km-diameter Xiuyan crater is located in the Liaodong Peninsula in northeastern China. The crater is exposed in a Proterozoic metamorphic rock complex composed of granulite, hornblendite, gneiss, tremolite marble, and marble. A drilling positioning at the centre of the crater reveals the geological structure and stratum of the crater [1]. The bottom at the center of the crater covers about 100 m thick lacustrine sediments underlain by 188 m thick crater-fill breccia. A layer of impact breccia composed of clasts of granulite, gneiss, hornblendite and fragments of glass as well as clastic matrix, occurs at the lower part of the breccia units in the depth interval from 260 to 295 m. We have examined abundant planar deformation features (PDFs) in quartz from the impact breccia.

Results and discussion: Quartz with multiple PDFs was identified in the fine-grained matrix and within the clast of granulite. One to five sets of PDFs are observed in a single quartz crystal. A quantity of 70 quartz grains from five thin sections made from the clasts of granulite in the impact breccia recovered at the depth of 290 m were measured in detail by using a Universal stage to determine the orientations of PDFs relative to the optical axis. Total 13 forms of PDFs correspond to rational crystallographic orientations of quartz have been indexed, and these orientations of PDFs include the forms with miller indices of e{10$\bar{1}$4}, ω{10$\bar{1}$3}, π{10$\bar{1}$2}, ξ{11$\bar{2}$2}, r, z{10$\bar{1}$1}, s{11$\bar{2}$1}, ρ{21$\bar{3}$1}, {22$\bar{4}$1}, {31$\bar{4}$1}, t{40$\bar{4}$1}, x{51$\bar{6}$1}, m{10$\bar{1}$0} and a{11$\bar{2}$0}. PDFs parallel to the basal (0001) plane is absent. 44% of the quartz grains contain 3 sets of PDFs, and other 40 % contain 2 sets of PDFs. Of all the PDFs measured, 11.2 % of them, which did not correspond to rational crystallographic orientations of quartz, were not indexed. The most abundant PDFs are rhombohedron forms of π{10$\bar{1}$2}, ω{10$\bar{1}$3}, and r/z{10$\bar{1}$1} with frequency of 33.5%, 22.3% and 9.6%, respectively. The predominant occurrence of PDFs {10$\bar{1}$2} + {10$\bar{1}$3} and the absence of PDFs parallel to (0001) indicate a high intensity shock of the samples [2-4]. A predominant PDF form of {10$\bar{1}$2} in quartz suggests a shock pressure >20 GPa [4]. The occurrence of PDFs in quartz from the impact breccia provides crucial evidence for shock metamorphism of target rocks and confirms the impact origin of this crater.

Acknowledgements: This research was supported by CAS (Kzcx2-yw-140), NNSF of China (40872041) and President Foundation of CAS. The University of Vienna provided partial assistance to M.C. during a research visit in Vienna.

References: [1] Chen M. et al. 2010. *Chinese Science Bulletin* 55: 1777-1781. [2] Robertson P. & Grieve R.A.F. 1977. In *Impact and Explosion Cratering* by Roddy D.J.et al. Pergamon Press, New York. pp. 687-702. [3] Stöffler D. and Langenhorst F. 1994. *Meteoritics & Planetary Science* 29: 155–181. [4] Grieve R.A.F. et al. 1996. *Meteoritics & Planetary Science* 31: 6–35.