BALLEN QUARTZ FROM THE DEEP BAY IMPACT STRUCTURE. J. J. Smith[1], A. M. Therriault[2], and Y. Pan[1], [1]Department of Geological Sciences, 14 Science Place, University of Saskatchewan, Saskatoon, SK, Canada S7N 5E2 (jjs797@mail.usask.ca; pan@pangea.usask.ca), [2]Geological Survey of Canada, 601 Booth Street, Ottawa, ON, Canada, K1A 0E8 (ATherria@NRCan.gc.ca).

Ballen quartz is an impact related microscopic feature consisting of a series of closed or open loops that range in diameter from 35 to 65 µm. The loops themselves are comprised of tiny vugs that are filled with amorphous material. Unlike the ballen reported from other impact structures [e.g., 1,2,4], the ballen quartz grains from the Deep Bay structure contain planar deformation features (PDF). This occurrence has important implications for theories on ballen quartz formation, which is believed to be the result of a series of shock-induced thermal transformations [2].

Ballen quartz occurs throughout the suevite layer at Deep Bay and, in many instances, together with PDF. Had a melt phase occurred during the formation of ballen, these PDF would have been annealed. These structures were confirmed as PDF after they were etched and studied under the SEM. Petrographic studies revealed that the ballen loops act as a loci for the propagation of the PDF, which may also cross-cut the ballen loops. These findings suggest; a genetic relationship between the two, that the ballen may have formed prior to the PDF, and that the PDF exploited the structural weaknesses produced by the ballen loops. Ballen quartz that exhibited low shock effects (pressure ~14.9 GPa.) were clear and bright and the ballen loops were crisp and clear. In grains that were more strongly shocked (pressure ~17.3 GPa), quartz has reduced birefringence and in some cases is nearly isotropic. At this pressure the ballen appear to degrade, becoming diffuse and less clearly defined. These findings suggest that the ballen degrade as the shock pressure increases. U-stage measurements indicate a minimum shock pressure of ~20 GPa. Shock recovery experiments [3,5], have shown that above ~35 GPa quartz is converted entirely to glass. Since the ballen quartz with PDF has not been converted to glass, this constrains the upper pressure limit to ~35 GPa, a figure that is well below the ~50 GPa required to produce lechatelierite.

Ballen quartz at Deep Bay could not have formed as an end product of the pathway predicted in the model [2], because (1) the presence of ballen with PDF precludes the existence of a melt phase, (2) shock pressure is constrained to a maximum of ~35 GPa., well below the ~50 GPa required to produce lechatelierite, and (3) ballen formed prior to the formation of PDF, which, according to shock recovery experiments, indicates that they formed prior to the formation of diaplectic glass.

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