Bosumtwi Impact Structure, Ghana: Suevite Types and Melt Petrography

Reimold, Wolf Uwe[1] Coney, Louise[2] Gibson, Roger L.[2]
[1]Museum für Naturkunde, Humboldt Universität zu Berlin, Invalidenstrasse 43, 10115 Berlin, Germany [2]Impact Cratering Research Group, School of Geosciences, University of the Witwatersrand, Private Bag 3, P.O. Wits 2050, Johannesburg, South Africa

The Bosumtwi structure is a 10 km diameter, 1.07 Ma old complex impact crater (Koeberl and Reimold, 2005). This structure is unique in that it has retained impact breccia crater fill as well as ejecta in the form of proximal impact breccia, and distal tektite/microtektite, deposits. Two ICDP drill cores (LB-07A and LB-08A) into the crater interior intersected suevite (impact breccia dominated by clastic components but carrying a distinct melt clast component, from the mesoscopic to microscopic scale) and polymict lithic impact breccia (no melt component). In addition, suevite occurs both north and south of the crater rim. Suevite specimens from all three settings have been investigated both macroscopically (in the field and in drill core) and by optical and electron microscopy: they are distinctly different from each other. The within-crater suevite is characterized by small (mm- to cm-scale), scarce melt fragments, lacks granitoid clasts, and contains clasts with relatively moderate shock deformation levels (Coney et al. 2007; Ferriere et al. 2007), whereas the out-of-crater suevite is relatively melt-enriched, carries a prominent granitoid clast component, is relatively enriched in moderately to strongly shocked target rock clasts, and has melt fragments up to several decimeters size. Furthermore, suevite from the north differs from that from the south in that it is relatively enriched in granitoid clasts and depleted in shale clasts (this work; Boamah and Koeberl 2006). Major element abundances mirror these differences, whereas trace element abundances are similar for all three suevite types.

Electron microprobe analysis of melt fragments has identified several distinct types: homogeneous clasts composed of one melt phase only (massive or vesiculated); heterogeneous, massive or vesiculated clasts composed of distinct schlieren of either mafic or felsic composition; and intensely mixed melts. EMPA analysis shows that pure mineral phases such as lechatelierite after quartz (with limited alumina addition), plagioclase, or K-feldspar occur, but that other melt types of mixed-mineral parentage (quartz-feldspar; feldspar-mafic mineral; quartz-feldspar-mafic mineral), and perhaps even bulk target rock compositions, occur. Mafic melt is always transformed to highly porous secondary phyllosilicate. To date, no distinct statistical differences with respect to preferred provenance of these melt types within or without the crater has been recorded. It is, however, certain that melt size distribution (small particles within, large ones outside of the crater) and clast population are characteristic for the different geographic suevite occurrences. Implications of this for impact breccia formation and emplacement will be discussed.

References

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