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Shock Levels in Fallback and Fallout Impact Breccias at the Bosumtwi Impact Structure, Ghana: Results of Drill Core Studies

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The 10.5-km-diameter Bosumtwi impact structure, Ghana, 1.07 Ma old, is largely filled by Lake Bosumtwi. During a recent ICDP-sponsored drilling project, two boreholes (LB-07A and LB-08A) were drilled into the crater fill and underlying bedrock of the structure, into the deep crater moat and the outer flank of the central uplift, respectively. The 545.1-meter-deep ICDP borehole LB-07A contains two different impactite units; first (333.4–415.7 m below lake level) are suevite and lithic impact breccias, underlain (415.7 – 470.6 m) by monomict impact breccias. Metasediments form the basement (470.6–545.1 m). Shock deformation in the suevites and lithic breccias includes planar deformation features (PDFs) in quartz (1 to 3 sets), rare diaplectic quartz glass and rare diaplectic feldspar glass, indicating derivation of these suevites from the <35 GPa shock zone of the transient crater. Core LB-08A is subdivided into upper 25 m of polymict lithic breccia intercalated with suevites, and brecciated metasediment with a few suevite injections from 262–451 m. The first part of the core is polymict and represents fallback impact breccia. Quartz grains with PFs and PDFs (common: 1–3 sets; 4 rare) in suevites frequently display a toasted appearance, and some are decorated with small fluid inclusions. PDF orientations indicate shock pressures of at least 16 GPa; in the top 5 m of suevite shock pressures up to 35 GPa are indicated from the presence of diaplectic quartz, and melt particles in suevite indicate pressures higher than 45 GPa. This heterogeneity of the shock levels in the suevite represents the mixture of variably shocked (and melted) target components. Similar shock levels are indicated in suevite deposits outside the northern crater rim, which were drilled in 1999. A main difference between the fallback and fallout suevite at Bosumtwi is, though, the vastly greater amount of melt (including glass) in the fallout suevite (outside the crater); this is somewhat similar to observations made at the Ries crater.