DISCOVERY OF SHOCKED QUARTZ AND IMPACT MELT GLASS FROM THE ORA BANDA IMPACT STRUCTURE, WESTERN AUSTRALIA.

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Introduction: The Ora Banda structure is a recently discovered impact structure located in the Eastern Goldfields of Western Australia, ~80 km northwest of the town Kalgoorlie. The structure is buried by regolith and is defined by concentric circular geophysical anomalies (magnetics, gravity, passive seismic) approximately 5 km in diameter with a central uplifted area. The structure was first recognized by gravity surveying of the area during gold exploration and subsequent drilling. Target rocks consist of Archean greenstones (basalt/gabbro successions) of the Ora Banda domain of the Kalgoorlie Terrane [1]. Core samples from a diamond drill hole (total depth= 180.5 m), ~850 m south of the center of the anomaly, within the interpreted annular moat, were acquired in collaboration with industry partners. Well-formed shatter cones, which provide diagnostic evidence of hypervelocity impact, were found at the surface in sparse outcrop near the center of the structure, as well as in drill core [2]. Here we present the first report of shocked quartz and detection of an extraterrestrial geochemical component in impact melt glass in polymict suevite breccia from drill core samples.

Samples and Methods: Four samples of polymict and suevitic breccia from the drill core were studied. Ten polished thin sections were prepared to search for planar fractures (PFs) and planar deformation features (PDFs) in quartz. Crystallographic orientations of PDFs in shocked quartz were determined using a universal stage (u-stage) at Lund University, a crucial step in confirming that the planar features observed in quartz provide diagnostic evidence of impact [3,4]. *In-situ* geochemical analysis of impact glass from two thin sections from sample 20OB08 was conducted using laser ablation inductively coupled plasma mass spectrometry (LA-ICPMS) at Curtin University, and electron probe microanalysis (EPMA) at the University of Western Australia.

Results and Discussion: The impact breccias have gray, green, and brown clay matrices, are predominantly clast-rich (lithic breccia) and vary from matrix- to clast-supported. Breccia clast lithologies range from igneous (plutonic and volcanic), to sedimentary, and individual mineral clasts. Shocked quartz and impact melt glass occur in samples 20OB06 and 20OB08, respectively.

Shocked quartz. Seventeen quartz grains with PDFs were identified within the matrix and clasts from suevitic breccia sample 20OB08. A total of 39 sets of PDFs were measured and indexed using the u-stage and are oriented along common PDF crystallographic orientations [5], including $\{10\bar{1}3\}$ and $\{10\bar{1}2\}$. The PDF orientations in the sample suggest that the quartz grains with PDFs were subjected to shock pressures above 20 GPa [5,6].

Geochemistry. Impact melt glass was identified and targeted by EMPA and LA-ICPMS. Preliminary data show the glass composition is broadly basaltic andesite (SiO_2 = 54 wt%), and it has anomalous siderophile element concentrations. Concentrations of Ir in the glass are up to ~287 ppb; the Ir abundance is significantly higher than that in the mafic target rock lithologies [7] and terrestrial rocks (i.e. MORB, UCC) [see 8]. The abundances of Ir (~0.25 ppm) and Cr (250 ppm) are interpreted as meteoritic in origin, and indicate the impactor was most likely an iron meteorite.

Age Constraints: Palynomorph dating of the lowest sand-silt sediment infill of the crater, sitting directly above the suevite breccia, indicates an Early Cretaceous upper age limit for the impact event [9]. Geochronological U-Pb studies are ongoing to search for evidence of impact-age resetting.

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References: [1] Smithies et al. (2022) *Geological Society of Western Australia* Report 226. [2] Quintero R. R. et al. (2021) *LPSC Abstract* #1921 [3] Ferrière L. and Osinski G. R. (2013) *in Impact Cratering: Processes and Products, Osinski G. R. and Pierrazo E. (eds)*: 106–124. [4] Ferrière L. et al. (2009) *Meteoritics & Planetary Science*, 44:925–940. [5] Stöffler D. and Langenhorst F. (1994) *Meteoritics*: 29:155-181. [6] Grieve et al. (1996) *Meteoritics & Planetary Science* 31:6–35 [7] Said N. et al. (2011) *Geochimica et Cosmochimica Acta* 75:2882–2910 [8] Tagle R. and Hecht L. (2006) *Meteoritics & Planetary Science* 41:1721–1735. [9] Nguyen, S.T. (2021) *Master's thesis, University of Western Australia*, 46p.