TEKTITE SUBORBITAL SCIENCE.

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Introduction: Splash form Australasian (AA) "australite" button tektites reentered at ~10 km/s, according to high confidence tests from the 1960s [1]. Recent experimental and numerical results for shocked quartz clearly show that shock to vaporization only produces around half of the 10 km/s australite reentry value [2]. Further, launch and reentry speeds are equivalent for an unpowered or "coasting" suborbital trajectory as per basic mechanics [3], and kinetic energy (KE) is proportional to the square of velocity. Thus, half of the 10 km/s australite launch speed and ¾ of the required launch KE for those tektites remains unaccounted for. Options are considered.

Transportation issues. Little or "no isotopic differences are found between AA tektites and terrestrial crustal rocks" according to Humayun and Koeberl [4], clearly indicating that these objects are neither vapor condensate, nor did they lose significant mass through vaporization. The missing KE supply of australite transport must be something other than silica vapor. Shock is also problematic as the sole transport engine for very large (~kg scale) spheroid splash form philippinite tektites [5] that show static equilibrium through solidification, a single central bubble and highly uniform morphology.

Suborbital reality. The 10 km/s australite reentry speed comes with a minimum Time Of Flight (TOF) of ~3.25 hrs associated with the lowest possible KE terrestrial launch condition at that speed. That minimum KE launch also results in a fall point ~288° longitude from launch [6], for a surface range of ~32,000 km. This doesn't match the australite fall region of dry Lake Rebecca, 29.9°S 122.1°E, for any Indochina launch. Dry Lake Rebecca, S. Australia, is only ~6100 km from the Glass-Koeberl 22°N 104°E centroid region of Indochina [7].

These elements of the AA imprint, and their place in the general continua of AA tektite properties vs. geographic distribution, are all at odds with a launch from anywhere near Indochina, or even from within the same hemisphere as Indochina. This is the suborbital reality.

Available alternatives. AA microtektites of the Indian Ocean, Southern Ocean, and most recently in Antarctica were likely launched above 10 km/s, thus becoming more disrupted then their 1cm-scale australite cousins. AA microtektites show increasing homogeneity with more southerly fall sites [8], implying increasing mix of the melt for more southern sites. Medium angles above horizontal for australite or microtektite launch at ≥ 10 km/s launch speed means loft times of 7 to 15 hours. This means 105° to 225° Earth rotation during loft, along with whatever latitude was traversed. This is without question.

Summary: The velocity of australites remains unexplained. Their fall sites in S. Australia at 10 km/s is inconsistent with a launch from anywhere in that hemisphere. Alternative AA source regions must explain these elements of the imprint.

References: [1] D. R. Chapman & H. K. Larson, 1962 *NASA Tech Note* D-1556. [2] Kraus et al., 2012, *Journal of Geophysical Research*, Vol. 117, E09009. [3] R.R. Bate, D.D. Muller, J.E. White, 1971, *Dover Publications*. [4] M. Humayun & C. Koeberl, 2004, *Meteoritics & Planetary Science* 39, Nr 9, 1509–1516. [5] A. Whymark 2015, *Lunar and Planetary Science Conference*, abstract #1095. [6] T.H.S. Harris & H. Povenmire, 2015, *Lunar and Planetary Science Conference,* abstract #1291. [7] B.P. Glass & C. Koeberl, 2006, *Meteoritics & Planetary Science* 41, Nr 2, 305–326. [8] B.P. Glass, personal dialog, 2015.