TEKTITE SUBORTIBAL CONSTRAINTS.

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Introduction: 1960's tests which faithfully reproduced flange flattening of splash form Australasian (AA) "australite" button tektites indicate ~10 km/s atmospheric reentry speed with very high confidence [1]. Recent work matching experimental and numerical results of shocked quartz, however, clearly shows that shock to threshold vaporization level only produces around half of the 10 km/s australite re-entry value [2]. Suborbital launch and reentry speeds are equivalent for an unpowered or "coasting" trajectory as per basic mechanics [3], leaving half of the 10 km/s australite launch speed yet to be explained.

Trouble with the velocity engine. Humayun and Koeberl have explicitly demonstrated little or "no isotopic differences between AA tektites and terrestrial crustal rocks" [4], clearly indicating that these objects are simply not vapor condensate. For vapor plume expansion as the "other half" of the australite tektite suborbital engine, available choices are the halogens or water [4], with the caveat that inadequate vapor pressure constraint prevents peak temperature determination in the tektite formation process [4]. Shock alone is also problematic as the transport engine for very large (~1 kg-scale) spheroid philippinite tektites [5]. These tektites show nearly perfect static equilibrium during cooling through solidification, with uniform shape and central bubble.

Trouble with the law. Suborbital laws also accompany the 10 km/s australite reentry speed. The minimum Time Of Flight (TOF) for a terrestrial 10 km/s launch is ~3.25 hrs for a westerly launch from the Equator at low elevation (EL), where Earth's spin subtracts from the kinetic energy of the launch [6]. This launch condition results in an equatorial fall point at ~ 72° east of launch longitude, a surface range of 4/5 of Earth's circumference or approximately 32,000 km.

Conversely, the australite fall region of dry Lake Rebecca, 29.9°S 122.1°E, is only ~6,100 km from the Glass-Koeberl strewn field centroid. Lake Rebecca is also at an azimuth (AZ) of ~160° from the Glass-Koeberl Indochina "strewn centroid" region, vs. our minimum TOF example of 270° AZ.

Tough Choices. To hit Lake Rebecca from the commonly assumed 22°N 104°E Australasian tektite source region [6] with the high-confidence australite launch speed of 10 km/s, an EL/AZ of 52.972°/112.336° launch does so with a loft time of 7.46 hrs. If we accept Indochina as the AA tektite source region, we must also accept an australite loft duration of roughly 7.5 hours, vastly longer than previously proposed or considered, equating to Earth rotating ~112° during tektite loft, nearly 1/3 of a full rotation.

Summary: The velocity engine of the australites is not yet explained. Shock alone gives only one half of the high-confidence 10 km/s speed for australites. We must also accept loft times of several hours along with the proposed AA tektite source region of Indochina. Otherwise, we must seek alternative possibilities for the AA tektite source region to better explain these seemingly incongruent 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, 2015, *Lunar and Planetary Science Conference,* abstract #1291. [7] B.P. Glass C. Koeberl, 2006, *Meteoritics & Planetary Science* 41 Nr 2, 305-326.