A terrestrial mafic component in Australasian tektites and associated strata; Geochemical record of the Bolaven impact.

*Jason S Herrin[1], Dayana Schonwalder[1], Kerry Sieh[1], James D. P. Moore[1], Tawatchi Chualaowanich[2], Brian Jicha[3], Brad Singer[3], Vanpheng Sihavong[4], Weerachat Wiwegwin[5], Punya Charusiri[5]

1. Earth Observatory of Singapore, Nanyang Technological University, 639798 Singapore, 2. Department of Mineral Resources, Ministry of Natural Resources and Environment, Ratchatewi, 10400 Bangkok, Thailand, 3. Department of Geoscience, University of Wisconsin–Madison, Madison, WI 53706, 4. Department of Geology and Mines, Ministry of Energy and Mines, Vientiane, Lao People's Democratic Republic, 5. Department of Geology, Chulalongkorn University, Khet Pathumwan, 10330 Bangkok, Thailand

Whilst compositions of Australasian tektites are consistent with a predominantly sandstone target lithology, chemical evidence suggests that a minor basaltic component is also ubiquitous in Australasian tektites. A mafic or ultramafic component within the Australasian target rocks has long been hypothesized [1,2] based on sporadic enrichment in Ni, Co, and Cr in some tektites [2-4]. Attempts to interpret this as chemical contribution from the impactor [3,4] are frustrated by a lack of concomitant enrichment of highly siderophile elements which would seem to preclude inheritance of siderophiles from common asteroid types [2,5]. The occurrence of Cr,Fe,Ni-oxide dendrites on microtektite surfaces [4] demonstrates that these elements can also be locally concentrated by high-temperature processes in the impact plume, offering a likely explanation for anomalous Ni, Cr, and Co concentrations in some tektites amplified above what can be explained by direct mixing with terrestrial mafics. We performed a principal component analysis on major-element compositions of 241 tektites from various locations around the strewnfield and found that >90% of the observed chemical variation can be attributed to mixing of Mesozoic sequences of the Khorat Plateau with Bolaven basalts, with more distal tektites tending toward higher proportions of basalt. Variations in the Sr-isotopic composition of the tektites shows mixing of a low-Sr, high-$^{87/86}$Sr end member with a high-Sr, less-radiogenic component [6], which is also consistent with an admixture of bedrock and basalt from the Bolaven. More basalt-like Sr is observed in more distal tektites, Australites in particular. Characteristically high ^{10}Be in Australasian tektites could be derived from a tropical volcanic target wherein layered basalt flows weather rapidly to clay-rich saprolite, a process well-suited for absorption and retention of meteoric ^{10}Be. As with the other chemical trends described, characteristics inherited from target basalt, in this case high ^{10}Be, are more expressed with increasing distance from Indochina [7]. The finite half-life of ^{10}Be ($t_{½}$=1.39My) would necessitate that a significant fraction of the basaltic target saprolitized within a few million years of the impact, implying an active or recently active volcanic field. In summary, the majority of geochemical variation in Australasian tektites can be ascribed to mixing of sandstone/mudstone bedrock with a recently weathered basalt. The geographic distribution of these chemical trends is consistent with a basalt-over-bedrock target geology with the upper basaltic layers offering greater mass contribution to distal trajectories. Although fragments of basalt are unlikely to survive weathering, we have also observed chemical signals of a basaltic component in immobile trace element systematics (e.g. Zr/Nb, Hf/Ta) of the red pebbly laterite stratigraphic layer intimately associated with muong nong tekites throughout the region. Dissolution and re-precipitation of basaltic and other components of the impact deposit likely contributed to formation of this ferricrete layer. We also explore whether the impact might have resulted in an initial ~3500 km^2 outpouring of basalt at the impact site and influenced the subsequent evolution of the field. [1] Koeberl (1992) GCA 56:1033–1064. [2] Wasson (1991) EPSL 102:95 –109. [3] Goderis et al. (2017) GCA 217:28-50. [4] Folco et al. (2018) GCA 222:550-568. [5] Shirai et al. (2016) LPSC #1847. [6] Blum et al. (1992) GCA 56:483–492. [7] Ma et al.

(2004) GCA 68:3883–3896.

Keywords: australasian, tektite, Bolaven, Laos, impact, bolide

