A MULTIPLE-IMPACT ORIGIN OF SOUTHEAST ASIAN TEKTITES.

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There are four strewn fields of tektites. The Australasian field is the largest and, at ~0.7 Ma the youngest; a particularly important subset consists of the layered or Muong-Nong-type tektites found throughout Southeast Asia. These are often large; the largest weighs 13 kg and is a fragment. The Muong-Nong tektites seemed to have formed as puddles of silicate melt; the layering may have resulted from minor incorporation of local detritus followed by flowage. Like all tektites, the compositions of the Muong-Nong tektites are closely similar to those of mean continental sediments. Concentrations of certain volatiles are higher in the Muong-Nong tektites than in the smaller, splash-form (e.g., spheroid; dumbbell; teardrop-shaped) tektites found in the same regions. This indicates that the degree of outgassing of the Muong-Nong melt was less than that of the splash-form tektites and thus, that Muong-Nong tektites better preserve the composition of the precursor material.

It is generally accepted that tektites formed by the impact melting of near-surface sediments followed by ballistic ejection from the crater. Although the Czechoslovakian tektites are associated with the Ries crater and the Ivory Coast tektites with Bosumtwi Crater, the crater parental to the Australasian tektites has not been found. Many Australian tektites show aerodynamic sculpturing requiring that, after formation by melting, they solidified, then passed through the atmosphere. This clearly required an explosion that was sufficiently energetic and localized to blow off the overlying atmosphere. The remaining Australasian tektites do not show aerodynamic features, and need not have been outside the atmosphere.

The Muong-Nong field extends at least from Kompong Speu, Cambodia, to Hainan Island, China, a SSW-NNE distance of ~1200 km. The width of the field is at least 800 km. If all the tektites formed in a single crater with a radius of 50 km, the most distant of these would have traveled at least 550 km. It is inconceivable that globs of molten silicate could have been flung 550 km (a minimum ballistic velocity of 2.4 km s⁻¹ in vacuo!) and landed without complete disintegration and mixing with unmelted local materials. If atmosphere were present the melt would have been reduced to droplets which would have been decelerated after a short distance.

The most viable alternative seems to be that Muong-Nong tektites formed in a multitude of local craters (this idea is similar to that of Barnes and Pitakpaivan [1962]), who suggested that molten puddles formed in situ by melting soil). If so, we would expect Muong-Nong type (and probably also splash-form) tektites to show significant regional variations in chemical and possibly isotopic (e.g., Sr) composition that correlate with the mean compositions of the main near-surface sediments 0.7 Ma ago.
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The present study was undertaken to investigate this possibility. In the first phase we will determine concentrations of 30-35 elements in Muong-Nong (and a few splash-form) tektites collected known sites throughout Southeast Asia. If differences associated with location are observed, samples representative of the main sediments present 0.7 Ma ago in the same Southeast Asian regions will be collected and investigated.

Preliminary determinations by Xinwei Ouyang on 5 Muong-Nong tektites from Cambodia, Thailand, Laos and Vietnam show differences by factors of 1.1-1.2 in Na, K, Cr, Fe, Co, Se, Rb, Cs, rare earths, Th and U, by factors of 1.2-1.5 in Zn and Ga, and by factors of 1.5-2 in Ni, As and Sb. Studies of additional samples from these localities are required to confirm that these correspond to regional differences.

Splash-form tektites from Vietnam and Thailand show significantly lower contents of Zn, Ga, As and Sb than do the Muong-Nong-type tektites. We found no significant difference in the concentration of the alkali elements Na, K, Rb and Cs, thus these were not appreciably volatile in the tektite melt. To search for evidence of differential volatilization as a function of depth, two teardrop tektites were divided into bulb center, bulb edge and tail samples. No consistent differences in volatile contents were observed, an indication that devolatilization occurred well before the final shape was established.