LAYERED TEKTITES OF SOUTHEAST ASIA: RESULTS OF 1998 EXPEDITION TO LAOS AND VIETNAM. P. S. Fiske[1], C. C. Schnetzler[2], J. F. McHone[3], K. K. Chanthavaichith[4], I. Homsombath[4], T. Phouthakayalat[5], B. Khenthavong[6] and P. T. Xuan[7] [1]Physics and Space Technology Directorate, L-45, Lawrence Livermore National Laboratory, Livermore, CA 94550, fiske1@llnl.gov, [2]Department of Geography, University of Maryland, College Park, MD 20742, cschnetz@ltpmail.gsfc.nasa.gov, [3]Physics Department, University of Alabama at Birmingham, Campbell Hall, Room 310, 1300 University Blvd., Birmingham, AL 35294-1170, jmchone@hotmail.com, [4]Department of Geology and Mines, Ministry of Industry and Handicraft, Vientiane, Lao P.D.R., [5]Industry and Handicraft Department, Savannakhet, Lao P.D.R., [6]Science Technology Environment National Organization, P.O. Box 739, Savannakhet, Lao P.D.R., [7]Institute of Geological Sciences, National Center for Science and Technology, Hanoi, Vietnam

Introduction: We carried out a field investigation of layered tektite localities in Laos and Vietnam in February of 1998. During our 3-week expedition we recovered a total of 18 kg of layered tektite fragments from 10 sites (Figure 1) including 5 localities around the town of Muong Nong (Laos), the "discovery" locality of layered tektites [1]. Site locations were precisely determined using GPS. At three sites we carried out semi-controlled excavations of 2x2 or 1x2 meter areas, mapping all tektite finds. Sieving the soil removed from these excavations allowed us to recover an estimated >95% of the tektite fragments present.

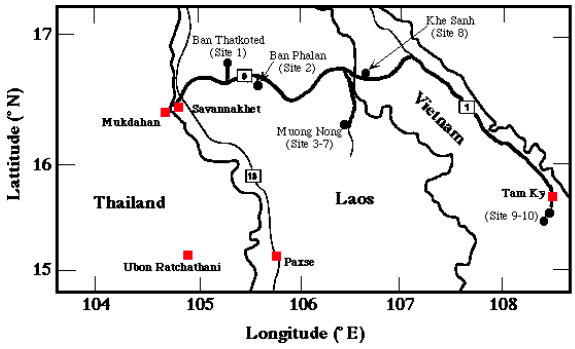

Figure 1: Map showing route of the expedition (bold black line).

Results: The localities we visited, and the material we recovered, are tabulated below:

Site #	Location	Description
1	N16° 50'29.92" E105°20'13.99"	7 pieces on surface. Total mass = 100 g
2	N16°38'00.89" E105°36'55.77"	4 pieces on surface. Total mass = 10 g
3	N16°22.336' E106°27.595'	1964 pieces from 3 excavations in bomb crater. Total mass = 3.9 kg
4	N16°22.434' E106°28.364'	222 pieces from excavation in bomb crater. Total mass = 6.6 kg
5	N16°22.217' E106°27.883'	68 pieces from excavation in bomb crater. Total mass = 1.9 kg
6	N16°23.633' E106°30.00'	205 pieces in bomb crater fill. Total mass = 1.1 kg
7	N16°22.800' E106°30.00'	10 pieces found in floor of gravel quarry, 2 pieces found in-situ. Total mass = 250g
8	N16°40.71' E10642.33'	86 fragments found in-situ along road cut. Total mass = 500 g
9	N15°32.29' E108°27.22'	12 fragments found on surface of gravel quarry. Total mass = 40 g
10	N15°32.70' E108°29.00'	117 pieces found on surface. Total mass = 1.4 kg.

Extent of "layered-only" region. We found only layered tektites in central Laos. This confirms previous observations [2] and suggests that the "layered only" region extends from NE Thailand through Laos and into Central Vietnam. The extent of the "layered-only" subfield is well-constrained to the east and west but poorly constrained to the north and south. As presently known, the "layered only" subfield is approximately 50,000 km^2.

Distribution and size of tektite deposits. Our excavation at site 3, and interviews with villagers who had uncovered tektites in the floors of bomb craters, suggest that the original deposits of tektite glass were highly localized. At site 3, villagers had excavated over 700 kg of tektite fragments, including individual pieces over 10 kg, from two small pits dug into the side of a bomb crater. This is the largest single deposit of layered tektite glass ever reported. Physical evidence from the excavation site suggests that most of this mass may have represented a single contiguous block that fragmented after cooling. At site 6, a farmer had excavated over 200 kg of tektite fragments from a bomb crater that was subsequently used as a water reservoir (Figure 2)

Abundance of tektites. By any measure, the abundance of tektites around the town of Muong Nong, Laos, is exceptional. However an absolute abundance may be impossible to determine because we can sam-

ple the tektite-bearing horizon only in the floors of

Figure 2: Farmers removed over 200 kg of tektites from this bomb crater (Site 6). We found 1.1 kg of layered tektite fragments along the edge of the crater.

bomb craters. We were able to make a semi-quantitative estimate of tektite abundance at site 8, a road cut north of the town of Khe Sanh in Vietnam (Figure 3). At that site we recovered 500 g of tektites from 50 m of road cut. Given the geometry of the road cut and the amount of each layer exposed we estimate a tektite abundance of 100 g/m^2. In comparison, the tektite abundance in NE Thailand is 2-20 g/m^2 [3].

Figure 3: Tektite bearing horizon (marked by gray line) exposed along road cut north of Khe Sanh, Vietnam.

Stratigraphic occurrence of tektites. Our excavations in Laos and Vietnam confirm previous reports [4-5] that the tektites are found at the top of a lag gravel (Figure 4). In NE Thailand and Central Laos the lag deposit is composed of indurated pebbles of laterite and minor quartz and lithic clasts. In Vietnam the lag deposit can be composed of either laterite or other lithic clasts. Where lag deposits are absent or poorly developed we were unable to find any tektites.

Figure 4. Close-up of exposure of pebbly laterite horizon at site 7. A small tektite fragment was found in-situ at the top of the pebbly horizon.

The stratigraphic age of tektites has been a source of considerable misunderstanding. Evidence from NE Thailand [3] and from this expedition clearly shows that the tektites are not in a chronostratigraphic horizon but lie atop a lag deposit that may have been buried and re-exposed several times since the tektites were deposited.

Conclusions: The Southeast Asian tektite strewn field represents a uniquely well-preserved ejecta deposit from a recent large meteorite impact on Earth. The presence of a sub-field that contains only layered tektites, and the possibility that individual masses were as large as 1000 kg, may provide important constraints on the physical and chemical processes that take place during impact melt formation and ejection. While travel in this region has been, until recently, nearly impossible our experience demonstrates that field-based research, especially in collaboration with Southeast Asian scientists, is feasible and productive.

References: [1] Lacroix A. (1935) *C. R. Acad. Sci.* (Paris)*, 200,* 2129-2132. [2] Schnetzler C. C. and McHone, J. F. (1995) *Meteoritics & Planet. Sci., 30,* 575. [3] Fiske P. S. et al. (1996) *Meteoritics & Planet. Sci., 31,* 36-41. [4] Barnes V. E. and Pitakpaivan K. (1962) *Proc. Nat. Acad. Sci. U.S.A., 48*, 947-955. [5] Ford R. J. (1988) *Austral. J. Earth Sci., 35*, 483-490.

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