THE 770KA TEKTITE PRODUCING IMPACT EVENT: EVIDENCE FOR DISTAL ENVIRONMENTAL EFFECTS IN NE THAILAND. K. T. Howard[1] , S. Bunopas[2], C.F. Burrett[1], P. W.Haines[1] and M.D. Norman[1] [1]University of Tasmania, School of Earth Science. P.O. Box 252-79 Hobart, Tasmania, Australia, 7001. Email kthoward@utas.edu.au [2]c/o Geological Survey Division, Dept. of Mineral Resources, Rama IV Rd., Bangkok 10400, Thailand.

Introduction: Large impact events will have extensive environmental effects, but these are rarely reported from the ancient record due to problems of preservation and recognition. A major impact event at 770ka in the SE Asian region is believed to have been responsible for the formation of the Australasian tektite strewn field, although the exact location of the impact site has not yet been identified. Here we report possible evidence of the environmental effects of this event from Thailand. Such studies may provide new constraints on the location of the source crater(s).

Study location: The study has focused on sandpits at Ban Tha Chang, 16km east of Khorat, northeast Thailand. Ban Tha Chang is about 400km west of the area where layered tektites are most abundant, this area is believed by many to be close to the impact centre [1]. Based on other sections [2], the sands lie immediately above the regionally extensive 770ka tektite bearing layer. Six interbedded facies outcrop in two active sandpits. Facies 1-4 have chaotic grainsize distributions and were rapidly transported and deposited in catastrophic flood events. These are overlain by two facies considered more characteristic of normal fluvial processes.

Fossil trees and charcoal: The flood deposits contain abundant partially or wholly petrified trees that are confined to two distinct stratigraphic horizons. The trees have trunks of up to 2 metres diameter and are typically shattered, branchless, snapped, uprooted and burnt to the core (figures 1 and 2). These sands also contain abundant (up to 10%) detrital charcoal that is pervasive throughout facies 1-4. This further supports deposition of these sands in high energy flood events involving an extremely cluttered, sediment laden fluid [3].

Figure 1: Shattered, burnt tree.

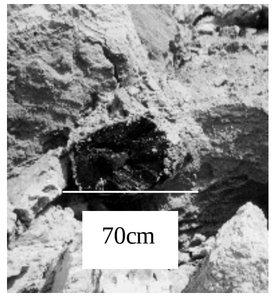

Figure 2: Tree that is burnt to the core.

Micro-impact glasses: Black glass particles (typically ≤ 100µm) are abundant at up to 45 particles/gram in sands from Ban Tha Chang. Glass rather than crystalline composition is demonstrated by environmental scanning electron microscope (ESEM) scanning and morphological examination as well as scanning electron microprobe (SEM) analyses. The glasses vary in morphology from irregular to subspherical to, more rarely, tear drop shapes (figure 3) and on the basis of 20 analyses may be divided into two distinct compositional groups. On average group A glasses are composed almost exclusively of SiO_2 (97.7%), while group B glasses possess low SiO_2 (37%), high Al_2O_3 (28%), anomalous fluorine (6.6%), low CaO (2.60%) and MgO (1.73%) contents. The glass compositions do not resemble volcanic glasses and Quaternary volcanism is not known in the region. Neither do they individually resemble the composition of typical Australasian tektites although the combined bulk composition is close to tektite compositions (with the exception of F). We tentatively suggest an impact origin for the glasses. The heterogeneity of compositions is more characteristic of proximal impact glasses formed by local scale melting. In contrast tektite formation apparently involves large scale homogenisation of the surface crust.

Group A glasses may have been formed from a quartz rich target lithology such as quartz sand or sandstone. Appropriate target lithologies from which to form group A glasses exist throughout central and northeast Thailand. The composition of group B glasses could be explained by a highly weathered (silica depleted) granitic target, bearing significant deposits of fluorite. Highly weathered, fluorite-rich granites are common in western Thailand.

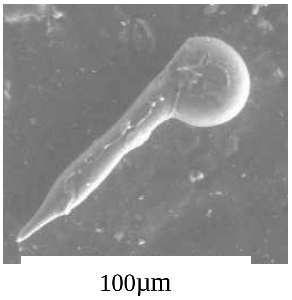

Figure 3: teardrop shaped micro impact glass.

Impact induced shock metamorphism: Quartz grains in sands at Ban Tha Chang contain irregular planar fractures and, more importantly, microstructures that strongly resemble shock-induced planar deformation features (PDF's) (figure 4). These PDF's occur in sets generally spaced at less than 10µm intervals. Studies aimed at determining the crystalographic orientation of the PDF's, necessary to confirm an impact origin, are in progress. PDF's form at shock pressures in the 10 to greater than 30 GPa range [5]. Also present are non-fractured grains of quartz rimmed by a thin carapace of melt ('cored inclusions'), a feature also suggestive of impact processes [4] (figure 5).

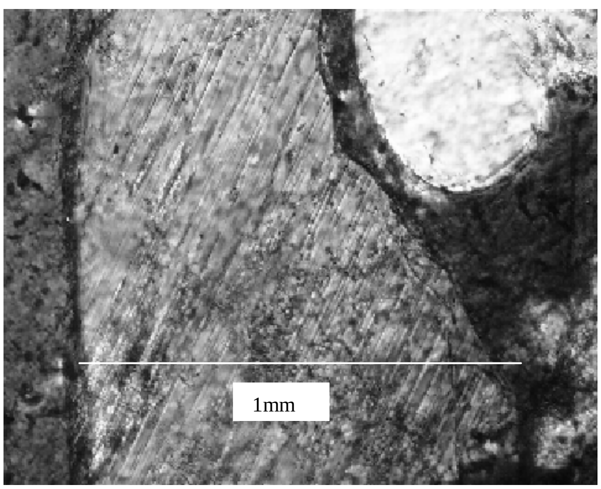

Figure 4: PDF's in

Figure 5: Quartz grain rimmed by melt ('cored inclusion').

Conclusions: The presence of two distinct glass compositions suggests the possibility of multiple impacts or impacts into an heterogeneous target. If multiple impacts are involved environmental effects of the event may be spread over a wider area than is the case in a single point source impact. The association of evidence for forest destruction and burning, along with suspected impact products, suggests that the former may bear witness to the environmental destruction related to an impact event.

It is suggested that forest destruction led to accelerated erosion and greatly increased sediment supply in the region thereby overwhelming existing drainage networks. At Ban Tha Chang, the increased sediment and woody debris supply to the paleo-Mun River created a series of log-jam and dam burst depositional events that deposited sand facies 1-4. Such events are likely to have been widespread throughout Thailand as denoted by the occurrence of similar tree deposits in sandpits and along riverbanks throughout the region [6].

Although these sands are yet to be accurately dated their close stratigraphic association with one of the regional tektite bearing layers in Thailand suggests that the trees, flood deposits and inferred impact products represent aspects of an environmental catastrophe that accompanied the 770ka impact event.

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