IMPACT WAVE DEPOSITS PROVIDE NEW CONSTRAINTS ON THE LOCATION OF THE K/T BOUNDARY IMPACT; Hildebrand, A.R. and Boynton, W.V., Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721

All available evidence is consistent with an impact into oceanic crust terminating the Cretaceous Period. Although much of this evidence is incompatible with an endogenic origin, some investigators still feel that a volcanic origin is possible for the K/T boundary clay layers. Following the dictum that remarkable hypotheses require extraordinary proof this latter view may still be reasonable, especially since the commonly cited evidence for a large impact stems from delicate clay layers and their components (i.e.no catastrophic deposits), and the impact site has not yet been found.

Impact sites have been suggested all over the globe, but are generally incompatible with known characteristics of the boundary clay layers. We feel the impact is constrained to have occurred near North America by: the occurrence of a 2 cm thick ejecta layer only at North American locales, the global variation of shocked quartz grain sizes peaking in North America (e.g. 1), the global variation of spinel compositions with most refractory compositions occurring in samples from the Pacific region (2), and possibly uniquely severe plant extinctions in the North American region (3). Also the ejecta layer may thicken from north to south (4). A new constraint on the impact location comes in the form of impact wave deposits; giant waves are a widely predicted consequence of an oceanic impact (e.g. 5).

We have investigated the K/T boundary interval as preserved on the banks of the Brazos River, Texas. We support previous suggestions (e.g. 6) that the coarse deposits at the boundary may reflect a giant wave origin. We have found the K/T fireball and ejecta layers with associated geochemical anomalies interbedded with this sequence which apparently allows a temporal resolution 4 orders of magnitude greater than typical K/T boundary sections.

A literature search reveals that such coarse deposits are widely preserved at the K/T boundary (See Figure 1). Geochemical anomalies associated with these deposits have been described from localities in New Jersey (7), Hatteras Abyssal Plain (8), Alabama (9), and Haiti (10). The suite of high-energy deposits includes turbidites preserved in abyssal environments and coarse sediments lying on erosional surfaces in continental shelf environments. Glick and Stone (11, 12) describe extensive deposits up to 20 metres thick containing clasts up to 5 metres diameter from near shore sections in Arkansas. These sediments may represent material deposited from the impact wave surging onto land and carrying material back to sea in the backwash. Possibly of even greater interest, similar coarse deposits of the basal Hornerstown Formation in New Jersey are an abundant source of fossils. For example, this unit contains ammonites, marine reptiles (mosasaurs), birds, turtles and crocodiles; many of the species represented became extinct at the boundary. If this deposit was produced by a giant impact wave and if the fossils are not reworked, it may provide compelling evidence that these creatures survived to the close of the Cretaceous Period.

Impact wave deposits have not been found elsewhere on the globe, suggesting the impact occurred between North and South America. The coarse deposits preserved in DSDP holes 151-3 suggest the impact occurred nearby. Although subsequent tectonism has complicated the picture, a number of interesting structures occur nearby; an intriguing possibility occurs at approximately 15°N, 78°W on the northern side of the Columbian basin. This structure is the correct size and shape, and may have the necessary target rock characteristics to be the impact location.

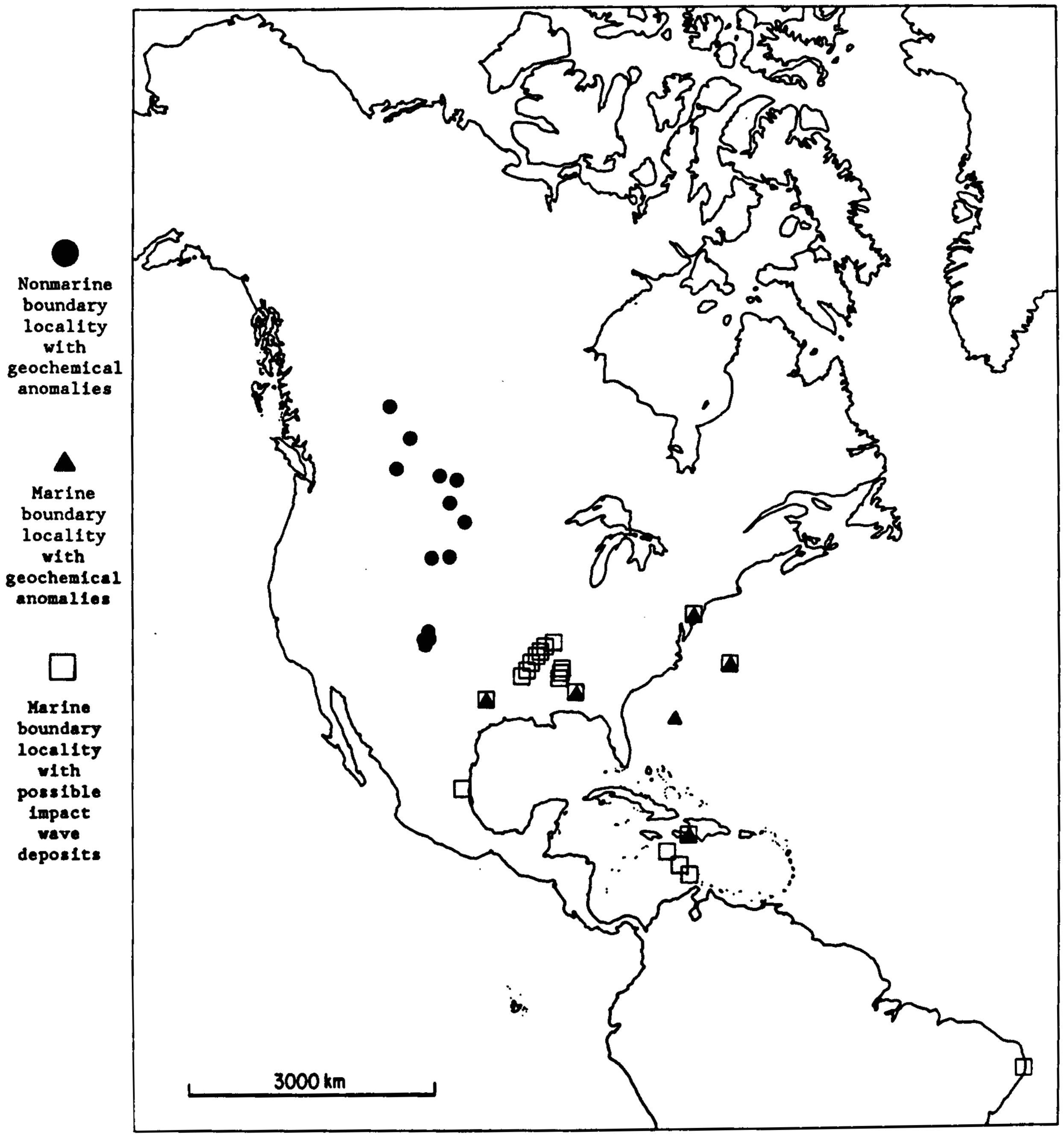

Figure 1: American marine and nonmarine K/T boundary localities

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