STRATIGRAPHY AND SEDIMENTOLOGY OF THE K/T BOUNDARY DEPOSIT IN HAITI; S. Carey, H. Sigurdsson, S. D'Hondt, Graduate School of Oceanography, University of Rhode Island, Narragansett, R.I. 02882 and J.M. Espindola Instituto de Geofisica, UNAM Ciudad Universitaria, Mexico City, Mexico.

The K/T boundary sequence is exposed in uplifted carbonate sediments of the southwest peninsula of Haiti. It is found at 15 localities within the Beloc formation, a sequence of limestone and marls interpreted as a monoclinal nappe structure thrust to the north. This tectonic deformation has affected the K/T boundary deposit to varying degrees. In some cases the less competent K/T deposit has acted as a slip plane leading to extensive shearing of the boundary layer, as well as duplication of the section. The presence of glassy tektites, shocked quartz and an Ir anomaly directly link the deposit to a bolide impact. Stratigraphic and sedimentological features of the tripartite sequence indicate that it was formed by deposition from ballistic fallout of coarse tektites, emplacement of particle gravity flows and fine grained fallout of widely dispersed impact ejecta.

In sections with limited tectonic disruption, the K/T deposit consists of at least three distinct units that are separated by relatively sharp contacts (fig. 1). At the base is a 20 to 30 cm thick, light olive brown smectite unit (1) with little or no carbonate. It contains smectite spherules which are the alteration products of impact glass or tektites. The second unit from the base consists of 20 to 40 cm light olive grey spherules, which range up to 15 mm in diameter. Unit 2 is distinctive in being poorly sorted and ungraded. It contains carbonate and clay rip-up clasts up to 4 cm in length. The unit is sometimes cross-bedded and at some locations the contact with the underlying unit is clearly erosive. Overall the unit fines upward and the upper parts consist of alternating cm to mm scale lenses of smectite and carbonate sediment. Spherules are very abundant in the lower part of the unit but very poorly sorted. The top-most unit in the K/T sequence is a reddish yellow brown smectite, 0.5 to 1 cm thick (unit 3, fig. 1). This unit contains shocked quartz grains and is associated with an iridium anomaly of 28 ng/g [1]. A high content of octahedral and dendritic crystals of Ni-rich spinel, of probable extraterrestrial origin, is also characteristic of this unit.

The size and shape of tektites and carbonate fragments in units 1 and 2 (fig.1) have been determined by image analysis of cut vertical sections from plaster casts of the deposit. In the basal section the mean of the maximum diameter varies strongly with stratigraphic height, varying from about 3 mm at the base to 1 mm at the top (fig. 2). Most of the tektites are not perfectly spherical but are instead slightly ovoid in shape (aspect ratio~0.75). Tektites from unit 2 have similar morphologies to those of unit 1 but include some that are significantly larger in size. In addition, tektites and carbonate clasts of unit 2 show evidence of preferential alignment of their long axis.

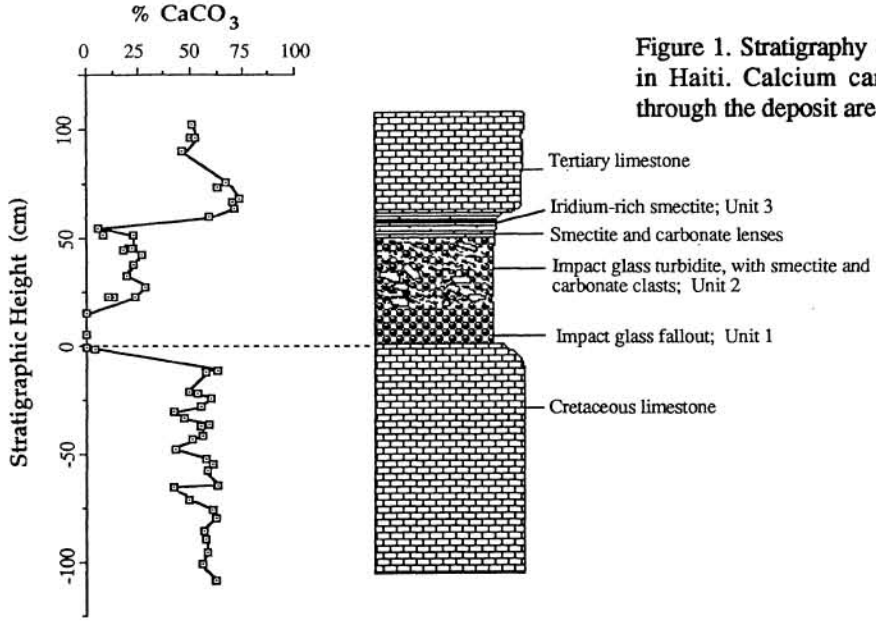

Figure 1. Stratigraphy of the K/T boundary sequence in Haiti. Calcium carbonate contents of samples through the deposit are shown on the left.

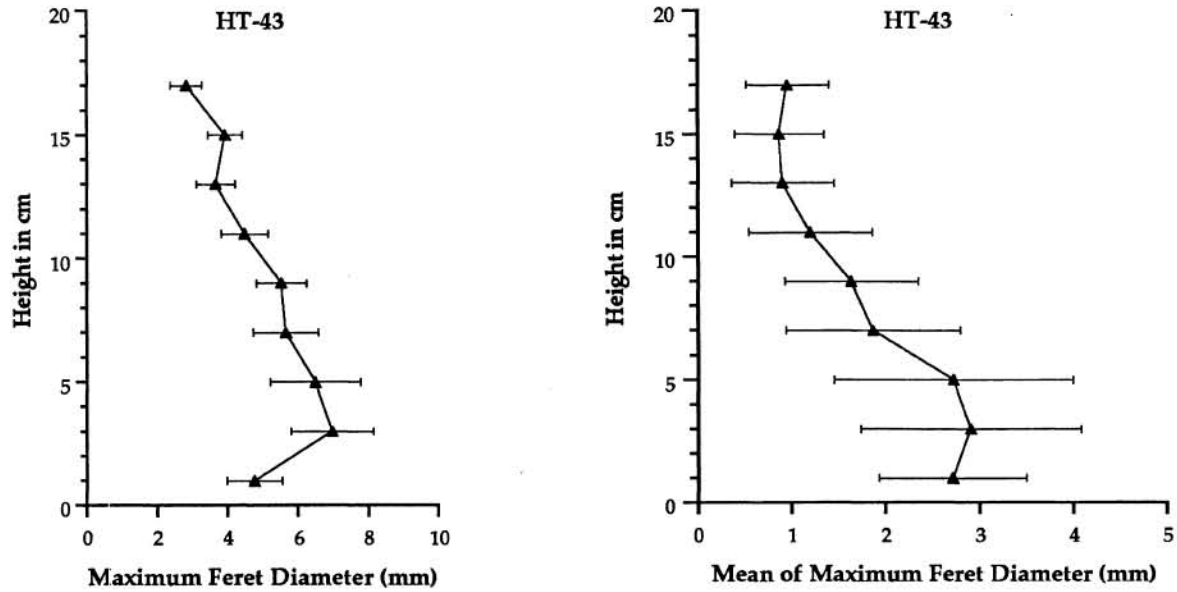

Figure 2. Variation in the maximum (left) and the mean of the maximum diameter (right) as a function of stratigraphic height in unit 1 of the K/T boundary deposit in Haiti. Data collected by image analysis.

The K/T section at Beloc is interpreted as a depositional sequence resulting from the impact of a bolide with the earth. Stratigraphic relations indicate that the sequence consists of several different sedimentary processes.The basal unit is attributed to ballistic fallout of tektite spherules based on the normal grading, good sorting, and low carbonate contents. Lack of orientation of elongate particles provides support for deposition by passive settling through the water column following ejection and transport of particles through the atmosphere. In constrast, the presence of rip-up clasts, cross-bedding and an erosive contact with the underlying unit indicates that unit 2 was deposited from some type of particle gravity flow. The presence of Cretaceous microfossils in this unit is consistent with incorporation of sediment into the flow during transport. The preferential alignment of tektites can also be attributed to the production of particle fabric during deposition of turbidity currents and grain flows.

There are two potential mechanisms for the origin of the flow that deposited unit 2. The first is that the flow was derived directly from a bolide impact and consisted of a mixture of hot particles and gas that moved across the water surface at high velocity. As the flow moved away from source it eventually mixed with water and made the transition to the submarine environment. A second possiblity is that unit 2 represents gravity flow or current redeposition of impact glass spherules caused by far field effects of the impact. An impact of the size proposed for the K/T boundary is likely to have generated large magnitude earthquakes and tsunamis. Both of these phenomenon can trigger remobilization of sediment in the marine environment. The sequence at Beloc suggests that there was sufficient time to allow deposition of tektites by fallout before the unit 2 flow arrived. It is interesting to note that the more proximal K/T sections at Mimbral, Mexico does not appear to contain an undisturbed tektite fall unit. This sequence is attributed largely to a megawave or tsunami deposit associated with the impact [2].

[1] Jehanno, , C., D. Boclet, L. Froget, B. Lambert, E. Robin, R. Rocchia and L. Turpin (1992) *Earth Planet. Sci. Lett.*, 109, 229-241.
[2] Smit, J., A. Montanari, N.H.M. Swinburne, W. Alvarez, A.R. Hildebrand, S. V. Margolis, P. Claeys, W. Lowrie and F. Asaro (1992) *Geology*, 20, 99-103.