displays a crude low-angle cross-bedding with alternating layers of pebbly sandstone and sandstone, dominantly composed of a mixture of spherules (Fig. 14B) and Cretaceous foraminifers. Internal truncations occur, but measurement of current directions was not possible. Unit II sharply overlies Unit I and has locally truncated Unit I. The beds of Unit II are well lithified and are more continuous than at Mimbral; individual layers (e.g., the parallel laminated bed at 60 cm) could be traced over 150 m, and a strongly eroded outcrop at the other side of the dam (300 m southwest) shows the same lithostratigraphic subdivisions. Unlike Mimbral, Unit II displays a wide variety of (current) ripple structures that allow a large number of paleocurrent measurements (Figs. 15 through 18). Where possible, the direction of migration of the ripples was measured on bedding planes, and otherwise a three-dimensional view of the ripples was obtained, using vertical sections at a perpendicular angle to each other (Fig. 16). The ripple structures observed are all compatible with origin as current-ripples. Ripples indicative of oscillation (waves) were not found. The ripple types observed vary from straight crested to linguoid, possibly lunate, ripples-in-drift to climbing ripples, with transitions in between. The basal 10 cm of Unit II displays ripple structures—associated with parallel-laminated beds—somewhat reminiscent of standing-wave– (antidune?-) type ripples (Fig. 17). A prominent, well-lithified bed, similar to the Mimbral Unit II beds, occurs at 55 to 62 cm. This bed is parallel laminated, and in thin section it shows an alternation of foraminifer-rich and darker lithic grain-rich laminae. Unit III begins at 78 cm, where the first thin silt layer appears. Unit III further consists of fine-sand layers with ripple structures alternating with (draping) thin silt layers. The top of Unit III (105 to 107 cm) displays a very fine scale flaserlike alternation of silts and millimeter-sized ripples (Fig. 19). Iridium concentrations are high in this interval (0.8 ng/g, R. Rocchia, personal communication, 1994). The top layers of Unit III are burrowed (Fig. 15). Unit III is capped by a silt layer 4 cm thick, overlain by a lithified silty micritic limestone layer (Fig. 14C), again similar to the one at Brazos River and Mimbral. This silty limestone layer is followed by a rhythmically bedded series of gray hemipelagic shales of the Velasco Formation, containing basal Danian foraminifers. The silty limestone and the first few centimeters of the Velasco Formation contain high iridium concentrations (R. Rocchia, personal communication, 1994). Although the silty limestone layer is greenish gray as is the Mendez Formation, the limestone layer is greatly depleted in Cretaceous foraminifers compared with the Mendez (compare Figs. 14A, B). Danian foraminifers have not been observed in the silty limestone, but they appear in the Velasco shales just above it. Therefore, we infer that the silty limestone layer is not Maastrichtian in age, as believed by some (Keller et al., 1994), but basal Danian (P0 Zone) in age.

The paleocurrent directions measured are shown in Figures 15 and 18. The current directions are bidirectional when integrated over the entire thickness of the K/T sandstone unit. The dominant directions are away and toward the Chicxulub crater, but that may be a coincidence. Within individual layers the current directions appear stable and unidirectional (Fig. 15), as they do when measured at different places in the same layer. Those opposite current directions demonstrate that the individual sandstone layers are deposited by currents repeatedly changing direction in almost 180°. The bidirectional currents are somewhat reminiscent of tidal-cycle currents, but such currents are difficult to explain in a semienclosed-basin environment and at a water depth of 500 m.

The sedimentology of Unit II at first glance makes one think of turbidity currents with repetitive Bouma sequence (A)B-C alternations. The opposing current directions then could be explained by reflected turbidites (Best and Bridge, 1992). The general setting of these opposing cross-beds of Unit II in the large-scale energy decreasing-up sequence I through III and in the smaller-scale energy decreasing-up sequence of Unit II is thought to be too small and gradual compared to energy differences between a supposed initiating turbidity current and a reflected one. Also Unit III is quite different from a turbidite setting, regarding the preservation of the ripple forms sharply overlain by a mud drape, contrary to the more gradual transition from Bouma C to D in a true turbidite.

A better explanation seems to be an origin by landward-breaking wave surges alternating with the seaward return flow of a series of large tsunami waves. Gravity flows may have helped to transport clastic material from the coast, ~70 km to the west, into the deeper basin but are not directly involved in the deposition of the K/T sandstone unit. The general thinning- and fining-upward trend shows the decreasing energy of tsunami waves, and in the final stages current velocity sufficiently decreases in between individual wave arrivals to allow the settling of the fine silt and clay of Unit III.

El Peñon, Mexico

El Peñon is located on a hilltop where the "flagstones" covering the dam of the Porvenir reservoir were quarried, mainly from Units II and III of the clastic complex. These units are therefore exposed over several acres, allowing investigation of the sedimentary structures preserved on the surface of the sandstone layers (Figs. 20, 21).

As at Mimbral and Lajilla, current measurements demonstrate periodic changes in current direction, consistent with the previously mentioned hypothesis of deposition by breaking tsunami waves.

El Peñon may be important for the correct interpretation of the many burrow structures that occur on and in the top of the K/T sandstone complex in almost every outcrop of the Gulf Coast. Most burrows (*Zoophycos, Chondrites*) occur in the topmost sand layers only, and all those seem to penetrate from above *after* deposition of the K/T sandstone unit. The burrow fabric show a distinct tiering; different types of burrows occur on different bedding planes. This tiering leads to alternation of more intensively burrowed beds and hardly burrowed beds, a