K-T BOUNDARY TEKTITES FROM NEAR BELOC, HAITI; G.A. Izett; U.S. Geological Survey, Box 25046, Denver, CO 80225

On the southern peninsula of Haiti near Beloc, a 0.5-m-thick bed of marl marks the Cretaceous-Tertiary (K-T) boundary [1]. In 1990, corroded glass objects were found in some (about 2%) of these smectite pellets. The pellets compose about 60% of the lower 2 cm of the K-T marker bed [2]. They are typically hollow and range from 0.5 to 3.5 mm in diameter, although some are as large as 1.0 cm. The pellets have shapes typical of tektites and microtektites, including spheroids, discoids, spindles, teardrops, rods, and dumbbells [3]. In 1980, these smectite pellets were referred to as "possible tektites" by Maurrasse [4] and 10 years later as altered tektites by Hildebrand and Boynton [5]. The presence of glass in some of the smectite pellets and the chemical and physical properties of the glass confirm that they are pseudomorphs of tektites [2].

In reflected light, the glass is dark brown to black; in transmitted light, it ranges from pale honey yellow through yellowish brown to dark brown. The glass contains fairly common large spherical and almond-shaped bubbles but lacks microlites and crystallites. This combination of petrographic features distinguishes the glass of tektites from other natural glass, such as obsidian. The index of refraction of the glass (n=1.518-1.542) is higher than that of glass of most other classes of tektites; however, it is similar to that of Ivory Coast microtektites. The water content of the K-T tektites is 0.18 wt.% as determined by the coulometric method on about 0.070 g of the glass.

Electron-microprobe analyses of 45 individual K-T tektites showed that their major-element chemical composition is, in general, similar to that of other tektite groups, except that they have lower Si (range, 50%-68% SiO_2; mean, 63% SiO_2) and higher Fe, Ca, and Na. Some tektites (pale yellow) have unusually high contents of Ca (20% CaO) and S (0.6%)! Laser-ablation inductively-coupled mass-spectrographic analyses of the tektites showed that their trace-element content is similar to that of other types of tektites, except that they contain more Sc, V, Cu, Zn, Ga, Sr, Sn, and Ba and less B, Mn, and Hf. Furthermore, the Cr, Ni, and Co content of K-T tektites is lower than most other tektite groups. The rare-earth-element (REE) content of the K-T tektites is similar to that of the other tektite groups and the North American Shale Composite. The light REE elements La and Ce are about 60-90 times amounts in chondrites, and heavy REE are about 20 times amounts in chondrites. The chemical composition of the K-T tektites, especially the REE, indicates that the target rock melted during the K-T impact was moderately siliceous, not mafic or ultramafic as has been widely speculated. The unusually high content of Ca and S suggest that melted rocks may have been, in part, marine organic-rich or pyritic limestone.

Most of the K-T tektites were completely altered to smectite, and the alteration process perfectly preserved their original shape. The process began with surface solution of the tektite glass by pore fluids. Smectite or proto-smectite precipitated from the pore fluids and formed a thin shell or rind

K-T tektites
Izett, G.A.

that encased the tektite. This process produced both hollow and solid smectite pseudomorphs of tektites. Amounts of Si, Al, and Ti are similar in the K-T tektites and the smectite pseudomorphs; however, Mg is three times higher, Fe is slightly higher, and Ca, Na, and K are significantly lower in the smectite pseudomorphs than in the tektites. REE are severely depleted in the smectite pseudomorphs relative to the K-T tektites. Thus, chondrite-normalized REE patterns of K-T boundary clays do not reflect the chemical composition of its progenitor material.

The Haiti K-T boundary smectite pseudomorphs of tektites are similar to hollow tektite-like smectite spherules in DSDP 603B [6] and alumino-phosphate spherules at western United States K-T sites [7]. The K-T tektites are compositionally and texturally unlike the K-T sanidine spherules of Smit and Klaver [8] and the Ni-rich spinel-bearing clay pellets of Montanari and others [9], Smit and Kyte [10], Kyte and Smit [11], and Smit [12]. These authors suggested that K-T spherules inherited a dendritic crystal texture from a precursor mineral that crystallized from a mafic impact-produced liquid. Presumably the sanidine and Ni-rich clay spherules were not originally tektites (by definition glass) produced by the K-T impact(s).

Mineralogic observations indicate that the Haitian K-T bed is not a primary air-fall bed composed entirely of impact ejecta. Rather, it contains a small volcanogenic component of locally derived material admixed with impact ejecta during deposition on the sea floor. Thus, the thickness of the Haiti K-T bed may not reflect the original air-fall thickness of impact ejecta.

The K-T bed on Haiti contains an Ir abundance anomaly (2.3 ppb) [13] and shock-metamorphosed quartz, quartzite, and metaquartzite grains [2]. The Haiti shocked quartz grains are similar in size to those in K-T boundary rocks of western North America, but the abundance of such grains on Haiti (less than 0.01%) is less than at western North America sites [2, 7].

The presence of tektites, which most earth scientists agree are of terrestrial impact origin, in the same bed with a Pt-group abundance anomaly and shocked quartz strengthens the Alvarez K-T impact hypothesis and weakens the Officer and Drake volcanic hypothesis for the explanation of Ir anomalies, shocked quartz, and boundary phenomena.

REFERENCES: (1) Maurrasse, F.J-M.R., 1982, Miami Geological Society, 130 p.; (2) Izett, G.A., U.S. Geological Survey Open-File Report 90-635, 31 p.; (3) Baker, G., 1963, in O'Keefe, J.A., ed., Tektites: Chicago, University of Chicago Press, p. 1-24; (4) Maurrasse, F.J-M.R., 1982, Transactions du 1er Colloque sur la Géologie d'Haiti, Port-au-Prince, 1982, p.184-198; (5) Hildebrand, A.R., and Boynton, W.V., 1990, Science, v. 248, p. 843-847; (6) Klaver, G.T., van Kempen, T.M.G., Bianchi, F.R., and van der Gast, S.J., 1987, Initial reports of the Deep Sea Drilling Project, Leg 93, v. XCIII, Part 2, p.1039-1056; (7) Izett, G.A., 1990, Geological Society of America Special Paper 249, 100 p.; (8) Smit, J., and Klaver, G., 1981, Nature, v. 292, p. 47-49; (9) Montanari, A., Hay, R.L., Alvarez, W., Asaro, F., Michel, H.V., Alvarez, L.W., and Smit, J., 1983, Geology, v. 11, p. 668-671; (10) Smit, J., and Kyte, F.T., 1984, Nature, v. 310, p. 403-405; (11) Kyte, F.T., and Smit, J., 1986, Geology, v. 14, p. 485-487; (12) Smit, J., 1990, Geologie en Mijnbouw, v. 69, p. 187-204; (13) Alvarez, W., Alvarez, L.W., Asaro, F., and Michel, H.V., 1982, Geological Society of America Special Paper 190, p. 305-315.