KT BOUNDARY IMPACT GLASSES FROM THE GULF OF MEXICO REGION

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Cretaceous-Tertiary boundary (KTB) tektite glasses occur at several sites around the Gulf of Mexico. Contrary to rumor among KTB workers, glass fragments have been found by several researchers in the base of the spherule bed at Arroyo el Mimbral in NE Mexico. The presence of green, red, and transparent glass fragments at Mimbral only, demonstrates that the Mimbral glass is not a laboratory contamination by Beloc glass. The chemistry and ages of the glass are consistent with an origin from the Chixculub impact crater in Yucatan. No evidence supports a volcanic origin for the KTB glasses.

Tektite glass from the KT boundary was first discovered at Beloc, Haiti [1; 2] and subsequently at DSDP sites 536 and 540, and at Arroyo el Mimbral in NE Mexico [3; 4]. At Beloc and Mimbral, glass particles occur as remnant cores within altered chlorite-smectite spherules. Informal discussions among KT workers have made it clear that finding glass in these sections is not always easy. Preserved glass occurs concentrated in local portions of the spherule bed because of irregular lithification and weathering intensity. Glass abundance is very low (<2% of the spherule fraction), and many spherule-bearing samples do not yield glass. Collections of samples from this outcrop taken on four different field expeditions over a two-year period have yielded glass fragments in three different laboratories:

• Glass was first found in the February 1991 collection taken at the time of the discovery of the KT Mimbral clastic bed by Smit, Montanari, Swinburne and Alvarez [3]. The discovery of glass was made independently by Hildebrand (Geological Survey of Canada) and by S. V. Margolis and Claeys (University of California at Davis), and reported by telephone to Smit and Alvarez at Berkeley on the same day (May 16, 1991).

• Hildebrand revisited the Mimbral outcrop in December 1991, and glass was again found independently in the samples from that trip by Hildebrand and by Margolis and Claeys.

• Montanari revisited the Mimbral outcrop in April 1992, and glass was once again found by Margolis and Claeys.

• Smit and T. Roep revisited the Mimbral outcrop in November 1992, together with R. Rocchia. Smit has found glass in samples taken then, from a different part of the outcrop than was previously sampled.

The glass is commonly preserved within clear sparry calcite crystals in the center of the spherules. Glass cores were also found preserved in the center of chlorite-smectite clay spherules. In the U.C. Davis procedure, samples of the spherule bed are disaggregated by ultrasound and digested over night in buffered acetic acid. The insoluble residue is then sieved to eliminate the finer fraction (<62μm). The glass fragments are hand-picked under the binocular microscope. The Mimbral outcrop has so far yielded less glass, and of generally smaller size fragments, than Beloc. Concentration of glass varies by more than a factor of 1000 from point to point in he Mimbral outcrop. The highest abundances found to date occur in the basal 2 cm of the spherule layer. Similar variability in glass concentration has been found in the Beloc outcrops.

The glass from Mimbral ranges in size from 0.1 mm to 3 mm and shows a great variety of color: dark brown to black (35%), amber-yellow (25%), green (20%), transparent (10%), red (10%). Individual glass grains from Mimbral contain widely varying compositions ranging from green to yellow glass within a single grain. The amber and black-to-green glasses have also been described at the Beloc KTB site in Haiti, [1; 2] but to our knowledge the red, green and transparent glasses have no equivalent at Beloc. At DSDP site 540 and 536 small (<50 μm) green, brown amber and clear-colored glass fragments have also been found [4].

The glass from Mimbral and Beloc displays surface features such as etching, dissolution pits, furrows and sculpting similar to tektites [3, 5, 6]. The glasses are isotropic under polarized light and have a comparable range in refraction indexes (1.51 to 1.55 at Mimbral, 1.52-1.54 at Beloc [2]).

Polished section of Beloc and Mimbral samples appear smooth and free of microliths [1; 2; 3; 6]. Under SEM-BSE a few fragments of the Mimbral glass exhibit inhomogeneities and vague flow structure with variable proportions of Fe and Si. Similar flow structure and schlieren with high and low Si have also been described from the highSi-K Beloc glass samples [6].

The black and yellow glasses from Beloc and Mimbral appear very similar (Table). The fairly abundant Mimbral K-rich glass does not seem to have a Beloc equivalent. Koeberl and Sigurdsson [6] have reported only one fragment of a high Si-K glass rather distinct from the Mimbral composition (Table). The DSDP glass appears to have a feldspathic composition (Table) [4].

The water content, determined by FTIR spectroscopy, on the Beloc and Mimbral black glass is 0.03 and 0.05 wt% H_2O respectively. This is definitively in the range expected for tektites and impact glasses and an order of magnitude lower than volcanic glasses [7]. These value confirm the data obtained for the Beloc glass by Koeberl and Sigurdsson [6].

The surface morphology, the absence of crystallites in the matrix, the chemistry and low water content of the glass all demonstrate the impact origin of the KTB glass. The volcanic origin of the Beloc glass proposed by Jehanno et al. [8] is unwarranted. The glass chemistry and ages confirm Chixculub as the KTB impact crater [9; 10; 11; 12] The discovery of KTB glass at several sites around the Gulf of Mexico defines a KTB strewnfield and justifies theuse of the term tektite for the KTB glass.

Table : Microprobe analyses of the KTB glasses from the Gulf of Mexico. All Fe as FeO.

	Black Mimbral [3]	Black Beloc [av. 2; 3]	Yellow Mimbral [3]	Yellow Beloc [6]	K-rich Mimbral [3]	Hi Si-K Beloc [6]	DSDP Leg 77 [av. 4]
SiO_2	62.99	63.14	52.2	48.73	66.20	86.00	65.47
Al_2O_3	15.73	14.96	12.4	13.25	18.73	6.93	20.68
FeO	5.32	5.37	4.73	4.98	5.67	2.45	0.40
MgO	3.01	2.77	3.9	4.02	2.64	1.15	0.12
CaO	6.88	7.18	22.96	24.71	0.84	0.38	2.65
K_2O	1.5	1.55	0.58	0.65	3.68	2.21	6.99
Na_2O	3.34	3.46	2.02	2.54	0.84	0.38	2.63
TiO_2	0.7	0.73	0.56	0.64	0.02	0.47	0.05
MnO	0.13	0.17	0.14	0.15	0.0	0.05	0.03
S	nd	0.0	nd	0.22	nd	0.0	nd
TOTAL	99.65	99.33	99.49	99.89	98.62	100.02	99.02

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