$^{40}Ar/^{39}Ar$ AGE (66-64 Ma) OF K-T BOUNDARY TEKTITES; G.A. Izett[1], G.B. Dalrymple[2], L.W. Snee[1], and M.S. Pringle[2], [1]U.S. Geological Survey, Box 25046, Denver, CO 80225; [2]U.S. Geological Survey, MS 937, 345 Middlefield Road, Menlo Park, CA 94025

In 1990, glass was found in smectite pellets in a 0.5-m-thick bed of marl that marks the K-T boundary near Beloc, southern Haiti [1]. The smectite pellets are typically hollow and generally range in diameter from 0.5 to 3.5 mm, although some are as large as 1.0 cm. They have shapes typical of tektites, including spheroids, discoids, spindles, teardrops, rods, and dumbbells. In 1980, these pellets were referred to as "possible tektites" by Maurrasse [2] and 10 years later as "altered tektites" by Hildebrand and Boynton [3]. In addition to smectite pellets, the K-T marker bed contains an iridium abundance anomaly [4] and shocked quartz and quartzite-metaquartzite grains [1, 3].

The discovery of glass in the smectite pellets has several important implications. First, the presence of glass and its properties confirm that the pellets are pseudomorphs of tektites [1]. Second, the coincidence of three different types of impact-related material (iridium, shocked quartz, and tektites) in the K-T marker bed supports the Alvarez impact-extinction hypothesis that an asteroid or comet(s) struck the Earth at end-Cretaceous time. Third, the presence of glass in the smectite pellets provides the opportunity to date the K-T impact-produced glass (tektites) and, therefore, the K-T impact event.

$^{40}Ar/^{39}Ar$ ages of K-T tektites were determined in U.S.G.S. laboratories at Menlo Park, CA and Denver, CO by two methods--total fusion and incremental heating. Total-fusion and several incremental-heating ages (in progress) were made on single tektites (~1 mm) in Menlo Park using a continuous laser, IR-radiometer, extraction line, and rare-gas mass spectrometer. An incremental-heating age (13 steps) was determined on about 50 millimeter-size tektites in Denver using a resistance furnace, extraction line, and rare-gas mass spectrometer.

Neutron flux monitors, K-T tektites, and sanidine from a K-T boundary bentonite were irradiated in the U.S.G.S. TRIGA reactor in Denver, where they received about 2×10^{18} NVT. One irradiation package contained 32 K-T tektites 0.3-1.3 mm in diameter and a 0.031 g split of sanidine crystals (100 mesh) from a bentonite (HCB) that lies just above the K-T boundary at Hell Creek, MT. In this reactor package, the K-T tektites (90G15-K) and HCB sanidine were sandwiched between sanidine from the Fish Canyon Tuff, which was used as a flux monitor. A second irradiation package contained another group (0.067 g) of K-T tektites (90G15-L), which was irradiated with hornblende as a flux monitor (MMhb-1, 519.5 Ma). Two sets of $^{40}Ar/^{39}Ar$ ages (see table below) were calculated for the K-T tektites and HCB sanidine because slightly different values (27.55 Ma and 27.80 Ma) for the Fish Canyon Tuff sanidine flux monitor are used currently by U.S.G.S. laboratories in Menlo Park and Denver, respectively [5].

Averages for the seven laser total-fusion $^{40}Ar/^{39}Ar$ age determinations made in Menlo Park on K-T tektites (90G15-K) are 64.4±0.4 Ma (Menlo Park calibration) and 65.0±0.4 (Denver calibration), a difference of about 1%. The averages of laser total-fusion $^{40}Ar/^{39}Ar$ ages for HCB sanidine are 64.5±0.4 Ma (Menlo Park calibration) and 65.1±0.4 (Denver calibration). The total-fusion ages of the K-T tektite and HCB sanidine are identical within the analytical uncertainty. In another experiment, an incremental-heating $^{40}Ar/^{39}Ar$ age of 65.6±0.7 Ma (13-step plateau age) was determined in Denver for a group of K-T tektites (90G15-L). About 55% of the argon was released in the four highest temperature steps.

Our $^{40}Ar/^{39}Ar$ ages of K-T tektites (64.4±0.4 Ma, 65.0±0.4, and 65.6±0.7 Ma) and HCB sanidine (64.6±0.4 Ma and 65.1±0.4) are also compatible with conventional K-Ar ages of (1) HCB sanidine (64.6±1.0 Ma) and (2) sanidine from two other K-T boundary bentonites (64.8±1.4 Ma and 65.8±1.2 Ma) from Montana and Canada [6]. Obradovich [7] reported a slightly older $^{40}Ar/^{39}Ar$ age of 66.0±0.54 Ma for a split of HCB sanidine using Minnesota hornblende (MMhb-1, 519.5 Ma) as a flux monitor, which is compatible with the incremental heating age of 65.6±0.7 Ma determined in Denver using MMhb-1 as a flux monitor.

In summary, $^{40}Ar/^{39}Ar$ ages of Haiti K-T tektites are 64.4 Ma, 65.0 Ma, or 65.6 Ma, depending upon what ages are used in Menlo Park and Denver for flux monitor standards (Fish Canyon Tuff sanidine or hornblende MMhb-1). The source of the systematic interlaboratory difference (1%) used for the ages of flux monitor standards in Menlo Park and Denver is yet to be determined.

Material	$^{40}Ar_R$ (Moles[1])	$^{40}Ar_R/^{39}Ar_K$	$^{40}Ar_R$ (%)		Age (Ma) ± is 1 σ Denver	Menlo Park
		HAITI K-T TEKTITES (90G15-K)				
Glass	3.313	8.285	96.5		65.0±0.4	64.4±0.4
Glass	5.945	8.250	91.4		64.7±0.4	64.1±0.4
Glass	2.620	8.244	94.0		64.7±0.5	64.1±0.5
Glass	6.022	8.286	98.7		65.0±0.4	64.4±0.4
Glass	6.232	8.259	98.8		64.8±0.4	64.2±0.4
Glass	3.971	8.350	99.7		65.5±0.4	64.9±0.4
Glass	4.317	8.311	98.9		65.1±0.3	64.6±0.3
				MEAN	*65.0±0.4*	*64.4±0.4*
BENTONITE BED, (HCB) JUST ABOVE K-T BOUNDARY, HELL CREEK, MT						
Sanidine	3.749	8.208	97.9		64.8±0.4	64.2±0.4
Sanidine	9.058	8.266	99.2		65.2±0.4	64.6±0.4
Sanidine	8.275	8.277	99.1		65.3±0.4	64.8±0.4
				MEAN	*65.1±0.4*	*64.5±0.4*

Decay constants: $\lambda_\beta=4.962\times10^{-10}$ yr^{-1}; $\lambda_\epsilon+\lambda_{\epsilon'}=0.581\times10^{-10}$ yr^{-1}. [1]Moles x 10^{-14}

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