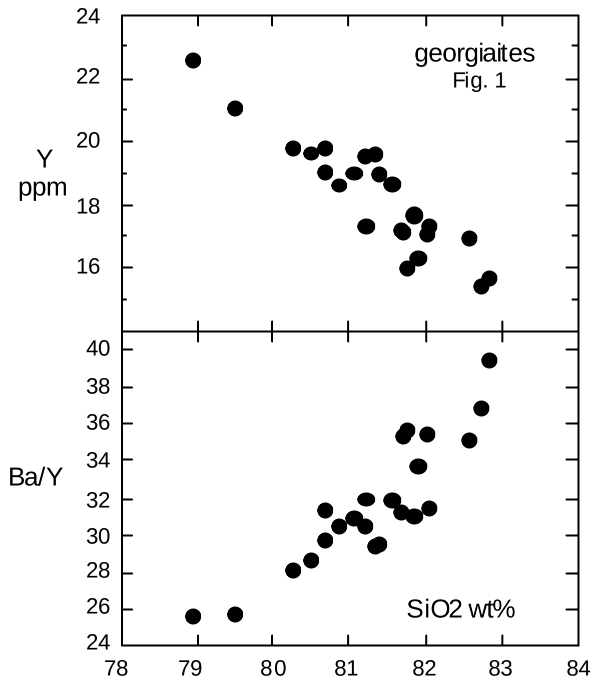
CRUSTAL COMPONENTS IN NORTH AMERICAN TEKTITES: TRACE ELEMENT COMPOSITIONS OF GEORGIAITES BY LASER ABLATION ICPMS. E. F. Albin[1,2], M. D. Norman[3], and M. F. Roden[2] [1]Department of Space Sciences, Fernbank Science Center, Atlanta, Georgia 30307 USA, [2]Department of Geology, University of Georgia, Athens GA 30602-2501 USA, [3]GEMOC, School of Earth Sciences, Macquarie University, N. Ryde NSW 2109 Australia

Abstract - Twenty-three individual georgiaites have been analyzed for trace element abundances by laser ablation ICPMS. These data show that georgiaites are compositionally distinct from other tektite groups. Compared to indochinites, bediasites, and moldavites (IBM tektites), georgiaites are less enriched in LREE/HREE, have smaller Eu anomalies, lower La/Sc, Th/Sc, and La/Th, and higher Rb/Cs ratios. Trace element characteristics of IBM tektites are consistent with targets composed predominantly of post-Archean upper crustal sediments [1,2]. In contrast, the geochemical characteristics of georgiaites suggest an additional component in their target which has compositional characteristics more similar to Archean-type crust. Good correlations of refractory trace element ratios (e.g., Ba/Y) with major element compositions show that compositional variations within the georgiaite group are caused by mixing of compositionally distinct components from the target stratigraphy rather than loss of Si by volatilization.

Introduction - Eocene age tektites are common in southeastern North America. Like other tektites, they are certainly products of terrestrial meteorite impact, but the details of their origin, including the location of their parent crater and composition of the target rocks, are poorly understood. A recently discovered crater beneath Chesapeake Bay has been proposed as a possible source for the North American tektites [2,3,4,5]. Georgiaites are characterized by high-silica compositions (Fig. 1) which are distinguished from other tektite groups by their low Al_2O_3 contents and high Na/K ratios [2]. We have analyzed 23 individual georgiaites, 2 indochinites, and a moldavite for their trace element compositions by laser ablation ICPMS to define the geochemical characteristics of georgiaites, and to constrain the nature of their source. These are the same georgiaites for which major element data were reported previously [5].

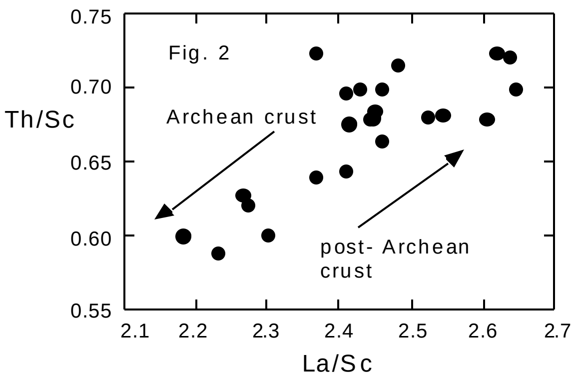
Results - Average trace element compositions of the georgiaites, 2 indochinites, and a moldavite are given in Table 1. Analytical procedures for the laser ablation ICPMS analyses are described by [6]. For this study, 3 to 6 spot analyses were performed on each tektite using ^{44}Ca as an internal standard and the NIST 612 glass for external calibration of relative element sensitivity. 24 determinations of the 612 glass as an unknown during the course of this study demonstrate a precision of 2-4% for all elements and an accuracy of 2% for the average of these analyses relative to the calibration values.

Like other tektite groups [1,2], georgiaites have a range of compositions with good correlations between major and trace element abundances (Fig. 1) [5]. Both mixing and loss of Si by volatilization have been suggested as mechanisms to account for the compositional variations within tektite groups [2]. For the georgiaites, the good correlations among refractory trace element ratios and major element compositions (Figs. 1, 2) suggest that these trends are more likely to result from mixing of different components in the target rather than loss of Si.



Trace element abundances show that georgiaites are distinct from other tektite groups (Tables 1, 2; Fig. 3). The REE patterns of IBM tektites (Fig. 3) clearly show that these impact glasses formed by melting of upper crustal sediments [1, 2]. La/Th, La/Sc, and Th/Sc ratios, which are diagnostic indicators of post-Archean upper crust [7], are also consistent with this interpretation (Table 2). Rb/Cs ratios of indochinites and moldavites are ~10-20 (Table 2), which are typical values for upper crustal sediments [8]. In contrast, georgiaites have REE patterns characterized by less enrichment of LREE/HREE and a smaller Eu anomaly (Fig. 3), which are features associated more with Archean upper crust rather than post-Archean sediments (Table 2).

La-Th-Sc abundances of georgiaites also suggest the presence of a component in the georgiaites that is compositionally similar to Archean crust (Fig. 2, Table 2). For example, La/Th ratios of georgiaites are identical to that of the Archean upper crust, whereas La/Th ratios of moldavites and indochinites closely match that of post-Archean sediments (Table 2). Th/Sc and La/Sc ratios of georgiaites are lower than those of moldavites and indochinites, and intermediate between those of Archean and post-Archean crust (Table 2, Fig. 2).



Rb/Cs ratios of georgiaites range from 38-52 (Table 2). These values are higher than those of most upper crustal sediments, either Archean or post-Archean, which cluster around 10-20. The Rb/Cs of primary Archean crust is poorly known, but it appears to be around 35-85 [9]. In general, crystalline crustal rocks tend to have higher Rb/Cs than sediments [9], so the relatively high Rb/Cs of the georgiaites may be indicating crystalline rocks in their target stratigraphy, and would be consistent with a component of Archean-type crust in these tektites. The Chesapeake Bay crater apparently penetrated crystalline Precambrian basement [3], and partially melted basement fragments have been found in the Exmore breccia associated with the Chesapeake Bay crater [10], perhaps providing a link to the compositional characteristics of georgiaites.

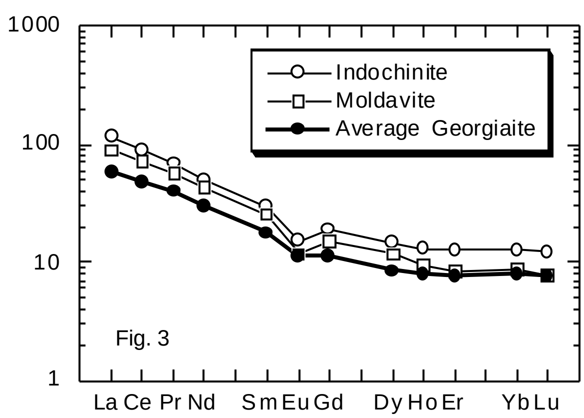


Table 1. Trace element compositions of georgiaites, indochinites (IN), and a moldavite (MO) by laser ablation ICPMS. All data in ppm.

	Georgiaite (n=23)		IN	IN	MO
	mean	1σ	EA	TM102	EA
Sc	8.7	1.0	13.2	12.9	6.6
V	45	7	73	79	26
Co	7	1	11	12	6
Ni	6	2	14	18	11
Rb	76	5	109	122	140
Sr	163	8	134	133	170
Y	18.2	1.8	31.4	31.1	22.3
Zr	187	14	316	309	305
Nb	8.1	0.7	19.7	19.3	8.3
Cs	1.7	0.2	5.8	6.7	14.0
Ba	572	25	395	404	891
La	21.1	2.0	40.8	41.4	32.9
Ce	46.2	4.0	82.4	83.4	67.0
Pr	5.32	0.51	9.37	9.50	7.84
Nd	20.6	2.0	35.2	35.5	29.7
Sm	4.07	0.43	6.72	6.88	5.80
Eu	0.99	0.09	1.25	1.31	1.03
Gd	3.44	0.40	5.85	5.75	4.65
Dy	3.22	0.31	5.46	5.57	4.44
Ho	0.67	0.07	1.12	1.12	0.77
Er	1.87	0.20	2.94	3.20	2.09
Yb	1.91	0.17	3.18	3.14	2.18
Lu	0.29	0.03	0.45	0.47	0.31
Hf	4.6	0.4	8.4	8.0	7.8
Ta	0.57	0.05	1.39	1.40	0.74
Th	5.8	0.5	16.0	16.4	14.3
U	1.5	0.1	2.1	2.4	2.6

Table 2. Key trace element ratios of tektites and continental crust. Georgiaites (GA), indochinites (IN), and moldavite (MO). Archean (AC) and post-Archean (PA) upper crust from [7] except Rb/Cs for post-Archean sediments [8] and Archean crust [9].

	GA	IN	MO	AC	PA
La/Th	3.6	2.5	2.3	3.5	2.8
Th/Sc	0.7	1.2	2.2	0.4	1.0
La/Sc	2.4	3.1	5.0	1.4	2.7
La/Yb	11.0	13.0	15.1	10.0	13.6
Eu/Eu*	0.81	0.62	0.60	0.99	0.65
Rb/Cs	44	19	10	35-85	19

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