SPHERULES FROM UPPER EOCENE SEDIMENTS AT ODP HOLE 689B, MAUD RISE, ANTARCTIC; B.P. Glass, Geology Department, University of Delaware, Newark, DE 19716, and C. Koeberl, Institute of Geochemistry, University of Vienna, Althanstrasse 14, A-1090, Vienna, Austria.

Montanari et al. [1] reported a positive Ir anomaly in upper Eocene sediments from ODP Hole 689B taken on the Maud Rise in the Weddell Sea, Antarctic (64 31.009'S. Lat., 03 05.996'E. Long; 2080 m water depth). A well-defined enrichment in Ir abundance occurs between 100-110 cm depth in Section 6 of Core 14H (~ 128.75 m subbottom). Previous work has shown that upper Eocene clinopyroxene-bearing (cpx) spherules are associated with a positive Ir anomaly (e.g., [2]). Vonhof and Smit [3] found microtektites and microkrystites associated with the Ir anomaly and suggested that they might belong to the North American and clinopyroxene-bearing spherule strewn fields, respectively. They also speculated, based on oxygen and carbon isotopic data, that increased surface productivity at the time of the late Eocene spherule event(s) at Hole 689B may have been the result of cooling triggered by the impact(s) that produced the spherule layer(s). We report on the concentration of spherules and the stratigraphic relationship between the microtektites and cpx spherules at this site, as well as provide description of and petrographic data and major oxide compositions for the spherules.

Twenty-seven samples with a sample spacing of ~ 2 cm through the layer and a spacing of 5-10 cm above and below the layer were obtained from Hole 689B. The samples were disaggregated and wet sieved into < 63 m, 63-125 m, and > 125 m size fractions. The coarser size fractions were searched for spherules using a binocular microscope with up to 50X magnification. Approximately 390 microtektites and 670 cpx spherules (> 63 m) were recovered. The vertical distributions of the cpx spherules and microtektites are nearly identical; however, the peak abundance of the microtektites is at 100-101 cm and the peak abundance of the cpx spherules is at 103-104 cm depth in Section 6 of Core 14H. In addition, the microtektites are more abundant than the cpx spherules above the peak abundance and less abundant than the cpx spherules below the peak abundance (scattered cpx spherules and microtektites were found as high as 90 cm above and at least 10 cm below the peak abundance).

We estimate that the concentration of microtektites (> 125 m) at this site is ~ 52/cm^2. This is much lower than the concentration of upper Eocene North American microtektites found at Barbados and the Caribbean Sea and Gulf of Mexico sites [4]. The concentration of cpx spherules is estimated to be < 1 (> 125 m)/cm^2, which is much lower than found at most previously described cpx spherule-bearing sites.

The microtektites are generally transparent and colorless to pale brown. Some fragments of tektite glass are also present. Of the splash forms, most are spherical (~ 82%); teardrop, disc, dumbbell, and other shapes make up about 7%, 6%, 1%, and 4%, respectively. Approximately 14% of the microtektites from the > 63 m size fraction are > 125 m in size.

The cpx spherules range from opaque black to translucent pale yellow in color. The translucent spherules are birefringent due to their cryptocrystalline nature. Approximately 40% of the cpx material are fragments; the remainder are generally irregular spheroids. In a few cases two spherules are fused together. They exhibit a range of crystalline textures similar to those observed in upper Eocene cpx spherules from other sites. Some of the cpx spherules contain Ni-rich spinels with equant or skeletal crystal outlines.

The major oxide compositions of 15 microtektite and 10 cpx spherules were determined by energy dispersive X-ray analysis. The microtektites have SiO_2 contents > 75 wt.% and like North American (N.A.) microtektites, they have low MgO (< 1 wt.%) and CaO (<1 wt.%) (Table 1). However, compared with previously analyzed N.A. microtektites, the Hole 689B microtektites generally have lower Na_2O contents (< 0.3 wt.%), although some N.A. microtektites and tektite fragments from sites 612 and 904 also have Na_2O contents < 0.3 wt.%. In addition, the Hole 689B microtektites have more variable FeO contents and some have higher Al_2O_3 contents for a given SiO_2 content than previously analyzed N.A. microtektites. The Hole 689B cpx spherules have lower SiO_2 (< 70 wt.%), Al_2O_3 (< 8 wt.%), and TiO_2 (< 0.4 wt.%) and higher MgO (> 4 wt.%), CaO (up to 16 wt.%) and Na_2O than the microtektites. The cpx spherules also have high NiO contents (up to 0.3 wt.%). They are petrographically and compositionally similar to upper Eocene cpx spherules found at other sites.

The age and major oxide composition of the microtektites suggest that they might be part of the N.A. microtektite strewn field, as previously suggested [3]. If so, the North American strewn field is at least four times larger than is presently mapped. The low concentration of microtektites at Hole 689B is compatible with the Chesapeake Bay structure being the source for the N.A. strewn field. The cpx spherules at Hole 689B are similar to upper Eocene cpx spherules previously found at other sites around the world; and if they all belong to the same event, it would appear that this layer may be global in extent. The low

concentration at Hole 689B is compatible with the 100 km diameter Popigai structure being the source crater for the cpx spherule layer, since Hole 689B is farther from the Popigai structure than are the other cpx spherule-bearing sites.

Trace element and additional major element studies are underway.

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Table 1. Major oxide compositions (wt. %) of selected microtektites and cpx spherules from ODP Hole 689B, Maud Rise, Antarctic.

Sample-Number	SiO_2	Al_2O_3	FeO	MgO	CaO	Na_2O	K_2O	TiO_2	NiO
				Microtektites					
750-16	75.1	14.7	4.75	0.86	0.50	0.19	2.65	0.57	n.d.
735-15	75.2	21.1	0.65	0.71	0.09	0.00	0.91	0.68	n.d.
735-13	75.3	12.4	7.02	0.72	0.87	0.15	2.50	0.34	n.d.
735-12	75.6	11.5	7.12	0.83	1.03	0.27	2.62	0.38	n.d.
740-32	77.3	12.6	4.74	0.73	0.50	0.08	2.84	0.55	n.d.
740-29	77.5	17.4	1.35	0.76	0.14	0.02	1.57	0.64	n.d.
740-17	78.3	17.1	1.25	0.75	0.13	0.01	1.19	0.63	n.d.
735-14	78.8	12.9	2.97	0.88	0.67	0.07	2.63	0.52	n.d.
735-10	79.4	13.7	3.45	0.60	0.31	0.04	1.33	0.52	n.d.
740-30	83.6	12.8	0.34	0.41	0.12	0.02	1.67	0.41	n.d.
				Cpx Spherules					
735-19	59.4	6.14	5.92	10.9	14.0	0.89	1.70	0.25	0.25
735-18	60.7	6.88	3.50	8.83	16.0	0.88	2.14	0.26	0.23
740-6	61.8	6.01	5.58	9.18	13.0	1.03	2.58	0.29	n.d.
735-20	62.0	5.69	3.75	8.31	16.7	0.19	1.50	0.22	0.08
740-12	62.4	6.65	4.95	9.75	13.6	0.60	1.75	0.25	n.d.
735-21	63.8	4.58	6.10	8.15	14.2	0.38	1.73	0.16	0.30
740-2	64.2	7.32	4.31	7.84	12.5	0.78	2.17	0.26	n.d.
740-15	66.0	5.39	8.84	8.43	6.98	1.39	2.13	0.25	n.d.
735-17	68.5	8.51	6.88	4.29	6.77	1.33	2.56	0.38	0.18

n.d. = not determined