MORE UPPER EOCENE (NORTH AMERICAN?) TEKTITES AND IMPACT EJECTA OFF NEW JERSEY; B.P. Glass[1] and C.M.G. McHugh[2]; [1]Department of Geology, University of Delaware, Newark, DE 19716, [2]Department of Geology, Queens College, City University of New York, Flushing, NY 11367, and Lamont-Doherty Earth Observatory of Columbia University, Palisades, NY 10964.

Previous studies have shown that an 8-cm-thick layer of impact ejecta (including tektites, shocked quartz, coesite, and stishovite) occurs at Deep Sea Drilling Project (DSDP) Site 612 on the Continental Slope off New Jersey [1, 2]. During Leg 150 of the Ocean Drilling Project (ODP) two additional sites, drilled within 9 km of Site 612, were found to contain late Eocene impact ejecta. Site 904A, 4.9 km north (up slope) of Site 612, was found to contain a layer of tektite glass and shocked quartz [3, 4]. In addition to tektite glass and shocked quartz at Site 904A, we report here the discovery of coesite and clinopyroxene-bearing spherules. Site 903C was drilled 7.5 km to the northwest of Site 904. A 7-cm-thick laminated layer was identified in core 56R, section 6, from Site 903C, which was described as a "... silty to very fine sandy interval ... that may contain microtektites" [4]. The sandy interval in core 56R, section 6, appears to be equivalent in age to the upper Eocene tektite layer found at Sites 612 and 904A. We report here the discovery of impact ejecta (but no tektite glass) at Site 903C [4].

At Site 904A (Core 45X, Section 2) the impact ejecta (including tektite glass and shocked quartz) was found concentrated in a layer at least 5 cm thick with scattered occurrences as much as 10 cm below the main layer [3] and as high as 80 cm above the layer. We found numerous white opaque grains up to at least 1 mm in size in the layer. X-ray diffraction data indicate that these grains are composed of coesite or mixtures of coesite and shocked quartz. We also found clinopyroxene-bearing (cpx) spherules, most of which have been entirely replaced by pyrite. The pyrite spherules still exhibit the original crystalline textures of the cpx spherules that they replaced. The pyritized cpx spherules are generally < 200 μm in diameter and are concentrated about 15 cm below the main ejecta layer, although a few scattered ones are found in the lower part of the main ejecta layer.

We note that the microstratigraphy at Site 904 is similar to that at Site 612 -- i.e., at both sites cpx spherules are found below or in the lower part of the main ejecta layer, large tektite fragments are concentrated in the lower part of the main ejecta layer, and smaller splash forms (microtektites) and unmelted impact ejecta (e.g., shocked quartz and coesite) are concentrated in the upper part of the ejecta layer. This suggests a sequence of events rather than a random mixing of clasts and matrix within a viscous debris flow as proposed by Poag and Aubry [5].

We found impact ejecta concentrated in a 2-cm-thick layer between 25 and 27 cm in section 6, core 56R, at Site 903C. No microtektites or tektite fragments were observed. We did find white opaque grains of coesite, shocked quartz with multiple sets of planar deformation features, and shocked orthoclase and plagioclase feldspar. In addition, we found almandine garnet, staurolite, and tourmaline similar in appearance and composition to garnet staurolite, and tourmaline found in the ejecta layer at Sites 612 and 904.

MORE UPPER EOCENE TEKTITES: Glass, B.P., and McHugh, C.M.G.

The similarity in biostratigraphic age, petrology of the ejecta, and composition of the tektite glass (at Sites 612 and 904) indicates that the ejecta layer at all three sites belongs to the same event. Poag et al. [6] and Poag and Aubry [5] proposed that a 15 x 25 km structure (Toms Canyon) located 40 km north-northwest of DSDP Site 612 is an impact crater and the source for the Site 612 ejecta layer. The progressive decrease in thickness of the ejecta layer in going from Site 612 to Site 904 to Site 903 (i.e., north-northwestward from Site 612 towards the Toms Canyon structure) does not seem to be consistent with a source area in the vicinity of the Toms Canyon structure.

Although some author's [e.g., 7] have concluded that the Site 612 tektite layer is older than the North American tektite layer found at Barbados (and other sites in the Caribbean and Gulf of Mexico), we believe the biostratigraphic data are ambiguous and that the Site 612 and 904A tektite (or ejecta) layers, as well as the Site 903C ejecta layer, probably belong to the North American tektite strewn field.

Poag et al. [8] have suggested that an 85-km diameter structure in the mouth of Chesapeake Bay is an impact structure and that it may be the source of the North American tektites. We note that the mineralogy of the ejecta layer at sites 612, 903, and 904 is similar to that of the matrix in the Exmore boulder bed (cored by the U.S.G.S. near Exmore, Virginia) which has been identified [5, 9] as impact ejecta from the Chesapeake Bay structure. At all four sites (Exmore, Sites 612, 903, and 904) the light minerals in the carbonate-free fraction consist of quartz, potash feldspar, and sodium feldspar in order of abundance. In addition, staurolite and almandine garnet are found in the ejecta layer at all four sites. Furthermore, we note that the geographic variation in thickness of the ejecta layer at sites 612, 903, and 904 and the absence of tektite glass at Site 903 are consistent with a ray-like distribution [10] of tektite glass from a source region in the vicinity of the mouth of Chesapeake Bay.

If the Chesapeake Bay structure is the source crater for the ejecta layers at sites 612, 903, and 904, then the layers are much thinner than would be predicted using previously established equations that relate ejecta thickness to crater size and distance from the crater. For example, Stoffler et al.'s [11] equation indicates a thickness of ~ 4 m for an ejecta layer at the distance that sites 612, 903, and 904 are from the Chesapeake Bay structure. This implies that previous equations for relating thickness of an ejecta layer to size of and distance from the source crater do not work in this case, or that the Chesapeake Bay structure is not the source of ejecta (including tektites) at these sites, or that the layer at all three sites has been mostly removed by later processes. We favor the first possibility.

References: [1] Thein, J. (1987) *Init. Rept. DSDP*, 95, 565. [2] Glass, B.P. (1989) *Meteoritics*, 24, 209. [3] McHugh, C.M.G. et al. (in press) *Proc. ODP, Sci. Res.*, 150. [4] Mountain, G.S. et al. (1994) *Proc. ODP, Sci. Res.*, 150. [5] Poag, C.W. and Aubry, M.P. (1995) *Palaios*, 10, 16. [6] Poag, C.W. et al. (1992) *Geology*, 20, 769. [7] Miller, K.G. et al. (1991) *Palaios*, 6, 17. [8] Poag, C.W. et al. (1994) *Geology*, 22, 691. [9] Koeberl, C. et al. (1995) *Meteoritics*, 30, 528. [10] Koeberl, C. (1989) *Proc. Lunar Planet. Sci. Conf.*, 19th, 745. [11] Stoffler et al. (1975) *JGR*, 80, 4062.