MELT SPHERULES FROM PETER'S POND, A CAROLINA BAY, SOUTH CAROLINA

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Introduction: Very high temperature melt products from Peter's Pond (Carolina Bay) near Blacksville SC consist of highly vesiculated **ropy melts** and three types of glassy spherules, ≤700 mm in diameter. These melt products (MPs) include welded glassy spherules, thermally processed clay clasts, and partially melted clays. Mullite- and corundum-bearing glasses and spherules occur in contact with clay balls that appear to have experienced low-grade thermal alteration.

Mineralogy: Observations of clay-melt interfaces with mullite or corundum-rich glassy enclaves indicate that the melt glasses in these MPs are derived from clays enriched in kaolinite with smaller amounts of iron oxides and illite**.** MPs with a mullite-glass core are partly rimmed by partially dissolved kaolinite clay balls; mullite needles penetrate the clay-glass interface. In addition, the melt interface has quench crystals of aluminous hematite set in Fe-poor and Fe-rich glasses. Mullite, corundum and an aluminosilicate phase are common in the refractory spherules. Impactites and shards also contain 'black clay clasts' enriched in carbonaceous matter that display a considerable range of thermal decomposition in concert with increased vesiculation and vitrification of the clay host. The interface between mullite-rich glass and a thermally decomposed black clay clast is decorated by iron silicide (Fe_3Si or gupeiite) spherules.

Petrology: Host glass compositions are remarkably uniform as are the compositions of Al-rich phases. Mullite–bearing spherules are the most common type and typically contain a few corundum crystals. Al-hematite-bearing spherules are less common, and spherules with both mullite and Al-hematite are least common. The iron silicide spherules probably formed by reduction of FeO in the glass during the thermal breakdown of carbonaceous matter in the black clay. The occurrence of mullite and Fe_3Si indicates formation by a very high-energy mechanism in a reducing environment unknown under natural conditions with the exceptions of lightning strikes[1] and impact craters[2]. In addition to the very high temperature and reduced phases described above, 10-20 μm-sized Fe_3C spheres (cohenite) with tiny inclusions of Fe phosphide (steadite), containing up to 1.10 wt % Ni and 0.78 wt % Co, are found in the reduction zones of spherules and shards within 10s of microns of highly oxidized Al-hematite. Neither cohenite nor steadite are naturally occurring terrestrial minerals and are only found in meteorites and gray cast iron. In addition, magnetic fractions extracted from the same, disturbed deposit within the Peter's Pond rim and along an old railroad cut, were analyzed by INAA. These samples contain 15±7 ppb of Ir, 395±40 ppm of Ni, and 574±57 ppm of Cr.

Conclusions: The mineralogy observed in these MPs indicates very high temperatures consistent with formation in an impact plume, *e.g.*, ejecta from the Chesapeake Bay impact event, or from a very unusual industrial process.

References: [1] A. A. Sheffer *et al*., 2003 LPSC XXXIV, abstract #1467. [2] V. Hoffman et al., 2005 68th Ann. Met. Soc. Mtg.