**Introduction:** Terrestrial impacts of all sizes expel large quantities of broken rock debris that eventually interacts with either air or water before it comes to rest in a sedimentary debris deposit. Past analyses of ejecta deposition in an atmosphere have treated the ejecta blanket either as a rigid, moving plate [1], or as the independent flight of a large number of rock fragments [2, 3]. Although these models accurately represent the two extremes in which the mass of the ejecta sheet is either much greater or much less than the mass of the air along the trajectory, the most common situation occurs when the ejecta mass is comparable to the air (or water) mass. In this case some interesting new phenomena arise.

**Density Currents:** Sedimentologists have long noted that, in lakes, the annual bloom of tiny diatoms rains to the bottom and forms distinct annual layers of sediment even though the Stokes settling time of an individual diatom might be years or even decades. The answer to this puzzle is the recognition that it is not individual diatoms, but instead density currents, driven by vast numbers of diatoms concentrated in the upper lake waters, that actually rain to the bottom. This phenomenon was investigated experimentally by Carey [4], who showed that when fine sediment deposited in seawater become sufficiently abundant, the dense upper layer became unstable and formed negatively buoyant plumes that rained to the bottom. Cary did not succeed in deriving a meaningful criterion for the onset of this behavior, but study of the literature on gas-solid flows [5] shows that when the particles are small enough to be treated in Stokes flow, and the density current is large enough to be treated as turbulent, the dimensionless number:

\[
B = \frac{2\alpha^2}{\sqrt{\frac{V h}{\rho \rho_0 g}}}
\]

where \(\alpha\) is the fluid viscosity, \(a\) particle diameter, \(V\) the volume fraction of particles in a layer of thickness \(h\), \(\rho\) the fluid density, \(\rho_0\) the particle density and \(g\) is the acceleration of gravity. When \(B < 1\) the particles fall separately and when \(B > 1\) they fall together in density currents. Several experiments in air have clearly demonstrated the clumping that occurs when \(B >> 1\) [6, 7].

**Implications:** Impact ejecta falling into the atmosphere or ocean may, under many plausible circumstances, clump into density currents that flow to the ground much more rapidly than one might expect for the single particles themselves. In addition, the ejecta deposits themselves may show flow structures more indicative of the velocity of the density currents than of the environment in which they were deposited. This may be of particular importance with respect to the deposition of the thick Archean sphereule beds observed in Australia and South Africa [8].