Sampling of impact plume components from Wabar impact craters.
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Introduction: The state of matter and processes within the impact plume is of considerable interest. Temperatures and pressures within the plume may be extreme, and potentially a major fraction of the total energy and material activated by the impact may be transferred through this zone. However, the actual conditions within the plume remain unknown and subject to poorly constrained modelling.

To improve this situation it is suggested to explore the materials formed during the life time of the plume. For small craters like Wabar (formed as an iron meteorite impacted into quartz-rich, sandy eolian and lacustrine sediments) a major fraction of the impactite material formed as agglutinates. It is suggested that during the agglutination stage small volumes of plume material became trapped within the aggregates. For plumes dominated by immiscible gas (e.g. metals or metallic oxides gasses trapped in a silica matrix), simple cooling of the gas eventually leads to supersaturation and condensation of new solid phases. These materials will reflect the conditions in the plume and thus provide the constraints searched for. Provided that the agglutinated aggregate is sufficiently rigid, the process results in an macroscopically empty vesicle, except that it hosts the new formed solids. The solids decorating the interior of these vesicles (plume-trapping vesicles) distinguish them from vesicles forming by gas exsolution from a melt.

Figure 1. Plume-trapping vesicle from Wabar impactite, cut surface. The smooth surface of the vesicle is decorated by metal condensate (white dots).