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DUSTER: collection of meteoric CaO and carbon smoke particles in the upper stratosphere

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Abstract.

Nanometer- to micrometer-size particles present in the upper stratosphere are a mixture of terrestrial and extra-terrestrial origins. They can be extraterrestrial particles condensed after meteor ablation. Meteoric dust in bolides is occasionally deposited into the lower stratosphere around 20 km altitude. Nanometer CaO and pure carbon smoke particles were collected at 38 km altitude in the upper stratosphere in the Arctic during June 2008 using DUSTER (Dust in the Upper Stratosphere Tracking Experiment and Retrieval), a balloon-borne instrument for the non-destructive collection of solid particles between 200 nm to 40 microns. We report the collection of micron sized CaCO_3 (calcite) grains. Their morphologies show evidence of melting and condensation after vaporization suggest at temperatures of approximately 3500 K. The formation environment of the collected grains was probably a dense dust cloud formed by the disintegration of a carbonaceous meteoroid during deceleration in the Earth atmosphere. For the first time, DUSTER collected meteor ablation products that were presumably associated with the disintegration of a bolide crossing the Earth's atmosphere. The collected mostly CaO and pure carbon nanoparticles from the debris cloud of a fireball, included: 1) intact fragments; 2) quenched melted grains; and 3) vapor phase condensation products.

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