Mem. S.A.It. Vol. 87, 210

Memorie della

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

V. Della Corte[1], F. J. M. Rietmeijer[2], A. Rotundi[3,1], M. Ferrari[1], and P. Palumbo[3,1]

[1] INAF-IAPS, Istituto di Astrofisica e Planetologia Spaziali, Area di Ricerca di Tor Vergata, Via Fosso del Cavaliere 100, 00133, Rome, Italy

[2] Department of Earth and Planetary Sciences, MSC03 2040, 1-University of New Mexico, Albuquerque, NM 87131-0001, USA

[3] Dip. Scienze e Tecnologie, Università degli Studi di Napoli "Parthenope", Centro Direzionale I C4 80143 Napoli, Italy

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.

Acknowledgements. The DUSTER project was funded by the Italian Space Agency (ASI), PRIN2008/MIUR (Ministero dell'Istruzione dell'Universitá e della Ricerca), PNRA 2013(Piano Nazionale Ricerca Antartide). CNES graciously provided this flight opportunity. We thank E. Zona and S. Inarta at the Laboratorio di Fisica Cosmica INAF, Osservatorio Astronomico di Capodimonte-Universitá di Napoli Parthenope. F.J.M.R. was supported by grant NNX07AI39G from the NASA Cosmochemistry Program. We thank three anonymous reviewers who assisted us in introducing our new instrument. Abbreviations