GLOBAL COMPOSITION OF COMETARY DUST PARTICLES FROM 67P/CHURYUMOV-GERASIMENKO AS DEDUCED FROM THE COSIMA/ROSETTA INSTRUMENT.

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Introduction: After a ten-year journey, the Rosetta spacecraft arrived at comet 67P/Churyumov-Gerasimenko (hereafter 67P) on August 6, 2014. The time-of-flight secondary ion mass spectrometer, COSIMA (COmetary Secondary Ion Mass Analyzer), was on board the Rosetta orbiter. During two years, the instrument allowed *in situ* analysis of the dust particles ejected from 67P, before and after the comet's perihelion [1,2]. COSIMA collected more than 35,000 cometary particles and fragments thereof [3], at a low impact velocity (< 10 m s^{-1} [4]), with size ranging from 14 µm (the internal microscope camera COSISCOPE has a 14 µm/pixel resolution) to 1000 µm and analyzed *in situ* about 250 of them (Fig. 1).

Results and Discussion: The whole set of particles analyzed by COSIMA, between September 2014 and June 2016, present similar mass spectra signatures, which constitute a specific fingerprint for 67P's dust (Fig. 2). Even if the observed signature variations reflect some compositional diversity among the particles, they are not correlated to their size, typology [5], date of collection or time interval between collection and measurements [6]. This signature indicates that, at the scale of ~ 40 µm (spatial resolution of the COSIMA ion beam), 67P dust particles are always a mixture of carbonaceous matter and mineral phases.

The global composition of 67P's dust, as deduced from COSIMA measurements, will be presented [6]. It will be compared to the *in situ* analyses of comet 1P/Halley, obtained by the Giotto and Vega missions [7,8], to the laboratory analyses on 81P/Wild 2 dust particles captured by the Stardust mission [9] and to the Chondritic Porous Interplanetary Dust Particles (CP-IDPs) collected in the stratosphere and thought to originate from comets [10].

The average elemental composition of 67P's dust has a high carbon content (atomic $\mathrm{C/Si} = 5.5^{+1.4}_{-1.2}$ on average) [6] close to the solar value and comparable to comet 1P/Halley's value [11]. COSIMA measurements show that the minerals phases are mostly anhydrous. We have estimated that the carbonaceous content is approximately 45 % in mass in 67P dust particles (Fig. 3). It shows that the macromolecular carbonaceous matter, previously identified as being the main carbon-bearing component of dust particles [12], is one of the main constituents of the non-volatile components of comet 67P's nucleus.

The whole composition, rich in carbon and non-hydrated minerals, points to a primitive matter that likely preserved its initial characteristics since the comet accretion in the outer regions of the protoplanetary disc.

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Wuppertal, Germany; von Hoerner und Sulger GmbH, Schwetzingen, Germany; the Universität der Bundeswehr, Neubiberg, Germany; the Institut für Physik, Forschungszentrum Seibersdorf, Seibersdorf, Austria; and the Institut für Weltraumforschung, Österreichische Akademie der Wissenschaften, Graz, Austria; and is led by the Max-Planck-Institut für Sonnensystemforschung, Göttingen, Germany. We acknowledge the support of the national funding agencies of Germany (DLR, grant 50 QP 1302), France (CNES), Austria, Finland and the ESA Technical Directorate. Rosetta is an ESA mission with contributions from its Member States and NASA.

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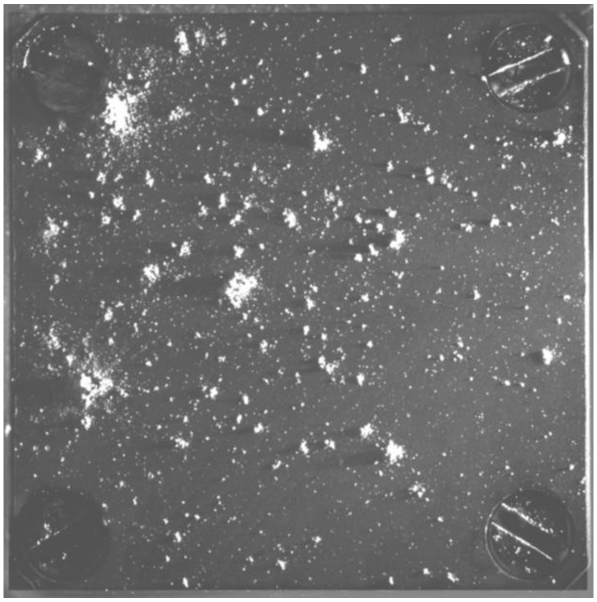

Fig. 1. A collecting target (10 mm x 10 mm) of the COSIMA instrument showing tiny fragments of the nucleus, up to a millimiter in size, having impacted it. Credit: ESA / Rosetta / MPS for COSIMA MPS / CSNSM Team / UNIBW / TUORLA / IWF / IAS / ESA / BUW / MPE / LPC2E / LCM / IMF / UTU / LISA / UOFC / vH & S.

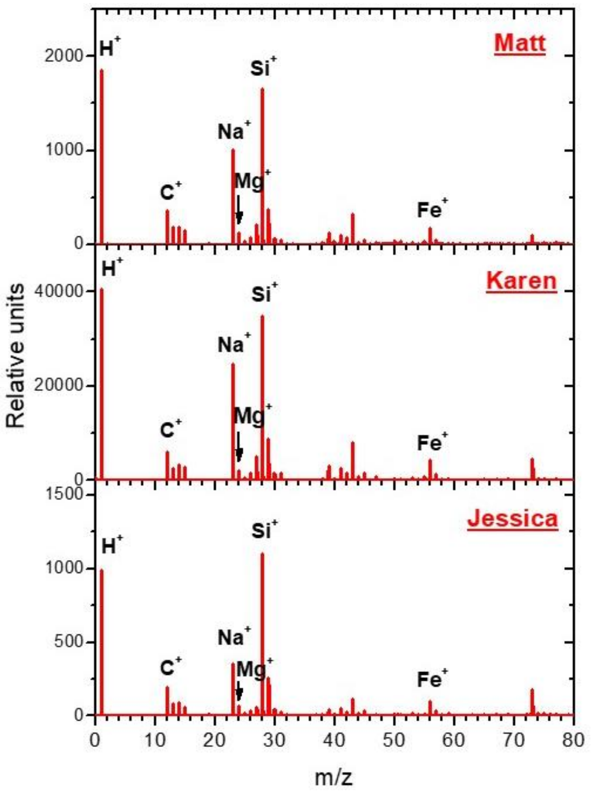

Fig. 2. Typical positive ion mass spectra of three dust particles (Matt, Karen and Jessica) from comet 67P. The spectra are obtained after data post-processing and displays the major quantified elements, C, Na, Mg, Si and Fe [6].

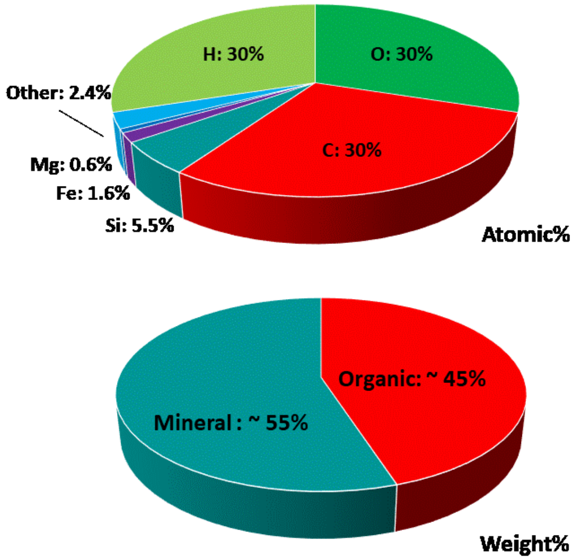

Fig. 3. Top panel: the average elemental composition of the dust particles of comet 67P. Lower panel: the average mass distribution of minerals and organic material in these particles [6].

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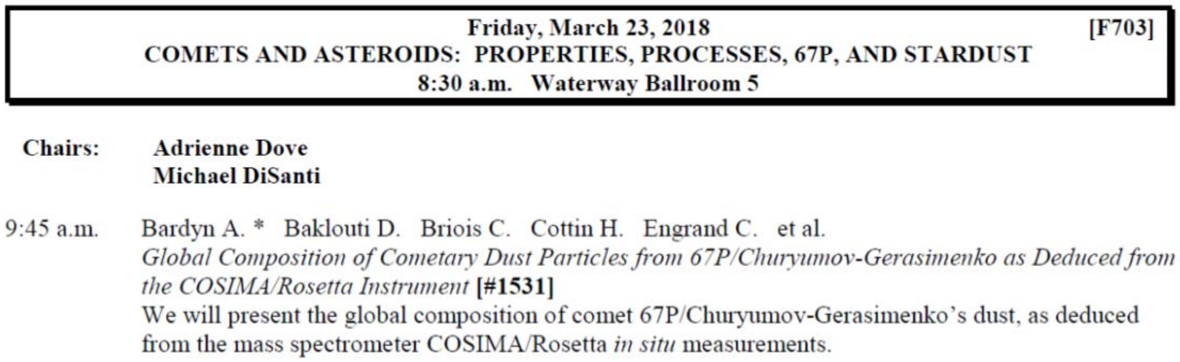

Friday, March 23, 2018 **[F703]**
COMETS AND ASTEROIDS: PROPERTIES, PROCESSES, 67P, AND STARDUST
8:30 a.m. Waterway Ballroom 5

Chairs: **Adrienne Dove**
Michael DiSanti

9:45 a.m. Bardyn A. * Baklouti D. Briois C. Cottin H. Engrand C. et al.
Global Composition of Cometary Dust Particles from 67P/Churyumov-Gerasimenko as Deduced from the COSIMA/Rosetta Instrument **[#1531]**
We will present the global composition of comet 67P/Churyumov-Gerasimenko's dust, as deduced from the mass spectrometer COSIMA/Rosetta *in situ* measurements.