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Recent Results on Cometary Dust by Rosetta/COSIMA

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1. Introduction

The Cometary Secondary Ion Mass Analyzer (COSIMA) was a dust analysing instrument on board the Rosetta spacecraft which orbited the comet 67P/Churyumov-Gerasimenko (here after 67P) for more than two years before landing on the nucleus and thus ending the mission. COSIMA collected dust particles from the inner coma of 67P on metal target plates, imaged them, and used its ToF-SIMS to probe their composition.

2. Dust physical properties and flux

The registered particles have sizes between 14μm (image resolution) and about 1 mm. Most break apart on hitting either the funnel during entry or the target plate and can be classified according to their structure [4]. The internal strength of these particles was found to be on the order of 10^3 Pa, with sub-units of 30-40 μm being more stable [3]. The pre-perihelion flux has been analysed in [5].
More recently, [6] analysed the size distribution of collected dust for the whole mission (Fig. 1).

3. Composition

The cometary dust is composed of partly organic and partly silicatic phases. [8] and [2] found many rock forming elements in the dust, and the these elements (with the noteable execptions of C and Si) show in their abundances some similarities with carbonaceous chondrites [9] (Fig. 2). For the organic phase, the spectral signature of the cometary organic matter is mostly present in the low mass range (Fig. 3). This is related to the presence of a complex organic matter which could present some similarities with the IOM

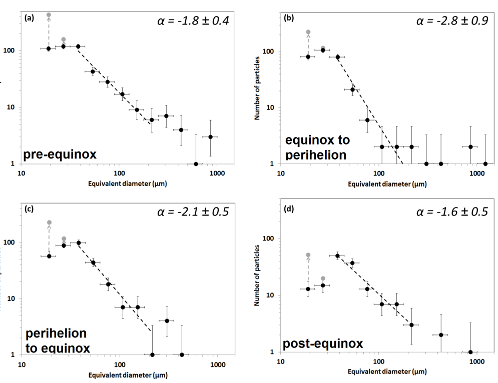

Figure 1: Distribution of collected particle size during different phases of the mission: Size distribution measured (a) between Aug. 2014 and the May 2015 equinox, (b) between the equinox and the perihelion, (c) between the perihelion and the Apr. 2016 equinox and (d) between Apr. 2016 and the end of Sept. 2016. The dashed lines are the best fits for the size distribution of the particles in the 30 μm to 150 μm size range. The corresponding cumulative power index is given in each panel. The grey dots indicate the number of particles adjusted for the estimated observational bias resulting from the detection method.

extracted from carbonaceous chondrites [1]. The isotopic ratio for oxygen shows VSMOW values within the uncertainties, see Fig. 4, [7].

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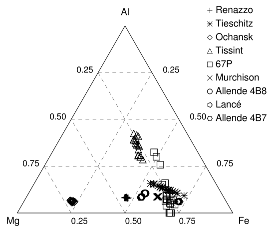

Figure 2: Ternary diagram of ion counts for the elements Mg, Fe and Al. Each data point marks the average abundance over a randomly chosen set of spectra from a specific sample.

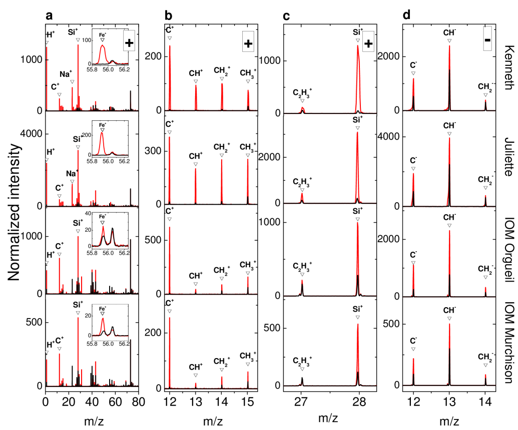

Figure 3: Mass spectra of cometary particles Keneth and Juliette (first and second row), and IOM from CI chondrites Orgueil and Murchison. Measurements on the target substrate and the sample are distinguished by the black and red color, respectively.

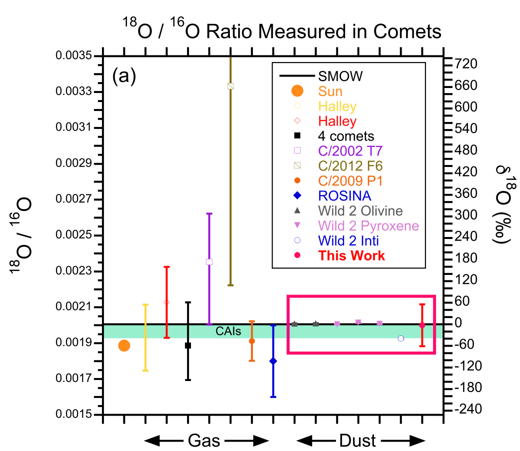

Figure 4: Oxygen isotop ratios for 67P dust compared with other measurements

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