Geophysical Research Abstracts
Vol. 21, EGU2019-2157, 2019
EGU General Assembly 2019

Oxygen Isotopes in H_2O in the Coma of Comet 67P / Churyumov-Gerasimenko measured with the Rosetta / ROSINA DFMS

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Using the ROSINA Double Focusing Mass Spectrometer (DFMS) on board the ESA spacecraft Rosetta, Hässig et al. (2016) previously determined the 16O / 18O ratio of CO_2 in the coma of the comet 67P / Churyumov-Gerasimenko to be 494 $\pm$ 8, which is consistent within 1-sigma uncertainty with the terrestrial value of 498.7 $\pm$ 0.1 measured by Baertschi (1976). The solar wind measured by McKeegan et al. (2011), on the other hand, exhibited 18O-depletion with its 16O / 18O ratio of 530 $\pm$ 2.

In contrast, the 16O / 18O ratio of H_2O in the coma of 67P was found to be 445 $\pm$ 35 by Schroeder et al. (2018) based on 3820 in-situ measurements of H2_16O / H2_18O and 16OH / 18OH that had also been performed with the DFMS, which represents an $\sim$ 11% enrichment of 18O compared with the terrestrial value. This is consistent with leading self-shielding models, which predict primordial water in comets to be between 5 $\sim$ 20 % more enriched in the heavier Oxygen isotopes than terrestrial water.

The 16O / 17O ratio, however, could not be easily determined due to the low signal from the H2_17O peak and its overlap with the much larger HDO peak. To obtain an estimate for the 16O / 17O ratio of H_2O in 67P's coma, the H2_17O peak had to be separated from that of HDO by manually fitting 35 DFMS mass spectra with equal-width Gaussians. These spectra were selected for their strong signal and had been acquired on dates close to either the inbound or outbound equinoxes of 67P in May 2015 and March 2016 respectively. The average 16O / 17O ratio thus found was 2182 $\pm$ 170, an $\sim$ 17% enrichment of 17O compared with the terrestrial 2632 $\pm$ 69.