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Hydrogen halides at Comet 67P/Churyumov-Gerasimenko as detected by ROSINA-DFMS

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The Rosetta spacecraft has been studying the coma of comet 67P/Churyumov-Gerasimenko (67P/C-G) in-situ from the comet encounter in August 2014 up to end of mission in September 2016. The Rosetta Orbiter Spectrometer for Ion and Neutral Analysis (ROSINA) contains a double focussing mass spectrometer (DFMS) with a mass range 13–140 u/e. It is optimized for high mass resolution and large dynamic range for the chemical and isotopic characterization of the volatiles in the coma. Since comets retained information about the physical and chemical conditions of the protoplanetary disk from which they formed, they may provide insights into the halogen chemistry in the early Solar System.

We have studied the halogen-bearing compounds in the coma with DFMS on 67P/C-G's inbound journey during four periods, as the gas production increased towards perihelion and as the comet's subsolar latitude moved from the northern to the southern hemisphere: (A) when Rosetta was close to the comet, during 1–31/10/2014, at 3.0–3.3 AU, (B) during the close flybys on 14/2/2015 and on 28/3/2015 at 2.3 AU and 2.0 AU, (C) post-equinox between 10/5/2015 and 1/6/2015, at 1.5–1.7 AU, and (D) around perihelion between 9/7/2015 and 31/8/2015, at 1.24–1.31 AU.

The main halogen-bearing compounds in the comet atmosphere were found to be the hydrogen halides HF (hydrogen fluoride), HCl (hydrogen chloride) and HBr (hydrogen bromide). HF and HCl could be observed during all four periods, while hydrogen bromide could, due to its low abundance, only be detected during period A, when Rosetta was close to the comet. An increase in the halogen-to-oxygen ratio as a function of distance was observed which suggests a distributed source for HF and HCl, probably through progressive release of these compounds from grains.

This contribution will address the abundance and variability of the hydrogen halides in the coma as well as the cometary isotopic ratios for 37Cl/35Cl and 81Br/79Br.