A Comparison of Oxidized Carbon Abundances among Comets. M. A. DiSanti[1], M. J. Mumma[1], B. P. Bonev[1,2], G. L. Villanueva[1,3], Y. L. Radeva[1], W. M. Anderson[1], K. Magee-Sauer[4], E. L. Gibb[5] [1]NASA-Goddard Space Flight Center, Greenbelt, MD USA, [2]Catholic University of America, Washington, DC USA, [3]NASA Post-doctoral Fellowship Program, [4]Rowan University, Glassboro, NJ USA, [5]U. Missouri-St. Louis, St. Louis, MO USA.

Comets contain relatively primitive icy material remaining from the epoch of Solar System formation, however the extent to which they are modified from their initial state remains a fundamental question in cometary science. One means of assessing the degree to which ices were processed prior to their incorporation into the nucleus is to measure the relative abundances of chemically related parent volatiles. For example, formation of C_2H_6 by hydrogen atom addition (e.g., to C_2H_2) on surfaces of icy-mantled grains prior to their incorporation into the nucleus was proposed to explain the high C_2H_6 to CH_4 abundance observed first in C/1996 B2 (Hyakutake) [1]. The large abundance ratios C_2H_6/CH_4 observed universally in comets since Hyakutake establishes H-atom addition as an important and likely ubiquitous process. Comparing C_2H_6/C_2H_2 among comets can provide information on the efficiency of this process.

CO should also be hydrogenated on grain surfaces. Laboratory irradiation experiments on interstellar ice analogs have shown this to require very low temperatures, the resulting yields of H_2CO and CH_3OH being highly dependent both on hydrogen density (i.e., fluence) and on temperature in the range ~10-25 K [2], [3]. The relative abundances of these three chemically-related molecules in comets provides one measure of the efficiency of H-atom addition to CO on precometary grains.

Here, we compare the oxidation sequence of carbon in eight comets observed with modern near-infrared echelle spectrometers. The small pixels and high spatial resolution delivered by such instruments (1 arcsecond or less) favor the detection of native ices (i.e., those housed in the nucleus). We use our measured native abundances of CO, H_2CO, and CH_3OH to assess the efficiency of H-atom addition, which our results suggest may vary by more than a factor of two among comets in our database. We will discuss possible implications regarding formation conditions.

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