

Connecting the Dots - Between Interior Composition and Activity of Comets

Murthy S. Gudipati

Science Division, Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109, USA.

All the data we have so far about a comet's bulk composition is from the cometary outgassing – whether atomic, molecular, or particulate. Surface chemical composition is more certain now than the physical properties on the upper tens of centimeters to several meters of the crust. Below this “more thermally processed crust” it is expected that comets pristine/primordial material is kept unaltered for billions of years. Thus, the chemical composition and physical state of the nucleus plays critical role on the outgassing properties of comets.

The term “pristine/primordial” is also somewhat vague, as we still have very little understanding of how cometary nucleus is formed from a few micron-sized interstellar ice grains to millimeter-size protoplanetary disk grains to meters-to-kilometers icy bodies that became Kuiper Belt Objects, Centaurs, and subsequently Comets. If the ice grains from interstellar stage are evaporated and recondensed during the protoplanetary stage into millimeter-size grains the primordial nature starts from there onwards. If not, primordial material in comets can be traced all the way back to interstellar ice grains, which are far better understood.

Assuming that the ice grains of interstellar stage are unaltered, I will discuss what a comet's interior composition could be and how the Rosetta observations could be rationalized and where the potential disagreements could be.

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