Characterization of complex organic matter obtained by implantation of sulfur into water ice with propane: implications for Europa

We report the result of experiments of sulfur ion implantation into water: propane ices at 80K, including an analysis by Ultra High Resolution Mass Spectrometry of the resulting organic refractory matter. Organic compounds on the surface of Europa, coming from the internal ocean or exogenous input, would be processed by the heavy flux of energetic particles, including sulfur ions, coming from Jupiter's magnetosphere. We find our experiment produced a varied and complex organic matter (several thousand unique formulas), including both aliphatic and aromatic compounds, and a small minority of sulfur bearing organics. The dose used in our experiment corresponds to a geologically short time on the surface of Europa, counted in years to thousands of years, thereby showing the potential for quick alteration of any organic matter that would reach the surface. Our results have implications for the type of organic matter that could be observed on the surface by the JUICE and Europa Clipper space missions.