Properties of organic haze particles produced in simulated early Earth atmospheres

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Photochemistry in the atmosphere of the early Earth may have led to the formation of complex organic molecules, similar to those observed in the haze layer on Saturn's moon Titan. With a mildly reducing atmosphere, the balance between trace gases such as CH_4 and CO_2 may have had a considerable effect on the chemical and physical properties of the aerosols formed by these organic products. A haze layer on the early Earth would

have had significant implications for the evolution of the planet's atmosphere and emerging life on its surface. Despite the implications of such a haze layer, there have been few laboratory studies of the organic material produced under possible early Earth conditions. We have developed a method by which we can analyze the aerosol products in real time, using an Aerosol Mass Spectrometer (AMS) to study the chemical composition and size of particles as a function of trace gas composition. We use a deuterium lamp with a spectral range from 115 - 400 nm to produce particles from gaseous mixtures of $CH_4/CO_2/N_2$, thus simulating the low ultraviolet wavelengths available to the early Earth's atmosphere. Ongoing studies explore the chemical and physical properties of these aerosols as function of C/O ratio as well as other experimental parameters such as temperature and total pressure. Additional instruments are used in conjunction with the AMS to give complementary information about the morphology of these haze particles. The properties of the haze aerosols formed using the UV lamp are also compared to those from previous studies using an electrical discharge source.