Geophysical Research Abstracts,
Vol. 11, EGU2009-12013, 2009
EGU General Assembly 2009

Sodium Salts in Ice Grains from Enceladus' Plumes: Probes of a Subsurface Ocean

F. Postberg (1,2), S. Kempf (1,3), J. Schmidt (4), N. Brillantov (5,6), B. Abel (7,8), A. Beinsen (7), U. Buck (9), and R. Srama (2)

(1) Max Planck Institut für Kernphysik, Heidelberg, Germany (Frank.Postberg@mpi-hd.mpg.de), (2) Institut für Geowissenschaften, Universität Heidelberg, Germany, (3) IGEP, Universität Braunschweig, Dermany, (4) Nichtlineare Dynamik, Universität Potsdam, Gemany, (5) Department of Physics, Moscow State University, Russia, (6) Department of Mathematics, University of Leicester, UK, (7) Institut für Physikalische Chemie, Universität Göttingen, Germany, (8) Wilhelm Oswald Institut für Physikalische und Theoretische Chemie, Universität Leipzig, Germany, (9) Max Planck Institut für Dynamik und Selbstorganisation, Göttingen, Germany

One key requirement for the formation of life precursors on Enceladus, is liquid water below its icy surface. Although measurements and model calculations for Enceladus plume source suggest temperatures close to the melting point, direct evidence for liquid water has not been produced so far. We present compositional measurements by Cassini's dust detector of ice particles emitted from Saturn's cryo-volcanic moon Enceladus into the E ring. Since sodium is considered as crucial indicator for an Enceladus ocean, our detection of sodium salts within the grains provide the first evidence for mineral enriched liquid water below the moon's icy surface.

In nearly all particles detected in situ by the Cosmic Dust Analyser (CDA) aboard the Cassini spacecraft, we found sodium (Na) in varying concentrations. Most spectra also show potassium (K) in lower abundance. In mass spectra that are particularly sodium rich, sodium salts (like NaCl and NaHCO3) are identified as Na bearing components. This is only possible if the plume source is liquid water that is or has been in contact with the rocky material of Enceladus' core. The abundance of minerals as well as the inferred basic pH value of those grains exhibit a compelling similarity with the predicted composition of an Enceladus ocean. The Na-rich ice particles likely are frozen ocean droplets expelled through the plumes into the E ring.

From the compositional analysis, models for grain production and ejection can be derived which give new insights in plume dynamics and subsurface processes. They also allow the refinement of models for a water-rock-interaction at the bottom of the liquid layer.