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CONTROL ID: 1476034 **TITLE:** Hydrocarbons on Phoebe, Iapetus, and Hyperion: Quantitative Analysis
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ABSTRACT BODY: We present a quantitative analysis of the hydrocarbon spectral bands measured on three of Saturn's satellites, Phoebe, Iapetus, and Hyperion. These bands, measured with the Cassini Visible-Infrared Mapping Spectrometer on close fly-bys of these satellites, are the C-H stretching modes of aromatic hydrocarbons at ~3.28 μm (~3050 cm-1), and the are four blended bands of aliphatic -CH2- and -CH3 in the range ~3.36-3.52 μm (~2980-2840 cm-1). In these data, the aromatic band, probably indicating the presence of polycyclic aromatic hydrocarbons (PAH), is unusually strong in comparison to the aliphatic bands, resulting in a unique signature among Solar System bodies measured so far, and as such offers a means of comparison among the three satellites. The ratio of the C-H bands in aromatic molecules to those in aliphatic molecules in the surface materials of Phoebe, NAro:NAliph ~24; for Hyperion the value is ~12, while Iapetus shows an intermediate value. In view of the trend of the evolution (dehydrogenation by heat and radiation) of aliphatic complexes toward more compact molecules and eventually to aromatics, the relative abundances of aliphatic -CH2- and -CH3- is an indication of the lengths of the molecular chain structures, hence the degree of modification of the original material. We derive CH2:CH3 ~2.2 in the spectrum of low-albedo material on Iapetus; this value is the same within measurement errors to the ratio in the diffuse interstellar medium. The similarity in the spectral signatures of the three satellites, plus the apparent weak trend of aromatic/aliphatic abundance from Phoebe to Hyperion, is consistent with, and effectively confirms that the source of the hydrocarbon-bearing material is Phoebe, and that the appearance of that material on the other two satellites arises from the deposition of the inward-spiraling dust that populates the Phoebe ring.

KEYWORDS: [5470] PLANETARY SCIENCES: SOLID SURFACE PLANETS / Surface materials and properties, [5422] PLANETARY SCIENCES: SOLID SURFACE PLANETS / Ices, [5215] PLANETARY SCIENCES: ASTROBIOLOGY / Origin of life, [6280] PLANETARY SCIENCES: SOLAR SYSTEM OBJECTS / Saturnian satellites. (No Image Selected) (No Table Selected) **SPONSOR NAME:** Dale Cruikshank

<u>Additional Details</u> **Previously Presented Material:** A paper of the same content and authorship has been submitted to the annual meeting of the Division for Planetary Sciences, American Astronomical Society, October, 2012, but has not yet been accepted, rejected, or scheduled.
A paper presenting a portion of this work has been submitted to Icarus and is
currently in revision after the first review comments were received. Cruikshank presented a portion of this material at a workshop at UCLA, and Pendleton presented a portion of this material at the NASA Astrobiology Science Conference in Atlanta, GA.

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