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Titan and Earth: Sisters or Strangers?

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As the only other world in our solar system with a nitrogen-dominated atmosphere, Titan naturally invites comparisons with Earth. One obvious similarity is the highly non-solar ratio of nitrogen to noble gases; but on Titan this ratio is over 1000 times greater than it is on Earth. The reason(s) for this difference will become apparent as we evaluate abundances and isotope ratios of these constituents, which should be measured by the Huygens GCMS in January 2005, and reported at this meeting. On Earth, most of the carbon that is missing from the atmosphere is now in the form of CO2 bound up in carbonate rocks. On Titan, we find CH4 instead of CO2, and this gas must have a source that replenishes the atmosphere even today, allowing carbon to avoid the isotopic fractionation we find in nitrogen and oxygen. Instead of carbonate rocks on Titan, we expect the deposited carbon to be a mixture of liquid hydrocarbons and precipitated aerosols on the surface, producing mud, slush, swamps and perhaps occasional lakes, all highly flammable. Formation of methane in Ti- tans interior is an attractive hypothesis, testable by accurate values of D/H in Titans H2O. What is the source of methane and how does the gas reach the atmosphere?

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