transformed into (a) genetically customized and self-designed successors, (b) totally mechanized forms, or (c) other entities that replace their organic predecessors over a brief geological time scale. Life on Earth will likely provide the answer within the coming millennium.

247. The Effect of Impact Gardening and Impact-Induced Pyrolysis on the Concentration of Organic Molecules on Mars

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The Viking landers were both equipped with instruments capable of detecting organic molecules down to a level of a few parts per billion. Neither lander detected any organic signature at all, resulting in the conclusion that the Martian surface is hostile to organic molecules. New research indicates that Viking may not have been able to detect the type of organic molecule expected at the surface, calling the above conclusion into question.

Each year, an estimated 2.5×10^5 kg of organic material (principally as kerogens) reaches Mars, delivered via interplanetary dust and other particles smaller than 1 mm in diameter. An estimated 10% of this material could survive as metastable decay products. The concentration of organics depends on the rate of accumulation vs. the rate of destruction and/or mixing to depth. The current estimate for the rate of accumulation (given above) is based on the flux of such particles at Earth, then scaled to Mars. The rate of destruction is very poorly constrained at present.

This research attempts to quantify through numerical simulations the effects on concentration of both mixing organics to depth by impact gardening as well as the destruction of organic molecules by impact-induced heating. From these models, we conclude that while mixing plays an incredibly important role, destruction of organic molecules due to impacts *is not* a significant factor in determining concentration. It is important to note that these results represent a global average and that local variations are expected.

254. The Lewis and Clark Fund for Exploration and Field Research in Astrobiology

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The American Philosophical Society (APS), the oldest learned society in North America, was the scientific sponsor of Lewis and Clark's Corps of Discovery in 1804. This spirit of exploration continues today, and nowhere is it more visible than in the vision and efforts of the National Aeronautics and Space Administration (NASA). The American Philosophical Society and the NASA Astrobiology Institute (NAI) have, therefore, partnered to promote the continued exploration of the world around us through a new program of research grants in support of astrobiological field studies undertaken by graduate students and junior scientists less than 5 years beyond their Ph.D. Astrobiologists, whether members of the NAI or not, are encouraged to apply

The Lewis and Clark Fund for Exploration and Field Research in Astrobiology is open to field studies in any area of interest to astrobiology. Grants may be used for travel and related expenses, including field equipment, up to $5,000. Applications will be reviewed by a committee that includes members of the NAI, the APS, and the wider science community as needed. Recipients will be designated as Lewis and Clark Field Scholars in Astrobiology.

Additional information, including application forms and instructions, is available at: http://www.amphilsoc.org/grants/astrobiology.htm

266. Thermodynamic Modeling of Methane Production by Metamorphic Serpentinization at 0.2–5 kb and 300–600°C: Implications for Archean Atmospheric Evolution and Subduction Fluid Composition

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Abiotic methanogenesis during metamorphism of ultramafic rocks involving a CO_2-bearing fluid may have played an important role in the evolution of Earth's prebiotic atmosphere. Although many studies focus on the role of oceanic hydrothermal systems, abiotic methanogenesis would likely have accompanied metamorphic fluid-rock interaction in olivine-rich rocks in many Archean crustal environments, including contact, low-grade regional, and subduction-zone metamorphism. To evaluate quantitatively the conditions and productivity of abiotic methanogenesis, we present a series of P-T diagrams contoured for fO_2 and fluid composition. We employ an equilibrium thermodynamic model in which fO_2 is buffered by Fe-bearing olivine, magnetite, and a hydrous ultramafic silicate. We assume ideal solution in all Fe+Mg bearing phases. Our results suggest that serpentinization stabilizes methane-dominant fluids at all calculated pressures (0.2–5 kb) to roughly 50°C higher than the forsterite+water = antigorite+brucite equilibrium. For a C-bearing fluid on an Archean oceanic geotherm, this leads to a "metamorphic methane window" of 300–350°C at ~1 kbar. Once formed, methane is effectively inert, and can be quantitatively degassed to the atmosphere. Given the common occurrence of komatiites in the Archean, their contact and regional metamorphism may have provided important source for atmospheric methane. Similarly, Archean subduction would lead to abiotic methanogenesis in the shallow mantle. Because of the comparatively large volume of ultramafic material in the crust and mantle, its metamorphism could be a larger methane source than methanogenesis by microbes or oceanic hydrothermal systems.

274. Raman Spectroscopic Characterization of the Thermal History of Permineralized Fossils

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The thermal alteration of kerogen in shales has been studied intensively over the years mainly by those interested in the thermal history and oil potential of these rock units. This process has not, however, been as thoroughly studied in kerogen preserved in permineralized rocks. Permineralization, the process by which petrified trees are produced, is also an important mode of fossilization for Precambrian microbes. It is therefore of much interest to those searching for evidence of ancient life on Earth and elsewhere.

Permineralized fern fossils from two Eocene-aged localities have been analyzed using UV Raman spectroscopy and shown to differ significantly in their levels of thermal alteration. A modern fern species was used as a proxy for the initial state of the fossilized organic matter. Raman analyses were also performed on thermally altered modern ferns in order to determine the sequence of natural degradation steps taken by the fossils. The sequence progresses smoothly with increasing temperature and time of exposure to this heat. These changes reflect the early stages of the degradation of fossilized organic matter. When such data are combined with those from previous studies of more mature permineralized kerogen (e.g., Precambrian microfossils), a more complete understanding of this important mode of fossilization can be attained.

276. Analysis of CO Emission in Comet C/2002 T7 (LINEAR) from Infrared Observations

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Cometary nuclei are the most primitive remnants of the early Solar System. Their physical and chemical attributes allow a glimpse into the conditions in which icy bodies formed. Only in recent years has it been possible to routinely study parent volatiles at infrared wavelengths. A significant variation in composition among ten comets sampled to date has been demonstrated, and this forms the foundation of a new cometary taxonomy based on chemistry.

In spring 2004, we observed comet C/2002 T7 (LINEAR) using the facility echelle spectrometer (CSHELL) at the NASA Infrared Telescope Facility on Mauna Kea, Hawaii. CSHELL offers seeing-limited spatial resolution and sufficiently high spectral resolving power ($R \sim 2.5 \times 10^4$) to permit line-by-line intensities to be measured along its 30 arcsecond-long slit. Emission lines from multiple molecular species were targeted in the 3–5 micron spectral region, and our observations revealed an extremely rich chemistry in comet T7. Here we present production rates, mixing ratios, and rotational temperatures for CO spanning UT May 3–9 2004 and May 30–June 2 2004, based on analysis of lines in the R and P branches of the $v = 1 - 0$ fundamental ro-vibrational band near 4.7 microns. Through comparison with abundances of other oxygen-bearing molecules, specifically formaldehyde (H_2CO) and methyl alcohol (CH_3OH), potential implications for the comet's volatile carbon-oxygen history will be discussed. The prospects for using results of laboratory ice irradiation experiments, as a comparative to our cometary observations will also be explored.This research is supported by the NASA Astrobiology Program (RTOP 344-53-51), and by the NASA Planetary Astronomy Program (RTOP 344-32-98).