ments, including the $\Delta^{33}S$–$\delta^{34}S$ relationships of Archean sulfides and the $\Delta^{33}S$–$\Delta^{36}S$ relationships of 1,650–500 Ma sulfides and sulfates. Furthermore, our recent discovery of the absence (or minor presence) of MIF-S in several major Archean sedimentary formations (~3.5–~2.7 Ga in age) suggests that MIF-S signatures in sedimentary rocks may have been created by non-photochemical reactions.

We have conducted detailed mineralogical and geochemical investigations on the same sedimentary rock samples that we and previous investigators analyzed for MIF-S and found that the shale samples with strong MIF-signatures ($\Delta^{33}S > \pm 1‰$) generally have: (a) highly matured (altered) kerogen with H/C ratios <0.1; (b) high concentrations of organic C (>~2 wt% today; >~6 wt% in the original sediments); (c) an abundance of iron oxides and carbonates; and (d) strong hydrothermal alteration signatures (e.g., Zn and/or Cu enrichment). In contrast, one or more of these characteristics are absent in samples with no MIF signature. These data suggest that MIF-S signatures may have been created during the early diagenesis of very organic-rich sediments by reactions involving a variety of sulfur-bearing aqueous and solid compounds, iron-bearing minerals, and organic matter.

381. The Science of the Lunar Polar Volatile Deposits

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The Moon possesses an extremely small tilt of its rotation axis relative to the plane of its orbit. Near the poles impact craters and other topographic lows are permanently shaded from the Sun. While lunar polar temperatures have not yet been directly measured, thermal models show maximum surface temperatures of 40 kelvins are likely common, and 25 kelvins is possible, potentially allowing cold trapping of volatiles. There are many potential sources of lunar polar volatiles. These include solar wind hydrogen—with abundances enhanced by slow diffusion through cold lunar mineral grains, comets, wet asteroids, IDPs, interstellar molecular clouds, the Earth and the Moon itself. Emplacement mechanisms are direct impact into the poles, and ballistic random walk of molecules with trapping prior to escape. Loss mechanisms are dominated by Lyman alpha ultraviolet radiation and micrometeorite vaporization and remobilization. Preservation mechanisms are thermal diffusion into the regolith where temperatures and diffusivities permit, burial by macrometeorite impact, and chemical processing to hydrated minerals or organics. This zoo of sources and processes suggests a complex and highly interesting volatile deposit at the poles regardless of its economic merits. Landed experiments that sample the polar regolith in various ways are virtually certain to yield interesting results, and may yield insights into the volatile history of the Earth-Moon system.

382. Observations of Hydrocarbons in Circumstellar Disks

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Astronomical observations of circumstellar disks are one of the few ways of tracking coagulation, collisions, and chemistry in protoplanetary disks—the processes that take the raw materials of the interstellar medium and turn them into planets. Polycyclic aromatic hydrocarbons (PAHs) comprise the primary visible form of organic matter in disks; silicates, however, are the most abundantly observed disk constituents. We will assess the importance of organics in three particular disks at a range of evolutionary states.

Mid-infrared (8–13 micron) spectra were taken at with ground-based telescopes of: HD 34700, a <1 Myr old T Tauri binary star, HD 141569, a 5 Myr old star in the process of clearing its gas and dust, and BD +20 307, a >300 Myr old star with a debris disk. The younger disks appear dominated by PAH line emission, making them unusual compared to the majority of young disks which show silicates. In both cases, the disks are also spatially resolved. We will discuss the evolutionary paths that might have led to their "peculiar" compositions. The old disk is dominated by very small silicate grains located at ~1 AU from the star, making it unusual compared to the majority of older systems which contain only large grains. Spitzer space telescope spectra with greater sensitivity and a wider range of wavelengths will be obtained by the time of the meeting and will be used to search for PAH emission in the old debris disk.

386. Cyanobacterial Biomarker Lipids in Hypersaline Microbial Mats and Environmental Adaptation

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Defining the functional role of microbial lipids and the consequence of membrane modulation in response to environmental adaptation can provide valuable information