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Decomposition of Organic Compounds by Atacama Desert Soils and on Mars

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We report the results of laboratory simulations of the Viking labeled release (LR) experiments that examine the degradation kinetics of organic substrates using Atacama soils as Mars analogs. In the Viking LR experiments, radioactive gas evolution was monitored after the addition of a 14C-labeled aqueous organic substrate into a sealed test cell that contained a martian surface sample [1]. In the LR experiments, a rapid release of labeled carbon dioxide (attributed to a thermally labile oxidant) was observed. This was followed by a slower log-linear release of carbon dioxide observed after the first oxidative reaction ceased. We find that the kinetics of decomposition of organic substrates by the Atacama soil samples differs from the LR results. However, overtime the overall rate of organic decomposition by some Atacama soils exceeds the rate of decomposition seen in the Viking LR experiments. These results suggest that when wetted, these Atacama samples can be a more active catalyst for organic chemical decomposition than the Viking surface samples. Atacama soil deposits can contain highly oxidizing species (including iodates, chromates, and perchlorate) which are likely formed by photochemical reactions at the soil/atmosphere interface, analogous to the possible photochemical origin of martian oxidants. Due to differences in water availability, solar flux, soil composition, and atmospheric composition, specific mechanisms and reaction products may differ, but it appears that similar photochemical processes may be occurring both in the Atacama and on Mars.

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References: [1] Levin G. V. and Straat P.A. (1977) JGR, 82, 4663-4667.