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RE-QUESTIONING THE EXISTENCE OF ORGANICS ON MARS?

Abstract

Organics are expected to exist on Mars based on meteorite infall, in situ production, and any possible biological sources. Yet they have not been detected on the martian surface; are they there, or are we not capable enough to detect them? The Viking gas chromatograph–mass spectrometer did not detect organics in the headspace of heated soil samples with a detection limit of parts per billion. This null result strongly influenced the interpretation of the reactivity seen in the Viking biology experiments and led to the conclusion that life was not present and, instead, that there was some chemical reactivity in the soil. The detection of perchlorates in the martian soil by instruments on the Phoenix lander and the reports of methane in the martian atmosphere suggest that it may be time to reconsider the question of organics. The high-temperature oxidizing properties of perchlorate will promote combustion of organics in pyrolytic experiments and may have affected the ability of both Phoenix's organic analysis experiment and the Viking mass spectrometer experiments to detect organics. So the question of organics on Mars remains open. A primary focus of the ongoing Mars Science Laboratory will be the detection and identification of organic molecules by means of thermal volatilization, followed by gas chromatography–mass spectrometry—as was done on Viking. However, to enhance organic detectability, some of the samples will be processed with liquid derivatization agents that will dissolve organics from the soil before pyrolysis, which may separate them from the soil perchlorates. Nonetheless, the problem of organics on Mars is not solved, and for future missions other organic detection techniques should therefore be considered as well.