

DETECTION OF METHANE IN THE MARTIAN ATMOSPHERE: EVIDENCE FOR LIFE

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Using the Fourier Transform Spectrometer at the Canada-France-Hawaii Telescope, we observed a spectrum of Mars at the P-branch of the strongest CH₄ band at 3.3 μm with resolving power of 220,000. Summing up the spectral intervals at the expected positions of 18 strongest Doppler-shifted martian lines, we detected the absorption by martian methane at a 3.9 sigma level. The observed CH₄ mixing ratio is 11 ± 4 ppb. Total photochemical loss of CH₄ in the martian atmosphere is equal to 1.8 × 10⁵ cm⁻² s⁻¹, and the CH₄ lifetime is 440 years. Heterogeneous loss of atmospheric methane is probably negligible, while the sink of CH₄ during its diffusion through the regolith may be significant. There are no processes of CH₄ formation in the atmosphere, so the photochemical loss must therefore be balanced by abiogenic and biogenic sources. The mantle outgassing of CH₄ is 4000 cm⁻² s⁻¹ on the Earth and smaller by an order of magnitude on Mars. The calculated production of CH₄ by cometary impacts is 2.3 per cent of the methane loss. Methane cannot originate from an extinct biosphere, as in the case of “natural gas” on Earth, given the exceedingly low limits on organic matter set by the Viking landers and the dry recent history which has been extremely hostile to the macroscopic life needed to generate the gas. Therefore, methanogenesis by living subterranean organisms is the most likely explanation for this discovery. Our estimates of the biomass and its production using the measured CH₄ abundance show that the martian biota may be extremely scarce and Mars may be generally sterile except for some oases.