Laboratory spectral constraints on the composition and origin of Phobos: Reconciling the Vis-NIR/Mid-IR contradictions

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The origin and compositional makeup of Phobos, the larger and innermost satellite of Mars, remains uncertain. Phobos will be targeted by the Mars Moon eXplorer mission currently scheduled for a 2024 launch. In preparation for the upcoming exploration of Phobos, we have undertaken an investigation of various proposed spectral and compositional analogues of Phobos surface material. Fundamentally, Phobos presents a contradiction in that at visible and near-infrared wavelengths, Phobos is spectrally similar to D-type asteroids –possibly represented by meteorites like Tagish Lake –but at longer wavelengths, Phobos is more consistent with anhydrous silicate mixtures similar to basalts. Each wavelength range is therefore suggestive of different formation mechanisms: gravitational capture versus reaccretion of Martian ejecta. By investigating mixtures of various analogue materials, we are attempting to determine if any plausible mixtures of known components such as Martian regolith breccia, Tagish Lake carbonaceous chondrite, or their constituent phases, can reproduce the spectrum of Phobos over both the visible-near infrared and mid-infrared wavelength ranges.

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