

The Colorado Plateau of Mars: Layered Sedimentary Rocks of North Terra Meridiani

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The upper crust of Mars is layered. The layers are seen mostly in crater and trough walls. Terra Meridiani is exceptional, with regional-scale outcrops covering at least 300,000 km², an area larger than the Colorado Plateau (~260,000 km²). Hundreds of Mars Global Surveyor (MGS) Mars Orbiter Camera 1.5-6 m/pixel images were targeted to document the physical, geologic, and geomorphic properties of layered outcrops in Terra Meridiani and SW Arabia (9°N-3°S, 10°W-9°E). The layers have differing physical properties: when eroded, some produce mesas, buttes, and cliffs; they can have differing albedos; they have mappable stratigraphic relations; and some have characteristic, erosional geomorphic expressions identifiable throughout the region (marker beds). The bedding is essentially horizontal, individual layers can be up to 10s of meters thick; groupings of similar layers can be > 200 m thick. Unconformities, marking periods of erosion/non-deposition, are recognized by buried and partly exhumed impact craters ranging in diameter from ~0.1 km to > 30 km. A 1989 thermal infrared Phobos 2 Termoscan image shows the layering and that the outcrops are colder than their surroundings at mid-day. Their thermal inertia, from MGS Thermal Emission Spectrometer data, is 410-490 J m⁻² K⁻¹ s^{-0.5}, values indicating coarse/very coarse sand if the materials are unconsolidated (they are not), or solid, indurated material with a patchy, thin covering of eolian debris and/or a thin regolith of outcrop weathering products. The layered materials are sedimentary, and they are rock. Large craters (10-30 km dia.) being exhumed from within the layered units have within them 10s to 100s of thin, uniform beds; these suggest the depositional environment inside was different from outside the craters. Observations in SW Arabia show that very large craters (> 100 km dia.) may have once been buried and later exhumed. The thinly-bedded layers in these craters may be reworked sediment derived from intercrater layered material that once lay topographically and stratigraphically above the crater rims. The hematite in central Terra Meridiani observed by TES is part of a mantle that overlies previously-eroded light-toned layered rock.