A Proposed Landing Site for the 2001 Lander in a Hematite-Rich Region in Sinus Meridiani. Philip R. Christensen, Joshua Bandfield, Victoria Hamilton, and Steven Ruff, Arizona State University, Tempe, AZ 85284, Richard Morris and Melissa Lane, Johnson Space Center, Houston, TX, Michael Malin and Kenneth Edgett, Malin Space Science Systems, San Diego, CA, and the TES Science Team.

The Thermal Emission Spectrometer (TES) instrument on the Mars Global Surveyor (MGS) mission has identified an accumulation of crystalline hematite (α-Fe_2O_3) that covers an area with very sharp boundaries approximately 350 by 350-750 km in size centered near 2°S latitude between 0 and 5° W longitude (Sinus Meridiani) [*Christensen et al.*, submitted]. The depth and shape of the hematite fundamental bands in the TES spectra show that the hematite is relatively coarse grained (>5-10 µm). The spectrally-derived areal abundance of hematite varies with particle size from ~10% for particles >30 µm in diameter to 40-60% for unpacked 10 µm powders [*Christensen et al.*, submitted]. The hematite in Sinus Meridiani is thus distinct from the fine-grained (diameter <5-10 µm), red, crystalline hematite considered, on the basis of visible and near-IR data, to be a minor spectral component in Martian bright regions.

A map of the hematite index has been constructed using TES data from 11 orbits, including the six in which hematite was detected and five orbits that passed nearby that showed no evidence of hematite. The boundaries of the hematite-rich region are sharp at spatial scales of ~10 km. Within this region there are spatial variations in spectral band depth of a factor of two to three. At the present time the hematite-rich region has not been completely mapped. However, by using the bounding orbits to the east and west in which hematite was not detected, we can establish that this region covers an area that is between 350 and 750 km in length and over ~350 km in width (1.2×10^5 to 2.6×10^5 km^2).

The hematite-rich surface discovered by TES closely corresponds with smooth-surfaced unit ('sm') that appears to be the surface of a layered sequence [*Christensen et al.*, submitted]. The presence of small mesas superposed on 'sm' and the degraded nature of the small impact craters suggests that material has been removed from this unit. These layered materials do not appear to be primary volcanic products (i.e., lava flows) because there are no associated lava flow lobes, fronts or pressure ridges; there are no fissures or calderae, nor any other features that can be interpreted as volcanic within 'sm' [*Christensen et al.*, submitted]. Bowl-shaped depressions in 'sm' and the remnant mesas on top of a portion of this unit suggest that deflation has removed material that was once above the present surface of 'sm'. The most likely cause of the deflation is wind, which suggests that the layered materials are relatively friable. In summary, Sinus Meridiani hematite is closely associated with a smooth, layered, friable surface that is interpreted to be sedimentary in origin [*Christensen et al.*, submitted].

We have considered five possible mechanisms for the formation of an extensive deposit of crystalline grey hematite fall into two classes depending on whether they require a significant amount of near-surface water [*Christensen et al.*, submitted]: (1) chemical precipitation that includes origin by (a) precipitation from oxygenated, Fe-rich water (iron formations), (b) hydrothermal extraction and crystal growth from fluids, (c) low temperature dissolution and precipitation in water; and d) formation of surface coatings, and (2) high-temperature oxidation of magnetite-rich lavas. The formation of red hematite by weathering and alteration is not consistent with the coarse, grey crystalline hematite observed in Sinus Meridiani. None of these models can be eliminated based on currently available data, but precipitation from Fe-rich water may be a slightly more plausible hypothesis based on the association with an apparent sedimentary unit, the extensive size, the distance from a near-surface regional heat source, and the lack of evidence for extensive surface water interactions elsewhere on Mars [*Christensen et al.*, submitted]. The TES results thus provide probable mineralogic evidence for large-scale water interactions. The Sinus Meridiani region therefore may be an ideal candidate for future landed missions searching for biotic and pre-biotic environments.

The thermal inertia in the region of high hematite signature (latitude 3°S to 2°N; longitude 0° to 7°W) measured using high resolution, pre-dawn Viking Infrared Thermal Mapper (IRTM) data [*Christensen and Moore*, 1992] varies from 5.3 to 10.1 (units of 10^{-3} cal cm^{-2} sec$^{-1/2}$ K^{-1}; 221 to 423 in units of J m^{-2} sec$^{-1/2}$ K^{-1}), with an average value of 7.4. These values are only slightly higher than the Martian average value of ~6.5 [*Palluconi and Kieffer*, 1981], and indicate an average particle size of the surface materials of 800-900 µm [*Presley and Christensen*, 1997]. The rock abundance for this area varies from 1 to 13%, with an average value of 7% areal rock cover [*Christensen*, 1986]. These values are typical for much of Mars [*Christensen and Moore*, 1992], but are lower than the values observed at the Viking Lander and Pathfinder sites [*Golombek et al.*, 1999]. Based on these results, the physical characteristics of this site satisfy all of the engineering requirements for the missions currently planned.

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