AN EVALUATION OF THE POSSIBLE EXTENT OF BEDROCK EXPOSURE IN THE 
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A major objective in remote sensing studies of Mars is to provide 
constraints on the properties and composition of the bedrock in the area 
under observation. However, the active aeolian environment and the 
ubiquitous presence of dust on Mars make the realization of this objective 
difficult at best, and impossible at worst. Here we present results of 
work undertaken to relate the amount of (possible) bedrock exposures 
visible in the highest resolution Viking imaging data to results obtained 
from remote sensing studies of the Sinus Meridiani region.

The location chosen for this study (15°N to 15°S, 330° to 360°W) 
includes a significant portion of the classical low albedo region of Sinus 
Meridiani and is entirely within the cratered highland terrain of Mars. 
This region has been the subject of several studies of spectral 
reflectance at visual wavelengths (1-5), as well as being included in 
global studies at thermal infrared (6-10) and radar (11-13) wavelengths. 
This wealth of remote sensing data has important implications for the 
aeolian environment of Mars (e.g., 1, 4-6, 9, 14) but the degree to which 
these data can be related to bedrock that underlies the aeolian cover is 
more difficult to assess. Most studies of visual reflectance conclude 
that low albedo regions are "less" obscured by the dust that dominates the 
high albedo regions (e.g., 1-3). However, what fraction of the martian 
surface (having either low or high albedo) has a reasonable likelihood of 
providing information about rocks associated with the terrains present on 
various geologic units? Presley and Arvidson (4) used visual and thermal 
infrared data to infer that the surficial units exposed in western Arabia 
and Sinus Meridiani were mixed aeolian deposits, predominantly decoupled 
from the underlying bedrock. Thus, any bedrock exposures will likely be 
small compared to the scale of the data used in that study (hundreds of 
meters to kilometers, 4). Thermal infrared measurements at multiple 
wave-lengths indicate that from 5% to 20% of the martian surface consists 
of material much more competent than dust or sand (15), with the low 
albedo regions generally having more exposed competent materials than the 
high albedo regions (10). Unfortunately, the competent materials observed 
in this manner may be either rocks (10, 15) or indurated sediments (16). 
We are using the highest resolution Viking images (all with <35 m/pixel) 
obtained within the study area to provide an independent assessment of the 
surface exposures that are most likely relevant to the local geology.

What do we look for in the images as representing possible exposures 
of bedrock? Bedrock is defined as "the solid rock underlying the soil and 
other unconsolidated materials, or appearing at the surface where these 
[unconsolidated materials] are absent" (17). Thus, we looked for 
locations that had the least likelihood of an overlying accumulation of 
unconsolidated materials, particularly sand or dust transported to the 
area by aeolian processes. The images examined in the study (Table 1) 
have resolutions of from 8 to 34 m/pixel, so we are unable to identify 
features smaller than a few tens of meters in dimension, so it is likely 
that there are areas within any given picture element that include some 
aeolian dust or sand. However, it seems likely that steep slopes will 
shed most unconsolidated materials downslope and thus provide the 
"cleanest" surface that might reasonably be expected to include bedrock. 
This assumption means that our results are best considered to be upper 
limits.
EXTENT OF BEDROCK EXPOSURE IN THE MARTIAN HIGHLANDS

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We examined almost 400 high resolution images that fell within the study area, estimating the percentage of the area of each frame that was a possible exposure of the underlying bedrock. Interior walls of impact craters (e.g., Viking orbiter frame 748A12) provided the most numerous occurrences of steep slopes of competent material. However, even the best images had smooth-textured surfaces covering the majority of crater interiors—areas that probably include some talus accumulations but which also might be mantled by dust—that were not considered to be good candidates for possible bedrock exposure. Walls of channels and other cliffs provided additional candidates sites. We also noted steep slopes on materials that are easily eroded and appear to be superposed on the surrounding terrain (e.g., Viking orbiter frame 708A25). These materials appear to be related to major depositional events within the region; this material is probably more competent that aeolian dust but it less likely that it will be related to the local geology. The entire image set provided the following results: 70% had <1% bedrock exposure, 25% have <5% bedrock exposure, and only 5% have <10% bedrock exposure (all of which are eroded layers like Viking orbiter frame 708A25). The high resolution images covered only about 10% of the total study area but we believe they are representative of the region as a whole. We found no significant difference in exposures between high albedo and low albedo regions, although the layered material is somewhat more common in the low albedo regions. These results will be compared to high resolution thermal infrared data to assess whether the competent depositional layers might be related to exposures of competent "duricrust" inferred from thermal infrared data (e.g., 16).

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Table 1. High resolution Viking images in study region.

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<th>Frame Number</th>
<th>Area (km²)</th>
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