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Spectra of Rocks and Soils from the Eastern Shoshone Range, Nevada

by

Graham R. Hunt

U.S. Geological Survey, Denver, Colorado 80225

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Bidirectional reflection spectra were recorded from samples selected from the NASA MSS Site 021 in the Shoshone Range, Nevada, by Gary Prost of the Superior Oil Co., Houston, Texas. Prost has processed NASA airborne multispectral data recorded during overflights of this site, and his interpretation of the imagery implies that certain mineralogies should have specific spectral responses in the 0.55- to 0.725- μm band, in the 0.65- to 1.0- μm range, and in the bands centered near 1.6 μm and 2.2 μm. In his processed imagery, samples 1 and 18 are from areas which show up as cyan; 8, 17, and 26A, as magenta; 16B, as red; 16C, as pink; 31, as white; and 33, as blue.

The spectra of the soil samples are shown in figure 1; they fall naturally into three categories: (1) those shown in figure 1a have high reflectivity (> 60 percent) near 1.6 μm and very well defined 1.4-, 1.9-, and 2.2- μm features, which indicate the presence of clay minerals. They also display a well-defined feature near 0.9 μm and a fall-off in intensity to shorter wavelengths and shoulders near 0.65 and 0.5 μm, all due to the presence of iron. Samples 31 and 16C are more similar to each other than to 16B, and they decrease more rapidly in intensity at shorter wavelengths than does 16B. (2) Sample 33 shows a response different from that of the other soils shown in figure 1b, in that the curve is essentially flat from 0.55 to longer wavelengths and the overall reflection is about half that of the other four. (3) The spectra of samples 18, 8, 17, and 26A are generally similar to each other, although 26A is flatter and shows a quite well-defined 2.2- μm feature, which is not as well pronounced in the other three spectra.

Figure 2 shows spectra recorded from different surfaces of rock sample 26A. These spectra are of coatings which are yellow, yellowish-brown, green, and green-gray. It is the green material which causes the unusual maximum near 0.55 μm and minima near 0.65 and 0.9 μm. The 0.65-μm feature is characteristic of the presence of the copper ion.

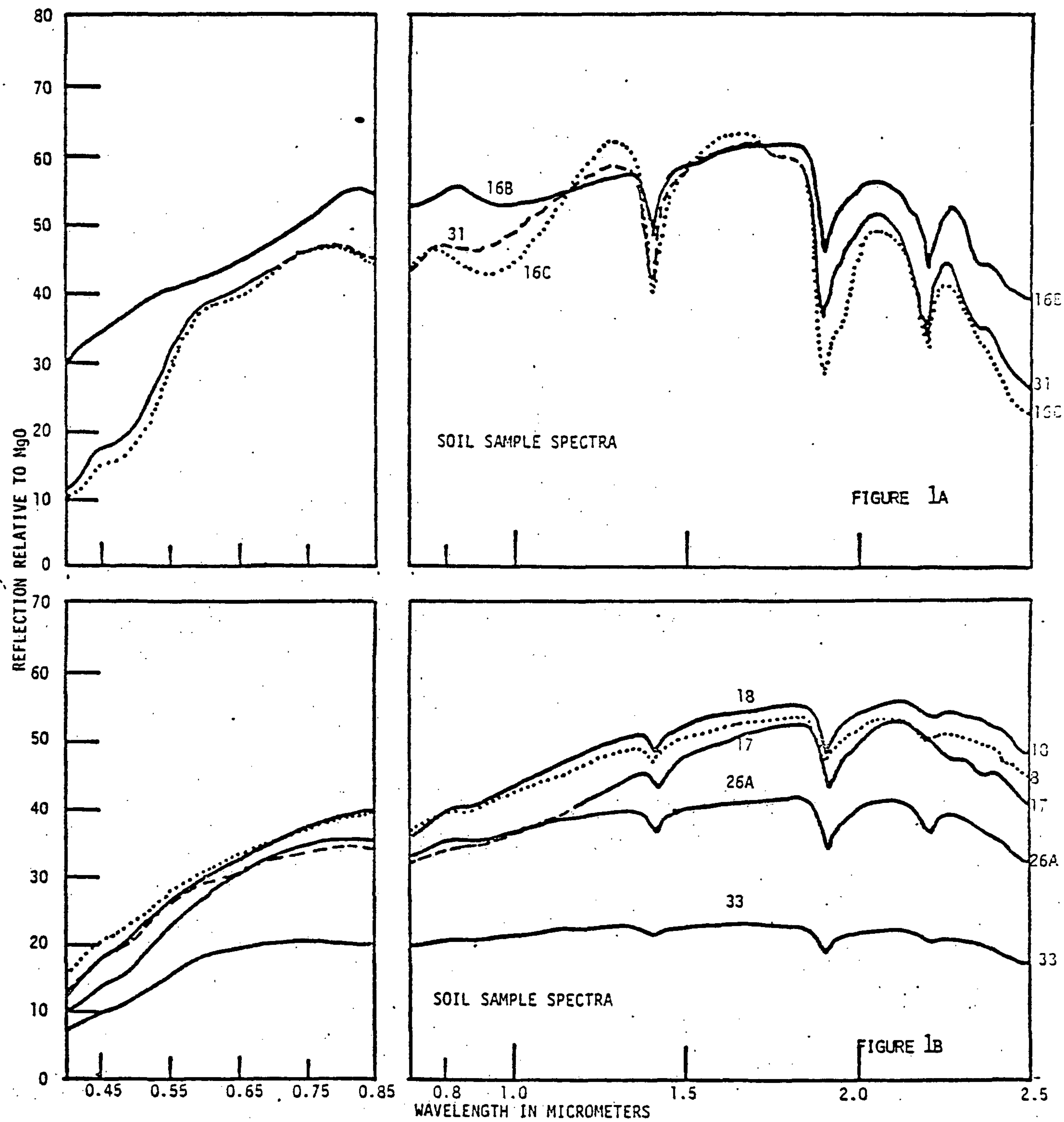
Figure 3 displays the spectra of the rock surfaces divided into three categories: (1) Figure 3a shows the spectra of the very bright (> 60 percent reflection at 1.6 μm) samples, including the spectrum from the yellow area on rock 26A. In these two spectra the 2.2- μm feature is well defined (as are the 1.4- and 1.9- μm features). (2) Figure 3b shows the collected rockspectra that show a higher response in the 0.55- to 0.725- μm region, a situation exhibited by the green areas on the 26A rock surfaces and by sample 17. It is interesting to note that in the lower of the two 26A sample spectra, the 1.4- μm feature is shifted to longer wavelengths and the 2.2- μm feature, very apparent in the other 26A sample, is missing. (3) Figure 3c shows spectra from rock samples very heavily coated with iron oxide; these samples display the typical hematite-goethite signatures.

Figure Captions

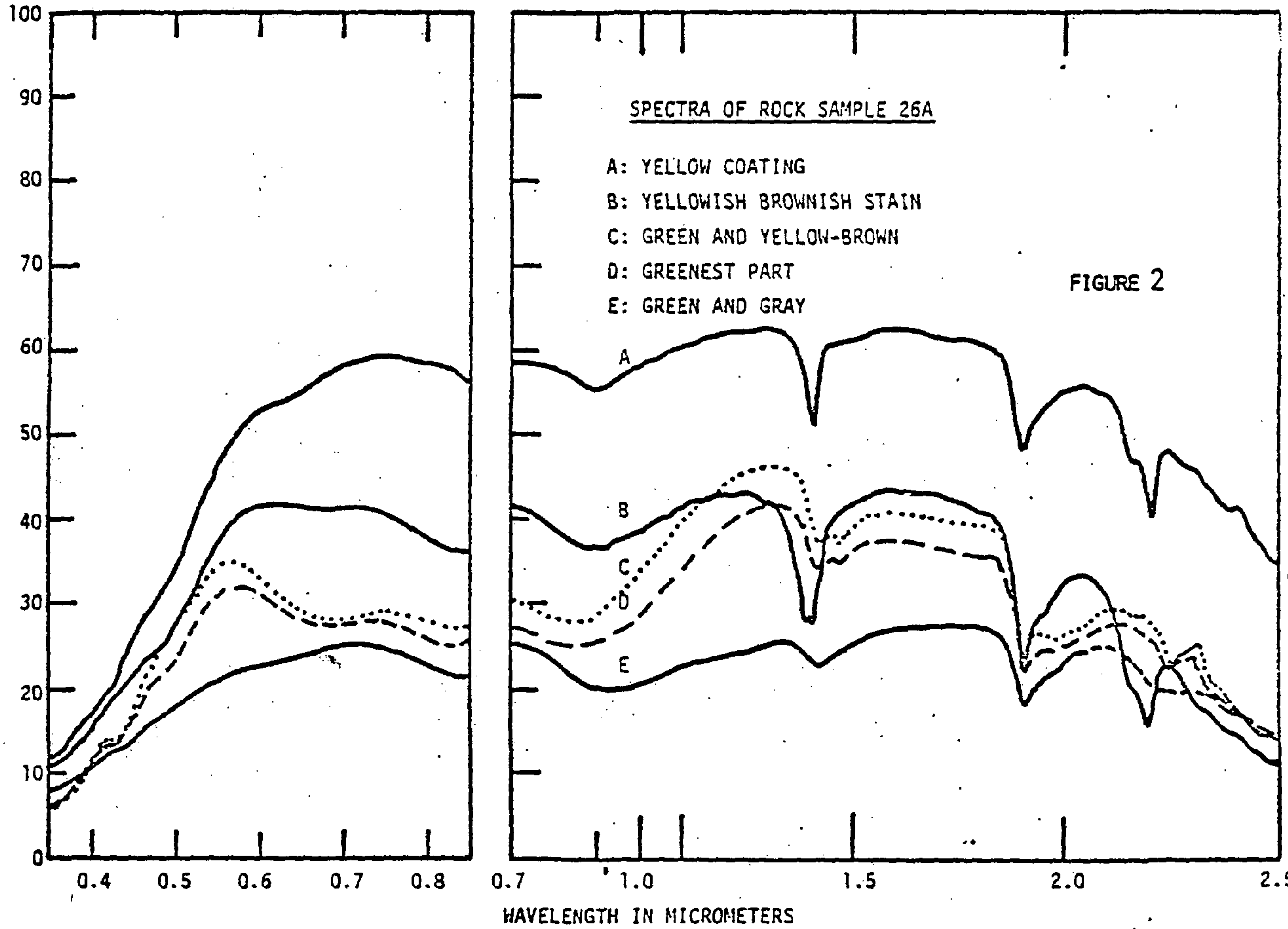
Figure 1. Spectra of soil samples. A. Soil samples whose spectra show high reflectivity near 1.6 μm and well defined 0.9 and 2.2 μm bands. B. Soils with lower reflectivity. Wavelength expansion different in 0.35 to 0.85 μm from that in 0.7 to 2.5 μm range. Spectra overlap between 0.7 and 0.85 μm.

Figure 2. Spectra of surface materials on rock sample 26A. Wavelength expansion different in 0.35 to 0.85 μm.

Figure 3. Spectra of rocks. A. Rocks with high reflection at 1.6 μm. B. Rocks that display higher reflection near 0.6 than near 0.9 μm. C. Rocks that show characteristic iron oxide features. Wavelength expansion different in 0.4 to 0.85 μm from that in 0.7 to 2.5 μm. Spectra overlap between 0.7 and 0.85 μm.

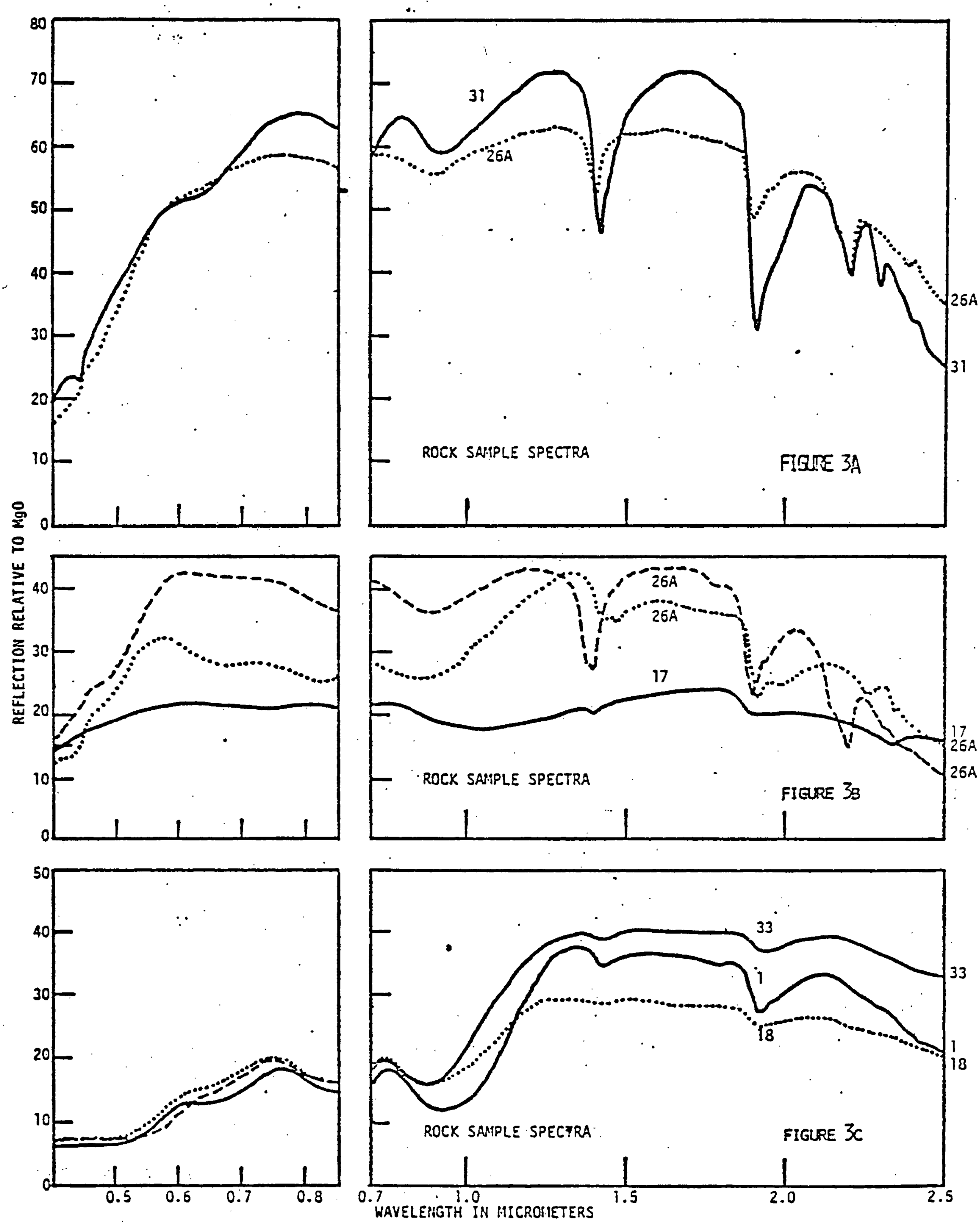


REFLECTION RELATIVE TO MgO
80
70
60
50
40
30
20
10
0
16B
31
16C
SOIL SAMPLE SPECTRA
FIGURE 1A
70
60
50
40
30
20
10
0
18
17
26A
33
SOIL SAMPLE SPECTRA
FIGURE 1B
0.45
0.55
0.65
0.75
0.85
0.8
1.0
1.5
2.0
2.5
WAVELENGTH IN MICROMETERS



SPECTRA OF ROCK SAMPLE 26A
A: YELLOW COATING
B: YELLOWISH BROWNISH STAIN
C: GREEN AND YELLOW-BROWN
D: GREENEST PART
E: GREEN AND GRAY
A
B
C
D
E
100
90
80
70
60
50
40
30
20
10
0
0.4
0.5
0.6
0.7
0.8
0.7
1.0
1.5
2.0
2.5
WAVELENGTH IN MICROMETERS

FIGURE 2



REFLECTION RELATIVE TO MgO
WAVELENGTH IN MICROMETERS
ROCK SAMPLE SPECTRA
FIGURE 3A
31
26A
26A
31
ROCK SAMPLE SPECTRA
FIGURE 3B
26A
26A
17
17
26A
26A
ROCK SAMPLE SPECTRA
FIGURE 3C
33
1
18
33
1
18