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SURFACE-MATERIAL MAPS OF VIKING LANDING SITES ON MARS; H.J.
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We have mapped the surface materials at the Viking landing
sites [1] to gain a better understanding of the materials and
rock populations at the sites and to provide information for
the future exploration. The maps extend to 9 m in front of
each lander and are about 15 m wide -- an area comparable to
the area of a pixel in high resolution Viking Orbiter images.
   The maps are divided into near and far fields (Fig. 1).
Data for the near fields are from: 1/10-scale maps [2],
unpublished maps, and lander images. Data for the far fields
are from: 1/20-scale contour maps [3], contoured lander camera
mosaics [3], and lander images. Rocks were located on these
maps using stereometric measurements and the contour maps.
   Map units are: (1) fine, (2) soillike, and (3) rock
materials. Coordinates, length (L), width (W), and height (H)
for each rock are recorded in a file for computational
purposes. For many rocks, L or W was estimated. Size-
frequency and area-covered distributions of rocks (Fig. 2) are
derived from the file according to the surrounding map unit,
field, and size. All rocks mapped within fine material and all
rocks >0.25 m in the two fields are included in the
distributions, but rocks <0.25 m in the soillike areas of the
far fields are assumed to have the same distribution as rocks
<0.25 m in the soillike areas of the near fields.
   The forms of our size-frequency distributions of rocks are
similar to previous ones [2,4]. Frequencies of rocks >0.18 m
are larger at Lander 2 than Lander 1, but the reverse is true
for smaller rocks. Fractions of area covered by the larger
rocks in logarithmic size-bins are irregular and yield no
simple relations for extrapolations to larger sizes of rocks,
but the areas covered by small rocks diminish rapidly with
decreasing size (Fig. 2). Our fractions of area covered by
centimeter-size and larger objects and rocks are about 0.12 at
Lander 1 and about 0.16 at Lander 2. Outcrops of rock cover an
additional 4.5% of the area at the Lander 1 site. These
fractions of area are comparable to those estimated for the
sites from Viking Orbiter thermal data for rock abundances with
unspecified size-frequency distributions, but assumed to be
equivalent to rock surfaces about 0.10 to 0.15 m across [5].
   We suggest that the following equation [6] for the fraction
of area covered by rocks larger than 0.10 m could be used for
preliminary design and planning studies because mathematical
descriptions of martian rock populations are unknown and the
possibilities are large [7]:

$$A = C * D^{-0.66},$$

where A is the fraction of area covered by rocks with diameters
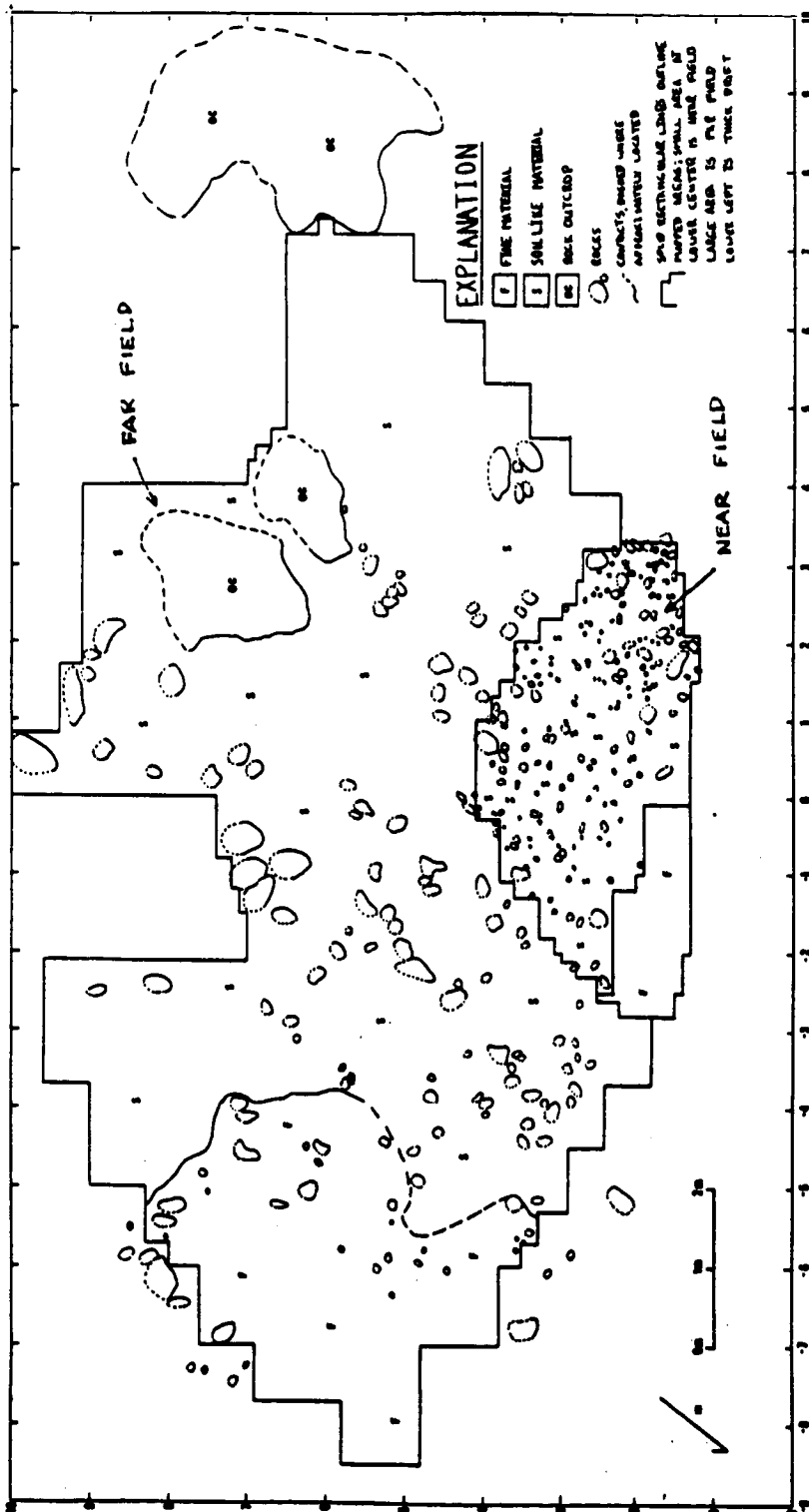larger than D (in meters) and C varies with location on Mars.

Figure 1 . Surface-material map at the Viking 1 site. Mapped area is divided into a near field (A) and a far field (B). The population of rocks <0.25 m within the soillike areas of the far field are assumed to be the same as those for soillike areas in the near field. Coordinates are in meters from center of Lander 1 (0,0). (Map prepared by John M. Keller).

For various locations, we also suggest that C can be adjusted to give values of A that match those of rock abundance maps [5b]. In reality, the exponent on D varies. For ejecta from craters in rock, the exponent on D can vary with the size interval considered and distance from the crater; values may range from -3, or so, to even positive ones. Values of C for craters also vary and may be near zero for alluvium. For the Moon, a nominal value for the exponent on D is -0.5.
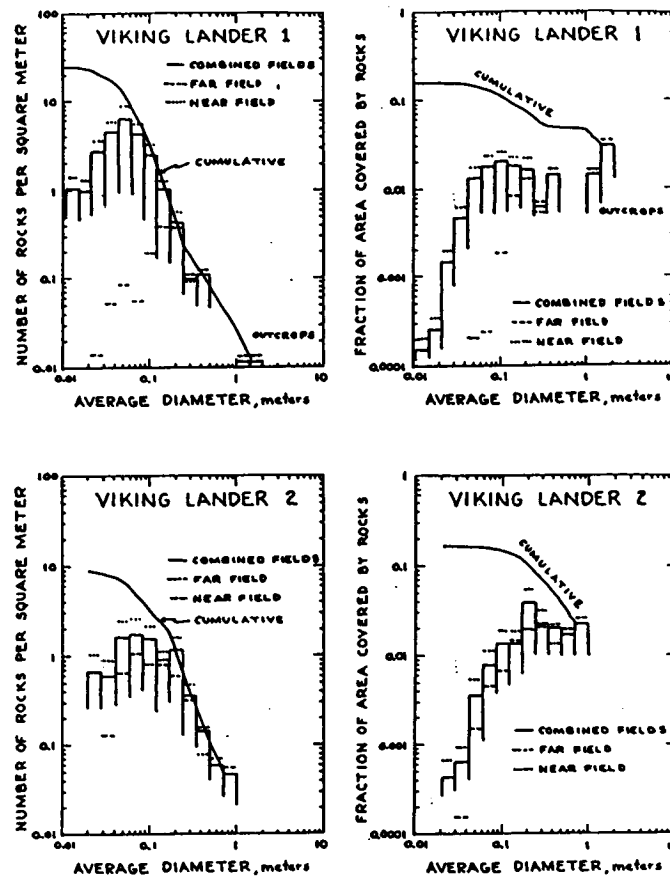

Figure 2. Size-frequency distribution and fraction of area covered for rocks at the Viking 1 and 2 landing sites.

REFERENCES

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