FABRIC OF LUNAR SOIL by Arshud Mahmood, Woodward-McNeill & Assoc., 2140 W. Olympic Blvd., Los Angeles, Ca.90006; James K. Mitchell, Univ. of Calif., Berkeley, Ca. 94720, and W. David Carrier, III, Bechtel Inc., 50 Beale St., San Francisco, Ca. 94119.

The particle arrangement of lunar soil drew early attention because of its importance in explaining the existence of probable high porosity on lunar surface (1). After the surveyor missions the concern about the density of surface layer subsided (2), and although an apparatus was developed for in-place sampling of regolith (3), it was never used on the lunar surface. The core tubes brought back from lunar missions were X-rayed. These radiographs have been used in preparing records of changes in texture and structure with depth (4). The sketches prepared from radiographs can be a source of data for fabric studies. The preferred orientation of the long axes of elongate grains seen in Apollo 16 core tube sketches was determined. These orientation results are presented here and are correlated with stratigraphy and penetration resistance.

At station 4 (Stone Mountain) the double-core drive-tube sample 64001/64002 was taken at a point about one meter away from the location of Self Recording Penetrometer test 4. Interpretations of both the core-tube stratigraphy (4) and the penetration resistance (5) point to the possibility that a contact between two different formations exists at about 50 cm depth. The grain orientation for this core tube also indicated that the depositional history of the material below 50 cm depth may have been different from that of the soil layer above, Fig. 1. Although the grain orientation study could not have detected the contact which the penetrometer results showed, the grain orientation reinforces the differences detected by the stratigraphy and the penetration resistance. In this way, when examined in the light of related stratigraphic information, the grain orientation provides one part of the information that helps define the fabric-property relationships in lunar soil.

Similar particle orientation results were found for the ALSEP area(station 10). The upper 30 cm portion in core tubes 60009/60010 which was less densely packed and contained a higher percentage of opaques showed a somewhat stronger preferred orientation than the lower strata. In core tubes 60013 and 60014 (station 10'), the upper 36 cm exhibited a strong preferred orientation, while the lower material, which is believed to be from a different source had a weaker preferred orientation.

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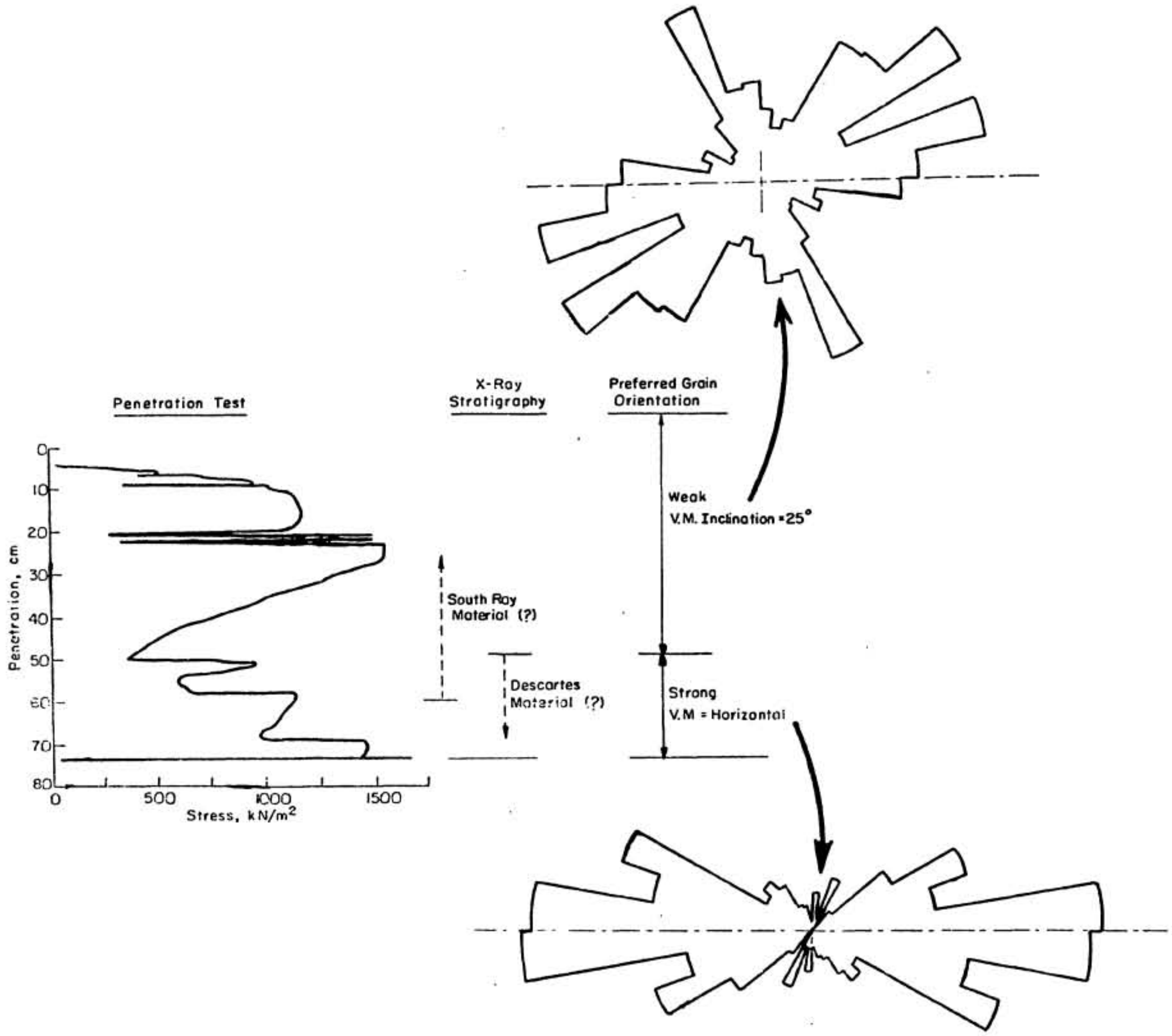

Fig. 1: Relationship Between the Penetration Resistance, Stratigraphy from Core Tubes, and Preferred Grain Orientation (at Station 4, Apollo 16)

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In addition to the study of core tubes, lunar soil samples composed of submillimeter sized grains can be deposited in the laboratory to provide another source of grain arrangement data. In one such experiment, 75-150 micron fraction of sample 14163,148 was separated by wet sieving with freon. Orientation of grains in the vertical plane was determined by depositing the soil into glass cubes fabricated from pieces of transparent glass slides. Vertical sides of the cubes were photographed, and the grain arrangements visible through the glass were analyzed. After photographing the sides, the soil was densified by tapping the cube. On densification by this dynamic compaction the axes of grains lost the preferred horizontal orientation, as was revealed in photographs taken after compaction.

It can be concluded that some of the layerings in core tubes also differ in the preferred orientation of grains. Laboratory deposited samples of lunar soil exhibited particle orientations that depended on the method of preparation.

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