GEOLOGY OF THE APOLLO 14 LANDING SITE

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Apollo 14 astronauts Alan B. Shepard and Edgar D. Mitchell landed on the moon on February 2, 1971, in an area referred to as the Fra Mauro region approximately 550 km south of the mountainous southern rim of the Imbrium Basin. The area is underlain by the Fra Mauro Formation represented by ridges and valleys roughly radial to the Imbrium Basin. The Fra Mauro is interpreted as material excavated by the large impact event that produced the Imbrium Basin (ref. 1, 2).

The LM landed in a broad valley 1,100 m west of Cone crater, which is located on a Fra Mauro ridge. Cone crater, 340 m in diameter, is relatively young and sharp rimmed. Blocks of ejected material as large as 15 m across occur near the rim. A ray of blocky ejecta extends westward beyond the landing site (fig. 1; ref. 3). Cone crater ejecta are presumed to have been excavated from depths as great as 60 to 80 m, well below the regolith, which is estimated to be 10 to 20 m thick in the Fra Mauro region. In the valley, the surface at the landing site is relatively smooth and fine-grained except where larger craters such as Doublet and Triplet have also penetrated through the regolith into what is considered to be Fra Mauro material.

Figure 1 shows traverse routes from the LM for the two EVAs: the first, westward to deploy the ALSEP and to collect samples; and the second eastward to within 20 m of the rim crest of Cone crater. The distribution of rock fragments on the surface is shown by symbols and patterned areas on the map and by circular insets that represent 10 m radius areas around photographic panoramic stations in which all rock fragments larger than 10 cm were mapped from the panoramic photographs.

A primary geologic objective of Apollo 14 was to sample and photograph the ejecta from Cone crater, because it most probably represents the "bedrock" Fra Mauro Formation beneath the local regolith. A secondary sampling objective was to collect soil and rock fragments from the regolith in the valley west of Cone ridge. Apollo 14 returned approximately 43 kg of lunar samples, fulfilling both sampling objectives. The samples included 35 rocks that weigh more than 50 g each, and about 30 smaller rocks between 10 and 50 g, as well as rock chips and fines collected with a scoop and with drive tubes. As expected, samples from the valley regolith included a finely fragmented, well mixed assemblage along with "soil breccias" that were formed by shock induration of regolith material by relatively small meteorite impact (refs. 4, 5).

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Rock fragments collected in the blocky ray ejected westward from Cone crater between the so-called North Boulder Field (station H) and Cone crater rim (station C1) were expected to provide a radial sample that would indicate a rough correlation between rock types and depth of excavation within Cone crater. The size of boulders increases toward the rim of Cone crater. Light colored rocks unique to the crater rim were recognized at station C1. Like all other large boulders photographed on the EVA 2 traverse they appeared to be layered and/or fractured clastic breccias that include fragments of older rocks that are both lighter and darker in color than their surrounding groundmass (ref. 6). The white rocks include primarily dark clasts. Because the white rocks are rare in occurrence, and were seen only on the crater rim, it is suggested that they are among the deepest of those excavated from Cone crater. In the discontinuous blocky ray west of Cone crater, it is reasonable to expect some mixing of ejecta from different depths.

References and notes

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7. Work done under NASA contract number T-65253-G.

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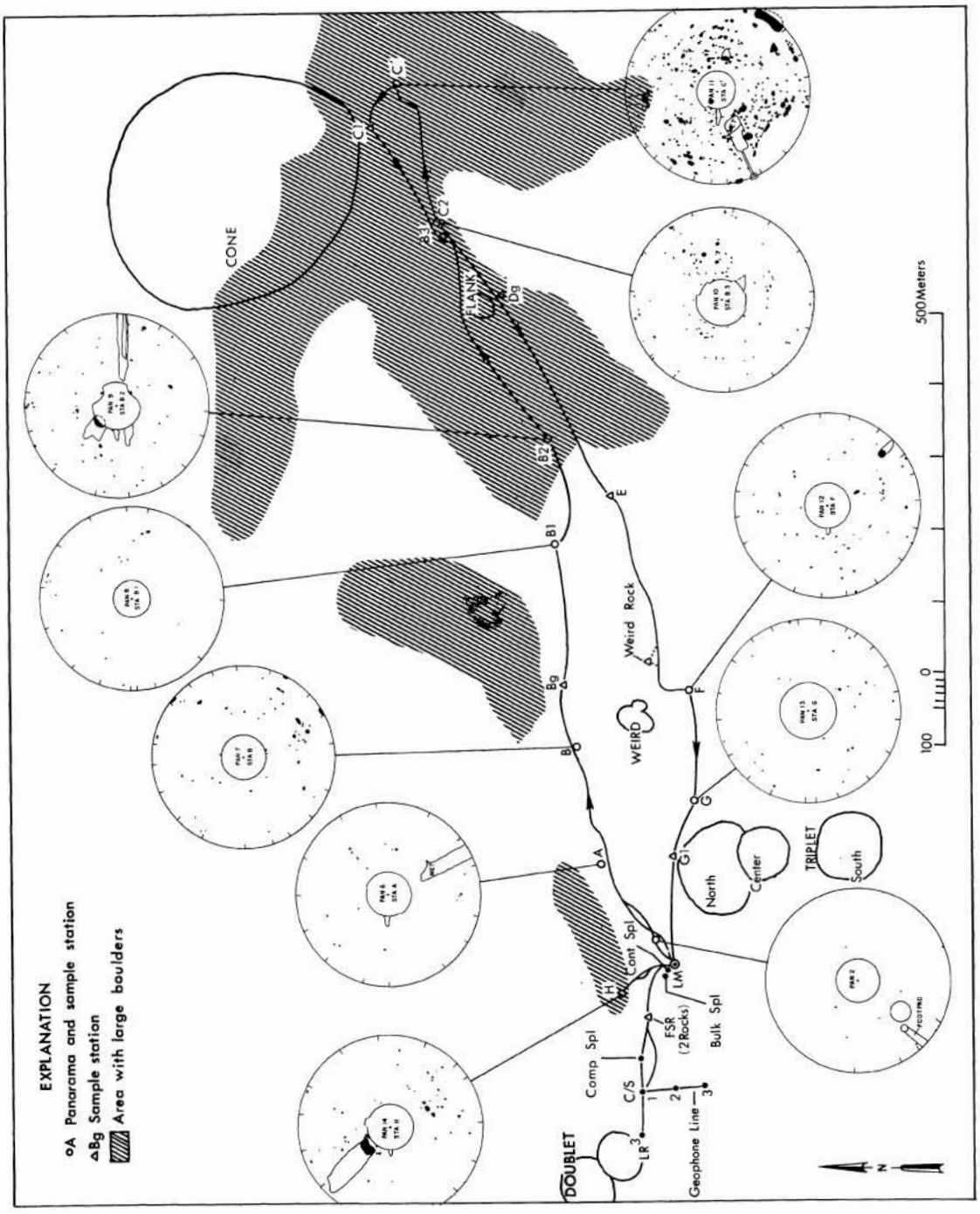

Figure 1. Traverse map of the Apollo 14 site. Circles are 10-m radius areas at panorama stations showing distributions of rocks larger than 10 cm (ref. 3).

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