

GEOLOGY OF THE IMBRIUM BASIN APENNINE MOUNTAINS AND THE ORIGIN OF PRE-IMBRIAN TOPOGRAPHY. Paul Spudis and James W. Head, Department of Geological Sciences, Brown University, Providence, R.I. 02912.

The Apennine Mountains form the southeast portion of the outer ring of the Imbrium basin and are part of the most prominent topography associated with the impact basin. This region was heavily influenced by the Imbrium event, which was responsible for the Apennine scarp and the emplacement of an extensive ejecta deposit.^{1,2,3} The Apollo 15 mission explored the base of the Apennines (Figs.1,2)⁴. Detailed geologic mapping of this area has been undertaken to address the following problems: 1) What is the origin of the major geologic units and structure and how are they related to the Imbrium basin event?; 2) What are the characteristics and origin of pre-Imbrian topography and how did they influence the Imbrium basin deposits and structure?; 3) What effects do these factors have in determining the provenance of highland samples collected during Apollo 15? Fig.1 illustrates the geology of the Apennines and Fig.2 shows major elements of pre-Imbrian structure and topography.

Pre-Imbrian Terrain and Structure - Several large craters and basins formed in pre-Imbrian time and exerted a marked influence on subsequent events. The topographic prominence of the Apennines is in part due to preservation of a terrain segment between depressions produced by these features. The large basin centered near Copernicus¹ is the oldest major feature detected in the region and has produced the regionally low topography in that area⁵ and in the western Apennines, where the trace of an outer ring of the basin has been mapped¹. The abrupt contact between mare and uplands within Imbrium to the SW of Archimedes may be explained by the extension of this basin ring and its influence on the Imbrium event. The Aestuum basin⁶ has accentuated this depression in the SW part of the area. A similar regional depression has also been produced by the Vaporum basin. The eastern Apennine area was radically affected by the formation of the Serenitatis basin which created a large, multi-ringed depression, and emplaced a significant ejecta deposit. Much of the eastern map area lies between the second and outer ring of Serenitatis, an area characterized by a domical facies in Orientale⁸ and several other basins¹. The Apollo 15 site lies at the junction of the Serenitatis and Imbrium basin outer rings. Abundant smaller pre-Imbrium craters have been mapped in the Apennines and a decrease in density toward Serenitatis may be attributable to the effects of ejecta from that event. Just prior to the formation of the Imbrium basin, the Apennine region was a relatively heavily cratered highland region surrounded by and strongly influenced by large crater and basin-related depressions.

Imbrium Geology and Structure - Imbrium-related geologic units (Fig.1) include: massifs, which are concentrated along the Apennine scarp; sub-massifs and concentrically lineated terrain, distributed throughout but concentrated toward the scarp region; domical terrain, interspersed between the above units, but more abundant in the NE area between the Serenitatis rings; and radially lineated terrain, concentrated away from the backslope. The following factors have been important in influencing the characteristics and

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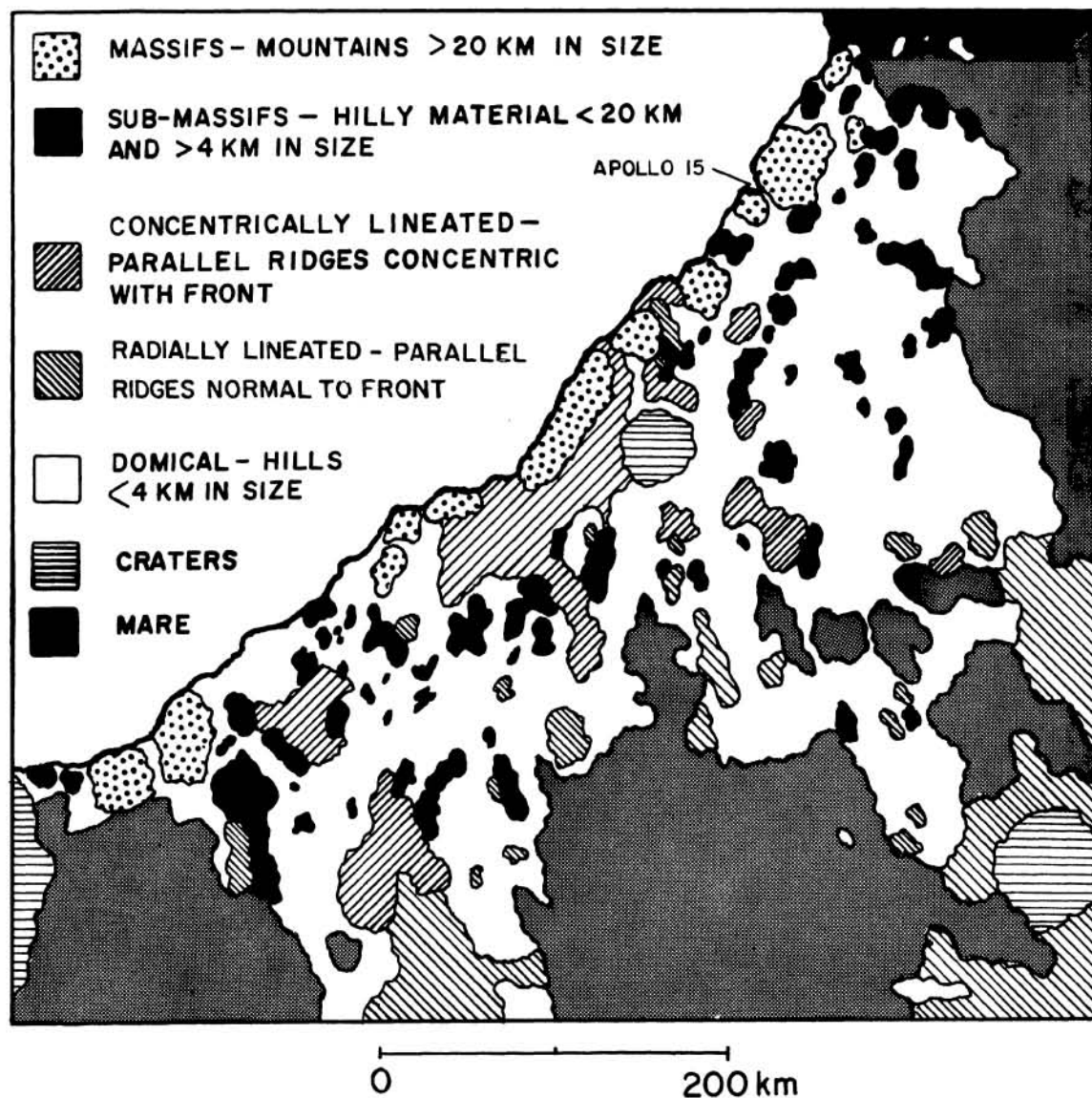
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Figure 1. Geologic map of the Apennine Mountains. Apennine front is shown by heavy irregular line. Units are not in stratigraphic order.

distribution of these units: a) Concentration of massive units in the SW Apennines appears to be due to the concentration of pre-Imbrian highland topography there; b) the more subdued nature of the NE Apennines appears due to the influence of the Serenitatis event; c) Many of the sub-massifs are the remnants of pre-Imbrian crater rims (compare Figs. 1,2); d) the topographic prominence of the massifs along the front, the characteristics and distribution of the concentrically lineated terrain, the truncation of a large crater along the front, and the abundance of pre-Imbrian craters support a model of

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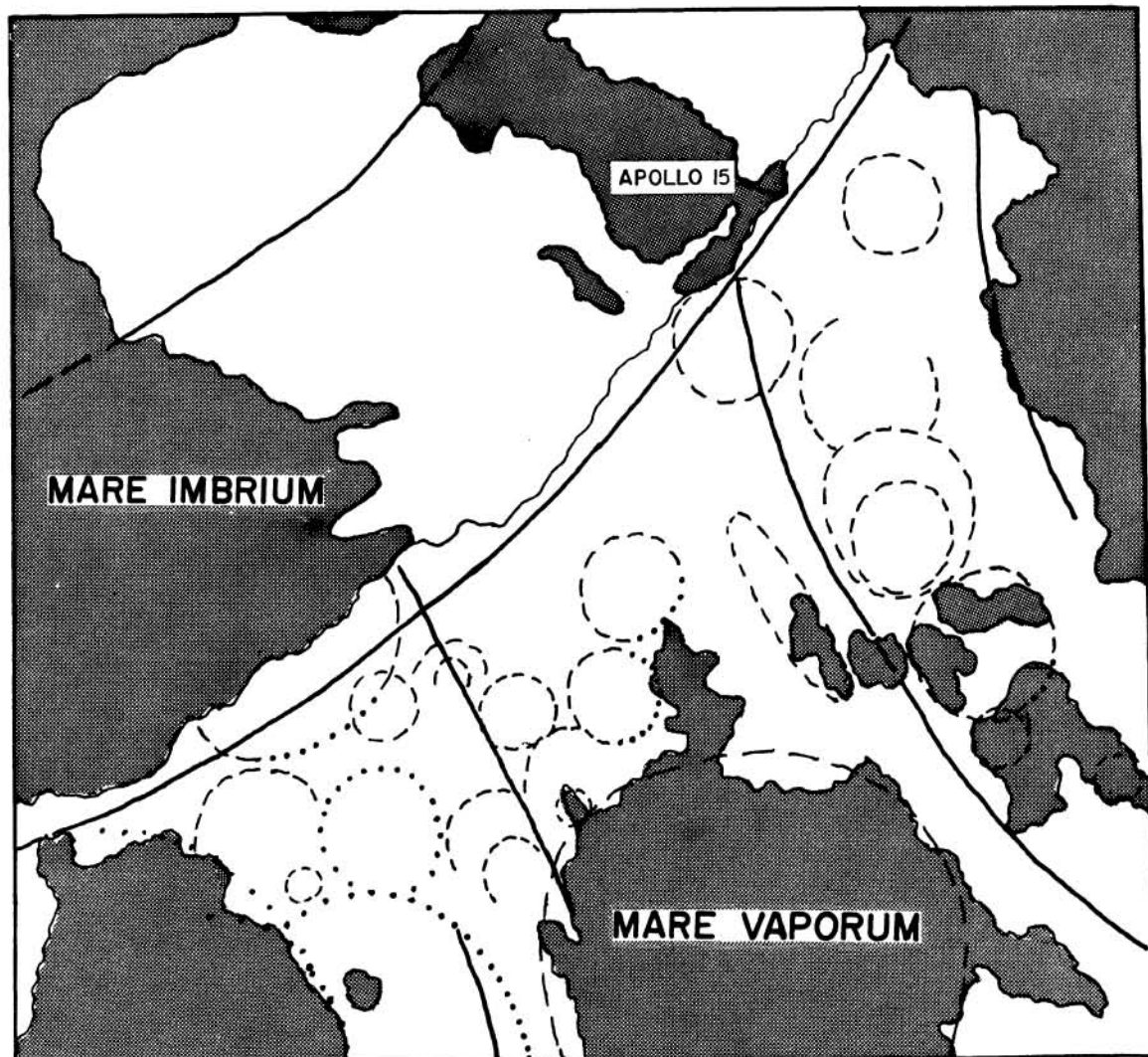
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Figure 2. Basin rings and pre-Imbriam craters in the Apennine Mountains. Dashed lines indicate a higher degree of certainty than dotted lines. Basin ring locations taken from (1,7). Area bounded by 29N, 12N, 10E, and 10W.

basin formation where the outer basin scarp (Apennines) has been formed by downfaulting of a megaterrace along the base of intense basin rim uplift, at a distance of 1.2-1.5 crater radii from the crater rim crest⁹.

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