

## ARE EARLY MAGNESIUM-RICH BASALTS WIDESPREAD ON THE MOON?

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There is new evidence based on orbital X-ray data that early magnesium-rich subsurface basalts may not be limited to Mare Crisium and that in Mare Crisium and elsewhere these basalts may constitute a basin-wide layer.

X-ray data in Mare Crisium indicates that the craters Picard and Peirce penetrated the surface layer of mare basalt to expose high-magnesium material at a lower level (1). Low altitude X-ray data from Apollo 15 suggests that this layer (layers?) of early subsurface basalt in Mare Crisium may extend across the entire basin. Three orbits traversing Mare Crisium from east to west (north of the craters Picard and Peirce) show the highest Mg/Si ratios concentrated within topographically higher border areas of the mare on both the east and west side of the basin. These may be early magnesium-rich basalts which were not completely covered by subsequent volcanic flows. Subsidence of the central part of the basin, as a result of initial loading by high-Mg basalts, may have caused later flows to gravitate toward the middle of the basin, leaving earlier flows exposed at the edges (2). Therefore, these border areas may represent an extension of the early high-magnesium basalts dredged up at Picard and Peirce.

By analogy, Mare Fecunditatis may also contain extensive early magnesium-rich basalts. The indications that such a layer exists--primarily below the surface--are similar to those for Mare Crisium. Two impact craters in northern Mare Fecunditatis have excavated material from depth with higher concentrations of magnesium than the surrounding mare basalt. From this we may infer that high-Mg basalts, erupted early in the history of Mare Fecunditatis, underlie those on the mare surface. High-magnesium, low-albedo areas along the northeast and northwest edges of the Mare may be the surface expressions of these early basalts rather than post-mare, localized pyroclastic deposits (which is the most common explanation). It is important to note here that many of the discontinuous low-albedo areas encircling the maria, which at one time were thought to be the youngest mare units, are now believed to be the oldest (3). Older, low-albedo mare units are also found in Mare Tranquillitatis bordering the Haemus Mountain peninsula in the northwest of the Mare and along the narrow strip of terra separating Mare Tranquillitatis from Mare Fecunditatis. These older mare units have (perhaps coincidentally) higher concentrations of magnesium than the central basalts which have partly embayed them.

Orbital X-ray evidence of early Mg-rich basalts in these basins suggests that similar basalts may be present in other basins as well. Interestingly, the scattered patches of mare basalts which failed to completely flood the floor of the Smythii basin (4) are characterized by Mg/Si ratios comparable to the extremely high ones at the Picard crater in Mare Crisium which represent material from the high-Mg subsurface basalt. Could it be that the limited volcanism in the Smythii basin was arrested after the high-magnesium basalts were emplaced?

Our studies show that early lunar volcanism--at least in the eastern maria--extruded high-magnesium materials that are largely buried by

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subsequent units. Random samplings of the early units by cratering suggest that they are widely distributed beneath the surface basalts and may comprise a large proportion of the volume of mare material. If this is so, early high-magnesium basalts are underrepresented in the lunar sample suite and, perhaps, in models for mare basalt petrogenesis.

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REFERENCES

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