PYROCLASTIC DEPOSITS IN THE FLOOR-FRACTURED CRATER ALPHONSUS

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Alphonsus, the 118 km diameter floor-fractured crater, is located immediately east of Mare Nubium. Eleven pyroclastic deposits have been identified on the crater's floor. Early telescopic spectra suggest that the floor of Alphonsus is noritic, and that the pyroclastic deposits contain mixtures of floor material and a juvenile component including basaltic glass.

Head and Wilson contend that Nubium lavas intruded the breccia zone beneath Alphonsus, forming dikes and fractures on the crater floor. In this model, the magma ascended to the level of the mare but cooled underground, and a portion broke thru to the surface in vulcanian (explosive) eruptions. Alternatively, the erupted material could be from a source unrelated to the mare, in the style of regional pyroclastic deposits.

High-resolution images and spectroscopy from the Moon Mineralogy Mapper (M^3), Diviner Lunar Radiometer, and Lunar Reconnaissance Orbiter Camera Narrow Angle Camera (NAC) provide data to test these formation models.

Spectra from M^3 confirm that the crater floor is primarily composed of noritic material, and that the Nubium lavas are basaltic. Spectra from the three largest pyroclastic deposits in Alphonsus are consistent with a minor low-Ca pyroxene component in a glass-rich matrix. The centers of the 2 micron absorption bands have wavelengths too short to be of the same origin as the Nubium basalts.

Diviner Christiansen feature (CF) values were used to estimate FeO abundances for the crater floor, Nubium soil, and pyroclastic deposits. The estimated abundance for the crater floor (7.5 +/- 1.4 wt.%) is within the range of FeO values for Apollo norite samples. However, the estimated FeO abundance for Nubium soil (13.4 +/- 1.4 wt.%) is lower than those measured in most mare samples. The difference may reflect contamination of the mare soil by highland ejecta.

The Diviner-derived FeO abundance for the western pyroclastic deposit is 13.8 +/- 3.3 wt.%. This is lower than the values for mare soil samples, but within the range of analyzed pyroclastic glasses.

The NAC images of the pyroclastic vents highlight their bright wall materials. The M^3 spectra of the southeastern vent indicate that this bright material is noritic, likely crater floor material exposed by explosive eruption.

These observations address the hypothesis that Nubium lavas intruded the fracture network beneath Alphonsus, leading to localized vulcanian-style eruptions. This model implies that the eruption products should be dominated by crystalline basalt fragments similar in elemental composition and mineralogy to mare lavas.

The bright noritic material exposed in the vent walls is consistent with explosive eruptions. The estimated FeO abundances for the pyroclastic deposits are too low to be consistent with FeO abundances measured in mare basalts, but are within the range of pyroclastic glass samples. The visible- to near-infrared (VIS-NIR) spectra of the pyroclastic deposits and Nubium soils are significantly different, suggesting that the pyroclastics are unrelated to the mare basalts. The pyroclastic spectra are consistent with Fe-bearing glass plus small amounts of noritic wall rock. Similar glassy materials dominate regional pyroclastic deposits, suggesting a deep source for the pyroclastics observed in Alphonsus.