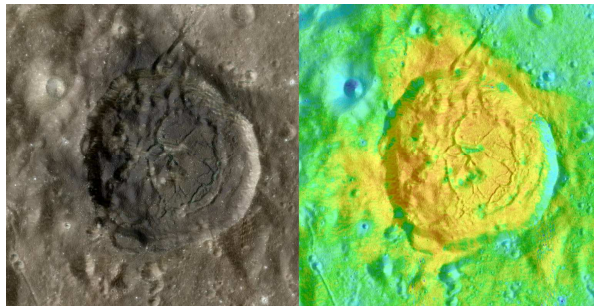


**COMPLEX VOLCANISM AT LUNAR FLOOR-FRACTURED CRATER OPPENHEIMER U.** L.R. Gaddis<sup>1</sup>, K. Bennett<sup>2</sup>, B. Horgan<sup>3</sup>, Marie McBride<sup>3</sup>, J. Stopar<sup>4</sup>, S. Lawrence<sup>5</sup>, J.O. Gustafson<sup>6</sup> and T. Giguere<sup>7</sup>. <sup>1</sup> U.S. Geological Survey, Astrogeology Science Center, Flagstaff, AZ; <sup>2</sup> Northern Arizona Univ., Flagstaff, AZ; <sup>3</sup> Purdue Univ., West Lafayette, IN; <sup>4</sup> Lunar and Planetary Institute, Houston, TX; <sup>5</sup> Johnson Space Center, Houston, TX; <sup>6</sup> Cornell Univ., Ithaca, NY; <sup>7</sup> Univ. Hawaii, Honolulu, HI ([lgaddis@usgs.gov](mailto:lgaddis@usgs.gov)).

**Introduction:** Complex volcanism is observed in floor-fractured crater (FFC) Oppenheimer U, located in the northwest floor of Oppenheimer crater (35.2°S, 166.3°W, 208 km dia., **Figure 1**) on the lunar far side [1-3]. Fifteen sites of localized pyroclastic volcanism have been identified in the floor of Oppenheimer crater [4]. Studies with Moon Mineralogy Mapper data (M<sup>3</sup>, 0.4-3  $\mu$ m, 86 bands [5]) suggest that Oppenheimer U deposits show variable compositions and the most iron-rich volcanic glass thus far identified on the Moon. Here we examine the floor of Oppenheimer U and show evidence for possible multiple eruptive episodes.

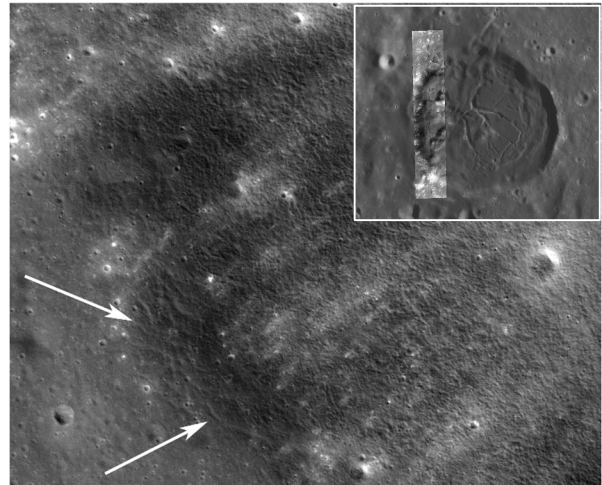


**Figure 1.** Oppenheimer U crater (38 km dia.). (Left) Kaguya MI mosaic (R=900 nm, G=750 nm, B=415 nm). (Right) Derived FeO (wt. %) [8].

**Analysis:** Data from the Lunar Reconnaissance Orbiter (LRO) Wide Angle Camera (WAC) [6] and mineral maps such as FeO derived from SELENE Kaguya Multiband Imager (MI) data [7, 8] for Oppenheimer U crater (**Figure 1**) show a flat floor with prominent fractures, especially on the east and central portions of the floor. Superimposed on those is a very dark pyroclastic mantle that covers much of the crater floor and extends up to 10 km to the west beyond the crater rim. The western floor of Oppenheimer U has a network of at least 6 irregular depressions (**Figures 1, 2, inset**). Topographic data (~60 m/pixel [9]) indicate that the depressions are ~2 to 4 km wide and up to 5.5 km long. The deepest of these depressions is ~1300 m, and it has an asymmetric profile with a steep (~35°) western edge and a more gently sloping interior margin (~27°). No raised rim is observed in association with any of these depressions.

A survey of LRO Narrow Angle Camera (NAC) [14] data for this area indicates that there are no small, cone-like features situated on fractures in the floor of Oppenheimer U. NAC data shows that (**Figure 2**) the pyroclastic deposit is a dark unit draped on the crater

wall, with prominent dark streaks trending downslope toward the floor and possible cracks at slope breaks.



**Figure 2.** NAC frame M184632274 (inc. angle 43°) showing cracks (white arrows) in mantling material and streaks of low-albedo material trending downward (to the right) toward the crater floor.

**Summary:** These results suggest the presence of a widespread pyroclastic deposit in the floor of Oppenheimer U crater that erupted violently from multiple source vents, possibly in several episodes. The presence of multiple vents in the floor of Oppenheimer U crater, their association with relatively large irregular depressions, and possible cracks in the mantling deposit supports their origin via a fire-fountain style of eruption [2]. Such eruptions are associated with higher magmatic volatile contents and effusion rates than the Vulcanian-style eruptions observed in FFCs such as those at Alphonsus and elsewhere [e.g., 10]. These results support earlier analyses that indicated a more complex style of volcanism in Oppenheimer crater [2].

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