Imbrium Mayhem

The formation of the Imbrium basin created large rim segments, such as the Apennine and Carpathian mountains, and inner concentric rings that are partially preserved as mare ridge arcs and scattered peaks (Pico and Piton, for example). But ejecta from Imbrium also affected a huge portion of the lunar surface. Nearest the impact site, debris coated the uplifted Apennine range with layers of rock excavated from deep below the surface. Farther away from ground zero, ejecta not only rained from the sky but also surged laterally, scouring the Moon’s surface. And of the millions of cubic kilometers of rock excavated from the Imbrium basin, some must have escaped lunar orbit, pummeling Earth and perhaps even reaching as far as Mars and Venus.

The impact-debris layer on the lunar surface is thickest near Imbrium and thins with distance. Yet more than 1,000 km to the south, a layer of pulverized ejecta may account for the smooth plains lying between the craters of the southern highlands. In some places, debris fell in sufficient quantity to completely bury preexisting terrain and fill in craters. This may be why Ptolemaeus, Hipparchus, Albategnius, and many other smaller craters have such smooth floors.

The floor of Ptolemaeus is especially unusual because it contains about a dozen very shallow depressions that are visible only at very low Sun angles. The largest and most pronounced of these “saucers” is designated Ptolemaeus B (L75 in the Lunar 100) and lies just north of the relatively fresh 8-km-diameter impact crater Ammonius. Ptolemaeus B is about 10 km wide and looks very much like an impact crater that has been covered but not completely buried. The other saucers on the Ptolemaeus floor are similar but smaller and apparently more completely covered. In my view, the saucers are craters — either formed by random impacts or from Imbrium debris — that are blanketed by a layer of Imbrium ejecta. If you look closely at neighboring Albategnius, you will see that it too features saucers on its floor.
When to View Them

**Alpine Valley:**
October 14th and 29th;
November 12th and 28th.

**Imbrium sculpture:**
October 13th and 29th;
November 12th and 28th.

**Ptolemaeus B:**
October 14th and 29th;
November 13th and 28th.

*Universal dates indicate when these features are favorably illuminated.*

The scorching of the Ptolemaeus region was first noted by American geologist Grove Carl Gilbert in 1893. He observed that the area was crossed by linear grooves and that to the northeast, near the craters Boscovich and Julius Caesar, there were linear ridges and strangely elongated craters. Gilbert recognized similar striations in the lunar highlands both north and south of Mare Imbrium and realized that all these marks must be related to the formation of the Imbrium basin. The “Imbrium sculpture” (LO3), as Gilbert called the features, was probably made by horizontally flowing Imbrium ejecta plowing into preexisting terrain. Around Boscovich, this flowing mass knocked down crater walls, leaving intact only the rims radial to Imbrium. In other areas, closely spaced Imbrium debris pounded the surface, creating chains of overlapping secondary craters. Much of the area between Mare Nubium and Mare Tranquillitatis bears the scars of being violently scraped and scoured by flowing debris.

One of Gilbert’s most famous examples of Imbrium sculpture is the Alpine Valley (L19), a 150-km long linear feature radial to Imbrium. Yet this valley probably was not made by flying or surging debris. The Alpine Valley appears to have resulted from horizontal stresses that pulled apart a previously continuous piece of crust. On Earth such linear features are called graben, and the extensional force may be from plate-tectonic movements. A terrestrial equivalent of the Alpine Valley is the Gulf of Aqaba that separates the Sinai and Arabian peninsulas. These lunar and terrestrial graben have the same dimensions, but the Alpine Valley is flooded by lava issuing from the very narrow sinuous rille that snakes across the middle of the valley, while the Gulf of Aqaba graben is covered with ocean water. On Earth we understand how plate tectonics fractures and pulls apart land masses; we are not at all certain what forces created the Moon’s Alpine Valley. But the fact that its long axis is radial to the Imbrium basin suggests that the two must be related somehow.

Charles A. Wood is the author of The Modern Moon: A Personal View and the Lunar 100 Card (both available from Sky Publishing) and maintains the Lunar Photo of the Day Web site, (www.lpm.org), which showcases the finest amateur and professional Moon images.

A prominent portion of Grove Carl Gilbert’s “Imbrium sculpture” is located near the crater Manilus.