Concentric Fractures and Craters

Two craters separated by 2,400 kilometers (1,500 miles) share a surprising number of unusual features. Situated in the libration zone on the Moon’s southeastern limb is Humboldt (L87 in the Lunar 100), a 207-km-diameter crater that is always a little difficult to see. Under favorable illumination, shortly after full Moon, the crater displays wall terraces and a broad complex of stubby central peaks. Its easternmost wall has a high, steep scarp with piles of collapsed terraces at its base. These features are typical of large complex craters.

Along the edges of Humboldt’s floor are four dark patches. The largest one lies against the western wall. It tapers southward from a narrow neck to a broader region that embays rim debris at the floor’s southern end. This dark material is normal mare lava, like that in nearby Mare Fecunditatis. A similar, but much smaller, ribbon of lava is just visible along the crater’s northwestern rim. Both of these lava flows leaked up through fractures and faults created by the impact that formed Humboldt.

A third dark area is easier to observe and is found at Humboldt’s northeast rim. This patch differs from the others in that it drapes the crater wall’s lower terraces. This immediately suggests that the dark stuff is not just lava, which can’t flow uphill, but is pyroclastic ash deposited by an explosive eruption. The beautiful photo above, taken by the Apollo 15 astronauts, also shows rilles that are roughly radial and concentric to the crater rim. The dark spots are well shown too, with the one on the right of this image covering the nearby terraces as well as the crater floor.

Halfway across the lunar disk is Pitatus (L84), a similar but smaller (97-km-wide) crater. Pitatus straddles the edge of southern Mare Nubium and the lunar highlands. Like Humboldt, Pitatus is a complex crater with a central peak and wall terraces, but because it’s older, its features are less prominent. Pitatus also has a smooth floor crossed by rilles that are mostly concentric, but with a few narrow radial ones too. The entire floor is covered by smooth, gray lava that oozed from fissures and flooded the crater with enough material to cover the original floor and bury the

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Volcanism may have helped shape two of the Moon’s most intriguing features.

**When to View Them**

- **Pitatus and Hesiodus A:**
  - December 13th and 29th;
  - January 12th and 28th.

- **Humboldt:**
  - December 6th and January 4th.

Universal dates indicate when these features are favorably illuminated.

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**The Lunar 100**

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Both Pitatus and Humboldt are known by the graphically descriptive term “floor-fractured crater” (FFC). Brown University scientist Peter Schultz first recognized that FFCs share common traits, including volcanic features on their floors and networks of rilles. Many other FFCs, such as Posidonius and Petavius, also have floors that are uplifted. Typically, FFCs are large and found near the edges of maria. Piecing together these clues, Schultz proposed that FFCs were normal impact craters that had been modified by volcanism.

Schultz believes that magma rose up deep fissures at the edges of basins and collected under nearby impact craters. Lava from these near-surface reservoirs leaked onto the floors of the associated craters, partially filling them and also often pushing up their floors. This uplift produced the concentric and radial rilles characteristic of FFCs. And sometimes gas-rich magma explosively erupted, ejecting dark pyroclastic material around small volcanoes. In fact, most of the volcanic dark-halo craters on the Moon lie within FFCs.

Humboldt and Pitatus share another unusual trait: both have concentric craters nearby. Hesiodus A (L81) is a 34.9-km-diameter, double-rim crater just west of Pitatus, and on the floor of Humboldt is an unnamed 6.7-km-diameter concentric crater. It is probably not a coincidence that these strange craters formed where they did. In total, 53 concentric craters are known, and all of them occur near the edges of maria—just like FFCs.

The inner rings of both Hesiodus A and the Humboldt crater are rounded like donuts, whereas their outer rims are normal. Like FFCs, concentric craters appear to be ordinary impact craters, but the origins of their inner rings is uncertain. Whether the donuts result from the crater-forming impact or from subsequent volcanic modification, it’s strange that other nearby craters of similar size don’t have inner rings too.

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 website (www.lpod.org), which showcases the finest amateur and professional Moon images.