The Ghosts of Mare Nubium

*This southern lunar sea has well-worn shores.*

**Mare Lava Flows** make up the dark patches of the Moon that we can vaguely see with our unaided eye. Nearly all this material fills basins that were blasted out by impacts long ago. As I showed in my previous two columns in the December and January issues, parts of basin rims are still easily visible at Humorum and Nectaris. For some older structures, however, little remains beyond the roundish patch of mare itself to indicate the existence of a nearly invisible basin. Mare Nubium, south of the lunar equator and just east of Mare Humborum, is a good example.

Nubium is only clearly defined on its southern and eastern shores, which are bounded by bright heavily cratered highlands. To the north, Mare Nubium's lavas merge with Mare Cognitum and other ambiguously edged dark patches south of Mare Imbrium. Evidence for Nubium's underlying rim is slight, with the small line of hills called the Mercator Scarp being the only conspicuous remnant. Nonetheless, with this and the highland boundaries, we can estimate the diameter of the impact basin at about 700 kilometers (435 miles) — the same size as the basin that contains Mare Serenitatis.

Mare Nubium has much thinner lavas than those in Serenitatis. We know this because Nubium exhibits many partially buried craters, whose rims just barely rise above the surface. These craters must have formed on the original basin floor but were covered by later lava flows. For example, Kies is a low-rimmed crater at the southwestern edge of Nubium that filled with lava, possibly through a gap in its wall.

To the east of Kies lie several "ghost" craters. These have been completely covered by mare lava and become visible only with low-angle Sun illumination. We can use ruined crater Wolf as a guide to these features. A line of partially and fully buried craters lie to its north, two of which have enough rims left to merit names: Gould and Opelt. Farther east of Wolf, close to the famous Straight Wall, many low ridges hint at other lava-inundated craters.

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<td>B Bullialdus</td>
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<td>C Kies P1 (L50)</td>
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L. numbers refer to Charles Wood's Lunar 100 list; see SkyandTelescope.com/lunar100.

**Phases**
- First quarter: Feb. 2, 23:13 UT
- Full Moon: Feb. 9, 14:49 UT
- Last quarter: Feb. 16, 21:37 UT
- New Moon: Feb. 25, 1:35 UT

**Distances**
- Perigee: Feb. 7, 7:00 UT, diam. 33° 01”
- Apogee: Feb. 19, 17° 00 UT, diam. 29° 30”

**Librations**
- Mare Australe: Feb. 8
- Mare Smythii: Feb. 9
- Pascal (crater): Feb. 21

For key dates, black dots on the map indicate what part of the Moon's limb is tipped the most toward Earth by libration under favorable illumination.

To find out more about Nubium and other lunar landforms, visit The Moon Wiki at http://the-moon.wikispaces.com.
Exploring the Moon

**YOUNG AND OLD** Left: The 60-kilometer-wide crater Bullialdus stands out from other eroded craters in Mare Nubium. Its terraced rim and central peak denote a geologically young, “complex” crater that formed after most of the lava flooded the impact basin. Right: Crater Wolf (bottom) is the most distinct feature among the “ghost” craters surrounding it. Near the center of the view, crater Gould has been nearly swallowed by the mare lavas.

But these are less well defined. It’s impossible to tell if they’re real ghosts or just figments of our imagination.

The top surface of Mare Nubium does contain some features. The most dramatic is the 60-km-wide (37-mile) crater Bullialdus, a smaller version of Copernicus. Bullialdus is a young, “complex” crater.

Terraces ring its inner wall, which step down 3.5 km (2.2 miles) to a partly flat floor. The crater interior includes some scattered hills and has a central peak consisting of a tight cluster of five or six mountains. Secondary craters that often line up in short chains also convey the youthfulness of Bullialdus.

Another fascinating feature rises up from Nubium’s surface. Just west of Kies is a volcanic dome with a small pit on its summit. This is one of the Moon’s more conspicuous domes and it even has a designation: Kies Pi. According to measurements by the amateur Geological Lunar Researches Group, Kies Pi is a fairly typical dome about 14 km (9 miles) wide and 160 meters (525 feet) high with a 1.3° slope. The gentle grade means that you’ll see this dome only when the Sun’s rays graze the surface — exactly the conditions necessary to glimpse the ghost craters.

Opportune low Sun angles occur at waxing gibbous (between 9 and 10 days old) and waning crescent (between 24 and 25 days old).

Mare Nubium may lack a dramatic basin rim, but it’s otherwise chock-full of delights for the informed observer.

**SUBTLE PEAK** The 45-km-wide crater Kies was nearly lost to flooding lava. When the lighting is just right, careful observation of nearby Kies Pi (arrowed) will reveal a pit at the summit of this ancient volcano.

Planetary geologist Charles Wood contemplates the Moon from his home in West Virginia.