



# Mystery Maria

NEARLY ALL the Moon's big maria ("seas") are circular because they fill ancient impact basins. But Mare Frigoris isn't. Frigoris (L26 in the Lunar 100) is a 1,500-kilometer-long (930-mile), 200-km-wide arc of lava that spans from Oceanus Procellarum in the west to the craters Atlas and Hercules in the east.

A few of the Moon's biggest features are also its most puzzling.

One characteristic of Mare Frigoris that may help explain its origin is the fact that it's mostly concentric with the Imbrium impact basin. But Frigoris isn't the only mare hugging Imbrium's rim. Mare Vaporum, Sinus Medii, Sinus Aestuum, and Mare Insularum help define a moat of lava that encircles much of Imbrium.

And Imbrium isn't the only basin surrounded by maria. If you look closely outside the main rim of Mare Crisium (L10), you'll notice that it's surrounded by a similar, but less conspicuous, lava arc. Arrayed around Crisium are Lacus Bonitatis, Mare Anguis, and Mare Undarum. These lesser mare regions are low zones, and the key to understanding them is realizing that, unlike typical impact craters, large basins have more than one rim. For reasons that we don't fully understand, the highly energetic impacts that produce depressions larger than about 300 km across create a series of concentric rings inside the main basin rim and fault scarps outside it. Indeed, the features we call

The Lunar 100		
L	Feature name	Significance
10	Mare Crisium	Mare contained in large circular basin
26	Mare Frigoris	Arcuate mare of uncertain origin

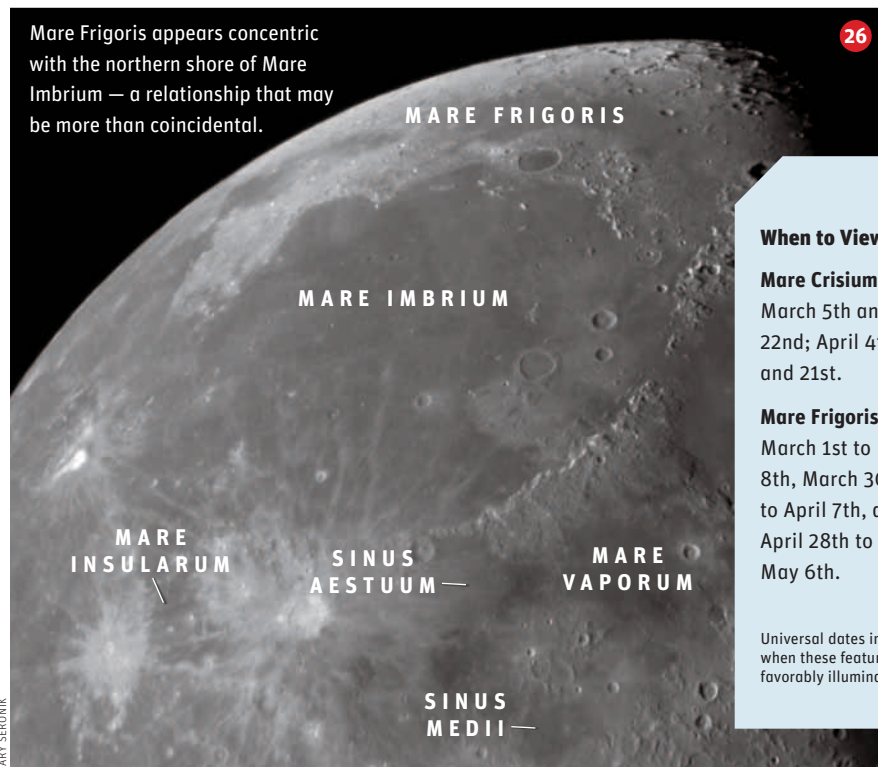
See *Sky & Telescope*: April 2004, page 113, or point your Web browser to [SkyTonight.com/lunar100](http://SkyTonight.com/lunar100).

"basins" typically have two to six concentric rings and are more accurately referred to as multiring impact basins. This aspect is best illustrated by the far-side basin Orientale — the youngest and least modified lunar basin.

Although six rings have been mapped around Orientale, only three are clearly visible. The most dramatic is the 930-km-wide Cordillera Mountains ring, which is partially visible when the western edge of the Moon is tilted toward us by libration. Inside the Cordillera range are three smaller, hilly rings. Some lunar scientists speculate that two indistinct rings also exist outside the Cordillera rim.

In the low zones between Orientale's rings are the puddles of mare lava named Lacus Autumni and Lacus Veris. The lavas forming these "lakes" apparently rose up through fractures associated with the rings and ponded in the spaces between them.

Orientale's nearly pristine nature provides a model of basin topography that helps explain some otherwise mysterious features found at older basins. For example, the Imbrium basin's equivalent of the Cordillera rim is the Apennine range. The Apennine rim has a diameter of 1,160 km, and

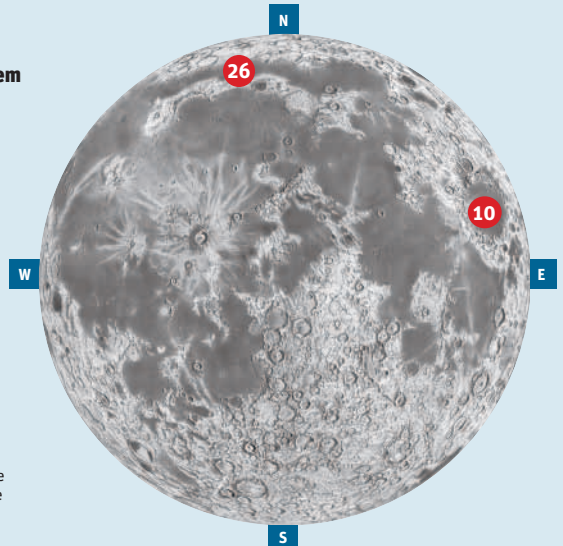


## When to View Them

**Mare Crisium:**  
March 5th and 22nd; April 4th and 21st.

**Mare Frigoris:**  
March 1st to 8th, March 30th to April 7th, and April 28th to May 6th.

Universal dates indicate when these features are favorably illuminated.



## ■ exploring the moon

beyond that is a 1,700-km-diameter rim that's defined partially by the northern shore of Mare Frigoris. Perhaps the lava in Frigoris fills a broad depression between two basin rims, just as in Lacus Veris and Lacus Autumni outside Orientale. The only problem with this explanation is that except for the edge of Frigoris and a few scattered peaks, there's very little topographic evidence for a Frigoris rim!

At the Crisium impact basin, the best-preserved outer ring passes through the crater Geminus and traces its way along the southern edge of the Taurus Mountains. The space between the 1,075-km-diameter Geminus ring and Crisium's mountainous 500-km-diameter main ring is relatively low and flat. Within this zone we find the small mare patches of Bonitatis, Anguis, and Undarum.

Can rings and ponds really explain Mare Frigoris? Perhaps. Nearby Oceanus Procellarum is another arcuate mare. It stretches about 2,000 km along the Moon's western limb. Procellarum was long considered a different class of mare from the circular maria. But perhaps Procellarum is the western third of a

3,200-km-wide circular basin. This putative basin has been mapped with several boundaries and has been known by different names: the Procellarum basin and the Gargantuan basin.

According to one interpretation, the giant basin's main rim involves the western shore of Procellarum and the northern edge of Frigoris but is poorly defined along its southern margins. In another interpretation, the northern edge of Frigoris is the boundary of an inner ring of a basin that includes nearly two-thirds of the lunar near side. The existence of a gigantic Procellarum basin is controversial, but if it's real in any of its guises, Frigoris is probably somehow related to it.

Regardless of which explanation is correct, Frigoris seems tied to impact basins after all — just like most other mare deposits on the Moon. \*

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