Hidden Maria and Dusty Debris

The Moon is geologically simple—it has impact cratering and volcanism, and everything else is related or a footnote. Although there are landforms that are purely impact or purely volcanic in nature, many lunar features are convoluted combinations of both. The reason is that neither volcanism nor impact cratering is particularly tidy. Ejecta from impacts is thrown great distances across the lunar surface, and sometimes as far afield as Earth, where pieces land as lunar meteorites. Volcanism embays, floods, covers, buries, destroys, and even lifts up craters that get in its way. Indeed, part of the fun of observing the Moon is trying to figure out the complex interplay between these two processes.

In general the story of the lunar highlands (the broad, bright, and battered expanse covering much of the Moon's southern hemisphere) is the story of craters on top of craters on top of craters. However, even here we find a number of intriguing “problem craters.” Consider Wargentin (L43 in the Lunar 100). It's an 84-kilometer-wide (52-mile) crater that has the same diameter as Tycho yet looks completely different. Tycho is a deep depression with magnificently terraced walls and a pyramidal central peak. Wargentin, on the other hand, lacks these features and appears to be filled to overflowing with some sort of smooth material. Classic selenographers assumed that the fill was lava but didn't seem to notice that the maria (where most lunar lava is found) are much darker than Wargentin.

After Orientale was recognized as a huge, relatively fresh impact feature, basin ejecta was proposed as the material filling nearby Wargentin. But there were problems with this explanation too. In your telescope you can see radial lines of debris that point back to Orientale, lying both north and south of the crater. Yet if you look closely you'll notice that none of this textured material actually covers Wargentin. Moreover, the crater's surface has a Y-shaped wrinkle feature that looks very much like a mare ridge.

A decade ago researchers at the University of Hawaii noticed a small, dark halo crater near the south end of Wargentin's floor. Using telescopic observations made with color filters, they were able to establish that the dark material in the halo was mare basalt. The little crater itself is a normal impact that dug through the light surface material and excavated underlying mare lava. This information, taken with the telltale smooth floor and wrinkle ridge, shows that...
Wargentin was indeed flooded by lava. And notice the smooth area to the northwest, between Schickard and Inghirami. It looks to me like lava overflowed the low part of Wargentin's rim and spread out onto the surrounding terrain. Can you imagine what an enormous lava fall that must have been?

Schickard (L39) is another odd crater that reflects a mixture of impact mechanics and volcanism. Measuring 227 km across, its great size is only one of its noteworthy aspects — it also features a prominent diagonal stripe. This feature gives Schickard's floor a bright middle and dark ends. If you look closely at the southwest corner of the crater you can see that the pale stripe is draped with lineations that are radial to Orientale. This suggests that the lighter material was also deposited during Orientale's formation. In the eastern half of Schickard's stripe you will find two craters with dark halos, establishing that the light material is just a thin veneer covering mare lavas. And the dark ends of the crater are mare basalts, but since they aren't covered by Orientale ejecta, they must have erupted onto the surface after the basin formed 3.84 billion years ago.

All this points to a complex history for Schickard. After the crater formed, mare lavas flooded its floor.

Next, the entire area [including Wargentin] received a dusting of light-hued Orientale ejecta. Sometime later, fresh lavas erupted on the northern and southern ends of Schickard's floor, and subsequent impacts left their signatures as dark-halo craters.

As you scan the region you will find several more dark-halo craters. In fact, they can be used to map out a broad region where older mare lavas were covered by Orientale ejecta. Such hidden maria, or cryptomaria as they are called, suggest that an ancient impact basin may exist here. We know that one overlooked old basin lies between the craters Schiller and Zucchius (S&T: April 2005, page 70), and there may be others. Prowl around when the Sun is high over the area and use the dark-halo craters as probes to see through Orientale's dusting of debris. *

A lunar scientist with an amateur's eye, 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.lpdq.org).

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**The Lunar 100**

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<td>Schickard</td>
<td>Crater floor with Orientale basin ejecta stripe</td>
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<td>Wargentin</td>
<td>A crater filled to the rim with lava</td>
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