

IMBRIUM DOUBLE BASIN

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It is proposed that the Imbrium basin on the Moon was created by two distinct overlapping impact events. In this model, the ring structure can more directly be explained as resulting from two separate impacts. The first basin to form is designated as Imbrium-North. Imbrium-South formed later, in the process erasing the southern rim of Imbrium-North.

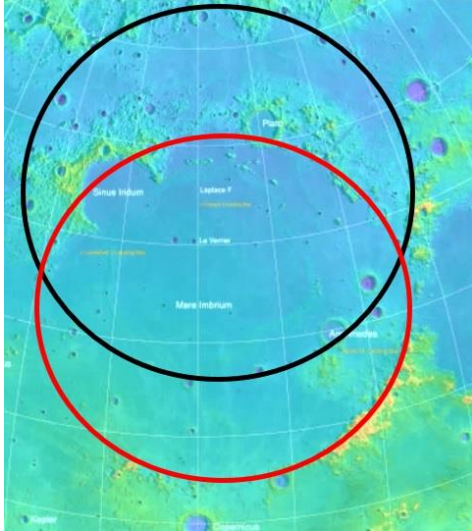


Figure 1: Imbrium Double Basin
(base map: Clementine LIDAR)

In Figure 1, the Imbrium-North basin is outlined in black, while Imbrium-South is outlined in red. Imbrium-North is centered at 15W (345E) longitude, 45N latitude. Imbrium-South is centered at 15W (345E) longitude, 30N latitude. Each has a diameter of roughly 1,100 kilometers, with Imbrium-North slightly larger than Imbrium-South.

This can be compared with the legacy model which includes all of these features into a single large Imbrium basin (Figure 2).

The offset between the 2 Imbrium impact in the Lunar Orbiter image in Figure 3.

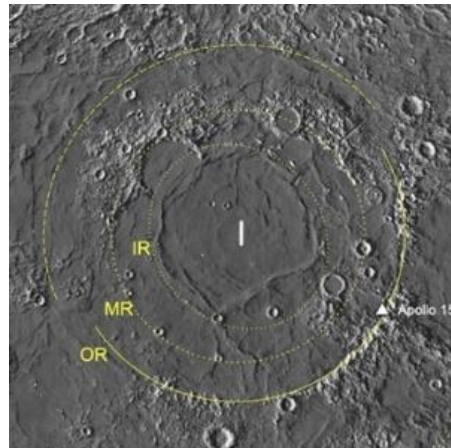


Figure 2: Legacy model;
Imbrium (1)

basins is clearly evident

There are several advantages to the double Imbrium basin concept. The formation of two basins would eliminate the need to invoke the impact of a protoplanet, as envisioned for the legacy Imbrium basin. (1) The Imbrium-North and Imbrium-South basins would have formed by the impact of objects within the normal size distribution of the early solar system.

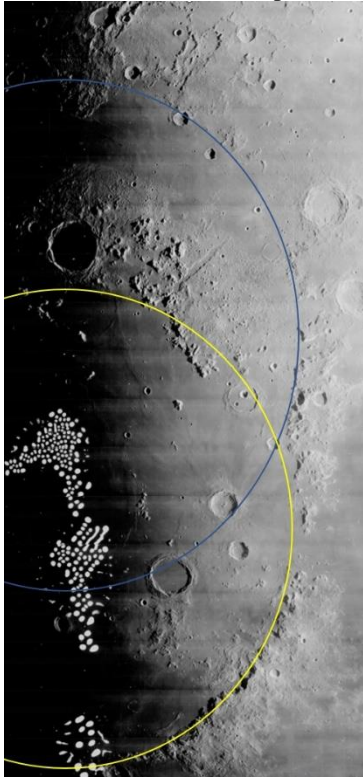
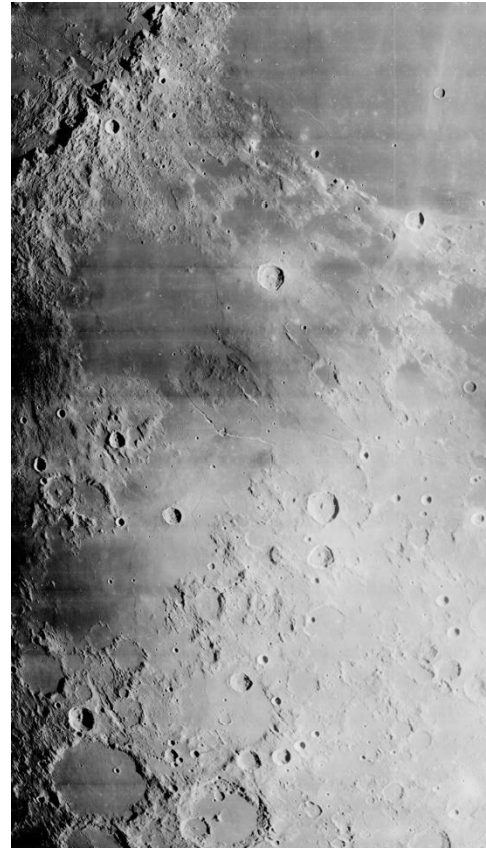


Figure 3: Double Imbrium Basin; Lunar Orbiter 4 image 4103-M (credit: LOIRP)

Another puzzling geologic feature is the Imbrium sculpture. The radial grooves that make up this formation appear to have two orientations. (1). The model of two Imbrium basins provides a logical solution. It is proposed that a separate generation of ejecta sculpture was formed by each Imbrium impact event. In this case, the first generation of grooves was created by the Imbrium-North impact. Those features were filled in by ejecta from the impact that created the Imbrium-South basin. That second impact created its own set

of radial gouges that are more pristine in appearance.

Those two generations of radial grooves can be seen in Figure 4 (Lunar Orbiter 4 image 4097-M; credit: LOIRP).



Sequential impacts may also explain the existence of the Appenine Bench Formation without invoking a highlands volcanic eruption scenario. The shock wave from the second Imbrium impact would have partially melted the rim massifs of the first basin. This semi-molten ejecta would have then formed the relatively smooth ABF deposit. This would be reworked material from the lower crust, explaining its K-rich (potassium) nature.

Reference:

- (1) "Origin and implications of non-radial Imbrium Sculpture on the Moon"
Peter H. Schultz & David A. Crawford
Nature volume 535, pages 391–394 (2016)