Lunar Views:
Making an Impact

Galileo was the first person to observe the moon through a telescope. Ever since then, professional and amateur scientists have been trying to answer the question about what formed all of the features we observe on our heavenly companion.

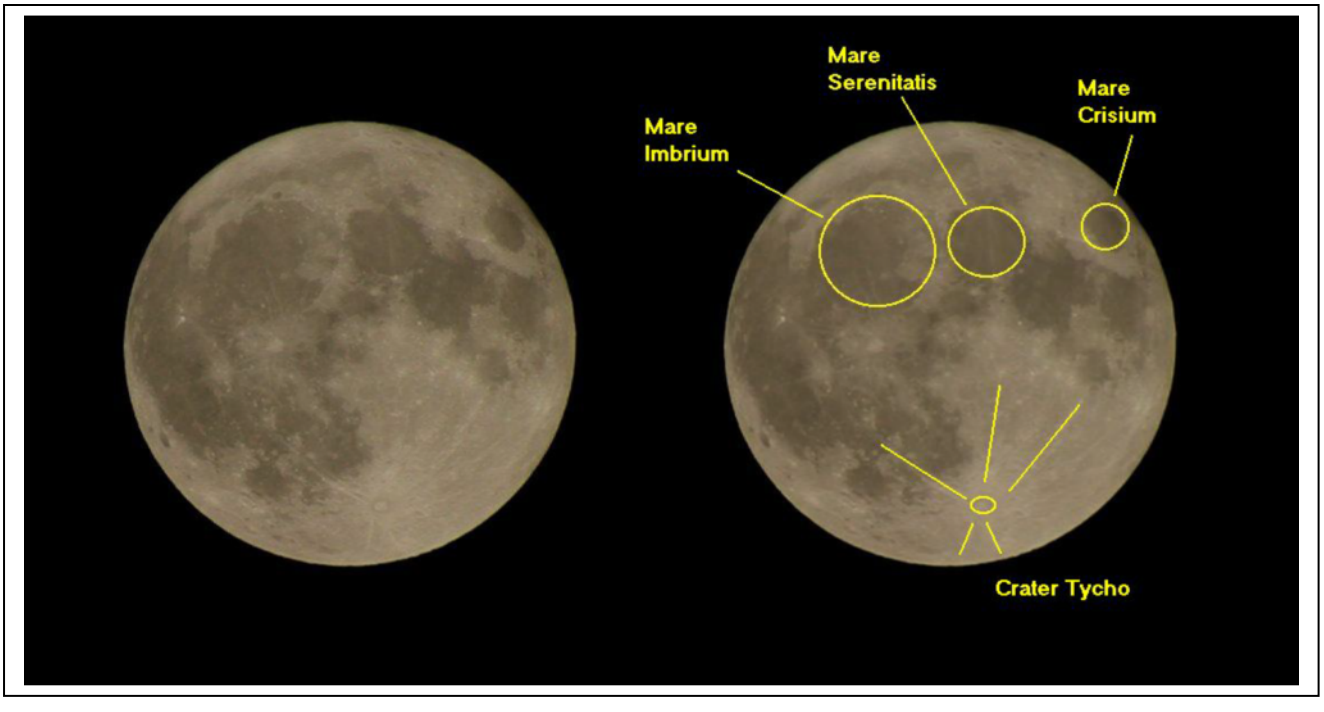
For most of the time since Galileo, it was widely believed that the craters on the moon were of a volcanic origin. There are still a few renowned scientists that hold on to this theory. This is a quite natural conclusion to make. Look around the surface of our Earth. What forms almost every crater that we see? Volcanism! So, it just seems natural that if the majority of the craters we see on Earth are volcanic, then the majority of the craters on the moon must be volcanic. In fact, there is only one obvious crater on the Earth that is not volcanic, the famous Meteor Crater in northern Arizona. If you are ever in this area, or flying over it, this crater is a definite must-see for any amateur astronomer. There are other non-volcanic crater remnants on Earth, but they are far less obvious.

So, at least we know by looking around on Earth that craters can be formed when a large alien object such as a meteor, asteroid, or comet comes smashing into our home planet. Since the Earth and the moon are so close to each other, wouldn't we expect there to be as many impact craters on Earth as there are on the moon? And, shouldn't we expect the proportion of impact to volcanic craters to be about the same on Earth and on moon? Well, the answer is no. For one thing, the geological slate of the surface of the Earth is constantly being erased by the erosive forces of wind, water, plate techtonics, and even volcanism. Thus, any craters that were formed on Earth more than a few hundred million years ago have been wiped away. The moon has no atmosphere to promote erosion by wind and water, and the crustal motion of the moon has been dormant for several billion years. Thus, the craters that formed

on the moon dating back almost completely to the formation of the solar system are still right there in nearly pristine condition.

So what about the origin of the craters on the moon? Are they volcanic or are they caused by impact? Look at all the volcanoes on Earth, they are all more or less the same size. They rarely exceed more than a few miles in diameter, most are just a few thousand feet in diameter. But, look at the variety of size of the craters on the moon. With a decent amateur telescope on a night of good seeing, you can resolve detail on the moon down to about one-half mile. Look closely and you will see craters as small as this. In fact, the Apollo astronauts, because they were standing right on the surface, could see craters that were just inches in diameter. Now with your telescope, look at the opposite end of the scale. There are also craters that are over 100 miles in diameter. You will see craters of all sizes quite easily. So, if these craters were volcanic, why would there be such an incredible range of size on the moon but not on the Earth? If you think instead about craters being caused by impact, it is quite easy to imagine the moon being bombarded by objects with a huge variety of sizes creating craters of all sizes.

Now step back from observing the individual craters, and look at the entire moon when it is full. Notice that even many of the dark mare basins are somewhat circular in shape. To me, the most obvious circular basins are Mare Imbrium, Mare Serenitatis, and Mare Crisium.



While looking at the face of the full moon through your scope or binoculars, find the crater Tycho. This should be a fairly easy to find crater in the south-central region. It is not an incredibly huge crater, but what makes it so easy to find are all of the bright rays that spread out from it, and thus point to it. The crater itself has a very bright central area surrounded by a darker ring of material, and then the lighter shaded rays that spread out from it. By observing this crater, it is just so easy to imagine a large asteroid smashing into the surface of the moon and spraying material out in all directions.

The impact theory for lunar feature formation has also been tested here on Earth through various experiments where an extremely high-speed projectile is fired into a test bed. Conventional bomb craters and nuclear weapons tests have also helped mankind to understand the impact nature of the lunar surface. Analysis of the lunar rock samples brought back by the Apollo astronauts has also helped to validate impact cratering on the moon.

Even though the majority of lunar craters are created by impact, there are a few that are truly of volcanic origin. In some future issue, I'll discuss these.

Next time, I'll discuss how different sized impactors create formations with different characteristics. Until then, observe the moon yourself and see if you notice how craters look the same, but how they look different.

You are welcome to contact me by email at doug@ShoestringAstronomy.com, and view some of the astronomical fun I have at www.ShoestringAstronomy.com