

## Impact Crater and Melting Repair Mechanism

# Shinichiro MADDO[1]

[1] Utsunomiya University

### Problem

When we observe the shapes of impact craters, there are various types, such as being flat inside, having surrounding lava flow like a shield volcano, etc. If these impact craters are made by the same mechanism, what is this mechanism?

### Mistakes in the Ordinary Explanation

In the ordinary explanation of impact craters, there are two types of craters. One type has a diameter smaller than 5 kilometers and the other type has the diameter greater than 5 kilometers. For the smaller type, craters should be bowl shaped. For the larger type, the craters have central uplifts which remain not excavated. They thought that the inside floor of a crater is flat because the ejector fall down again into the crater.

However, there is a mistake in the ordinary explanation. The bowl shaped crater is made by the shock wave which is created when the meteorite exceeds the sound barrier. If the meteorite loses some of its energy and become less rapid than sound, the shock wave will not be created. Therefore, it is physically impossible that the conical shaped frontier of the shock wave exceed the meteorite. The meteorite, which lost its energy enough to create shock wave, can create a meteorite hole deep into the earth with its remaining energy, yet.

The central uplift of a crater is a trace of the lava which flowed out from its meteorite hole.

### Melting Repair Mechanisms

On the Moon and planets, underground rocks become hotter the deeper you go, because of the heat created by the radioactive material which is ubiquitously contained in the rocks. The underground temperature will be higher than the melting point on the surface. If the meteorite hole is made into the rocks which are hotter than the melting point on surface, the rocks will melt because the pressure will decrease to the point of surface. The rocks melt to be lava which contains gases such as vapor, and other volcanic gases. The pressure of the gases pushes up the lava to the surface. The lava flowed out will make flat the bottom. In some cases the lava will spill out of a crater and make the shape of a shield volcano. In some cases the trace of the lava, which flowed out of the meteorite hole, is marked as a central uplift. In other cases central pits of lava are created above the meteorite holes. Moreover, in some cases, the central uplifts cave in and make a caldera.

I call this mechanism the melting repair mechanism.

### Conclusion

The mechanism of making an impact crater is explained by the melting repair mechanism. The melting repair mechanism is basically the same on all planets and the Moon.

If the energy of the meteorite is large enough, the meteorite will make not only a crater on the surface with the shock wave but also a meteorite hole at the center of the crater. In the case where the meteorite hole reached the rocks enough hot to melt, the lava is created and pushed out to the surface by the pressure of the gases. In the case where the meteorite has small energy, no lava flow will occur. In such cases, the place inside the ring shaped mountain chain will be excavated in the shape of a bowl.

If the meteorite has enough energy, the lava flow out of the meteorite hole will fill the bottom of the crater and make the bottom flat. In some cases, the traces of lava flowing out are marked as central uplifts. In some cases where the lava is great amount, the lava will spill over from the crater and make a shape like a shield volcano.

### References

1. Barlow, N. G., *Mars: An Introduction to its interior, Surface and Atmosphere*, Cambridge, 2008.
2. Faure, G. & Mensing, T. M., *Introduction to Planetary Science: The Geological Perspective*, Springer, 2007.
3. Grego, Peter, *Venus and Mercury: and How to Observe Them*, Springer, 2008.
4. North, Gerald, *Observing the Moon: The modern astronomer's guide*, Second Edition, Cambridge, 2007.