How does a volcanic crater grow? Grab some TNT and find out (w/ video)

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A new University at Buffalo study in the journal *Geophysical Research Letters* examines maar craters, which resemble the bowl-like cavities formed by meteorites but are in some ways more mysterious.

Scientists often can discern pertinent details about meteorites—when they struck, how large they were, the angle they approached Earth and other information—by measuring the diameter and volume of the impact crater.

Maar craters, which form when fissures of magma beneath Earth's surface meet groundwater, causing volcanic explosions, are not as telling, scientists say. The possibility of multiple explosions at varying depths led most scientists to believe that measuring a maar's size is not the best way to gauge the energy of individual explosions or determine future hazards.

UB geologist Greg A. Valentine, PhD, and other volcano researchers found instead that examining a maar's shape and the distance it ejects magma, ash and other debris to be a more accurate barometer of the eruption's force. The findings are important, he said, because they could assist scientists in estimating how big future volcano eruptions might be.

"It's something that, up until this point, had only been suspected," said Valentine, a professor of geology and lead author of the Geophysical Research Letters paper. "The simulations we did prove that crater diameter is not a good indicator of explosion energy for these volcanoes." The scientists drew their conclusions on a series of UBfunded experiments conducted last summer at a test site in Ashford, N.Y. They built three test beds of gravel, limestone and asphalt. In the first experiment (see the video below) one charge of TNT and plastic explosive was detonated.

In subsequent experiments, the charge was divided into three parts and detonated individually at different depths. The final dimensions of each crater were about the same. That matters, according to Valentine, because it shows that it's easy to overestimate the energy of explosions if one assumes that the crater comes from one blast, not several.

The dispersal of ejected material differed depending on the location of the charge. For example, the first experiment launched debris more than 50 feet from the crater. Debris from subsequent experiments simulating blasts further underground mostly went up in the air and fell back into the crater or around its rim. As a result, it forced dusty gas—like the ash that shut down air travel in Iceland and beyond in 2010—into the surrounding air. This can be seen in the video below.

Although the experiments provided valuable information, Valentine said they were similar to a practice run. More detailed experiments are being planned for the near future, he said.

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Provided by University at Buffalo