Geologists make their own lava to prep for explosive experiments

June 29 2016, by Charlotte Hsu

The lava-making furnace, viewed from above. Credit: Douglas Levere

How do you make your own lava?

Dump 10 gallons of basaltic rock into a high-powered induction furnace.

Let it heat up for 3 or 4 hours. Stir occasionally with a steel rod. Once the mixture is red hot and bubbling at 2,500 degrees Fahrenheit, pour it out.

That's the recipe, according to University at Buffalo geologists who are melting 10 gallons of rock at a time to prep for explosive experiments anticipated later this summer.

The work is taking place at a geohazards field station in Ashford, New York, about 40 miles south of Buffalo.

The facility, run by UB's Center for GeoHazards Studies, is equipped with microphones, thermal cameras, pressure sensors and other gear that the scientists will use to record what happens when they expose their molten rock to water.

Lava-water interactions are common in nature but poorly understood.

They drive the formation of volcanic maar craters, such as Hunt's Hole in New Mexico or Lake Nyos in Cameroon.

They can also enhance the explosive potential of ice-covered volcanoes, such as Iceland's Eyjafjallajökull, whose 2010 eruption unleashed an ash cloud that grounded air traffic across much of Europe for nearly a week.

The UB lava-making operation—one of the largest in the world—will provide a rare, close-up view of the interplay between molten rock and water.

The research will yield insight on why the two substances sometimes generate huge explosions when they come together, and sometimes cause no damage at all.

"The eruption at Eyjafjallajökull was more explosive due to the presence of water," says project lead Ingo Sonder, a research scientist at UB's Center for GeoHazards Studies. "Events like that don't happen often, but there is a threat of a big impact when they do. As geologists, we want to understand the conditions that generate explosions—how much water do you need? How much time?"

The answers could help scientists better gauge the danger that volcanoes near ice, lakes, oceans and underground water sources pose to surrounding communities.

Ingo Sonder, a research scientist at UB's Center for GeoHazards Studies, pours the lava from the furnace after the melt is complete. Credit: Douglas Levere

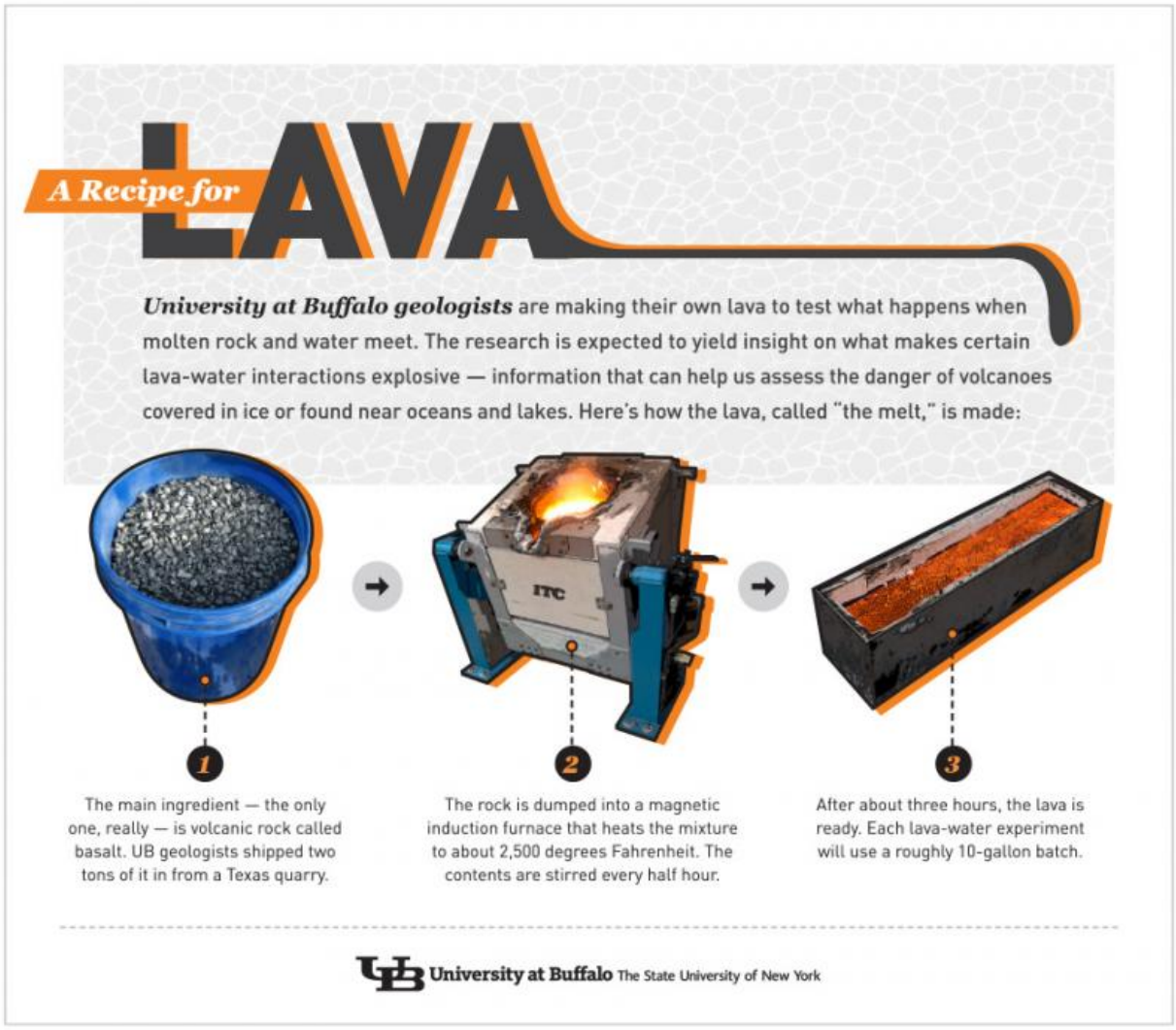
Scaling up lava science

Experiments on water and lava have been done on a smaller scale, with a lot less lava, at Universität Würzburg in Germany, where Sonder previously worked. His UB team will build on the Würzburg research by using larger quantities of both materials to better mimic natural volcanic settings.

"Previous studies have used a coffee cup-sized amount of lava," says UB geology postdoctoral researcher Alison Graettinger. "They did it at a small-scale. We're doing it bigger, because there are a lot of questions about whether we'll see the same results when experiments are scaled up."

The research, funded by the National Science Foundation, will be overseen by a core group that includes Sonder, Graettinger and UB geology professor Greg Valentine, who directs the Center for GeoHazards Studies in UB's College of Arts and Sciences.

After the scientists perfect their rock-melting process, the explosive lava-water experiments will start.



Credit: Bob Wilder

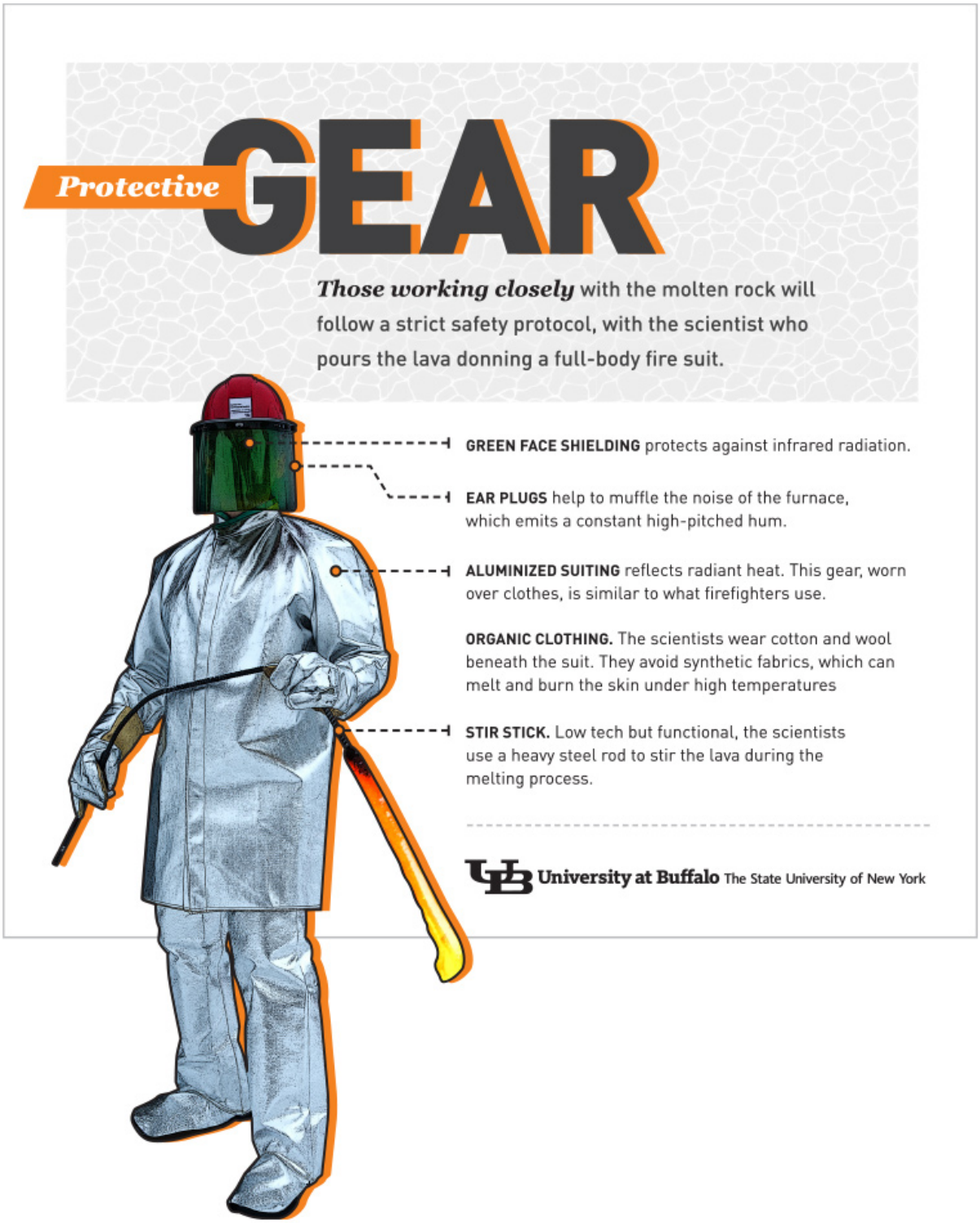
The tests will involve pouring the lava—called "the melt"—into a slim, 4-foot-long metal box that simulates the narrow channels through which molten rock flows inside volcanoes.

Then, the team will inject the lava with water to see what happens. Each experiment will use a nearly 10-gallon batch of melt, and the scientists expect to go through hundreds of gallons of lava by the time they are

done with their project.

Safety will be a priority: Those working closely with the molten rock will follow strict safety procedures, with the scientist who pours the lava donning space suit-like protective gear that includes a reflective suit, gloves and green face shielding to protect against infrared radiation.

"It's exciting to be doing this science," Graettinger says. "No one has done it before on this scale, and these lava-water interactions aren't well understood. Sometimes when water and lava meet, the lava will appear to completely ignore the water. Sometimes, the lava will cool and form distinctive cracking patterns, or form interesting shapes like pillow lavas. And sometimes, the reaction is violent. Why?"



Credit: Bob Wilder

An international user facility for testing hazards

The Geohazards Field Station where the research is occurring began operations in 2012 at a 700-acre experimental site in Western New York.

UB's Center for GeoHazards Studies is working to develop portions of the site as an international user facility—a place where scientists worldwide can come and run large-scale experiments simulating geological hazards. The first project done on-site, led by Valentine and Graettinger, involved detonating dynamite under gravel, ping pong and tennis balls to model how debris flies during a volcanic eruption.

The field station's buildout is guided by feedback from the scientific community, including about 50 geohazards experts who met at UB in 2010 to discuss field research needs.

The lava furnace provides unique experimental capabilities at the site and, eventually, could be available for use by other researchers, Valentine says.

Provided by University at Buffalo