World's Biggest Landslide Floated Like a Hovercraft

Becky Oskin, Yahoo News, 1-21-15

Imagine a landslide as big as Rhode Island speeding toward you as fast as an Indianapolis 500 sprint car.

Just how can a mountain move so fast? The massive Heart Mountain landslide in Wyoming raced to its final resting place on a cushion of carbon dioxide gas, similar to a hovercraft gliding on air, a new study suggests.

"Even I have a hard time visualizing a mountain moving 50 kilometers [31 miles], but you can move it if the friction is low enough," said lead study author Tom Mitchell, a geophysicist at University College London in the United Kingdom. [Natural Disasters: Top 10 US Threats]

The Heart Mountain landslide is the largest landslide ever found on Earth's surface (larger landslides exist in the ocean). Many scientists think the slide was triggered by a violent volcanic eruption in Wyoming's Absaroka volcanic field 48.8 million years ago. The blast launched a 31-mile-long ridge of Madison Limestone toward the Southeast. The slab broke up as it traveled; now, more than 100 huge limestone blocks are scattered across some 1,310 square miles (3,400 square kilometers) of younger rocks in northwestern Wyoming and southeastern Montana.

Geologists noted the unusual juxtaposition of rocks more than 100 years ago, but have yet to agree on how the landslide glided across the landscape. These strange observations have fueled one of Heart Mountain's greatest mysteries: how the landslide crossed more than 28 miles (45 km) along a surface tilted at an angle of less than 2 degrees. (A typical landslide slope angles at 45 degrees or higher, Mitchell said.) Evidence from some studies suggests the slide covered this distance in only 3 minutes, racing at a third of the speed of sound. But other studies have argued that the blocks gradually shifted into place over the course of a million years. Other popular ideas have included earthquakes, volcanic fluids or the slow tug of gravity.

Float like a butterfly?

Remnants of the Heart Mountain landslide are spread across 1,300 square miles (3,400 square kilomete …

Now, laboratory experiments on limestone and dolostone rocks from the landslide seem to support the idea that the landslide slid catastrophically fast. In the tests, conducted at INGV Rome's specialized laboratory, Mitchell and his colleagues ground together limestone and dolostone at high pressures and speeds to mimic the landslide. Almost as soon as the experimental landslide started, the rocks started to break down and release carbon dioxide gas.

"You can produce these gases early on, at the very early stages of landslide slip," Mitchell told Live Science.

The gas cushion, trapped between the landslide block and rocks underneath, could have lifted the heavy limestone and reduced friction to nearly zero, according to the study, published online Dec. 23, 2014, in the journal Earth and Planetary Science Letters. "It's almost like it's weightless," Mitchell said.

The experimental setup limited the researchers to testing the effects of about 0.6 miles (1 km) thickness of rock, but the Heart Mountain landslide carried a wall of rock that was 1.2 to 2.5 miles (2 to 4 km) thick.

Mitchell said the thicker rock would likely result in even more extreme conditions. "The size of the mountain doesn't matter," he said. "This thin cushion of gas is all you need at high speeds."

Tiny bubbles and other structures in the experimentally sheared rocks also matched those seen in the real-world landslide rocks at the layer that marks the contact between the landslide and the rocks underneath, the researchers reported. These matches indicate to the researchers that the natural structures could have been produced by gas escaping during the landslide.

"It's fabulous science," said John Craddock, an expert on the Heart Mountain landslide who was not involved in the study. "All of a sudden, you have experimental evidence that even with really tiny displacements, you do generate a gas," said Craddock, a structural geologist at Macalester College in St. Paul, Minnesota. "It validates the hovercraft idea."

Craddock thinks the amount of carbon dioxide gas released by the landslide would have left a signal in the rock record, and he has been searching for the evidence. "We haven't found anything yet, but it's got to be a lot," he said.