Scientists map volcanic plume under Yellowstone

15 April 2011, By MATT VOLZ , Associated Press

Aerial view showing faults associated with the northeastern side of the Yellowstone caldera. Image: U.S. Geological Survey

Scientists using electric and magnetic sensors have mapped the size and composition of a vast plume of hot rock and briny fluid down to 200 miles below Yellowstone National Park's surface, according to a new study soon to be published.

The so-called "geoelectric" imaging of a plume to this extent is a first, giving researchers a clearer picture of the material that feeds Yellowstone's volcanic features, said Robert B. Smith, the study's co-author, a University of Utah professor emeritus and a coordinating scientist of the Yellowstone Volcano Observatory.

The information will help scientists better understand the evolution of these hot spots that are an integral part of continental drift and are active in 20 places around the world from Hawaii to Iceland, he said.

"This is the first time that an electrical image has been made of a plume anywhere in the world, period," Smith said. "We're getting much more information on the composition and evolution of the earth."

The plume is made up of solid rock, partly molten rocks and briny fluid that conducts electricity like seawater, said Smith and principal author Michael Zhdanov, a University of Utah geophysics professor. The plume rises from the earth's depths at a 40-degree angle and extends 400 miles from east to west, the data found. The image of the plume reaches a depth of 200 miles, the limit of the technology.

A previous study by Smith using seismic waves measured the plume's depth to at least 410 miles below the Montana-Idaho border.

The study will be published in Geophysical Research Letters within the next few weeks, according to the American Geophysical Union.

The new data, which measured the plume's electrical conductivity to create the image, supplements Smith's seismic data that gave scientists their first detailed look at the plume in 2009. Both seismic and electrical conductivity are imaging technologies that reveal different things.

Together, the data reveal a plume that is larger and contains more brine and fluid than previously believed.

"All this is very important to better understand the physics of this plume," Zhdanov said. "We are just learning. It's a very new phenomenon and now we've got another tool to get an image and better understanding of the composition and geographical shape."

That tool may help lead one day to developing a way to better forecast eruptions and other volcanic activity, he said.

Derek Schutt, an assistant professor at Colorado State University, said others have used the geoelectric technology but not to these proportions. The technology is a useful supplement to seismic measurements and will lead to a better understanding of how the earth is forming, he said.

"I think what this will be particularly useful for is we can understand much better the magma distribution of what's under Yellowstone," he said.

The research says nothing about the chance for a large eruption happening at Yellowstone, which draws millions each year to see its bubbling pots and spouting geysers. Yellowstone's caldera, a 37-by-25-mile volcanic feature at the center of the park, has erupted three times since the North American continent drifted over the hot spot. The last eruption was 642,000 years ago.

The plume stops rising about 60 miles below the surface. Some of that melted rock then leaks up, possibly through a series of rock fractures, to a chamber about five miles below the surface of the Yellowstone caldera, Smith said. That magma chamber feeds the volcanic activity on the surface.

If enough of the plume breaks off and rises to the chamber, an eruption could happen. But that accumulation happens very slowly over thousands of years and there is no indication of when an eruption could occur, Zhdanov said.

APA citation: Scientists map volcanic plume under Yellowstone (2011, April 15) retrieved 25 October 2020 from https://phys.org/news/2011-04-scientists-volcanic-plume-yellowstone.html