Scientists discover reason for Mt. Hood's non-explosive nature

February 13 2012

Mount Hood, in the Oregon Cascades, doesn't have a highly explosive history. (Photo courtesy Alison M Koleszar)

(PhysOrg.com) -- For a half-million years, Mount Hood has towered over the landscape, but unlike some of its cousins in Oregon's Cascade Mountains and many other volcanoes around the Pacific "Rim of Fire," it doesn't have a history of large, explosive eruptions.

Now a team of scientists has found out why.

In new research just published online in the *Journal of Volcanology and Geothermal Research*, lead author Alison Koleszar of Oregon State University and her colleagues describe how mixing of magma deep beneath Mount Hood appears to have prevented it from blowing its top over the millennia. Their research has been funded primarily by the National Science Foundation.

Volcanic eruptions are usually described as "high-explosivity" or "low-explosivity" events, said Koleszar, who is a post-doctoral researcher in OSU's College of Earth, Ocean, and Atmospheric Sciences. Many volcanoes have experienced both. High-explosivity events are often referred to as Plinian eruptions, named after Pliny the Younger who described the eruption of Mount Vesuvius that destroyed the Roman city of Pompeii in AD 79. During these eruptions, large amounts of magma are ejected into the atmosphere at high velocity – such as Mount St. Helens in 1980 and Mount Pinatubo in 1992.

But studies of the rocks around Mount Hood show that the volcano has never experienced a Plinian eruption despite having similar chemical magma composition and gas contents as other volcanoes that have gone through these violent episodes.

The reason, Koleszar says, is that eruptions at Mount Hood appear to be preceded by episodes of intense mixing between magmas of different temperatures. Hot magma rises from deep below Mount Hood and mixes with the cooler magma that underlies the volcano. Heat from the deeper, hotter magma increases the temperature and lowers the viscosity of the magma that eventually erupts.

Instead of exploding, a la Mount St. Helens, magma at Mount Hood oozes out the top of the volcano and piles up to form a lava dome.

“If you take a straw and blow bubbles into a glass of milk, it will bubble up and allow the pressure to escape,” Koleszar said. “But if you blow bubbles into a thick milkshake you need more pressure and it essentially ‘erupts’ with more force as bits of milkshake get thrown into the air. Add a little heat to the milkshake, though, and it thins out and bubbles gently when you blow into it, more like the glass of milk.

"That what Mount Hood has been doing – heating things up enough to avoid a major explosion.”

What happens instead of an explosive eruption is more of a hiccup, according to Adam Kent, an OSU volcanologist who was Koleszar’s major professor when she earned her doctorate. The researchers analyzed three eruptive events on Mount Hood from the past 30,000 years, the last of which occurred about 220 years ago. These low-explosivity events resulted in the formation of lava domes near Mount Hood’s summit. Crater Rock, on the south side of the mountain, is a remnant of one of these lava domes.

“Instead of an explosion, it would be more like squeezing a tube of toothpaste,” said Kent, who also is an author on the study. “Lava piles up to form a dome; the dome eventually collapses under its own weight and forms a hot landslide that travels down the side of the volcano. In contrast, during a Plinian event such as the kind seen at other volcanoes, ash and rock are blown high into the air and distributed all over.”

Although Mount Hood lacks an explosive history, it doesn’t mean the 11,240-foot peak is completely docile. Collapses of the lava dome at Crater Rock about 1,500 years ago, and again 220 years ago, sent scalding landslides of hot lava blocks down the south side of the volcano, Kent pointed out.

“These types of events have dominated the eruptive activity at Mount

Hood for the past 30,000 years," Kent said. "The other danger is from lahars, which are major mudflows that stream down the side of the mountain at some 50 miles-an-hour, with the consistency of cement. They result when heat from the magma melts snow and mixes it with the volcanic ash and rock.

"Lahars probably accompany most eruptions of the volcano, and can even occur between eruptions after heavy rains or rapid snowmelt," Kent added. "And they can go quite a ways – all the way to the Columbia River, for instance."

Koleszar said few other volcanoes around the world act quite like Mt. Hood. It is, she said, a poster child for low-explosivity eruptions.

"Mount Hood is really cool because it is such a model for one extreme of volcano behavior," Koleszar pointed out. "It may not have the colorful history of Mount Mazama or St. Helens, but it has its own niche among volcanoes – and now we better understand why it behaves the way it does."

Provided by Oregon State University