Icelandic volcano sits on massive magma hot spot

October 24 2014, by Andy Fell

Holuhraun fissure eruption on the flanks of the Bárðarbunga volcano in central Iceland on Oct. 4, 2014, showing the development of a lava lake in the foreground. Vapor clouds over the lava lake are caused by degassing of volatile-rich basaltic magma. Credit: Morten S. Riishuus, Nordic Volcanological Institute

Spectacular eruptions at Bárðarbunga volcano in central Iceland have been spewing lava continuously since Aug. 31. Massive amounts of erupting lava are connected to the destruction of supercontinents and dramatic changes in climate and ecosystems.

New research from UC Davis and Aarhus University in Denmark shows that high mantle temperatures miles beneath the Earth's surface are essential for generating such large amounts of magma. In fact, the scientists found that the Bárðarbunga volcano lies directly above the hottest portion of the North Atlantic mantle plume.

The study, published online Oct. 5 and appearing in the November issue of *Nature Geoscience*, comes from Charles Lesher, professor of Earth and Planetary Science at UC Davis and a visiting professor at Aarhus University, and his former PhD student, Eric Brown, now a post-doctoral scholar at Aarhus University.

"From time to time the Earth's mantle belches out huge quantities of magma on a scale unlike anything witnessed in historic times," Lesher said. "These events provide unique windows into the internal working of our planet."

Such fiery events have produced large igneous provinces throughout Earth's history. They are often attributed to upwelling of hot, deeply sourced mantle material, or "mantle plumes."

Recent models have dismissed the role of mantle plumes in the formation of large igneous provinces, ascribing their origin instead to chemical anomalies in the shallow mantle.

Based on the volcanic record in and around Iceland over the last 56 million years and numerical modeling, Brown and Lesher show that high mantle temperatures are essential for generating the large magma volumes that gave rise to the North Atlantic large igneous provinces bordering Greenland and northern Europe.

Their findings further substantiate the critical role of mantle plumes in forming large igneous provinces.

"Our work offers new tools to constrain the physical and chemical conditions in the mantle responsible for large igneous provinces," Brown said. "There's little doubt that the mantle is composed of different types of chemical compounds, but this is not the dominant factor. Rather, locally high mantle temperatures are the key ingredient."

More information: *Nature Geoscience*, www.nature.com/ngeo/journal/va … t/full/ngeo2264.html

Provided by UC Davis