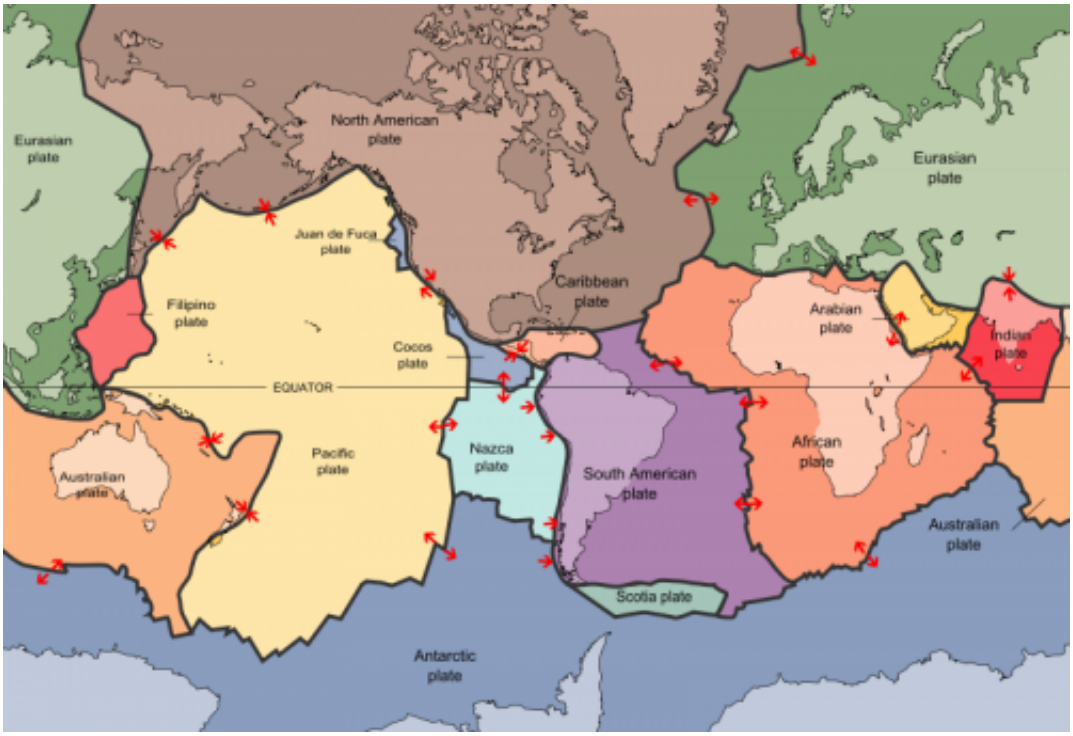
Researchers find evidence of hot spot that burned eastern underside of US tectonic plate

September 16 2013, by Bob Yirka



This map shows 15 of the largest tectonic plates. Credit: USGS

(Phys.org) —A combined team of researchers from the U.S. and China has found evidence of what they believe is burning on the underside of the North American tectonic plate. In their paper published in the journal *Nature Geoscience*, the team describes how they used data from a minor earthquake that occurred in the eastern part of the North America in 2011 to reveal hot spot activity below.

Hot spots are plumes of hot material that rise from deep within the Earth—sometimes, when encountering thin crust, they burst through forming volcanoes such as that which occurred with the Pacific Plate causing the formation of the Hawaiian Islands. Scientists believe that while tectonic plates move around, hot spots do not. Thus, plates sometimes move over the top of a hot spot. In the case of North America, the researchers believe that as the tectonic plate shifted to the west, its underside was burned from below by a hot spot—like a dinner plate passing over a candle. So great was the movement, it left the hot spot hiding beneath the Atlantic Ocean, where it persists to this day.

To come to these conclusions, the researchers studied data from the earthquake that occurred back in 2011, centered in Virginia. Because seismic waves travel slower when moving through warmer rock, the researchers were able to discern that there lies a ridge of warm rock beneath the North American tectonic plate—evidence they say of burning left behind by the hot spot, as its depth is roughly equal to the depth of the bottom of the plate. The research data indicates that the scaring reaches from Missouri in the west towards Virginia in the east, then north-east through Maryland, Pennsylvania, New York and Massachusetts before appearing on the underside of the crust below the Atlantic Ocean.

Prior research by other scientists has suggested that when a tectonic plate passes over a hot spot, and can't burst through, the result is oftentimes diamond-bearing formations. In addition to studying seismic waves, the researchers also noted that there is a diamond-bearing formation over one part of the scarred segment—in Kentucky—further proof they say, that their assumptions about the hot spot are correct.

More information: Hidden hotspot track beneath the eastern United States, *Nature Geoscience* (2013) DOI: 10.1038/ngeo1949

Abstract

Hotspot tracks are thought to be the surface expressions of tectonic plates moving over upwelling mantle plumes, and are characterized by volcanic activity that is age progressive. At present, most hotspot tracks are observed on oceanic or thin continental lithosphere. For old, thick continental lithosphere, such as the eastern United States, hotspot tracks are mainly inferred from sporadic diamondiferous kimberlites putatively sourced from the deep mantle. Here we use seismic waveforms initiated by the 2011 Mw 5.6 Virginia earthquake, recorded by the seismic observation network USArray, to analyse the structure of the continental lithosphere in the eastern United States. We identify an unexpected linear seismic anomaly in the lower lithosphere that has both a reduced P-wave velocity and high attenuation, and which we interpret as a hotspot track. The anomaly extends eastwards, from Missouri to Virginia, cross-cutting the New Madrid rift system, and then bends northwards. It has no clear relationship with the surface geology, but crosses a 75-million-year-old kimberlite in Kentucky. We use geodynamical modelling to show that an upwelling thermal mantle plume that interacts with the base of continental lithosphere can produce the observed seismic anomaly. We suggest that the hotspot track could be responsible for late Mesozoic reactivation of the New Madrid rift system and seismicity of the eastern United States.

© 2013 Phys.org

Citation: Researchers find evidence of hot spot that burned eastern underside of US tectonic plate (2013, September 16) retrieved 28 April 2024 from https://phys.org/news/2013-09-evidence-hot-eastern-underside-tectonic.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.