Ancient super-eruptions in Yellowstone Hotspot track 'significantly larger' than expected

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The entire cliff would have been deposited very quickly from a fast-moving current of hot gas and ash (a pyroclastic density current), and the extreme temperatures (900-1000°C) caused the ash to weld to the ground and effectively enameled the area in dense volcanic glass. Note how the ancient top soil has been baked to orange terracotta in response to the intense heat. Credit: Marc Reichow, University of Leicester

A number of giant super-eruptions between 8 and 12 million years ago that could be larger than the colossal eruptions known to have taken place at Yellowstone have been identified in the United States through research led by the University of Leicester.

The international research team suggests that while the number of volcanic eruptions thought to have originated from the central Snake River Plain in Idaho, USA is less than previously believed, the 12 recorded giant eruptions were likely 'significantly larger' than research has previously suggested.

Dr Tom Knott, Professor Mike Branney and Dr Marc Reichow, from the University of Leicester's Department of Geology's Volcanology Group, conducted the research with a team of international collaborators from the University of California, Santa Cruz, the University of Copenhagen, Denmark and Idaho State University.

Using a multi-technique approach, including whole-rock and mineral chemistries, palaeomagnetic data, and radio-isotopic dates, the team has been able to 'fingerprint' individual eruption deposits and correlate these over vast regions (e.g., 1000's km^2).

In establishing widespread correlations, the team drastically reduced the number of eruptions previously thought to have originated from the central Snake River Plain by more than half.

Scenic canyon in southern Idaho, USA, which beautifully exposes several cliff-forming, intensely-welded deposits each recording an individual giant eruption. Credit: Marc Reichow, University of Leicester

The researchers have reported that one of the super-eruptions from the Yellowstone hotspot-track, defined as the Castleford Crossing eruption, occurred about 8.1 million years ago and estimate the eruption volume to have exceeded 1,900 km^3. The single volcanic sheet covers an area over 14,000 km2 in southern Idaho, and is more than 1.3 km thick in the caldera of the super-volcano.

This is just one of 12 giant eruptions reported from the area by the Leicester team, who show that intense hotspot magmatism caused major crustal subsidence, forming the 100 km-wide Snake River Basin. The

team also demonstrates that these eruptions were in fact significantly larger than previously thought and may rival those better known at Yellowstone.

Dr Knott said: "While it is well-know that Yellowstone has erupted catastrophically in recent times perhaps less widely appreciated is that these were just the latest in a protracted history of numerous catastrophic super-eruptions that have burned a track along the Snake River eastwards from Oregon to Yellowstone from 16 Ma to present.

"The size and magnitude of this newly defined eruption is as large, if not larger, than better known eruptions at Yellowstone, and it is just the first in an emerging record of newly discovered super-eruptions during a period of intense magmatic activity between 8 and 12 million years ago."

More information: Thomas R. Knott et al. Mid-Miocene record of large-scale Snake River–type explosive volcanism and associated subsidence on the Yellowstone hotspot track: The Cassia Formation of Idaho, USA, *Geological Society of America Bulletin* (2016). DOI: 10.1130/B31324.1

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