Distant Deposits Hint at Huge Eruption

By linking volcanic deposits on either side of the Atlantic Ocean, a team of geologists has found evidence for what they suggest is the largest known eruption in the last half billion years.

The clues for such a large eruption 454 million years ago come from layers of soft rock called bentonite that appear frequently in deposits from Earth's Ordovician period. Geologists regard bentonite as the remains of volcanic ash that blanketed the ground after an eruption and was later transformed into a clay-like rock. The prevalence of Ordovician bentonite beds in North America and northern Europe has caused many researchers to wonder whether these deposits came from a common volcano or group of volcanoes.

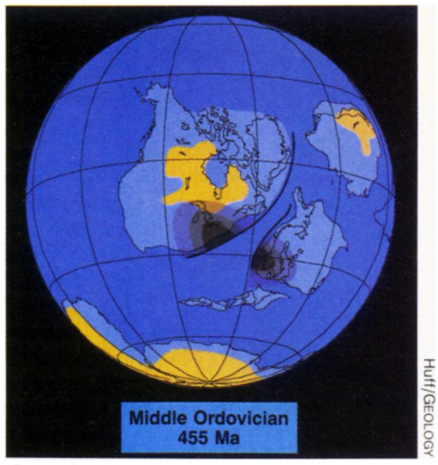
"The beds were there and people have known about them for decades. But nobody had ever tried any systematic effort to see if they could be related to each other," says Warren D. Huff of the University of Cincinnati. "What we have done is bring together all the pieces of evidence we could muster on that question."

In the October GEOLOGY, Huff and his colleagues now present evidence relating two major bentonite beds on the two continents. Not only did these deposits hail from the same volcano, they also originated during the same eruption, the researchers propose.

To link the distant beds, Huff and his coworkers used a form of chemical fingerprinting that compares the relative concentrations of six rare elements in the bentonites. This method suggests that a thick Scandinavian layer called the Big Bentonite is the same as a major North American bed called the Millbrig. The fingerprinting can also distinguish the two big layers from others at the same locations, showing that the others erupted at different times, Huff says.

In North America, the Millbrig bed spreads from western Iowa to Quebec and northern Alabama. Averaging about 1 to 2 meters in thickness, the bed is thickest in the Appalachian region, which would have been the North American coastline during Ordovician times. In Europe, the Big Bentonite bed extends from north-central Sweden to the Baltic region and northern Poland. During the time of the eruptions, the ancestral North American continent lay across a small ocean from the Baltoscandian continent, which carried present-day Scandinavia, the Baltics, and eastern Russia. The beds apparently came from a volcano located off the eastern coastline of North America.

From the aerial extent of the Big Bentonite and Millbrig deposits, the researchers calculate these layers contain 340 cubic kilometers of ash. A much larger amount of ash must have fallen in the ocean that separated the two continents. Using the presumed location of the continents at the time, Huff and his colleagues estimate that at least 800 cubic km disappeared in the water. The total of 1,140 cubic km represents the largest known ashfall.



Huff/GEOLOGY

Gray shows ash thickness on early North American and Baltoscandian continents.

Although the blast would have created a globe-circling dust cloud, it apparently did not cause any major extinctions, the researchers report. This finding, they say, casts doubt on the idea that a cloud from a meteorite impact caused the dinosaurs and other creatures to die out 65 million years ago.

While the new report has intrigued some geologists, many remain skeptical about the proposed correlation between the two beds. "They may be right, they just haven't demonstrated it yet," says Scott D. Samson of Syracuse (N.Y.) University.

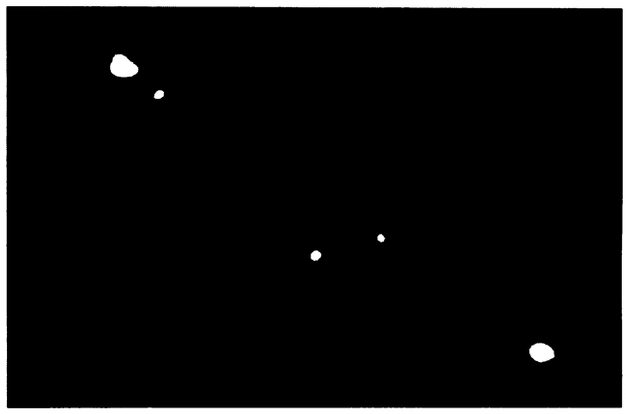
Michael R. Rampino of New York University questions the analogy between a volcanic dust cloud and one from an impact. The latter carries much more energy and may have lofted material higher in the atmosphere, he says.

Huff says his group is currently conducting a more refined type of fingerprinting on the bentonite beds, which could resolve some of the remaining questions. Later this month, researchers will hold a session on the Ordovician bentonites at a meeting of the Geological Society of America. *– R. Monastersky*

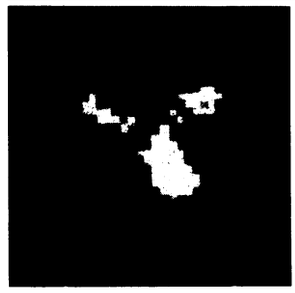
Gravity's lens: Hubble gets sharpest image

Examining a distant cluster of galaxies, the Hubble Space Telescope has produced the sharpest picture ever of a cosmic mirage called gravitational lensing. Researchers say that as Hubble takes more of these high-resolution images, they will yield a more accurate estimate of the universe's dark matter – material that can't be observed like ordinary matter.

Richard S. Ellis of Durham University in England and his colleagues weren't searching for a gravitational lens when they began analyzing a Hubble image, taken last November, of a remote galactic cluster called AC114. But graduate student Ian Smail spotted two unusual structures on opposite sides of the Hubble picture. The objects were nearly mirror images of each other, indicating that dark matter in the cluster, which lies 4 billion light-years from Earth, acts as a giant lens. The gravity field of the unseen material had bent starlight from a more distant body, much as a distorted glass lens might create multiple images from a single light source.



NASA



Above: Highest-resolution picture ever taken of gravitational lensing. Arrows show mirror images of a background galaxy distorted by dark matter in the galactic cluster AC114; objects in the center are material from the cluster. Left: The Extreme Ultraviolet Explorer detected a quasar-like body, PKS 2155-304, 2 billion light-years beyond the Milky Way.