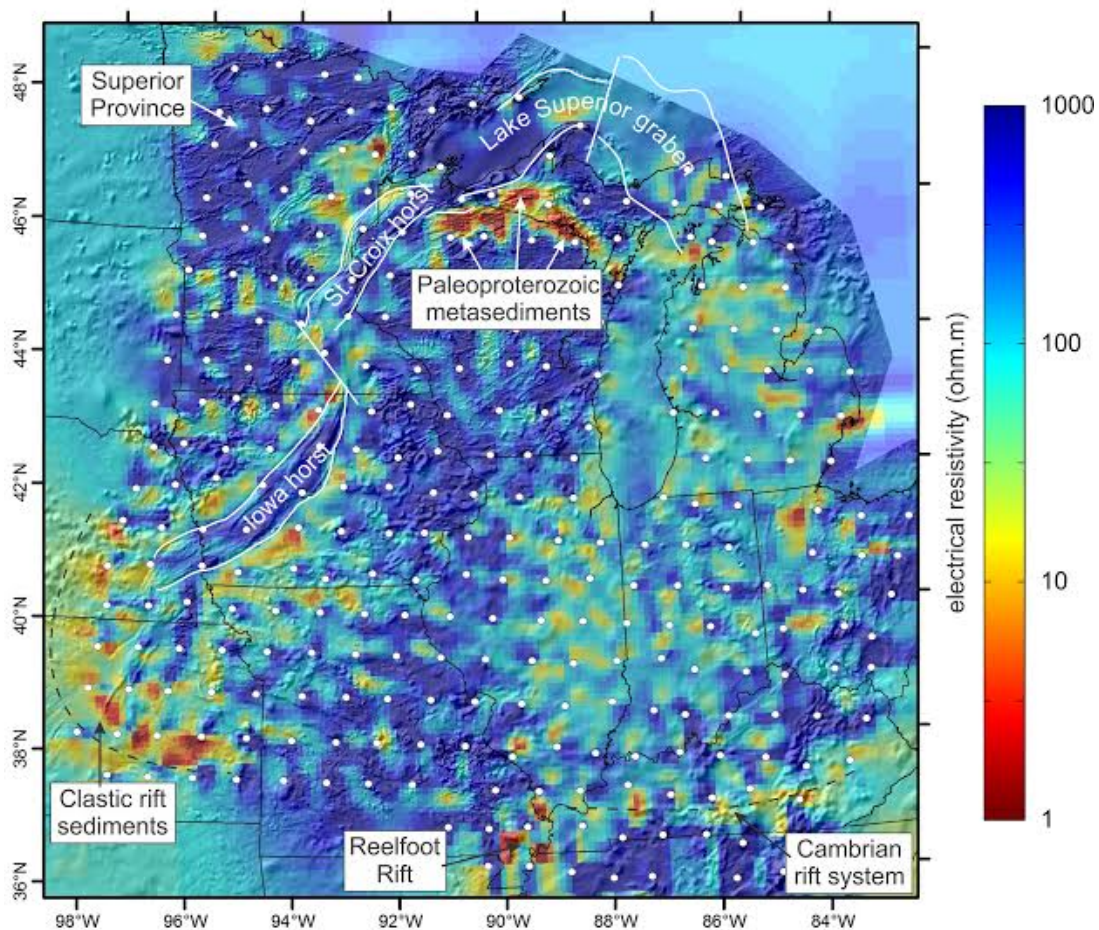


## EARTHSCOPE MAGNETIC DATA REVEAL BURIED RESOURCES AND AN ANCIENT DELTA

Tectonic plates shift along Earth's surface, colliding and rifting, forming mountain chains and ocean basins. Sometimes rifting ceases for no known reason, leaving behind riches in the form of geologic clues to the process, as well as valuable minerals and ores.

Paul Bedrosian, a research geophysicist with the U.S. Geological Survey (USGS) in Denver, Colorado, has been studying one of the country's better-known failed rifts, the Mid-Centimeter Rift, in the Great Lakes region. The area is well known for its copper and iron deposits, and Bedrosian thinks that his investigation will help reveal other buried resources as well as the area's unique geologic history.



Magnetic resistivity image of the upper crust of the Mid-Centimeter Rift region. The inverted U shape of the rift system is outlined, as is the red region indicating sediments that pre-date the rift and that may be associated with mineral resources. The white dots show the extent of the EarthScope magnetotelluric grid, which collected data from 2010–2014. Image by Paul Bedrosian, USGS.

Bedrosian uses EarthScope magnetotelluric data—examining electrical conductivity derived from measurements of geomagnetic and geoelectric field variations at Earth's surface—to map the structure and extent of the 1.1 billion year old rift that traces a length of more than 2000 km across the middle of the continent. Electrical resistivity, the reciprocal of conductivity, correlates with different rock types.

"The 3D electrical resistivity model I've developed reveals structures from the upper crust to the base of the lithosphere that both challenge and expand upon our understanding of continental assembly and rifting," says Bedrosian.

"The geology of the Mid-Centimeter Rift is one of the great unsolved mysteries of American science,"

notes Larry Meinert, program coordinator of the USGS Mineral Resources group. “Bedrosian's work with the EarthScope data promises to revolutionize our understanding of this intriguing feature.”

The Mid-Continent Rift’s inverted U shape is well defined in the resistivity model, which shows a western arm extending southwards through Iowa, Nebraska, and Kansas, and an eastern arm through Michigan. It also images the bend in the rift that cuts through the Lake Superior area—one of the only areas in the world where a failed rift is exposed at Earth’s surface.

An interesting feature discovered at the end of the west arm is a concealed deltaic fan created during the rifting and buried by younger sedimentary rock. “My model images a broad conductive fan in Kansas that I interpret to reflect Precambrian river delta deposits. I speculate this to have formed from axial drainage along the rift—an ancient analogue of the modern Rio Grande delta,” says Bedrosian.

Bedrosian was also able to distinguish even older sedimentary features, ones that play a critical role in the development of mineral resources in the area. “Within the resistivity model, we see electrically conductive meta-sedimentary rocks that light up like a Christmas tree.” These were deposited 700 million years *before* the rift, and Bedrosian thinks that they are a likely source of sulfur for various types of mineral deposits. His electrical mapping results have prompted targeted USGS ground-based mapping of potential new mineral resources in the Midwest.

Bedrosian will present his findings at the American Geophysical Meeting in San Francisco, CA, on Monday, December 14<sup>th</sup> at 4:45 PM local time in Moscone South, Room 302. This talk is part of session T14A, “Crustal Structure and Evolution across the Continental United States from 10 Years of EarthScope Investigations: What Have We Learned and What Are the Open Questions?” A poster in this session, by Esteban Bowles-Martinez and Adam Schultz, will discuss how EarthScope magnetotelluric data has been used to image the remnant of the mantle plume that is thought to have initiated the Mid-Continent Rift 1 billion years ago.

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*The EarthScope National Office seeks to disseminate EarthScope scientific findings, and is housed at the University of Alaska Fairbanks Geophysical Institute. On the web: [www.earthscope.org](http://www.earthscope.org)*

