# A billion-year-old piece of North America traced back to Antarctica

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An international team of researchers has found the strongest evidence yet that parts of North America and Antarctica were connected 1.1 billion years ago, long before the supercontinent Pangaea formed.

"I can go to the Franklin Mountains in West Texas and stand next to what was once part of Coats Land in Antarctica," said Staci Loewy, a geochemist at California State University, Bakersfield, who led the study. "That's so amazing."

Loewy and her colleagues discovered that rocks collected from both locations have the exact same composition of lead isotopes. Earlier analyses showed the rocks to be the exact same age and have the same chemical and geologic properties. The work, published online 5 August (ahead of print) in the September issue of the journal *Geology*, strengthens support for the so-called SWEAT hypothesis, which posits that ancestral North America and East Antarctica were joined in an earlier supercontinent called Rodinia.

The approximately 1.1 billion year old North American Mid-continent Rift System extends across the continent from the Great Lakes to Texas. Volcanic rocks associated with the rift, which appears to represent an aborted tectonic attempt to split the ancestral North American continent of Laurentia, are well exposed in the Keweenaw Peninsula of the Upper Peninsula of Michigan from which they take their name, the Keweenawan large igneous province. The rift extends in the subsurface beneath Minnesota, Iowa, Nebraska, Kansas and Oklahoma to the

Franklin Mountains near El Paso, Texas where related rocks are exposed. In this latest report, Loewy, Ian Dalziel, research professor at The University of Texas at Austin, Richard Hanson of Texas Christian University and colleagues from several overseas institutions, find that rocks barely peeking through the ice in Coats Land, a remote part of the Antarctic continent south of the Atlantic Ocean basin, reflect a former continuation of the North American rift system. Loewy began her collaboration with Dalziel several years ago as a graduate student at the University of Texas at Austin.

Loewy et al. use new lead (Pb) isotopic data from the 1.1-billion-year-old rocks from Coats Land, to constrain the positions of Laurentia (ancestral North America) and Kalahari (ancestral southern Africa) in the 1-billion-year-old supercontinent, Rodinia. The Coats Land rocks are identical in age to both the Keweenawan large igneous province of the North American mid-continent rift and the contemporaneous Umkondo large igneous province of southern Africa. Comparison of the isotopic compositions, however, unequivocally links the Coats Land rocks with the Keweenawan province. Together with paleomagnetic data this suggests that the Coats Land block was a piece of Laurentia near west Texas 1.1 billion years ago. Furthermore, the Coats Land block collided with the Kalahari Precambrian craton of Africa during a 1-billion-year-old collision. Based on this reconstruction, Laurentia collided with Kalahari along Antarctica's Maud mountain belt, which would represent a continuation of the 1-billion-year-old Grenville mountain belt of eastern and southern North America.

Thus the tiny Coats Land block of Antarctica is a 'tectonic tracer' providing critical clues to the geographic relationships between three of the major continents of the planet in the time interval 1.1 – 1.0 billion years ago, just prior to the opening of the Pacific Ocean basin, the hypothesized 'Snowball Earth' glaciations, and the rise of multi-cellular life.

**More information:** *Geology* doi: 10.1130/G32029.1