

Earth Magnetic Pole Reversal imminent?

The Earth is blanketed by a magnetic field. It's what makes a compass point north, and what protects our atmosphere from damage by charged particles from space. **Without a magnetic field, our atmosphere would slowly be stripped away and life as we know it would not exist today.**

What has geophysicists abuzz is the recent realization that the strength of Earth's magnetic field has been decreasing for the last 160 years at an alarming rate. **This collapse is centred in a huge expanse of the Southern Hemisphere, extending from Zimbabwe to Chile, known as the South Atlantic Anomaly.** The magnetic field strength is so weak there that it's a hazard for shipping and the satellites that orbit above the region. And it seems the field is continuing to grow weaker, raising the possibility of a global reversal of the magnetic poles. Such a major change would affect all our technological navigation systems, as well as a number of biological life forms.

As it is currently understood, Earth's magnetic field is created by convecting iron in our planet's liquid outer core. From the wealth of observatory and satellite data that document the magnetic field over recent times, we can model what the generating medium would have to look like. Analyses and models reveal an astounding feature: There's a patch of reversed polarity beneath southern Africa at the core-mantle boundary where the liquid iron outer core meets the slightly stiffer part of the Earth's interior. **This patch is believed to be the main culprit creating the South Atlantic Anomaly.**

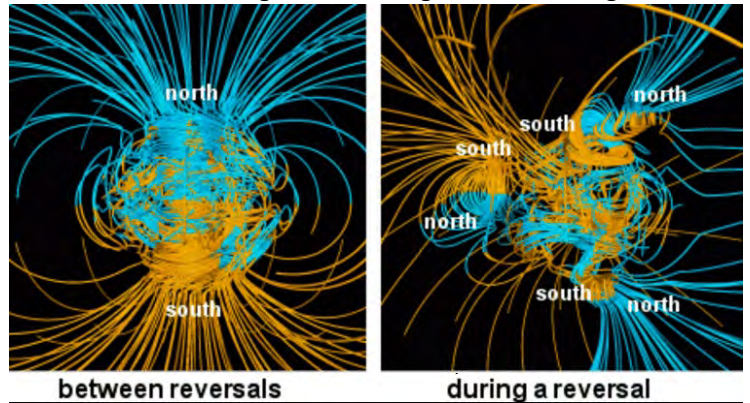
The magnetic residue in mid Atlantic sediments shows that the Earth's magnetic field has reversed frequently over the history of the planet, but the last reversal is in the distant past, some 780,000 years ago. **The rapid decays of the recent magnetic field, and its pattern of decay, naturally raises the question of what the trend is and how long it has been declining.**

It is Archaeo Magnetism that takes us further back in time. In archaeo magnetic studies, geophysicists team with archaeologists to learn about the past magnetic field. For example, clay used in making pottery contains small amounts of magnetic minerals, such as magnetite. When the clay is heated its magnetic minerals lose any inherent magnetism and on cooling absorb the direction and intensity of the magnetic field existing around it at that time. **By determining the age of the pottery, and the archaeological site from which it came, an archaeo magnetic history can be recovered.** This provides a substantial history of archaeo magnetism for the Northern Hemisphere.

In contrast, the Southern Hemisphere archaeo magnetic record is scant. **There have been virtually no data from southern Africa and South America that might provide insight into what created today's South Atlantic Anomaly.**

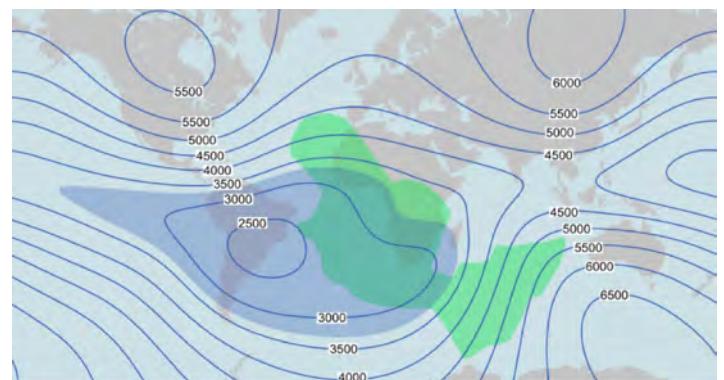
But now recent studies show that the ancestors of today's southern Africans, Iron Age farmers who began to migrate into the region around 1,500 years ago, did leave us some clues. **They stored their grain in hardened clay bins.** These bins then, either by ritual cleansing or natural disaster, frequently were burned, upon which its magnetite aligned itself to the prevailing magnetic field.

Left, the Earth's magnetic field we're used to. On the right, a model of what the magnetic field might be like during a reversal



between reversals

during a reversal



— Magnetic Field Strength Units: nanoTesla ■ Area associated with the South Atlantic Anomaly ■ Hot dense mantle at the core-mantle boundary

Magnetic flux field changes happening deep within the Earth, beneath the Limpopo River Valley



Grain bins of the style used centuries ago.



Limpopo River Valley, Location of the South Atlantic Anomaly.

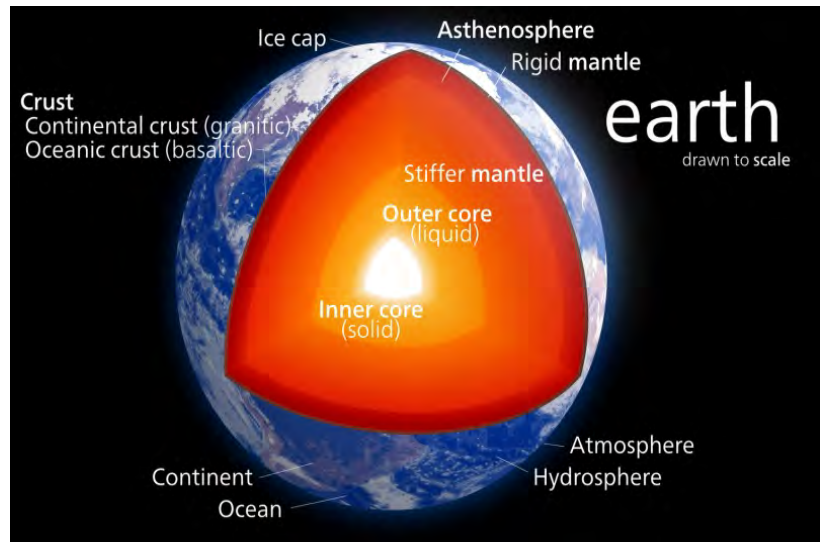
Sampling at Limpopo River Valley locations has yielded the first archaeo magnetic history for southern Africa between A.D. 1000 and 1600. It reveals a period in the past, near A.D. 1300, when the field in that area was decreasing as rapidly as it is today. Then the intensity increased again, albeit at a much slower rate. **The occurrence of two intervals of rapid field decay – one 700**

years ago and one today – suggests a recurrent phenomenon. Could the reversed flux patch presently under South Africa have happened regularly, further back in time than records have shown? why would it occur again in this location? Modern technology shows that a large area of slow seismic shear waves characterizes the core mantle boundary beneath southern Africa. This particular region underneath southern Africa has the somewhat wordy title of the African Large Low Shear Velocity Province. While thousands of kilometres across, its boundaries are sharp. Interestingly, the reversed core flux patch is nearly coincident with its eastern edge. **This fact suggests that the unusual African mantle changes the flow of iron in the core underneath, which in turn changes the way the magnetic field behaves at the edge of the seismic province, and leads to the reversed flux patches.** Occasionally one patch may grow large enough to dominate the magnetic field of the Southern Hemisphere – and then the poles reverse.

The clues provided by the ancestors of modern-day southern Africans will help us to further develop the proposed mechanism for reversals.

If this is correct, pole reversals may be

“Out of Africa.”



Cutaway image of the Earth's interior

