Earth's magnetic poles not likely to flip

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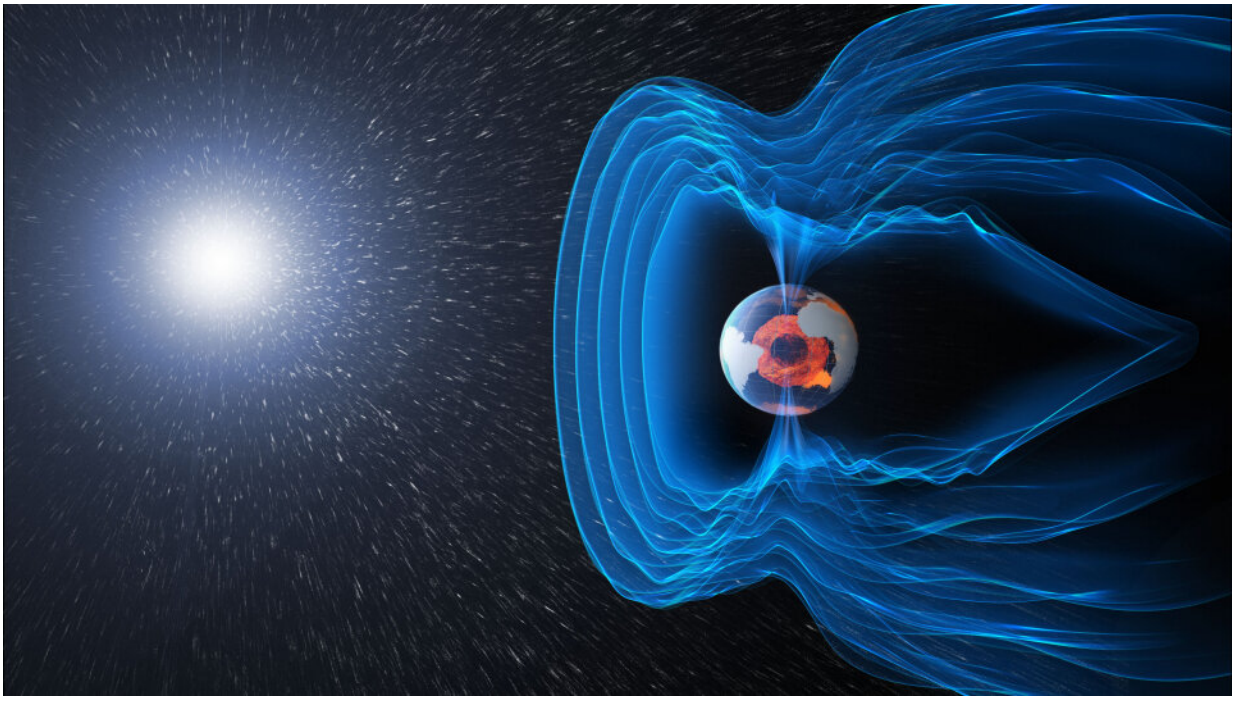

Credit: ESA/ATG medialab

The emergence of a mysterious area in the South Atlantic where the geomagnetic field strength is decreasing rapidly, has led to speculation that Earth is heading towards a magnetic polarity reversal. However, a new study that pieces together evidence stretching back 9,000 years, suggests that the current changes aren't unique, and that a reversal may not be in the cards after all. The study is published in *PNAS*.

The Earth's magnetic field acts as an invisible shield against the life-threatening environment in space, and solar winds that would otherwise sweep away the atmosphere. However, the magnetic field is not stable, and at irregular intervals at an average of every 200,000 years polarity reversals happen. This means that the magnetic North and South poles swap places.

During the past 180 years, Earth's magnetic field strength has decreased by about 10 percent. Simultaneously, an area with an unusually weak magnetic field has grown in the South Atlantic off the coast of South America. This area, where satellites have malfunctioned several times due to exposure to highly charged particles from the sun, is called the South Atlantic Anomaly. These developments have led to speculation that we may be heading for a polarity reversal. However, the new study suggests this may not be the case

"We have mapped changes in the Earth's magnetic field over the past 9,000 years, and anomalies like the one in the South Atlantic are probably recurring phenomena linked to corresponding variations in the strength of the Earth's magnetic field," says Andreas Nilsson, geologist at Lund University.

The results are based on analyses of burnt archaeological artifacts, volcanic samples and sediment drill cores, all of which carry information about the Earth's magnetic field. These include clay pots that have been heated up to over 580 degrees Celsius, volcanic lava that has solidified, and sediments that have been deposited in lakes or in the sea. The objects act as time capsules, and carry information about the magnetic field in the past. Using sensitive instruments, the researchers have been able to measure these magnetizations and recreate the direction and strength of the magnetic field at specific places and times.

"We have developed a new modeling technique that connects these

indirect observations from different time periods and locations into one global reconstruction of the magnetic field over the past 9,000 years," says Andreas Nilsson.

By studying how the magnetic field has changed, researchers can learn more about the underlying processes in the Earth's core that generate the field. The new model can also be used to date both archaeological and geological records, by comparing measured and modeled variations in the magnetic field. And reassuringly, it has led them to a conclusion regarding speculations about an imminent polarity reversal:

"Based on similarities with the recreated anomalies, we predict that the South Atlantic Anomaly will probably disappear within the next 300 years, and that Earth is not heading towards a polarity reversal," concludes Andreas Nilsson.

More information: Andreas Nilsson et al, Recurrent ancient geomagnetic field anomalies shed light on future evolution of the South Atlantic Anomaly, *Proceedings of the National Academy of Sciences* (2022). DOI: 10.1073/pnas.2200749119

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