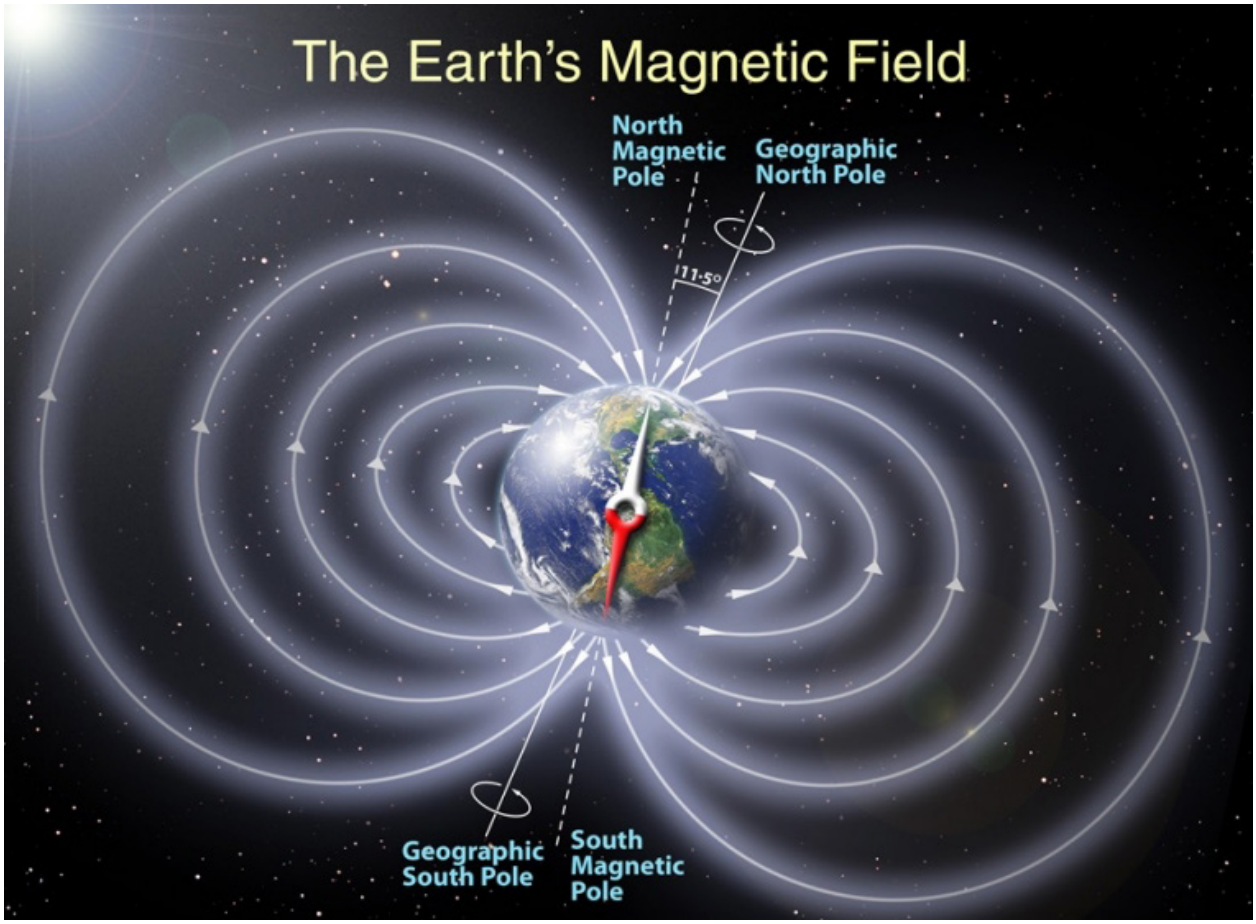
# 2012: Magnetic pole reversal happens all the (geologic) time

Sheet 3

**Note:** This sheet uses information published in the USA; some spelling does not conform with Standard Australian English.




Reid, Peter *The Earth's Magnetic Field*, The University of Edinburgh http://www.nasa.gov/topics/earth/features/2012-poleReversal.html

Scientists understand that Earth's magnetic field has flipped its polarity many times over the millennia. In other words, if you were alive about 800,000 years ago, and facing what we call north with a magnetic compass in your hand, the needle would point to 'south'. This is because a magnetic compass is calibrated based on Earth's poles. The N-S markings of a compass would be 180 degrees wrong if the polarity of today's magnetic field were reversed. Many doomsday theorists have tried to take this natural geological occurrence and suggest it could lead to Earth's destruction. But would there be any dramatic effects? The answer, from the geologic and fossil records we have from hundreds of past magnetic polarity reversals, seems to be 'no'.

Reversals are the rule, not the exception. Earth has settled in the last 20 million years into a pattern of a pole reversal about every 200,000 to 300,000 years, although it has been more than twice that long since the last reversal. A reversal happens over hundreds or thousands of years, and it is not exactly a clean back flip. Magnetic fields morph and push and pull at one another, with multiple poles emerging at odd latitudes throughout the process. Scientists estimate reversals have happened at least hundreds of times over the past three billion years. And while reversals have happened more frequently in 'recent' years, when dinosaurs walked Earth a reversal was more likely to happen only about every one million years.

Sediment cores taken from deep ocean floors can tell scientists about magnetic polarity shifts, providing a direct link between magnetic field activity and the fossil record. The Earth's magnetic field determines the magnetization of lava as it is laid down on the ocean floor on either side of the Mid-Atlantic Rift where the North American and European continental plates are spreading apart. As the lava solidifies, it creates a record of the orientation of past magnetic fields much like a tape recorder records sound. The last time that Earth's poles flipped in a major reversal was about 780,000 years ago, in what scientists call the Brunhes-Matuyama reversal. The fossil record shows no drastic changes in plant or animal life. Deep ocean sediment cores from this period also indicate no changes in glacial activity, based on the amount of oxygen isotopes in the cores. This is also proof that a polarity reversal would not affect the rotation axis of Earth, as the planet's rotation axis tilt has a significant effect on climate and glaciation and any change would be evident in the glacial record.

Earth's polarity is not a constant. Unlike a classic bar magnet, or the decorative magnets on your refrigerator, the matter governing Earth's magnetic field moves around. Geophysicists are pretty sure that the reason Earth has a magnetic field is because its solid iron core is surrounded by a fluid ocean of hot, liquid metal. This process can also be modeled with supercomputers. Ours is, without hyperbole, a dynamic planet. The flow of liquid iron in Earth's core creates electric currents, which in turn create the magnetic field. So while parts of Earth's outer core are too deep for scientists to measure directly, we can infer movement in the core by observing changes in the magnetic field. The magnetic north pole has been creeping northward — by more than 600 miles (1,100 km) — since the early 19th century, when explorers first located it precisely. It is moving faster now, actually, as scientists estimate the pole is migrating northward about 40 miles per year, as opposed to about 10 miles per year in the early 20th century.

Another doomsday hypothesis about a geomagnetic flip plays up fears about incoming solar activity. This suggestion mistakenly assumes that a pole reversal would momentarily leave Earth without the magnetic field that protects us from solar flares and coronal mass ejections from the sun. But, while Earth's magnetic field can indeed weaken and strengthen over time, there is no indication that it has ever disappeared completely.
A weaker field would certainly lead to a small increase in solar radiation on Earth — as well as a beautiful display of aurora at lower latitudes — but nothing deadly. Moreover, even with a weakened magnetic field, Earth's thick atmosphere also offers protection against the sun's incoming particles.

The science shows that magnetic pole reversal is — in terms of geologic time scales — a common occurrence that happens gradually over millennia. While the conditions that cause polarity reversals are not entirely predictable — the north pole's movement could subtly change direction, for instance — there is nothing in the millions of years of geologic record to suggest that any of the 2012 doomsday scenarios connected to a pole reversal should be taken seriously. A reversal might, however, be good business for magnetic compass manufacturers.

Source: NASA, *2012: Magnetic Pole Reversal Happens All The (Geologic) Time*
http://www.nasa.gov/topics/earth/features/2012-poleReversal.html