Lost in migration: Earth's magnetic field overdue a flip

Chris Wickham, Reuters

(Reuters) - The discovery by NASA rover Curiosity of evidence that water once flowed on Mars - the most Earth-like planet in the solar system - should intensify interest in what the future could hold for mankind.

The only thing stopping Earth having a lifeless environment like Mars is the magnetic field that shields us from deadly solar radiation and helps some animals migrate, and it may be a lot more fragile and febrile than one might think.

Scientists say earth's magnetic field is weakening and could all but disappear in as little as 500 years as a precursor to flipping upside down.

It has happened before - the geological record suggests the magnetic field has reversed every 250,000 years, meaning that, with the last event 800,000 years ago, another would seem to be overdue.

"Magnetic north has migrated more than 1,500 kilometres over the past century," said Conall Mac Niocaill, an earth scientist at Oxford University. "In the past 150 years, the strength of the magnetic field has lessened by 10 percent, which could indicate a reversal is on the cards."

While the effects are hard to predict, the consequences may be enormous. The loss of the magnetic field on Mars billions of years ago put paid to life on the planet if there ever was any, scientists say.

Mac Niocaill said Mars probably lost its magnetic field 3.5-4.0 billion years ago, based on observations that rocks in the planet's southern hemisphere have magnetisation.

The northern half of Mars looks younger because it has fewer impact craters, and has no magnetic structure to speak of, so the field must have shut down before the rocks there were formed, which would have been about 3.8 billion years ago.

"With the field dying away, the solar wind was then able to strip the atmosphere away, and you would also have an increase in the cosmic radiation making it to the surface," he said.

"Both of these things would be bad news for any life that might have formed on the surface - either wiping it out, or forcing it to migrate into the interior of the planet."

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Earth's magnetic field has always restored itself but, as it continues to shift and weaken, it will present challenges - satellites could be more exposed to solar wind and the oil industry uses readings from the field to guide drills.

In nature, animals which use the field could be mightily confused - birds, bees, and some fish all use the field for navigation. So do sea turtles whose long lives, which can easily exceed a hundred years, means a single generation could feel the effects.

Birds may be able to cope because studies have shown they have back-up systems that rely on stars and landmarks, including roads and power lines, to find their way around.

The European Space Agency is taking the issue seriously. In November, it plans to launch three satellites to improve our fairly blurry understanding of the magnetosphere.

The project - Swarm - will send two satellites into a 450 kilometre high polar orbit to measure changes in the magnetic field, while a third satellite 530 kilometres high will look at the influence of the sun.

DESCENT INTO CHAOS

Scientists, who have known for some time the magnetic field has a tendency to flip, have made advances in recent years in understanding why and how it happens.

The field is generated by convection currents that churn in the molten iron of the planet's outer core. Other factors, such as ocean currents and magnetic rocks in the earth's crust also contribute.

The Swarm mission will pull all these elements together to improve computer models used to predict how the magnetic field will move and how fast it could weaken.

Ciaran Beggan, a geomagnetic specialist at the British Geological Survey in Edinburgh, said studies have also refined our understanding of how the field reverses.

They have focused on lava flows. When these cool and form crystals the atoms in iron-rich molten rock align under the influence of the magnetic field, providing a geological memory of the earth's field.

But that memory looks different in various locations around the world, suggesting the reversal could be a chaotic and fairly random process.

"Rather than having strong north and south poles, you get lots of poles around the planet. So, a compass would not do you much good," said Beggan.

While the whole process takes 3,000-5,000 years, latest research suggests the

descent into a chaotic state could take as little as 500 years, although there are significant holes in scientific understanding.

"Although electricity grids and GPS systems would be more vulnerable, we are not really sure how all the complex things that are linked together would react," Beggan said.

(Editing by Dan Lalor)

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