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The Earth's Magnetic Field

The earth has a magnetic field, which is why a compass needle points north. All the evidence we have indicates that the earth's magnetic field is generated in its core, which is composed mainly of iron and nickel at temperatures of more than 3,400-4,700°C (6,100-8,500°F). In 1820, Orsted discovered that a sustained electric current produces an electric field, and in 1831, Faraday found that a changing magnetic field induces an electric voltage. It was thus postulated that if the earth began with a large electrical current in its core, that would have produced a strong magnetic field. However, because there would be no ongoing power source, that current would decay and the magnetic field would decay also. However, this decaying magnetic field as it changed would itself induce another electrical current, weaker than the original one. Because the magnetic field is strong enough, its exponential decay rate can be accurately calculated.

In the early 1970s, it was noted that measurements since 1835 of the main (or dipole) part of the earth's magnetic field showed that it had been decaying at a rate of 5 percent per century.[1] Archaeological measurements show that the earth's magnetic field was 40 percent stronger in AD 1000 than it is today.[2] Thus, it was proposed that the earth's magnetic field was caused by a freely-decaying electric current in the earth's core, which is entirely consistent with the demonstrated rate of field decay and experiments on the materials that make up the earth's core.[3] Furthermore, it was calculated that the current could not have been decaying for more than 10,000 years; otherwise its starting strength would have been sufficient to melt the earth. Thus, the earth must be less than 10,000 years old.

However, because uniformitarian geologists maintain the earth is billions of years

1 A. L. McDonald and R. H. Gunst, 1967, An analysis of the earth's magnetic field from 1835 to 1965, *ESSA Technical Report, IER 46-IES 1*, Washington: US Government Printing Office; T. G. Barnes, 1971, Decay of the earth's magnetic field and the geochronological implications, *Creation Research Society Quarterly*, 8 (1): 24-29.

2 R. T. Merrill and M. W. McElhinney, 1983, *The Earth's Magnetic Field*, London: Academic Press, 101-106.

3 T. G. Barnes, 1971; F. D. Stacey, 1967, Electrical resistivity of the earth's core, *Earth and Planetary Science Letters*, 3: 204-206.

old, and this decaying current model for the origin of the earth's magnetic field is incompatible with that timescale, their preferred model is a self-sustaining dynamo. In their model, the earth's rotation and convection circulates the molten, liquid iron/nickel in the outer core, thus producing an electric current that generates the magnetic field. However, sustained research has not produced a workable geodynamo model, because there are many problems such a model must overcome, including explaining the measured electrical currents in the sea floor.[4] Nevertheless, recently a numerical model of the supposed geodynamo has been produced that even displays reversal behavior.[5] However, this numerical geodynamo model is based on computer simulations, which could easily have hidden flaws, and that also depend on the starting parameters used. Indeed, to make the simulations appear to work, values for one component of the magnetic field must be made ten times higher than the true value based on actual measurements, and the electrical conductivity of the molten metal in the outer core must be made more than twelve times higher than laboratory measurements would allow.[6]

Nevertheless, the major criticism used by uniformitarian geologists against the young-earth, freely-decaying electric current model for the earth's magnetic field is the evidence in volcanic rocks that the magnetic field has reversed numerous times in the past. While volcanic lavas are still molten, the magnetic domains within some of the crystallizing magnetite (iron oxide) grains partly align themselves in the direction of the earth's magnetic field at that time, so that once the rock is fully cooled, that magnetic alignment is "frozen in." Thus, volcanic rocks, particularly on the ocean floor, contain a permanent record of the earth's magnetic field through time. However, even though uniformitarian geologists do not have a good explanation for these magnetic field reversals, they maintain, of course, that the young-earth, freely-decaying electric current model must be invalid. Furthermore, their geodynamo model requires at least thousands of years for a reversal to occur. Therefore, with their dating assumptions, they believe reversals occur at intervals of millions of years, in keeping with their insistence that the earth is old.

Unlike uniformitarian geologists' geodynamo model, the young-earth, freely-decaying electric current model for the earth's magnetic field is easily modified to explain field reversals consistent with the paleomagnetic data in volcanic rocks. As the liquid molten metal in the earth's inner core flowed upward due to convection,

4 L. J. Lanzerotti et al, 1986, Measurements of the large-scale direct-current earth potential and possible implications for the geomagnetic dynamo, *Science*, 229: 47-49.

5 G. A. Glatzmaier and P. H. Roberts, 1995, A three-dimensional convective dynamo solution with rotating and finitely conducting inner core and mantle, *Physics of the Earth and Planetary Interiors*, 91: 63-75; G. A. Glatzmaier and P. H. Roberts, 1995, A three-dimensional self-consistent computer simulation of a geomagnetic field reversal, *Nature*, 377: 203-209.

6 D. R. Humphreys, 1996, Can evolutionists now explain the earth's magnetic field? *Creation Research Society Quarterly*, 33 (3): 184-185.

this would make the field reverse quickly.[7] Furthermore, the catastrophically subducting tectonic plates during the Flood cataclysm would have sharply cooled the outer parts of the core, driving convection in the outer core.[8] Thus, most of the reversals would have occurred during the year of the Flood, every week or two, and then after the Flood there would have been large fluctuations due to residual motion. This is supported by measurements on archaeological materials from about 1000 BC and AD 1000, which show that the surface geomagnetic field intensity slowly increased to a maximum about the time of Christ, and then declined slowly before becoming approximately exponential from AD 1000 onwards. However, the reversals and fluctuations would not have halted the loss of energy, which would decay even faster through the whole period.

This modified young-earth model also explains why the sun, as a gigantic ball of hot, energetically-moving, electrically-conducting gas, reverses its magnetic field every eleven years.[9] On the other hand, the dynamo model has trouble explaining how the sun not only reverses its magnetic field, but also regenerates it and maintains its intensity, supposedly over billions of years. A test was also proposed for the young-earth magnetic field model, namely, that magnetic reversals should be found in volcanic rocks known to have cooled in days or weeks. For example, it was predicted that in a thin lava flow, the outside would cool first and record the earth's magnetic field in one direction, while the inside would have cooled a short time later and have recorded the field in another direction. Three years after this prediction appeared in print, leading paleomagnetism researchers found such a thin lava layer that had cooled within fifteen days and had 90° of reversal recorded continuously in it.[10] Furthermore, a few years later the same investigators reported finding similar evidence of an even faster reversal.[11] This evidence thus corroborates the modified young-earth, freely-decaying electric current model for the earth's magnetic field, and conclusively demonstrates the impossibility of the billions-of-years uniformitarian geodynamo model.

In order to deal with this devastating quandary, evolutionists have sought to find various arguments or loopholes by which they might yet salvage the billions-of-years geodynamo model. Some have suggested that the decay of the magnetic field

7 D. R. Humphreys, 1986, Reversal of the earth's magnetic field during the Genesis Flood, in *Proceedings of the First International Conference on Creationism*, vol. 2, R. E. Walsh, C. L. Brooks and R. S. Crowell, eds., Pittsburgh, PA: Creation Science Fellowship, 113-126.

8 J. R. Baumgardner, 1986, Numerical simulation of the large-scale tectonic changes accompanying the Flood, in *Proceedings of the First International Conference on Creationism*, vol. 2, R. E. Walsh, C. L. Brooks and R. S. Crowell, eds., Pittsburgh, PA: Creation Science Fellowship, 17-30.

9 D. R. Humphreys, 1986.

10 R. S. Coe and M. Prévot, 1989, Evidence suggesting extremely rapid field variation during a geomagnetic reversal, *Earth and Planetary Science Letters*, 92 (3/4): 292-298; A. A. Snelling, 1991, "Fossil" magnetism reveals rapid reversals of the earth's magnetic field, *Creation Ex Nihilo*, 13 (3): 46-50.

11 R. S. Coe, M. Prévot and P. Camps, 1995, New evidence for extraordinarily rapid change of the geomagnetic field during a reversal, *Nature*, 374 (6564): 687-692; A. A. Snelling, 1995, The "principle of least astonishment"! *Creation Ex Nihilo Technical Journal*, 9 (2): 138-139.

is linear rather than exponential.[12] However, experimental measurements indicate that currents in resistance/inductance circuits always decay exponentially, not linearly, after the power source is switched off. Thus, even if a linear fit of the very recent measurements of the magnetic field looks reasonable, it's physically absurd when dealing with the real world of electric circuits, where exponential decay is an intrinsic component of electromagnetic theory. Furthermore, the originator of the young-earth model for the magnetic field was a professor of physics who had written university textbooks on electromagnetism! In any case, if the decay had been linear, the upper limit for the age of the earth's magnetic field would still only be 90 million years, well short of the uniformitarian 4.5 billion years, and future linear decay would mean the earth's magnetic field would soon disappear all together!

Other evolutionists have suggested that, even though the dipole component of the earth's magnetic field has been decaying, the strength of the non-dipole field has been increasing, so the total magnetic field has remained almost constant.[13] However, this apparent loophole has already been dealt with and categorically closed.[14] In fact, this claim results from confusion between measurements of the magnetic field intensity and its energy. The non-dipole component of the magnetic field may experience a small increase in its field intensity, but it does not represent a large enough increase in energy to compensate for the enormous amount of energy being lost from the dipole component. Indeed, using the data from the International Geomagnetic Reference Field for the most accurately recorded period from 1970 to 2000, the measurements show that the dipole part of the field steadily lost 235±5 billion megajoules of energy, while the non-dipole part gained only 129±8 billion megajoules, so that over that 30-year period, the net loss of energy from all observable parts of the field was 1.41±0.16 percent.[15] At that rate, the total energy stored in the earth's magnetic field (including both the dipole and non-dipole components) is decreasing with a half-life of 1,465±166 years.

The implication of this demonstrable conclusion, based on hard and accurate published field data, is that the young-earth creationist model has been emphatically confirmed. At creation, the earth's magnetic field was generated by freely-decaying electric currents in the outer core, but convection in the outer core during the Flood cataclysm caused reversals in the polarity of the field, followed by subsequent intensity fluctuations. Nevertheless, the magnetic field has rapidly

12 A. Hayward, 1987, *Creation and Evolution: The Facts and the Fallacies*, London: Triangle SPCK, 137-139.

13 R. Ecker, 1990, *Dictionary of Science and Creationism*, Buffalo, NY: Prometheus Books, 105.

14 D. R. Humphreys, 1990, Physical mechanism for reversal of the earth's magnetic field during the Flood, in *Proceedings of the Second International Conference on Creationism*, vol. 2, R. E. Walsh and C. L. Brooks, eds., Pittsburgh, PA: Creation Science Fellowship, 129-142.

15 D. R. Humphreys, 2002, The earth's magnetic field is still losing energy, *Creation Research Society Quarterly*, 39 (1): 1-11.

and continuously lost total energy ever since it was created, and the rate of that loss indicates that the earth and its magnetic field were created only about 6,000 years ago.