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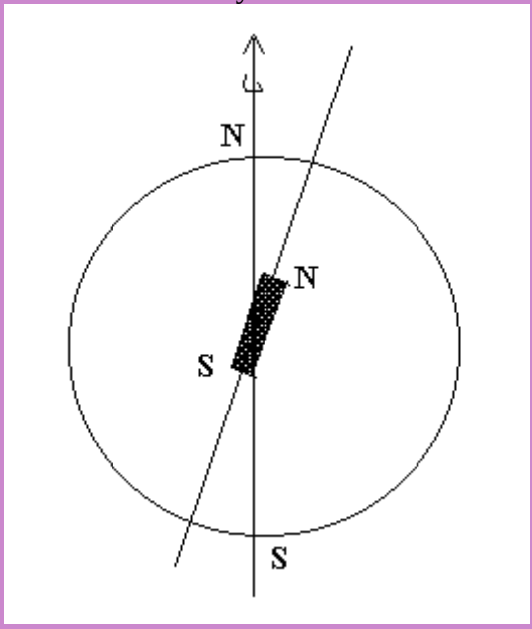
Earth’s magnetic umbrella

The earth’s magnetic field does more than just point sailors and trekkers to magnetic north, says S.Ananthanarayanan.

The earth behaves like a great big bar magnet and makes any free magnet on the earth align itself along nearly the N-S direction. Magnetic ores, which aligned themselves like this were useful to point the direction and were the first navigating compasses. The ore was called *loadstone*, as it would *lead* the way.



Where the field comes from

The source of the field is the iron-rich core of the earth. The core of the earth is so hot that it is in the molten state. All the earth, in fact, could be said to be *floating* on this molten, liquid core. Being liquid, this core is also *fluid*, and is able to slowly rotate, with respect to the earth. The result is that the magnetic center slowly rotates and magnetic north is not fixed with respect to the geographic north. This, in fact, is the reason that although magnetic north is almost true north, at the present time, it is not exactly so.

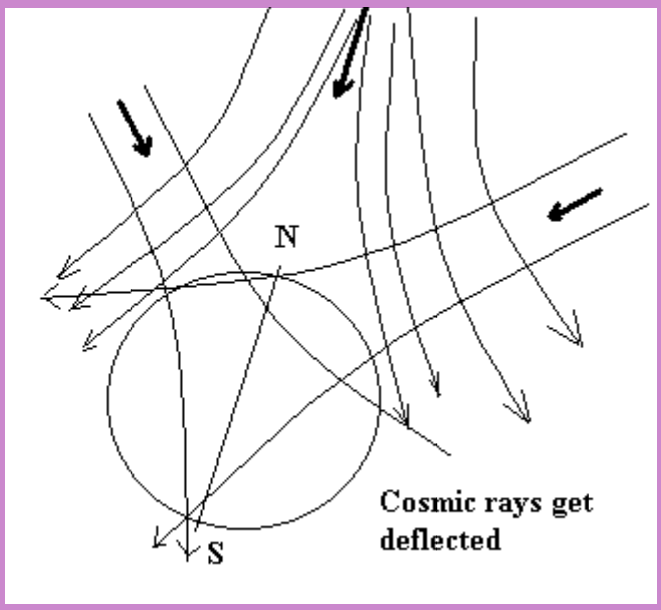
Geographic north-south is the earth’s axis of rotation. Magnetic N-S is right now nearly the same way, but it slowly changes direction and periodically switches to point the other way. Records of the history of the direction of the field , frozen into sediments down on the seabed, show that the magnetic field has reversed hundreds of times in the past 400 million years. The last reversal was 730,000 years ago. And during the last 200 years it is found that the magnetic North pole has wandered by 1100 km.. But another observation, which is disturbing, is that the strength of the field is also reducing by about 5% every 100 years.

The other role

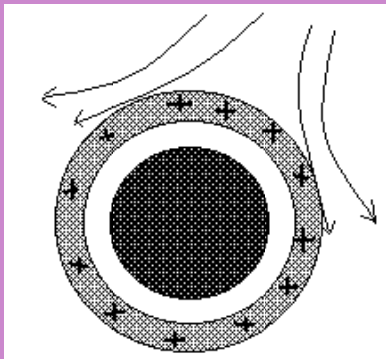
Apart from helping navigation, the other role of the magnetic field is that it deflects deadly, high energy, charged radiation that comes in from outer space. The earth is constantly bombarded by protons, the positively charged nuclei of hydrogen and alpha particles, the positively charged nuclei of helium. If this barrage were to squarely strike the earth, one could expect disturbance of the atmosphere, effects on climate and genetic and other effects on living things on the surface of the earth.

But thanks to the earth's magnetic field, this stream of charged particles gets pushed aside, with the magnetic field acting as a kind of umbrella. The stream of charged particles is like an electric current and magnetic fields deflect electric currents. This is the principle of the electric motor, where magnets placed around the coil of wire mounted on the spindle turn the spindle round when a current is passed through the wire. In the same way, the earth's magnetic field diverts the dangerous salvo coming in from space.

This is the reason that the weakening of the magnetic field is disturbing. If the field were to drop by 10%, it was feared that the level of radiation striking the earth could be disastrous.



But fortunately



Charged ionosphere deflects cosmic rays

Researchers at the University of Munich, Germany have fortunately discovered that there is a feature of the atmosphere that does take care of this danger. The recent study shows that when the magnetic field is drastically reduced, the effect of the incoming radiation is first to create a highly ionized layer at the outer reaches of the atmosphere. This makes the earth behave, well, not like a bar magnet, but like an electrically charged ball. Movement of the atmosphere also results in currents, which lead to magnetic effects.

The result is that charged particles coming in are presented with a barrier not unlike the magnetic field and the earth stays protected!