

Random Facts by Katie Mullaly

From Pole to Pole, Magnetic That Is

Although most of us, myself included, lack a directional indicator, other animals on this planet are lucky enough to have one. What gives these animals an ability to find their way instinctively? What also give us humans the ability, but using a compass, to find our way, at least when it comes to our physical location? This magic guidance beacon is the earth's magnetic field.

Birds migrate using the magnetic field as a compass. How birds use this field isn't known exactly, however there are a couple of theories. First, magnetite, a stone that will attract pieces of iron, has been found in parts of a pigeon's neck. This piece of magnetite could act as a compass, directing the bird north or south. Secondly, there could be these small magnets located in the birds' eyes, providing a migrating bird some direction.

A compass works much the same way. It has a needle with a southerly magnetic charge causing it to point towards the north pole.

The strength and location of the magnetic field of the earth will fluctuate and wobble. This can only be caused by a magnetic field generated by a fluid, not by a solid-bar magnet. Since we cannot actually see the liquid iron core of the earth, we can only hypothesize how the field is formed. Because this molten core is very hot, it probably contains convection cells (pockets of very hot liquid flowing up with pockets of cooler liquid flowing down). These cells create one kind of flow within the core. The convection flows will then cross other flow patterns that are created due to the earth's rotation. And, if there is a weak magnetic field already present due to a solid iron inner core, an electric current will begin to flow producing a stronger magnetic field. But this is all just a theory.

Jupiter has a very strong magnetic field, most likely due to its fast rotation, while Venus has a very slow rotation, thus a very weak magnetic field. Mars has no magnetic field. The theory behind this is that Mars has no liquid core – it is completely solid.

When we take a compass reading, we always need to include the declination in our determination of where we are. This declination is the number of degrees off from true north that the compass needle points. This declination is caused by the instability of the earth's magnetic core due to its liquid properties. The magnetic pole can move by as much as 30 degrees around the pole. Today, it is located in northern Siberia.

The most significant aspect of this magnetic instability is the fact that the poles have reversed many times over the history of the earth. This polarity reversal causes the magnetic north pole to switch places with the magnetic south pole. Just think of the angle of declination you would need in order to get a correct compass reading.

Why the poles reverse is still unknown. It is known that the strength of the magnetic poles can vary due to fluctuation and changes in the flow at the core. It is possible that the magnetic field can even fade to near zero. As the field regenerates, the poles possibly become reversed.

The evidence of polar reversal comes mainly from the sea floor. As the ocean spreads in certain zones (another topic for Fact Girl), lava flows to the surface, forming a new section of the sea floor. As the

lava cools, the small magnetite grains in the lava align with the location of the earth's magnetic pole at that time. The lava then solidifies, leaving the grains permanently aligned towards the north magnetic pole. These grains leave a permanent record of the magnetic polar location at the time the rock was formed.

What triggers these reversals and when another reversal will happen is unknown. But, it would be interesting to see what would happen, and how it would affect the human race. Remember in *Water World* when the girl had the map on her back and they realized that the poles had flipped and therefore had to turn the girl upside down? I guess even Hollywood knows a bit about geology.