

The magnetic earth

David Burges

MOST OF US give little thought to the earth's magnetism, beyond a general awareness that compasses point north and are an aid to navigation. It seems that the Chinese discovered the magnetic compass as early as 200 B.C. The ancient Greeks knew that the lodestone or magnetite attracted iron towards it. It is known that the Vikings used a lodestone to navigate, and later, at the end of the twelfth century, Europeans were using this simple compass to aid navigation. In recent years it has also come to light that some animals and birds are able to utilise the earth's magnetic field in following their migration routes.

A vital shield

Yet it is probably no exaggeration to say that life on earth actually depends upon the earth's magnetic field. It has been described as "one of nature's great gifts",¹ for which, of course, we would substitute "one of God's great gifts". This is because it acts as a shield to prevent dangerous radiation bombarding the earth. Our planet is constantly subjected to two types of radiation: cosmic rays, which are energetic particles emanating from distant stars; and the 'solar wind', which consists of charged particles streaming away from our own sun. Both can cause cancer and other diseases, and are potentially lethal to most forms of life. In contrast to the earth, Venus and the moon have no detectable magnetic fields, and that of Mars is extremely weak.

The effect of the solar wind is seen in the aurorae, or polar lights, the spectacular glowing bands and sheets of light seen in the sky at certain times of year. They are caused by particles from the sun striking the molecules in the upper atmosphere. Because the resulting particles are electrically charged they cascade down towards the magnetic poles, so that they are mostly seen at high latitudes.²

Measurements made by artificial satellites have shown that the earth's magnetic field, or magnetosphere, extends out into space like a giant pear-drop with its tail pointing away from the sun, some 40,000 miles in the direction of the sun

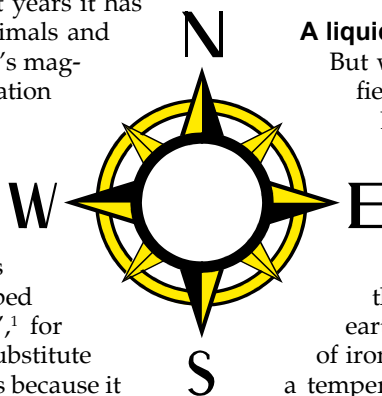
but much further on the night side.³ The result is that most of the solar wind is deflected around the earth, and the surface is thus protected from its harmful effects. Furthermore, it is thought that without this protective shield much of the earth's atmosphere would be stripped away, as seems to have happened on Mars, leaving earth as sterile as its neighbour. Here is yet another happy circumstance which, in the wisdom of the Creator, allows life to flourish upon earth.⁴

A liquid core

But what is the source of the magnetic field that has such beneficial effects?

Even today scientists know little of "the foundations of the earth" which the Creator has laid. However, studying the seismic waves produced by earthquakes has allowed them to construct a theoretical model of the centre of the earth. It seems that the core is a ball of iron nearly 7,000 kilometres across, at a temperature of more than 5,000°C.⁵ The outer 2,260 kilometres are liquid and the inner part is solid under the extreme pressure. The liquid portion is thought to be in constant turbulent motion under the twin effects of convection and gravity.

However, to produce a magnetic field in a metal conductor requires an electric current. Just as an electric current is produced by moving a magnet in a bicycle dynamo, so an electric current in a moving conductor (such as the earth's liquid iron core) will produce a magnetic field, and theoretically, once established, it can become self-sustaining. But the key question is this: How did the electric current get established in the first place? To this scientists have no positive answer, speculating that it might have been 'seeded' by a nearby star!



1. Adrian Cho, "Great balls of fire", *New Scientist*, 25 Aug. 2001, p. 25.
2. Patrick Moore, *Atlas of the Universe*, 1997, p. 160.
3. *Ibid.*, p. 38.
4. See "Life on earth", *Apr. 2005*, p. 121.
5. Cho, *op. cit.*, p. 25.

Now, in a spectacular experiment, a group of researchers in the USA is planning to build a large test sphere three metres across, containing fourteen tonnes of molten sodium metal stirred by paddles, in an attempt to simulate the conditions within the earth's core.⁶ They hope to study how a magnetic field can begin, grow and become self-sustaining.

Another mystery to be studied is how the earth has apparently reversed its magnetic poles in the past, as recorded in the magnetism of ancient rocks. The strength of earth's magnetic field is currently declining, which might imply that such a reversal is imminent. If the field were to reverse, then for a time the earth would be unprotected and receive much larger doses of radiation than normal, with serious consequences for its inhabitants.

The foundations of the earth

It is remarkable that, with all the advances in scientific knowledge in the modern world, so little is known about the interior of the planet beneath our feet. Why the compass points north

is nearly as mysterious today as it was to the ancient Chinese. Truly God's challenge to Job concerning the creation of this wonderful world is as pointed with reference to today's scientists as it was when first uttered:

"Where were you when I laid the foundations of the earth?

Tell Me, if you have understanding.

Who determined its measurements?

Surely you know!

Or who stretched the line upon it?

To what were its foundations fastened?

Or who laid its cornerstone,

When the morning stars sang together,

And all the sons of God shouted for joy?"

(Job 38:4-7, NKJV).

Thankfully, as the psalmist recognised, everything in creation is under the control of the Almighty, including the structure of the earth: "For the LORD is a great God, and a great King above all gods. *In His hand are the deep places of the earth*: the strength of the hills is His also" (95:3,4).

6. *Ibid.*, p. 26.

North, south, east and west

Tony Benson

THE FACT THAT we have four directions, four points of the compass—north, south, east and west—is something we take for granted, like the fact that there are seven days in the week or twelve months in the year. But why four? There are two basic reasons:

- 1 We naturally think of something or someone as having a front, a back, a left side and a right side.
- 2 If we think of the daily motion (as it appears to us) of the sun, we have four main points: sunrise, midday (when the sun is at its highest), sunset and midnight (when the sun is at its furthest point below the horizon).

When we think of north, south, east and west we do not have either of these concepts in mind, but the ancients expressed the four points of the compass either in relation to the above two concepts or in relation to the physical characteristics of the direction in question. Let me explain this to make it clearer, using the Hebrew Scriptures:

East. The basic word for 'east' is *mizrach*, which refers to the rising of the sun. Other terms for the points of the compass are based on a

person facing towards the rising of the sun. An alternative word for 'east' is thus *qedem* (there are several similar words), which has the basic meaning of 'front', and arises from this concept of a person facing the rising sun.

West. Following on from the above, one word used for 'west' is *maarab*, which refers to the setting of the sun. The most common word, however, is *yam*, the word for 'sea' and used because to the west of Israel is the Mediterranean Sea. Very rarely the word *acharon* is used for the west, though it is not so translated in the AV. This means 'hinder' or 'behind', and relates to the fact that, when facing the sun's rising, west is behind.

North. The predominant word for 'north' is *tsaphon*, meaning 'hidden' or 'dark' and referring to the fact that when the sun is in this direction in its circuit it is hidden below the horizon and the earth is in darkness. The Hebrew word *semol*, meaning 'left' (that is, left hand), is also used of the north, though not translated 'north' in the AV. This reflects the fact that if one faces the sunrise north is to the left.