

Magnetic poles

Historically, the north and south poles of a magnet were first defined by the Earth's magnetic field, not vice versa, since one of the first uses for a magnet was as a compass needle. A magnet's North pole is defined as the pole that is attracted by the Earth's North Magnetic Pole when the magnet is suspended so it can turn freely. Since opposite poles attract, the North Magnetic Pole of the Earth is really the south pole of its magnetic field (the place where the field is directed downward into the Earth).

The positions of the magnetic poles can be defined in at least two ways: locally or globally. The local definition is the point where the magnetic field is vertical. This can be determined by measuring the inclination. The inclination of the Earth's field is 90° (downwards) at the North Magnetic Pole and -90° (upwards) at the South Magnetic Pole. The two poles wander independently of each other and are not directly opposite each other on the globe. Movements of up to 40 kilometres (25 mi) per year have been observed for the North Magnetic Pole. Over the last 180 years, the North Magnetic Pole has been migrating northwestward, from Cape Adelaide in the Boothia Peninsula in 1831 to 600 kilometres (370 mi) from Resolute Bay in 2001. The magnetic equator is the line where the inclination is zero (the magnetic field is horizontal).

The global definition of the Earth's field is based on a mathematical model. If a line is drawn through the center of the Earth, parallel to the moment of the best-fitting magnetic dipole, the two positions where it intersects the Earth's surface are called the North and South geomagnetic poles. If the Earth's magnetic field were perfectly dipolar, the geomagnetic poles and magnetic dip poles would coincide and compasses would point towards them. However, the Earth's field has a significant non-dipolar contribution, so the poles do not coincide and compasses do not generally point at either.

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