MAGNETISM AND MATTER

THE EARTH'S MAGNETISM

TERRESTRIALMAGNETISM

Earth is a natural source of magnetic field

Elements of the earth's Magnetic Field The earth's magnetic field at a point on its surface is usually characterised by three quantities:

(a) declination

(b) inclination or dip and

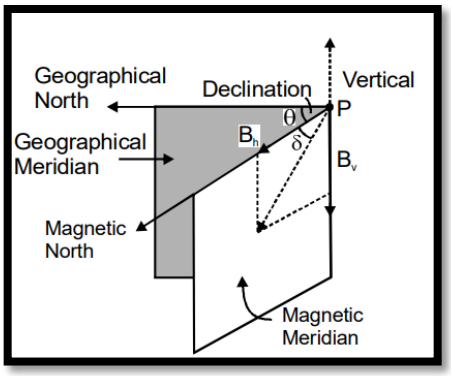
(c) horizontal component of the field. These are known as the elements of the earth's magnetic field.

(a) Declination A plane passing through the geographical poles (that is, through the axis of rotation of the earth) and a given point P on the earth's surface is called the geographical meridian at the point P. Similarly, the plane passing through the geomagnetic poles (that is, through the dipole-axis of the earth) and the point P is called the magnetic meridian at the point P.

The angle made by the magnetic meridian at a point with the geographical meridian is called the declination at that point.

(b) Inclination or dip the angle made by the earth's magnetic field with the horizontal direction in the magnetic meridian, is called the inclination or dip at that point.

(c) Horizontal component of the earth's magnetic field As the name indicates, the horizontal component is component of the earth's magnetic field in the horizontal direction in the magnetic meridian. This direction is towards the magnetic north. Figure shows the three elements. Starting from the geographical meridian we draw the magnetic meridian at an angle θ (declination). In the magnetic meridian we draw the horizontal direction specifying magnetic north.



The magnetic field is at an angle δ (dip) from this direction. The horizontal component BH and the total field B are related as

$B_H = B\cos\delta$

$B = B_H/\cos\delta$

Thus, from the knowledge of the three elements, both the magnitude and direction of the earth's magnetic field can be obtained.

Ex. The horizontal component of the earth's magnetic field is 3.6 × 10-5 T where the dip is 60º. Find the magnitude of the earth's magnetic field.

Sol. We have BH = B cos δ

$$B = \frac{B_H}{\cos\delta} = \frac{3.6\times10^{-5}T}{\cos 60^{\circ}} 7.2\times10^{-5}T$$