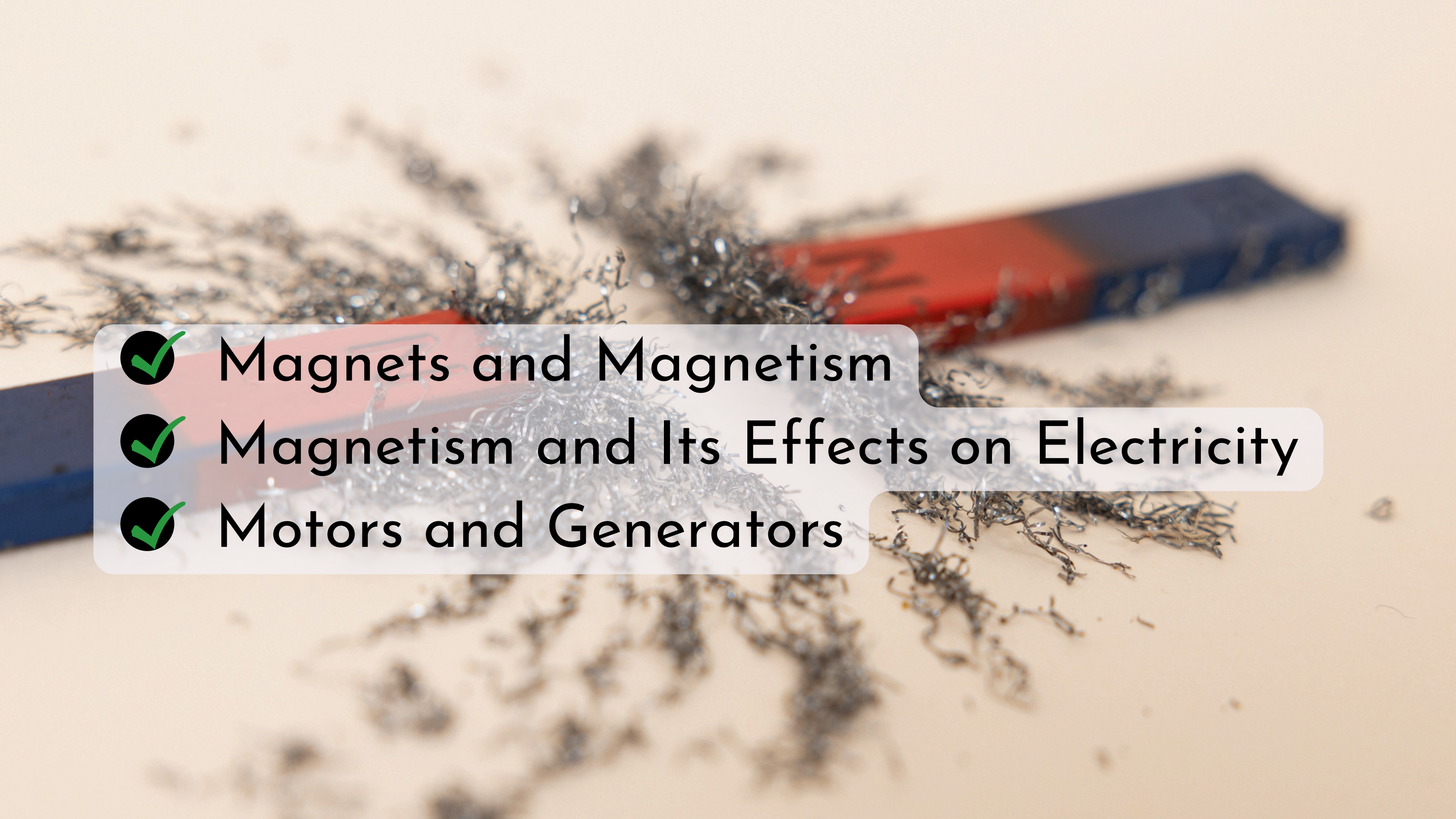




ENVIRONMENTAL FRIENDLINESS

GREEN ENERGY

- 
- ✔ Magnets and Magnetism
 - ✔ Magnetism and Its Effects on Electricity
 - ✔ Motors and Generators

MAGNETS &



MAGNETISM

PART



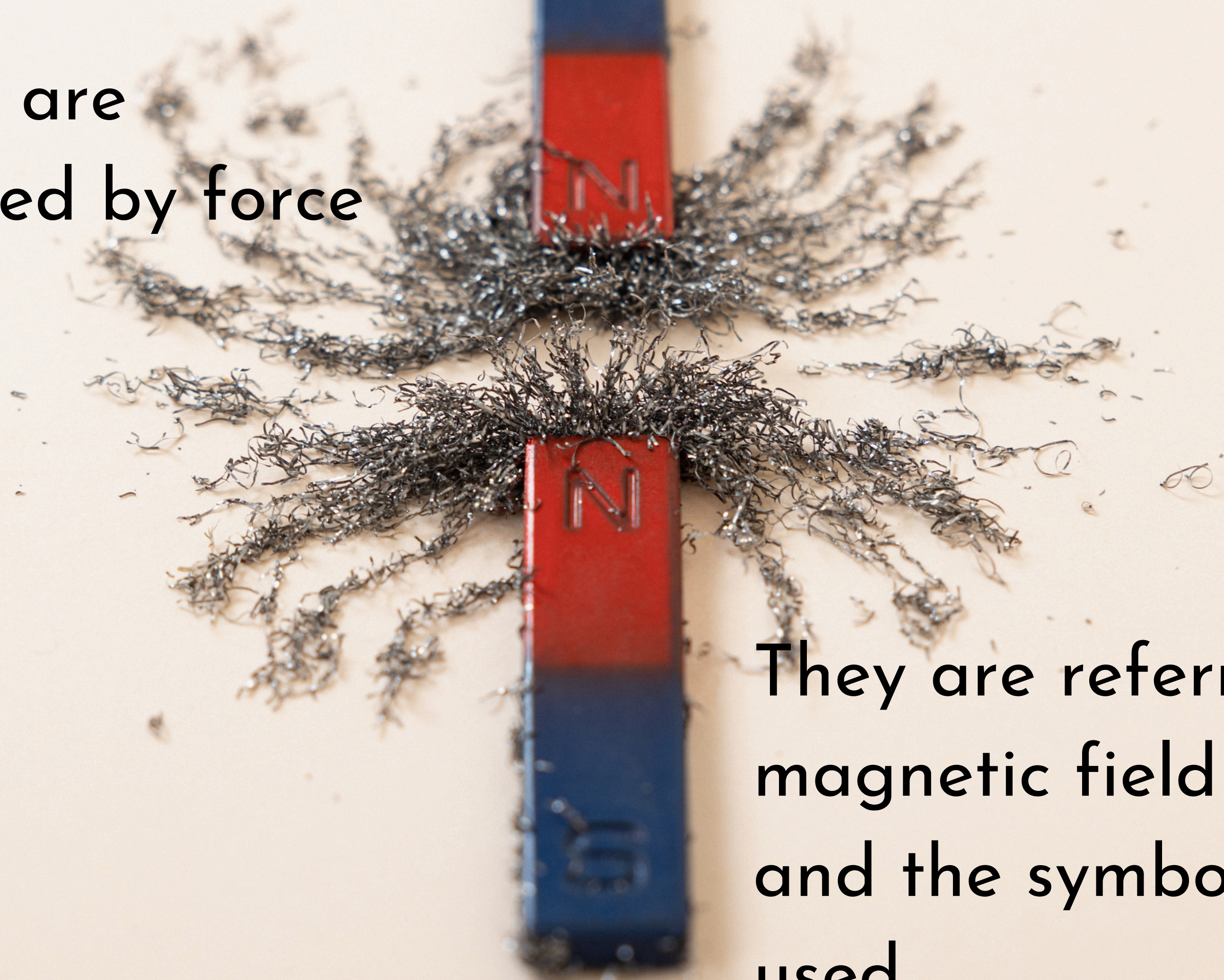
Magnetism is a physical phenomenon produced due to the motion of electric charge.



Besides the push of voltage, electrons can also be affected by a magnetic field.

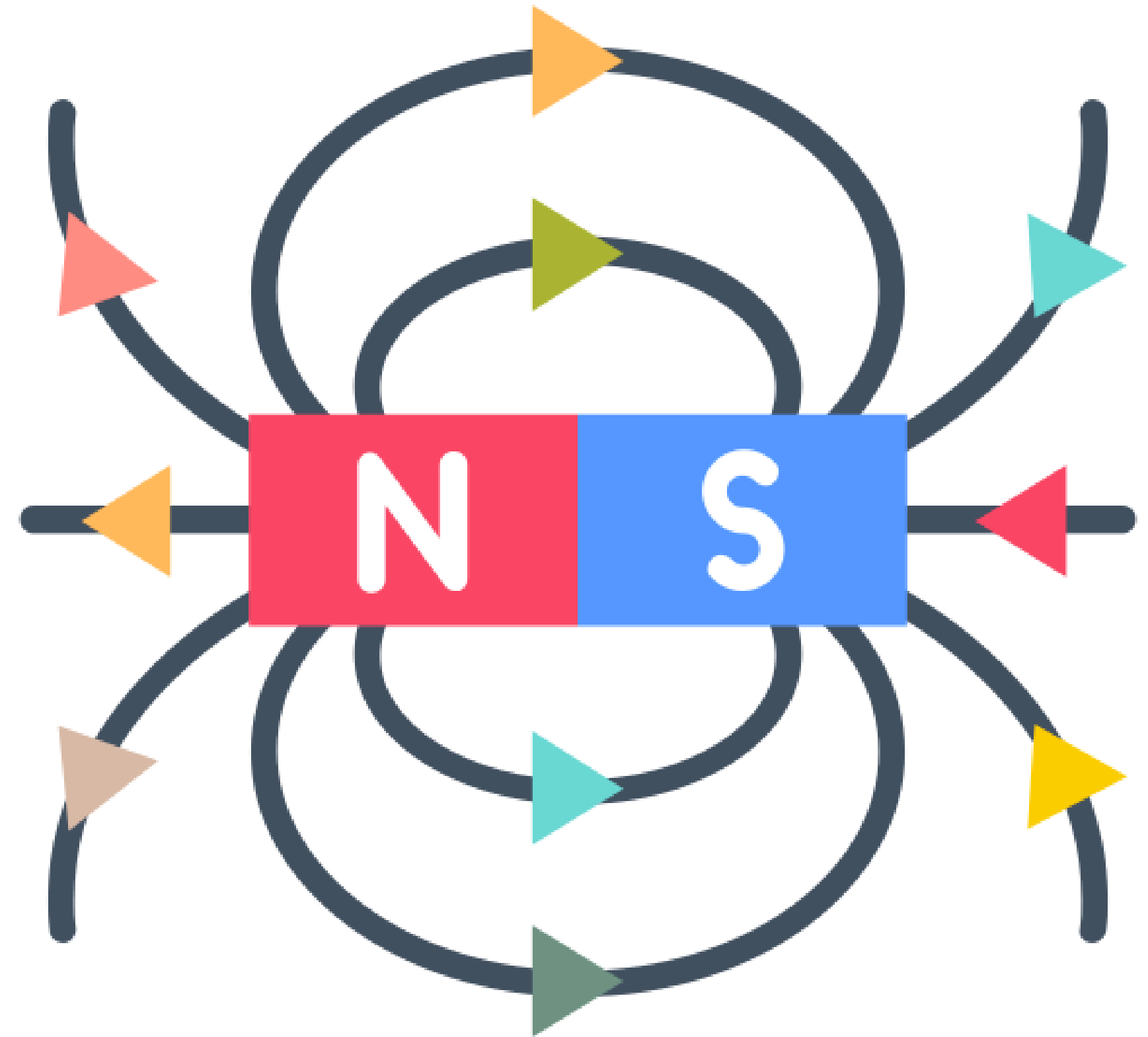


Magnets are surrounded by force fields.

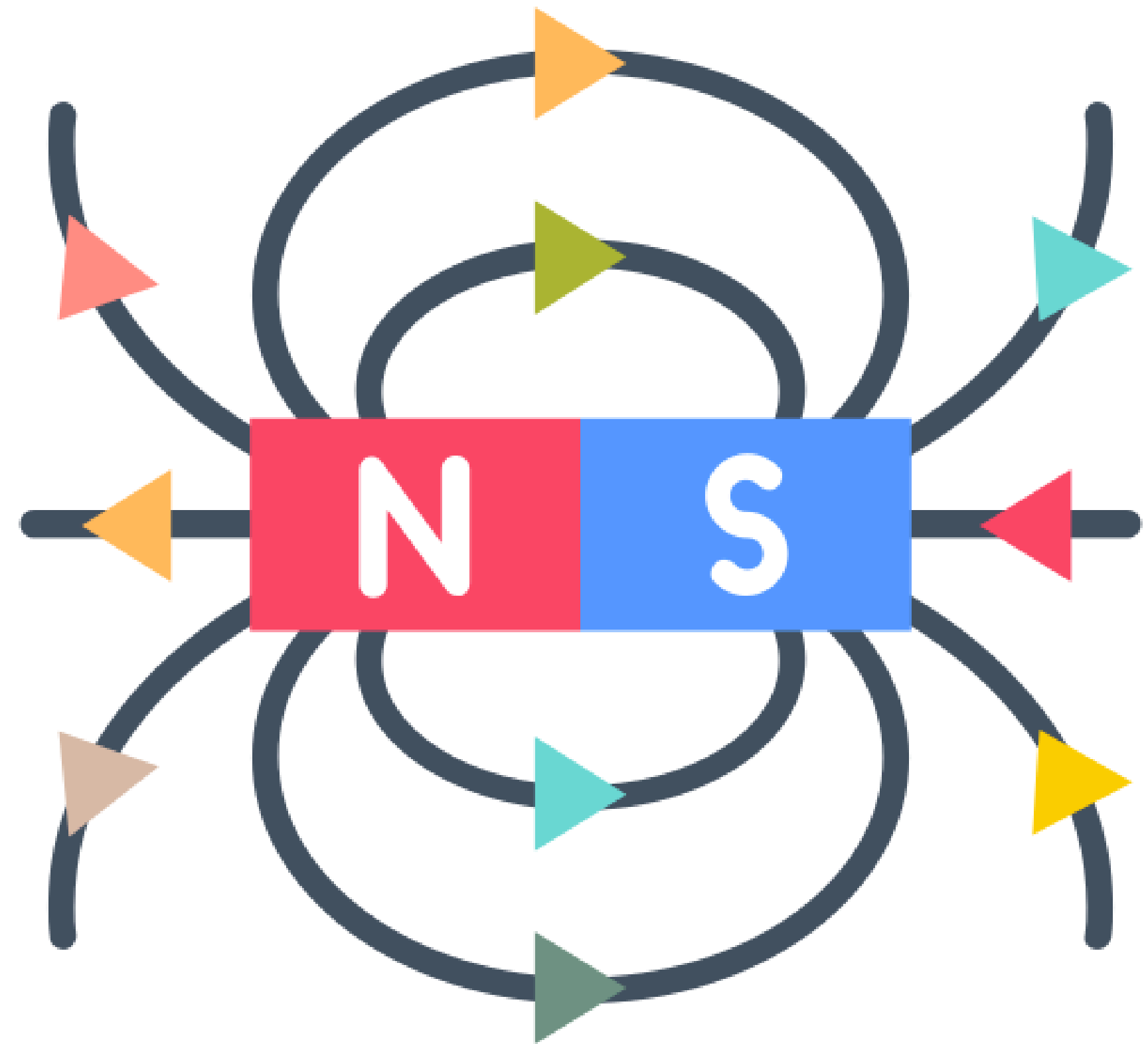


They are referred to as magnetic field lines and the symbol, **B** is used.

On a magnet the field lines always go from North to South.

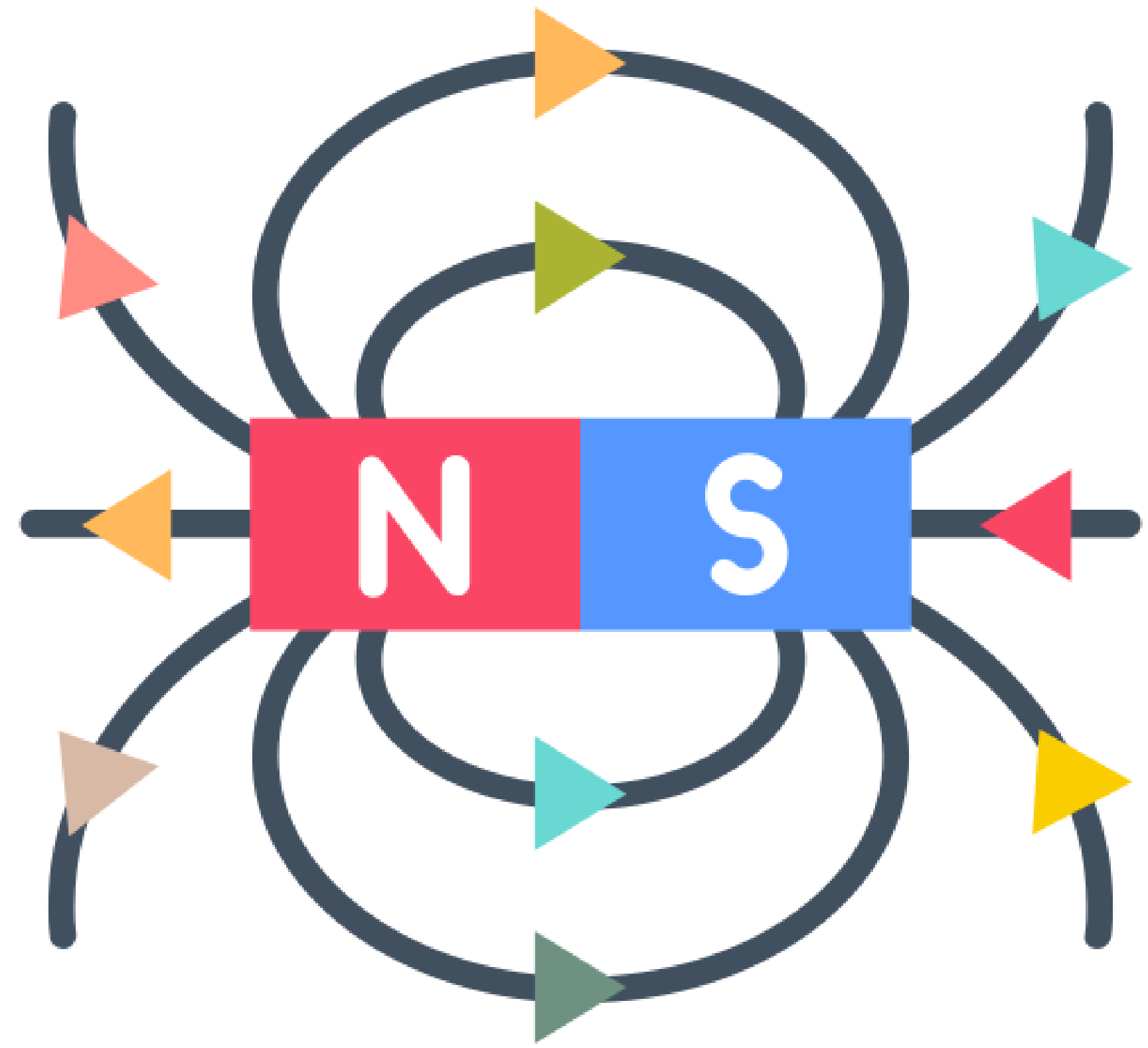


Magnetic fields can be expressed in terms of **imaginary magnetic field lines**, which have the following characteristics....



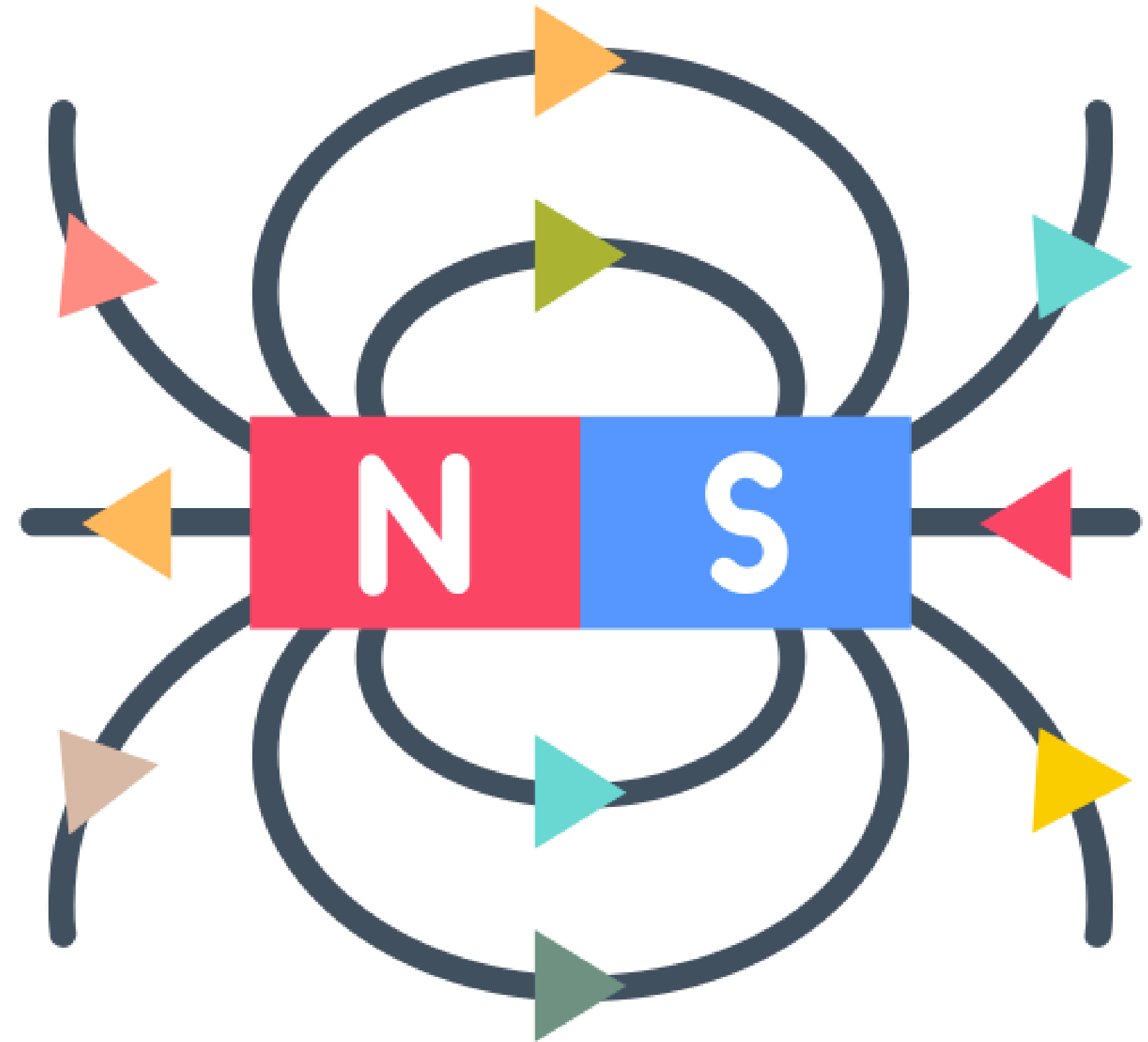
Magnetic field lines:

- never cross or touch
- are directed from a N pole to an S pole
- have a longitudinal tension within each line, causing it to behave as a stretched elastic band



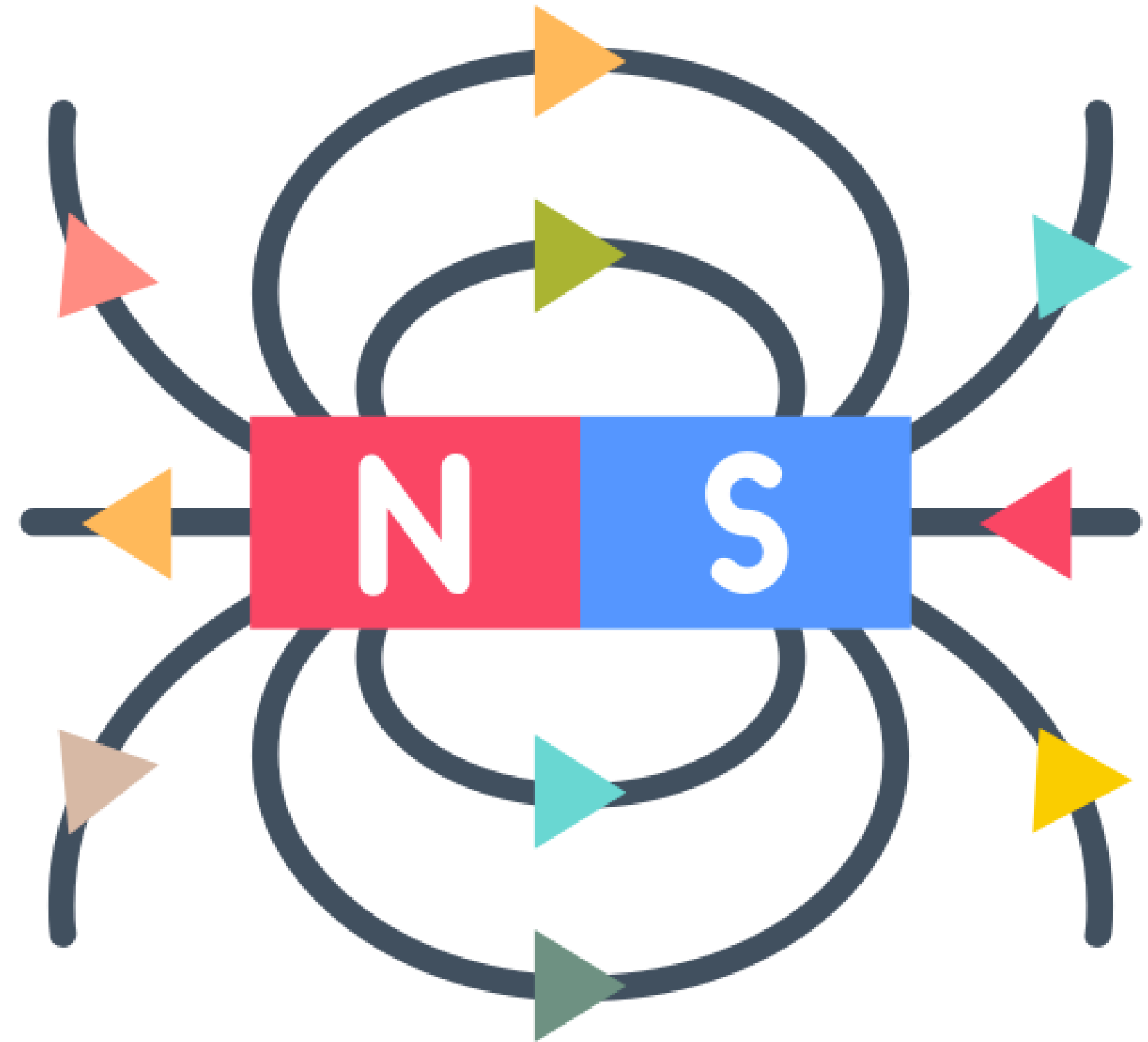
Magnetic field lines:

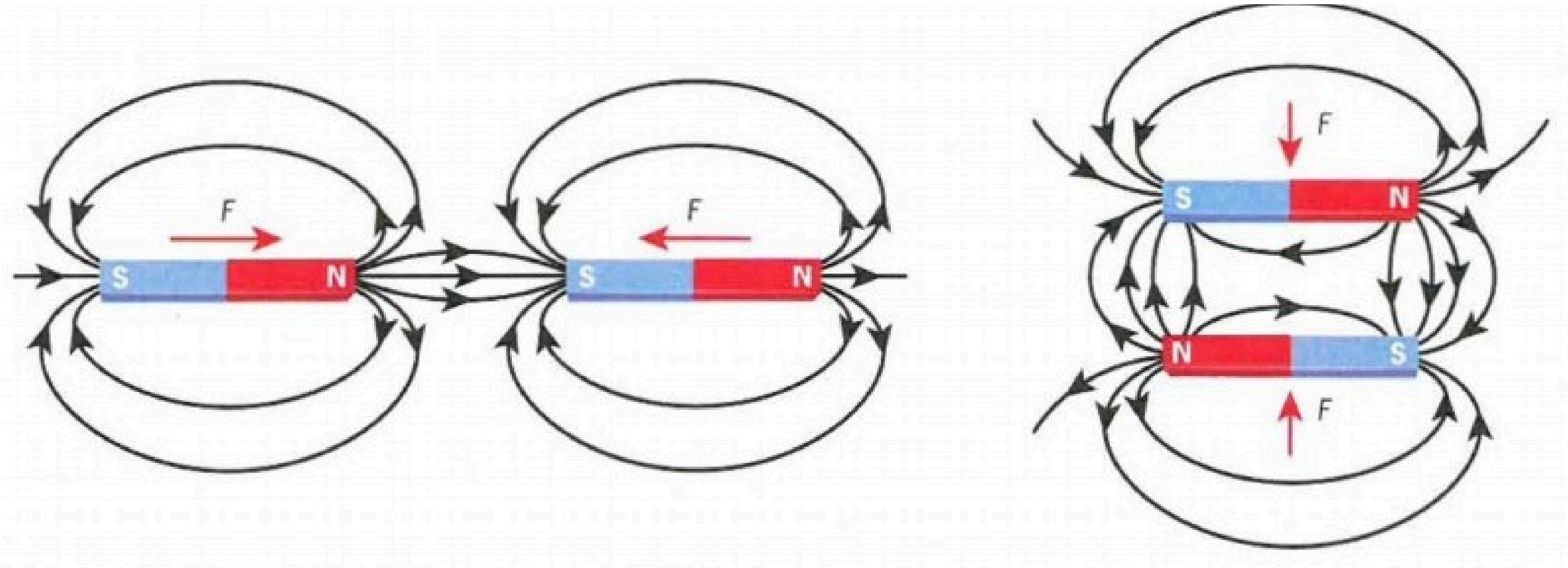
- experience lateral repulsion between lines that are close 'side by side'
- experience uniformity where the lines are evenly spaced and parallel.



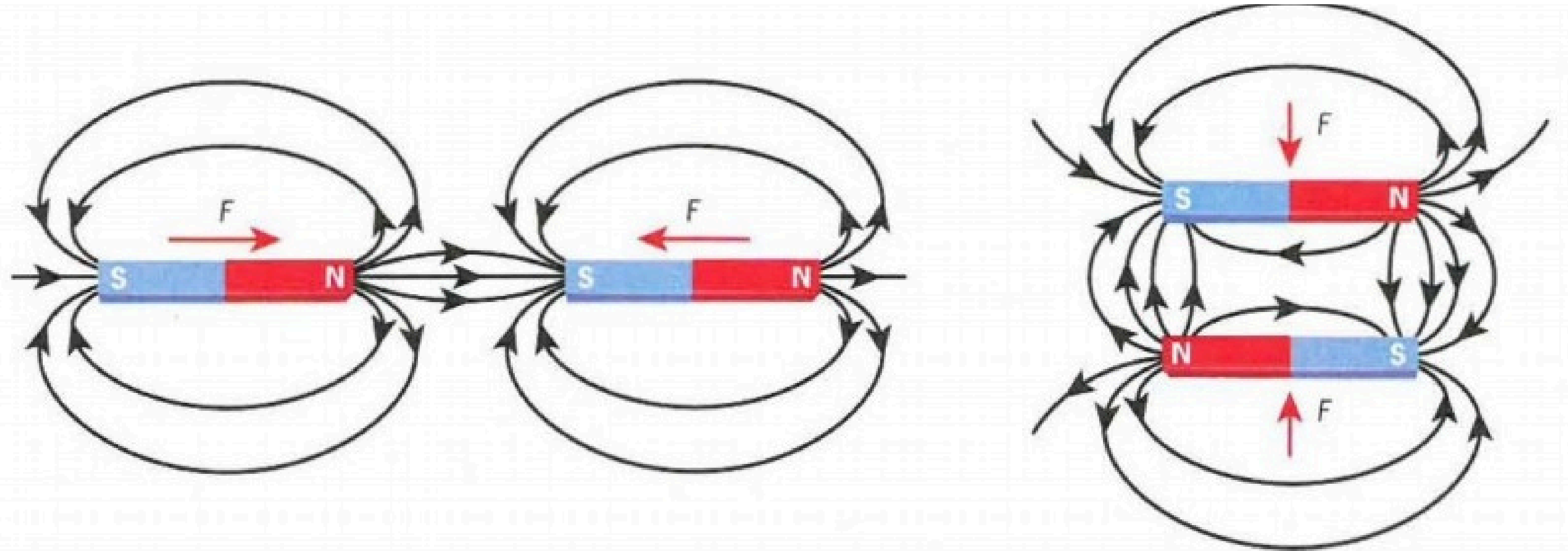
Magnetic field lines:

- are stronger where the lines are more concentrated



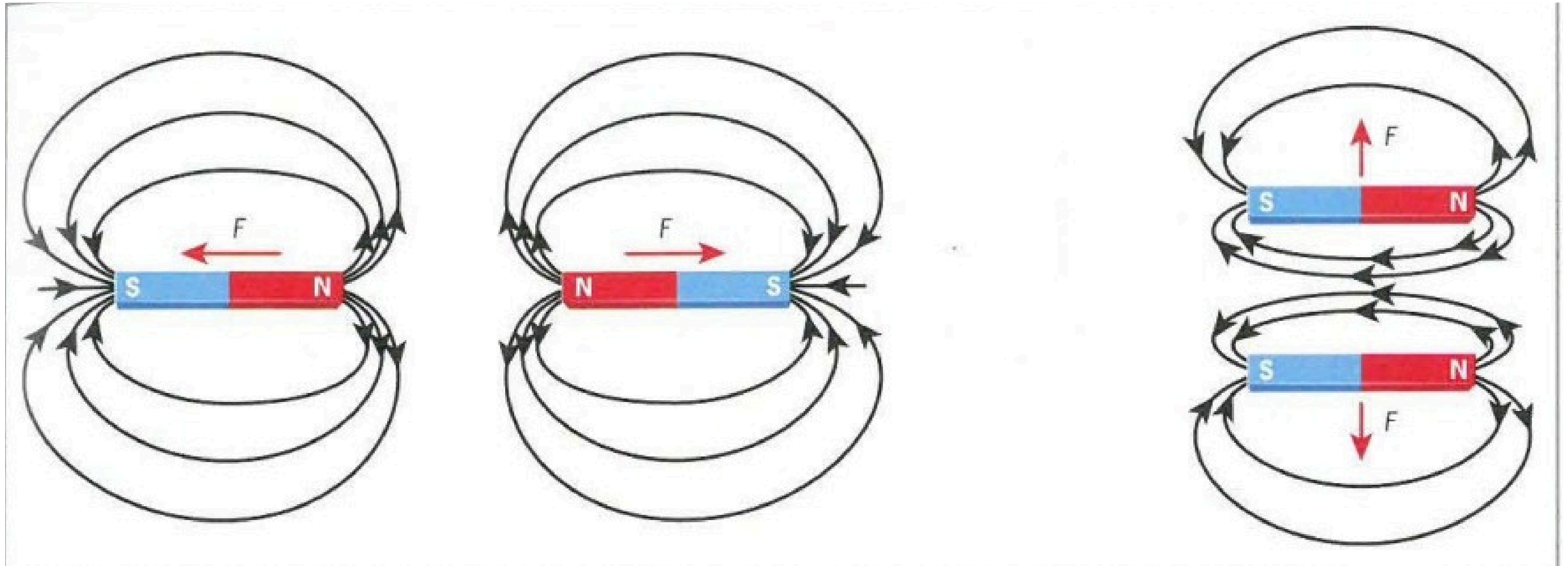


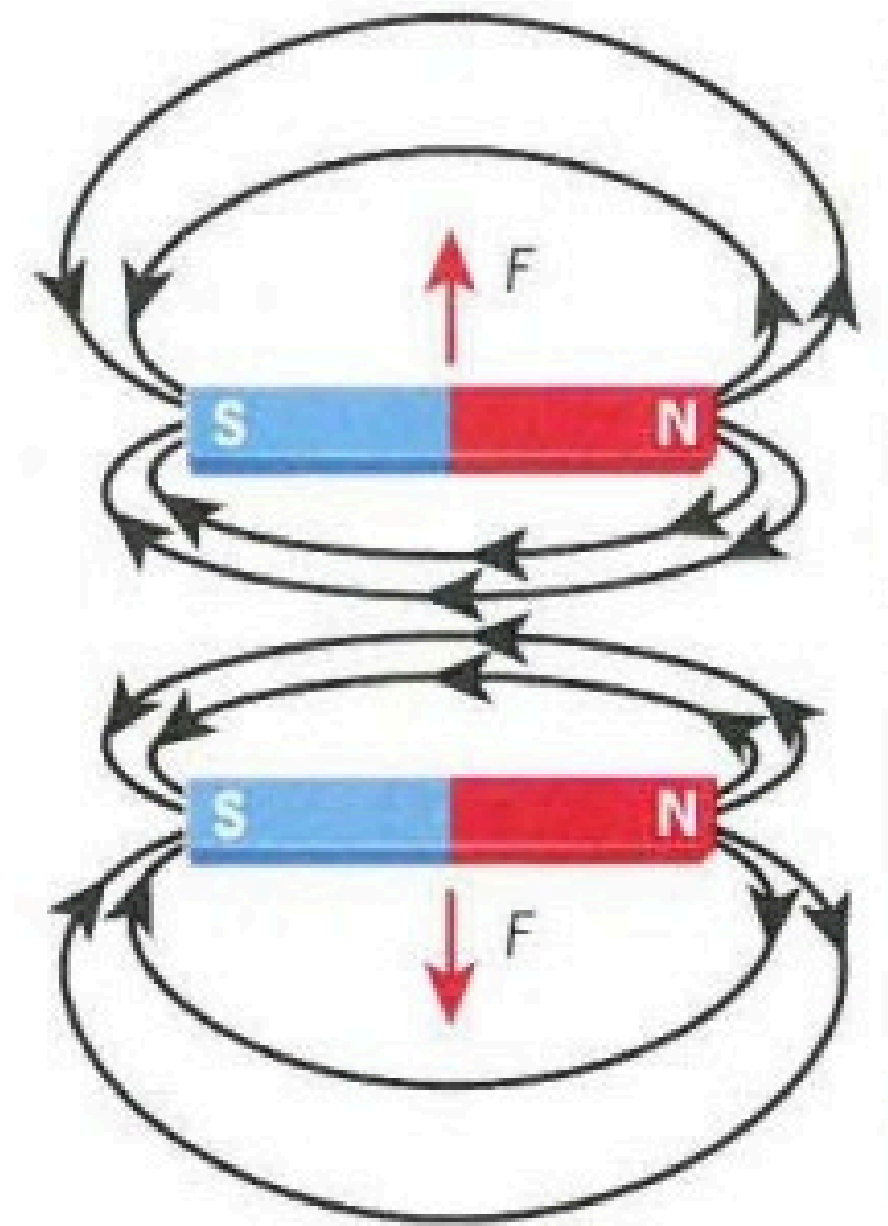
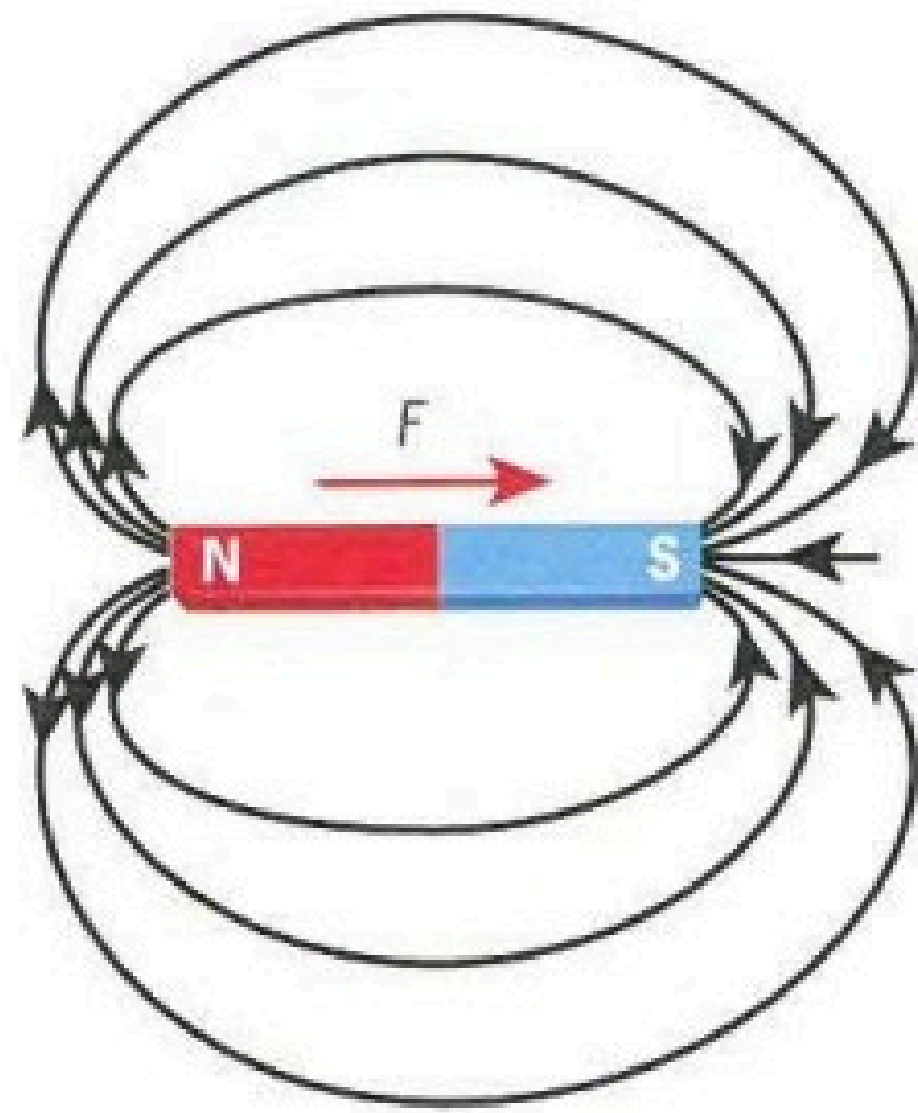
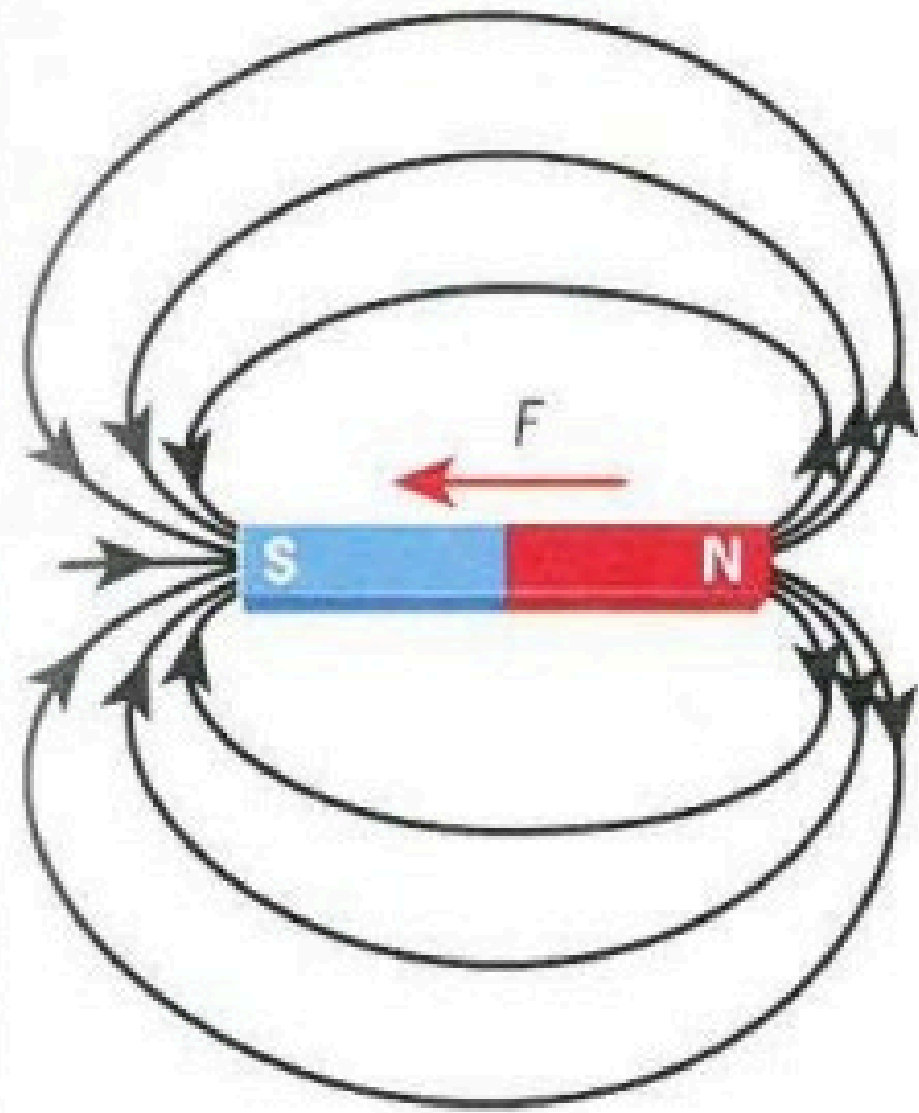
The figure above shows the behaviour of magnetic field lines between **OPPOSITE** poles



Forces of **ATTRACTION** exist between **OPPOSITE** poles due to the longitudinal tension within the field lines joining them.

The figure below shows the behaviour of magnetic field lines between the **SAME** poles





Forces of **REPULSION** exist between **SIMILAR** poles due to the lateral push between field lines lying close to each other, side-by-side.

Magnetic materials are those that can be in a **magnetised** or **demagnetised** state, but **non-magnetic** materials **cannot** be magnetised.



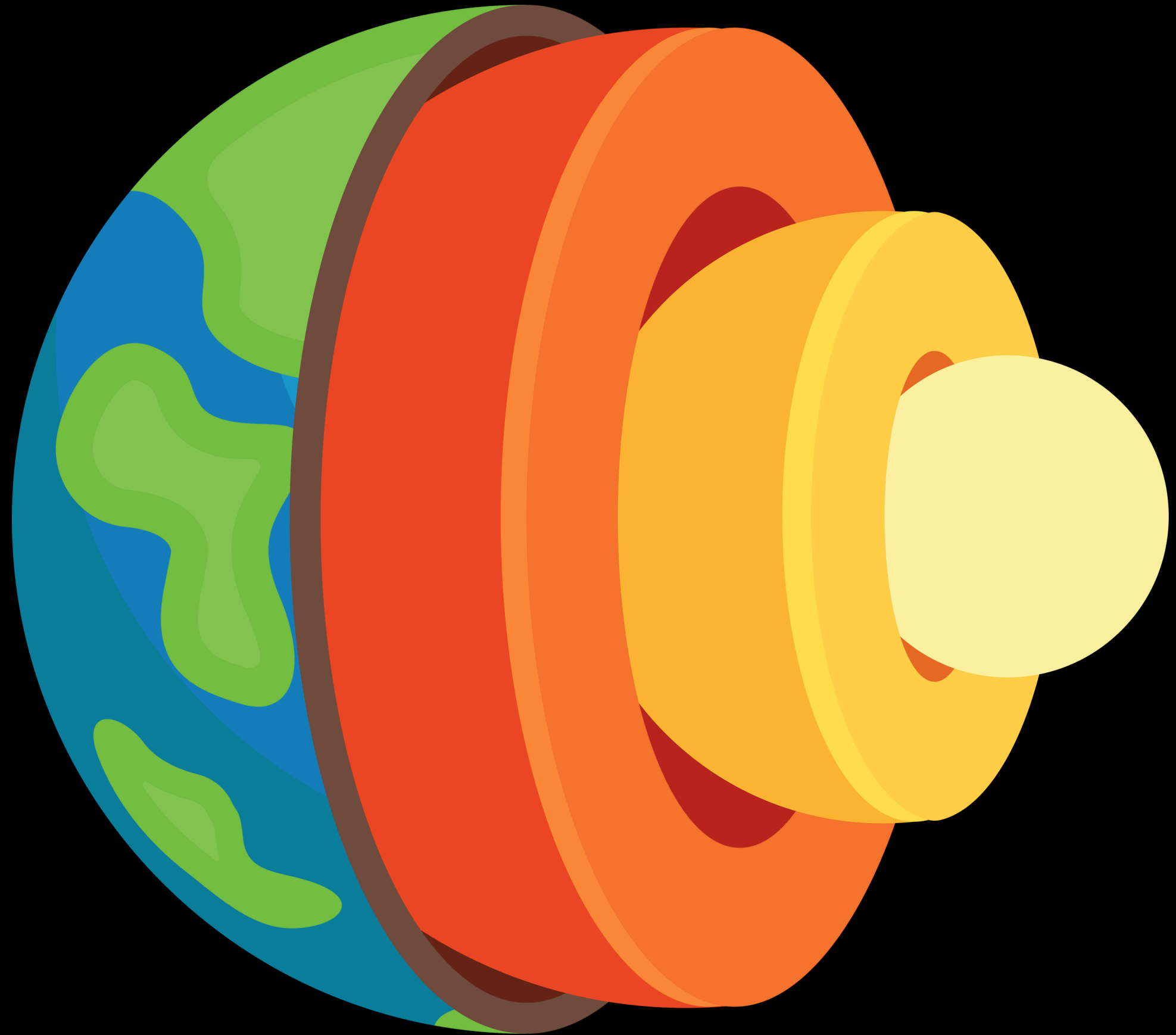
Iron, Nickel and Cobalt, together with a few alloys and rare-earth metals, are all examples of metals with magnetic properties.

They are **ferromagnetic.** Simply meaning that they have magnetic properties.

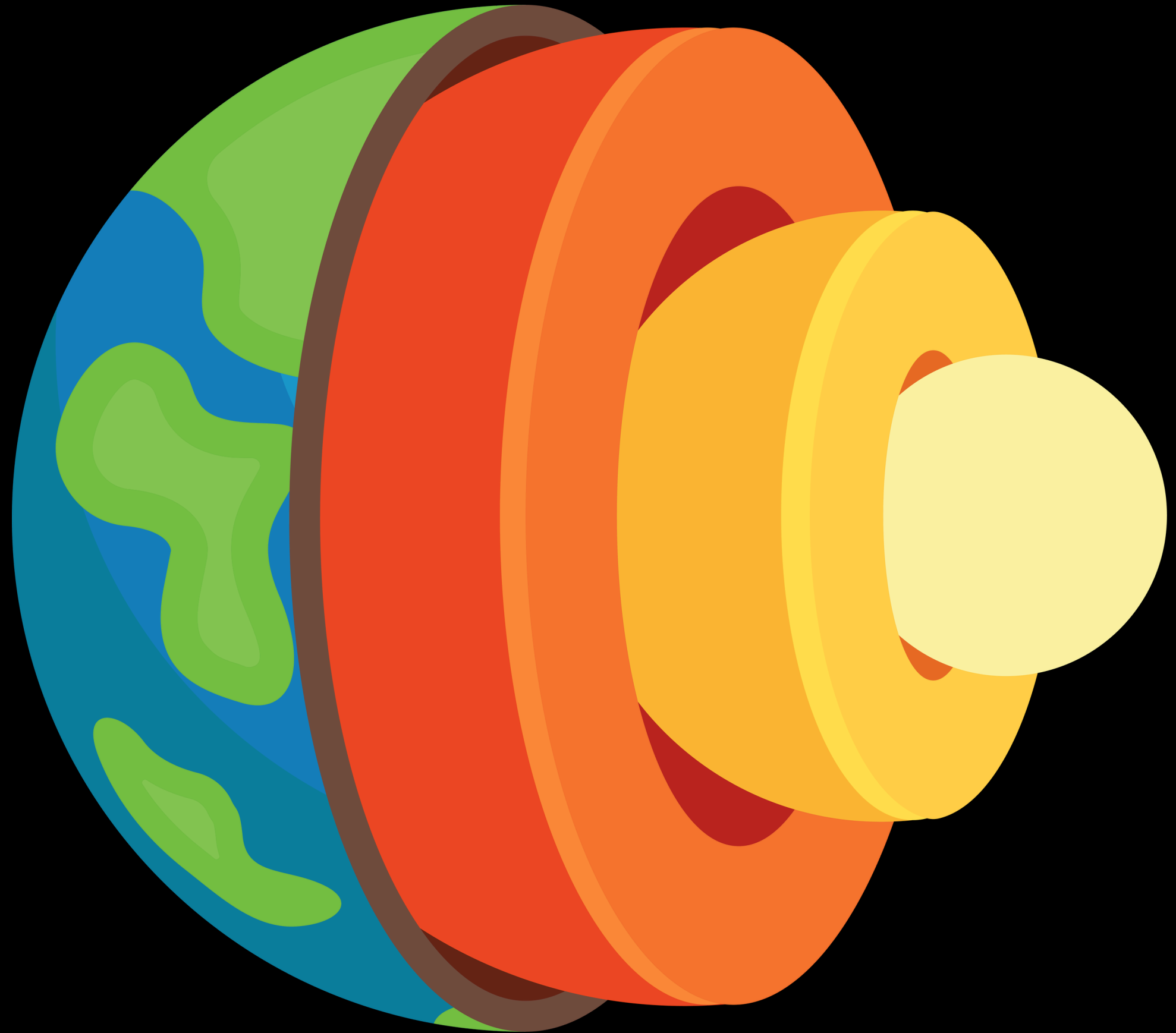
They are located within the Earth's crust.



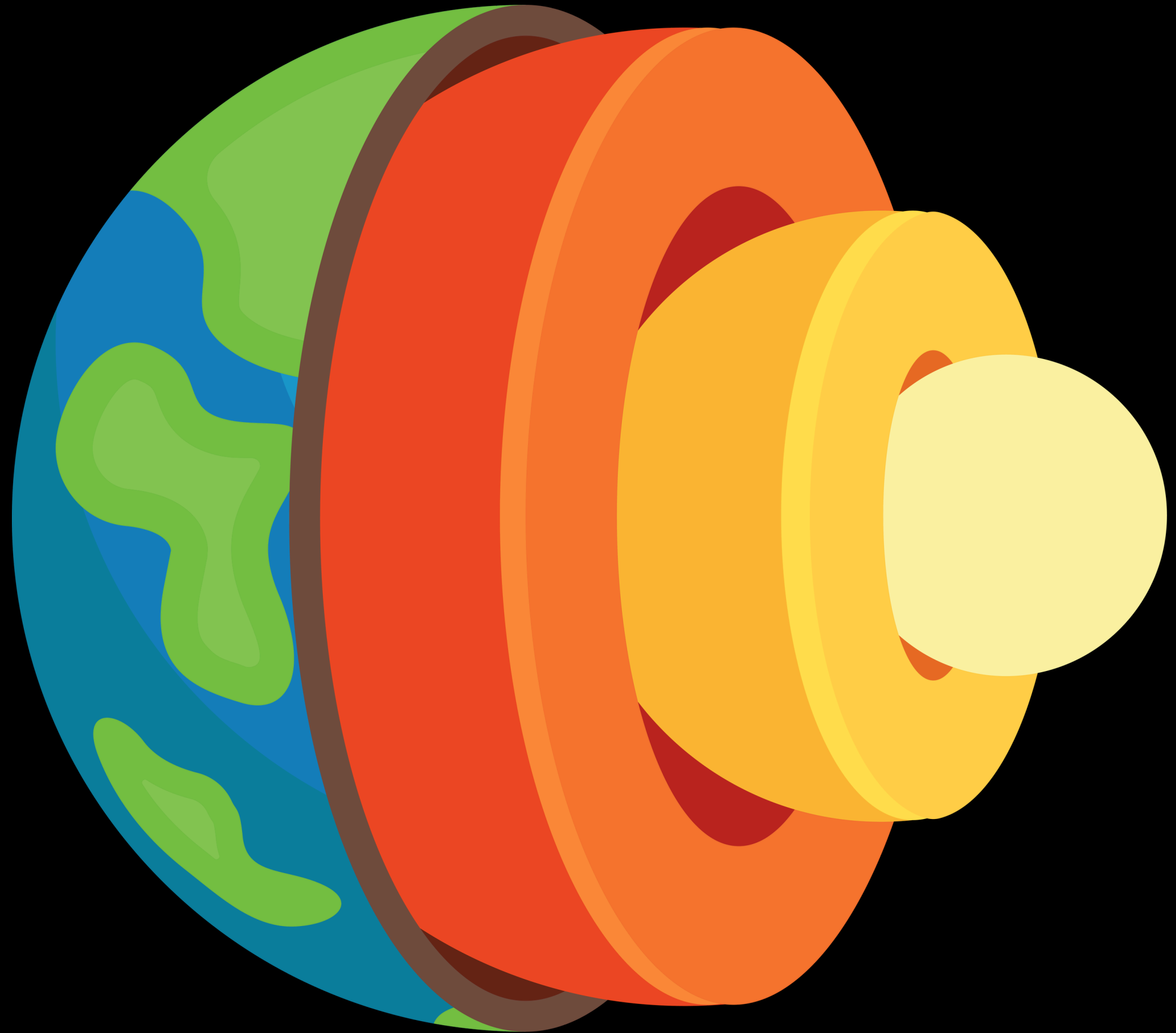
The inner core at the very center of the Earth is solid iron and nickel.



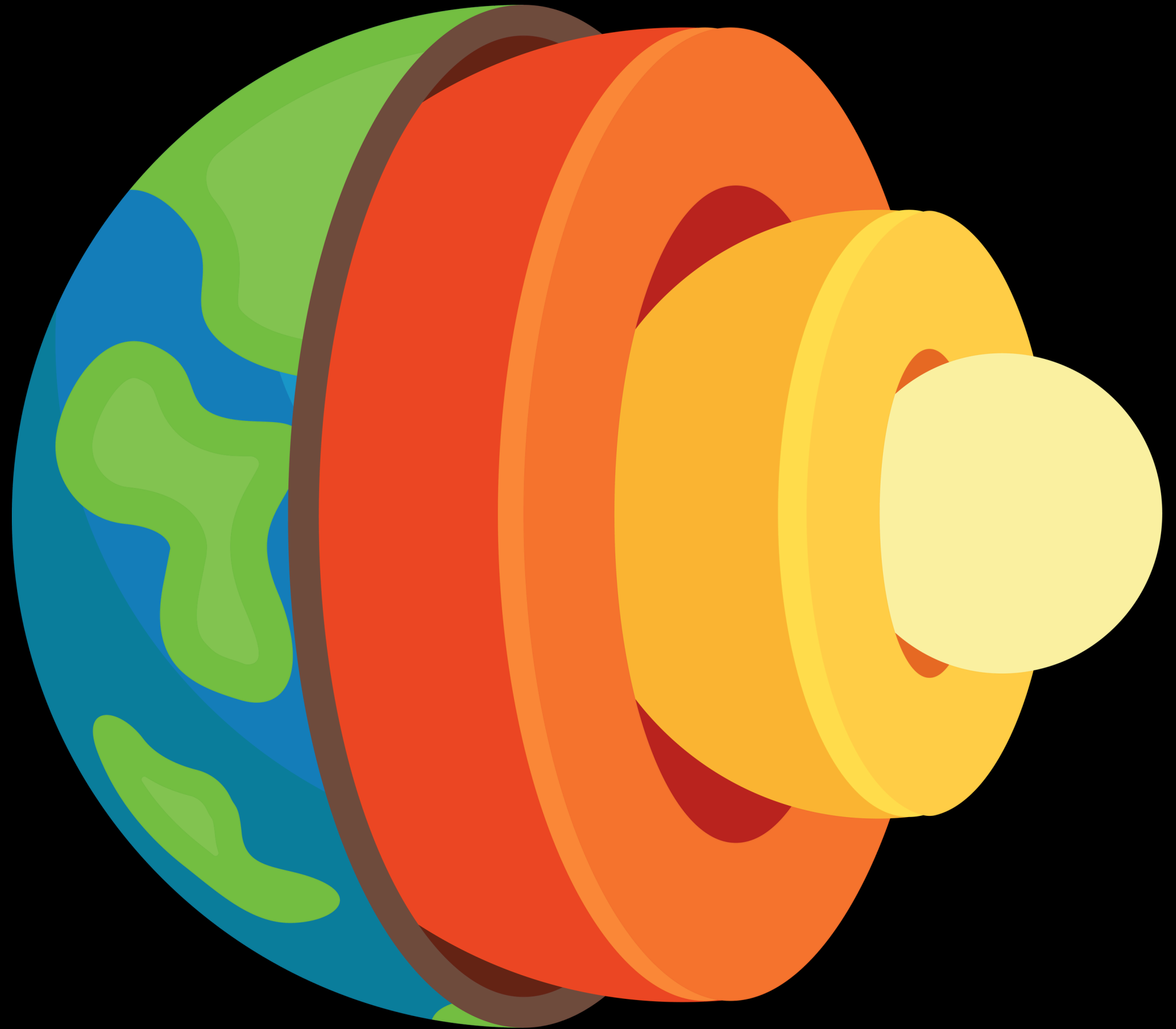
Surrounding it is
the outer core,
which is made of
molten (liquid)
iron.



The molten iron in
the outer core
moves in **circular
convection
currents.**

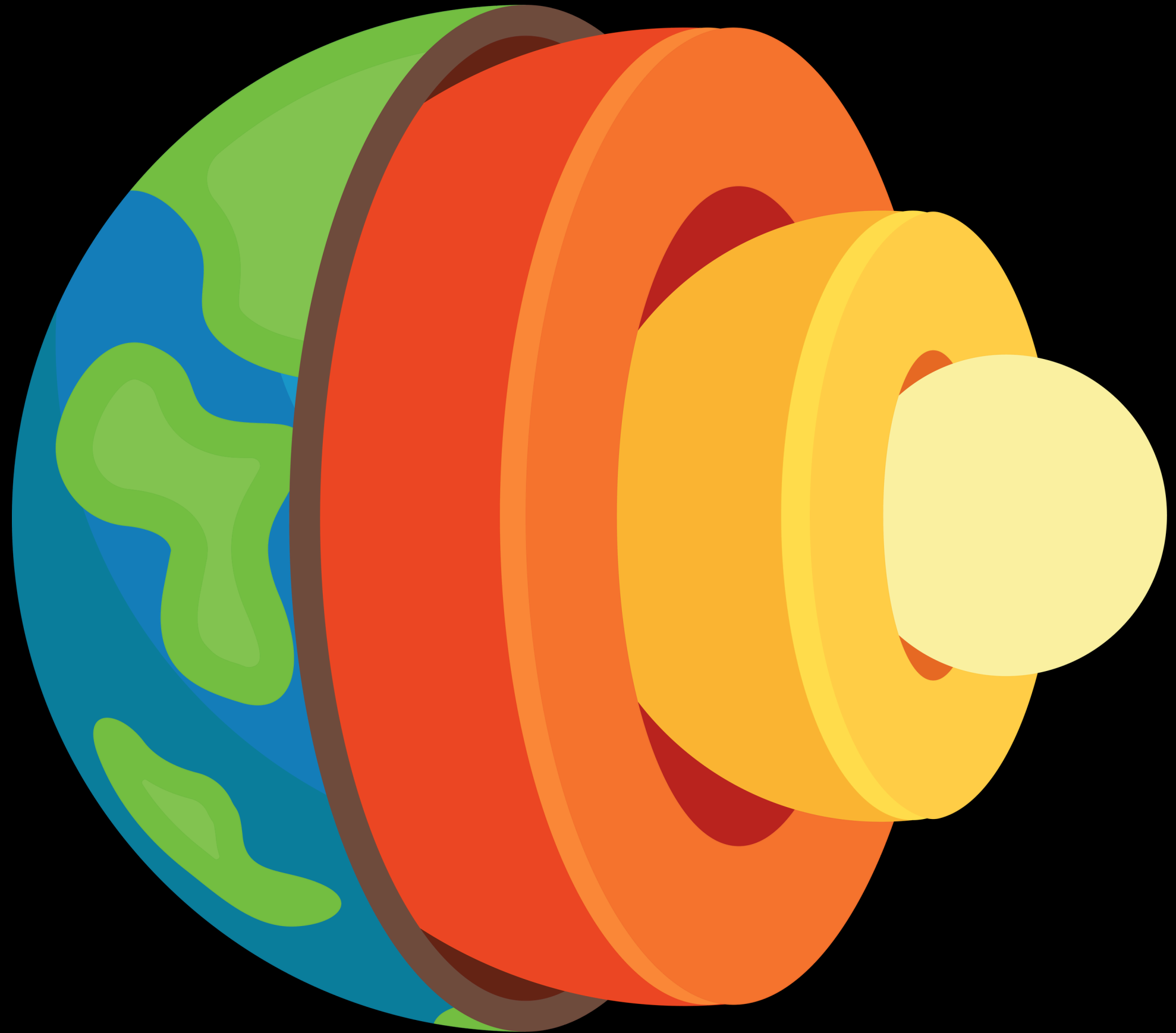


As this liquid metal moves, it creates electric currents.

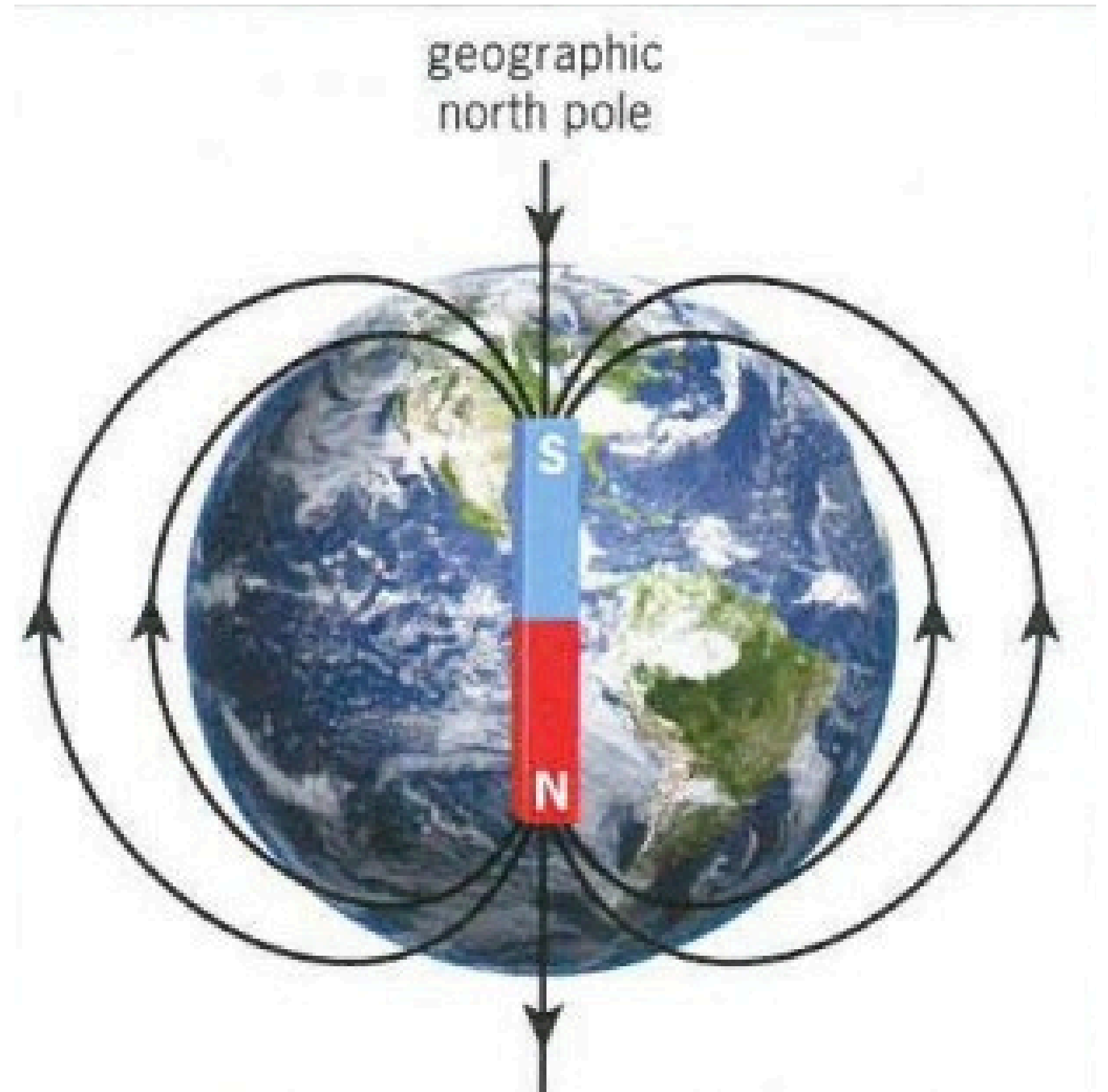


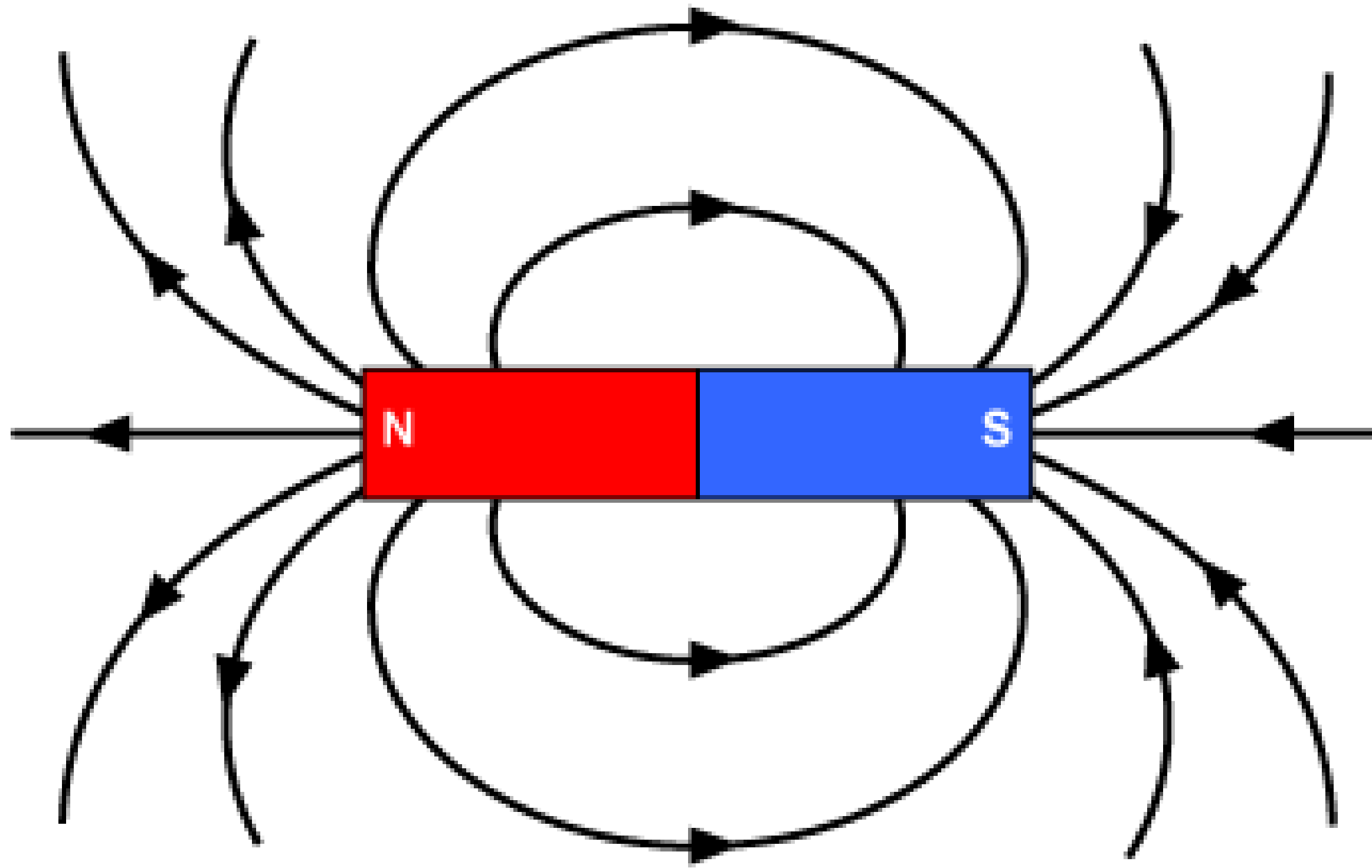
These electric currents produce Earth's magnetic field.

This process is called the **geodynamo** effect.



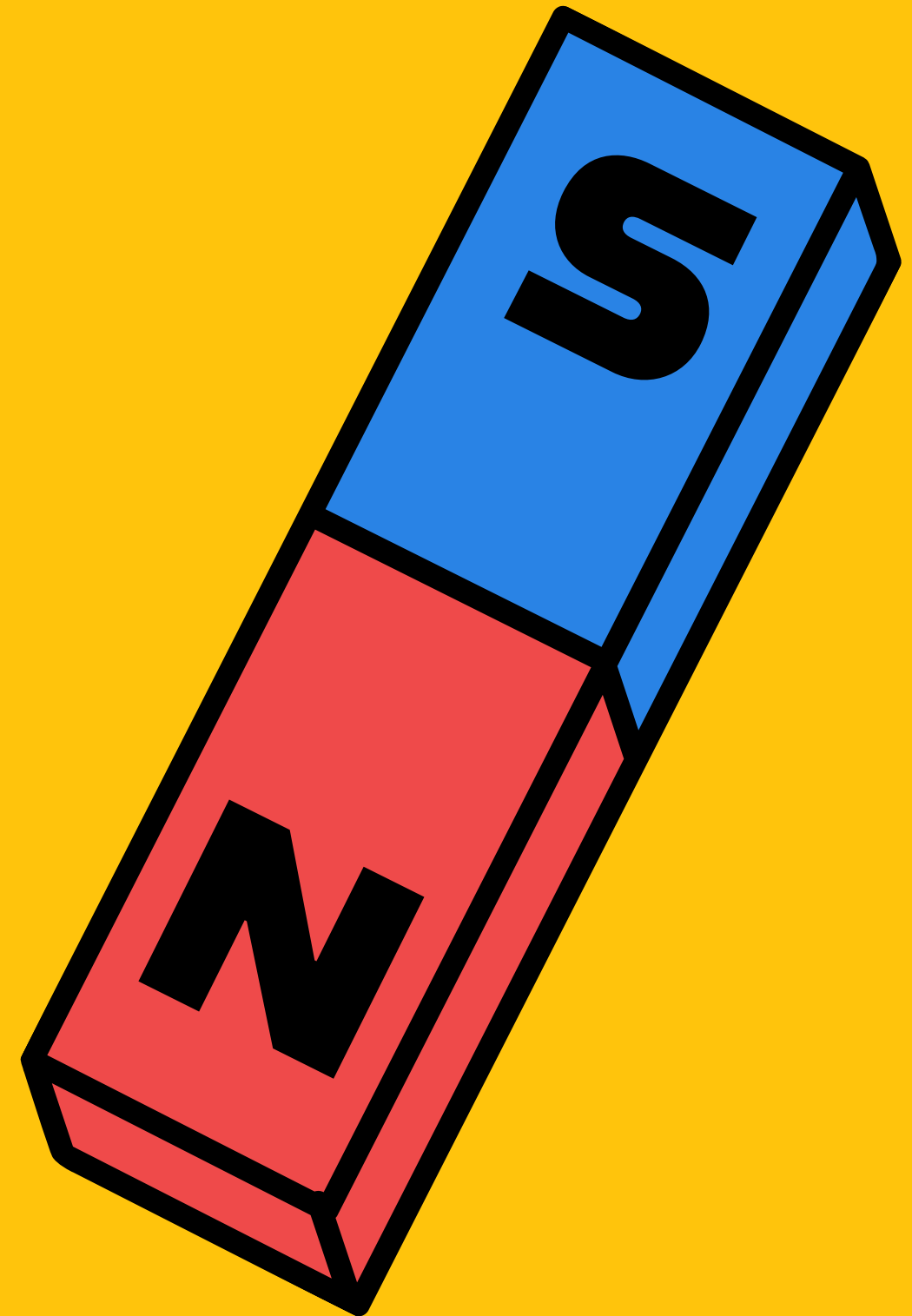
Earth, therefore, is surrounded by magnetic field lines.



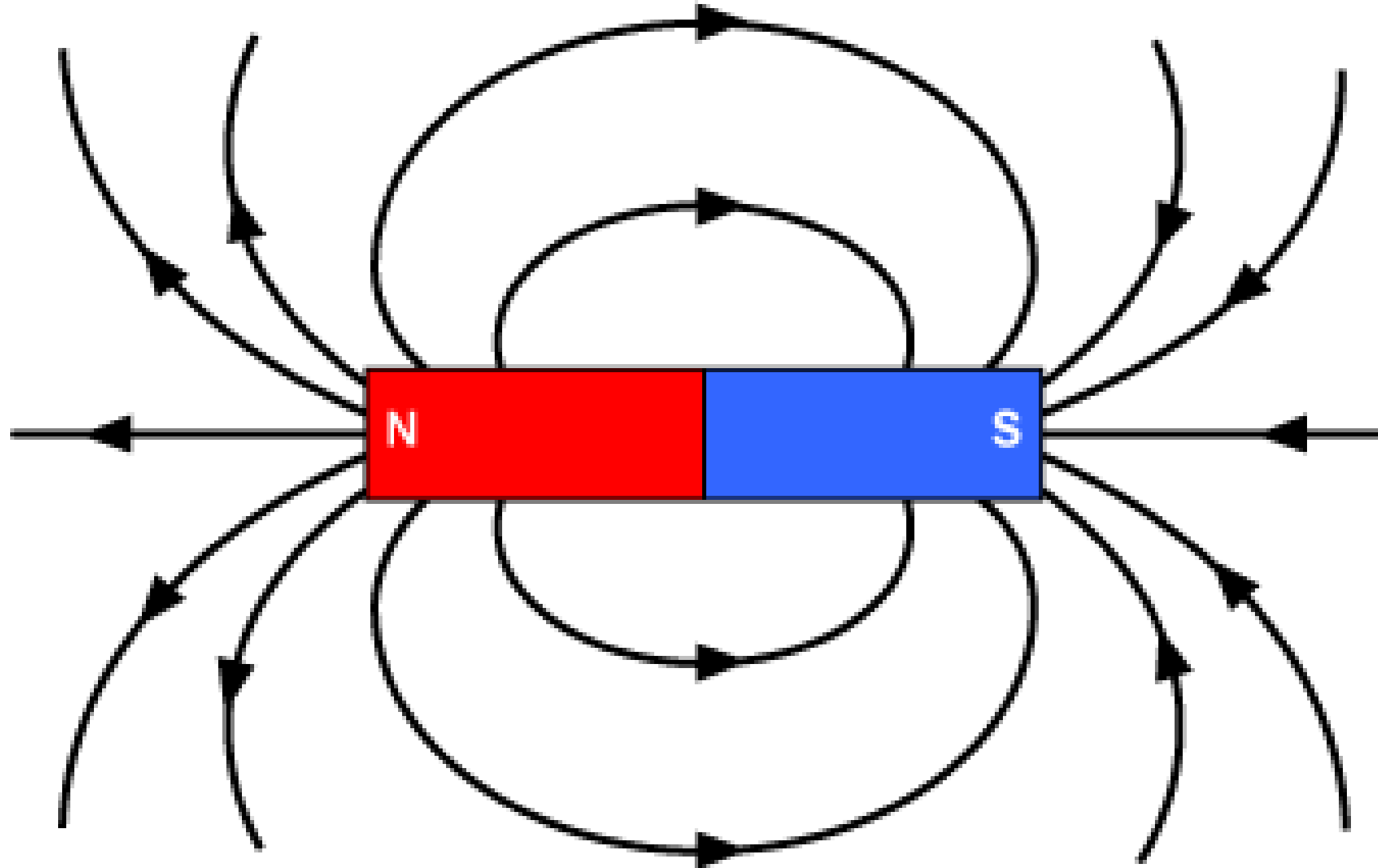


A magnet is dipolar because it has two poles.

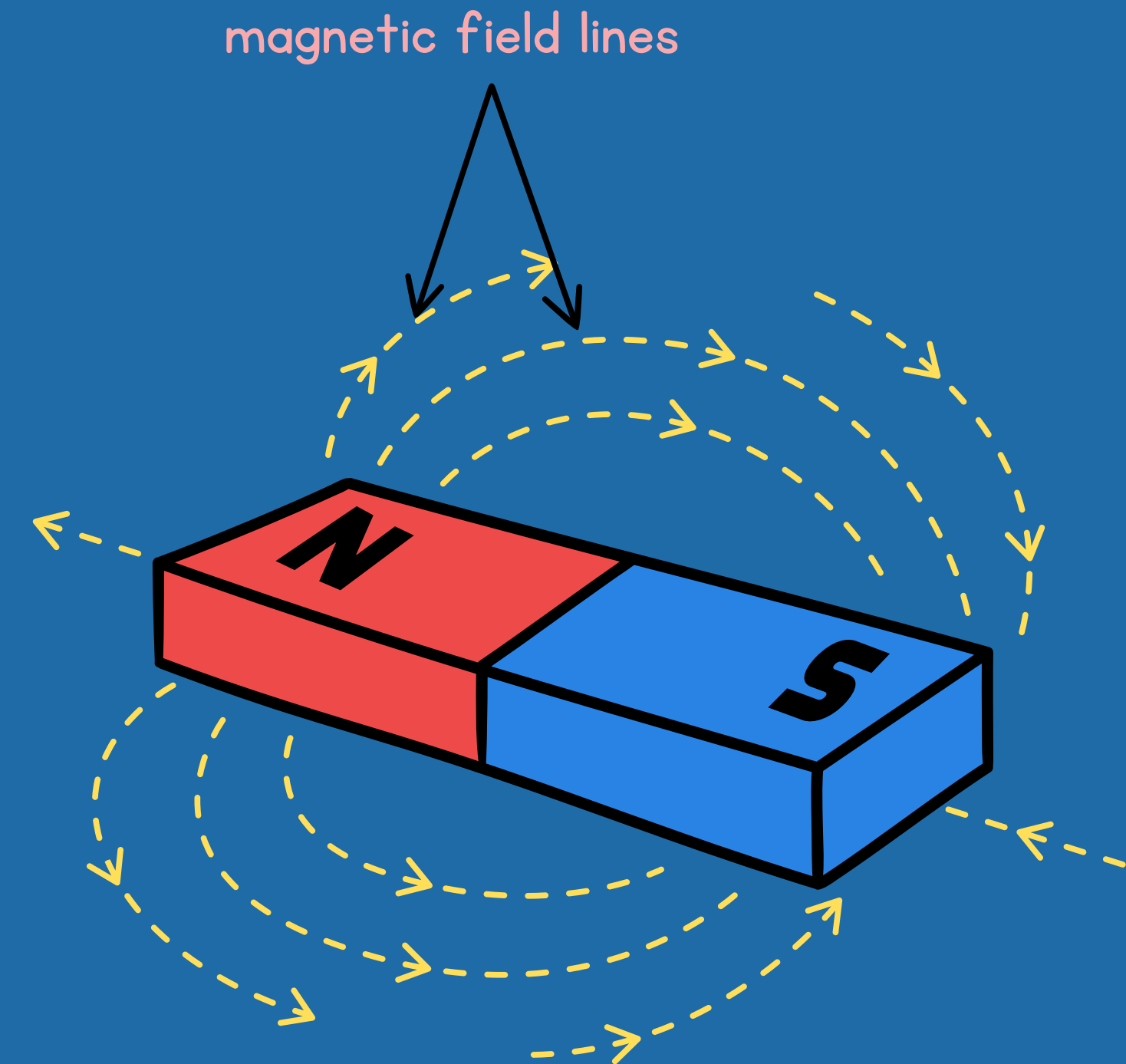
They have a
NORTH and a
SOUTH pole.



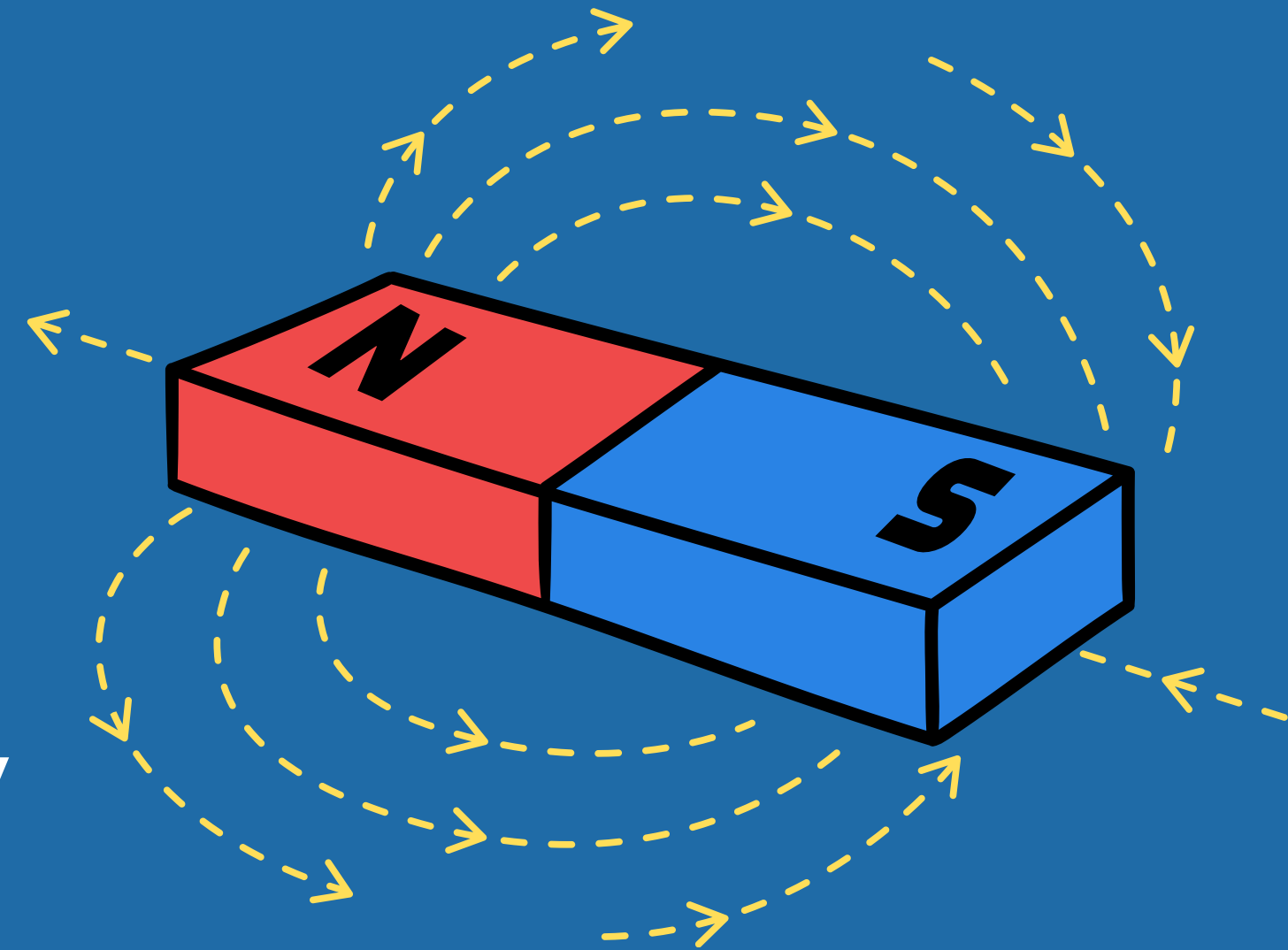
The poles on a magnet are the areas where its magnetic strength is **STRONGEST** because the magnetic field lines are **most dense** there.



A **magnetic field, B** is the area around a magnet or moving electric charge where the force of magnetism is exerted. It can pull or push other magnetic objects.

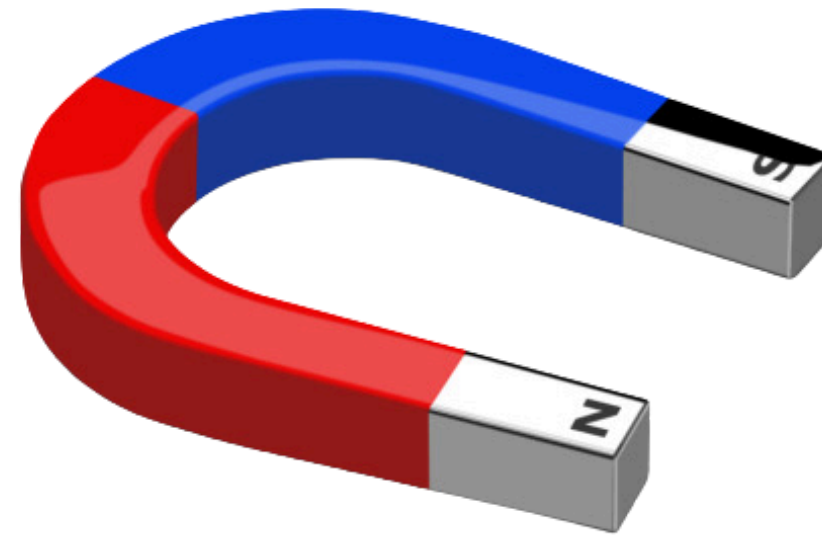


Magnetic fields are invisible but they are responsible for the most notable property of a magnet: a force that pulls on other **ferromagnetic materials**, such as iron, steel, nickel, cobalt, etc., and **attracts** or **repels** other magnets.

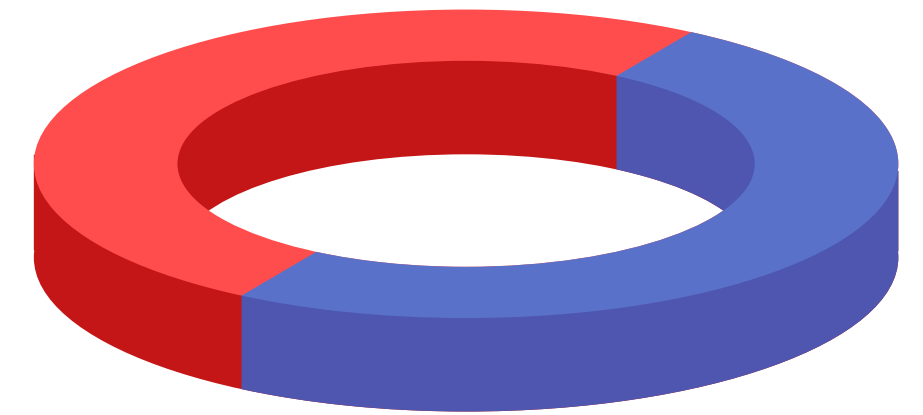




bar magnet

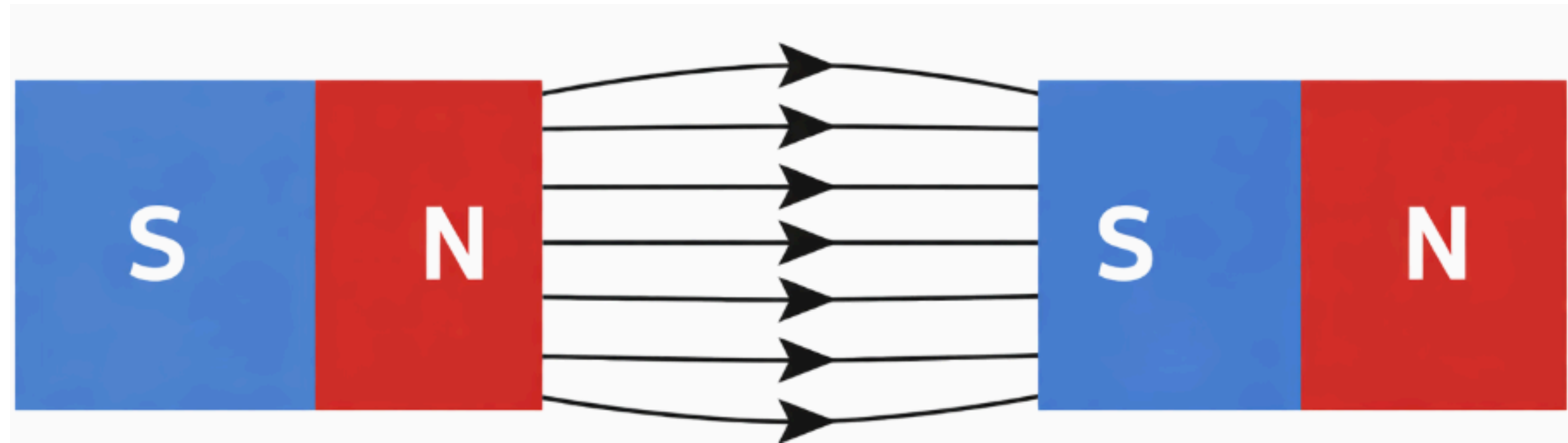


horse shoe or U-shaped magnet

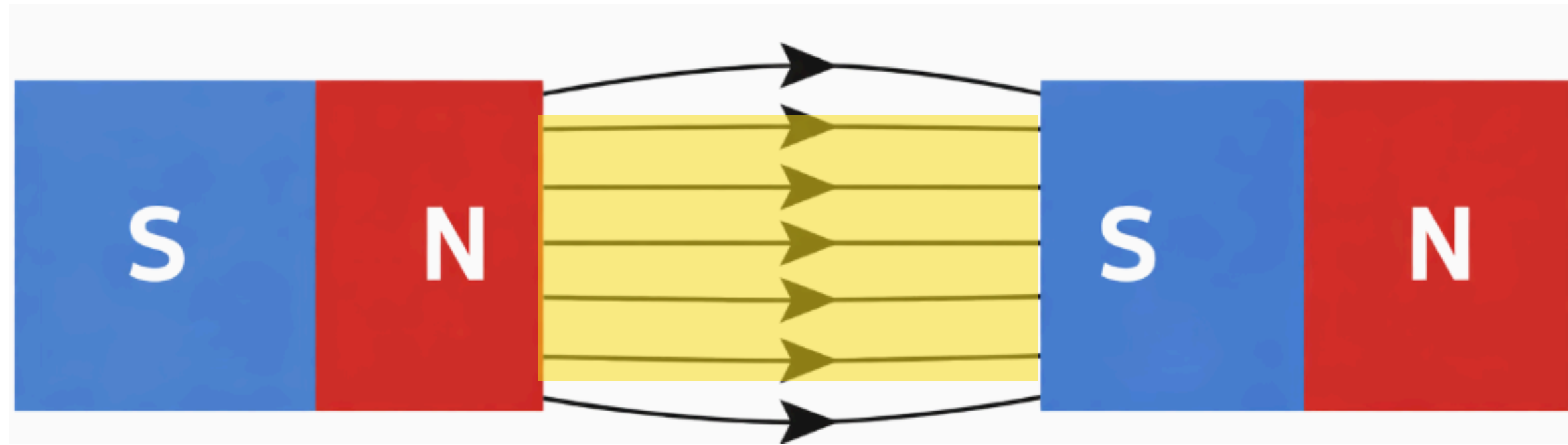


ringed magnet

Magnets come in a variety of shapes and sizes: bar, horse shoe or U shaped and ringed.

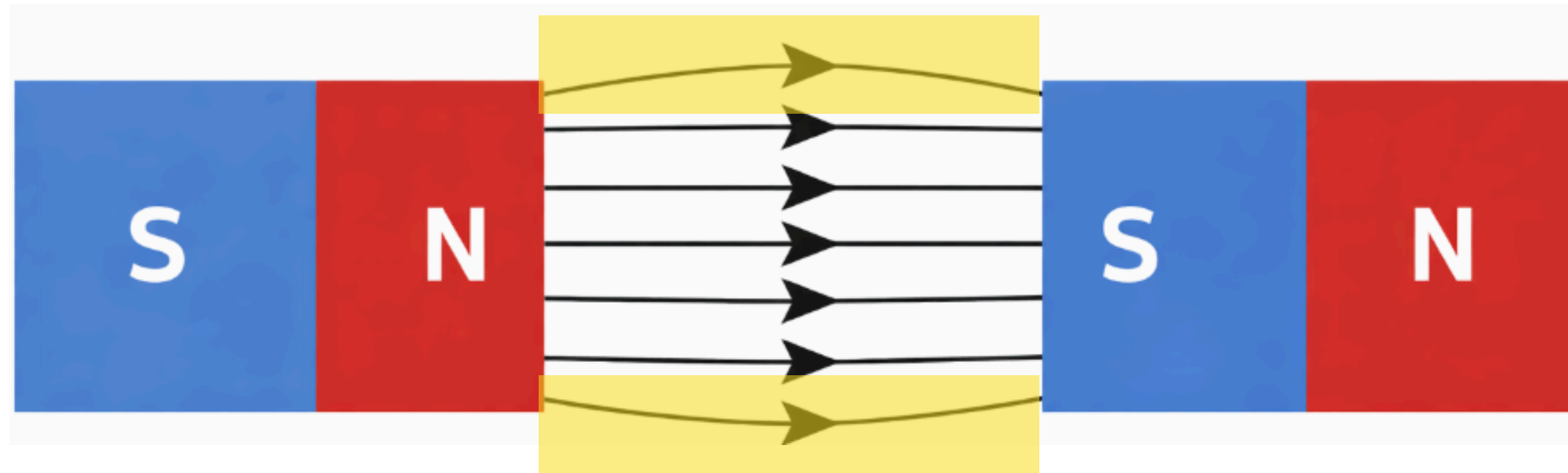


When opposite poles of a magnet are in close proximity to each other, a uniform magnetic field is produced.



Unlike the lines at the upper and lower edges of the field, each line in the **central region** between the poles is being repelled downward by the lines above it and repelled upward by the lines below it. These lines therefore remain straight.

Since they are parallel and evenly spaced, the field is uniform.



Towards the **edges**, the field is **not uniform**.

Field lines at the top are laterally repelled only from lines below, and field lines near the bottom are laterally repelled only from the lines above.

A close-up photograph showing two hands holding bar magnets. The hand on the left holds a magnet with a red 'N' pole on the left and a black 'S' pole on the right. The hand on the right holds a magnet with a black 'S' pole on the left and a red 'N' pole on the right. The two magnets are held horizontally, with their like poles (N-N and S-S) facing each other, demonstrating magnetic repulsion. The background is a light-colored wooden surface.

There are **TWO** laws of magnetism.

The first law states that:

- 1. Like poles repel.**



...and the second one states that,

2. Unlike poles attract

Magnetism is caused by the motion of electric charges (electrons) within certain metals.



It is the force of magnets.

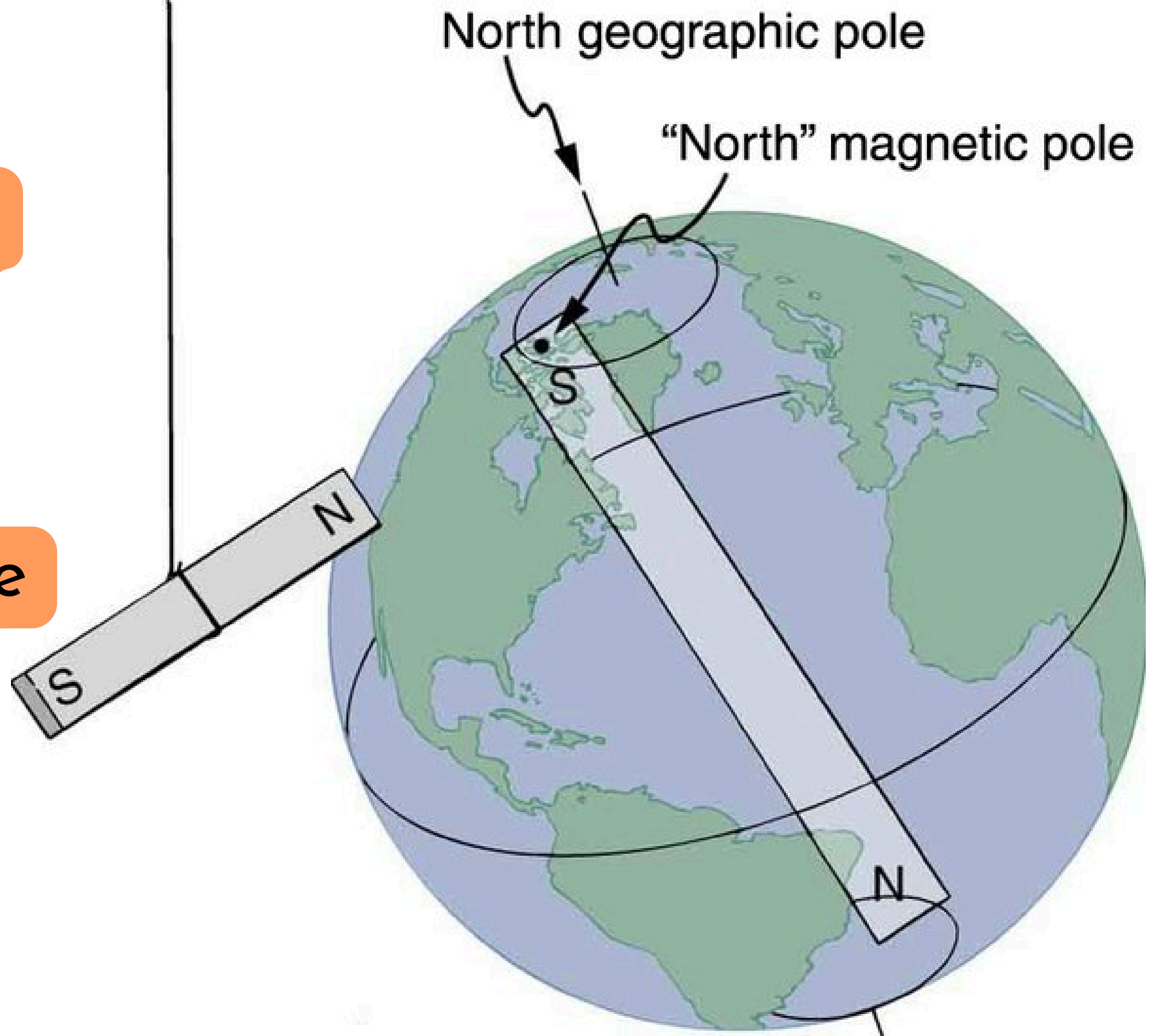
When objects are not in direct contact with each other, but forces still exist between them, they are categorized as **NON-CONTACT** forces.



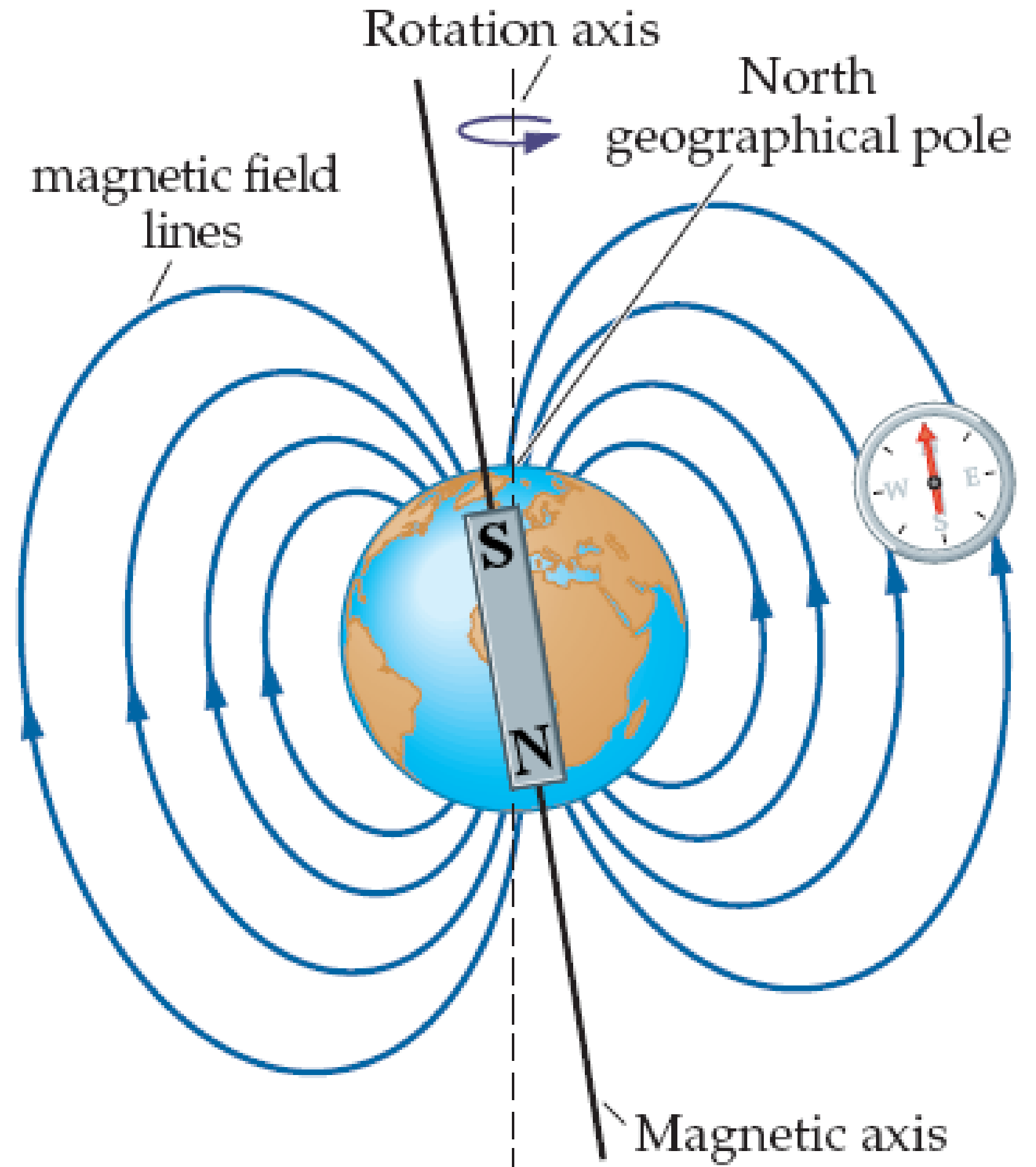
Magnetism is a non-contact force.



If a bar magnet is freely suspended, it aligns itself in the direction of the Earth's magnetic field.



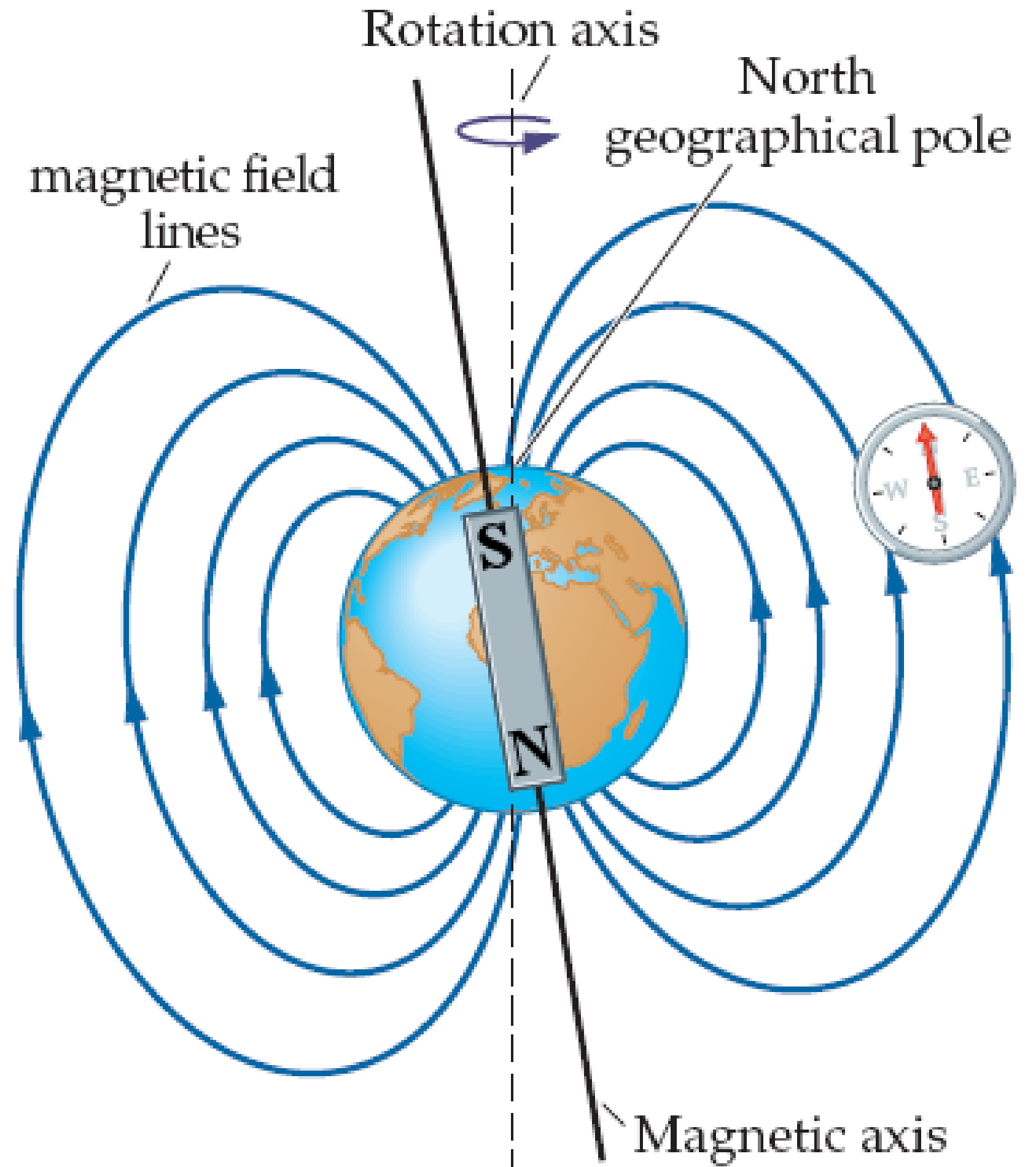
The Earth is a large but weak magnet.



When you use a compass the magnetic dial within it has both a **North** and a **South** Pole.

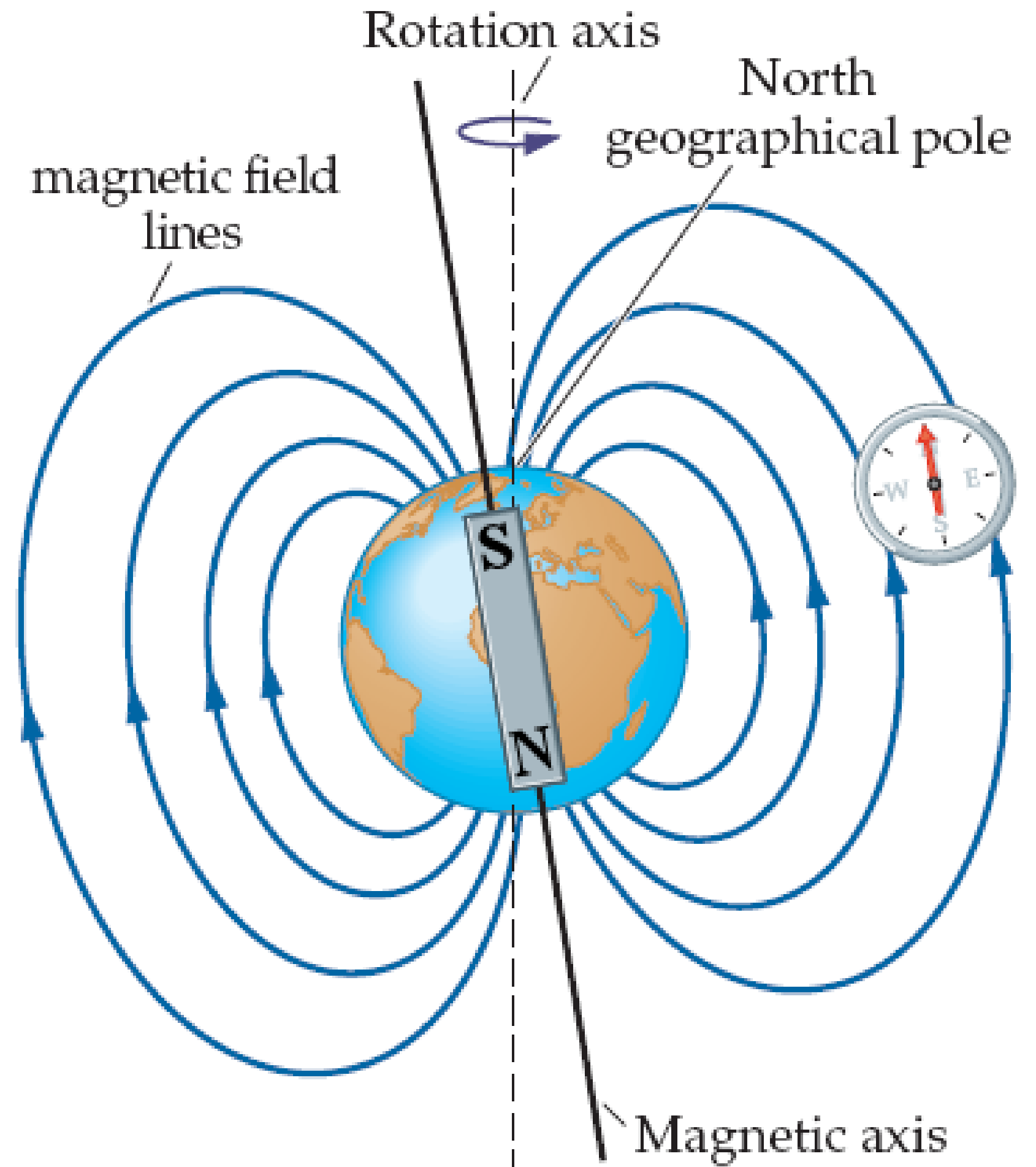
When the North Pole of the dial feels an attraction, we *think* we are moving North.

However, North poles are *only* attracted to South poles.



Hence, what we recognise as Earth's North Pole is **in fact** Earth's South Pole, which is attracting the North Pole of the magnet within the compass.

The North pole is really **Earth's North geographical pole** because, in reality, it is actually the **South Pole**.



Additionally, when the South Pole of the dial feels an attraction, we think we are moving South.

However, South Poles are **only** attracted to North poles.

What we recognise as the South Pole is in fact Earth's North Pole, attracting the South Pole of the magnet within the compass.



Earth's South Pole is really **Earth's South geographical pole** because in reality, it is the North Pole.



Earth's magnetic field protects it and us from solar and cosmic radiation.



It also provides a navigational reference for animals to find their way.

Earth's
magnetic field is
measured in
tesla (T).



The tesla (T) is the SI unit of magnetic flux density (magnetic field strength).

It applies to any magnetic field, including those produced by:

- Permanent magnets
- Electromagnets
- Electric currents in wires
- MRI machines
- Laboratory magnetic fields

