Ten things you might not know about the Earth's magnetic field

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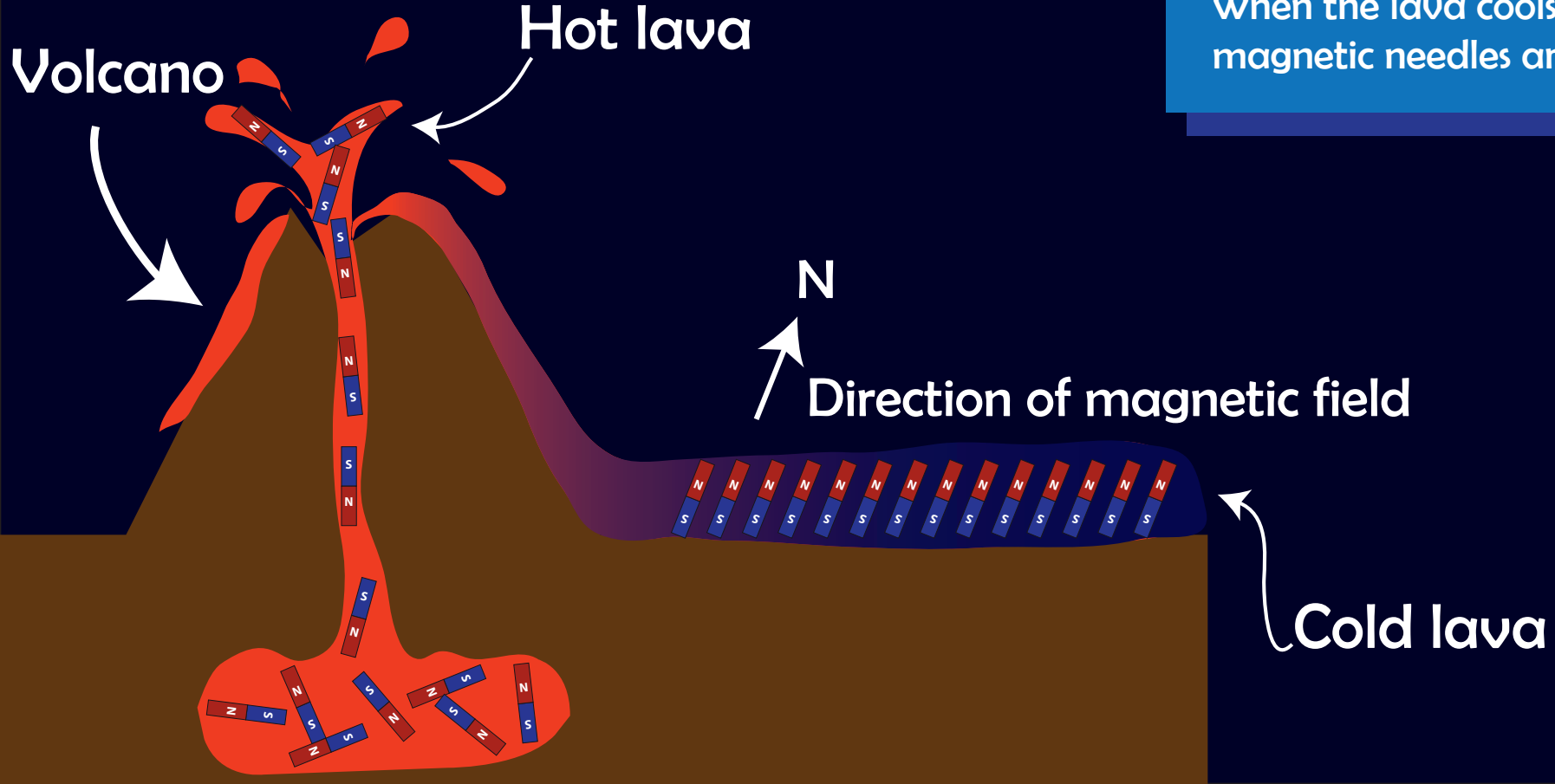
1. Rocks can capture the Earth's magnetic field when they are formed

Magnetic needles inside a hot lava align themselves to the magnetic field

When the lava cools down, the magnetic needles are locked in



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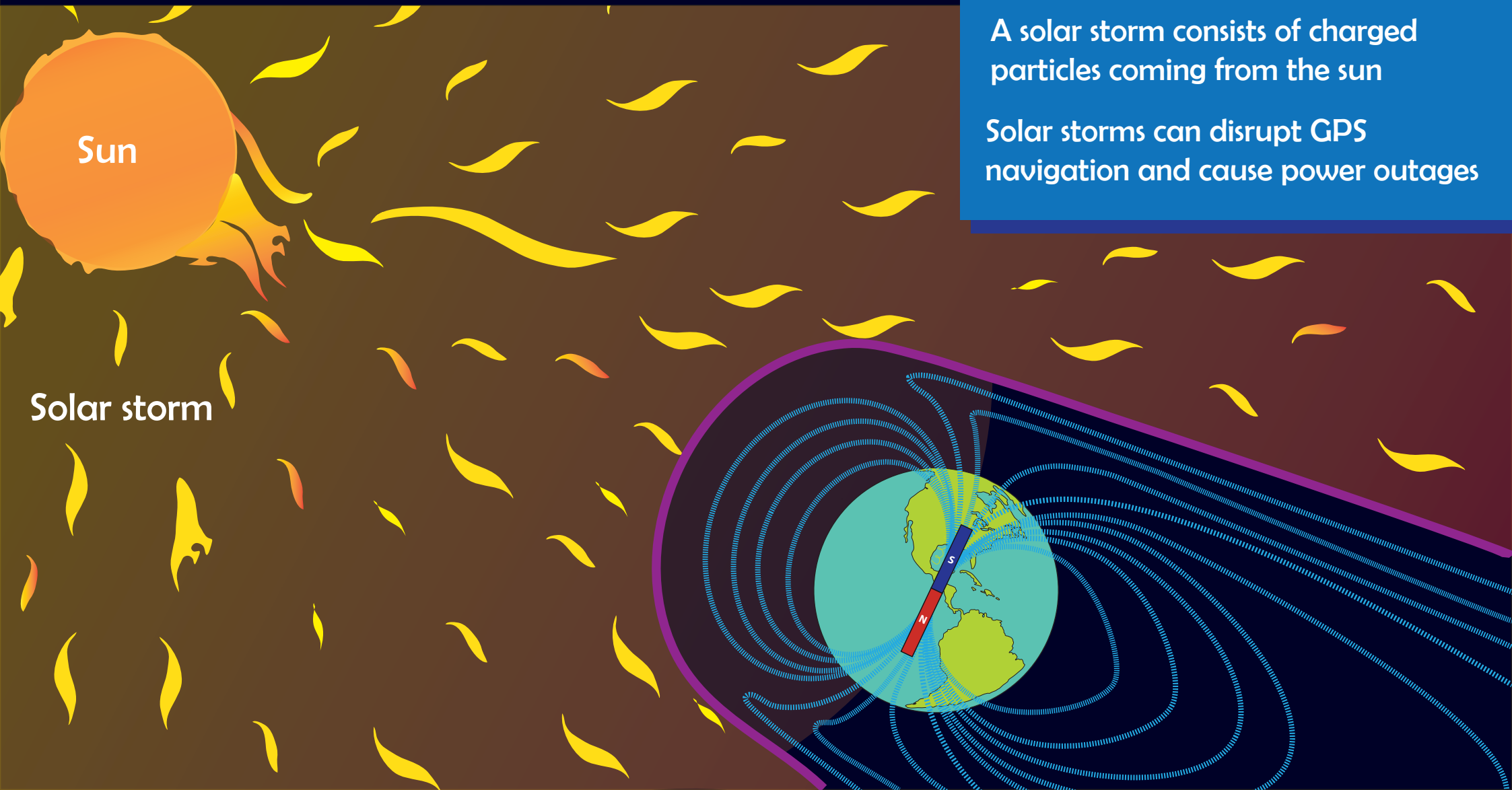
2. The Earth's magnetic field protects us from solar storms



A solar storm consists of charged particles coming from the sun

Solar storms can disrupt GPS navigation and cause power outages

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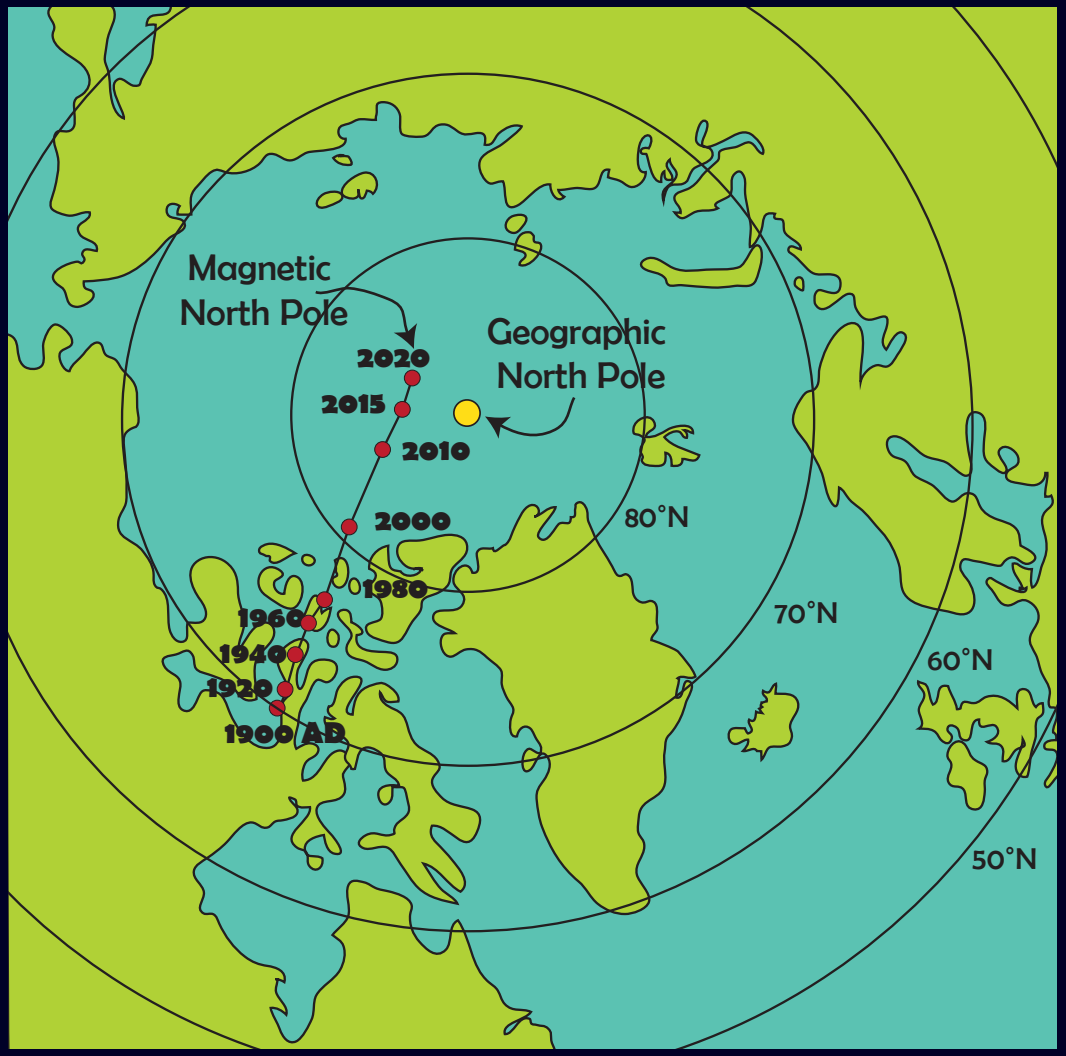
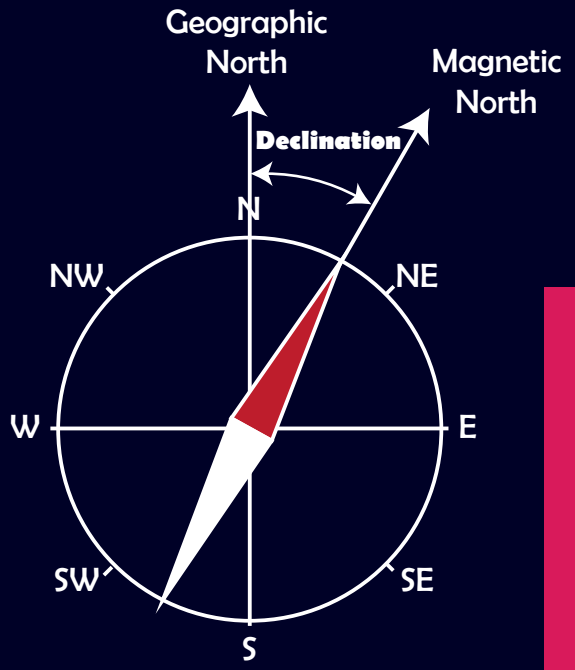
3. The magnetic and geographic poles of the Earth are not in the same location



The magnetic north and south pole of the Earth move around

The geographic poles are located on the spin axis of the earth



The difference between the magnetic and geographic north pole is called 'declination' and this is often displayed on maps

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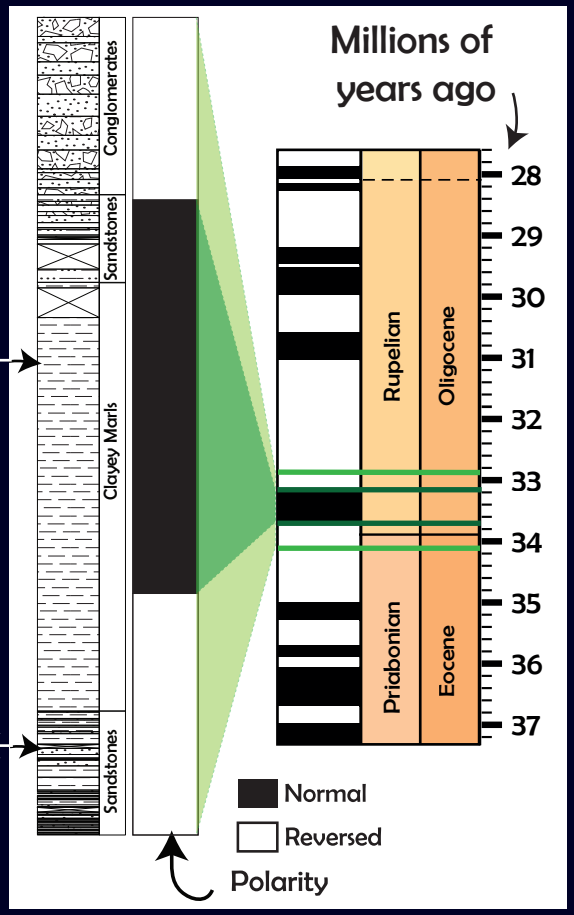
4. The magnetic poles of the Earth have switched position many times in the past

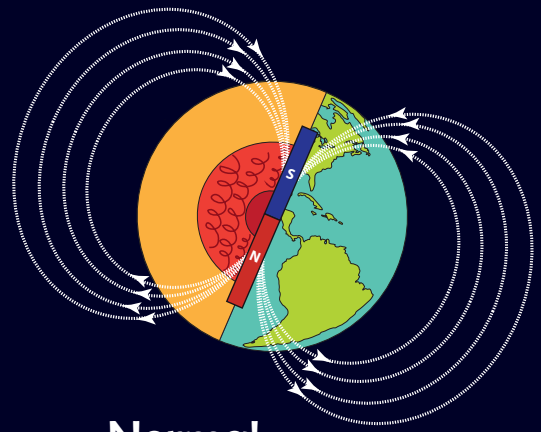
The magnetic north and south pole have reversed many times

The recognition of normal and reversed polarities in sediments can be used to find out how old those sediments are

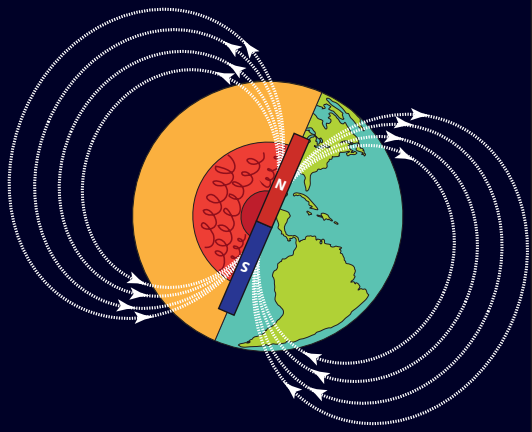
These rocks are around 33 million years old!

While these ones are 1 million years older





Normal (field as it is now)



Reversed

This is called 'magnetostratigraphy'

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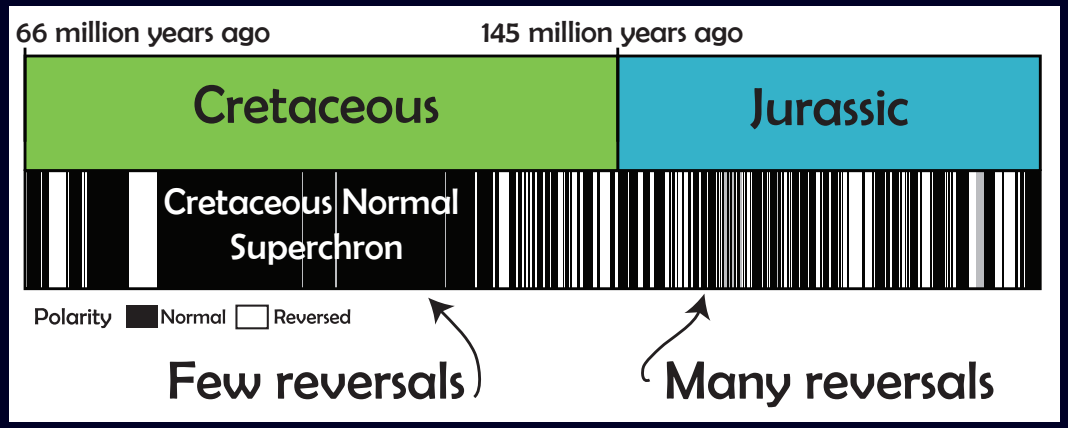
5. The frequency of reversals is highly variable

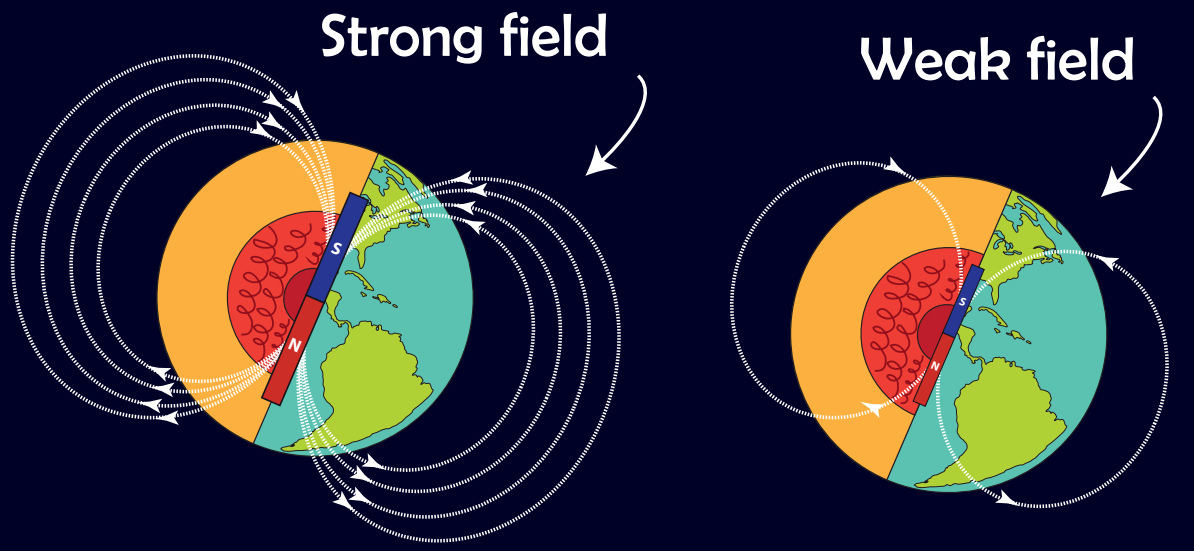


There are times when the poles flipped every 100,000 years

At other times the poles did not flip for millions of years on end, these periods are called 'superchrons'

Researchers at the University of Liverpool are studying the link between plate tectonics and how often the poles flip

When the field is strong, it seems to flip much less



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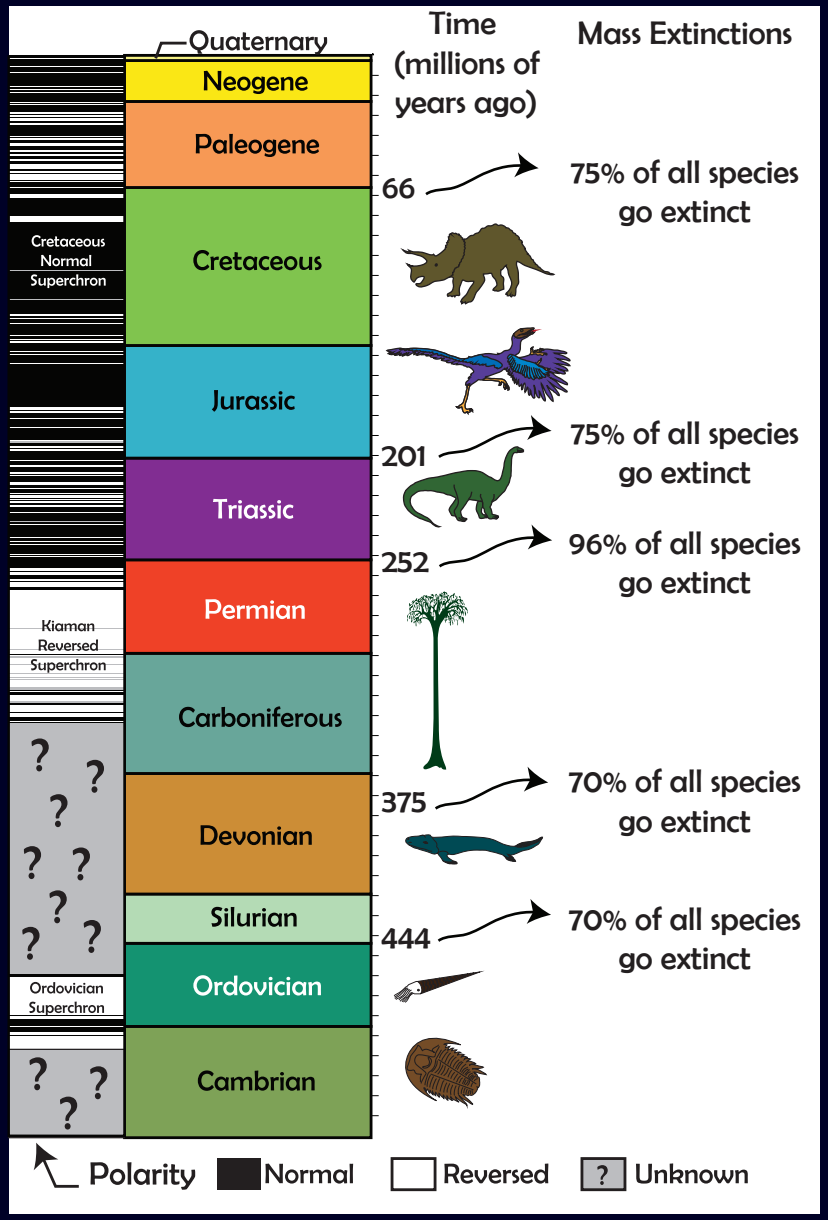
6. Reversals are not linked to extinctions

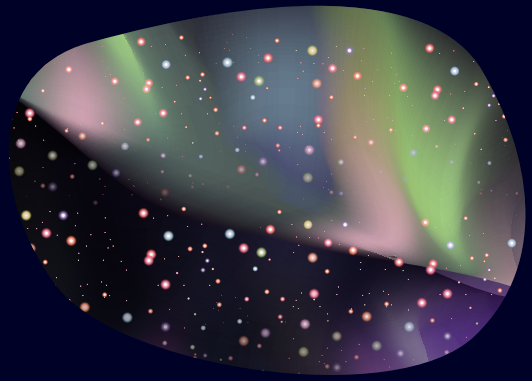


There are many more reversals than mass extinctions!

The strenght of the field declines during a reversal, this weakens the protection against solar storms

The extra radiation may be harmful to organisms, but there is no evidence for a link to mass extinctions

We might see more northern lights!



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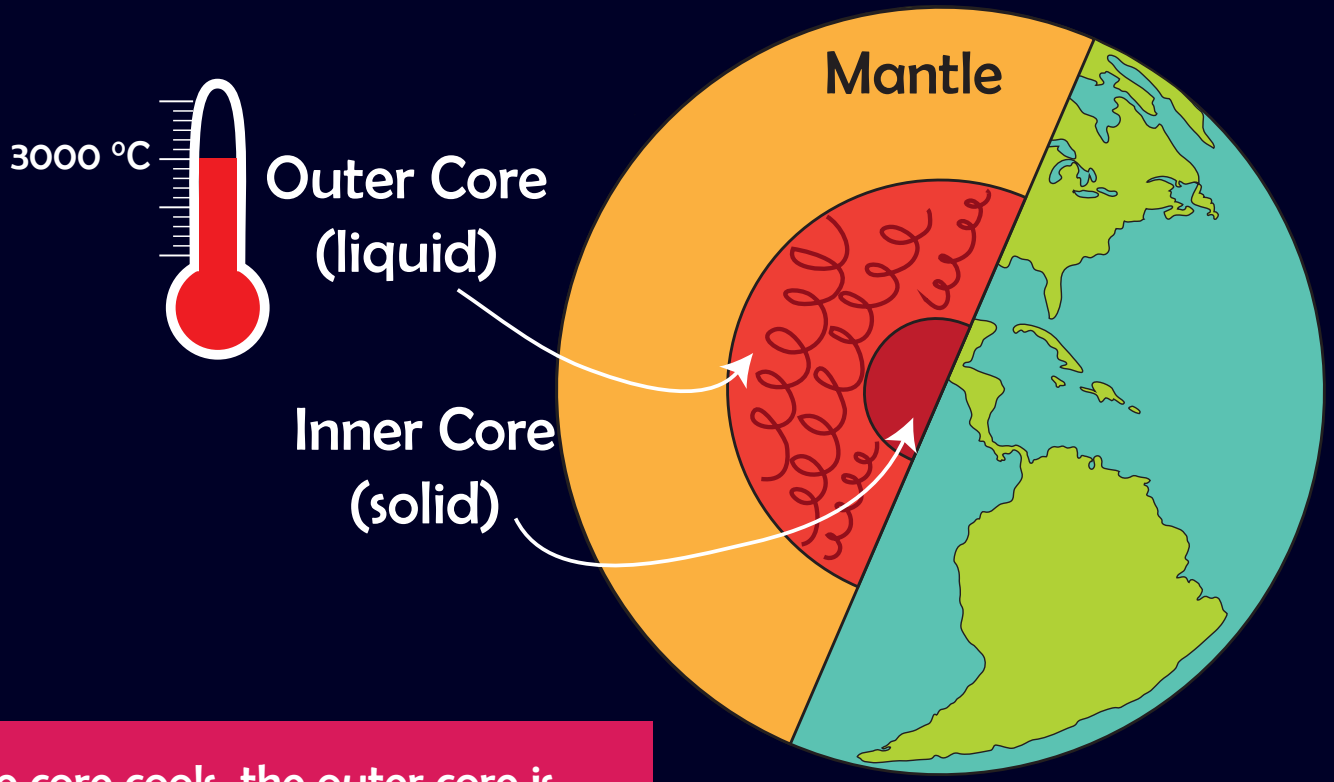
7. Earth's magnetic field forms by movement of liquid iron in the outer core, this is called the 'geodynamo'



The outer core is the only fluid layer in the Earth

The outer core contains mostly iron and nickel, this liquid flows like water!

As the core cools, the outer core is getting smaller, while the inner core grows by about 1 mm per year

Researchers at the University of Liverpool are trying to find out when the inner core first appeared

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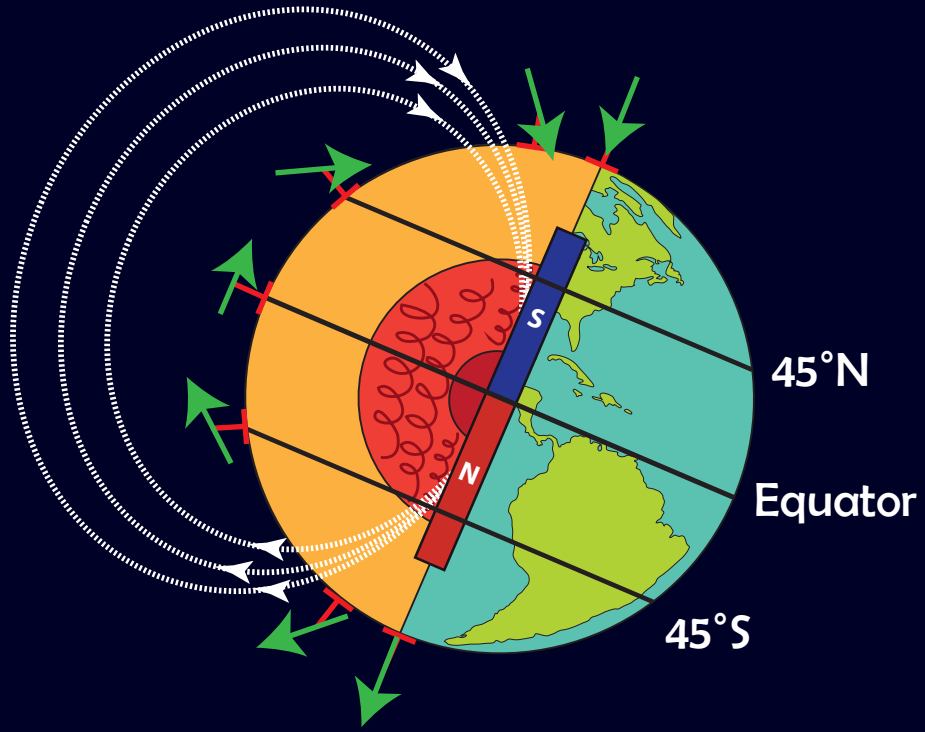
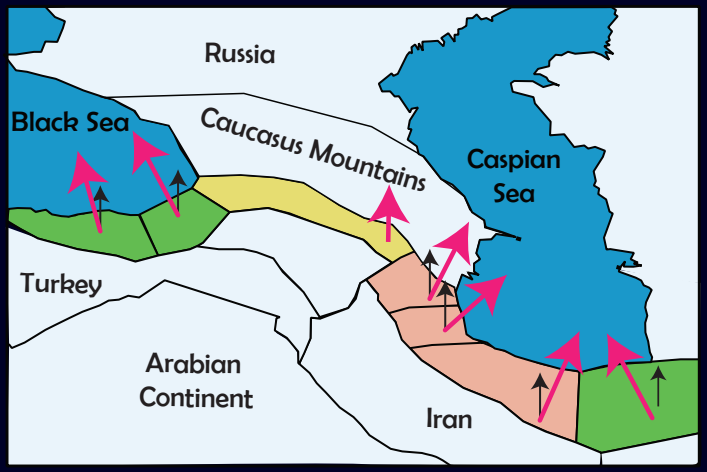
8. The Earth's magnetic field of the past can be used to reconstruct plate tectonics

Rocks record magnetic dip (green arrows), which can be used to tell the latitude at which the rock was formed



Reconstruction of the position of the continents 250 million years ago based on paleomagnetism



We can also reconstruct rotations (pink arrows) of tectonic blocks using declination

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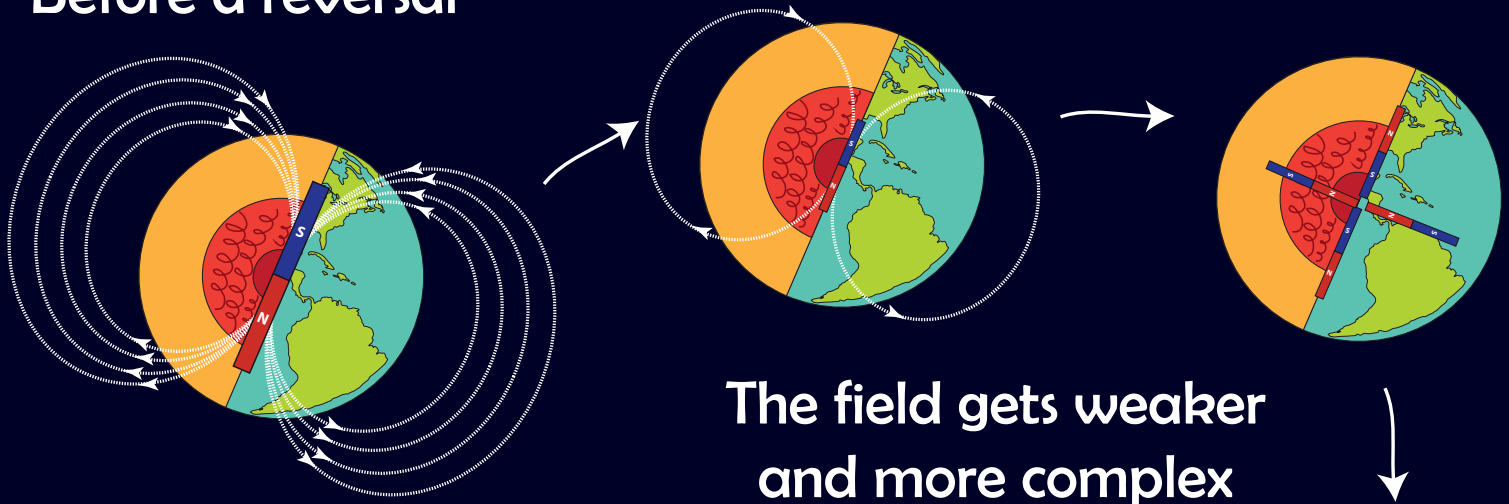
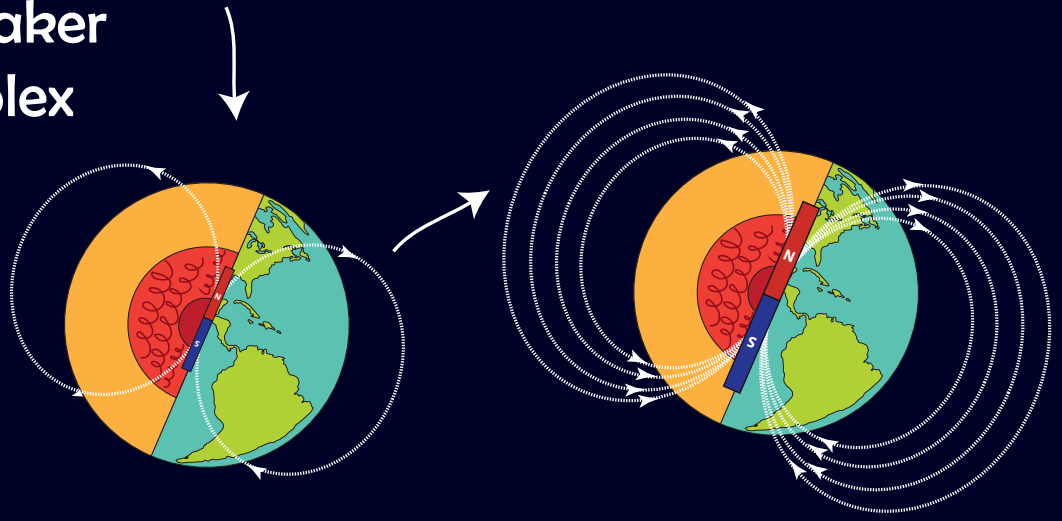
9. The flip of the magnetic poles of the Earth takes several thousand years

Most of the magnetic field can be thought of as if there is a bar magnet inside the earth

Before a reversal



The field gets weaker and more complex while it flips



During a reversal, the strength of the dipole decreases, and then starts to increase in the opposite direction

And gets stronger in the opposite direction

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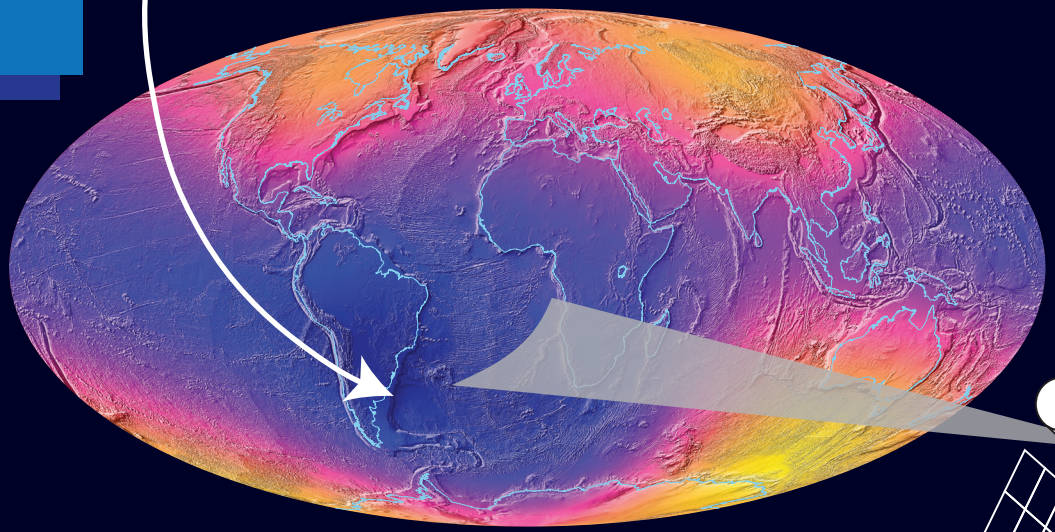
10. The magnetic field of the Earth has a patch where the field is weaker

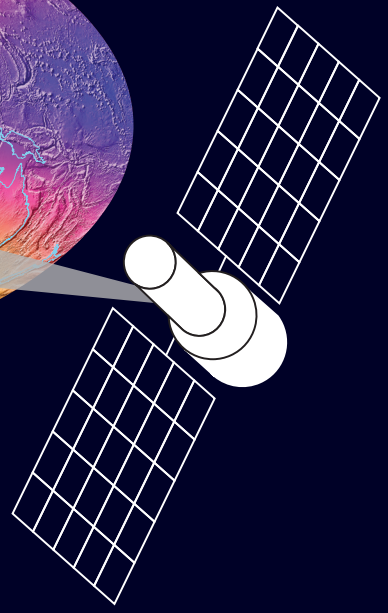
Researchers at the University of Liverpool study if there were more weak patches above the South Atlantic region in the past millions of years

This weak patch is called the 'South Atlantic Anomaly'

When satellites orbit through the South Atlantic Anomaly they are exposed to strong radiation



This map shows the strength of the magnetic field today, varying between weak (blue) and yellow (strong)



The International Space Station requires extra shielding for passing through the South Atlantic Anomaly