Paleomagnetism and Seafloor Spreading theory

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Paleomagnetism

The concept of paleomagnetism is the study of the Earth's ancient magnetic field, preserved in rocks, sediment, or archeological materials Geophysicists who specialize in paleomagnetism are called paleomagnetists. Certain magnetic minerals in rocks can record the direction and intensity of Earth's magnetic field at the time they formed. This record provides information on the past behavior of the geomagnetic field and the past location of tectonic plates[1]

Paleomagnetism is based on the principle that some magnetic minerals, such as magnetite, hematite, and pyrrhotite, become aligned with the Earth's magnetic field when they cool down or crystallize. This process is called thermoremanent magnetization (TRM). Other types of magnetization can also occur, such as chemical remanent magnetization (CRM), which is caused by chemical reactions or changes in mineralogy, or detrital remanent magnetization (DRM), which is caused by the alignment of sedimentary grains in water currents[1]

Paleomagnetism can reveal the history of the Earth's magnetic field, which has undergone many reversals and fluctuations over time. By measuring the orientation and polarity of the magnetic minerals in rocks, paleomagnetists can determine the age and location of the rocks when they formed. This can help to reconstruct the movement and evolution of the continents and ocean basins, as well as the climate and geodynamics of the Earth. Paleomagnetism also provides evidence for plate tectonics, continental drift, and seafloor spreading.

Paleomagnetism is a fascinating and important branch of geophysics that can help us understand the Earth's past and present.

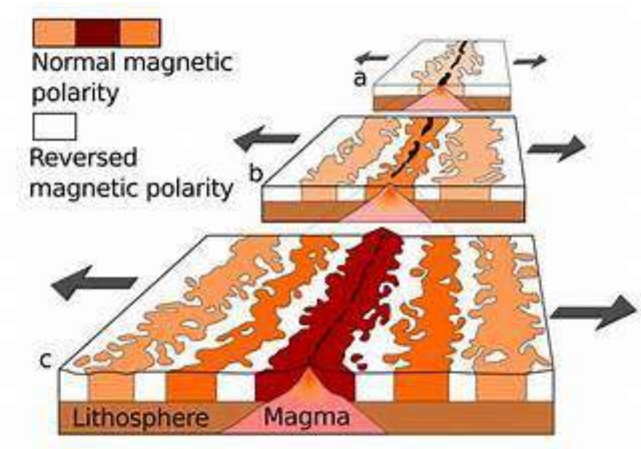

Fig: Seafloor spreading due to paleomagnetism

Seafloor Spreading theory

Seafloor spreading theory is the idea that new oceanic crust is formed at mid-ocean ridges by volcanic activity and then moves away from the ridge. The theory was proposed by Harry H. Hess in 1960. Seafloor spreading occurs when magma rises in the rift between two tectonic plates that are separating, and cools down by the seawater, forming a new crust.

Seafloor spreading helps explain continental drift in the theory of plate tectonics. When oceanic plates diverge, tensional stress causes fractures to occur in the lithosphere. The less-dense material rises, often forming a mountain or elevated area of the seafloor. Eventually, the crust cracks. Hot magma fueled by mantle convection bubbles up to fill these fractures and spills onto the crust. This bubbled-up magma is cooled by frigid seawater to form igneous rock. This rock (basalt) becomes a new part of Earth's crust.

The magnetism of mid-ocean ridges helped scientists first identify the process of seafloor spreading in the early 20th century. Basalt, the once-molten rock that makes up most new oceanic crust, is a fairly magnetic substance, and scientists began using magnetometers to measure the magnetism of the ocean floor in the 1950s. They discovered that the magnetic polarity of the ocean floor alternates in stripes parallel to the mid-ocean ridges. This pattern is explained by the fact that the Earth's magnetic field reverses its direction periodically, and the basalt records the direction of the field at the time it solidifies. By measuring the width and polarity of the magnetic stripes, scientists can determine the age and rate of the seafloor spreading[23]

Seafloor spreading is not consistent at all mid-ocean ridges. Slowly spreading ridges are the sites of tall, narrow underwater cliffs and mountains. Rapidly spreading ridges have much more gentle slopes. The Mid-Atlantic Ridge, for instance, is a slow spreading center. It spreads 2-5 centimetres (.8-2 inches) every year and forms an ocean trench about the size of the Grand Canyon. The East Pacific Rise, on the other hand, is a fast spreading center. It spreads about 6-16 centimetres (3-6 inches) every year. There is not an ocean trench at the East Pacific Rise, because the seafloor spreading is too rapid for one to develop! [2]

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