Seafloor Spreading

For Prelims: Seafloor Spreading, tectonic plates, Ring of Fire, Pangea

For Mains: Seafloor Spreading concept and associated geographic features

Why in News?

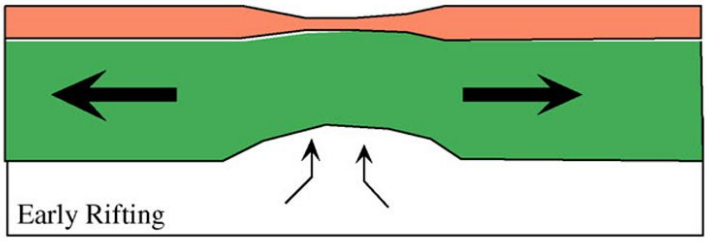
According to a study that analyzed data from the last 19 million years, **Seafloor spreading rates have slowed down by roughly 35% globally.**

What are the Highlights of the Study?

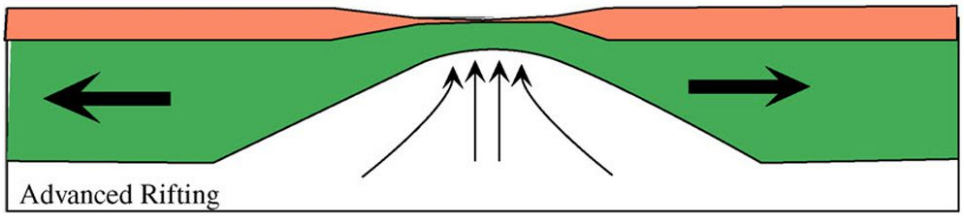
- For this study, researchers **selected 18 of the world's largest spreading ridges** (mid-ocean ridges).
    - A ridge or a mountain ridge is a **geographical feature consisting of a chain of mountains or hills** that form a continuous elevated crest for an extended distance.
- By **studying magnetic records in the rocks on the oceanic crust**, they calculated how much oceanic crust had formed over the last 19 million years.
    - **Basalt rocks** on the oceanic crust contain magnetic properties.
    - Their **magnetism is influenced by the Earth's magnetic field** when the magma reaches the surface and begins cooling to form the crust.
- But the records are incomplete **because the crusts get destroyed at subduction zones.**
    - **Subduction zone is a point where two** tectonic plates **collide,** causing one of them to sink into the Earth's mantle beneath the other plate.

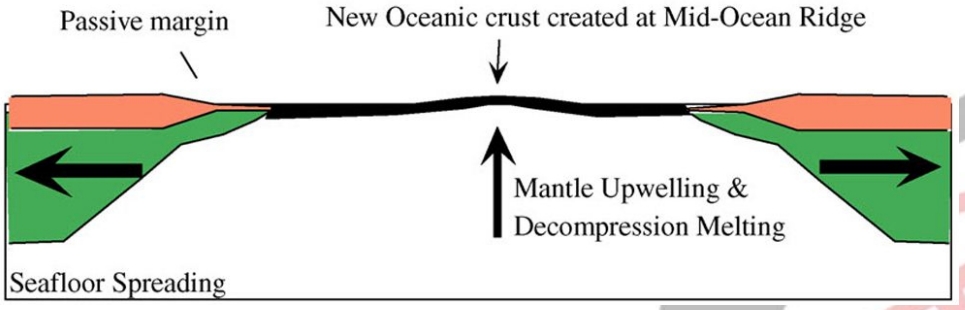
What is Seafloor Spreading?

- The seafloor spreading hypothesis was proposed by the **American geophysicist Harry H. Hess in 1960.**
- Seafloor spreading is the **process of magma welling up in the rift** as the old crust pulls itself in opposite directions. **Cold seawater cools the magma**, creating a new crust.
- The **upward movement and eventual cooling of this magma** has created high ridges on the ocean floor over millions of years.
    - However, the seafloor is destroyed in subduction zones, where oceanic crust slides under continents and sinks back into the mantle, and is reforged at seafloor spreading ridges.
- The **East Pacific Rise is a site of major seafloor spreading** in the **Ring of Fire**.
    - It is located on the **divergent boundary of the Pacific Plate, the Cocos Plate** (west of Central America), the Nazca Plate (west of South America), the North-American Plate and the Antarctic Plate.



Continued thinning of crust and mantle lithosphere





What are the Reasons behind the Decline of Seafloor Spreading?

- **Growing mountains on the continents** might be one of the factors driving the slowdown (as it causes resistance to seafloor spreading).
    - About 200 million years ago, when the **supercontinent** Pangea **start breaking**, there weren't any major plate collisions or related mountain chains.
    - The continents were fairly flat back then.
- **Mature Stage of the Supercontinent Breakup**: As **Pangea progressively broke apart**, new ocean basins formed and eventually, the widely fragmented continents started running into each other.
    - This happened, for instance, **between India and Eurasia**, the Arabian Peninsula and Eurasia as well as Africa and Eurasia.
        - This is a **natural consequence of a 'mature' stage** of supercontinent breakup and dispersal.
- **Changes in mantle convection** could also be playing a role as **mantle convection transports heat** from the earth's interior to the surface.
    - A mantle is a **layer inside a planetary body** bounded below by a **core and above by a crust.**
    - Mantle convection describes the **movement of the mantle as it transfers heat** from the white-hot core to the brittle lithosphere.
        - The **mantle is heated from below, cooled from above**, and its overall temperature decreases over long periods of time.

What can be the Impact of Seafloor Spreading?

- Seafloor spreading influences **sea level** and **carbon cycle.**
    - **Seal Level:**
        - Increasing the rate of seafloor spreading inflates the ridge. Hot, young lithosphere is forming and moving away from the ridge at a faster rate and moving a greater distance from the ridge before it cools and contracts. So sea level rises.
    - **Carbon Cycle:**
        - **Faster rates mean more volcanic activity,** which injects **greenhouse gases**

into the atmosphere.

Source: DTE

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