



Africa's Afar Triangle: Birthplace of a Potential New Ocean

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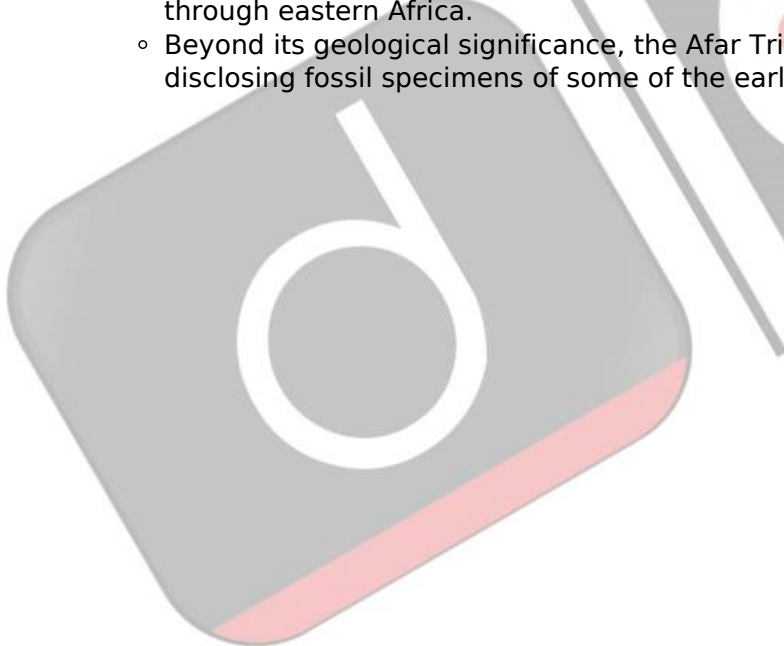
Why in News?

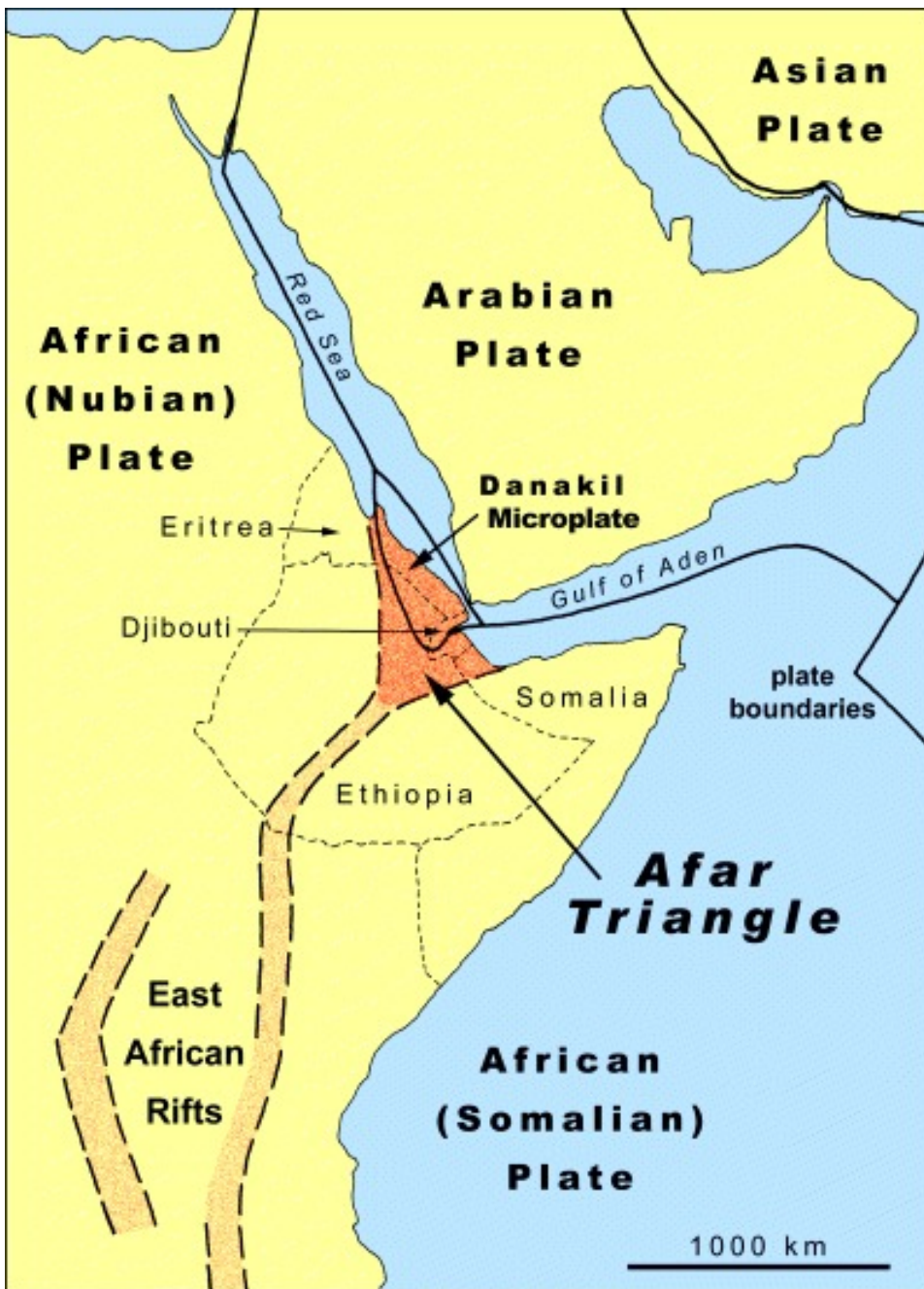
Recent geological findings suggest that [Africa's Afar Triangle](#) could be the birthplace of a new ocean in 5 to 10 million years.

- This phenomenon, unfolding amidst the rich and diverse landscapes of the African continent, offers a rare glimpse into the **dynamic processes that shape Earth's geography**.

What is Africa's Afar Triangle?

- **About:** The **Afar Triangle**, nestled in the [Horn of Africa](#), is a geological depression where three [tectonic plates](#), the **Nubian, Somali, and Arabian plates** converge.
 - It is part of the **East African Rift system**, which extends from the Afar region down through eastern Africa.
 - Beyond its geological significance, the Afar Triangle holds a rich **paleontological history**, disclosing fossil specimens of some of the earliest [hominins](#).





- **Tectonic Movement and Rift Expansion:** The Afar region has been experiencing gradual tectonic movements for millions of years.
 - The rift's expansion was notably highlighted in **2005** when a significant rift opened up in the **Ethiopian desert**, indicating the ongoing separation of the African continent at a tectonic level.
- **Factors Responsible for Rift's Expansion:**
 - One of the key factors driving the rifting process is believed to be a **massive plume of superheated rocks** rising from the mantle beneath East Africa.
 - This plume could be exerting pressure on the overlying crust, causing it to stretch and fracture.
 - Also, the magmatism in the region, particularly at the **Erta Ale volcano**, offers clues to the tectonic transition, with characteristics that mimic those of a [mid-ocean ridge](#).
 - Magmatism is the formation and motion of magma below Earth's surface. It contributes to various phenomena on Earth, such as filling tectonic cracks, forming mountains, and aiding in the release of heat from the Earth's core.
- **Formation of Ocean:** This ongoing rift expansion in this region could potentially lead to the formation of a new ocean, tentatively named the "**Alvor-Teide Atlantic Rift**".
 - This new body of water would be the result of the [Red Sea](#) and the [Gulf of Aden](#) flooding

over the Afar region and into the East African Rift Valley.

Key Terms

- **Tectonic Movement:** Tectonic movement refers to the large-scale motion of the Earth's lithosphere caused by the interactions of tectonic plates.
 - There are three main types boundaries formed due to tectonic movements: Divergent Boundaries, Convergent Boundaries and Transform Boundaries
- **Rifting:** Rifting refers to the geological process where the [Earth's Lithosphere](#) (**the outermost layer of the Earth**) is stretched and thinned, leading to the formation of rift valleys or basins.
 - This process usually occurs at **divergent plate boundaries** where tectonic plates move away from each other.
 - As the plates move apart, tensional forces cause the lithosphere to crack and break, creating **rift zones**.
- **Mid-Oceanic Ridge:** A mid-oceanic ridge is a **long underwater mountain range** that forms along divergent boundaries between tectonic plates in the oceanic crust.
 - These ridges are characterised by volcanic activity and the upwelling of magma from the mantle, which solidifies to form a new oceanic crust.
 - Mid-oceanic ridges are key features of **seafloor spreading**, where new crust is continuously created as tectonic plates move apart.



TECTONIC PLATES

OR LITHOSPHERIC PLATES

ABOUT

- ▶ Massive, irregularly-shaped slabs of solid rock (Crust + Top Mantle)
- ▶ In 1967, McKenzie, Parker and Morgan came out with the concept of Plate Tectonics

TYPE

- ▶ Continental or Oceanic (whichever occupies the larger portion of plate)
- ▶ Pacific plate - Oceanic; Eurasian plate - Continental

MAJOR AND MINOR PLATES



THE INDIAN PLATE

- ▶ Includes - Peninsular India and the Australian continental portions
- ▶ East Extension - Rakim Yoma Mountains (Myanmar) to Java Trench
- ▶ West - Makrana coast of Balochistan (Pakistan)
- ▶ Rate of Movement - 54 mm/year in northeast direction
- ▶ Boundary b/w India and Antarctic plate - Marked by an oceanic ridge (divergent boundary)
- ▶ Formation of Himalayas - Collision of Indian and Eurasian plates

PLATE MOVEMENT

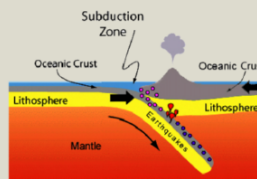
- ▶ Plates constantly move horizontally over the Asthenosphere
- ▶ Collision/drifted away of plates result in earthquakes/volcanic eruptions

Asthenosphere - a zone of Earth's mantle lying just beneath Lithosphere; believed to be much hotter and more fluid than Lithosphere

SUBDUCTION

Occurs when tectonic plates shift and one is pushed under another

Downgoing oceanic plate → Pushed into hotter Mantle plate → Heats up → Mixes volatile elements → Produces magma → Volcanic eruption



BOUNDARIES OF PLATES

- ▶ **Convergent/Destructive**, where plates move into one another (subduction zones)
- ▶ **Divergent/Constructive**, where plates move apart (rift valleys)
- ▶ **Transform/Conservative**, where plates move sideways in relation to each other (creates faults)

UPSC Civil Services Examination, Previous Year Question (PYQ)

Q. Consider the following: (2013)

1. Electromagnetic radiation
2. Geothermal energy
3. Gravitational force
4. Plate movements
5. Rotation of the earth
6. Revolution of the earth

Which of the above are responsible for bringing dynamic changes on the surface of the earth?

- (a)** 1, 2, 3 and 4 only
(b) 1, 3, 5 and 6 only
(c) 2, 4, 5 and 6 only
(d) 1, 2, 3, 4, 5 and 6

Ans: (d)

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