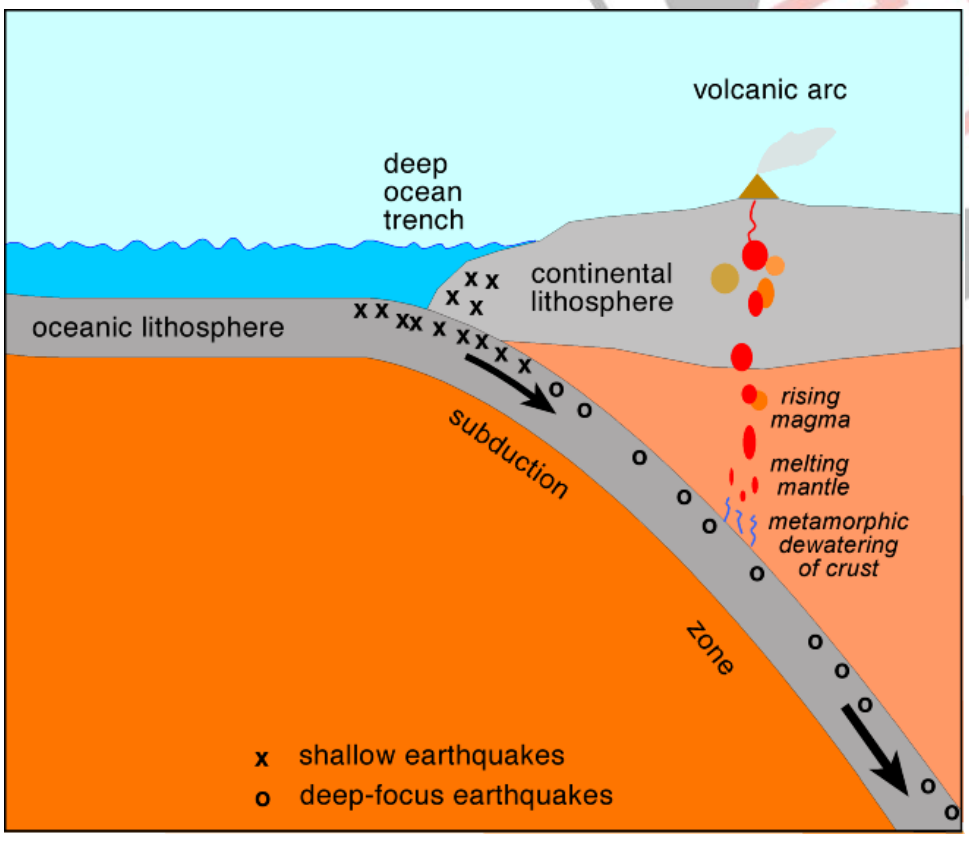
Hadean Proto Crust

Source: TH

A study by Macquarie University suggests that **unique chemical signatures** linked to **plate tectonics (& subduction)** were already present in **Earth's early crust (Hadean proto crust) before tectonic plate movements began**.

- **Chemical signatures** are **specific chemical patterns in ancient rocks** that serve as **indicators of plate tectonic processes**..
  - Traditionally, these signatures, like enriched **Light Rare Earth Elements (LREEs)** and **specific isotopic ratios (Nd, Sr, Pb)** indicated **subduction**.
- However, the study finds that **these signatures could form without subduction**, challenging the idea that these signals are exclusive to plate tectonics.
  - A **subduction zone** is the region where subduction occurs, marked by **deep ocean trenches, volcanic arcs**, and **earthquakes**.



Hadean Proto Crust & Hadean Aeon:

- The **Hadean proto crust** is **Earth's earliest crust**, formed within the **first 200 million years of the Hadean Aeon (4.6 to 4 billion years ago)**, a period marked by **extreme heat, volcanic activity**, and a **partially molten surface.**

    - Over time, parts of the **molten surface cooled and solidified, forming the first crust.**
- **Hadean Aeon** was followed by the **Archean Eon (4 to 2.5 billion years ago),** marked by the **formation of Earth's first stable crust,** the **beginning of plate tectonics,** and the **emergence of life.**
    - As the surface cooled, **thick crust formed the first continents,** which moved over the **semi-fluid asthenosphere beneath.**

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

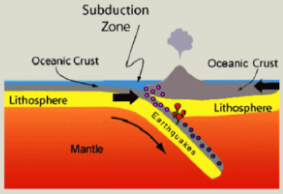
- Plates constantly move horizontally over the Asthenosphere
- Collision/drifting away of plates result in earthquakes/volcanic eruptions

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 ocean 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)

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