Seismicity Study of Arunachal Himalaya

Why in News

Recently, a study by the **Wadia Institute of Himalayan Geology** (WIHG), pertaining to the exploration of the elastic properties of rocks and seismicity in **Arunachal Himalaya,** has revealed that the area is **generating moderate earthquakes at two different crustal depths.**

- WIHG is an autonomous institute of the Department of Science & Technology (DST), Government of India.
- The region has been placed into **Seismic Zone V**, thus most vulnerable to earthquakes.

Key Points

- **The Study:**
  - WIHG has installed 11 broadband seismic stations (connected through the **Global Positioning System**) along the **Lohit River Valley of Arunachal Himalaya** to understand the elastic properties of rocks and seismicity in the **easternmost** part of India.
  - It used both **teleseismic (earthquakes that occur more than 1000 km from the measurement site)** and **local earthquake data** with the help of **seismometers.**

    A **seismometer is an instrument** that responds to ground motions, such as caused by earthquakes, volcanic eruptions, and explosions.

- **Latest Findings:**
    - **Two Different Crustal Depths: Low magnitude earthquakes** are concentrated at **1-15 km depth,** whereas slightly higher than **4.0 magnitude earthquakes** are mostly generated from **25-35 km depth.**
        The **intermediate-depth is devoid of seismicity** and coincides with the zone of fluid/partial melts.
    - **High Poisson's Ratio:** Extremely **high Poisson's ratio** was also obtained in the higher parts of the **Lohit Valley,** indicating the presence of fluid or partial melt at crustal depths.
        - **Poisson's ratio** is a measure of the Poisson effect that describes the expansion or contraction of a material in directions perpendicular to the direction of loading.
        - A **high Poisson's ratio denotes** that the material exhibits large elastic deformation, even when exposed to small amounts of strain.

- **Significnace:**
  - **Underthrusting of the Indian Plate:**
    - Himalaya is a result of collision between the Indian and the Eurasian plates about 50-60 million years ago. Due to continuous underthrusting of Indian plate beneath the Eurasian plate, stresses are increasing and accumulating progressively in the Himalayas.

      The Eurasian Plate is a tectonic plate which includes most of the continent of Eurasia (a landmass consisting of the traditional continents of Europe and Asia), with the exceptions of the Indian subcontinent, the Arabian subcontinent, and the area east of the Chersky Range in East Siberia.
    - This process keeps **modifying the drainage patterns and landforms** and is the pivotal reason for causing an **immense seismic hazard in the Himalayan mountain belt** and adjoining regions, necessitating assessment and characterization of earthquakes in terms of **cause, depth and intensity.**
  - **The Tuting-Tidding Suture Zone:** TTSZ is a **major part of the Eastern Himalaya,** where the Himalaya takes a sharp southward bend and **connects with the Indo-Burma Range.**

    This part has gained importance in recent times due to the **growing need of constructing roads and hydropower projects,** therefore emphasising the need for understanding the pattern of seismicity in this region.
  - **Crustal Thickness:** The crustal thickness in this area varies from 46.7 km beneath the Brahmaputra Valley to about 55 km in the higher elevations of Arunachal, with a marginal uplift of the contact.
    - This marginal uplift defines the boundary **between crust and the mantle,** technically called the **Moho discontinuity.**
    - The Moho discontinuity has been defined by the **distinct change in velocity of seismological waves** as they pass through changing densities of rock.

Source: PIB