Predicting Earthquakes

Why in News

According to a recently published study, researchers have **developed a new way to improve the prediction of earthquakes.**

Key Points

- **Earthquakes:**
    - Earthquakes **usually occur along faults** (fractures between rocks which can range from a few millimetres to thousands of kilometres).
    - When **two blocks of earth slip past one another, seismic waves are generated** in a short span of time and earthquakes occur.
        - The waves travel to the surface causing destruction and are difficult to predict, making it challenging to save lives.
- **Earlier Attempts:**
    - Scientists have attempted to recreate the faults and their sliding in laboratories to try and understand the conditions in them during earthquakes.
    - However, the **actual conditions are so complex** that it is **difficult to recreate** them with full accuracy which makes the prediction of earthquakes difficult.
- **New Method:**
    - Researchers have now used a **different approach** for earthquake prediction by trying to predict the **frictional strength** of **phyllosilicates.**
        - **Frictional Strength:** It is the force required to cause movement along a fault.
        - **Phyllosilicates:** Minerals in the form of thin plates found along the weakest part of the faults where earthquakes occur.
    - The researchers **analysed artificial fault zones on a microscopic scale to identify processes** that occurred during the experiment.
    - A **set of equations were then formulated to predict how the frictional strength of phyllosilicate changes,** along with a change in conditions such as **humidity** or the **rate of fault movement.**
    - This made it easier for modellers to **simulate fault movement in natural conditions, including earthquakes.**
    - The new model predicts that **movement along phyllosilicate-rich fault zones becomes more difficult as it becomes faster** and this has been consistent with experiments.
    - This behaviour of movement becoming more difficult **prevents earthquakes and suggests minerals other than phyllosilicates play an important role in causing earthquakes.**
    - However, **more work and research is needed to clearly explain** it and to understand the relation between the force that holds a fault together and the force needed to move the fault.

Seismic Waves

- Vibrations from an earthquake are categorised as **P (primary)** and **S (secondary) waves.** They travel through the Earth in **different ways and at different speeds.** They can be detected and analysed.
    - **P-waves:**
        - These are the **first waves** detected by **seismographs** (instruments used to detect and record earthquakes).
        - These are **longitudinal waves** which means they **vibrate along the same direction as they travel.**
        - Other examples of longitudinal waves include **sound waves** and **waves in a stretched spring.**
    - **S-waves:**
        - These waves arrive at the **detector after primary waves.**
        - These are **transverse waves** which means they vibrate at a right angle to the direction in which they travel.
        - Other examples of transverse waves include **light waves** and **water waves.**
- **Both types** of seismic waves can be **detected near the earthquake centre** but **only P-waves** can be detected **on the other side of the Earth.**
    - **P-waves can travel through solids and liquids** (since they are longitudinal waves) whereas **S-waves can only travel through solids** (as they are transverse waves). This means the liquid part of the core blocks the passage of S-waves.
- The earthquake events are **scaled** either **according to the magnitude or intensity of the shock.**
    - The **magnitude scale** is known as the **Richter scale.** The magnitude relates to the **energy released** during the earthquake which is expressed in absolute numbers, **0-10.**
    - The **intensity scale or Mercalli scale** takes into account the **visible damage** caused by the event. The range of intensity scale is from **1-12.**

Source: DTE