

Sedimentary basins of India

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Sedimentary basins are the richest sources of petroleum products across the world. The method of their formation, the reason for the rich mineral resources and their distribution across India is an area of interest for UPSC. The presence of nearly 40 Hydro Carbon sedimentary basins across India and the recent exploration of the Bengal basin also makes it all the more important.

In news: ONGC began production in Bengal basin, making it India's eighth functional.

Placing it in syllabus: Geography

Static dimensions

1. What are sedimentary basins?
2. Methods of formation
3. Why are hydrocarbon deposits found in sedimentary basins?
4. Economic advantages of sedimentary basins

Current dimensions

1. Sedimentary basins of India

Content:

India has **26 sedimentary basins** covering an area of 3.14 million square kilometres. Of these, 16 are onland basins, 7 located both onland and offshore and 3 completely offshore. Broadly Indian sedimentary basins have been divided into **four categories based on their degree of prospectivity**.

Table : Categories of Indian sedimentary basins

Type of basins	Area (Sq. KM)	Hydrocarbons Prospectivity	Basins/ Region
Category I (7 Basins)	518500	Established commercial production	Cambay, Assam Shelf, Mumbai offshore, Krishna Godavari, Cauvery, Assam Arakan Fold Belt and Rajasthan
Category II (3 Basins)	164000	Known accumulation of hydrocarbons but no commercial production as yet	Kutch, Mahanadi-NEC & Andaman-Nicobar
Category III (6 Basins)	641000	Indicated hydrocarbon shows that are considered geologically prospectivity.	Himalayan Foreland, Ganga, Vindhyan, Saurashtra, Kerala-Konkan-Lakshadweep & Bengal
Category IV (10 basins)	461200	Uncertain potential which may be prospective by analogy with similar basins in the world.	Karewa, Spiti-Zaskar, Satpura-South Rewa-Damodar, Narmada, Decan Syneclise, Bhima-Kaladgi, Cuddapah, Pranrita-Godavari, Bastar, Chhattisgarh
Deepwater	1350000		East & west coast from 400 m water depth to EEZ
Total	3134700	-	

Oil and Natural Gas Corporation (ONGC) Limited recently began crude oil production from the **Ashokenagar-1 well, Bengal Basin** in 24 Pargana district. This has made the Bengal basin **India's eighth producing basin**. The first hydrocarbon consignment produced during well testing was sent to Indian Oil Corporation Limited's Haldia Oil Refinery.



The other basins where commercial production is already going on are – **Cambay, Mumbai Offshore, Rajasthan, Krishna Godavari, Cauvery and Assam-Arakan Fold Belt**. Seven out of the eight producing basins of India covers **83 percent of established oil and gas reserves** that have been put to production.

What are sedimentary basins?

- Sedimentary basins are regions of the Earth where long-term subsidence creates accommodation space for accumulation of sediments.
- As the sediments are buried, they are subject to increasing pressure and begin the **processes of compaction and lithification** that transform them into sedimentary rock.
- Sedimentary basins occur in diverse geological **settings usually associated with plate tectonic activity.**
- Tectonic processes that lead to subsidence include the thinning of underlying crust; sedimentary, volcanic or tectonic loading; or changes in the thickness or density of adjacent lithosphere.
- They are classified by their tectonic setting (divergent, convergent, transform, intraplate), the proximity of the basin to the active plate margins, and whether **oceanic, continental or transitional crust underlies the basin.**

Methods of formation:

Sedimentary basins form primarily in **convergent, divergent and transform settings.**

- **Convergent** boundaries create foreland basins through tectonic **compression of oceanic and continental crust during lithospheric flexure.**
- Tectonic extension at **divergent** boundaries where continental rifting is occurring can create a **nascent ocean basin leading to either an ocean or the failure of the rift zone.**
- In **tectonic strike-slip settings**, the lower, hotter part of the lithosphere will “flow” slowly away from the main area being stretched, whilst the upper, cooler and more brittle crust will tend to fault (crack) and fracture. The combined effect of these two mechanisms is for the

Earth's surface in the area of extension to subside, creating a **geographical depression which is then often infilled with water and/or sediments.**

Why are hydrocarbon deposits found in sedimentary basins?

- The structures formed in sedimentary basins are known to act as **traps for hydrocarbons** (i.e. natural gas and petroleum).
- The processes that lead to the formation of these deposits are associated with rifting zones.
- Hydrocarbon traps **form in permeable layers of rock (such as sandstone) called reservoir rocks that are 'capped' by impermeable rocks (such as shale).**
- Since water is denser than both petroleum and gas, they will not mix.
- Water will then force these fossil fuels through permeable rocks until they pool together in traps formed by cap rocks.

Advantages of sedimentary basins:

- It preserves unique information regarding the history of tectonic, biologic, oceanographic, and atmospheric events during Earth's evolution.
- Basin fill contains most of the fuel and water, and many of the mineral resources, that are critical for society and industrial civilization.
- Would contribute towards attaining the goal for reducing oil import dependence.

Mould your thought:

1. Explain the importance of sedimentary basins. Why are hydrocarbons formed in a sedimentary basin?

Approach to the answer:

- Define a sedimentary basin.

- Explain its importance
- Explain why hydrocarbons are formed in a sedimentary basin
- Brief about India's sedimentary basins
- Conclusion