

# The Geological Evolution of Bangladesh and the Formation of Its Mineral Wealth

## Introduction

Bangladesh, though renowned today for its sprawling riverine landscape, conceals beneath its alluvial surface a rich and tumultuous geological history. From ancient cratonic roots to recent deltaic deposits, every layer tells a story of drifting continents, advancing seas, and earth-shaking tectonic drama. The country's mineral wealth — its coal, gas, limestone, hard rocks, and peat — is a direct result of these processes.

This essay presents a comprehensive and scholarly exploration of the geological evolution of Bangladesh, serving as a one-stop reference for its physical geography, mineral origins, and future resource potential.

## Geological Framework

Bangladesh's geology is fundamentally divided into three major regions:

- **Precambrian Indian Shield:** To the northwest and northeast, ancient rocks (over 540 million years old) form the basement complex. Here we find granites, gneisses, and schists — the geological elders of the land.
- **Bengal Basin:** One of the world's largest sedimentary basins, continuously subsiding under the weight of Himalayan erosion and riverine deposition.
- **Chittagong-Tripura Folded Belt:** A tectonically active region, thrust and folded by the Indian Plate colliding with the Burmese microplate.

These provinces dictate the mineral and fossil fuel distribution across Bangladesh.

## Fossil Fuels

### Coal

Coal forms when lush, swampy forests accumulate organic material faster than it can decay, usually in deltaic environments with frequent flooding. Over millions of years, burial under sediments compresses this material into peat, lignite, and finally bituminous coal.

- **Key Deposits:**
  - **Barapukuria Coal Mine** (Dinajpur) — major operating coalfield.
  - **Phulbari** and **Khalashpir** — potential reserves.
- **Geological Setting:** Late Miocene–Pliocene deltaic plains.

### Natural Gas

Gas forms mainly from plankton buried in fine marine sediments, which under pressure and heat over time generate hydrocarbons. Structural traps such as folds and faults lock the gas into porous rocks.

- **Key Fields:**
  - **Bibiyana, Kailashtila, Titas, Habiganj, Jalalabad**, primarily located in the Sylhet Fold Belt.
- **Geological Setting:** Miocene-aged marine to deltaic sandstones, folded into anticlines.

## Hard Rocks

Ancient crystalline rocks are remnants of Earth's early continental crust.

- **Occurrences:**
  - **Barind Plateau**
  - **Madhupur Tract**
  - **Lalmai Hills**
- **Rock Types:** Granite, gneiss, quartzite.
- **Economic Use:** Aggregate for construction, riprap, decorative stones.

## Limestone

Warm, shallow seas during the Eocene allowed shell-bearing organisms to flourish. Their calcium carbonate skeletons accumulated over millions of years into massive limestone deposits.

- **Major Sites:**
  - **Takerghat, Chhatak, Jaflong** in Sylhet.
  - Minor marine deposits in **St. Martin's Island**.
- **Uses:** Cement, quicklime, agricultural lime.

## Peat

Peat forms in stagnant swampy environments where dead plant material partially decomposes.

- **Deposits:**
  - **Sundarbans**
  - **Sylhet Haors**
  - **Gopalganj**
- **Future Potential:** Over geological timescales, peat may convert into lignite-grade coal.

## Physical and Geological Provinces

### Sylhet Basin

Initially submerged during the Eocene, Sylhet built thick limestone beds. As river systems later expanded, the basin transformed into a lush deltaic plain — perfect for trapping both coal and natural gas. Mild tectonic folding created anticlines that serve as efficient gas traps today.

### **Jamuna Basin**

A vast alluvial basin formed by the Brahmaputra-Jamuna river system. The organic-rich sediments here hold minor coal prospects but haven't matured sufficiently for major fossil fuel accumulations yet.

### **Barind Plateau**

An uplifted and weathered relic of Pleistocene alluvium. Underneath its lateritic soils lie pockets of crystalline basement rocks. However, no major fossil fuels exist here due to the absence of thick organic sediment burial.

### **Chittagong Hill Tracts (CHT)**

Once a part of deeper marine settings, the CHT lacks significant fossil fuel deposits because: - The deep-sea sediments were poor in organic material. - Rapid tectonic uplift prevented the burial and maturation of any organic remains. Nevertheless, minor natural gas seeps exist at isolated locations.

### **Madhupur Tract**

An uplifted terrace of old river deposits, featuring lateritic soils and minor hard rocks. Economically more important for agriculture than for mineral extraction.

## **Future Resource Prospects**

Given sufficient geological time:

- **Peatlands** like the Sundarbans and Gopalganj could become lignite fields.
- **Deeper Sylhet gas pockets** may yield new hydrocarbon discoveries.
- **Offshore Bengal Basin** exploration could reveal significant untapped oil and gas reserves.
- **CHT** might contribute indirectly by eroding and depositing organic-rich sediments into future adjacent basins.

Region	Future Resource Potential
Sundarbans	Peat may transform into lignite
Sylhet Basin	Deeper gas fields possible
Offshore Bengal Basin	High oil and gas potential
Chittagong Hill Tracts	Minor unless new sedimentary basins form

## **Geological Evolution Timeline**

Period	Event
>540 million years ago (Precambrian)	Formation of the Indian Shield (crystalline rocks)
Mesozoic Era (250–65 mya)	Weathering and sedimentation over shield
66 mya	Collision of India and Asia; beginning of Himalayan uplift
Eocene (50–34 mya)	Sylhet submerged under shallow sea; limestone deposition
Miocene (23–5 mya)	Bengal Basin rapid subsidence; coal and gas formation
Pliocene to Present (5 mya–Now)	Delta building, peat formation, ongoing tectonic activity

## Conclusion

The minerals and resources of Bangladesh are the footprints of a grand saga: where ancient continents collided, oceans rose and fell, and rivers danced across newborn landscapes. Hard rocks whisper tales from Earth’s infancy, fossil fuels narrate the luxuriant green worlds of past swampy deltas, and limestones capture the memory of ancient seas.

Understanding this dynamic interplay is not just an academic exercise — it holds the key to sustainably managing Bangladesh’s natural wealth and predicting where future treasures may still lie buried.

## References

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“The geology of Bangladesh is not merely a story of stone and soil; it is a saga of continents drifting, oceans retreating, mountains rising, and life evolving across epochs.”