EWCE 203

Geology and Geomorphology

Sedimentary Rocks

Types of sedimentary rocks

Clastic Sedimentary Rocks:

Conglomerate:

- Made up of more or less **rounded** fragments.
- 2 to 4 mm or larger diameter

Breccia:

- Fragments are **more angular** than rounded.

Tillite:

- Fragments are **laid down by glaciers**

Sedimentary Rocks



Conglomerate:

- Contains large **rounded** particles.
- Space between the pebbles is generally **filled with smaller particles** and
- A **chemical cement that binds** the rock together

Sedimentary Rocks



Breccia:

- Composed of **angular** fragments.

- Spaces between the large fragments can be **filled** with a matrix of smaller particles or **a mineral cement** which binds the rock together.

Sedimentary Rocks

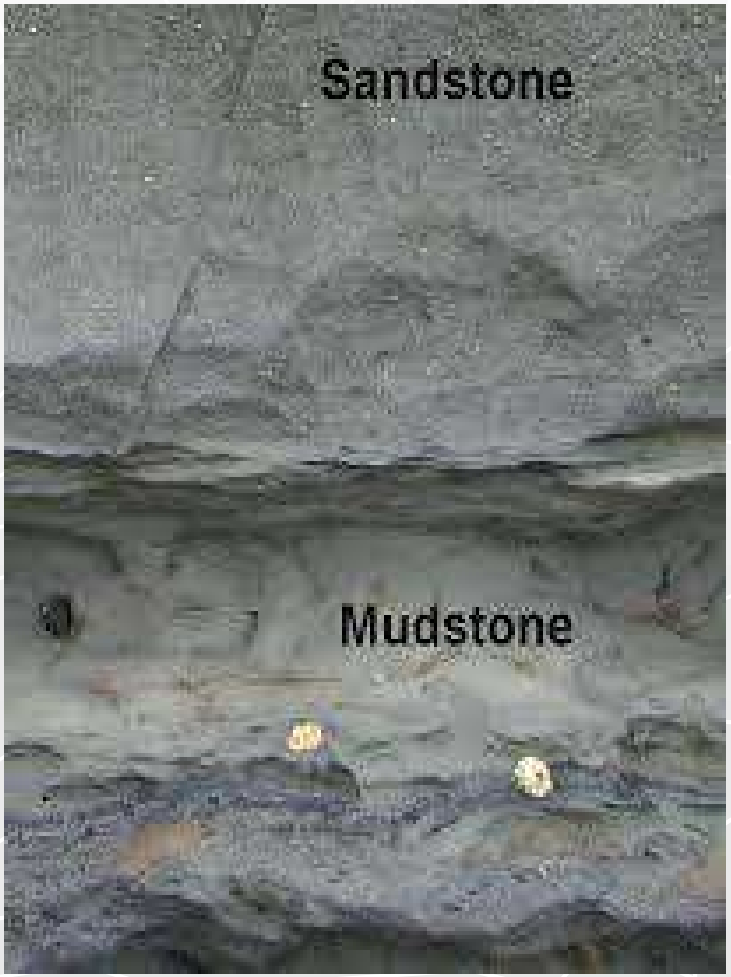


Dwyka Tillite.

Sedimentary Rocks

Sandstone:

- Formed by consolidation of **sand size particle** ie **0.0625 to 2mm** dia.
- Sizes in between conglomerate and mudstone.



Mudstone:

- Composed of **clay and silt size particles**
- Sizes less than 0.0625mm in dia.

Chemical Sedimentary Rocks

Limestone:

- Composed primarily of **calcium carbonate** ($CaCO_3$) in the form of the mineral calcite. It most commonly forms in clear, warm, shallow marine waters.
- Usually an **organic sedimentary rock** that forms from the accumulation of shell, coral, algal, and fecal debris.
- **Can also be a chemical sedimentary rock** formed by the precipitation of calcium carbonate (calcite) from lake or ocean water precipitate as calcite

- **Dolostones**:

  -large concentration of $CaMg(CO_3)_2$

  -dolomite

Dolomite:

- Also known as "dolostone" and "dolomite rock".
- Composed primarily of the mineral **dolomite**, $CaMg(CO_3)_2$.
- Found in sedimentary basins worldwide.



Dolomites" are a **mountain range** in northeastern Italy and part of the **Italian Alps.**

Sedimentary Rocks

Evaporite:

- Rocks formed by the evaporation of water are called Evaporite - **gypsum**, **anhydrite**, **halite** (common salt)

- Composed of **minerals precipitated** from solution with the evaporation of liquid.







Sedimentary Rocks





Salt Field in Maheshkhali and Teknaf

Organic Sedimentary Rocks

- Organic sedimentary rocks are those **containing large quantities of organic molecules,** Organic molecules contain carbon.

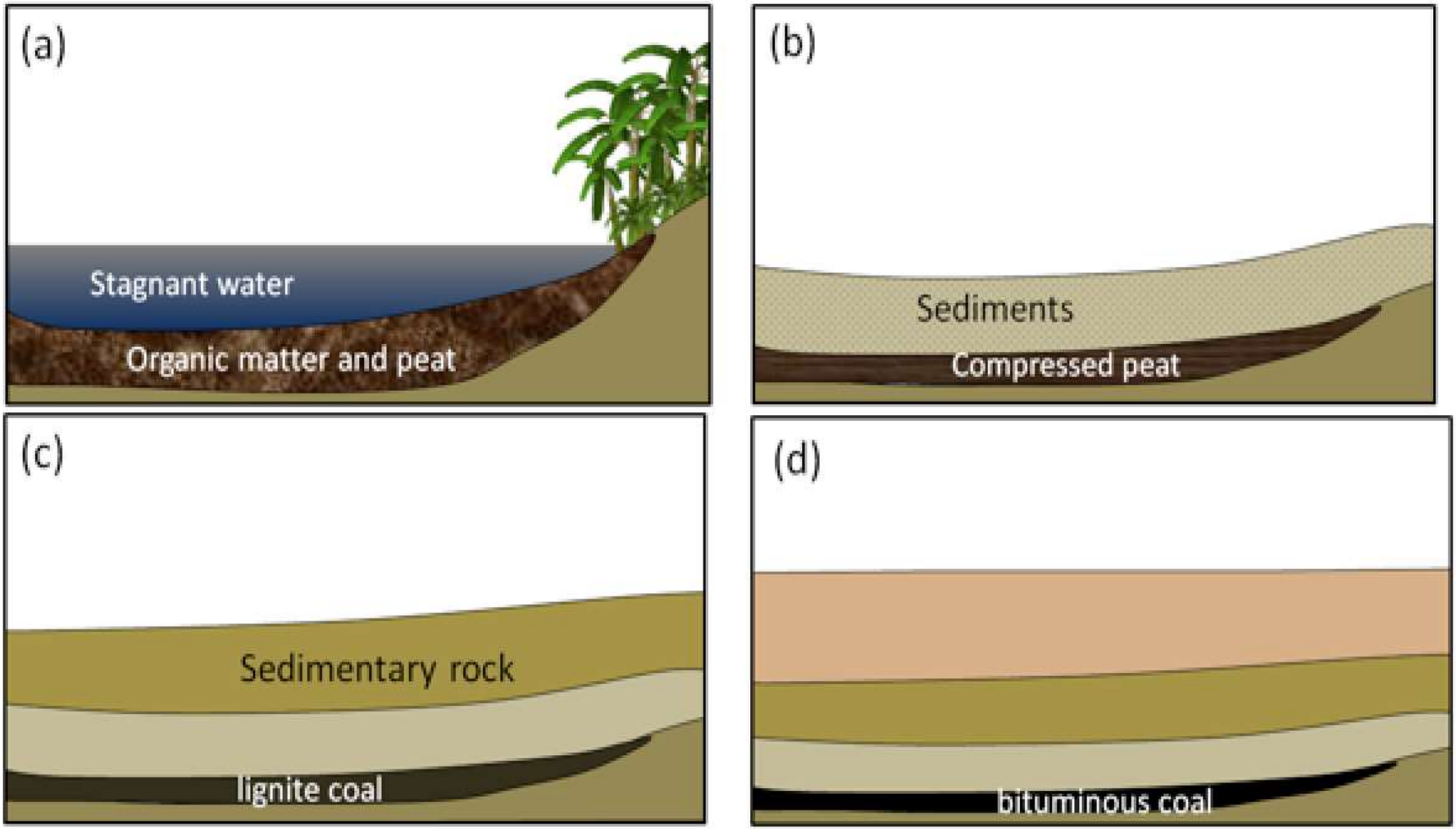
- Such as materials **form from the soft tissues of plants and animals**.

What is coal?

Coal

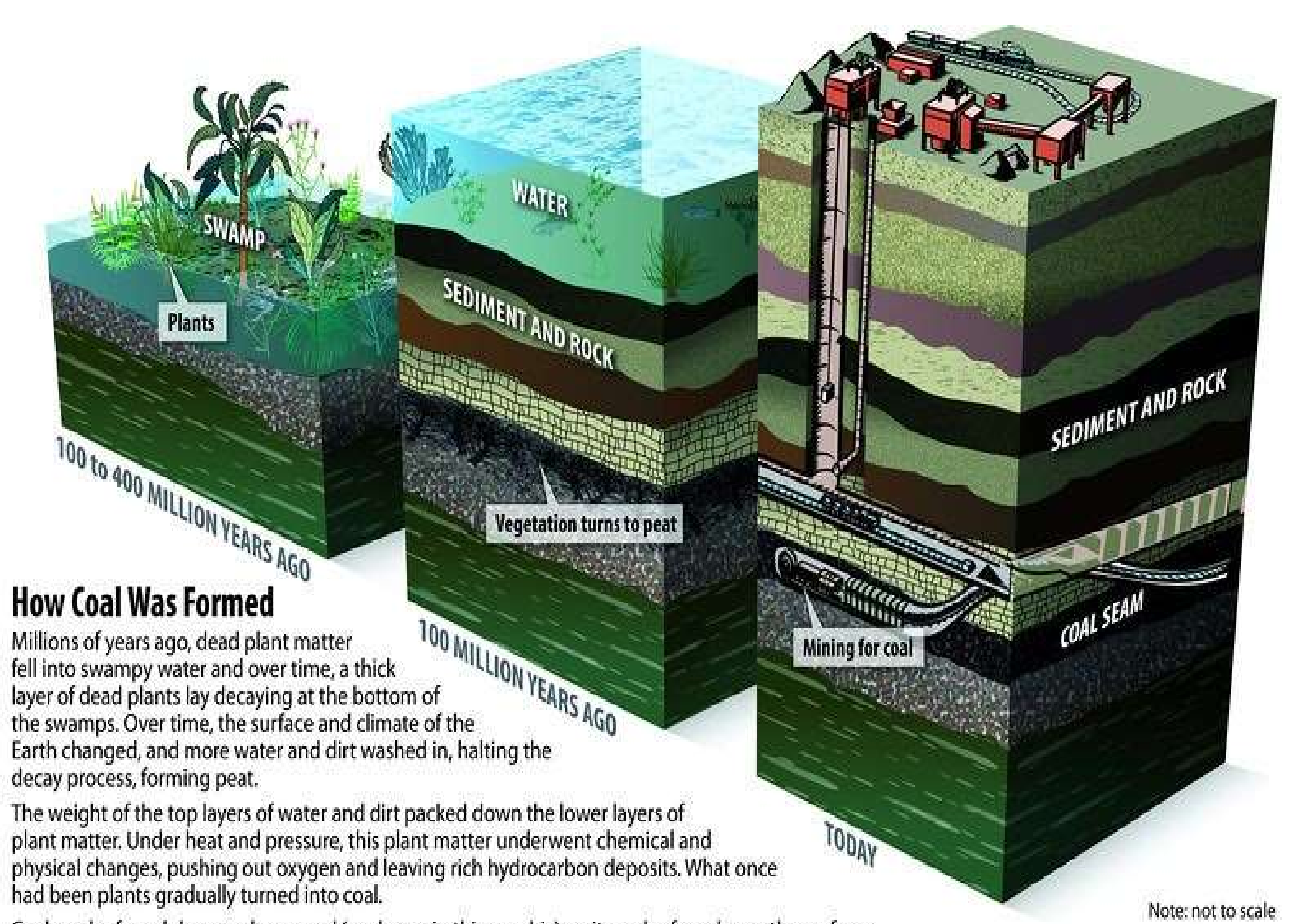
- Also called **black gold**.
- **Found** in sedimentary strata [layers of soil].
- Contains **carbon**, **volatile matter**, **moisture** and **ash** [in some cases **Sulphur** and **phosphorous**]
- Mostly **used for power generation and metallurgy**.
- Coal **reserves are six times greater** than oil and petroleum reserves.

Formation of Coal



Formation of Coal

- **Formation of coal begins** when plant matter is prevented from decaying by accumulating in low-oxygen, acidic water.
- **Accumulation of plant matter** within **a swampy area** forms a layer of **peat**;
- Plant matters are **buried under sediment;** heated and compressed;
- With greater burial, **lignite** coal forms;
- At even greater depths, **bituminous** and eventually **anthracite coal** form as pressure and temperature increases.
- .



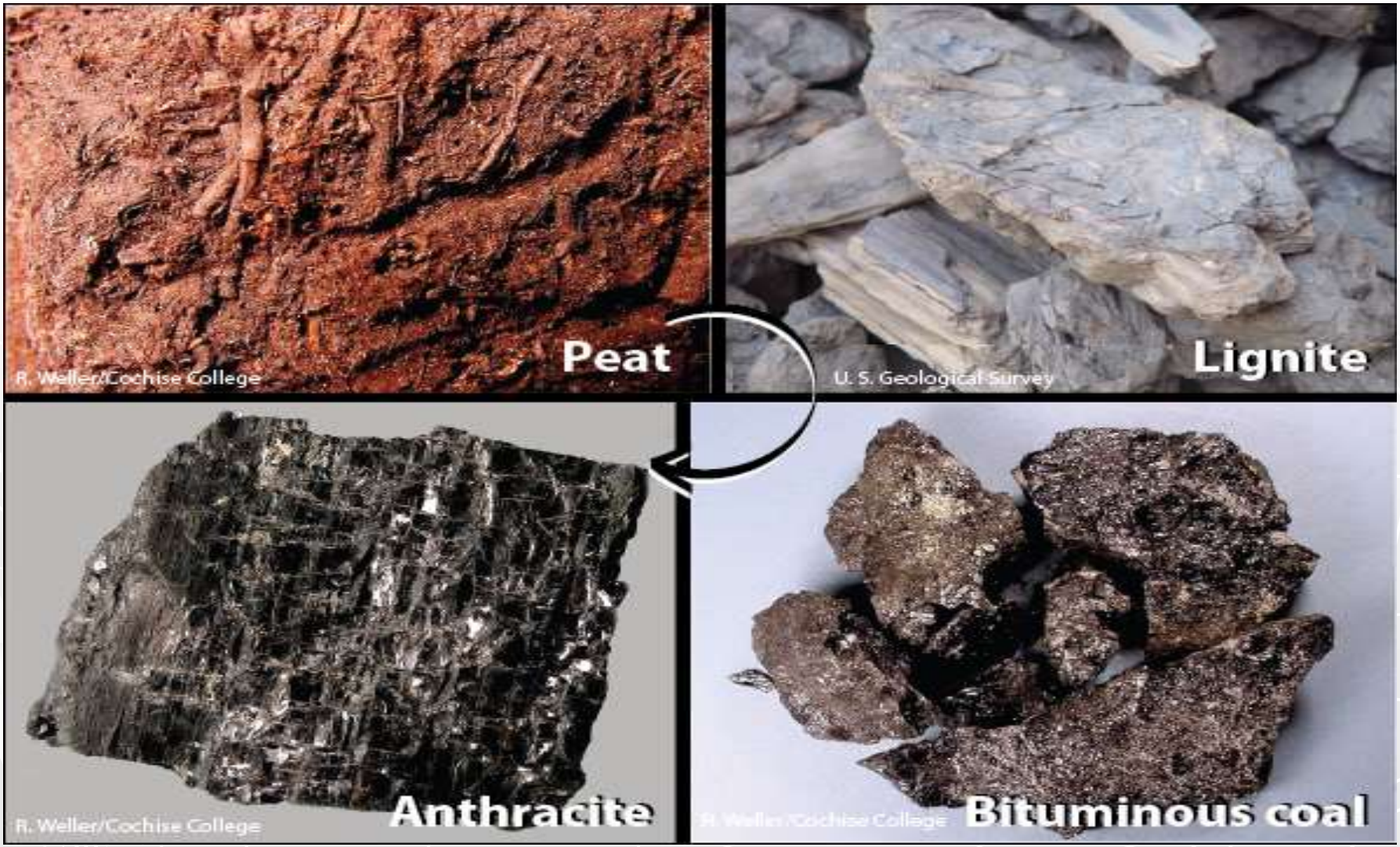
How Coal Was Formed

Millions of years ago, dead plant matter fell into swampy water and over time, a thick layer of dead plants lay decaying at the bottom of the swamps. Over time, the surface and climate of the Earth changed, and more water and dirt washed in, halting the decay process, forming peat.

The weight of the top layers of water and dirt packed down the lower layers of plant matter. Under heat and pressure, this plant matter underwent chemical and physical changes, pushing out oxygen and leaving rich hydrocarbon deposits. What once had been plants gradually turned into coal.

Coal can be found deep underground (as shown in this graphic), or it can be found near the surface.

Note: not to scale


Peat
R. Weller/Cochise College
U. S. Geological Survey
Lignite
Anthracite
R. Weller/Cochise College
R. Weller/Cochise College
Bituminous coal

Coal:

Transition from **peat to anthracite** results in a progressive increase in the **carbon concentration**, in the **hardness**, and in the **amount of energy available** to be released upon combustion.

Peat:

- Plant matters
- A **soft, spongy** and **brownish** deposit
- **Plants' textures** are easily recognizable.

Time coupled with pressure by deep burial, sometimes by earth's movement, **gradually transformed peat into coal**.

During this process, **the % of carbon increases** as the volatile **hydrocarbon** and **water** are forced out of the deposit.

Ranking of Coal

Coals are ranked based on the % of carbon, ash and moisture content:

- **Peat.**
- **Lignite or brown coal.**
- **Bituminous or soft coal** – Highly volatile.
- **Anthracite or hard coal** – An industrial coal contain carbon 48.40%.

Organic Sedimentary Rocks

Peat:

- **First stage** of transformation.
- Contains **less than 40 to 55 per cent carbon & more impurities.**
- Contains sufficient **volatile matter** and **lot of moisture.**
- Left to itself, it **burns like wood**, gives less heat, emits more smoke and leaves a **lot of ash.**



Lignite:

- **Brown coal.**
- Lower grade coal.
- **40 to 55 per cent carbon.**
- Intermediate stage.
- Dark to black brown.
- Moisture content is high (over 35 per cent).
- It undergoes **SPONTANEOUS COMBUSTION** [Bad. Creates fire accidents in mines]



Bituminous Coal:

- **Soft coal**; most widely available and used coal.
- Derives its name after a liquid called bitumen.
- **40 to 80 per cent carbon.**
- Moisture and volatile content (15 to 40 per cent)
- Dense, compact, and is usually of black color.
- **Does not have traces of original vegetable material.**
- Calorific value is **very high** due to high proportion of carbon and low moisture.
- Used in production of **coke and gas**.
-



Anthracite Coal

- **Best quality**; hard coal.
- **<u>80 to 95 per cent carbon</u>**.
- Very little volatile matter.
- Negligibly small proportion of moisture.
- Semi-metallic lustre.
- Ignites slowly and burns with a nice short **blue flame.**



Coal Reserve in Bangladesh:

Till date **five major gondwana coalfields** have been discovered in Bangladesh.

Coal field (district)	Year of discovery	Discovered by	**Depths of coal seam (in meter)**	No. of coal seam	Reserve (million ton)	Status
Jamalganj (Joypurhat)	1962	SVOC	640-1158	7	1053	Minig not feasible economically
Barapukuria (Dinajpur)	1985	GSB	118-506	6	303	Underground mine started production
Khalashpir (Rangpur)	1989	GSB	257-451	8	147	Undeveloped
Dighipara (Dinajpur)	1995	GSB	250	7	200	Undeveloped
Phulbari (Dinajpur)	1997	BHP	152-246	1	380	Open pit mine feasibility study undertaken in 2004

Why Coal Mining is difficult in Bangladesh?

Facts that make coal mining difficult in Bangladesh is:

- the **greater depths** of coal seams and more importantly because of the
- occurrence of a **100-200 meter thick loose water bearing sandy layer covering the coal deposits**.

Coal Quality (Barapukuria):

Characteristics:

- Mainly of **homogeneous type** having dirt band and vitreous to sub-vitreous luster **weakly coking coal**.

- **Rank**: In accordance with USA Ranking System (ASTM Method) Barapukuria Coal is **High Volatile Bituminous Coal**.
- So, this is an Industrial Standard Coal.

Coal composition is given below:

S.N.	ITEM	PERCENTAGE
1	Ash	12.40%
2	Moisture	10.00%
3	Fixed Carbon	48.40%
4	Volatile Matter	29.20%
5	Sulpher	0.53%

Features of Sedimentary Rocks

Stratification of Sedimentary Rocks

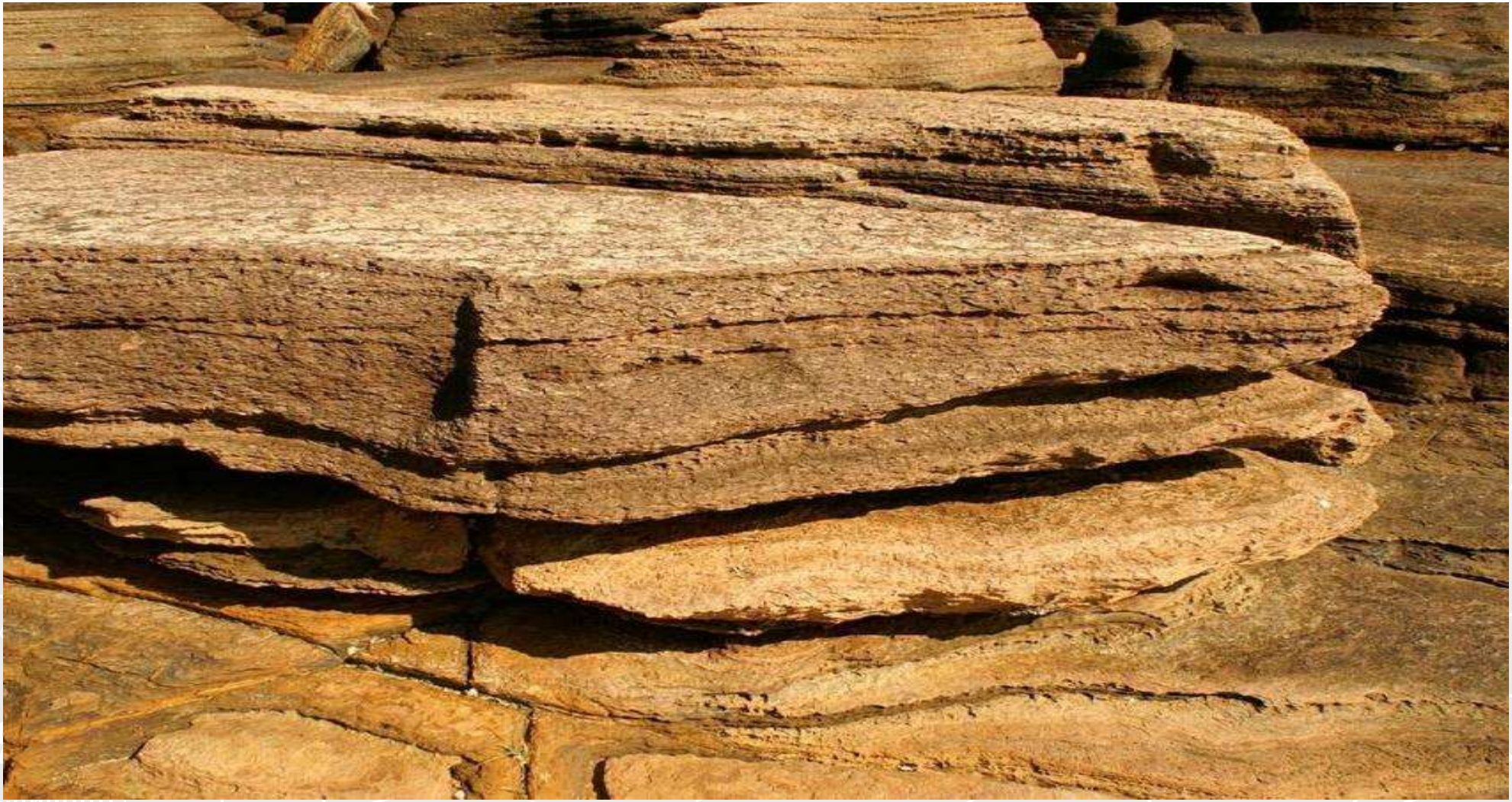
- Single most characteristic features.
- **Beds or layers** are separated by **bedding planes.**
- Each bedding plane **marks the termination one deposits** and beginning of another.



Types of beddings

Parallel Bedding:

- bedding planes are horizontal and parallel.



Laminated Bedding:

- Closely spaced bedding



Crossed or inclined bedding:

- beds are **laid down at an angle** of horizontal.



Graded bedding:

- **Coarse particles at bottom** and fine particles at top.



Ripple Marks: Are little waves of sands that are commonly develop on the surface of sand dune, along of beach, on the bottom of streams.



- **Bedding Preserved in sedimentary** rocks often **furnish clues** to the **conditions that prevailed** when sediments are originally deposited.



Mud cracks:

- On dried surface of the muds, **cracks left exposed** by subsiding water of a river or ponds.
- Make their appearance when a **deposits of silts or clay dries out and shrinks.**



Concretions:

- **<u>Local concentration of cementing materials</u>** that has lithified a deposits in to a sedimentary rocks.
- Range in size from a fraction of **cm to a meter** or more.
- Cementing materials may be **calcite, silica** etc.



Geodes:

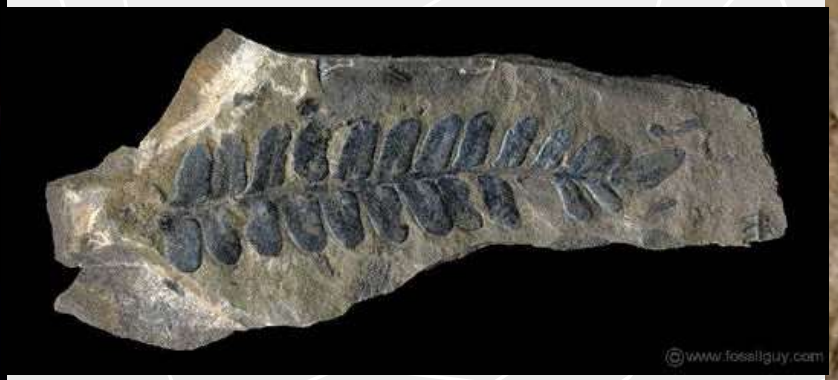
- Roughly **spherical hollow structure** **up to 10 cm or more dia.**
- **Outer layer is lined with the crystals** and **projects inward** toward the hollow centers.
- Occurs most commonly **in limestone**.



Fossils:

- Means any **direct evidence of past life**.
- Abundant in sedimentary rocks like mudstone, shale and limestone.
- Example**:** **bones of dinosaurs**, **Footprints** of long extinct animal, delicate **impression of leaf**.







Thanks