Sedimentary Environments

Chapter 8

Does not contain complete lecture notes. To be used to help organize lecture notes and home/test studies.

What is a sedimentary rock?

- **Sedimentary rocks are products of mechanical and chemical weathering**
- **They account for about 5 percent (by volume) of Earth's outer 10 miles**
- **Contain evidence of past environments**
  - **Provide information about sediment transport**
  - **Often contain fossils**

What is a sedimentary rock?

- **Sedimentary rocks are important for economic considerations because they may contain**
  - **Coal**
  - **Petroleum and natural gas**
  - **Sources of iron, aluminum, and manganese**

Turning sediment into rock

- Many changes occur to sediment after it is deposited
- Diagenesis – all of the chemical, physical, and biological changes that take place after sediments are deposited
  - Occurs within the upper few kilometers of Earth's crust

Turning sediment into rock

- Diagenesis
  - Includes
    - Recrystallization – development of more stable minerals from less stable ones
    - Lithification – unconsolidated sediments are transformed into solid sedimentary rock by compaction and cementation
    - Natural cements include calcite, silica, and iron oxide

Types of sedimentary rocks

- Sediment originates from mechanical and/or chemical weathering
- Rock types are based on the source of the material
  - Detrital rocks – transported sediment as solid particles
  - Chemical rocks – sediment that was once in solution

Detrital sedimentary rocks

- The chief constituents of detrital rocks include
  - Clay minerals
  - Quartz
  - Feldspars
  - Micas
- Particle size is used to distinguish among the various types of detrital rocks

Detrital sedimentary rocks

- Common detrital sedimentary rocks (in order of increasing particle size)
  - Shale
    - Mud-sized particles in thin layers that are commonly referred to as laminea
    - Most common sedimentary rock

Detrital sedimentary rocks

- Sandstone
  - Composed of sand-sized particles
  - Forms in a variety of environments
  - Sorting, shape, and composition of the grains can be used to interpret the rock's history
  - Quartz is the predominant mineral

Detrital sedimentary rocks

- **Conglomerate and breccia**
  - **Both are composed of particles greater than 2mm in diameter**
  - **Conglomerate consists largely of rounded gravels**
  - **Breccia is composed mainly of large angular particles**

Chemical sedimentary rocks

- **Consist of precipitated material that was once in solution**
- **Precipitation of material occurs in two ways**
  - **Inorganic processes**
  - **Organic processes (biochemical origin)**

Chemical sedimentary rocks

- **Common chemical sedimentary rocks**
  - **Limestone**
    - **Most abundant chemical rock**
    - **Composed chiefly of the mineral calcite**
    - **Marine biochemical limestones form as coral reefs, coquina (broken shells), and chalk (microscopic organisms)**
    - **Inorganic limestones include travertine and oolitic limestone**

Chemical sedimentary rocks

- Common chemical sedimentary rocks
  - Dolostone
    - Typically formed secondarily from limestone
  - Chert
    - Made of microcrystalline quartz
    - Varieties include flint and jasper (banded form is called agate)

Chemical sedimentary rocks

- Common chemical sedimentary rocks
  - Evaporites
    - Evaporation triggers deposition of chemical precipitates
    - Examples include rock salt and rock gypsum

Chemical sedimentary rocks

- Common chemical sedimentary rocks
  - Coal
    - Different from other rocks because it is composed of organic material
    - Stages in coal formation (in order)
      - 1. Plant material
      - 2. Peat
      - 3. Lignite
      - 4. Bituminous

Classification of sedimentary rocks

- Sedimentary rocks are classified according to the type of material
- Two major groups
  - Detrital
  - Chemical

Classification of sedimentary rocks

- Two major textures are used in the classification of sedimentary rocks
  - Clastic
    - Discrete fragments and particles
    - All detrital rocks have a clastic texture
  - Nonclastic
    - Pattern of interlocking crystals
    - May resemble an igneous rock

Sedimentary environments

- A geographic setting where sediment is accumulating
- Determines the nature of the sediments that accumulate (grain size, grain shape, etc.)

Sedimentary environments

- Types of sedimentary environments
  - Continental
    - Dominated by erosion and deposition associated with streams
    - Glacial
    - Wind (eolian)
  - Marine
    - Shallow (to about 200 meters)
    - Deep (seaward of continental shelves)

Sedimentary environments

- Types of sedimentary environments
  - Transitional (shoreline)
    - Tidal flats
    - Lagoons
    - Deltas

Sedimentary environments

- Sedimentary facies
  - Different sediments often accumulate adjacent to one another at the same time
  - Each unit (called a facies) possesses a distinctive set of characteristics reflecting the conditions in a particular environment
  - The merging of adjacent facies tends to be a gradual transition

Sedimentary structures

- Provide information useful in the interpretation of Earth history
- Types of sedimentary structures
  - Strata, or beds (most characteristic of sedimentary rocks)
  - Bedding planes that separate strata
  - Cross-bedding

Sedimentary structures

- Types of sedimentary structures
  - Graded beds
  - Ripple marks
  - Mud cracks

Fossils: Evidence of past life

- By definition, fossils are the traces or remains of prehistoric life now preserved in rock
- Fossils are generally found in sediment or sedimentary rock (rarely in metamorphic and never in igneous rock)

Fossils: Evidence of past life

- **Geologically fossils are important for several reasons**
  - **Aid in interpretation of the geologic past**
  - **Serve as important time indicators**
  - **Allow for correlation of rocks from different places**