Characteristics of Sedimentary Rocks

- Deposited at the earth's surface by wind, water, glacier ice, or biochemical processes
- Typically deposited in strata (layers) under cool surface conditions. This is in contrast to stratified volcanic rock (tuff), which has a hot origin.

Types of Sedimentary Rock

- **Clastic**: made up of **CLASTS** (broken-off particles) and **CEMENT** (typically calcite, quartz, or hematite)
  - Examples: sandstone, siltstone, conglomerate
- **Chemical/Biochemical**: deposited by inorganic means such as precipitation or evaporation (commonly consisting of one mineral), or originated through the activity of living organisms
  - Examples: limestone, chert

Weathering

- **Weathering**: changes that take place in a rock exposed at the earth's surface
- **Mechanical Weathering:** breaking larger pieces into smaller pieces (clasts), with no change of chemical composition
- **Chemical Weathering:** original minerals partially dissolve, and new minerals form that are more stable at the lower temperature and pressure, and more moist environment at the earth's surface.

Transportation and Deposition

- **Clastic sediment**: clasts are transported by wind, moving water, glaciers, and/or gravity.
  - Clasts are deposited when the transport energy is not sufficient to move the particles. As transport energy diminishes, the larger particles are deposited first.
- **Chemical sediment**: dissolved ions are precipitated from solution by biological activity, chemical change, or evaporation.

Energy of Environment

- **High-energy** environments can carry both large and small particles. Typically the conditions are catastrophic (landslide, flood).
- **Low-energy** environments (lake, deep ocean) can carry only small particles.

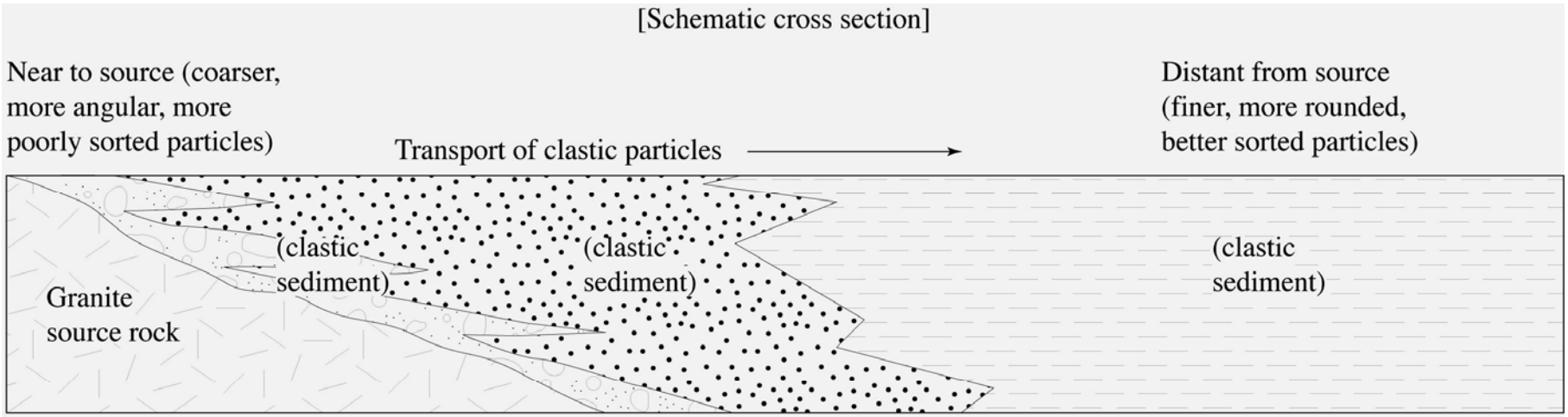
Texture (clastic rocks only)

- Particle size
  - Clay (very fine-grained): <1/256 mm
  - Silt (fine-grained): 1/256 to 1/16 mm
  - Sand (medium-grained): 1/16 to 2 mm
  - Pebbles (coarse-grained): >2 mm
- Particle size indicates the energy of the transporting medium. Larger grain size: more energy needed.
- Cement: calcite, quartz, or hematite cement is common.

Maturity of Clastic Sediment

Note: maturity does not refer to "older" or "younger" rock.

- **Textural maturity:**
  - Angularity: well rounded, subrounded, angular
  - Sorting: well sorted (all particles the same size), poorly sorted (different sizes together)
- The longer the time and distance of transportation, the better the rounding and the degree of sorting.
- **Mineralogical maturity:** (Goldich's Weathering Series)
  - Removal of clay
  - Presence of feldspar indicates immaturity.
  - Quartz is most resistant to chemical weathering.



Distance from source	Near →		Far
Energy of environment of deposition	High →		Low
Size of the largest transported particle (related to energy)	Large →		Small
Angularity *vs*. roundness	Angular (sharp corners and edges) →		Rounded
Degree of sorting	Poor (wide range of particle sizes) →		Good (narrow range of particle sizes)
Minerals present	Both stable (e.g., quartz) and unstable (e.g., feldspar)	Chiefly stable (e.g., quartz)	Stable (e.g., clay derived from weathered feldspar)
Maturity	Immature →		Mature
Examples	Breccia, arkose, conglomerate	Quartz sandstone, siltstone	Mudstone, shale

Sedimentary Structures, Misc.

- Bedforms created by the agent of transportation
  - Stratification: horizontal layering at time of deposition
  - Symmetrical ripples: wave action
  - Asymmetrical ripples: wind or flowing water, indicating direction of current flow
  - Crossbeds: internal layering at an angle inside a stratum (lee side of a ripple, or lee side of a sand dune)
  - Mud cracks: develop in fine-grained sediment exposed to drying for an extended period.
- Coquina
- Evaporation of sea water: first calcite, then gypsum, then halite precipitating in a sequence

Chemical/Biochemical Rocks

- **Limestone** ($CaCO_3$) – formed by precipitation of calcite. Mostly in marine environments, comprised of the shells of dead organisms
- **Dolomite** [Ca,Mg (CO_3)] – formed as Mg partially replaces Ca in limestone
- **Gypsum** ($CaSO_4 \cdot 2H_2O$) and **Halite** (NaCl) – precipitated as sea water evaporates
- **Chert** (SiO_2) – altered microscopic shells of silica-secreting organisms
- **Coal** (mostly C) – altered plant remains

Sedimentary Rocks

- **DIAGENESIS**: physical and chemical changes occurring in sediment after deposition
- Diagenesis includes compaction, and cementation of loose sediment into coherent rock.
- Diagenesis takes place at much lower temperatures than metamorphism.