

- Sedimentary Processes

- o Why do we care?

- Sedimentary rocks are the most common rock type at Earth's surface
    - We utilize them for many things:
      - Construction and building materials
      - Almost all fossils are found in sedimentary rocks
      - Fossil fuels, like coal and natural gas, come from sed. Rocks
      - Soils are associated with sedimentary processes
      - Landslides involve sedimentary processes

Forming Sedimentary Rocks

- Start with some pre-existing rock (**Parent rock**)

- o Does not matter what type

- Have to destroy parent rock to create raw material for building new rock

- **Weathering**=breakdown of rock into particles (sediment)

- o 1. **Physical weathering**: mechanically or physically breaking down the rock (roll down hill)

- **frost wedging**: when water freezes, it expands, so the ice presses against the sides of the crack, making it wider
    - each time water gets in the crack and freezes, the crack widens until it finally splits.
      - Ex- pot holes in the winter time

- o **Chemical weathering**: chemically alter the rock to break it down (dissolve in acid)

- More common than physical weathering on many environments
    - Remember: different minerals will react at different rates
    - Notice the last minerals to form in Bowen's Reaction Series are the most stable at earth's surface
      - They form at near surface conditions, and are this hard to break down
    - Notice the first minerals to form in BRS are the least stable at earth's surface
      - They form at T/P conditions very different from earth's surface, so they are less stable and easier to alter
    - Water is key for many chemical weathering reactions
      - Rain isn't pure water
        - o Contains dissolved CO<sub>2</sub>, SO<sub>2</sub>, nitrates
        - o  $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{CO}_3$  (=Carbonic acid)
        - o  $\text{Feldspar} + \text{H}_2\text{O} + \text{H}_2\text{CO}_3 \rightarrow \text{kaolinite} + \text{dissolved ions}$
        - o So you can change feldspar (hardness 6) into kaolinite (hardness 1.5) with a little water and acid

- o **Erosion:** moving sediment from one place to another
  - 4 things in nature commonly cause erosion
    - water
    - wind
    - gravity (landslides)
    - ice (glaciers)
  - Erosion requires energy to lift and move the sediment
- o **Deposition**
  - As energy levels drop, sediment can't be carried any further. It must be put down
  - **Basin:** any natural depression that can hold sediment
  - **Accommodation space:** the amount of space available in a basin to hold the sediment
  - **Subsidence:** as sediment is deposited, its weight may cause the basin to sink
    - This can open new accommodation space at the top of the basin
  - Sediment is deposited in layers (**strata, beds**)
    - Each bed can be named to help geologists communicate easier; they'll know exactly which bed other geologists are talking about.
- o **Lithification:** process of becoming solid rock
  - **Compaction:** squashing the particles of sediment closer together
    - When first deposited, plenty of space between the grains
  - As the stratum gets buried, the weight of the overlying beds compacts the grains, so little space is left between them
  - **Cementation:** the grains must be stuck together with natural cements
    - Water is squeezed out
    - Dissolved materials in the water left behind
    - $\text{CaCO}_3$ ,  $\text{SiO}_2$ , Fe, etc
    - These precipitates glue grains together

### Types of Sediments

- 3 basic types. The names can vary...
  - o 1. **Clastic Sedimentary:** detrital particles are produced by physical weathering
    - classified by grain size using common terms (gravel, sand, etc)
    - certain traits of clastics are useful to determine the environment they were deposited in
      - Trait 1: Sorting
        - o Measurement of how uniform the grain size is
        - o Well sorted grains are similar in size
        - o Moderately sorted grains are some sizes mixed together
        - o Poorly sorted grains are lots of different sizes

- Trait 2: Roundness
  - o Measures how spherical the grains are
  - o Poorly rounded grains are jagged, angular, and blocky
  - o Moderately rounded grains are somewhat spherical
  - o Well rounded grains are very spherical
  - o Longer transport = more rounded!
- Common clastic rocks
  - Formed by lithifying clastic sediments
  - Classified by the primary grain size
    - o Gravels = **conglomerate** (if gravels are moderately rounded) and **breccia** (if gravels are poorly rounded)
    - o Sand = **sandstones**
    - o Silt = **siltstone**
    - o Clay = **shale** (if layered) and **Mudstone** (if unlayered)
- o 2. **Chemical Sediments**
  - form via chemical reactions
    - dissolution and re-precipitation
    - saltwater evaporation
    - can form thick layers of chemical sedimentary rocks
    - Note: maturity factors don't apply to chemical sed. Rocks
    - They are transported as dissolved ions, so they don't get rounded, sorted, etc
  - Usually comprised of 1 major mineral type
  - ID the mineral to ID the rock
    - Halite = rock salt
    - Gypsum = rock gypsum
    - Quartz = Chert
  - These layers can be economically important deposits
- o 3. **Biogenic Sediments**
  - composed of plant and animal remains
    - ex- carbonates from shells
    - compressed plant material
  - classified by the types of materials present
    - ex- chalk = tiny carbonate shells poorly cemented together
    - ex- limestone = carbonate particles (size varies)
    - ex- coal = compressed plant remains

### Mass Wasting (Landslides)

- Transport of sediment and associated materials downhill via gravity
- Why do we care?
  - o Closed road=higher fuel costs, detours, and higher prices for shipped goods
- Case Study: Huascarán