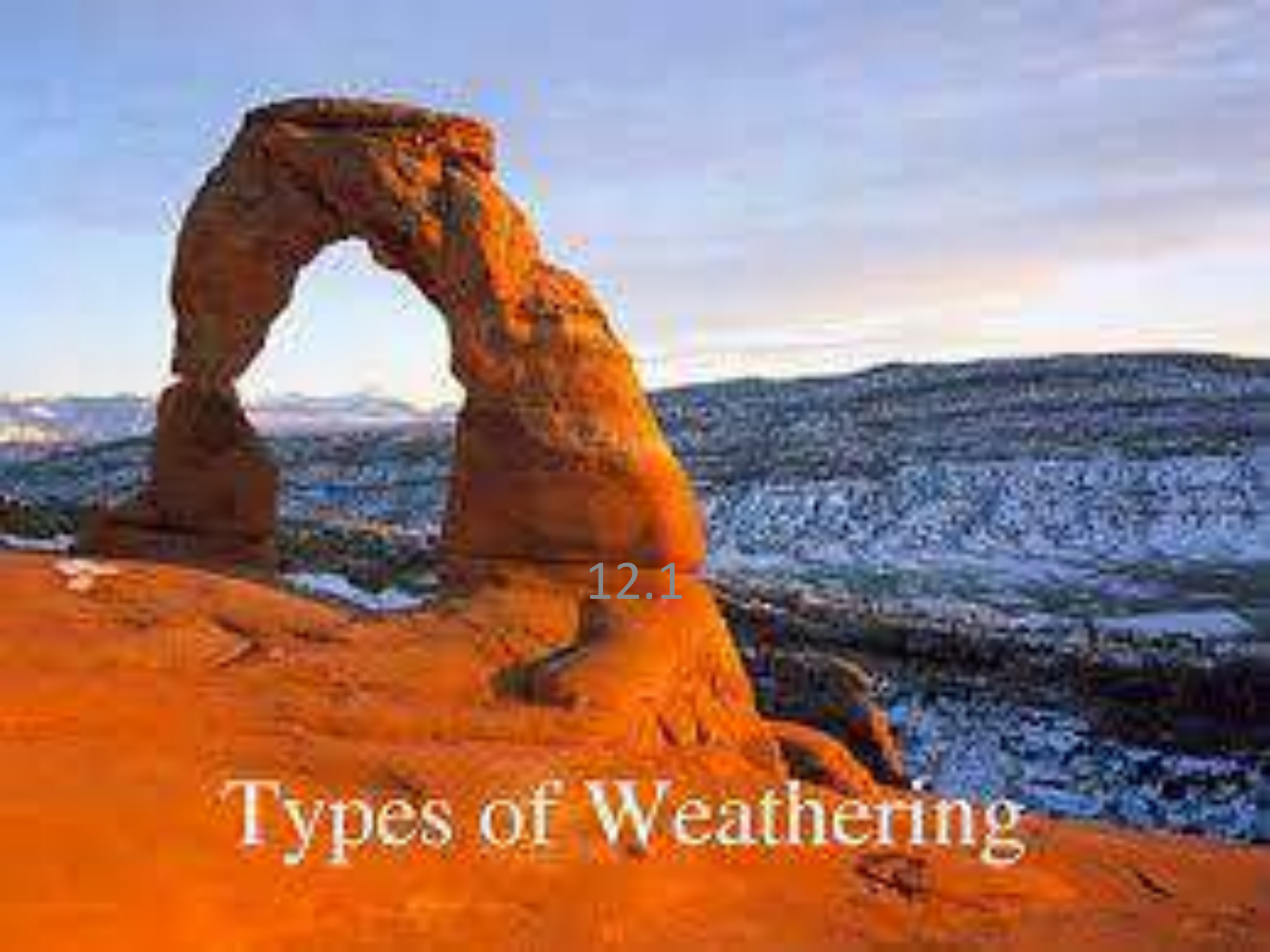
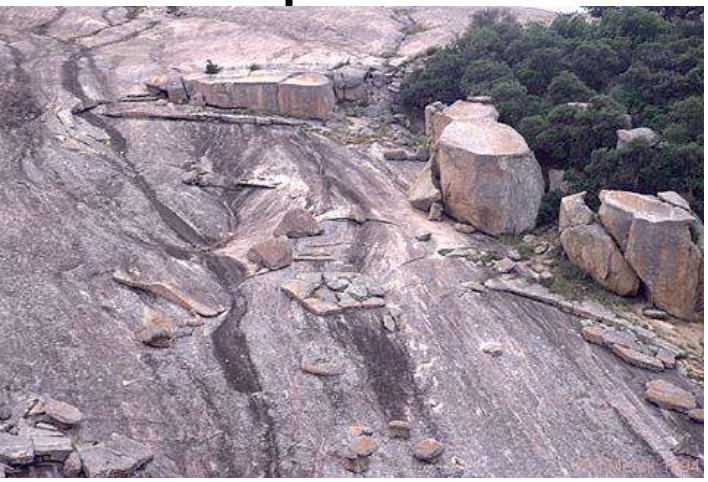

12.1
Types of Weathering

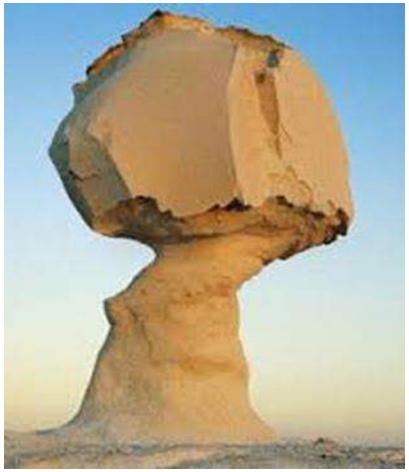
Weathering

- Remember granite forms underground where temps high & no H_2O or O_2.
  - When pushed up to Earth's surface, pressure & temps decrease dramatically!
- Weathering- breakup of rock due to exposure to processes that occur at Earth's surface.



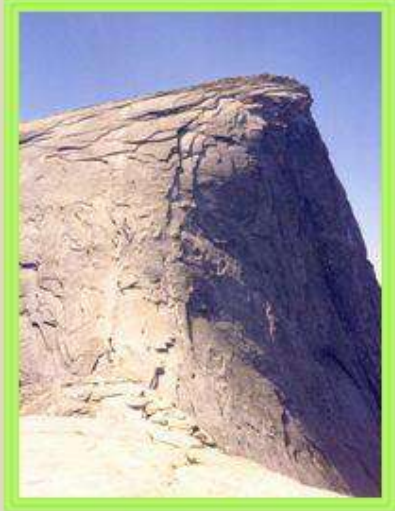
Types of weathering

- Mechanical (physical) – breakdown of rocks and minerals by physical
  means. Like grinding food with your teeth
- Chemical – breakdown of rocks and minerals by chemically changing their composition. Like stomach acid on your food



Types of Mechanical Weathering

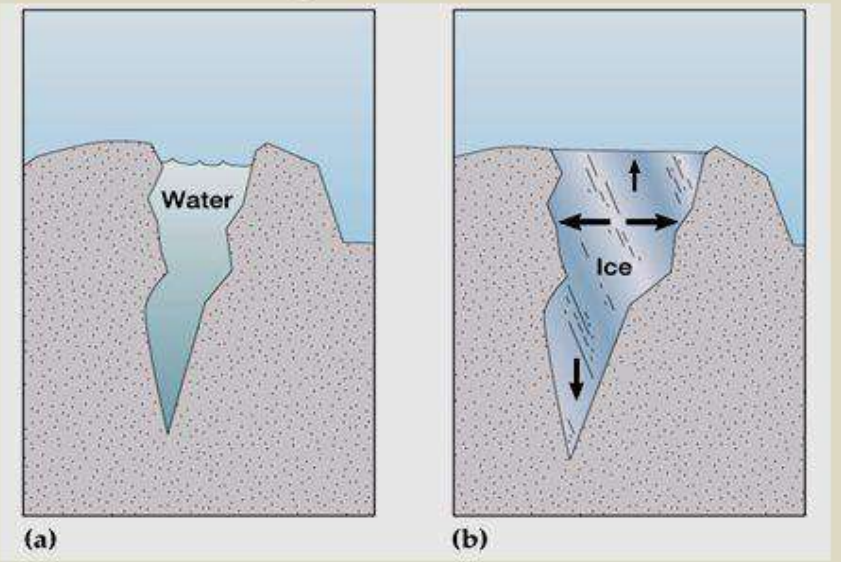
wetting & drying



exfoliation

plant roots

Root wedging of an exfoliation slab, Yosemite National Park, California

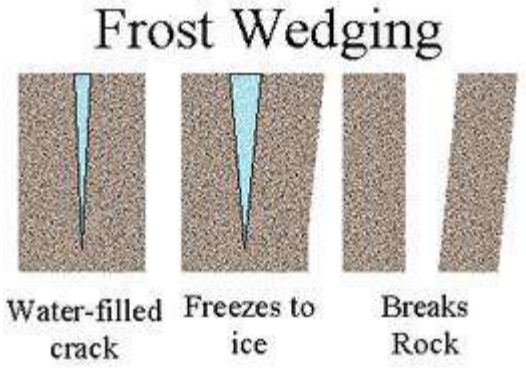


Mechanical Weathering

- Mechanical weather-Disintegration, when rock is split or broken into smaller pieces of same material without changing the composition
- Includes: frost wedging, wetting + drying, abrasion by rock materials, plant + animal activity + exfoliation that occurs as result of upward expansion.

Effects of Ice & Water

- Water occupies 10% more space when frozen; puts pressure on the container
- Frost wedging: water held in cracks of rock, wedges rock apart when freezes
  - Common where temp varies f/ below freezing to above freezing frequently.
  - Occurs mostly in porous rocks
  - Responsible for potholes (helped by ice heaving- water in ground freezes + lifts pavement which collapses when ice thaws)

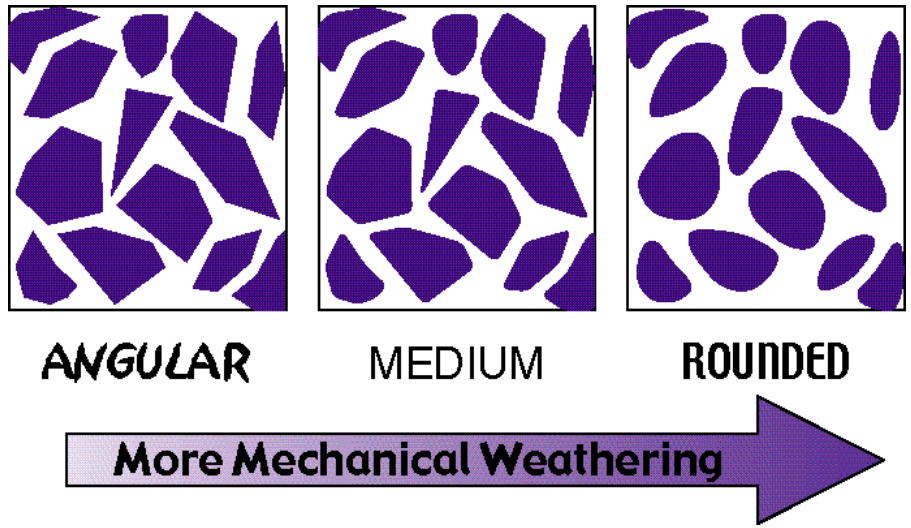


Repeated Wetting/Drying

- Repeated wetting/drying by liquid water can break up shale + other rocks containing clay
  - Clay swells when wet + shrinks when dry; repeated swell/shrink breaks up rock

Abrasion

- Water, wind, ice move rocks (even gravity!)
- Abrasion: Physical wearing down of rocks as they rub or bounce against each other.
- As moving larger rocks grind/scrape against other rocks
- Occurs in windy areas, under glaciers, stream channels.

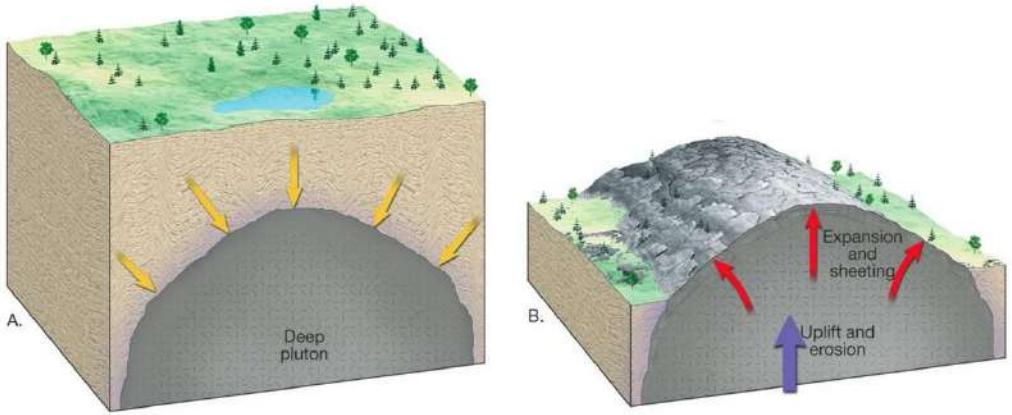


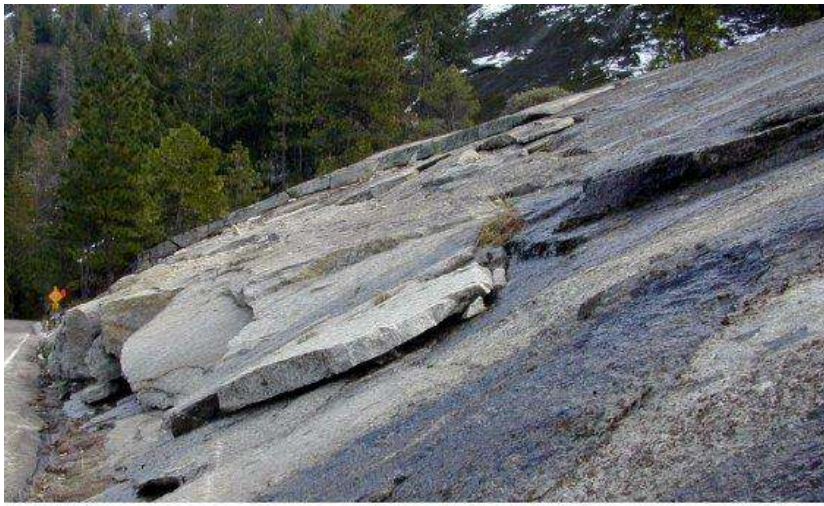
Plants & Animals

- Plant's roots wedge into cracks of rocks and split rocks when grow.
  - Ex. Trees, shrubs, moss
- Burrowers: dig holes in soil allowing air, water to reach bedrock, weathering it
  - Also bring rock fragments to surface where weather faster.

Upward Expansion & Exfoliation

- Upward expansion of rocks formed below Earth's surface results in exfoliation.
- Ex. Granite- lifted up + rocks above warn away, removal of overlaying rocks lessons pressure along surface of granite- causes granite to break along joints parallel to surface.
  - Seen in exposed peaks, outcrops

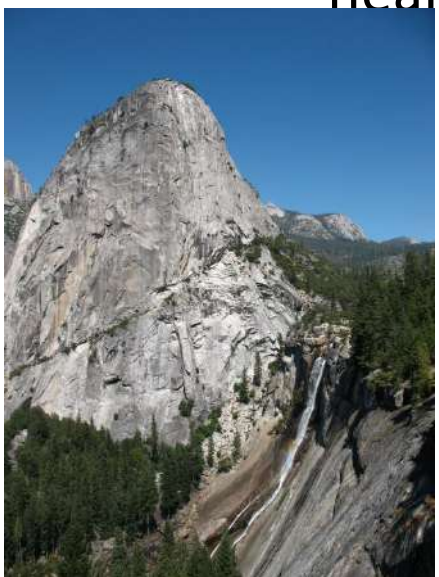




Exfoliation slabs, Yosemite National Park, California

Upward Expansion & Exfoliation cont.

- Overtime loosened sheets break off- exposed outcrop
  - Forms rounded mountain peaks- exfoliation domes
    - Ex. Yosemite, Ca; Stone Mountain, GA; Superloaf Mtn near Rio de Janeiro Brazil



Chemical Weathering

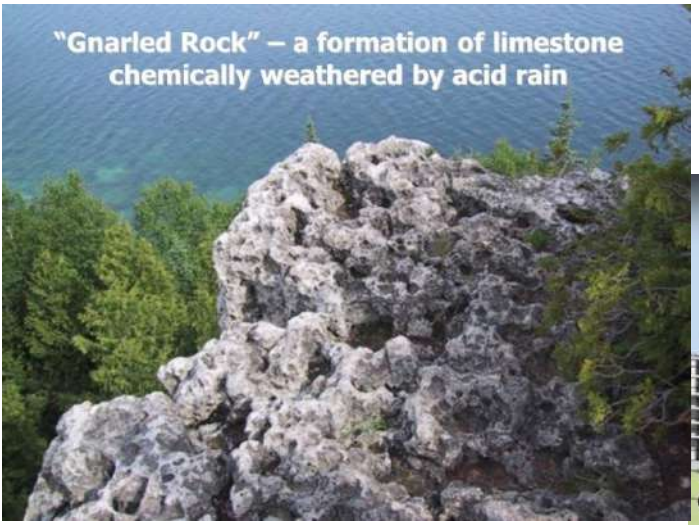
- All chemical weathering involves H_2O or H_2O vapor
- Hydrolysis- chemical weathering by reaction of water with other substances.
  - Common mineral reactants: feldspar, hornblende, augite
  - When exposed to H_2O dissolve to ions and react with H_2O forming clay minerals
    - Ex. Kaolinite

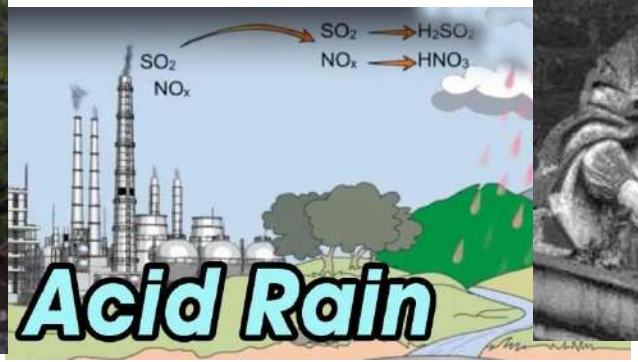
Acid Weathering

- Water's effect heightened by presence of acids dissolved in H_2O
- Ex. Carbonic acid (formed when dissolves CO_2 in rainwater falling through air)
  - When seeps into ground reacts w/ minerals
  - Ex. Feldspar hornblende, augite, biotite mica
  - Has even greater effect on calcite (dissolves completely so no clay minerals remain- unless impure)
    - Ex. Caverns in limestone bedrock

Acid Rain

- SO_2, nitrogen compounds, CO_2 released by industries reacts w/ water → acid rain
- Acid rain increases the rate of weathering
  - Can cause structures of concrete, stone & metal to wear quicker
- Acids can also come from decay of plants + animals, dissolved by rain + carried to bedrock





Oxygen

Oxidation- chemical reaction of O_2 with substances

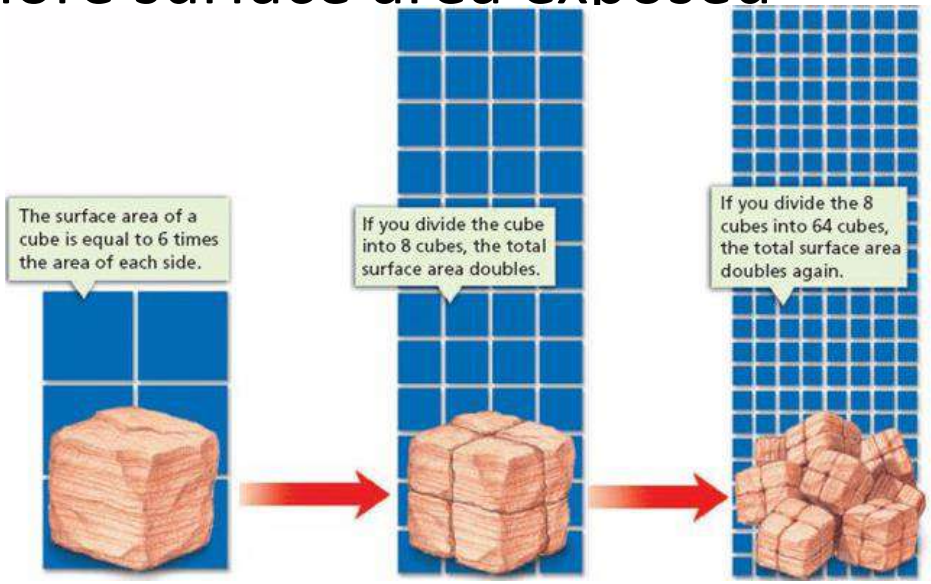
- Effective at weathering minerals w/ iron
- Brown- red color of exposed rocks
- Ex. Magnetite, pyrite, dark colored ferromagnesian silicates- hornblende, augite, biotite.

Oxidation forms types of rust (iron oxides)

- Red-iron oxide called hematite
- Yellowish-brown- limonite

Rate of Weathering

- Surface exposure: rate of weathering affected by amount of rock surface exposed to chemical weathering
  - When rock broken into smaller pieces by mechanical weather, more surface area exposed- weather more quickly



Rates of Weathering

- Composition: different composition of rocks respond differently to same weathering processes.
  - Ex. Palo Duro Canyon, Tx
  - Remnants of rock (different compositions) some more resistant to same weathering
    - some more resistant rocks protect layers of less-resistant

Weather Resistant?

- Quartz not reactive w/ H_2O, O_2 or acids- mostly unchanged by chemical weathering
  - hard, no cleavage- resists mechanical weathering
  - Gradually broken to smaller pieces.
- Feldspar, hornblende, biotite mica, augite, calcite, gypsum- affected by both (mechanical, chemical)
- Sandstones, quartzite, quartz-pebble conglomerates are as durable as the cements in them.
  - Calcite more rapid weathering
  - Silica more resistant

Weather Resistant? Cont.

- Quartzite, silica-cemented sandstones + conglomerates most durable of sedimentary rocks

- Shale most easily weathered
  - Easily split b/w layers + crumble into clay
- Marbles, limestone fairly resistant to mechanical but calcite attacked by acids in H_2O
  - In most climates less durable
  - In dry climates among most durable

Rates of Weathering

- Climate:
  - Warm, wet climates more conducive to chemical + mechanical weathering
  - Cold, dry- mechanical plays a larger role
    - Ex. Windblown rock materials can wear away rock surfaces in dry, desert climates.
- Topography: slope of landscape also determines rate of weathering
  - Rocks on flat area likely to stay in place
  - Rocks on slope move as result of gravity
    - Promote more erosion and continuously exposes less-weather material

- https://www.schooltube.com/video/f2c42addfb6d40ccacb3/

- Book Work: pg 263 # 1-6