PHYSICAL WEATHERING:
(Fragmentation)

Controls of Weathering

1. Moisture
2. Temperature
3. Plants
4. Geochemical Environment
5. Rock Type
   - Mineralogy
   - Texture
6. Time

Moisture & Temperature

- Water = Catalyst
- Rates of Reaction Double for Every 10°C Increase in Temp
- Freeze-Thaw

Freeze-Thaw

- Tiny Crack
- Rock
Freeze-Thaw

Crack Filled w/ Water

Freeze--Thaw
Water in Crack Freezes

Tension

Freeze-Thaw

Crack Grows

Freeze--Thaw

Freeze--Thaw

Freeze--Thaw

Freeze--Thaw

Freeze--Thaw
Freeze-Thaw
More Water in Bigger Crack

Freeze-Thaw
Ice Forms Enlarging Crack

Freeze-Thaw
Oh Sh
**Role of Plants**

- Plant Chemistry
- Tension Set up by Roots

**Plant Growth**

Seed Germinates in Crack
Best Way to Break Rock?

Create Tension Within

Role of Rock Type

- Porosity: % Void Space
- Permeability: Ability for Fluid to Penetrate
- Particle Size:
  - Volume v. Surface Area

Leaching of Cement or Other Integral Mineral Grains -> Disintegration
Cement Leached Out by CaCO₃ Dissolution

• NOₓ or SO₂ or CO₂ + Water = Acid
  Acid + Calcite = Ions in Solution
Accentuation of Pre-Existing Planes of Weakness (e.g. Joints, Bedding)

- Spheroidal Weathering
- Sheeting
- Exfoliation

Cubes to Spheres
Spheroidal Weathering

Half Dome, Yosemite NP: an Exfoliation Dome

Photograph by Carroll Ann Hodges, USGS


Delicate Arch

Arches National Park, Utah

Balanced Rock
Thermal Contraction: Experiments (unlikely to be important) vs. Observation (it happens)

Diurnal Thermal Cycles: Experiments (unlikely to be important) vs. Observation (it happens)

Unloading: Release of Confining Pressure
Mine “Rock Bumps”

Thermal Contraction: FCRs

Diurnal Thermal Cycles:
Experiments (unlikely to be important) vs. Observation (it happens)

Weathering “Facies”

Thermal Contraction:
FCR

Diurnal Cycles:
Experiments (unlikely to be important) vs. Observation (it happens)