

Weathering of Rocks

- 1) Why we see weathering**
 - a) Most minerals are not stable at the Earth's surface (See Table 7.1)**
 - b) The Earth wants to be flat – lowest energy state**
 - c) Topography provides energy**
- 2) Weathering in the Rock Cycle**
 - a) Three Dynamic Processes of Breaking and Removing rock**
 - i) Weathering - the disintegration and decomposition of rock at or near the surface**
 - ii) Erosion**
 - iii) Mass wasting**
- 3) Types of Weathering**
 - a) Mechanical (Physical)– breakdown of rocks into smaller pieces.**
 - b) Chemical – decomposition of rocks by chemical reactions.**
- 4) Mechanical Weathering**
 - a) Mechanical weathering breaks down rocks/minerals**
 - b) Mechanical Weathering - making smaller pieces**
 - c) Smaller particles increases the amount of exposed surface area (See Figure 9.8)**
 - d) Does not change the chemical composition of the minerals**
 - e) Types of Mechanical Weathering**
 - i) Frost wedging –**
 - (1) water penetrates into cracks, expands when it freezes.**
 - (2) Must have:**
 - (a) Adequate moisture**
 - (b) Cracks in rocks**
 - (c) Freeze/thaw cycles**
 - ii) Salt wedging – growth of minerals in cracks**
 - (1) Desert environments**
 - (2) Water evaporates, ions in solution combine to form minerals**
 - iii) Biological wedging –**
 - (1) plant roots penetrate into cracks causing cracks to widen.**
 - (2) Must have:**
 - (a) Climate hospitable for plants.**
 - (b) Adequate moisture and temperature.**
 - iv) Unloading**
 - (1) Removal of overlying material allows rock to expands**
 - (2) Top layers expand more than deeper layers**
 - (3) Causes sheeting or exfoliation**
 - v) Thermal Expansion**
 - (1) repeated daily heating and cooling of rock; ex. Desert environments**
 - (2) heat causes expansion; cooling causes contraction.**
- 5) Chemical Weathering**
 - a) Chemical alteration of minerals.**
 - b) Results in new minerals and ions in solution.**

- c) Water and acid are essential.
- d) Types of Chemical Weathering
 - i) Hydrolysis - any reaction in which water participates.
 - ii) Ion exchange – H⁺ replaces other cations.
 - iii) Dissolution - mineral completely dissolves, leaving only ions in solution.
 - iv) Oxidation - reaction in which elements gain or lose electrons (example: rust).
 - v) Acid Hydrolysis - Dissolution
 - (1) $\text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{H}_2\text{CO}_3$
 - (2) $\text{CaCO}_3 + \text{H}_2\text{CO}_3 \rightarrow \text{Ca}^{2+} + 2\text{HCO}_3^-$
 - vi) Acid Hydrolysis & Secondary Minerals
 - (1) Dissolution
 - (2) Minerals dissolve in water
 - (3) For example: salts
 - vii) Oxidation
 - (1) Iron silicate dissolves
 - (2) Iron oxidizes
 - (3) Oxidized iron combines with water
 - (4) Leaves iron oxide
- 6) Results of Weathering
 - a) Spheroidal Weathering
 - i) Water moves through joints
 - ii) Frost wedging
 - iii) Chemical dissolution – get clays
 - iv) Joints enlarge
 - v) Corners are attacked more aggressively – get rounding of the material
 - vi) Fines (clays and silts) wash out of rock
- 7) Weathering Products
 - a) Regolith – a loose layer of broken rock and mineral fragments.
 - b) Dissolved Ions
 - c) Bowen's Reaction Series and Weathering (See Table Chart Below)
 - d) Relative susceptibility to weathering
- 8) Factors influencing Weathering Rates
 - a) Rock structures – chemical/mineral composition, physical features
 - b) Topography
 - c) Climate and Weathering (see section 9.5)
- 9) Benefits of Weathering
 - a) Creates soil
 - b) Produces clay, sand, and gravel
 - c) Produces minerals

