

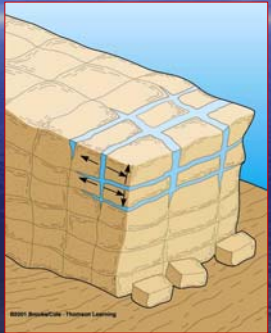
How are Earth Materials Altered?

- Differential weathering and erosion
 - Structural and chemical differences in rock can produce spectacular formations
 - Mechanical weathering
 - Chemical weathering




How are Earth Materials Altered?

- Mechanical Weathering
 - Physical forces break rocks into smaller pieces that retain the chemical composition of the parent material
 - Frost action
 - Pressure release
 - Thermal expansion/contraction
 - Salt crystal growth
 - Organic activity



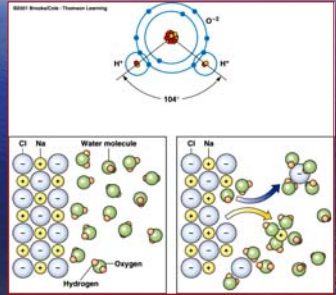
Weathering Processes

- Factors Influencing Weathering Processes
- Physical Weathering Processes
- Chemical Weathering Processes



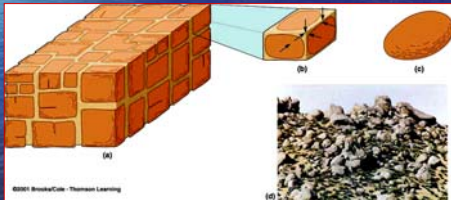
How are Earth Materials Altered?

- Chemical Weathering
 - Decomposition of parent material to produce new minerals and ions. Agents include atmospheric gases, water, and acids.
 - Other processes:
 - Solution
 - Oxidation
 - Hydrolysis



How are Earth Materials Altered?

- Factors controlling the rate of chemical weathering
 - Stability of minerals is opposite their order of crystallization
 - Mechanical weathering increases the surface area of parent rock, enabling chemical processes to act more effectively
 - Presence of fractures, particle size, climate, parent material



Physical Weathering



Figure 13.7

Figure 13.8

Exfoliation in Granite



Figure 13.11

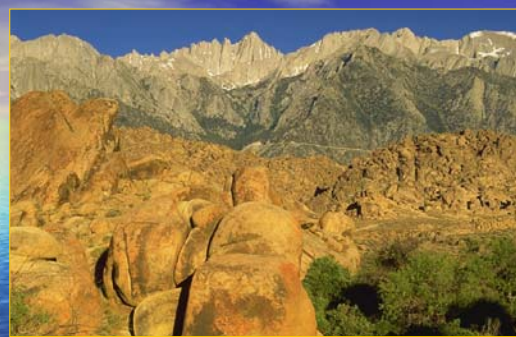
Chemical Weathering



Karst Topography and Landscapes

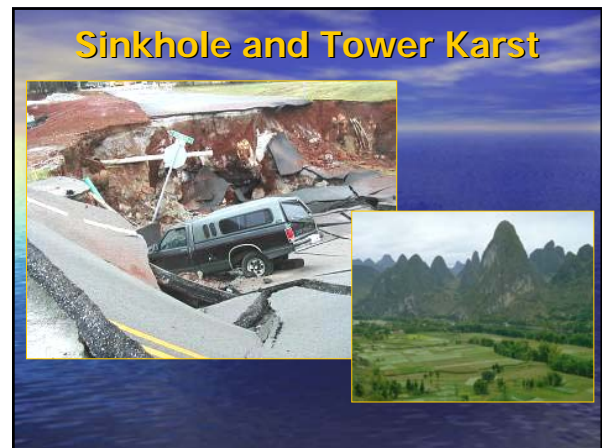
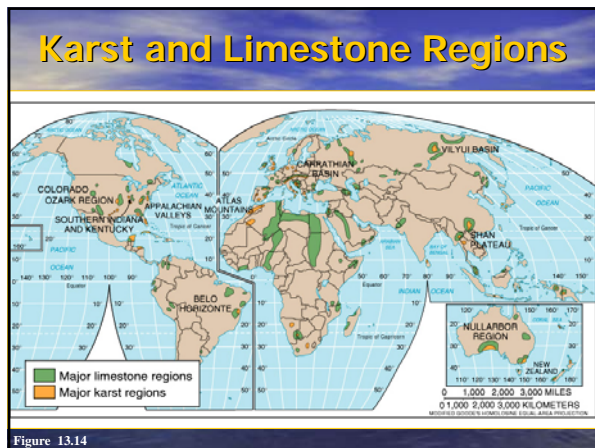


- Formation of Karst
- Lands Covered with Sinkholes
- Caves and Caverns



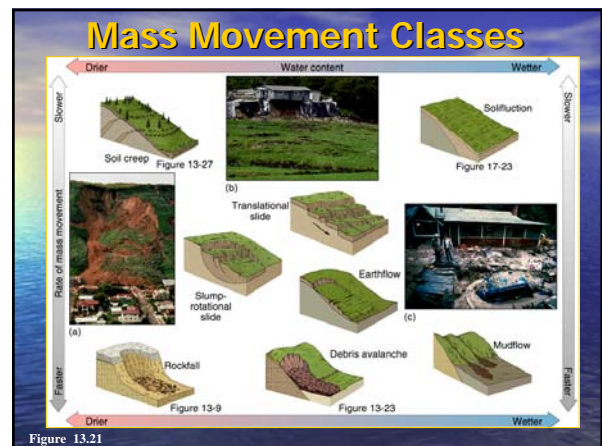
Physical weathering on Mt. Whitney in background
Chemical weathering on Alabama Hills in foreground

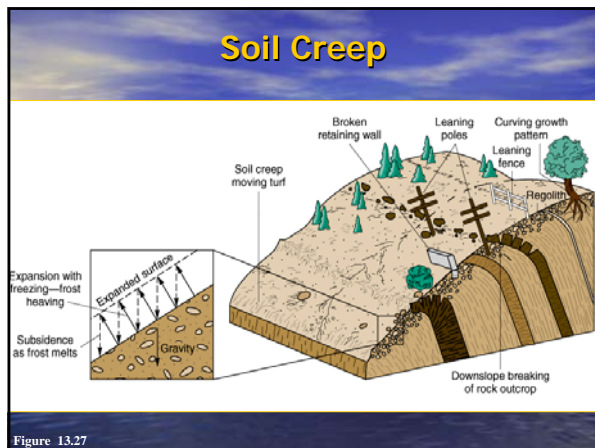
Figure 13.12



Mass Movement Processes

- Mass Movement Mechanics
- Classes of Mass Movements
- Human-Induced Mass Movements (Scarification)





Recognizing and Minimizing the Effects of Mass Movements

A photograph of a road with a retaining wall. The road is paved and has a concrete retaining wall on the right side. The wall is made of large, rectangular blocks. The area behind the wall is a grassy slope.

- Conduct a thorough geologic investigation of the area in question
- Assess risks and take steps to minimize the effects of events

Recognizing and Minimizing the Effects of Mass Movements

- Slope stability maps indicate where to place roads, developments, and utility lines
- Drainage of high areas or other water control measures helps prevent movement

A slope stability map of a coastal area. The map shows various shades of orange and red, indicating different levels of slope stability. A legend at the bottom left explains the colors:

- Relatively stable**: Lightest shade of orange.
- Decreasing stability**: Medium shade of orange.
- Relatively unstable**: Darkest shade of orange.

 The map also includes a scale bar (0 to 1,500 m) and a north arrow. A note at the bottom left states: "Horizontal contact between rocks of different stability. Tick marks are toward more easily eroded rocks. Erosional undercutting may cause oversteepening of more resistant rocks, leading to landsliding."

Recognizing and Minimizing the Effects of Mass Movements

- Reducing the angle of slope using cut-and-fill or benching
- Retaining walls and drainage pipe
- Rock bolts hold unstable surface rock to solid bedrock

