

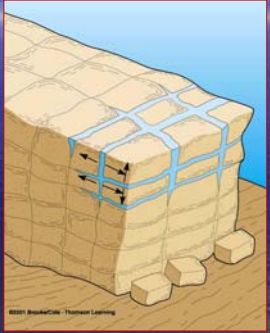
## How are Earth Materials Altered?

- 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



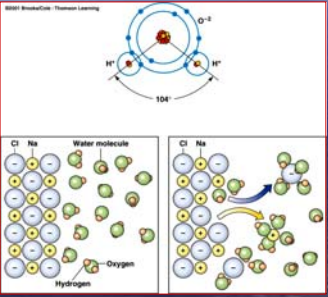
## Weathering Processes

- 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

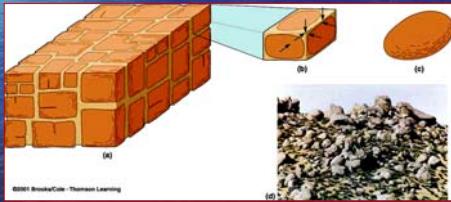


Figure 13.11

## Physical Weathering



Figure 13.7

Figure 13.8

## Exfoliation in Granite

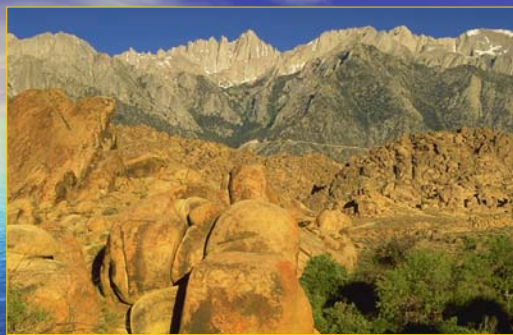


Figure 13.11

## Chemical Weathering



Figure 13.12



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

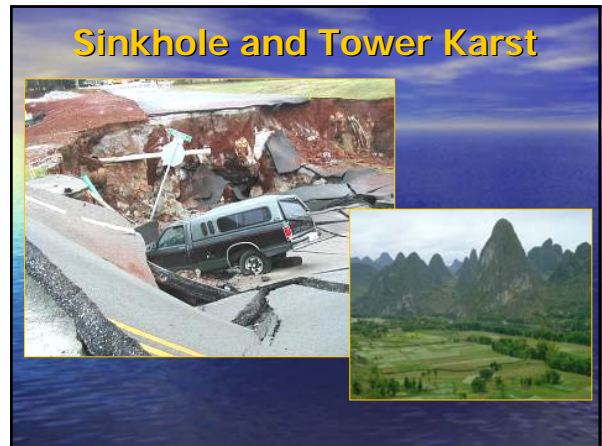
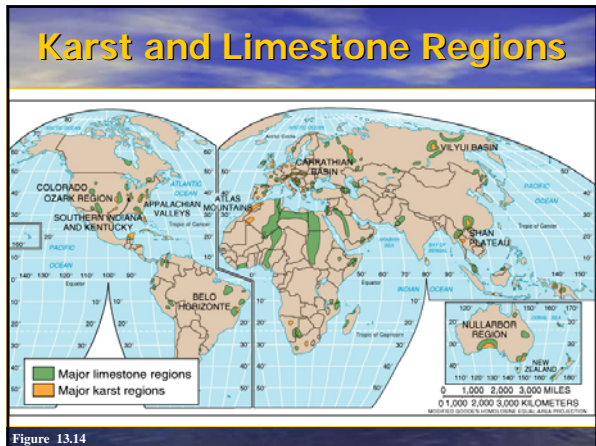
Figure 13.12

## Karst Topography and Landscapes



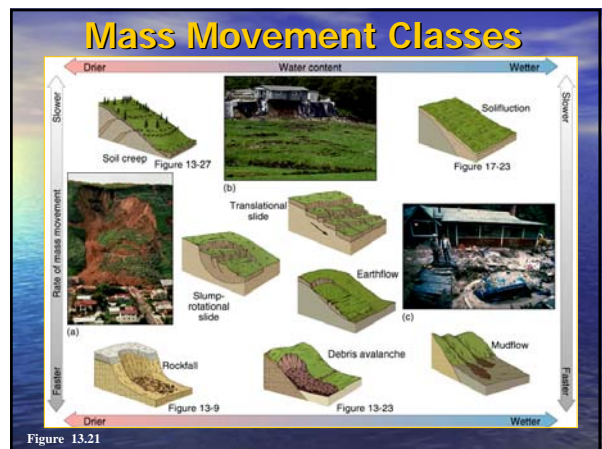
- Formation of Karst
- Lands Covered with Sinkholes
- Caves and Caverns

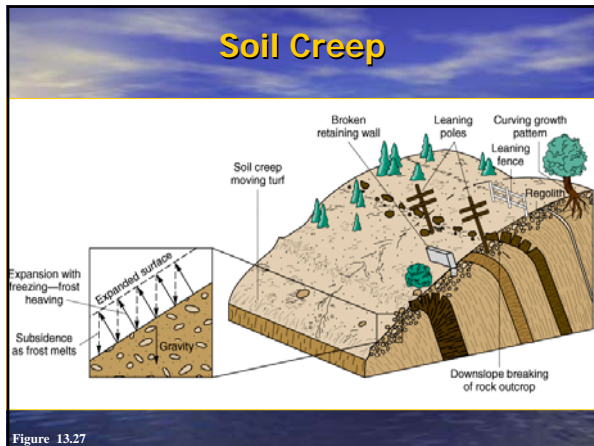
Figure 13.13



### Mass Movement Processes

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





## Recognizing and Minimizing the Effects of Mass Movements

- 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

The map shows a slope stability map with a legend. The legend includes:
 

- Relatively stable:** Indicated by a solid line.
- Relatively unstable:** Indicated by a dashed line.

 The map also includes a scale bar (0 to 1,500 m) and a north arrow.

## 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

