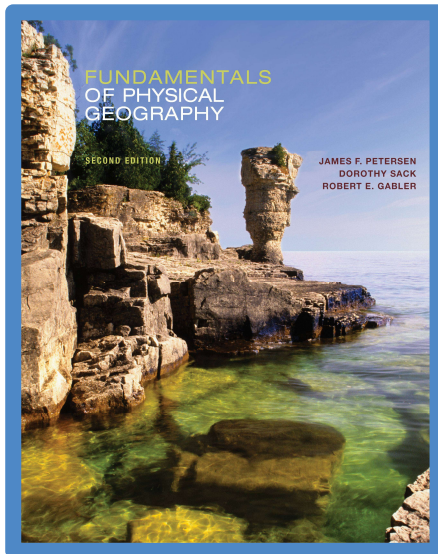


Fundamentals of Physical Geography 2e

Water Resources and Karst Landforms

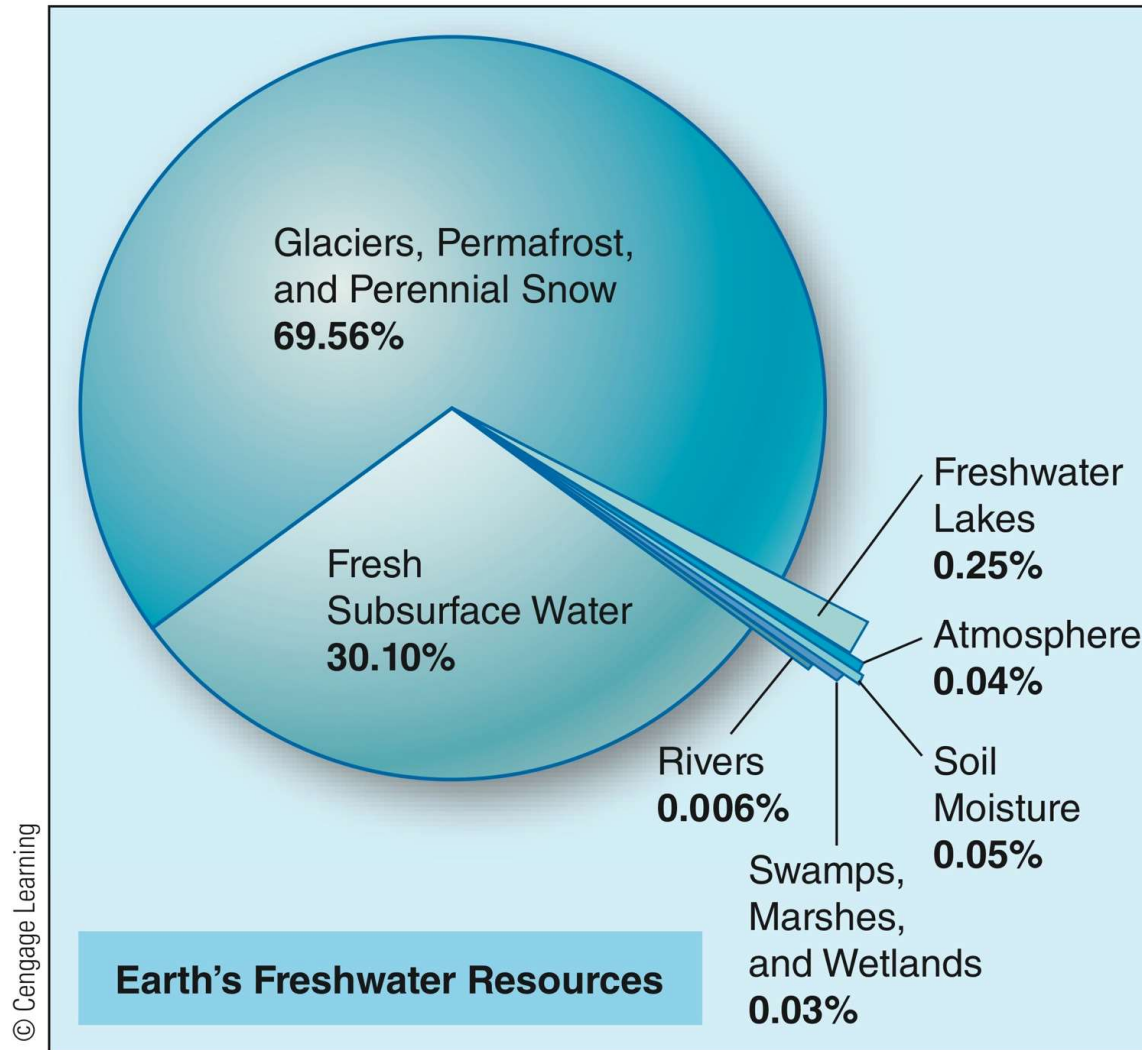
13



- ⌘ Peterson
- ⌘ Sack
- ⌘ Gabler

Introduction

- Subsurface water
 - Carries other substances
 - Influences the form and appearance of the landscape
 - Freshwater source
- United Nations: recognition of crucial role of water
 - Decade for Action: Water for Life



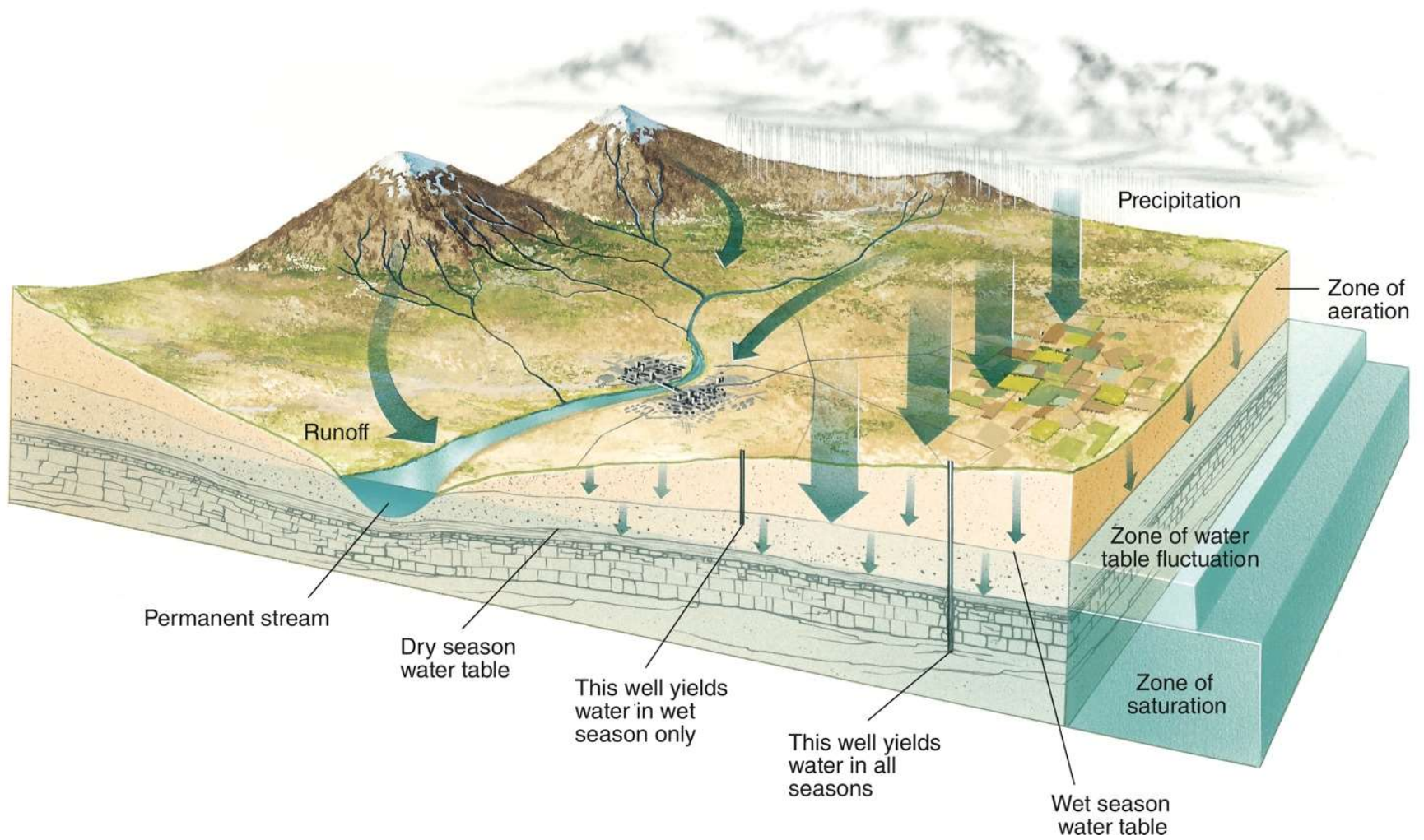
What percentage of liquid freshwater flows in rivers?

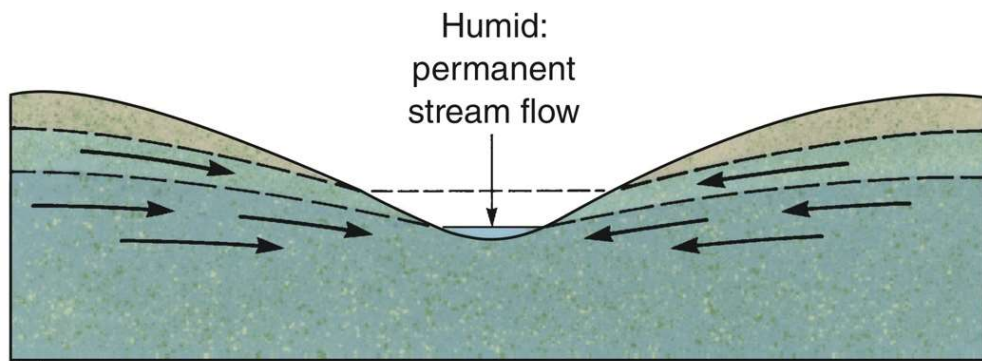
Nature of Underground Water

- What is subsurface water?
- Infiltration
 - Recharges amount of subsurface water
- Subsurface water zones
 - Zone of aeration
 - Percolation
 - Soil water

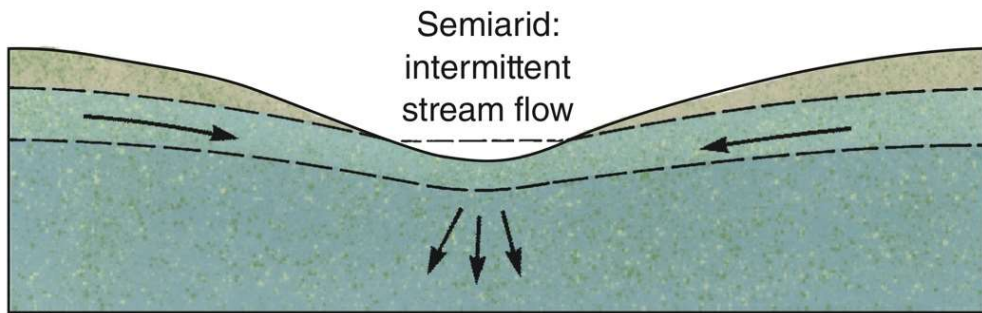
Nature of Underground Water

- Subsurface water zones
 - Zone of saturation
 - Groundwater
 - Water table
 - Intermediate zone
 - Middle layer
 - Alternates between unsaturated and saturated conditions
 - What is the process of water mining?

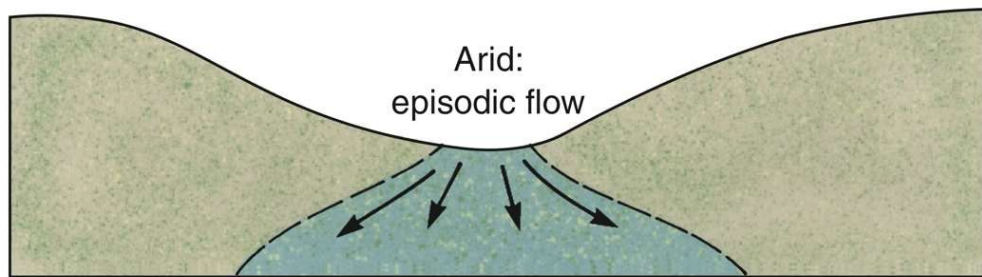




(a)



(b)



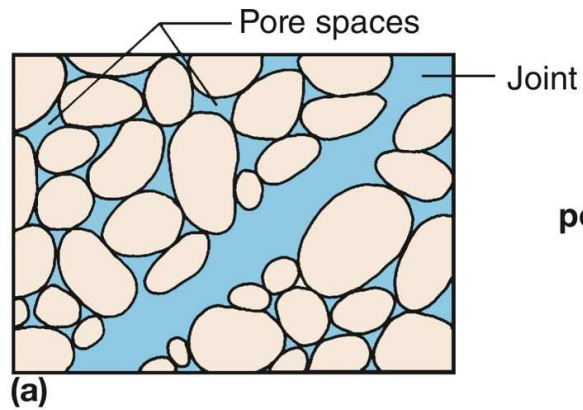
(c)

No water table except
by seepage from stream

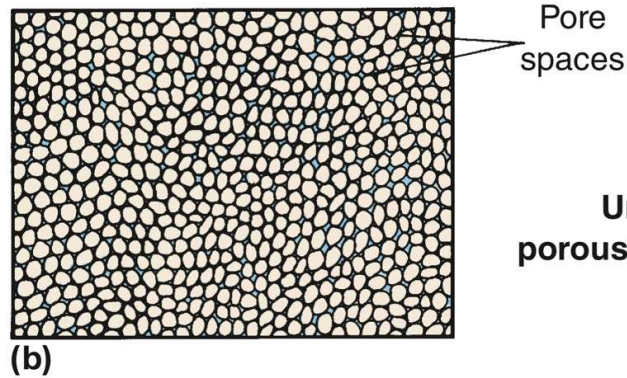


Nature of Underground Water

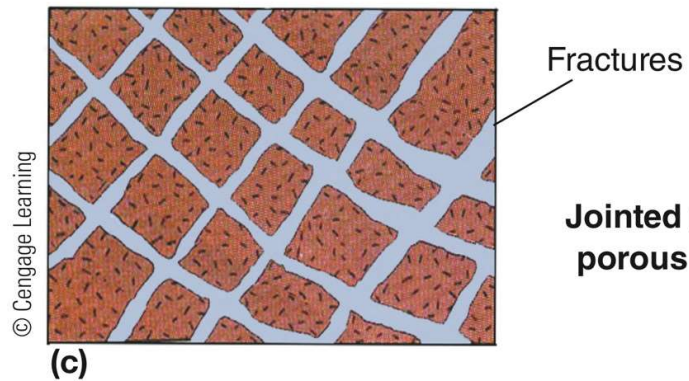
- Groundwater storage and movement
 - Factors affecting groundwater amount and availability
 - Amount of precipitation
 - Rate of evaporation
 - Capacity of ground to accept and transmit water to subsurface
 - Amount and type of vegetation
 - Porosity
 - Permeability



**Jointed sandstone
porous and permeable**



**Unjointed clay
porous and impermeable**

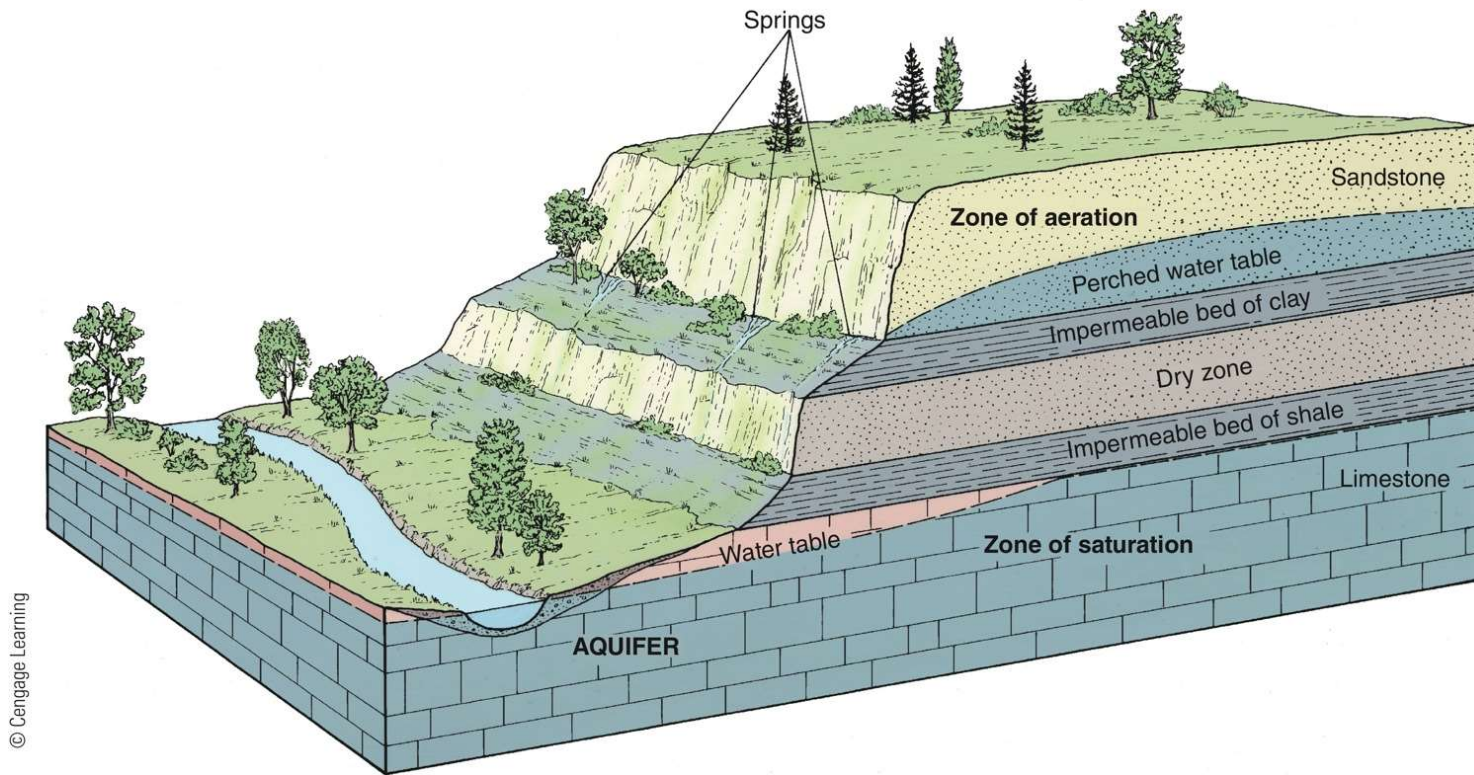


**Jointed nonporous rock
porous and permeable**

**Which of these three
types of Earth
materials would be
best for obtaining
water?**

Nature of Underground Water (cont'd.)

- Groundwater storage and movement
 - What rock materials comprise most aquifers that supply water for human use?
 - Aquiclude
 - Perched water table



Is a perched water table a reliable source of groundwater?

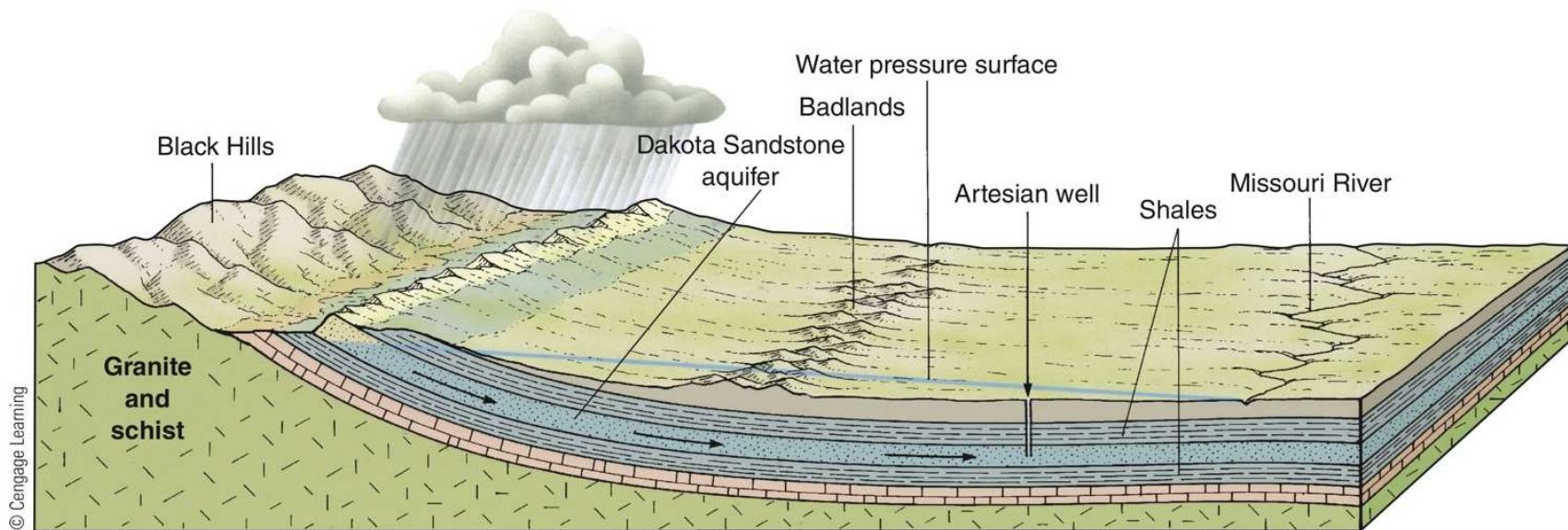
Springs

- Natural outflows of groundwater to the surface
- What causes a spring to flow continuously rather than intermittently?
- Artesian spring
 - Pressurized groundwater resources



USGS Florida Cooperative Res. Unit

What evidence indicates that this is a spring rather than a puddle or small pond that accumulated from rainwater?



Why is the water in this aquifer under pressure?

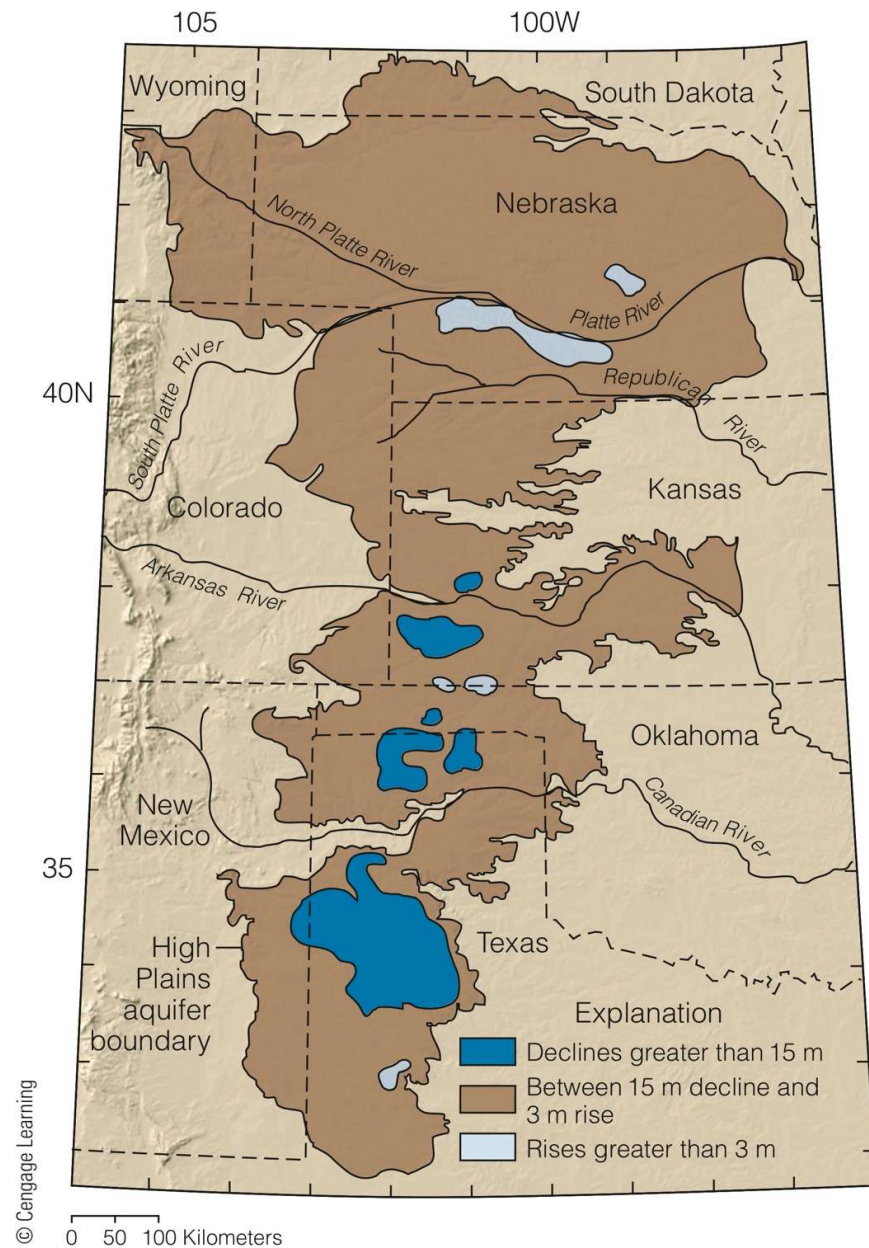
Using Groundwater Resources

- Groundwater is a critical resource
 - Half of US population: drinking water
 - Agriculture: irrigation
 - Habitat: wetlands
- Wells
 - Artificial openings dug or drilled down to a point below the water table

Using Groundwater Resources

- Reducing reserves
 - Rate of groundwater removal may exceed the rate of groundwater recharge
 - Ogallala Aquifer: irrigation consumption
 - Subsidence
 - What is the process of artificial recharge?

Why do you think the drop in water supply has been greatest in the southern part of the aquifer?



Using Groundwater Resources

- Groundwater quality
 - “Hard water”: large mineral content
 - Groundwater pollution
 - Acid mine drainage
 - Toxic substances or salt water introduced into the zone of saturation

Nature of Underground Water (cont'd.)

- Acid mine drainage
 - Subsurface water flowing through mines or mine tailings undergoes chemical reactions
 - Highly acidic and metal-rich water
 - Serious environmental concern
 - Some coal- and metal-mining regions: Eastern U.S. and parts of Australia, South America, and South Africa
 - Limit by controlling underground water flow

The Physical Science Perspective

Using Groundwater Resources (cont'd.)

- Geothermal water
 - Water heated by contact with hot rocks in the subsurface
 - Hot springs
 - Geyser
 - What are the characteristics of the best geothermal water for energy use?



R. Gabler

George Marler/National Park Service



How do geysers differ from hot springs?

Landform Development by Subsurface Water and Solution

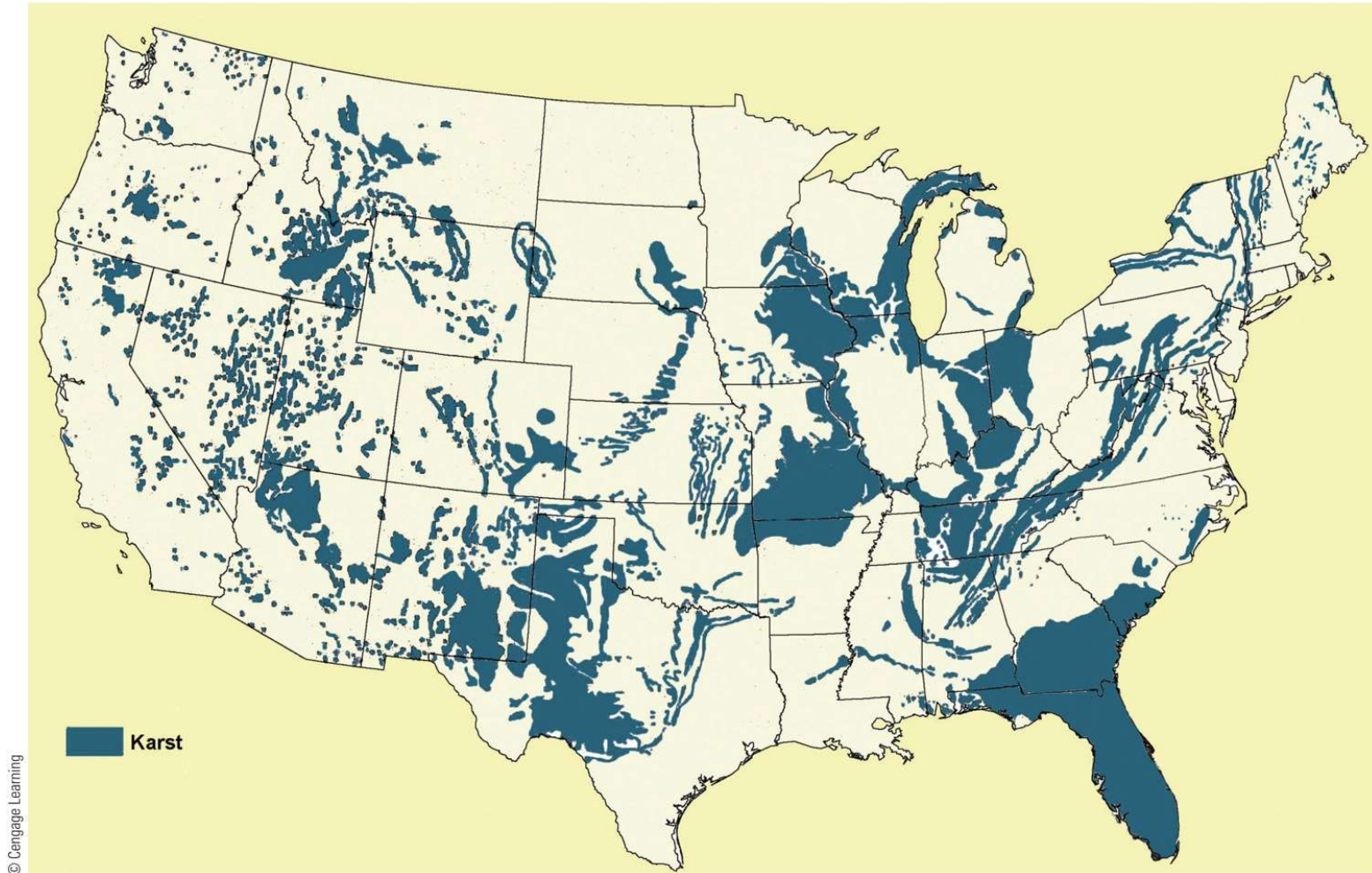
- Subsurface water
 - Dissolves, removes, transports, and deposits rock-forming materials
 - Mechanical role
 - Encourages mass movement
 - Chemical role
 - Carbonation and other solution forms

J. Petersen

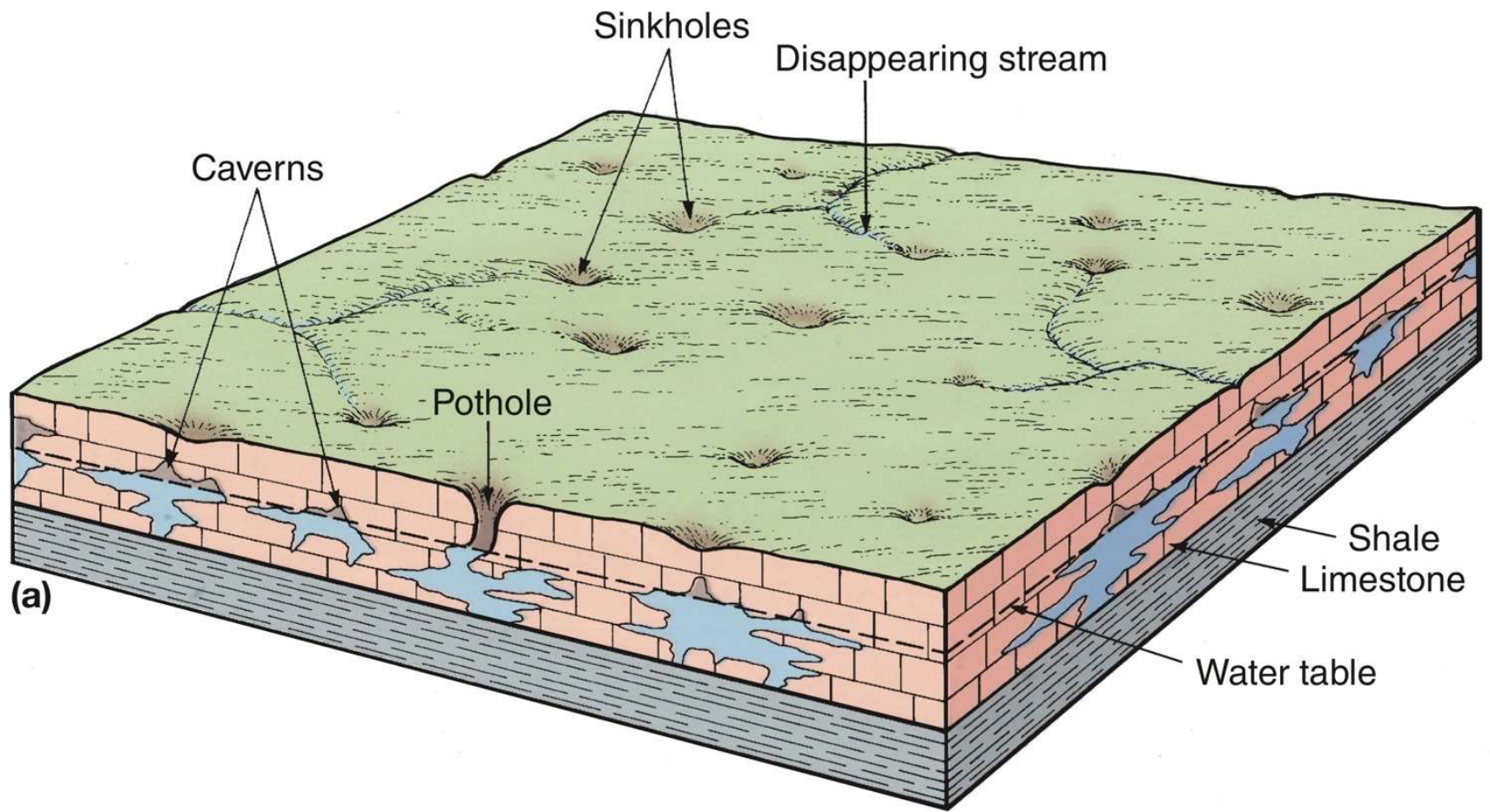


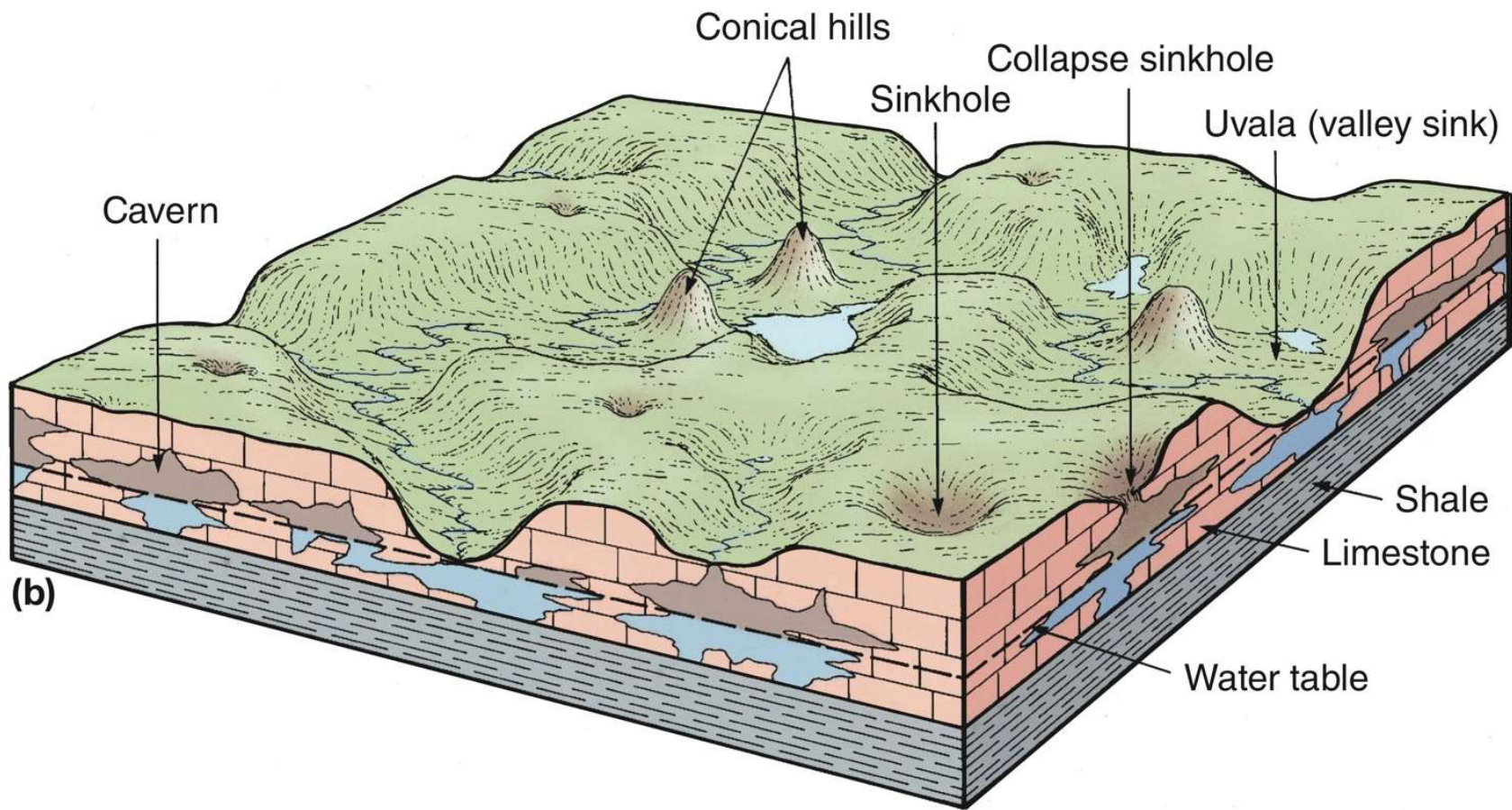
Landform Development by Subsurface Water and Solution (cont'd.)

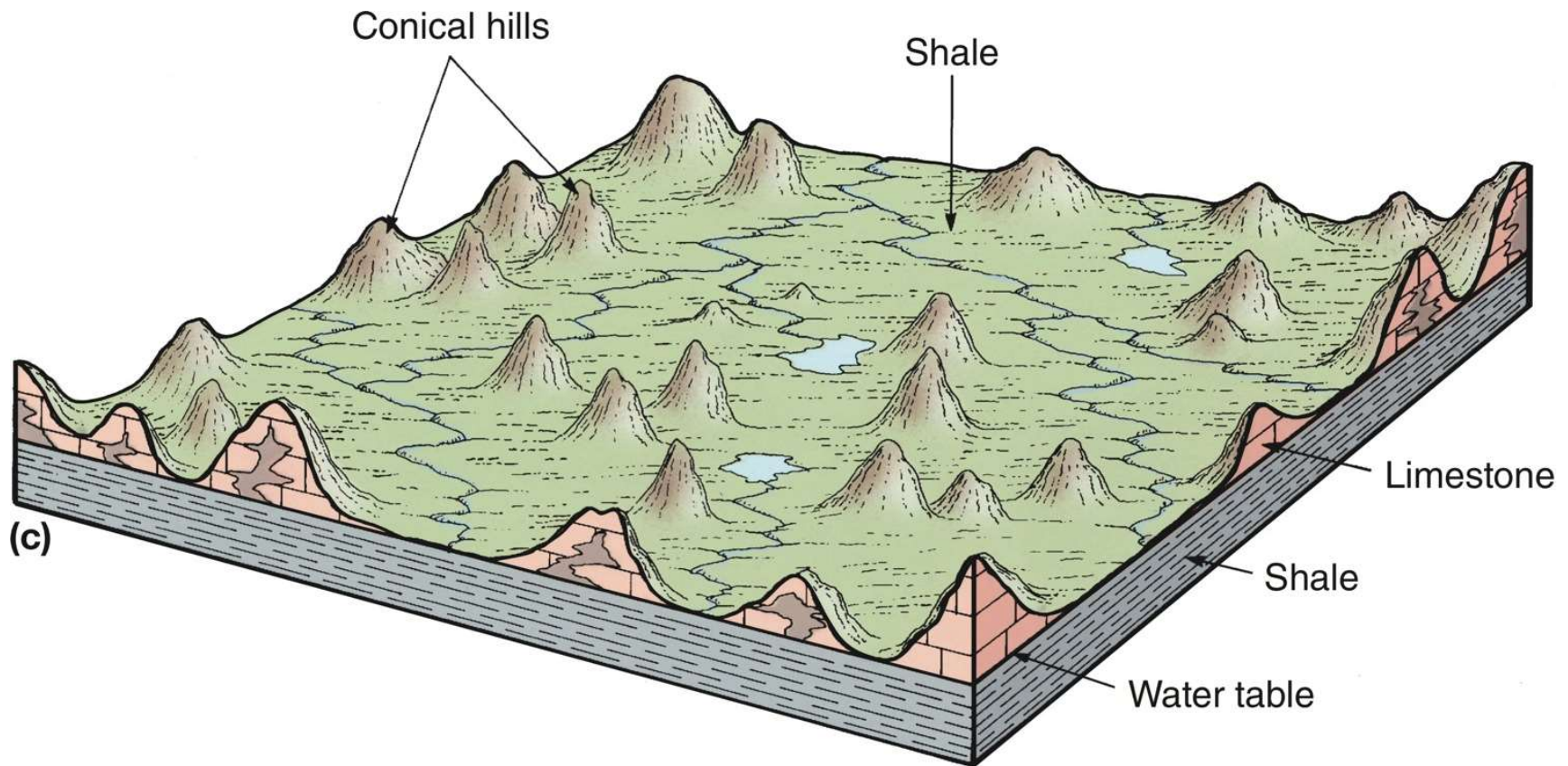
- Karst landforms
 - Landforms features created by the solution and reprecipitation of calcium carbonate
 - Named for Karst Plateau, Croatia
 - Development of karst landscape
 - Warm, humid climate
 - Ample precipitation
 - Carbon dioxide
 - Subsurface water movement



Where is the nearest karst area to where you live?





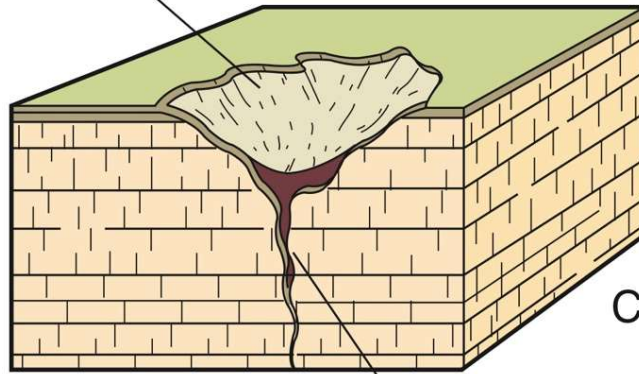


Why are there no major depositional landforms created at the surface in areas of karst terrain?

Landform Development by Subsurface Water and Solution (cont'd.)

- Karst landforms
 - Sinkholes
 - Solution sinkholes
 - Collapse sinkholes
 - Uvalas: valley sinks
 - Disappearing streams
 - Caverns: caves
 - Swallow hole

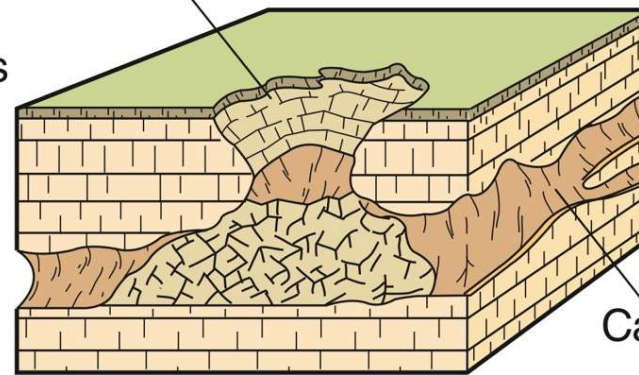
Solution sinkhole



(a)

Fractures

Collapse sinkhole



(b)

Cavern

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Why is a large void below not necessary for a solution sinkhole to form?



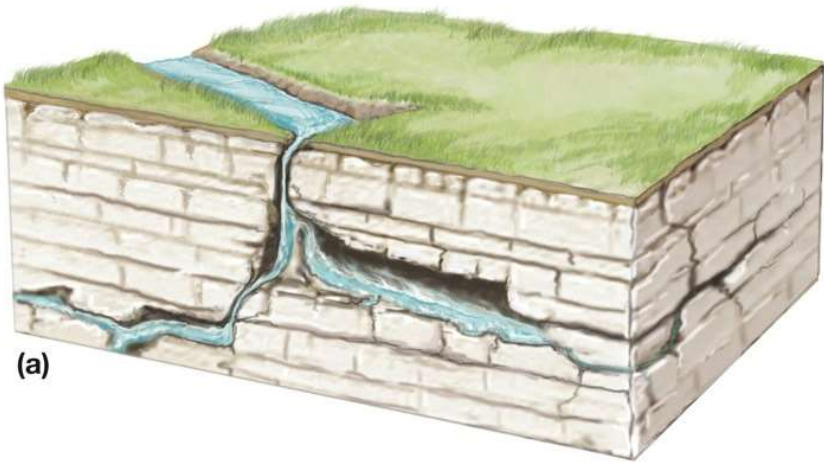
D. Sack

What limitations might solution sinkholes place on the type of agricultural activity undertaken on this farm?

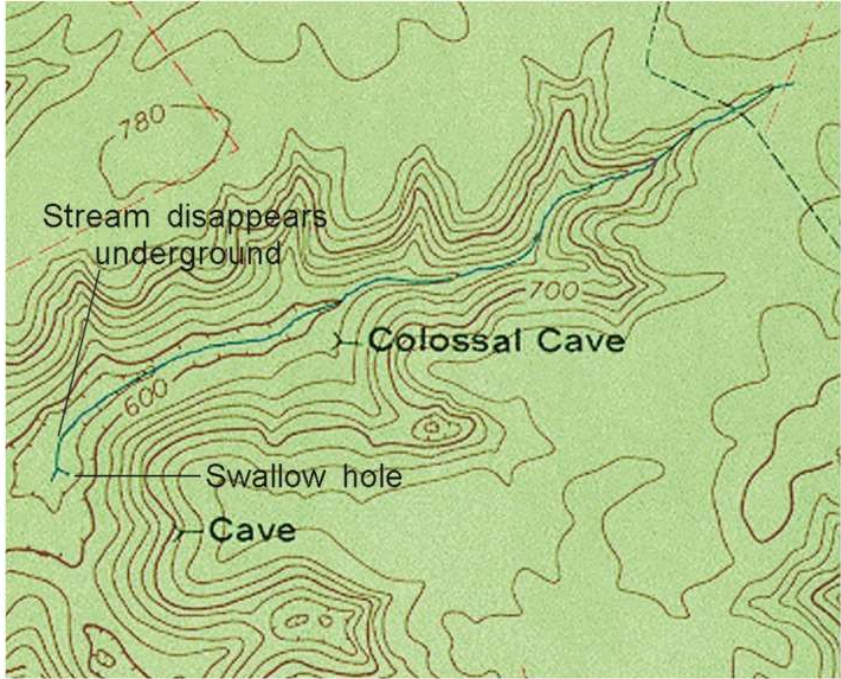
St. Petersburg Times/ZUMAPRESS/Newscom



What human activities might contribute to the occurrence of such hazards?



(a)



(b)

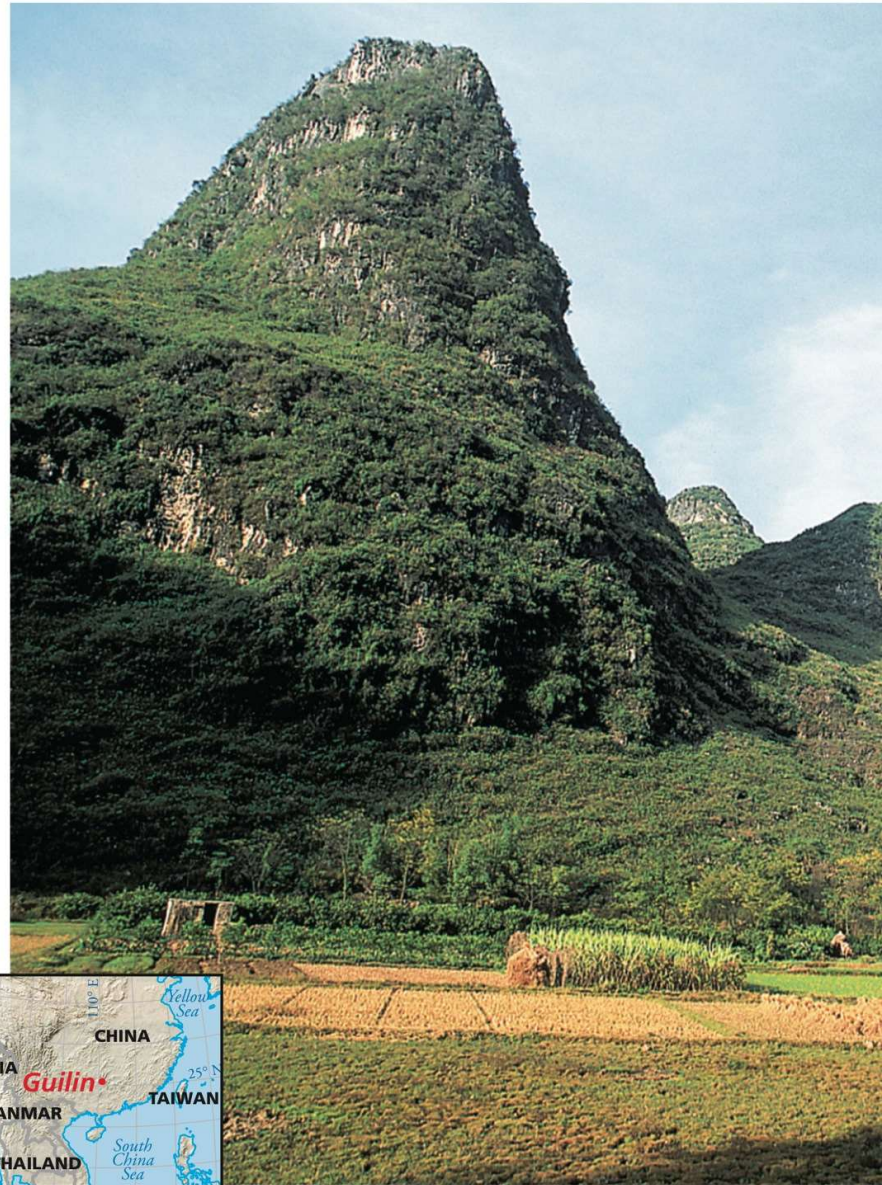
Landform Development by Subsurface Water and Solution (cont'd.)

- Karst landforms
 - Conical hills: haystack hills or hums
 - Tower Karst: high and steep-sided

Courtesy Parris Lyew-Ayee



How does tower karst differ from conical hills?



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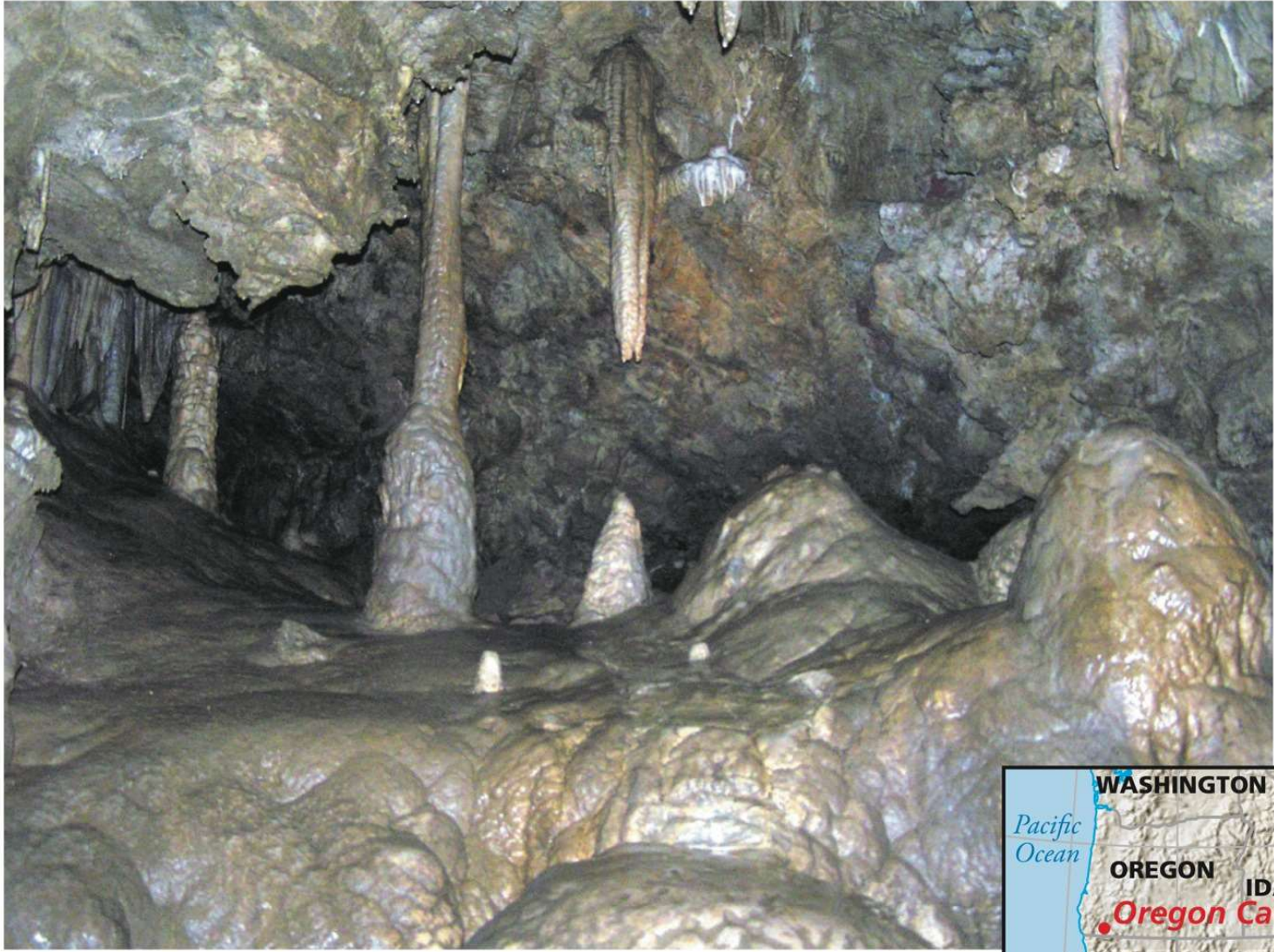
Landform Development by Subsurface Water and Solution (cont'd.)

- Karst landforms
 - Cavern development
 - Strong influence: nature of fracturing
 - Caves
 - Speleothem: chemical precipitate
 - Travertine or dripstone: stalactites, stalagmites, and columns
 - What is speleology?

John Blanton/Shutterstock.com

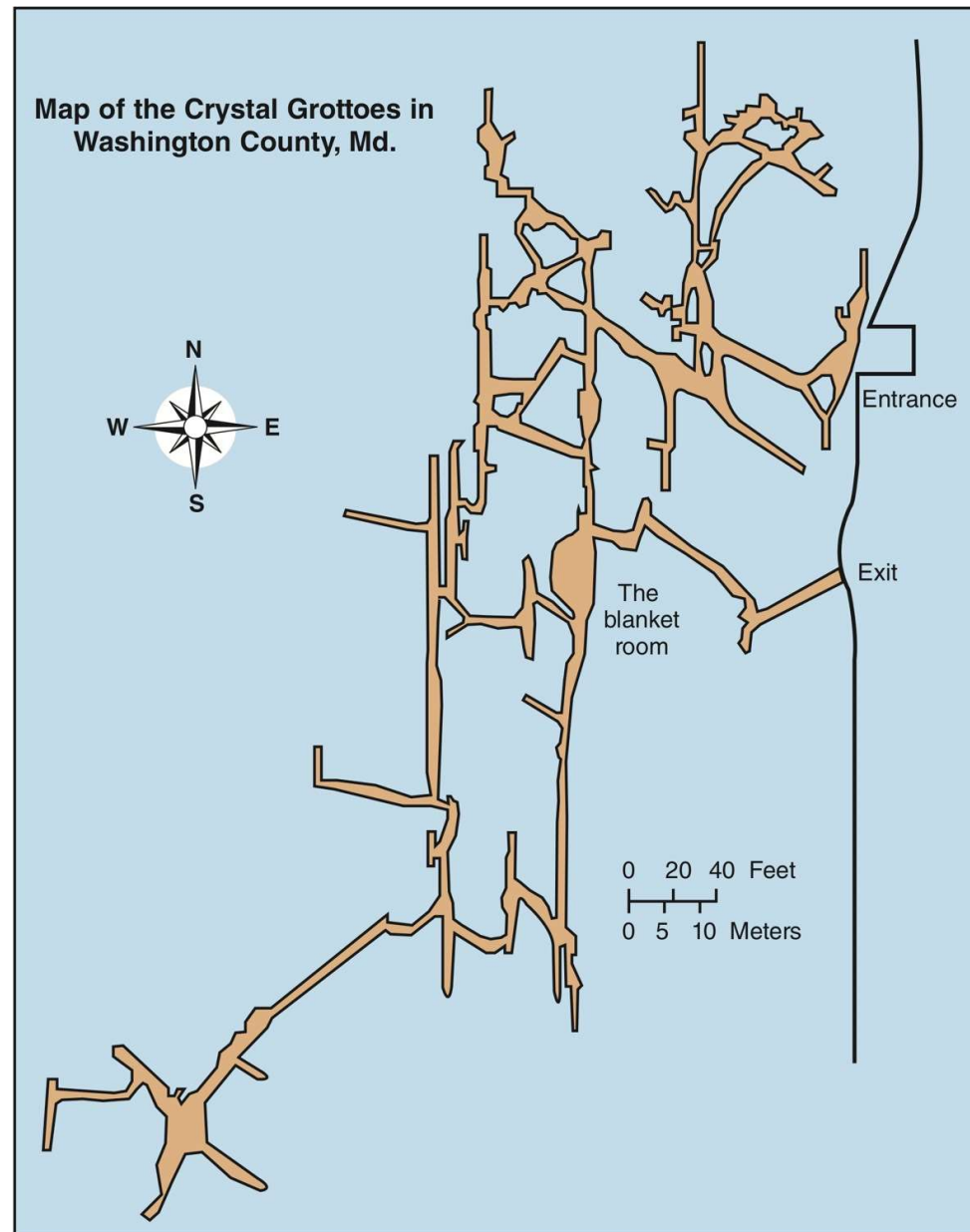


National Park Service Photo, Derek Marohn

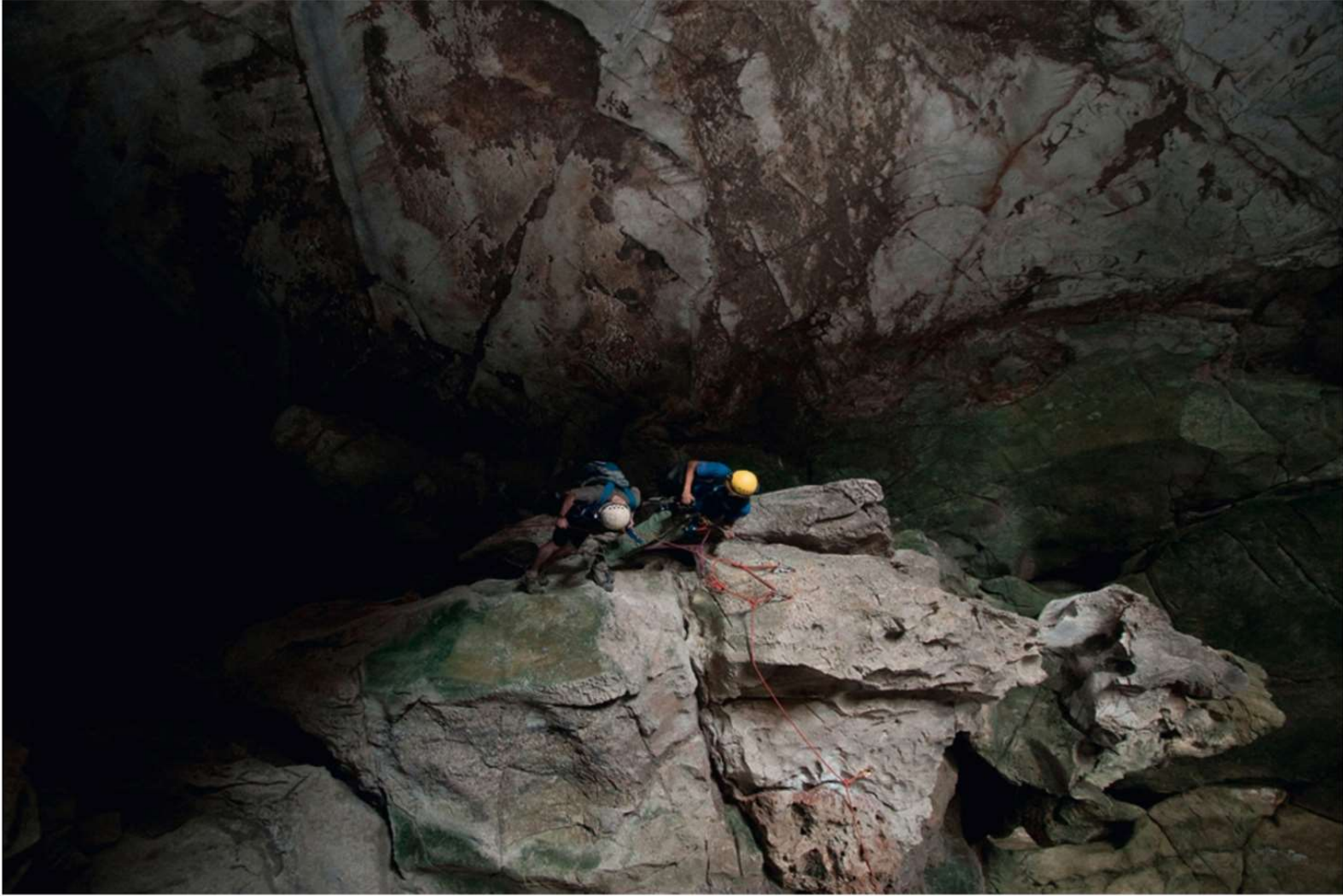


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What does the arrangement of the passageways reveal about the dominant bedrock fracture patterns present in the region?



Dan Morris Photography

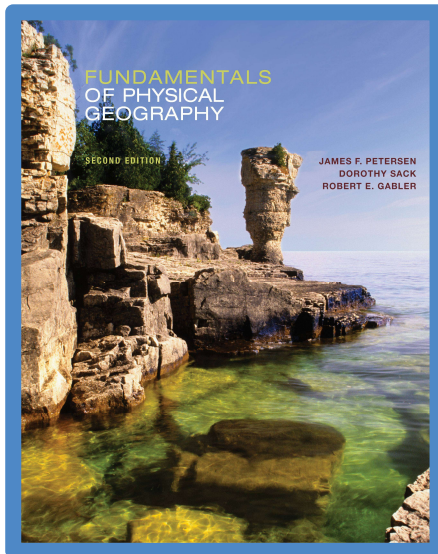


Fundamentals of Physical Geography 2e

Water Resources and Karst Landforms

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<end of chapter>



- ⌘ Peterson
- ⌘ Sack
- ⌘ Gabler