

Earth Science

Chapter 16 - Groundwater

Section 2 – Groundwater and Chemical Weathering

STANDARDS:

SES3. Students will explore the actions of water, wind, ice, and gravity that create landforms and systems of landforms (landscapes).

a. Describe how surface water and groundwater act as the major agents of physical and chemical weathering.

e. Explain the processes that transport and deposit material in terrestrial and marine sedimentary basins, which result, over time, in sedimentary rock.

Objectives

- **Describe how water chemically weathers rock.**
- **Explain how caverns and sinkholes form.**
- **Identify two features of karst topography.**

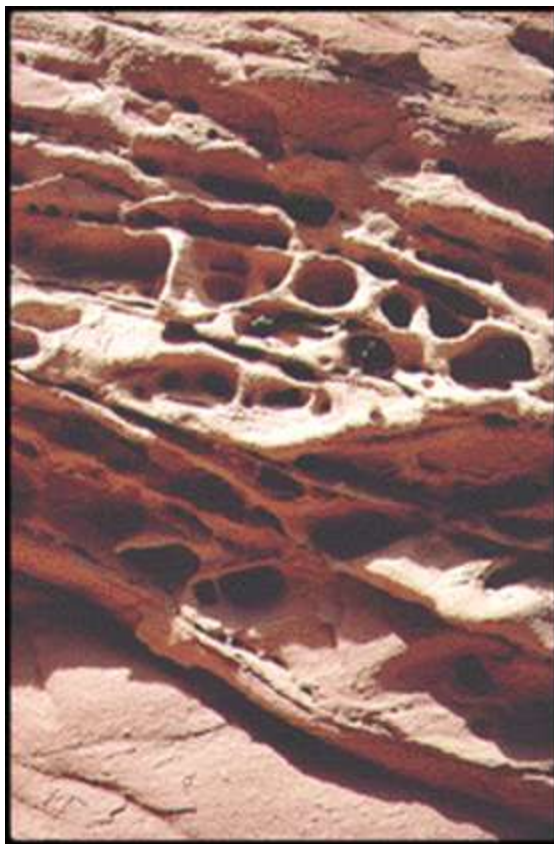
Groundwater and Chemical Weathering

- **As groundwater passes through permeable rock, minerals in the rock dissolve. The warmer the rock is and the longer it is in contact with water, the greater the amount of dissolved minerals in the water.**
- **Water that contains relatively high concentrations of dissolved minerals, especially minerals rich in calcium, magnesium, and iron, is called *hard water*.**
- **Water that contains relatively low concentrations of dissolved minerals is called *soft water*.**

Minerals and Rocks By: Anna, Sarah, and Sumer
Chemical Weathering



Chemical Weathering is the alteration of a rock's internal structure by removing and/or adding elements which produce new minerals. Chemical weathering occurs faster in warm, wet climates. Most rocks at Earth's surface are not chemically stable, and are constantly going through the process known as weathering. Weathering is a process that involves mechanical disintegration which is physical weathering, and chemical decomposition, which is chemical weathering. This is the first step to forming soil. It breaks down the primary minerals in a rock into new *secondary minerals* that are more stable in surface environments. Sometimes plants can cause chemical weathering, and dissolve rocks. This is caused by plant acids, that eat away at the surface of the rock and breaking it's minerals down, to form simpler compounds. Many rocks have been shaped by chemical weathering.





Sometimes they can form caves like the limestone cave above. This cave was formed basically out of precipitation. Limestone rock is dissolved over many years and seeps into the ground and into the cavern, or Limestone cave, and it slowly builds up over many years. All of these rocks have been chemically weathered by one force or another and are now formed to look like this.

Results of Weathering by Groundwater

- **One way that minerals become dissolved in groundwater is through chemical weathering.**
- **As water moves through soil and other organic materials, the water combines with carbon dioxide to form carbonic acid.**
- **This weak acid chemically weathers the rock that the acid passes through by breaking down and dissolving the minerals in the rock.**



Caverns

cavern - a natural cavity that forms in rocks as a result of the dissolution of minerals; also a large cave that commonly contains many smaller, connecting chambers

- **Rocks that are rich in the mineral calcite, such as limestone, are especially vulnerable to chemical weathering.**
- **Although limestone is not porous, vertical and horizontal cracks commonly occur through limestone layers.**
- **As groundwater flows through these cracks, carbonic acid slowly dissolves the limestone and enlarges the cracks.**
- **Eventually, a cavern may form.**

Stalactites and Stalagmites

- **When water containing dissolved calcite drips from the ceiling of a limestone cavern, some of the calcite is deposited on the ceiling.**
- **As this calcite builds up, it forms a suspended, cone-shaped deposit called a *stalactite*.**
- **When drops of water fall on the cavern floor, calcite builds up to form an upward-pointing cone called a *stalagmite*.**

Sinkholes

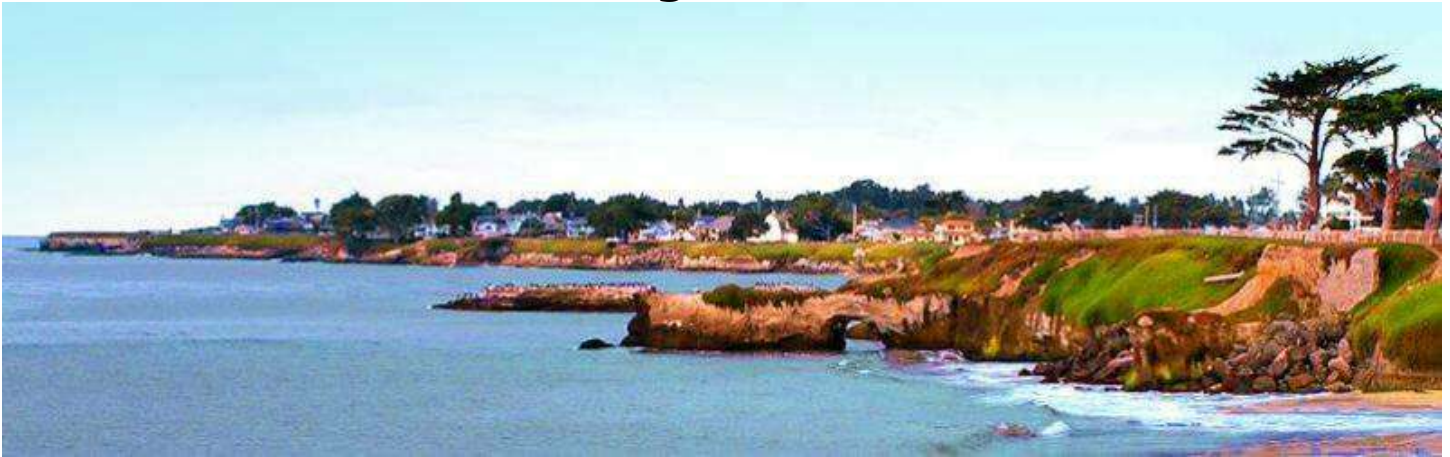
sinkhole - a circular depression that forms when rock dissolves, when overlying sediment fills an existing cavity, or when the roof of an underground cavern or mine collapses

- ***Subsidence sinkholes* form by a similar process except that as rock dissolves, overlying sediments settle into cracks in the rock and a depression forms.**
- ***Collapse sinkholes* may form when sediment below the surface is removed and an empty space forms within the sediment layer.**
- **Collapse sinkholes may also form during dry periods, when the water table is low and caverns are not completely filled with water.**

- Collapse sinkholes may develop abruptly and cause extensive damage.

Natural Bridges

- When the roof of a cavern collapses in several places, a relatively straight line of sinkholes forms.
- The uncollapsed rock between each pair of sinkholes forms an arch of rock called a *natural bridge*.
- When a natural bridge first forms, it is thick, but erosion causes the bridge to become thinner.



- **READING CHECK**

How are sinkholes related to natural bridges?

A natural bridge may form when two sinkholes form close to each other. The bridge is the uncollapsed rock between the sinkholes.

Karst Topography

karst topography - a type of irregular topography that is characterized by caverns, sinkholes, and underground drainage and that forms on limestone or other soluble rock

- **Common features of karst topography include many closely spaced sinkholes and caverns.**
- **Generally, karst topography forms in regions where the climate is humid and where limestone formations exist at or near the surface.**

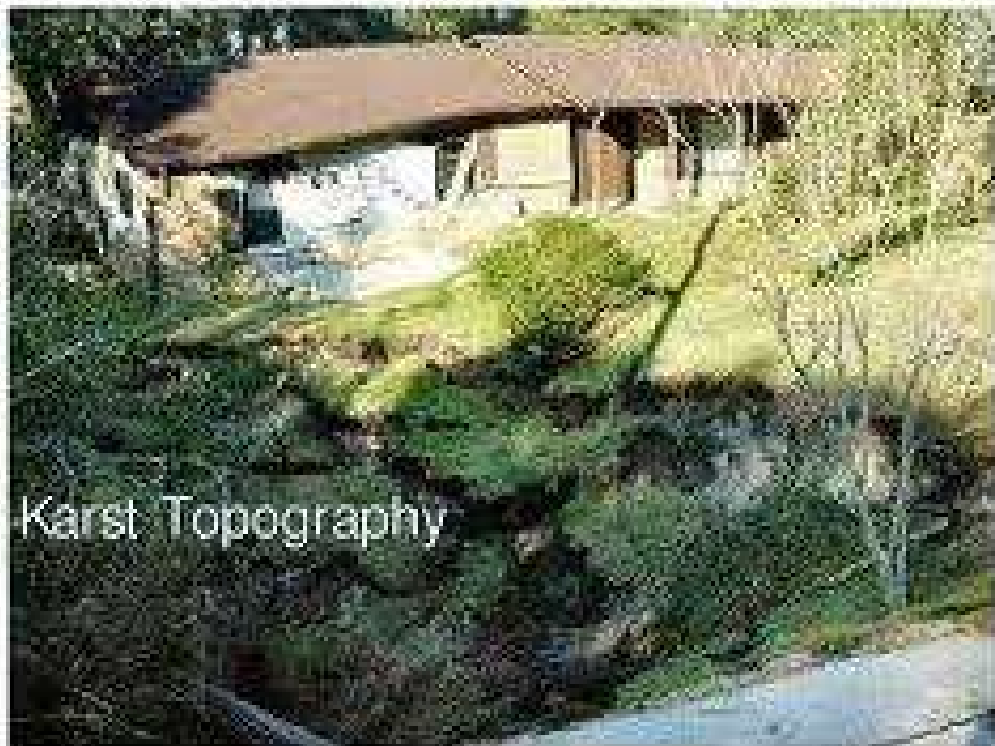
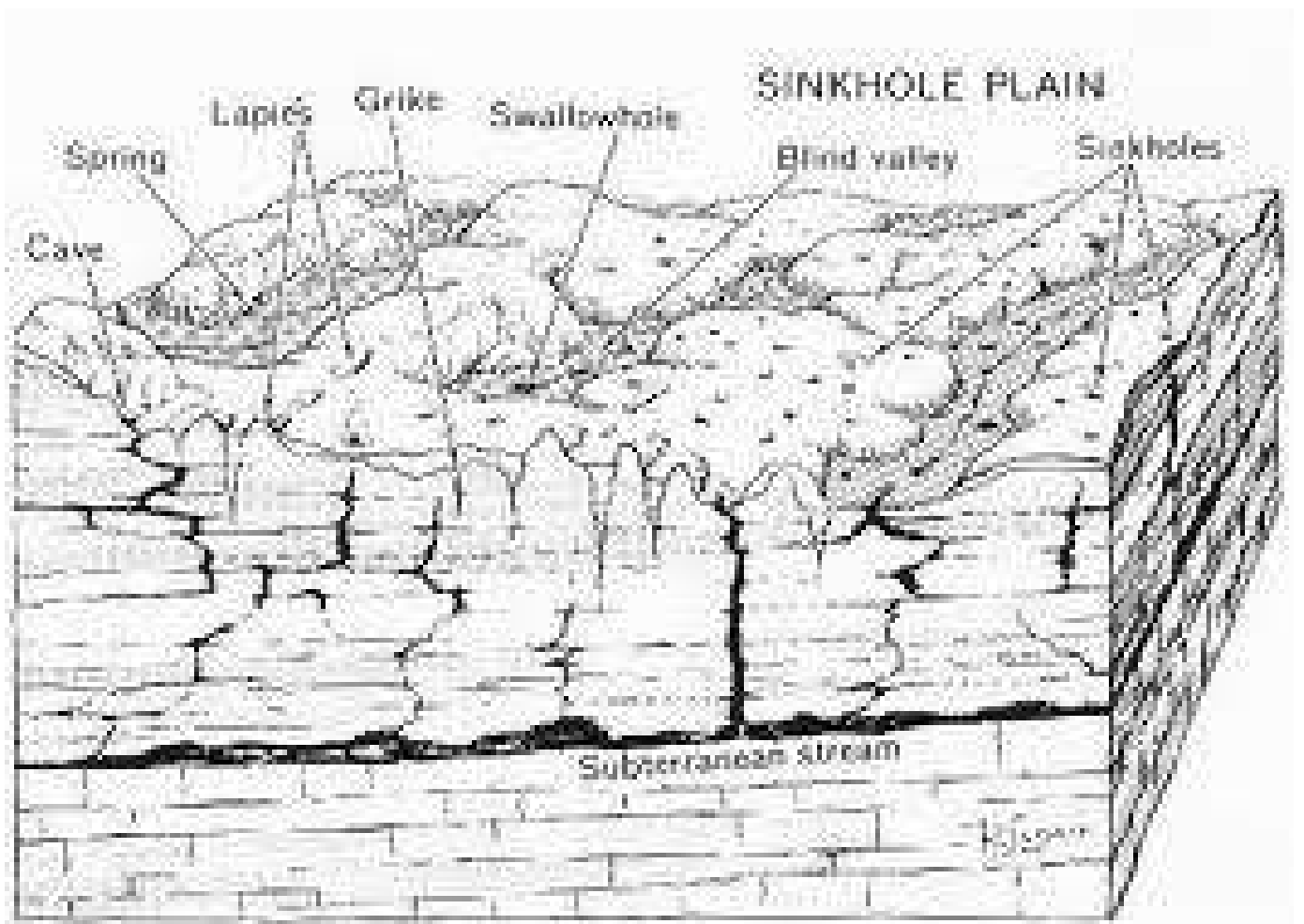


Karst



A complex landscape sculptured by water





The Making of a Sinkhole

