

# Weathering

- In simple terms - “**weathering**” is the simple breaking down of rocks by wind, rain, sleet, etc. over time
- The broken pieces of rocks fall from exposed mountainous areas and are transported away by passing rivers
- Rivers **deposit** the material further downstream

# Two types of Weathering

## Mechanical

- When large rocks are broken into smaller pieces
- Frost and sub-zero temperatures are the main causes
- Plants animals can also cause it (**roots getting into rocks can cause it to crumble**)

## Chemical

- When rocks dissolve as rainwater reacts with minerals in the rock
- Rainwater is the main cause of it

# Weathering

## Mechanical



## Chemical



# Freeze-thaw Action

- By day, rainwater falling onto exposed rock can gather in the cracks and crevasses
- These crevasses are like jugs of water
- By night, temperatures drop at times below freezing causing the water to freeze and expand by 9-10%
- This puts great strain on the rock as they are not flexible (**rocks are not flexible like elastic bands**)

# Freeze-that Action

- By morning, the temperature will have risen causing the ice to **thaw** and contract, returning to it's normal size as water
- The pressure on the rocks is now released
- However, the process of freezing and thawing over many thousands of years will eventually become too much for the rocks, causing them to break up into small pieces of **scree** which gather at the bottom of mountain slopes

Scree (small rock which once was part of the mountain itself)



# Carbonation

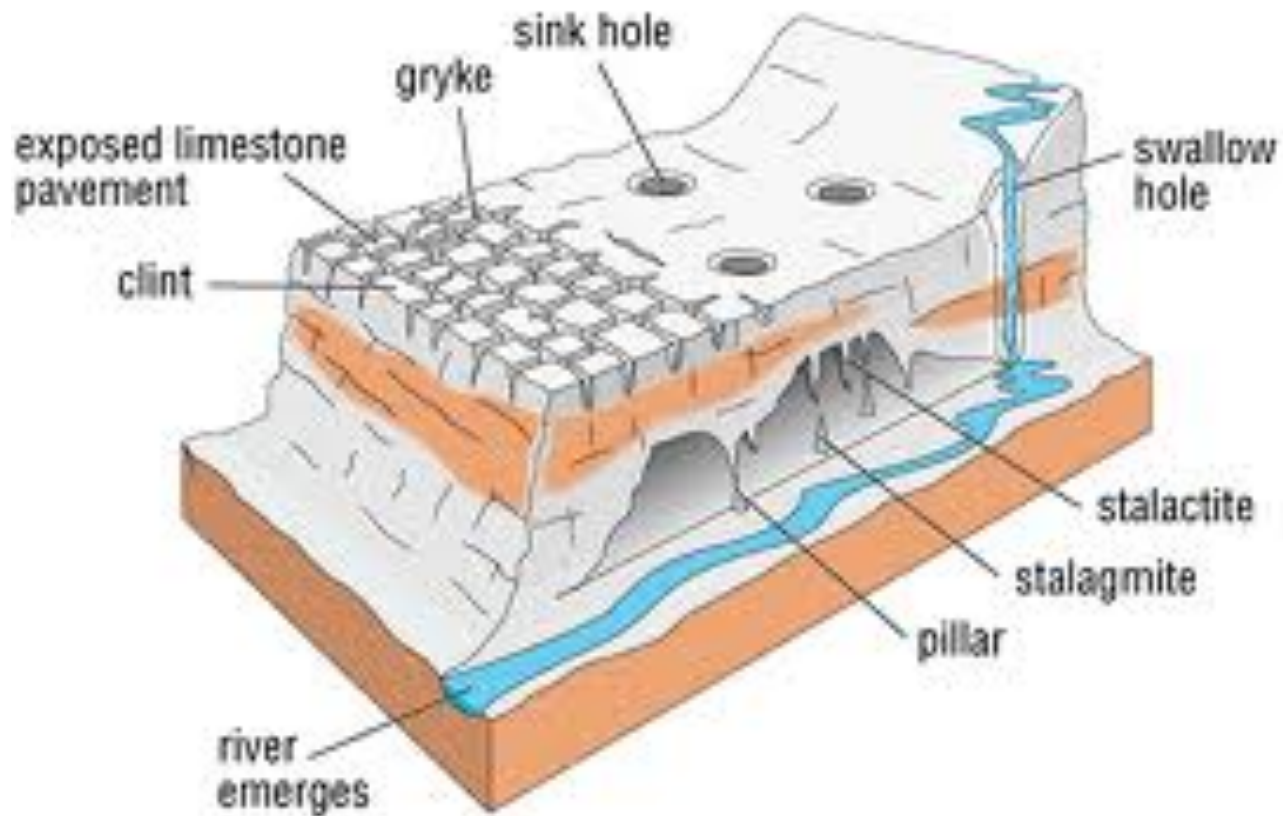
- Carbonation is a process of chemical weathering and involves the journey of rainwater through the atmosphere, onto the earth's surface, and into the limestone rock
- When rainwater falls from clouds it mixes with gases in the atmosphere, forming a **weak carbonic acid**
- This weak carbonic acid then falls onto the exposed limestone, where it mixes with a mineral known as **calcium carbonate**

# Carbonation

- The result of this mixing is the formation of an agent known as **calcium bicarbonate**
- This calcium bicarbonate is very erosive and can carve out various different features in the limestone, both on the surface and below it as the limestone is less resistant to erosion



# Limestone Features



# Limestone Features

## Surface Features

- Limestone Pavement
- Clints (**blocks**)
- Grikes (**groves**)
- Swallow hole
- terraces

## Underground Features

- Passage
- Cave
- Cavern
- Stalagmites (**bottom**)
- Stalactites (**top**)
- Pillars

# Limestone Features - Stalactites

- **Carbonation** plays an important role in the development of underground features like stalagmites and stalactites.
- As rainwater passes through the atmosphere it encounters gases like carbon dioxide, which turns the water in a weak **carbonic acid** (increasing erosive power of water).
- On reaching the rock surface, the weak carbonic acid mixes with minerals in the limestone such as **calcium carbonate**, thus creating **calcium bicarbonate**.

# Limestone Feature - Stalactites

- This transformation of water into this erosive substance helps carve out an underground cave over many thousands of years.
- On reaching the roof of the cave, some of the water **evaporates** (it is a liquid) leaving the solid particle of calcite on the roof of the cave.
- Over time this constant process of evaporation and deposition causes the calcite to grow downwards from the roof of the cave to form a carrot-shaped **stalactite**.

# Limestone Features - Stalagmites

- Other droplets of water drop on to the floor of the cave and evaporate there instead.
- The force of the falling water creates a “**splash-effect**”, dispersing the calcite irregularly along the floor of the cave.
- This constant process repeats itself over thousands of years to form irregular shapes growing up from the floor known as **stalagmites**

# Limestone Features - Limestone Pavement

- A limestone pavement is a large, flat area of limestone that has had its soil cover removed and have been exposed at the surface over a long period of time.
- Limestone is made up of layers of permeable strata. Water can pass through the surface layer of the limestone, thereby eroding it through the process of carbonation

# Limestone Features - Limestone Pavement

- The powerful force of the falling water erodes area of less resistant limestone, causing them to wear away to form fissures known as grikes.
- The areas of more resistant limestone is eroded at a slower pace, allowing blocks of limestone (clints) to form, which are separated on either side by grikes.