

# EARTH'S CHANGING SURFACE



# Weathering

Together, weathering and erosion work continuously to wear down the material on Earth's surface.

**weathering** – process that breaks down rock and other substances of Earth's surface

**erosion** – removal of rock particles by wind, water, ice or gravity

Weathering acts slowly, but over time will break down the largest and hardest of rocks

**mechanical weathering** – rock is physically broken down into smaller pieces by processes

**chemical weathering** – process that breaks down rocks through chemical changes

# Mechanical Weathering

Abrasion	Rock particles wear away rock
Freezing & Thawing	Breaks rock by ice wedging
Animal actions	Ground breaks away by animals burrowing
Plant growth	Roots grow into cracks of rocks and pry them apart



# Chemical Weathering

Acid Rain	Results from burning fossil fuels causing minerals to wear away rapidly
Carbonic Acid	Forms from $\text{CO}_2$ dissolving in water then weathers marble and limestone
Living Organisms	Plants produce weak acid that slowly dissolve rock that surround roots
Oxygen	Oxidation produces rust on some rocks that have iron



# Important factors that determine the rate at which weathering occur are:

- **climate** – refers to the average weather conditions in an area; both types of weathering occur faster in wet climates
- **type of rock** – some minerals dissolve faster than others

# Soil Formation

# Soil formation

- **bedrock** – solid layer of rock beneath the soil; once exposed bedrock gradually weathers in smaller particles that are the basic material of soil
- **soil** – loose mixture of rock particles, minerals, decayed organic material, air and water in which plants can grow

# Soil formation

- **humus** – dark colored substance in soil from decayed organic material
- **fertility** – measure of how well soil supports plant growth
- **loam** – soil that is made up of equal parts of clay, sand, and silt; best for growing most types of plants

Soil formation continues over a long period and gradually develops layers called horizons.



Cross section of soil showing horizons.

Soil formation continues over a long period and gradually develops layers called horizons.

- **topsoil** – the “A” horizon or the top layer is crumbly, dark brown mixture of humus, clay and other mineral
- **subsoil** – the “B” horizon in below topsoil consisting of clay and other particles washed down from top soil, but little humus
- **“C” horizon** – bottom layer containing partly weathered rock

Soil is full of living organisms – some are decomposers that break down the remains of dead organisms and others mix the soil, making space for air and water which help plants thrive.



# Soil conservation – management of soil to prevent its destruction

- **contour plowing** – farmers plow their fields along the curves of the slope to help slow runoff of excess rainfall, which may wash away the soil
- **conservation plowing** – farmers leave dead weeds and stalks of previous year's crops to all return nutrients to the soil, retain moisture and hold the soil in place
- **crop rotation** – farmer plants different crops in a field each year

# Erosion & Deposition

## Water and Wind

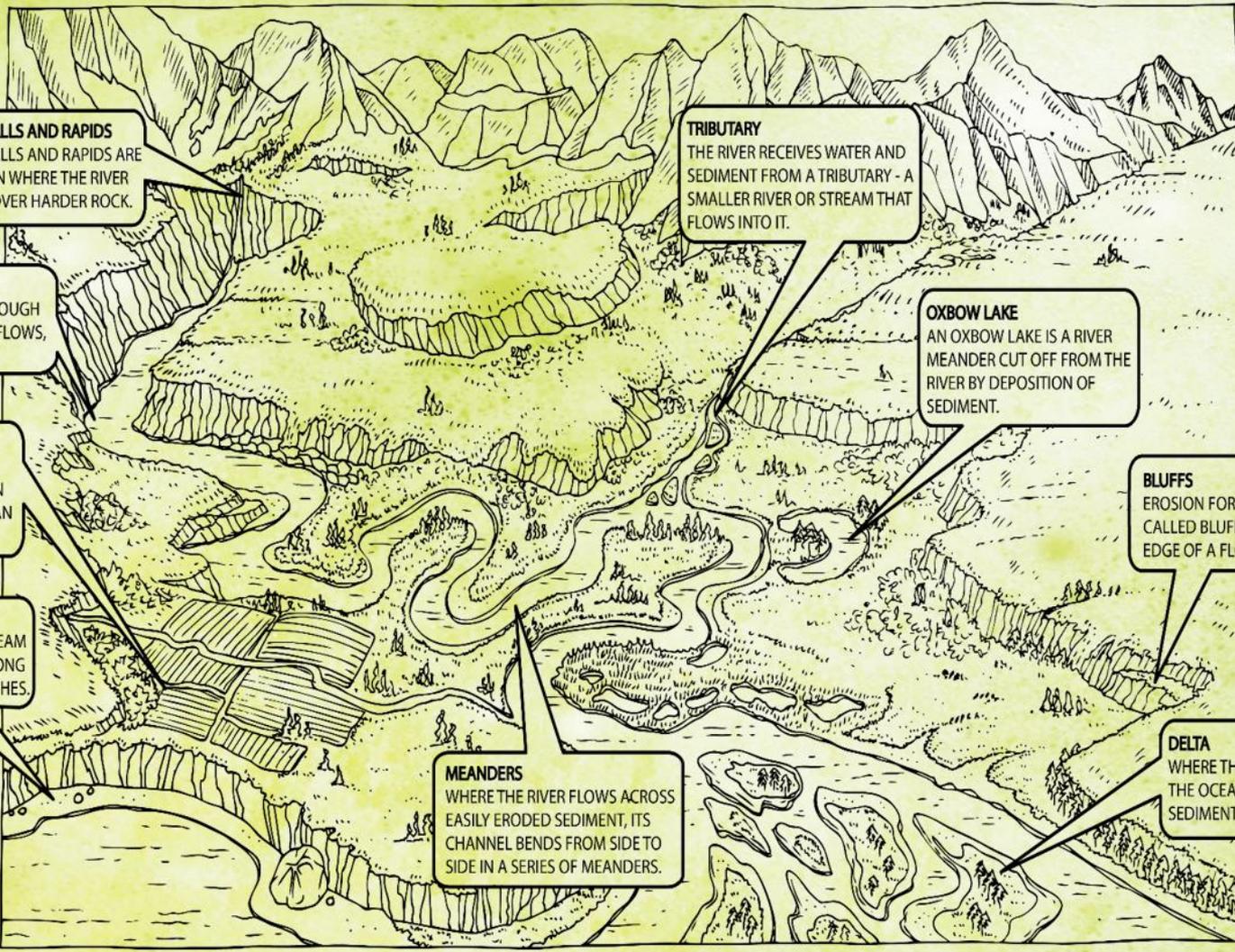
# Water Erosion & Deposition

Moving water is a major agent of erosion, especially along streams, rivers, at beaches, and underground.

- **stream** – active water channel that erodes land and transports sediment
- **river** – form on steep mountain slopes

# Rivers form a variety of features:

- **waterfalls** – occur where a river meets an area of rock that erodes slowly
- **flood plains** – flat, wide area of land along a river that is often covered when the river overflows during a flood
- **meanders** – loop-like bend in the course of a river and becomes more curved over time
- **oxbow lakes** – meander that has been cut off from sediments being deposited and damming up the ends
- **delta** – sediment deposited where a river flows into an ocean or lake and builds up a landform



**WATERFALLS AND RAPIDS**  
WATERFALLS AND RAPIDS ARE COMMON WHERE THE RIVER PASSES OVER HARDER ROCK.

**V-SHAPED VALLEY**  
NEAR ITS SOURCE, THE RIVER FLOWS THROUGH A DEEP, V-SHAPED VALLEY. AS THE RIVER FLOWS, IT CUTS THE VALLEY DEEPER.

**FLOOD PLAIN**  
A FLOOD PLAIN FORMS WHERE THE RIVER'S POWER OF EROSION WIDENS ITS VALLEY RATHER THAN DEEPENING IT.

**BEACHES**  
SAND CARRIED DOWNSTREAM BY THE RIVER SPREADS ALONG THE COAST TO FORM BEACHES.

**MEANDERS**  
WHERE THE RIVER FLOWS ACROSS EASILY ERODED SEDIMENT, ITS CHANNEL BENDS FROM SIDE TO SIDE IN A SERIES OF MEANDERS.

**TRIBUTARY**  
THE RIVER RECEIVES WATER AND SEDIMENT FROM A TRIBUTARY - A SMALLER RIVER OR STREAM THAT FLOWS INTO IT.

**OXBOW LAKE**  
AN OXBOW LAKE IS A RIVER MEANDER CUT OFF FROM THE RIVER BY DEPOSITION OF SEDIMENT.

**BLUFFS**  
EROSION FORMS CLIFFS CALLED BLUFFS ALONG THE EDGE OF A FLOOD PLAIN.

**DELTA**  
WHERE THE RIVER FLOWS INTO THE OCEAN, IT DEPOSITS SEDIMENT, FORMING A DELTA.

**groundwater** – underground water that can cause erosion through a process of chemical weathering forming caves

- **stalactite** – formed from deposits in dripping groundwater that hang on the roof of a cave
- **stalagmite** – formed through deposits that build up a cone-shape on the cave floor

**waves** – shape the coastlines through erosion by breaking down rock and transporting sand and other sediment; erode land by impact of great force and **abrasion**, or grinding away at shore

- **beach** – area of deposited sediment carried in by a wave

# Wind Erosion and Deposition

- Wind causes erosion by deflation, or the process by which wind removes surface materials and abrasion.
- Two common types of wind-blown deposits are **dunes**, piles of wind-blown sand and **loess**, or a crumbly, windblown deposit of silt and clay

# Erosion & Deposition: Mass Movement and Glaciers

# Erosion

**erosion** – process by which natural forces move weathered rock and soil, or sediment, from one place to another

Factors that effect rate of erosion

- weather
- climate
- topography
- type of rock

# Deposition

**deposition** – the laying down or settling of eroded material



# Mass Wasting

- **mass wasting** – downhill movement of a large mass of rocks or soil because of the pull of gravity (examples include: landslides, mudslides, slump and creep)



# Glacier

**glacier** – large mass of ice that formed on land and moves slowly across Earth's surface; form in areas where the amount of snowfall is greater than the amount of snowmelt

- **continental glacier** (or ice sheets) – covers large areas of land and move outward from central location; exist today on Antarctica and Greenland
- **valley glacier** (alpine) – long, narrow glacier that forms when snow and ice build up high in a mountain valley

# How Glaciers Shape the Land

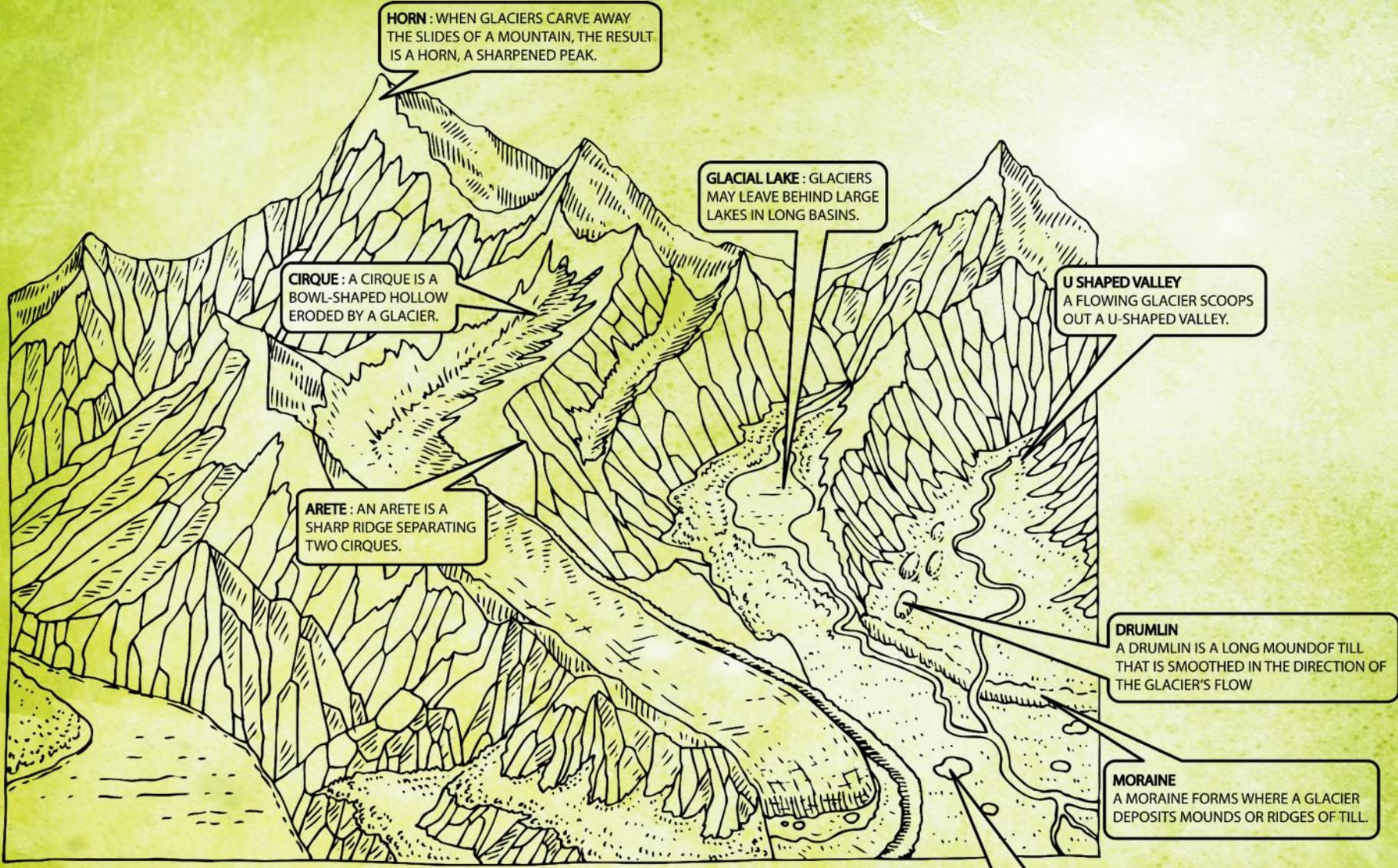
Two processes by which glaciers erode the land and **plucking** and **abrasion**.

**plucking** occurs when a glacier flows over the land, it picks up rocks and large boulders dragging them across the land, causing **abrasions**, or gouges and scratches in the bedrock

# Glacial Depositions

When a glacier melts, it creates various landforms which include:

- **till** – mixture of sediment that is deposited directly on the surface
- **moraine** – ridge formed from till deposited at the edge of glaciers
- **kettle** – small depression that forms when a chunk of ice is left in till then eventually melts



**HORN** : WHEN GLACIERS CARVE AWAY THE SIDES OF A MOUNTAIN, THE RESULT IS A HORN, A SHARPENED PEAK.

**GLACIAL LAKE** : GLACIERS MAY LEAVE BEHIND LARGE LAKES IN LONG BASINS.

**CIRQUE** : A CIRQUE IS A BOWL-SHAPED HOLLOW ERODED BY A GLACIER.

**U SHAPED VALLEY**  
A FLOWING GLACIER SCOOPS OUT A U-SHAPED VALLEY.

**ARETE** : AN ARETE IS A SHARP RIDGE SEPARATING TWO CIRQUES.

**DRUMLIN**  
A DRUMLIN IS A LONG MOUND OF TILL THAT IS SMOOTHED IN THE DIRECTION OF THE GLACIER'S FLOW

**MORaine**  
A MORaine FORMS WHERE A GLACIER DEPOSITS MOUNDS OR RIDGES OF TILL.

**KETTEL LAKE**  
A KETTEL LAKE FORMS WHEN A DEPRESSION LEFT IN TILL BY MELTING ICE FILLS WITH WATER.