



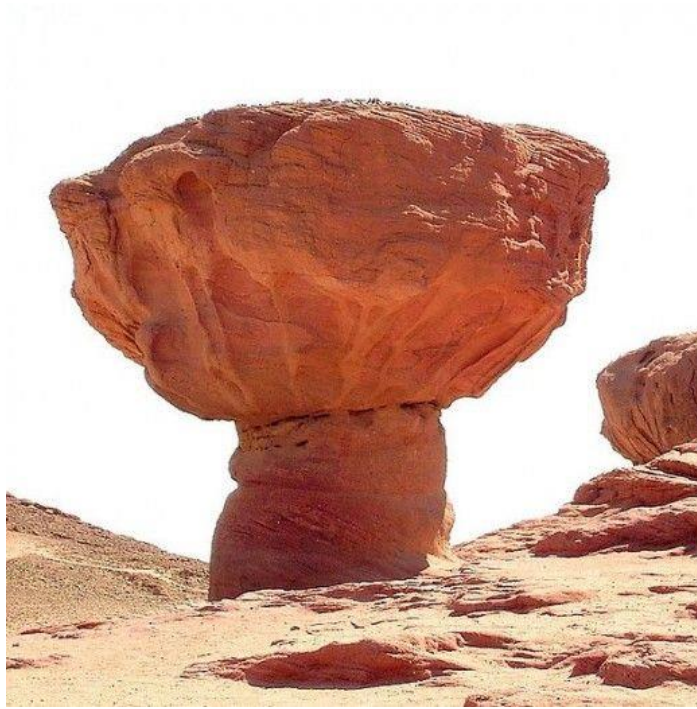
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SP: SOCIAL SCIENCE
GRADE 9: TERM 3
GEOGRAPHY: LEARNER BOOKLET

Learner Name: _____ Grade: 9 _____

SURFACE FORCES THAT SHAPE THE EARTH





WORD BANK

CONCEPT	DEFINITION
Weathering	Describes the breaking down or dissolving of rocks and minerals on the surface of the Earth. Water, ice, acids, salts, plants, animals, and changes in temperature are all agents of weathering.
Physical weathering	Refers to the geological process of rocks breaking apart without changing their chemical composition.
Chemical weathering	Is caused by rain water reacting with the mineral grains in rocks to form new minerals (clays) and soluble salts.
Biological weathering	The weakening and subsequent disintegration of rock by plants, animals and microbes.
Erosion	The process that wears away the river bed and banks.
Hydraulic action	This is the sheer power of the water as it smashes against the river banks.
Abrasion	When pebbles grind along the river bank and bed in a sand-papering effect.
Attrition	When the rocks that the river is carrying knock against each other. They break apart to become smaller and more rounded.
Solution	When the water dissolves certain types of rocks, e.g. limestone.
Deposition	Is the process where material transported by a river is deposited. Deposition occurs when the river loses energy.
River course	Refers to the specific path that a river follows as it crosses the land.
Spur	A piece of land jutting into a river or stream or a ridge descending from mountains into a valley. Spurs are formed from erosion over time and frequently divide tributaries or valleys.

Interlocking spurs	One of any number of projecting ridges that extend alternatively from the opposite sides of the wall of a young, V-shaped valley down which a river with a winding course flows.
V-shaped valley	Is formed by erosion from a river or stream over time. It is called a V-valley as the shape of the valley is the same as the letter "V".
A waterfall	A river or other body of water's steep fall over a rocky ledge into a plunge pool below. Waterfalls are also called cascades.
A gorge	A narrow valley with steep, rocky walls located between hills or mountains. A gorge is often smaller than a canyon, although both words are used to describe deep, narrow valleys with a stream or river running along their bottom.
Floodplain	Is a generally flat area of land next to a river or stream. It stretches from the banks of the river to the outer edges of the valley.
A levee	Is a natural or artificial wall that blocks water from going where we do not want it to go.
An oxbow-lake	Is a U-shaped lake that forms when a wide meander of a river is cut off, creating a free-standing body of water.
Meander	Is one of a series of regular sinuous curves, bends, loops, turns, or windings in the channel of a river, stream, or other watercourse. It is produced by a stream or river swinging from side to side as it flows across its floodplain or shifts its channel within a valley.
Deflation	When small particles are removed, the ground surface gets lower and rockier.
River delta	Is a landform created by deposition of sediment that is carried by a river as the flow leaves its mouth and enters slower-moving or stagnant water.
Sand dunes	Are ridges or hills of sand found at the top of a beach, above the usual maximum reach of the waves.
Sandbar	Also called Offshore Bar, submerged or partly exposed ridge of sand or coarse sediment that is built by waves offshore from a beach.
Suspension	A process whereby fine sediment is transported in a river. When the sediment is deposited from the water it is known as silt .
Saltation	Is a specific type of particle transport by fluids such as wind or water. It occurs when loose materials are removed from a bed and carried by the fluid, before being transported back to the surface.
Creep	Slow downslope movement of particles that occurs on every slope covered with loose, weathered material.
Wave-cut cliffs	Form when waves erode a rocky shoreline. They create a vertical wall of exposed rock layers.
Sea arches	Form when waves erode both sides of a cliff. They create a hole in the cliff.
Sea stacks	Form when waves erode the top of a sea arch. This leaves behind pillars of rock.
Wave-cut platform	A platform is broadened as waves erode a notch at the base of the sea cliff, which causes overhanging rock to fall.
Glacial cirques	Are mountain valley heads which have been shaped into deep hollows by the erosion of small glaciers. Cirques are concave, circular basins carved by the base of a glacier as it erodes the landscape.

An arête	Is a thin, crest of rock left after two adjacent glaciers have worn a steep ridge into the rock.
A horn	Results when glaciers erode three or more arêtes, usually forming a sharp-edged peak.
A glacier	A huge mass of ice that moves slowly over land. Glaciers are often called rivers of ice .
A moraine	Is material left behind by a moving glacier. This material is usually soil and rock.
Drumlin	Oval or elongated hill believed to have been formed by the streamlined movement of glacial ice sheets across rock debris, or till.
A spit	An extended stretch of beach material that projects out to sea and is joined to the mainland at one end.
A sea cave	A type of cave formed primarily by the wave action of the sea. The primary process involved is erosion.
Pit caves	Form in limestone as a result of long-term erosion by water.
Beaches	Are features of deposition found in coastal areas between high and low tide.

TOPIC 1: WEATHERING

UNIT 1: CONCEPT OF WEATHERING

Weathering is the process whereby rocks and minerals near or at the surface of the earth are broken down into smaller pieces. Soil is formed through this process. Weathering is caused by, water, plant growth, animals and changes in the atmosphere. The surface minerals of rock get broken down and are transported away by water, wind or ice. There are three types of weathering: physical, chemical and biological.

PHYSICAL WEATHERING

Physical weathering causes rocks to crumble without any chemical changes. The rocks are broken up into smaller pieces. There are two main types of physical weathering

- **Freeze/Thaw:** When it rains, water runs into the cracks and holes in rocks. If the temperature drops below freezing, the water freezes. The frozen water **expands** and forces the cracks in the rock to widen, eventually breaking the rock apart.
- **Expansion and contraction:** Rocks expand when they are heated, and contract when they are cooled. The particles which make up rocks expand and contract at different rate. This can cause tiny fractures within the rocks and small grains of rock to break off. It is called **granular disintegration**. The sun heats the outer layers of rocks during the day. At night, when it becomes cold these outer layers contract. This causes the thin outer rock layer to crack and peel off. The peeling off of thin layer is called **exfoliation** and it occurs particularly in hot dry climates.

Physical weathering happens mostly in places where there is **little soil and few plants grow**, such as mountain regions and hot deserts.

Activity 1:**Date:**

1. What is weathering?
2. Name the causes of weathering.
3. How are surface minerals transported?
4. List THREE types of weathering.
5. What is physical weathering?
6. Name TWO types of physical weathering.
7. How does frozen water cause rocks to break apart?
8. What is granular disintegration?
9. What is exfoliation?
10. Where does physical weathering mostly occur?

Examples of granular disintegration:

Platberg near Harrismith

**Examples of freeze-thaw weathering:**

Examples of exfoliation:



Exfoliation slabs, Yosemite National Park, California

CHEMICAL WEATHERING

This happens when rocks are weathered due to the effects of chemicals. Rainwater is **slightly acidic because carbon dioxide from the air** dissolves in it. As the rainwater moves through the rocks, minerals in the rocks may react with it. This weakens the bonds between the particles in the rock to cause weathering.

Some types of rocks are easily weathered by chemicals. For example, limestone and chalk, which are made of mineral called calcium carbonate. When acidic rainwater falls on limestone or chalk, it dissolves the rock. This is called carbonation. The acidic rain seeps into the ground and becomes groundwater. Limestone caves form when acidic groundwater seeps through limestone rocks and dissolves holes in the rocks. Over time the holes get bigger, forming caves. The groundwater carries the dissolved materials away. Some rock types are hard and are not easily weathered by chemicals, for example granite.

Oxidation is another kind of chemical weathering that occurs when oxygen mixes with minerals in a rock to form oxides. Rust, for example, is iron oxide. When rocks containing iron are exposed to air the iron is oxidised. This can weaken the rocks and make them crumble. If the rock contains iron it becomes reddish in colour.

It occurs most in places where high temperatures and moisture in the air make chemical weathering happen faster. **Chemical weathering helps to form soil**, so we can find that soils are deeper in warm, moist regions.

Hydrolysis is a cycle of chemical reactions that involve water and minerals called silicates. Silicates are present in many different kinds of rock including sandstone and granite. Certain silicate minerals absorb water and change into clay. Clays are soluble and are easily washed out of rocks. The rock now becomes unstable and may crumble, grain by grain.

Examples of chemical weathering:



BIOLOGICAL WEATHERING

The actions of animals and plants can wear away rocks. This is called biological weathering. For example, burrowing animals such as rabbits, moles and meerkats break up soil and rocks and expose them to the atmosphere. Earthworms and ants also contribute to weathering.

In the countryside bushes and trees can grow from cracks in rocks. This is because plant roots can grow in cracks. As they grow bigger, the roots push open the cracks and make them wider and deeper. Eventually pieces of rock may fall away. We often see parts of roads and pavements that have been lifted by tree roots.



Activity 2:

Date:

1. Describe what happens in the freeze/thaw stage of physical weathering.
2. What is chemical weathering?
3. What happens to rainwater during chemical weathering?
4. Where does chemical weathering occur the most?
5. What is the product of chemical weathering? (what does it make?)
6. Are all rocks weathered in the same way? Why not?
7. Discuss how biological weathering occurs.
8. Describe the process of hydrolysis.

IMPACT OF HUMAN ACTIVITIES ON WEATHERING

Humans add to BIOLOGICAL weathering every time they change the surface of the ground by removing soil and rock, building roads, making dams and all types of construction. To build roads, people sometimes use dynamite to blast large rocks along mountainsides.

Chemical weathering by humans is mostly due to pollution. Many chemicals dumped on the ground and in rivers increase chemical weathering.

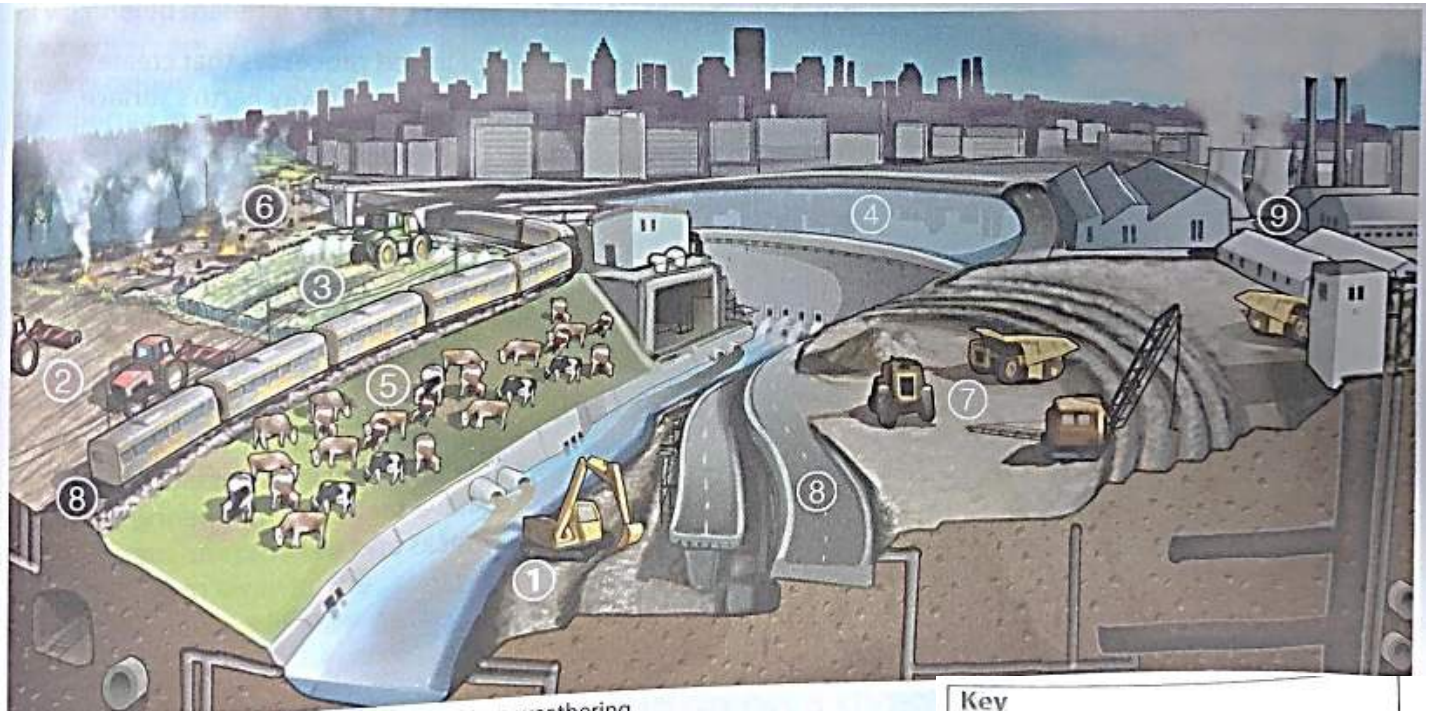
People can cause biological weathering just by walking. Over time, paths in the countryside become damaged because of all the feet wearing them away.

Sometimes farmers clear the ground by burning the vegetation. This causes chemical changes in the soil and can cause rocks to break up because of the intense heat.

When humans burn fossil fuels such as coal, oil and natural gas, carbon dioxide and sulphur dioxide escape into the air. These dissolve in the water in the clouds and make the rainwater more acidic than normal. This type of rain is called **acid rain**. Acid rain makes chemical weathering happen more quickly. Buildings and statues made from rock are damaged as a result.

Effects of acid rain:



Activity 3:**Date:**

1. Identify ONE example from the drawing of each:
 - a. Physical weathering
 - b. Chemical weathering
 - c. Biological weathering
2. Name some of the ways that human activities expose soil and rocks.
3. Describe one-way human activities contribute to chemical weathering.
4. What human activity has increased biological weathering, as you can see in the drawing?

Key

1. New rocks exposed to weathering by roads
2. Vegetation removed and soil exposed by machines
3. Human activities add chemicals to the air, soil and water
4. Dams take up land which could have been used for farming
5. Animals change the soil and rocks when they burrow, walk and spread their waste
6. Heat from fires changes the physical and chemical composition of soil
7. Underground tunnels weaken rocks and soil
8. Roads and railways bring pollution to the countryside
9. Human settlements pollute the air and water

Activity 4:**Date:**

1. Look at the pictures labelled A – E below. For each picture state whether it causes physical, chemical or biological weathering.

A**B****C****D****E**

2. Look at the pictures below labelled A – D. For each picture state what process has caused the weathering.



TOPIC 2: EROSION AND DEPOSITION

DIFFERENCE BETWEEN WEATHERING, EROSION AND DEPOSITION

Weathering occurs when rocks and minerals are broken down into smaller pieces. Erosion is the movement of these weathered materials by water, wind or ice. Wind, water and ice are the main agents of erosion: they transport the broken down rocks. Deposition is when sediment and broken down substances are deposited (laid down). This often occurs when the agent, for example the river or the wind, slows down and no longer has enough energy to carry the sediments.

	Weathering	Erosion	Deposition
Definition:	Decomposition (breaking down) of rocks, soil and their minerals. No movement of material takes place	Movement of soil, mud, rock and other particles, usually by wind, water or ice.	Laying down of eroded material, usually by water, wind or ice.
Types:	Physical, chemical and biological	Water, wind, ice, gravity	Water, wind, ice
Result:	Small particles of rock, soil	Land forms are created by the removal of rock and soil particles	Landforms are built up by deposited material



Different kinds of weathering that affect Earth's surface

- Frost shattering
- Exfoliation
- Carbonation
- Oxidation
- Biological weathering

Weathering

Weathering is the breaking down of rocks and soil by the action of the weather. There is very little movement other than loose material falling under the force of gravity. We have seen that weathering attacks rocks and soil in a number of ways.



Water, wind, and ice erode the surface of Earth

- Ice erosion
- River erosion
- Wind erosion

Erosion

Erosion always involves movement whereas weathering happens in one place. The three agents of erosion are water, wind and ice.



Weathered and eroded material is eventually deposited on the land

- Sand dunes
- Beach

Deposition

Weathering and erosion produce rocks, sand and soil. This material is deposited in places on the land. Some of the features made by deposition are sand dunes, **scree** slopes, beaches, and **river deltas**. You will learn more about deltas in Unit 2.

Activity 5:

Date:

1. What are the differences between weathering, erosion and deposition.
Draw the following table in your notebook to complete the answer.

Weathering	Erosion	Deposition
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2. Give examples of the following:
 - Weathering
 - Erosion
 - Deposition
3. Refer to **PAGE 6: CHEMICAL WEATHERING**
 - a. Write the names of the following minerals next to the correct chemical weathering processes: granite, iron, limestone.
 - b. Think of examples of how chemical weathering may benefit people.

RIVERS – FEATURES OF EROSION AND DEPOSITION

Running water is the most important agent of erosion. Rivers erode, transport and deposit all the time. The main feature caused by river erosion is the river valley itself. A river can be divided into three sections as it flows in its valley from its source in the mountains to its mouth at the sea. They are the upper course, middle course and lower course. We will look at the effects of erosion and deposition in each of these sections of a river.

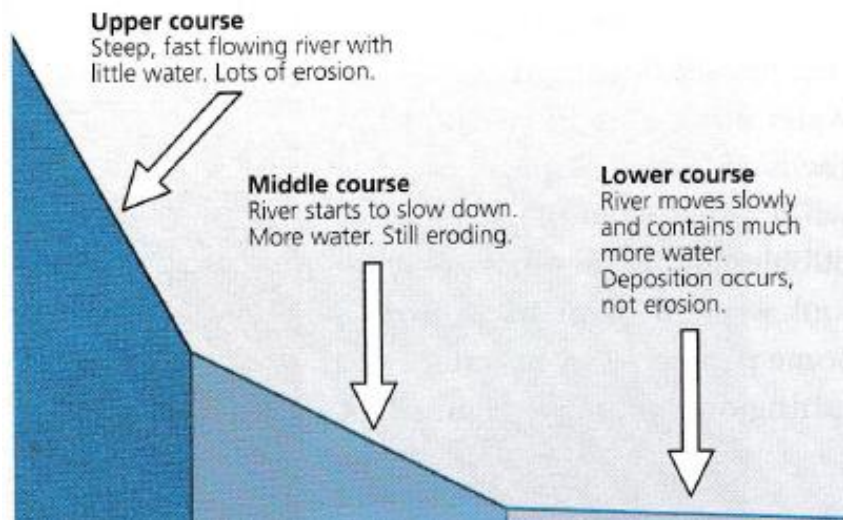
Sediment: solid material that has been or is being eroded, transported and deposited

Source: where river starts

Mouth: where river ends

A river moves its load by:

- Rolling large stones and boulders along the bottom of the channel
- Carrying sand, mud and silt in suspension
- Carrying minerals in solution



THE UPPER COURSE

Erosion is the main process in the upper course of a river. Hardly any deposition takes place. At high elevations, rivers are narrow and have steep gradients. The river flows fast and moves large rocks along the bottom of its bed. These rocks deepen the river valley by cutting downwards, causing a steep sided V shaped valley. It is two or three times deeper than it is wide. The tributaries are short and steep. Between the tributaries are ridges of harder rock around which a river is forced to wind as it moves downstream. These are called interlocking spurs. They form where the river is forced to swing from side to side around these more resistant ridges.

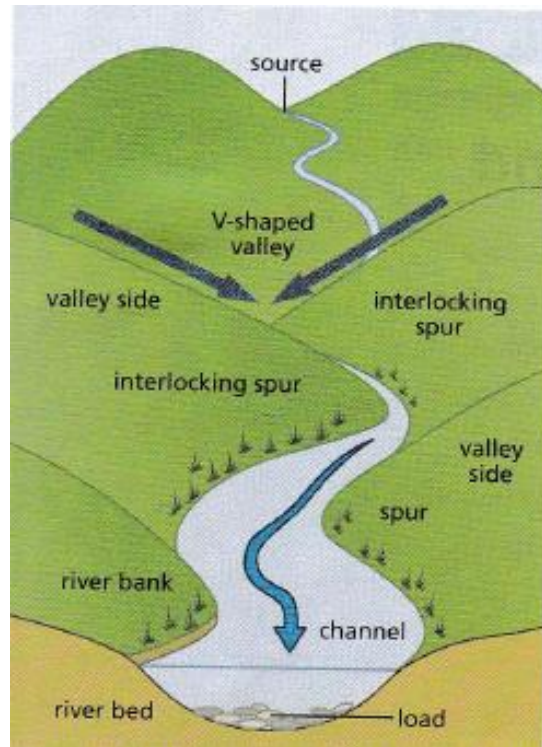
Activity 6:

Date:

1. Name the most important agent of erosion.
2. What are three divisions of a river?
3. How does a river move its load?
4. Define the following:
 - a. Sediment
 - b. Source

- c. Mouth
5. Explain what happens at each river division.
 6. Name the main process in the upper course of the river.
 7. Explain how interlocking spurs are formed.

Features of a rivers upper course



A rapid is fast flowing and turbulent part of a river. Rapids are formed in the upper course of a river where harder rock is exposed in the course of the quickly flowing river. The water flows over and around the harder rock. Rapids form white water when the water bubbles and rushes making it look white, violent and frothy. A waterfall is a sudden drop in a river's gradient.

Gorges and canyons are deep-sided valleys that have been formed by downward river erosion. Gorges are linked to waterfall formation. A gorge is usually straighter than a canyon.

A canyon usually forms when a river flows faster and downward erosion increases.

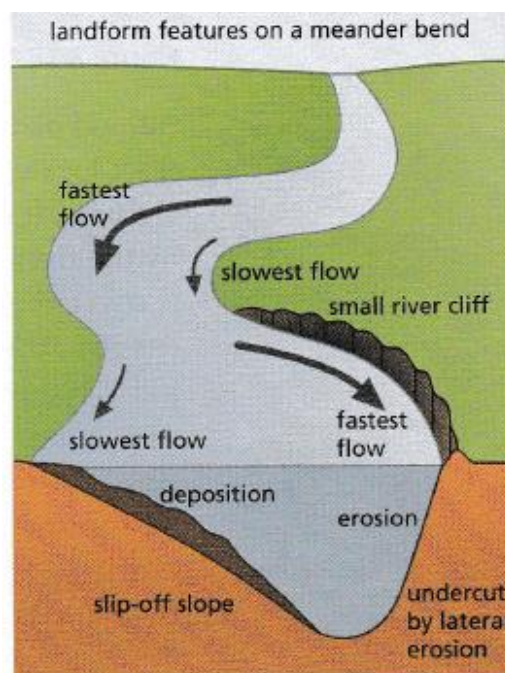


THE MIDDLE COURSE

Erosion is still the main process in the middle course of a river, but some deposition also takes place. The river flows more slowly and the tributaries are longer. The river channel becomes much wider and deeper. Its valley is wider and flatter. Unlike the straight channel of the upper course, there are many meanders in the river in the middle course. A meander is formed by both deposition and erosion. Meanders form due to the greater volume of water carried by the river in lowland areas. This results in more lateral (sideways) erosion than downward erosion, causing the river to cut into its banks.

Water flows fastest on the outer bend of a river where the channel is deeper and there is less friction. This is due to water being flung towards the outer bend as it flows around the meander. This causes more erosion, making the river deeper. This lateral erosion leads to the formation of steep sided river cliffs.

Because the river flows slowly on the inner bend, it has less energy and deposition occurs. This results in a shallower channel. Over time materials build up on the inner bend. This is called a slip-off slope.



A meander in the river, the outer bank erodes and a river cliff is formed. Deposition occurs on the inside bank, where the speed of the river is slower.



THE LOWER COURSE

In the lower course of a river the slope is gentle and the river flows more slowly. In the lower course the main features are caused by deposition of eroded material. The valley is wide and almost level. The meanders become more noticeable as the river continues to undercut the outside bank and deposit on the inside bank. Eventually an ox-bow lake may form.



A Meandering river with an ox bow lake

A flood plain is a flat region of a valley floor located on either side of a river channel. It contains sediments deposited by the river that flows through it and is covered by water during floods when the river overflows its banks. The soils in a flood plain are thick and fertile and the land is flat. The

farmers who use the floodplains areas around the Nile River rely on these fertile deposits to supply nutrients to their fields each year as the river floods its banks.

As a river slowly meanders across its flood plain, it deposits material in the middle of its channel. These deposits often form small islands in the channel. The channels split off and re-join each other to give a braided appearance. These are called braided rivers.



A braided river

When a river carrying eroded materials meets standing water or nearly flat-lying ground, it slows down and deposits its load. The river may form a delta if it meets standing water.



Delta

Deltas are triangular shaped deposits of sediment that form where a large river meets the ocean. They form at the place where a river flows into the sea or lake. When a river or stream suddenly reaches nearly flat ground, like a broad flat valley or plain, an alluvial fan develops at the base of the slope. This feature is formed when the speed of flow is suddenly greatly reduced, for example when a stream rushing down the hillside reaches a gently sloping valley floor. When this happens, the river is unable to carry much of its load and deposits are laid down in a fan shape.

Many stream channels move across the curved surface of the alluvial fan, forming and un-forming many channels as sediments are deposited.



Alluvial fan

An alluvial fan is a triangle-shaped deposit of gravel, sand, and even smaller pieces of sediment, such as silt. This sediment is called alluvium. Alluvial fans are usually created as flowing water interacts with mountains, hills, or the steep walls of canyons.

Activity 7:

Date:

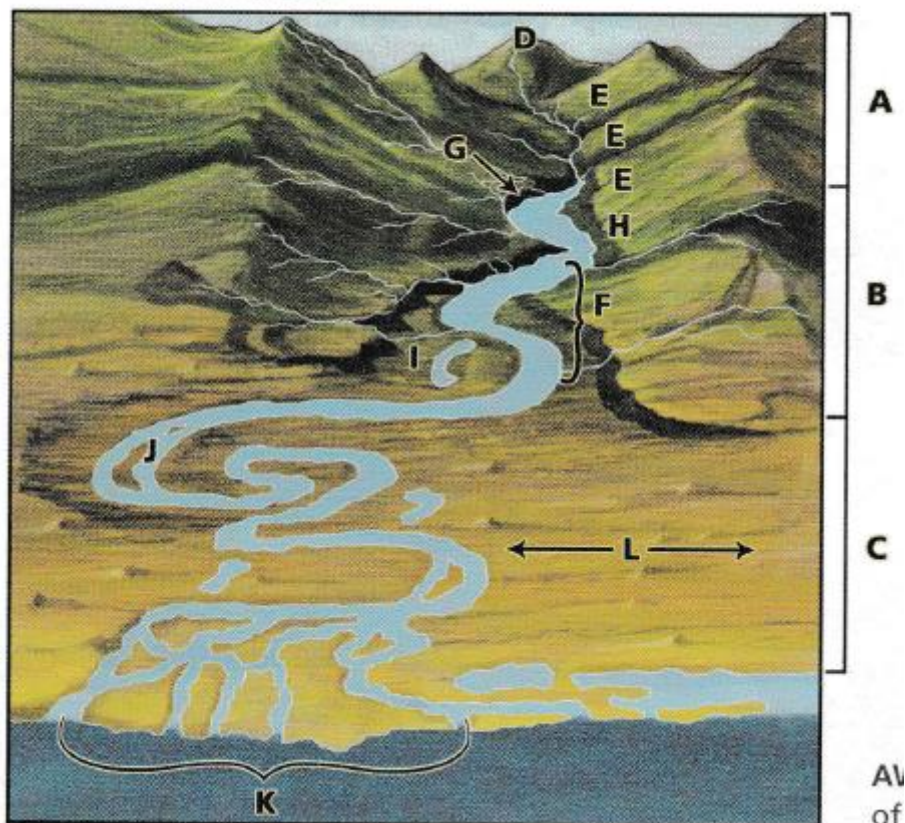
- The diagram below shows the course of a river from its source to its mouth. Choose terms from the word box to identify the features labelled A to L.

Interlocking spurs
Upper course
Oxbow lake
Meander

Braided stream
Middle course
Flood plain
River cliff (outside bend)

Delta
Lower course
Source
Slip-off slope (inside bend)

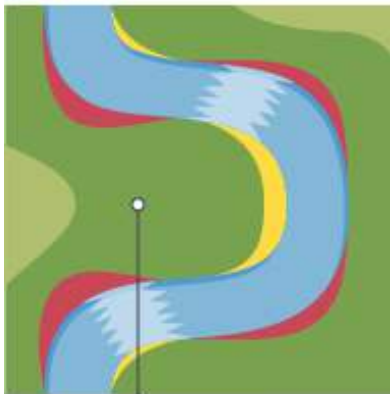
FEATURES OF A RIVER



2. What is a rapid and how is it formed?
3. What is a waterfall?
4. What is the difference between a gorge and a canyon?
5. What is a meander and how is it formed?
6. Explain what happens at a slip-off slope.
7. What kind of slope and flow occurs at the lower course of the river?
8. Name a feature that can form from a meander.
9. Can farmers use soil found on flood plains? Give a reason for your answer.
10. Explain how the following are formed:
 - a. Braided river
 - b. Delta
 - c. Alluvial fan

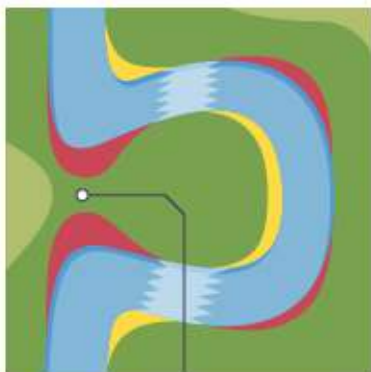
OX-BOW LAKES

Formation of ox-bow lakes



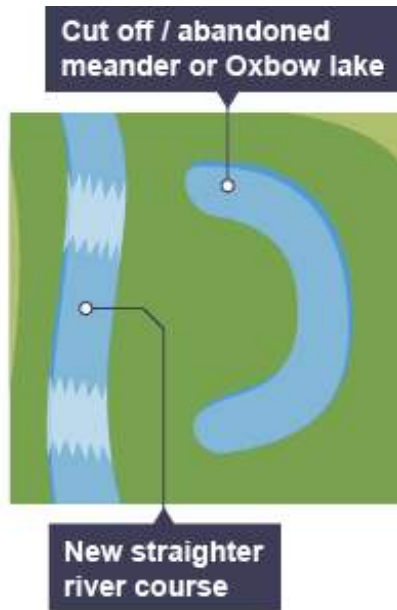
**Erosion makes
the neck narrow**

As the outer banks of a meander continue to be eroded the neck of the meander becomes narrower and narrower.



**During floods river
takes shortest course
through the neck**

Eventually the two outer bends meet and the river cuts through the neck of the meander. The water now takes its shortest route rather than flowing around the bend.



Deposition slowly cuts off the old meander bend forming a new straighter river channel. Due to deposition the old meander bend is left cut off from the main channel as an ox-bow lake. Over time the ox-bow lake may fill up with sediment and dry up. When the water dries up, the feature left behind is known as a meander scar.

Activity 8:

Date:

1. Draw the formation of an ox-bow lake in your books with the correct labels showing the process.
2. Describe the process of the formation of an ox-bow lake.

UNIT 3: SEA – FEATURES OF EROSION AND DEPOSITION ASSOCIATED WITH WAVE ACTION

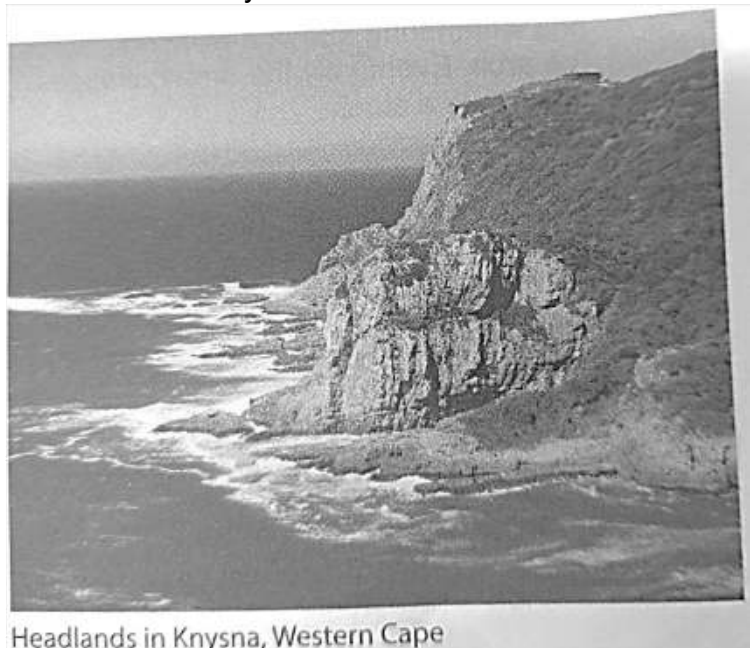
Ocean waves release a large amount of energy when they wash against the land. Like rivers, waves carry a load of sand, silt and stones. Waves continuously erode the coast. Erosion is much greater when waves are larger, during storms and strong winds.

Headlands and bays

Headlands are pieces of land that stick out into the sea. Bays are curved areas in between headlands. Rocks of different hardness and resistance are the main cause of headlands and bays.

Cliffs

A cliff is a steep wall of rock that is formed by wave erosion. Cliffs form in a similar way to waterfalls.



Headlands in Knysna, Western Cape

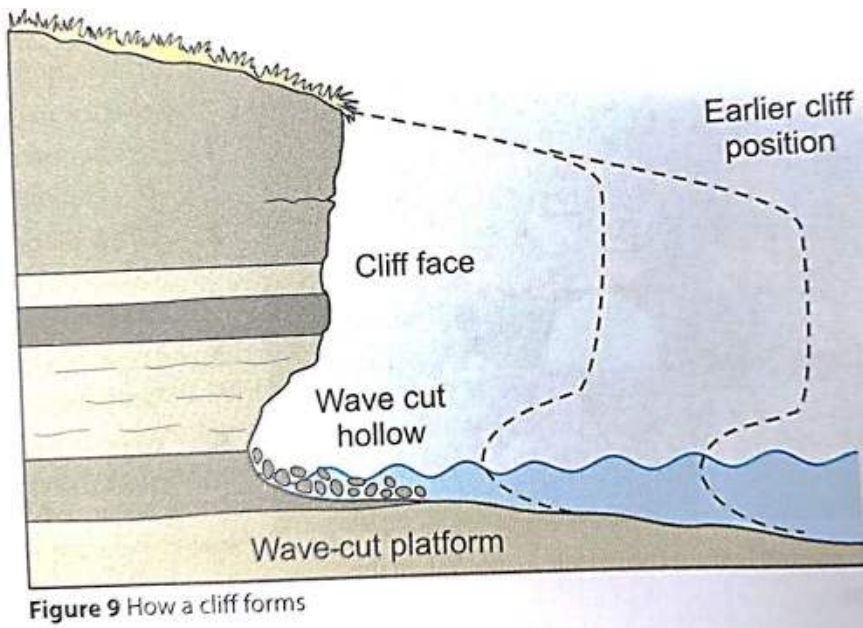


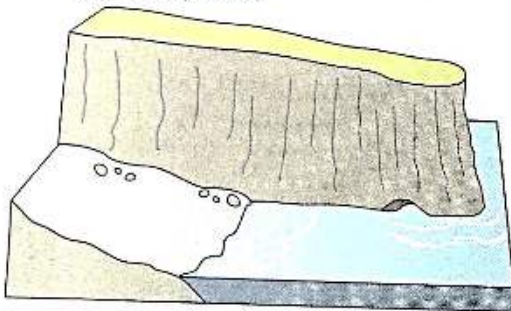
Figure 9 How a cliff forms

Caves, arches and stacks

Caves, arches and stacks are formed by wave erosion. Each feature is part of a cycle of erosion that takes a long time to form, compared to a human lifetime.

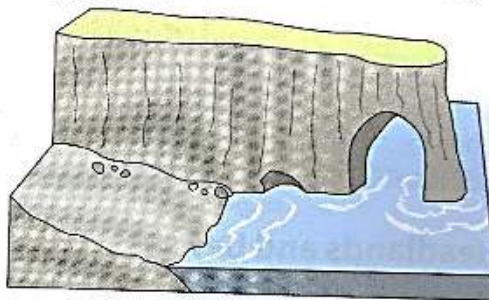
1. Cave

Waves attack weak points in the cliff. Small caves form around the weak points.



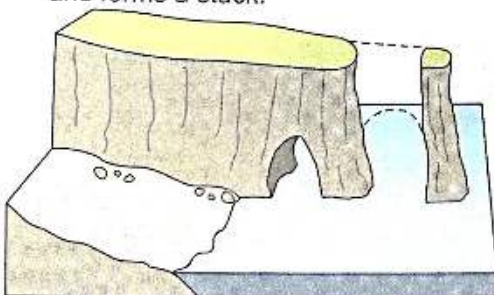
2. Arch

Two caves may form back-to-back on either side of a headland. An arch forms when two caves meet.



3. Stack

Wave erosion at the base of the arch and weathering above it weaken the arch. Eventually the arch collapses and forms a stack.



4. Stack

A stack is a column of rock which stands apart from the land.

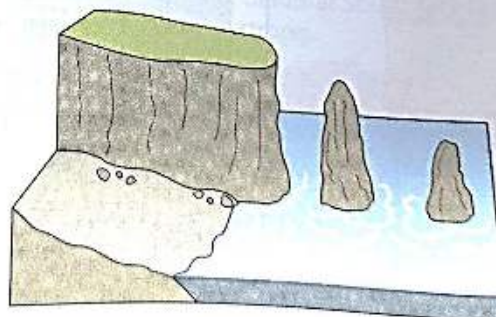


Figure 10 How caves, arches and stacks form



Figure 11 A coastal feature called Hole in the Wall, in the Eastern Cape

FEATURES OF DEPOSITION CAUSED BY WAVE ACTION

Material that is eroded from headlands is transported in waves and currents. This material is then deposited along the coast.

Beaches

The most common deposition feature is a beach. A beach is an area of loose sand or stones that covers parts of the coast between low tide and high tide. If waves push the loose material up the beach at an angle, this action is called a **longshore drift**.

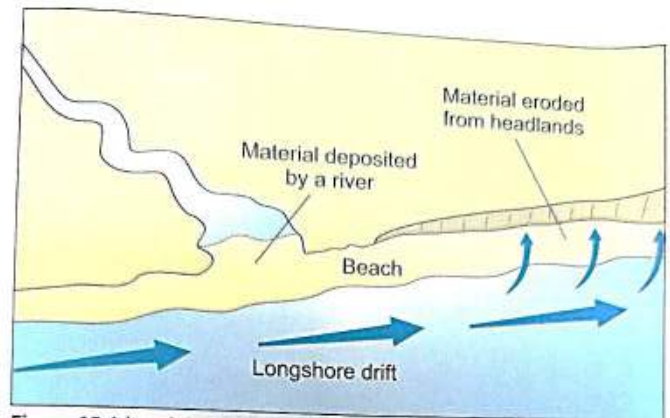


Figure 12 A beach between two headlands in the Western Cape

Spits

Spits are narrow ridges of sand that stick out into the sea or river mouth. They are formed by the action of the waves and the longshore drift. Sometimes water is trapped behind the spit. This area may become a marshy area of mud and plants, called a salt marsh.

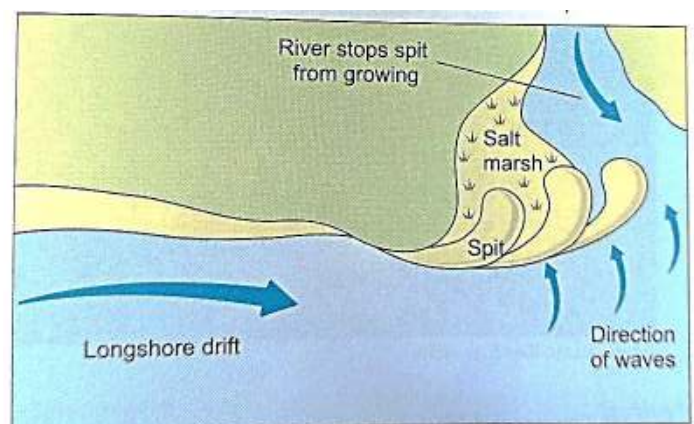
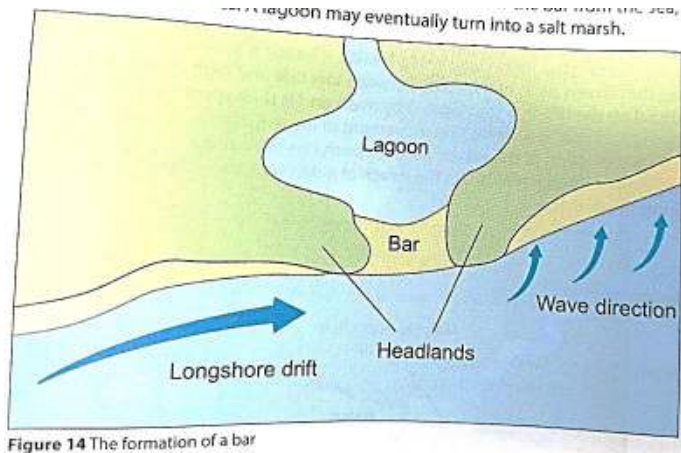


Figure 13 The formation of a spit

Bars

Bars form when a spit grows across a bay and joins two headlands. An area of water called a lagoon forms behind the bar. The lagoon may be filled with water that will eventually turn into a salt marsh.

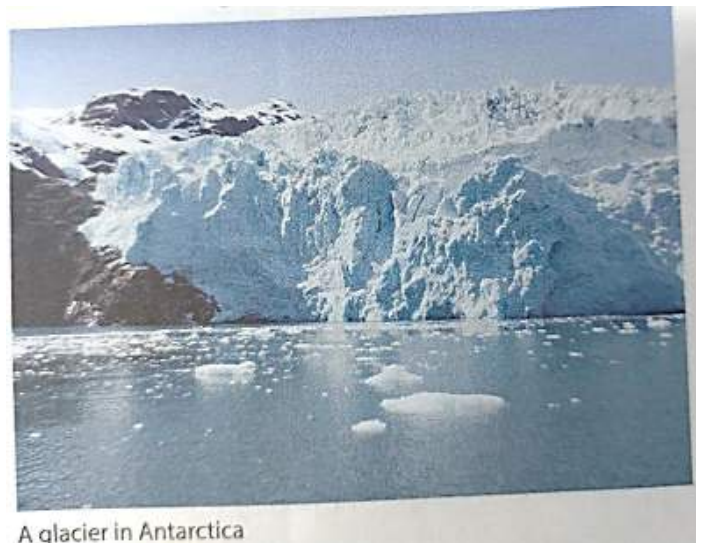


UNIT 4: MOVING ICE – FEATURES OF EROSION AND DEPOSITION WITH GLACIATED LANDSCAPES

About 18 000 years ago, 30% of Earth's surface was covered with ice. This was a long period of very cold weather known as the Ice Age. Snow built up on the land and turned into ice. Ice grew into thick layers, hundreds of metres deep. Masses of ice moved slowly over the land. These ice masses are called **glaciers**.

Features of erosion in glaciated landscapes

Glaciers erode the land. When they melt, they dump all the material carried in the ice to form deposition features. The main kind of erosion is caused by **abrasion**.



Cirques

These are bowl-shaped hollows in glaciated mountain areas.



The formation of an arête

An arête is a ridge on a mountain, which has been eroded by a series of glaciers on both sides. If a pointed peak remains, it is called a horn.

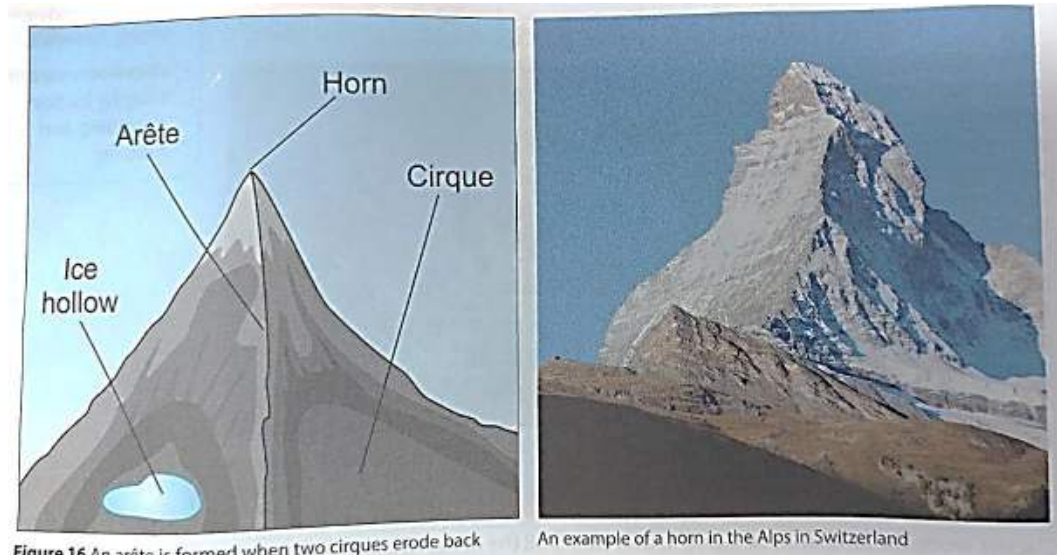
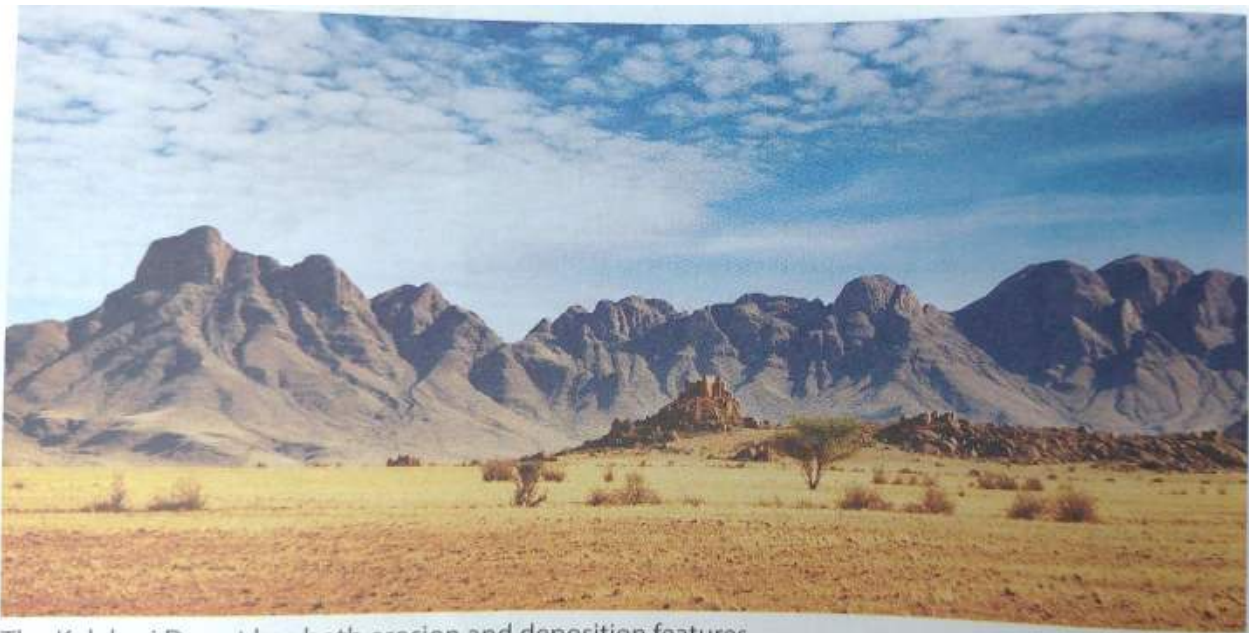


Figure 16 An arête is formed when two cirques erode back

An example of a horn in the Alps in Switzerland

UNIT 5: WIND – FEATURES OF EROSION AND DEPOSITION ASSOCIATED WITH WIND

Winds pick up soil and sand and transport it, suspended in the air or cause it to bounce along the ground. Wind erosion and deposition happen where there is little vegetation, such as the desert and semi-deserts.



The Kalahari Desert has both erosion and deposition features.

FEATURES PRODUCED BY WIND EROSION

The loose particles blown by the wind may knock against other objects and cause erosion. This kind of erosion is called abrasion. One feature produced this way is called a mushroom rock. Other features produced by wind erosion are **yardangs and troughs**.

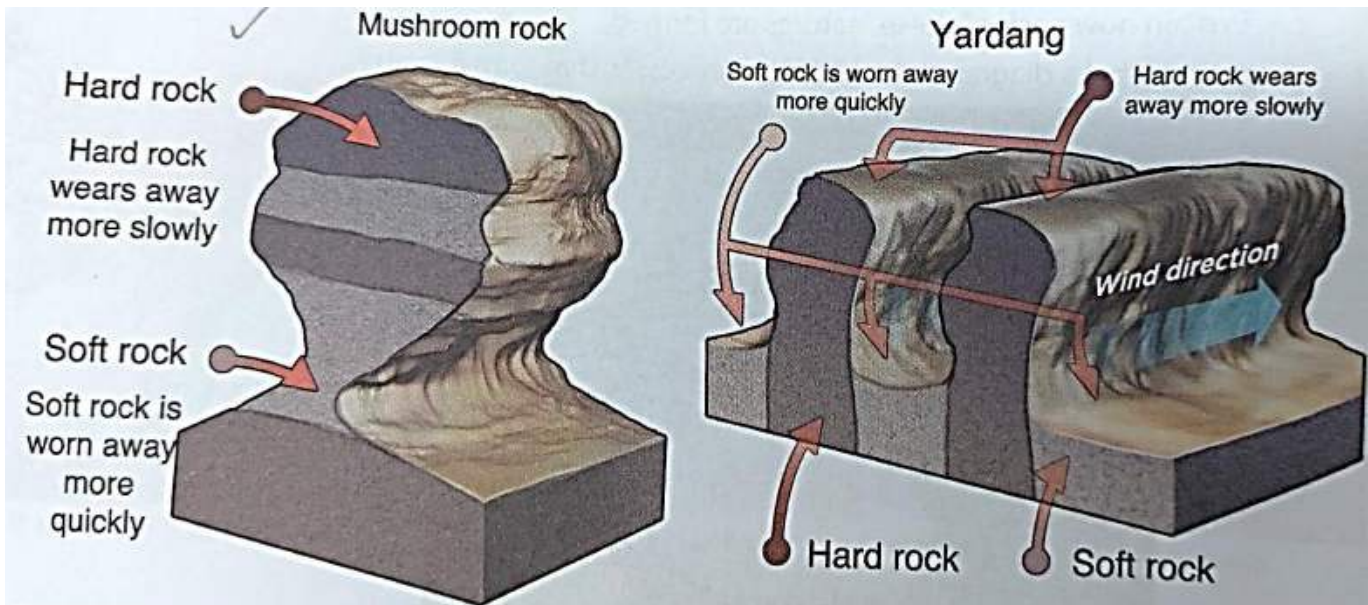
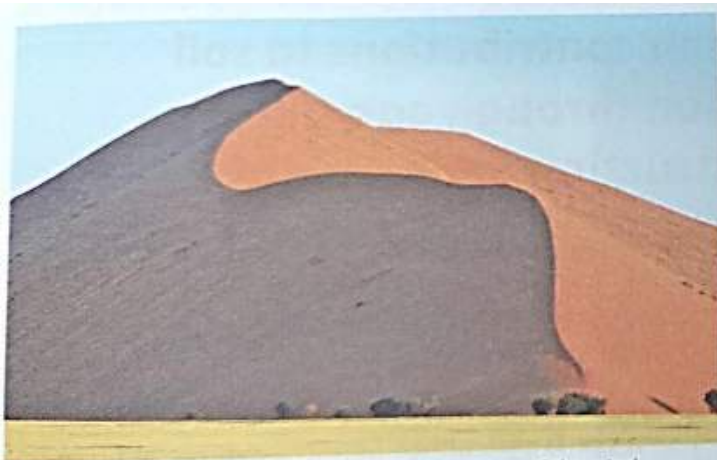


Figure 20 Different erosion features created by the wind: mushroom rocks and yardangs

FEATURES PRODUCED BY DEPOSITION

Material carried in the wind is deposited once the speed of the wind drops. The most common kind of deposition feature in the desert is the sand dune.



Sand dunes constantly change shape with the action of the wind

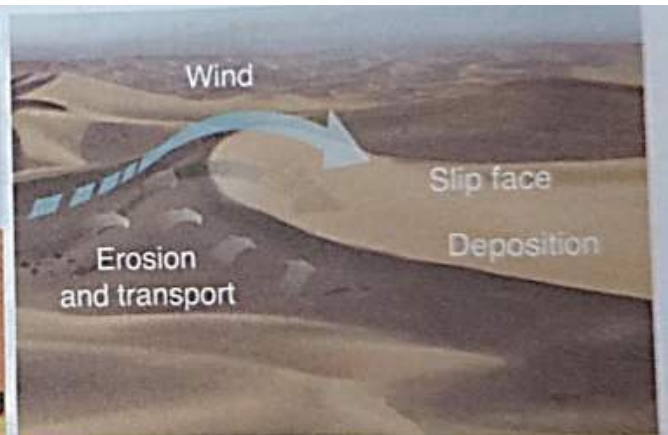
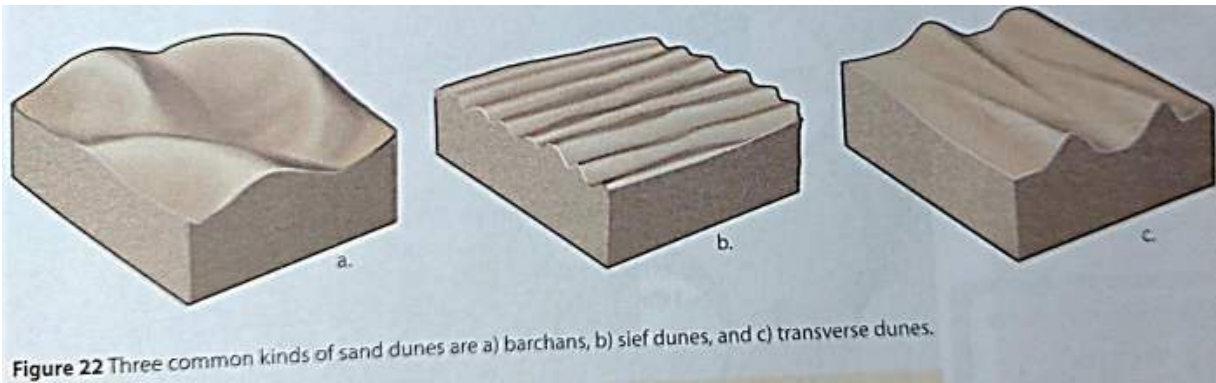


Figure 21 Formation of a sand dune

Desert wind storms can blow for a number of days. After the storm, the position and shape of the sand dunes is often completely changed. Sand dunes never stay in one place for long. Not all sand dunes are the same shape as seen below.



TOPIC 3: THE IMPACT OF PEOPLE ON SOIL EROSION

HUMAN CONTRIBUTIONS TO SOIL EROSION THROUGH AGRICULTURE, CONSTRUCTION AND MINING

Soil erosion is a natural process. Soil erosion is only a problem when more soil is eroded than is replaced by natural soil-forming processes. The main contributors to soil erosion is **agriculture**. Industry, **deforestation** and construction also contribute to soil erosion.

HOW AGRICULTURE CONTRIBUTES TO SOIL EROSION

Removing natural vegetation and ploughing the land weakens the soil making it more easily washed or blown away. Animals also contribute to soil erosion by breaking up the soil with their feet. If too many animals are kept in one place they can eat all the plants and expose bare soil to erosion.

HOW CONSTRUCTION CONTRIBUTES TO SOIL EROSION

Road building and the construction of buildings require large areas of vegetation to be cleared. This exposes the soil to erosion. Soil may also be removed, or covered with concrete and other building materials.



HOW MINING CONTRIBUTES TO SOIL EROSION

Surface mining, such as open-cast coal and iron ore mines exposes the rocks for mining by removing all the vegetation and soil from above the rocks. The soils may be pushed into large mounds/piles. Dust and chemicals from the mine may pollute the soil.

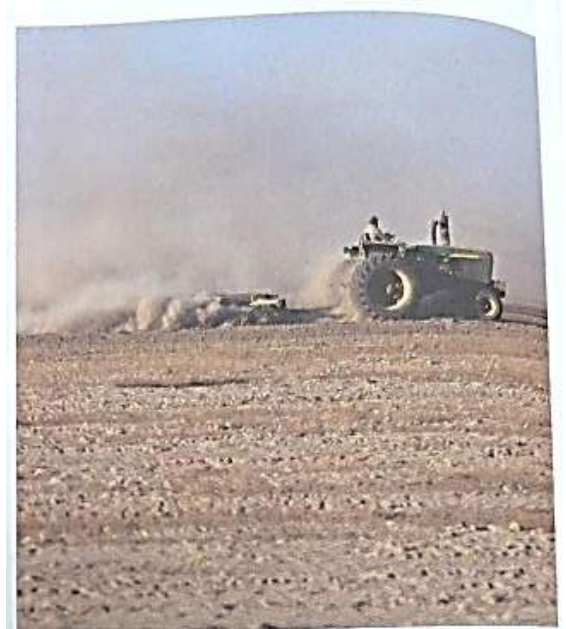


CASE STUDY: AGRICULTURE AS A CONTRIBUTOR TO EROSION

Modern commercial farmers use farming methods that can contribute to soil erosion. Each of the farming methods below is used on farms in South Africa.

USING MACHINES

Farmers use the following kinds of machines: ploughs, seed planters, crop sprayers, harvesters and weeding machines. Most of these machines are pulled by tractors. When farmers plough the land they break up and loosen the soil causing erosion.



Ploughing the land contributes to soil erosion

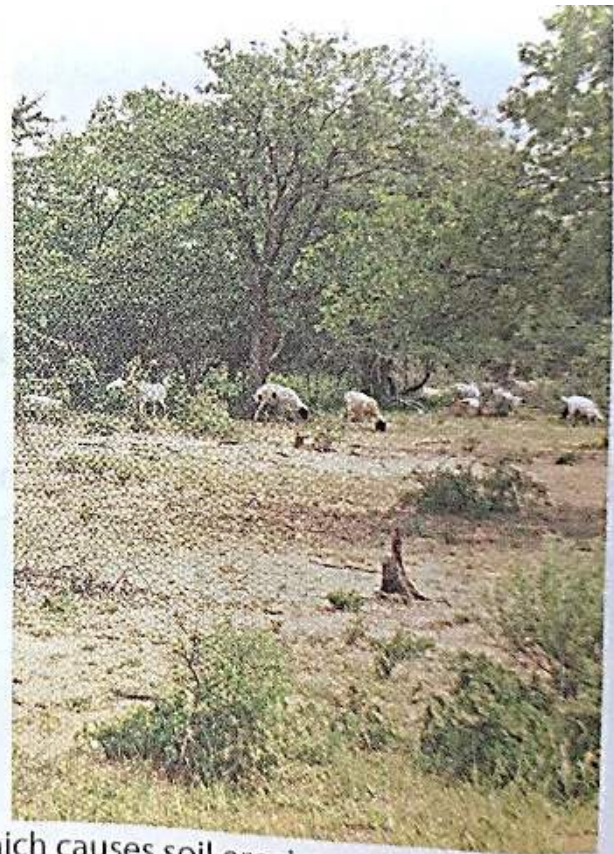
Farming methods like **monoculture** contribute to soil erosion. For example, if a farmer plants maize every year, the soil will lose nutrients becoming less fertile and more easily eroded. However, some crops put nutrients back into the soil. If farmers grow different crops in a particular order they can maintain soil fertility and reduce soil erosion. This is called **crop rotation**.



Evidence of soil erosion due to lack of crop rotation on this maize farm

ANIMALS

Farmers keep too many animals on their land. This is called **overstocking**. Overstocking leads to **over-grazing**. Over-grazing results in large areas of soil being exposed to erosion. The removal of plants means that there are fewer roots to hold the soil together. The soil is more easily washed away or blown away.



Overstocking leads to over-grazing, which causes soil erosion

AN EXAMPLE OF SOIL EROSION IN KWAZULU-NATAL

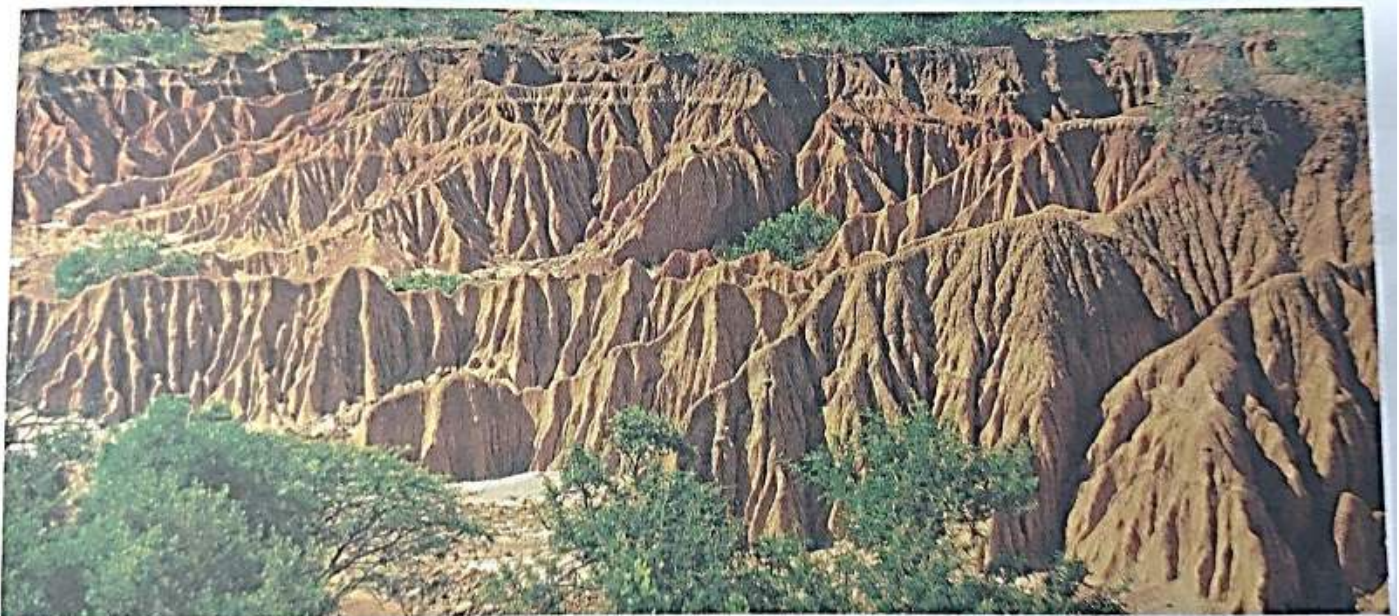


Figure 3 Soil erosion in the Ithala Game Reserve in KwaZulu-Natal. The area in the foreground used to be covered in thick soil, next to a small stream.

Activity 9:**Date:**

1. How does sea cause erosion and deposition?
2. Write down whether the following are formed through erosion or deposition.

Headlands	Bays	Cliffs	Stacks	Arches
Caves	Beaches	Spits	Bars	Cirques
Arête	Yardang	Trough	Mushroom rock	Sand dune

3. Label the diagram below:

