GEOMORPHOLOGY

TOPOGRAPHY ASSOCIATED WITH HORIZONTAL STRATA
KAROO LANDSCAPE

PROCESSESS ASSOCIATED WITH THE DEVELOPMENT OF HILLY LANDSCAPES

1. These hills are formed because the top layer is more resistant to weathering and erosion than the layers underneath.
2. Because the top layer is resistant they stand out as hills and mountains.
3. The reason for the flat top is that the strata are horizontal to the horizon.

CONCEPTS

1. **WEATHERING**

   the breakdown of rocks into smaller pieces.

2. **EROSION**

   The removal of broken material by wind water or ice.

HILLY LANDSCAPE

- **WET AND HUMID**
- **ARID AREA**

HILLY LANDSCAPE

- **1. WET AND HUMID**
- A. **CHARACTERISTICS**
  - Slopes are rounded.
  - Deep soils develop.
  - Rocks are horizontal and sedimentary.
  - Steep hilly landscapes develop.

B. **FORMATION**

  - Results from chemical weathering.
  - Chemical wreathing results from rainfall

2. ARID AREAS

- A. **CHARACTERISTICS**
- Landscapes are more rugged.
- Soils are course and thin.
- Weathering and erosion leads to steep uneven slopes.
- B. **FORMATION**
- Mechanical weathering is most active.
- The rock is physically broken down into fragments.

3. Basaltic Plateau

- A. **CHARACTERISTIC**
- The landforms are flat at the top and are higher than the surrounding areas.
- The landform must have at least one steep side.
- B. **FORMATION**
- This forms when lava moves out of a crack onto the earth's surface.

CANYON LANDSCAPE

- A. **CHARACTERISTIC**
- Canyons form deep, steep sided valleys.
- Canyons are most common in arid areas because of chemical weathering.
- B. **FORMATION**
- Canyons develop over a long period of time due to vertical erosion of a river.
- Over time the valley becomes deeper.
- The deeper the valley gets the faster the erosion process.
- The canyon is wide at the top and narrow at the bottom.

KAROO LANDSCAPE

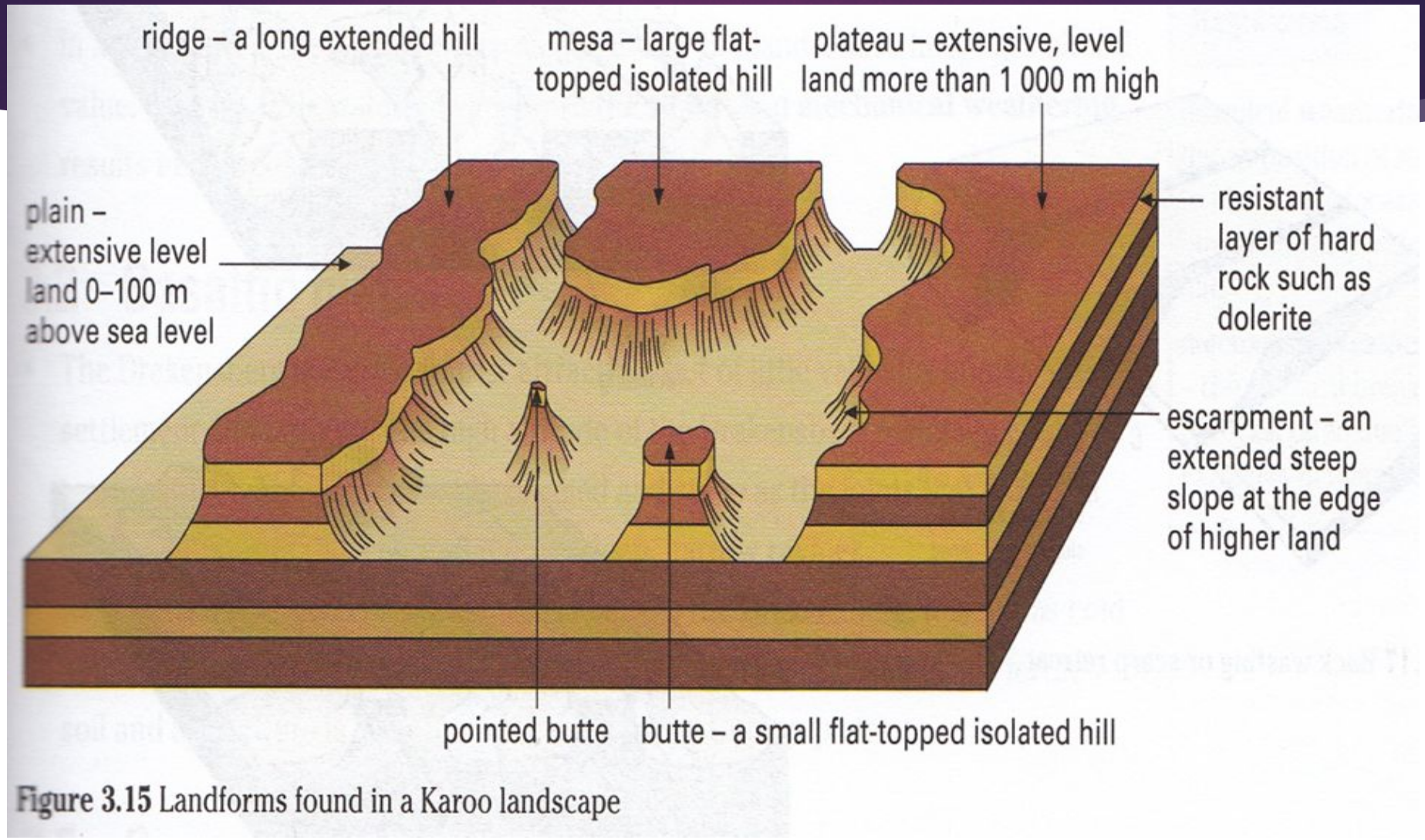


Figure 3.15 Landforms found in a Karoo landscape

KAROO LANDSCAPE

- A. **CHARACTERISTICS**
- This type of landscape forms because of erosion.
- The landscape is characterised by flat topped mountains.
- Dolerite forms the flat top of the hill which is more resistant to erosion.
- B. **FORMATION**
- Magma intruded in between the horizontal layers of the hard and soft rock.
- The magma cooled and formed horizontal sills.
- A typical karoo landscape of flat-topped hills developed.

ACTIVITY

	HUMID LANDSCAPE	ARID LANDSCAPE
SLOPE		
TYPE OF WEATHERING		
SOIL		
PROCESS AND FORMATION		

CONCEPTS

1. **BACK WASTING/ SCARP RETREAT**

   slopes eroding backwards to their original position.

2. **Mesa**

   flat topped hill with the diameter greater than the height.

3. **Butte**

   flat topped hill with the height greater than the diameter.

4. **Conical hill**

   a rounded hill that forms after the cap rock has been removed.

UTILIZATION OF THESE LANDSCAPES BY PEOPLE

- **1. HILLY LANDSCAPE , HUMID**

- In wet areas , soils are more well developed making them better for agricultural activities.
- Slopes are better drained because of vegetation cover.

HILLY LANDSCAPES : ARID

- 1. The use of land is more limited because there is less water and the soils are thinner.
- 2. the slopes limit cultivation.
- 3. there is large scale erosion because of the lack of vegetation
- 4. grazing is more suitable.

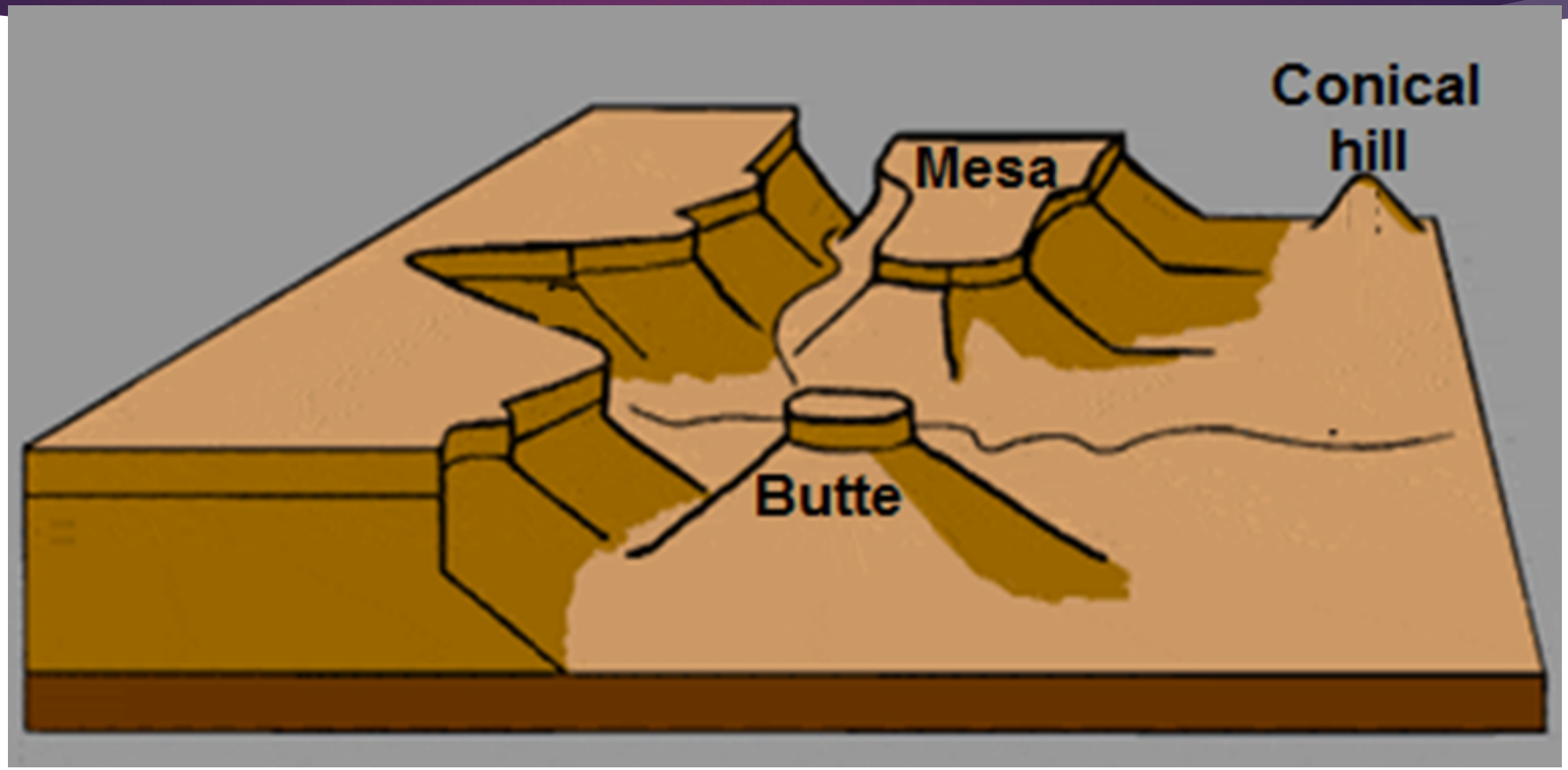
Basaltic plateau

1. Basaltic plateaus produce fertile soil.
2. High rainfall and fertile soil produce good agricultural land.

CANYONS

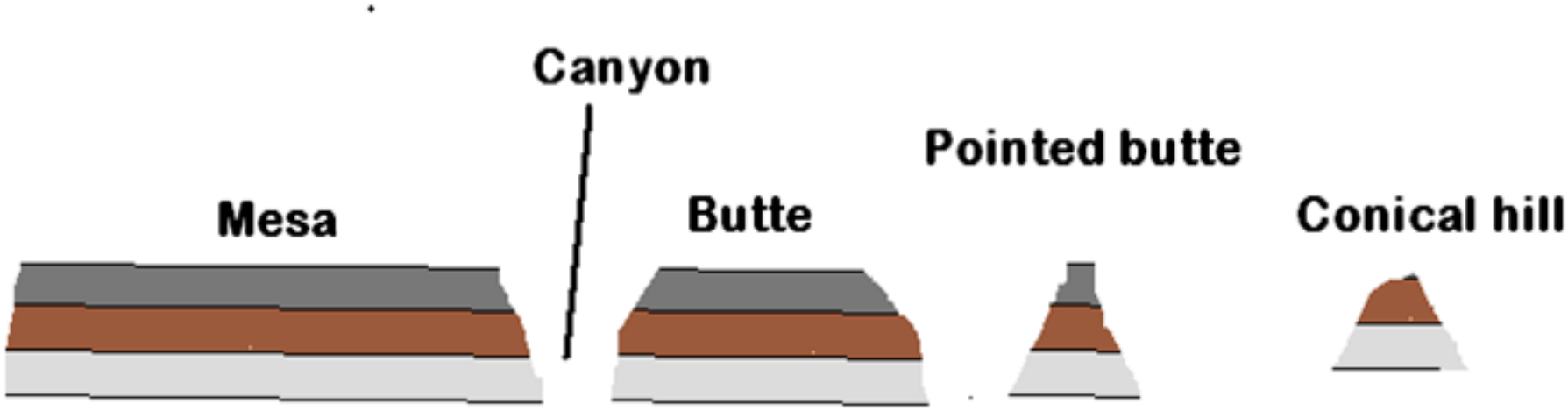
1. Steeps sides and limited valley floor space makes it difficult to farm.
2. Canyons are used as tourist attractions because of their beauty.

MESA , BUTTE, CONNICAL HILL

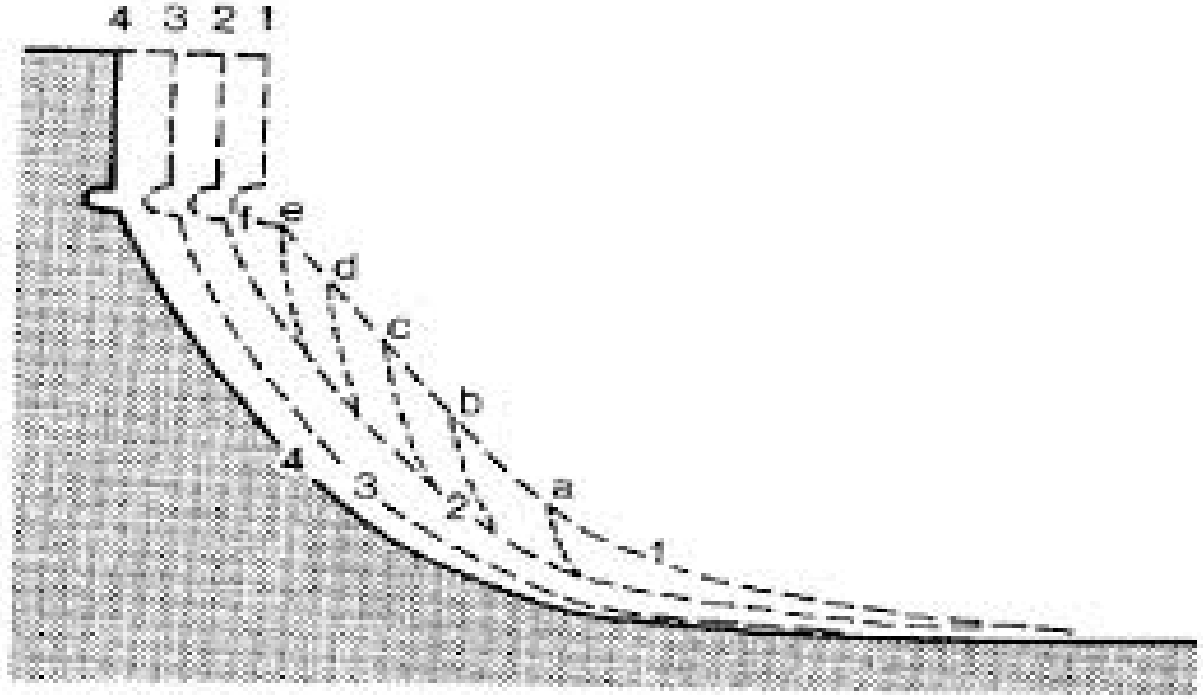


MESA

BUTTE


Canyon
Pointed butte
Mesa
Butte
Conical hill

SCARP RETREAT



SCARP RETREAT

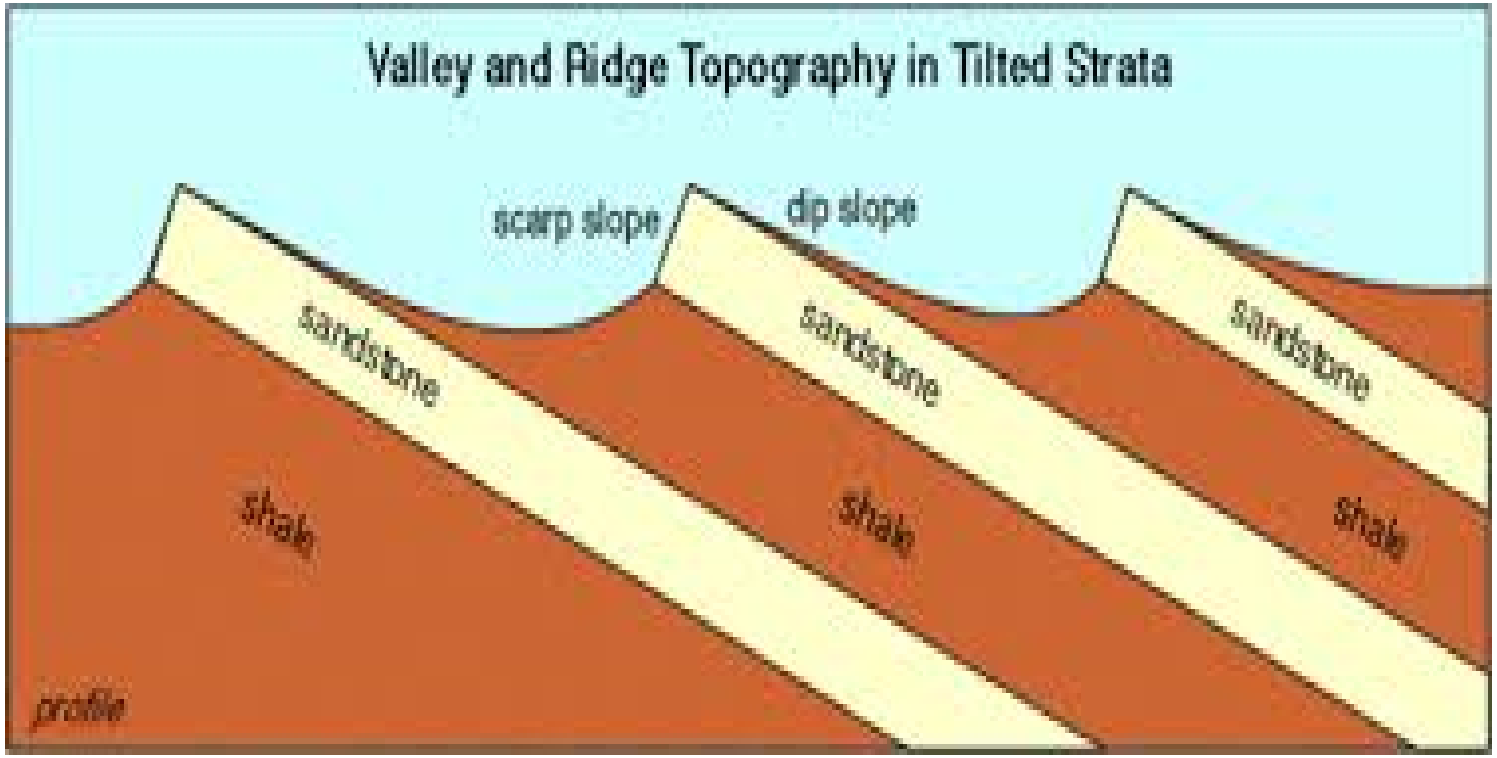
1.SLOPES ERODING BACK PARELLEL TO THEIR ORIGINAL POSITION.

2. THESE ARE COMMON IN DRY AREAS.

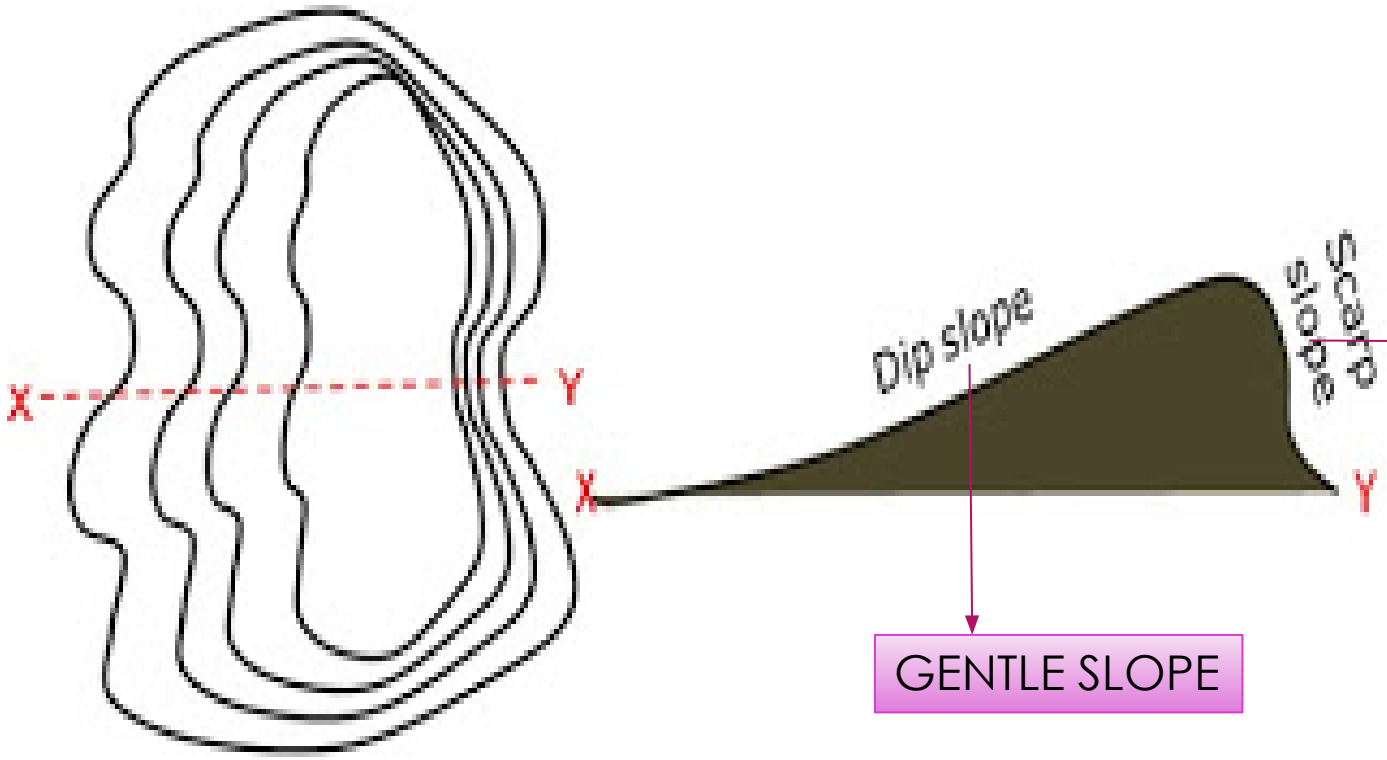
SCARP RETREAST IS ALSO KNOWN AS BACK WASTING.

3. THE SLOPE MANTAINS ITS HEIGHT BUT GETS NARROWER.

TOPOGRAPHY ASSOCIATED WITH INCLINED STRATA



DIP SLOPE AND SCARP SPOLE



STEEP SLOPE

GENTLE SLOPE

CONCEPTS

1. **ASYMMETRICAL**

   the two sides that are not mirror images.

2. **Homoclinal rigde.**

   collective name for asymmetrical ridges.

3. **CUESTA**

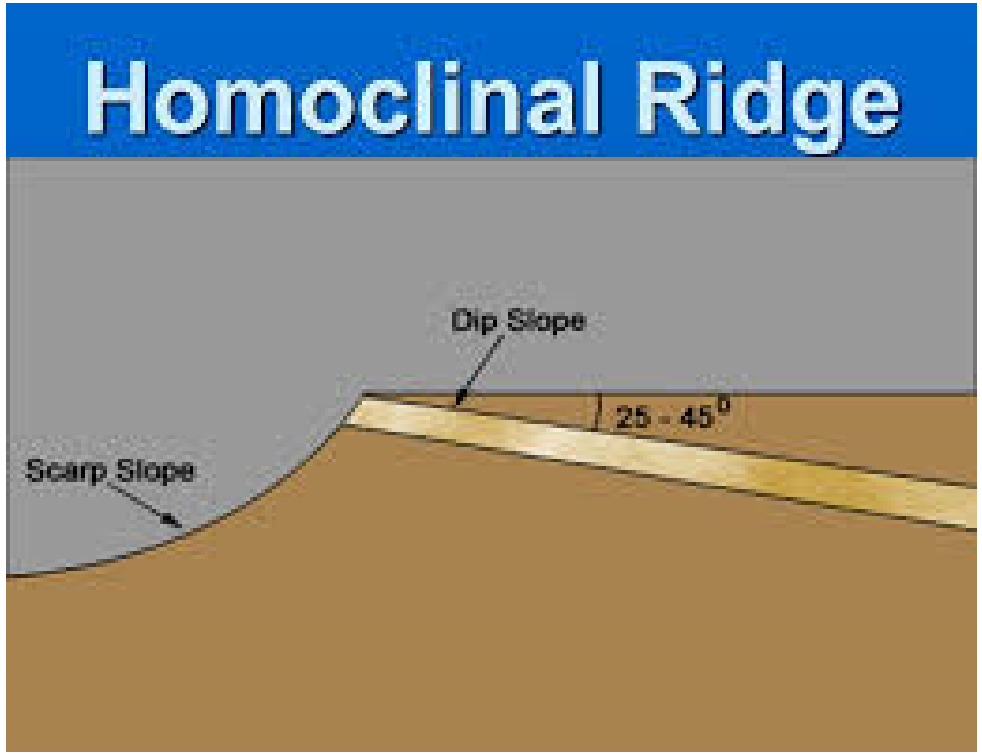
   asymmetrical ridge caused by rocks inclined at an angle

   between 10º and 25º.

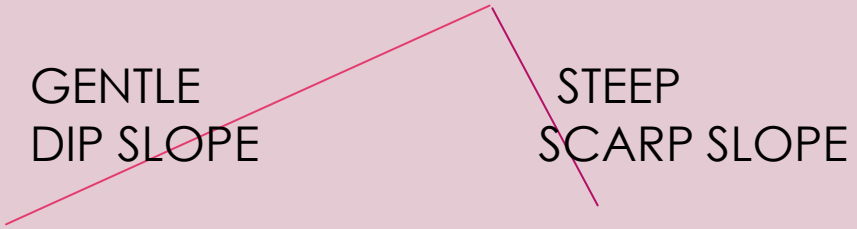
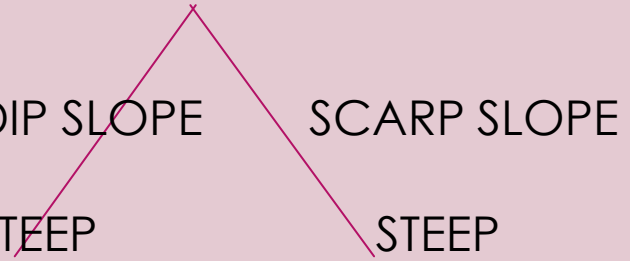
4. **HOGSBACK**

   A ridge caused by an angle greater than 45 º

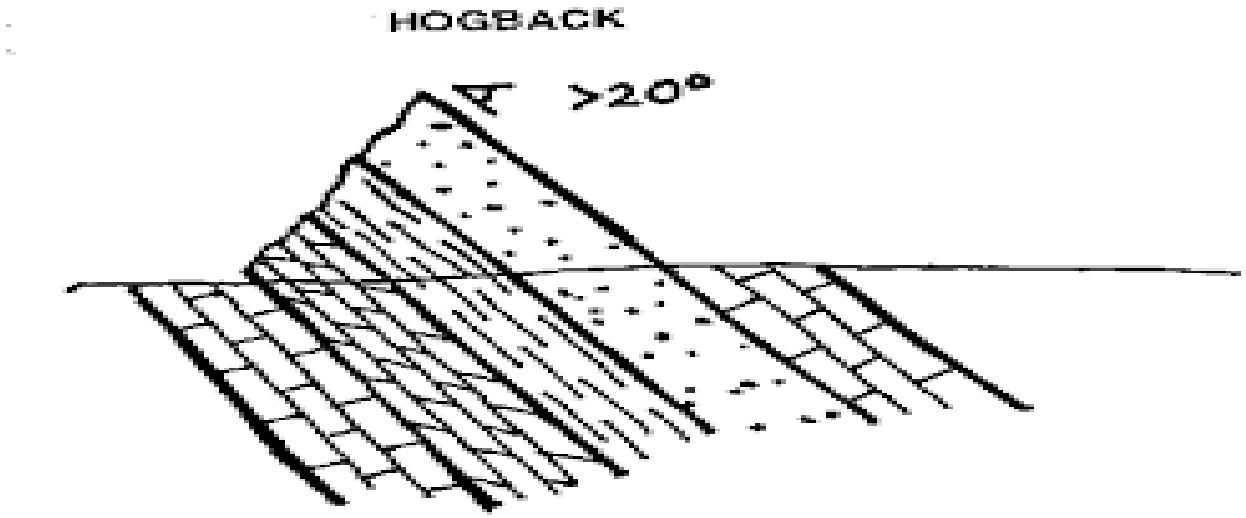
HOMOCLINAL RIDGE ; STEEP SCARP SLOPE, GENTLE DIP SLOPE- 10º-35º



HOMOCLINAL RIDGE

CUESTA	HOGSBACK
	
1. Has a gentle dip slope and a steep scarp slope.	1. It has a steep dip slope and a steep scarp slope.
2. It as an asymmetrical shape.	2. The angle of the dip slope is 45⁰
3. The angle of the dip slope is 25⁰	3. It forms a narrow ridge.

HOGSBACK : STEEP SCARP SLOPE AND GENTLE DIP SLOPE



CUESTA

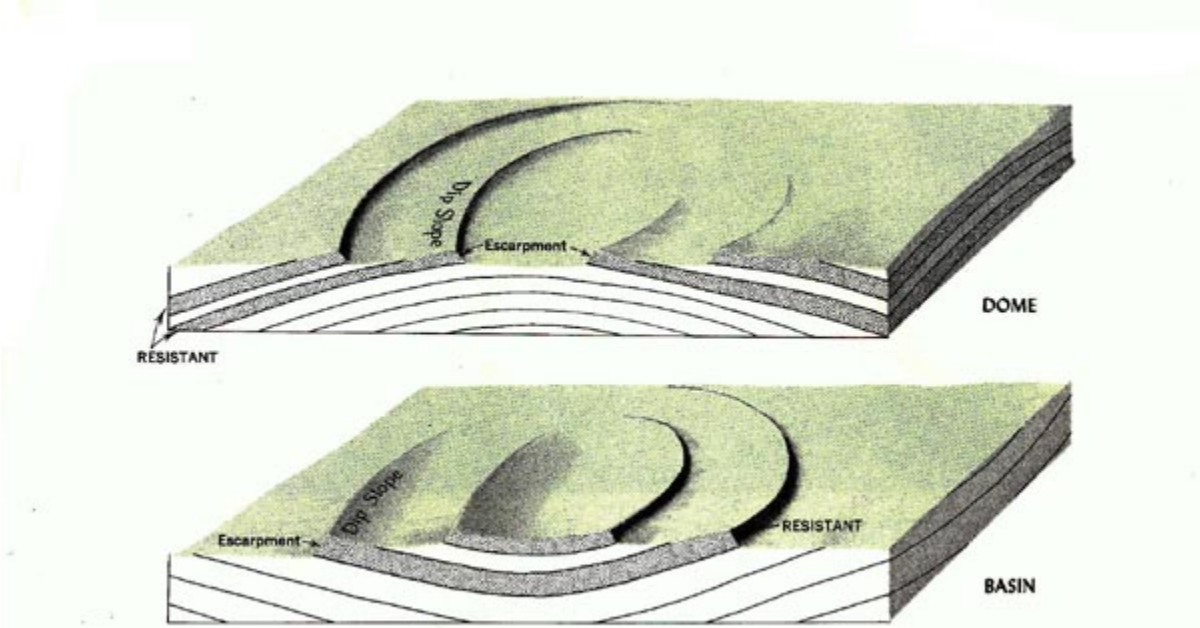
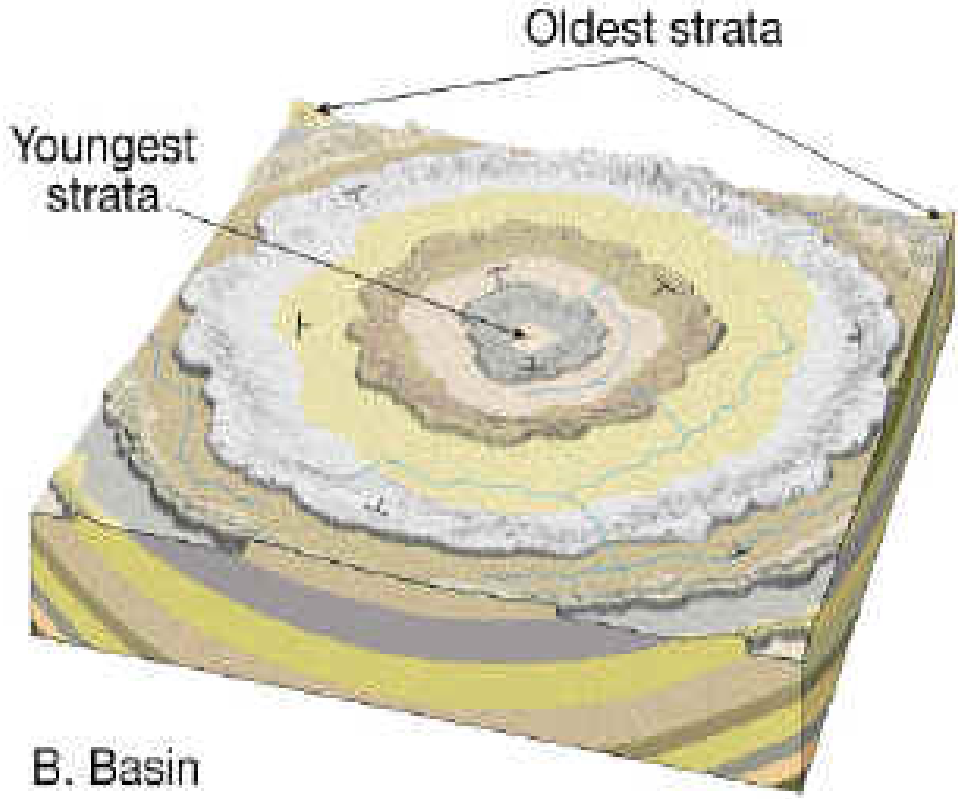


Fig. 15.10 Diagram to illustrate the development of cuestas in structural domes and basins. Dip slopes face outward from center of dome, inward toward center of basin.

CUESTA BASIN

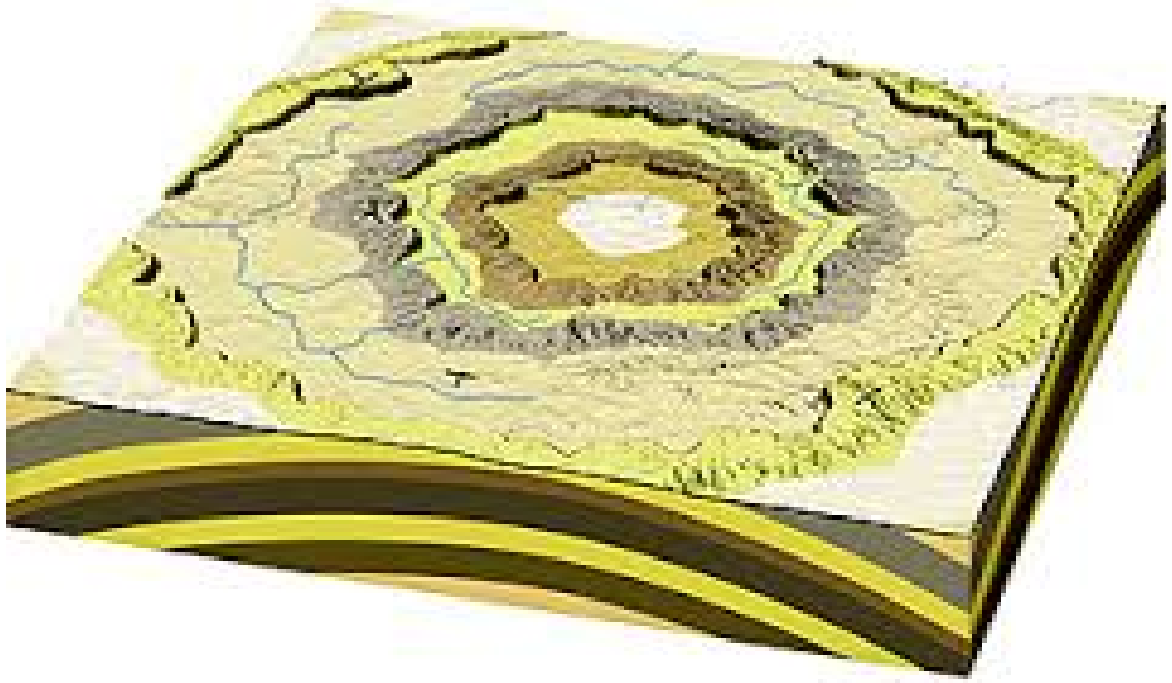


1. A circular depression in the earth's crust.
2. The magma solidifies and the central part sags downwards.

USES

1. Allows for the seepage of water into the ground. This makes a good source of groundwater.
2. Farmers use this water to irrigate their land.
3. Settlements can be built here.

CUESTA DOME



1. Formed in sedimentary rocks where the rocks are forced upwards.

USES

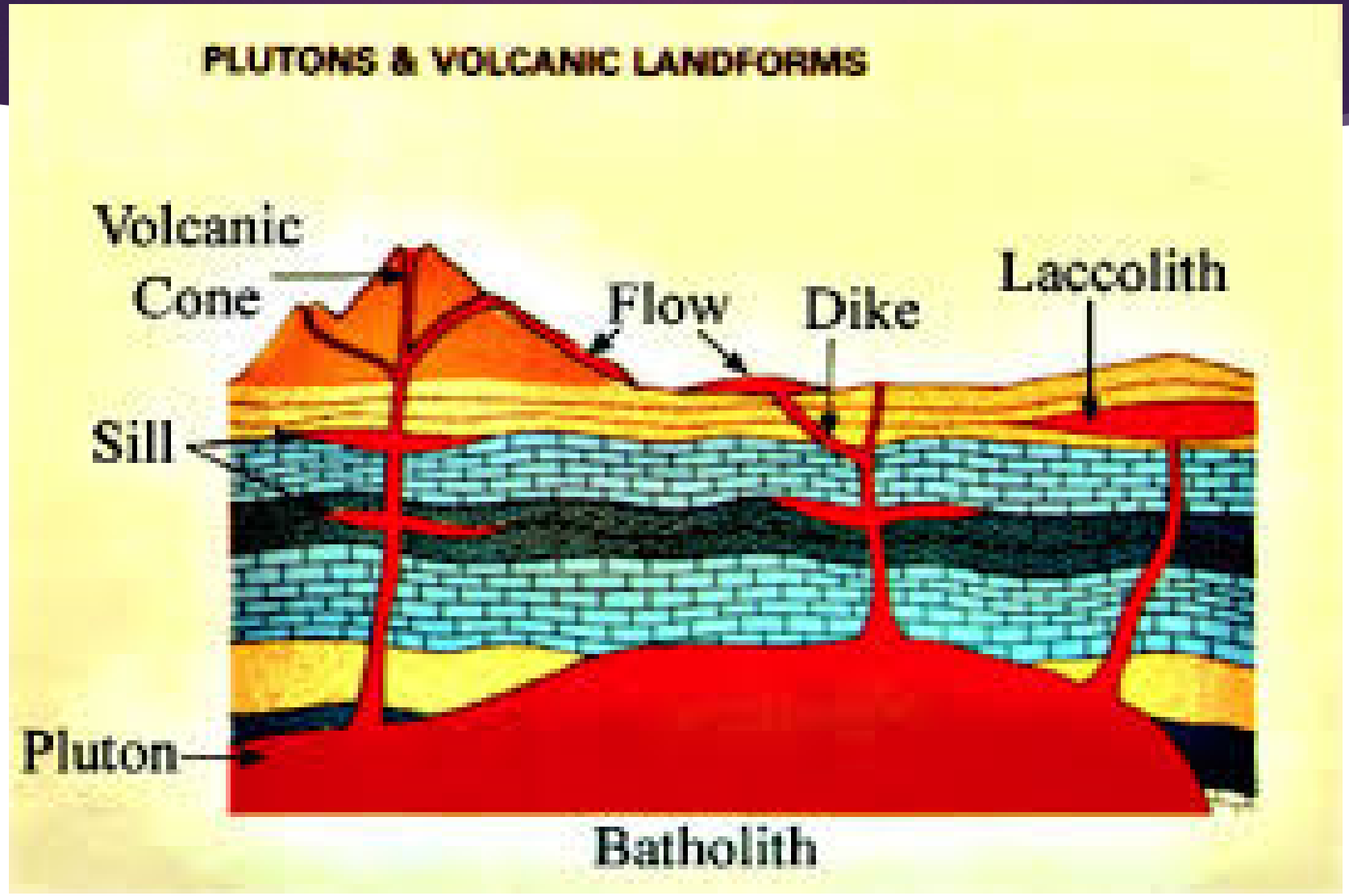
1. These domes have porous sandstone and impermeable shale.
2. This allows for the build up of petroleum which can be mined.

ACTIVITY

1. Tabulate the landforms associated with horizontal sedimentary and inclined sedimentary rocks. (8)
2. Describe horizontal sedimentary strata. (1)
3. Provide one characteristic each of :

3.1. Hilly landscape (1)
3.2. Basaltic plateau (1)
3.3. canyon landscape (1)
3.4. karoo landscape (1)
4. Explain scarp retreat. (2)
5. Name 2 similarities between a mesa and a butte. (2X2)(4)
6. Name one difference between a mesa and a butte. (2)
7. Draw a sketch to illustrate a mesa and a butte. Label the 4 slope elements on the mesa. (6)
8. Why is the conical hill different from a mesa. (2)
9. Describe an inclined strata. (1)
10. Provide 2 reasons that cause strata to be inclined. (2)
11. Draw a sketch to illustrate a dip slope. (2)
12. Explain the difference between a cuesta and a hogsback. (2)
13. Provide a significance of a cuesta dome and a cuesta basin. (4)

TOPOGRAPHY ASSOCIATED WITH MASSIVE IGNEOUS ROCKS



BATHOLITH

LOPOLITH

A SAUCE SHAPED FEATURE
WHEN THE MAGMA COOLS THE WEIGHT PUSHES IT DOWN CAUSING IT TO SAG.

LACCOLITH

A MUSHROOM SHAPED ROCK
FORMED WHEN MAGMA PUSHES UP TOWARDS THE SURFACE AND INTRUDES BETWEEN HORIZONTAL LAYERS.

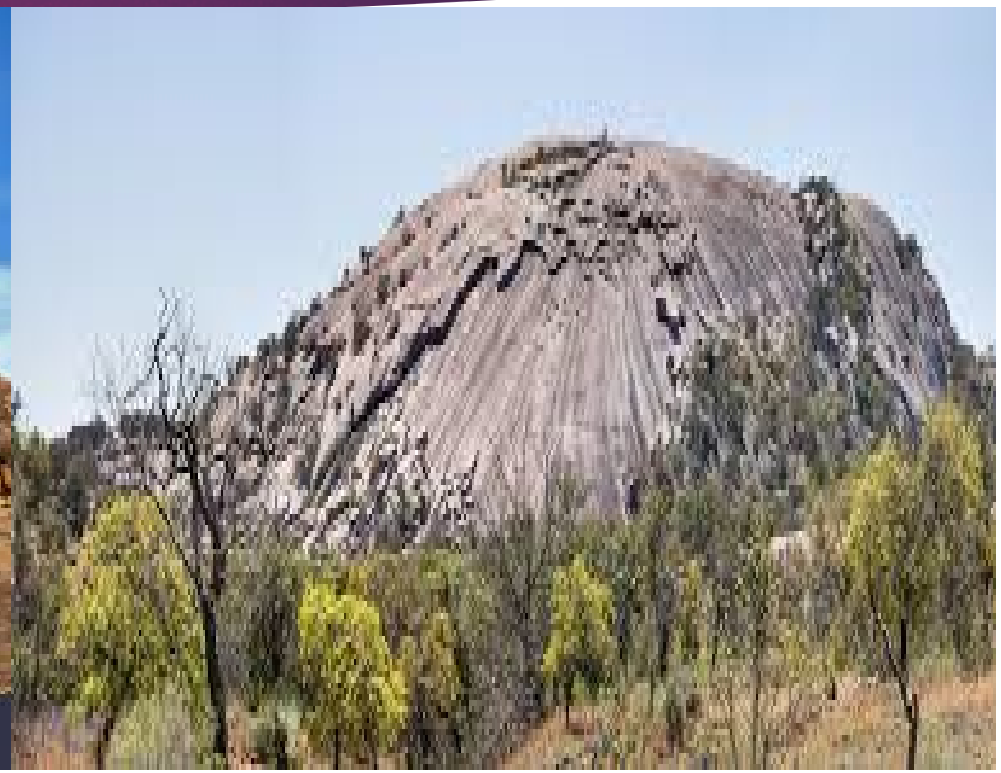
SILL

INTRUSION BETWEEN LAYERS OF HORIZONTAL SEDIMENTARY ROCK.
OCCURS WHEN MAGMA IS MORE FLUID.

DYKE

MAGMA PUSHES VERTICALLY UPWARDS INTO CRACKS IN THE OVERLYING ROCKS FROMING A WALL-LIKE FEATURE.
OCCURS WHEN MAGMA IS MORE FLUID
WHEN EXPOSED TO THE SURFACE IT FORMS A SHAPE SIMILAR TO A HOGSBACK

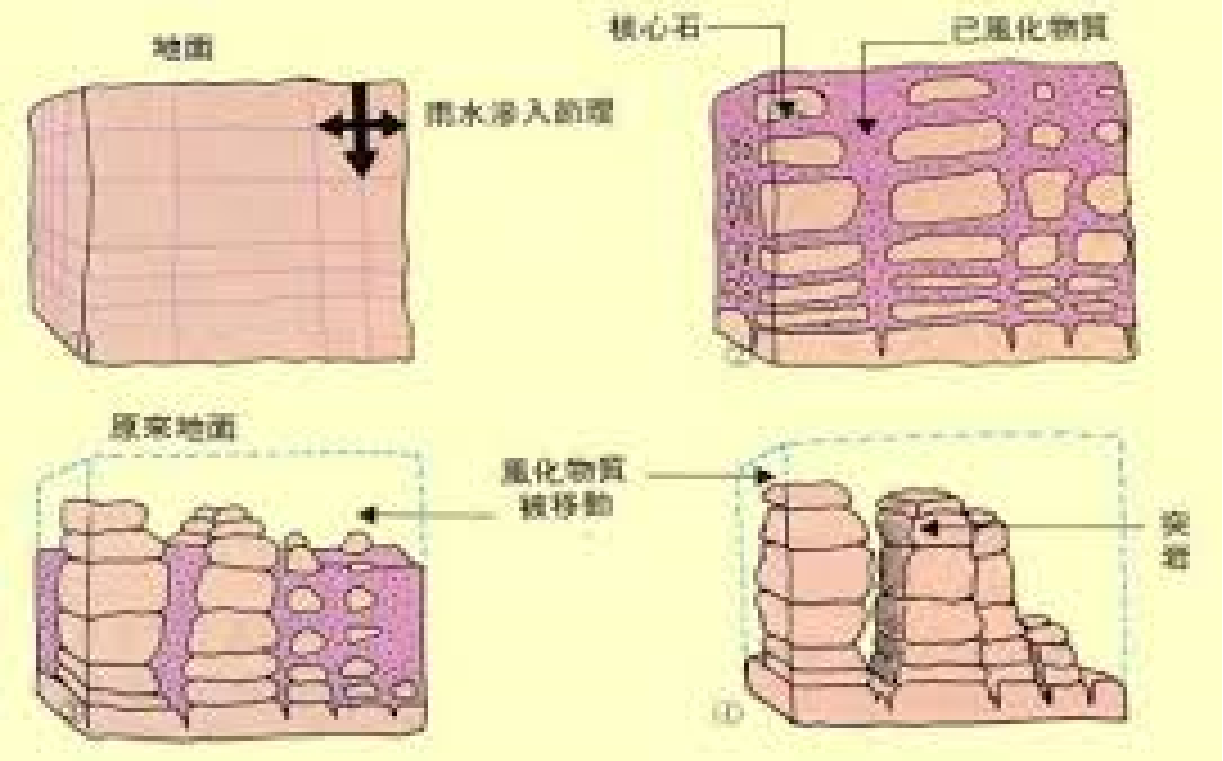
GRANITE DOME



ACTIVITY

TORS

FORMATION OF TORS



FORMATION OF A TOR

STAGE 1

- The development of a tor starts of when the igneous rock cools below the earths surface.
- Joints and cracks form when cooling of the granite takes place.

STAGE 2

- Ground water seeps into the joints and cracks and weathering takes place.
- Groundwater also dissolves minerals in the granite. (chemical weathering)
- More joints and cracks appear as the overlying rocks are removed.

STAGE 3

1. The overlying layer of rocks have been removed exposing the core stones on the surface of the earth.
2. Piles of rectangular core stones are now visible on the earth's surface.

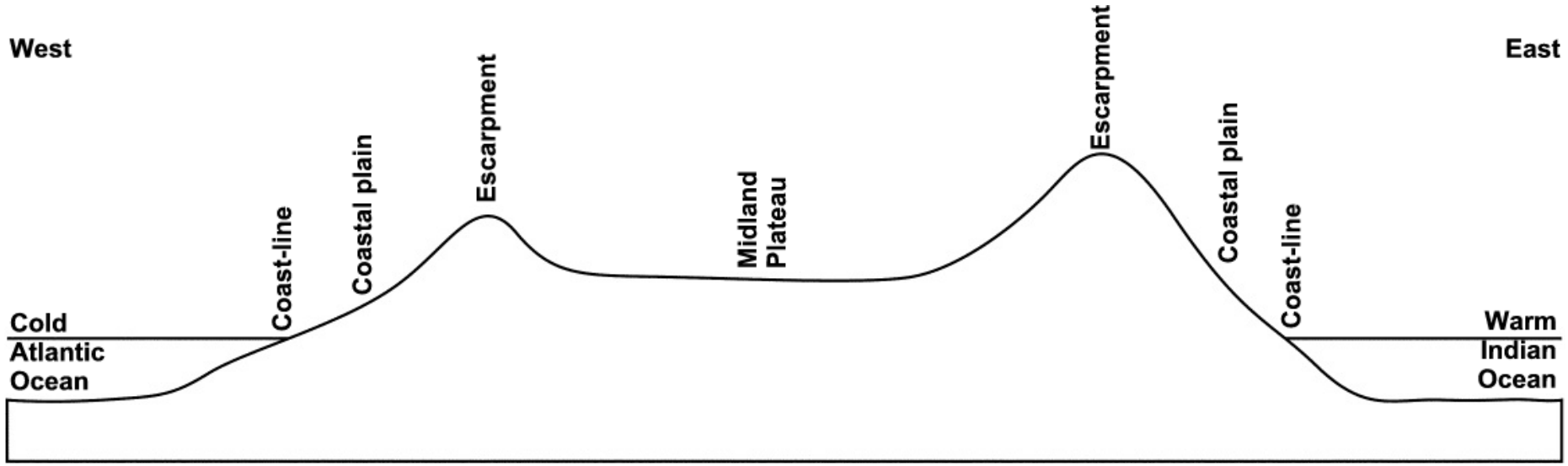
SUMMARY
TOPOGRPAHY ASSOCIATED WITH :

HORIZONTAL STRATA	INCLINED STRATA	MASSIVE IGNEOUS ROCKS
1. HILLY LANDSCAPE	1. CUESTA	1. DOMES
2. BASALTIC LANDSCAPE	2. HOMOCLINAL RIDGE	2. BATHOLITH
3. CANYON LANDSCAPE	3. HOGSBACK	3. LOPOLITH
4. PLATEAU		4. LACOLITH
5. CANYON		5. SILL
6. MESA		6. DYKE
7. BUTTE 8. CONNICAL HILL 9. PEDIPLAIN		7. TORS

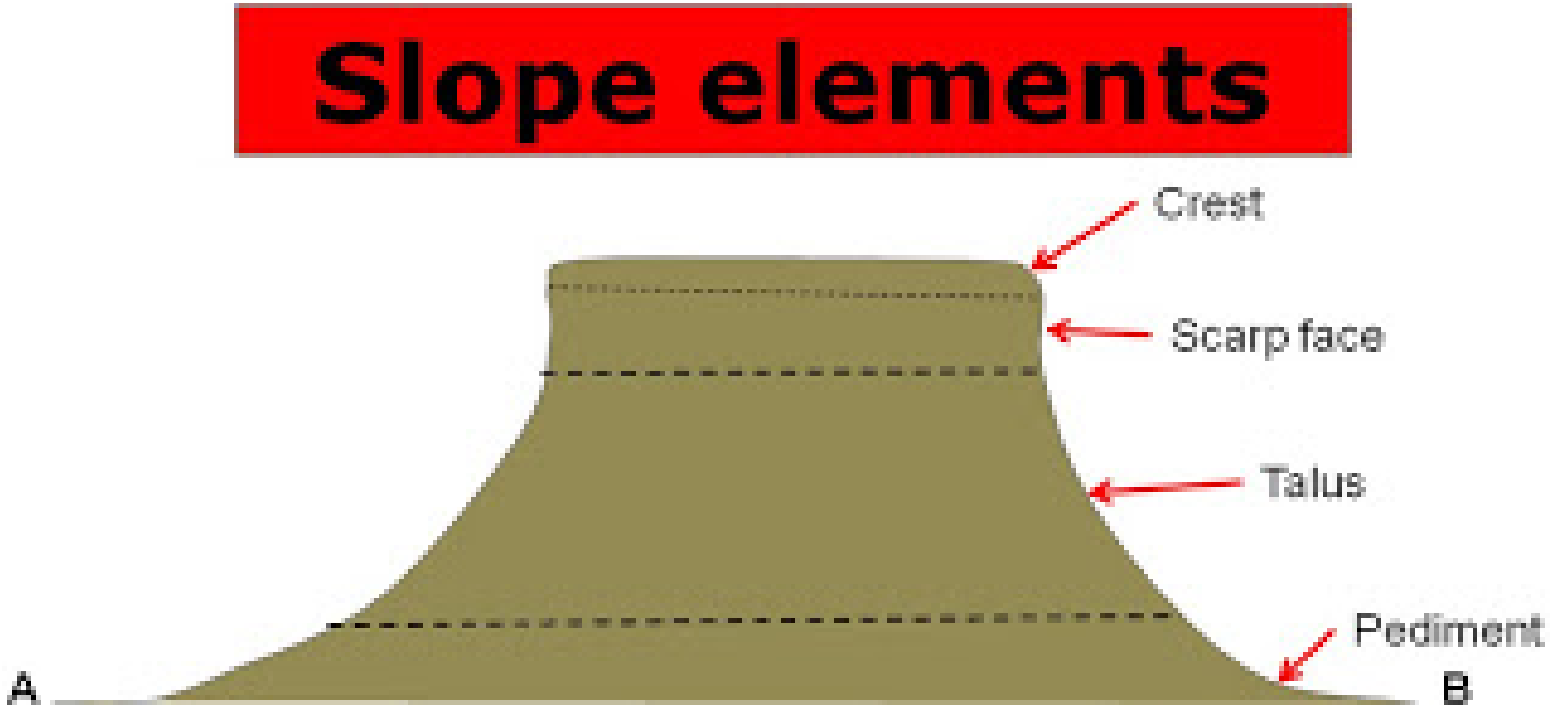
ACTIVITY

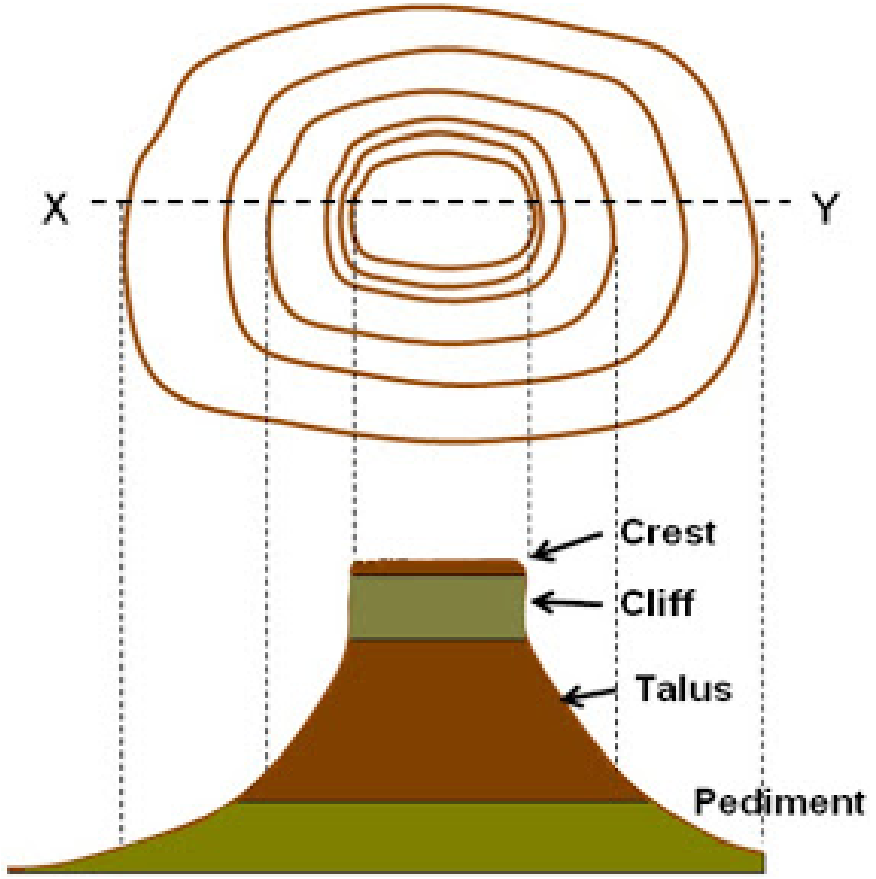
1. Name the landforms associated with massive igneous rocks.
2. Provide one characteristic of each of these landforms.
3. Explain the formation of the batholith and the lopolith.
4. Explain the formation of the tor.

OVERVIEW OF SOUTH AFRICA'S TOPOGRAPHY



TYPES OF SLOPES

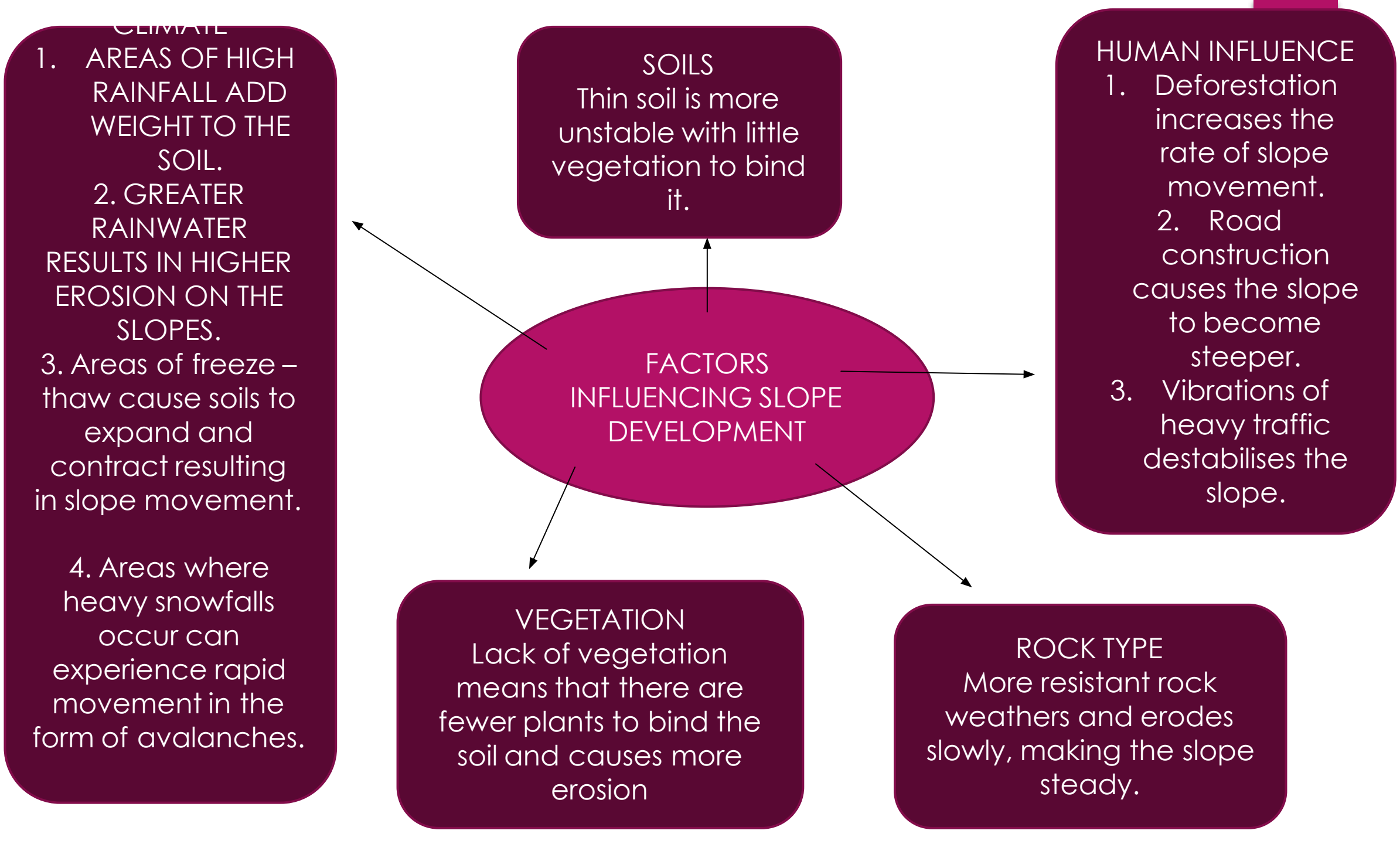



X
Y
Crest
Cliff
Talus
Pediment

SLOPE DEVELOPMENT OVER TIME

The development of slopes refers to how slopes changes over time.

These changes are influences by ; soil , rock structure, climate , vegetation cover and human activities.


CLIMATE
1. AREAS OF HIGH RAINFALL ADD WEIGHT TO THE SOIL.
2. GREATER RAINWATER RESULTS IN HIGHER EROSION ON THE SLOPES.
3. Areas of freeze – thaw cause soils to expand and contract resulting in slope movement.
4. Areas where heavy snowfalls occur can experience rapid movement in the form of avalanches.
SOILS
Thin soil is more unstable with little vegetation to bind it.
FACTORS INFLUENCING SLOPE DEVELOPMENT
HUMAN INFLUENCE
1. Deforestation increases the rate of slope movement.
2. Road construction causes the slope to become steeper.
3. Vibrations of heavy traffic destabilises the slope.
VEGETATION
Lack of vegetation means that there are fewer plants to bind the soil and causes more erosion
ROCK TYPE
More resistant rock weathers and erodes slowly, making the slope steady.

ACTIVITY

1. **What is meant by slope development.**
2. **Discuss how the following factors influence slope development:**
   - **a) human activity**
   - **b) vegetation cover**
   - **c) rock type**

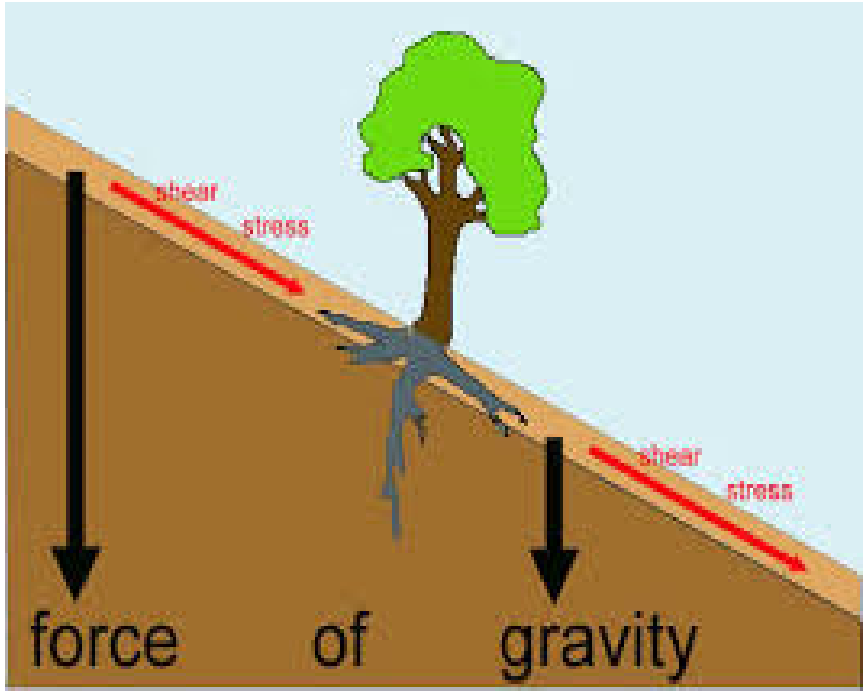
MASS MOVEMENT

- **mass movement**, often called **mass wasting**, is the downslope **movement** of a **mass** of surface materials, such as soil, rock, or mud. The most basic reason is the angle of repose, or slope of the hillside. Other causes of **mass movements** include earthquakes, lack of vegetation, abundance of water, geology, and gravity.

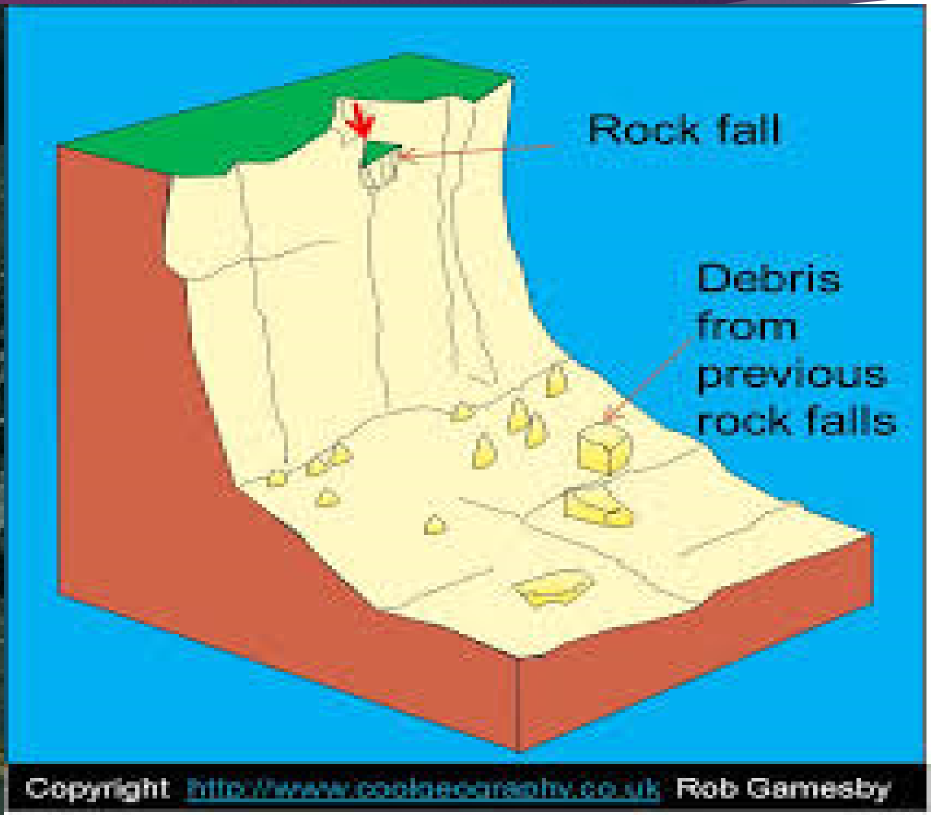
Factors affecting mass movement

- Slope of the land surface: When the slope gradient is steep, mass movement is rapid.
- Water content: Water acts as a lubricant, which makes it easier for material to move. Following a period of heavy rain, regolith is heavier and flows more quickly.
- Human activity: Hills are often cut into during the construction of roads. This makes the hill unstable, which can lead to mass movement. The vibrations from machinery and traffic can also result in mass movement, as can deforestation.
- Tectonic activity: volcanic activity can lead to the movement of material downslope. Mudflows (lahars), occur when the snow or ice covering a crater melts during an eruption. This mater mixes with soil to form mud. Earthquakes can also cause areas of hills or mountains to move downslope.
- Plants and trees: the tree/plant roots bind soil in place and prevent mass movement.
- Slope material: Mass movement is also affected my slope material, whether it is consolidated (such as rocks) or unconsolidated.
- Geological structure: Rocks with faults, and potential weaknesses within it are more vulnerable to weathering and less resistant to downslope movement.

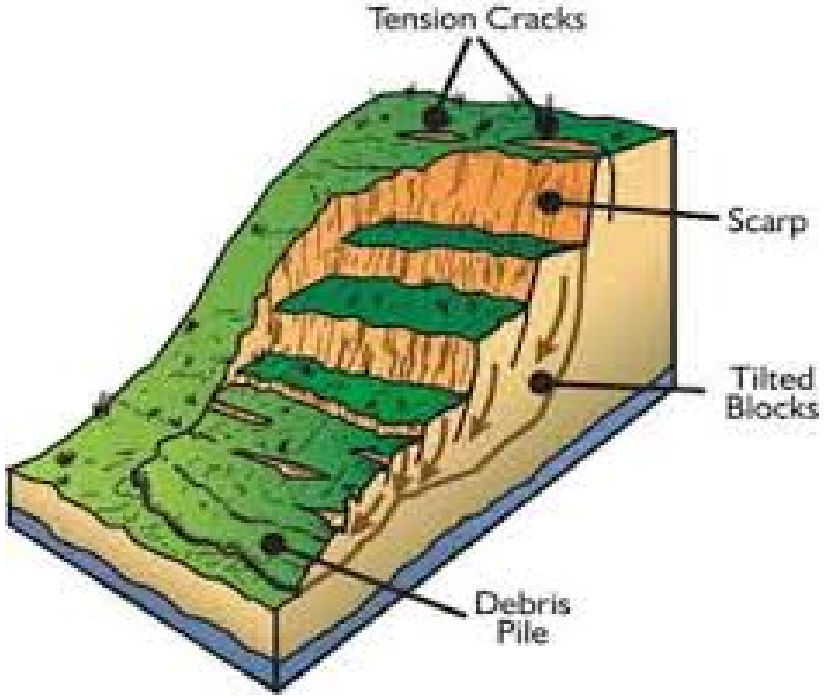
MASS MOVEMENT



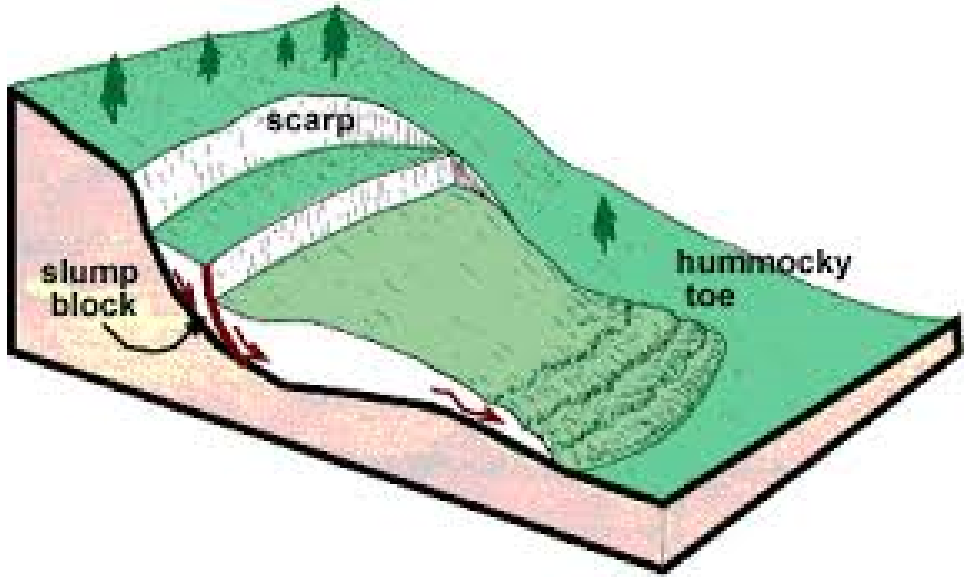
ROCK FALLS


Rock fall
Debris from previous rock falls
Copyright http://www.coolgeography.co.uk Rob Gamesby

LANDSLIDES

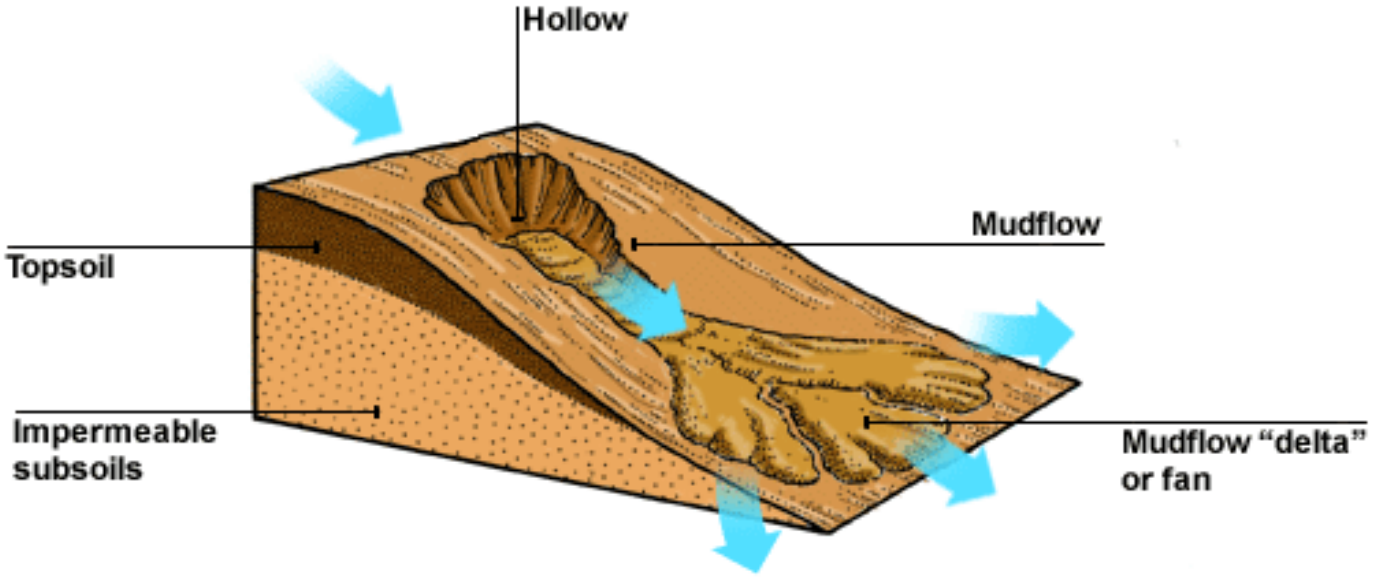


SLUMPS

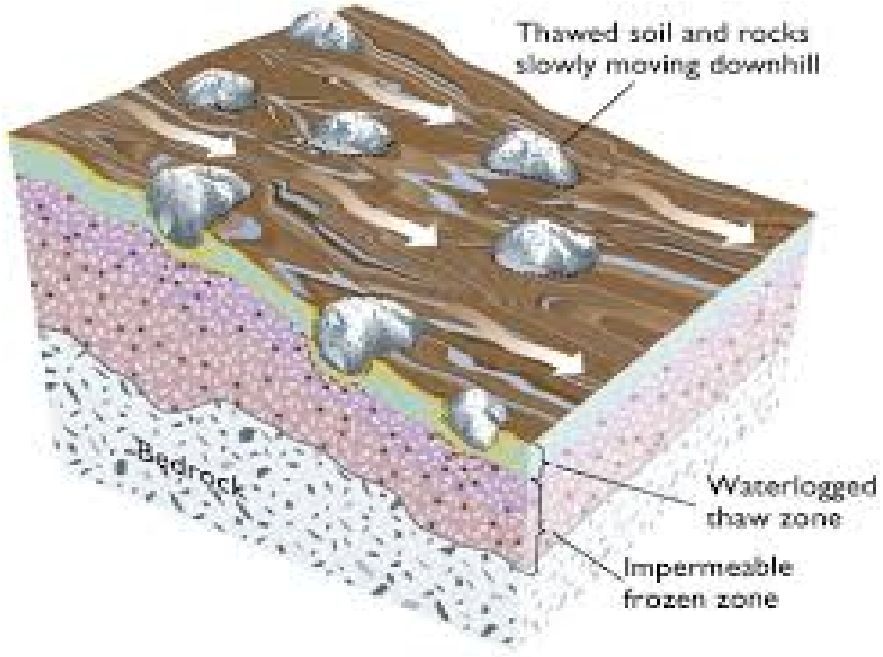


MUDFLOW

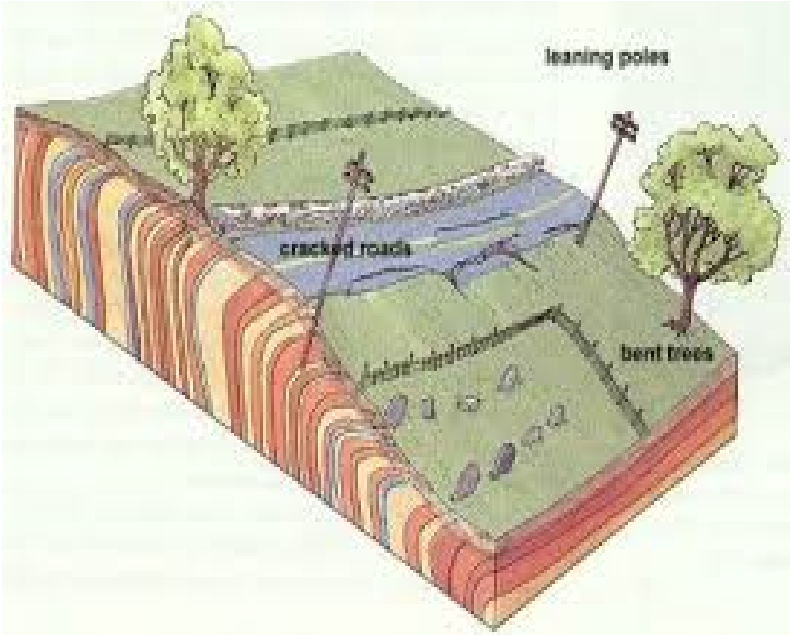
MUDFLOW

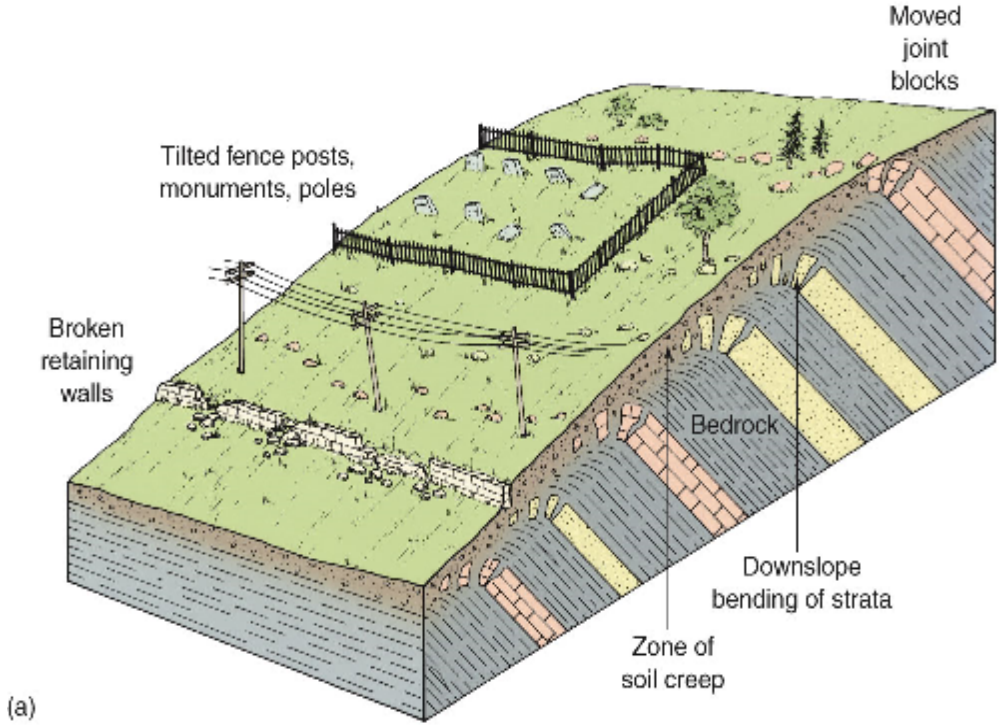

Hollow
Mudflow
Topsoil
Impermeable subsoils
Mudflow "delta" or fan

SOLIFLUCTION



SOIL CREEP


leaning poles
cracked roads
bent trees


Moved joint blocks
Tilted fence posts, monuments, poles
Broken retaining walls
Bedrock
Downslope bending of strata
Zone of soil creep
(a)

SOIL CREEP

TYPE OF MOVEMENT	SPEED OF MOVEMENT	FACTORS INFLUENCING MOVEMENT	RESULTS
SOIL CREEP	SLOWEST MOVEMENT 1CM /YEAR	• MAINLY IN HUMID AREAS • GOOD VEGETATION COVER. • VEGETATION COVER HOLDS THE SOIL, RESULTING IN SLOW MOVE DOWNHILL	TERRACES
SOLIFLUCTION	SOIL FLOW 1M/YEAR	• OCCURS IN ARTIC AREAS • IN SUMMER , SURFACE LAYERS THAW, BUT SUBSOIL REMAINS FROZEN. • THE TOP LAYER OF THE SOIL FLOWS OVER THE FROZEN BOTTOM LAYER	LOBES OF SOIL
MUDFLOW	RAPID MOVEMENT	• OCCURS AFTER HEAVY RAINS • SOIL BECOMES HEAVY WITH WATER • MUD FLOWS RAPIDLY DOWN THE SLOPE	FLOW TRACKS LEAVE A SCAR
LANDSLIDES	RAPID MOVEMENT	• OCCURS IN ROCKS THAT ARE PARALLEL TO THE EARTH • ROCKS ATE JOINTED(HAVE CRACKS)	FLAT RUPTUERD SURFACE
SLUMPS	RAPID MOVEMENT	OCCURS WHEN LESS RESISTANT ROCK LIES ON TOP OF RESISTANT ROCK.	CURVED SURFACE
ROCKFALLS	RAPID MOVEMENT	OCCURS ALONG MOUNTAINOUS AREAS	BOULDERS LIE ON THE FOOT

HUMAN INFLUENCE ON MASS MOVEMENT

1. URBANISATION

- Development on steep slopes.
- Vegetation is removed.

2. Deforestation

- Decreases slope stability by exposing the soil.

3. TRAFFIC

- Vibrations of heavy traffic can destabilise slopes.
- Speeds up soil creep.

4. Mining

- Blasting can trigger off slope failure.