

SECTION 3

Geomorphology

Unit 11 Topography associated with horizontally layered rocks

CHECKLIST:

Topography associated with horizontally layered rocks

- Characteristics and processes associated with the development of landscapes
- Concept of scarp retreat or back wasting
- Utilisation of these landscapes by people

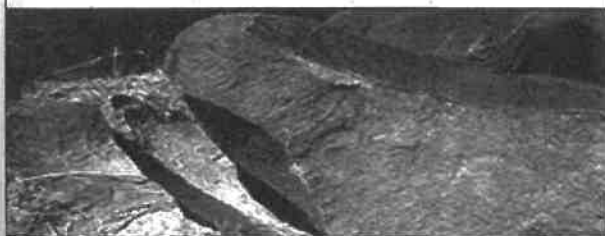


Revision – types of weathering

Weathering causes the disintegration of rock near the surface of the Earth and can be classified either as mechanical (physical) or chemical.

Ice wedging

- Is also called freeze-thaw.
- Water seeps into cracks in rocks.
- The water in the cracks freezes and expands.
- This expansion causes the rock to break apart.
- Angular rock litter on the slopes is called scree.



Exfoliation

- During the day high temperatures cause the rock to expand.
- At night the cooler temperatures cause the rock to contract.
- This expansion and contraction weakens the rock.
- The outside layers of the rock peel off.
- Exfoliation is usually common in igneous rocks, and especially granite.



Sandblasting

- Wind carrying grains of sand.
- Can wear away the softer layers of rock.



Lightning strikes

- Rocks are split when hit by lightning.



Physical or mechanical weathering: rocks are broken down into smaller pieces

Biological weathering

- This takes place when rocks are worn away by living organisms.
- Trees and other plants can grow within the cracks in a rock formation.
- As the roots grow bigger they push open cracks in the rocks making them wider and deeper.
- Over time the growing tree eventually splits or breaks the rock.



Hydrolysis

- This is the chemical breakdown of a substance when combined with water.
- A chemical reaction occurs between the minerals found in the rock and rainwater.
- When it rains, water seeps down into the ground and comes in contact with granite rocks.
- The feldspar crystals in the granite react with the water and are chemically altered to form clay minerals.
- The rock is weakened.

Dissolution

- This happens when minerals in the rock become dissolved to form a solution.
- It occurs when salt crystals come into contact with water seeping through the rock to form a calcium carbonate solution.

Oxidation

- This occurs when iron in rocks reacts with oxygen and forms an iron oxide.
- The reaction weakens the rock and it crumbles easily.
- This causes the rock to break down.
- Iron oxide is brownish-red in colour, which explains why some rocks look red, especially in arid areas.

Chemical weathering: causes exposed rocks to undergo a chemical change

Carbonation

- This involves the mixing of rainwater with carbon dioxide to make a weak carbonic acid solution.
- The acid reacts with minerals in the rocks.
- This acid rainwater dissolves the calcium carbonate in limestone forming a calcium bicarbonate solution.
- This type of weathering is important in the formation of caves.

Plants and bacteria

- Roots of plants force rocks apart and allow water to penetrate the rock and chemical weathering can result.
- Roots also release chemicals that weaken the rock.
- Burrowing and digging animals allow the rock to be exposed to the elements and chemical weathering can result.



Learning tip for kinaesthetic learners: When you are out in the countryside, have a look at the rocks you see around you. Try to identify the types of weathering that you can see.

MY OWN NOTES

Horizontally layered rocks and the resultant landscape – characteristics and processes

Land- scape	Characteristics:	Process:
Hilly areas (wet and humid)	<ul style="list-style-type: none"> slopes are rounded results in gently rolling (undulating) landscape deep soils form on slopes 	<ul style="list-style-type: none"> chemical weathering dominant the rock decomposes as a result of chemical reactions to the minerals in the rock chemical weathering includes- hydrolysis, dissolution, oxidation and plants and bacteria
Hilly areas (arid)	<ul style="list-style-type: none"> landscape is more angular and rugged soils are coarse and thin on the slopes 	<ul style="list-style-type: none"> mechanical weathering most active mechanical weathering includes- ice wedging, exfoliation, sandblasting, biological factors and lightning strikes
Basaltic plateaus	<ul style="list-style-type: none"> flat and elevated above sea level escarpment leads up onto the plateau vertical joints formed in the basaltic layers due to shrinkage when cooling uniform in their resistance to erosion resulting in flat plateaus 	<ul style="list-style-type: none"> lava flow from fissures to form the horizontal layers over the eastern interior of South Africa as far north as Zimbabwe the upper parts of the Drakensberg are the remains of these lava flows
Canyon landscapes	<ul style="list-style-type: none"> form deep, steep-sided valleys with narrow valley floors most common in arid areas as mechanical weathering is more active Examples: the Grand Canyon, USA ; Fish River Canyon, Namibia the Blyde River Canyon is an example of a canyon in a humid area 	<ul style="list-style-type: none"> develop over a long period of time the river establishes its course on the surface sediments rivers erode vertically as a result of rejuvenation hard layers of sedimentary rock form the vertical cliffs and the softer sedimentary rock form gentler slopes overall effect is a step-like, steep-sided valley with a river on the floor of the canyon
Karoo landscapes (mesa, butte and conical hill)	<ul style="list-style-type: none"> this landscape forms as a result of erosion over millions of years the landscape is characterised by flat-topped hills separated by wide, flat plains dolerite sills form the flat tops of the hills as they are more resistant to erosion (Figure 11.1) 	<ul style="list-style-type: none"> the intrusion of magma between horizontal layers of sandstone and shale cooled magma forms hard dolerite sills further erosion of the flat plateau forms mesas, buttes, pointed buttes a conical hill remains once the hard layer of dolerite has been removed

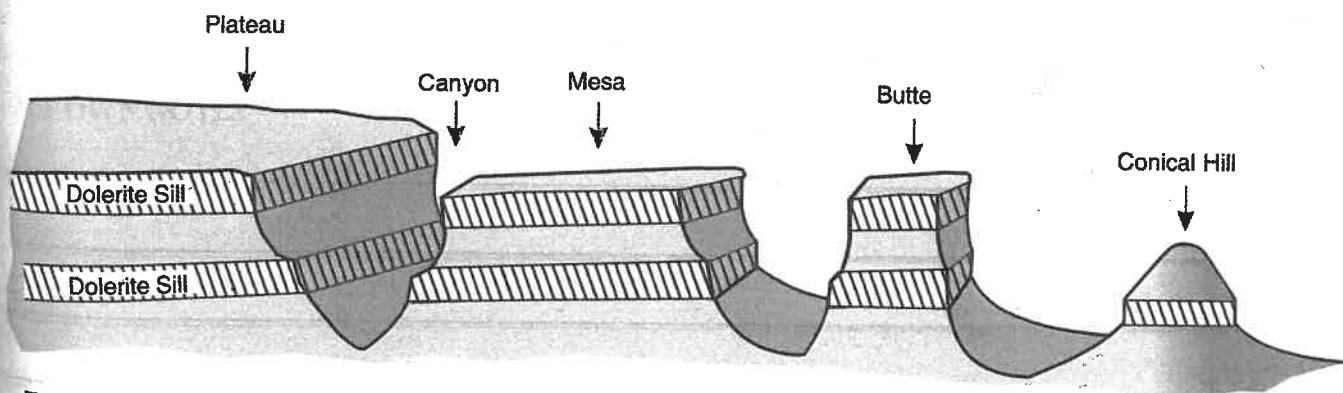


Figure 11.1 Development of a Karoo landscape

How do you distinguish between a mesa and a butte?

- A mesa is a flat topped hill with steep sides. It is not as large as a plateau.
- A butte is a flat topped hill with steep sides and has a smaller area on top.
- A pointed butte is a butte that has been eroded even further.

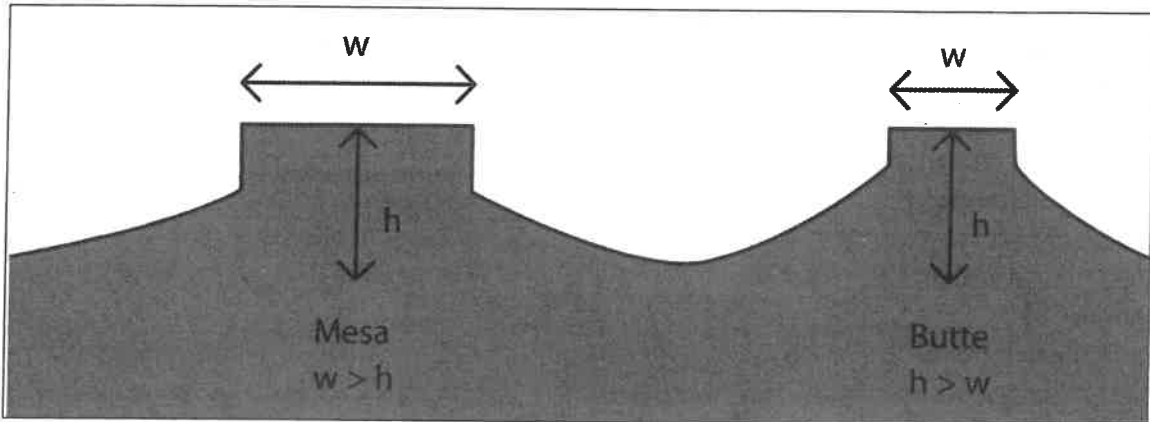


Figure 11.2

Concept of scarp retreat or back wasting

- A scarp is the cliff-like face or slope between the high area and the low flat land.
- Back wasting or scarp retreat refers to the change in position of the scarp as a result of erosion.
- This means that the cliff or scarp erodes backwards.
- If the scarp is capped by a layer of hard resistant rock, the scarp will maintain its form (shape) as it retreats.
- Scarp retreat takes place along the edges of plateaus (escarpments), mesas and buttes. As the slope retreats the surrounding lower, flat areas eventually join to form a **pediplain**. This pediplain is the extensive, flat plain.

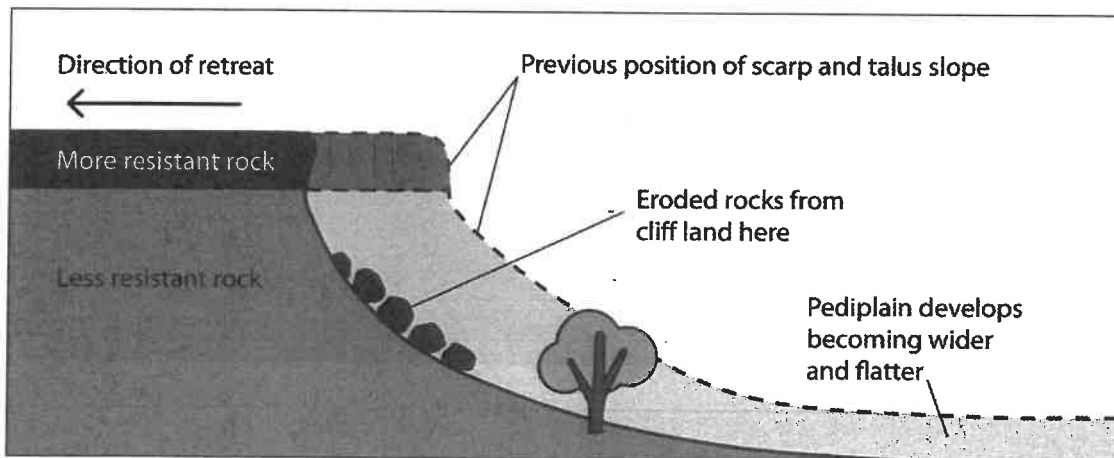


Figure 11.3

MY OWN NOTES

Utilisation of these landscapes by people

Land utilisation by humans is determined by relief, soil and climates as well as social and economic needs.

Hilly landscapes - arid areas

- slopes are more angular
- less water and thinner soil limits use of land
- steep slopes limit cultivation
- large scale erosion is also common on the slopes because of the lack of vegetation
- more suitable for grazing

Canyons

- steep sides and limited valley floor space makes it difficult to farm
- water in the valley is not always accessible
- form physical barriers; too wide to build bridges across.
- tourist attraction because of their beauty

Basaltic plateau

- produce fertile soils rich in iron
- high rainfall and fertile soils produce good agricultural land
- high altitude plateaus can experience low winter temperatures which are not suitable for agricultural activities
- access to high plateaus is limited, mountain passes are costly to build and maintain

Utilisation of these landscapes by people

Karoo landscapes

- flat and therefore are easy to farm and to build transport routes
- mostly found in the drier parts of South Africa, limiting agricultural activities in the area
- soils are thin and rainfall is limited
- rainfall is mostly in the form of thunder showers which often lead to sheetwash runoff rather than the rain infiltrating the ground
- suitable for large-scale sheep farming
- also a major tourist destination because of its beautiful scenery, plant life and fossils

MY OWN NOTES
