Unit 13 Topography associated with massive igneous rocks

CHECKLIST:

Topography associated with massive igneous rocks

- Identification of batholiths, laccoliths, lopoliths, dykes and sills ☐
- Characteristics and processes associated with the development of granite domes and tors ☐

Magma wells up from great depths of the Earth in liquid

If cooling takes place deep beneath the surface of the Earth the rock formed will have large crystals as the cooling would have taken place slowly.

Granite is a common form of igneous rock that forms deep beneath the Earth's surface.

Granite forms large batholiths and the top of an exposed batholith is called a dome.

If the magma reaches the surface of the Earth cooling will be rapid and there will be a lack of crystal structure in the rock.

Dolerite and basalt are the most common type of igneous rocks formed with rapid surface cooling.

Dolerite intrusions form sills and dykes.

Identification of batholiths, laccoliths, lopoliths, dykes and sills

Batholith:
- Is the largest intrusive feature.
- Forms deep below the surface.
- The rock type is granite.
- They are irregular in shape with steep sides.

Lopolith:
- Is a saucer shaped feature.
- Formed by intrusion of magma between layers of sedimentary rock.
- The weight of overlying rock causes the intrusion to collapse while cooling.
- Forms a cuesta basin when exposed due to erosion.

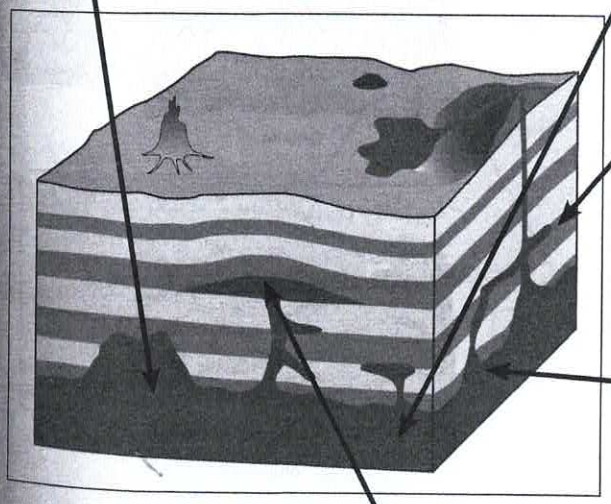

Figure 13.1 Igneous intrusions

Sill:
- Horizontal intrusion of magma between sedimentary rocks forms a sill.
- Dolerite is the common rock type of sills.
- It is a common feature of the Karoo landscape.
- When exposed by erosion, sills result in flat-topped hills.

Dyke:
- Vertical intrusion of magma across the horizontal layers of sedimentary rocks.
- It results in a serrated ridge and hogsbacks when exposed by erosion.

Laccolith:
- Is a mushroom-shaped feature.
- Intrusion of magma between layers of sedimentary rock forms a laccolith.
- The upward bending of the sedimentary rocks is a result.
- It results in a cuesta dome when overlying sedimentary rocks are eroded, exposing the laccolith.

Unit 3 Topography associated with massive igneous rocks

1 What are massive igneous rocks?

- Unlike sedimentary rocks, most igneous rocks do not form layers. Massive igneous rocks are formed when magma cools down and solidifies.
- When these rocks are exposed by weathering and erosion, they usually appear at the surface as granite domes or tors.

1.2 What are the intrusive bodies associated with massive igneous rocks?

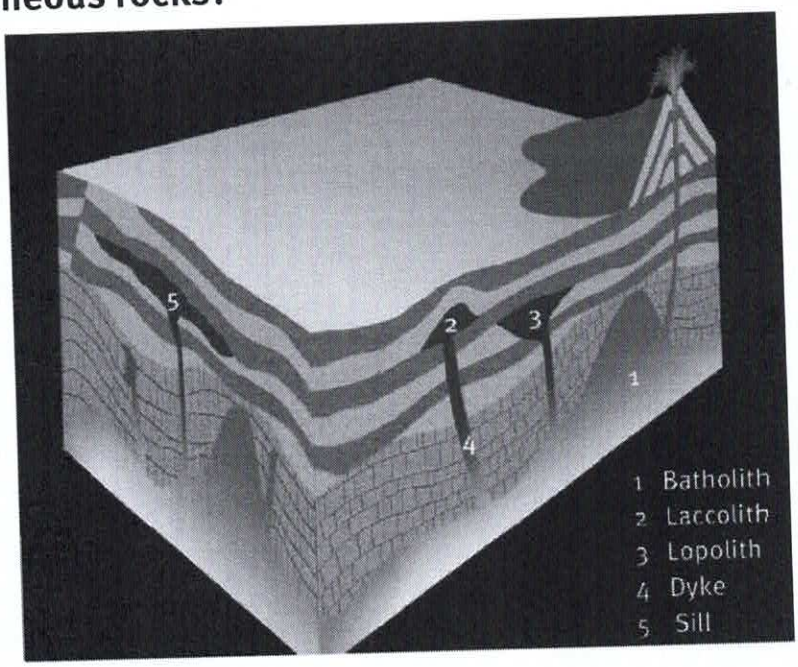

FIGURE 54 Intrusive bodies associated with massive igneous rocks

- Landforms such batholiths, laccoliths, lopoliths, dykes, sills and pipes are formed by intrusive igneous activity (**Figure 54**).
- These rocks are formed when an enormous mass of magma does not reach the surface, but instead pushes (intrudes) into spaces underground and then solidifies.
- These formations may be exposed on the surface of the Earth only after millions of years of erosion.

TABLE 14 The various intrusive igneous rock bodies

Intrusion	Description
Batholith	Largest of all intrusive forms. It is usually made of granite. Paarl Mountain is an example of a batholith.
Laccolith	A mushroom-shaped intrusion. It pushes the overlying strata upwards.
Lopolith	Magma intrudes between sedimentary layers. The layer underneath cannot support the weight and sinks down. A saucer-shaped intrusion is formed. It is connected to the magma source by means of a dyke or pipe.
Dyke	A wall-like intrusion that cuts almost vertically across existing strata.
Sill	A horizontal rock layer formed as magma spread between layers.
Pipe	A chimney-shaped intrusion. Magma can move through a pipe, often to the surface.

2 Granite domes and tors

2.1 How are granite domes formed?

Granite domes usually arise from batholiths or laccoliths, which intrude into and penetrate sedimentary layers. Erosion and weathering then occurs until a large granite mass appears on the land surface.

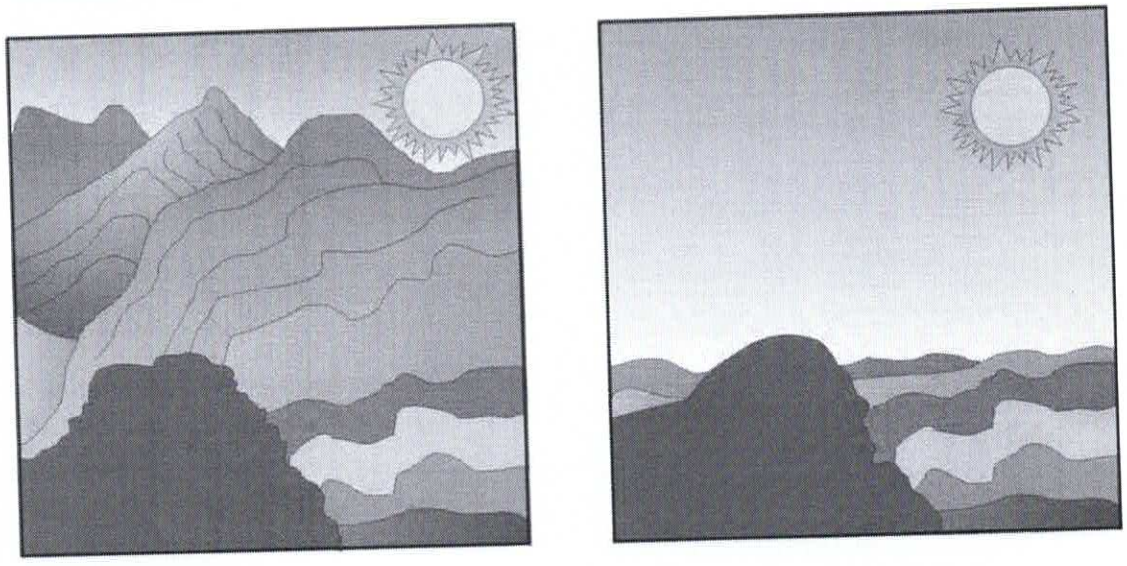

FIGURE 55 Stages in the exposure of a batholith to form a granite dome by erosion

2.2 What are tors and how are they formed?

- Tors look like a heap of partially rounded boulders, called core stones looking like they are piled on top of each other.
- They are found in regions where there are massive igneous rocks, usually granite. This type of rock formation often consists of granite. In South Africa, there are many tors in Namaqualand and the Lowveld.
- Tors are caused by chemical weathering below the surface. Vertical and horizontal joints in the rock are formed as magma cools and contracts.
- When water passes through the joints they are widened by chemical weathering. As the joints widen, distinctive rock shapes are formed.
- The rocks break down and become more rounded.

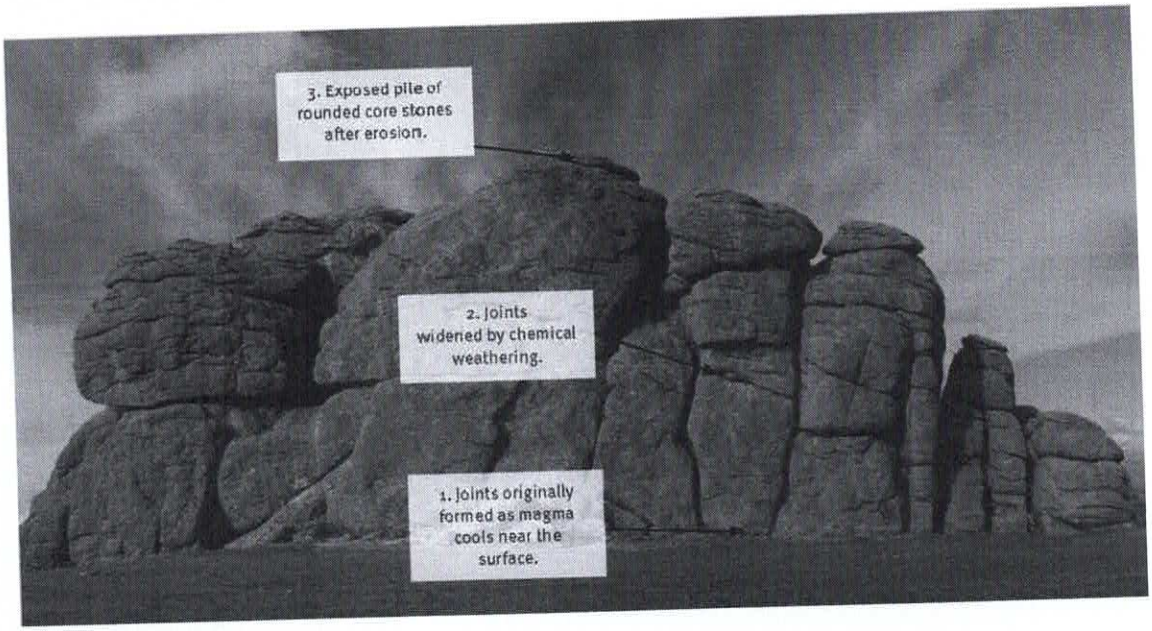

FIGURE 56 The formation of tors by weathering of jointed igneous rock

Characteristics and processes associated with the development of granite domes and tors

Granite, when exposed on the surface of the Earth, forms two distinctive types of landform features, namely granite domes and to

Landform	Granite dome	Tors
Characteristics	• usually round and smooth when exposed • they are light in colour • exposed domes are part of a much larger and deeper lying **batholith**	• isolated, exposed piles of rocks • rocks are stacked one on top of another and are well rounded in appearance • rocks are not joined to each other except for the bottor row of boulders which may still be attached to the solic rock below • usually igneous rocks of either granite or dolerite
Processes	• intruding batholiths cool down • cooling results in the contraction of the magma and orthogonal joints develop • overlying layers of rock are removed by weathering • removal causes a decrease in the pressure allowing the batholith to expand • expansion joints develop which are curved in shape • water seeps into these joints and cracks allowing further weathering in rounded granite domes • weathering continues on the exposed dome • surface weathering causes exfoliation and granular disintegration	• development of a tor begins with the cooling of igneou rock below the surface • cooling magma results in joints and cracks in the rock • seeping ground water into the cracks and joints results in weathering • further joints and cracks occur with erosion of surface layers • ground water also dissolves minerals in the igneous roc • removal of overlying rock layers exposes the core ston of the igneous rock • the pattern of the core stones is determined by how fa apart the joints were in the original igneous intrusion
Diagram of the landform