Hello everyone, I'm doctor Manoj Ibrampurkar.

Assistant professor in geology at the Dhempe

College of Arts and Science, Miramar.

This lecture is scheduled

for TYBSc geology students.

Under the course Igneous Petrology

today we will discuss about

occurrence of hypabyssal igneous rock.

It is included in Unit 1.

Topic three under module.

9. In this lecture,

we will see what are hypabyssal,

igneous rocks, types of igneous

intrusions and the mode of occurrence

of hypabyssal igneous rocks.

At the end of this lecture you will

be able to define hypabyssal igneous

rocks and understand the various

types of hypabyssal intrusions.

So there are two types of igneous

intrusions, major and minor.

When the magma is emplaced at

great depth in the crust

and the magmatic body is very large

they're called us major intrusions,

also called us plutonic igneous rocks,

whereas when the magma intrudes at

shallow depths in the crust and the

magmatic body is smaller in size,

relatively smaller in size,

then that body is called as

hypabyssal igneous rock.

So when magma solidifies on its way to

the surface of the earth at shallow depth,

the resulting rock is called a hypabyssal igneous rock.

In such rocks,

the cooling rate is intermediate

between the cooling at very

great depth and on the surface.

That is, the minerals formed are

medium grained because the rate of

cooling is moderate or moderately slow.

So most of the hypabyssal igneous

rocks are medium grained in nature.

And they are exposed on the surface of

the earth only after substantial erosion.

The various forms of hypabyssal

igneous rocks are.

dykes, sills,

ring dykes, cone sheets,

Phaccoliths and volcanic necks.

Dykes they are the most common hypabyssal

Igneous rocks.

They are shallow igneous intrusions.

Discordant with the.

Country rock discordant with the

structure of the country, rock.

They are usually a wall

like body tabular on top.

This black color represents here

dyke and the various colors

here are sedimentary rocks,

so this igneous body has cut across

this the sedimentary certification and

therefore it is discordant in nature.

Such dykes are usually

5 to 10 meters in thickness.

However, the thickness can vary from

few centimetres to even 20 or 25 meters.

And the length can extend from few.

100 meters to few kilometers also.

Since this solidify at shallow depths.

The grain size is medium grained,

however, at the contact with the country,

rock the rock the dyke may be fine

grained or even sometimes glassy.

Dykes rarely occur individually,

and most of the time they occur in groups.

And such occurrences are called

dyke swarm and most of the time

dykes are made up of dolerite,

which is a mafic igneous rock.

We have many dykes along the coast of Goa.

So dyke swarms intrude the Earth's crust when

the earth’s crust is subjected to tension.

When tension is applied

Fractures develop parallel to

each other and perpendicular to

the direction of the tensional forces,

and these lectures are then occupied

by Magma and you get dyke swarms.

However, some dykes occur in a different

Disposition… that is radial disposition.

When a magma thrust

against the roof of its chamber,

the forces that are developed

create radial fractures and these

fractures maybe also filled by magma,

resulting in radial dykes.

Sometimes the fractures are

included multiple times.

If the same fracture is included multiple

times with a similar magma,

similar composition,

then those dykes are called

as multiple dyke however, if.

The magma composition varies

from the earlier intrusion.

Then the multiple dykes are

called less composite dyke.

Coming to Sills.

Sills are similar to dykes except

that they remain concordant with

the structure of the country rock.

In this diagram this was the dyke.

Now this body has moved parallel to

the structure of the country Rock.

Now this is 1 sedimentary layer and

this is another sedimentary layer.

The magma has intruded along the

bedding junction of these two beds

and therefore, it is a concordant body,

So, such intrusions are called as seals.

They may be few meters in thickness

and spread over few square kilometers.

Similar to dykes they are medium

grained except at the contact

with the country rock.

And also has closely spaced

joints close to the contact.

Sills intrude only when the overlying

pressure is less than the

pressure of the magma that intrudes.

Again, sills are also most of

the time made up of dolerites.

Dykes which show circular outcrop

are called less ring dykes. The inner

and outer walls of the intrusion

may be parallel or have different

degrees of curvature which converge,

forming a crescent outcrop.

Occasionally, the ring may be complete.

In ring dyke the walls move either

parallel to each other or deep outwards

as you go inside the earth's crust and this

is a characteristic feature of the ring dykes.

This happens because the ring dykes

are formed when calderas are formed,

usually as explained earlier.

Calderas are formed when the roof

of the magma chamber collapses

inside the magma chamber,

creating fractures which diverge as

you go inside the earth's crust.

These fractures are then filled

by the intruding magma,

resulting in ring dyke.

Ring dykes are also found in ring

complexes such as that of carbonatites.

Coming to cone sheets.

Cone sheets are similar to ring dykes.

That is, their outcrop is arcuate or sometimes complete rings.

But the main difference with the ring

dyke is that cone sheets converge or

they deep inwards as you go inside.

See here this angle,

They dip towards each other,

whereas in the ring like they were

dipping away from each other.

So, such fractures are formed

when magma intruding magma

pushes the overlying roof rocks,

and concentric circular fractures

are formed as the magma.

Intrudes into these fractures.

Next is Phaccoliths.

Phaccoliths are lens shaped, concavo-

convex shaped intrusions parallel to the

bedding plane along axial regions of folds.

So, if you see here,

this is a Phaccolith where the magma has

intruded along the axial region of the fold.

The limb is usually under stress,

whereas the axial regions

are under low stress.

Therefore, this is the best

place for magma to intrude,

and when these spaces are occupied by magma,

the resulting body is called Phaccolith. Most of the time they are mafic

in composition because the magma is mobile,

but these are not very common rocks.

Laccolith is plano-convex body

convex upwards and plane downward.

Usually there is a source feeder also.

Now this type of.

Body is formed when the intruding

magma is viscous in composition and

it uplifts the overlying rocks.

Resulting in uplift of the entire

topography when such bodies are exposed

on the surface of the earth, they are

circular in outcrop.

And domical in shape.

Usually, such rocks are felsic in composition,

so they are more viscous.

They do not spread out.

And last his volcanic neck,

also called as volcanic pipe.

These are pipe like openings that

connects the magma chamber to the volcano.

Now they are exposed on the surface

of the Earth after the erosion of

the volcanic rock they're joining.

Volcanic rock has been eroded

and the vent stands out as a column

or a circular cylindrical body.

This type of bodies are called as

volcanic necks. So to summarize.

Hypabyssal rocks solidify at shallow depths.

They're usually medium grained

and they occur as dykes,

sills, ring dykes, cone sheets,

phaccoliths, laccoliths and volcanic

necks. Amongst all these, dykes

are the most common occurrence.

For references on this topic,

you can refer these books one by Mihir Bose and .

another by John Winter.

Thank you very much.