Hello students, today we'll start

with a third year course that is

on GC 110 Indian Stratigraphy

So in this module we will be talking

about geology and Stratigraphy of Goa,

Group of rocks.

It is divided into 2 parts so let

us see what is there in Part 1.

Outline of this module is geology and

Stratigraphy group of rocks will

be talking about introduction on

Anmod Ghat Trondjhemitic Gneiss

Trondjhemite-Tonalite Gneissic Suit (TTG) that is TTG.

Then we will be seeing what

is chandranath granite gneiss

Tamdi felspathic gneiss

Dudhsagar granite

and Canacona granite

At the end of this module.

You will be able to understand

the geology and stratigraphy

of rocks belonging to the.

Goa group. Further it will also

help in understanding the Precambrian

crustal evolution and the palaeo-

tectonics of Goa region.

So let's get started, Iin the introduction.

Let's see what Goa group of rocks?

What are the different parts?

It consists of

So geologically the state of

Goa occupies an area about 3700

square kilometer on the West Coast

of India forms a part of the

Indian pre-Cambrian Shield.

The Region consists of greenschist supra

crustal rocks which overlie a basement

consisting of trondjhemitic (peninsular) gneiss

Intruded by mafic, ultramafic and granitic rocks

After that,

the Late Cretaceous Deccan traps are seen

towards the northern end of the Goa region.

This is only seen at the northern

flanks while the laterite Rocks and

The alluvium and sand are seen as cap

rocks on the goa group of rocks.

The sequence oldest to youngest,

as described by the Geological

Survey of India 1996,

consist of the Peninsular Gneissic complex,

which is the Archean.

This complex forms the basement

for the Goa group of rocks.

The goa group of metavolcanic and

metasedimentary assemblages starting

from the Archean to the Proterozoic age.

This is covered by Deccan Traps

of Upper Cretaceous to Eocene in

age and later we have the cap.

Rock that is the Laterite

which is of Cenozoic and beach sands

Of quaternary age

Now let us see how these things

came into picture.

The first geological map of the Goa

The region was prepared by Ortal in 1957.

Later Gokul et at all in 1985.

revised and classified this

northwestern extension of the Dharwar

Super Group into four portions.

that is what we called it

is the Goa Group of rocks.

So we will be studying each

of these a bit later,

but first we'll try to see which are the

different classification that comes in.

Further,

Dessai in 2011 identified Ponda Group,

an integrated Goa group with a

contagious western DharwarSuperGroup.

So we have the Gokul 1985 Goa

Group classification and the

revised Desai 2011 classification.

Introducing the Ponda group.

And telling us its relation to

the West and the DharwarSuperGroup.

So first we'll see what is

Anmod Ghat trondjhemitic gneiss

The oldest known rock in Goa is

the Anmod Ghat trondjhemitic gneiss with

an age of about 3.4 billion years,

which was reported in 1987 while Sm-Nd

and U-Pbwork has provided

an age of 3300 million years. These gneiss

which forms the basement of Goa group.

Can be correlated with the

older part of the Peninsula.

gneissof South India.

It is over this basement that the

Goa Group of rocks are resting.

The gneiss iis exposed in Anmode

and is equivalent to the Gorur Gneiss

from Hassan district of Karnataka

So basically the Anmod Ghat

trondjhemitic gneiss forms,

the basement for resting of the Gorur Gneiss

So the Anmode Ghat gneiss is fine

grained, granulated.

And has metamorphic fabric

with accessories zircons

The foliation trends North South.

And it has a depth of about

60 to 70 degrees West.

It has a low initial strontium

ratio of very low potassium content

and shows a negative ND value. Over

all the gneiss shows ortho Genesis.

The next is the trondhjemite-tonalite gneisses

suit that is called as the TTG.

The TTG suit.

Are very well exposed in the

southern part of Goa.

That is the Chauri,

Palolem and Agonda in the Canacona taluka.

The belt ends WNW-ESE

and attains a width of over

5 kilometers towards the coast in

the West and pinches out in the East.

The formation of this suit is

heterogeneous polyphase Genesis

migmatites that consist of both.

Mafic and felsic.

The palaeosomes and the felsic

neosomes are reminiscent of the

Londa migmatite gneiss

So basically this trondhjemite-tonalite gneisses

are formed by heterogeneous

process and it has both the felsic

as well as the mafic component than

is compositionally similar to

the Anmode Ghat gneiss and in particular

also contains low abundance of K2O.

The trondhjemite-tonalite gneisses

rock is overlain by the greenschist

supra crustal rocks

of Barcem formation of

Goa group of rocks.

The residual material remaining

from the partial melting of the

earlier basaltic crust resulted

in an isolated enclaves of the

hornblende schist within the gneiss and has led

to the development of the banded

and migmatitic gneiss of

Trondjhemite-Tonalite composition. Where

else at several places the gneiss

shows retrograde metamorphism that

is from hornblende to biotite.

And consist of restite material.

Such rested materials are quite

prominent and are very well visible

in the outcrops Palolem

So what are the major contributions

of Gokul et al 1985 classification?

So this classification is very well

known and well used in the understanding.

Goa Group of Rocks in this scheme

of classification,

all the granitic gneisses and the granites

From Goa were considered coeval and

intrusive into the meta sediments.

The Meta conglomerate,

which is underlain by the greenstone

sequence where assigned the status of

para conglomerate, the granitic gneisses,

are considered as intrusives into

the Super Crystal Greenstone.

Gokul et al.

1985 identified four types.

That is the chandranath granite gneiss

Than Tamdi felspathic gneiss

The Dudhsagar granite

and the Canacona granite

Though all these four types of granite

basically form as an intrusive.

In the Supra crustral greenstone belt of Goa.

So let us see each of these in detail.

So the first one is the

Chandranath granite gneiss

This nice is well exposed at Paroda, Quepem

Extends in E-W trend from Sanguem in

the east to Colva-Banaulim in the west.

Covering a length of less than 22

kilometers and is over 11 kilometers wide.

Chandranath granite gneiss is grey in colour

and varies in composition from

granodiorite to quartz-diorite.

It is very well foliated,

and the foliation trends NE, Southwest,

and dips by 50 degrees East.

The Chandranath granite is also known

to be intrusive, syn-kinematically

Within the first phase of folding

of the metasediments,

the Nd isotope studies provided model

age of about 2900 million years,

indicating that the protolith are

either younger than the trondhjemites or

are less enriched in light REE.

Intrusion of the gabbroic rocks.

So these gabbroic rocks are then

placement of the Chandranath granite gneiss

was followed by an intrusive of the.

Gabbroic Rock,

which were later identified to form

a layer of peridotite gabbro complex

So the complex is intruded along a major

shear zone that runs northwest southeast.

The outcrop occur at Pernem,

Valpoi, Bondla, and Canacona

Among this the Bondla exposure is much clearer.

It consists of an ultra

mafic rocks at the base,

followed by mafic

gabbros, leucogabbros and rarely

by granophyric rocks on the top.

So basically it is a an intrusive.

Which consists of mafic to felsic rock.

The ultramatic zone consists

of cumulates of chromite layer

alternating within those of olivine

So this ultramafic zone at the

base of the intrusive gabbroic body.

The mafic zone shows uniform layering

whereas the gabbroic intrusive

are seen occurring higher than

intrusive Chandranath granitic gneisses.

according to Devaraju, the complex.

Enclosed within the supracrustal Rock,

And was emplaced during the early stages

of the basin formation and prior

to the deposition of the supracrustal rocks.

Whereas theTamdi felspathic

gneiss and the Dudhsagar granite

That is the type two and three types.

The third type are considered to be

synkinematic with the second phase of

the deformation of the Goa group of Rocks,

whereas the fourth one that is

the Canacona granite .

Which is been exposed in the

Char Rasta-Chauri,

Palolem and Agonda, in Canacona

taluka and is equivalent to the Chandranath

granite gneiss.

The Canacona granite is depicted

as an intrusive into the TTG gneisses

This was reported by GSI in 1996.

It has been dated about 2395 million years.

The Canacona granite is distinctively late.

Nonfoliated, an exhibit a

discordant relationship with the.

WNW-ESE foliation

Gneiss or migmatite.

So basically it is nonfoliated an it has

discordant relationship with the TTG,

so compositionally it is

potassic in comparison

with the host gneiss/migmatite which is

strongly foliated and relatively sodic.

These exposures are well

seen in Palolem and Agonda,

and they occur as bosses and plutons.

The contacts are sheared, patches

and shreds of older gneiss can be traced

on either side of the younger intrusives phase.

The granite is a very coarse or

coarse grain compared to the gneiss.

They're grey to

Pinkish Grey in color and contains

relict phases from the host TTG gneiss.

so this is the description

of the Canacona granite.

So in the end of this lecture module.

We have seen the basic introduction to

The Goa group is the basic geology.

We have tried to see what is Anmod Ghat

Trondjhemitic Gneiss its occurrence,

the composition and

the way they are being formed.

Then we saw what other Trondjhemite-

Trondjhemite-Tonalite Gneissic Suit is that is TTG

The which is the basement for the

overlying green schist supra crustal

of Barcem formation of Goa group of rocks.

The barcem formation,

which is the lowest in the Group of rocks,

is directly over land on the TTG,

and then we saw what are the four

different types of intrusives that is,

the Chandranath granite gneiss

The Tamdi felspathic gneiss

The Dudhsagar granite and

the Canacona granite

So in the next module we will be seeing

the detailed stratigraphy of Goa,

which will be overlined on the

Trondjhemite-Tonalite Gneiss

These are the references.

The work is well being reported

in the book on Natural Resources

of Goa A geological perspective

by Fernandez and Widdowson 2009.

The work is also well reported in

Stratigraphy and structure of Goa

by Gokul at all in 1985 and the

revised Stratigraphy is being reported

in the geology of Goa revisited

by Dessai in 2011.

So these are the references for

Goa group of rocks.

Thank you.