

Title of the unit: unit-

4, module name: structures and textures of metamorphic rock.

Part-3.

My name is Kimberly Fiona Afonso,

In this module we will highlight the

different textures and structures

of metamorphic rock. At the end of

this module we will be able to

list the textures and structures

in the metamorphic rock and

also relate the terms textures,

structures and fabric in metamorphic rocks.

The textures of metamorphic rocks.

1st is your granoblastic fabric. Grano-

plastic fabric is created under

hydrostatic state of stress is.

Granoblastic fabric consists of

isotropic aggregates of equidimensional,

euhedral grains of more or less similar size.

For example in quartzites and marbles.

For granoblastic polygonal when viewed under thin sections the grains appear as equidimensional polygons with grain boundaries, that meet at triple junctions at approximately 120 degrees between them.

The next is a Hornfelsic fabric are typical fabric developed in contact metamorphosed rocks, such as in Pelites, (shale, mudstones) or even any fine grained igneous rocks.

These are fine grained rocks and lack foliation.

These are called as hornfels.

The rocks have been baked and indurated by heat of the intrusive magma.

Usually the magma is of granitic composition.

For example biotite hornfels.

Hornfels are massive, hard, splintery and sometimes very tough and durable.

Traces of bedding,

planes and parent rock may be retained.

We need to remember,

depending upon the character of emplacement,

If the intrusion is of a forceful kind,

It will produce a strongly foliated

rock rather than hornfelsic fabric.

That will result in the rock that will

be forming contact gneisses and schists.

Grains if it's at a higher grade

of metamorphism.

of regional kind,

all of the hydrous minerals and

sheet silicates become unstable,

and thus there are very few

minerals present that would

show preferred orientations.

It is then rich in quartz and

feldspars with very minor amount

of platy and prismatic minerals.

The resulting rock will have a (granofels).

granoblastic fabric. Example is a granulite.

This is the rock if it lacks  
foliation at very high grades,  
will result in a granoblastic fabric.

Few examples of rock that show  
isotropic fabric are quartzites,  
which shows again a granoblastic texture.

It is basically a rock made up  
entirely of equidimensional quartz.

They are formed by metamorphism  
of quartz arenites due to the  
metamorphic effect that occurs.

Quartz will recrystallize as interlocking  
crystals that make up the rock very hard.

Another example that exhibits a  
granoblastic texture is marble.

Basically you have a limestone  
or dolostone that is made up of  
only calcite or dolomite.

Once subjected to metamorphism,  
it is converted to marble,  
which is mostly made up of the crystallized

quartz sorry calcite and dolomite.

The recrystallization usually

obliterates all fossils.

This is a hand specimen of marble

showing a granoblastic texture.

Let us take a look at few of the

structures of metamorphic rock.

But first we will look at this slaty cleavage.

It's a type of a continuous cleavage,

in which the individual grains are too

small to be seen under the unaided eye.

It is a fine penetrative foliation.

It is defined by closely spaced planes,

along which the rock cleaves

easily when hit with a hammer.

Slates are usually often aphanitic.

In other words, where you find grain,

individual members are very hard to see by

our naked eye and have a very dull lust-

ure on the well develops slaty cleavage.

The cleavage planes may lie parallel

to the original bedding or across it

depending on the direction of the

applied non-hydrostatic stresses.

This is an image of the rock solid

showing slaty continuous cleavage.

Phyllites have a slightly coarser,

continuous cleavage.

They have a lustrous Sheen on

foliated surface as the grain size is

slightly closer than that of slates,

and where the individual aligned

crystals become large enough to

see with the naked eye.

That is,

the grain size is almost medium to coarse.

The foliation is termed as schistosity.

It is a very coarse, penetrative foliation.

This is a hand specimen of

Phyllite showing a lustrous.

sheen on a foliated surface.

Schistosity is characterized by

more intensely metamorphosed rocks,  
due to which the, relict magmatic as well  
as sedimentary features are here erased.

The rocks here usually break irregularly  
along the planes of Schistosity.

These are also commonly lineated that  
is expressed by long segregation  
of contrasting minerals due to  
metamorphic differentiation,  
for example chlorite or mica schists.

Schistose:

Is the structure that is due to  
predominance of flaky, lamellar, tabular,  
rod-like and highly cleavable minerals  
such as mica, chlorite, talc, which,  
under dominant influence of  
directed pressure and dynamothermal  
metamorphism forms  
layers and folia arranged in  
more or less parallel layers.

These folia maybe plain, undulating

or lenticular in shape,

where they wrapped around the

porphyroblasts.

This is a hand specimen showing

a chlorite Schist

Slates/Phyllites and schists are strongly

foliated and formed under low grade

metamorphism due to the abundance

of platy phyllosilicates minerals

as compared to higher grade rocks.

Then I just take a look at

or gneissose structure.

It's a weakly foliated rock.

It is defined by with parallelism

of inequant mineral grains or due to

mechanical compositional layering.

The rock here do not break easily

along the foliation.

When the a foliation consists of

a millimeter to centimeter scale

layering in which the mineral proportions,

colors, or textures may vary,

and along which there is no particular

strong tendency to break,

this fabric is gneissic and the rock

that shows such fabric is called as a Gneiss.

These are poor in platy minerals

and represent a high grade of metamorphism.

Gneiss is a medium to coarse grained

rock granoblastic to lepid-

blastic (lepidoblasti)c texture is

due to the metamorphic texture that

is developed due to platy minerals

such as the mica, talc, chlorites,

graphites and align preferentially

to produce a planar fabric

and compositionally they are made up

of dominantly quartz and feldspars.

And micas and hornblende.

This composite structure due to the

alternation of schistose and granulose band

and lenticles which are dissimilar,

both and mineral composition

as well as in texture,

the dark band or schistose bands are

essentially ferromagnesian minerals

like micas, hornblende,

whereas, the granulose, shows the

light colored minerals essentially

made up of quartz and feldspar.

This is the rock Gneiss showing a difference

in the layering wherein you have

the dark bands as well as the light

colored bands. Maculose structure is

characterized by a spotted appearance

of the rock that may be caused due

to the formation of large sized

crystals called as porphyroblasts

within an otherwise fine grained rock.

These are results of thermal contact,

metamorphism of argillaceous

rocks such as shale.

It is due to the incipient crystallization

of minerals like andalusite and  
biotite minerals that part in part  
a maculose structure to the rock.

Cataclastic structure:

It is a structure of fragmented rocks  
developed by shearing stresses upon hard,  
brittle materials in the upper zones  
of the Earth's crust where there is  
very little new mineral formation.

If you have soft rocks like shale or Tufts,  
they develop cleavage whereas, the  
harder rocks are shattered and  
finally crushed into powder with  
the formation of this crush breccia.

Augen fabric it is a type of a  
porphyroclastic fabric in which the  
alkali feldspars or the plagio-  
clase feldspars occurs as clasts or  
ovoidal megacrysts that have survived  
deformation in a finer ground matrices.

This is a sheared granitoid showing

strong foliation of dark bands,  
mainly being biotite and the  
lighter bands of quartz and feldspar.

Here you can see in this image  
that the original feldspar,  
which occurred as a phenocryst,  
has resisted the deformation and  
remained lenticular and Augen shaped.

So how do we relate textures,  
structures and fabric in a rock?

We need to remember,  
suppose we take the example of foliation.

Foliations is of planar fabric.

It is a directional feature.

It is produced due to penetrative  
deformation in metamorphic rocks.

This type of foliation is observed  
at all scales, for example,  
at a regional scale or an outcrop  
scale at the hand specimen level  
and even under microscope.

So therefore,

depending at what scale a person

has made the observation,

that term foliated fabric could be used.

Foliated structure,

if it is seen at a hand specimen

level or even on an outcrop scale,

or a regional scale as well as foliated

texture if it is seen under thin section.

Because we need to remember

foliation is a penetrative fabric.

It occurs both as a texture

as well as structure,

so therefore fabric will

incorporate both textures,

sometimes called as a microstructure

as well as structures.

These are the references.

Thank you.