



ENGINEERING GEOLOGY
LAB MANUAL

EXPERIMENT – 1

Study of physical properties and
Identification of minerals referred
Under theory

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

FELDSPAR

1. Form	:	Tabular
2. Colour	:	Pale Pink
3. Streak	:	White
4. Luster	:	Vitreous
5. Fracture	:	Uneven
6. Cleavage	:	Absent
7. Diaphaneity	:	Opaque
8. Hardness	:	7
9. Specific Gravity	:	2.5
10. Occurrence	:	Adilabad
11. Origin	:	Igneous
12. Uses	:	Tiles
13. Name of the Specimen	:	Feldspar
14. Chemical Composition	:	$KAlSi_3O_8$

QUARTZ

1. FORM	:	Amorphous
2. Colour	:	White
3. Streak	:	Colourless
4. Luster	:	Vitreous
5. Fracture	:	Uneven
6. Cleavage	:	Absent
7. Diaphaneity	:	Opaque
8. Hardness	:	7
9. Specific Gravity	:	3
10. Name of the Specimen	:	Quartz
11. Occurrence	:	South India
12. Origin	:	Igneous
13. Uses	:	Used as gemstone and in watch industries etc
14. Chemical Composition	:	Sio ₂

FLINT

1. Form	:	Tabular form
2. Colour	:	Brown
3. Streak	:	Colourless
4. Luster	:	Earthy
5. Fracture	:	Absent
6. Cleavage	:	Absent
7. Diaphaneity	:	Opaque
8. Hardness	:	7
9. Specific Gravity	:	3 to 4
10. Occurrence	:	Vizayanagaram, Visakhapatnam
11. Origin	:	Igneous
12. Uses	:	Fillers of fertilizers
13. Name of the Specimen:		Flint
14. Chemical Composition:		Silica

JASPER

1. FORM:	Lamellar
2. Colour:	Dark Brown
3. Streak:	Dark Brown
4. Lustre:	Earthy
5. Fracture:	Absent
6. Cleavage:	Absent
7. Diaphaneity:	Opaque
8. Hardness:	3 to 4
9. Specific Gravity:	2.5
10. Occurrence:	Vizayanagaram
11. Origin:	Sedimentary
12. Uses:	Paints and Soil Stabilization
13. Name of the Specimen:	Jasper
14. Chemical Composition:	SiO ₂

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

OLIVINE

1. Form:	:	Amorphous
2. Colour:	:	Yellowish green
3. Streak:	:	White
4. Luster:	:	Earthy
5. Fracture:	:	Absent
6. Cleavage:	:	Absent
7. Diaphaneity:	:	Opaque
8. Hardness:	:	5
9. Specific Gravity:	:	3 to 4.5
10. Occurrence:	:	Karnataka
11. Origin:	:	Igneous
12. Uses:	:	Paints
13. Name of the Specimen:	:	Olivine
14. Chemical Composition:	:	(Mg, Fe) ₂ SiO ₄

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

HORNBLENDE

15. FORM:	:	Tabular
16. Colour:	:	Pale Pink
17. Streak:	:	White
18. Luster:	:	Vitreous
19. Fracture:	:	Uneven
20. Cleavage:	:	Absent
21. Diaphaneity:	:	Opaque
22. Hardness:	:	7
23. Specific Gravity:	:	2.5
24. Occurrence:	:	Adilabad
25. Origin:	:	Igneous
26. Uses:	:	Tiles
27. Name of the Specimen	:	Feldspar
28. Chemical Composition	:	KAlSi ₃ O ₈

MUSCOVITE

1. Form:	:	Lamellar
2. Colour:	:	White
3. Streak:	:	White
4. Luster:	:	Vitreous
5. Fracture:	:	Uneven
6. Cleavage:	:	Absent
7. Diaphaneity:	:	Transparent in individual layer & opaque as whole
8. Hardness:	:	2 to 3
9. Specific Gravity:	:	2.5
10. Occurrence:	:	Gudur
11. Origin:	:	Metamorphic
12. Uses:	:	Poor conductor of heat
13. Name of the Specimen	:	Muscovite
14. Chemical Composition	:	$KAl_2 (Al Si_3) O_{10} (OH, F)_2$

BIOTITE

1. Form:	:	Lamellar
2. Colour:	:	Black
3. Streak:	:	Dark brown
4. Luster:	:	Vitreous
5. Fracture:	:	Uneven
6. Cleavage:	:	Absent
7. Diaphaneity:	:	Transparent in individual layers & opaque as whole
8. Hardness:	:	2 to 3
9. Specific Gravity:	:	2 to 3
10. Occurrence:	:	Nellore
11. Origin:	:	Metamorphic
12. Uses:	:	Iron boxes
13. Name of the Specimen:	:	Biotite
14. Chemical Composition:	:	$K(Mg, Fe_3)(Al Si_3)O_{10}(OH, F)_2$

ASBESTOS

1. Form:	:	Fibrous
2. Colour:	:	Green
3. Streak:	:	Colourless
4. Luster:	:	Silky
5. Fracture:	:	Uneven
6. Cleavage:	:	Absent
7. Diaphaneity:	:	Opaque
8. Hardness:	:	4 to 6
9. Specific Gravity:	:	3 to 4.5
10. Occurrence:	:	Cuddapah, Andhra Pradesh
11. Origin:	:	Metamorphic
12. Uses:	:	It is used to make sheets
13. Name of the Specimen	:	Asbestos
14. Chemical Composition	:	$2\text{Mg}_3\text{Si}_2\text{O}_5(\text{OH})_4$

CHLORITE

1. Form:	:	Granular
2. Colour:	:	Black and Green
3. Streak:	:	Colourless
4. Luster:	:	Metallic
5. Fracture:	:	Uneven
6. Cleavage:	:	Absent
7. Diaphaneity:	:	Opaque
8. Hardness:	:	3
9. Specific Gravity:	:	3 to 4.5
10. Occurrence:	:	Karnataka
11. Uses:	:	Paints
12. Name of the Specimen:	:	Chlorite
13. Chemical Composition:	:	ClO_2

KYANITE

1. Form:	:	Bladed
2. Colour:	:	Blue
3. Streak:	:	Colourless
4. Luster:	:	Vitreous
5. Fracture:	:	Uneven
6. Cleavage:	:	Absent
7. Diaphaneity:	:	Opaque
8. Hardness:	:	6
9. Specific Gravity:	:	4.5 to 5
10. Occurrence:	:	Karnataka
11. Uses:	:	Abrasive and Ornaments purposes
12. Name of the Specimen	:	Kyanite
13. Chemical Composition	:	Al_2SiO_5

GARNET

1. Form	:	Rhombic
2. Color	:	Ruby
3. Streak	:	Light Brown
4. Luster	:	Earthy
5. Fracture	:	Absent
6. Cleavage	:	Absent
7. Diaphaneity	:	Opaque
8. Hardness	:	7
9. Specific	:	4.5
10. Name of the Specimen	:	Garnet
11. Occurrence	:	Gudur, Andhra Pradesh
12. Uses	:	Ornaments
13. Chemical Composition	:	$\text{Fe}_3 \text{Al}_2 (\text{SiO}_4)_3$

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

TALC

1. Form	:	Amorphous
2. Colour	:	White
3. Streak	:	White
4. Luster	:	earthy
5. Fracture	:	No
6. Cleavage	:	Absent
7. Diaphaneity	:	Opaque
8. Hardness	:	1
9. Specific	:	2.5
10. Name of the Specimen:		Talc
11. Occurrence	:	Udaipur, Rajasthan
12. Uses	:	It is used as talcum powder and in creams etc.
13. Chemical Composition:		$Mg_3 Si_4 O_{10} (OH)_2$

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

CALCITE

Form	:	Bladed
Colour	:	Honey Yellow
Streak	:	White
Lustre	:	Vitrous
Fracture	:	Uneven
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	5
Specific	:	2.5 to 3
Name of the Specimen:		Calcite
Occurrence	:	Tamil Nadu
Uses	:	Bombs, gun powders, anti – air craft
Chemical Composition:		CaCO_3

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

PYRITE

Form	:	Crystalline
Colour	:	Fool's gold
Streak	:	Black
Luster	:	Metallic to sub - metallic
Fracture	:	Uneven
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	6
Specific	:	3 to 4.5
Name of the Specimen:		Pyrite
Occurrence	:	Cuddapah, Andhra Pradesh
Uses	:	Paints, Paper industries
Chemical Composition:		FeS ₂

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

HAEMETITE

Form	:	Amorphous
Colour	:	Dark brown
Streak	:	Brown
Luster	:	Metallic
Fracture	:	Absent
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	7
Specific	:	6 to 7
Name of the Specimen:		Hematite
Occurrence	:	Goa
Uses	:	Steel, and iron industries
Chemical Composition:		Fe ₂ O ₃

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

MEGNETITE

Form	:	Amorphous
Colour	:	Gray
Streak	:	Brown
Lustre	:	Greasy
Fracture	:	Absent
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	7
Specific	:	5.5
Name of the Specimen	:	Magnetite
Occurrence	:	Goa, Maharashtra
Uses	:	Iron ore
Chemical Composition	:	Fe ₃ O ₄

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

CHROMITE

Form	:	Amorphous
Colour	:	Black
Streak	:	Black
Lustre	:	Earthy
Fracture	:	Absent
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	7
Specific	:	4.5
Name of the Specimen	:	Chromite
Occurrence	:	Karnataka
Uses	:	Paints, Cr ore
Chemical Composition	:	Fe Cr ₂ O ₄

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

GALENA

Form	:	Tabular
Colour	:	Gray and black
Streak	:	Black
Lustre	:	Vitrous
Fracture	:	Even
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	6
Specific	:	5.5
Name of the Specimen	:	Galena
Occurrence	:	Maharashtra
Uses	:	Ornamental and atomic purposes
Chemical Composition	:	Pbs

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

PYROLUSITE

Form	:	Amorphous
Colour	:	Black
Streak	:	Black
Lustre	:	Earthy
Fracture	:	Absent
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	7
Specific	:	6
Name of the Specimen	:	Pyrolusite
Occurrence	:	Adilabad, Vizayanagaram
Uses	:	Maganese ore (steel industries)
Chemical Composition	:	MnO ₂

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

GRAPHITE

Form	:	Amorphous
Colour	:	Gray
Streak	:	Gray
Lustre	:	Sub-Metallic or greasy
Fracture	:	Absent
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	4
Specific	:	2.5 to 2.8
Name of the Specimen	:	Graphite
Occurrence	:	Anakapalli, Andhra Pradesh
Uses	:	Pencils
Chemical Composition	:	C

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

MAGNESITE

Form	:	Amorphous
Colour	:	White
Streak	:	White
Luster	:	Earthy
Fracture	:	Absent
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	7
Specific	:	4.5
Name of the Specimen	:	Magnesite
Occurrence	:	Doddakanya, South India
Uses	:	Magnesium ore, jertilizers
Chemical Composition	:	MgCO ₃

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

BAUXITE

Form	:	Concretionary
Colour	:	Reddish Brown
Streak	:	Brown
Lustre	:	Earthy
Fracture	:	Uneven
Cleavage	:	Absent
Diaphaneity	:	Opaque
Hardness	:	7
Specific	:	3
Name of the Specimen	:	Bauxite
Occurrence	:	Visakhapatnam, Srikakulam
Uses	:	Aluminum ore
Chemical Composition	:	Al

EXPERIMENT – 2

Megascope and microscopic description
and identification of rocks referred

Under theory

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

IDENTIFICATION OF IGNEOUS ROCKS

AIMS

The aim of this unit is to present you the different type of rocks, main factors for classification and petrogenesis of igneous rocks

OBJECTIVES

After completing this Unit, students should be able to Describe the

Different type s of Igenous rocks (volcanic, Hypabasal and plutonic rocks).

Main factors used in the classification of igneous rocks.

Order of crytallisation in which minerals are formed.

Petrogenesis.

PEGMATITE

I Petrography

- | | |
|-----------------|---|
| 1. Colour index | : Leucocratic (light colour) |
| 2. Mineralogy | : a) Essential minerals : Quartz, Feldspars,
b) Accessory minerals: Beryl, tourmaline, apatite |
| 3. Texture | : Very coarse grained granular |
| 4. Structure | : Pegmatitic |

II Petrogenesis

- | | |
|----------------------------|--|
| 1. Mode of formation | : Veins and dykes. |
| 2. Depth of formation | : Great depth |
| 3. Conditions of formation | : Plutonic conditions (high pressure and high
temperature) |
| 4. Name of the rock | : Pegmatite. |

GRANITES

GRANITES

Granites are of two types, based on their colour (a) pink granite, in which the K-feldspars are more predominant than the plagioclase feldspars. (b) Grey granite, in which the plagioclase feldspars are more predominant than the K-feldspars. They exhibit two distinct types of a) Equigranular b) Inequigranular (porphyritic). They are the most abundant rock types among other igneous rocks. In hand specimen, granite is a light colored coarse grained granular rock. It is mainly composed of quartz, feldspars, and micas. Apatite, magnetite, zircon and sphene are found as accessories. The coarse grained texture indicates that the rock is formed under the plutonic conditions.

The systematic description of the granular granite is given in a new format below.

I. Petrography

1. Colour index Leucocratic

2. Mineralogy

- a) essential minerals : quartz, alkali feldspar and micas
- b) accessory : apatite, magnetite, zircon, sphene,
Hornblende and pyroxene.

3. Texture : Coarse grained, equigranular.

II. Petrogenesis

1. Mode of formation : Big batholiths to small plutonic

2. Depth of formation : Great depth (deep seated)

3. Conditions of formation : Plutonic conditions (high pressure and high temperature).

4. Name of the rock : Granite

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

PORPHYRITIC GRANITE.

I. Petrography

- 1. Colour Index : leucocratic
- 2. Mineralogy : quartz, alkali feldspars, and micas.
 - a) Essential minerals : apatite, zircon, magnetite, sphene,
Hornblende and pyroxene.
 - b) Accessory minerals : Coarse grained in equigranular
- 3. Texture : Coarse grained in equigranular
- 4. Structure : Porphyritic

II. Petrogenesis

- 1. Mode of formation : Big batholiths to small pluton
- 2. Depth of formation : Great to intermediate depth
- 3. Conditions of formation : Plutonic conditions (high pressure and
High temperature.
- 4. Name of the rock : Porphyritic granite

DOLERITE

Dolerite is a dark coloured medium grained granular rock. It is mainly composed of labradorite plagioclase feldspar and augite pyroxene. Magnetite, apatite and sphene are found as accessories. The medium grained texture indicates that the rock is formed under hypabyssal conditions.

The systems description of the rock is given in a new formal below;

I. Petrography

1. Colour index : Melanocratic
2. Mineralogy :
 - a) Essential minerals : Labradorite plagioclase and augite pyroxene.
 - b) Accessory minerals : Magnetite, olivine, apatite and sphene.
3. Texture : Medium grained.

II. Petrogenesis

1. Mode of formation : Dykes
2. Depth of formation : Intermediate (shallow depth)
3. Conditions of formation : Hypabyssal conditions (moderate pressure and temperature)
4. Name of the rock : Dolerite.

BASALT

Basalt is a dark-ash coloured fine grained rock. It is mainly composed of labradorite Plagioclase augite pyroxene. Magnetite, olivine and apatite are found as accessories. Quartz, calcite and zeolites are found as secondary minerals in cavities and vesicles of the rock. The fine grained texture indicates that the rock is formed under volcanic conditions. The systematic description of the rock is given in a new format below.

I. Petrography

1. Colour index : Melnocratic
2. Mineralogy :
 - a)Essential minerls : labradorite plagioclase and augite pyroxene
 - b)Accessory minerals : olivine. Hornblende, magnetite and apatite.
3. Texture : Fine grained
4. Structure : Vesicular and amygdaloidal

II. Petrogeneis

1. Mode of formation : Sills, flows, and dykes
2. Depth of formation : Surface intrusive and extrusives
3. Conditions of formation : Volcanic conditions
(low pressure and temperature)
4. Conditions of formation : Basalt

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

DESCRIPTION OF SEDIMENTARY ROCKS

AIMS

The aim of this unit is to provide provide you the description of some important sedimentary rocks.

OBJECTIVES

After completing this unit you should be able to:

Identify the sedimentary rocks

Recognize the minerals of sedimentary rocks

Describe the textures & formation of sedimentary rocks.

1. CONGLOMERATE

It is a common rudaceous rock formed under continental environment. It is mainly consolidated with rounded and subrounded pebbles and gravels. These pebbles and gravels are made up of quartz, feldspars and rock fragments. Ferrugeneous and siliceous cementing materials envelop the pebbles and gravels. In handspecimen, the rock is easily distinguished from breccias by its characteristic rounded pebbles and gravels.

The systematic description of the rock is given below.

- | | |
|-----------------------|--|
| 1. Clastic Nonclastic | : Clastic |
| 2. Colour | : shades of grey, brown |
| 3. Mineralogy | : Quartz feldspars, clay, hematite and limonite (goethite) |
| 4. Structure | : Rounded rudite |
| 5. Texture | |
| (a) Grain size | : Coarse grained |
| (b) Grain shape | : Rounded to subrounded |
| (c) Sorting | : Poorly sorted |
| 6. Nature of matric | : Ferrugeneous and siliceous |
| 7. Name | : Conglomerate |

2. SANDSTONE

It is most common clastic rock founded in basinal environments such as river, lakes and marginal seas. It is formed due to consolidation of sand particles. The sand particles are mainly made up of rounded quartz grains. In handspecimen, it is in brown or yellow or grey or buff colour, and exhibits medium grained texture. Sometimes sizegrading and rippling features are seen in it. Well sorting of grains is a characteristic feature of many sandstones. If a sandstone is completely composed of quartz, it is termed as arthoquarzite. If a sandstone contines 75% of quartz and 25% of feldspar, it terms as arkose. If a sandstone has more than 30% of matrix of clay, chlorite and glauconite, it terme as greywacks. A fine grained greywake (sandstone) terms into shale.

The systematic description of the ripple sandstone is given below:

- | | |
|-------------------------|--|
| 1. Clastic / Nonclastic | : Clastic |
| 2. Colour | : Brown or yellow or greyor buff |
| 3. Mineralogy | : Quartz with little amount of feldspar and
Siliceous or ferrugeneous clays |
| 4. Structure | : Ripple marks, arenite |
| 5. Texture : | |
| a) Grain size | : Medium grained |
| b) Grain shape | : Rounded to subrounded |
| c) Sorting | : Well sorted |
| 6. Nature of matrix | : Siliceous or ferrugeneous or both |
| 7. Name of the rock | : Ripple sandstone |

3. SHALE

It is a fine grained argillaceous sedimentary rock that have been formed by the consolidation of beds of mud, clay or silt. The mud and clay are in chlorite, muscovite and quartz. In handspecimen, it has varied colours like grey, brown black or yellow and exhibits fine grained texture and thin layering.

The systems description of the rock is given below:

- | | |
|-------------------------|---|
| 1. Clastic / Nonclastic | : clastic |
| 2. Colour | : Grey brown or black |
| 3. Mineralogy | : Chlorite muscovite, kaolin, and quartz. |
| 4. Structure | : Thin layering |
| 5. Texture: | |
| a) Grain size | : Fine grained |
| b) Grain shape | : Variable |
| c) Sorting | : Poorly sorted |
| 6. Nature of matrix | : Ferrugeneous or siliceous |
| 7. Name of the rock | : Shale |

4. LIMESTONE

It is a fine grained non clastic sedimentary rock that has been formed by the precipitation of calcium carbonate solutions which are derived from seawater. In handspecimen. It looks grey and exhibits fine grained texture. It is made up of mainly calcite. There are many varieties of limestone. If a limestone is porous with full of foramineral shells, it terms as chalk. If a limestone contains shells of brachiopods or Lamellibranchs, it terms as shelly limestone. If a limestone contains high volums percentage of dolomite, it grades into dolomite.

The systematic description of a normal limestone as given below:

1. Clastic / Nonclastic	: Non clastic
2. Colour	: Grey
3. Mineralogy	: Calcite (Ca C03)
4. Structure	: layering
5. Texture: a) Grainsize	: fine grained
b) Grainshape	: variable
6. Nature of matrix	: Calcareous
7. Name of the rock	: Limestone

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

DESCRIPTION OF METAMORPHIC ROCKS

AIMS

The aim of this unit, is to provide you description of metamorphic rocks.

OBJECTIVES

After completing this unit, you should be able to

Describe the different types of metamorphic rocks

Describe the mineralogy of different types of rocks

1. SLATE

Slate is a fine grained lowgrade regional metamorphism rock; which is transformed from shale by regional metamorphism. It is characterized by slaty cleavage, along which it splits into thin sheets or layers. State is variable in its colour from grey to black Systematic description of the rock is given below.

1. Colour : Variable (grey yellow green brown or black)
2. Mineralogy : Muscovite, chlorite, feldspar, quartz
3. Structure : Sheet or layers with slaty cleavage
4. Type of metamorphism : Regional metamorphism
5. Conditions of metamorphism : Low pressure and low temperature
6. Nature of parent rock : Pelitic (shale)
7. Name of the rock : Slate

2. MARBLE

Marble is either contact (thermal) or regional metamorphic rock transformed from a metamorphosed limestone. It is a coarse grained granular rock commonly exhibits white colour (but some marbles may be in different colours due to impurities). Its colour, texture, soft and smooth surfaces promote the rock into commercial grade in building industry.

Systematic description of the rock is given below:

1. Colour : White (rarely pink, shades of green etc)
2. Mineralogy : Calcite
3. Structure : Beds with sacchardial form
4. Type of metamorphism : Contact (thermal) metamorphism
5. Conditions of metamorphism : High temperature and low pressure
6. Nature of parent rock : Limestone
7. Name of the rock : Marble

3. QUARZITE

It is a metamorphosed sandstone formed under either contact or regional metamorphism. In hand specimen, it is rather earthy white to brown in colour and exhibits granular form. It is mainly composed of recrystallized quartz. Its colour, texture, hardness and toughness promote the rock into commercial grade in building industry.

Systematic description of the rock is given below:

1. Colour : Variable (shades of white to brown)
2. Mineralogy : Quartz
3. Structure : Beds with granular form
4. Type of metamorphism : Contact metamorphism
5. Conditions of metamorphism : High temperature and low pressure
6. Nature of parent rock : Sandstone
7. Name of the rock : Quartz

4. SCHISTS

Schists of many kinds (or varieties) depending upon their colour and composition. All of them have a unique character i.e. Schistosity or foliation. They are common rock type of the Precambrian terrains. Inhandspecimen they are coarse grained rocks and are in different shades of colours from dark green to brown and also exhibit characteristic foliation. They are mainly composed of phyllosilicates and double chain silicates.

They are derived from either sedimentary or igneous rocks by the regional metamorphism.

One of the schists (brown biotite schist) is describe d in a systematic way for the clear understanding to the student.

- | | |
|-------------------------------|--------------------------------------|
| 1. Colour | : Dark brown |
| 2. Mineralogy | : Brown bioite, garnet, quartz |
| 3. Structure | : Schistose or foliation |
| 4. Type of metamorphism | : Medium grade regional metamorphism |
| 5. Conditions of metamorphism | : Moderate pressure and temperature |
| 6. Nature of parent rock | : Pelitic (shale) |
| 7. Name of the rock | : Garnet biotite schist. |

5. GNEISSES

Gneisses are of many kinds (or varieties) depending upon their colour and composition. All of them have a unique character i.e. gneissosity or banding (or lineation). They are common on rock types of the Precambrian terrains. In handspecimen, they are coarse grained rocks with alternate dark and white (light) bands. Each band its own colour and composition. Generally, the white bands is mainly composed of felsic minerals such as quartz and feldspars, while dark band is rich in mafic minerals, such as piroxenes, amphiboles, epidotes, garnets and biotite micas.

They are derived from either sedimentary or igneous rocks by high grade regional metamorphism.

One of the gneisses (quartzofeldspathic gneiss) is described in a systematic way for the clear understanding to the students.

- | | |
|-------------------------------|--|
| 1. Colour | : Shades of grayish whits |
| 2. Mineralogy | : Quartz, feldspar, biotite, hornblende |
| 3. Structure | : Gneissose or banding (felsic and mfic bands) |
| 4. Type of metamorphism | : High grade regional metamorphism |
| 5. Conditions of metamorphism | : Moderte pressure and high temperature |
| 6. Nature of parent rock | : Granite |
| 7. Name of the rock | : Quartzo-feldspathic gneiss (peninsular geniss) |

EXPERIMENT – 3

Megascopic and microscopic identification
of rocks and minerals

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

HALITE

1. Form	:	granular
2. Colour	:	is clear or white
3. Streak	:	white
4. Lustre	:	vitreous.
5. Fracture	:	conchoidal
6. Cleavage	:	perfect
7. Diaphaneity	:	transparent to translucent
8. Hardness	:	2
9. Specific	:	2.1
10. Name of the Specimen	:	Halite
11. Occurrence	:	
12. Uses	:	Major source of salt and as mineral specimens
13. Chemical Composition	:	Nacl

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

CORUNDUM

1. Form	:	trigonal
2. Colour	:	Green, Brown, Pink
3. Streak	:	White
4. Lustre	:	Vitreous
5. Fracture	:	Conchoidal
6. Cleavage	:	absent
7. Diaphaneity	:	transparent to translucent
8. Hardness	:	9
9. Specific	:	4.0
10. Name of the Specimen	:	Corundum
11. Occurrence	:	several places in India
12. Uses	:	gemstone
13. Chemical Composition	:	Al_2O_3

EXPERIMENT – 4

Interpretation and drawing of sections for
geological maps showing tilted beds,
faults, uniformities etc.,

GEOLOGICAL MAP -1

AIM

The aim of this unit is to draw a geological section along X-Y axis and interpret the geological map.

OBJECTIVES

After drawing the profile you will be able to

Describe the geology of the area

Explain the structure of the area

Describe the topography

Explain the succession of the beds

List out the beds

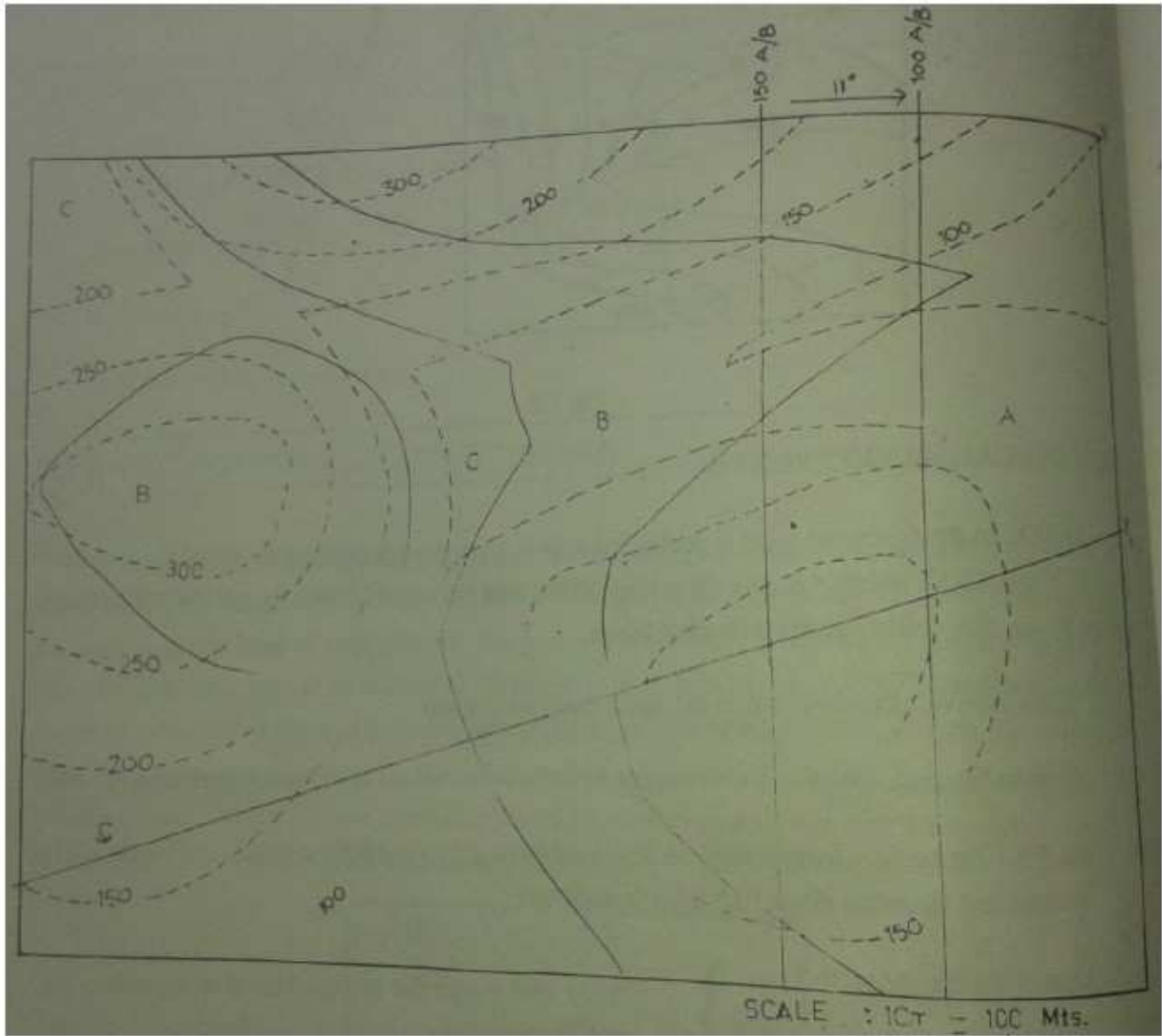
PRECAUTION

Draw two straight lines for the same bedding plain to calculate the dip of the bed

Note: Never draw on straight line for one bedding plane and a second straight line for another

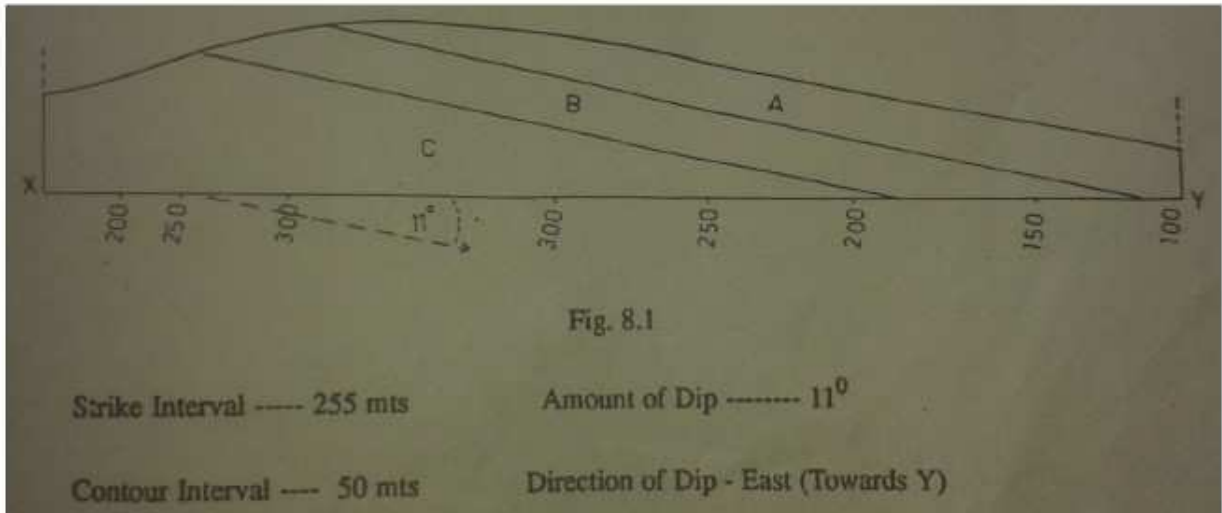
Bedding plane for calculation of dip

SECTION ALONG X-Y (TRUE DIP DIRECTION)



SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

SECTION ALONG X-Y (TRUE DIP DIRECTION)



GEOLOGICAL INTERPRETATION

Topography

In the map highest contour is of 300 mts. And the lowest is of 100 mts. The area is having two

Hills, one in the west and the other in South-East region. These two hills are having different heights.

Both the hills are showing gradual slopes. These are valleys present in the area.

General Geology

In the area there is only one series of 3 beds which are confirmable.

Geological Structure

In the area the beds are striking North-South and dipping with 11° towards East (towards Y). A small outlier is present in Western region.

(When a younger bed is surrounded by an older bed the resulting structure is outlier).

Geological Succession

In the area the beds are deposited in the order: C-B-A in normal marine conditions. All the formations are confirmable. Later they are up-lifted and tilted to attain the present attitude. When they are exposed to erosion, an outlier is formed.

NOTE: This outlier is purely an erosional feature.

GEOLOGICAL MAP -2

GEOLOGICAL INTERPRETATION

Topography

In the give map the maximum topographic elevation is 500 mts. And the minimum is 50 mts.

There is a hill in the centered region of the map having an elevation of above 500 mts. A river valley is in the western direction. It is indicated by the 'V' shaped contour lines.

General Geology

There are altogether 5 beds in the area. Their boundaries are almost parallel to each other. All the beds belong to one series only.

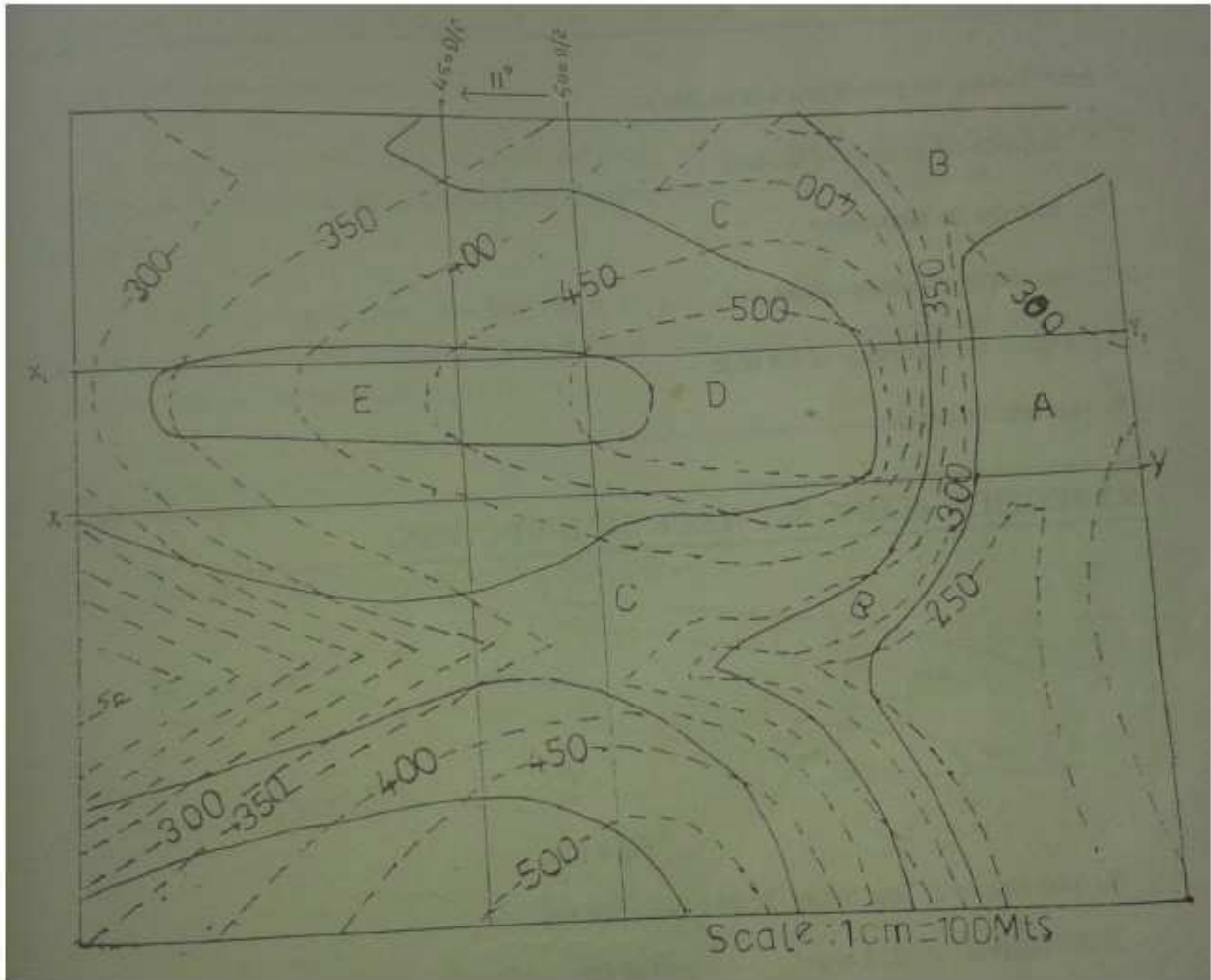
Geological Structure

In the map all the beds are striking in the direction North-South and dipping at an amount of 11o and formed due to erosion i.e. younger beds are surrounded by older beds. In the map younger bed E is surrounded by the older bed D. It is purely an erosional feature.

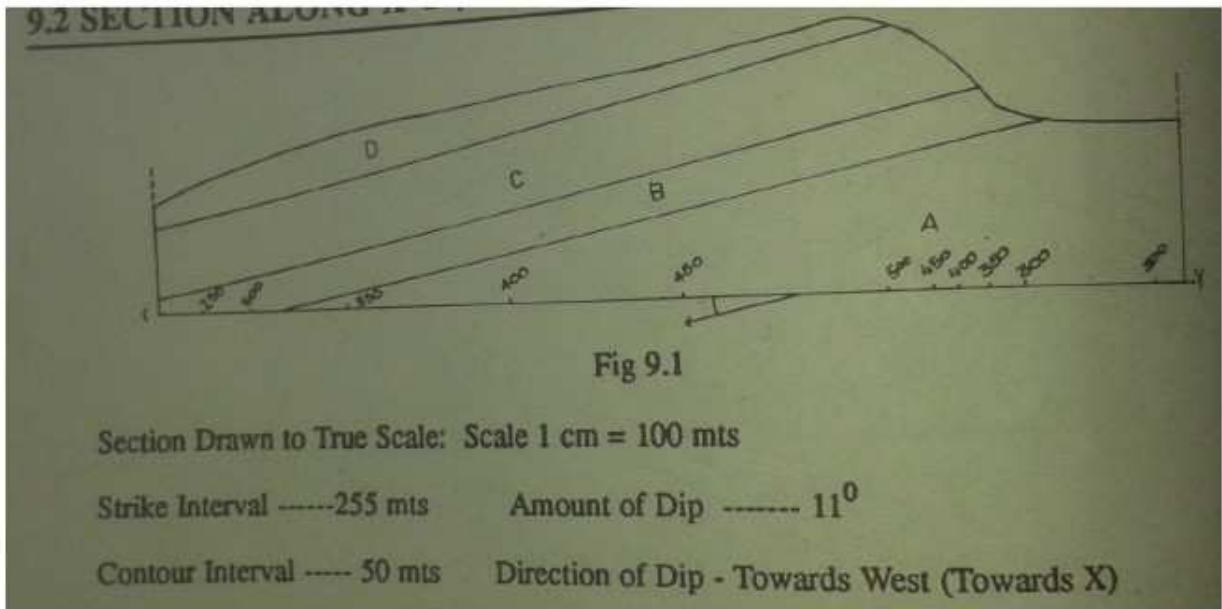
Geological Succession

In the map all the beds are confirmable and belong to one series. The younger beds follows the older one in the direction of dip. Therefore the succession is A-B-C-D-E, A being the oldest and E being younger.

The above geological succession is shown in the geological section of the map. The individual thickness of the beds can be obtained from the geological section by measuring the perpendicular distances between the two bedding planes.



SECTION ALONG X-Y (TRUE DIP DIRECTION)



SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

GEOLOGICAL MAP -3

GEOLOGICAL INTERPRETATION

Topography

In the given map the maximum topographic elevation is of 400 mts towards North of the area and a minimum of 100 mts, towards south of the area. There are two gently gradient river valleys in the ea directing towards south.

General Geology

There are altogether 5 beds in the area. Their boundaries are almost parallel to each other and all of them belong to only one series.

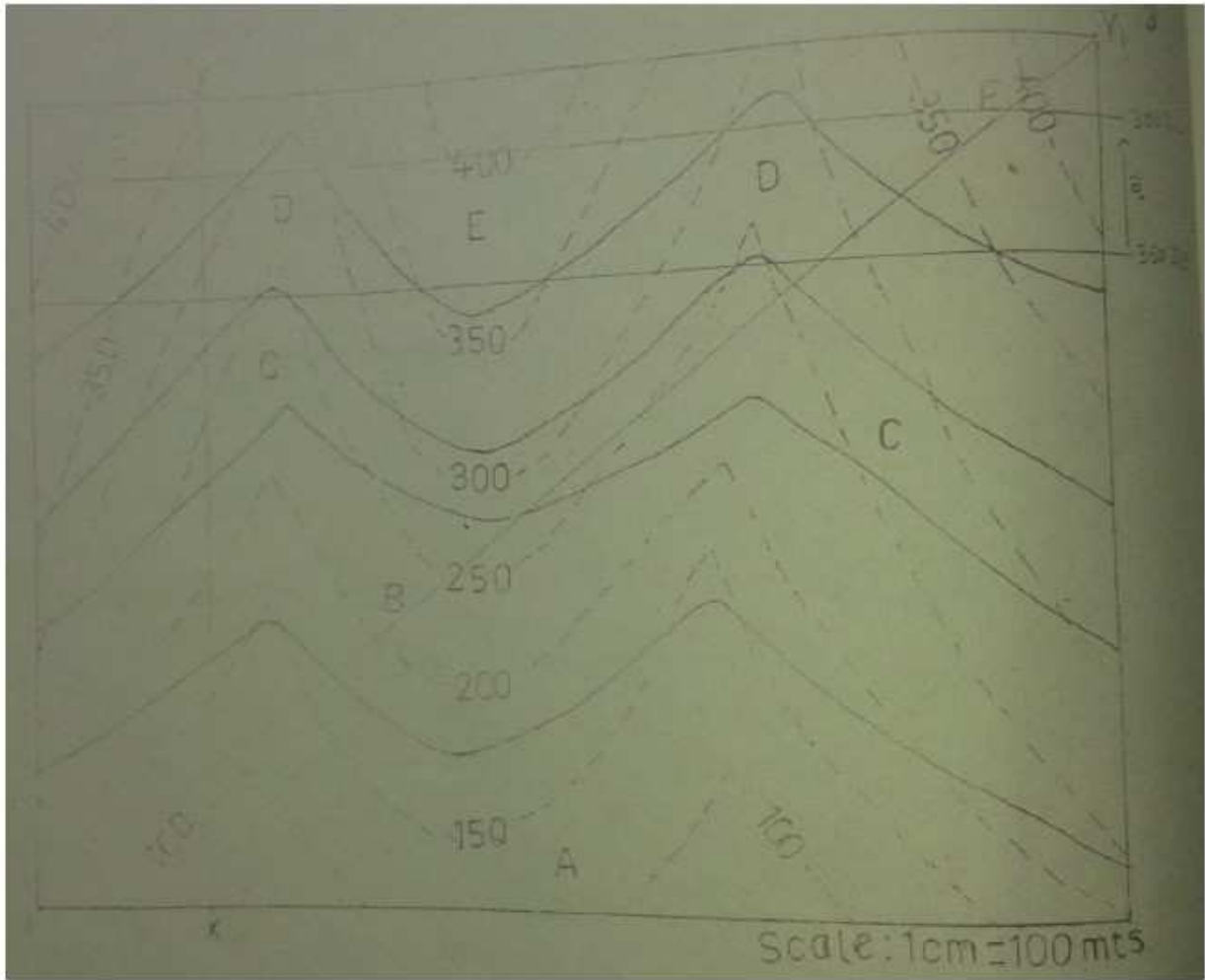
Geological Structure

In the map all the beds are striking in the direction East-West and dipping with an amount of 10o towards North (towards Y), No recognizable structure.

Geological Succession

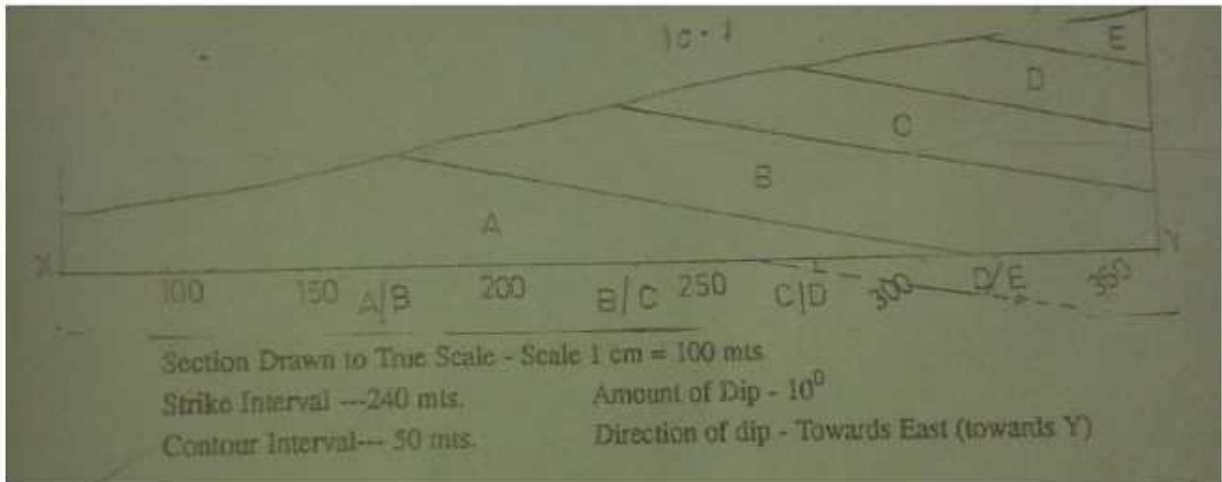
In the map all the beds are confirmable and belong to only one series. The younger beds follow the older in direction of dip. The beds are deposited in the order A-B-C-D-E in normal marine conditions.

Later on they are up lifted tilted subsequently eroded to give the present configuration.



SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

SECTION ALONG X-Y (TRUE DIP DIRECTION)



GEOLOGICAL MAP -4

GEOLOGICAL INTERPRETATION

Topography

In the given map the highest contour is of 550 mts. In the east and lowest is of 100 mts in the west. The area is of gentle slope from east to west. There is no trace of any prominent valley formation.

General Geology

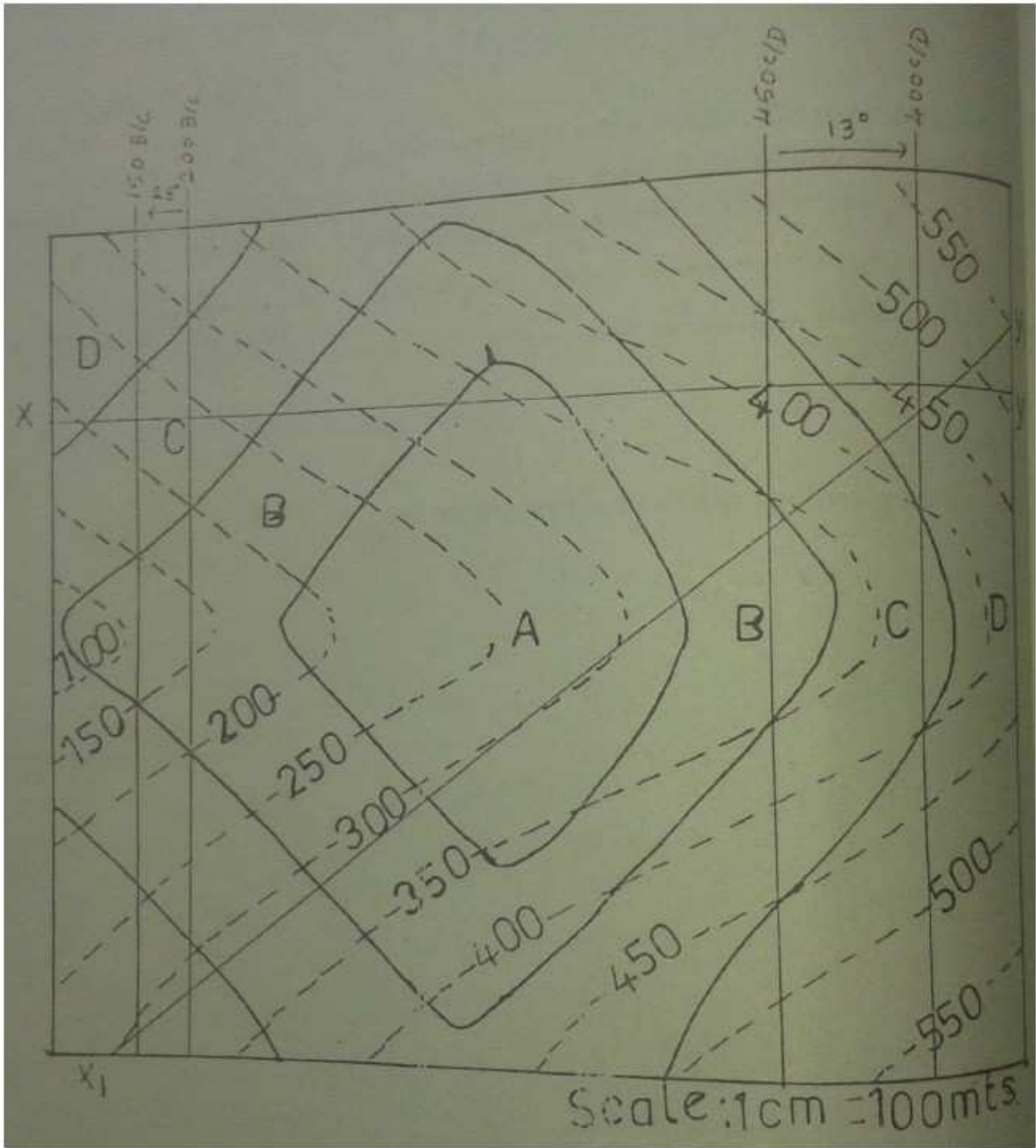
There are 4 beds in the area. All of them belong to one series only. The boundaries are parallel to each other and the beds are repeated.

Geological Structure

In the map all the bedding planes strike in the North – South direction and dip in reverse directions. i.e., the bedding planes towards East dip with an amount of 13° towards East and the same bedding planes towards west dip with an amount of 28° towards West. In the area the structure is an anticlinal fold which is evident. From the repetition of beds in reverse order and one dipping away from the other in opposite directions.

Geological Succession

In the area all the beds are confirmable and are deposited in normal marine conditions in the order A-B-C-D Later on they were uplifted, tilted and subjected to folding giving rise to anticline. (Anticline is a convex shaped body with the two limbs dipping away from each other and having older group of rocks at the centre.)



SECTION ALONG X-Y (TRUE DIP DIRECTION)

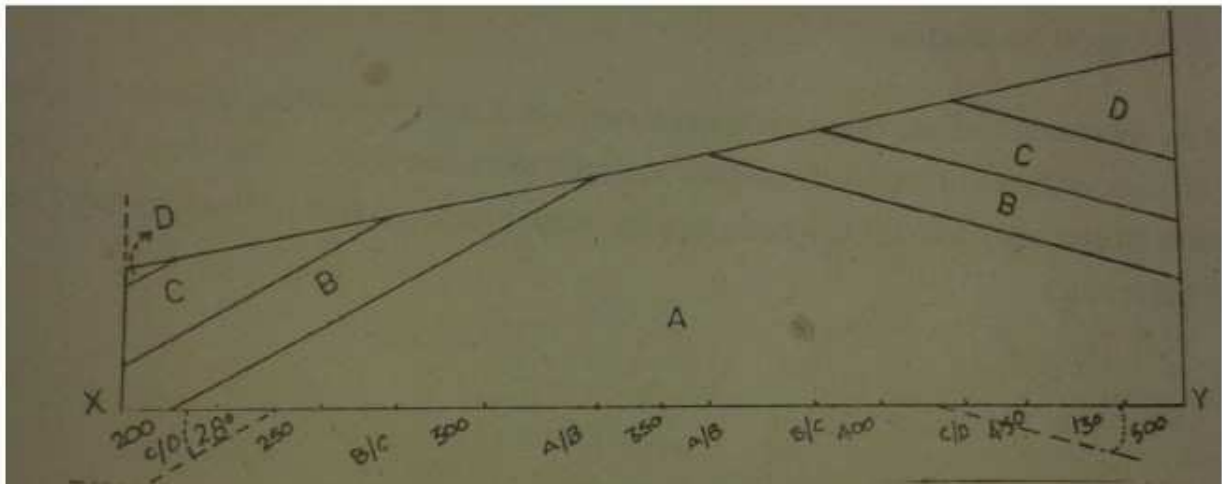


Fig. 11.1

C/D bedding plane on the right side
dipping towards east

Amount of dip - 13°
Direction of dip (towards Y)

GEOLOGICAL MAP -5

GEOLOGICAL INTERPRETATION

Topography

In the given map the highest contour is 550 mts in the West and the West of 100 mts., in the Eastern area. The area is a gentle sloping one from West to East as indicated by the trend of the contours.

General Geology

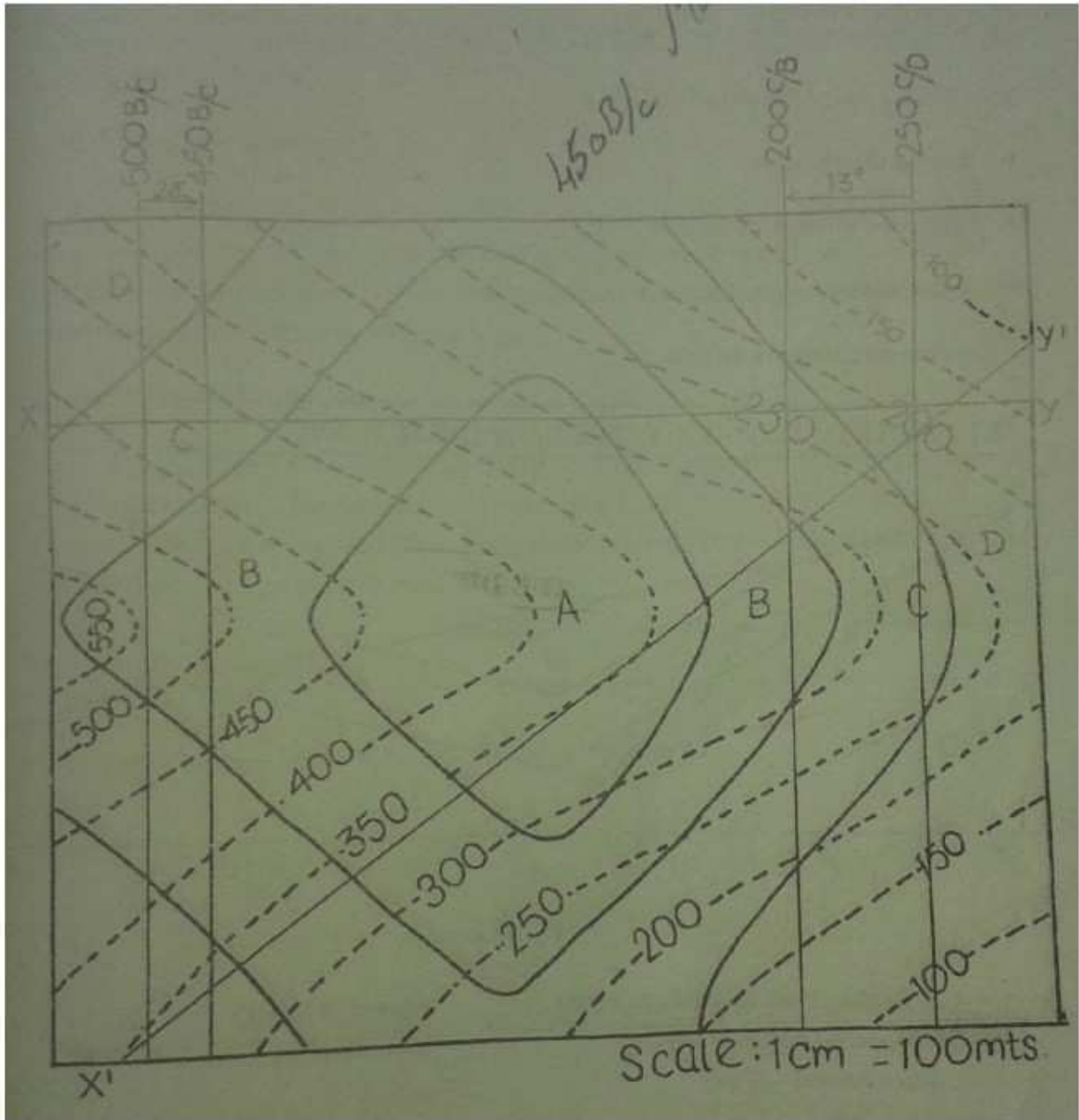
There are 4 beds in the area. All belong to only one series. The boundaries are parallel to each other. The beds are repeated.

Geological Structure

In the map all the beds are strike in North-South direction and they dip in different directions. The beds towards West dip towards east and the beds towards east dip towards West, at of 28° and 13° respectively. This reversal of the dip directions of the same beds indicate that the structure is a fold, and the dip directions indicate that it is a syncline.

Geological Succession

In the map all the beds are confirmable and the succession being D to A. These beds are deposited under normal marine conditions and later they were uplifted, tilted and subjected to folding giving rise to a synclinal (a syncline is a concave shaped structure with the two limbs dipping towards each other and having younger group of rocks at the centre.



SECTION ALONG X-Y (TRUE DIP DIRECTION)

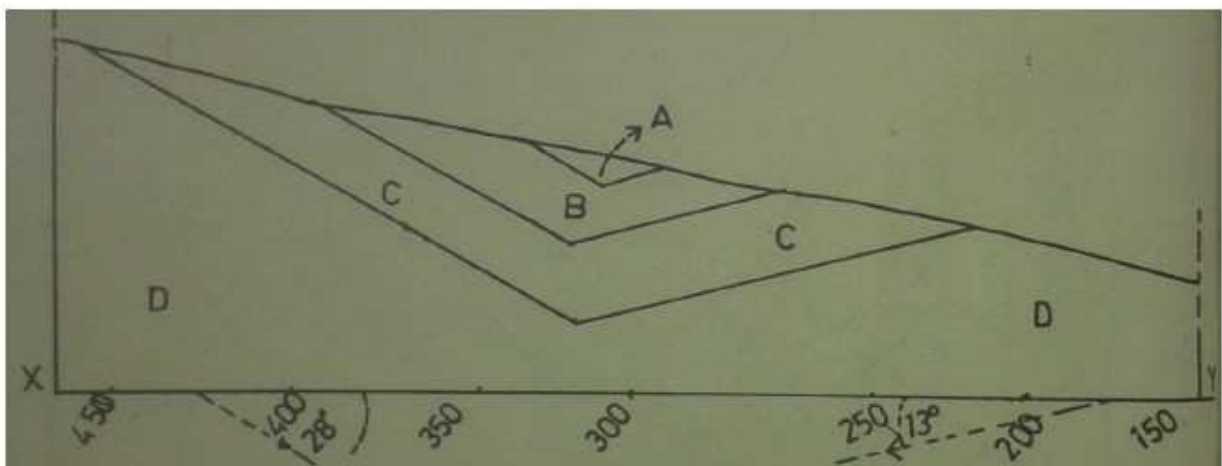


Fig. 12.1

C/D Bedding Plane (In the Eastern part)
Strike Interval - 210 mts
Contour Interval - 50 mts

Amount of dip - 13°
Direction of dip (West Towards X)

B/C Bedding Plane (in the Western part)
Strike Interval - 90 mts
Contour Interval - 50 mts

Amount of dip - 28°
Direction of dip-East (Towards Y)

GEOLOGICAL MAP – 6

GEOLOGICAL INTERPRETATION

Topography

In the given map the highest contour is 400 mts lying in the north and the lowest contour is of 100 mts being in the south. It is a uniformly sloping from north to south as indicated by contour spacing. There are river valleys with up-stream direction being north.

General Geology

In the area there are 5 beds belonging to two series. One series consisting of older beds and the other of younger beds.

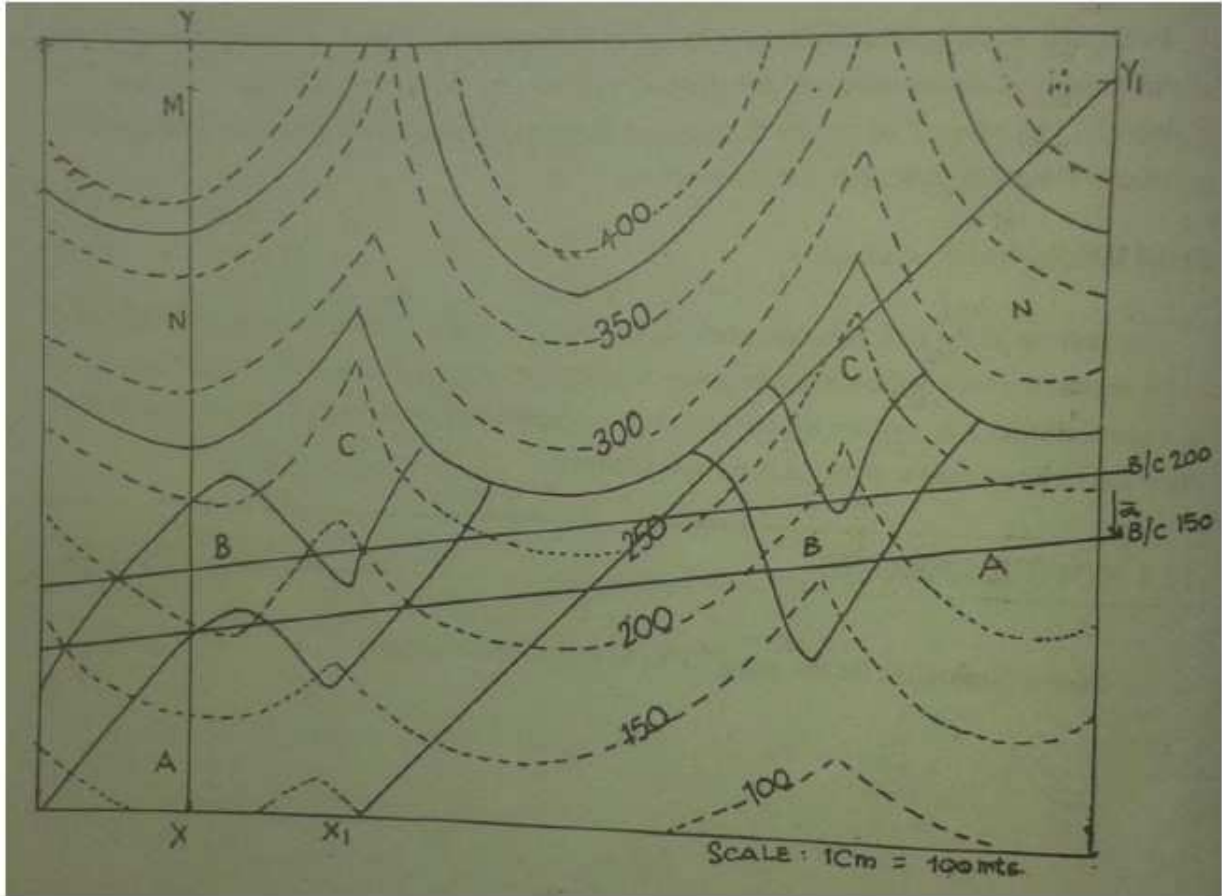
Geological Structure

In the map the older group of beds (C B A) is strikes almost east west and dips at 18° towards south (towards X), whereas the younger group of beds is horizontal. There is an unconformity between the older and younger group of beds. It is evident by the truncation of older beds along a line.

Geological Succession

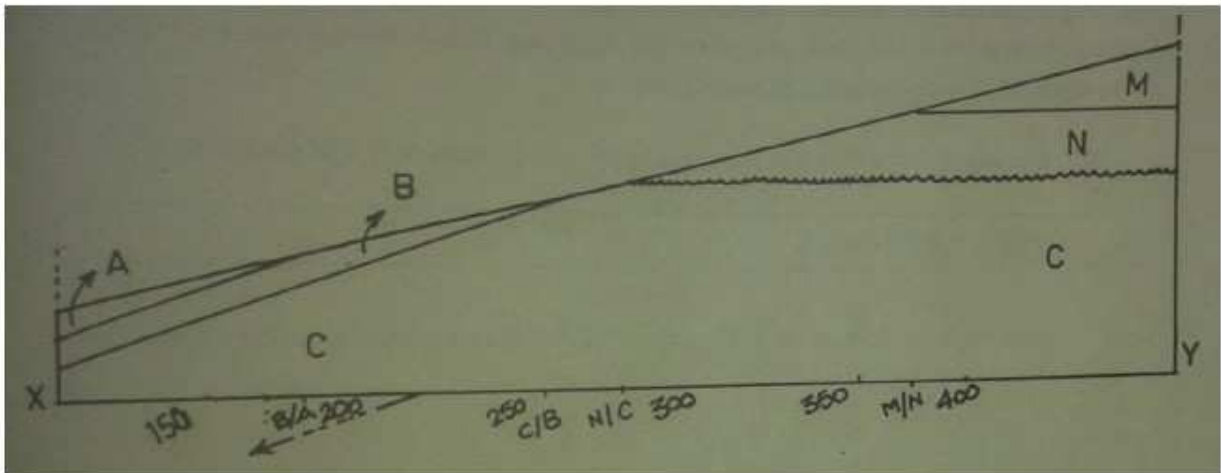
In the area the beds of different series are unconformable. The succession in the area the older beds are deposited under normal marine conditions. Later on they were uplifted and tilted followed by erosion. After the erosion the beds were submerged into the sea. Then the younger group of beds (N-M) was deposited, thereby producing an unconformity.

X the older series of C, B & A is overlain by the younger series of N & M unconformably.



SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

SECTION ALONG X-Y (TRUE DIP DIRECTION)



GEOLOGICAL MAP – 7

GEOLOGICAL INTERPRETATION

Topography

In the given map the highest contour is of 450 mts at NE corner, and lowest is of 100 mts in the SW corner of the map. The contour lines are sinuous indicating an undulating area. There is a possibility of two rivers one in the direction NE to SW, and the other in the direction east to west.

General Geology

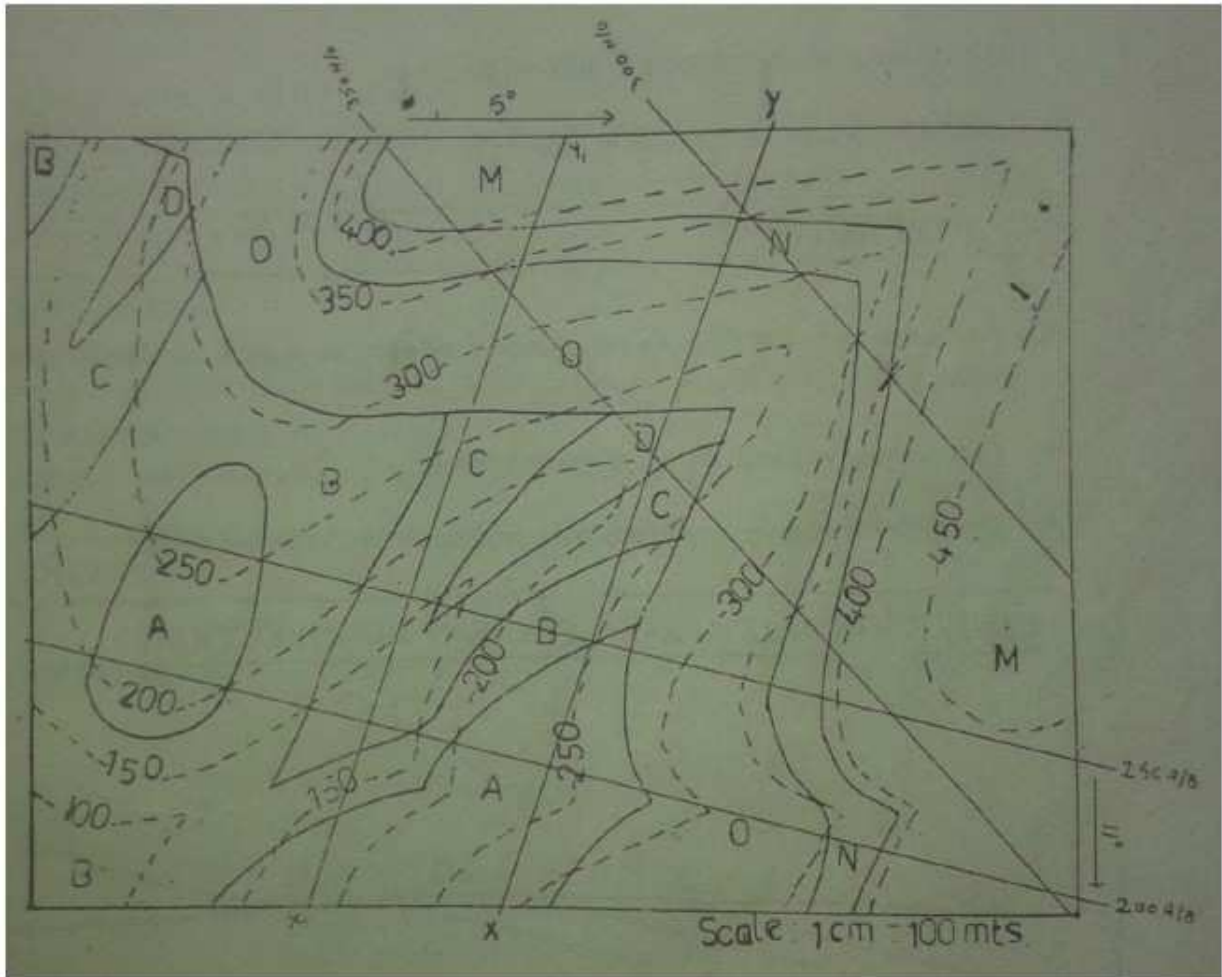
In the area there are 7 beds of which four belong to older series and 3 to younger series.

Geological Structure

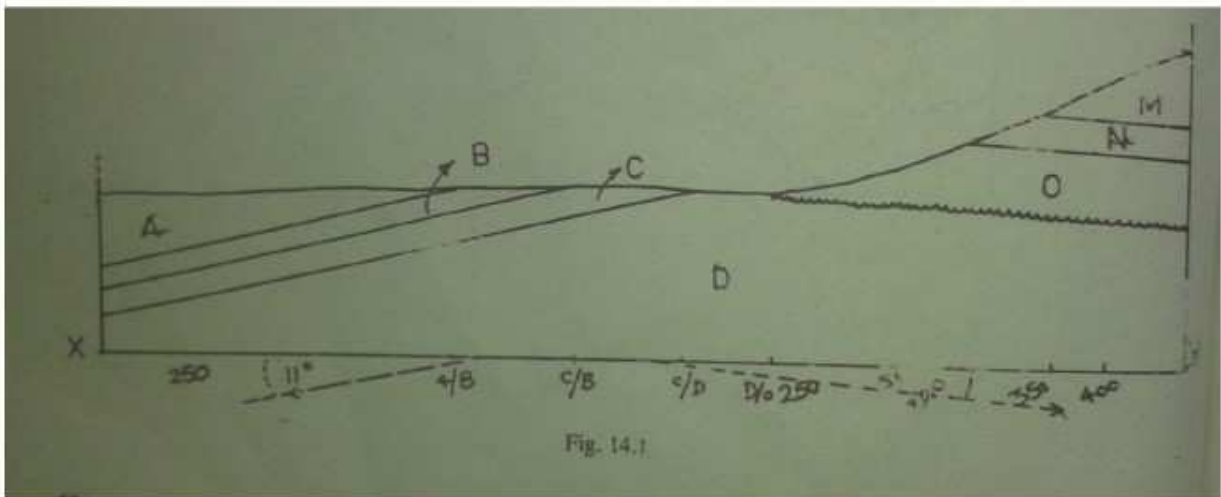
The older series of beds strike SE-NE and dips 11° in the direction SW (towards X). Whereas the younger group of beds strike NW-SE, and dips at an angle of 5° in the direction which is clearly seen in the map against which the older beds abruptly end. The beds are repeated in the area not be to any geological structure but it is due to erosion.

Geological Succession

In the area the beds are unconformable and they belong to two series. The older beds are deposited in the older D-C-B-A in normal marine conditions, later on they were uplifted and tilted to attain the attitude. Then the deposition of younger beds O-N-M on the erosional surfaces of the older beds.



SECTION ALONG X-Y (TRUE DIP DIRECTION)



GEOLOGICAL MAP – 8

GEOLOGICAL INTERPRETATION

Topography

In the given map the highest contour is of 250 mts and the lowest of 50 mts. There may be a river in NW-SE direction.

General Geology

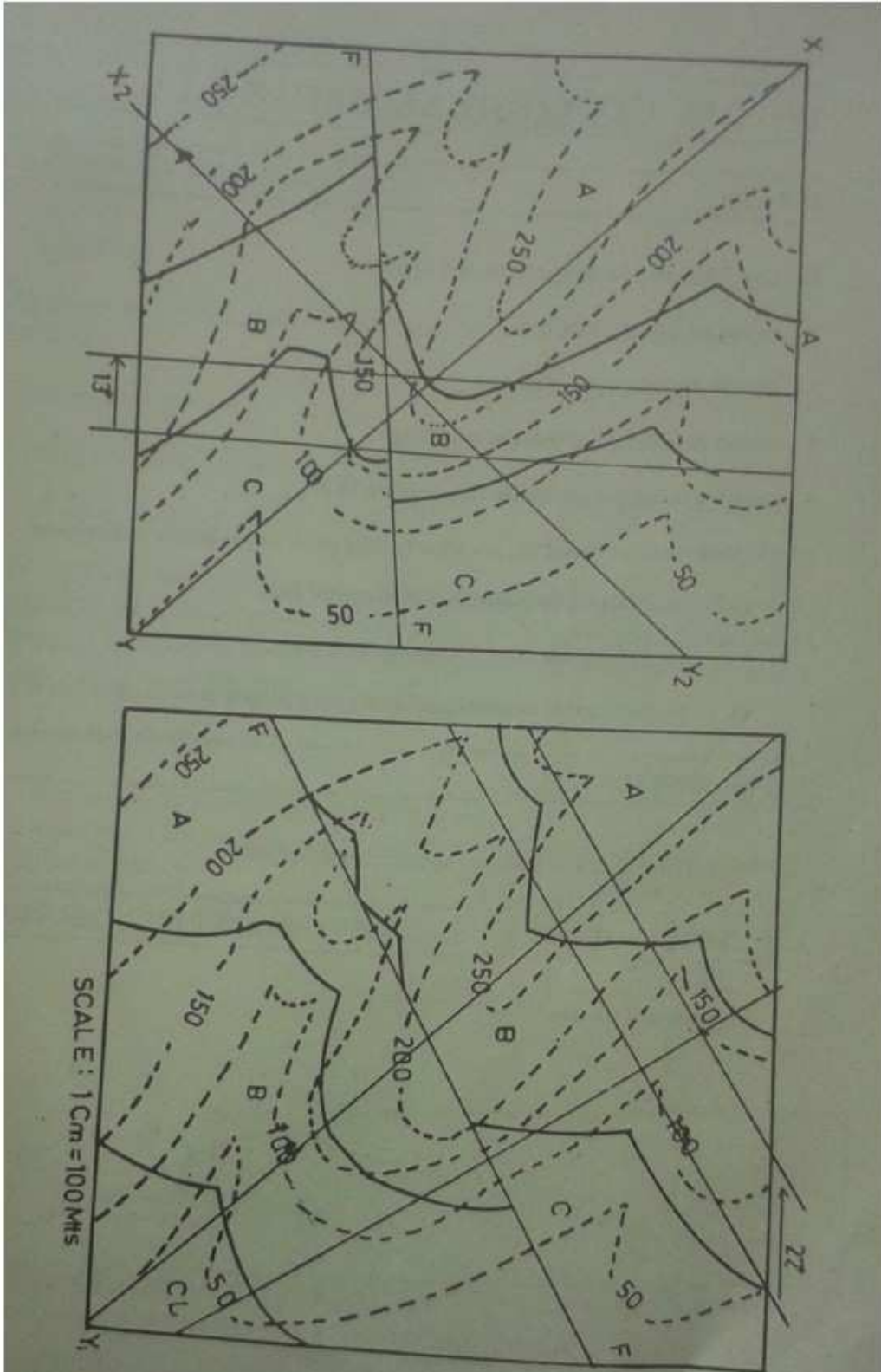
In the area there are beds which are confirmable

Geological Structure

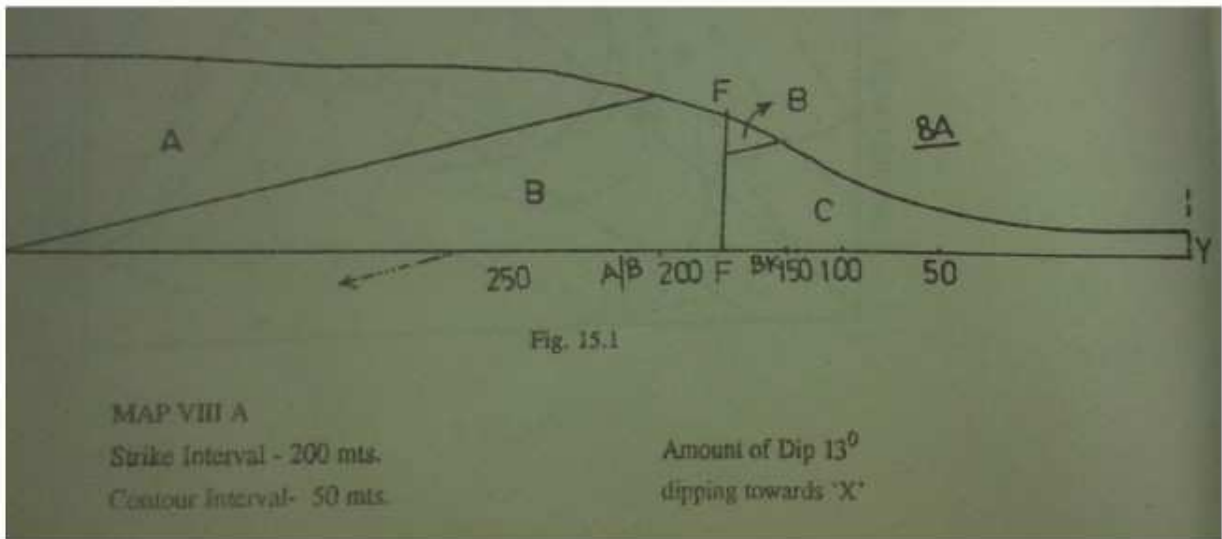
In the map 8 A the beds strike almost N-S and dip at 13° towards West. Where as in map 8B the formation strike NE-SW and dip at 22° towards NW (towards X1). In both of them a fault is present, which is displacing the beds. In both the cases the fault strikes almost East-West and it is a vertical fault. In map 8B the beds are displaced by 300 mts.

Geological Succession

In the map the beds are conformable and their succession is C-B-A. In the area the CBA are deposited in normal marine condition, later they were uplifted and tilted. After tilting they were faulted displacing the beds by 300 mts.



SECTION ALONG X-Y (TRUE DIP DIRECTION)



GEOLOGICAL INTERPRETATION

Topography

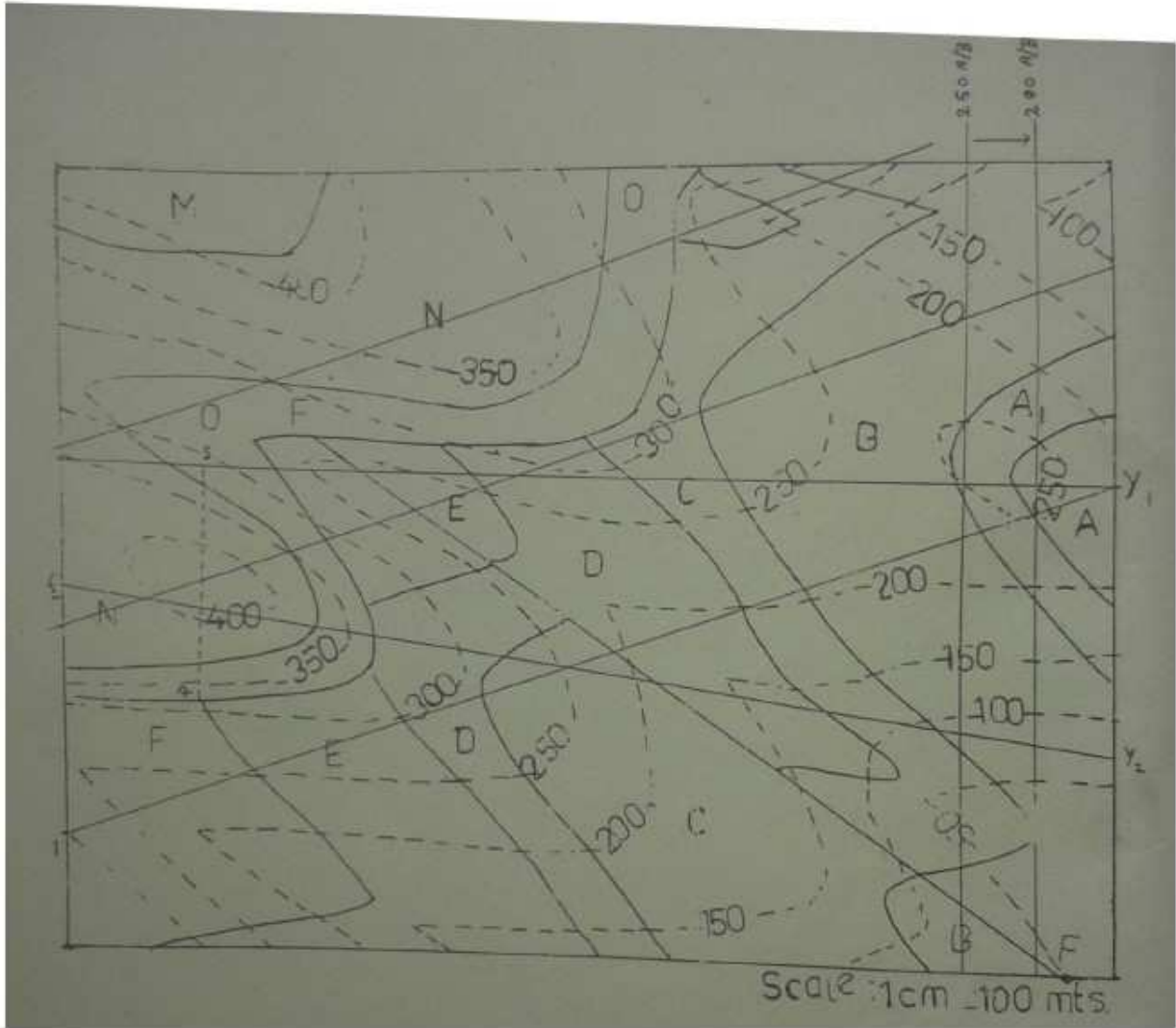
In the given map the highest contour is of 400 mts. In the eastern region and the lowest contour is of 50 mts SE corner. There is a valley in the direction NW-SW there is also a ' small amount having a height of 250 mts.

General Geology

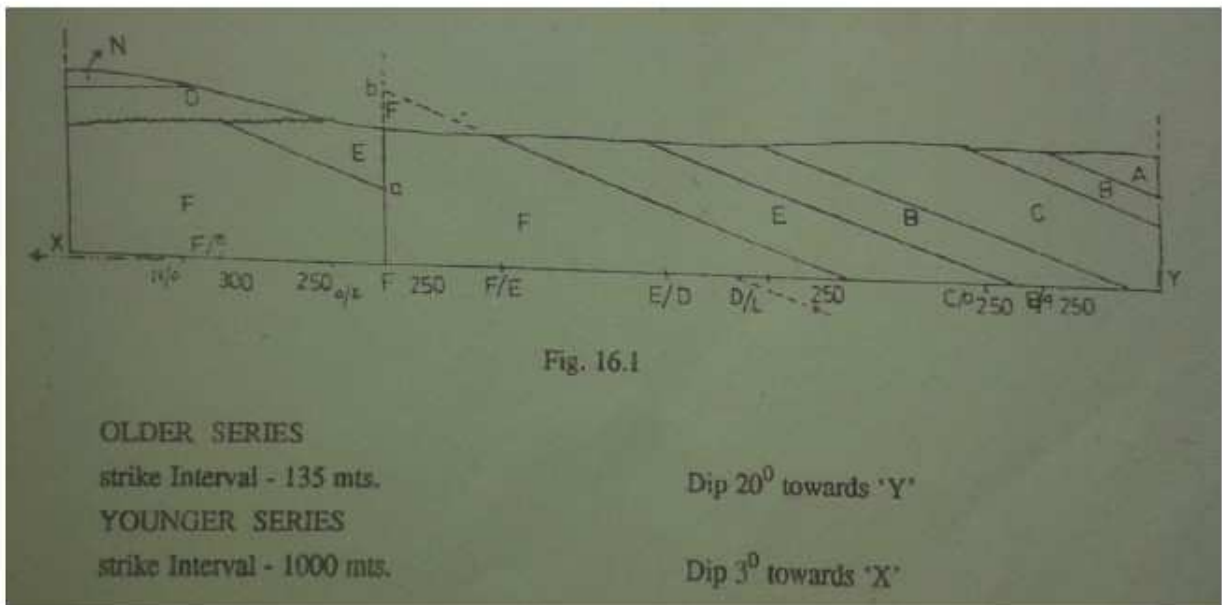
In the given map the older beds strike NS and dip towards east (towards Y) with an amount of 20° whereas the younger group of rocks strike NE-SW and dip 30° towards NW (towards X). The two series of unconformable. There are two important structures one is an unconformity and the other being a fault in older series. The fault strike NW-SE and has a vertical dip.

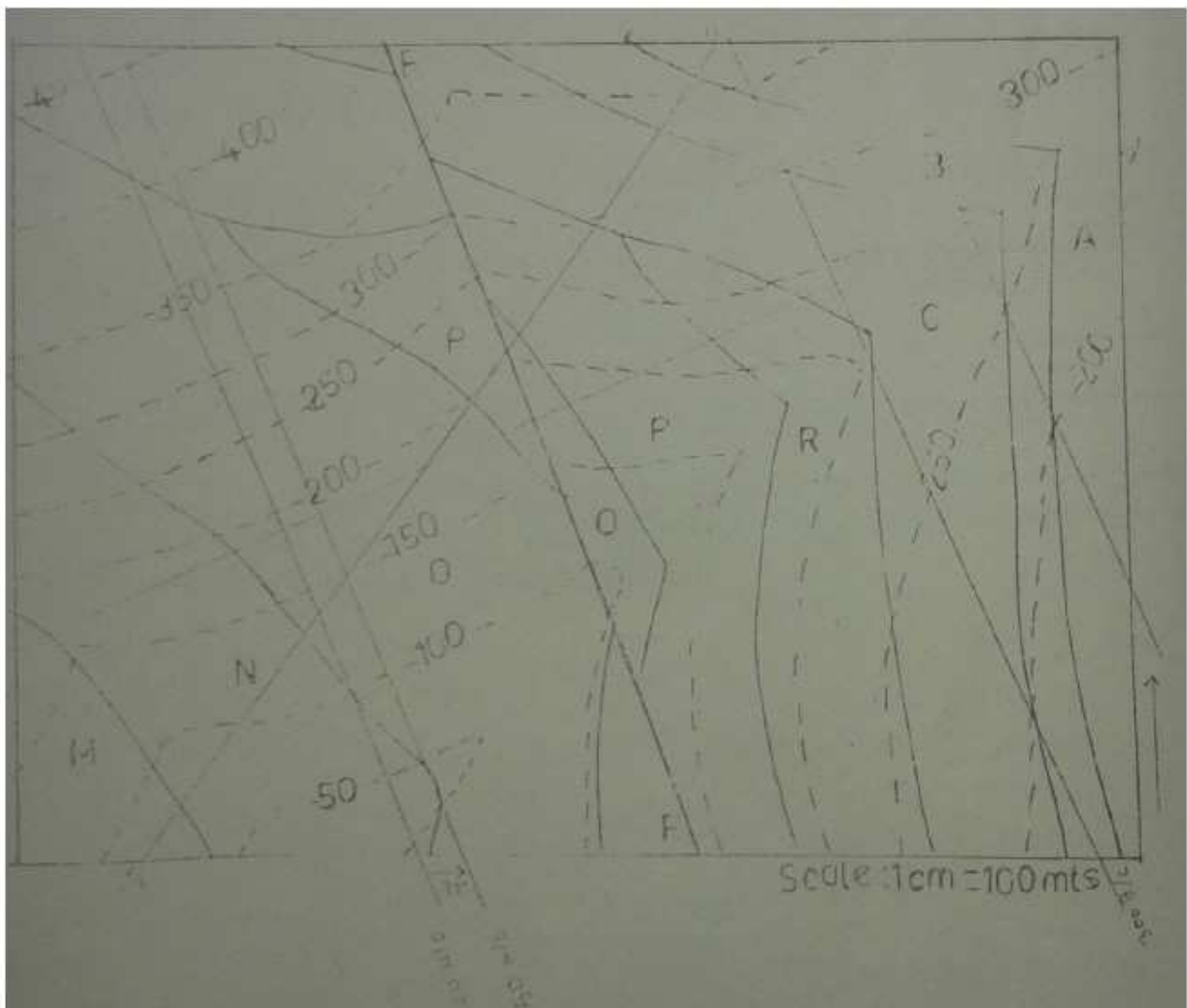
Geological Succession

In the area the beds F-E-D-C-B-A are deposited conformably in a normal marine conditions. Later on they were uplifted and tilted to attain the attitude. Then they were subjected to faulting resulting in a displacement of about 190 mts. After faulting they were eroded and submerged under the sea. Then there was deposition of younger series O-N-M unconformably over the older series.



SECTION ALONG X-Y (TRUE DIP DIRECTION)





SECTION ALONG X-Y (TRUE DIP DIRECTION)

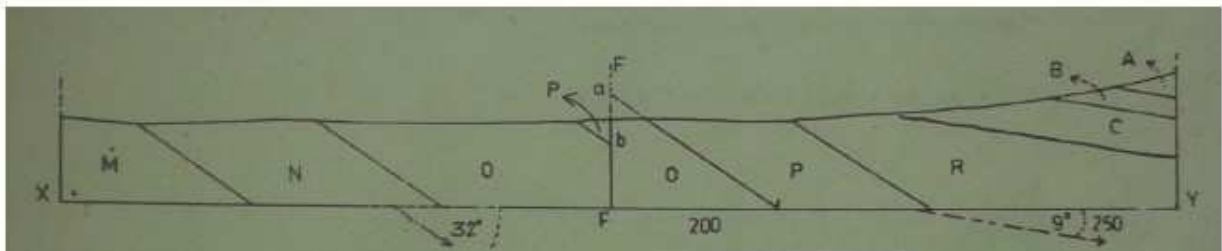


Fig. 17.1

MNO beds (Older series)

Strike interval - 80 mts

ABC beds (younger series)

Strike interval - 280 mts

Dip 32° towards 'Y'

Dip 9° towards 'Y'

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

GEOLOGICAL INTERPRETATION

Topography

In the given map the highest contour is of 450 mts in NW corner and the lowest is of 50 mts in the south. The area is a gently and uniformly sloping one. There is a river valley in the area.

General Geology

In the given map there are two series of beds. The older comprises of 5 beds and the younger of three beds, resting unconformity on the older series.

Geological Structure

In the area both the series strike in NW-SE direction but with different dips. The older series dip at 32° and the younger series at 9° towards Y. There are two structures one is an unconformity and the other is a fault which has produced a displacement of nearly 105 mts. The fault also strikes in the same. Directions both the series and has a vertical dip.

Geological Succession

In the area first the older group of beds is deposited in the order M-N-O-P-R, under normal marine, conditions later on they were uplifted and tilted, and eroded. Then they were submerged in the sea. Again there was a deposition of younger series in the order C-B-A unconformity on the older series. Lastly both the series were faulted displacing the beds by about 105 mts. Faulting of the beds occurred after the formation of both the series of formation.

EXPERIMENT – 5

Simple structural geology problems

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

PROBLEMS – 1

AIM

The aim of this unit is to determine the true and vertical thickness of the formation

OBJECTIVES

After solving the problems you should be able to:

Determine the true thickness of the formation

Determine the vertical thickness of the formation.

MATERIALS

Set-square, Circular, Eraser, Pencil, White papers

ATTENTION

Before you solve the problems given in exercise you carefully go through the unit.

PROBLEM

The width of out crop of shale formation measured in East-West direction is 750 mts. The strike direction of the shale formation is North-South and dipping with an angle 25° towards East. Determine the true and vertical thickness of the formation (The region is one of no relief)

METHOD

1. Assume the scale as 1 cm = 100mts
2. Draw a horizontal line "AB" which represents the East-West direction
3. Draw one more vertical line on "AB" line and note it as "OP" which represents the North-South direction.
4. Take a point "C" on "AB" line from point "A" from "AB" line with a distance 7.5 cms (as per

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

Scale 750 mts = 7.5 cms) Make a point and not it as “D”. Now the “CD” is the width of the

Out crop

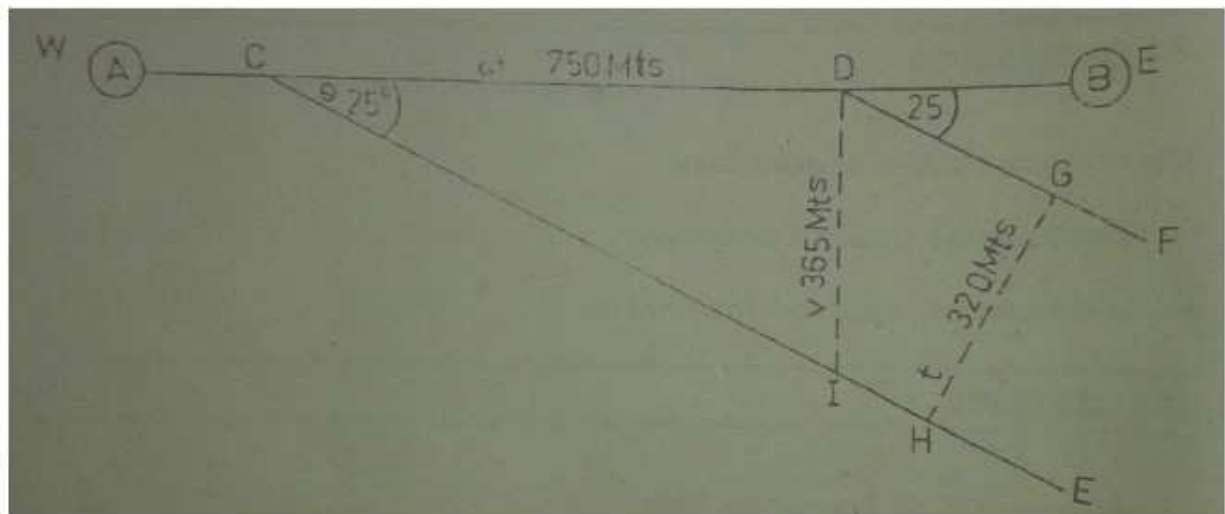
5. From point “C” draw a line “CE” with an angle 25° to “AB” line towards East direction

6. From the point “D” draw a “DF” line parallel to “CE”

7. Draw a “DI” line from point “D” at right angles to the horizontal line to get the vertical

Thickness of the formation

8. Draw another perpendicular line “GH” to “DF” and “CE” lines this is the true thickness Of the formation.



SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

PROBLEM - 2

19.0 AIM

The aim of this unit to determine the dip amount of the formations and true thickness of the geological formation.

19.1 OBJECTIVES

After solving the problem you should able to:

Determine the dip amount and dip direction of the geological formations

Determine the true thickness of the formations

19.2 MATERIALS

Set – square, Circular, Eraser, pencil, White papers

ATTENTION

Before you solve the problems you carefully go throught the unit 1 and 2 of Block-I,
Course – III

19.3 PROBLEM

The width an out crop of a rock formation dipping towards east 200 mts on ground level. Its vertical thickness is 350 mts. Determine the amount of its dip and also the true thickness of the formation.

19.4 METHOD

1. Assume the scale as 1 equal to 50 mts.
2. Draw a horizontal line “AB” which represents ground level and East-West direction.
3. Draw a vertical line “OP” on “AB” line which represents North-South direction.
4. Take a point “C” on the “AB” line, from point “C” measure the width of the out crop.

As per scale 200 mts = 4 cms

SREE VAHINI INSTITUTE OF SCIENCE AND TECHNOLOGY

5. From point "C" with 4 cms distance put another point and note as "D". Now the "CD" is the

Width of the out crop.

6. From the point "D" draw a perpendicular line. As per scale the vertical thickness is 7 cms. (350

Mts = 7 cms). From "D" with a distance of 7 cms put another point on a vertical line and noted

As "E".

7. Join the points "C" and "E" with a line. The "CE" line represents the bottom of the bed.

8. Draw a line "DG" parallel to "CE". "DG" is the top of the bed.

9. Draw a perpendicular line "HI" on "CG" line and extend towards the "DG" line. This "HI"

Is the true thickness of the formation.

10. Measure the angle DCE or BDG. This angle gives the dip amount of the bed.

