SEMESTER-2 (HONS.)
GEO-A-CC-2-04-P&TH
THEMATIC MAPPING ND SURVEYING LAB
TOPIC : 4 (P) &3 (TH)

Semester II

Geological map

Lecture : 1

NAME OF TEACHER:
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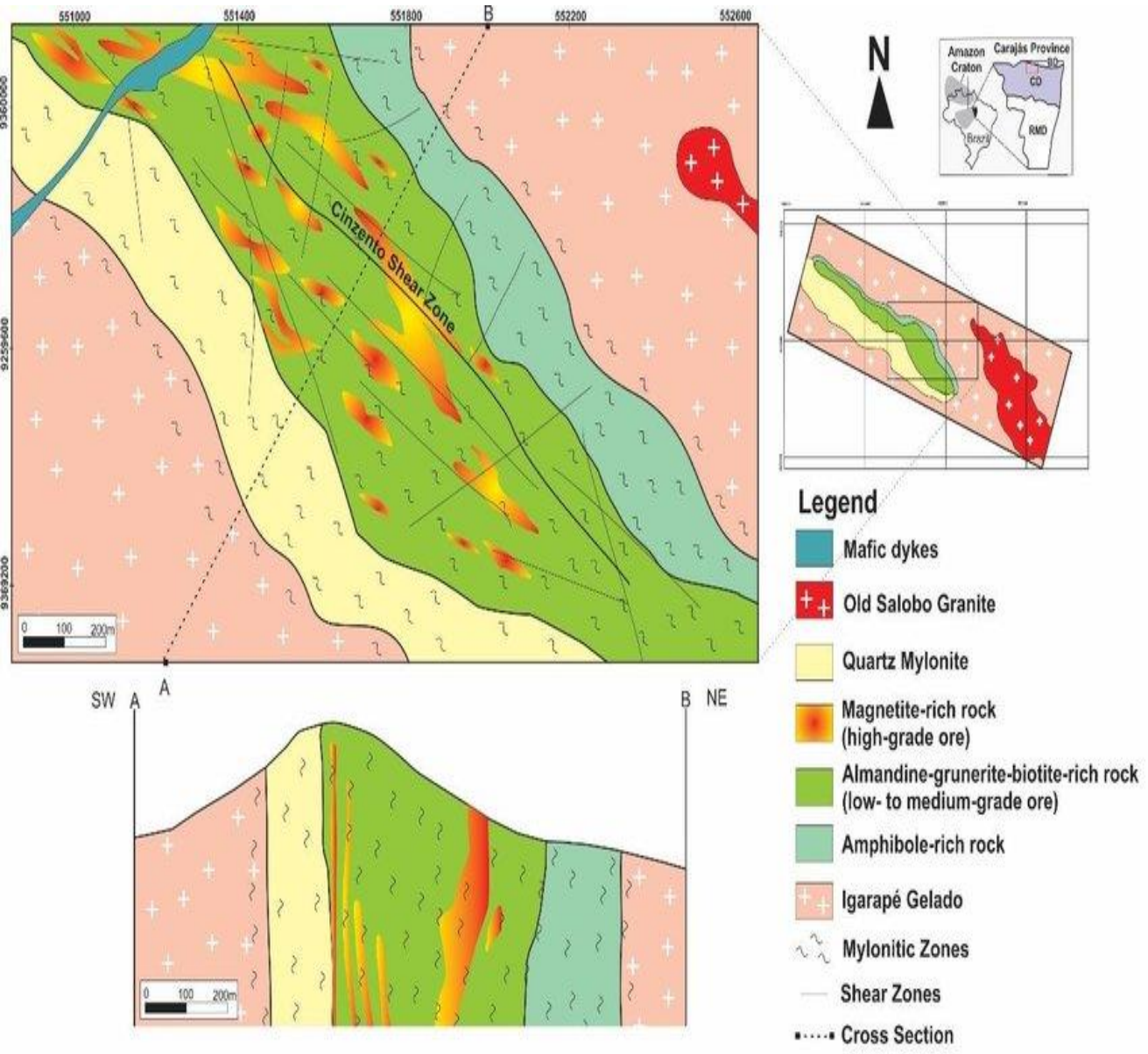
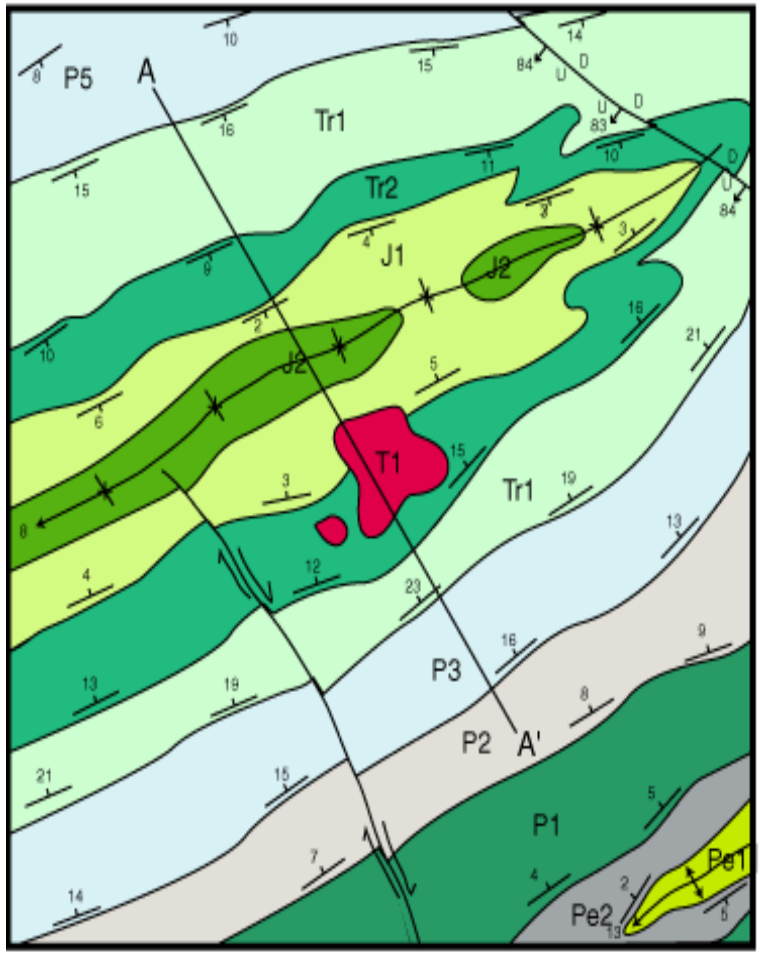
RAMMOHAN COLLEGE

- **What is a Map?**
- A map is a picture or representation of the Earth's surface, showing how things are related to each other by distance, direction, and size.
- Maps are a way of showing many things about a portion of the earth's surface on a flat piece of paper that can be carried and transported easily.
- A map is not a photograph of the Earth's surface. It can show many things that a picture cannot show, and as a result, a map looks different in many ways from a photograph of the Earth's surface.

Geological map





- Geological map

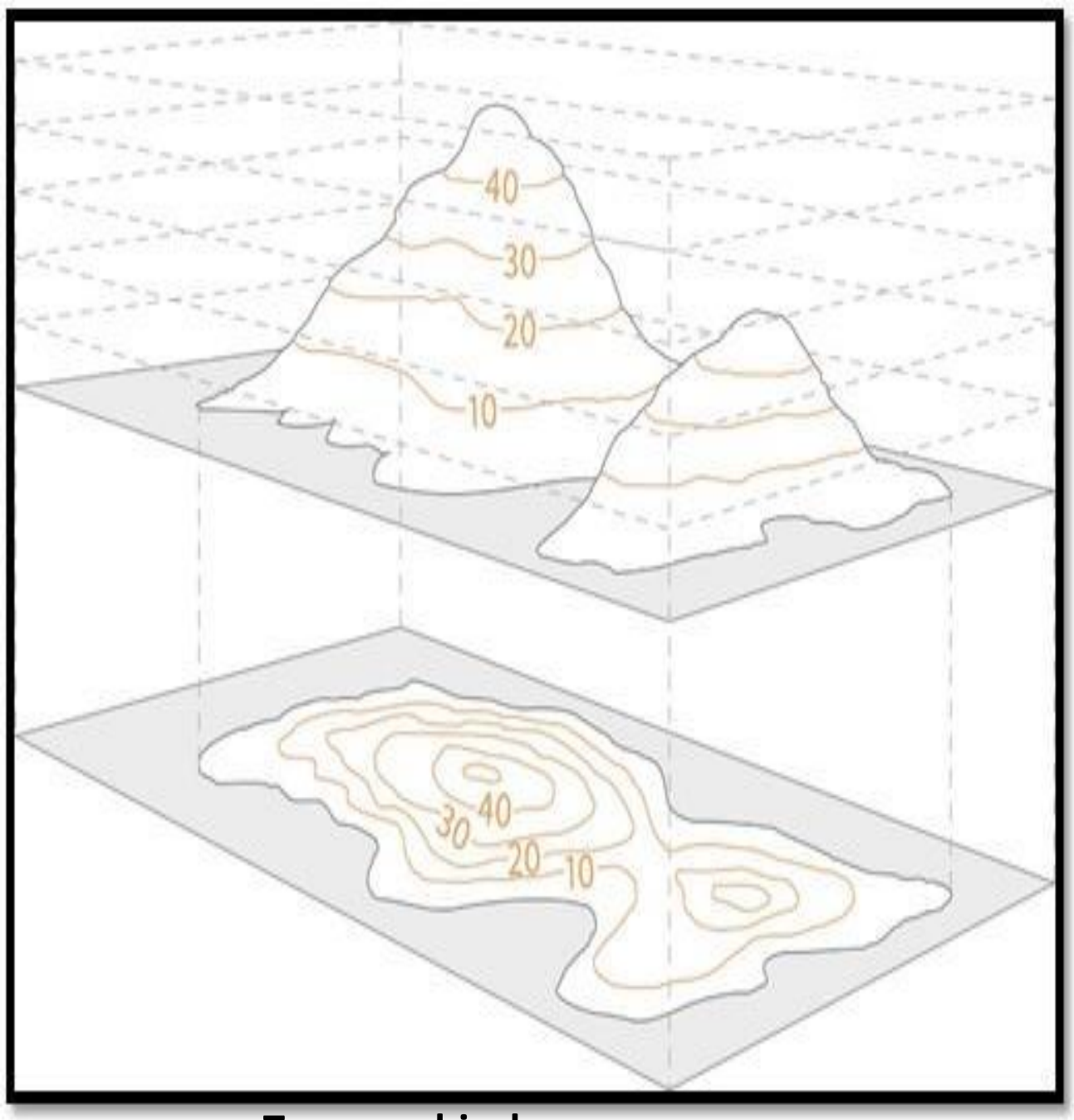
- **Geological maps show the geographical pattern of the composition of the earth surface by means of lithology, stratigraphic structure and succession of geological formation**.
- It is representation of the rocks as exposed on the surface of the earth. Portions of the rocks exposed on the surface of the earth are called as the '*outcrops'.*
- A geologic map records the distribution of rock and soil materials.
- It provides to identify and protect valuable resources, avoid risks from natural hazards.

- A geologic map is a map of the different types of rocks or structures that are on the surface of the Earth.
- By mapping different rock types and structures, geologists can determine the relationships between different rock formations which can then be used to find mineral resources, oil, and deposits.
- Geologic maps are used to interpret the structure, mineralogy, paleontology, and the historical record of the Earth's crust.
- **Geologic maps** are our most important and complete compilation of information about the solid Earth we live on, and we cannot understand the Earth without them. We use geologic maps and the fundamental information they provide in many ways.

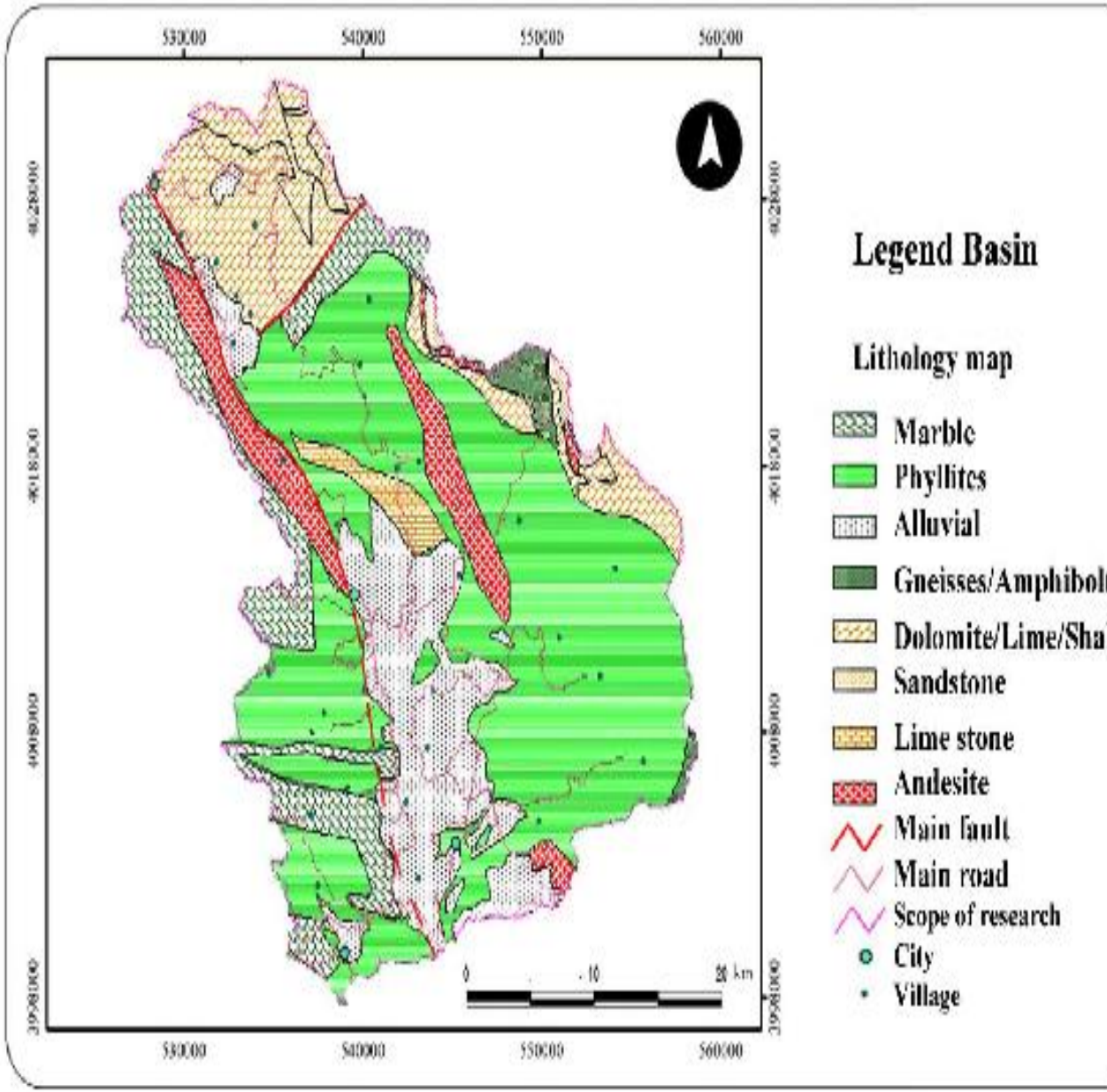
- The object of a geologic map is to convey as accurate a sense as possible of the rock identities and structures of the **bedrock** of a region - i.e. **what lies beneath the cover of vegetation, soil, buildings, water, and regolith**.
- Usually, this must be inferred from fragmentary information coming from: **Outcrops, Drilling, Seismic stratigraphy**

❑A geologic map involves three levels of information, that we will consider in turn:

- *The information that any map needs to function as a scale model of the world, including:*
  - A scale
  - An indication of the location in the real world that it represents.
  - Representations of roads, bodies of water, buildings, etc.
- *Information about the surface topography of the mapped region:*
  - Topographic counter lines
- *Information about the bedrock:*
  - The identity of the rocks
  - The orientation of strata
  - The presence of structures such as faults, folds, domes, and basins.



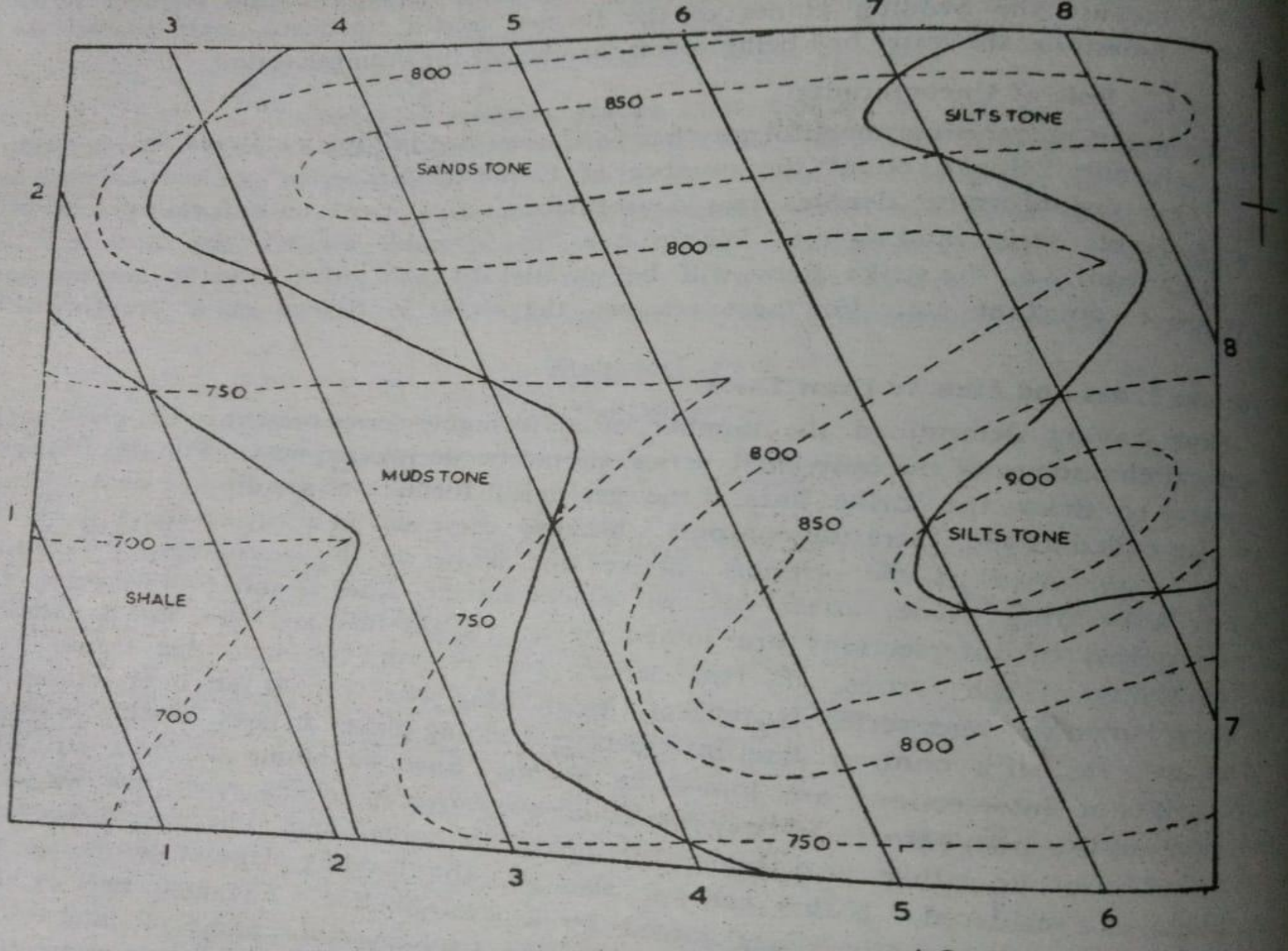
Topographical map



Lithological map

• Basic map information:

- **Scale**: Like any map, geologic maps have scale. In addition, a scale indicating the equivalency of a unit of measure on the map to one in the real world will be present. E.G., "Scale 1:50,000" means "one unit of measurement on the map equals 500,000 unit in the real world." This applies to any unit.
  - In the US, scales of 1:62,500 and 1:125,000 are often used because they roughly make one inch on the map equal one or two miles respectively on the map.
  - In other countries, scales of 1:50,000 and 1:100,000 are common.
- **Location**: Like any map, geologic maps have titles indicating the general location they represent. In addition, most contain indication of longitude and latitude in their margins.
- **Contour lines:** Information about the three-dimensional surface of the Earth can be compressed onto a two dimensional map using contour lines. ***Contour lines display the intersection between an imaginary horizontal plane with the actual ground surface.***



contour interva
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Map No. 15, st
and 7 pass thro

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(*ii*) s
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(*iii*) s
(*iv*) s

3·6. **Inform**

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from the st
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the strike li
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important a
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3·6

To
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by consideri

- ***Rock beds:*** homogenous sedimentary rock layers are called beds.
- ***Bedding plane:*** the plane that separates *two successive beds* are called a bedding plane.

➢A rock bed is bounded by two bedding planes, namely: **upper bedding plane and lower bedding plane.**

➢**The bedding plane may be horizontal, vertical, folded, faulted etc.**

➢***Dip:*** **the inclination of a bedding plane with respect to the horizontal plane is called dip.**

- **Dip**
  - **True dip**
  - **Apparent dip**

- ***Dip direction:*** **the geographical direction in which the beds dip is called the dip direction.**
- ***Strike:*** **the direction perpendicular to the direction of true dip is called the *strike*. And a line drawn in this direction is called *a strike line*.**

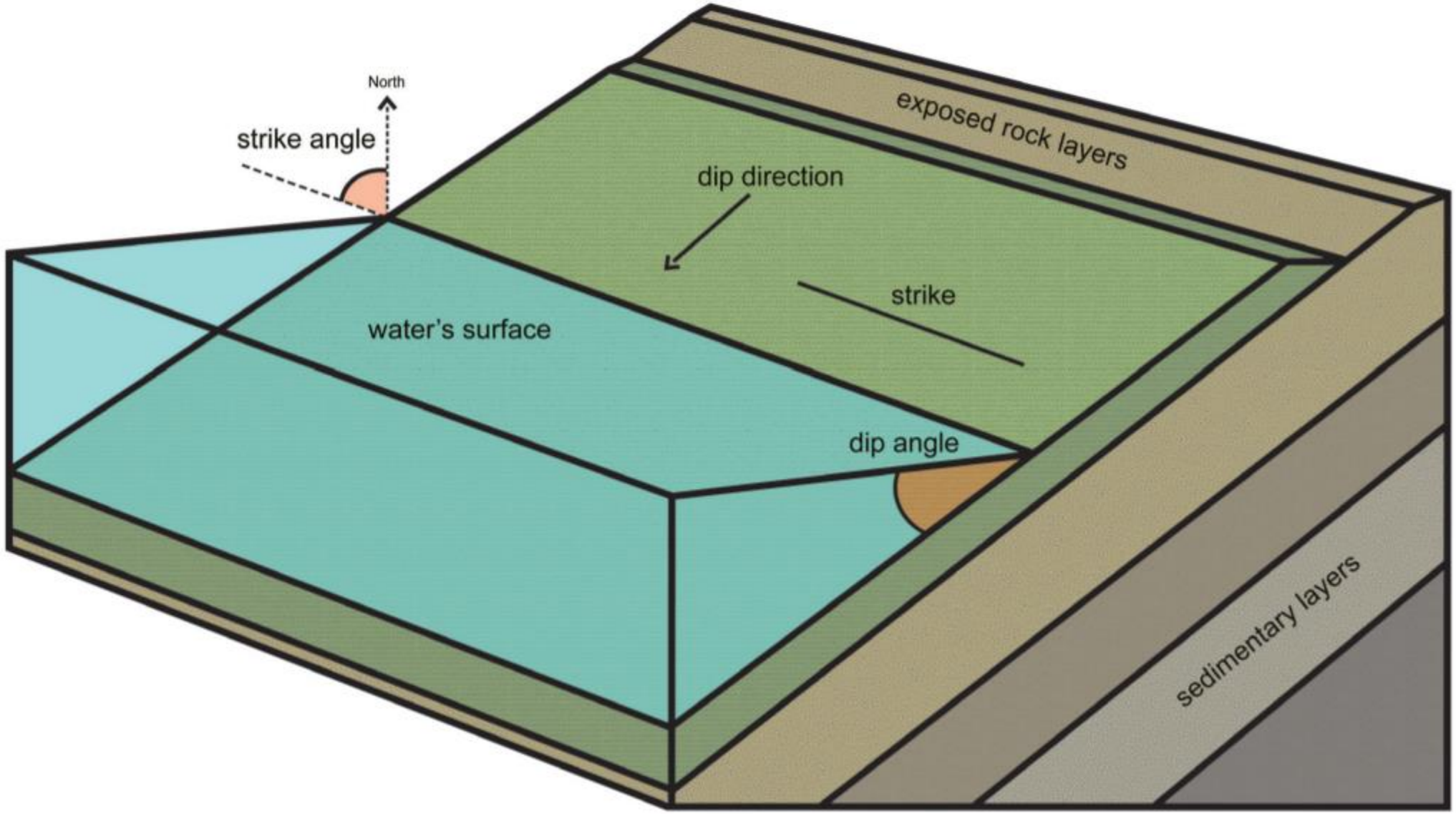


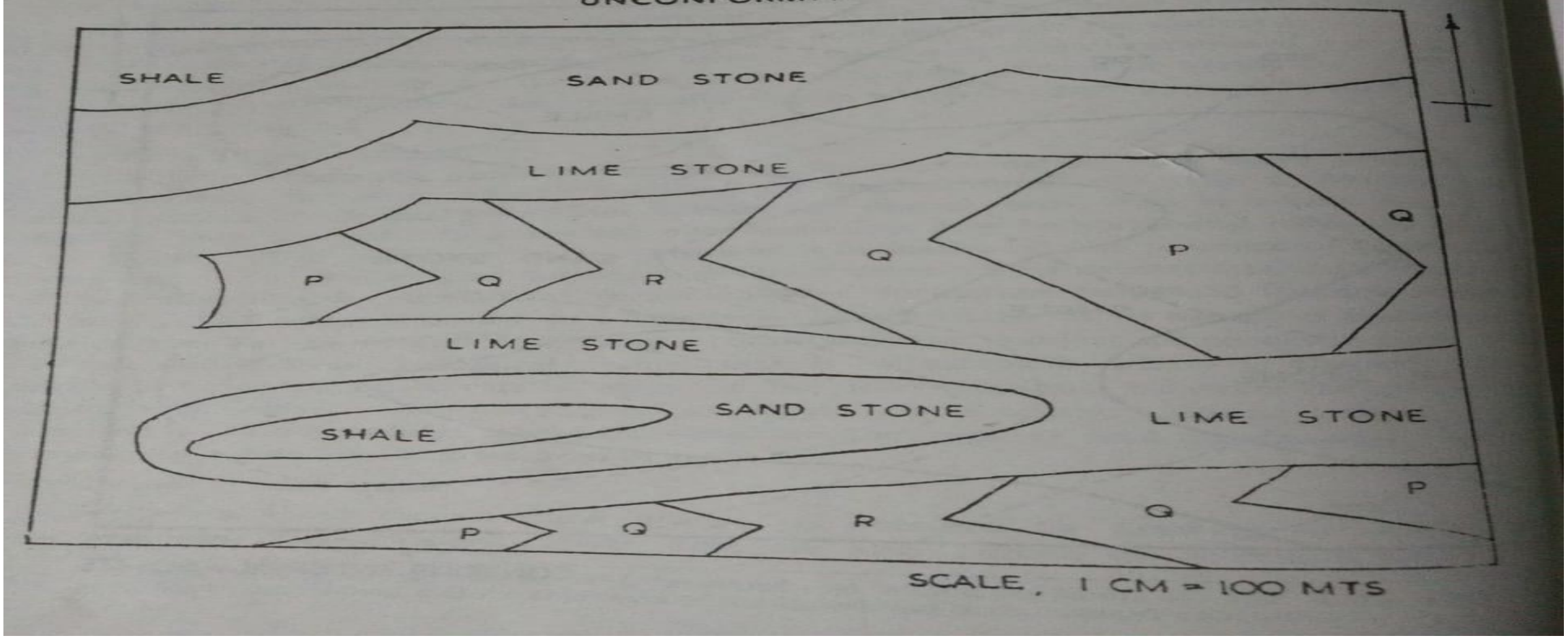
Figure 12.8 | A demonstration of strike and dip. In this example, the beds are dipping to the southwest.

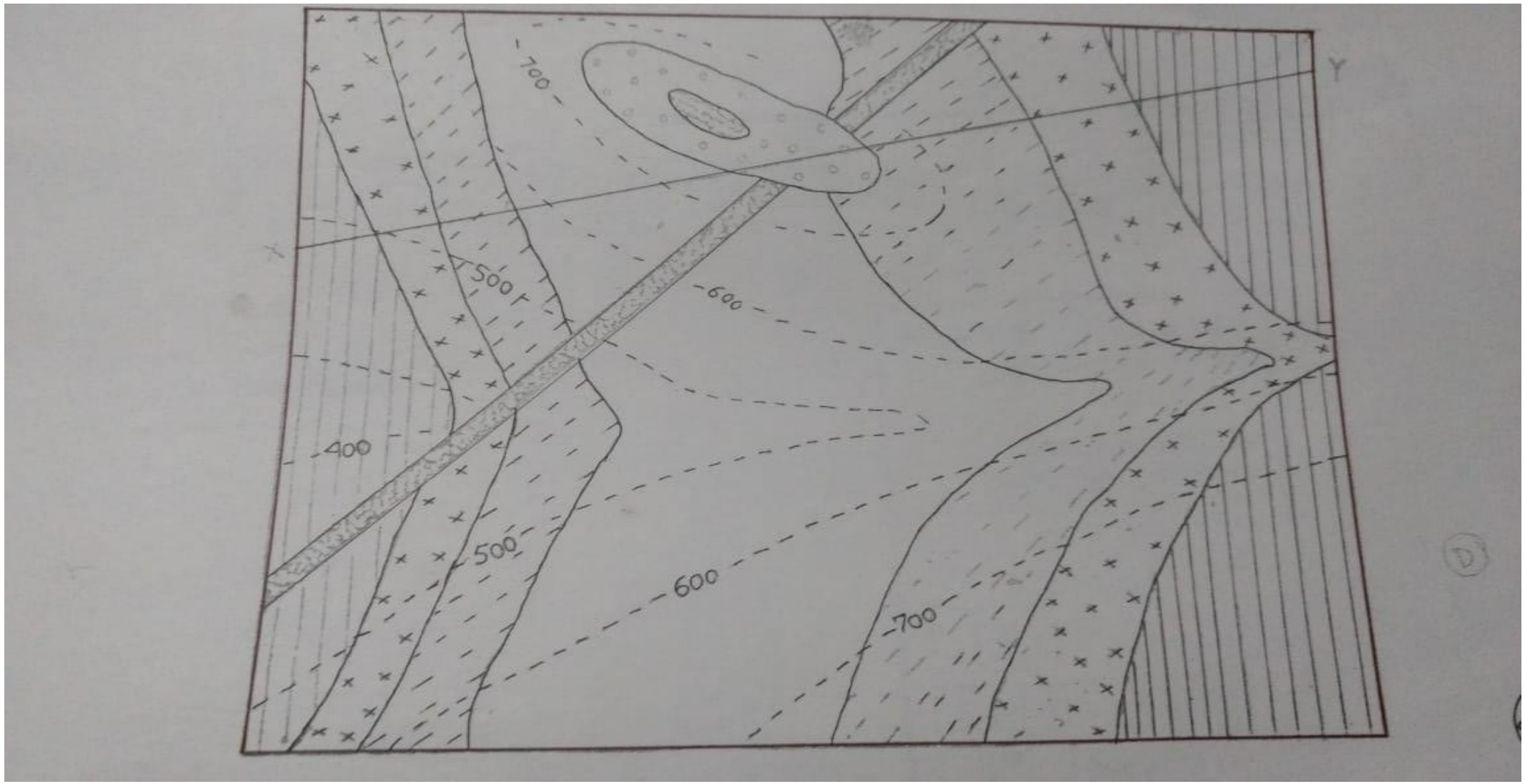
against the border line of map, but this is ... truncation, because in such cases, the bedding planes are made to stop, artificially. If only one conformable series of beds be exposed in the map, the attitude of such a series could be horizontal or inclined, the latter including the folded beds, but a combination between these varieties is not possible.

Characters of two conformable series

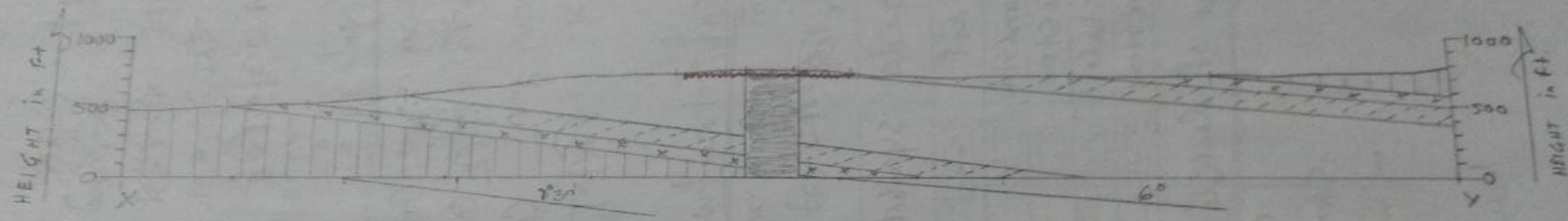
If one set of bedding planes abut against or are truncated by another set of beds within the frame work of the map, this indicates the presence of two series of conformable beds in the given map (See Map No. 12). The relative ages between the two or more conformable series are established by studying the inter-relations between the several beds. *That series is older whose bedding planes end abruptly, against the other.* It will be noticed that the outcrops of the "older series" end generally against *only one bedding plane* of the "younger series"

MAP NO. 12
UNCONFORMITY




700
500
600
400
500
600
700
X
Y

GEOLOGICAL SECTION ALONG THE LINE XY



SCALE - 1 inch = 1000 ft.

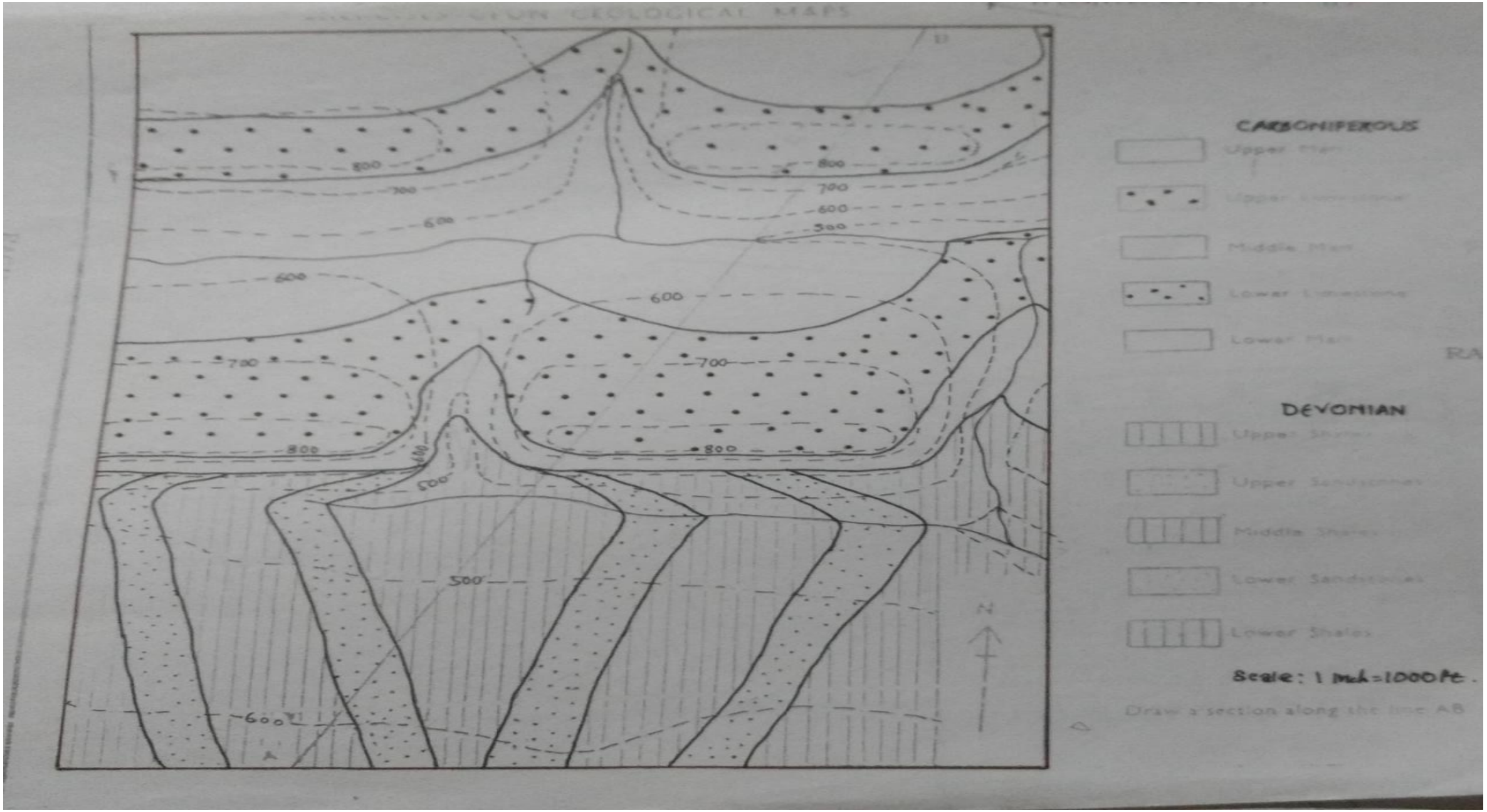
SEQUENCE OF ROCK BEDS

UPPER SERIES (Horizontal)

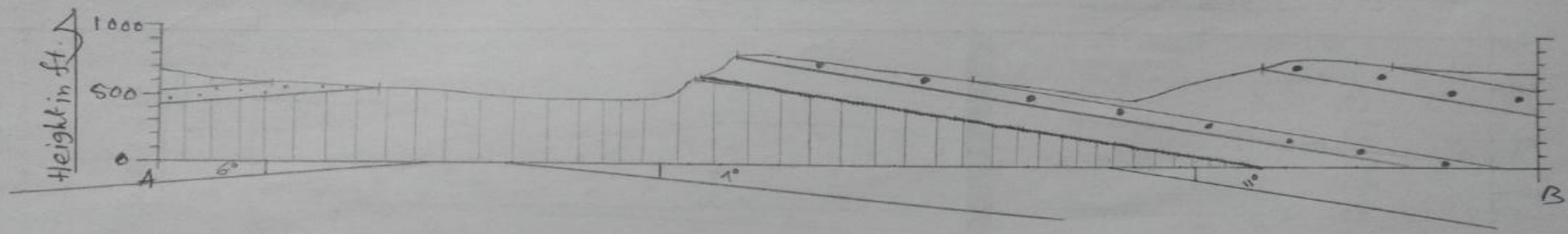
Line of unconformity

LOWER SERIES (FOLDED)

DYKE.


CARBONIFEROUS
Upper Marl
Upper Limestone
Middle Marl
Lower Limestone
Lower Marl
DEVONIAN
Upper Shales
Upper Sandstones
Middle Shales
Lower Sandstones
Lower Shales
Scale: 1 inch = 1000 ft.
Draw a section along the line AB
800
700
600
500
N
A
B

GEOLOGICAL SECTION ALONG THE LINE AB



SCALE: 1 inch = 1000 ft.

INDEX

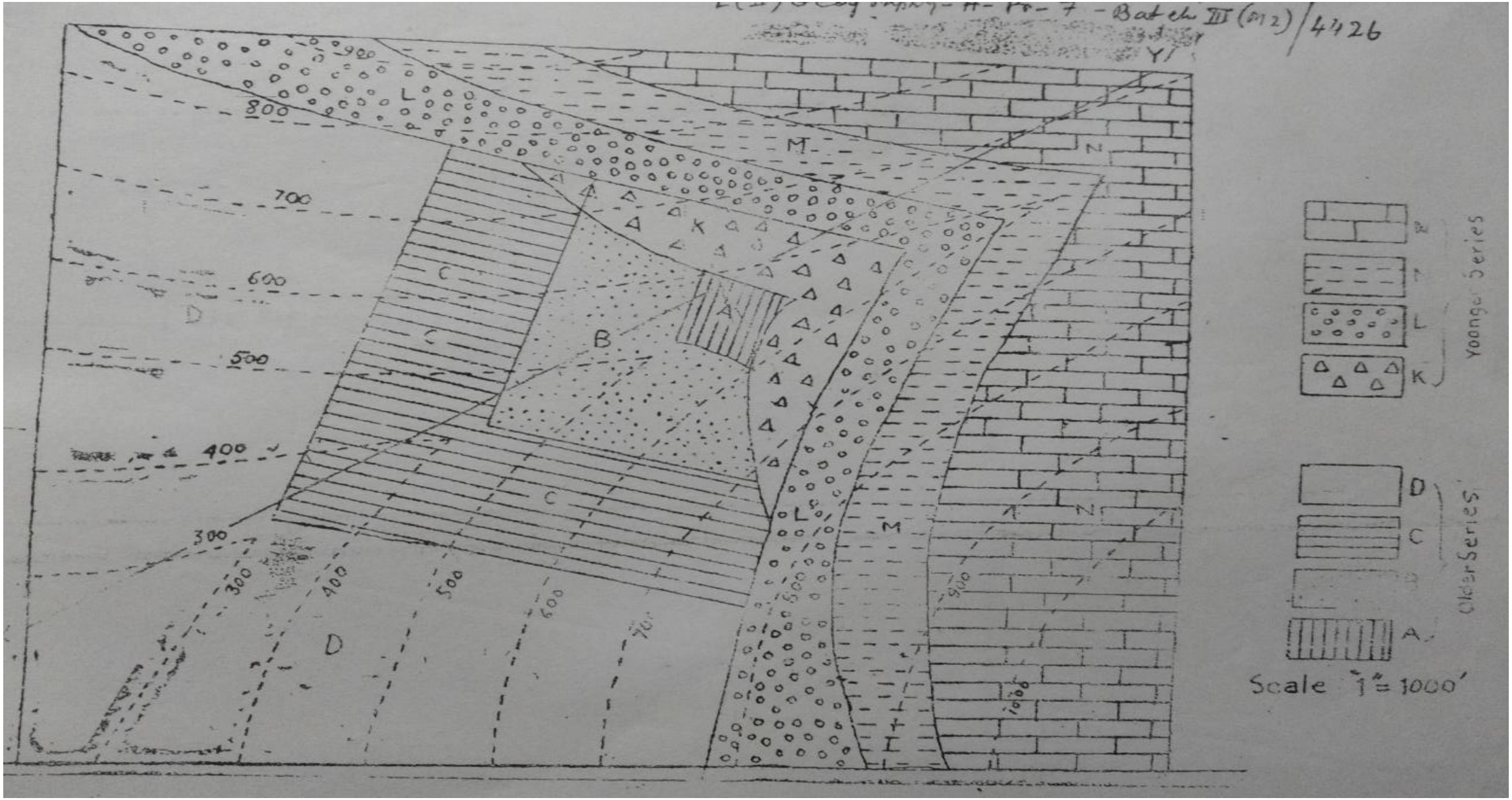
Sequence of Rock beds

UPPER SERIES - CARBONIFEROUS

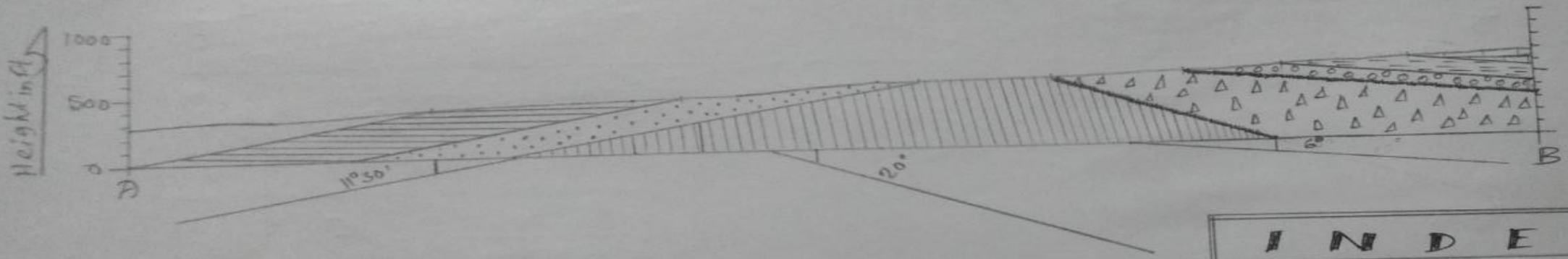
- Upper Marl
- Upper limestone.
- Middle Marl
- Lower Limestone.
- Lower Marl.
- Line of unconformity.

LOWER SERIES - DEVONIAN

- Middle shales.
- Lower sandstone.
- Lower shales.


Batch III (M2)/4426
Y
900
800
700
600
500
400
300
M
N
K
C
B
A
L
D
Younger Series
Older Series
Scale 1" = 1000'

GEOLOGICAL SECTION ALONG THE LINE AB



SCALE:- 1 inch = 1000 ft.

INDEX

Sequence of Rockbeds

UPPER SERIES

N

M

L

Line of unconformity

MIDDLE SERIES

K

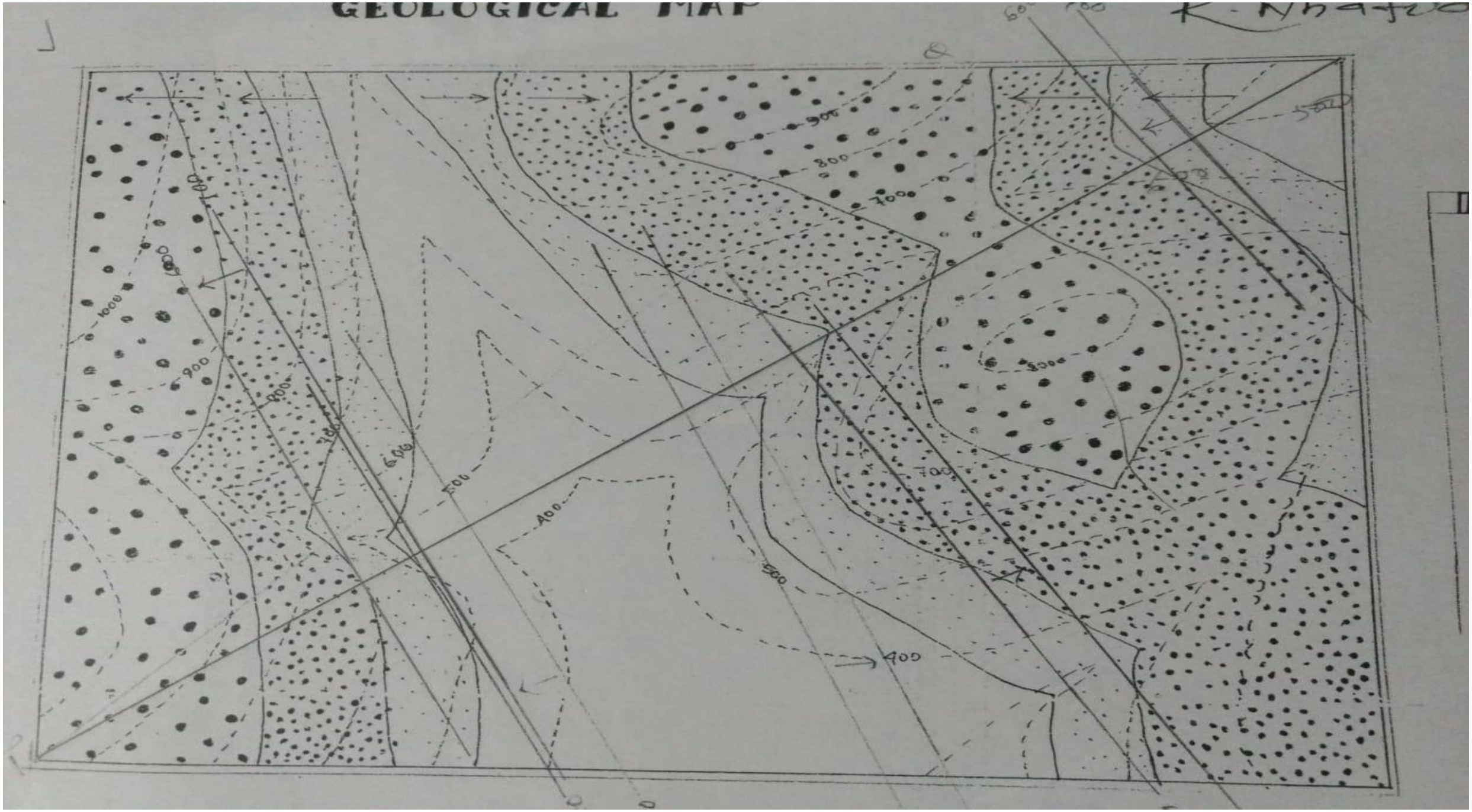
Line of unconformity

LOWER SERIES

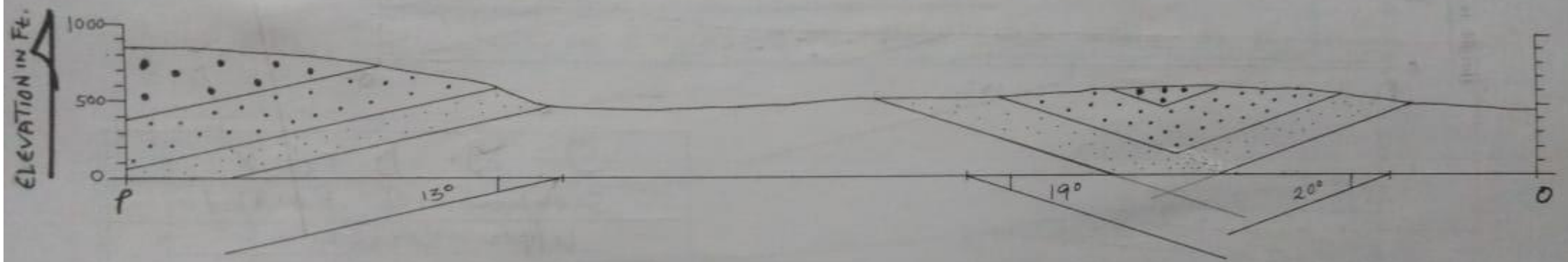
D

C

B


GEOLOGICAL MAP
1000
900
800
700
600
500
400
500
400

GEOLOGICAL SECTION ALONG THE LINE PO



SCALE: 1 inch = 1000 ft.

INDEX

SEQUENCE OF ROCKBED

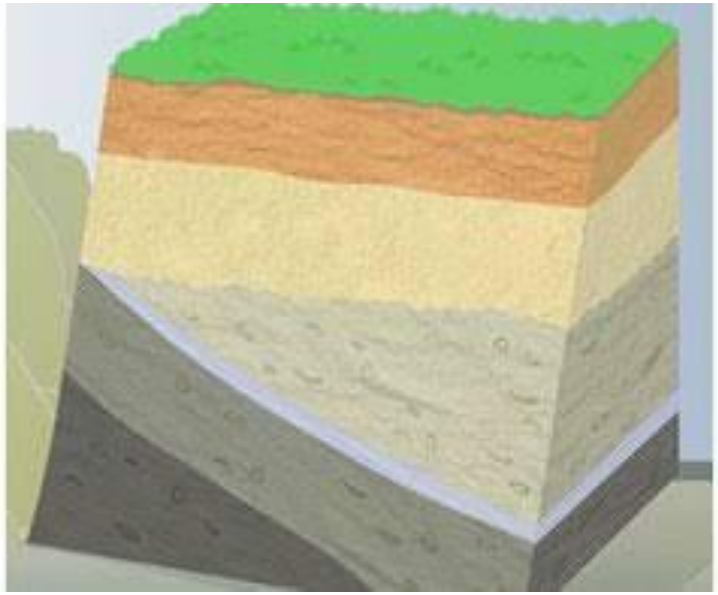
- Grit
- Sand stone
- Mud stone
- Shale

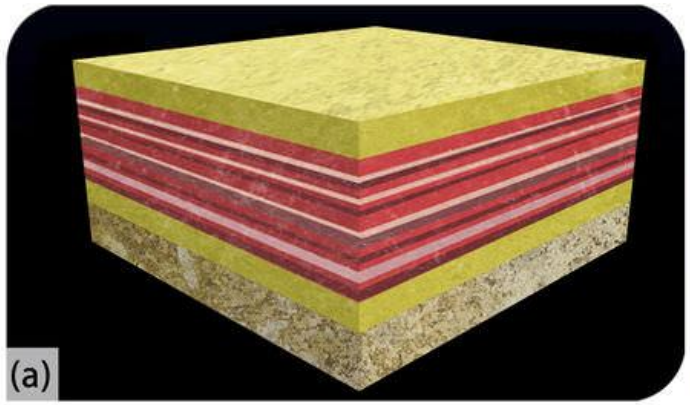
Geological map

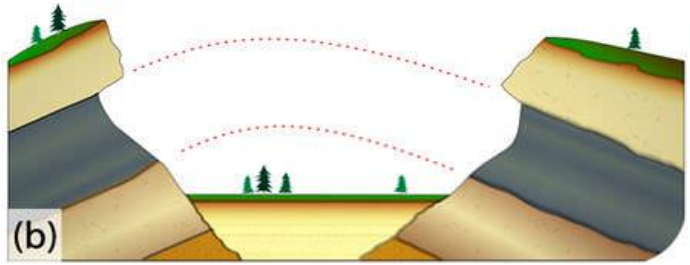
Lecture:2

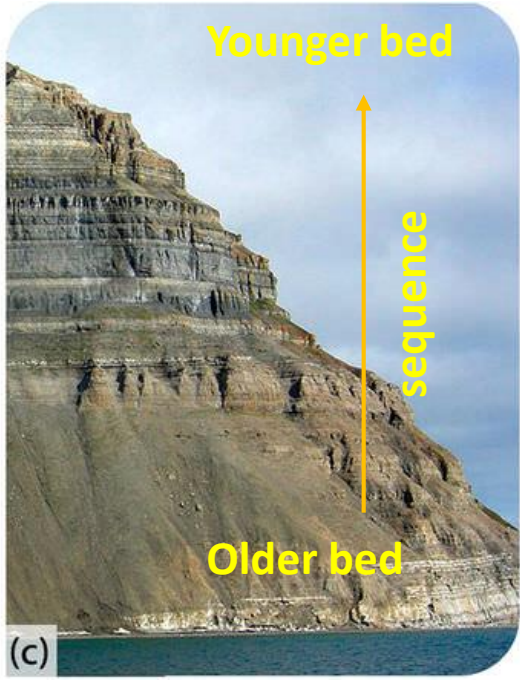
Rock bed – bedding plane - sequences

Rock beds: Homogenous individual sedimentary rock layers are called beds.
Thickness of bed may vary from thin layer bed to very thick layer bed.



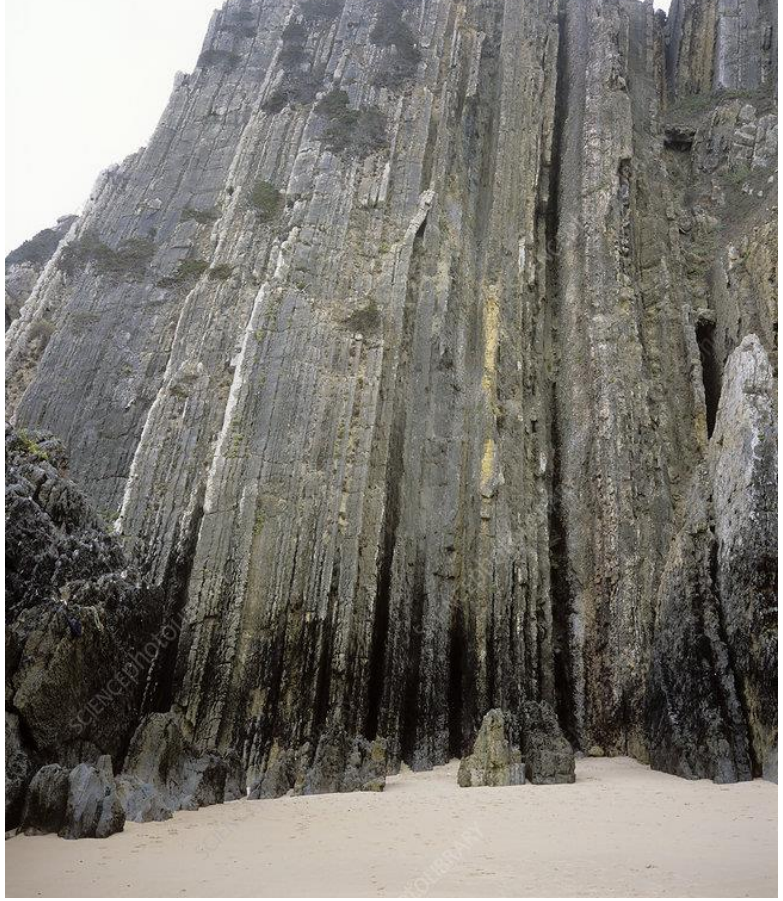






Bedding plane: the plane that separates *two successive beds* are called a bedding plane.
A rock bed is bounded by two bedding planes, namely: **upper bedding plane and lower bedding plane.**

- **The bedding plane may be horizontal, vertica**

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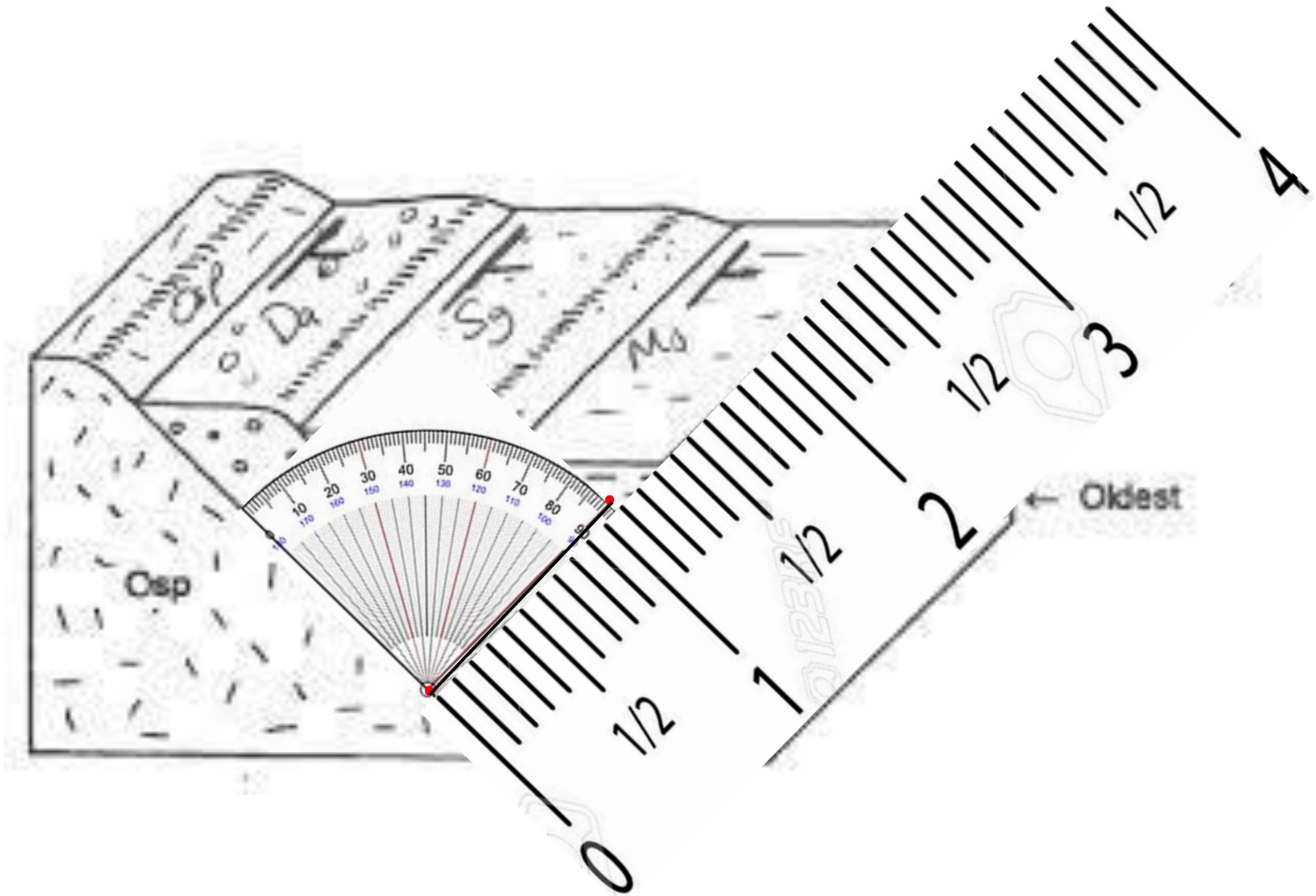
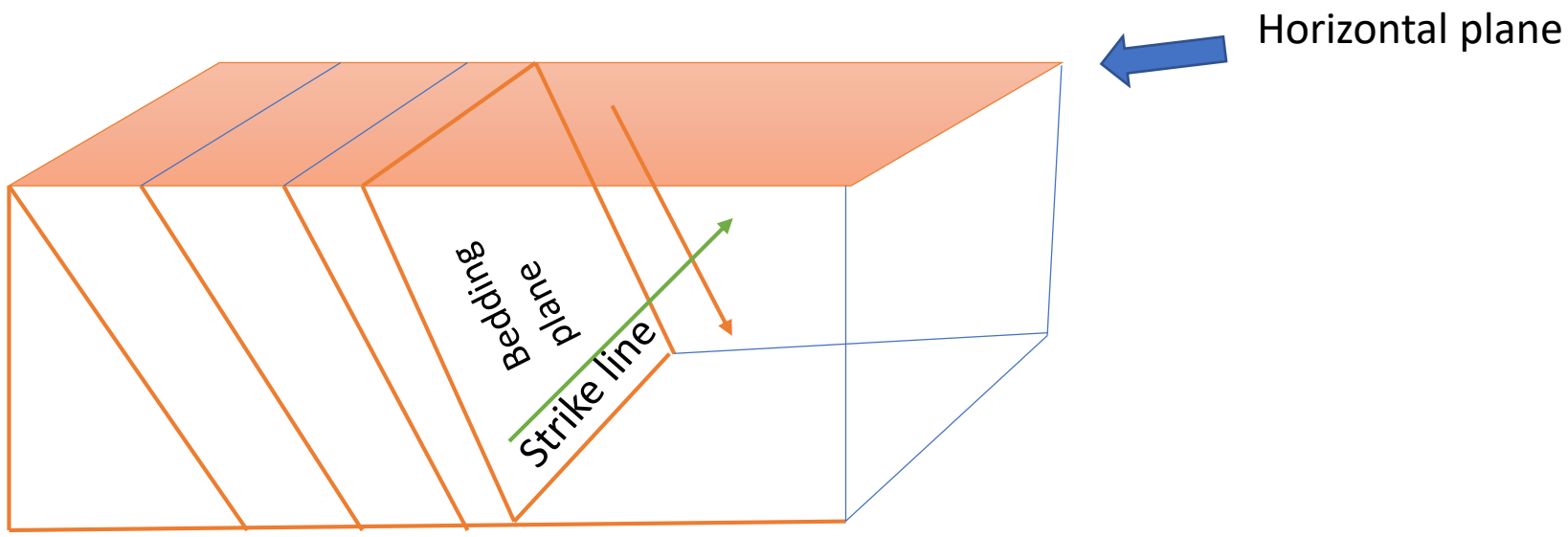
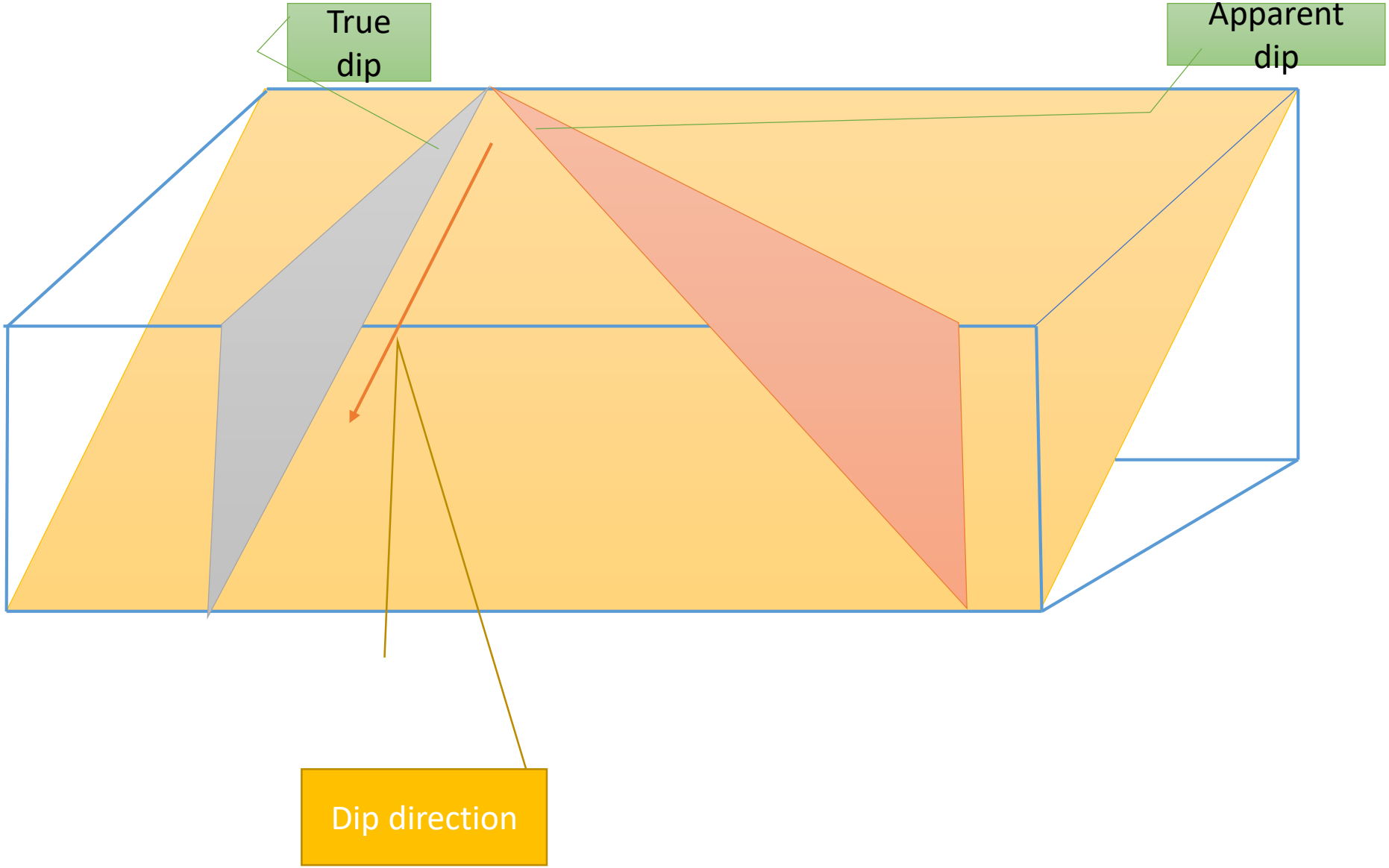
structure?

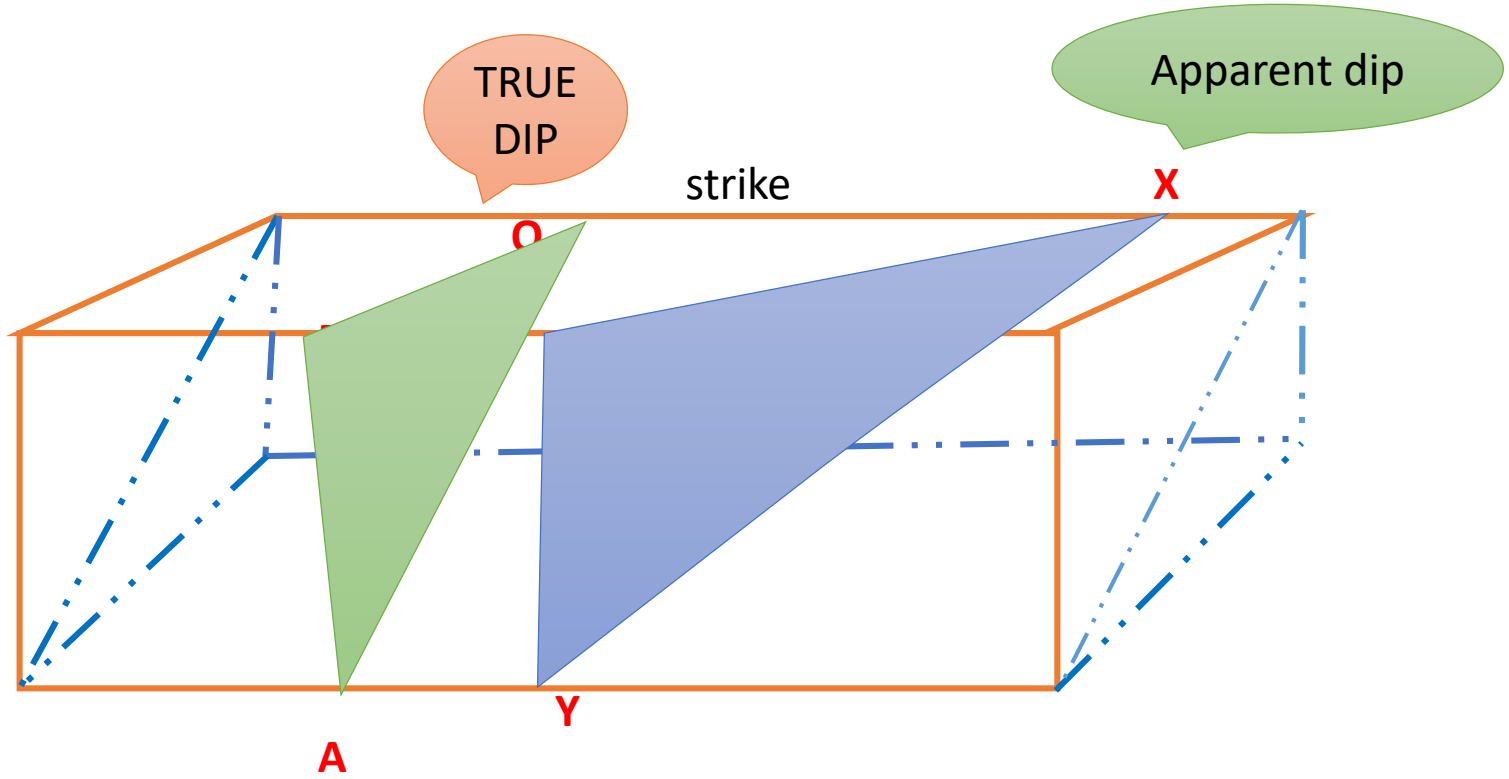


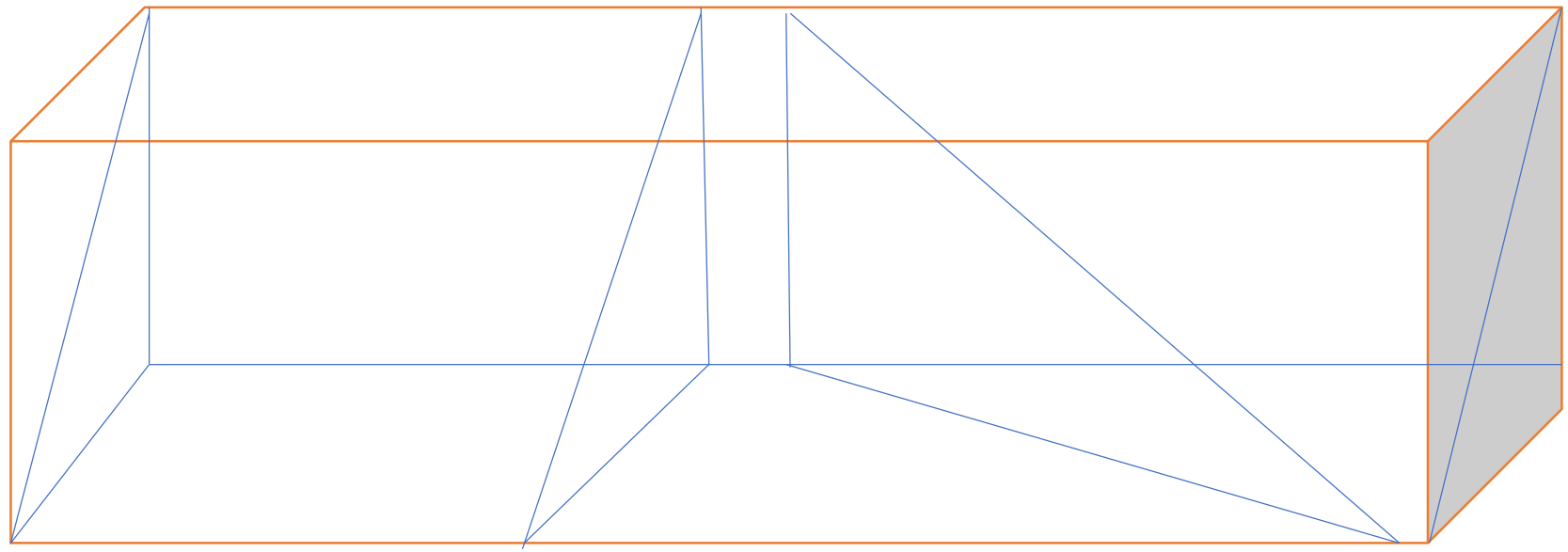
Dip and strike lines



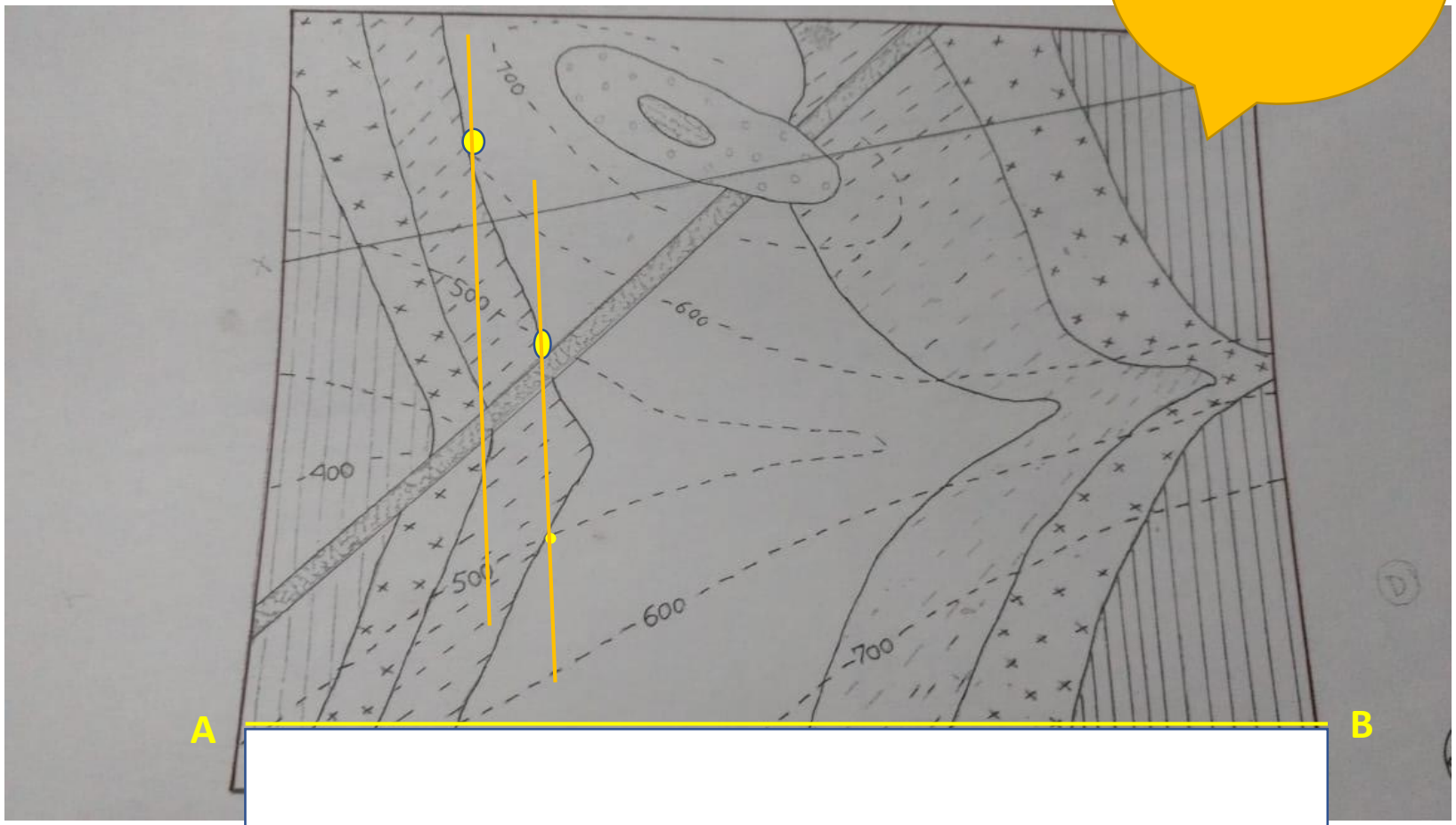
Dip: (1) True Dip and (2) Apparent Dip


True dip
Apparent dip
Dip direction


TRUE
DIP
Apparent dip
strike
X
O
Y
A



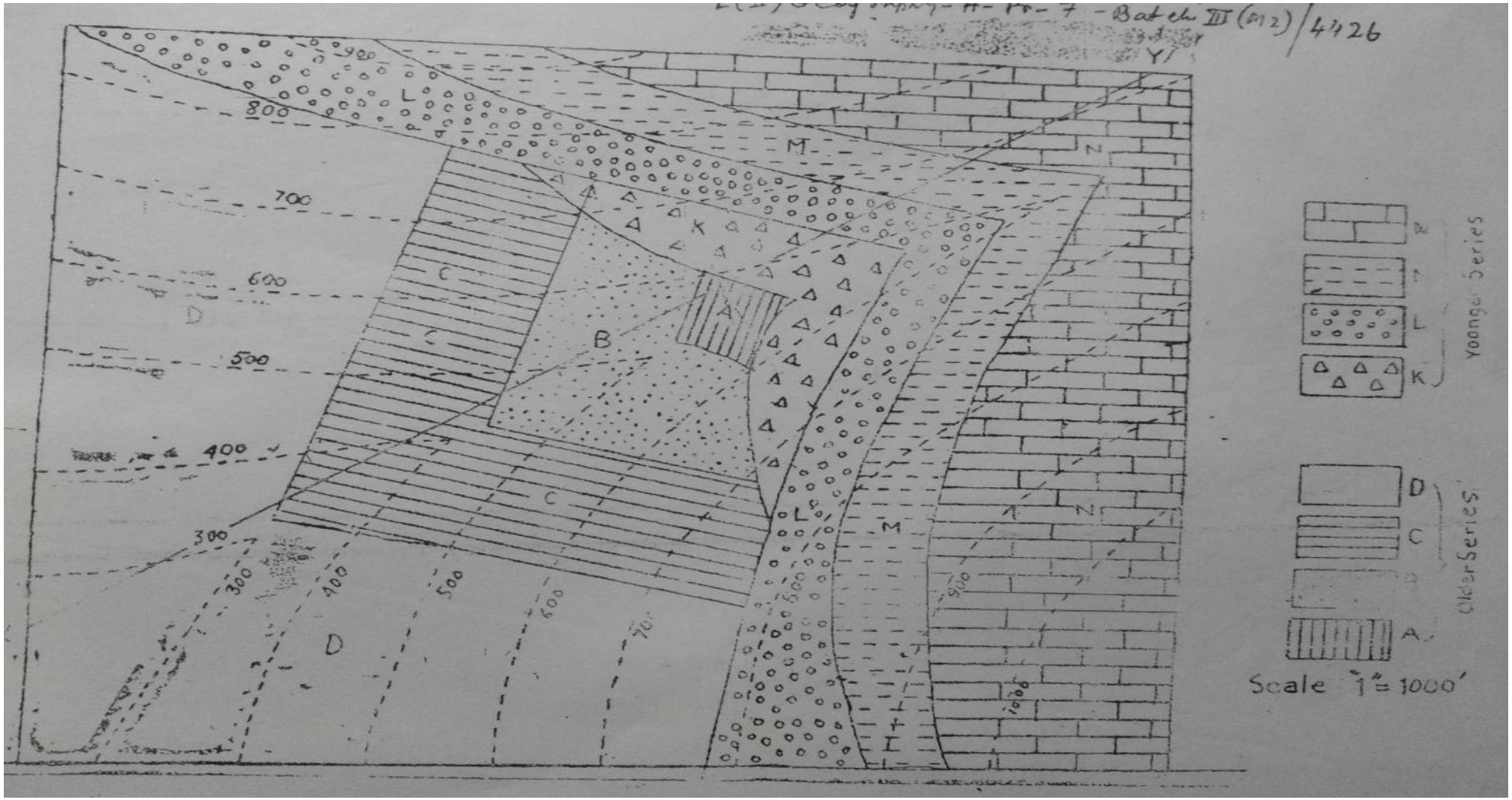
Outcrops and cross section and dip direction:

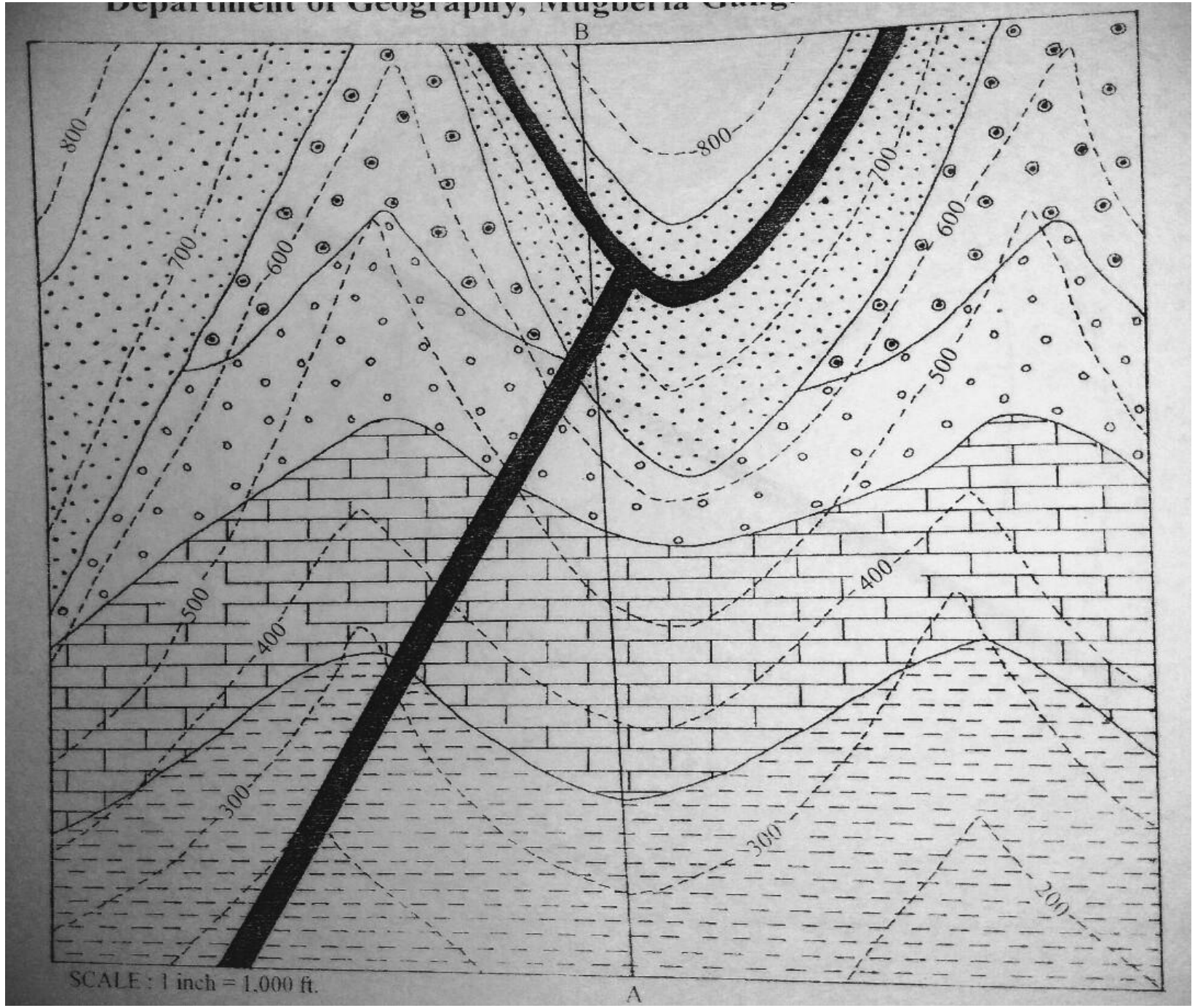


Outcrop

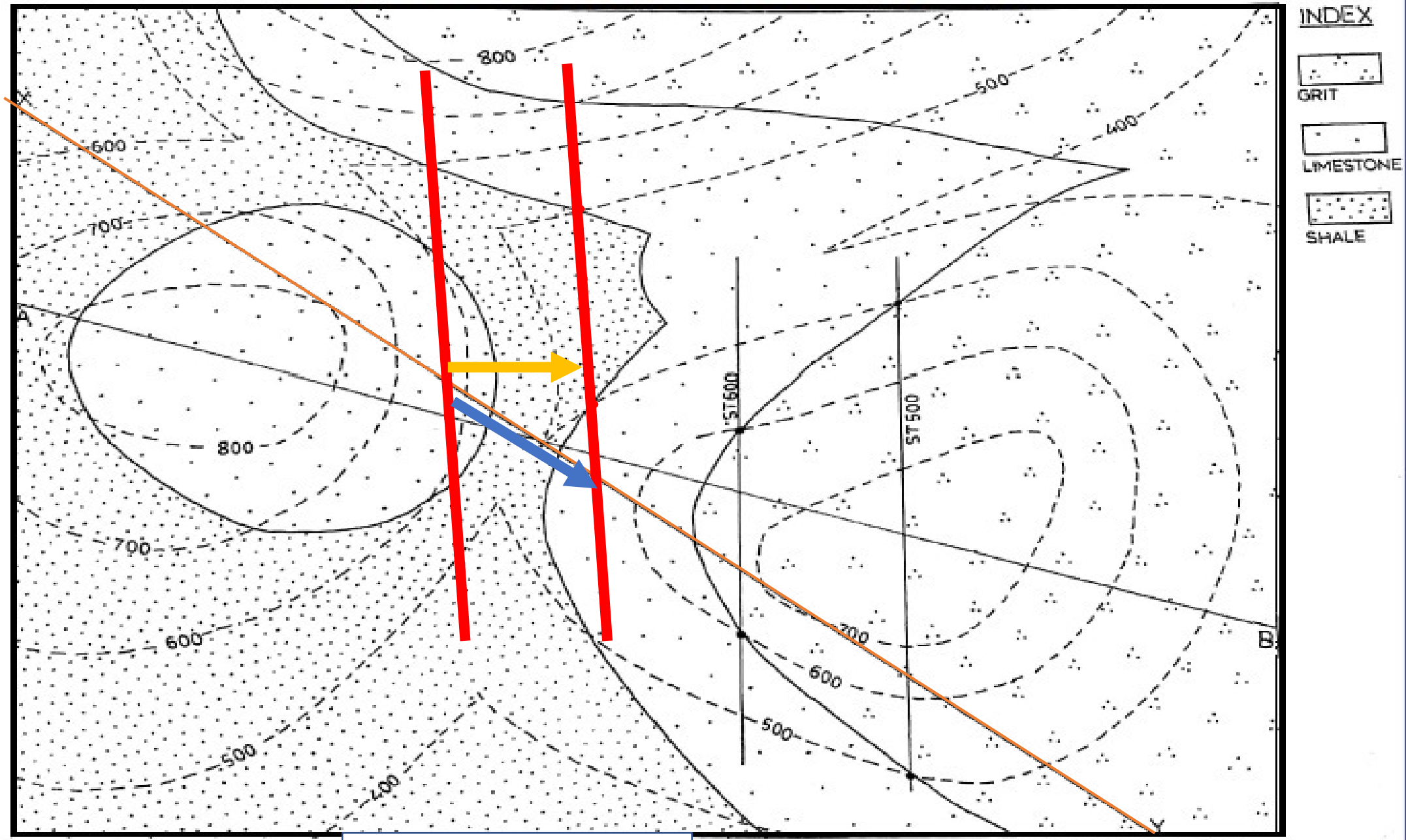
Line of unconformity:

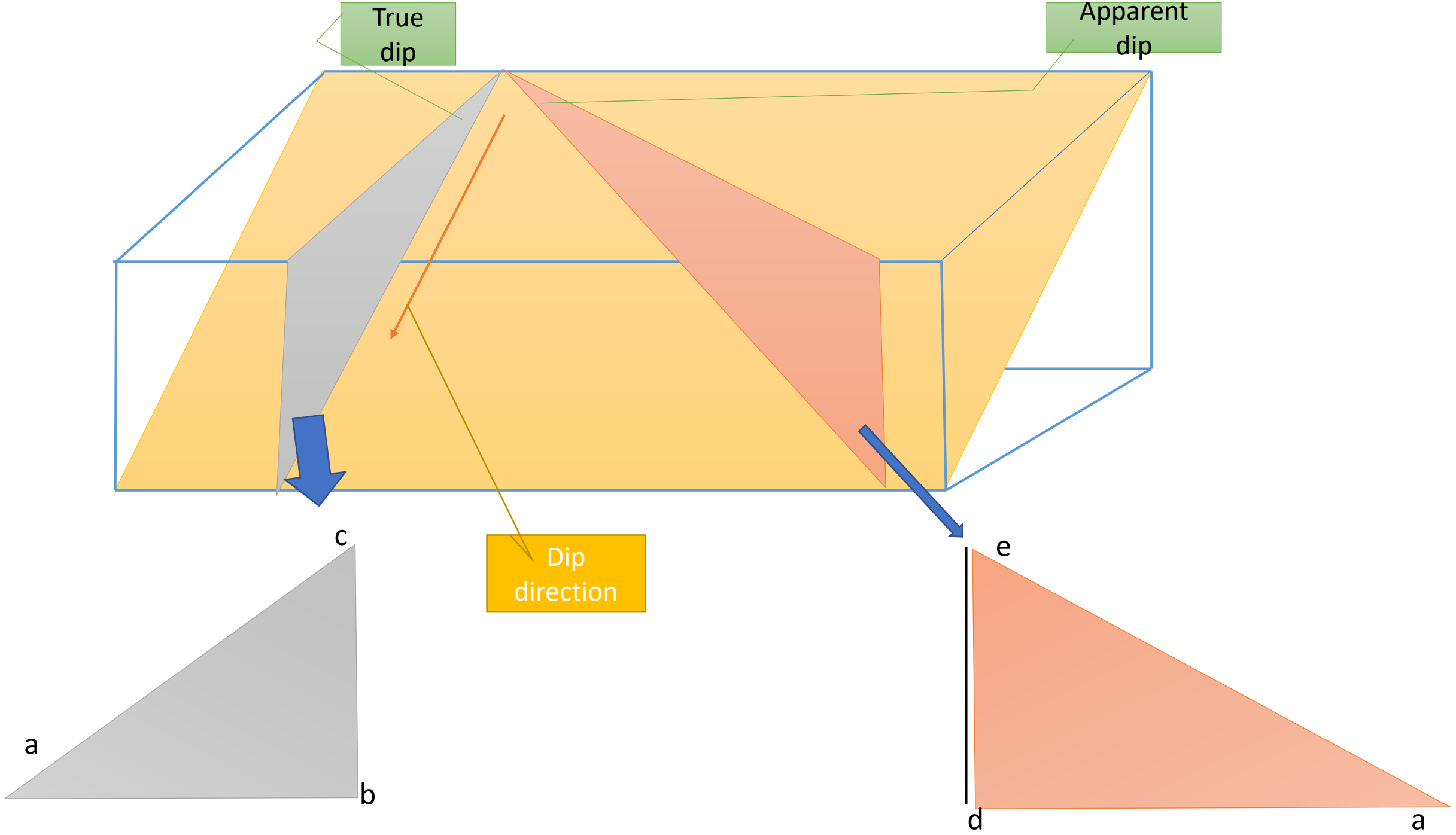
Map reading:




B
800
800
700
700
600
600
500
500
400
400
300
300
200
SCALE : 1 inch = 1,000 ft.
A

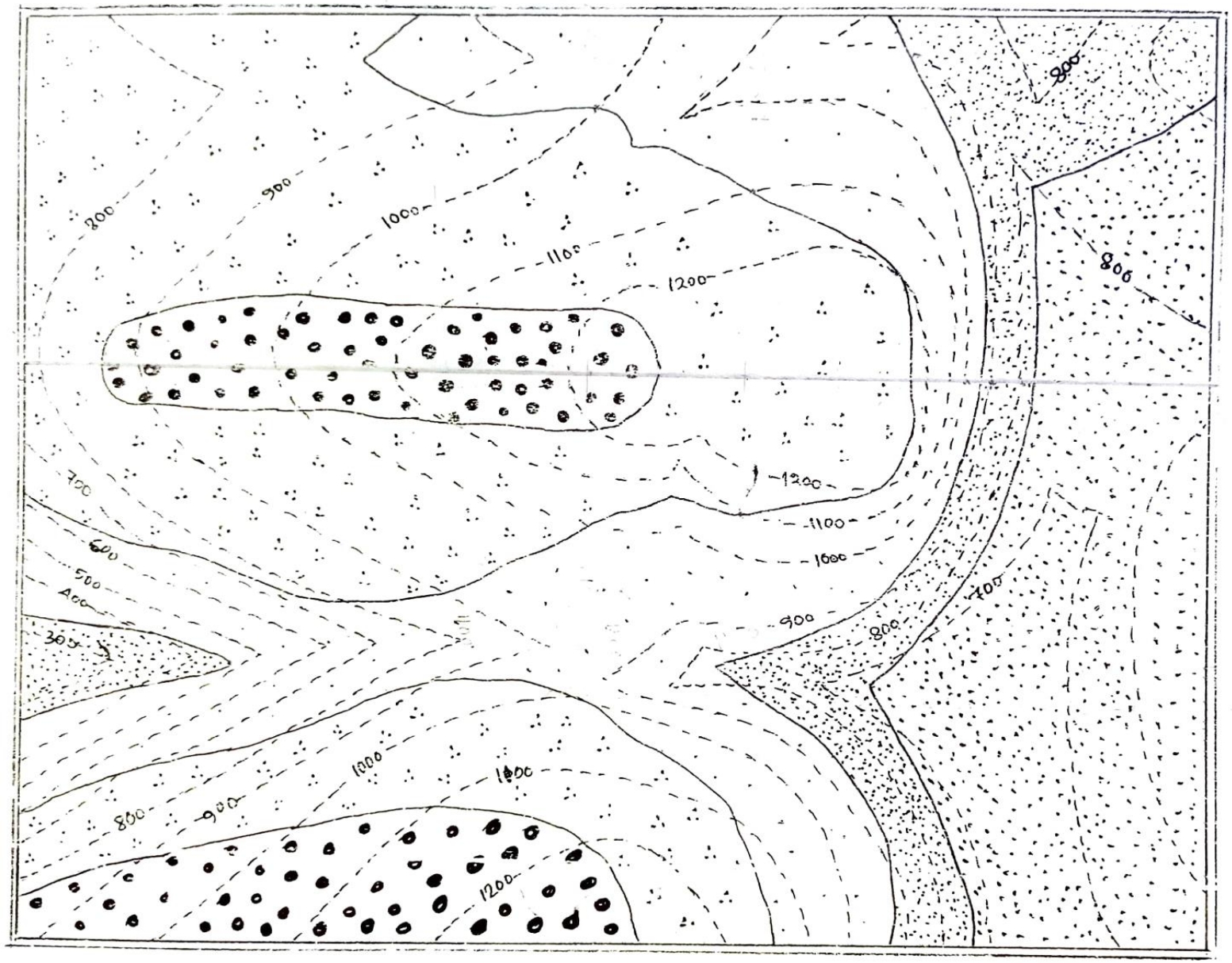
GEOLOGICAL MAP NO:1




True dip
Apparent dip
Dip direction
c
a
b
e
d
a

G – Map

Lecture -3



INDEX

GRIT

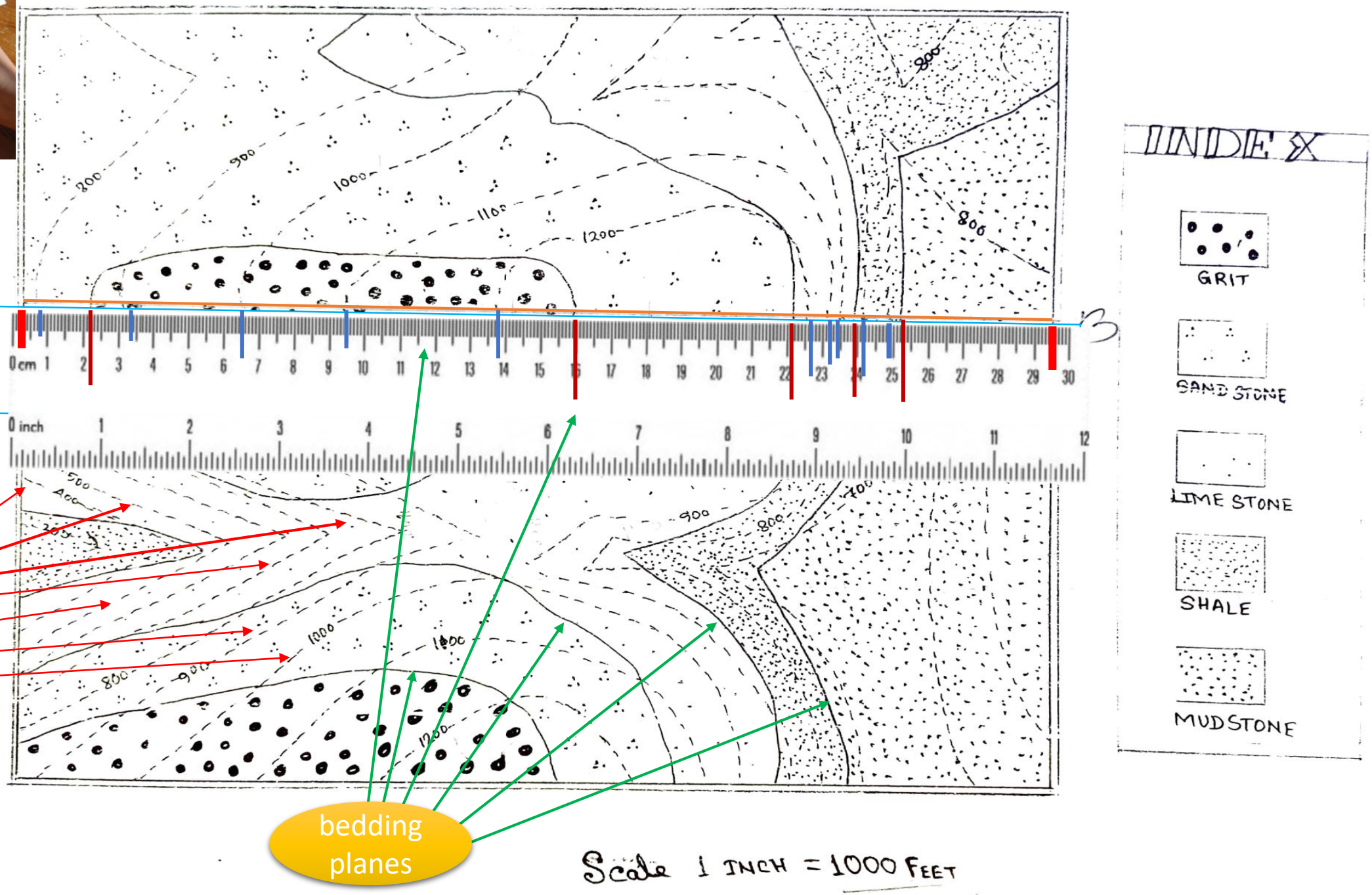
SAND STONE

LIME STONE

SHALE

MUDSTONE

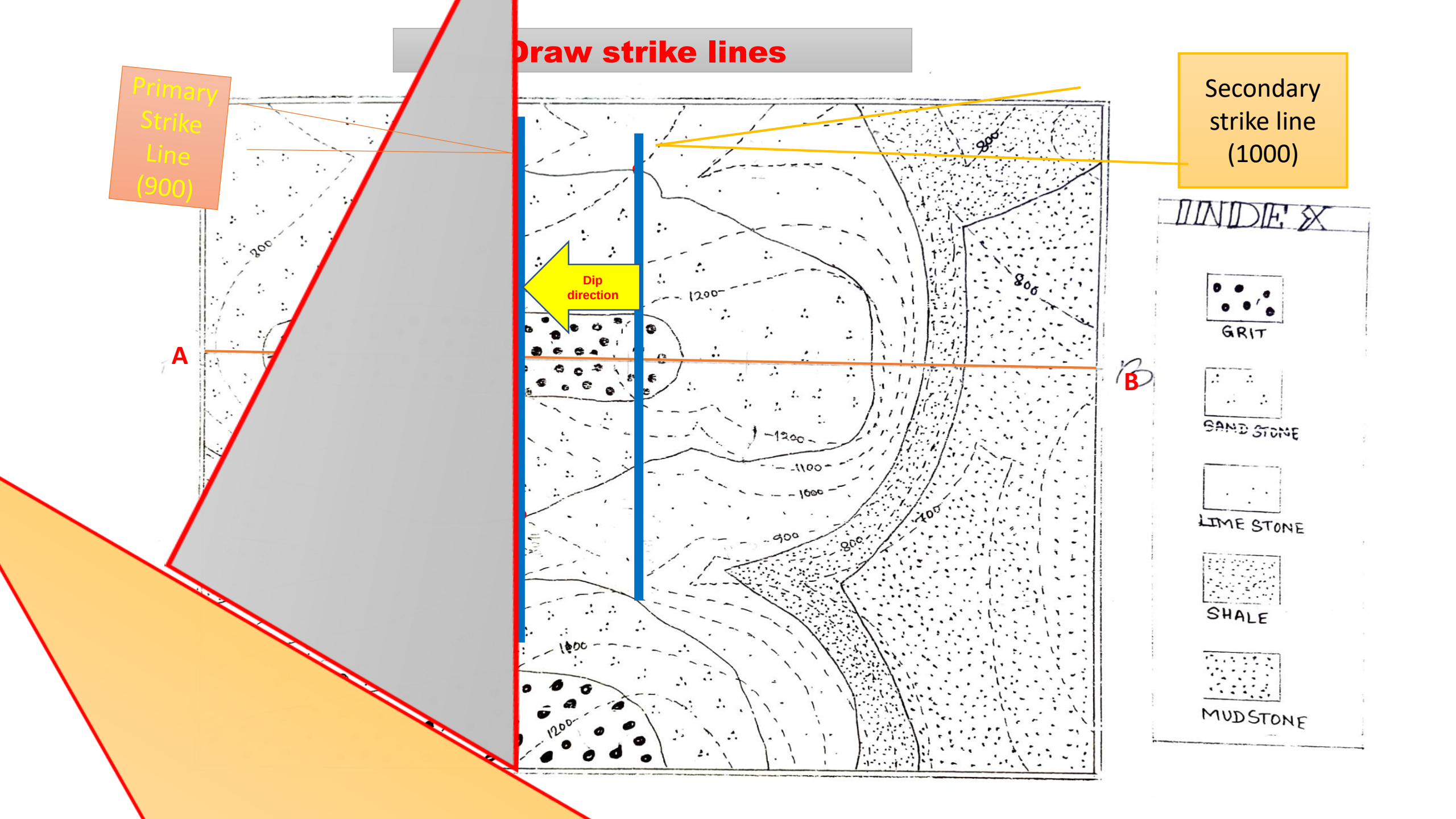
Scale 1 INCH = 1000 FEET

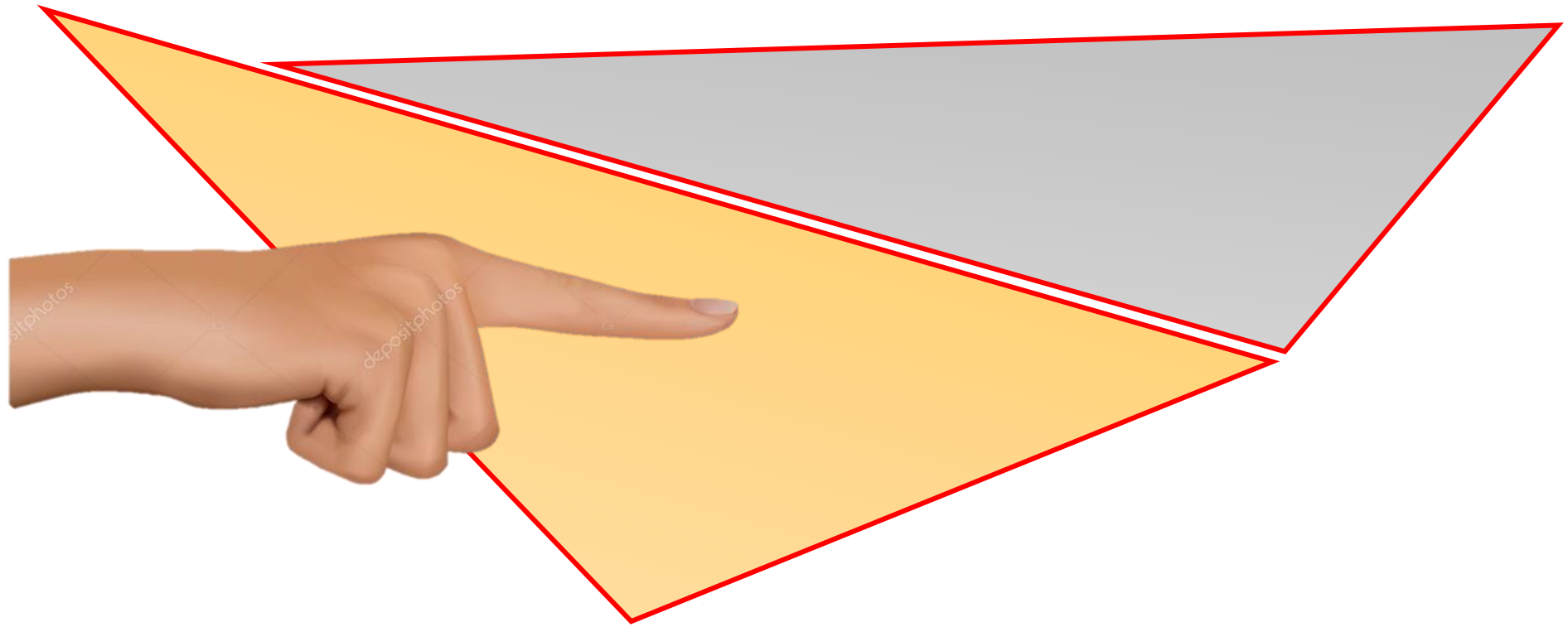


contours

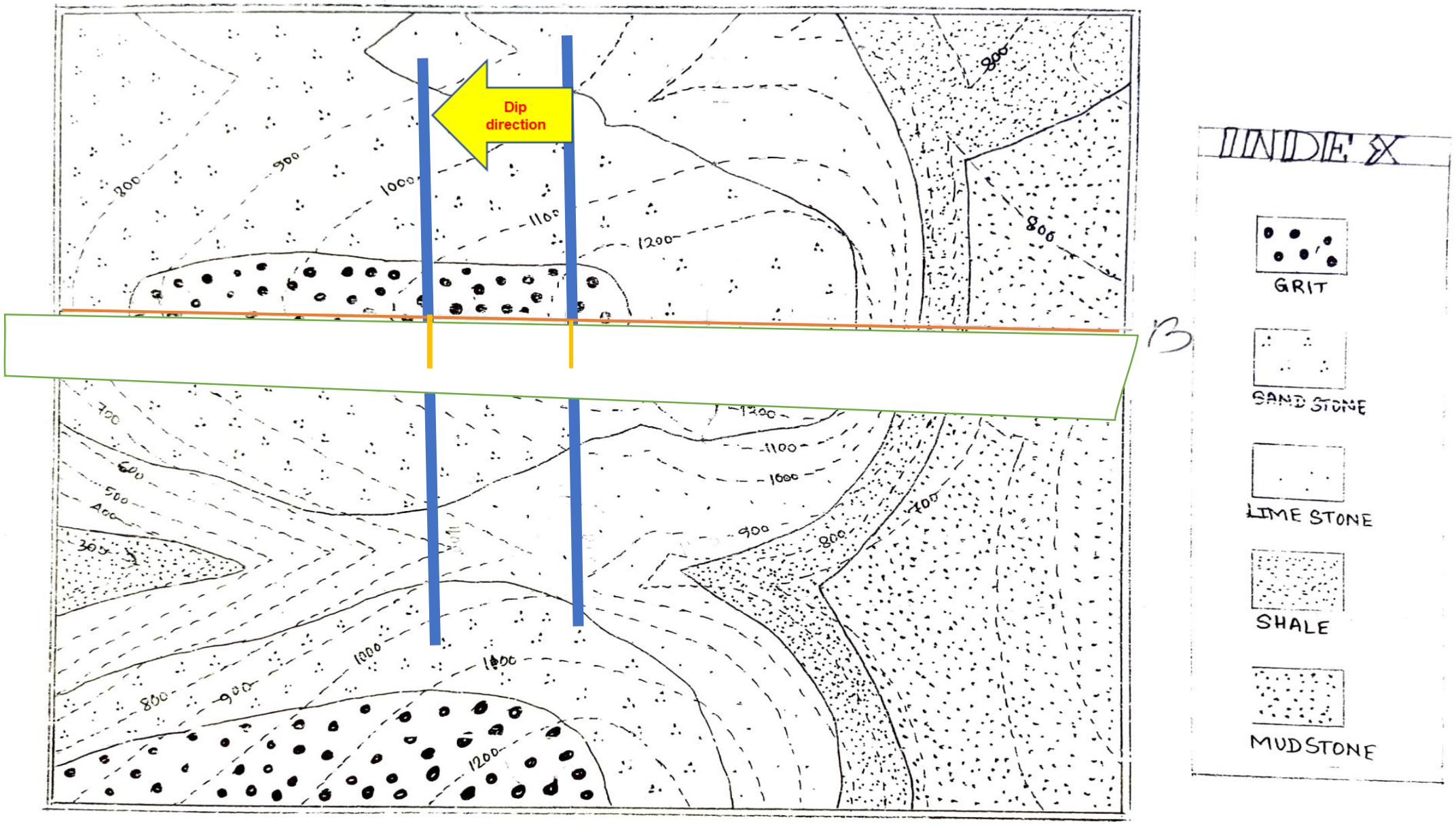
bedding planes

Draw strike lines

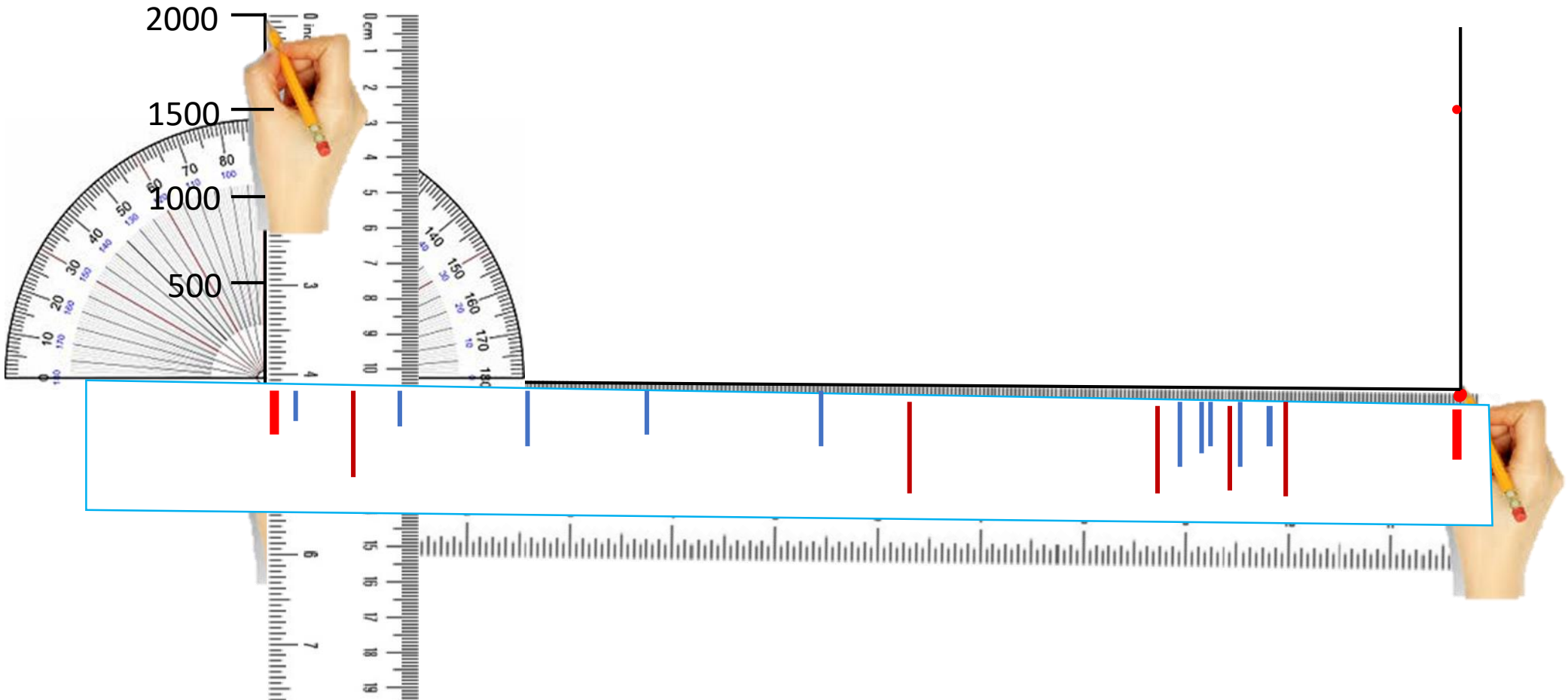




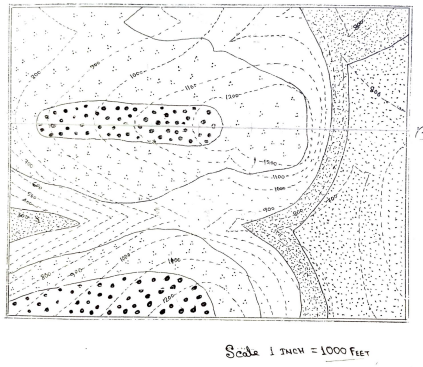
Calculate Dip Angle:

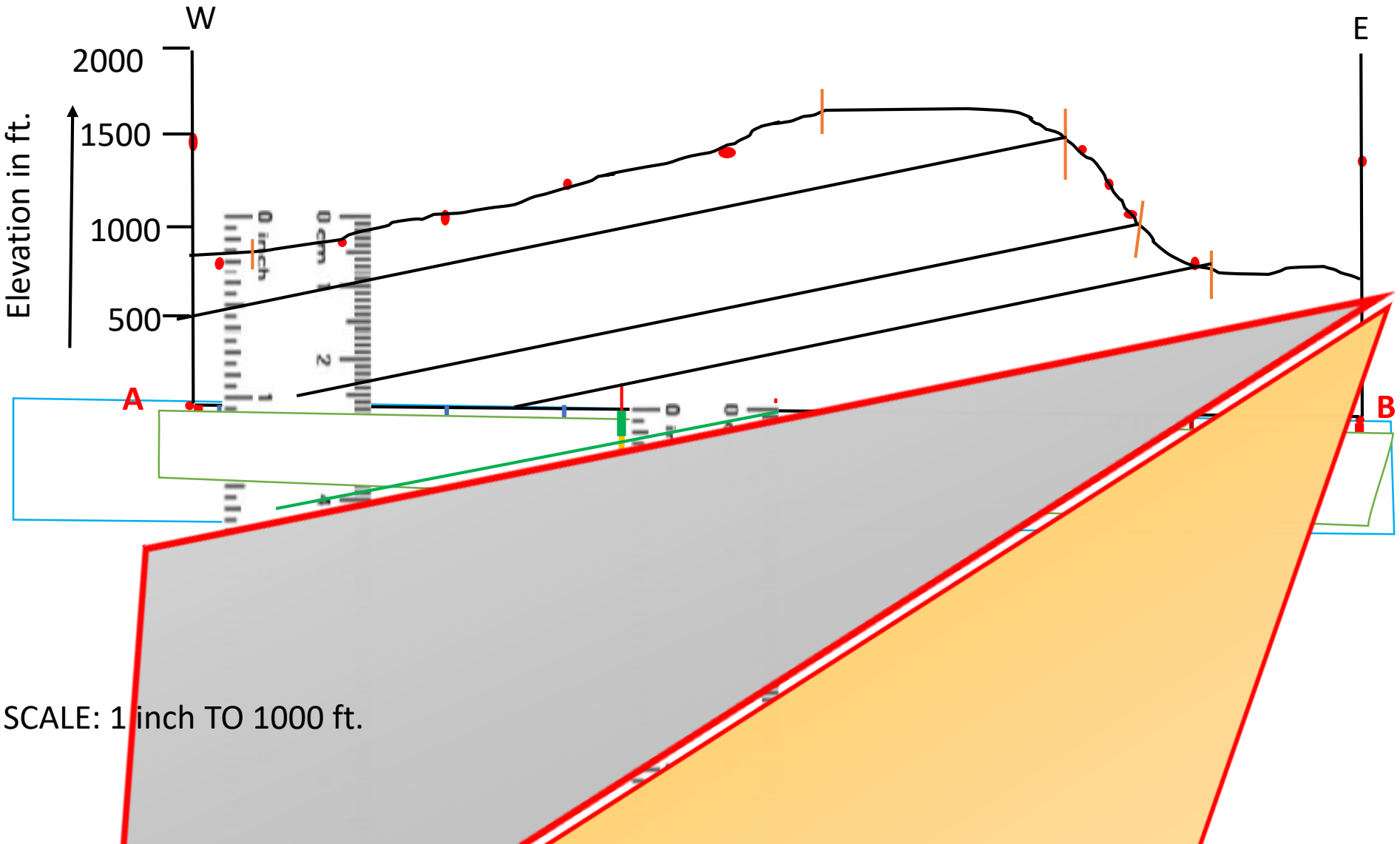


Scale 1 INCH = 1000 FEET


2000
1500
1000
500

GEOLOGICAL SECTION ALONG AB LINE

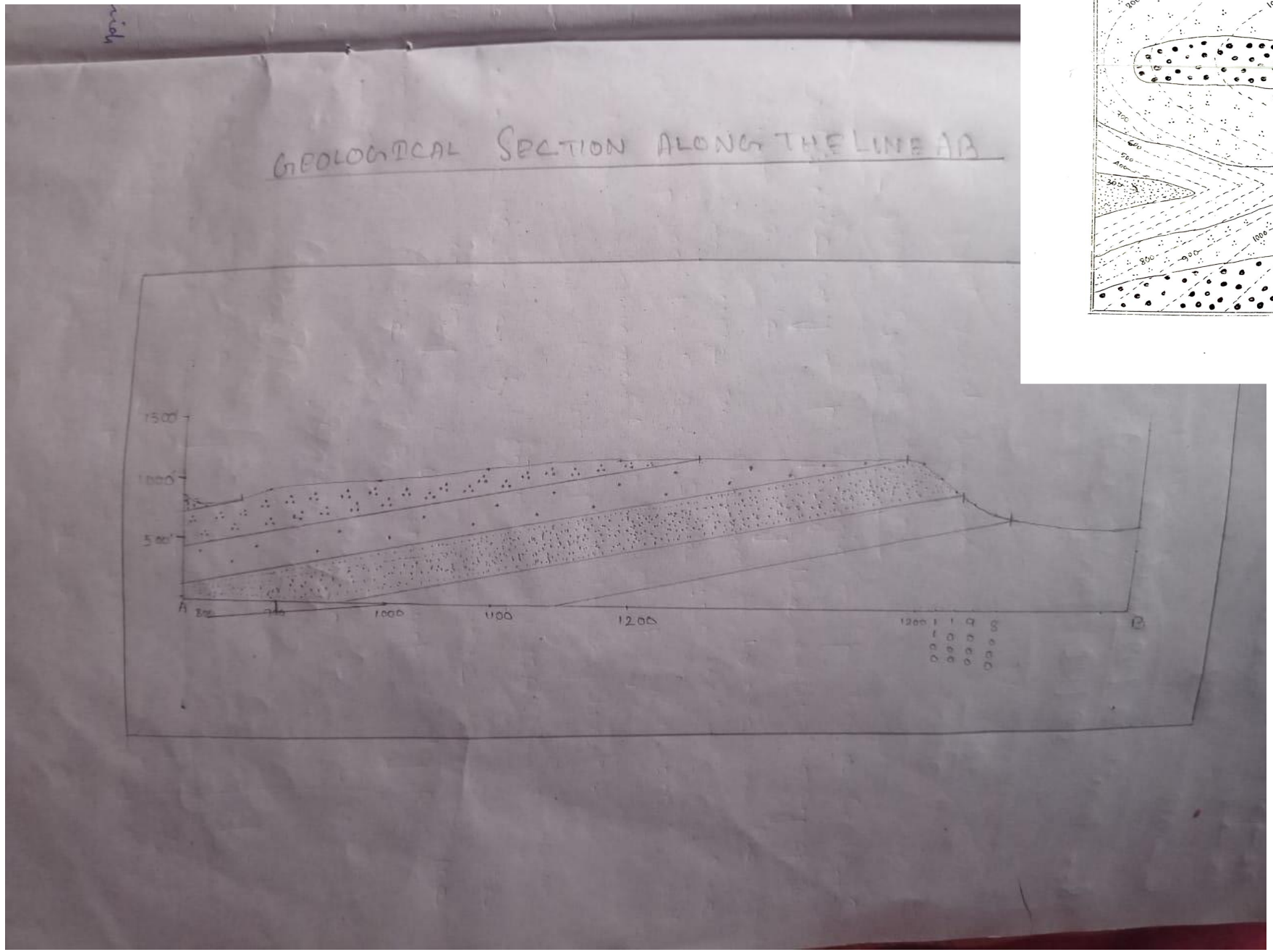


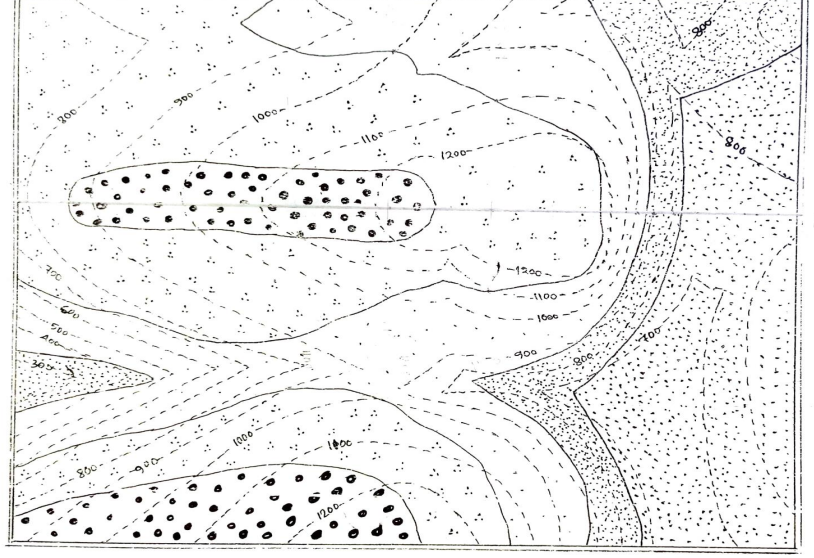


SCALE: 1 inch TO 1000 ft.

LEGEND

Sequences of rock beds





Scale 1 INCH = 1000 FEET

Section line

contours

Bedding plane

Mudstone

Shale

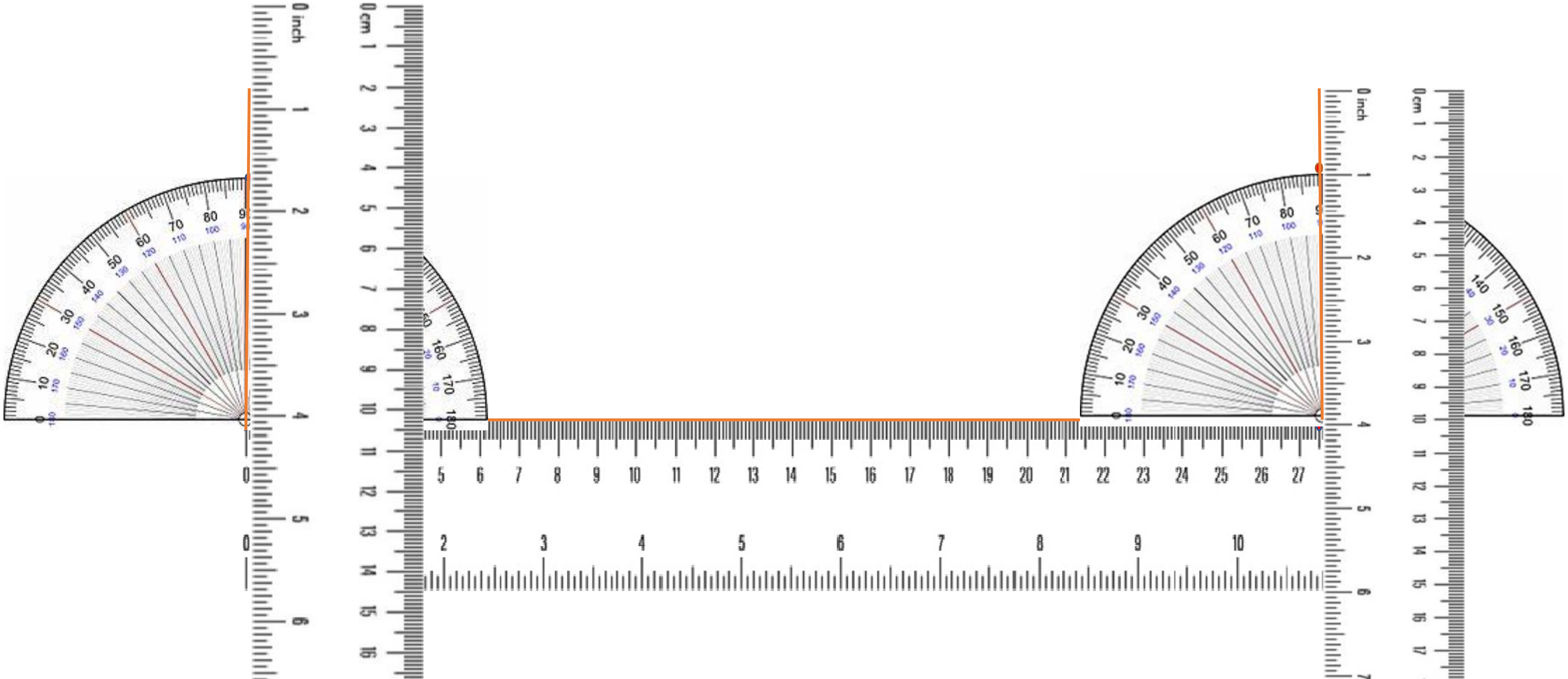
Limestone

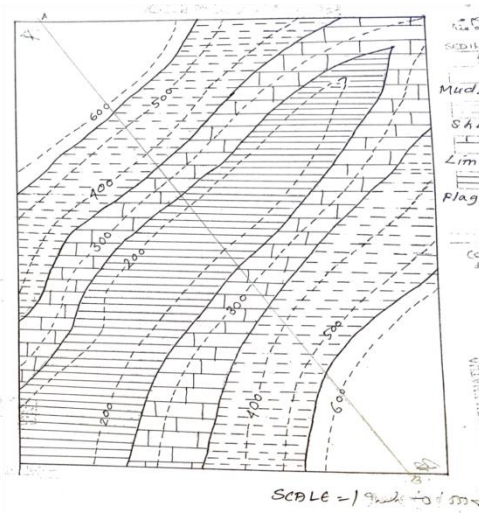
Flagstone.

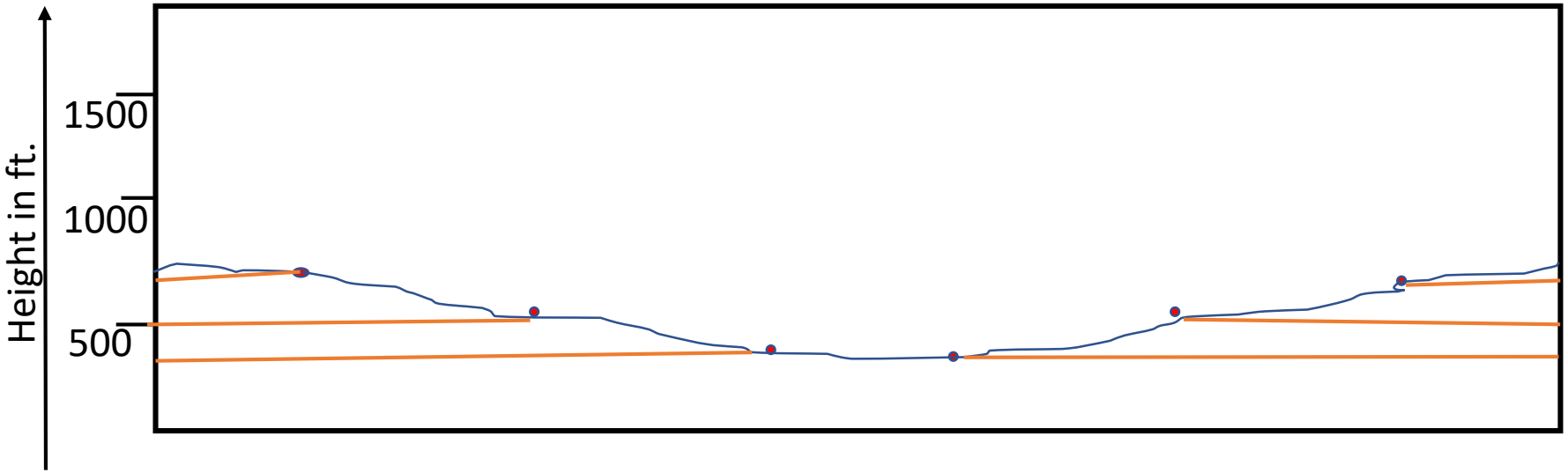
N

Put the strip in this way

Scale: 1 inch to 1000 ft.

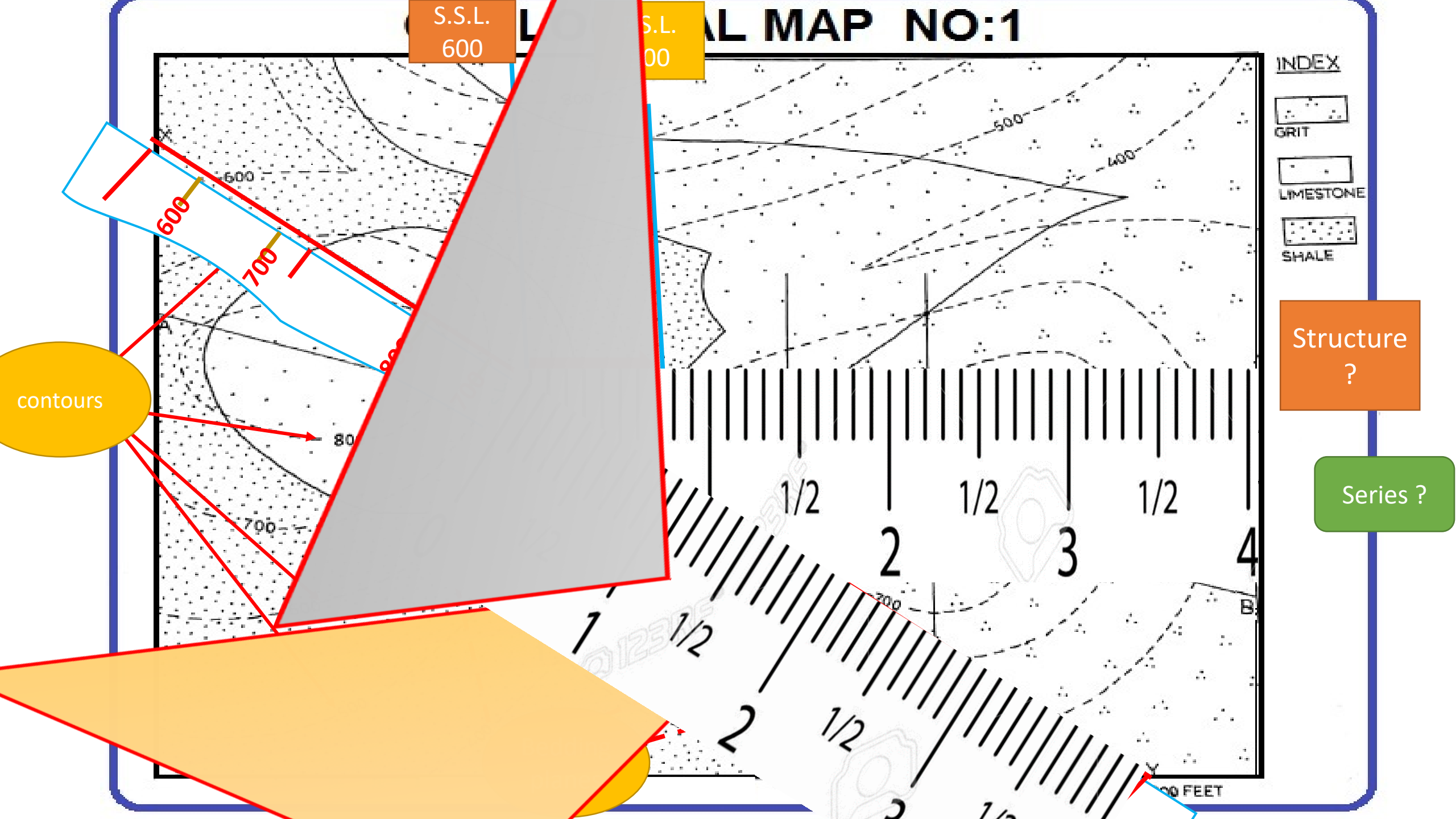

0 inch
0 cm
0 inch
0 cm

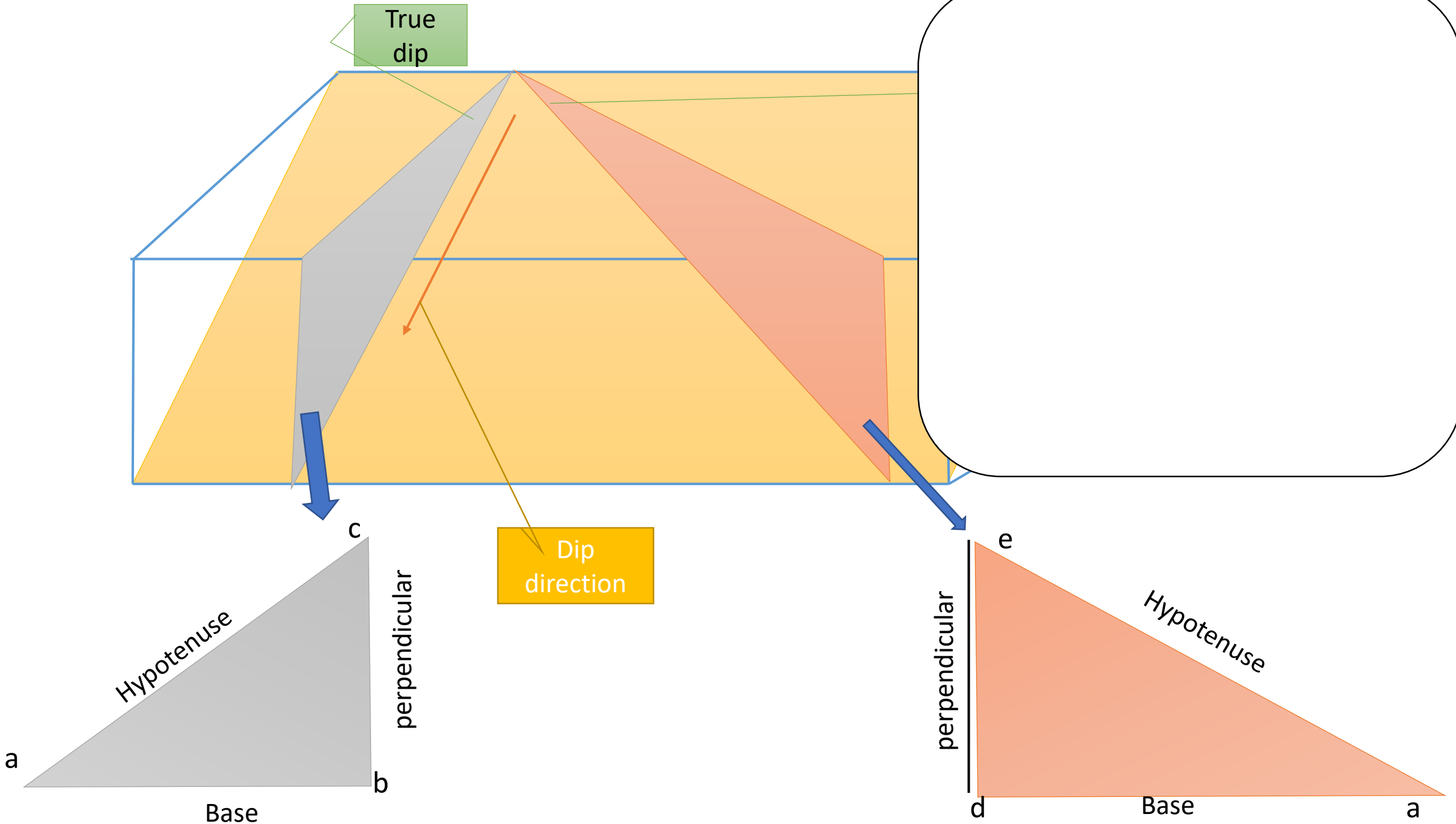

SCALE = 1


Height in ft.
1500
1000
500

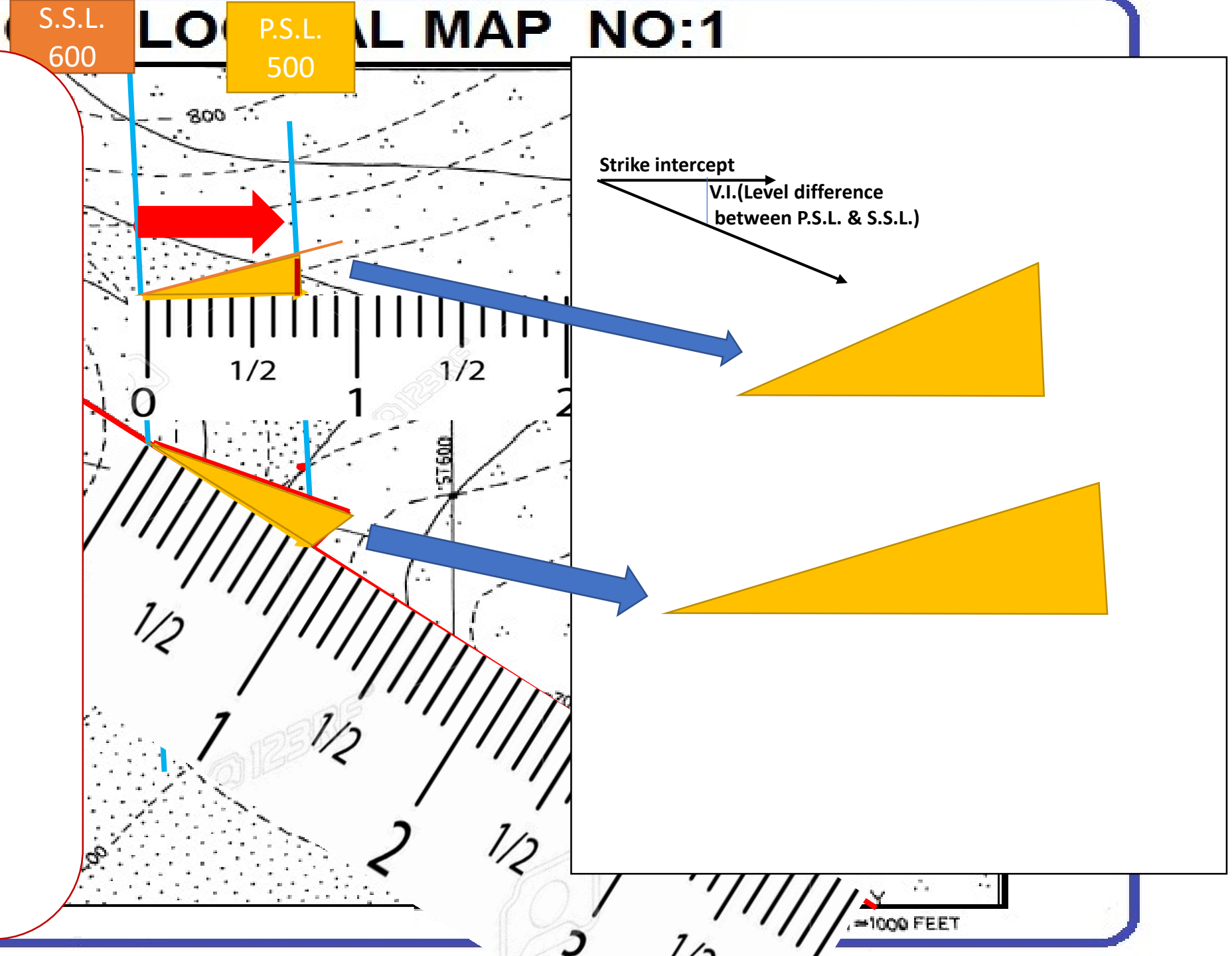
G - Map

Lecture: 4

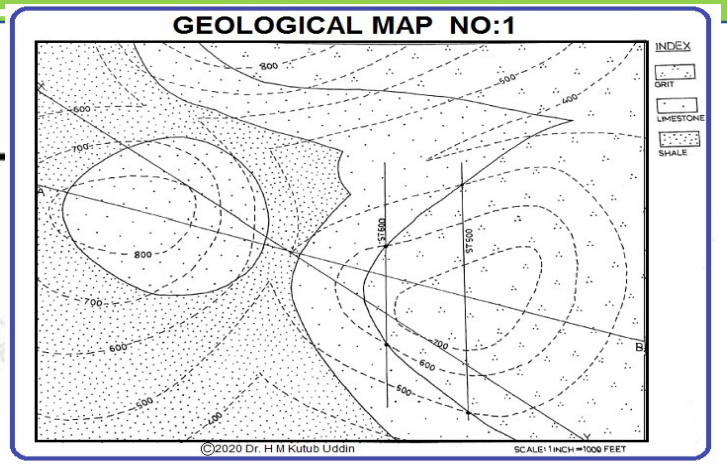

S.S.L.
600
S.L.
00
AL MAP NO:1
INDEX
GRIT
LIMESTONE
SHALE
600
700
800
500
400
contours
Structure
?
Series ?
1/2
2
3
4
FEET


True dip
Dip direction
c
perpendicular
Hypotenuse
a
b
Base
e
perpendicular
Hypotenuse
d
Base
a

Calculate Dip Angle



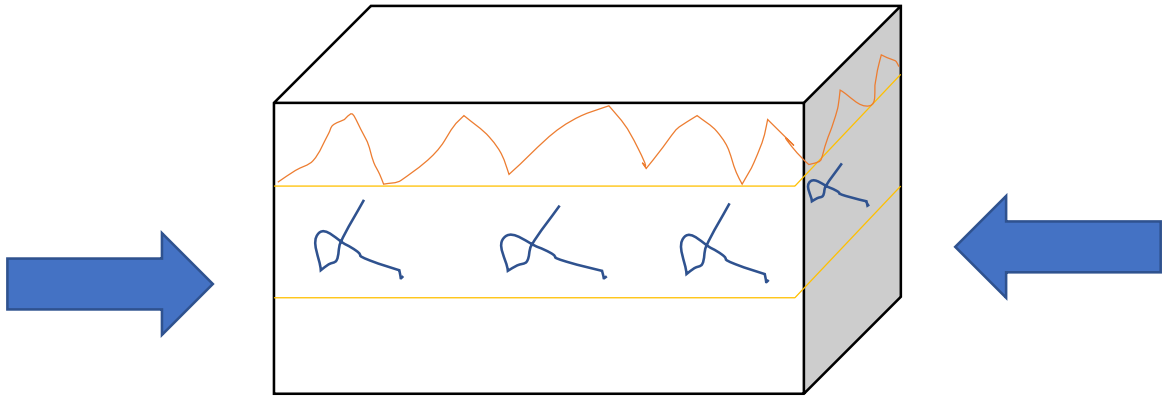
GEOLOGICAL SECTION ALONG AB LINE

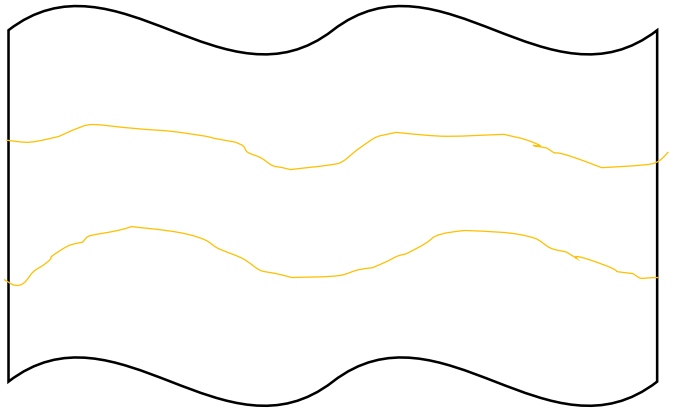


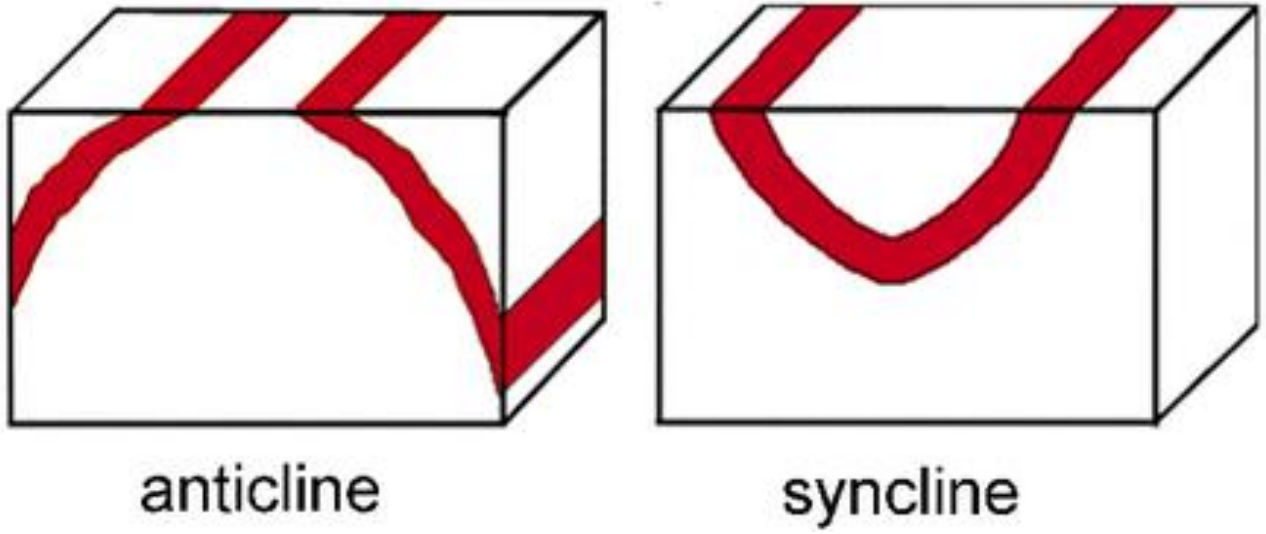
G-Map-5

Folded structure

Folded structure:







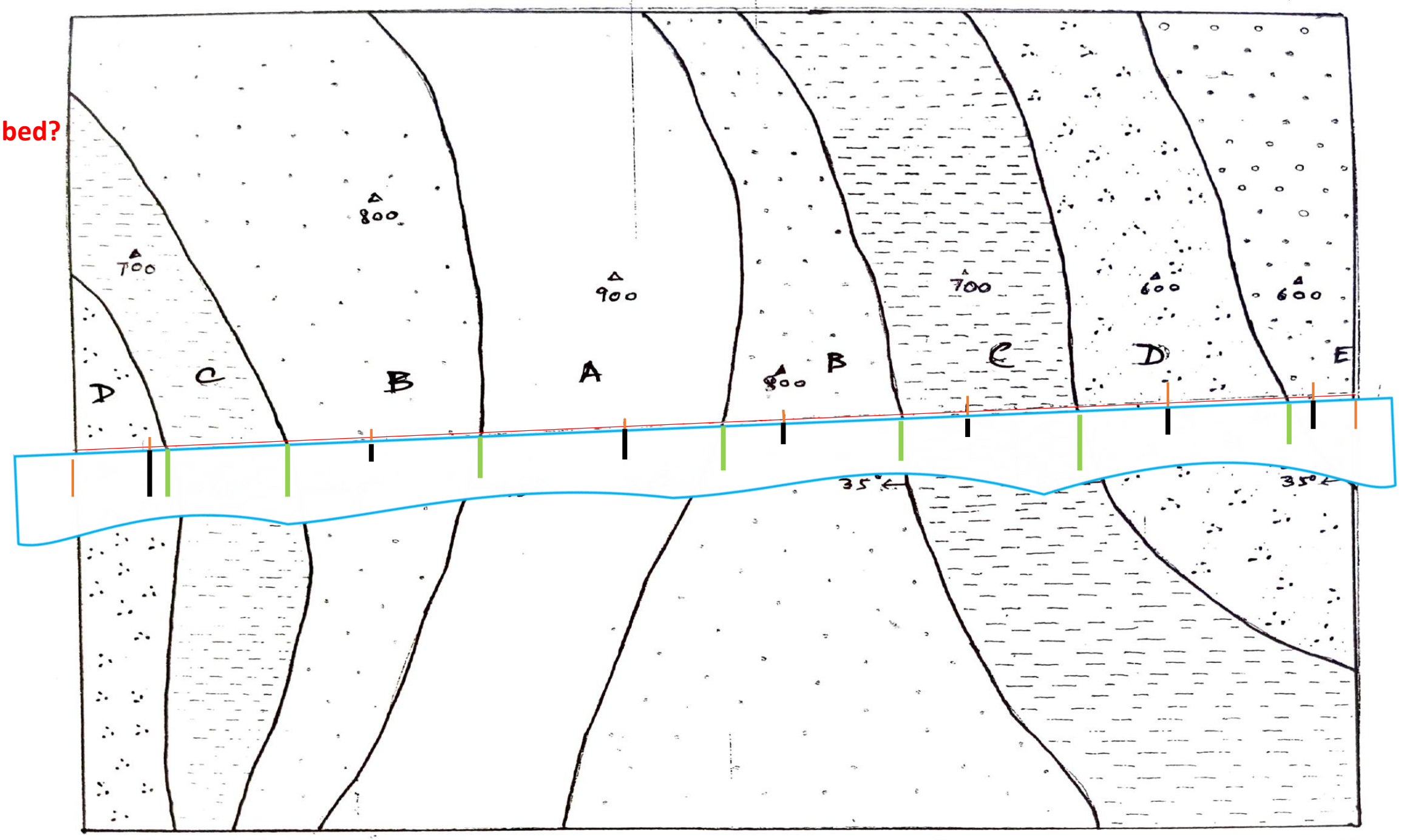
Anticlines are folds in which each half of the fold dips away from the crest.

Synclines are folds in which each half of the fold dips toward the trough of the fold.

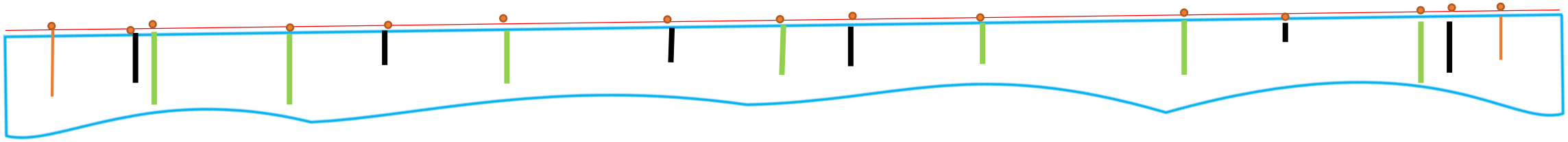
How to identify?

- **The outcrops of the beds repeat themselves.**
- **Contours will cross the bedding planes.**
- **There will be one or more core rock.**
- Most of the time , beds are found to dip in opposite directions in both sides of the core bed.

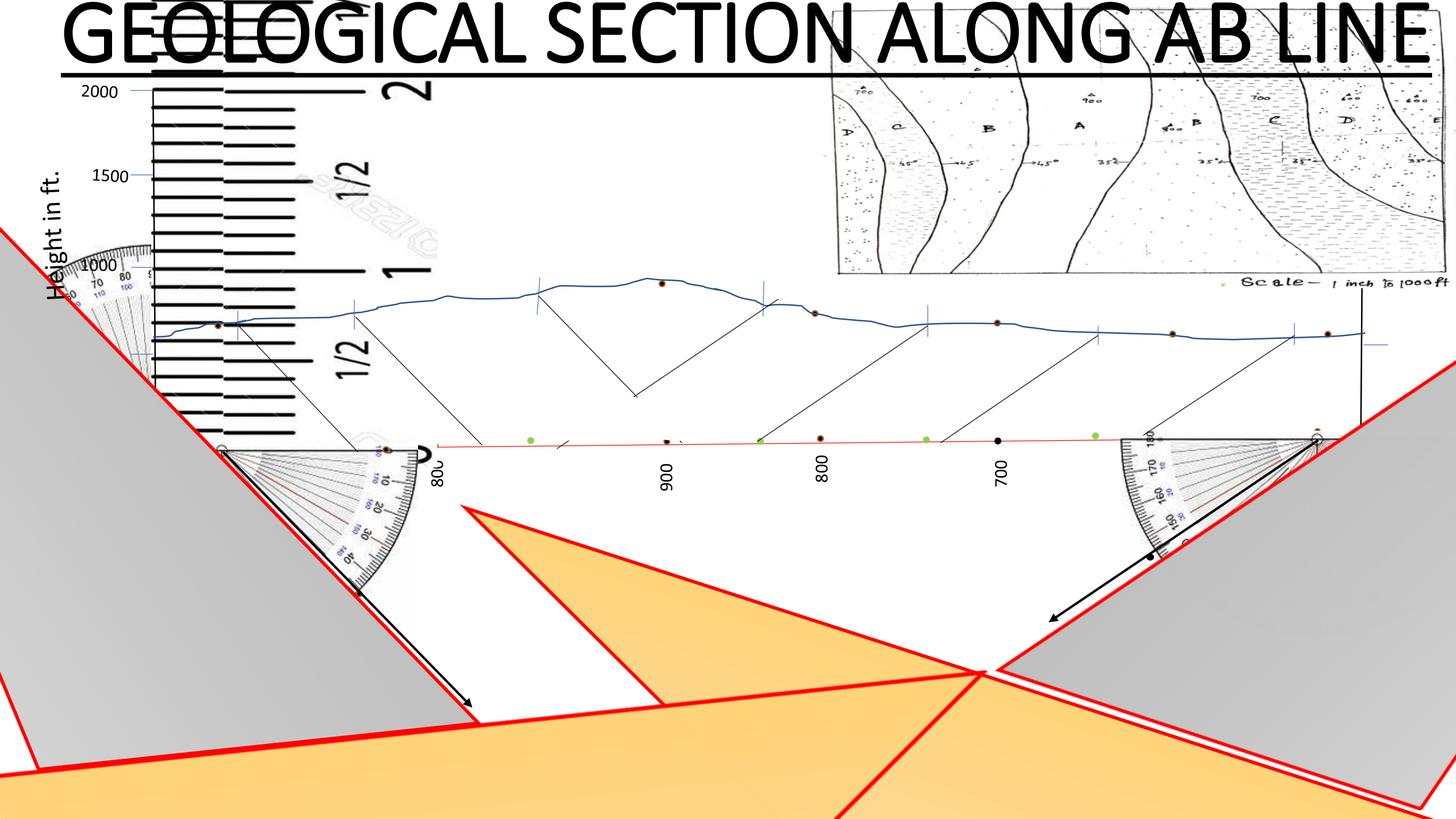
Core bed?

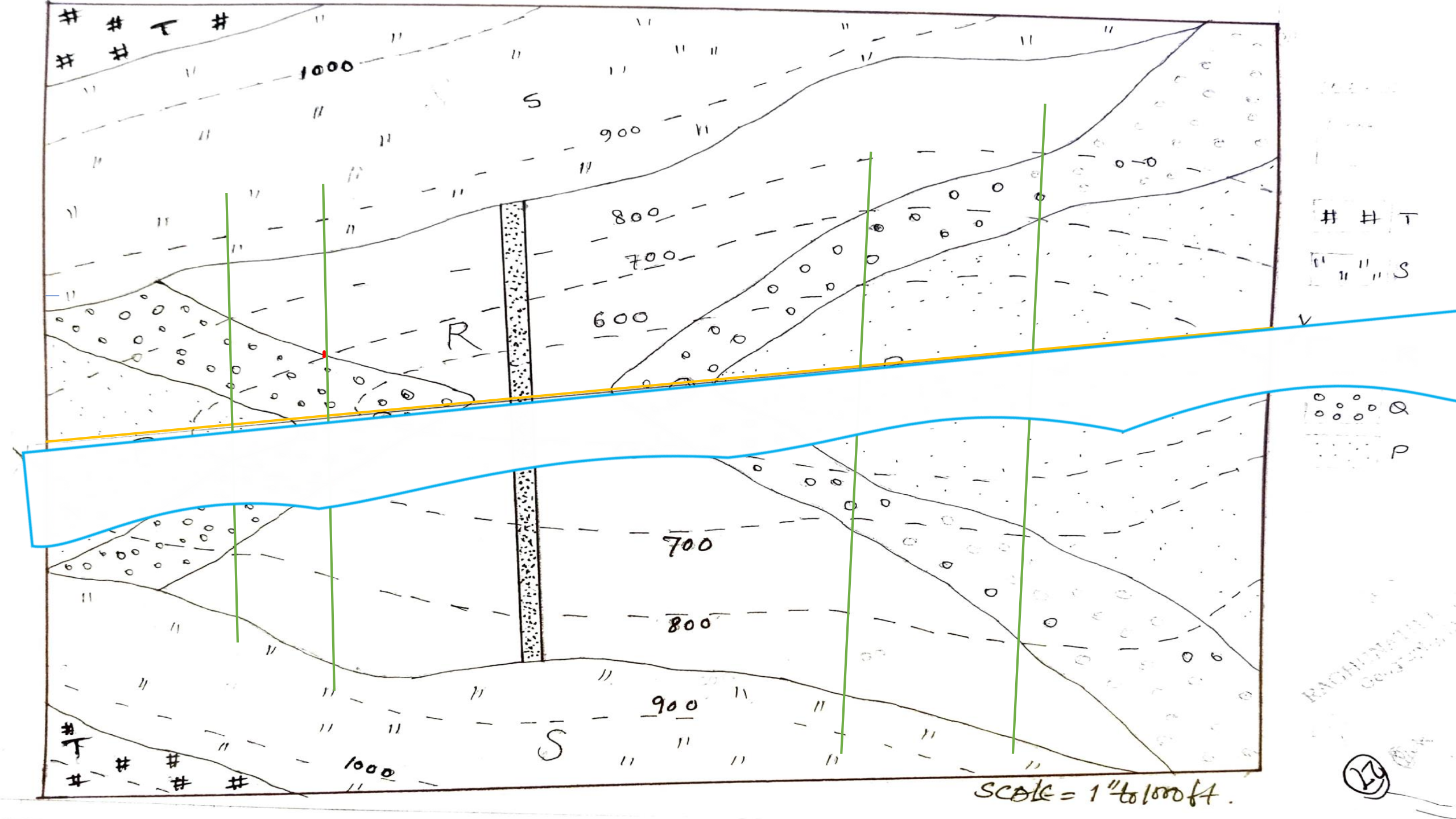


Scale – 1 inch to 1000 ft

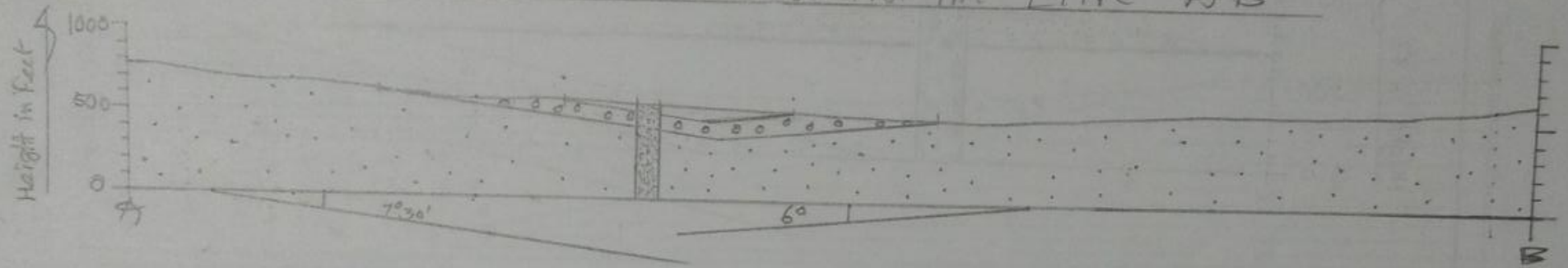


GEOLOGICAL SECTION ALONG AB LINE




1000
900
800
700
600
R
S
700
800
900
1000
S
T
Q
P
SCALE = 1" to 1000 ft.

GEOLOGICAL SECTION ALONG THE LINE AB

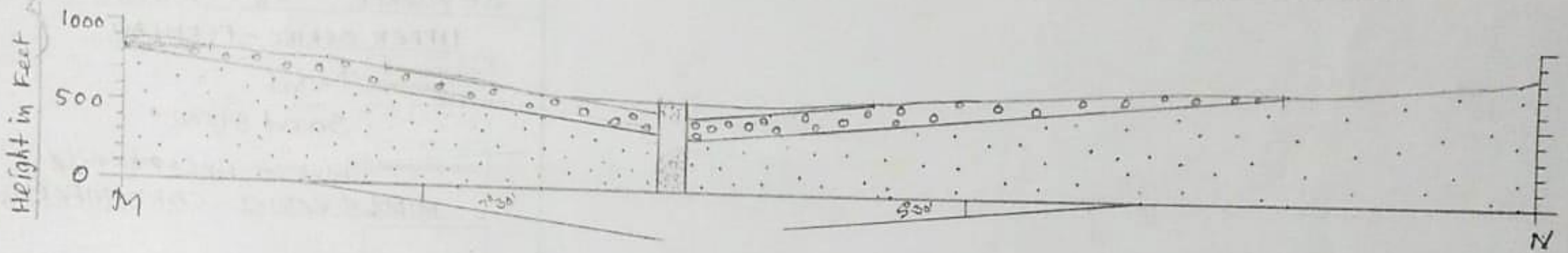


SCALE :: 1 inch = 1000 ft

INDEX
Sequence of Rockbed

R
Q
P
DYKE

GEOLOGICAL SECTION ALONG THE LINE M N



SCALE : 1 inch = 1000 Feet.

I N D E X

Sequence of Rock Bed

UPPER SERIES

S

Line of unconformity

LOWER SERIES

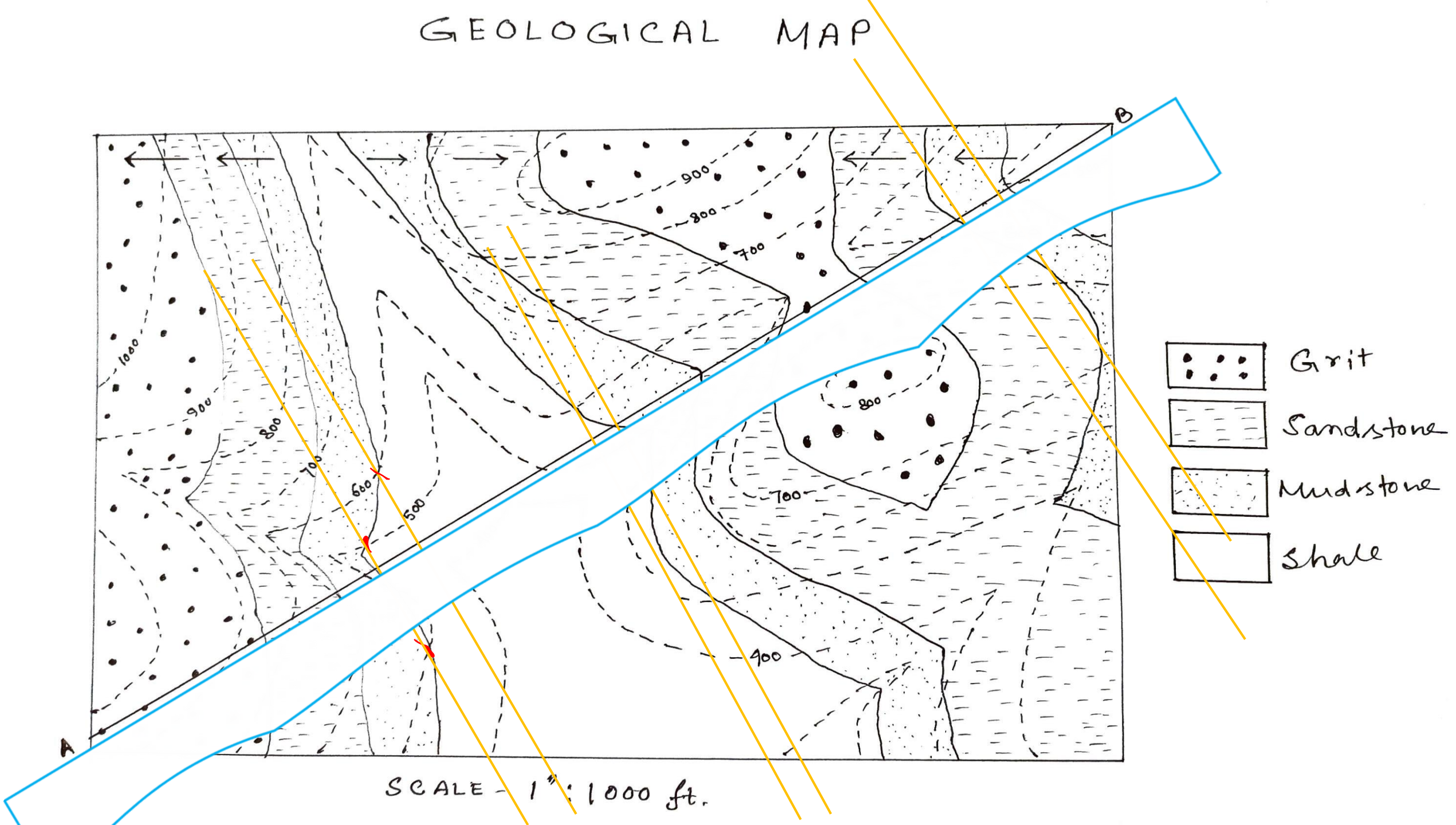
R

Q

P

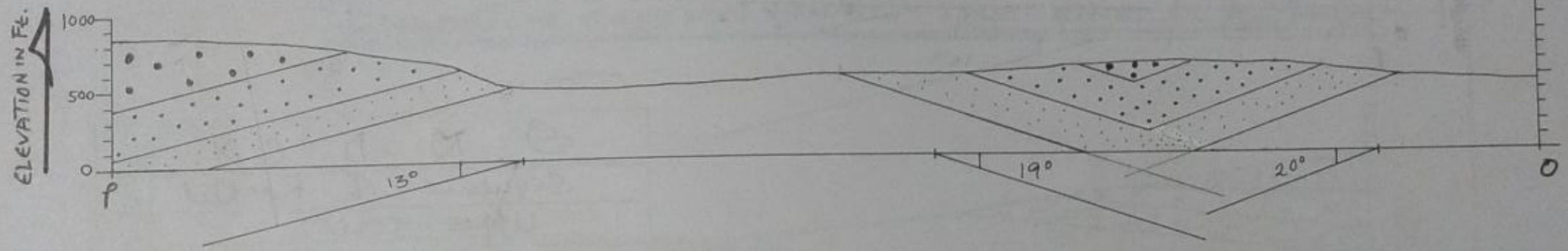
DYKE

GEOLOGICAL MAP



SCALE - 1" : 1000 ft.

GEOLOGICAL SECTION ALONG THE LINE PO

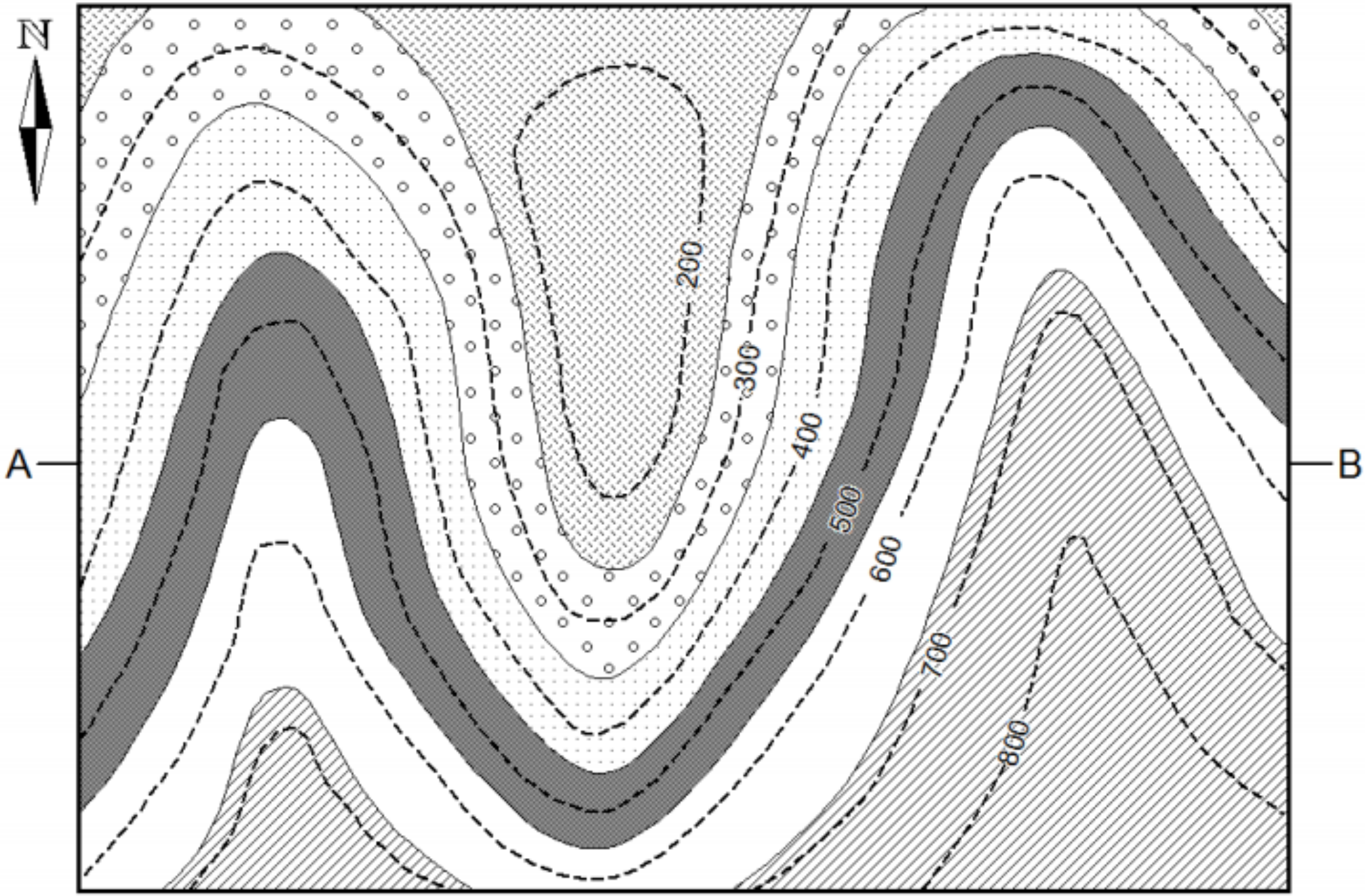


SCALE: 1 inch = 1000 ft.

INDEX

SEQUENCE OF ROCKBED

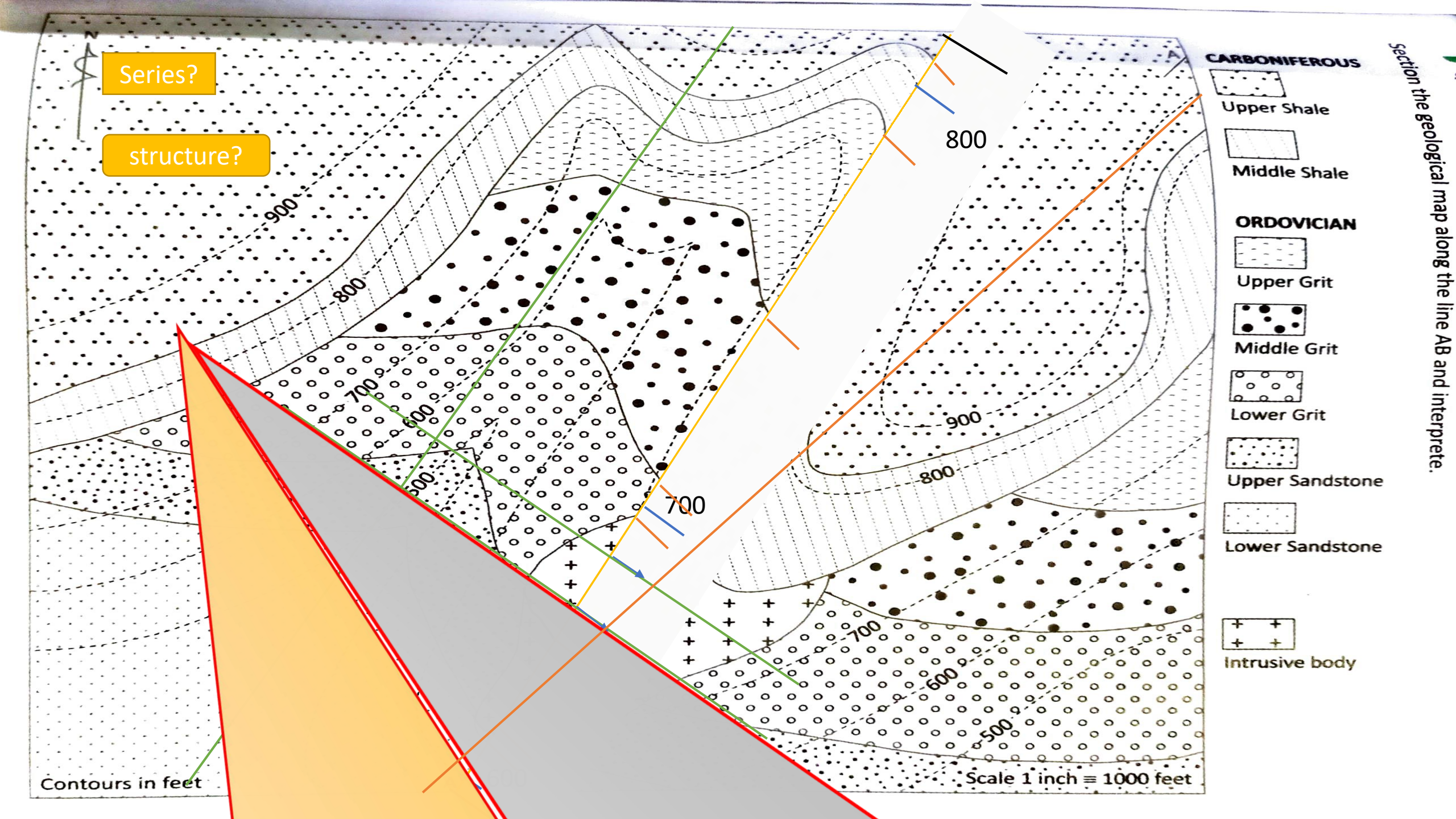
- Grit
- Sand stone
- Mud stone
- Shale

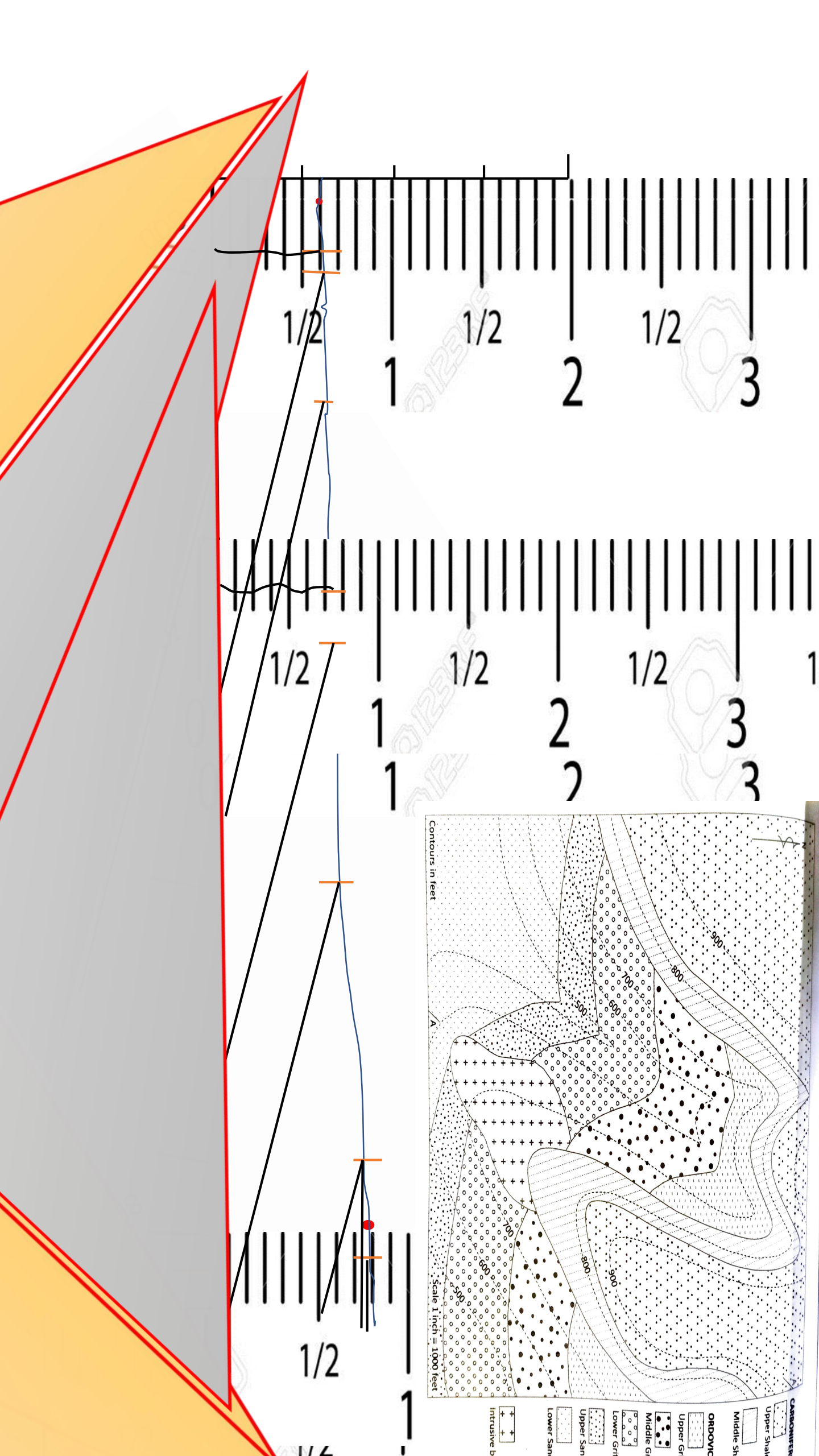


Scale 1:10 000

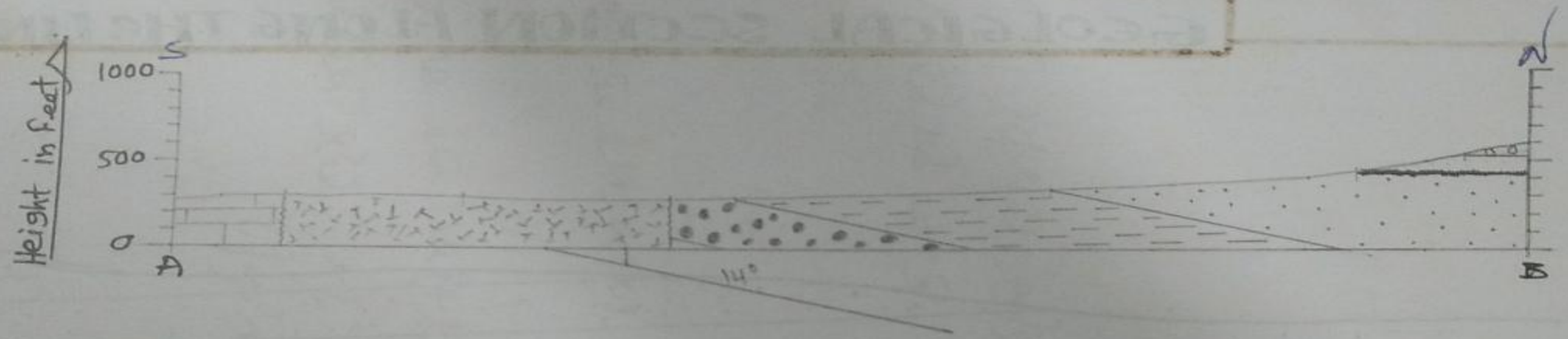
GEOLOGICAL MAP

LECTURE :6


Series?
structure?
N
A
CARBONIFEROUS
Upper Shale
Middle Shale
ORDOVICIAN
Upper Grit
Middle Grit
Lower Grit
Upper Sandstone
Lower Sandstone
Intrusive body
900
800
700
600
500
800
700
900
800
700
600
500
Contours in feet
Scale 1 inch ≡ 1000 feet
section the geological map along the line AB and interprete.


1/2
1
2
3
Contours in feet
Scale 1 inch = 1000 feet
500
600
700
800
900
A
A'
Intrusive b
Lower San
Upper San
Lower Gri
Middle Gr
Upper Gr
ORDOVIC
Middle Sh
Upper Shal
CARBONIFER

GEOLOGICAL SECTION ALONG THE LINE AB



SCALE : 1 Inch = 1000 Ft.

INDEX

Sequence of Rock bed

UPPER SERIES

H

G

Line of Unconformity

LOWER SERIES

F

D

C

B

Interpretation of geological map

Introduction :

- The geological map (scale: 1: 1000ft) has been analysed and interpreted with the help of a geological section line drawn along the line _____ ; extended from north east to south and the length of the line is _____inch on the map or _____ft on the ground.

General geology:

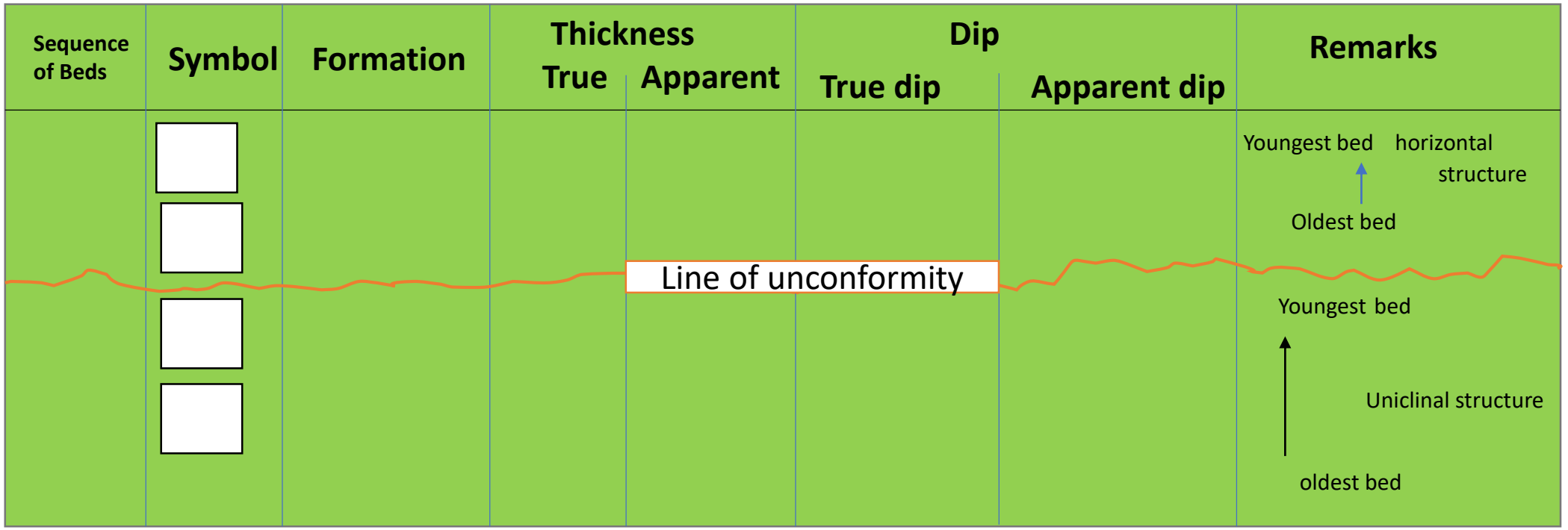
- There are two series of formations- carboniferous and Ordovician. Carboniferous is the younger formation consisting of two sedimentary beds (upper shale and middle shale). The older Ordovician formation consists of five sedimentary beds ( ) and one igneous intrusion in the form of Batholyth.

Topography:

- Topographically it is a low plateau region with general slope of the land from north to south. The maximum elevation lies about 900 ft while the minimum elevation lies about 500ft.

Geological structure:

- There are two series of formations- carboniferous and Ordovician. The younger carboniferous series constitutes a horizontal structure and the older Ordovician series constitutes an uniclinal structure having ____ apparent dip and _____true dip.



Geological history:

Topography and it’s relation with geological structure:

- REFERENCES:
- SARKAR, A, 2015. PRACTIAL GEOGRAPHY: A SYSTEMATIC APPROACH
- BOLTON. T. 2009 GEOLOGICAL MAPS: THEIR SOLUTION AND INTERPRETATION
- GOKHALE, N.W. MANUAL OF GEOLOGICAL MAPS