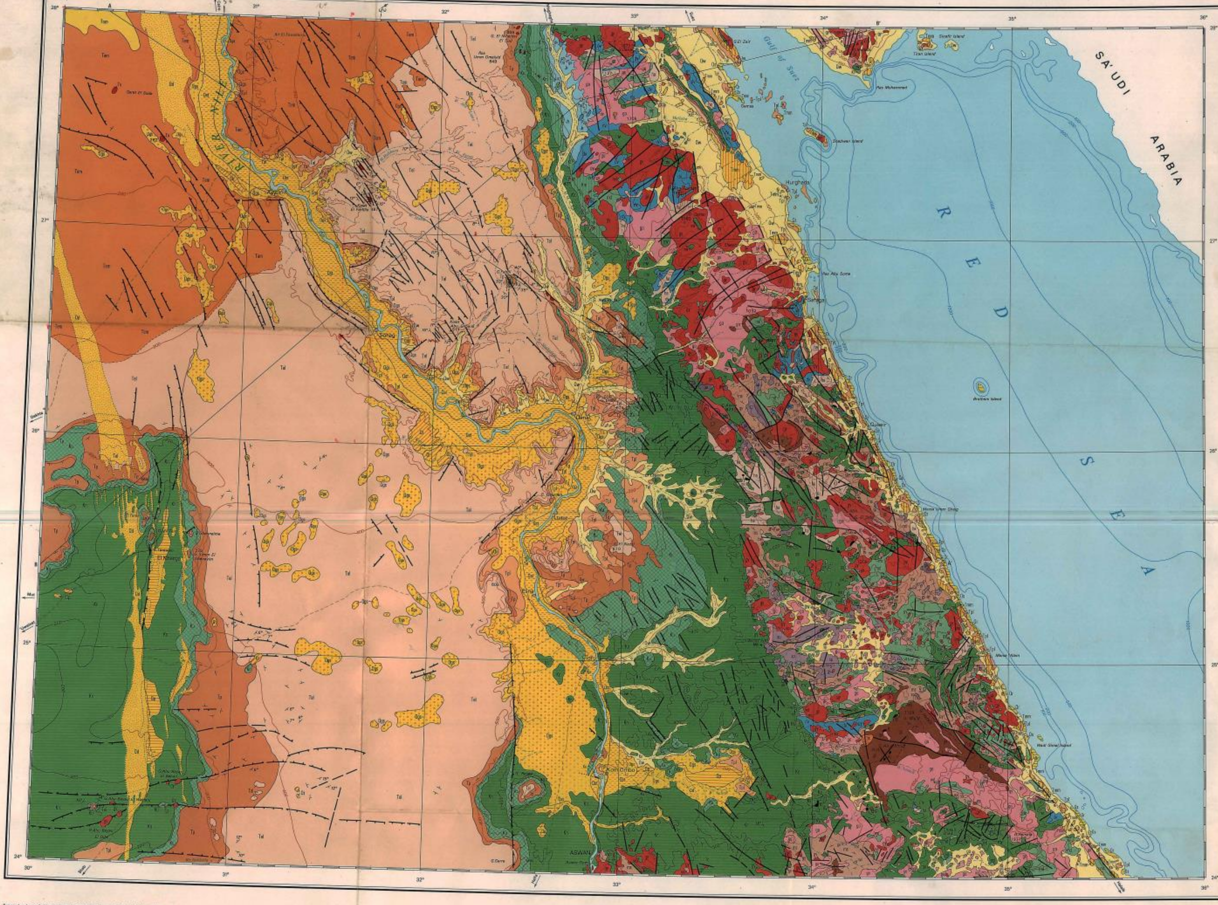
How to read and interpret a geologic maps

GEOLOGICAL SURVEY OF EGYPT (Cairo-1979)

ASWAN

GEOLOGICAL MAP SHEET NG-36



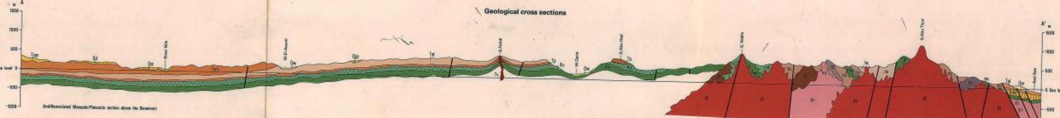
Surveyed and compiled by the Egyptian Geological Survey and Mining Authority 1979
Topographic data are based on the 1:500,000 topographic maps of the Survey of Egypt.
Coordinates are plotted according to the Transverse Mercator projection.

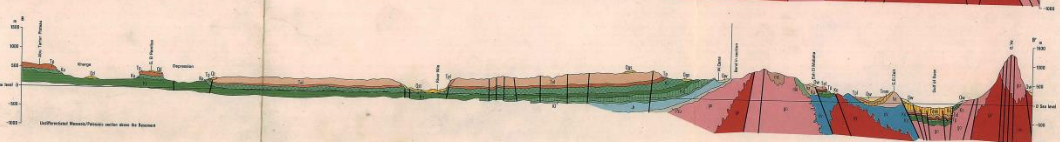
Scale 1:1,000,000

10 5 0 10 20 30 40 50 60 70 80 90 100 Kilometres

1 Millimetre = 1 Kilometre

Geological cross sections





1979 Magnetic declination for the centre of this sheet is 2° 24' easterly

Location map

STRATIGRAPHIC LEGEND

QUATERNARY (Q)

- Qd: Sand dunes.
- Qw: Wadi deposits.
- Qp: Playas or Mud pans.
- Qs: Sabkha.
- Qr: Coral reefs.
- Qn: Nile silt.
- Qg: Old gravels and sands.
- Qt: Tufa.

TERTIARY

- Tpl: Pliocene: Includes reefal limestone with clastic interbeds, generally forming terraces at base of higher Middle Miocene scarps along Red Sea Coast, continental lacustrine carbonates and clastics along Nile Valley and Wadi Qena, non-marine scree deposits outside Nile Valley and probably chalcedony sheets in south Kharga Oasis.
- Tmm: Middle Miocene: Includes fluviatile and continental clastics as well as marine upper beds of Gebel El Rusas Formation, Gypsum and overlying clastics with carbonate interbeds (Gasus Formation) along Red Sea Coast.
- Tv: Tertiary Volcanics: Mainly basalt flows, dykes and sills.
- Tom: Oligo-Miocene: Includes gravel spreads at north western corner of mapped area.
- To: Oligocene: Includes conglomerates of Nakheil Formation in Quseir Safaga stretch and further north.
- Tem: Middle Eocene: Includes carbonate and clay beds of Minia Formation, +400m thick, mainly exposed north of latitude 27°N.
- Tel: Lower Eocene: Includes thick limestone section with chert concretions (Thebes Formation) and upper clay beds of Esna Shale south of latitude 27°N in Western Desert and covering plateau surface flanking Wadi Qena to west and forming summit of Gab El Mallaha range in Eastern Desert.
- Tp: Paleocene: Includes upper part of Dakhla, Tarawan, Kurkur and lower part of Garra Formations in Western Desert, in Nile Valley and in Eastern Desert upper Dakhla beds, Tarawan and lower part of Esna Shale.

MESOZOIC — CRETACEOUS

- rc: Ring Complexes; essentially alkaline syenites.
- Kt: Trachyte plugs and sheets.
- Kv: Upper Cretaceous; Wadi Natash Volcanics: Mainly dolerites, basalts and andesites intruded in Nubia Sandstone at Wadi Natash area.
- Ku: Upper Cretaceous: Includes clastics, phosphate and carbonate rocks above Nubia Sandstone in Western Desert, Nile Valley, Red Sea Coast and Wadi Qena, mainly represented by Duwi Phosphate and lower part of Dakhla Formation.
- Kn: Nubia Sandstone: Includes clastic beds above the basement rocks and below marine Upper Cretaceous proper section along Red Sea Coast and south of latitude 28°N, north of this latitude Nubia Sandstone overlies Turonian beds especially at Wadi Qena.
- Kcn: Cenomanian and Turonian: Represented at Wadi Qena by continental to shallow marine clastics with minor fossiliferous carbonate interbeds, becoming more arenaceous at top, +120m thick.
- Kl: Lower Cretaceous: Includes at Wadi Qena, marine fossiliferous beds intercalated within a continental clastic section, +50m thick, and probably clastics above Basement Complex in south Sinai.

MESOZOIC — JURASSIC

- Jr: Jurassic: Represented at Wadi Qena by vertical cliffs of white sandstone north of latitude 27°N, +125m thick.

U. PALEOZOIC

- Pzu: Upper Paleozoic: Includes most probably, dated continental sandstone beds unconformably overlying basement rocks in northern reaches of Wadi Qena; +11m thick.

PRECAMBRIAN

- gy: Younger Granitoids: Gattarian granite and all post-tectonic granite, grano-diorite and adamellite.
- gb: Gabbro: Fresh olivine gabbro, norite and troctolite.
- fph: Post-Hammamat Felsite: Effusive felsite, felsite porphyry and quartz porphyry bodies.
- ha: Hammamat Group: Slightly metamorphosed conglomerate (Breccia Verde Antico), greywacke, arenite and siltstone.
- dv: Dokhan Volcanics: Slightly metamorphosed andesite, porphyrite and pyroclastic rocks.
- go: Older Granitoids: Syntectonic to late tectonic plutonites essentially of granodioritic composition previously referred to as grey granite, Shaitian granite or older granite.
- md: Metagabbro–Diorite Complex: Gabbroid and dioritic masses, tectonized, uralitized and affected by older granitoids.
- sp: Serpentinites: Serpentine, talc carbonate and related rocks.
- mv: Geosynclinal Shadli Metavolcanics: Fissure eruptions of surface or submarine effusives represented by regionally metamorphosed rhyolite, dacite, andesite, basalt and pyroclastic rocks.
- ms: Geosynclinal Metasediments: A wide range of lithological types including hornblende, biotite and chlorite schists, metagreywacke, metamudstone, phyllite, slate and occasional conglomerates.
- gn: Migif-Hafafit Gneisses and Migmatites: Psammitic, hornblende and biotite gneisses and migmatites.

GENERAL LEGEND

GEOLOGICAL SYMBOLS

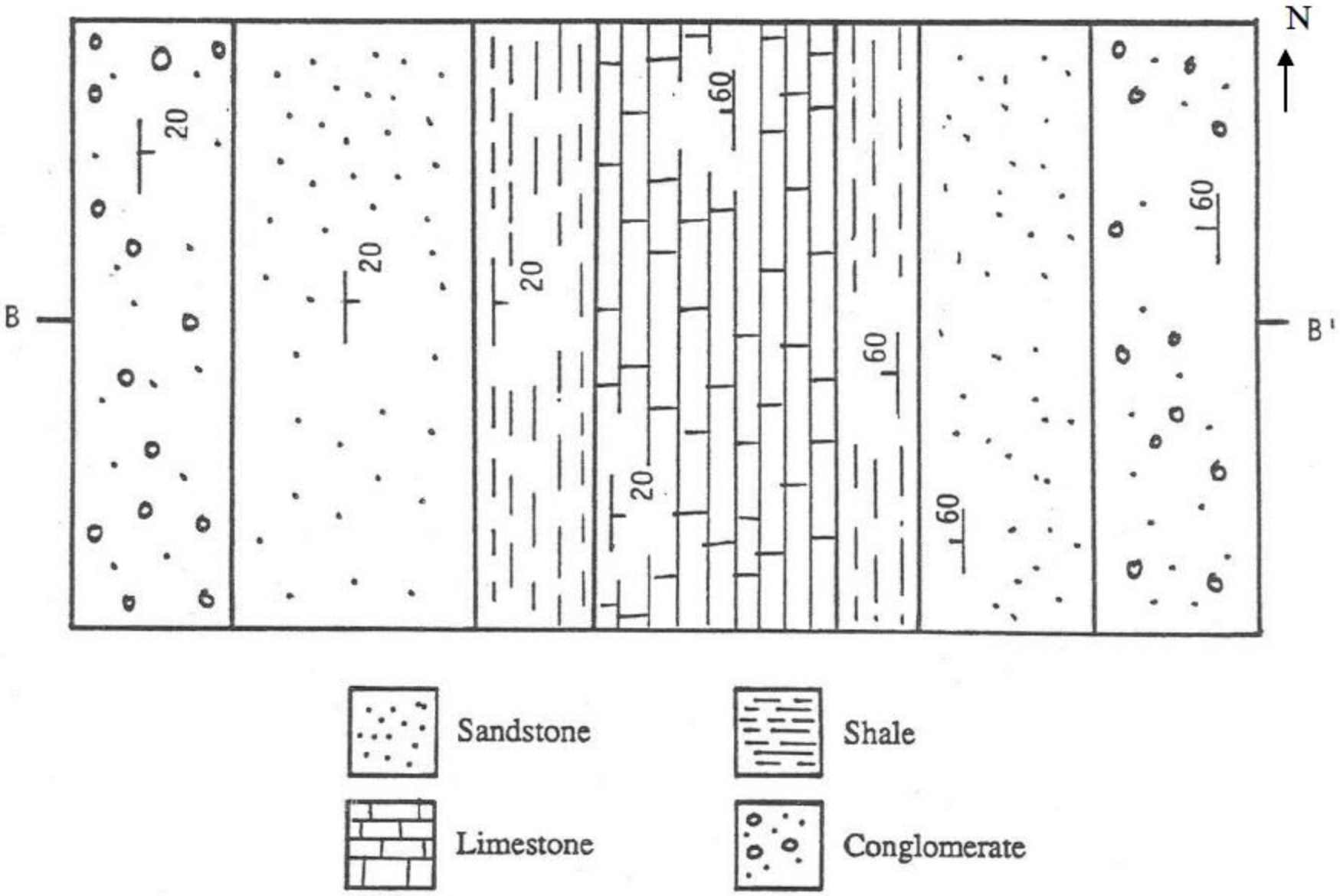
- Geological boundary, established, inferred, concealed
- Normal fault with visible dip
- Fault, probable, concealed
- Strike and dip of sedimentary beds in degrees, less than 5 degrees
- Strike and dip of foliation in Precambrian rocks
- A —— A' Geological cross section

GEOGRAPHICAL SYMBOLS

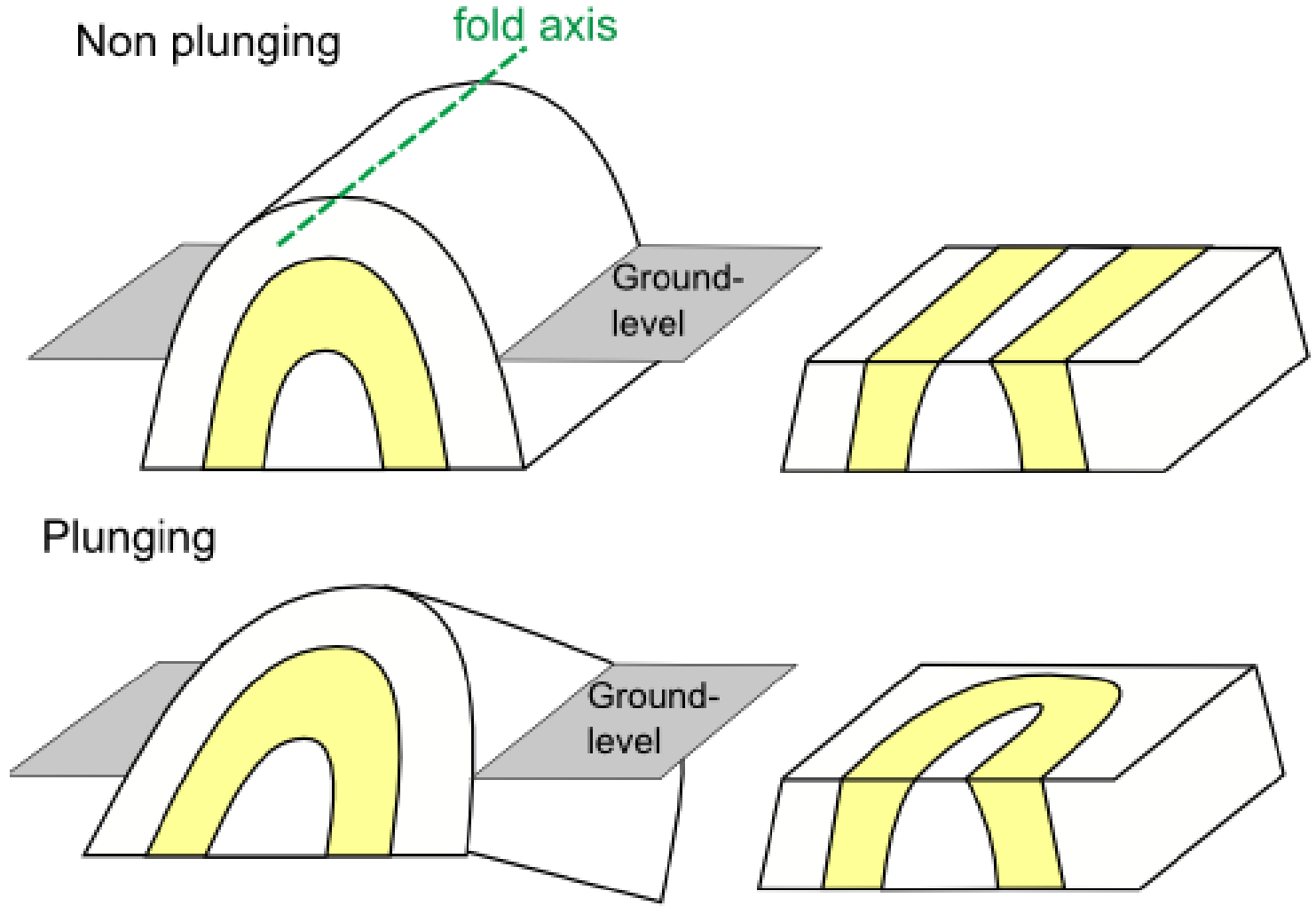
- Urban area
- Shiekh Shadli tomb
- Asphaltic road
- Track
- Quarry and mine
- Spot elevation in metres
- Water well
- Contour line in metres

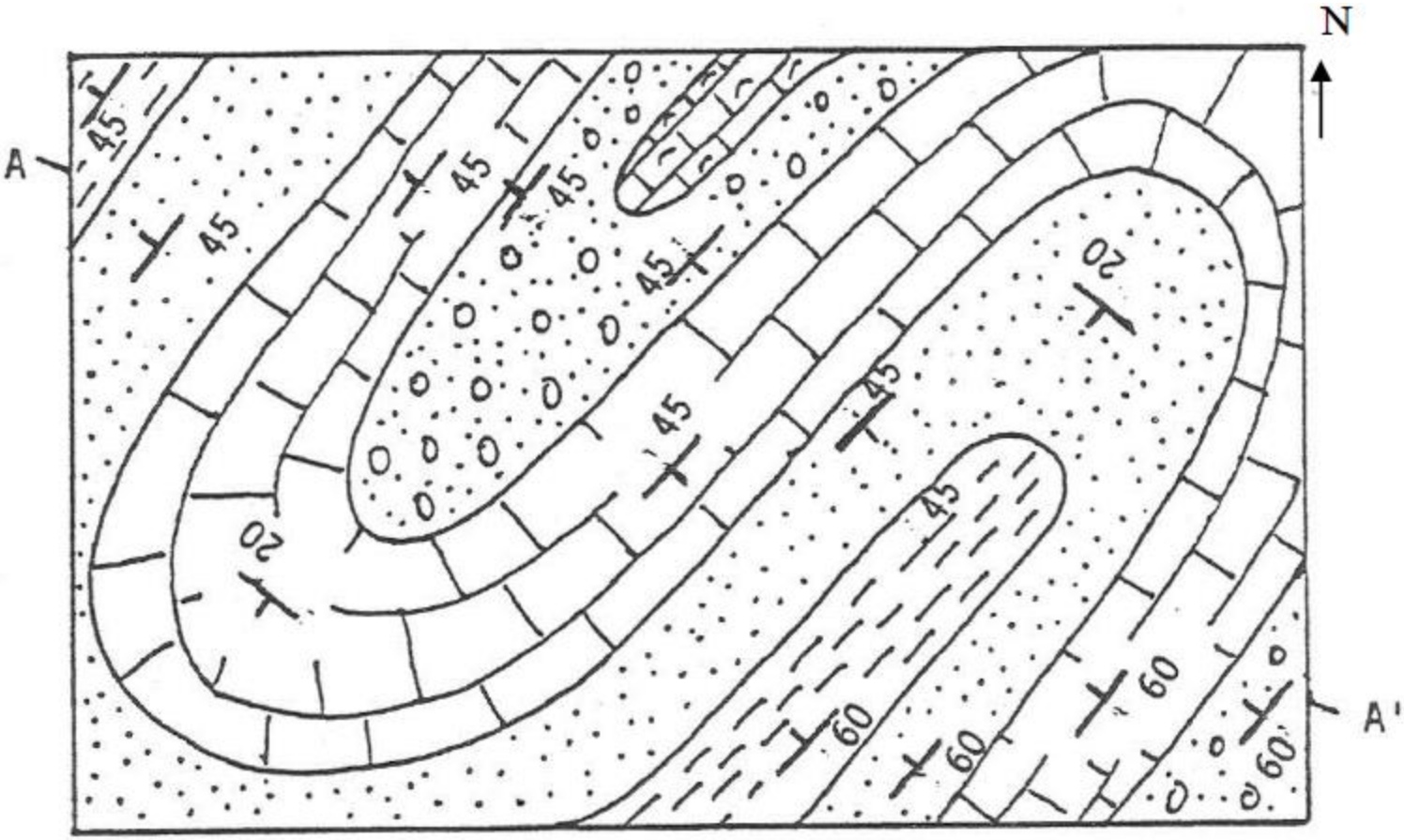
Map parts

- Map face “map view”
- Map legend + geologic symbols
- Cross sections
- Scale bar


N
B
B'
20
20
20
20
60
60
60
Sandstone
Shale
Limestone
Conglomerate

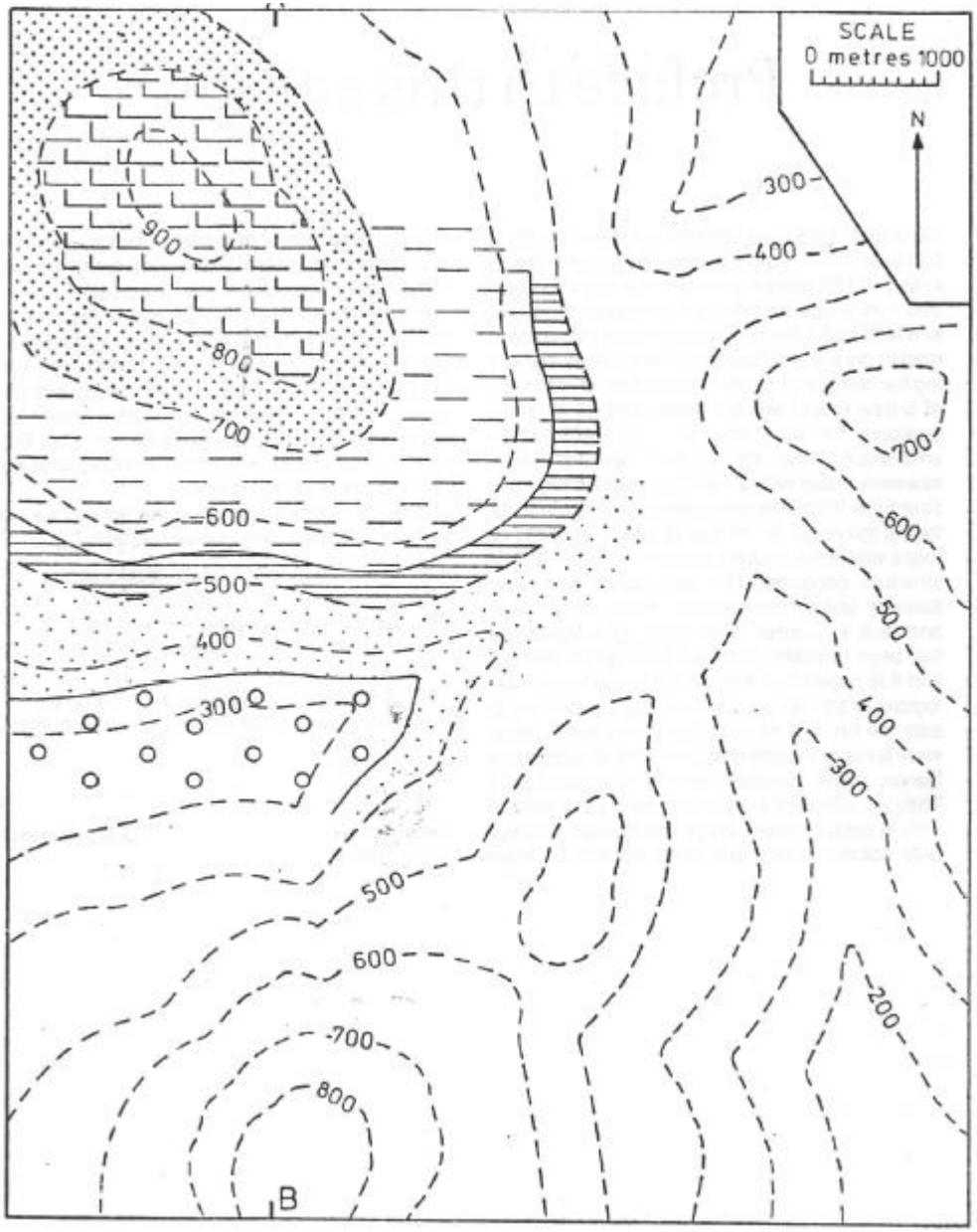
- Obviously, this is a fold. What kind is it?
- Draw the axial plane on your cross-section.
- Is this fold plunging or non-plunging?
- Is this a symmetric or asymmetric fold?
- Is the shale exposed in this area older or younger than the conglomerate


Non plunging
fold axis
Ground-
level
Plunging
Ground-
level


N
A
A'
45
20
60
Fossilferous Limestone
Limestone
Sandstone
Shale
Conglomerate

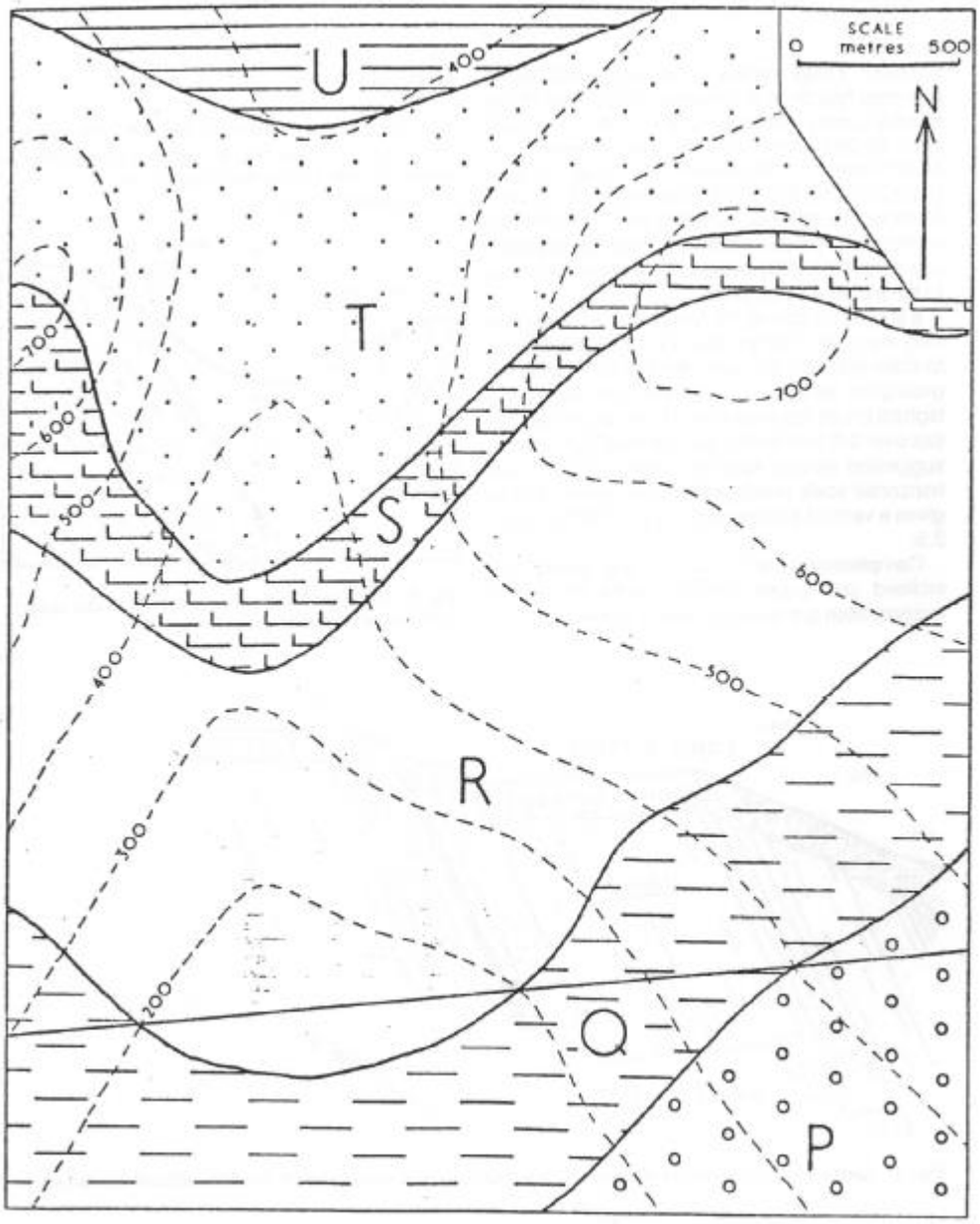
- What is the oldest rock unit here?
- What is the youngest rock unit here?
- What two types of folds can you identify in the section?

Measuring dip direction & amount



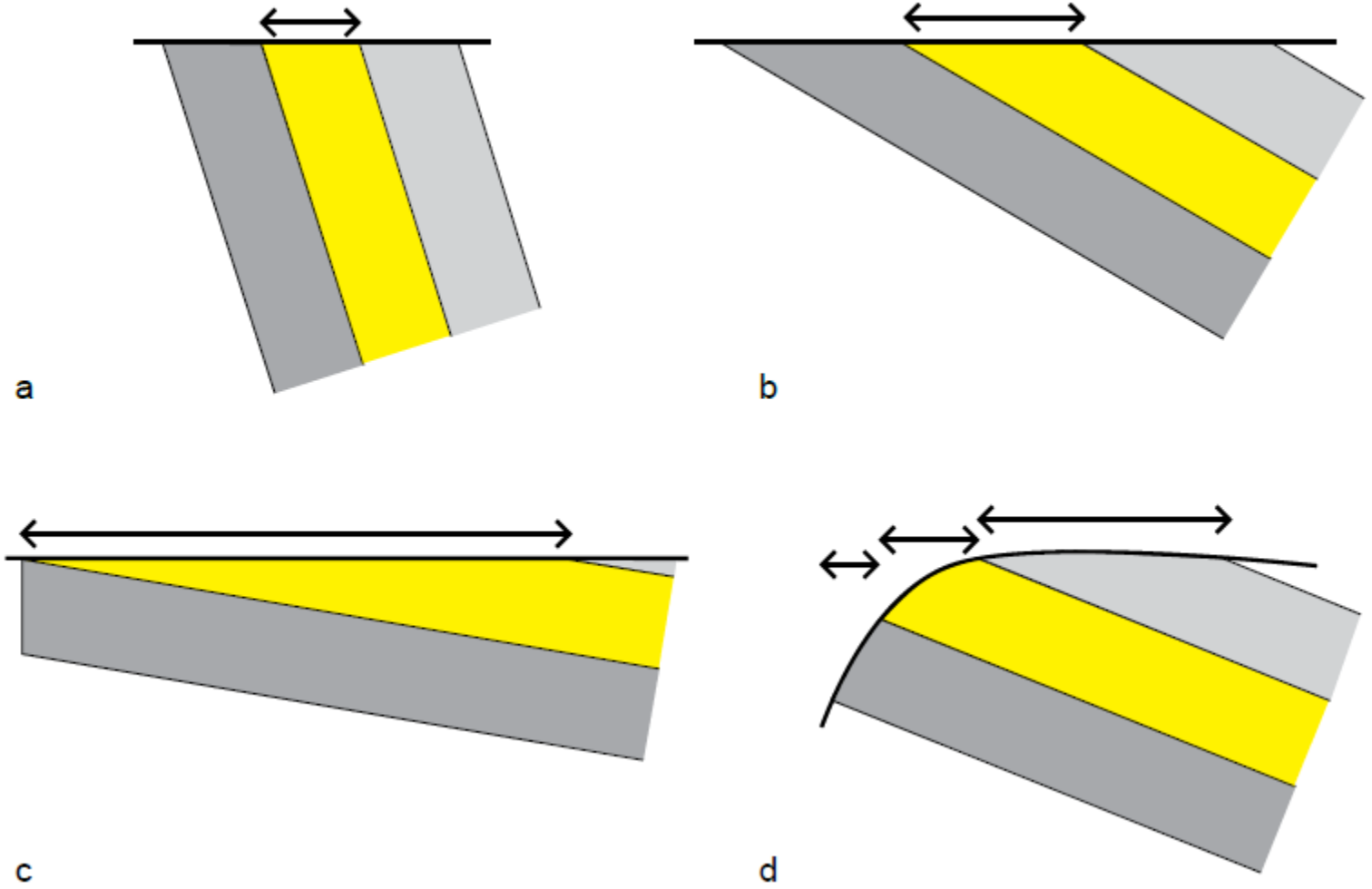
Horizontal strata

Outcrop thickness and topography gradient

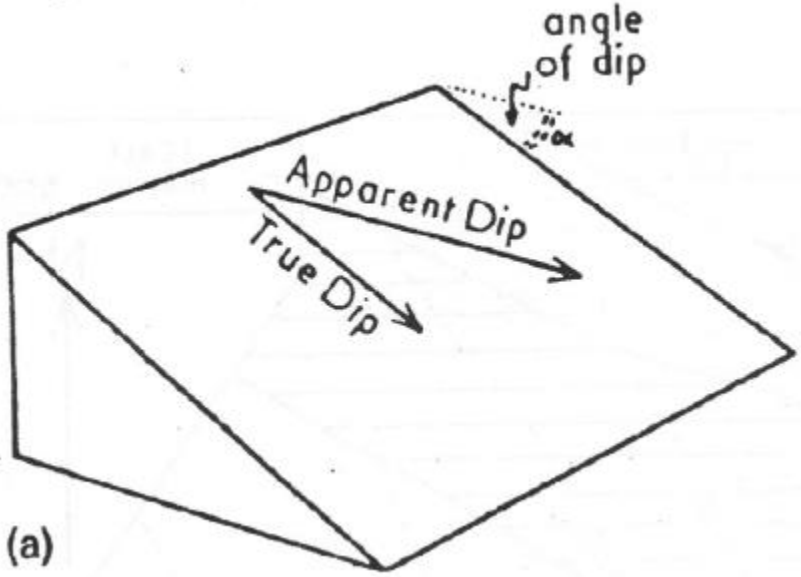


Inclined strata

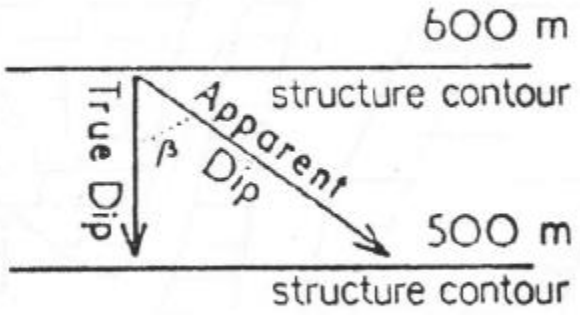
Effect of dip and topography on outcrop width



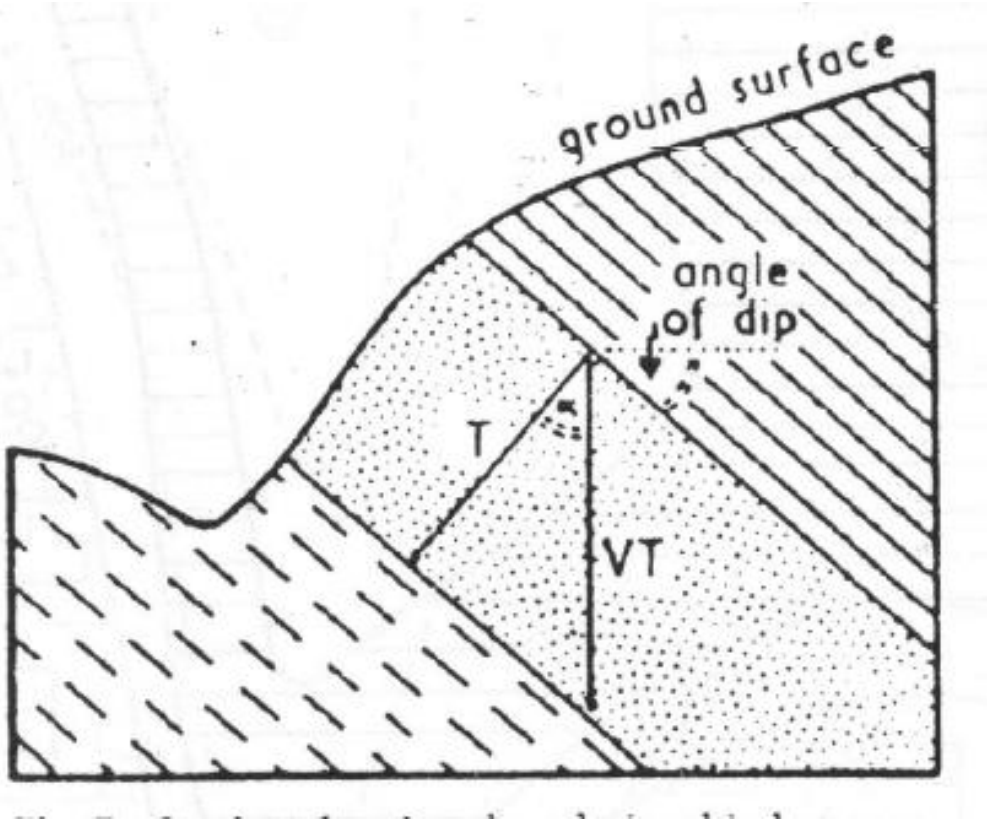
- True dip “ direction & amount”
- Apparent dip “ direction & amount”
- Structure contours = strike line
- Vertical thickness and true thickness


angle
of dip
α
Apparent Dip
True Dip

(a)


600 m
structure contour
True Dip
Apparent
Dip
β
500 m
structure contour

(b)


ground surface
angle
of dip
T
VT

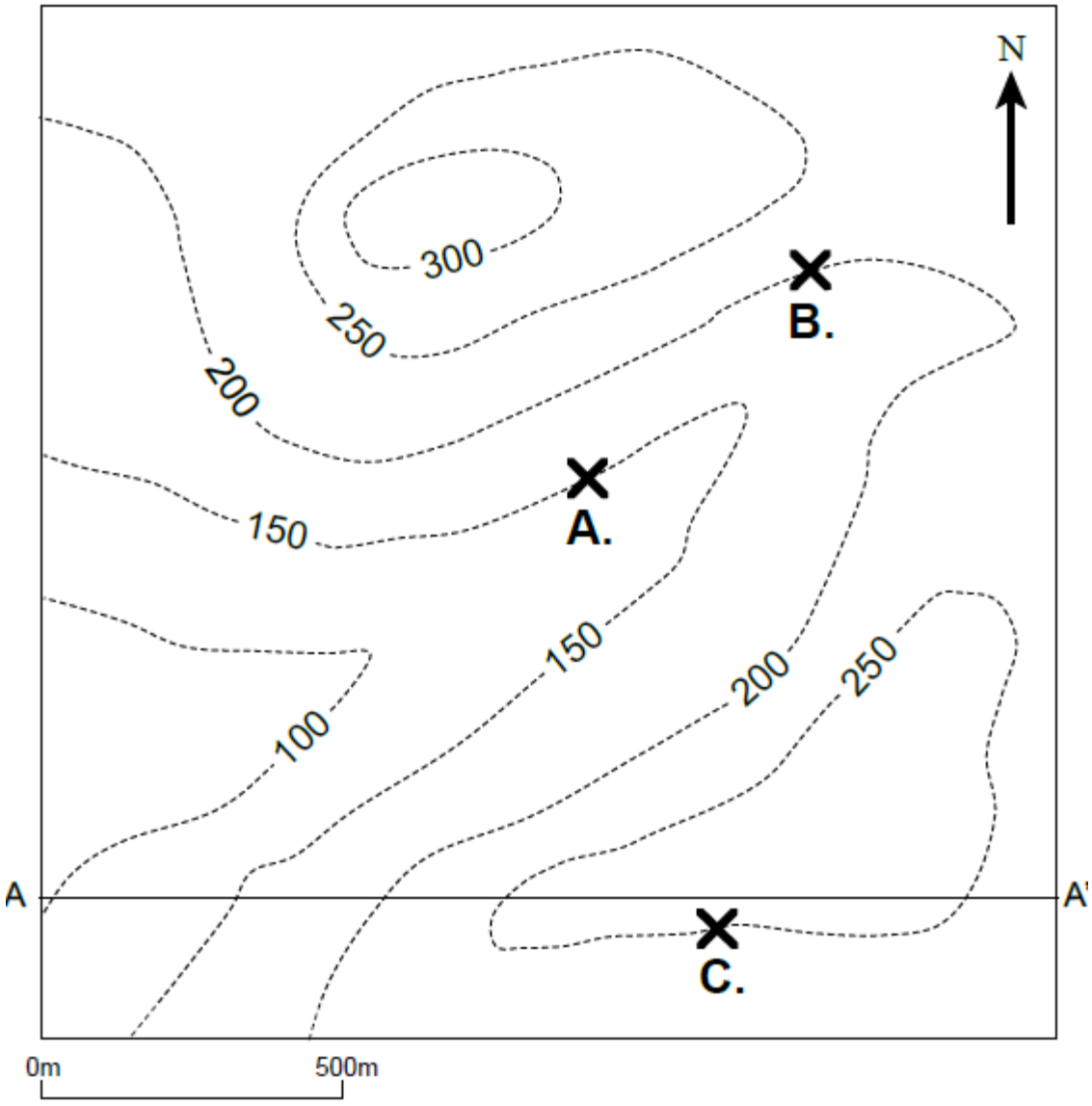
Drawing structure contours

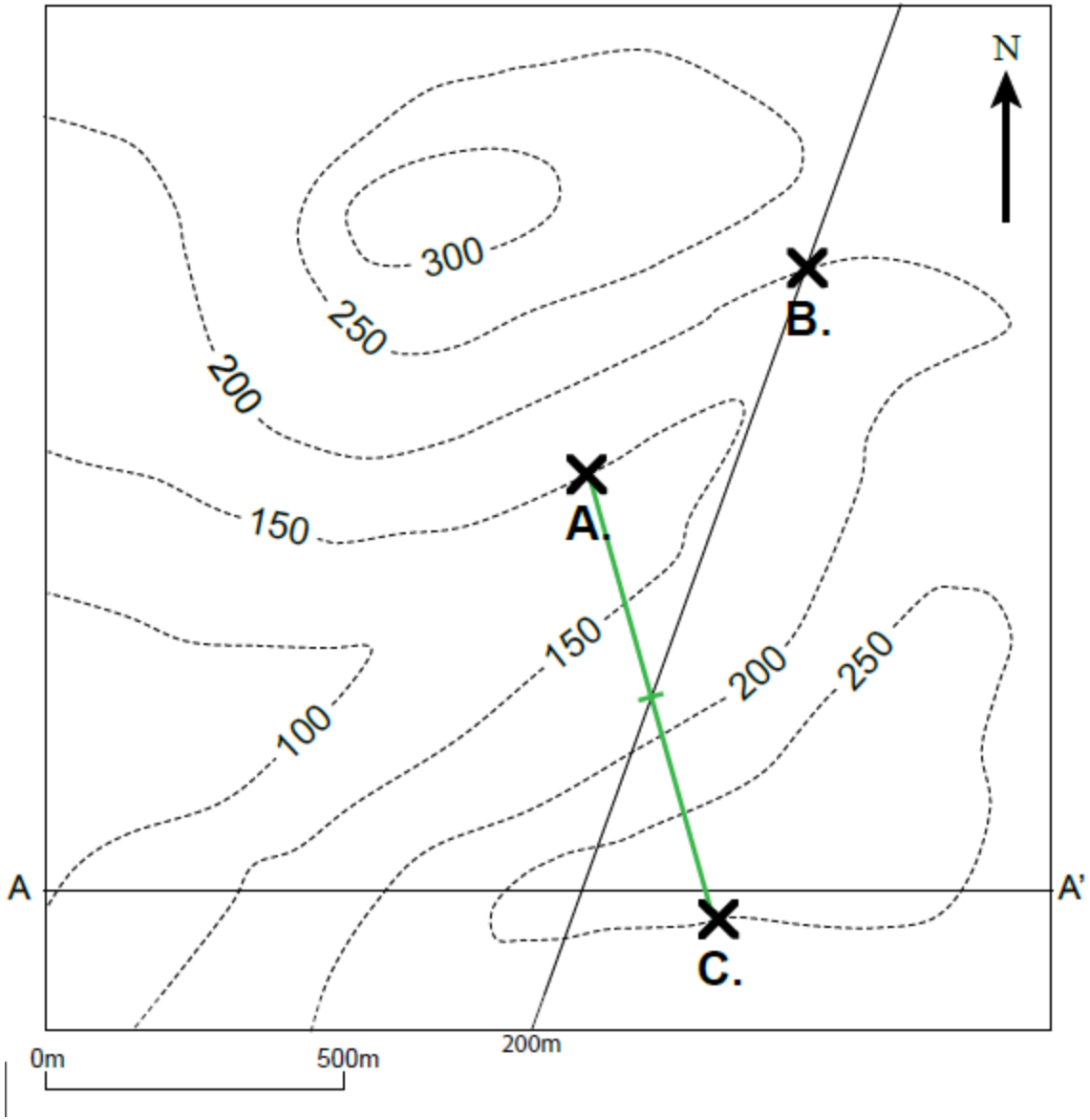
- Depending on:

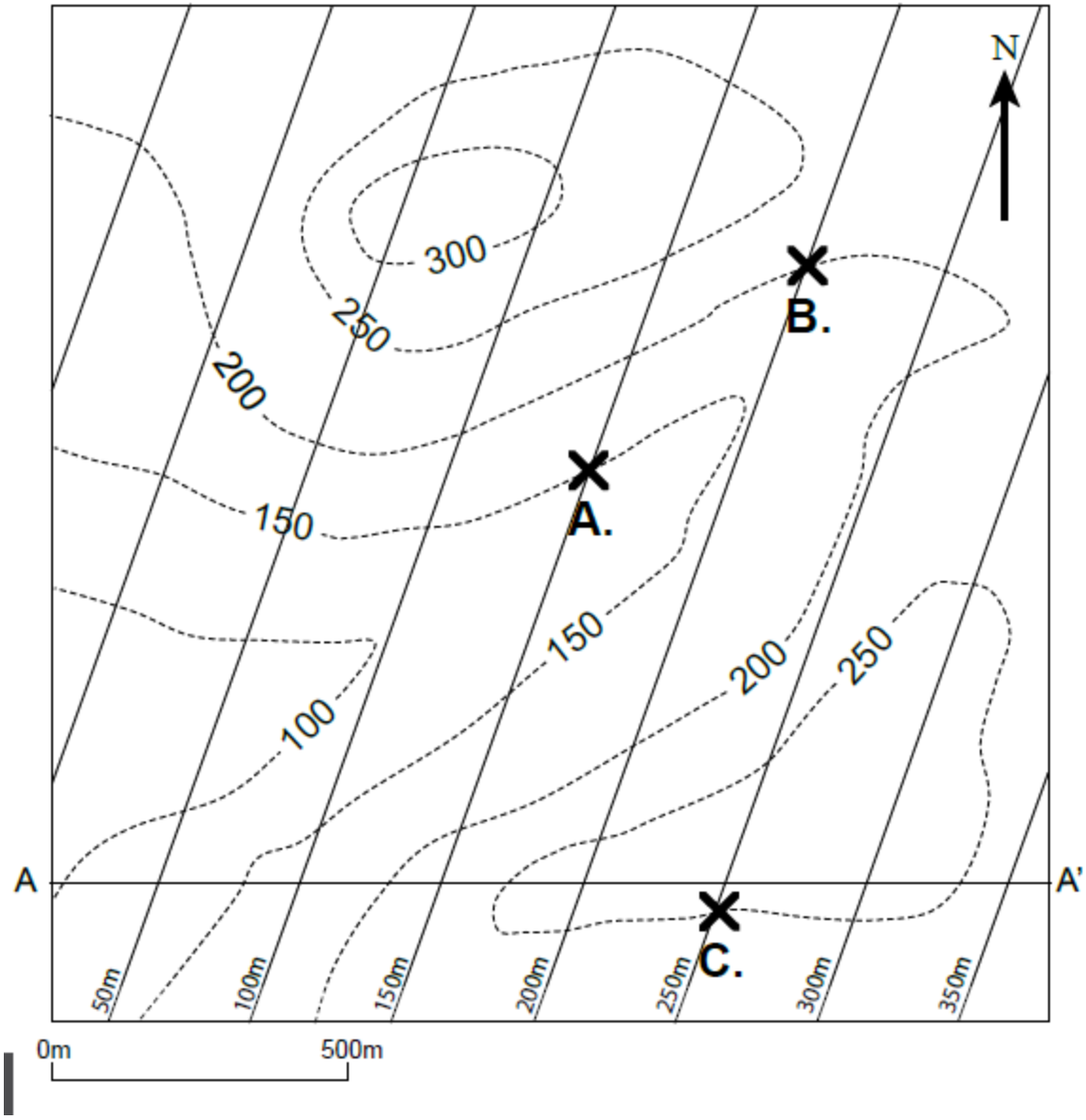
Points of bed surface exposure

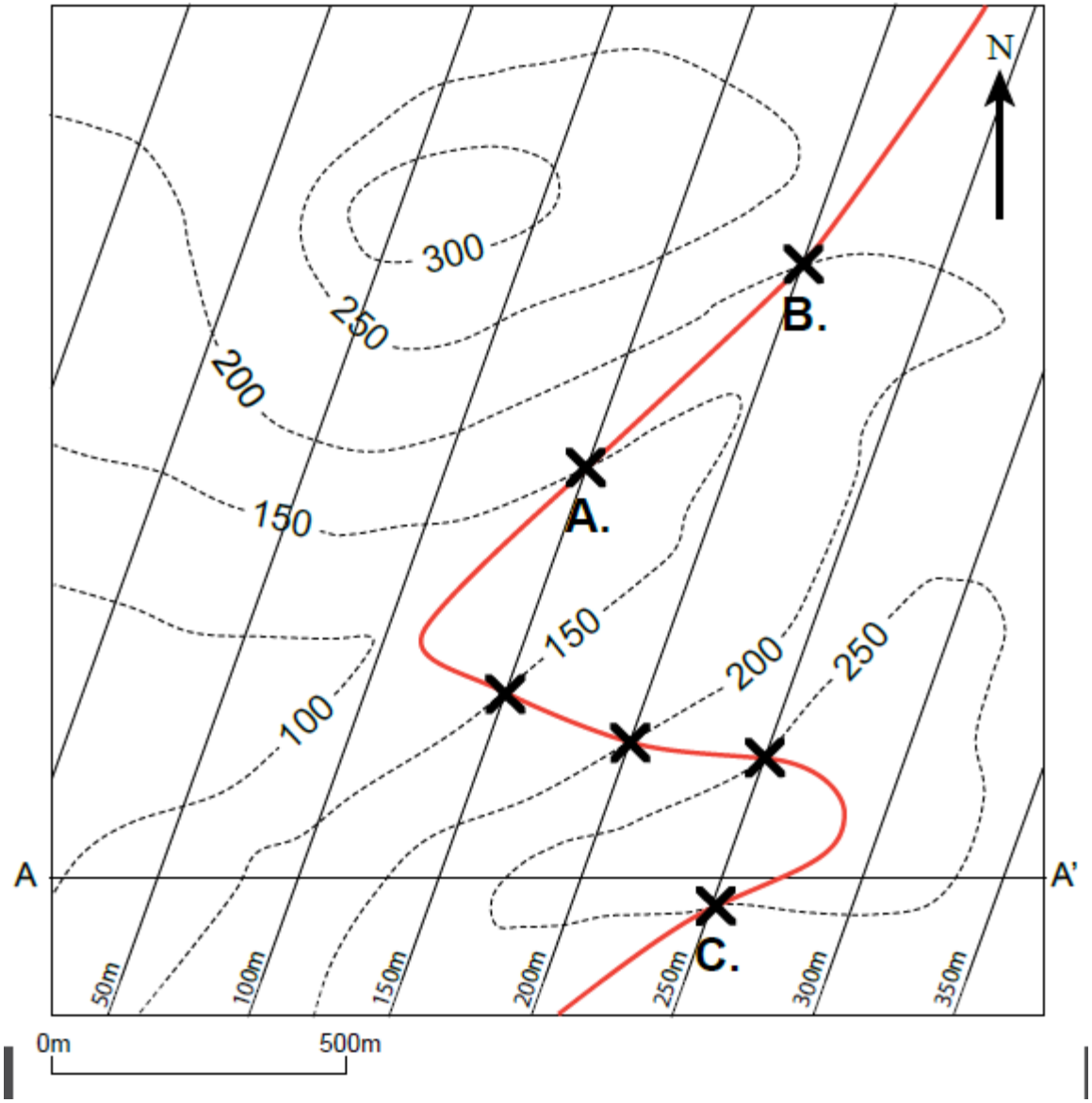
True dip

Apparent dips


N
300
250
200
150
100
150
200
250
B.
A.
C.
A
A'
0m
500m


N
300
250
200
150
100
150
200
250
A.
B.
C.
A
A'
0m
500m
200m


N
300
250
200
150
100
150
200
250
B.
A.
C.
A
A'
50m
100m
150m
200m
250m
300m
350m
0m
500m


N
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150
200
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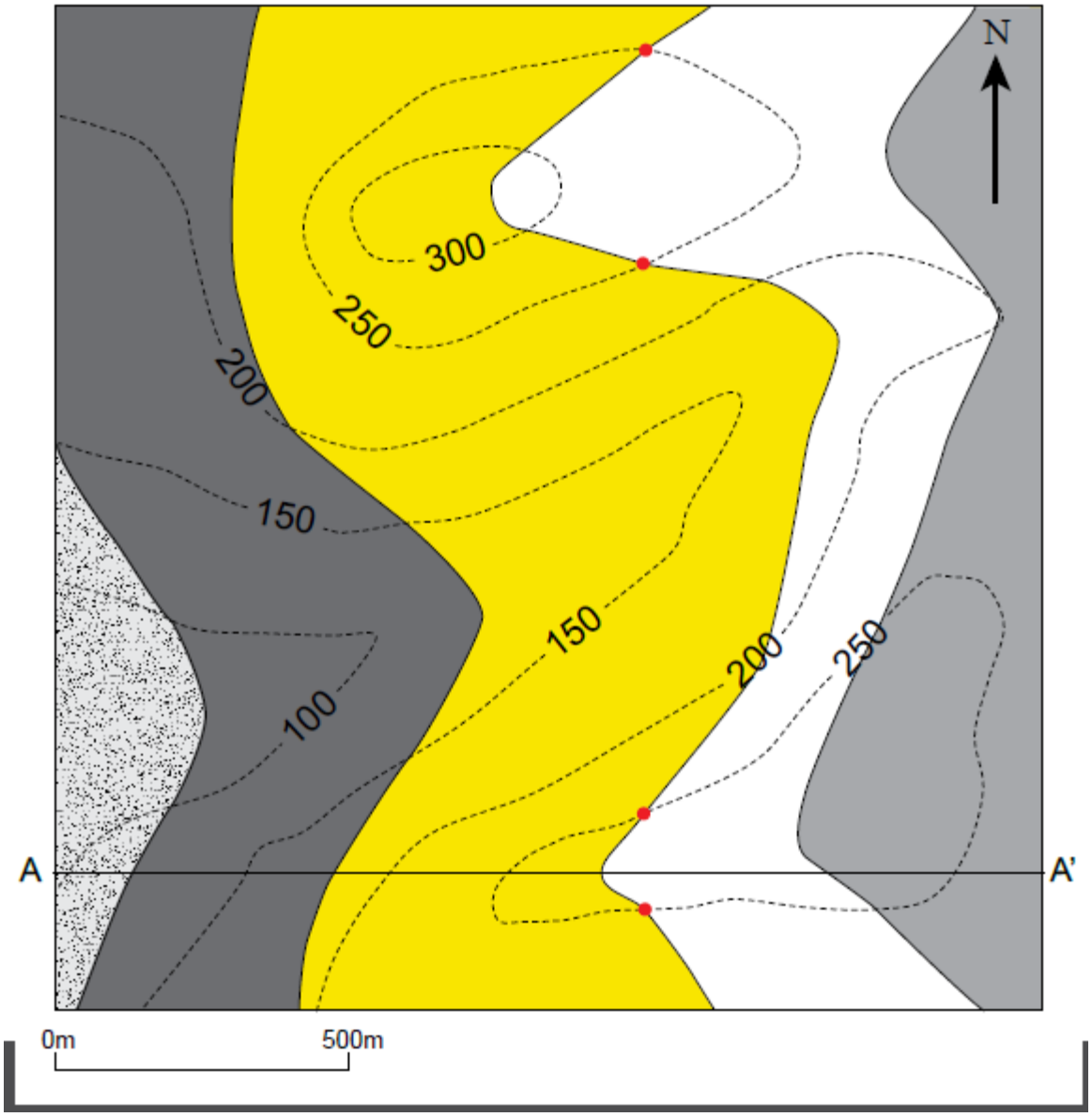
A.
B.
C.
A
A'
50m
100m
150m
200m
250m
300m
350m
0m
500m


N
300
250
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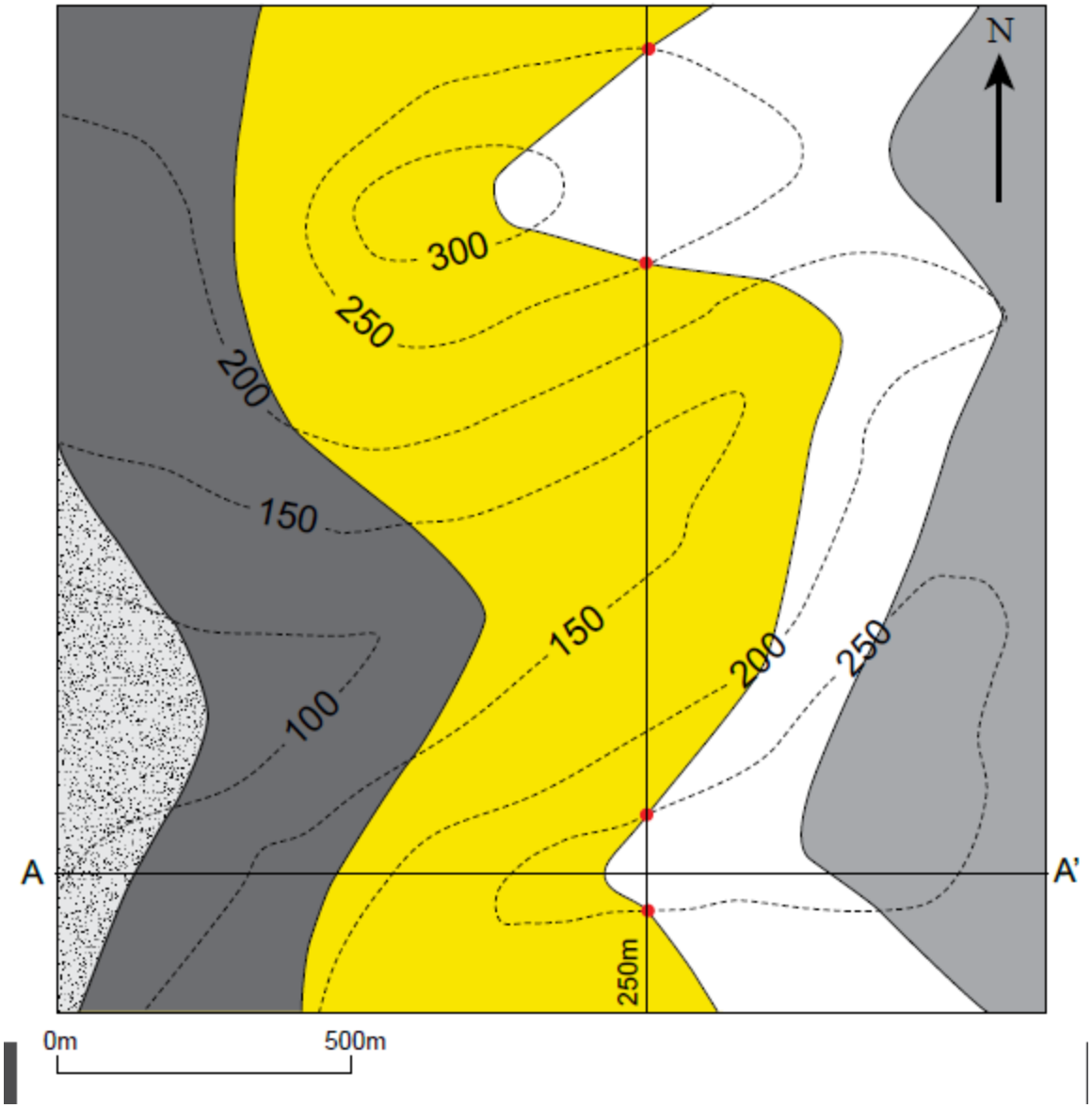
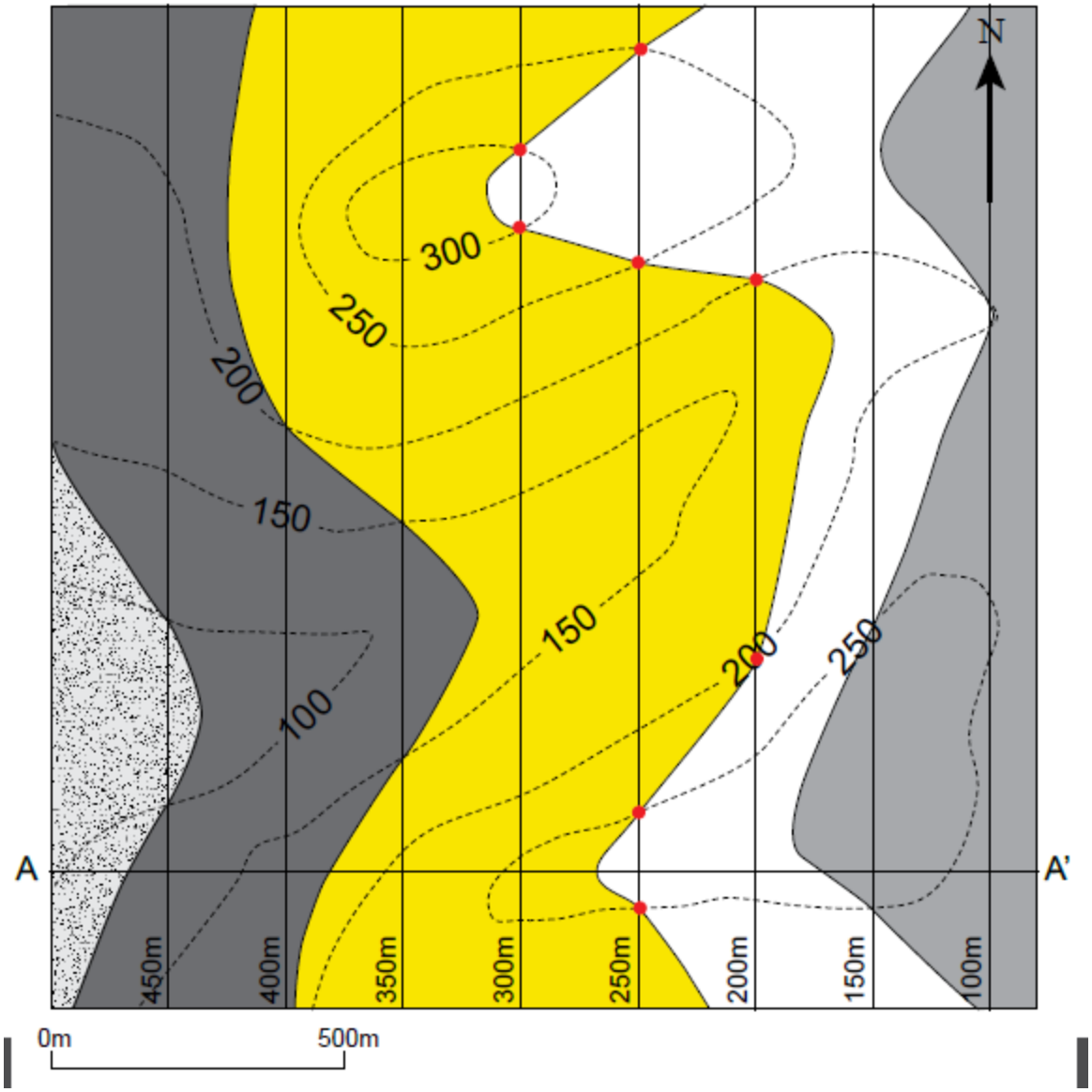
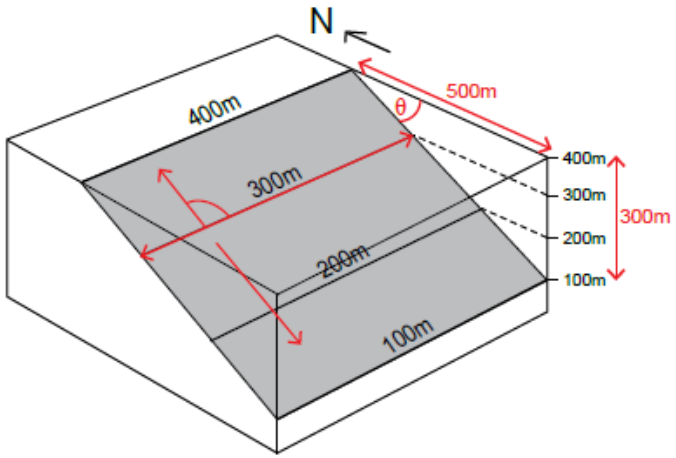
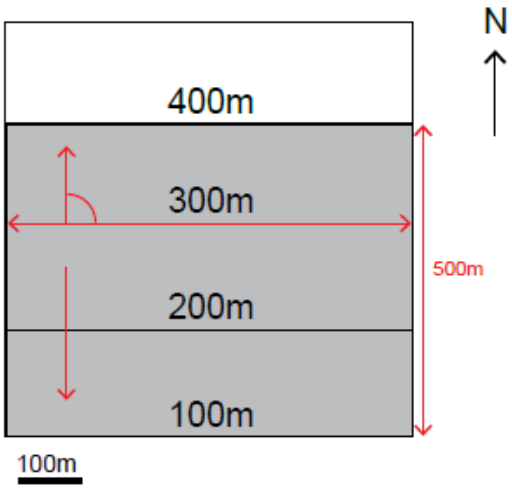
150
200
250
100
A
A'
0m
500m

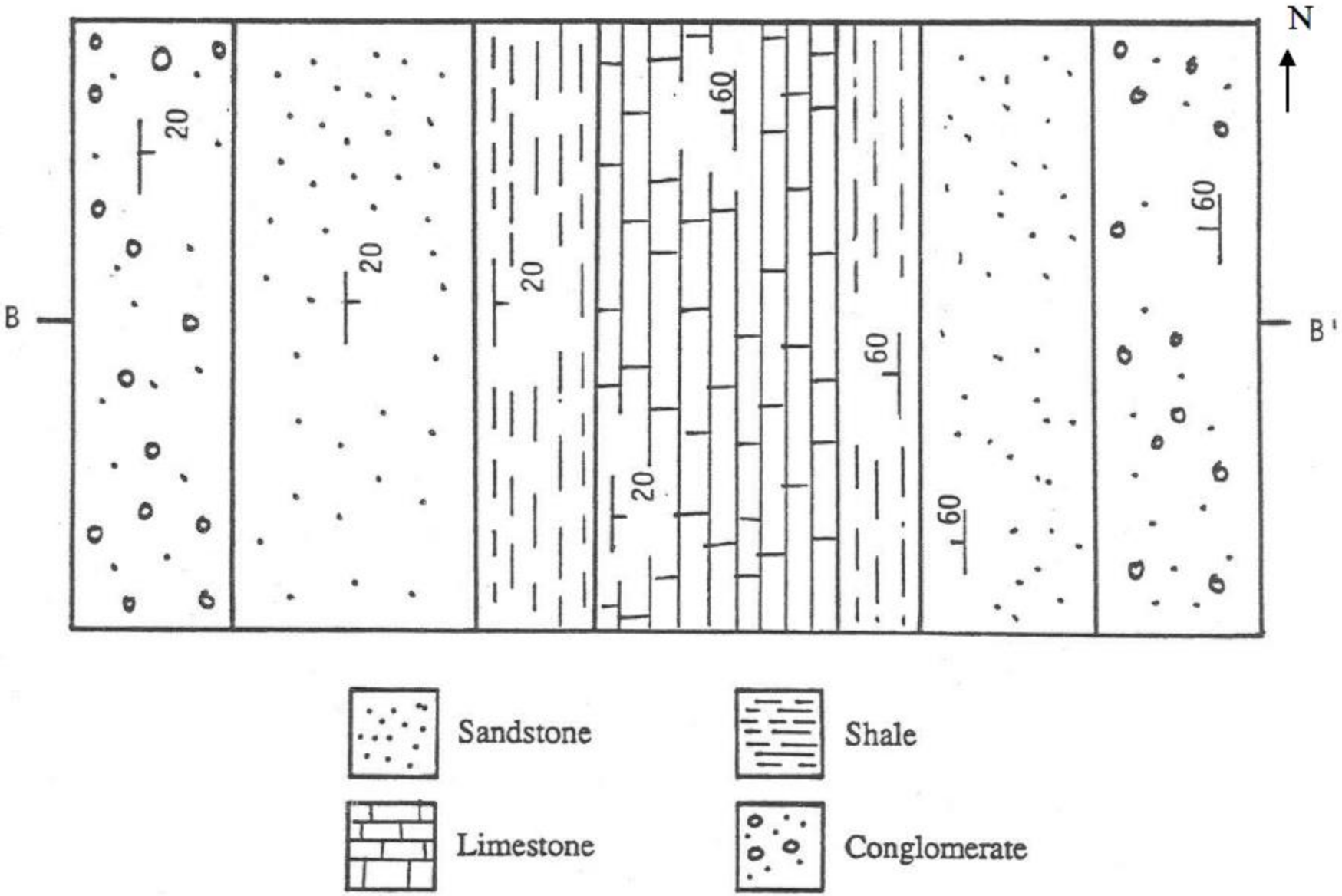

N
300
250
200
150
150
200
250
100
A
A'
250m
0m
500m


N
300
250
200
150
150
200
250
100
A
A'
450m
400m
350m
300m
250m
200m
150m
100m
0m
500m

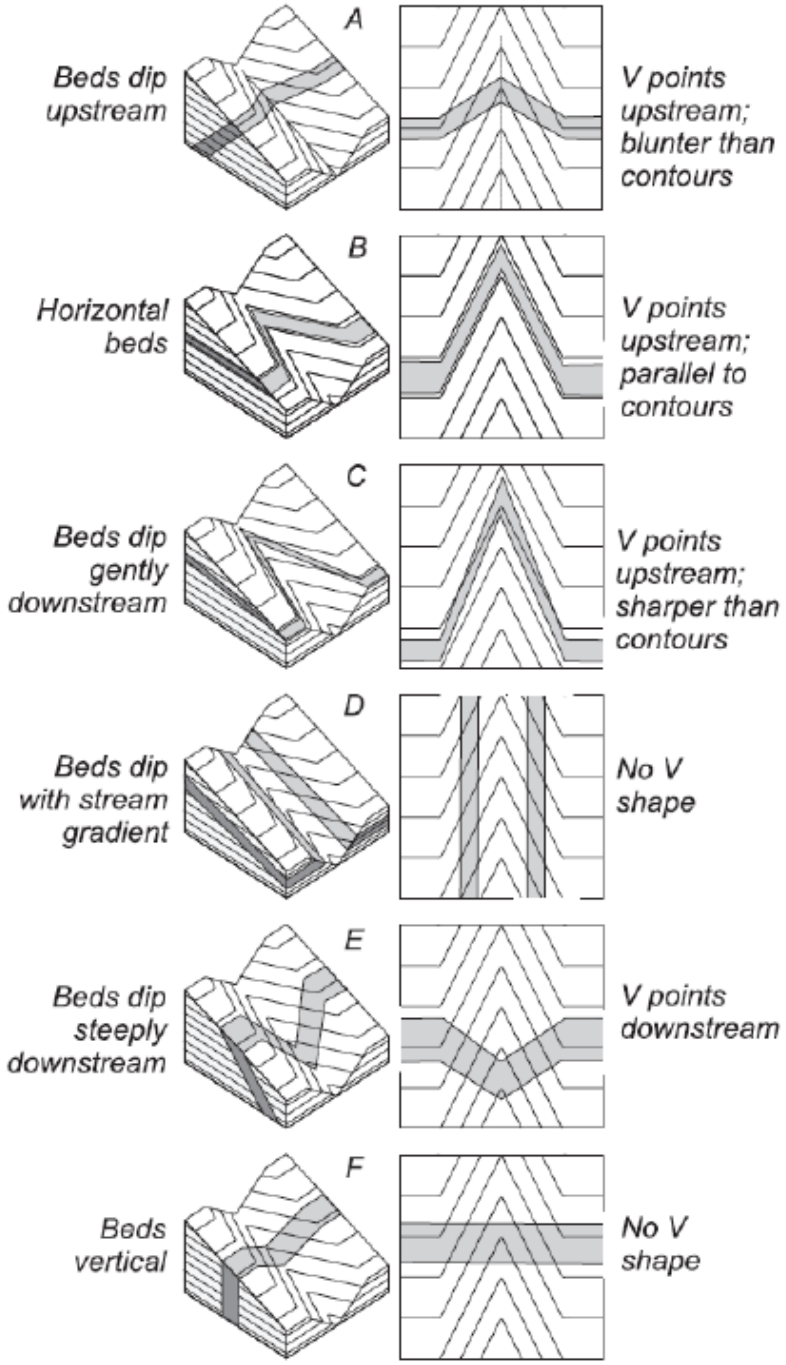
How to measure strike and dip from structure contours.







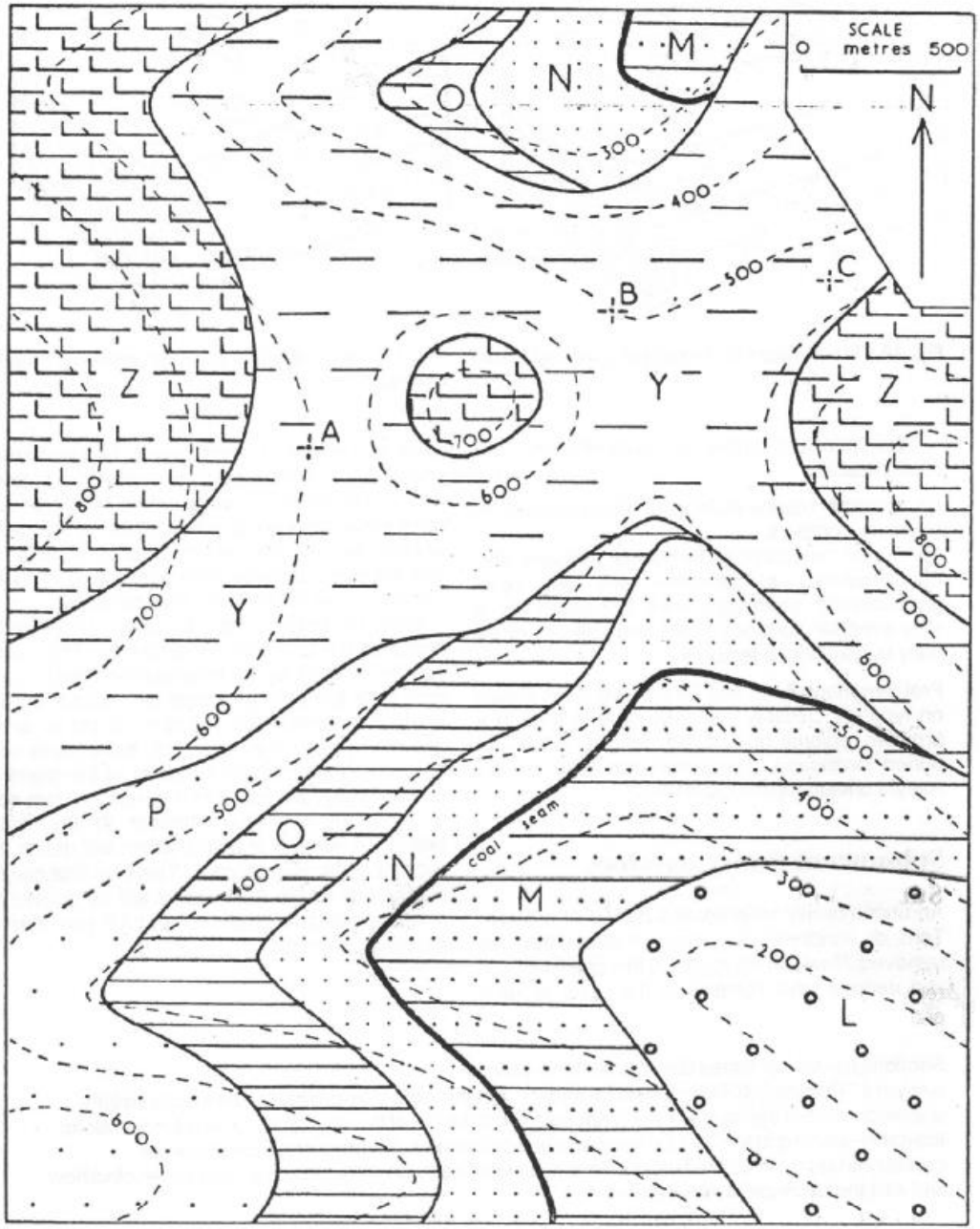
2. Dip direction from symbols


A
Beds dip upstream
V points upstream; blunter than contours
B
Horizontal beds
V points upstream; parallel to contours
C
Beds dip gently downstream
V points upstream; sharper than contours
D
Beds dip with stream gradient
No V shape
E
Beds dip steeply downstream
V points downstream
F
Beds vertical
No V shape

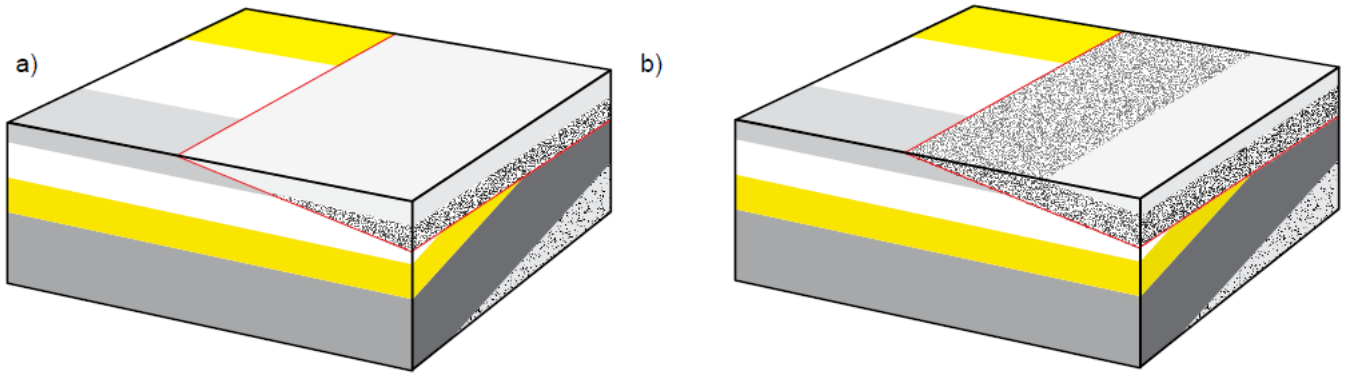
V's rule

Unconformities

Unconformities represent a break in deposition and a period of uplift and erosion. They can cover tens or hundreds of millions of years and tens or hundreds of metres of strata may be removed

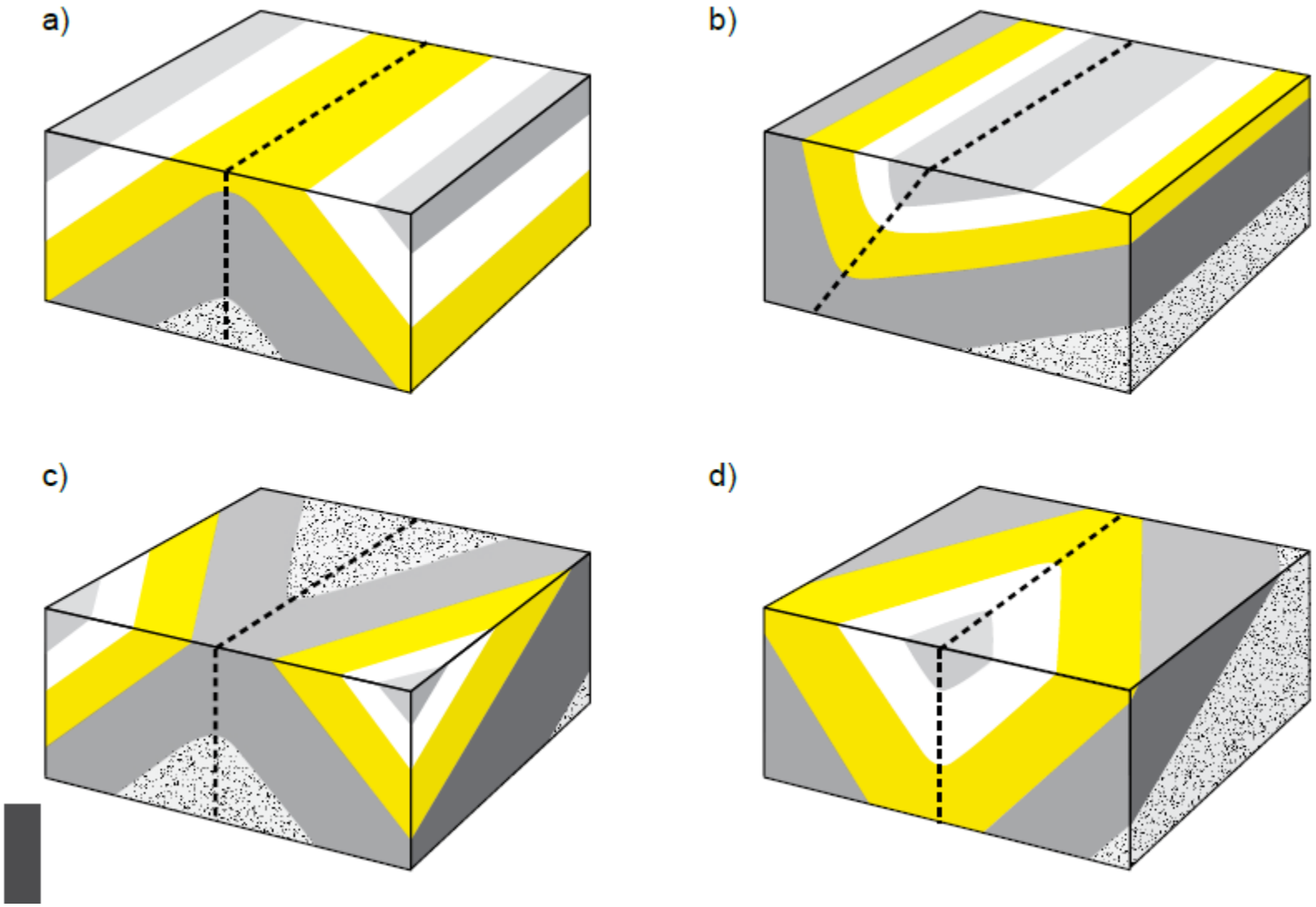


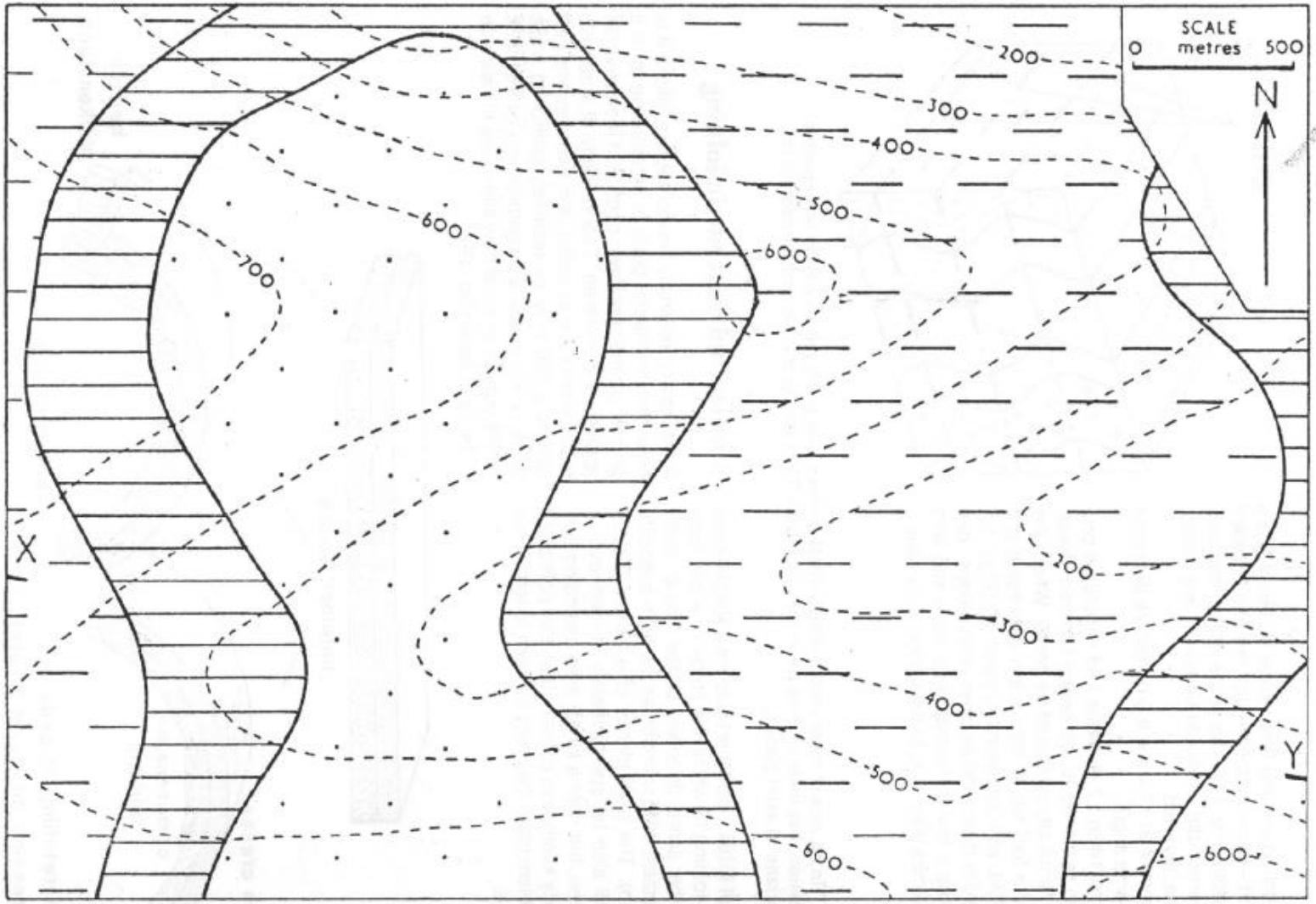
Where is the uc. Surface?



a) An example of onlap. b) An example of overstep unconformities

Folding




SCALE
0 metres 500
N
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500
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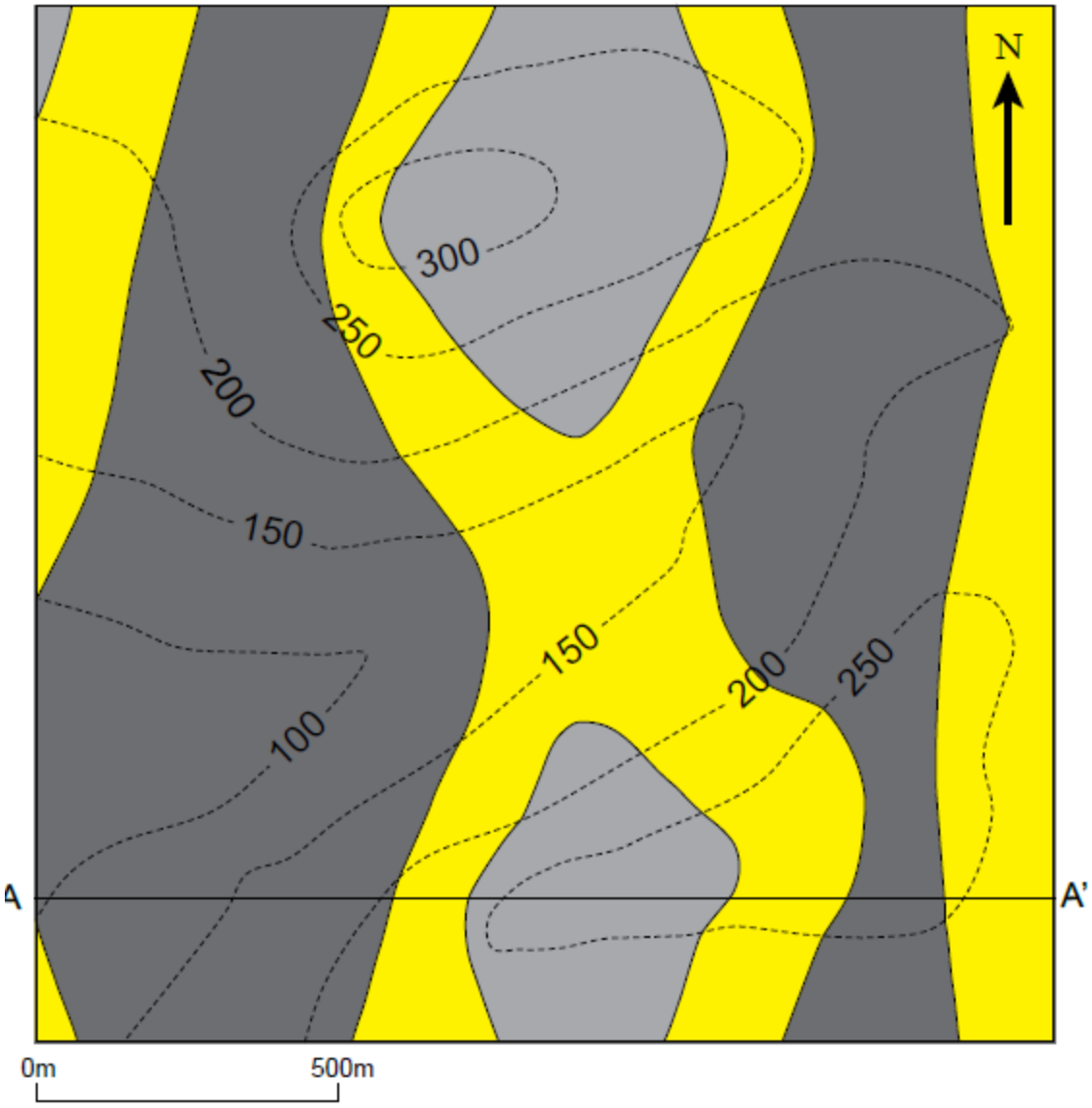
600
X
Y


N
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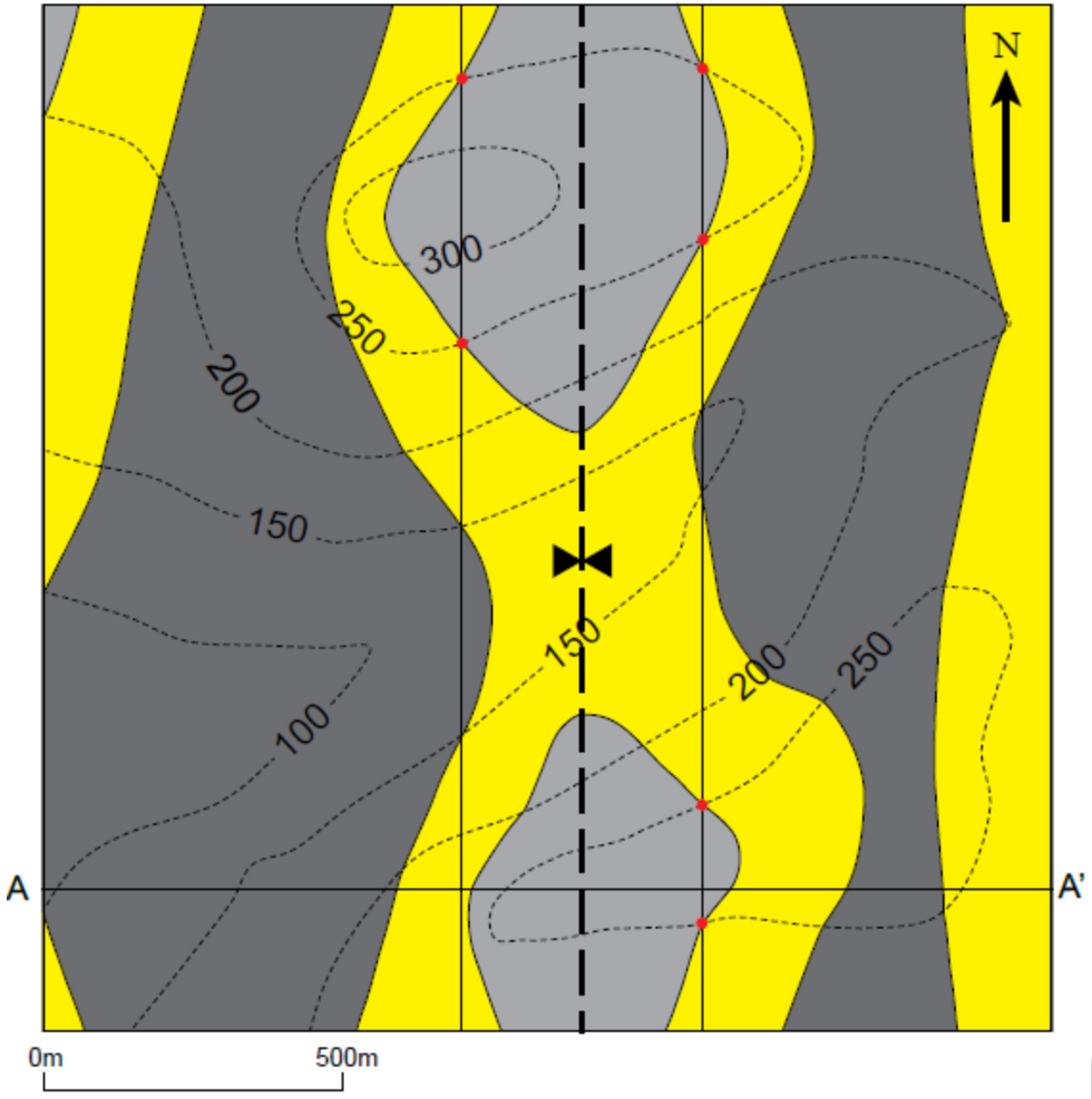
A
A'
0m
500m


N
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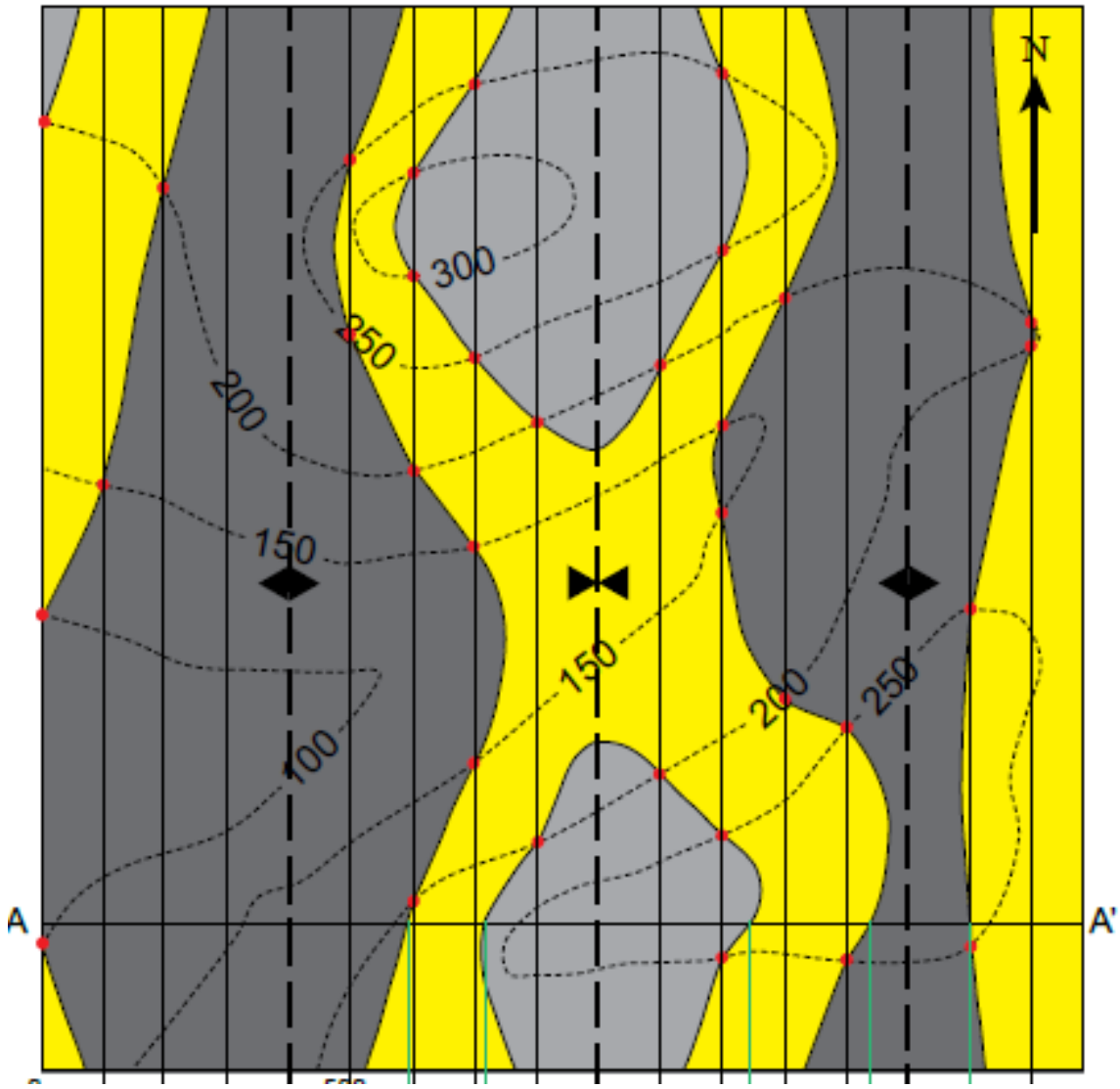
A'
0m
500m


N
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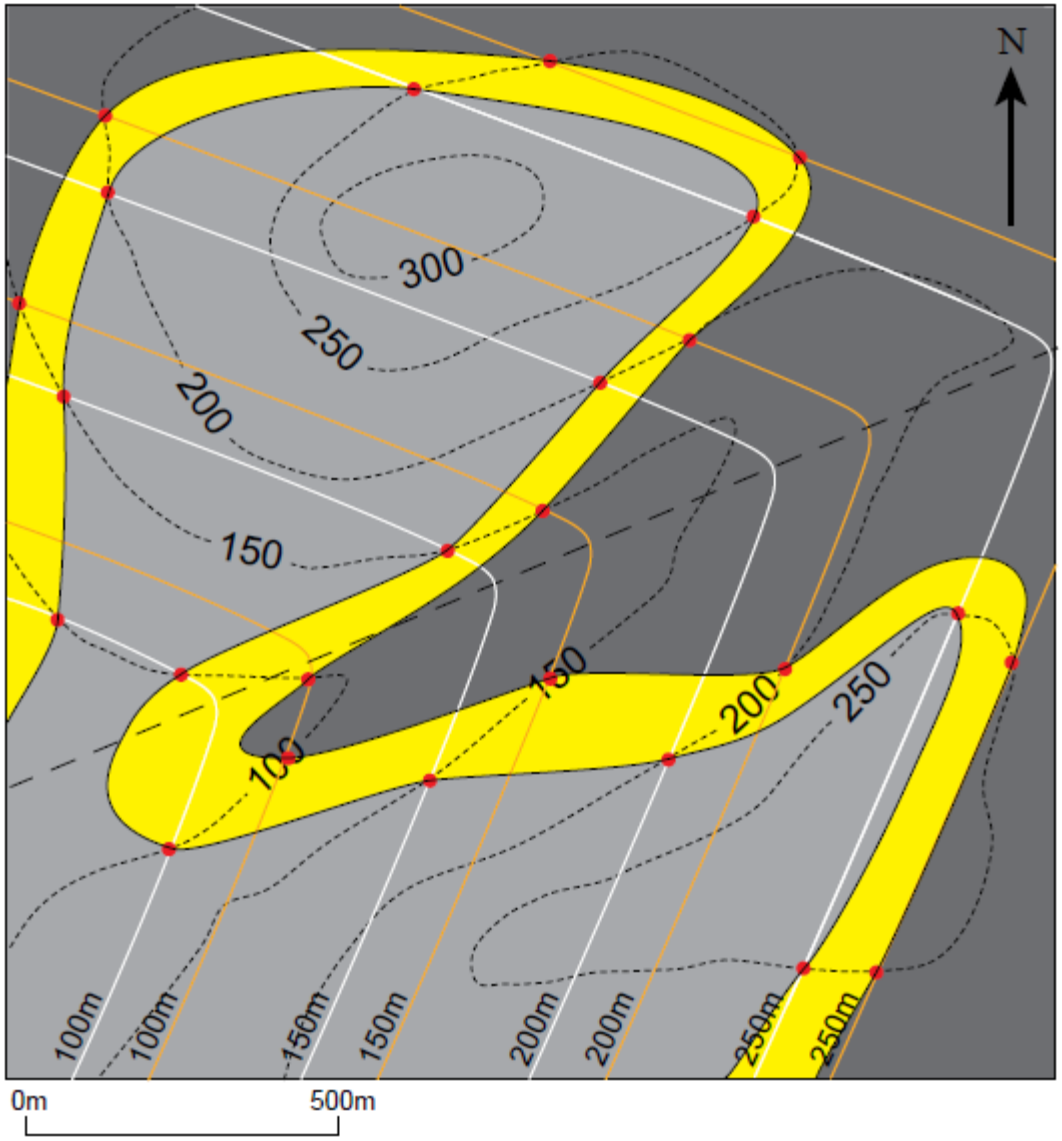
N
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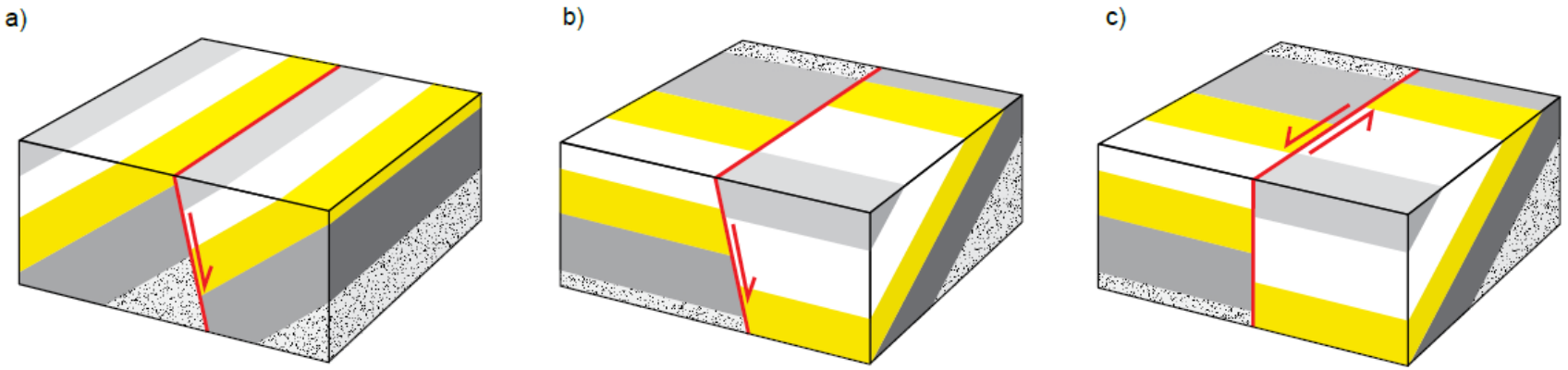
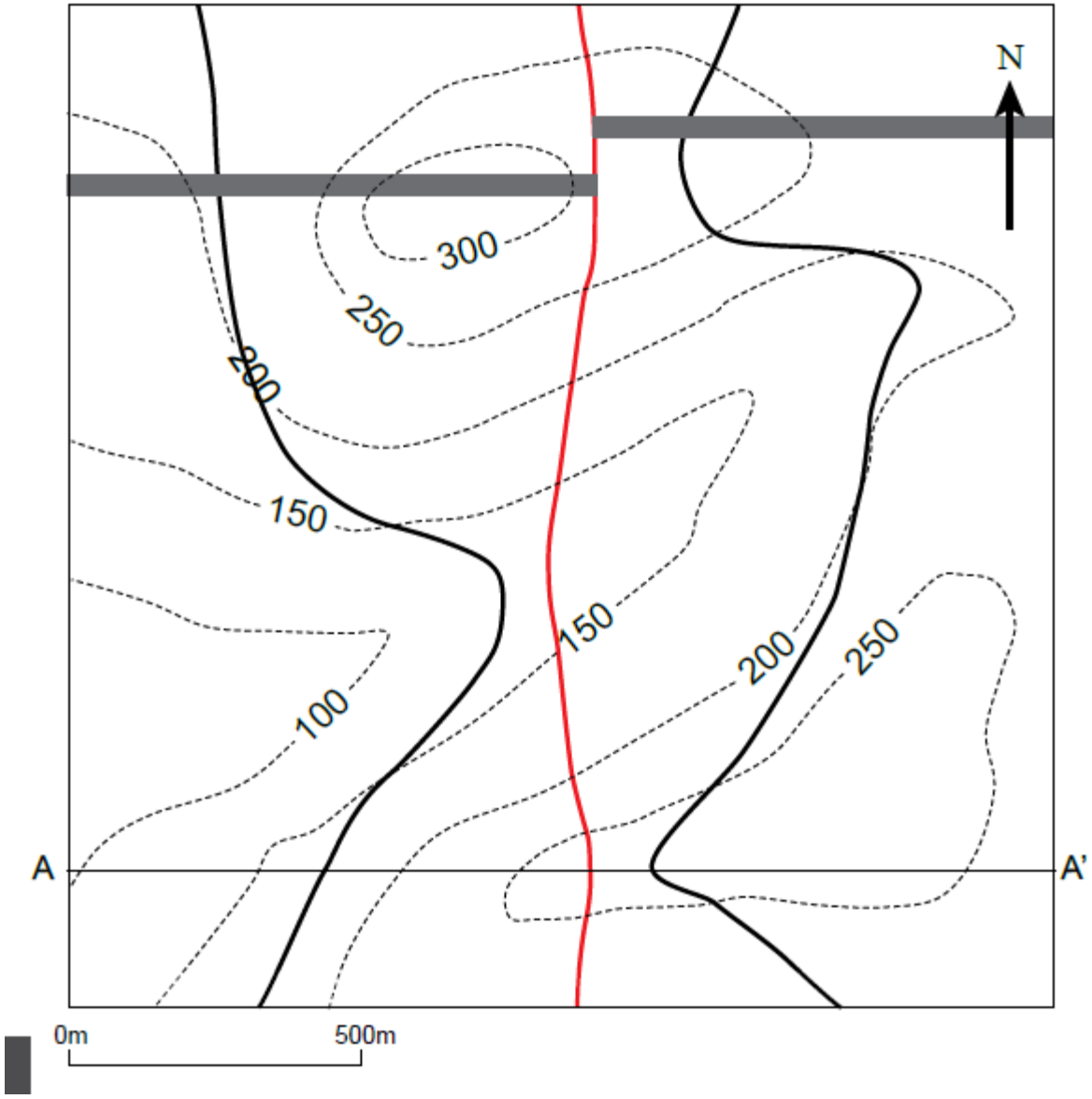
200m
250m
250m
0m
500m

Faults




N
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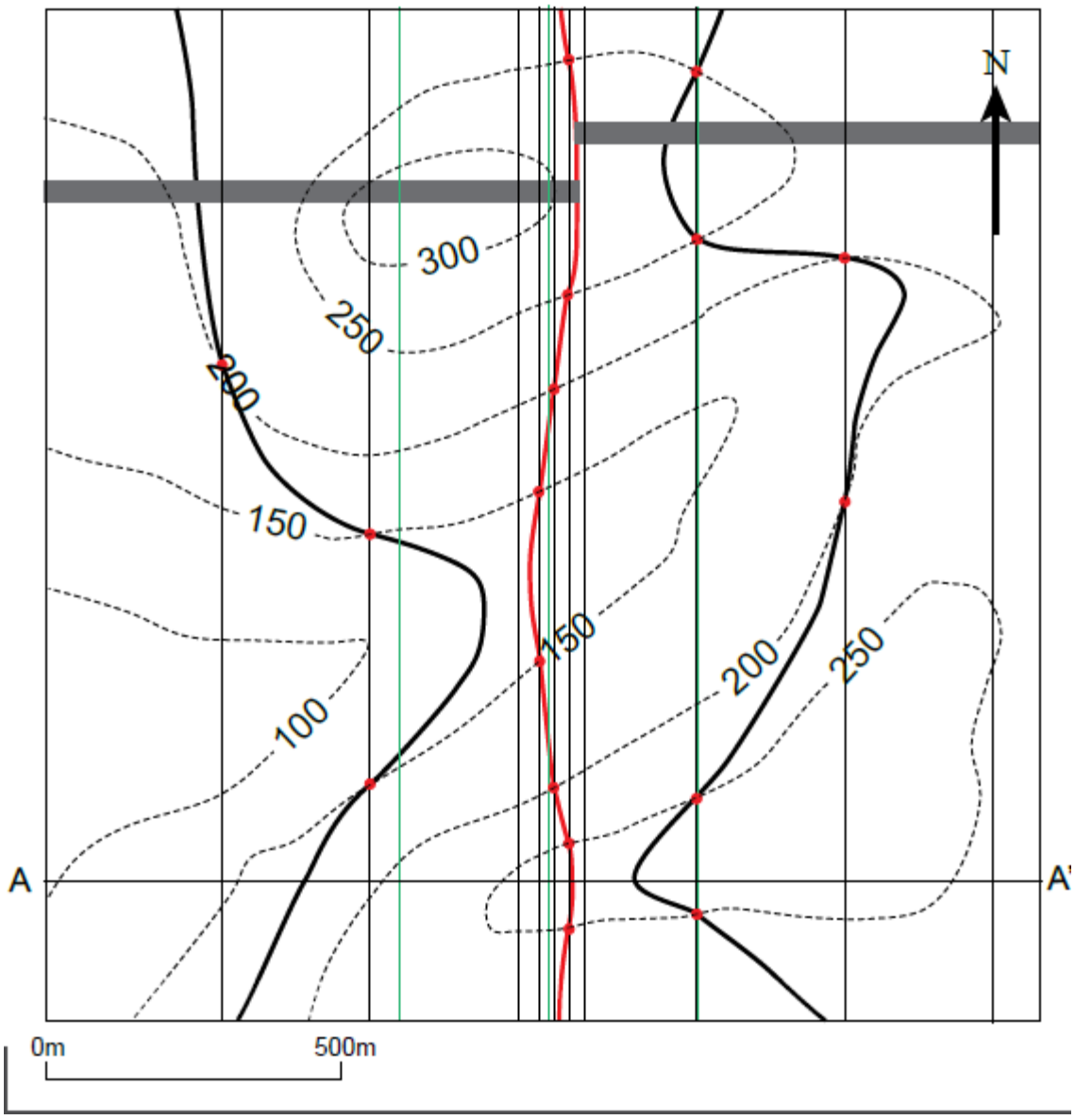
0m
500m

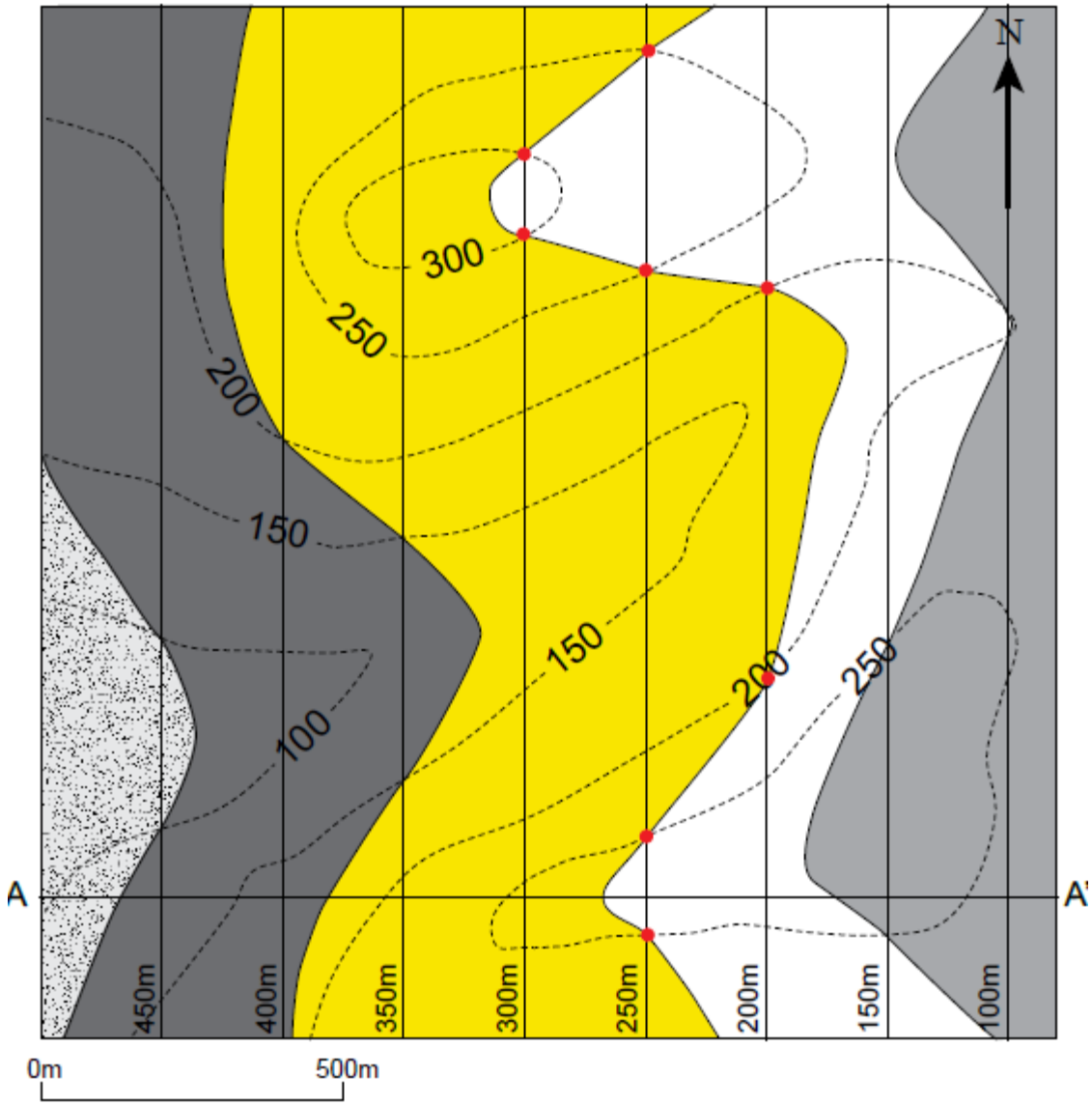

N
300
250
200
150
100
150
200
250
A
A'
0m
500m

Stratigraphic laws

- principle of original horizontality
- law of superposition
- principle of lateral continuity
- Cross-cutting relationships
- Inclusion principle

Cross-section

In order to provide a third dimension, one or more slices through the Earth are needed. Although cross sections are usually vertical, there are instances where it is desirable to project geologic structures on to a dipping plane such as the profile plane of a plunging fold. Cross sections show thicknesses, dip directions, folds, faults, unconformities, sediment thickness changes, igneous intrusions etc.


N
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A'
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300m
250m
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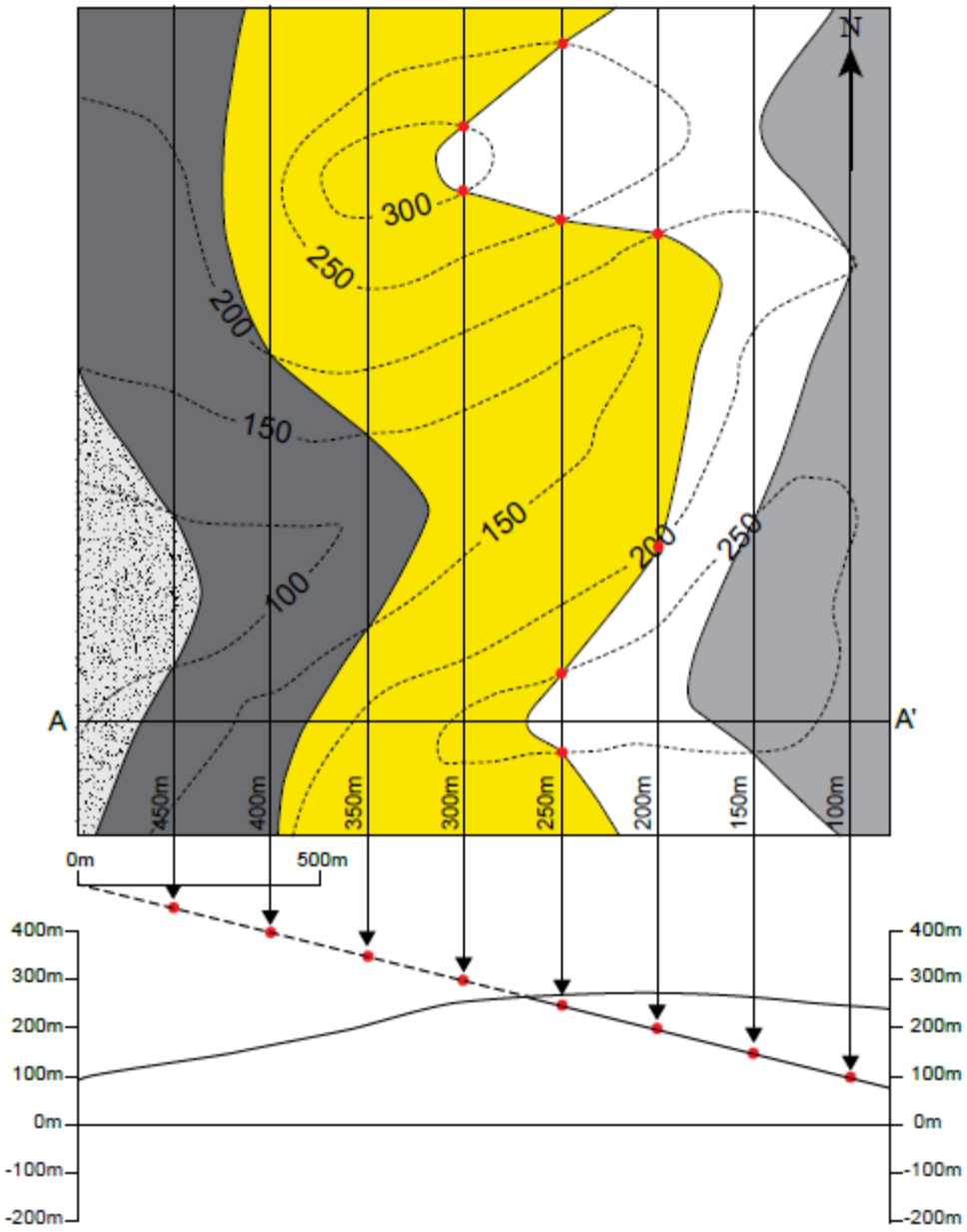
100m
0m
500m

Case 1


N
300
250
200
150
150
100
200
250
A
A'
450m
400m
350m
300m
250m
200m
150m
100m
0m
500m
400m
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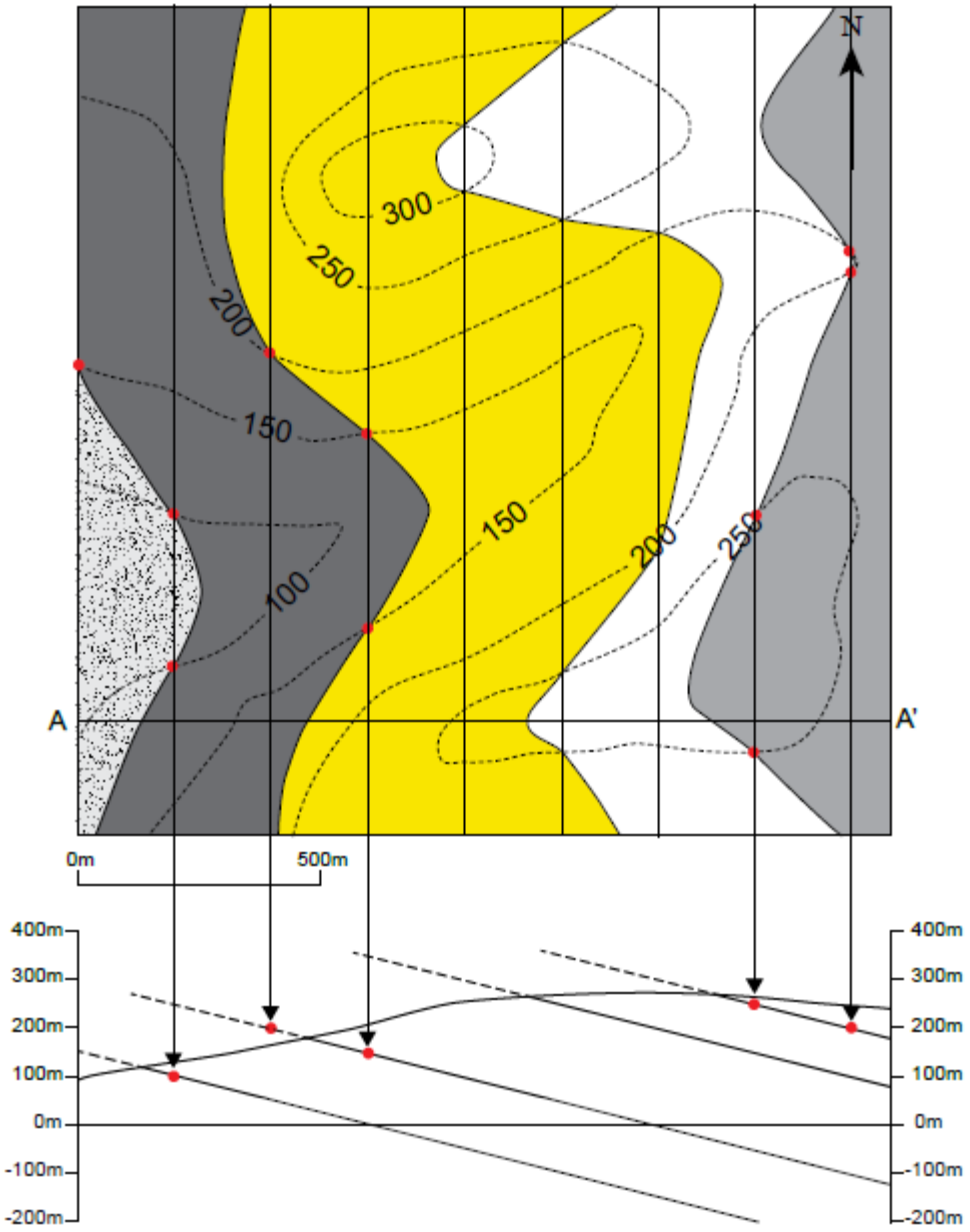
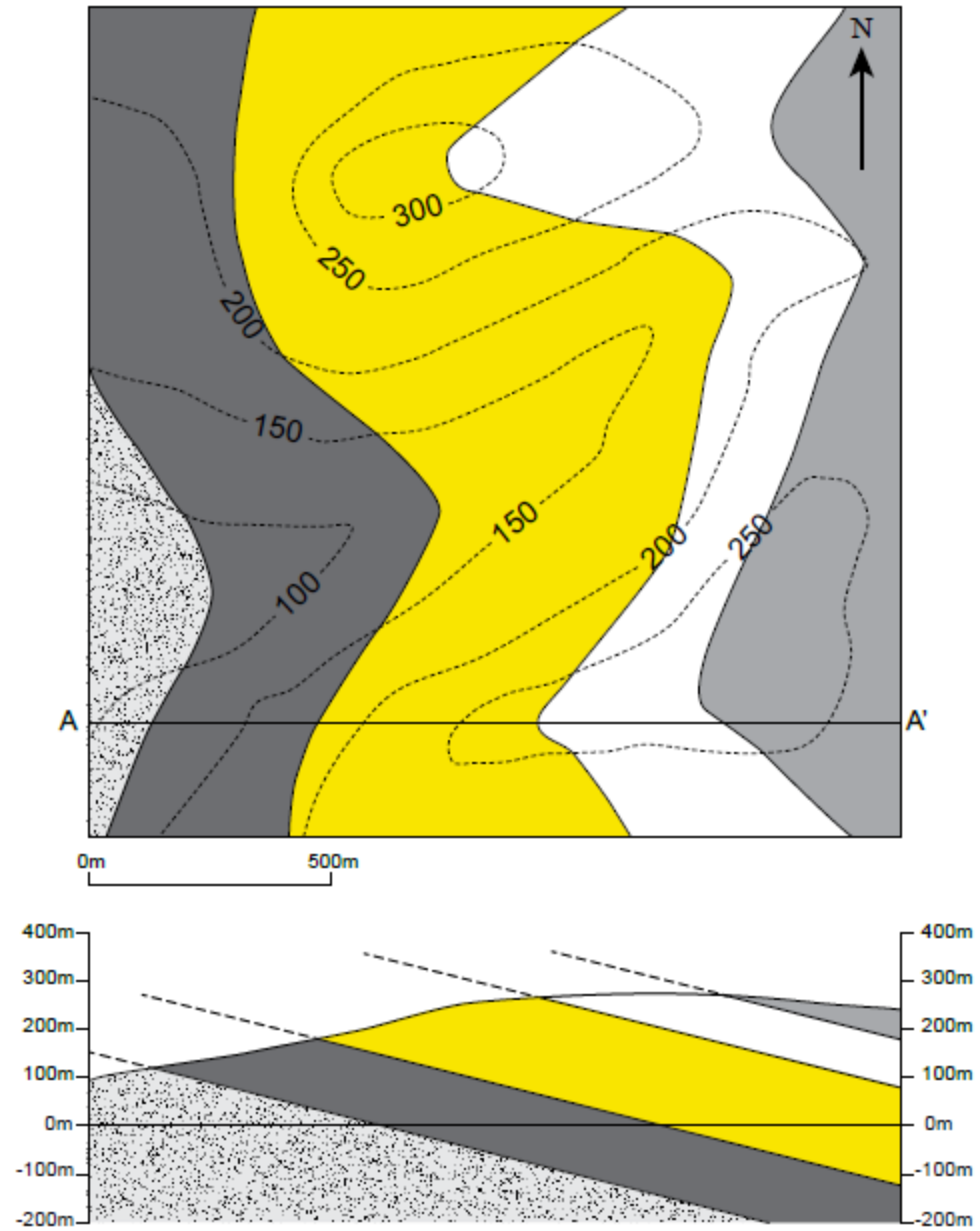
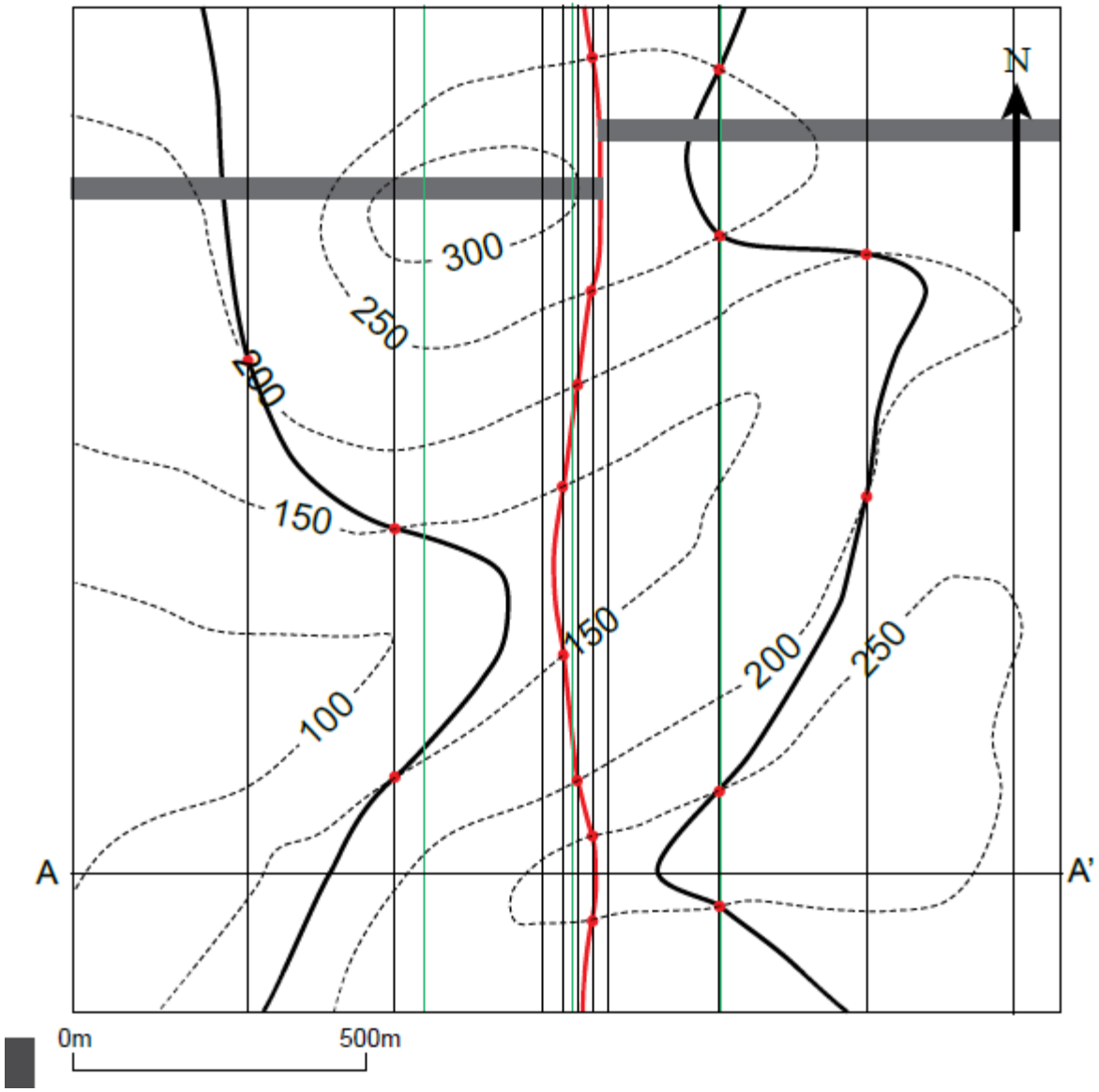
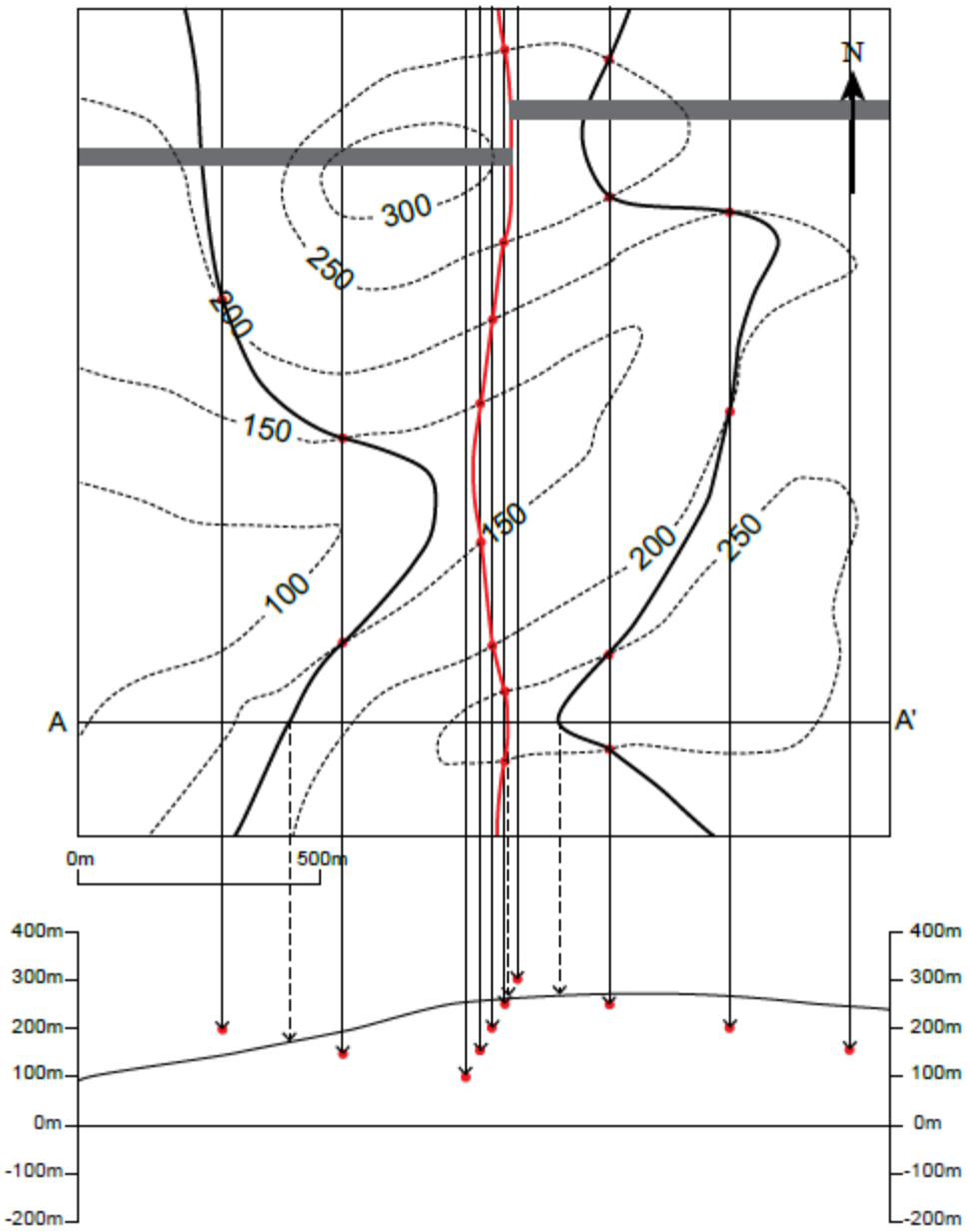
400m
300m
200m
100m
0m
-100m
-200m

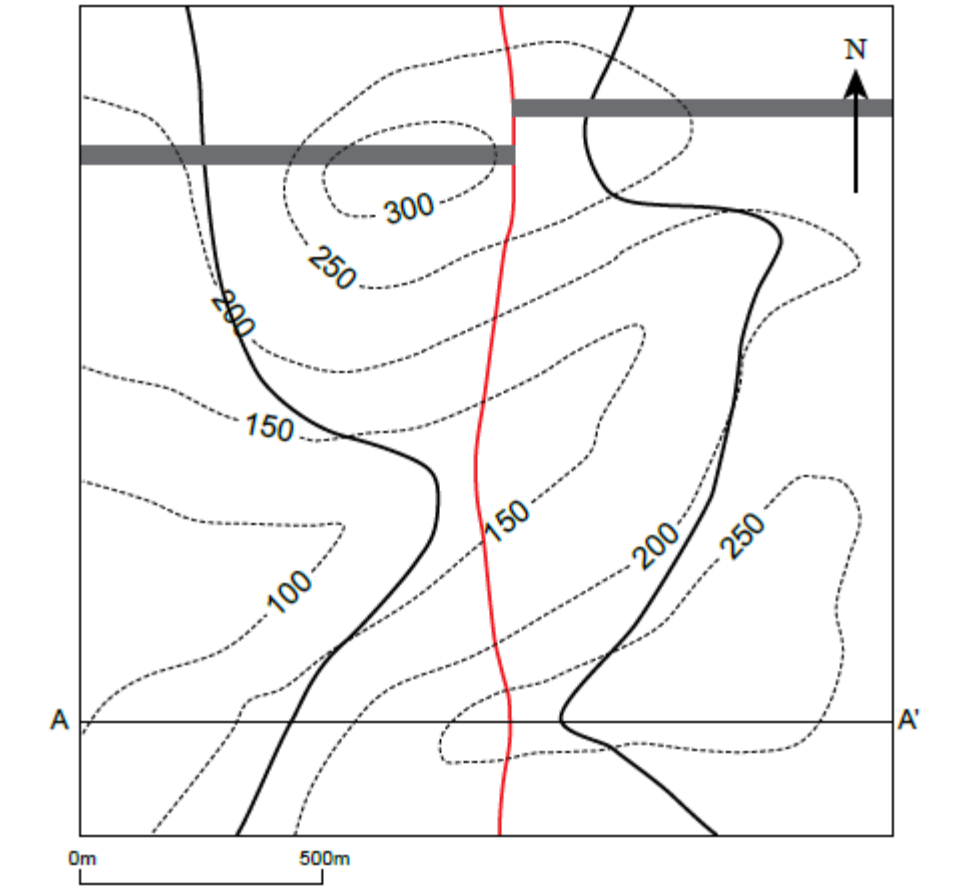

N
300
250
200
150
150
200
250
100
A
A'
0m
500m
400m
300m
200m
100m
0m
-100m
-200m
400m
300m
200m
100m
0m
-100m
-200m

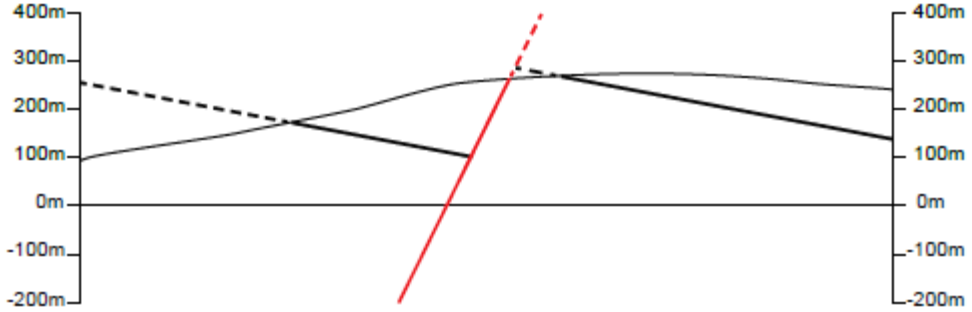

N
300
250
200
150
150
200
250
100
A
A'
0m
500m
400m
300m
200m
100m
0m
-100m
-200m
400m
300m
200m
100m
0m
-100m
-200m

Case 2

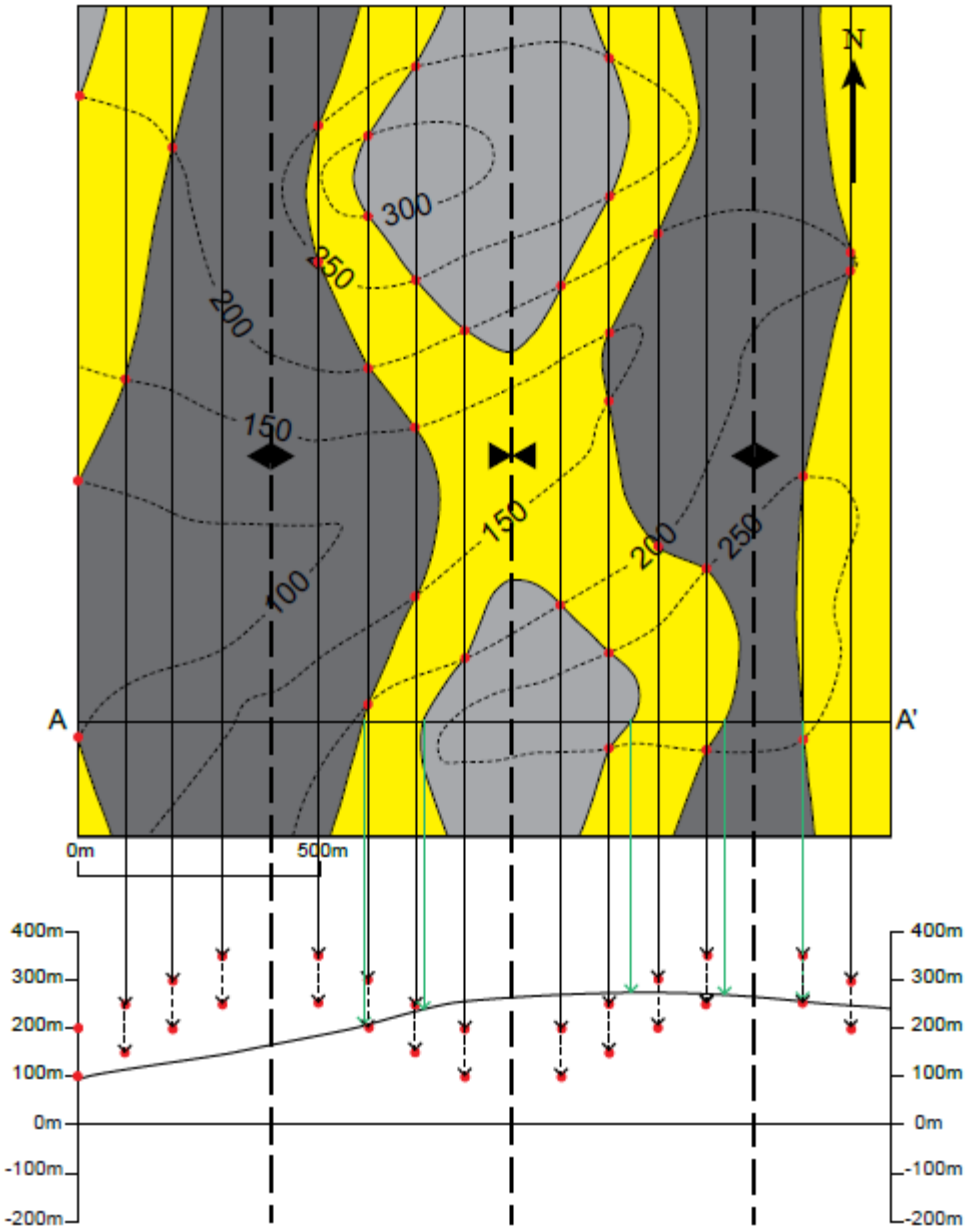


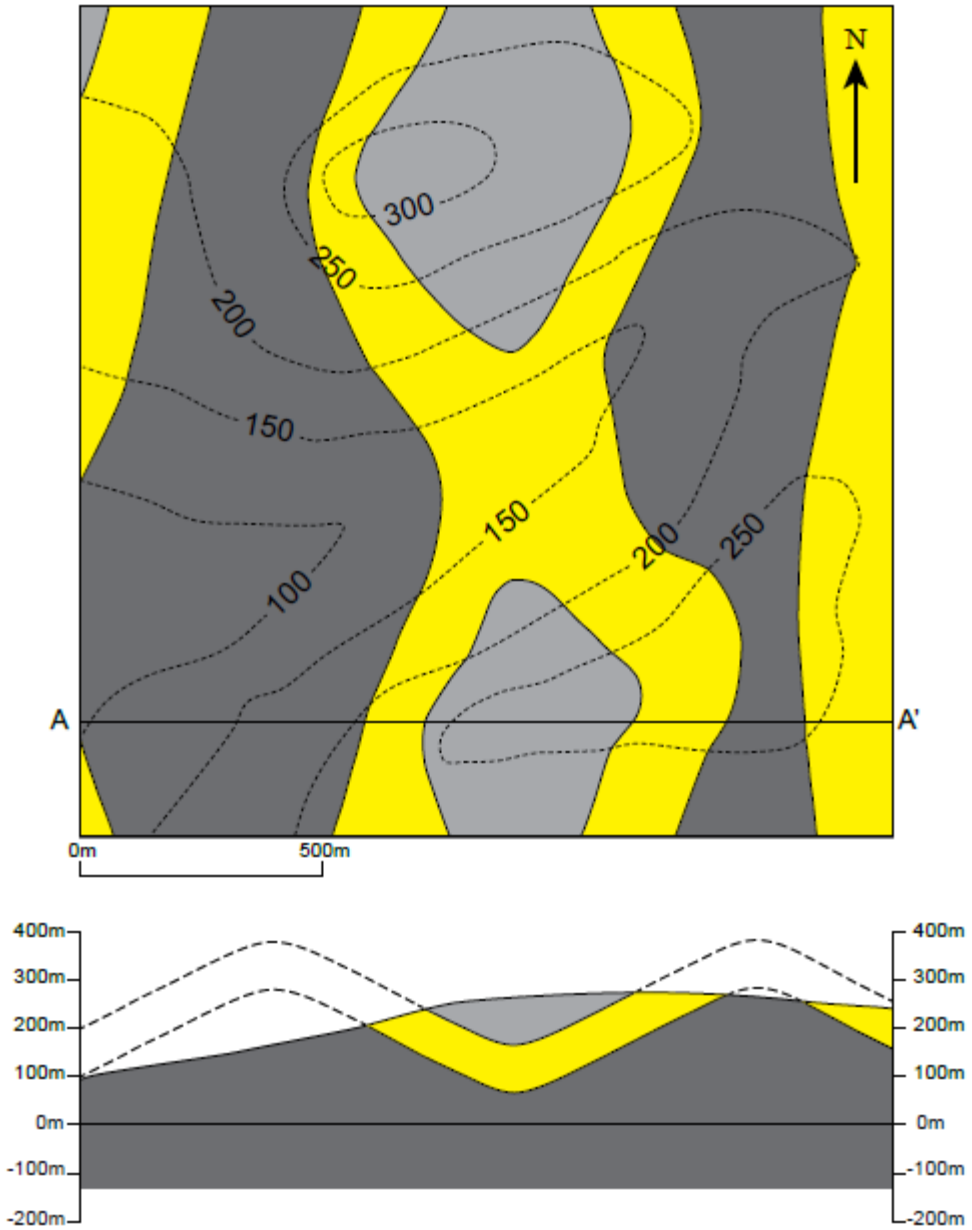

N
300
250
200
150
150
200
250
100
A
A'
0m
500m
400m
300m
200m
100m
0m
-100m
-200m
400m
300m
200m
100m
0m
-100m
-200m


N
300
250
200
150
150
200
250
100
A
A'
0m
500m

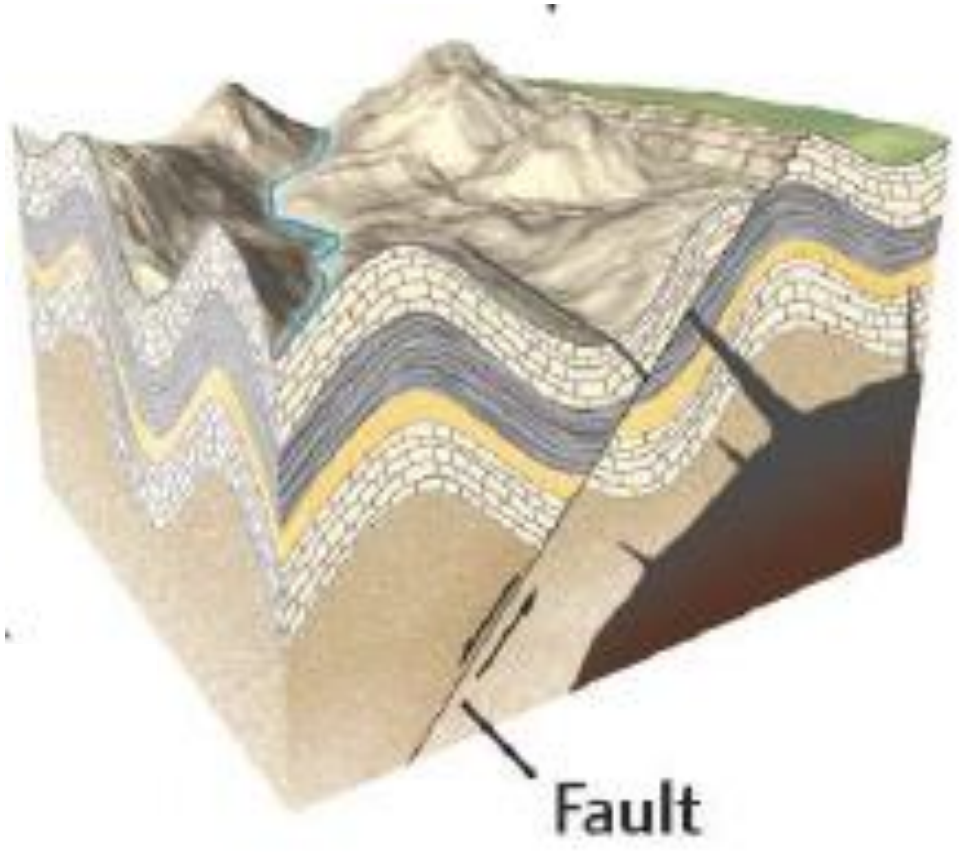

400m
300m
200m
100m
0m
-100m
-200m
400m
300m
200m
100m
0m
-100m
-200m

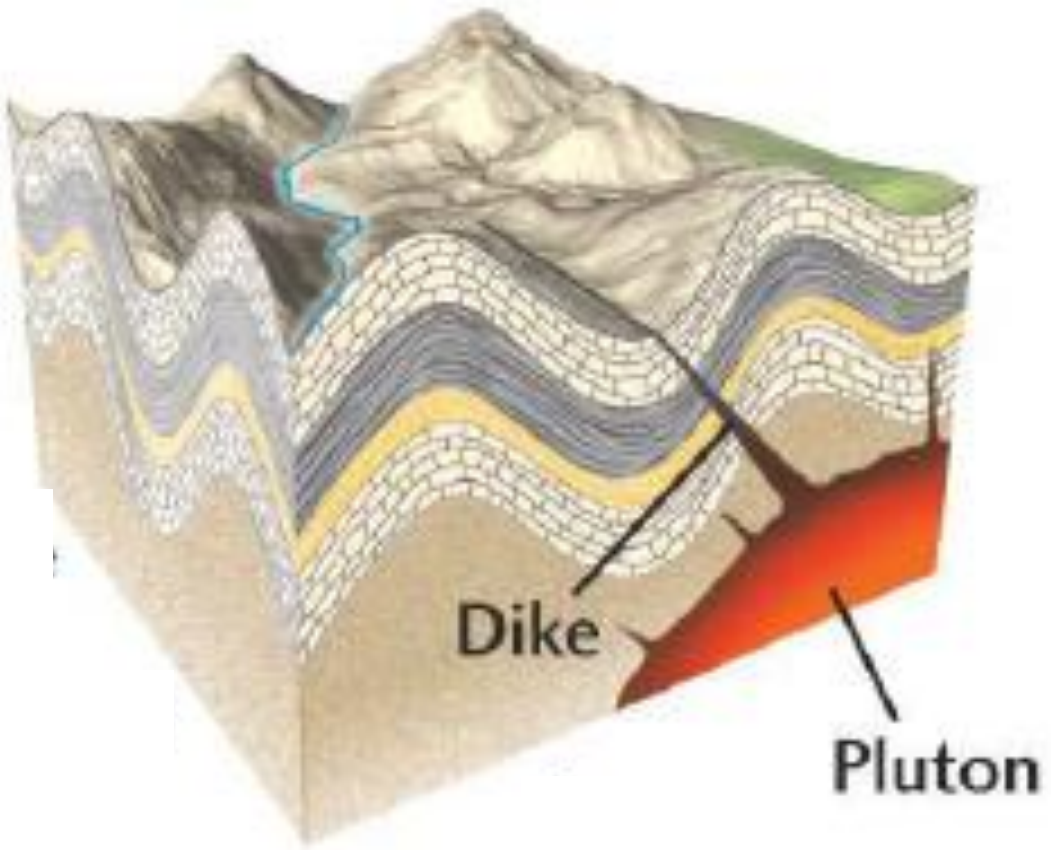
Case 3


N
300
250
200
150
150
200
250
100
A
A'
0m
500m
400m
300m
200m
100m
0m
-100m
-200m
400m
300m
200m
100m
0m
-100m
-200m


N
300
250
200
150
150
200
250
100
A
A'
0m
500m
400m
300m
200m
100m
0m
-100m
-200m
400m
300m
200m
100m
0m
-100m
-200m

Interpretation of geologic maps




Dike
Pluton