Faults

Some exercises adapted from Lisle, R. J., 2004, Geological Structures and Maps, Practical Guide, Third edition

http://www.impacttectonics.org/gcherman/downloads/GEO310/GCH_GESymbols/GCH_GE_Geology_Apps.htm

Faults

From Simple inclined planes:

Spacing between contours = contour interval / tangent (angle of dip)

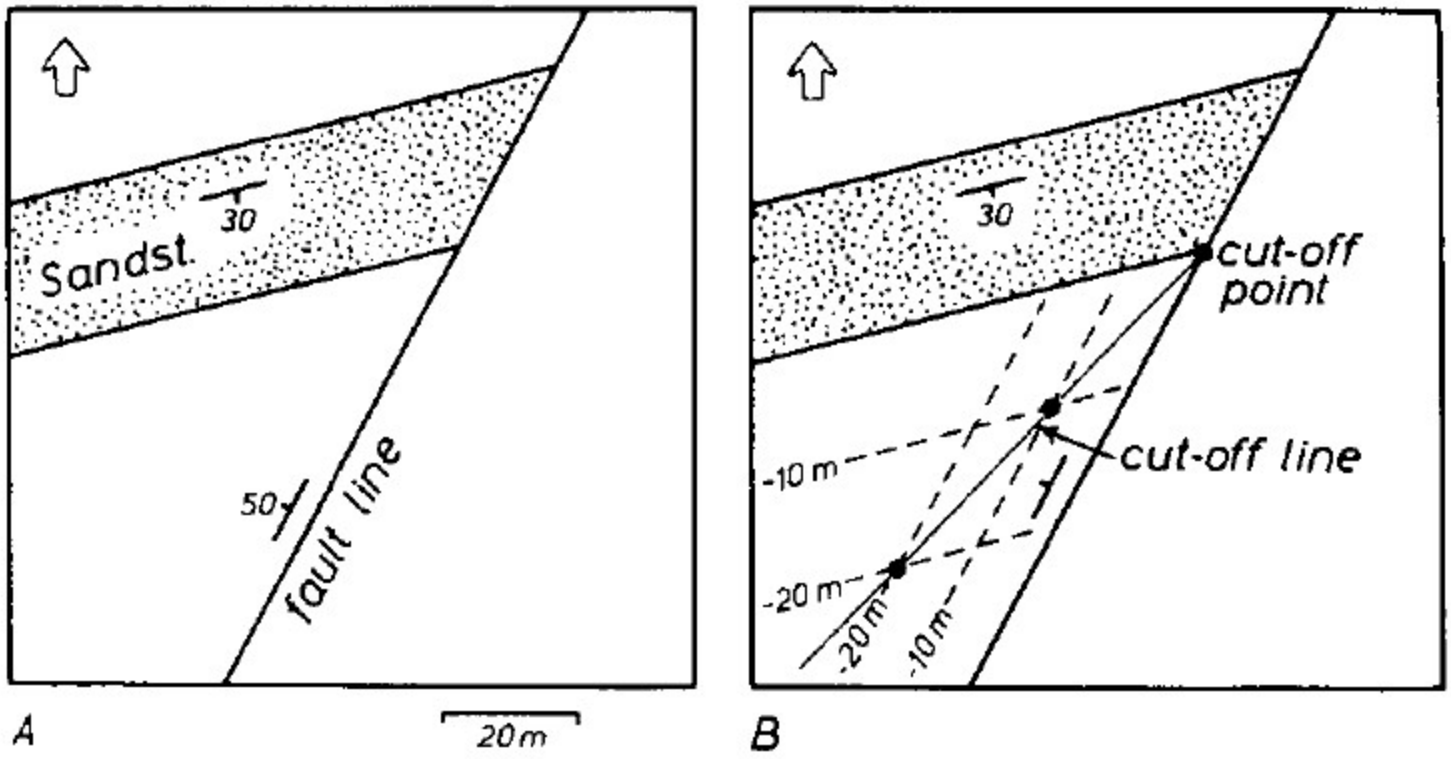


Fig. 4.4

Dip separation is the bed offset in the down dip direction of the fault (Fig. 4.7). The vertical component of the dip separation is called the *throw* and its horizontal component is the *heave*; both of these quantities can be seen in a plane perpendicular to the fault's strike. For a given fault, the ratio of the heave to the throw depends on the fault plane's dip in this manner:

tan (dip of fault) = throw/heave (Fig. 4.7)

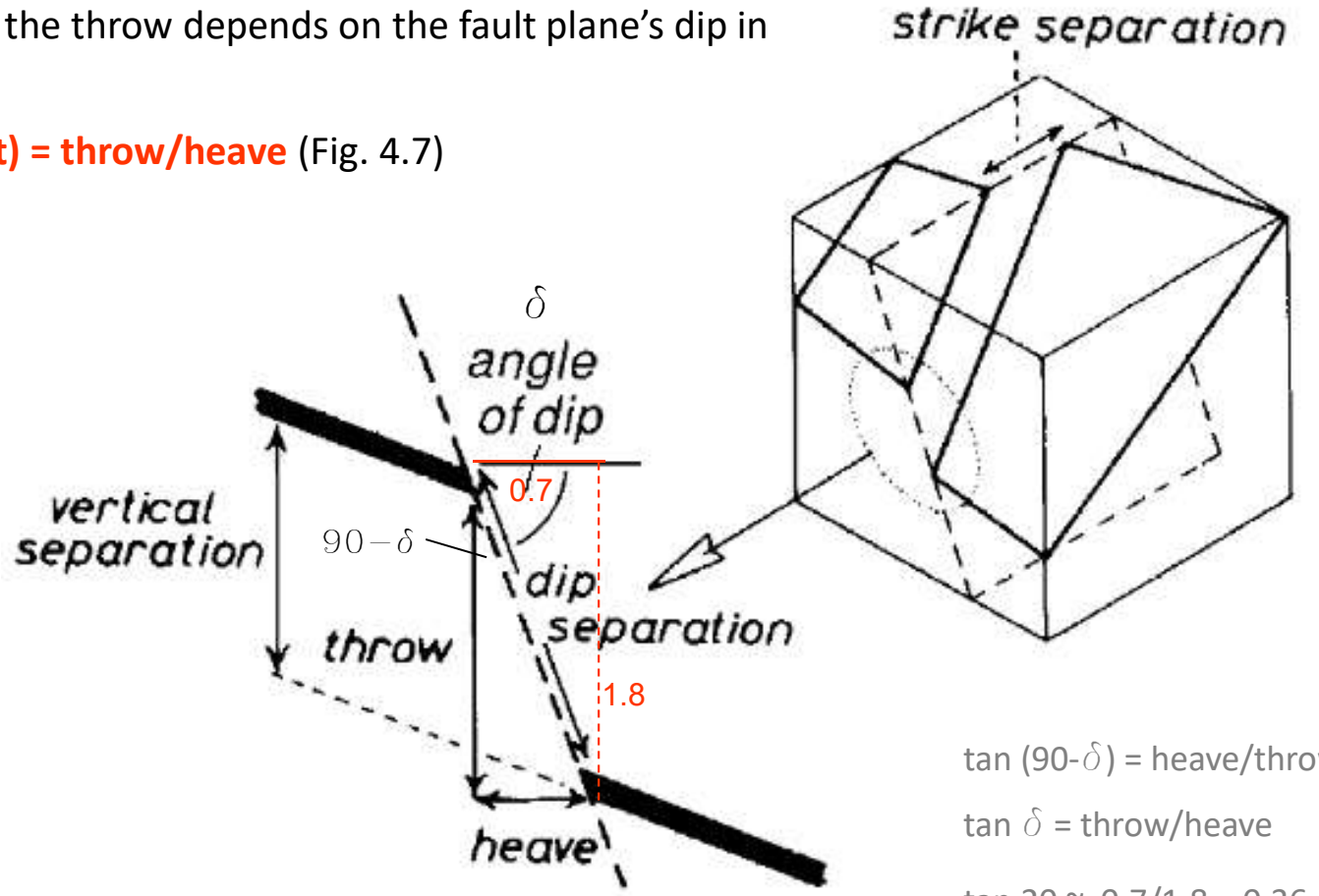


Fig. 4.7 Separation terms.

tan (90-δ) = heave/throw *and*

tan δ = throw/heave

tan 20 ~ 0.7/1.8 = 0.36

tan 70 ~ 1.8/0.7 = 2.70

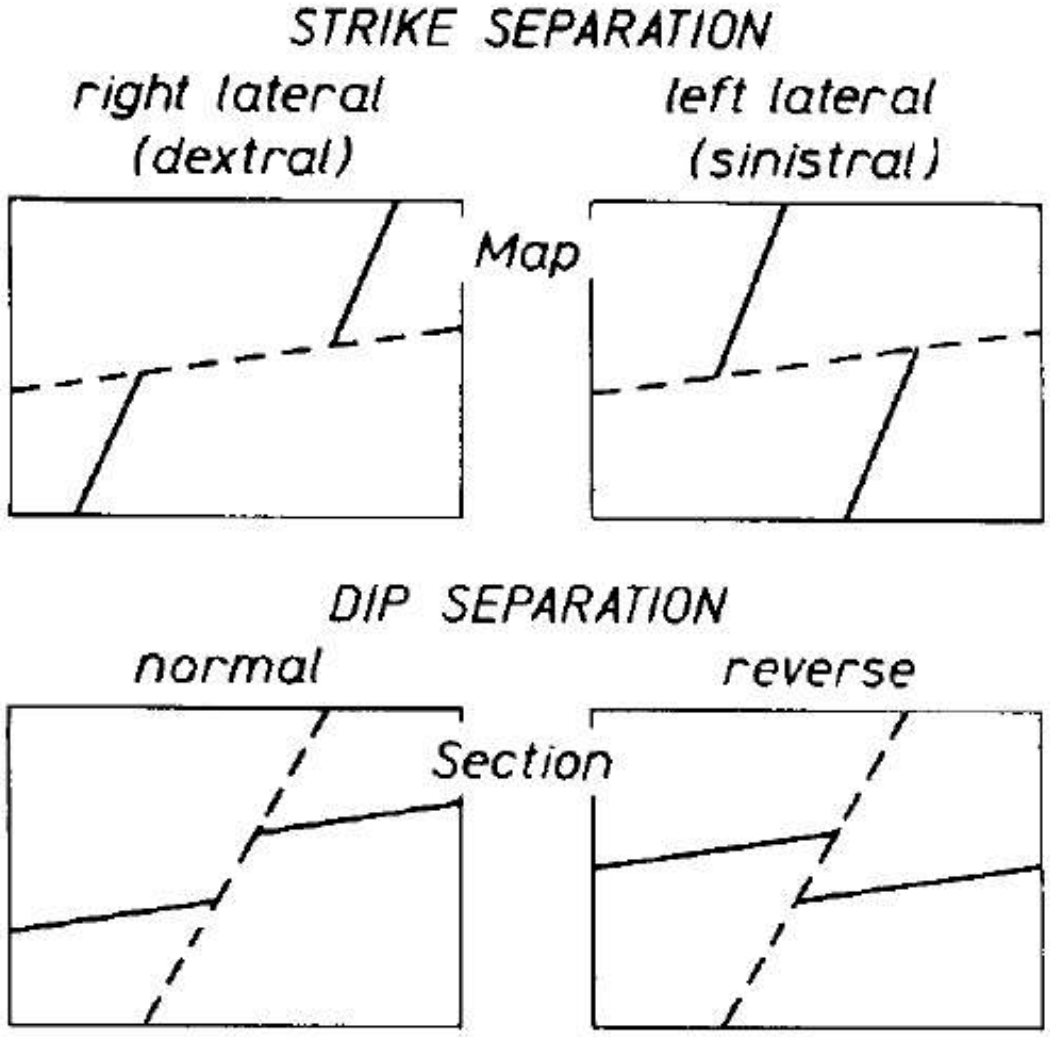
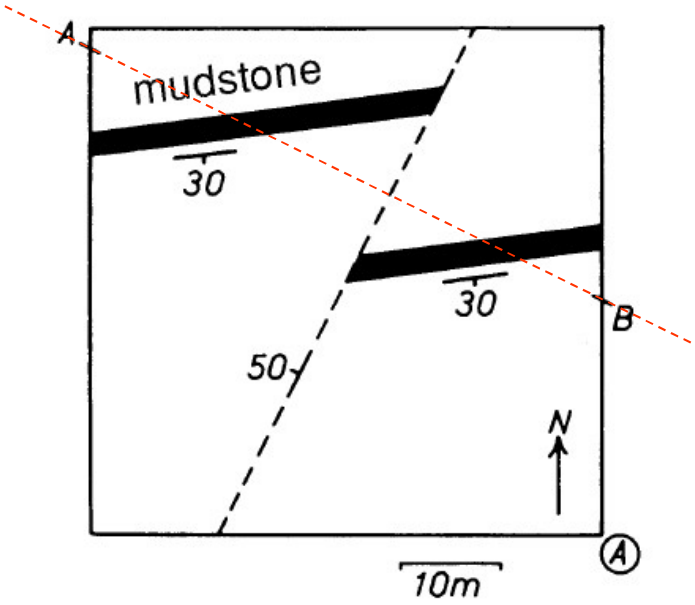
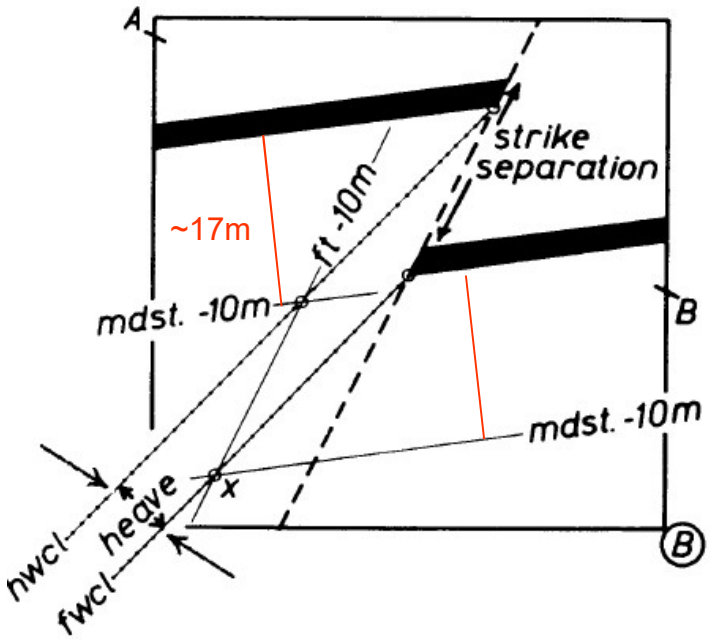


Fig. 4.8 Terms used to describe the sense of separation.





WORKED EXAMPLE

For the fault on the map (Fig. 4.9A) determine (a) the vertical separation, (b) the stratigraphic separation, (c) the strike separation, (d) the dip separation, and (e) the heave.

Structure contours and cut-off lines on the hanging (*hwcl*) and foot walls (*fwcl*) are constructed (using the method of the worked example in Section 4.1).

The vertical separation is determined by selecting any point on the map and calculating the height difference of the two displaced parts of geological surface. For example at point *x* (Fig. 4.9B),

height of mudstone bed in hanging wall = −10 m
height of mudstone bed in foot wall = −20 m
height difference = (−10) − (−20)
= 10 m = vertical separation
the stratigraphic separation = vertical separation × cos (dip)
= 10 m × 0.64 = 6.4 m.

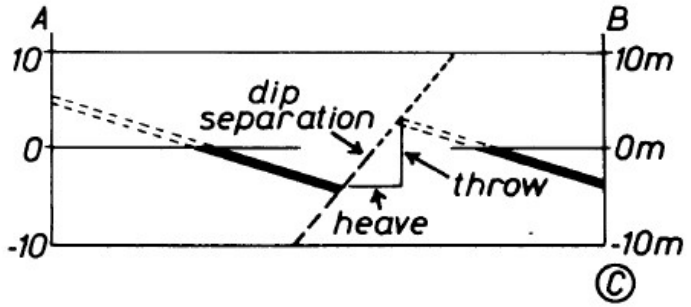


Fig. 4.9

The vertical separation is determined by selecting any point on the map and calculating the height difference of the two displaced parts of a geological surface.

For example at point *x* (Fig. 4.9B),

height of mudstone bed in hanging wall = –10m

height of mudstone bed in foot wall = –20m

height difference = (–10) – (–20)

= 10 m = vertical separation

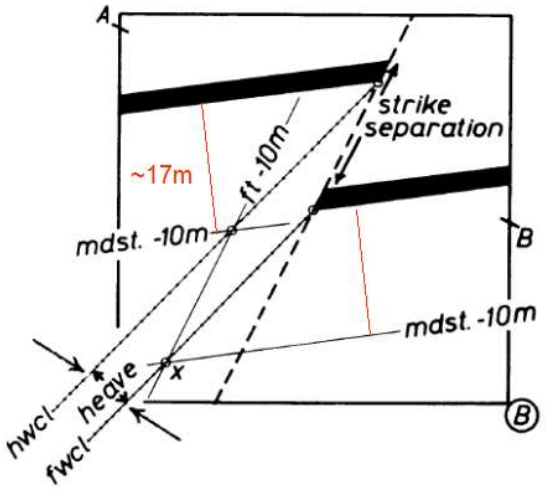
the stratigraphic separation = vertical separation x cos (fault dip) =

10m * 0.64 = 6.4 m.

From Section 43., page 61:

The *stratigraphic separation is the* shortest distance between two parallel planes, or the distance measured in a direction which is perpendicular to these planes.

Map



Cross Section

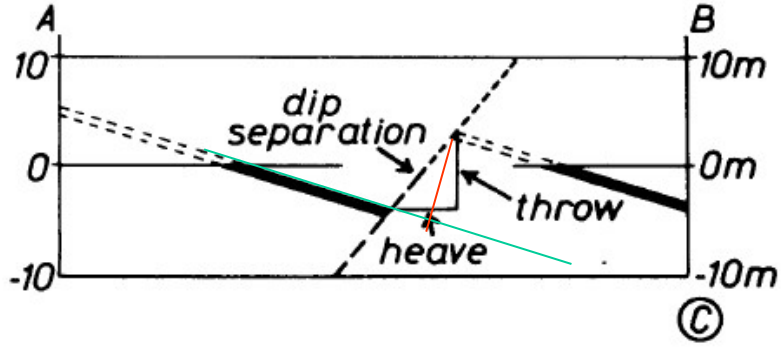


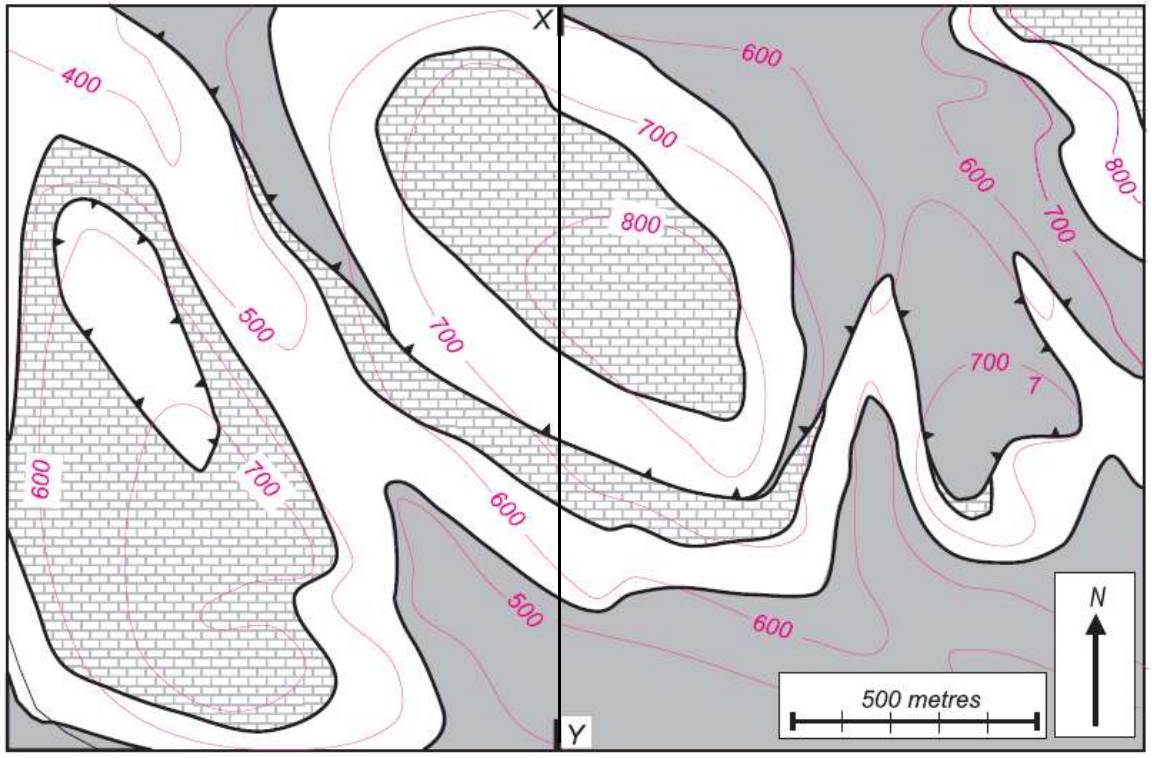
Fig. 4.9

PROBLEM 4.5

Determine the attitude (dip and dip direction) of the fault.
Draw a cross-section along the line X–Y.

Find the dip separation, throw, heave, vertical separation and strike separation of the fault.
Give a name to this fault.

Map



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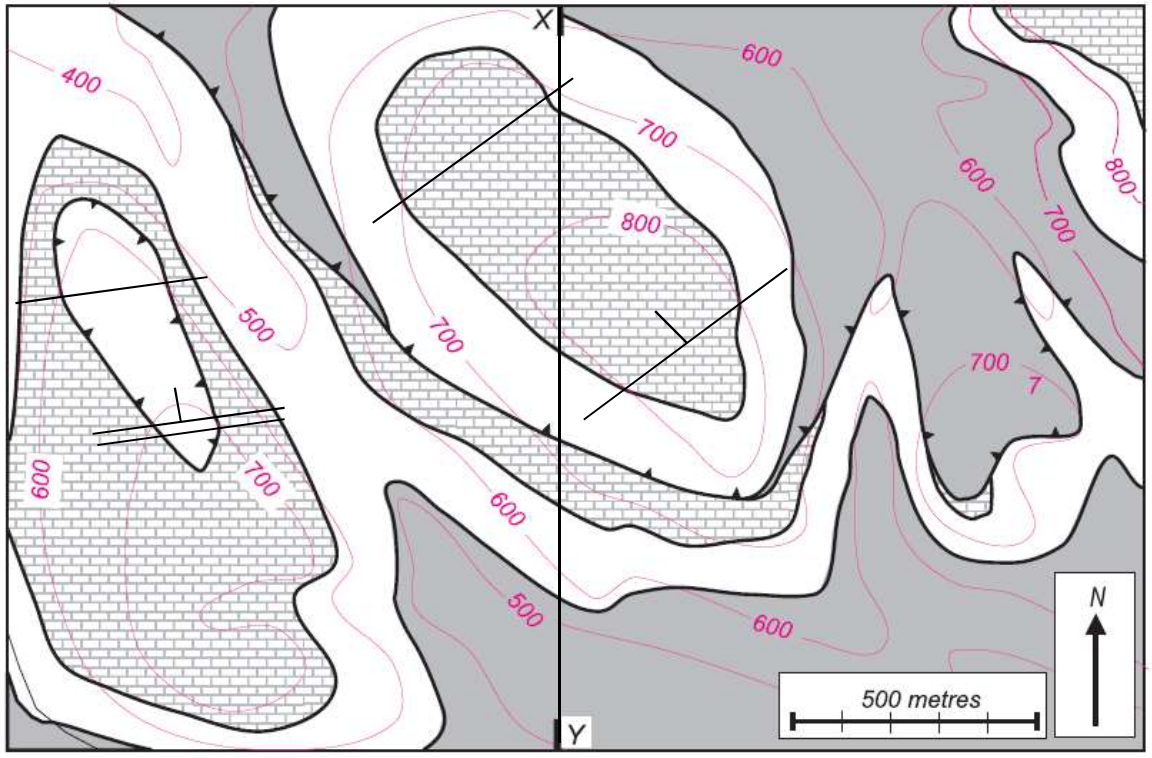

Fault strike / dip = 087 / 18 N

(TAN dip = 100 m / 300 m)

Bedding strike / dip = 050 / 9 N

(TAN dip = 100 m / 600 m)

40° DA deviation

Apparent dip ~ 7°

PROBLEM 4.5

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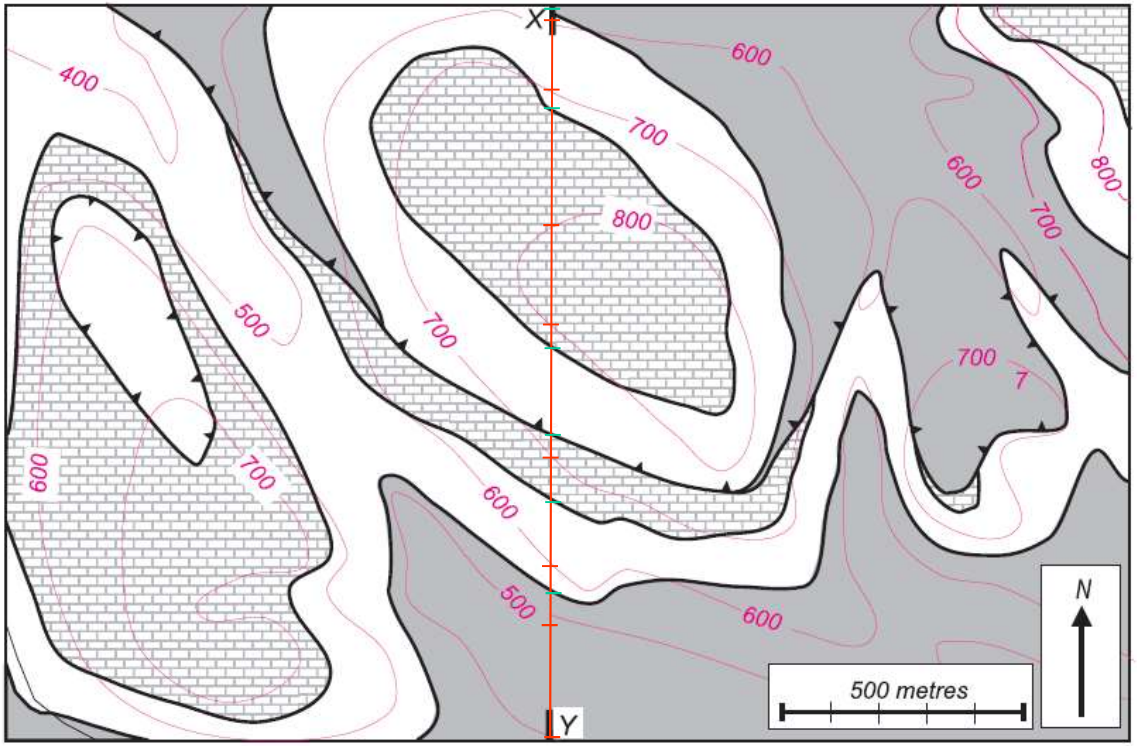
Find the dip separation, throw, heave, vertical separation and strike separation of the fault.
Give a name to this fault.



MAP

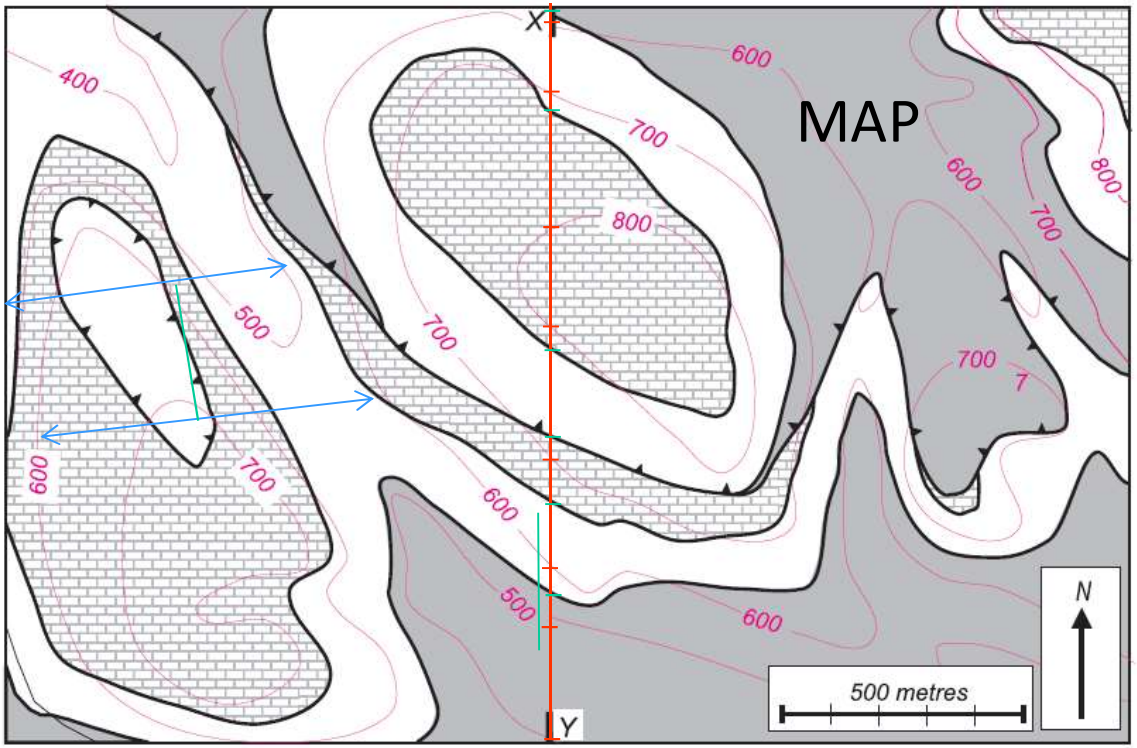
Cross Section

PROBLEM 4.5

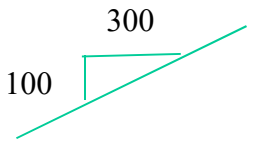
Determine the attitude (dip and dip direction) of the fault. Draw a cross-section along the line X–Y.

Find the dip separation, throw, heave, vertical separation and strike separation of the fault.

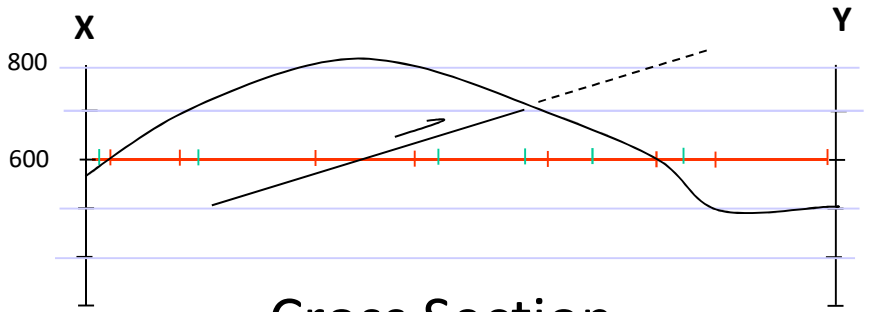
Give a name to this fault.



True fault dip ~18°



Dip azimuth deviation from the section line is <10° so the dip of the fault is just less than 18, or ~17°. In the section.



Cross Section

26° profile dip with bed dip/dip azimuth 26/320 and alpha (dip-azimuth deviation) ~24°

Apparent dip of ??

PROBLEM 4.5

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Draw a cross-section along the line X–Y.

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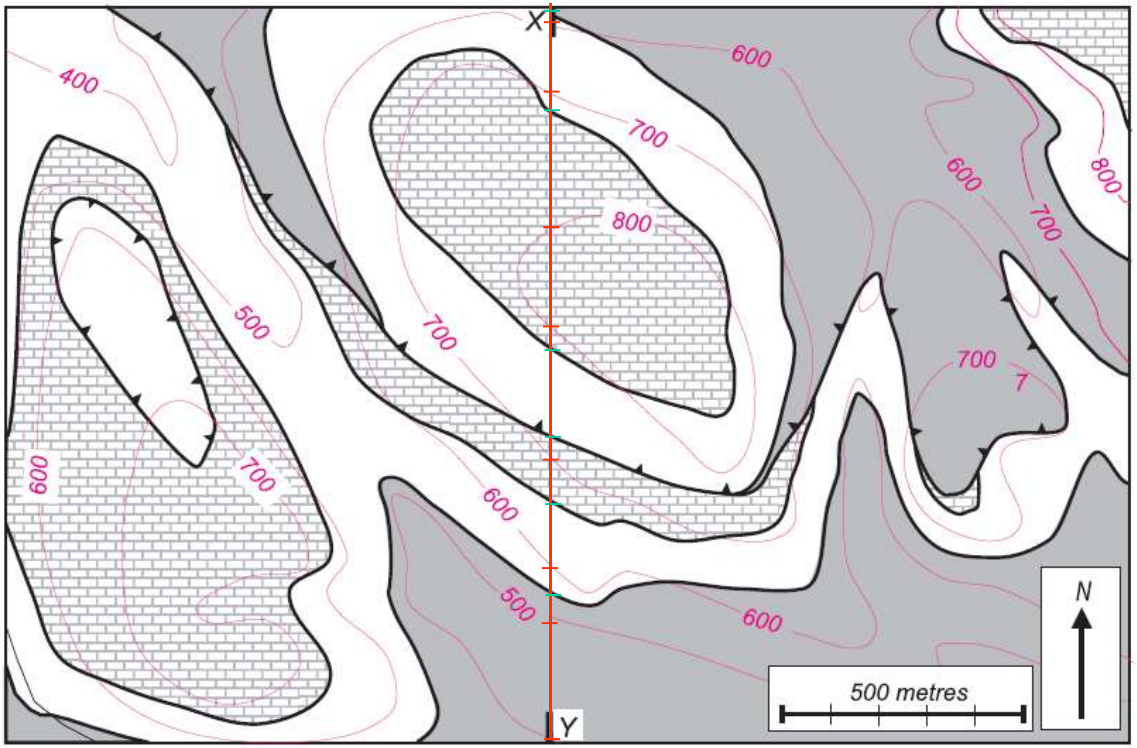
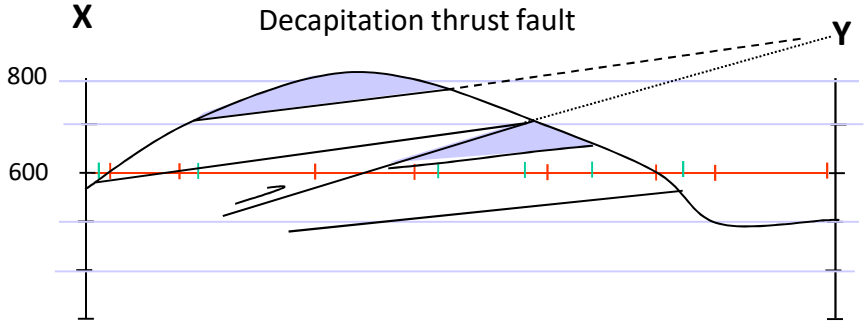
Give a name to this fault.



MAP



Cross Section

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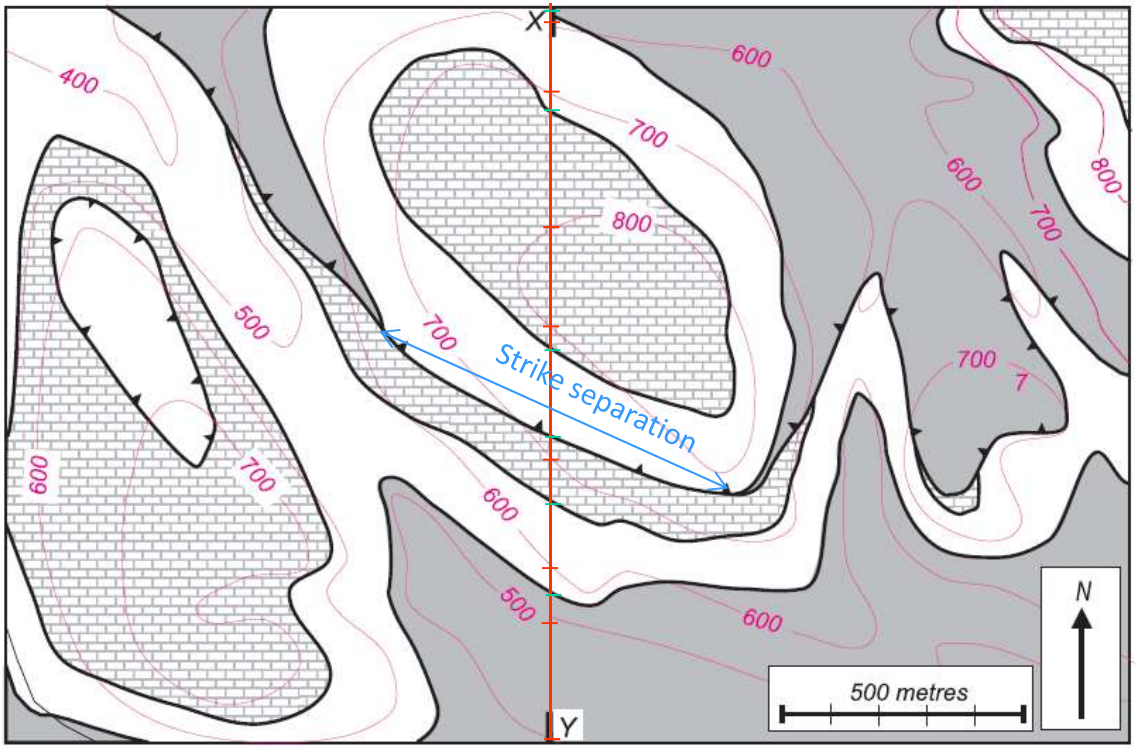
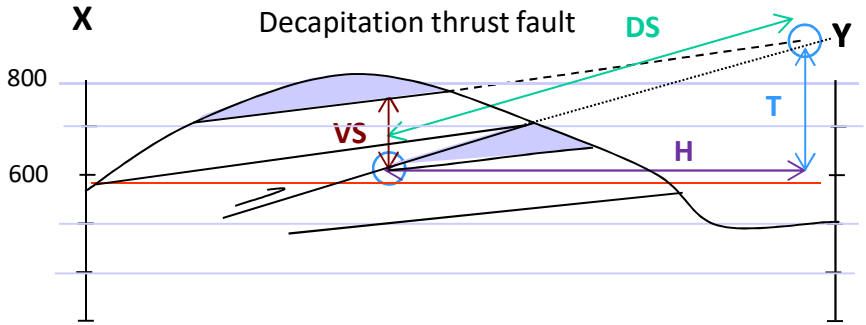
Draw a cross-section along the line X–Y.

Find the dip separation, throw, heave, vertical separation and strike separation of the fault.
Give a name to this fault.



MAP



Cross Section

DS Dip separation
VS Vertical separation
T Throw
H Heave

HOMEWORK

PROBLEM 4.3

Using the method described in 4.3, calculate:

(a) the strike separation, and
(b) the heave of the thrust fault.

Construct a cross-section along the line X-Y and determine:

(c) the dip separation, and
(d) the throw of the thrust fault.