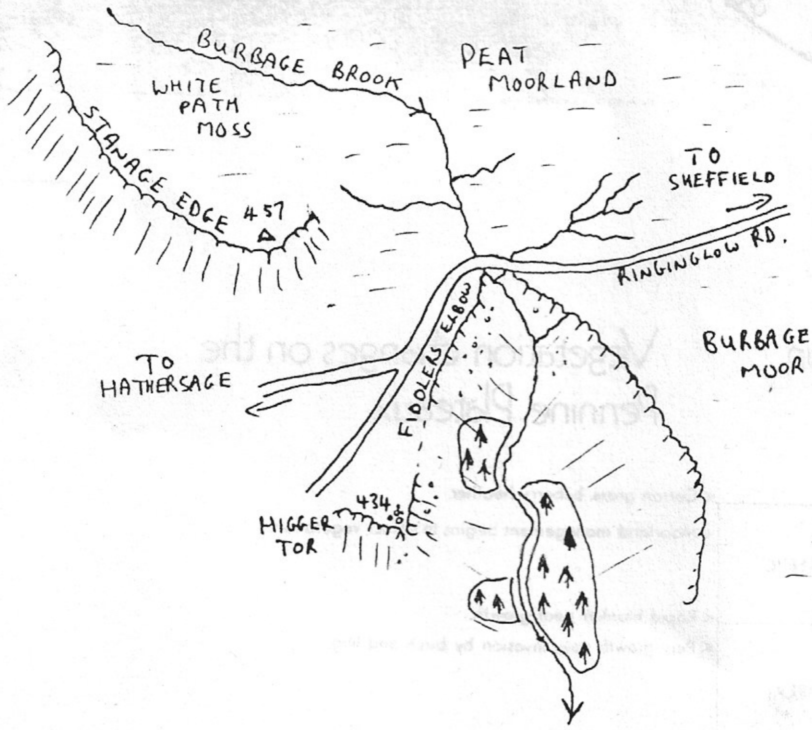
A RIVER AND ITS VALLEY

THE VALLEY

You will be studying the valley of BURBAGE BROOK. Burbage brook is a small stream found in the Peak District to the west of Sheffield. It rises on a GRITSTONE MOORLAND to the east of STANAGE EDGE. Initially it meanders over a level plateau of PEAT, cutting a narrow steep sided gully known as a GROUGH. South of Upper Burbage Bridge it descends rapidly and has cut a steep sided valley bounded by millstone grit edges; BURBAGE ROCKS to the east and FIDDLERS ELBOW to the west.

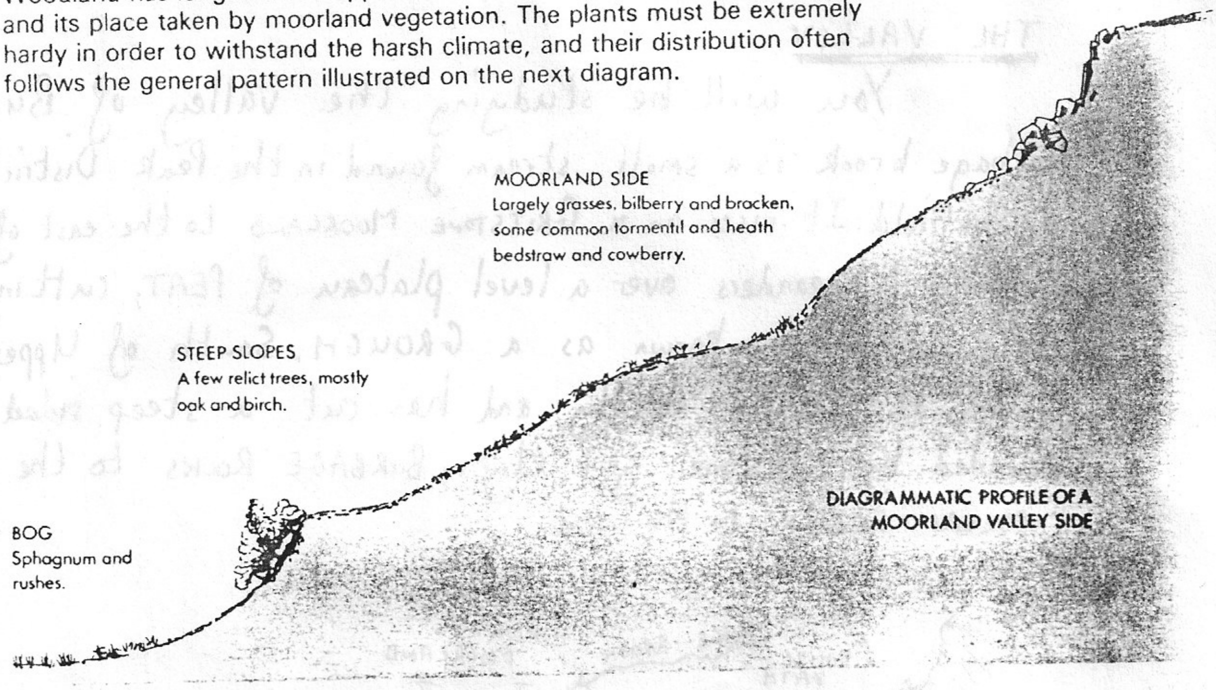


Vertical erosion by the stream has cut the steep-sided valley and more recently rejuvenation may have caused even more incision in the lower valley The valley sides below the edges (cliff faces) are covered with gritstone blocks which have been broken off the edges by FROST SHATTERING. It is likely that much of this weathering and downslope movement took place in the periglacial times which followed the last glaciation. SOLIFLUCTION may have caused the downslope movement of debris and produced the hill-top and hillside tors.

The following 3 pages show the general characteristics of the valley-side slopes and the downslope vegetation changes.

Gritstone Moorlands

Woodland has long since disappeared from most of the gritstone upland and its place taken by moorland vegetation. The plants must be extremely hardy in order to withstand the harsh climate, and their distribution often follows the general pattern illustrated on the next diagram.

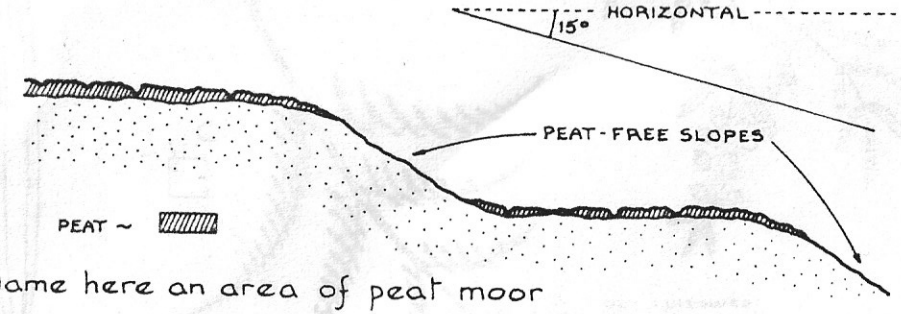


Vertical section through peat.

Vegetation changes on the Pennine Plateaux

1980 AD		< Cotton grass, bilberry, heather.
	SUB ATLANTIC	< Moorland management begins to affect vegetation.
	iron age	
600 BC		< Rapid blanket peat growth.
	bronze age	< Peat growth slow, invasion by birch and ling.
	SUB BOREAL	
	neolithic	
3000 BC		
	mesolithic	< Sphagnum and formation of blanket peat.
	ATLANTIC	
		< Open alder/birch community.
5500 BC		
	BOREAL	< Open oak/birch/pine forest.
7600 BC		< Open juniper/birch community.
	PRE BOREAL	
9000 BC		< Tundra with few trees, juniper/rowan.

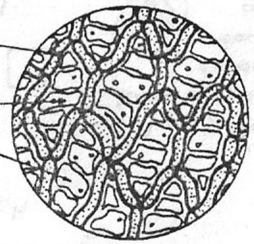
Large areas of high moorland are covered by 'blanket bogs' of thick peat. This peat cover is rarely found below 1,200 feet above sea level, or on slopes of more than 15°.

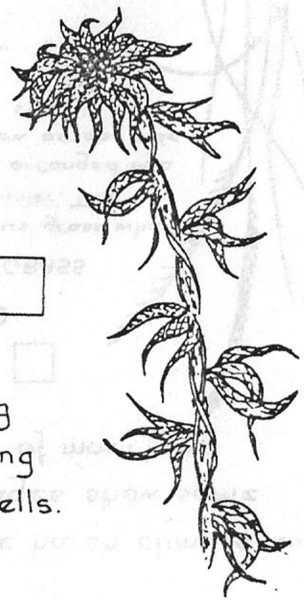


Name here an area of peat moor which you visit:- ....

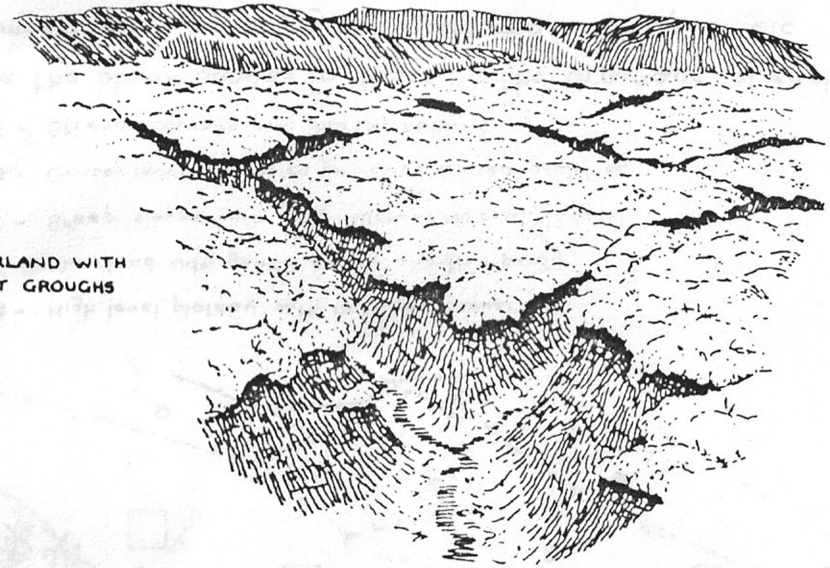
Use a map to find its height above sea level:- ....

Peat began to form on the hills about 7,500 years ago, when the climate of Britain became very wet. It consists of the undecayed remains of moorland plants, chiefly sphagnum moss, cotton sedge and heather. Decay is incomplete because the gentle slopes are often waterlogged, discouraging the bacteria which cause decay.





Bright green sphagnum moss is a major peat forming plant. The microscope reveals its living green cells around sponge-like dead cells. Find it in wet moorland hollows.

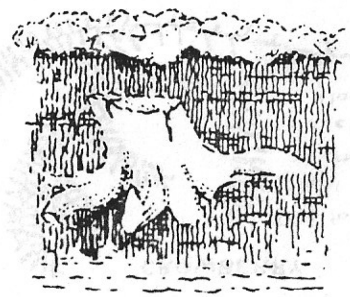


MOORLAND WITH PEAT GROUGHS

Very little new peat is forming in the Peak District because sphagnum moss is much less common than it was. A slightly drier climate, moorland drainage schemes and air pollution from cities are thought to have caused this. In many areas the peat is being washed away by streams which cut deep gullies or 'groughs' in the peat cover. Isolated blocks of peat are known as 'hags'.

Use the side of a grough to measure or estimate the depth of peat:- ....

PEAT HAG

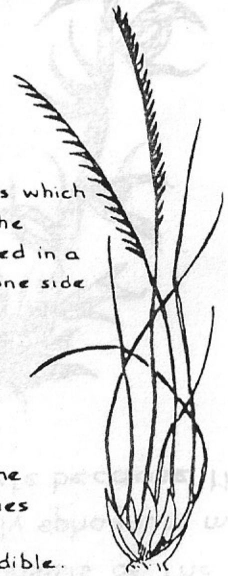


In some places, tree roots can be seen buried in the peat. They are the remains of former woodland which was destroyed by developing peat bogs.

Tick if seen:-

MOORLAND PLANTS

Relatively few plants can survive in the harsh climate and poor soils of the high moors. These pages show some typical moorland plants, and the type of moorland on which they are commonly found.
Tick the ones you identify.
List any others which you find.



☐ D

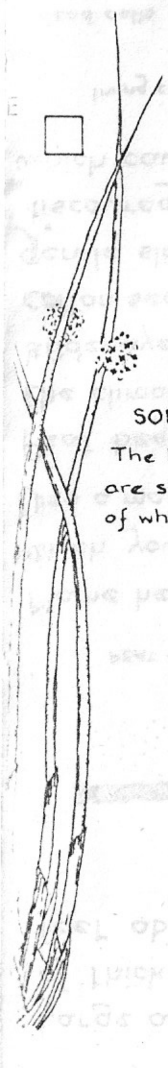
MAT GRASS

A wiry, deciduous grass which turns whitish in winter. The seeds are arranged in a double row on one side of the stem.

B, C ☐

BILBERRY

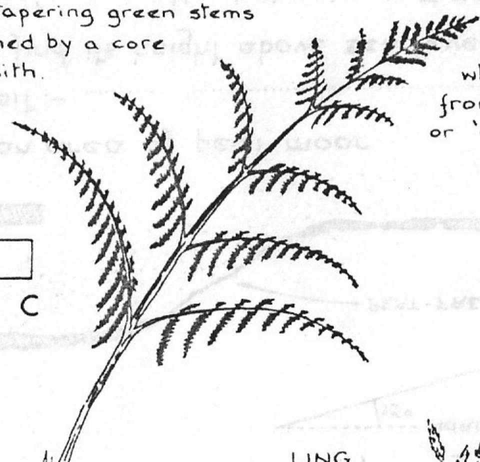
A green stemmed deciduous plant. The purplish black berries which develop from pink flowers are edible.



E ☐

SOFT RUSH

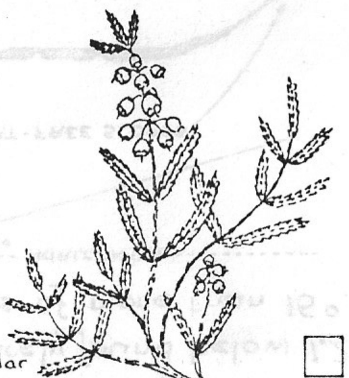
The long tapering green stems are stiffened by a core of white pith.



BRACKEN

Tall, branched ferns which spring annually from underground stems or 'rhizomes'.

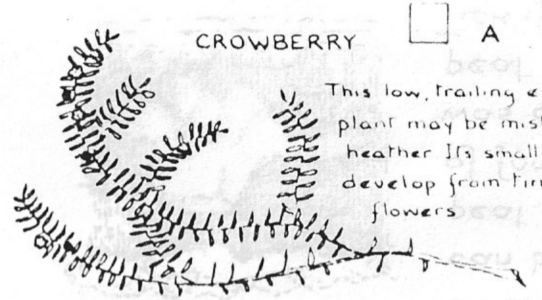
☐ C



LING

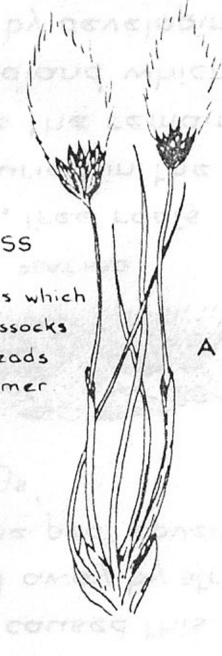
A woody-stemmed plant with tiny triangular evergreen leaves and pale purple flowers. It is more commonly known as heather.

☐ B



CROWBERRY ☐ A

This low, trailing evergreen plant may be mistaken for heather. Its small black berries develop from tiny pink flowers.



COTTON GRASS

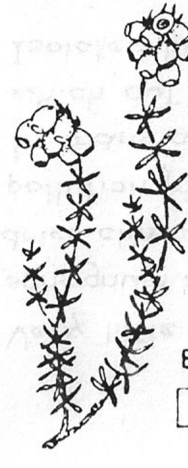
A moorland grass which grows in dense tussocks. The cotton seed heads can be seen in summer.

☐ A

SPHAGNUM

A bright green, feathery sponge-like moss.

E ☐



CROSS-LEAVED HEATH

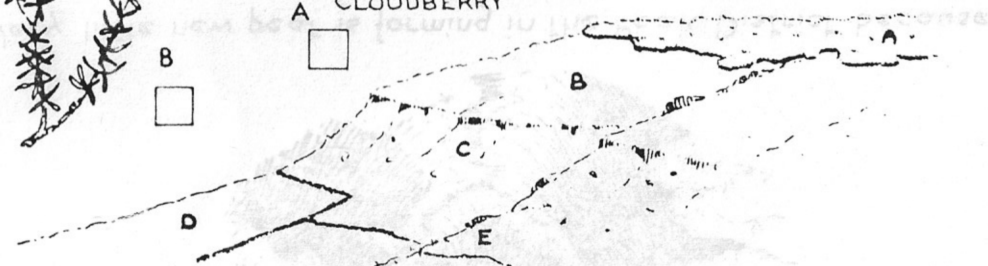
Pink flowers, and leaves in whorls of four distinguish this plant.

B ☐

CLOUDBERRY

The orange berry of this creeping broad leaved plant follows a white flower.

A ☐



- **A** - High, level plateau with thick peat cover. ....
- **B** - Moorland with gentle slopes and thin peat ....
- **C** - Steep slopes with rock outcrops No peat (Edges) ....
- **D** - Grassy moorland, often formerly enclosed, peat free ....
- **E** - Stream courses and marshy hollows ....

Use the blank spaces to describe the <u>drainage</u> of each type of moorland, e.g. very good, good, moderate, poor etc.

VALLEY CROSS SECTION

The valley side slope will be surveyed at two places in the upper valley. This will produce the data required for two cross sections. Since the rock type does not vary it will enable you to look at the influence of other factors on valley side steepness or shape.

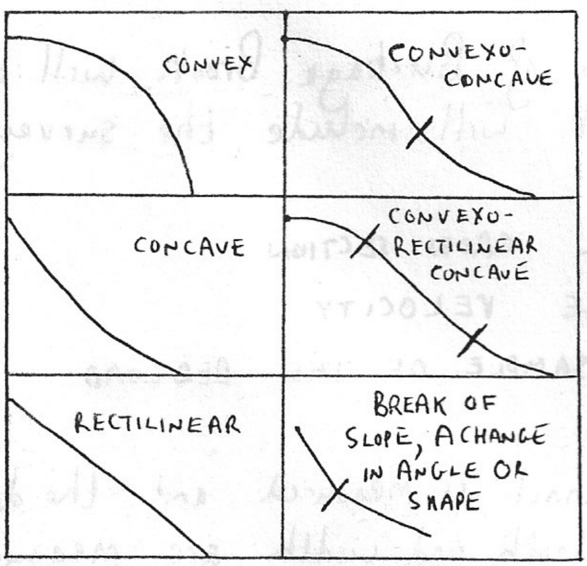
Does valley side steepness and shape change downstream?

Does aspect affect valley side shape and steepness?

Does speed of erosion by the stream affect valley side steepness?

Terminology

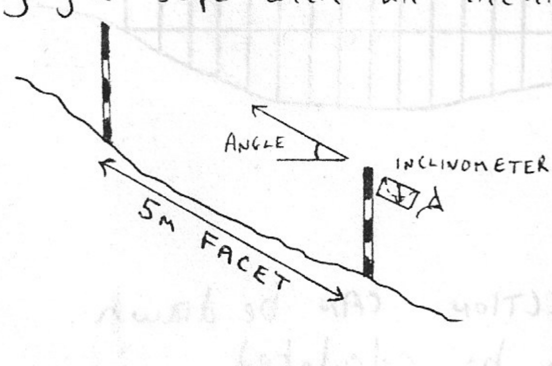
Typically slopes may have any of the following forms in profile



- EACH ELEMENT OF THE SLOPE IS KNOWN AS A SEGMENT
- THE STEEPEST SECTION OF SLOPE IS KNOWN AS THE MAXIMUM SEGMENT

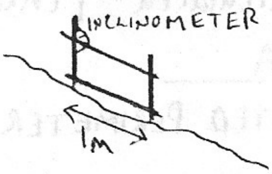
FIELDWORK

(i) Surveying a slope with an inclinometer



A 5m facet is measured with the tape and the two ends marked with ranging poles. The angle of the facet is measured with an inclinometer and the lower pole moved 5m above the upper pole.

(ii) Surveying a slope with a pantometer.

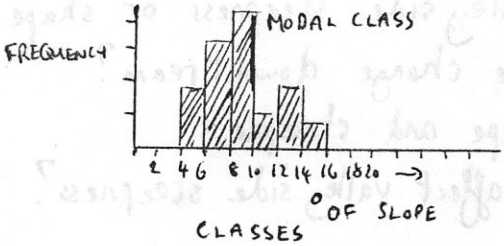


The pantometer has a built in inclinometer and measures the angle of a 1m facet.

FOLLOW-UP WORK

a) CROSS SECTIONS can be drawn with segments labelled.

b) SLOPE HISTOGRAMS can be drawn to compare the upstream and downstream section and the east and west facing slopes



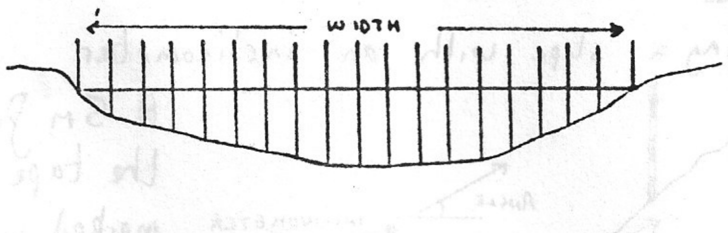
Modal values can be indicated.

THE RIVER

The main features of Burbage Brook will also be surveyed. The fieldwork will include the surveying of.

1. THE CHANNEL CROSS SECTION
2. THE AVERAGE VELOCITY
3. A RANDOM SAMPLE OF THE BED LOAD

1. The width of the channel is measured and the depth noted at 10cm intervals. The depth and width are measured and noted in metres (10cm = 0.1m)



FOLLOW-UP WORK

a) A channel CROSS SECTION CAN be drawn.

b) AVERAGE DEPTH can be calculated.

c) The CROSS SECTIONAL AREA can be calculated. It is WIDTH x AV. DEPTH.

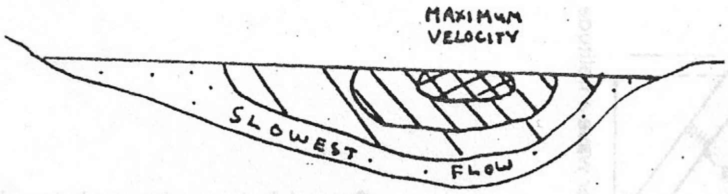
d) The HYDRAULIC RADIUS can be calculated (channel efficiency)

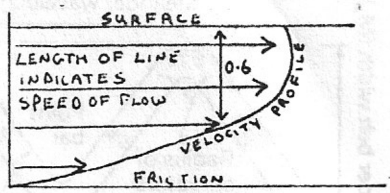
$$\text{Hydraulic radius} = \frac{\text{AREA}}{\text{WETTED PERIMETER}}$$

2. The average velocity is calculated using a FLOW METER, or an orange

AVERAGE VELOCITY using the flow meter is found at 0·6 of the depth from the surface.

AVERAGE VELOCITY using a floating orange is 0·8 of the average velocity of the orange.





FOLLOW-UP WORK

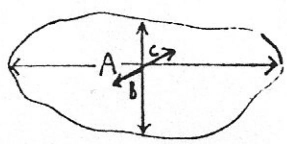
a) Average velocity can be calculated, several runs are needed. units are m/sec

b) The DISCHARGE can be calculated

DISCHARGE = CROSS SECTION AREA x VELOCITY

units are cumecs (cubic metres / sec)

3. A RANDOM SAMPLE of 30 bed load pebbles are taken and the LONG, INTERMEDIATE and SHORT AXES measured.



TYPICAL SIZES

SEDIMENT CLASS	AXIS A (mm)
BOULDERS	>256
COBBLES	64-256
GRAVEL	2-64
SAND	0·06-2·2

Gravel can be sub-divided:

COARSE GRAVEL	20-64 mm
MEDIUM GRAVEL	6-20
FINE GRAVEL	2-6

FOLLOW-UP WORK

a) The AVERAGE LONG AXIS can be calculated.

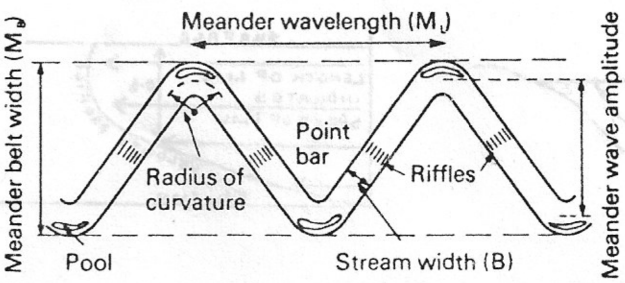
b) A DISPERSION DIAGRAM can be drawn to illustrate the MEDIAN, UPPER and LOWER QUARTILES and the INTER QUARTILE RANGE

c) A FREQUENCY HISTOGRAM can be drawn.

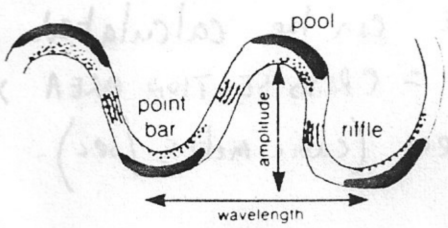
MEANDERS

FIELDWORK

SURVEY a short stretch of meanders to see if they follow the accepted pattern and illustrate the accepted relationships.



General features of meandering channels. Certain relationships have been established from measurements: thus $M_L = 6-10B$; $M_B = 14-20B$.



meandering