

# **CHAPTER 24 PRESENTATION OF PHYSICAL FEATURES ON TOPOGRAPHICAL MAPS**

## **Objectives**

After studying this chapter, students should be able to:

- differentiate between various methods of presenting relief on topographical maps.
- list the advantages and disadvantages of each method.
- attempt representing relief by any of the method shown.
- make comparison between various methods of showing reliefs on maps.
- calculate gradient and determine intervisibility of points.
- describe drainage patterns on maps.

### **24.1 Methods of Relief Representation**

Relief features on the earth surface can be easily represented on a topographical map. There are several methods of showing relief, particularly the form or contrasting levels of hills and valleys, including heights and the shapes above the ground at different levels and slopes. Some of these methods include:

#### **24.1.1 Contour**

Contour is by far the most extensively used method of showing relief on maps. A contour is a line that joins places of equal height above or below sea level. When they are used to represent height below sea level they are called submarine contour. Contours are often indicated in brown lines on topographical maps. They do not meet each other, however, every fifth contour line is thickened to facilitate easy reading. The interval between two contours is called the vertical interval. Usually, Nigerian map sheets on scale 1:100,000 have contour interval of 100ft, while that of 1:50,000 have contour interval of 50ft.

## **Advantages**

1. Contours show accurately surveyed point on the map.
2. It shows forms and shape of land features.
3. It can be combined with other like spot height, trigonometrically station, bench mark, etc.
4. Human features can be easily combined with contour lines.

## **Disadvantages**

1. The process of drawing contour is stressful, time consuming and costly.
2. Some minor information may be caught between two contour lines.
3. It may give a false impression of even surface between two consecutive contour lines.
4. The interpretation of contour maps require special skills or training.

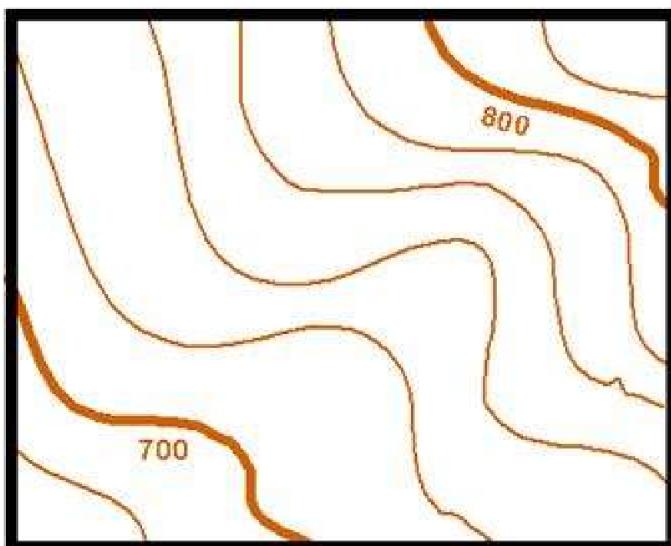


Fig. 24.1: Contour Lines

### **24.1.2 Form Lines**

Form lines are interpolated contour lines drawn between two accurately surveyed contour lines and two spot heights. Such lines do show the form of land and are shown in brown broken lines.

## **Advantages**

1. It shows the shape of land better.
2. It is cheaper to draw relative to contour lines.
3. It can accurately represent contour lines on smaller scale map where contour cannot be shown.
4. It shows an area of the earth on the map.

## **Disadvantages**

1. Form lines may give wrong information about relief since they are drawn by interpolation from contour.
2. It may be difficult to draw in rugged areas.
3. Height between two form lines cannot be shown.

### **24.1.3 Spot Height**

Spot height shows absolute heights. They are points on the map whose heights above sea level have been accurately determined. Each point is indicated by a dot with the height written beside it.

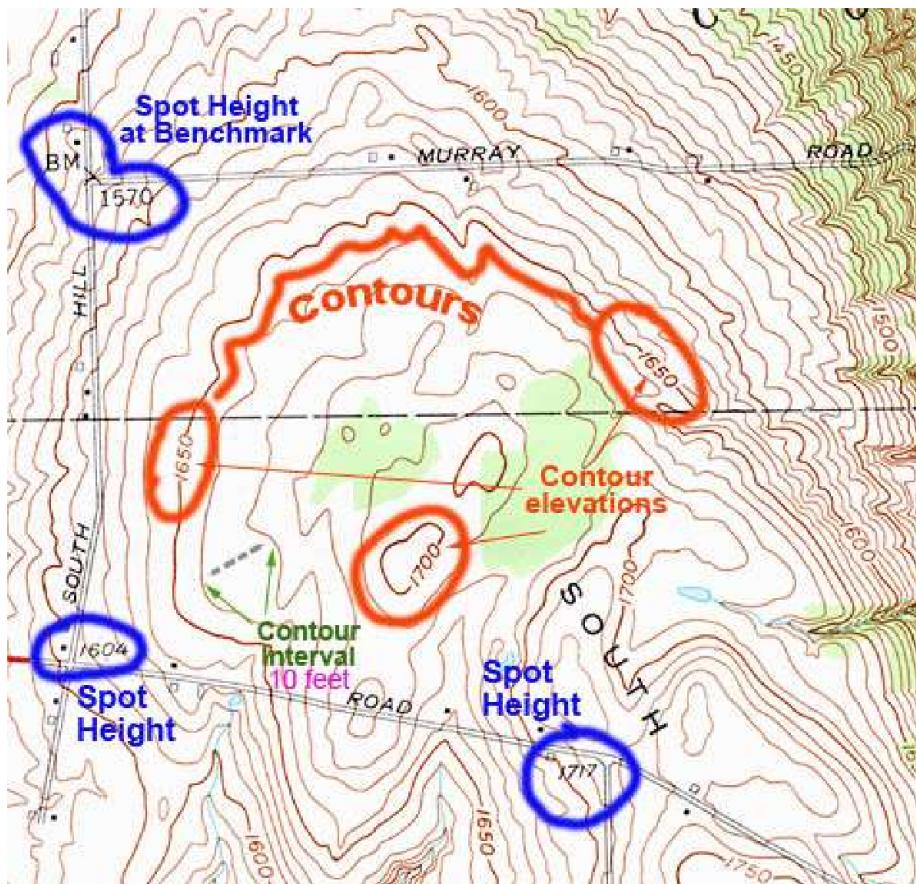


Fig. 24.2: Spot Heights

### Advantages

1. It gives precise information about heights of relief.
2. It reveal the exact heights of peaks and valley bottom.
3. It is easy to understand.
4. It may form the basis of other methods of showing reliefs.

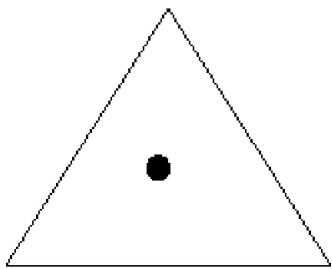
### Disadvantages

1. It does not give visual impression on the landforms or the general patterns of relief features.
2. Spot height cannot be used alone since the map reader need not read figure to imagine the shape or form of the figure.

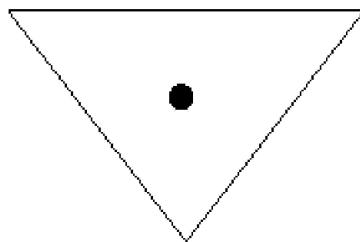
#### 24.1.4 Trigonometrical Station

This shows absolute heights. They are points on the Earth's surface which have been well surveyed out in the triangulation survey of a country. Triangulation points are usually on hill-lips or other elevation which command a mode view. Three types of trigonometrically station can be identified namely:

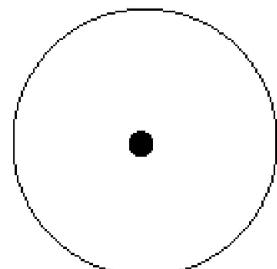
- (i) **Primary stations:** This is shown in a form of triangle with a thick black dot inside.



(a)



(b)



(c)

Figure 24.3(a) Primary station (b) Secondary station (c) Minor station

- (ii) **Secondary station:** This is shown in a reverse triangle with a thick black dot inside.

- (iii) **Minor stations:** They are shown in circles with a thick black dot inside. Trigonometrical stations serve the same purpose as spot heights in giving precise location as a result they have similar advantages and disadvantages as spot heights.

#### 24.1.5      **Bench Mark**

They are permanent marks made on object usually during leveling operations. They are usually placed on building, wall or on a bronze plate set into the surface of a wall or on the face of a concrete pillar by the roadside. The conventional symbol for bench mark is BM. They have similar advantages and disadvantages as spot heights.

#### 24.1.6 **Hachures**

Hachures are lines of convenient length drawn down the slope in the direction in which water will run on them. The lines generally show the shape of the land and nature of the slope. The lines are thicker and shorter and most crowded where slopes are steep and while on gentle slope, they are thin and far apart. Areas which are quite flat whether high or low land remain blank.



Fig. 24.4: Hachure

### **Advantages**

1. Minor important information or detail lost in contour maps are well brought out and captured.
2. It gives good visual impression of slopes and general shapes of the land.
3. The method can be combined favourably with other methods like contour and spot height.

### **Disadvantages**

1. It does not show actual height of places.

2. It is less scientific as it depends largely on manual skills.
3. It fails to show accurately the direction of slope.
4. Features other than relief cannot be shown or superimposed on hachure map.

#### **24.1.7 Layering**

This method is also called **layer – shading** or **layer – colouring**. It uses layer tint or colour to show differences in height. This is the method used in production of atlases. *Green is conventionally used for lowland, while brown is used for highland.* Layer-shading can be useful on a contoured map. However, the contour interval should be fairly large and must be carefully selected so as to show the significant changes in elevation. The area between one contour line and the next should be shaded or coloured carefully choosing a range of colours in such a way that the colour fades out.

#### **Advantages**

1. It gives good visual impression of general height than hachure.
2. It can be combined with other methods such as contour and spot height to produce an effective relief map
3. It shows differences in elevation at a glance.
4. The methods allow the superimposition of physical and cultural features.

#### **Disadvantages**

1. It does not show absolute height.
2. Some features like valley, spur, etc cannot be shown.
3. Where the tint/layer is dark, details may be obscured.
4. It may give false interpretation of relief between two contour lines.

#### **24.1.8 Hill Shading/Plastic Shading**

The method of hill shading assumes that the features being shown are in light with the sources of light either obliquely or vertically. If the source of the light is vertical, hilltops, plateaus, ridge crests as well as valley bottoms and plains are lighted while the slopes are in shadow. The steeper the slope the darker the shading. For oblique lighting, it is assumed light comes from the northwest, so that

western slopes are lighted while the eastern slope and southern – eastern slopes are in shadow.

### **Advantages**

1. It gives a perfect picture of the earth surface.
2. It may be useful in representing hilly areas.
3. It can be combined effectively with other methods such as contour and spot height.
4. It gives a good visual representation of relief.

### **Disadvantages**

1. It does not show absolute height.
2. It is difficult to distinguish between uphill and downhill when hill shading is used.
3. The method is expensive.

## **24.2 Identification of Physical Features on Topographic Maps**

Physical features refers to features of the landscape such as hills, mountains, plateau, valley, spur, etc. To identify these on topographical maps require acquiring necessary skill. In this section individual features of relief shall be illustrated with their associated contour patterns. Two broad categories of physical features can be identified on a topographical map namely (i) Inland features and (ii) Coastal features

#### **24.2.1 Inland Features**

1. **Hill:** A hill can be defined as elevation which stands some hundreds of metres above the ground. Two types of hills can be identified on topographical maps.
  - (i) **Conical hill:** The contour lines of the conical hill are widely spaced at the lower part and closely spaced at the upper part. The contour lines of a conical hill taper to a point, the value of the contour lines increases towards the centre.

**Round topped hill:** The contour lines of round topped hill are widely spaced at the base while at the upper part they are all closely spaced, but do not taper to a point. The innermost contour lines is larger than that of conical hill.

**Knoll:** A knoll has the same characteristics with the conical hill, the only difference is that, it is usually isolated in undulating areas or lowland.

**Plateau:** Plateau is a table land, it has a fairly flat top and steep sides. The innermost contour line is very large.

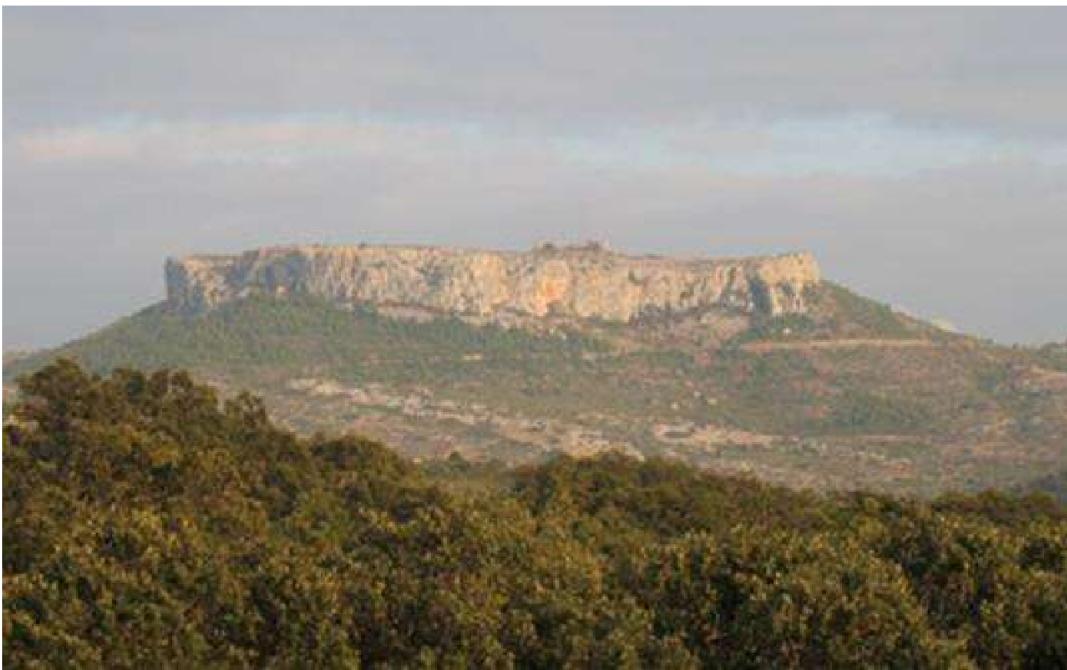


Fig. 24.8: Plateau

**Dissected Plateau:** A dissected plateau is a plateau whose surface has been eroded and cut by many river valleys.

**Spur:** A spur is an highland that separates two valleys, the top of the V-shape of the contour of a spur points to lower land.

**Valley:** A valley is a lowland between two hills, the tip of the V-shape of the contour lines of a valley points to higher ground.

**Cuesta:** A cuesta is a long, narrow elevation with a steep slope on one side and gentle slope on the opposite side. A cuesta is like a ridge in its linear form but differs from ridge because one side of it slopes consistently much more steeply than the other.

**Ridge:** Ridge is a long, narrow area of highland. On one side of the ridge is a scarp slope called **escarpment**. The contour lines of a ridge run almost parallel to each other. When the contour lines of a ridge stretch north-south, they form a longitudinal ridge.

**Gap:** Gap is a lowland that joins two hills when it is found in a ridge of hill it is called ‘*saddle*’, when it is found in a range of mountain. It is called a ‘*col*’. In a mountainous region gaps are usually useful for communication routes. Whenever any communication routes are constructed along such gap it is referred to as a ‘*pass*’.

**Watershed:** This is also called water parting or water divide. Watershed is usually where several rivers have their source.

#### 24.2.2 Coastal Features

1. **Mountain:** A mountain is an highland that generally rises about 500metres above the ground surface. It usually has a rugged steep slopes. The topmost point on a mountain is called its *peak or summit*.
2. **Slopes:** There are basically three types of slopes, these are:

- (i) **Even slope:** The contour lines of even slope are evenly spaced. The rate of decrease or increase in height called gradient is the same all the way through.
- (ii) **Concave slope:** The contour lines of concave slope are closer to each other near the upper level while they are widely spaced near the lower level.
- (iii) **Convex slope:** The contour lines of a convex slope are closer to each other near the lower level while they are more widely spaced near the upper level. Generally, we may divide slope into either steep or gentle slope. A steep slope have its contour lines closely spaced on topographical maps, while the gentle slope have a widely spaced contour lines on topographical maps.
- (iv) **Gorge:** A gorge is a narrow, deep, steep-sided valley. It is also known as ravine or canyons
- (v) **Cliff:** A cliff is a very steep rock face. It can be found on the inland or along the coast. When it is found along the coast. It is referred to as coastal cliff. Coastal cliff are indicated by two or more contour lines meeting at the coastline, however, if they are not vertical or not sufficiently high, they are shown by some conventional symbol.
- (vi) **Indulating lowland/Plain:** A plain is a broad, roughly level area. It may be a low-lying plain as the coastal plain or the floor plain of a river. It may also be on high elevation as the high plains of Hausaland in the Northern part of Nigeria. The contour lines of plains are single contour line several times on a topographical map.

Other Physical features shown on topographical maps include:

**Vegetation:** Vegetations are shown in green including symbol of plantation. Slight changes in the symbols may occur due to local differences in vegetation types. However, vegetation which is closely associated with water such as mangroves and marshes may be shown on blue, the colour of water features.

Other features include rock outcrops, sand dunes, craters, scattered cultivation, antiquities, etc.

#### **24.2.2. Costal Features on Topographical Maps**

Coastal features are features that are found in coastal areas. Examples of coastal features are:

1. **Cape:** A cape is a piece of land stretching out into the sea. Examples include cape verde in Senegal and cape three points in Ghana.
2. **Peninsula:** A peninsula is a long piece of land almost surrounded by water.
3. **Bay:** A wide indentation of the sea into the land. A good example is Fourah Bay in Freetown.
4. **Beach:** A gently sloping deposit of sand and gravel along the coast between low and high tide water marks. A beach is represented on a map by some conventional symbols as shown below.
5. **Spit:** An accumulated beach material that have become attached to one end of a headland or bay side and grow out into the open water.
6. **Bar:** Bar is a spit that has been extended and attached to the land at both ends or separated from the land at one end by one a small opening, when a bar joins an island to the mainland it is refers to as *tombolo*.
7. **Lagoon:** This is a body of water shut off from the open sea by a bar. A good example is Lagos Lagoon in Nigeria and Keta Lagoon in Ghana.



Fig. 24.16 Lagoon

8. **Bight:** This is a similar indentation to a bay, but it is larger and has a gentle curve. A good example are the Bight of Benin and the Bight of Biafra in Nigeria.
9. **Delta:** When a stream of river enters the sea, it empties its load of alluvium materials into the fairly quite water and gradually build its deposits seaward, spreading like a fan with number of tributaries. The spreading like a fan shape formed by these tributaries as rivers enters the sea is called *deltas*.
10. **Estuary:** This is formed when a river enters the sea in a broad funnel shaped mouth. The Imo River and the Cross River in Nigeria have estuarine mouths.

### **24.3 Identification of Cultural/Human Features on Maps**

The mark of human occupation on the earth's surface can be easily noticed on the landscape around him. For several years ago, human occupancy on the earth is evident in several features that include settlements, routeways, cultivation and other forms of land use. These features are represented on topographical map using different symbols.

#### **Settlement**

Settlement is any human habitation, big or small that is inhabited by one person or many individuals. A settlement may be a city, town, village, hamlets or camp. Depending on the scale of the map. A settlement may appear as a dot or as a polygon. Usually settlement appears as a polygon in a large scale map. Two types of settlement can be identified on a topographical map.

- (i) **Urban settlement:** Urban settlement is a large, compact settlement inhabited by a large number of people of diverse background. It is difficult to tell from a topographical map where a settlement is urban or rural, however, factors such as size of built up areas and facilities located in a

settlement e.g. post office, court house, school, hospital, etc can help us determine whether a particular settlement is urban or rural.

- (ii) **Rural Settlement:** In rural settlement, numbers of inhabitants are few, majority of inhabitants engaged in primary occupations mainly agriculture, forestry, hunting and fishing. Pattern of rural settlement may include the following:
- (a) **Nucleated:** In nucleated settlements building are crowded together and the main farmlands are located outside the settlement area.
  - (b) **Dispersed settlement:** Buildings or compounds are wide apart, and buildings are separated from one another by farm lands. Dispersed rural settlement can be identified by scattered dots on a topographical map.
  - (c) **Linear:** Usually settlements are arranged in a row or rows on either side of a transport route or a river. Linear settlements develop as a result of inhabitants desire to make maximum use of a transport route or river.

### **Situation and Sites of Settlement**

Situation refers to the position of a settlement in relation to the surrounding features and to other settlement. *Site* refers to the actual point on the Earth's surface where a settlement is located. Some factors that can influence the growth of settlement based on situational conditions are:

- (i) Accessibility due to the presence of good transportation system.
- (ii) Location of mineral deposits or close to water resources.
- (iii) Location at nodal points.
- (iv) Defence sites such as confluence point, top of the hill as in Idanre.
- (v) Non-flooded area.
- (vi) Presence of gap sites.

**Transportation:** These are represented on topographical maps by various symbols. Forms of transportation shown on maps include:

1. **Roads:** Road types are shown by depicting them as:

- (i) Main roads
  - (ii) Secondary roads
  - (iii) Minor roads
2. **Footpaths:** Two types of footpaths are shown on topographical maps, they are:
- (i) **Main paths:** They are numerous on maps and often provide shortcuts. They are sometimes motorable.
  - (ii) **Minor paths:** They are numerous, only that in most cases they are not motorable.
3. **Railway:** Both main rail line and rail sidings are shown on topographical maps. Rail sidings are lines leading off the main rail lines to sub-station.
4. **River/Ferry Routes:** Some topographical maps show ferry routes. On most West Africa topographical maps river routes are not shown because most rivers are not navigable due to the presence of rapids and cataracts along the river beds.

**Land Use:** Land use mostly shown on topographical map includes agricultural land use, plantations, forest reserves and scattered cultivation.

Other types of land use shown on topographical maps are:

- (i) Mining site depicted by the symbol of a crossed pick axe and mallet.
- (ii) Quarry – indicated by a specific conventional symbol on a map.

**Boundary:** On some topographical map district, state and international boundaries are shown either by the same symbol using different colour or by different symbols.

## 24.4 Gradient

Gradient means slope of the ground expressed as a ratio between height and length. Gradient describes how land rises and falls. To find the gradient between two points on a map first find the distance between them. The distance between

the two points is known as **Horizontal Equivalent (H.E)**. Then, find the difference between the height of the two points known as **Vertical Interval (VI)** divide the vertical interval (rise) by the horizontal equivalent (run) with the vertical interval reduced to unity or 1. Remember that heights are in feet on map and lengths are in centimeters. Therefore, you need to convert your value to equal unit, apply the scale factor before you calculate gradient.

## 24.5 Cross Profile and Intervisibility

A profile can be defined as the outline produced where the plane of a section cut the surface of the ground. Profile does not show the geological structure of the land. A profile can be longitudinal or transverse. A longitudinal profile is the type drawn along a line running along the top of the ridge from one end to the other. Transverse profile is the kind drawn across the ridge to a point on the opposite side. Three types of profile can be identified namely:

- (i) Simple profile
- (ii) Annotated profile and
- (iii) Transect diagram

### Advantages of Cross Profile

1. It shows at a glance the distribution of both human and physical features.
2. It quickly reveals the relationship between physical and human features.
3. It also show the relationship between various human features on the Earth's surface.

#### 24.5.1 Intervisibility of Point

Whether a point can be seen or not from another, is what intervisibility of points tries to describe. Intervisibility is a function of the surface configuration of the land between two points. Intervisibility between any two points on a single relief feature is likely if the slope between them is concave and is unlikely if the slope

is convex. A simple way of determining intervisibility of points is to draw a course profile for the section between the two points and draw the line of sight.

## 24.6 Description of Drainage Patterns in Maps

Drainage pattern describes the way rivers arrange themselves on a landscape. Six drainage patterns can be identified on a topographical map and these include:

- (i) **Dendritic pattern:** This is a drainage pattern in which river tributaries are spread in many direction like the branches of a tree.
- (ii) **Trellis:** This pattern develop where the trunk rivers are parallel and the tributaries join them at right angles or nearly so. This pattern is similar to *rectangular* pattern. In rectangular pattern the main streams and their tributaries display right angular bends. The right angular bends are due to control by joints and faults. It is a characteristic of an area where they are basement complex rocks outcrop on the surface of the Earth.
- (iii) **Radial:** This pattern develops where streams or rivers radiate like the spokes of a wheel in an area of volcanic or large conical hill.
- (iv) **Centripetal:** Centripetal pattern develops where streams converge into a central depression or an inland basin. A good example is in the drainage pattern of Lake Chad.
- (v) **Parallel:** Parallel pattern develops where the rivers flow parallel or nearly so down a slope.
- (vi) **Annual pattern:** Here the streams form a ring-like pattern. The development of annular pattern may be due to the interruption of the former stream channels by the formation of a crater lake.

## 24.7 Map Description and Interpretation

Description and interpretation of map is an important aspect of map reading, although, there is no one method of describing and interpreting a map. However, methods employed will depend very much on the nature of the area given. The

following simple steps will help you to make excellent description and interpretation of maps.

- Step 1:** Note the title of the map. A good topographical map will have a title and the title may give you a clue to the nature of the area.
- Step 2:** Check the scale of the map given. With the scale, you can estimate the area covered by the map, determine distances between various points and relative position of features on the map.
- Step 3:** Note all the physical features on the map and pay particular attention to contour interval of the map to determine the nature of the topography of the area. Consider also the direction of flow of rivers, you can easily determine this through the way river tributaries join the main river usually in varying angles down the slope.
- Step 4:** Pay attention to human features on the map, by studying conventional signs used on the map.
- Step 5:** Divide your map into regions. The division can be based mainly on the physical features or on a combination of physical and human features. You may even divide your map based on direction as North-eastern part, south eastern part, etc.
- Step 6:** Begin to provide detailed description and interpretation on each region, starting with the relief of the area including slope, drainage characteristics, vegetation, etc Then proceed to describe the human features such as settlement pattern, transportation and other forms of man's utilization of the region.

## **Summary**

In this chapter, you have learnt that:

- Contour is the most common and most effective way of showing relief on topographic maps.
- Physical features represented on topographical maps including hills mountains, plateau, ridges, etc.

- Human features represented on topographical maps include settlement, routeways, and various land use patterns that dot natural landscape.
- Gradient can be calculated by dividing vertical interval (rise) by the horizontal equivalent (run).
- There are three types of profile namely *simple cross profile, annotated profile and transect diagram*.
- Intervisibility of point is a function of land configuration of an area.
- The most common drainage pattern include: dendritic, trellis, radial, central, parallel and annular pattern.

### **Essay**

1. Discuss the advantages and disadvantages of contour as a method of showing relief on map.
2. Enumerate ten inland physical features and ten coastal feature that can be found on topographical map and describe them with illustrations using their various associated contour pattern.
3. Describe various drainage patterns that are observable on topographical map.
4. With the aid of appropriate diagram discuss why it is essential to determine intervisibility of points.