Department of Geology G.G.M Science College Jammu

E-content module

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Unit-3

3.4. Contours, Topographic and Geological Maps; Elementary Idea of Bed, Dip and Strike

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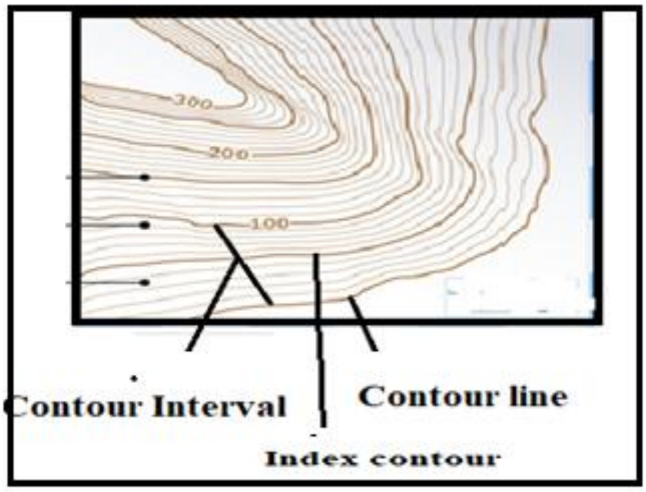
Contour Lines

Contours are lines drawn on a map connecting points of equal **elevation** or altitude from mean sea level. These contours indicate the equal **height and shape of the particular terrain**. If we followed a **contour line**, **elevation** would remain constant. A map showing the landform of an area by contours is called a contour map. The method of showing relief features through contour is very useful. Contour type and contour interval is shown **in Fig. 3.4.1**. A **contour** map is illustrated with contour lines, for example a topographic map, which shows valleys and hills and the steepness or gentleness of slopes of hills. The difference in elevation between successive contour lines is called contour interval on the contour map. These lines are useful because they illustrate the shape of the land surface and hence its topography on the map.



Contour lines(Fig.3.4a)

The contour lines have some important characteristics which are useful during the survey for reading contour maps.

1. A contour line is drawn to show places of equal heights.
2. Contour lines and their shapes represent the height and slope or gradient of the particular landform.
3. Closely spaced contours represent steep slopes while widely spaced contours represent gentle slope.
4. When two or more contour lines merge with each other, they represent features of vertical slopes such as cliffs or waterfalls.
5. Two contours of different elevation usually do not cross each other.

There are three types of contour lines, these are index contour lines which are thick and usually labelled with a number at one point along the lines. Second is the intermediate contour lines which are thinner and more common between index lines. Third type is supplementary lines represented in dated form, which indicates flat terrain.

Topographic Map

Map of small area drawn at large scale which depicts the detailed surface features both natural and man made is called **Topographic map**. The relief of the land form on the map is shown by contour lines. These topographic maps show lines for certain elevations only which are evenly spaced from each other. The gap between contour line is called the contour interval. For example, if map shows 100m contour interval, then contour lines for every 100 m of elevation such as lines at 0, 100, 200, 300, 400 and so on. Different maps use different intervals, depending on the topography. The topographical maps are drawn in the form of series of maps at different scales. The land features shown with the help of contours is shown **in Fig. 3.4b.**Therefore, in the given series, all maps uses the same reference point, scale, projection, conventional signs, symbols and colours. The topographical maps of India are prepared on 1 : 10,00,000, 1 : 250,000, 1 : 1,25,000, 1 : 50,000 and 1: 25,000 scale providing a latitudinal and longitudinal coverage of 4° x 4°, 1° x 1°, 30' x 30', 15' x 15' and 5' x 7' 30", respectively.

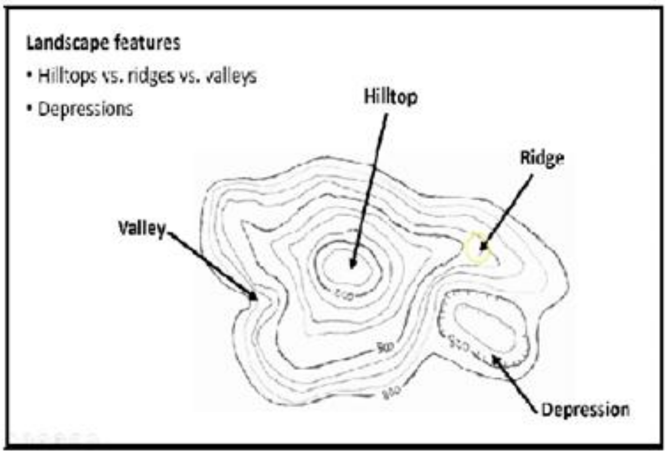


Fig.3.4b

The topographic map serve the purpose of base maps and are used to draw all the other maps. These maps show important natural and cultural features such as relief, vegetation, water bodies, cultivated land, settlements, and transportation networks etc. The topographic map of depression is shown in **Fig. 3.4c.**

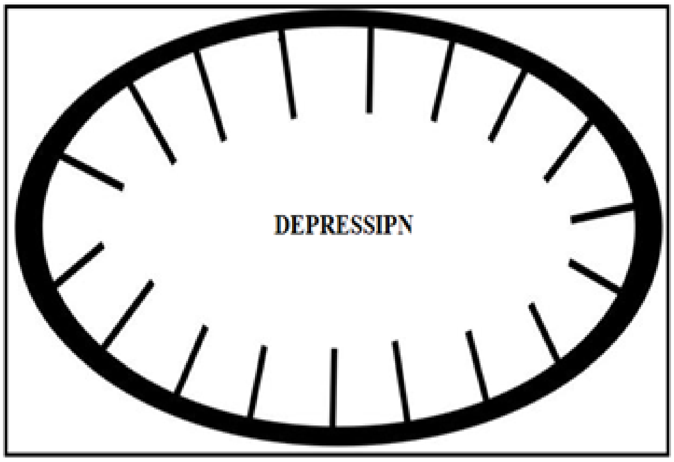


Fig.3.4c

Geological Map

A Geological map is a **map** which recorded **Geologic** information by the Geologist. These information are distribution of rocks units their nature, and age relationships, structural features such as folds, faults, joints, mineral deposits, and fossil localities.

The first modern Geologic map was drawn by William Smith (1769-1839). He recognized that sedimentary rocks occurred in a consistent sequence throughout the countryside. He recognised the position of a coal bed within the sedimentary rock sequence in one location that allowed him to predict its occurrence and depth beneath.

Construction of Geological Map

Three steps are involved during the construction of a geological map. These steps are; the Geologist locates natural or man-made exposures of rock called outcrops.

Second, step taken by the Geologist is to records outcrop locations and characteristics on a simple base map.

The third step taken by the geologist is to prepare a geologic map by interpreting the distribution and relationships between different rock units. The fundamental rock unit for mapping is the formation. A formation is a body of rock consisting of one or more rock types, that is present over a large geographic area. These characteristics allow it to be the basis for geologic mapping.

The outcrops provide several kinds of data that are critical for the map construction. The Geologist records the rock type, like, shale/ sandstone or granite, and a detailed description of their main physical characteristics. If sedimentary rock contains fossils, this may allow the rock to be dated more accurately. If more than one rock type is present, the nature of the contact between them is important. The Geologist records the shape and spatial orientation of each rock unit. Strike and dip symbols consist of a long "strike" line, which is perpendicular to the direction of greatest slope along the surface of the bed. The terms trend and plunge are used for linear features like fold axis strike line of the rocks and their symbol is a single arrow on the map. The arrow is oriented in the down going direction of the linear feature (the "trend") and at the end of the arrow. The number of degrees that the feature lie below the horizontal that is the "plunge" is recorded.

Rock units are mainly represented by colours. Instead of using colours certain symbols are also used. The different geologic mapping agencies and departments have different standards for the colours and symbols to be used for rocks of differing types and ages.

Geologists take two major types of instruments for measuring the orientation of the features these are hand compass (Brunton compass), Clino meter. These give the orientations of planes and line their inclination. Orientations of planes are measured as a "strike" and "dip", while orientations of lines are measured as a "trend" and "plunge".

Geologic maps also contain symbols representing geometric elements that are called as Geologic structures. The features are like bedding planes and structural features such as faults, folds, joints are shown with strike and dip or trend and plunge symbols which give three-dimensional orientations features. The symbol of dip and strike is shown in F**ig. 3.4d.**

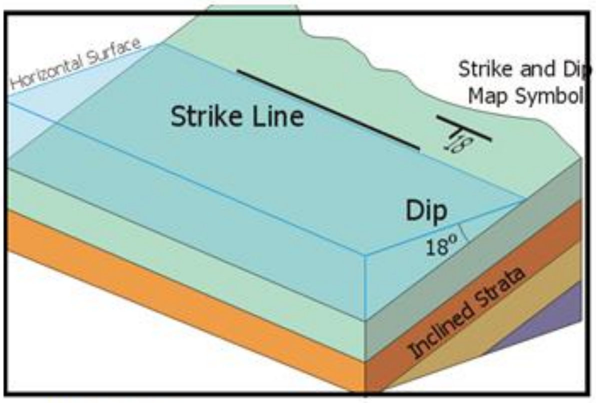


Fig.3.4d

Uses of Geological maps

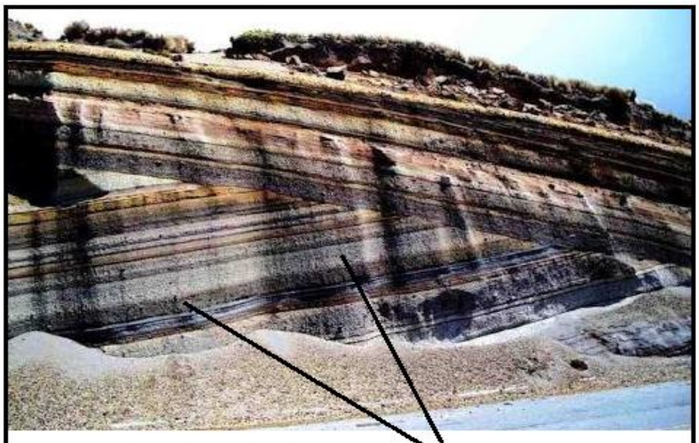
These maps helps to locate mineral deposits and energy resources, such as water, oil, natural gas, The geological maps are also used for the construction of various engineering projects such as reservoirs, dams, bridges, railway lines and roads.

Geologic maps are used for a variety of purposes, such as natural resource development, land use planning, andnatural hazard studies.

By studying a geologic map we can better understand possible dangers like the floods or earthquakes prone areas.

Bed

A bed is the smallest lithostratigraphic unit, which is a map able unit. Normally, beds ranging in thickness from a centimeter to several meters and are distinguishable from beds lying above and below it. These beds are the layers of sedimentary rocks that are distinctly different from overlying and underlying subsequent beds of different sedimentary rocks. Layers of beds are called strata. They are formed from sedimentary rocks being deposited on the Earth's solid surface over a long periods of time. The photograph is shown **in Fig. 3.4e.**



Bedding (Fig.3.4e)

The thick ness of the bed may vary as follows:

Very Thick Bed - 100cm
Thick Bed - 30cm
Medium Bed - 10cm
Thin Bed - 3cm
Very Thin Bed - 1cm

Layer with thickness less than 1cm is called a Lamina.

The sediments are layered in the same order that they were deposited, that depicts which beds are younger and which ones are older which is called the Law of Superposition.The structure of a bed is determined by its bedding plane. These beds can be differentiated in different ways, such as rock or mineral type and particle size. By knowing the type of beds, Geologists can determine the relative ages of the rocks.The formation of the beds follows the certain geological principles these are; Law of Superposition, Law of original horizontality, Law of lateral continuity, cross-cutting relationship. The Law of superposition states that the oldest rocks are deposited first and younger rock layers deposited last in the normal condition. This is used to date the stratigraphy and their relative ages. The Law of original horizontality states that if the beds are not horizontal, then the layers have suffered either folding or tilting. They were all deposited initially horizontally. Law of lateral continuity states that the bed deposits extend in all lateral directions.This suggest, that if two places are separated by erosional features have similar rocks, that means they were originally continuous. The relationship of Dip and strike is shown in **Fig. 3.4f.**

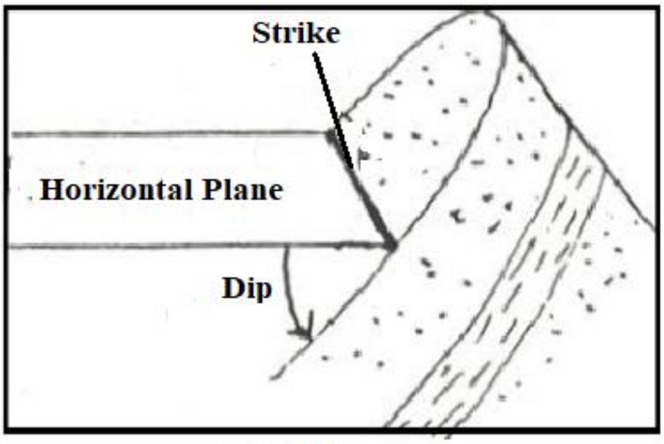


Fig.3.4f

The cross-cutting relationship states that a fault is younger than the rock layers that it goes through. It helps with relatively dating the rocks.

Dip And Strike of Geological Bed

Strike and dip together represents the attitude of the Geological beds that refer to the orientation and inclination of geologic feature. The inclination of the bedding plane with respect to horizontal surface is called dip of the bed. It literally means slope or inclination. Dip is a vector quantity which measures both dip direction and amount of its inclination. There are two types of the dips. These are

1. True dip (TD) and
2. Apparent dip (AD)

1. True dip (TD): When a vertical cross-section is perpendicular to the strike of the beds, the inclination seen in the cross section is called the true dip. True dip is always measured on vertical plane perpendicular to the strike of the feature. True dip can be calculated from apparent dip using trigonometry, if the strike is known. Geologic cross -sections use apparent dip when they are drawn at some angle not perpendicular to strike.

If a bed is not inclined or vertical that means bed is flat having a dip of 0° and a directionless strike.

2. Apparent dip (AD): Apparent dip is the **inclination of geologic beds** from any vertical cross section inclined (not perpendicular) to the strike of the geologic beds. These are measured on any inclined planes.

The *dip* gives the steepest angle of a tilted bed or feature relative to a horizontal plane, and is given by the number (0°-90°) as well as a letter (N,S,E,W) with rough direction in which the bed is dipping downwards.

The angle of dip is generally included on a geologic map without the degree sign. Beds that are dipping vertically are shown with the dip symbol on both sides of the strike, and beds. The angle of dip is generally included on a geologic map without the degree sign. Beds that are dipping vertically are shown with the dip symbol on both sides of the strike, and beds that are level are shown like the vertical beds, but with a circle around them. Both vertical and level beds do not have a number written with them

Strike line

The strike line of a bed, fault, or any other planar feature, is a line that is formed by joining the points of intersection of the bedding plane with the horizontal surface. *Strike* is recorded as either a quadrant compass bearing of the strike line say N 45° E or in terms of east or west of true north or south, a single three digit number representing the

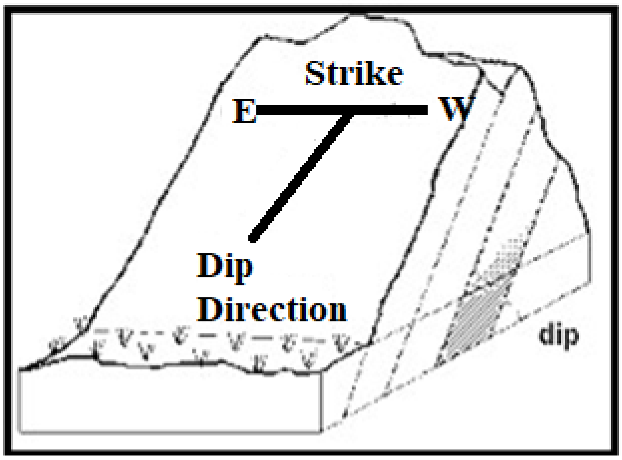


Fig.3.4g

azimuth. The lower number is given as N45°E or the azimuth number followed by the degree sign as of N45°E would be 045°. The dip is always perpendicular to strike direction. The strike direction and dip direction is shown **in Fig. 3.4g**

One technique is to always take the strike so the dip is 90° to the right of the strike. In this case the redundant letter following the dip angle is omitted. On the geological map it is represented by the symbol of a short line attached and at right angles to the strike symbol pointing in the direction which the planar surface is dipping down.

References:

https://www.bing.com/images/search