

Department of Geology G.G.M Science College Jammu

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Unit-3

3.5 Outcrops, Effects of Various Structures on the Outcrops. Clinometer/Brunton Compass and Its Uses.

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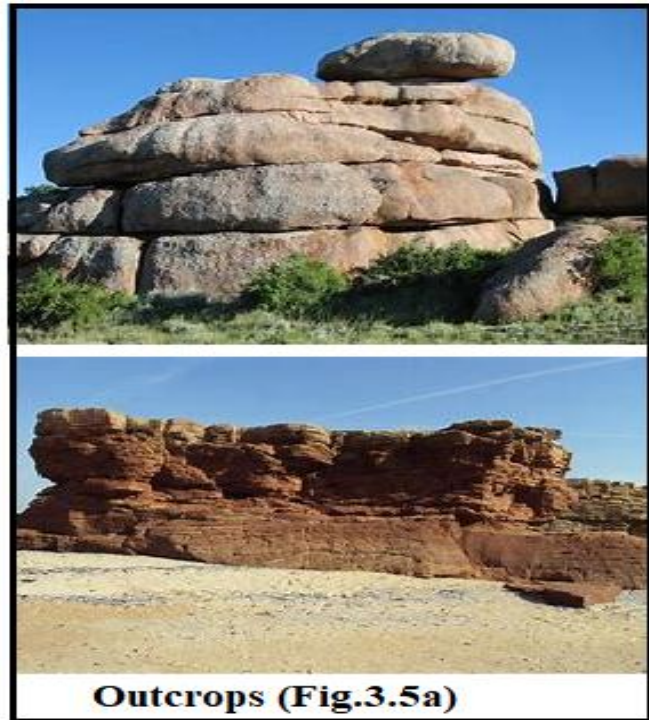
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Outcrop

Outcrop is defined as exposed bedrock or an unconsolidated deposit to the surface of the ground. These outcrops are generally found along riverbanks, along the slopes of deep gorge and also on the crests of ridges. These outcrops are formed by the action of natural agents like rivers action, wind action, glaciers action. The out crops are also resulted from mine work, by excavations and constructions of wells, prospect holes, shaft mines, and adits etc. The photograph of out crop is shown in **Fig.3.5a**

At most of the places outcrops are not exposed on the surface. They are mostly bedrock or superficial deposits which are covered by the soil and vegetation and cannot be seen and examined.

These are seen at places where the overlying cover is removed through erosion or tectonic uplift, the rock may be exposed, or crop out.



Outcrops (Fig.3.5a)

Why we Study the Outcrops?

The study of outcrop is widely used by Geologist in geological surveying. These outcrop exposures allow direct observation and sampling of the bedrock in situ for geologic analysis and creating geologic maps. The in situ measurements are important for establishing geological history of the area. Therefore, outcrops are very important for understanding the geologic time scale of earth history.

Some types of information that can only be obtained from the bedrock outcrops or by drilling and coring operations. The out crops are important for studying structural features of rocks such as orientations of bedding planes, fold axes, foliation, depositional features orientations, paleomagnetic orientations. Outcrops are also important for understanding fossil assemblages, and paleo-environment.

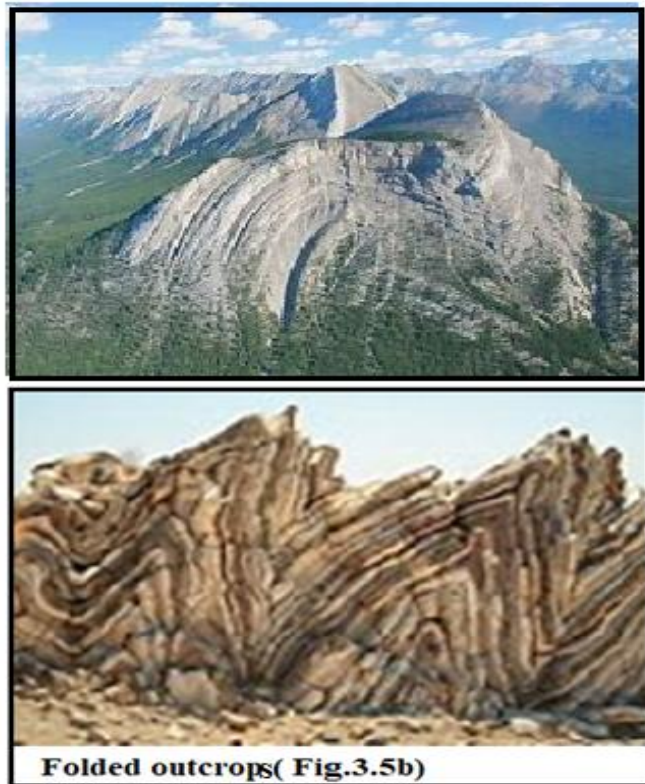
Effects of Structures on the Outcrop

The different structures in the outcrop rocks like, folds, faults, joints, bedding planes etc. effects the physical properties of rocks. These effects are discussed as below;

Effects of folds on outcrops: In the rock folds are mainly formed due to the tectonic forces and as a result, the rock outcrops get deformed, distorted or disturbed. Therefore, sedimentary strata, which were originally horizontal get inclined in some direction and are bent upward or downward. The photograph of folded outcrop is shown in **Fig.3.5b**.

For the construction of the tunnels in the folded outcrops the tunneling work is done along the thick bed of limbs, parallel to the axis of the fold. Because, along the crest of folds the bed contains numerous joints and other fractures. Therefore, if tunneling is made through them there is danger of falling of rocks from the roofs.

In case of quarrying, it is convenient to take up such work along the strike direction and along limbs of the folds. This provides the same kind of rock and also there is easily breaking the rocks along the bedding plane. Seepage problem of water in crests and troughs also can be avoided by taking up quarrying along the limb.



In the folded out crops syncline sometimes furnish favorable condition to tap up enormous quantity of ground water. Thus, artesian springs and wells have their origin in the syncline structures. The numerous fractures, joints, folded rocks act as channel ways for ground water movement.

In the construction of roads and railway tracks along hill slopes of the folded hills, the stability of the ground depends on the relation of the dip of beds and surface slope of the area. If slope of surface and dip of beds occur in the same direction, the ground is unstable and landslide may occur. The crest of

folds sometimes becomes convenient place for the occurrence of ore deposits under favorable condition.

Effects of faults and joints on the outcrops: Faulting causes the rupturing and displacement of the rocks along the plane of rupture. The effects may cause changes in the elevation of the ground, omission of some strata and repetition of some strata in the region. The photo of faulted outcrop is shown in **Fig. 3.5c**

Strike faults are developed parallel to the strike of the outcrops. These faults produce the repetition and omission of strata in the outcrop. This repetition of the strata occurs, when the downthrow is against the direction of the dip of the bed in which faulting has occurred. In the reverse and thrust faults there is crustal shortening and repetition of beds. Joints are also weaker planes in the rock outcrops. Therefore faulted and highly jointed outcrops are not safe and stable for the foundation works. Faults cause the fracturing and shattering of rocks along fault zones that means they are not compact or strong. Such places have very weak grounds therefore not fit for the foundations sites of the various structures.



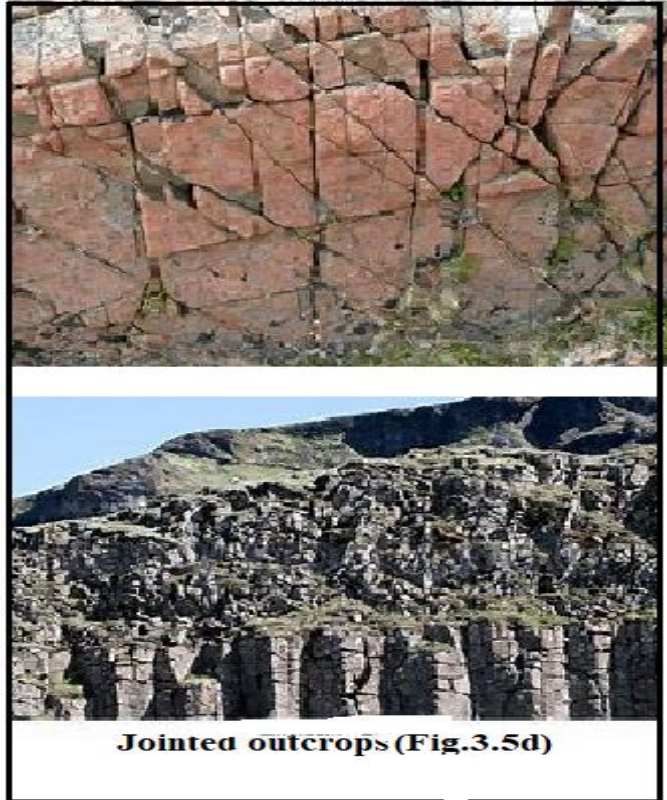
The faulted and jointed outcrops become porous and permeable, their strength decreases and gets saturated with water. This may causes serious groundwater problems in tunnels and reservoirs.

The outcrops which are highly fractured and jointed are unstable. The active faults become earthquakes prone and cause shaking of the groundwater. This shaking in the area may cause damage of civil engineering structures. Faults and joints also effect the movement of surface water. In some cases when dip direction of the fault plane and the surface slope occur in the same direction landslides may occur in such areas.

If the dams are constructed on the active fault zone and jointed rocks, there is always chances of dam failure. Therefore, precautions have to be taken in improving the competence of the site by giving proper treatment. Faulted and jointed outcrop causes leakage of water, if they occur in the reservoir basin.

This not only cause effective and significant loss of water but also endangers the safety of the dam by creating pressure over it. Jointed out crop is shown in **Fig.3.5d**.

The tunnel alignment should not come in the way of active faults. The fractured fault zones will be incompetent to provide safety to tunnels. As the fault zones are highly crushed therefore quarrying through them cannot produce blocks of good size. The porous, fault zones provide easy movement of water which cause the weathering of its material. The laying of roads and railways tracks along hill slopes the fault planes decreases the slope stability of the region.



In the faulted outcrop the saturation of water, increases the risk of landslide occurrence. Faults and Joints in the outcrop can contribute in improving ground water potential in hard rock areas. Sheet joints which occur at a depth plays significant role in increasing the ground water potential of the area. Fault zones and joints serve as important sites for the deposition of the mineral deposits. They are highly favorable places for the occurrence of a variety of ore minerals formed by different processes.

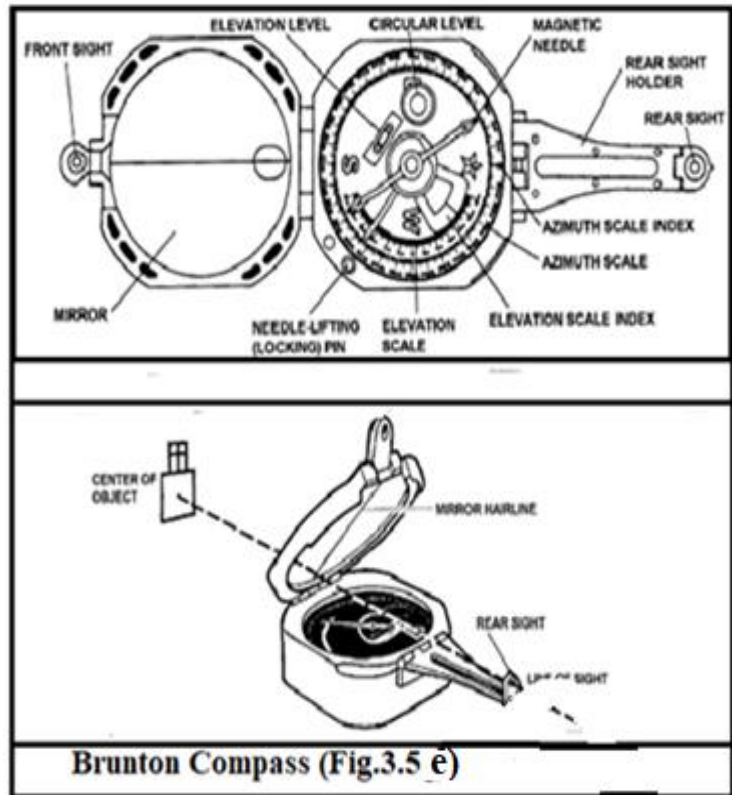
brunton/ Clinometer Compass

A Brunton compass is a precision compass made by David W Brunton. Brunton compass uses magnetic induction damping rather than fluid to damp needle oscillation. Geologist commonly uses the Brunton compass and clinometer during their field work.

The magnetic needle of the compass always pointed towards magnetic north direction. The Brunton compass has some additional arrangements than clinometer compass and is superior. Most frequent use of Brunton in the field is the calculation of the strike and dip of geological features like faults, contacts, foliation planes, sedimentary beds etc. Strike is measured by leveling the compass along the plane measured with the bull's eye level.

The main parts of the Brunton compass are 1). A clinometer, 2). A Compass, 3) and a sighting device.

Clinometer of Brunton compass is used for measuring dip angles. A compass unit is used to measure the direction of the any alignment of the feature. In Brunton sighting device is used in taking the front bearing and back bearing and hand levelling. The Brunton compass is used in determining the dip amount as well as dip direction. The Brunton compass is shown in Fig.3.5e.



Reading in the compass: The direction in which the compass needle points is known as magnetic North, and the angle between magnetic north and the true North direction is called magnetic declination or variation. This is because the angle to magnetic north is less than true North, which is 360^0 . This is called a negative declination.

Magnetic compass is used for finding the direction, taking traverses, and locating the self-position by the geologist on the map in the field work. It is used to get directional degree measurements (azimuth) through use of the Earth's magnetic field. By the user compass is hold at waist-height, and looks down into the mirror and lines up the target, needle, and guide line that is on the mirror. Once all three are lined up and the compass is level, the reading for that azimuth can be made

Place the bottom edge of the compass flat against the plane in consideration. Adjust the compass orientation, by making sure the bottom edge is always flat against



the plane, until the bubble in the bulls eyes level is centered. Read the either end of the compass needle to obtain the value of strike.

Dip is taken by laying the side of the compass perpendicular to the strike measurement and rotating horizontal level until the bubble is stable and the reading is noted.

A clinometer compass is an instrument for any geologist used for geological survey, mapping. The clinometer compass is shown in **Fig.3.5f**. It performs basic work of measuring angles of inclination of bedding plane.

References:

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

<https://pixabay.com/images/search/outcrops>

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