

# Geological Interpretation

Geological interpretation may be broadly grouped into two categories:

- 1) Lithological characters of rocks and 2) Structures

## Lithological Interpretation

The main aim of lithological interpretation is to mark information on the lithology, rock units with reference to their physical characteristics, topography, etc. This is based on photo-interpretation elements, e.g., tone, texture, pattern, size, association etc. The sedimentary areas generally yield more information on lithology and structures than those formed by igneous and metamorphic rocks do.

### Sedimentary rocks

Alternating sedimentary beds, which often differ considerably in physical characters, crop out in contact with one another. This apparent inhomogeneity of sedimentary terrain result in differential erosion between hard and soft beds. As a result, had resistant (e.g. sandstone) beds will stand out in relief over the less non-resistant ones (e.g. shales) and stratification is clearly expressed in topography. Even if the topographical effect is not pronounced, bedding may still be identified by bending due to preferential vegetation or tonal differences between individual beds.

Photo characteristics of common sedimentary rocks are given below:

- a) **Sandstone** – Show medium to light tone, due to presence of high quartz content, dryness and excellent internal drainage. Coarse-textured, dendritic, sub-parallel, angular joint controlled and trellises drainage. Sandstones usually form ridge, scarp, plateau, mesa, and butte type of landforms.  
In humid regions sandstone shows varying tones and rounded hills. In arid regions slopes are steeper and joints are more apparent due to absence/ scarcity of vegetation.
- b) **Shale** – Show generally dark tones as compared to sandstone and limestone, smooth texture and fine textured (high density) gullying drainage which are mostly dendritic / pinnate in pattern. Support good cultivation. Shale occupies valley, forming flat lying areas or lower slopes of scarps. In the ridge valley topography, the sandstone form ridges and shales occupy valleys. In humid regions shales exhibit smooth and rounded topography with concave (inward) hill slopes. In arid regions it show typical bad land topography, light to grey tone, sharp ridges and fine dendritic drainage.
- c) **Limestone** – In humid regions limestones show varying topography (gently rolling), medium tone, mottled texture, internal drainage and karst features such as sinkholes, solution enlarged joints etc. In arid regions limestone shows bold topographic expression similar to sandstone.

### Igneous rocks

Intrusive igneous rocks tend to be homogeneous over large areas, lack bedding, but show pronounced joints or fractures. Extrusive rocks exhibit special landforms.

#### **Intrusive rocks –**

- a) **Granite** – Show medium to light tone, coarse topographic texture, coarse textured drainage. Radial or angular drainage, hummocky inselberg and undulating pediment topography. Criss-cross joint patterns are noticeable. Upper parts of pediments are often stony and sparsely cultivated, tones are lighter. At places gully erosion occurs.
- b) **Dykes** – Dykes are identified as rectilinear or curved ridges that stand up because of greater resistance to erosion than the surrounding rocks. Vertical exaggeration helps in identification of dykes in a great way. They may also exhibit sharp tonal contrast with surrounding rocks.

#### **Extrusive rocks –**

- a) **Basalt** – Dark tones, medium texture, joint controlled, medium textured angular to dendritic drainage. Plateau, mesa and butte are common with serrated margins and concave profile. Flow layers noticeable at places on slopes. Low lying areas with black cotton soil (dark tone) with intensive landuse in Indian case. Elsewhere cinder cones with associated lava flows and flow structures are identifiable.
- b) **Acidic rocks** – Acidic flows have lighter tones. Form thick flows with prominent steep edges.

## **Metamorphic rocks –**

Since the large scale distinguishing characters are generally lacking in metamorphic rocks and the photo-characters are somewhat similar to their parent rocks. It's difficult to identify and interpret them from aerial photographs. Bedding is hardly recognised. The only clue to distinguish bedding in meta-sediments is possibly the tonal contrast.

- a) **Gneiss** – Characters broadly similar to granite. Bold hilly topography, steeper slopes and sharper crests compared to granites. Drainage is dendritic. Lineation may be visible.
- b) **Schist** – rounded hills, similar to shales are developed but the lower flanks of the hills are steep. Fine drainage and sometimes rectangular and annular pattern is seen. Hairy appearance of tone in the form of very fine lines, closely spaced and parallel appearance of the entire area is characteristic.
- c) **Slate** – Rugged, deeply dissected hills are commonly seen. Slate is mostly in contact with schist and the contact is sharp and irregular with transitional zones. Thin soil cover and poor vegetation cover.
- d) **Quartzite and marble** – show light to medium tones, which is same as their parent sedimentary rocks.

## **Structural Interpretation**

Using aerial photographs structural map with greater details and accuracy can be prepared. The main aim of structural interpretation is to mark the a) attitude (dip & strike); b) distribution; c) continuity/discontinuity of key horizons, and lineaments/faults to know the structural relationship of different formations. An understanding and analysis of geomorphology (drainage, slope changes) may help in the structural interpretation.

### **Beds**

Flat lying or horizontal beds show banded tone that follows the topographic contour. The resistant beds form steeper slopes or vertical cliffs. Dendritic drainage develops unless controlled by joints and faults.

Dipping beds show curved banded tone or vegetation patterns and form ridge valley topography. When the topographic surface coincides with bedding surfaces then the dip direction is readily apparent in aerial photographs. When bedding is expressed by bands of different photographic tones or by topographic breaks in slope, the rule of V's may be applied to determine the direction of dip, i.e. where the trace of a bed intersects a stream valley a V in the outcrop pattern will point in the direction of dip.

### **Folds**

Folds are commonly seen entirely on aerial photographs. Erosion may expose a cross section of folded structure. Drainage also helps in recognition and delineation of folds. Folds can be recognised by

- i. tracing or marker horizons which are curved
- ii. recognition of dip
- iii. drainage characteristics.

In case of plunging folds the streams curve around the nose of the fold and form annular pattern. Domes have annular/radial drainage, while the basins have centripetal drainage.

### **Faults**

It is very easy to identify the faults on aerial photo. Faults are expressed as anomalous truncations or offsets of formations, sharp topographic break and linear alignment of streams, water bodies or vegetation. Faults can also be expressed by offset of beds, offset of ridges, dykes etc. Faults are expressed as linear features having different photo tone, erosional textures on opposite sides of it. The tonal contrast along a linear feature may also be because of vegetation.

### **Joints**

Joints are expressed as linear features on aerial photographs. In horizontal or gently dipping formations two sets of intersecting faults may give rise to blocky appearance to topography. Rectangular drainage results due to intersecting (at 90°) joints. Vegetation alignment may also be seen along the joints due to the presence of moisture.

### **Unconformity**

Angular unconformity and non conformities can be easily identified on aerial photographs due to tonal and vegetational contrasts, topographic breaks, truncation of beds/formations.