

SEMESTER-6
GEOLOGY(H)
C13T-UNIT 6 (PHOTOGEOLOGY)
**Identification of Igneous &
Metamorphic rocks**

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Igneous Rocks

- **Lack of bedding or foliation**
- **Intrusive igneous rocks**
 - Massive and homogenous
 - Often well jointed which can be easily mapped on the remote sensing data due to vegetation and moisture differences
 - Dendritic drainage or rectangular/angular pattern
 - Occur in different shapes and dimensions
- **Extrusive igneous rocks**
 - Associated volcanic landforms such as lava flows, cones, craters, dykes etc.

Intrusive Igneous Rocks

- Intrusive (Plutonic) Igneous Rocks are formed by molten material rising within the earth but never reaching the surface, thus experiencing slow cooling and solid, unbroken nature.
- Later, if exposed by erosion of the overlying rocks, these rocks form impermeable surfaces on which dendritic or rectangular drainage patterns are well displayed.
- Gullies will be wide and U-shaped.
- Light tones often indicate areas of granite, while dark tones express the presence of gabbro or andesite.

Extrusive Igneous Rocks

- Extrusive are formed by the quick cooling and solidification of molten matter.
- Example: **lava flows**, the material is **often highly jointed or fractured due to the rapid cooling** and more susceptible to weathering and erosion than intrusive igneous rocks.
- Drainage tends to be **rectangular to parallel**, with **coarse texture** because of the permeable nature of the rocks.
- One might find **radial drainage** patterns indicating **volcano cone** development.
- Light toned areas indicate Rhyolite
- Dark tones indicate basalt etc.
- Lava flow areas often appear as dark toned sedimentary rocks, forming stair-step valley walls when the lavas are of different resistance to erosion.

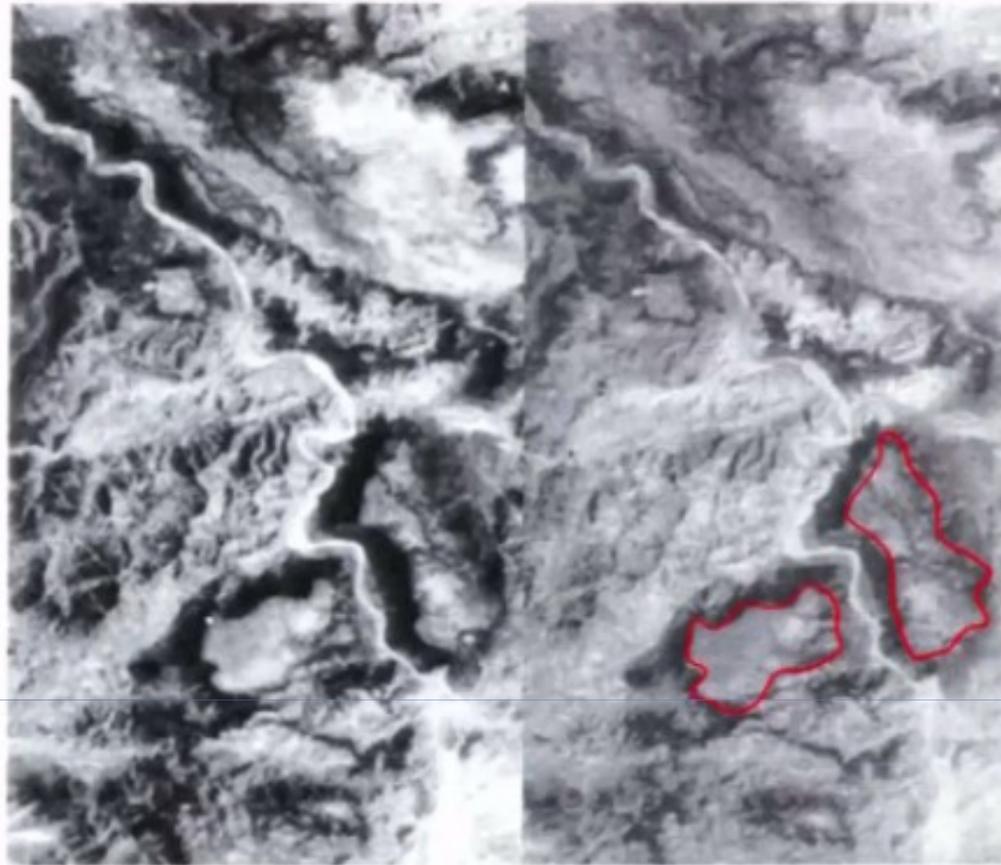


Fig. 16.4. MOMS-02P panchromatic stereo pair showing volcanic plateau landform in Somalia. (Courtesy of DLR, Germany)

- Now this is a typical of volcanic plateaus which you will come across in an igneous terrain what you have is very flat turtle like feature here and typical of here too. So this will clearly talk about the volcanic terrain mainly.



Fig. 16.5. Landform formed by flood basalt – Deccan Plateau, India. The topography is flat-topped plateau, generally dark-toned in the VNIR range, due to black-cotton soil. Vegetation is sparse and the terrain is marked by high-density dendritic drainage, monotonously extending over large tracts. (Landsat MSS4 infrared image)

GRANITE

Weathering	More in humid warm climates (<u>spheroidal weathering</u>) than in cold dry climates
Landform	Bodies of gigantic dimensions; low-lying topography, large boulders in valleys
Drainage	Low to medium density, rectangular or angular when well jointed
Vegetation	Poorly to thickly vegetated
Spectral characters	VIS-NIR-SWIR : light to medium toned, low emissivity bands due to quartz and feldspars in 9-11 μm and therefore darker appearance. Weathering, surface moisture, soil and vegetation may alter the response significantly

Metamorphic Rocks

- Marked by foliations and faint stratification
- Foliations are manifested as numerous photo-lineation parallel to each other
- **Examples:**
- **Quartzites, Marble, Schists, Phyllites, Slates, Gneisses**

Metamorphic Rocks

- **Gneiss:** Gneissic area show almost similar characteristics that is seen in granitic terrain.
- Shows prominent hilly topography
- Dendritic drainage to parallelism of the main stream (this is the main difference between the drainage in granitic and metamorphic terrain)
- Drainage shows some angularity
- **Schist:** shows rounded hills very fine drainage. Rectangular and angular pattern referred as *Waffle Pattern* - hairy appearance
- **Slate:** deeply dissected hills, rectangular drainage controlled by joints and cleavage planes.

Quartzite

Weathering: Highly resistant in both dry and humid climates.

Landform: Hills, ridges, scarps and topographically prominent features.

Drainage: Low to medium density because of steep slopes, rectangular or trellis pattern.

Vegetation: Massive Quartzite barren, weathered impure Quartzite may support good vegetation

Spectral characters:

•**VNIR-SWIR** : light toned (steep slopes),

•**TIR** : Low emissivity bands due to quartz and feldspars in 9-11 μ m and therefore darker appearance.

•Weathering, surface moisture, soil and vegetation may alter the response significantly

Metamorphic terrain

Landsat MSS
FCC

Folded metamorphic
strata

Canadian Shield



- Now typical of metamorphic terrain you will see in very linear features here and since they are highly deformed you can come across the folded metamorphic stratas and there is a typical landscape which one can see here

Schists, Phyllites, Slates

Weathering Generally incompetent rock

Landform Valleys and lower hill slopes, rounded forms in humid climate

Drainage Dendritic, well developed, high DD, controlled by foliation

Vegetation Fairly good vegetation in humid climate, sparse in arid climate

Spectral characters:

Depends on mineral composition: Fe-rich minerals produce dark tone in blue-green band (prominent absorption bands at 2.1-2.4 μm)

Gneisses

- **Weathering:** Greater resistance than schists and phyllites but lesser than quartzite
- **Landform:** Low lying undulating terrain, rounded smooth surfaces
- **Drainage:** High density, sub-parallel, sub-dendritic, rectangular
- **Vegetation:** Good vegetation cover
- **Spectral characters:** Highly variable, spectral banding of dark and light tone may be prominent.

THANK YOU