

## Geomorphology questions on Fundamental Concepts

2015 : " Present - day landforms bear more complexity than simplicity." Elucidate

and

2016 : " Geological structure has a dominant control on landforms and is reflected on them" Discuss

Frame Evolution and growth of geomorphology from parent discipline geology, involves long sequence of contributions. These ranges from Pre historic scholars to the modern contributors.

Geomorphic studies involves elaborate technical and empirical constituents of landform developments These are essentially generalised as - Fundamental Concepts of geomorphology - which provides Comprehensive base to interpret landscape devpt.

⇒ both the answers needs to be separately handled.

**Concept :** Complexity of geomorphic evolution is more common than simplicity

Answer Usually most of the topographic details have been produced during the current cycle of erosion, but there may exist within an area remnants of features produced during prior cycles.

It is rare thing to find landscape assemblages that can be attributed solely to one geomorphic process - though there can be one dominant process.

It may facilitate our interpretation of landscape to group them into 5 major categories (Hornberg 1952)

- Simple landscape
- Compound landscape
- Monocyclic landscape
- Multicyclic landscape
- Exhumed/ resurrected landscape

→ Simple landscapes are those which are product of single dominant geomorphic process. In comparison Compound landscapes are those in which two or more geomorphic processes have played major role in development of existing topography.



- It might be argued that nearly all landscapes are compound in nature as for rarely do we find any extensive area in which the landforms can be attributed solely to action of one process.
- It is however perfectly logical to designate a certain landscape as being primarily the work of running water - structural benches - even though, weathering, mass wasting and removal of loose material by wind may have contributed to its development.
- \* Compound landscape justifies complexities to be the rule of landforms than simplicity.
- Monocyclic landscapes are those that bear the imprint of only one cycle of erosion, in comparison, multicyclic landscapes have been produced during more than one cycle of erosion
- Monocyclic landscapes are less common than multicyclic and are in general restricted to such newly created land surfaces - as
  - recently uplifted portion of ocean floor
  - the surface of volcanic cone
  - lava plain and plateau



- Much of the world's topography bears the imprint of more than one period of erosion. The older erosional topography may be represented by only limited upland remnants or by benches along valley sides above present valley floors
  - Features of multicyclic origin has been described from all the continents except Antarctica.
  - \* It must be recognized that both monocyclic and multicyclic landscape may either be simple or compound in nature.
  - To the idea of complex evolution of landforms should be added the concept of polyclimatic landscapes. It has become evident that landscapes have evolved under more than one set of climatic conditions thus variations in dominant geomorphic processes.
  - Exhumed landscapes are those which were formed during past geological time, presently buried. Such landscapes may date back as far as Precambrian or as recent as Pleistocene.
- ⇒ Thus we can easily conclude the complexity is more the rule of landscape than simplicity.



**Concept :** Geologic structure is a dominant control factor in the evolution of landforms and is reflected in them.

Answer W.M. Davis advocated that landscapes are function of structure, process and stages. The term structure is applied for rock features as folds, faults, unconformities, along with physical and chemical attributes.

It includes all the phenomena and ways by which rocks of earth's crust differ from one another as

- presence / absence of joints
- rock massiveness
- physical hardness of constituent minerals
- susceptibility of mineral constituents to chemical changes
- permeability of rocks
- faults and folds etc.

The term structure also have stratigraphic implications and knowledge of rock sequence both in outcrop and in subsurface

During the process of erosion, it is inevitable that some structures will be more resistant to destruction than others.

→ Relative erodibility or rock resistance is subjective property - as gravel alluvium may survive on very



old river terraces, not because of its cementation or lithification but because it is so permeable that rainfall percolation is high restricting runoff.

→ Fractures as structural control - as joints are probably the most common rock structure breaking all rock types in all orogenic and epeirogenic settings. They control weathering, mass wasting and erosion. Formed due to contraction on cooling, tectonic stress and release of pressure, these provides openings for groundwater movements and weathering.

→ Differential fluvial erosion on layered rocks - most sedimentary rocks have layers of contrasting erodibility. The layering may be the result of sedimentary stratification, igneous intrusions or metamorphic differentiation. Weathering emphasize even slight contrast in lithology, but on a larger scale, belts of distinctive erosional topography form on the exposed edges of rock layers.

→ Volcanic plateaus are built of piles of lava and tephra sheets and intrusive sills, crossed by numerous dikes. Monogenetic or rapidly sequential eruptions may cover, very large area with fresh flow of lava. However the upper and lower mass wasting are intensified.



Tors are masses of jointed bare rock, stacked like blocks. They are not transported but result from differential weathering and erosion along joints. Typical to savannah and periglacial regions it indicates structurally controlled sub surface weathering

→ Most of the present day subaerial landscape is eroded on stratified sedimentary rocks. The sedimentary cover strata range from easily eroded unconsolidated Cenozoic glacial drift or coastal plain to stronger, better lithified and folded/faulted Mesozoic and Paleozoic rocks. Flat lying sedimentary rocks of contrasting erodibility form structural benches or valley walls. Popular terms - Mesa and Butte has evolved to differentiate structurally controlled ridges.

- In terms of cycle of erosion the structural characteristics determines the transition from young to old stages of landscape.

Terminology of  
Structurally controlled  
scarp & ridges

