SOURAV SIR'S CLASSES

Geological Work of Underground Water

(Part-1)

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Geological Actions of Ground Water

There are three processes by which different landforms are created by groundwater. They are-

1. Erosion

2. Transportation

3. Deposition

1. Erosion

The erosional action of groundwater is mainly dominated by the process of chemical weathering of rocks. Mechanical weathering of rock is negligible here. Groundwater brings about chemical erosion by the process of solution action, which is evident in the regions consisting of soluble rocks like limestones, dolomites, gypsum and anhydrites. In some area where deposits of salt occur in rocks solution effect is also observed there.

Important Erosional Features Associated With Karst Topography-

a) Karst topography- Karst Topography is the formation of landforms due to solution and deposition on any limestone or dolomitic region by the action of groundwater or surface water.

b) Lapies; Rillenkarran; Grikes and Clints- A weathered limestone surface is known as Lapies . Lapies form when water rushes over a limestone surface due to which uneven grooves and ridges form on the limestone's surface as it is partially removed by the solution process, thus giving rise to a rugged, irregular surface.

Rillenkarran are irregular surfaced structures formed when water flows over limestone surfaces. They are characterized by straight rounded grooves with sharper ridges.

Grikes and clints are karst features that develop when slightly acidic water dissolves the limestone or dolostone rock along cracks and fractures. Limestone region may consist of numerous conjugate joints at their surface. Over time erosion may widens and deepens the joints forming a more or less intersected surface pattern. These surfaces are called as limestone pavements. As the cracks enlarge and the intervening jointed areas are

completely lost by dissolution, there is formation of a groove and ridge pattern, which are called as clefts and ridges. Clefts in such pavements are called grikes and the ridges are called clints.

c) Sink Holes/ Dolines & Uvalas- Sink Holes are one of the most common features in Karst Topography. It is a depression on the limestone/dolomitic region that ranges from a shallow saucer shape to a funnel-shaped or cylindrical pipe.

In karst regions, a doline is a closed depression that drains underground. It might be formed like a cylinder, a cone, a bowl, or a dish. The diameter varies greatly, from a few meters to hundreds of meters. Doline is derived from the Slovenian term Dolina, which means valley. Doline are a type of sink hole that represents a topographic depression formed when underlying limestone bedrock is dissolved by groundwater. It is considered the most-fundamental structure of karst topography.
Uvalas are large, irregular, contiguous hollow forms in karst areas. Since karst processes are very slow, even the emergence of Uvalas is a long process. They go back to the formation of sinkholes. When sinkholes expand laterally by progressive erosion adjacent sinkholes can grow together to form a larger depression called as Uvalas.

d) Caverns, Galleries & Shafts- Caverns are karst caves that are formed due to the dissolution of soluble rock materials like limestone underground. As water seeps underground hollows are created where the water dissolves rocks within limestone areas while insoluble rocks stay intact to form the floors and walls of the caves. These caves formed below the surface are called as caverns.

Galleries are horizontal passages that links caverns at different distance. Shafts are vertical passage that connects caverns at different heights.

e) Arch/Natural Bridge- Due to dissolution effect some parts of the cavern roof collapses whereas some of the portions remains intact. The portions which keeps standing forms an arch and also connects the cavern at the top part thus forming a bridge like structure and are called as natural bridges..

f) Solution Valleys- The roof of the caverns may sometime collapse completely thus enlarging it in upward direction. Over time as the erosion continues a depression is formed which are usually elongated and narrow that resembles a closed-valley and is called as solution valley. These valleys are also called as dry-valley and common in limestone rocks. They may contain some sinking streams in them which are later lost due to flow in dolines, due to which these valley remains dry are hence are called as blind valley.

g) Polje & Hums/Pepino-Hills- The roof of the caverns collapse completely thus forming large depression of extensive size that are characterized with flat bottoms and closed shape with steep sides. They are called as polje.

They may be sometimes filled with water thus forming polje lakes. Small residual hills of resistant rocks that had survived the vehemence of erosion are sometimes found on the floor of polje and are called as Hums or pepino-hills.

h) Stylolites- They are irregular contacts developed between rocks of different compositions due to differential dissolution effect. At the stylolitic contact portions of less soluble rocks are found to project into the more soluble rock.

2. **Transportation-**

Transportation by underground water takes place by solution effect where the soluble rocks are dissolved along with the flow and deposited elsewhere thus forming different depositional landforms.

3. **Deposition**

Factors controlling deposition-

- Evaporation.
- Loss of CO_2.
- Change in temperature and pressure conditions in an area.

Important Depositional Features

1. Stalactites , Stalagmites & Drip-stone - They are the depositional landforms formed by underground water. Stalactites form where calcite rich water enters the cave through joints or fissures present in the ceiling. This water contains high concentration of carbonates and when the drop grows and falls down along the roof of the cave, it will deposit some calcite. This deposit grows from the roof downwards into slender stalk-like features and are called as stalactites.

Also drops falls on the floor of the cave from along the stalactite margins. With time deposition of calcium carbonate occurs at the floor, that grow upwards and are called as stalagmite. Drip-stones (pillars) are formed by the coalescence of a stalactite and a stalagmite to form a pillar-like structure.

2. Sinter & Travertine- In regions where superheated hydrothermal spring water (carrying high amount of dissolved calcites or silica) comes out to the surface, results in superficial deposits of silica or calcium carbonate. The silica -rich deposits are called as sinter and calcite- rich deposits are called as travertine.

3. Geode - Geodes are spherical to sub-spherical rock structures with an internal cavity lined with mineral materials. They have a durable outer wall that is more resistant to weathering than the surrounding bedrock. This allows the geode to survive intact when the surrounding bedrock weathers away. The mineral

lining the cavity is often a scintillating druse of tiny quartz crystals underlain by multiple bands of translucent gray and white agate.

4. Concretion- They are nodular or spherical deposits of calcareous or ferruginous matter around a nucleus (may be clay, silt or shale).

5. Replacement deposits- When the organic component of a matter is replaced by inorganic components like carbon, it results in the replacement deposits. Example-petrified wood (here the replacement process is slow and on a volume-to-volume basic where the internal tissue structure of plant is preserved).