SOURAV SIR'S CLASSES

Geological Work of River

(Part-4)

2. Transportation

The process of carrying the sediments generated by weathering and fluvial erosion, by the river / stream water downstream under the action of gravity is called as transportation. The total amount of sediments carried by river water is called as load. The stream transport in two ways-

i) **Chemical transportation-** Here the mineral matters that are soluble in water completely or partially are transported either in dissolved state or colloidal state. The load transported in dissolved state includes calcareous rocks like limestones and dolomites and even salts that are easily soluble in water and hence are transported in solution. Whereas some compounds of iron, manganese, phosphorous are transported in the form of colloidal solution.

Facts To Know

Colloid is a mixture in which one substance of dispersed insoluble particles is suspended throughout another substance. Colloidal solution refers to the overall mixture. Unlike a solution, in which solute and solvent constitute only one phase, a colloid has a dispersed phase (the suspended particles) and a continuous phase (the medium of suspension). To be a colloid, the mixture must be one that does not settle or would take a very long time to settle.

ii) Mechanical Transportation- In this case the sediment loads are carried mechanically due to the force of running river/stream water by different methods. Mechanical transportation depends on the following main factors-

a) Height of the source region

b) Velocity of river water

c) Volume of water entering the river system

d) Density of rock materials to be transported.

The stream transport load mechanically in two ways-

1. Suspended load- Fine sized sediments like clay and silt are transported in suspension as; they have low density hence floats on the water surface. The factors which determine the amount of suspended load that can be carried by the stream water and the time period for which they can remain in suspension are the velocity of flow and intensity of turbulence within water column.

2. **Bed load**- Two ways by which sediments are transported as bed-load are- saltation and traction or surface creep. Sand sized sediments are transported in **saltation** whereas coarse grains(like pebbles, cobbles and boulders) are transported as **traction load**.

Facts To Know

- The velocity of a stream depends on the following factors-

1. channel gradient
2. channel size and shape
3. amount of sediment load.

- The increase of velocity of river water increases the transporting power of a river as much as the 6^{th}-power of the velocity,

i.e- **Transporting Power ∞ V^6**

It means the during flood the transporting power of stream suddenly rises very much due to which the stream may carry big boulders downstream which were otherwise immovable.

3. Deposition

The sediment loads carried by river water are deposited downstream thus forming various depositional features. The materials which a stream deposits as sediments are called as "alluvium" or "alluvial deposits" or "fluvial deposits". Deposition by river water takes place due to the following conditions-

a) Decrease in channel gradient

b) Decrease in velocity of river

c) Decrease in volume of water (or amount of discharge)

d) Change is course of stream

e) Chemical precipitation

SOURAV SIR'S CLASSES

Types Of Depositional Features Produces By River Action

1. **Alluvial fans and Cones**- An alluvial fan is a triangle (or cone or fan)-shaped deposit of gravel, sand, and even smaller pieces of sediment, such as silt. These sediments are called alluvium. The stream carrying alluvium rushes down the mountain slopes into a broad flat valley region, where due to sudden decrease in gradient the velocity of flow decreases, thus depositing the alluvium therein to form a broad, low cone-shaped deposit called as alluvial fan. The alluvial fan is formed at the mouth of a dried-up river, in the mountain fronts. The narrow point of the alluvial fan is called its **apex**, while the wide triangle is the **fan's apron** (or **base**). Since the rivers that deposit alluvial fans tend to be fast-flowing, the first material to be laid down is usually coarse. However, fans consist of a wide range of sediment sizes and a high degree of sorting from apex to base. Usually the coarser sedimentary fraction forms towards the apex, with fine sands and silts toward the base.

Alluvial fans are built up in response to tectonic uplift, climatic change, and variations in the internal (autocyclic) balance between stream discharge, debris load, and surface gradient. Even in tectonically active mountains, climate can be a strong influence in alluvial fan development. They tend to be larger and more prominent in **arid** and **semiarid** regions, however, and generally are regarded as characteristic **desert landforms**. They are common in the **basin-and-range type of areas**, where the basic landscape configuration consists of mountains set against adjacent basins.

The term alluvial fan is applicable when the slope of the fan–shaped deposits is less than 10°. But if the slope is 10° to 50° then the term **alluvial cone** is used.

2. Bajada- Bajada are broad slope of debris deposits spread along the lower slopes of mountains by descending streams, usually found in **arid or semiarid** climates. A bajada is formed by the **coalescing of several alluvial fans along a mountain front**. Such coalescent fans are often mistaken for erosional landforms formed by fluvial action known as pediments. The repeated shifting of a debouching stream from one side of a fan to the other spreads the sediment widely and almost uniformly. As the sediment eventually grows together, the slope may extend outward from the mountain front to a distance of several kilometres. A bajada is usually composed of gravel**ly alluvium deposits and may even have large boulders inter-bedded in it. The** slope is usually less than 7°. But in humid climates, landforms of this nature are usually referred to as piedmonts.

3. **Flood-plain deposits**- Floodplain also called **alluvial plain** are flat land area adjacent to a stream, composed of unconsolidated sedimentary deposits (alluvium) and subjected to periodic inundation by the stream during flooding. Floodplains are produced by lateral movement of a stream during flood conditions, where the stream water overflows its banks and submerges the adjacent low lying areas thus depositing alluvial materials that form

the **overbank deposition**. Therefore they are absent where downcutting action by river is dominant. Features associated with the flood plains are as follows-

i) **Meanders and Ox-bow lakes**- Meander is defined as a pronounced curve, generally symmetrical S-shaped formed in the course of a river channel. Meanders develop in matured rivers in which side cutting maximum that results in the development of meanders. The outer bend of the loop in a meander is characterized by intensive erosion and vertical cliffs and is called the **undercut side**. This side has a concave slope. The inner side of the loop is characterized by deposition, a gentle convex slope, and is called the **slip-off side.** The meanders grow due to deposition of sediments along the slip-off side and erosion at the undercut side. Meanders continuously change their position and shift both downstream and to the side. The sideways movement occurs because at bends the swiftest currents shift toward the outside bank causing erosion at the outer of the meandering curve and deposition of sand at the inside of the curve. The sand deposits formed at the slip-off side of a meandering river are called as **Point bars**. The river having a meandering shpe is called as meandering river.

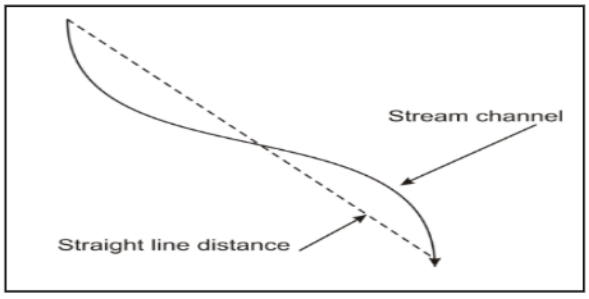
Oxbow Lake- These are small, wavy, horse-shoe shaped loops of abandoned channels that are detached from the main channel and formed adjacent to the main channel. Ox-bow lakes are formed during flood conditions, where because of intensive erosion action, the outer curve of a meander gets accentuated to such an extent into the flood plains that the inner ends of the loop near the neck of the meandering channel come close enough to get finally disconnected from the main channel. This result in the formation of a meander loop towards the outer bank of the channel that exist as independent water bodies called as oxbow lakes. The phenomenon is called as cut-off. These water bodies are converted into swamps in due course of time. Whereas the main channel now follow a more or less straight path.

Facts To Know

Neck & Cutoff- A **neck** is the upland between opposing meanders of a stream. A **cutoff** occurs when the neck between river meanders is eroded away and the meanders join to shorten the length of the channel. The slope of the channel increases as well when the river shortens its length.

Sinuosity Index (SI) For Meanders

$$\frac{\text{Length of stream channel}}{\text{Length of straight line distance}} = \text{sinuosity}$$



ii) **Natural levees**- They are narrow ridge of alluvium deposited at both sides of the channel. During high discharge periods when the stream floods, coarse sediment settles out near the stream channel and grades to finer material further away deposited over the flood plain. The over bank deposits of alluvium are often rich sources of nutrients for soils developed on the floodplain. Floodplain soils are usually quite fertile.