

Geological Work of Wind

(Part-1)

Wind- Wind is moving air .Wind is caused by differences in air pressure within our atmosphere. Air from high pressure areas flows toward areas of low pressure. The greater the difference in pressure, the faster the wind blows.

Geological Actions of wind

Geological actions of wind can be classified into three types-

1. Erosion
2. Transportation
3. Deposition.

All the above processes depends largely on the velocity of wind.

The geological actions of wind is particularly effective in areas that lacks plant cover, have low precipitation (or rainfall) and have a considerable diurnal and seasonal variation in temperature.

1. Erosion

The different types of erosional processes associated with wind are of three types-

- A. deflation
- B. abrasion
- C. attrition

In these erosional processes, wind uses sand as the agent of erosion.

A) Deflation-

The process of lifting up of loose sand grains of variable sizes and transporting them by strong wind is called as deflation. By this process the land surface is gradually lowered. The process is most evident in areas characterized by low rainfall (deserts). It depends on the factors like- wind velocity, nature of rock and the degree of weathering. Geological features produced by deflation are as follows-

i) **Hamada**- A hamada is a type of desert landscape consisting of high, largely barren, hard rocky plains, where most of the sand has been removed by deflation. The majority of the stone-strewn surfaces in the Sahara are called hamada. These are a form of lag deposits.

ii) **Blow-outs**- Also known as **deflation hollows**. These are depressions or hollows that are created on land surface due to continued deflation or removal of sand or silt deposits from areas having little or no vegetation.

Oases are formed when the depressions or hollows created due to deflation are filled with water (either rainwater or when the depression intersects the water table). Oasis may also support small scale vegetation (commonly palm trees or fertile tract of land) that occurs in a desert wherever a perennial supply of fresh water is available.

iii) **Desert pavements**- Due to deflation as the finer particles are removed from the land surface, the coarse grained pebbles becomes closely fitted together forming a harder layer that somewhat protects the underlying sediments from further erosion. The layer so formed by closely fitted pebbles is called as desert pavement.

B) Abrasion

High-speed winds carry soil particles, smaller rocks and other debris with it, that acts as **tools**. As the wind encounters any obstacle in its path the tools carried with the winds at high speed results in wearing away of the surfaces with which they comes in contact. This process is called as abrasion. The wind **sandblasts** rock surfaces by hurling sand particles on them. The debris acts like sandpaper, causing erosion and friction on adjacent rocks surfaces. Rock surfaces are scratched, polished, and worn away as a result of abrasion. The amount of material that the wind can carry is greatest near the base of the rocks; hence abrasion is most effective there. In other words, the main effect of abrasion is mostly observed in under-cutting and fluting at the base of an upstanding rock mass.

Geological features produced by abrasion are as follows-

i) **Yardang**- They are large area of soft, poorly consolidated rock and bedrock surfaces that have been extensively grooved by wind erosion. The rock is eroded into alternating ridges and furrows essentially parallel to the dominant wind direction. Yardang commonly develops in desert areas having vertical layers of alternate hard and soft rocks exposed at the surface.

ii) **Zeugen**- 'Zeugen' is a word from German language which means '**Like Table**'. When soft rocks covered by hard rocks are eroded by winds, hard rocks are left behind and they may looks like table and are known as 'Zeugen'. They are elongated in the prevailing wind direction. Here the strata are horizontal.



iii) **Ventifacts**- The pebbles present in desert areas are continuously eroded by wind blowing in variable directions, due to which reasons the pebbles develop smooth surfaces and are called as ventifacts. Depending on the number of abraded surfaces the pebbles are named accordingly as- **Einkanter** (one smooth surface), **Zweikanter** (two smooth surfaces) and **Dreikanter** (three smooth surfaces).

iv) **Pedestal rocks**- In desert regions when alternate layer of soft rock at the base covered by a hard rock occurs, then due to wind abrasion and sand blasting action near the base of the strata, it gets eroded. The erosion is such that it results in the development of a **mushroom-shaped form** of the rocks in which the lower softer rocks form a slender column that is capped by the overlying hard rock. These structures are also called as pedestal rocks.

C) Attrition-

Sand particles carried by the wind begin a friction process due to collision within themselves, reducing their size. This is referred to as attrition. In other words, attrition is the process of erosion of sand grains that occurs during their transportation due to collision among sand grains. Rocks undergoing attrition erosion are often found on or near the bedrock. Attrition is also partially responsible for turning boulders into smaller rocks and eventually to sand. High-speed winds, speed up the erosional process. Hard rocks, on the other hand, take a long time to erode, whereas soft rocks erode quickly.

2. Transportation

Three types of transportation processes operate in case of wind-

- A. **Suspension**- The finer particles (sand, silt, clay) are commonly transported by wind in the form of dust storms. Here the particles remain in suspended form and move with the wind flow for some time and settle down at some other place. This process is called as suspension.

- B. **Saltation** – Medium sized particles that cannot be transported in suspended form move near the surface in a parabolic path as they are lifted up and strike the ground with considerable force when they fall off.

This process of turbulent flow of air due to which the particles are made to roll forward and upon knocking against an obstacle they bounce up in the air and again fall off to the ground is called as saltation.

- C. **Surface creep/Traction**- It is the method of transporting heavy sand particles, pebbles through rolling and creeping at the surface.

3. Deposition

The drifted materials carried by wind tend to heap-up when they encounter any obstacle and hence leads to the formation of depositional landforms which are also termed as the **aeolian-deposits**. Different types of aeolian-deposits are as follows-

i) **Loess**- Sedimentary material of the silty or loamy variety that is typically yellow or brown in colour and that are deposited by the wind is known as loess. Loess are wind-blown silt and clay deposits. Loess are unstratified deposits and has high porosity.

ii) **Sand ripples**- These are small asymmetrical ridges that stretch parallel to one another. Ripples are formed at right-angle to the wind direction.

iii) **Sand dunes**- They are larger landforms than ripples. Dunes are accumulation of sand carried by wind usually in the form of round hillock or ridge with a crest. Dunes develop commonly in areas with strong winds that blow in same direction often. Most sand dunes are asymmetric in cross-section, i.e. it has a long, gentle slope in the wind-ward direction called as the stoss-side, a sharp crest and a short, steep-face in the down-wind direction called as the lee-side. The wind erodes sand from the windward stoss side and deposits the same on the lee-ward side (also called as slip face). Following are the different types of dunes-

a) **Longitudinal or Seif dunes**- These are large asymmetrical ridges of sand that develop parallel to the wind direction. Longitudinal dunes form when the sand supply is limited and wind is strong and blows in a constant direction.

Parallel series of longitudinal dunes often consists of bare stretches of desert in between them, which indicates that prevailing wind which are strong enough to drift the sand have a higher velocity along the bare strips than along dunes. Thus it causes to develop eddies of wind that carries the sand from the bare patches towards the sand strips on their either sides. This phenomenon is called as '**Shepherding effect**' of wind.