

# WEATHERING

**Weathering is a process of decaying and disintegration of rocks of the earth's crust exposed to atmosphere**

- **Main process of denudation**
- **Products of weathering removed from the place of formation – Erosion**
- **Rate of weathering depends upon**
  - a) Nature of the rock**
  - b) Climate**
  - c) Topography of the area**
  - d) Weathering agents**

# Kinds of Weathering

- **Agencies of Weathering are two in number:**
  - **Mechanical Weathering and Chemical Weathering**
- Mechanical Weathering - Physical change in which materials disintegrate by frost action, temperature, organisms etc.**
- **Frost action** – During day time ice melts and water percolates in the cracks of the rocks and at night due to fall in temperature water freezes and expands about ten times. Freezing and thawing of water breaks up even hardest rock into smaller pieces. Big fragments fall to lower level under the action of gravity – Talus/Scree. Sliding of rock waste is known as landslide.



Effect of Weathering on Granite

**Insolation** : In deserts the diurnal temperature is very high, the result is that the bare rock surface gets heated up during the day and expands. At night the temperature falls and rocks begin to contract. The alternate expansion and contraction produces a tension in the rock and are crushed to pieces

In semi-arid regions the shells resulting from the rocks in the above processes are of curved nature known as exfoliation. It is defined as peeling of concentric shells from surface of the rocks because of their unequal contraction and expansion under the influence of temperature changes. The effect of exfoliation are well known in the granitic rocks of Mt. Abu (Rajasthan)



Weathering near the sea coast due to salt crystallization

**Action of Rain** : The action of rain as an erosive agent is seen in what are known as earth pillars. The ideal condition for their formation is when rocks are composed of hard and soft material. The softer material is washed off while the harder remains at the top and acts as a cap thereby producing the earth pillars.

**Ice Action** : Ice plays a dominating role in the weathering of rocks. The development of crevases, U- shaped valleys, V-shaped valleys, kames, eskers etc. are the main features of glaciation.

**Wind Action** : As in humid regions rivers and in the colder regions the glaciers are the chief agents of denudation, similarly in deserts wind is the chief agent of denudation.

**Actions of animals and plants** : Burrowing animals such as rodents, termites and earth worms produce tons of fine earth everyday. Plants contribute much towards rock disintegration. Man being the social animal is also responsible for the disintegration of the rocks

# Chemical Weathering

Chemical weathering comprises changes in which minerals are decomposed, dissolved and loosened by the action of oxygen, water and  $\text{CO}_2$

**Oxidation** : Chemical union of oxygen with another chemical element. When oxygen reacts with iron, the later gets a coating of iron-oxide / rust. Rocks which contain a mineral content of Fe are oxidized during rainy season and the whole rock mass decomposes



Chemical Weathering (Oxidation)

**Solution** : Solvent action of water is the first important means of weathering, the more soluble rocks such as limestone and rocks containing calcareous cement. Solvent action is increased in the presence of CO<sub>2</sub> and the organic acids formed by the decay of dead animals and plants. Compounds of K, Na, Ca, Mg are readily removed in solution.

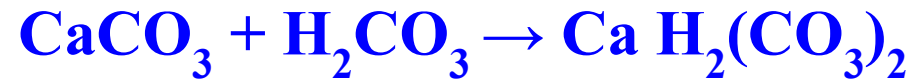
**Hydration** : It means chemical combination of water molecules with a particular mineral. Soil forming minerals occurring in the rocks do not contain any water. They undergo hydration when exposed to humid conditions.

A large number of minerals such as feldspars, Amphiboles, mica, pyroxenes etc. become hydrated forming hydrous compounds for instance:



Weathering of Limestones

**Carbonation** : Carbonic acid is very important agent of chemical weathering as it makes minerals more soluble. Atmosphere contains only 0.03% CO<sub>2</sub> but rain water may contain as higher as 0.45% CO<sub>2</sub>. Decomposition of organic matter liberates CO<sub>2</sub> in large amount. Carbonation tends to produce carbonates and Bicarbonates



**Weathering of building stone**

## **Biological Weathering**

**Produces organic acids thus adding to chemical reactions and which may also be an agent assisting mechanical disintegration. Organic matter is broken down by micro-organisms to give water and either Carbon dioxide or methane and small quantities of ammonia and  $\text{HNO}_3$ .  $\text{CO}_2$  is produced by aerobic micro-organisms, which require oxygen to survive. Methane is produced by anaerobic micro-organisms which flourishes in environment that are deficient in oxygen, referred to as reducing environment.**



## **Special characteristics of Weathering**

**Badland topography** : Badland is a peculiar feature of weathering by water. They look as if giant claws not water had raked through earth's crust, cutting and breaking it into gorges, towers and tumbled blocks. These badlands are found in the region of relatively high rainfall. When rain falls, there are few roots to capture water. It collects in gullies and dashes downwards cutting deeper and deeper through softer rocks.

**Mesas, Monuments and Goblins** : In badlands we find rocks sculptured into strange forms by erosion. The most typical features are mesas, natural bridges, towers, monuments and goblins. The main reason for such forms is uneven erosion due to difference in resistance of rocks. As the surface of rock is gradually cut away, the soft rocks are destroyed faster than the harder ones.