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## **Title – Weathering and its effect**

### **In partial fulfillment of ‘Your Degree’**

**Submitted by - Tim Moody**

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## Weathering – Dynamics on earth’s surface

Weathering is interaction of physical, chemical and biological processes that alters rocks, soils and their minerals in some general or specific way. These processes combine to produce soil from bedrock. Weathering transforms primary minerals, helps in building ecosystems, mediates the effect of toxic components within the biosphere, creates water flow paths that shape and weaken bedrock, and contributes to the evolution of landscapes.

### How Weathering different from erosion and metamorphism

#### Weathering and Erosion

Weathering is different from erosion as erosion is physical displacement of rocks, soils and other weathering objects by wind, water, ice or gravity while weathering is altering the state of the object. To put it simply if a particle is loosened, chemically or mechanically, but stays put, call it weathering. Once the particle starts moving, call it erosion.

#### Weathering and Metamorphism

The key difference between metamorphism and weathering is that weathering is a surface or near surface process while metamorphic changes takes place where either the pressure or temperature or both are significantly different than conditions found on the Earth’s surface.

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Weathering process can broadly be categorized in two categories

1. Mechanical weathering
2. Chemical weathering

### **Mechanical Weathering**

It is also called physical weathering; it is disintegration of a rock into smaller fragments, each with the similar properties as the original. Mechanical weathering mainly occurs by temperature and pressure exertion and changes.

#### Types of Mechanical Weathering -

##### Thermal Expansion

As the name suggested it is expansion in the particle due to heat. It often takes place in hot areas like deserts. As in the desert, the variation between the day time and night time climate is significant the objects tend to expand during the day time due to heat and then contracts in the night time. This continual process left the peeling off effects on the outer layers of the particles or rocks. It leads to formation of thin sheets over the main body and it is also called onion skin weathering. Thermal expansion only takes place in the presence of moisture.

##### Freeze-thaw weathering

When water in the rocks freezes and expands it leads to the cracking of rocks, this is known as freeze thaw weathering. Freeze thaw weathering mainly occurs in environments where temperature frequently fluctuates above and below freezing point. As water increases by almost 9% when frozen, this leads to expansion in the joints and cracks of the rocks. As the temperatures again goes above freezing point the water again fills the gaps and when it again freezes it further leads to widening of previous weathering. This repeated process leads to

weakening of rocks over the period of time and breaking into angular fragments. Laboratory tests have shown that frequent daily freeze-thaw cycles are more effective than seasonal freeze-thaw cycles to frost weathering.

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### Mechanical Exfoliation

Just imagines yourself taking off your head off your pillow, the pillow get backs into its shape. Similarly weathering happens when the pressure is taken off from a particle. For example at great depths plutonic rocks cool under pressure, once this overburden is removed they essentially depressurized and exfoliate. This lead to sheets of rock to peel off along with the least pressurized area. Over the period the rocks shatters along the fractures.

### Salt Crystal Growth

When salty water seeps into rocks and evaporates, it leaves salt crystals inside the rock. Due to heat these crystals expands and exert pressure on rocks. Sodium sulfate, magnesium sulfate, and calcium chloride have proved to most effective and efficient in disintegrating rocks. Some of them can even expand up to three times and more.

### Organic activity

how often we have seen plants in walls of old and uncared building and weakening them.

Similarly a seed encroaches into a rock and it gets there what it takes to expand then it start expanding which leads to breaking of rock.

### Abrasion

Wind abrasion based weathering can also weaken the rock or it can leave marks on the rocks.

### **Chemical Weathering**

Chemical weathering alters the internal structure of the particle or object addition of removal of inherent chemical element. Physical change or composition is due to the effects of chemical agents. Chemical weathering is highly dependent upon presence of active chemical fluids and optimal surface temperature for the process. Unlike mechanical weathering, chemical weathering can lead to an all together different particle after weathering with its own properties.

### Types of Chemical Weathering are --

#### Dissolution

It occurs when certain chemicals are dissoluble in water. For example - when water comes in contact with limestone, it dissolve calcite which is important element of limestone thus altering the whole composition of the limestone. Similarly marble tombstones and carvings are highly susceptible to chemical weathering by dissolution as they too contain halite and calcite.

#### Hydration

in hydration minerals in the rocks absorb water and expand thus leads to change in the state of the rock. For example Anhydrite changes to Gypsum after absorbing water.

### Hydrolysis

When acidic water comes in contact with rocks forming minerals like pyroxenes, amphiboles, and feldspars the soluble ions are removed in solution resulting in different composition. This process is called hydrolysis. For example - Kaolin clay and quartz are formed when feldspar reacts with acidic water.

### Oxidation

Rusting of iron is an example of oxidation. Iron came into contact with oxygen in water and form hydroxide. This gives the reddish brown effect on the surface.

### Acid rain

It can weather or alter the chemical composition of rocks. Acid rain happens when sulfur and water comes in contact.

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