Soil Genesis

An introduction

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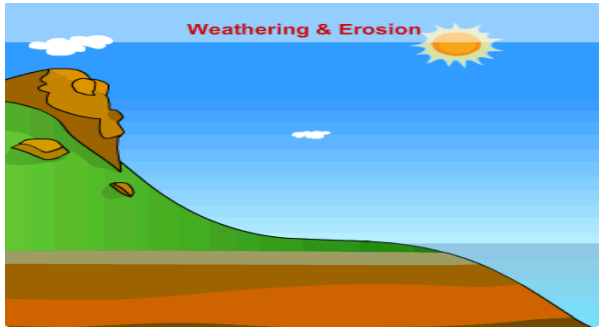
A definition

The formation of a soil from raw **parent material** or from a **pre-existing** soil encompasses the concept of soil genesis, Soil genesis involves both **progressive** and **regressive** processes

Weathering: A General Case

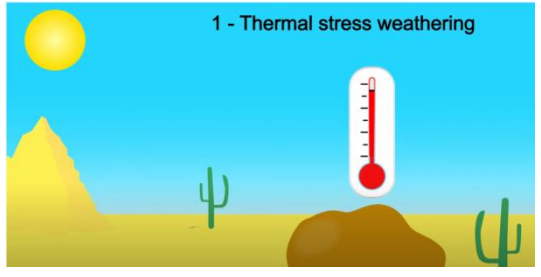
Weathering is a physical and biochemical processes that involves both **destruction** and **composition**. The original **rocks** and **minerals** are **destroyed** by both **physical disintegration** and **chemical decomposition**. Without affecting their **composition**, physical disintegration **breaks down** rock into smaller rocks and eventually into **sand** and **silt** particles that are commonly made up of individual minerals.

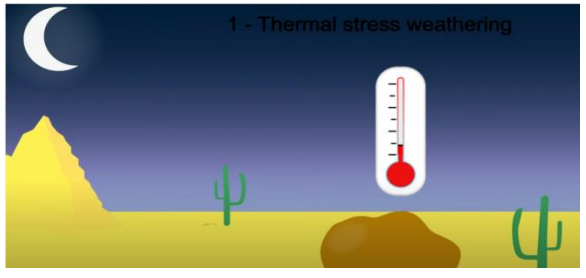


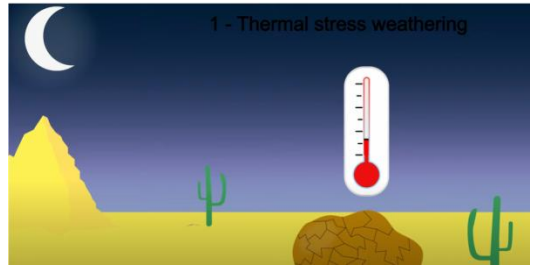
Physical Weathering (Disintegration)

- **Temperature**:

Rocks exposed to sunlight **heat up** during the day and **cool down** at night, causing alternate **expansion** and **contraction** of their minerals. As some minerals **expand more than others**, temperature changes set up differential stresses that eventually cause the rock to crack apart.







Physical Weathering (Disintegration)

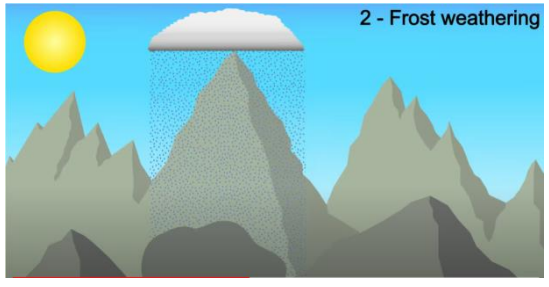
Because the **outer** surface of a rock is often **warmer** or **colder** than the more protected **inner portions**, some rocks may weather by **Exfoliation:** the ***peeling away*** of **outer layers.** This process may be sharply accelerated if ice forms in the surface cracks. When water freezes, disintegrating huge rock masses and mineral grains to smaller fragments.

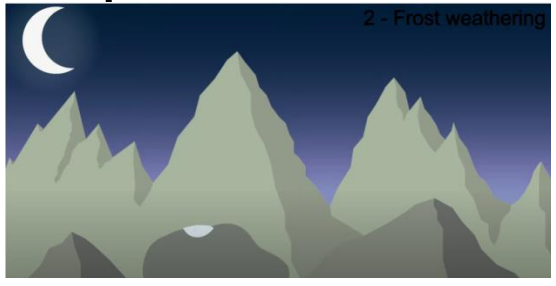
Physical Weathering (Disintegration)

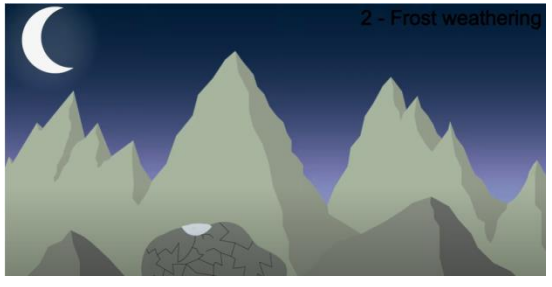
Physical Weathering (Disintegration)

- **Abrasion by Water, Ice, and Wind:**

When loaded with sediment, water has **effective cutting power**, as is demonstrated by the **valleys** around the world. The rounding of **riverbed rocks** and **beach sand grains** is further evidence of the abrasion that accompanies water movement.







Physical Weathering (Disintegration)

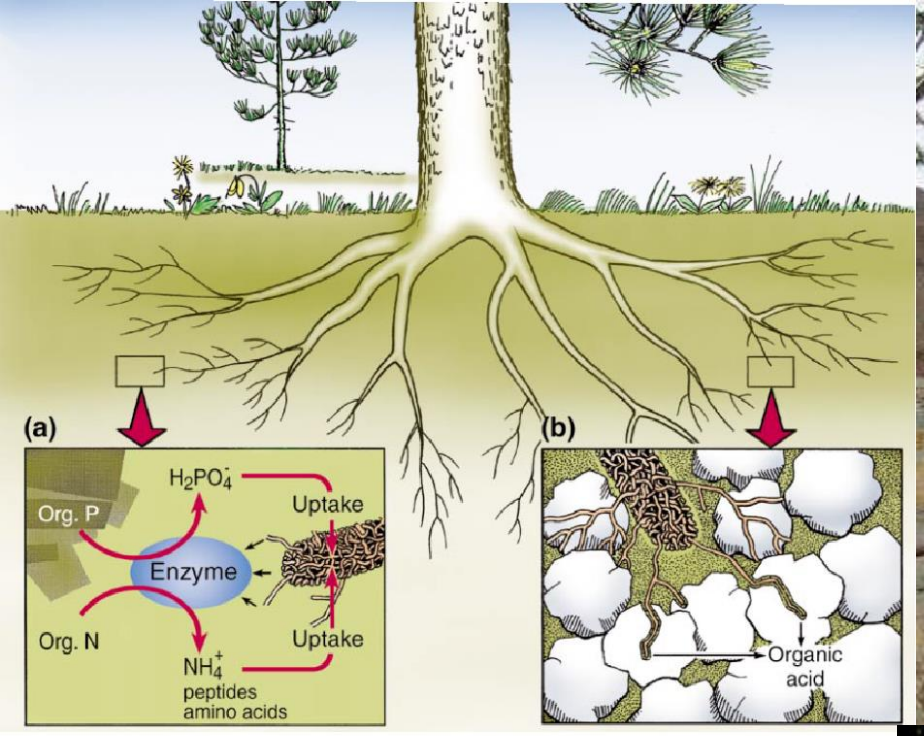
Windblown dust and **sand** also can **wear down** rocks by abrasion, as can be seen in the many **rounded rock** formations in certain **arid regions.** In **glacial areas**, huge moving ice masses **embedded** with soil and rock fragments **grind** down rocks in their path and carry away large volumes of material.

Biogeochemical Weathering

While physical weathering is confirmed in very cold or very dry environments, **chemical reactions** are most **intense** where the climate is **wet** and **hot**. However, **both types of weathering occur together**, and each tends to accelerate the other. For example, **physical abrasion decreases** the **size** of particles and therefore **increases** their **surface area**, making them more suitable to rapid chemical reactions.

Biogeochemical Weathering

Chemical weathering is enhanced by such **geological agents** as the presence of **water** and **oxygen**, as well as by such biological agents as the **acids** produced by **microbial and plant-root metabolism**. That is why the term biogeochemical weathering is often used to describe the process. The various agents act to convert **primary minerals** (e.g., feldspars and micas) to **secondary minerals** (e.g., clays and carbonates).


(a)
(b)
$H_2PO_4^-$
Org. P
Uptake
Enzyme
Org. N
Uptake
NH_4^+
peptides
amino acids
Organic
acid

What environmental factors influence soil formation?

In the late 19th century field studies by a team of Russian soil scientists led by **Dukochaev**. They noted **similar profile layering** in soils **hundreds** of kilometers apart, provided that the **climate** and **vegetation** were **similar** at the two locations. Such observations and much careful subsequent field and laboratory research led to the recognition by **Hans Jenny** of **five major** environmental factors that control the formation of soils. In **1941.**

Any Questions?