Biological Weathering 101

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Biological Weathering: Did you ever wonder where the soil beneath your feet comes from? The answer? Rocks! For instance, rocks became disintegrated and broken down into smaller particles in a process called weathering.

The process of weathering can result in the formation of soil by supplying particles like clay, silt, and sand. Also, the elements from the weathered rocks provide nutrients for plant and animal consumption.

In the environment, there are in fact three types of weathering that occur namely Physical Weathering, Chemical Weathering, and Biological Weathering.

In this post, we'll explore the biological weathering in detail.

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What is Biological Weathering?

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As its name suggests, *biological weathering* is a type of weathering brought about by various activities of living organisms. Along with other types of weathering, biological weathering can contribute to the further degradation of rocks and rock particles by making them more susceptible to other environmental factors, whether be it *biotic* or *abiotic* factors.

Types of Biological Weathering

Living organisms can contribute to the process of weathering in many ways. Depending on the mechanism of how rocks and rock particles are broken down, biological weathering is of two types: by physical means or by chemicals and organic compounds.

Biological Weathering By Physical Means

This is a type of weathering that occurs when a force or pressure is applied to break rocks apart or degrade the minerals in them. By increasing the exposed surface area of rocks, they make it possible for other physical factors to speed up their degradation.

By Plants

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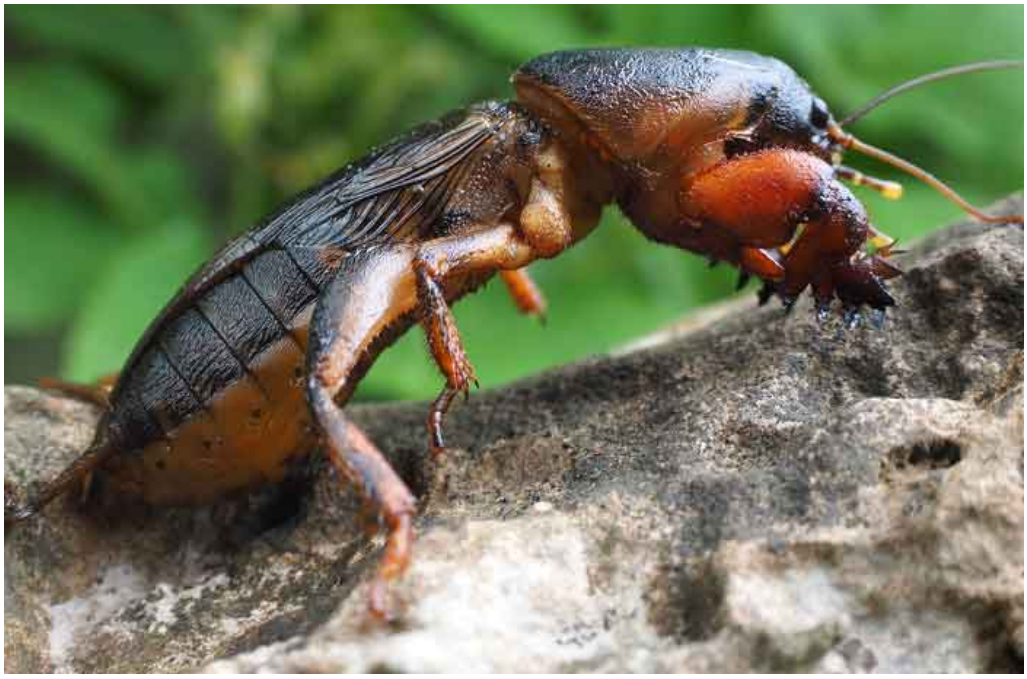
- Plants can grow anywhere as long as there is water. Roots of trees or plants in general can biologically weather rocks by growing into the cracks and fractures of rocks and soil. As a result, they become more prone to breakage and eventually fall part.

By Animals



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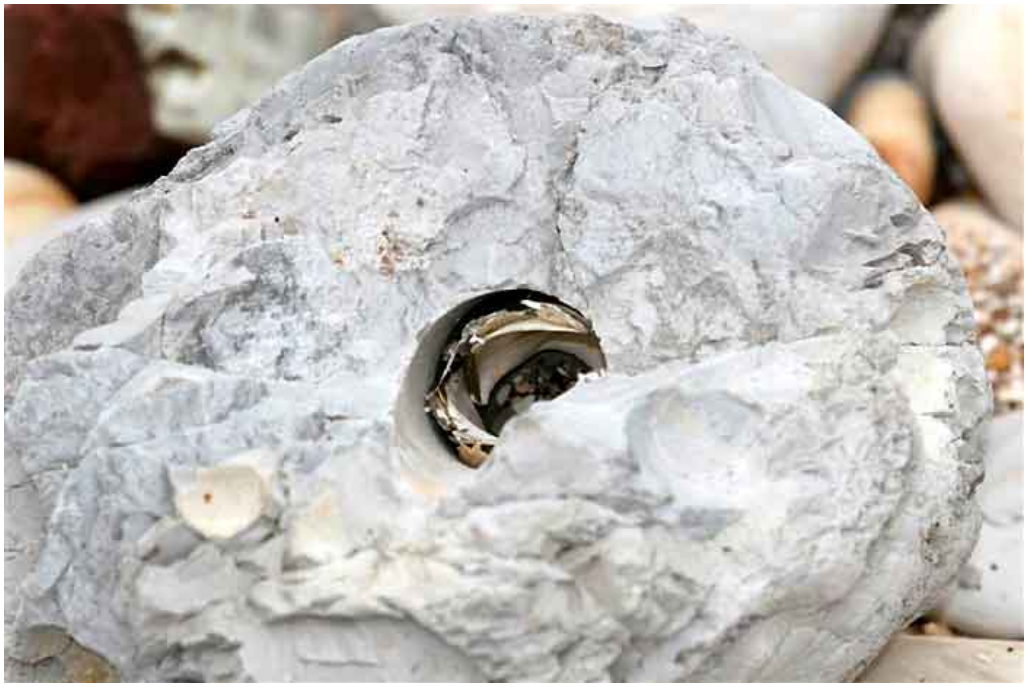
- Burrowing animals like shrews, **moles**, earthworms, and even ants contribute to biological weathering. In particular, these animals create holes on the ground by excavation and move the rock fragments to the surface. As a result, these fragments become more exposed to other environmental factors that can further enhance their weathering.

- When animals like birds forage for seeds and earthworms, they create holes and erode the upper surface of the soil, thus, contributes to weathering.



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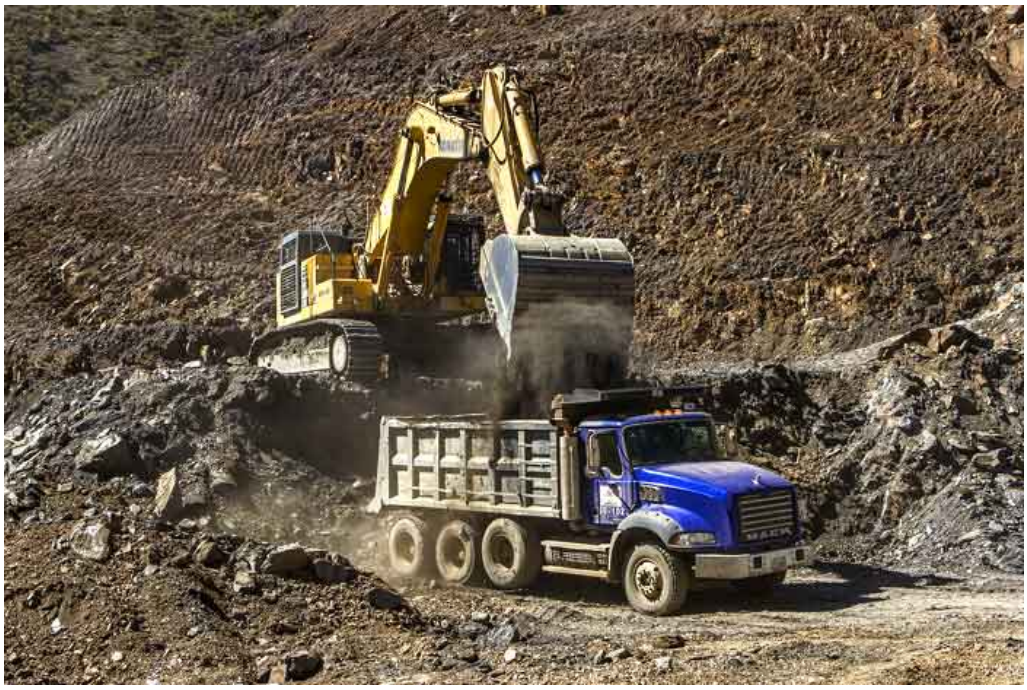
Source: Flickr

- An animal called the **Piddock shell** can drill into rocks in order for it to protect itself. By producing acids that can disintegrate the rock and turn it into fragments, it can create cracks and fractures and eat the minerals found in it.



- Like any other animal, humans can also indirectly contribute to biological weathering. By merely walking and running makes the soil particles crushed into smaller pieces. Other human activities such as planting and road construction can also contribute to biological weathering.

Biological Weathering By Chemicals/Organic Compounds

In this type of weathering, living organisms contribute through their organic compounds that contain molecules that acidify and corrode rock minerals. Because of such mechanism, biological weathering is also referred to as *organic weathering*.

By Plants

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- When the roots of plants grow deeper into the soil, they tend to create cracks and crevices in marbles and lime stones by producing certain acids that can eventually degrade them.

- According to studies, the mere presence of roots in the soil can wear out soil and rocks through the presence of humus. **Humus**, an organic component of the soil, can increase the availability of water, which then enhances the physical and chemical breakdown of rocks.

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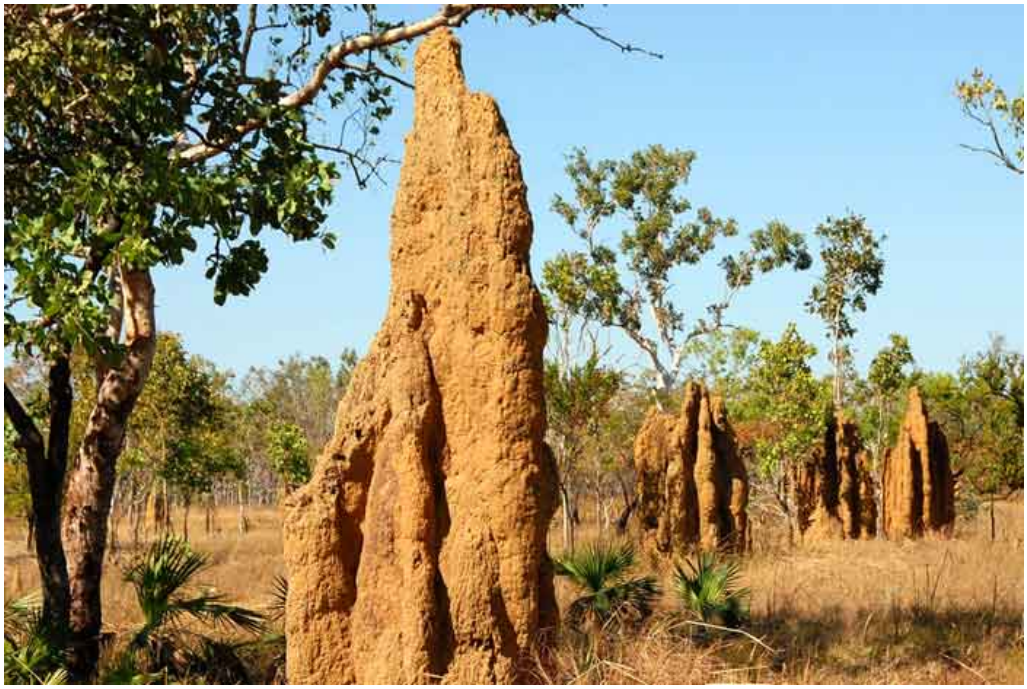
- When plants die, their roots (and other parts as well) are decomposed and are later on converted to organic matter which produces carbon dioxide. This carbon dioxide (CO_2), when combined with water (H_2O), produces weak *carbonic acid* which can degrade the surfaces of rocks and rock particles.

Suggested Reading: **Carbon Cycle Steps**

By Animals



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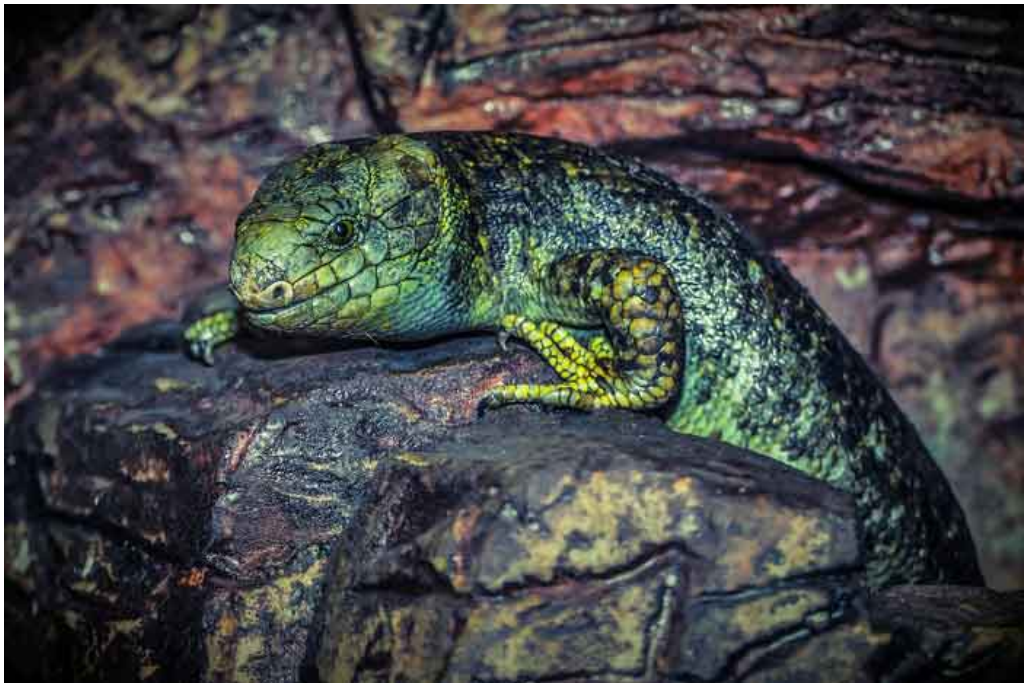
- While ants and termites can contribute to the physical breakdown of rocks, these animals can also contribute to their biological degradation. Aside from creating holes and passages in the ground, these animals also make possible the easy passage of oxygen and water to the soil, which in turn, bring the dissolution of soil, rocks, and rock particles alike.



- When animals die, their bodies are converted to substances, which when combined with minerals found in the soil and rocks, can contribute to their degradation.

By Microorganisms

Despite their minute size, did you know that some microorganisms can also break down the largest of rocks and hardest of soil?

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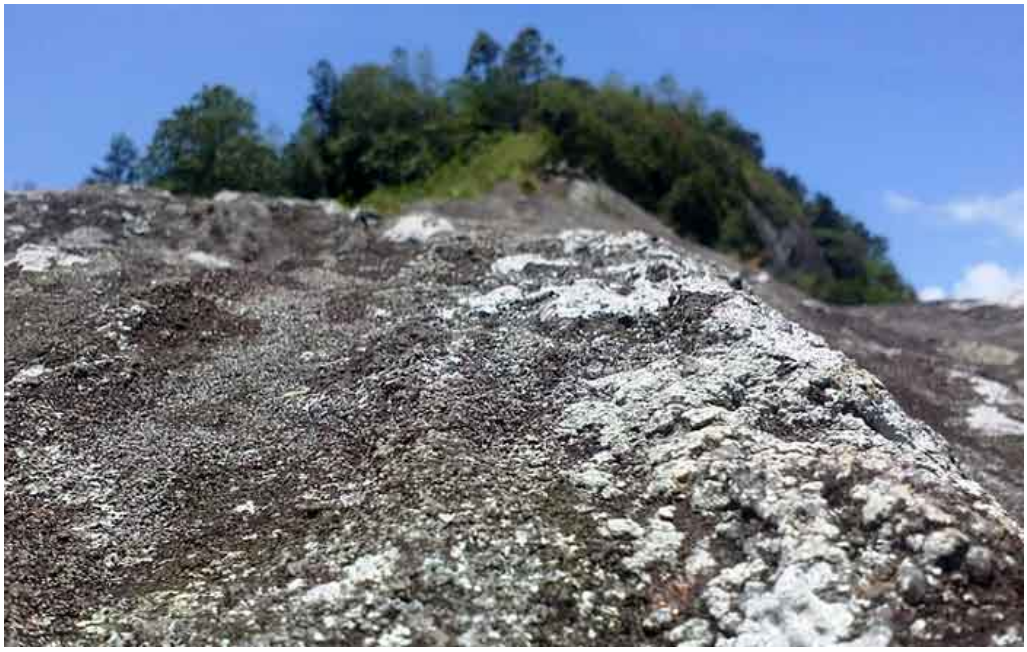
- One example of such activity is exhibited by *lichens*. In general, a lichen is a symbiosis between an **algae** and a **fungus**.



- The minerals in rocks are liberated when a fungus releases chemicals that can break them down. Such minerals are then consumed by the alga, further causing the wearing and development of cracks and gaps on the rock. As a result, cracked rocks become more prone to disintegration.

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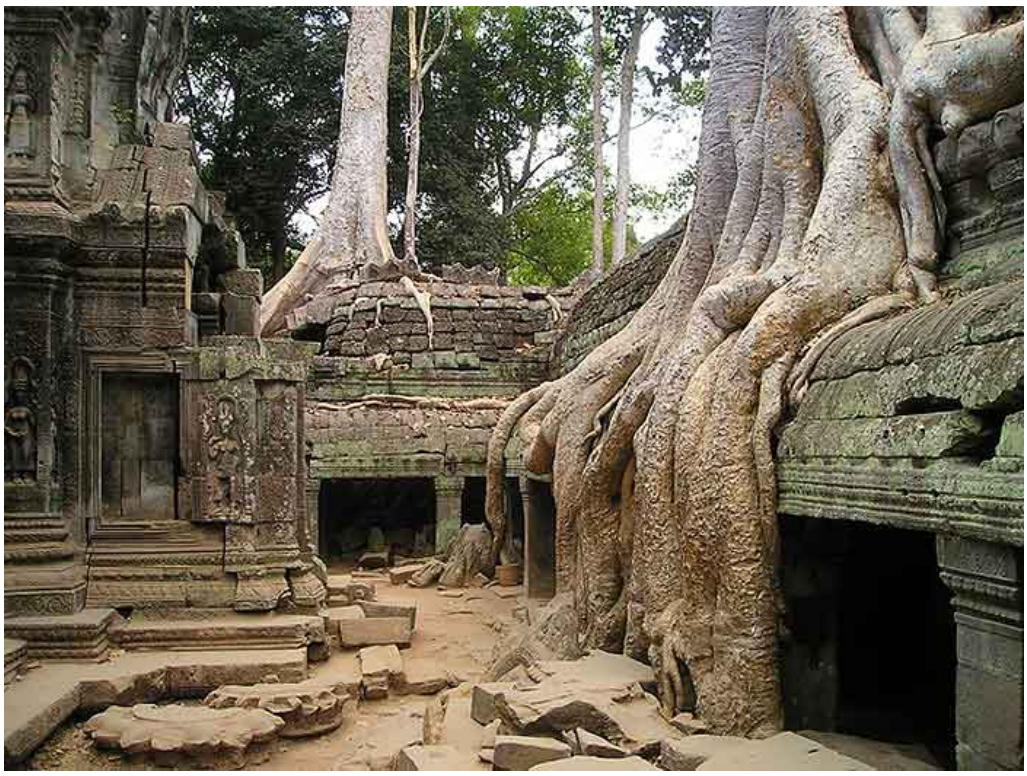
- Some fungi produce siderophores, a type of chelating agent which can absorb various minerals and nutrients from the soil. By trading cations for hydrogen ions, siderophores make the soil more acidic, hence more prone to degradation.

Source: Wikimedia

- Another good example of biological weathering of rocks is by a group of bacteria called Actinomycetes. According to a study published in the *Journal Microbial Ecology*, these bacteria through acid production, mineral solubilization, and metal leaching have successfully degraded rocks in Egypt.

Extreme Biological Weathering Examples

Ta Prohm – Ankor Wat Temple | Cambodia



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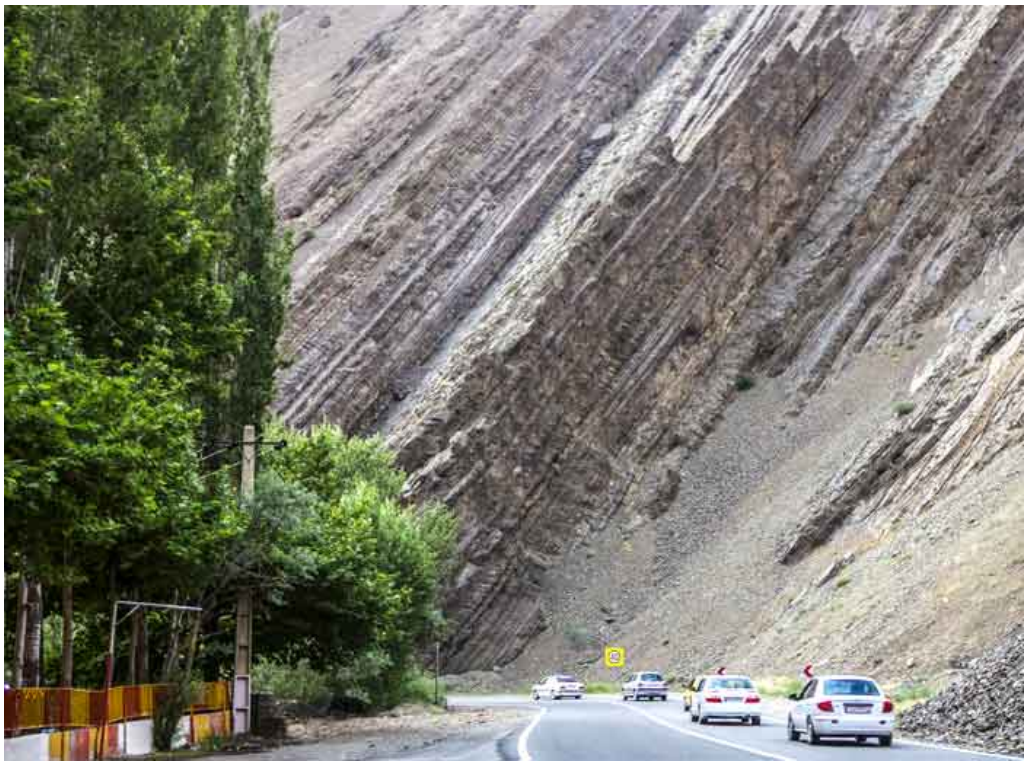
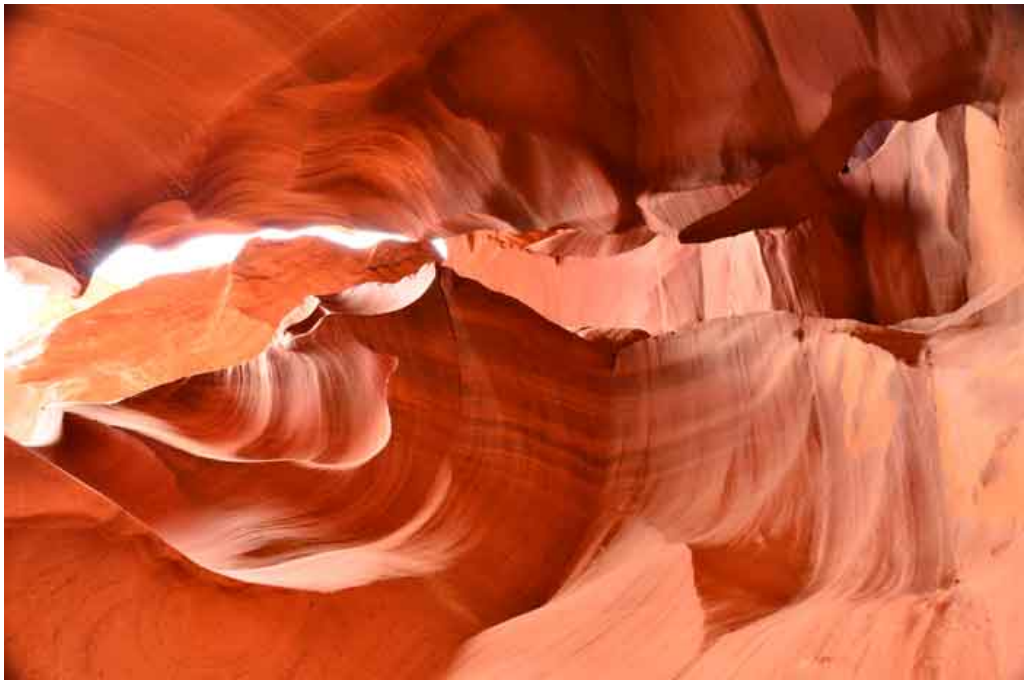
Steeply Dipping Sedimentary Rock Strata | Iran



Source: Wikimedia

Sandstone in Lower Antelope Canyon, Arizona | USA



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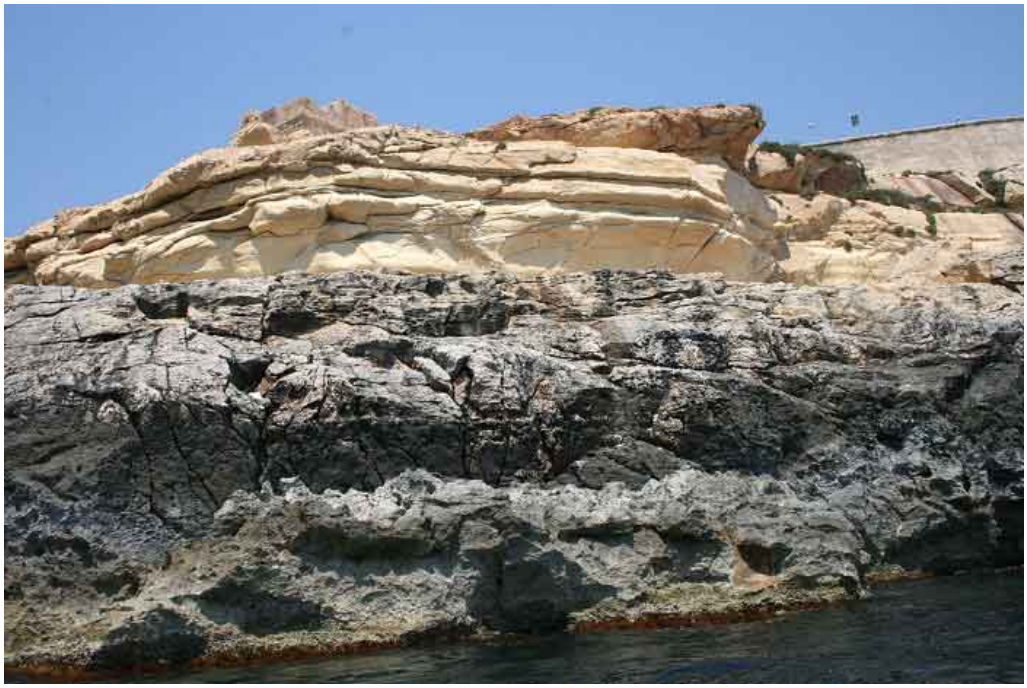
Sedimentary Rock With Sandstone | Malta



Advantages of Biological Weathering

As alluded earlier, weathering is responsible for the creation of soil. Below are some other benefits of biological weathering:

1. Formation of Nutrient Rich Soil

The very process of weathering is what creates the soil which then allows life to flourish on Earth. It is important to note that without it, minerals cannot be accumulated in the soil, hence, no nutrients will be available for plant and animal consumption.

2. Creation of Sediments

When broken, some rock pieces and particles eventually turn into sediments that are formed into different types of sedimentary rocks like *sandstones* and *limestones*. Usually,

the broken rock pieces become deposited by rivers and are compacted by great pressure, enough to create a sedimentary rock.

3. Contribution To Land Formation

Like the formation of sediment rocks, biological weathering can also contribute to the formation of land masses and landscapes. The process tends to be very slow as it needs a lot of time to accumulate soil and rock particles, along with intense pressure to carry it out.

Disadvantages of Biological Weathering

While biological weathering has good effects, too much of it can be catastrophic and might pose a potential danger to life. The following are just some of them.

1. Erosion of Soil

Ironic how the very same process that creates soil for vegetation and makes possible the life on Earth is also the process that contributes to its erosion. When soil particles are broken down to smaller particles, it becomes a lot easier for it to be carried away by environmental factors like water and wind. In relation to this, when the topmost soil gets eroded, its fertility declines hence causing a simultaneous reduction in the productivity of the land.

2. Mass Wasting

Mass wasting is a phenomenon wherein rocks are broken down to smaller particles up to the point they make possible an erosion further enhanced by gravity. For instance, a mudslide is a type of mass wasting wherein soil, and rock particles are mixed together forming a pool of mud that can bury almost anything. Another type of mass wasting is rock slides. As its name suggests, rock slides are huge masses of rocks fallen off by an avalanche.

3. Gradual Break Down

The saying "*Life will always find a way*" proves true for this example. As explained earlier, plant roots can grow in gaps beneath concrete and can create a force that is strong enough to break it. Sometimes, the effect can be damaging as it can make them more prone to breakage even with slight disturbances like an earthquake.

Imagine if weathering never occurred, the Earth would have a surface of the bare rock, and no plant or animal life could exist. However, too much occurrence of the process, as previously stated, can be catastrophic. Over time, even the largest of rocks and strongest of concrete will erode. While of course, the biological processes exhibited by living organisms is inevitable, humans can make certain efforts to mitigate its harmful effects.

At present, various environmental organizations promote the planting of trees in eroding mountains and other land masses. As a biological organism (who directly and indirectly contribute to biological weathering) of planet Earth, can you think of other ways too?

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