WEATHERING

Mark all the key verbs in the following text on ***Physical weathering.***

The weather in the earth's atmosphere acts upon the surface of the earth, causing even the hardest of rocks to change. By means of water, wind, and chemicals, the atmosphere attacks the land and breaks down its rock surface. This breaking down and wearing away of the earth's rocks by the earth's atmosphere is called **weathering.**

One kind of weathering changes only the size of the rock. Large rock masses are broken down into smaller pieces of the same rock material. An example would be pieces of granite at the foot of a granite cliff. This type of weathering is called **physical weathering**. The size of the rock is changed, but the kind of rock is not changed.

What causes physical weathering on the surface of rocks? One cause has to do with changes in temperature. The high temperatures of summer cause the rock material to expand, or get larger. In winter, the low temperatures cause the rock material to contract, or get smaller. Over the years, this expanding and contracting weakens the rock material, causing it to crack and to break off. Because rock is a poor conductor of heat, this expanding and contracting occur mostly on the surface of the rock. It is the surface rock material, therefore, that is most affected by temperature changes.

Another cause is known as frost wedging and hydrofracturing. Water in tiny cracks in rocks freezes from the outside surface toward the inside. Due to this kind of freezing, the pressure from the ice and trapped water increases as the water continues to freeze deeper into the rock. This pressure can, by means of countless tiny fractures, actually split the rock.

The roots of shrubs and trees also cause physical weathering. Some plants can grow in between the cracks in rocks. As the plant roots grow, they push against the sides of the cracks in the rock surface. The surface of the rock weakens and pieces of rock finally break off. As more and more rock pieces break off, the crack becomes larger. This allows even more room for water to collect or roots to grow. Animal burrows also promote physical weathering by removing some of the underlying support of rocks.

Temperature changes and the roots of shrubs and trees can break down a large rock mass into a pile of smaller pieces of the same rock material. The many small pieces are the results of physical weathering.

Check yourself

1. How can temperature changes cause physical weathering?
2. How can the roots of plants cause physical weathering?
3. How can animal burrows promote physical weathering?
4. What is another cause of physical weathering and how does it act?
5. Sum up the causes of physical weathering.

Language usage

Use similar connectors to those which are underlined in the text.
Transform the clauses if necessary.

Gap tests - grammar forms and their usage, word formation

Note the grammar form of the clue expressions, especially those ending with ***–s****.*

Is any of them evidently only a noun? ………………… or only a verb? ……………………..

What grammar forms can follow the verb ***be?***

What verbs are used before passive form of the verb (=3rd form)?

Is there a ***preposition*** *in the clue?*

Clue: affected bubble**s** chipped expand**s** occurring patche**s**152

propertie**s** release**s** through undergone weaken

Use one of the words twice.

Chemical weathering

There is a kind of weathering that does not change only the size of the rock material, but changes the material itself. You have most likely seen ……….…. of rust on a piece of iron or on an object that contains iron. It is no longer the same material that it was before the weathering took place. When rust forms, iron combines with oxygen from the air to form iron oxide, a new substance with different ………………**.** Iron is attracted by a magnet, but the iron oxide is not.

Sometimes you can observe orange discoloration in a rock and the rock may have become brittle. Pieces can easily be ………………. off. The orange color is probably a sign of iron oxide in the rock. The original rock contained iron or minerals with iron. A form of chemical weathering known as **oxidation** has changed the iron to iron oxide.

Sometimes when the outer layer is …………….. away, the inner rock appears to be a different color. The outer rock layer has …………………….. chemical weathering, but the inner has not. Different minerals have been formed in the outer layer.

There is some evidence that the freezing of water in rocks creates ideal conditions for chemical weathering. As water freezes, it ……………….. 9%. The resulting pressure can force films of water into micropores and crevasses within the crystal structure of the rock. There the water can ……………… the rock chemically.

A form of chemical weathering known as **carbonization** causes caves to form in rock material. Carbon dioxide from the air dissolves in water to form carbonic acid. This weak acid reacts slowly with some minerals found in rocks. One rock that is ……………. is limestone. Huge limestone caves can be formed over long periods of time by running water that contains dissolved carbon dioxide. The water flows ……………… underground cracks in the limestone. The carbonic acid continues to dissolve more and more of the limestone along the surface of the cracks until a cave is formed. As years pass, the cave becomes larger and may be many meters high and many kilometers long.

If a small amount of acid is dropped onto a piece of limestone, gas ……………. can be observed on the surface. A chemical reaction is ……………….. **.**

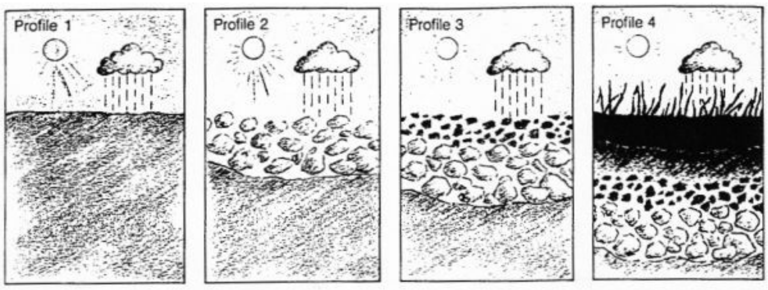
The rock …………….... carbon dioxide gas as the acid reacts with the limestone or calcium carbonate mineral in the limestone rock.

Answer these questions:

1. How does chemical weathering differ from physical weathering?
2. What forms of chemical weathering did you read about?
3. What creates ideal conditions for chemical weathering?
4. Explain the formation of limestone caves in one written sentence.

From rock to soil

Physical and chemical weathering are important in the formation of soil, the loose material on the surface of the earth that supports plant life. Profiles 1, 2, 3, and 4 show how soil forms when rock is weathered.



Profile 1 shows the solid layer of rock from which soil will form. This layer of rock, which is under every soil, is called bedrock. In Profile 1, very little weathering has taken place.

Profile 2 shows the first stages of soil formation. Weathering has caused large fragments of rock to break off from the solid rock. Water can easily penetrate to the bedrock, which is now below the surface.

In **Profile 3** zones of different particle sizes have formed. The particles near the surface are the smallest because they have weathered the longest. The particles near the bedrock are larger because weathering has begun there more recently.

Profile 4 shows a fully developed soil profile. Nearest the surface is a layer of **topsoil.** This layer contains **humus,** which is a dark brown or black substance that is formed when dead plants and animals decay. Humus is very rich in materials which plants need for growth. Because of humus, plants grow readily in topsoil.

Chemical weathering of soil changes its mineral content. Water filtering down through the topsoil removes some of the minerals. This process is called **leaching.** In the zone of leaching (the topsoil layer), only the minerals that are most resistant to weathering remain unchanged.

As shown in Profile 4, a layer of **subsoil** is found under the topsoil in a fully developed profile. Clay and other substances that have filtered down from the zone of leaching accumulate in this layer of the soil. The soil in this zone of accumulation contains few of the elements needed by plants for growth. If the topsoil is removed from an area and the subsoil is exposed, plants will not grow readily in the exposed subsoil.

Because climate affects the rate of weathering, it also affects the formation of soil profiles. In areas where the climate is humid and there is much precipitation, a soil profile several meters thick can develop in a period of a few thousand years. In desert regions, however, where there is very little water, weathering takes place much more slowly. Soil found in a desert is usually sandy and the particles are much larger than the tiny soil particles of a fully developed soil profile.

Check yourself

1. In a soil profile, where are the smallest particles found?
   Why?
2. How does climate affect the formation of soils?

Home task: Listen to research in soil in Uganda (link in IS - syllabus JAG02) and write a short summary.

Rates of weathering

Not all weathering of rock takes place at the same rate. The speed at which a rock weathers depends on several things:
1) the type and hardness of the minerals in the rock, 2) the type of rock, 3) the climate, 4) the topography, and 5) the exposure of the rock.

Use the words in the box to fill the gaps in the text.

affect all another around do over present so that is why therefore though

The minerals in a rock …………… the rate at which the rock weathers. Rocks made up of minerals that dissolve easily in water weather faster than rocks made of water-resistant minerals. Rocks made up of minerals that react with acids and with substances dissolved in water also weather faster. Limestone, as you have seen, is one example of a rock that weathers quickly when acid is …………………. .

Of the three types of rock, sedimentary rock generally weathers faster than igneous or metamorphic rock. Most sedimentary rocks form from grains that have been cemented together. Sedimentary rock is ………… more porous than igneous or metamorphic rock. Water can permeate the rock more easily. Often the cement is a mineral that water can easily dissolve. ………………… sandstone, for example, tends to weather faster than granite.

The climate of an area also affects the rate of weathering. The more precipitation in an area, the faster is the rate of weathering. Rocks weather fastest in a humid climate with a wide range in annual temperatures. In the United States, for example, rocks weather faster along the East Coast than they .... in the dry Southwest.

……………. 1500 B.C., the people of ancient Egypt built tall stone monuments called obelisks. Even ..…………..20 m or greater in height, each obelisk was carved from a single piece of rock (usually red granite from a quarry at Aswan). The builders also carved writings on the sides of these granite obelisks.

A little over a hundred years ago, in 1880, one of these obelisks came to New York City as a gift to the American people. Before coming to New York, this obelisk (now called Cleopatra's Needle) had been exposed to the climate of Egypt for ………… 3000 years. Even ………, the writing on its sides had weathered very little. But in the hundred years or so in New York City, the writing has been almost completely weathered away.

One key to explaining what happened to the writing on the sides of Cleopatra's Needle lies in the difference in climate between the two locations. Egypt is warm or hot …….. year long, and very dry. New York City has cold winters and hot summers and much more precipitation than Egypt. ……………… key has to do with substances found in the air in New York City which increase the rate at which chemical weathering occurs.

Check yourself

1. Why does sedimentary rock weather faster than igneous or metamorphic rock?
2. How can climate affect physical weathering? How can it affect chemical weathering? (Use proper language for čím……, tím…….)

Practice and remember:

Add -ing: underlie ………………., die ……………….., occur …........

Give the past tense: lie (=ležet)…………, undergo …………..,
weaken ………………, chip …………….,

Add suitable nouns: **an**other ….

Did you pronounce these words correctly?

B**u**rrow [a], we**dg**e [dž], thr**ough** [θru:], oc**cur** [ə`kə:], th**ough** [ðəu],
q**ua**rry [o], r**ea**dily [e], precipitation [prisipi`teišn], c**ar**ve [a:]=cut, c**ur**ve [kə:v]

Remember: **few** + countable nouns (few elements, years, people) = **málo**
a few = **několik**

Connectors for the <u>cause (=příčina)</u>: **because of, due to**

Connectors for the <u>effect /důsledek)</u>: **therefore, consequently, that is why, thus**

Connectors for <u>concession (=přípustka</u>): **(Even) though** / **although** he was ill**,**
despite / in spite of (illness)

Proportion to something: (čím….., tím……= **the** faster, **the** better)

Impact English for Science esf EVROPSKÁ UNIE MŠMT

Adapted from *Fariel, R.Hinds, R. Berey,D.:* ***Earth Science****, Addison-Wesley 1987*
Věra Hranáčová - Weathering - CJV RMU, 2014