**Unit 1 Earth’s Major Resources (Mineral Resources,**

**Water Resources, Energy Resources)**

***Text 1.2 Rocks. Identification of Rocks***

*Ex. 1. Study the vocabulary.*

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| --- | --- |
| ***alluvial fan*** – аллювиальный веерообразный конус выноса, конус из осыпавшихся пород у основания склона  ***angular*** - неокатанный, угловатый, угловой  ***breccias*** - брекчия  ***brittle*** - ломкий, хрупкий  ***to bury*** - закапывать, хоронить, зарывать(ся) в землю, погрузить(ся)  ***cap-rock*** - порода-покрышка  ***chert*** - роговик  ***clay*** - глина  ***coal*** - уголь  ***composition*** - состав  ***content*** - содержание, содержимое, состав  ***curved surface*** - криволинейная поверхность  ***to deposit*** - отложиться, отлагаться, осаждаться, выделяться  ***desert*** - пустыня  ***to distinguish*** - различать, отличать  ***to drill*** - бурить, пробурить  ***edge*** - край, грань, кромка, граница, острие  ***flint*** - кремень, халцедоновая разновидность кварца  ***floodplain*** - пойма реки, пойменная долина  ***foliated rock*** - слоистая порода  ***fossil shells*** - ископаемые раковины | ***glassy*** - зеркальный, гладкий, глянцевитый, хрупкий, прозрачный  ***grain*** - зерно, песчинка  ***heat*** - жара  ***layer*** - слой  ***limestone*** - известняк  ***mountain stream*** - горная река, горный поток  ***mud*** - грязь, мелкая порода, ил  ***mudstone*** - глинистый сланец, аргиллит, иловый известняк  ***particle*** - частица  ***pebble*** - галька  ***petroleum trap*** – нефтяная ловушка  ***plant remains*** – остатки растений  ***platy*** - плоский, с крупносланцеватой или пластинчатой структурой  ***precipitation*** - осадки, выпадение, выделение, увеличение  ***pressure*** - давление  ***reservoir rock*** – порода-коллектор  ***shale*** - сланец  ***silt*** - ил, осадок, наносы, грязь  ***size*** - размер  ***source rock*** – материнская порода  ***subsurface*** - нижний горизонт, подземный пласт, подпочва  ***texture*** - строение, структура  ***well-rounded*** - хорошо окатанный  ***with the naked eye*** - невооруженным глазом |

*Ex. 2. Read and translate the text.*

Rock is one of the solid materials of which the earth’s crust is mainly composed.

Rocks are classified and identified by their textures and mineral compositions. Igneous rock textures are based on the size of the mineral crystals. The grain sizes range from large enough to see with the naked eye to glassy with no crystals. Metamorphic rock textures are based on the size and orientation of the mineral crystals. A foliated metamorphic rock has parallel, platy crystals. Nonfoliated metamorphic rock has either uniform-sized crystals or a non-parallel orientation of platy crystals. Sedimentary rock textures are based on the nature, size, and shape of the grains and how they are bound together.

Sedimentary rocks.

Conglomerate is a clastic rock with a wide range of pebble- to claysize grains. The course grains distinguish it from other clastic sedimentary rocks. The particles are all well-rounded. A conglomerate is commonly deposited in a river channel or on an alluvial fan formed where a mountain stream empties into desert. If the particles are angular, the rock is called breccias.

Sandstone is composed primarily of sand grains that have been naturally cemented together. The sand grains can be broken off if the rock is loosely cemented. Sandstone is rough to touch. The rock can be white to buff to dark in colour.

Sandstones are commonly deposited on beaches, river channels, or dunes. It is a common reservoir rock for gas and oil and is the most important reservoir rock in North America.

Shale is composed of clay-sized particles and is the most common sedimentary rock. It is usually well-layered and relatively soft. Shale breaks down into mud when exposed to water. The colour of shale ranges from green and grey to black, depending on the organic content. The darker the shale, the higher the organic content. Shale is commonly deposited on river floodplains and on the bottom of oceans, lakes, or lagoons. Black shales are common source rocks for gas and oil.

A grey shale can be a cap-rock on a reservoir rock in a petroleum trap. Mudstone is similar to shale but is composed of both silt- and clay-sized grains.

Coal is brown to black in colour and very brittle. It has few, if any layers. Coal is composed of plant remains that were buried in the subsurface and transformed by heat and time. Lignite, bituminous, and anthracite and varieties of coal formed by increasing heat that causes the coal to become harder and change in texture and composition.

Chert or flint is amorphous quartz. It is very hard and cannot be scratched by a knife. Being amorphous (without crystals), chert breaks along smooth, curved surfaces, forming sharp edges and points. American Indians used chert to make arrowheads. Coloured varieties of chert include jasper, chalcedony, and agate. Chert can be formed by precipitation directly out of ground water or by recrystallization of fossil shells composed of SiO2 by heat and pressure. Chert is the hardest of all sedimentary rock to drill.

Ninety-nine percent of the sedimentary rocks that make up the earth’s crust are shales, sandstones, and limestones. Many sedimentary rocks are a combination of these three types. Sedimentary rock mixtures are described as sandy, shaly, and limey or calcareous.

*Ex. 3. Answer the following questions on the text.*

1. What are the tree main types of rocks according to their origin?

2. What are the most widespread sedimentary rocks?

3. What is the colour of sandstones?

4. Where is shale deposited?

5. What is the composition of coal?

6. What are the main characteristics of flint?

***Text 1.3 Water Resources. Ground Water***

*Ex. 1. Study the vocabulary.*

|  |  |
| --- | --- |
| ***absorb*** - поглощать  ***capillarity*** - капиллярная система  ***circulation*** - циркуляция, распространение, круговорот  ***to evaporate*** - испарять(ся)  ***to fall*** - падать, выпадать  ***ground water*** – грунтовые воды  ***to penetrate*** - проникать просачиваться | ***plant root*** - корень растения  ***pores*** - поры  ***rainfall*** - дождь, количество атмосферных осадков  ***to run off*** - стекать, сбегать  ***to sink*** - оседать, проходить, проникать, впитывать(ся)  ***soil*** - почва  ***stream*** - ручей, поток, струя |

*Ex. 2. Read and translate the text.*

Ground water is the water contained underground in the pores of soil and rock. When rain falls on the earth some evaporates, some is absorbed by plants, some runs off in streams and the remainder sinks into the earth to become ground water. The amount that sinks into the ground depends on various factors.

It is much to the point to inquire how much of the rainfall soaks into the ground, how much evaporates, how much is used by plant life, and how much runs off into the streams. It is certain that there is water in the ground in some places and there are good reasons to suppose that water may penetrate the rocks to a depth of a dozen miles.

The total amount of water varies greatly from place to place, and even from time to time in the same place.

Water which sinks into the earth moves not merely downward, but sideways and even back to the surface. Thus, there is a sort of circulation of underground water which is kept up fundamentally by gravity, and assisted by such agencies as capillarity and plant roots.

*Ex. 3. Answer the following questions on the text.*

1. What is ground water?

2. What happens to the rain water when it reaches the ground?

3. In what direction does water move when it sinks into the earth?

4. What agencies make the circulation of ground water possible?

***Text 1.4 Fossils***

*Ex. 1. Study the vocabulary*.

|  |  |
| --- | --- |
| ***above*** - выше, над  ***ancient*** - древний  ***ash layer*** – слой вулканического пепла, слой золы  ***below*** - ниже, над  ***bone*** - кость  ***burrow***- нора, ход, ископаемые следы  ***carbon*** - углерод  ***clastic*** - обломочный, кластический, распадающийся на фрагменты  ***deposited*** - отложенный, нанесенный  ***depositional environment*** - условия осадконакопления  ***evidence*** - доказательство  ***to fill*** - наполнять, заполнять  ***fossils*** - окаменелости  ***ground water*** – грунтовые воды  ***guide (index) fossil*** - руководящая окаменелость  ***layer*** - слой, уровень, пласт  ***marsh*** - болото, трясина  ***original matter*** – исходное вещество  ***overlying layer*** - перекрывающий слой, вышележащий слой  ***petrified wood*** – окаменелое дерево | ***pore spaces*** - поровое пространство  ***preserved*** - сохранившийся, законсервированный  ***to date relative age*** - установить относительный возраст  ***remains*** - остатки, останки  ***replacement*** - замена, замещение  ***to secrete*** - выделять  ***sedimentary rocks*** - осадочные породы  ***sediments*** - осадки  ***sequences*** - разрез  ***silicon*** - кремний  ***species*** - вид/виды  ***subsurface*** - нижний горизонт, подземный пласт, подпочва  ***trace fossils*** - ихнофоссилии, следы жизнедеятельности ископаемых организмов  ***track*** - след, тропа, дорожка, ход  ***trail*** - след, борозда, передний выступ раковины  ***unaltered*** - неизменный  ***underlying layer*** - нижележащий слой, подстилающий слой |

*Ex. 2. Read and translate the text.*

Fossils are the preserved remains of plants and animals in rocks. There are several ways in which fossils are preserved. Many animals that live in the sea such as corals and dams secrete shells of lime. The shells can be preserved unaltered in sedimentary rocks. Other animals have bones which are preserved. Plants can be preserved as carbon in mud, which becomes shale. Sometimes the pore spaces of bone or shell are filled with minerals deposited by groundwater in a process similar to the cementation of clastic grains into sedimentary rock. Other fossils are preserved when the original matter is completely replaced by another mineral in the subsurface. Petrified wood is formed by the replacement of wood by silicon dioxide that preserves the grain structure of the wood. Trace fossils, such as burrow, tracks, or trails, are indirect evidence of ancient life.

Vertical sequences of sedimentary rock layers that have been relative age dated can be used to determine the relative ages of the fossils in those rock layers. Geologists have collected and established the relative ages of most fossils.

A guide or index fossil is a distinctive plant or animal that lived during a relatively short span of geologic time. This fossil species identifies the age of any sedimentary rock in which it occurs. A fossil assemblage is a group of fossils found in the same sedimentary rock. It identifies that zone of rocks and the geologic time during which those rocks and fossils were deposited.

Fossils can also be used to determine the depositional environment of the sediments. Different plants and animals live in different environments such as beach, marsh, and deep ocean.

Fossils, like sedimentary rocks, can be indirectly dated by radioactivity. If volcanic ash layers that occur above or below the fossil are dated, the fossil is younger than the underlying ash layer and older that the overlying ash layer.

*Ex. 3. Answer the following questions on the text.*

1. What are fossils?

2. What are the ways in which fossils are preserved?

3. How can the relative age of fossils be determined?

4. What is an index fossil?

5. What is a fossil assemblage?

***Text 1.5 Oil Traps. (Anticlines, Synclines, and Domes)***

*Ex. 1. Study the vocabulary.*

|  |  |
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| ***anticline*** – антиклиналь  ***arch*** - арка  ***basin*** - месторождение, бассейн (например, нефтегазовый)  ***bbl (barrel)*** - баррель  ***bull’s eye*** - «бычий глаз», круглое окно, иллюминатор, фонарь  ***circular*** - круглый, круговой, кольцевой, циркулярный, дуговой  ***compressed*** - сжатый, спрессованный, сдавленный  ***compressional*** - сжимающий, сжатый, продольный  ***dome*** - купол  ***downward*** - вниз, понижающийся  ***to drill*** - бурить, пробурить  ***flat*** - плоский, равнинный, ровный  ***to fold*** - образовывать складки, складывать, сгибать, загибать  ***folding*** - складкообразование, перемещение пластов без разрыва сплошности  ***folds*** - складки, линии нарастания  ***force*** - сила, мощь, действие  ***formation*** - образование  ***hill*** - холм  ***level*** - уровень, горизонтальный  ***to level*** - выравнивать, делать ровным | ***lobate-shaped*** - дольчатый, имеющий округлые формы  ***nose*** - носовая часть, передний край, выступ, структурный мыс, шарнирная часть  ***oil field*** - нефтяное месторождение  ***pattern*** - образец, пример  ***plunging anticline*** - погружающаяся антиклиналь, периклинальный прогиб, структурный мыс  ***petroleum producers*** - нефтеносная / нефтедобывающая площадь  ***prolific*** - богатый, плодовитый  ***ridge*** - вершина, утес, увал, хребет, гребень  ***rock layers*** - обратный фильтр  ***to shorten*** - сокращать, уменьшать  ***shortening of the earth’s crust*** - сокращении земной коры  ***superimposed*** - наложенный, нанесенный, добавленный  ***surface*** - поверхность  ***syncline*** - синклиналь  ***tilted*** - наклонный, находящийся под углом  ***trap*** - ловушка  ***upward*** - вверх, поднимающийся  ***well*** - скважина, колодец |

*Ex. 2. Read and translate the text.*

An anticline is a large, upward arch of sedimentary rocks, whereas a syncline is a large, downward arch of rocks. Anticlines (but not synclines) form gas and oil traps. Folds such as anticlines expose the rocks to erosion. If the anticlines are relatively young, they haven’t been eroded and appear as topographic ridges on the surface. A series of young rising anticlines that are also prolific petroleum producers occur as a line of hills that cross the Los Angeles basin. These trend from Beverly Hills in the north, through the Inglewood (Baldwin Hills) and Dominguez fields, south-ward to long Beach, and offshore into the Huntington Beach field.

Most anticlines and synclines are not level and are tilted with respect to the surface of the earth. These are called plunging anticlines and synclines. During and after folding, erosion rapidly levels the folds. The pattern of an eroded plunging anticline and syncline is lobate-shaped, called a nose.

The formation of anticlines and synclines results in shortening of the earth’s crust. Forces that shorten the earth’s crust are compressional. If an area of the earth’s crust is compressed, the rocks will be folded into anticlines and synclines. If folds are present in the rocks of the earth’s crust, that area probably has been compressed some time in the past. 15

Domes

A dome is a circular or elliptical uplift. When eroded flat, a dome forms a bull’s eye pattern of concentric rock layers with the oldest rock in the centre. Domes also form gas and oil traps. Oil was first discovered in the Middle East in Bahrain, an island in the Persian Gulf, in 1932. The traps in Bahrain were domes with a low hill on the surface above each of them. A similar low hill above a dome in Saudi Arabia was drilled to find the first oil field there in 1937.

Anticlines and domes were the first type of petroleum trap recognized. They form many of the giant oil and gas fields of the world. Most of the Middle East oil fields are in anticline and dome traps. The Cushing oil field of Oklahoma, discovered in 1912, is located to the southwest of Tulsa. The trap is an anticline with three domes superimposed on it. The reservoir rock is the Bartlesville Sandstone along with several other sandstones and a limestone. The best producing wells are on the domes. The Cushing oil field will produce 450 million bbls of oil. It was the largest oil field in the world during World War I.

*Ex. 3. Answer the following questions on the text.*

1. What are the main types of oil traps?

2. What is an anticline?

3. What is a plunging anticline?

4. How do anticlines form?

5. What is a dome?