DOWNLOAD PDF ROCKS, MINERALS AND THE CHANGING EARTH

Chapter 1 : Minerals, Rocks & Rock Forming Processes

*Rocks, Minerals and the Changing Earth [John Farndon] on blog.quintoapp.com *FREE* shipping on qualifying offers. The natural wonders of the world are brought to life in this colorful, informative book, with easy-to-make practical projects.*

Wind, water, and ice erode and shape the land. Volcanic activity and earthquakes alter the landscape in a dramatic and often violent manner. Each one of these processes plays a role in the Arctic and Antarctica. Erosion is distinguished from weathering â€" the physical or chemical breakdown of the minerals in rock. However, weathering and erosion can happen simultaneously. Deforestation, overgrazing, construction, and road building often expose soil and sediments and lead to increased erosion. Excessive erosion leads to loss of soil, ecosystem damage, and a buildup of sediments in water sources. Building terraces and planting trees can help reduce erosion. Glaciers primarily erode through plucking and abrasion. Plucking occurs as a glacier flows over bedrock, softening and lifting blocks of rock that are brought into the ice. The intense pressure at the base of the glacier causes some of the ice to melt, forming a thin layer of subglacial water. This water flows into cracks in the bedrock. As the water refreezes, the ice acts as a lever loosening the rock by lifting it. Meltwater streams of many glaciers are grayish in color due to high amounts of rock flour. Above-freezing temperatures created a meltwater stream on the Scott Glacier, Antarctica. Photo courtesy of BlueCanoe Flickr. Glacial erosion is evident through the U-shaped valleys and fjords that are located throughout the Arctic and sub-Arctic regions. Glacial moraines are formed as a glacier recedes, leaving behind large piles of rock, gravel, and even boulders. Moraines may form at the foot terminal moraine or sides lateral moraine of the glacier or in the middle of two merging glaciers medial moraine. A U shaped Valley in Alaska. Glacial moraine in Kyrgyzstan. A fjord in Norway. Climate change is thought to be the underlying cause. As this heat is transferred to the land, the permafrost frozen soil thaws, making the coast vulnerable to erosion from wave action and storms which are more frequent due to warmer temperatures and open water. This video from the University of Colorado Boulder and the U. Geological Survey shows time-lapse images during one month of crumbling. This type of wind occurs when high-density cold air builds up at high elevations on the ice sheets, for example and moves downhill under the force of gravity. Katabatic winds in Antarctica and Greenland are intensely cold and fast, often reaching hurricane speed. You can hear these fierce winds in this YouTube video The winds in Antarctica carry small grains of sand that scour and erode the exposed rocks, resulting in unusual shapes and formations. These oddly shaped, eroded rocks are called ventrifacts. Ventrifacts are wind-eroded rocks found in the McMurdo Dry Valleys. They range from finger-sized to larger than houses. Image courtesy of Wikimedia. Geological evidence from Antarctica supports the theory that North America and Antarctica were connected approximately one billion years ago in the global supercontinent Rodinia. The continents eventually broke apart, merging again approximately million years ago in the supercontinent Pangaea. Fossil evidence from this time period confirms that Antarctica was connected to Australia and South America and much warmer than it is today. Most volcanoes occur at plate boundaries, where two plates are moving away diverging or together converging. Volcanic eruptions may be explosive violent or effusive passive , depending on the lava chemistry amounts of silica and dissolved gases. Silica is a mineral found in nature as sand or quartz. High levels of silica mean very viscous thick lava, and low levels mean more fluid lava. Dissolved gases build up inside the volcano, much like a can of soda or other carbonated beverage. The higher the level of gas, the more pressure that builds â€" and the more violent an explosion. The combination of silica and dissolved gas levels determines the type of eruption and shape of the volcano. Volcanoes are classified into four types, based on their lava chemistry and shape. A shield volcano has low levels of dissolved gas and silica in its magma. Its eruptions are effusive, and the very fluid lava moves quickly away from the vent, forming a gently sloping volcano. Mauna Loa in Hawaii is an example. A cinder cone volcano has low silica levels and high levels of dissolved gas, resulting in fluid lava that erupts explosively as a result of the immense pressure built in the magma chamber. A cinder cone volcano erupts by shooting fountains of fiery lava high in the air, which cools and forms a steep-sided conical structure. Lava Butte in Oregon is an example. A lava dome volcano has high silica levels and low dissolved gases in its magma. This results in effusive, viscous lava that forms a rounded, steep-sided mound. Lava domes are often created after an explosive eruption, which released much of the dissolved gas in the magma. The lava slowly continues to flow out of the volcano, forming a rounded, steep-sided mound. Since the eruption of Mt. Helens, a lava dome has been forming inside the crater of the volcano. A composite volcano has high levels of dissolved gas and silica and erupts explosively. Composite volcanoes often resemble steep-sided mountains before erupting. During violent eruptions, it can seem as if the whole top of the mountain has been blown off. Eruptions often include pyroclastic material ash and lava fragments , leaving the volcano to collapse inward and form a crater. Rainier in Washington are examples. Images courtesy of the U. Largely unexplored, the Gakkel Ridge runs underneath the Arctic Ocean. Scientists have discovered volcanic craters and evidence of surprisingly violent eruptions in the recent past. Map courtesy of the National Oceanic and Atmospheric Administration. Antarctica, too, is home to volcanic activity. Ross Island, located in the Ross Sea, is composed of three extinct volcanoes Mt. Terror, and Hut Point and Mt. The summit of Mt. Erebus from the front seat of a helicopter. Photo courtesy of Mt. Erebus is home to a permanent lava lake, or a large amount of molten lava contained in a crater. Only three volcanoes in the world have permanent lava lakes, making Mt. Erebus an important research site for scientists looking to better understand the internal plumbing system of volcanoes. However, its location permits only a six-week field season and its high altitude meters is physically challenging. Erebus lava lake in Erebus is also notable for its persistent low-level eruptive activity with almost daily eruptions. While the volcano has had some history of violent activity, most eruptions are passive lava flows similar to the volcanoes of Hawaii. As plates slowly move, their jagged edges stick and suddenly slip, causing an earthquake. The Gakkel Ridge underneath the Arctic Ocean experiences small earthquakes that accompany the volcanic activity found in the area. Antarctica, which lies in the center of a tectonic plate, does not experience many earthquakes. However, seismic activity is associated with eruptions of Mt.

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Chapter 2 : Earth Science for Kids: Rocks, Rock Cycle, and Formation

Activities, videos, songs, labs, worksheets, and websites that help teach the Earth's Resources (Soil, Rocks and Minerals) and it's constantly changing surface through erosion, deposition, volcanic action, etc.

But what exactly are rocks and minerals? What is the difference between them? How do they form? Where are they found? This article provides content knowledge about minerals , the three types of rocks , the rock cycle , and polar geology as well as online resources for further learning and connections to the National Science Education Standards. When you look at a rock and see different colors, those colors are minerals that make up that specific rock. There are over 3, named minerals; however, there are really only about 30 minerals that people who are not geologists will come across or need to concern themselves with. There are four criteria that must be met in order for something to be called a mineral: Not formed from the remains of plants or animals; that is, inorganic Naturally occurring, not man-made Has the same chemical makeup wherever it is found Ex: Quartz is always SiO2 Has a crystalline structure, which means that it has a specific repeating pattern of atoms. If all four of the criteria are not met, the substance is not a mineral. Here are a few tests that geologists rely on to identify what minerals they are looking at. Color â€” Color is a very common way to try to identify a mineral; however, it should not be used on its own. Because any mineral can be any color, you cannot use color alone to identify a mineral. Color can merely help you. Or, sometimes, confuse you! Shape â€” Minerals form in certain shapes based on the elements that make them up. Some minerals, such as quartz, only form in one particular shape. Others, such as calcite, can be found in multiple shapes. Hardness â€" How hard or soft a mineral is can tell you right away what mineral it could or could not be. The hardness of minerals is based on the Mohs Hardness Scale, which ranges from , 1 being the softest and 10 the hardest. Even if the color of the mineral itself changes from one specimen to another, the streak color is always the same. Luster â€" Luster simply means the way that light reflects off a mineral. Light can make a mineral look very dull or as shiny as a diamond. There are many other tests that geologists use; however, the tests listed above are usually sufficient for the amateur, and can help you identify the mineral. Igneous rocks form when magma or lava cools and hardens into a rock. Magma and lava are rocks that are so hot they move like a liquid. Magma is molten rock that is underground; lava is molten rock that is above the ground â€" and that is the only difference between them. A common igneous rock is granite. It is often used for countertops in homes because of its aesthetic appeal and its durability. Photo courtesy of U. Sedimentary rocks can form in one of three main ways. These sedimentary rocks form from the breakdown material of other rocks. When a rock is exposed to the elements, it will begin to erode. The small pieces that break off during erosion will collect in oceans and lakes. Over enough time and with enough pressure, these pieces will be compressed and cemented together to form a larger rock. This larger rock is a clastic sedimentary rock. A perfect example of this kind of sedimentary rock is a conglomerate. It is easy to see that this rock formed from the breakdown materials of other rocks. These sedimentary rocks are formed when mineral-rich water evaporates and leaves material behind. An example is halite. Halite is formed when sea water evaporates and leaves behind the salt, which then hardens. Halite samples Organic sedimentary rocks: These sedimentary rocks are formed from fossils. They are formed from the hard parts of dead organisms, such as bones and shells, which are cemented together and form into a rock. Coal is another organic sedimentary rock. It forms when plants die and are buried deep in the earth, where they are put under great pressure. Over enough time the pressure will change the plant remains into coal. Limestone Chert Coal Click on each image to see a larger versions. All photos courtesy of the U. Metamorphic rocks are formed when a rock is buried deep in the earth and is subjected to extreme pressure and heat. The pressure and heat causes the minerals in the rock to change into different minerals. This ends up changing the rock into a completely different rock. We call rocks that have been changed from one rock to another by pressure and heat metamorphic rocks. Gneiss is granite that has been put under extreme pressure and heat, which caused the rock to change into something different, a gneiss. Sometimes granite and gneiss can look very similar. One distinguishing characteristic of gneiss is its banding. Due to the pressure and heat that the granite is subjected to, similar minerals in the rock begin to align with each other, producing the bands in gneiss. This feature is known as gneissic banding. Gneiss Click on each image to see a larger version. Photos courtesy of the U. The cycle is shown in the picture below from the U. You will typically see a picture similar to this one when looking for diagrams of the rock cycle. It can be pretty difficult to follow rock formation in a circular pattern, so you may want to think of the pattern as more of a rock triangle than a rock cycle. If you are looking at the USGS rock cycle diagram, it appears as though the cycle goes: However, this is misleading. The triangle diagram shows how one type of rock can form any other type of rock. Places where hot magma rises up from the center of the earth cause the plates to spread apart from each other. These areas are known as divergent plate boundaries or rifts. One of the best examples of this type of plate boundary is the Mid-Atlantic Ridge in the middle of the Atlantic Ocean. This ridge is slowly causing North and South America to move farther and farther away from Europe and Africa. These areas are known as convergent margins or subduction zones. Because of the collision, these are areas in which deep trenches will form at the bottom of the ocean. The most famous trench is the Mariana Trench, located several hundred miles southeast of Japan, near Guam. This trench is the deepest part of the ocean, reaching almost seven miles below sea level. It is formed by the collision of two oceanic plates; the less dense Pacific Plate is subducted under the more dense Philippine Plate. Rocks that are pulled down with the crust are put under extreme pressure and heat, which will cause them to turn into metamorphic rocks. If they are pulled down far enough, the heat and pressure may cause the rocks to melt into magma, which will then rise up toward the surface and cool as igneous rocks. Despite being a very cold, very windy, and seemingly desolate place, Antarctica holds a lot of clues to the past. Nearly 98 percent of Antarctica is covered in ice and snow, leaving only about 2 percent that is exposed rock. Antarctica contains one of the longest mountain ranges in the world. The Transantarctic Mountains span a distance of nearly 3, miles and cut the continent into West Antarctica and East Antarctica. These mountains rise high above the surrounding snow and ice and even contain dry valleys â€” areas that are ice free. The Transantarctic Mountains are made mostly of a sedimentary rock that is known to Antarctic geologists as Beacon sandstone. This sandstone is between to million years old. There are areas where the sandstone has been intruded by a layer of igneous rock called dolerite. This is the result of volcanic activity, approximately million years ago, that caused molten rock to be injected between layers of sandstone. Antarctica used to be part of the supercontinent Pangaea. Pangaea is the name given to the enormous landmass that existed millions of years ago when all of the continents were together as one supercontinent. The climate of Antarctica was very different from how we know it today. Antarctica was warm, with lush vegetation and animals that thrived. This all changed when Pangaea began to break apart. It broke into two smaller supercontinents; Laurasia in the Northern Hemisphere and Gondwanaland, or Gondwana, in the Southern Hemisphere. After a few million years, Gondwana and Laurasia began to break down into smaller continents, which eventually became the continents as we know them today. When Antarctica broke away from Gondwana, ocean circulation patterns changed. This change in circulation had a tremendous effect on the climate of Antarctica. It became cold, and the plants and creatures living there could no longer survive. Some left behind their fossils for us to find. Each type of rock, whether igneous, sedimentary or metamorphic, can be found in Antarctica.

Chapter 3 : - Rocks, Minerals and the Changing Earth by John Farndon

Note: Citations are based on reference standards. However, formatting rules can vary widely between applications and fields of interest or study. The specific requirements or preferences of your reviewing publisher, classroom teacher, institution or organization should be applied.

In fact, there are thick books whose sole object is to describe and discuss sedimentary structures and their meaning. In a way sedimentary structures are the alphabet in which a lot of earth history is written, and the better we can decipher them the better will our understanding of the geologic past as well as of the future be. The implications of this observation of sedimentary structures are twofold: A the surface processes of the earth have been the same throughout earth history, and have been of comparable magnitude. B because we can examine what processes produce these structures today, we can go back and reconstruct the ancient world. The Origin of Sedimentary Rocks A sedimentary rock that we can examine in an outcrop has a long history and has been subjected to modification by various processes. The first process, WEATHERING, produces the materials that a sedimentary rock is composed of by mechanical freezing, thawing and chemical dissolution of minerals, formation of new minerals [clays] interaction between atmosphere, hydrosphere and earth surface rocks. Rivers are the main transporting agent of material to the oceans glaciers are at times important. During transport the sediment particles will be sorted according to size and density gold placers and will be rounded by abrasion. Material that has been dissolved during weathering will be carried away in solution. The sorting during transport is important because it is the reason that we have distinct clastic rock types conglomerates, sandstones, shales. An overview of sedimentary environments. Each sedimentary environment is characterized by a distinctive set of features such as, type of sediment, sediment association, sediment texture, sedimentary structures, and animal communities, and is in this way by using modern analogues that we can go back and reconstruct ancient landscapes. Compaction is effected by the burden of younger sediment that gets piled on top of older sediments rearrangement of particles, packing, dewatering. Minerals precipitated from the pore waters in these sediments cement together adjacent sediment grains. Thus, a coherent solid rock is formed. Significance of Sedimentary Rocks That sedimentary rocks are not only nice to look at, but are also important economic assets, is something that should be obvious to everyone living in states such as Texas, Oklahoma, and Louisiana the oil patch. Indiana also has oil and gas production, with gas from Devonian black shales New Albany Shale in Indiana being an important economic asset for the entire northeastern US. Not only oil and gas, but also a large variety of other resources are extracted from sediments and sedimentary rocks. Coal mined extensively in southeastern Indiana and lignite are special kinds of sedimentary rocks carbonaceous sediments; see above , and they constitute a very large resource that should last for several hundred additional years. Most of the iron ore in the world is mined from Precambrian sedimentary rocks, the largest lead-zinc-silver and copper deposits occur in sedimentary rocks mostly Precambrian, especially Proterozoic , and the largest gold and uranium deposits also are located in sedimentary rocks as well Archean to Proterozoic in age. Bauxite, the main ore for Aluminum production is basically a fossil soil also a sediment that formed in tropical climates. If we then also add the many building stones that are quarried from sedimentary rocks, and add in the raw materials for ceramics clay minerals from mudstones and shales , it is quite obvious that sedimentary rocks are indeed of considerable importance, and that it pays to understand them well. Gold and platinum nuggets from placer deposits river sands and gravels that contain detrital gold and platinum. Many of the gold rushes in the American West got their start with the discovery of placer gold deposits. Even today, placer gold mining can still be a profitable business. The largest gold accumulation in the world, the Witwatersrand of South Africa, is a Late Archean sedimentary basin with abundant "fossil" placer gold deposits. The hunt for gold always held a special attraction for men. Was it famine or scurvy -- I fought it; I hurled my youth into a grave. Have you seen it? You come to get rich damned good reason ; You feel like an exile at first; You hate it like hell for a season, And then you are worse than the worst. The summer -- no sweeter was ever; The sunshiny woods all athrill; The grayling aleap in the river, The bighorn asleep on the hill. The strong life that never knows harness; The wilds where the caribou call; The freshness, the freedom, the farness -- O God! Service Metamorphic Rocks Metamorphic rocks are those whose original texture, composition and mineralogy have been changed by conditions of high pressure and temperature higher than conditions of formation of starting material. The materials from which metamorphic rocks form are igneous rocks, sedimentary rocks, and previously existing metamorphic rocks. Mineralogical and textural changes during metamorphism occur essentially in the solid state. Metamorphic rocks form when the precursor materials igneous, sediment, etc. They are therefore most commonly encountered in the core zones of mountain belts uplifted root zone , in old continental shields, and as the basement rock below the sediment veneer of stable continental platforms. Metamorphic rocks may contain relic structures, such as stratification, bedding, and even such features as sedimentary structures or volcanic textures. Picture of a metamorphosed conglomerate. The pebbles look "normal" on the right hand cut, but they are much longer than expected on the left hand cut perpendicular. The pebbles were stretched during metamorphism because the rock was sufficiently hot to behave plastic and flow. Photomicrograph of a metamorphosed quartz sandstone. Whereas the original quartz grains were probably nicely rounded , recrystallization under high pressures and temperatures causes the grains to grow larger and impinge on each other. The sutured grain contacts that we see are typical for metamorphosed quartz sandstone. The most strongly metamorphosed rocks often show evidence of extensive deformation without fracturing in part detectable because of relict structures , and that observation indicates that these rocks behaved plastically see conglomerate above when they were hot and deeply buried. Usually, the older a portion of continental crust is, the more widespread are outcrops of metamorphic rocks erosion to very deep crustal levels, isostasy finally exposes root zones of mountain ranges. In older metamorphic rocks oftentimes several successive episodes of metamorphism can be determined with modern methods of investigation age determination on minerals of different stability, different isotopic systems. Outcrop of a metamorphic rock a gneiss that has experienced high temperatures and pressures. It has developed banding due to mineral segregation. Folding and deformation indicates that it behaved plastic. The lighter bands are mostly feldpar, quartz and muscovite, and seem to have undergone local melting. This rock basically shows evidence of the onset of partial melting in the lower continental crust, and if the process had gone further it would probably have been the source of a granite intrusion. These partially melted lower crustal rocks are also called migmatites. Readjustment occurs because the new conditions e. A new set of minerals or mineral assemblage will form that is stable under the new conditions. In other words, a new equilibrium mineral assemblage will appear equilibrium being a state where the mineral assemblage is stable and does not change. Schematic depiction of a metamorphic change of mineral assemblage. The initial rock at left consists of minerals A, B, and C that are stable under the initial conditions. Upon heating and burial minerals B and C become unstable and react to form a new set of minerals, D, E, and F, that are stable under the new conditions. Mineral A is stable over a wide range of conditions and did not change. The rock looks now mineralogically and texturally very different from before. Metamorphic changes proceed in the solid state thermal diffusion. However, water is always present in rocks pore spaces in sediments, as thin films between crystal boundaries , and it serves an important function for local ion exchange diffusion through the water films. Without water metamorphic changes would proceed extremely slow because diffusion through solids is much slower than diffusion through liquids. Thin film diffusion during metamorphism. A thin fluid film may be only a few water molecules thick in places along mineral boundaries takes up atoms from adjacent minerals. These can then diffuse through the fluid at greatly enhanced speeds when compared to diffusion through a solid. The elements marked in color are migrating down a concentration gradient towards a place where a new mineral is growing that uses them up thus low concentrations surrounding the growing mineral. The controlling parameters of metamorphism are: With rising temperature water that is contained in minerals crystal water will be expelled into the pore spaces, fractures and crystal boundaries. As the pore fluid content increases, chemical changes mediated through the pore fluids will speed up as well. The rate of diffusion also increases with temperature. Thus, new mineral assemblages will appear faster than at lower temperatures. At temperatures below degrees Celsius, chemical changes proceed so very slow that essentially no changes occur within geologically significant time spans. At temperatures of about to degrees Celsius we approach eutectic conditions for most rocks of the continental crust, and a vapor-rich water, possibly CO_2 partial melt will form.

Metamorphic rocks that have been heated to those temperatures show textural evidence that significant portions of the rock existed as a melt at one time migmatite , see above. Layers of rock with metamorphic texture alternate with layers of rock with igneous texture, meaning that part of the rock recrystallized from a melt. Those melts are of granitic composition and may rise in the crust to form granite plutons we have thus two types of granites in the crust: The Influence of Pressure: An increase in pressure tends to favor minerals of higher density, because their atoms are more tightly packed and the minerals occupy less space. An increase in pressure can be produced by deep burial of the rock lithostatic pressure , or by directed horizontal pressure stress at convergent plate margins subduction zones. Minerals will not grow in the direction of highest pressure, but rather in the direction of the lowest pressure. Therefore in rocks that were subject to high pressures, the metamorphic minerals will be elongated perpendicular to the direction of highest pressure. Platy minerals such as micas will be oriented perpendicular to the pressure. Elongate minerals like hornblende will point with their long axis in the direction of least pressure. The development of preferred mineral orientation in metamorphic rocks is called foliation, and is typical for regional metamorphism. The Influence of Fluids: In general, metamorphic changes take place without significant changes in the overall composition of the rock we can consider it a closed chemical system , only local mm to cm scale rearrangement of components occurs. The original minerals break down and a new set of minerals is formed that is stable under the new conditions of pressure and temperature. Fluid between crystals promotes chemical exchange within the otherwise solid state system. As seen earlier, this fluid derives from original pore water and water on fractures, and the fluid is enriched by atoms that are released from crystals. As temperature rises bound x-tal water is expelled, and some unstable minerals of comparatively low melting point will start to "melt" or dissolve into these pore fluids. Then diffusion will carry the dissolved materials to a nearby site of formation of a new metamorphic mineral. This process of local diffusion and reorganization of the rock into new minerals is called recrystallization. If on the other hand we have an open, or partially open system plenty of fluid available, high porosity [fractures], e. In that case addition or removal of large quantities of mineral bearing fluids the overall rock composition will change. This latter process is called metasomatism. The minerals that form during metamorphism are in parts the same as those that we know from igneous rocks we have to remember that the early differentiates form deeper in the earth under conditions of high pressure and temperature themselves.

Chapter 4 : Rock (geology) - Wikipedia

Rocks, Minerals and the Changing Earth by Challoner, Jack & Walshaw, Rodney & Farndon, John. Southwater, 05/28/ Paperback. Used; Good.

By the end of the unit students will know: Earth changes and is shaped through slow and rapid processes. Through a series of hands-on investigations students will experience the effects of weathering and erosion. Students will learn how to identify rocks and minerals via their properties. The Grade 4 Earth Science Unit is presented to students through a series of investigations, experiments, active learning experiences, questions, and assessments. Lessons are linked to the previous lesson and the lesson that follows via a conceptual storyline. This ensures the development of student understanding as students progress from one concept to the next. A Powerpoint presentation and video clip of the Mount St. In the previous lesson, students learned about rapid processes that change the Earth. Students experience weathering as the result of acid rain, roots, freezing and thawing of water. A Powerpoint presentation is included in the lesson to illustrate the effects of weathering. In Lesson 2 students learned about the effects of weathering. A Powerpoint presentation is included in the lesson to illustrate the effects of slow processes that change landforms. In the next lesson students learn that rocks are transformed through the rock cycle. After Lesson 4, students complete Formative Assessment 1. This assessment is aligned to the learning objectives of Lessons and provides feedback to the teacher, students, and parents about what students have learned in the beginning of the unit. The teacher is able to use information from this formative assessment to determine if additional instruction is necessary for student understanding of the concepts presented in Lessons before proceeding to the next section of the unit. In the next lesson students learn that rocks can also be identified based upon how they are formed. A Powerpoint presentation provides additional support for student understanding of this concept. In the previous lesson students learned that rocks are made of organic materials and minerals such as quartz, calcite, feldspar, mica, and hornblende. In the previous lesson, students learned how minerals are formed, and that they have a crystalline structure. After Lesson 9, students complete a post-assessment to determine their overall understanding of the concepts presented in the unit.

Chapter 5 : Rocks and Minerals for Kids | Facts about Rocks | DK Find Out

Earth - Rocks and Minerals - Earth is largely a ball of rock. Rocks form on and beneath Earth's surface under a wide range of physical and chemical blog.quintoapp.com rocks are made up of minerals. The minerals in some rocks are single chemical elements such as gold or copper, but the minerals in most rocks are compoundsâ€"combinations of.

This one lurked in shallow waters 3. But that was soon to change. Though a basic question, Hazen was taken aback. Morowitz was essentially asking whether the mineralogy that existed when Earth was new, and possibly when life originated , was different from what we see today. And as life evolved, it created a myriad of chemical niches that allowed new minerals to form. I sat down with Hazen to chat a bit about the film and the amazing world of minerals the following has been edited for length: Today we know of 5, or more mineral speciesâ€"each one a distinctive chemical composition and crystal structure. And of those 5,, more than two thirds are the result of the changes that life has made to Earth. So what was the first mineral in the universe? When we started thinking about minerals through deep time, surprisingly, no one had asked that question. In any field, origins are a big dealâ€"first life, first planets, first stars. But mineralogists had never asked, what was the first mineral? Right after the big bang, things are much too hot, and even after things condensed a little bit, it was only hydrogen and helium gas that made up the bulk of the universe. The next thing the hydrogen and helium gas did was condense into large stars. Minerals are formed from those other elements. When after that first star could you have the first crystal? The answer, it turns out, is in the gaseous envelopes of very energetic stars or exploding supernovas. As those gaseous envelopes expand and cool, you have concentrations of elements that are just high enough and temperatures just low enough that the first crystals can form. That first crystal, we think, was a microscopic species of diamond, because stars are carbon rich and because diamond forms at the highest temperature of any known crystal. What about the first minerals on Earth? As the gases around the earliest stars cooled, there may be a dozen more different crystals that formed of the commonest elements: These were the very first species of mineral crystals that littered the cosmos and formed the dust of those great clouds that eventually formed new solar systems. Earth formed from one of those clouds. The earliest planets may have had or minerals. Then as planets like Earth evolved over a billion years, we may have gotten up to 1, minerals, all forming from pure chemical and physical processes. How did minerals influence early life? The mineral surfaces protect, organize and template. They take those molecules and select and concentrate them The biggest question is: How does one go from molecules organized on a mineral surface to a set of molecules that makes copies of itself? Perhaps the minerals guided that process or perhaps they were merely a convenient place for molecules to meet and organize, and just by some pure chance event, just the right set of molecules came together and formed this self-replicating system. Though closely related to modern horseshoe crabs, trilobites went extinct million years ago. Rob Tinworth Robert Hazen studies thin slices of rock under a microscope in his lab at the Carnegie Institution. Fossil stromatolites represent some of the oldest known evidence of life on Earth. Doug Hamilton Are minerals still evolving today? Yes, of course they are. We are entering a period of very rapid evolution due to human activitiesâ€"the Anthropocene. Humans are altering the near-surface environment, and when you do that you create new chemical niches where minerals can form. We mine things, we build things, we shift things and we build chemical plants. One of the consequences of doing this is that new minerals arise. There are minerals that only occur in mine dumps or acid mine drainages. There are new minerals that only occur on the timbers of mine supports. Landfills now have weathering products of old computer screens and iPhones, which are forming new minerals of rare earth elements that are only just being discovered. Why should people care about minerals? Minerals are amazingly wonderful. They are important to every facet of society: We would have no technology and none of the conveniences of modern life were it not for the mineral realm. But our modern world is one facilitated by minerals. I think seeing minerals in this richer context of a co-evolving geosphere and biosphere just layers that much more importance and interest on the subject. For the NOVA documentary, you filmed all over the world. What was your favorite place to visit? But going to Western Australiaâ€"it was a privilege to be in this incredibly remote, incredibly beautiful, although sparse, desolate and dangerous land of the Pilbara. The rocks never experienced the kind of alteration and erosion that is known for virtually all younger rocks. I saw the outcrop first and fresh through my own eyes, but then I learned from them and could see it through the eyes of others who are more experienced. That was a truly transforming experience.

Chapter 6 : Interactives . The Rock Cycle . How Rocks Change

EROSION. Wind, water, and ice are the three agents of erosion, or the carrying away of rock, sediment, and soil. Erosion is distinguished from weathering â€" the physical or chemical breakdown of the minerals in rock.

Rocks are composed of grains of minerals, which are homogeneous solids formed from a chemical compound arranged in an orderly manner. The types and abundance of minerals in a rock are determined by the manner in which it was formed. Many rocks contain silica SiO2 ; a compound of silicon and oxygen that forms This material forms crystals with other compounds in the rock. The proportion of silica in rocks and minerals is a major factor in determining their names and properties. These physical properties are the result of the processes that formed the rocks. This transformation produces three general classes of rock: Those three classes are subdivided into many groups. There are, however, no hard-and-fast boundaries between allied rocks. By increase or decrease in the proportions of their minerals, they pass through gradations from one to the other; the distinctive structures of one kind of rock may thus be traced gradually merging into those of another. Hence the definitions adopted in rock names simply correspond to selected points in a continuously graduated series. Igneous rock Sample of igneous gabbro Igneous rock derived from the Latin word igneus, meaning of fire, from ignis meaning fire is formed through the cooling and solidification of magma or lava. Typically, the melting of rocks is caused by one or more of three processes: Igneous rocks are divided into two main categories: A common example of this type is granite. Volcanic or extrusive rocks result from magma reaching the surface either as lava or fragmental ejecta, forming minerals such as pumice or basalt. Most major igneous rocks are found along this scale. Granites and similar rocks, known as meta-granitoids, form much of the continental crust. These have diverse properties, depending on their composition and the temperature and pressure conditions in which they were formed. This process causes clastic sediments pieces of rock or organic particles detritus to settle and accumulate, or for minerals to chemically precipitate evaporite from a solution. The particulate matter then undergoes compaction and cementation at moderate temperatures and pressures diagenesis. Before being deposited, sediments are formed by weathering of earlier rocks by erosion in a source area and then transported to the place of deposition by water , wind , ice , mass movement or glaciers agents of denudation. Sedimentary rocks form under the influence of gravity and typically are deposited in horizontal or near horizontal layers or strata and may be referred to as stratified rocks. A small fraction of sedimentary rocks deposited on steep slopes will show cross bedding where one layer stops abruptly along an interface where another layer eroded the first as it was laid atop the first. Metamorphic rock Metamorphic banded gneiss Metamorphic rocks are formed by subjecting any rock typeâ€" sedimentary rock , igneous rock or another older metamorphic rockâ€"to different temperature and pressure conditions than those in which the original rock was formed. This process is called metamorphism , meaning to "change in form". The result is a profound change in physical properties and chemistry of the stone. The original rock, known as the protolith , transforms into other mineral types or other forms of the same minerals, by recrystallization. An intrusion of magma that heats the surrounding rock causes contact metamorphismâ€"a temperature-dominated transformation. Pressure metamorphism occurs when sediments are buried deep under the ground; pressure is dominant, and temperature plays a smaller role. This is termed burial metamorphism, and it can result in rocks such as jade. Where both heat and pressure play a role, the mechanism is termed regional metamorphism. This is typically found in mountain-building regions. Those that possess a texture are referred to as foliated ; the remainders are termed non-foliated. The name of the rock is then determined based on the types of minerals present. Schists are foliated rocks that are primarily composed of lamellar minerals such as micas. A gneiss has visible bands of differing lightness , with a common example being the granite gneiss. Other varieties of foliated rock include slates , phyllites , and mylonite. Familiar examples of non-foliated metamorphic rocks include marble , soapstone , and serpentine. This branch contains quartzite â€"a metamorphosed form of sandstone â€"and hornfels.

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Chapter 7 : Igneous, Sedimentary, and Metamorphic Rocks

The Rock Cycle Rocks are constantly changing in what is called the rock cycle. It takes millions of years for rocks to change. Here is an example of the rock cycle describing how a rock can change from igneous to sedimentary to metamorphic over time.

Rocks and the Rock Cycle What is a rock? A rock is a solid made up of a bunch of different minerals. Rocks are generally not uniform or made up of exact structures that can be described by scientific formulas. Scientists generally classify rocks by how they were made or formed. There are three major types of rocks: Metamorphic, Igneous, and Sedimentary. Metamorphic Rocks - Metamorphic rocks are formed by great heat and pressure. Metamorphic rocks are often made from other types of rock. For example, shale, a sedimentary rock, can be changed, or metamorphosed, into a metamorphic rock such as slate or gneiss. Other examples of metamorphic rocks include marble, anthracite, soapstone, and schist. Igneous Rocks - Igneous rocks are formed by volcanoes. When a volcano erupts, it spews out hot molten rock called magma or lava. This hardened magma or lava is called igneous rock. Examples of igneous rocks include basalt and granite. Sedimentary Rocks - Sedimentary rocks are formed by years and years of sediment compacting together and becoming hard. Generally, something like a stream or river will carry lots of small pieces of rocks and minerals to a larger body of water. These pieces will settle at the bottom and over a really long time perhaps millions of years , they will form into solid rock. Some examples of sedimentary rocks are shale, limestone, and sandstone. The Rock Cycle Rocks are constantly changing in what is called the rock cycle. It takes millions of years for rocks to change. Here is an example of the rock cycle describing how a rock can change from igneous to sedimentary to metamorphic over time. It cools and forms an igneous rock. Next the weather, or a river, and other events will slowly break up this rock into small pieces of sediment. As sediment builds up and hardens over years, a sedimentary rock is formed. When the pressure and heat get high enough, the sedimentary rock will metamorphose into a metamorphic rock and the cycle will start over again. They may change from one type to another and back again in practically any order. Space Rocks There are actually some rocks that come from space called meteorites. They may have different elements or mineral make up than a typical earth rock. Typically they are made up mostly of iron. Interesting Facts about Rocks The word "igneous" comes from the Latin word "ignis" which means "of fire. Sedimentary rocks form layers at the bottoms of oceans and lakes. Marble is a metamorphic rock formed when limestone is exposed to high heat and pressure within the Earth. Layers of sedimentary rocks are called strata. Activities Take a ten question quiz about this page.

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6 The changing earTh The Devils Marbles rocks are an extraordinary landform located in the Northern Territory. Once part of a solid layer of granite and sandstone rock, the processes of erosion and weathering led to.

The Earth is a solid sphere. Earth Materials Earth materials include solid rocks and soils, water, minerals, and gases in the atmosphere. Rocks come in many sizes and shapes. Rocks change in size, shape, and other properties. Soils have properties of color, particle size, and texture. Forces that Change the Earth Geological events volcanoes, earthquakes, erosion shape the earth. Animals and plants can change rocks and soil. Fossils Relationships to Earth Materials Fossils were created long ago. Intermediate 7 years - 11 years Concepts The Earth The Earth is layered from the outside in with solid crustal plates lithosphere , hot liquid rock mantle , and dense metallic center core. Peach as model for Earth Pit is the core Fruit is the mantel Skin is the crust Peach fuzz is the atmosphere. Earth Materials Earth materials are solid rocks and soils, water, and gases of the atmosphere. Earth materials provide many of the resources that humans use. Fossils were created long ago. Soil consists of weathered rocks, water, and decomposed organic materials from dead plants, animals, and bacteria. Soils are often found in layers with each layer having different properties. Soils have properties of color, particle size, texture, capacity to retain water, and y. Wind, water, and ice shape the Earth. Erosion is the wearing away and moving of earth. Rock is made of different combinations of minerals. Soil is made from different forms of rock, plant and animal remains, and living organisms. Earth materials provide shelter, water, and nutrients for animals survival. Fossils Relationships to Earth Materials Fossils were created from living organisms. Forces that Change the Earth Lithospheric plates tectonic plates the size of continents and oceans constantly move at the rate of centimeters per year as a result of movements in the mantle. Tectonic plates are made of rocks such as those we see exposed that the surface. The interior of the Earth is hot Heat flow and movement material within the Earth cause earthquakes and volcanic eruptions that create mountains and ocean basins. Gases and dust from volcanoes can change the atmosphere. These forces can act fast and slow. The can also be constructive and destructive geological events create landforms. Constructive forces include crustal changes, mountain building, volcanic eruptions, and deposition of sediment. Destructive forces include weathering and erosion. Forces that change the Earth continued Water erosion, meandering, rivers and streams The volume of water effects the size and shape of a stream. The slope of a stream effects the size and shape of the stream. The kind, size, and shape of earth material effects erosion. Water flow causes sand to be picked up. Water flow causes sand to be picked up and moved. Water flow causes sand to be dropped. Fine sand is moved more easily than coarse sand by streams. Deposits are formed as a result of the streams flow. Erosion and deposition occur in different places in a curving stream. Some streams flow straight and others make loops and curves. The movement of sand is affected by the angle of the channel, the number of channels, and the location of the channels. Different kinds of objects speed up or slow down the movement of sand. Scoring guide for water erosion, rivers, and streams Low level: Describes rain as related to streams and rivers and streams and rivers as concluding where seas and oceans begin. Describes rain and run-off as causing erosion and water from it as collecting in streams and rivers and emptying into seas and oceans. Describes rain and run-off as a powerful force proportional to the slope or volume of the flow. That water flow erodes the Earth in specific ways to create channels. And even thought large volumes of water or steep slopes can increase erosion long periods of time can erode the most erosion tolerant earth materials. Describes rain and run-off is a powerful force that erodes the Earth and how different flows of water interact with the Earth to create stream beds. How different interactions depending on flow volume related to precipitation and run-off , speed of the flow related to the slope, run-off and shape of the channel , and earth materials related to the flow of the water, mass, hardness, shape, and location of materials create different channels and deposits. Earth Materials Soil consists of weathered rocks, water, gases, and decomposed organic materials from dead plants, animals, and bacteria. Soils are often found in layers with each layer having different chemical compositions. Weathered rock is the basic component of soil, the amount of soil and its fertility and resistance to erosion are greatly influenced by plant roots and debris, bacteria, fungi, worms, insects, rodents, and other organisms. Eventually, those new rocks may be brought to the surface by movements in the mantle and cycle continues. The varied materials have different physical and chemical properties, which make them useful in different ways, for example, as building materials, as sources of fuel, or for growing the plants we use as food. Earth resources are nonrenewable. Fossils Relationship to Earth Materials Fossils were created from living organisms. Fossils were created in amber, replacement by crystallization, and imprints. Fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time. Forces that Change the Earth The surface of the earth changes due to slow processes, such as erosion and weathering, and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes. Thousands of layers of sedimentary rock confirm a long history of the changing surface of the Earth and the changing life forms whose remains can be found in successive layers. The youngest layers are not always found on top because of folding, breaking, and uplifting of layers. Human activity has changed the Earth farming, reducing forests, release of chemicals, and decreased the capacity of the environment to support some forms of life.

Chapter 9 : Earth Rocks! - Lesson - TeachEngineering

Earth's crust is made up of many different types of rocks. Over long periods of time, many rocks change shape and type as they are transformed by wind, water, pressure, and heat. Over long periods of time, many rocks change shape and type as they are transformed by wind, water, pressure, and heat.

What is the "stuff" near the surface of the earth made of? Lead the students to answers such as rocks, boulders, pebbles, dirt, soil, metals, gems, minerals, etc. These are the materials that make up the ground we walk on. It is what holds together lakes, rivers and oceans. It is where plants grow and where we build our roads, buildings and parks. We build tunnels through it, and we build bridges over it. These materials are collectively known as rocks, soils and minerals. What is the difference between rocks, soils and minerals? Make a chart on the board with three columns, labeled "Rocks," "Soils" and "Minerals. Minerals are non-living things and have a definite crystal-like structure. This means that they do not come from plants and animals and have a definite shape, such as square or an octagon. An example of a mineral is salt. Have you ever looked at salt closely? Did you notice that each individual grain has a shape to it? Salt is an example of a mineral. Rocks are usually several minerals stuck together. In fact, it is easier to find a mineral embedded in a rock than on its own. Rocks can also contain other things, like fossilized plants or animals. Rocks are labeled by how they were formed. There are three types of rocks: Lastly, soils are collections of very small pieces of rocks that were broken down over time. Soils often contain other things as well, like decaying plant pieces. Soils are typically identified by texture and how large the particles in the soil are. There are three different textures of soil: There are lots of other important uses for rocks, soils and minerals. Can you think of what they might be? We use rocks, soils and minerals to construct a lot of the things we use on a daily basis. Some of the materials we use that are actually considered rock, soils or minerals include metals steel, gold, copper, silver, aluminum, etc , concrete, ceramic, clay, sand, gems diamonds, emeralds, rubies, etc , salt, drywall and glass. Engineers use these materials when creating everything from buildings, to roads, to cars, to cell phones, to computers, to medicines. Rocks, soils and minerals are incredibly important to us in our daily lives. Today, we are going to learn more about rocks, soils and minerals and how engineers use them in everyday life. Lesson Background and Concepts for Teachers The crust of the Earth, where all plants and animals live, is composed of many different rocks, soils and minerals. Engineers care a great deal about rocks, soils and minerals since we build structures upon them, and, very importantly, they are the source for most of our building materials. These rocks, soils and minerals provide the landscape, a place for our food to grow, and the ground on which we build our roads and buildings. They also are the sources of building supplies we use to make everything from computers, to roads, to bicycles, to buildings, and even toilets! Even things such as oil, which are used to make plastics, only form because of the weight of the rocks and soils above oil deposits. The basic component in both rocks and soils are minerals. Minerals are solid inorganic compounds not from living material, such as plants or animals that have a definite chemical composition and a crystalline structure. A common example of a mineral is salt. Salt has a definite chemical composition Sodium Chloride or NaCl and has a crystalline structure. Some other examples of minerals include: Minerals are typically mixed with other minerals, so if we want to use just one particular mineral we may have to separate it from other minerals first. Rocks are actually aggregates of two or more minerals. In fact, minerals are more often found in rocks as opposed to being alone in their pure form. The mineral iron is usually found in a rock known as an ore that contains iron, but is mixed with other minerals. Rocks can also contain organic materials such as fossilized plants or animals. Rocks are categorized by how they were originally formed. These soils sediments get compacted over time and eventually cement to form a solid rock. Examples of sedimentary rocks include sandstone, limestone and shale. As magma cools and hardens, igneous rocks are formed. Examples of igneous rock include granite and obsidian. Metamorphic rocks are formed when the high temperatures and pressures below the surface of the Earth changes the structure of a sedimentary, igneous or other metamorphic rock. Examples of the metamorphic rocks include gneiss, schist and marble. Engineers use rocks when building roads. They also mix rocks with cement to form concrete, which is used for many construction projects. Soil often contains organic material from decaying plant material. There are many different ways to categorize soils. Soils are typically organized by texture. This is related to the size how large of the particles in the soil. The three different textures of soil are: Sand is the coarsest type of soil. Sand particles feel rough because they are sharp and large. Silt particles are smaller than sand particles, and because of this, silt feels smooth. Clay particles are the finest form of soil. Clay is very smooth and becomes very sticky when it is wet. Rocks, soils and minerals are very important to engineers. So much of what engineers use to build "things" comes from rocks, soils and minerals. Minerals are especially important, as they i. Metals and other minerals such as silicon are the primary components of electronics, such as computers, cell phones, digital cameras and televisions. Chemical engineers use minerals when creating new chemicals, including various life-saving and preventative medicines. Rocks and soils are also used extensively by civil engineers in construction projects, and metals and concrete have become the building materials of choice. Concrete is made from limestone, clay, water and aggregate usually gravel , and it is often used in the construction of bridges, roads, tunnels, dams and large buildings. Environmental engineers also care about rocks, soils and minerals because they use materials such as sand as water filters as well as study soils to see how water and pollutants move through them. Rocks, soils and minerals are very important to us as they make up many of the objects around us as well as where we build the buildings and roads that are the foundation for our civilization. The Grand Canyon Figure 1: We can also observe that the schists and gneiss metamorphic , as well as granite igneous , lie at the bottom as well. Near the top of the Grand Canyon is sedimentary rock, including shale, limestone, and sandstone. These patterns suggest geological changes over time, including the formation of rock from magma igneous , the transformation of this igneous or sedimentary rock under pressure and temperature to metamorphic rocks, as well as the erosion of layers through wind and water the Colorado River. Rocks that formed from liquid magma. Rocks formed when an igneous, sedimentary or metamorphic rock is altered by the heat and pressure deep within the Earth. Large soil particles that feel rough; sand drains water very well. Rocks that are formed when soil deposit become compacted over time and eventually cement. Soil particles that are smaller than sand, but larger than clay; silt is smooth, but does not become sticky when wet. Associated Activities Engineering for the Three Little Pigs - Students build different sand castles and test them to determine which one is best. Do we usually find minerals alone? No, usually we find minerals mixed with other minerals. These mixed up minerals in large solid form are known as rocks. Do you know what it is called when the rocks break down into lots of very small pieces? Well, these small pieces are collectively known as soil. What are the three types of soil? They are sand, silt, and clay. How do engineers use rocks, soils and minerals on a daily basis? Well, we learned that engineers use rocks, soils and minerals when they design buildings, roads, foundations, electronics, bridges, cars, appliances and all sorts of other things. Assessment Pre-Lesson Assessment Voting: Count the votes and write the totals on the board. Give the right answer. Who thinks windows are made out of soil? True, windows are made out of glass, which is made from sand, which is a type of soil. Are there different layers of rock and soil?