A rock formed by heat and pressure

The solid Earth (the mantle and crust) is made of rock. You may have noticed that there are many types of rocks, with soft sandy rocks that form the cliffs at Scripps Beach to hard rocks forming the mountains east of San Diego. Geologists have developed a way to classify the various rocks and understand pretty well where they come from and where they go. There are three general types of rocks, those that are formed by fusion (igneous rocks), those that are deposited from the air or water (sedimentary rocks) and those that are formed by "cooking" or otherwise altering another rock (metamorphic rock). Sedimentary rocks form breaking down other types of rocks into small particles and washing or blowing away; Metamorphic rocks formed from other rocks and igneous rocks forms dissolving other rocks. Then the rocks are always changing shape and are redistributed as part of a giant cycle of renewal. This cycle is called the rock cycle. (Picture copied from here) igneous rocks: crystallizing the form of molten material (magma). They can form or on the surface (igneous rocks estropervide), or deep in the crust (intrusive or plutonic igneous rocks). The volcanoes are places where magma erupts lava or ash. The rocks igneose estroniose can be in the form of: the intrusive rocks can be: the intrusive rocks can be: batholiths Dykes Dykes Sills Laccoliths Picture copied from here Weadiating Breaks Down parent material in loose control or dissolved ions. Wind or Water Transport products for atmospheric agents and deposit them in the basins to form sedimentary rocks. Sedimentary rocks: rocks produced by the action of weathering and erosion that break down rocks with pre-existing physical and chemical processes. Sediments are the things that are transported by wind, water or ice in a deposition site. There are three types of sediments: clastic sediments: made of particles of various sizes transported in suspension by wind, water or ice. The sand is an example of a clastic rock. Chemical Sediment: precipitated from the water. Halite (salt) is an example of a chemical rock. organic Sediment: precipitated or accumulated by biological means. Many plants and animals fall hard parts made for example of calcite and leave behind organic sediments. The limestone is an example of organic sediment. The burial of the sediment (or igneous rock) increases the pressure and the temperature of the rock and start to cook. The "cooked" rocks are called metamorphic rocks. Metamorphic Rocks: shape with recrystallization of igneous or sedimentary rocks. What happens when the change in temperature, pressure or fluid environment and a rock changes its form (E.G. The limestone is transformed into marble). The temperature range for the metamofismo is 150 c up to the melting temperature. The format type rock is controlled by the parent rock and the pressure / temperature conditions. The metamorphism due to the growth of new minerals, rotation or deformation of minerals and recrystallization of the mineral grains. The cycle is completed when the rocks are melted again and become magma. How fast the rock cycle? Principle of uniformity More than two hundred years ago, James Hutton lived and worked his way up the hills of Scotland. He was a keen observer, and he noticed many things about the world around him. He realized that some landforms can be created very quickly (ie the affection of floods, landslides, avalanches, volcanic eruptions), while others have to take a long time (construction and tearing of the mountains). Hutton few quantitative methods to estimate the long geological features have been taken to form. In order to estimate the geological rates, hutton developed the principle of uniformity which states that "the present is the key to the past"). Looking at what he was Around him, he guessed how geological formations should be created and how much time they requested. In this way, he realized that the earth was quite old, at least a few million years old. What do you do in popcorn? There are some ways in which the tree can be counted or annual layers in lakes. The method of supplying absolute geological staircase has become possible when radioactivity was discovered at the end of the last century. In the first few conferences I said that some isotopes of some elements were unstable and were subjected to radioactive decay. Think of a pan of Mais pop on the stove. Each kernel has potential for pop, but they do one at a time. You never know which particular kernel is going to burst, but you know if you wait long enough, most of them have jumped. Everything else is the same (ie temperature), the number of kernels that checks at a given time is related to the number of kernels left in the pan. Because the number of kernels decreases, the number of Mais kernels embedded increases. You could track the number of kernels to be checked and the number that has already been checked: the time scale is determined by the half-life or the time required for half of the kernels. From looking at the chart, it is obvious that the remaining number at any time decreases with time and more pop for units after POP later, when there are less left to pop. In fact, the number that pop during any interval depends on the number of unlooked kernels that were at the beginning of the interval. Mathematically, we can write this as: the number of remaining kernels = [the number at the beginning] x [a special number] to the power of [(- time on the stove) x (a time constant)] The special number is called "E" and is about 2,71828. The time constant is a number that depends on the speed with which the pieces of Mais pop. I used the number the Natural Registry of 2 (0.6931), because after a time unit, there are half of the initial kernels left. It is actually tracing the curve shown above with a hand calculator. Try: enter -0.6931, and then push the button "e ^ x" and get .5; This means that the initial kernels are left after 1 time unit. This unit is called "Half-Life". Now multiply 0.6931 times -2 (two time units) and press the button E ^ X. Repeat for numbers up to 8. Plot the unit of time (1 to 8) on the X axis and the axis E ^ (- Now * 0.6931) On the Y axis and you should get a curve something like that shown above. Return to radioactivity Radioactivity behaves in some way as the popcorn as described above. There are unstable isotopes of certain elements. These "parents" elements break into other "son" elements with particles from the nucleus. The speed with which this occurs only depends on the number of atoms around, then follows exactly the same function as described above. We can trace the number of parent and daughter atoms as we did for unparted and popcorn kernels: the constant of the decadence of a particular parent can be measured in the laboratory by counting the number of times particles for the second. If the constant decay of the parent is known, the age of a particular rock champion can be determined by comparing the relationship between parent to the child, assuming that there was no child in the sample to start, and no one was lost in the meanwhile. The decay rate is related to half a life as it is seen above. In fact, life is metÃ = 0.6931 / constant decay. (0.6931 is the natural logarithm of 2). All radioactive elements are decayed in the same way, some take a lot of time and a little decay very quickly. For a material to be used for geologists, he must have a half-life in the order of geological processes and being around. Here is a list of commonly used isotopes and their homes: the half of life for radioactive elements datable material favored by geologists due to the requirement that no child product is incorporated into the material to be started, the minerals that favored parents separated from the . The ignea rocks do this quite well excluding gases like argon and separating rubidium from strontium (this partition in different minerals during crystallization). Dating Minerals in sediments generally will give you the age when the mineral formed - not the sedimentary rock, so so Favor Ignea rocks for appointments purposes. Most of the isotopes used for dating have been billied years ago in a super-nova explosion, like the rest of the things we are made. However, please observe the short half-life of for example, carbon-14. This could not have survived from before the birth of the Earth and in fact it is made in the upper atmosphere from the bombing of cosmic rays. Carbon is also different as it is incorporated into organic material. It is used for dating things like trees, fires, fabric, land, corals, etc. and is good only for the last 50,000 years or down there. Putting everything together over the last few decades, the geologists found material datable in a lot of useful places. Now we know quite well as long as many parts of the rock cycle take. For example, we know that it takes millions of years to build a mountain and hundreds of millions of years to wear it back. It takes tens of thousands of years to make a decent ground and only a few years to wash it away. Now we can estimate the way in which quickly can change climate change (frighteningly fast!). Back to the top Back to page Syllabus Back to home page Lisa Tauxe Ltauxe@ucsd.edu Chapter 8: Metamorphal rocks 1. The metamorphic rocks are those rocks that have undergone changes in mineralogy, consistency and / or chemical composition due to changes in Temperature and pressure. The original rock could have been ignea, sedimentary or another metamorphic rock. 2. The pressure and heat driving metamorphism are consequences of three forces: (a) internal heat of the earth. (b) Weight of the rock above. (c) horizontal or tectonic forces that cause the deformation of the rocks. 3. Figure 8.1: pressures and temperatures increase while we go deeper into the earth. Temperatures increased with depth at different rates depending on the location. 4, Figure 8.2: A measure of the rate to which temperatures increase with depth is a measure of geothermal gradient. In most of the terrestrial crust, the geothermal gradient is ~ 30 ° / km, but some regions have higher slopes and a little low. Types of metamorphism There are different types of metamorphism. 1. Metamorphism of contact (Figs 8.3, 8.14 and 8.15): Generally occurs where high temperatures are limited to a small area, generally around the margins of an igneous intrusion. Geothermal gradients are high. 2. Hydrothermal metamorphism (figure 8.3): occurs typically along the spreading centers of the ocean crest at half of the ocean where the heated sea water is perched through hot and fractured basalt. Chemical reactions between heated sea water and the result of basalt in basalt metamorphism. Even the hydroterinal metamorphism can occur on the continents in which the rocks crustains are metamorphoused by invasion, hot fluids associated with ignea intrusions. 3. Metamorphism burial (Fig. 8.3): occurs when the sedimentary rocks that have suffered a diagnosis are buried even deeper. The degrees of diagnosis in metamorphism burial, a relatively mild type of metamorphism deriving from heat and pressure exerted by overlying sediments and sedimentary rocks. Although partial alteration of mineralogy and plot occur, the bed linen and other sedimentary structures are usually preserved. 4. Regional metamorphism (Fig. 8.3): When temperatures and pressures increase beyond the range of metamorphism burial, regional metamorphism takes over. Regional metamorphism occurs under high temperature and pressure conditions that can extend on vast areas. Regional metamorphism translates into intense alteration of the mineralogy and the consistency of the rocks, usually To the point where the original sedimentary structures are destroyed. Regional metamorphism is mainly due to the tectonic forces associated with the interaction between lithosphheric plates. This occurs in areas of active subduction and mountain building. 5. Cataclastic metamorphism: with high-pressure metamorphism resulting from crushing and rock cutting during tectonic movements, mainly long failures. Cataclastic metamorphism is generally located long long (Areas of detachment in which the rocks slide the latest the latest). The cataclastic metamorphism produces sliced and highly deformed rocks MYLONITI calls. Metamorphic and metamorphic facades 1. Figures 8.12 and 8.13: the extension of metamorphism can be defined on the basis of metamorphic and metamorphic facies. The term "metamorophic facies" describes the grouping of rocks of various mineral compositions formed in different temperature and pressure conditions. Metamorfici facies include different regions in the P-T space and take its name on the basis of certain characteristic minerals that are formed through the metamorphism of basalt mainly. 2. The metamorphic rocks formed under the lower temperatures and lower metamorphic pressures (10 KB) and moderate to high temperatures are called eclogitis and are often rich in garnet and piroxene. 8. The Hornfels include the series of rocks that derive from metamorphism of low-pressure contact and a wide range of temperatures. 9. Figure 8.15: Hornfels are metamorphic rocks that have been cooked in a position by an adjacent magmatic intrusion. The gunnei are generally heated recrystallization products of the original rock (typically sedimentary rock), coupled with chemical reactions that involve hot fluids from the nearby magmatic intrusion. These warm fluids invade rocks through fractures and spaces of pores and react with original minerals to produce new minerals. The edge of the altered rock around an igneous intrusion is called a halo contact. 10. Some rocks that have been metamorphoused at higher pressures and temperatures can be re-metamorphosized at lower temperatures and pressures, particularly in the presence of fluids, in a process called retrograde metamorphism. For example, an amphibleis can be partially re-metamorphous to a greescist. Serpentine minerals are often Retrograde metamorphism of ultrament rocks. Rocks and metamorphic textures 1. The metamorphic rocks are characterized by a certain set of minerals. They include family minerals such as quartz, feldpar, mica and in some cases pyroxene. New minerals include garnet, staurolit and kyanite that are found only in metamorphic rocks. 2. Metamorphic. Metamorphic. It can be divided into two groups based on their metamorphic plots (1) foliated and (2) unfolded. FOLOTATION 1. Figure 8.4: The deformation of some rocks such as SCisto and clay argilla rich (Greywacke) produces material changes that involve training of flat or wavy parallel aircraft inside the metamorphosate rock. These flat or wavy plans are indicated as a foliation. 2. The forgion generally reduces rocks to a corner towards the original bed linen unless the deformation is such that the foliation and bed linen are coincident. 3. Fig. 8.5: Foliation is produced mainly in rocks that contain platy minerals such as mica and chlorite. These platy minerals generally form when it is a metamorphous sandstone of splicer and racing (greywacke). While these platy minerals grow, their planes take a favorite orientation usually perpendicular to the main direction of the forces held the rock. The minerals in the original rock survive to metamorphism can rotate during deformation to acquire a preferred parallel orientation to platy minerals. 4. Minerals such as amphibians with long and elongated crystals also tend to take a preferred orientation during metamorphism. The elongated anointed crystals are parallel with the foil plane, and in addition point in a common direction to form the line line. 5. Rocks ratalized as the easily divided slate along Foliation aircraft, a characteristic called Slavature Cleavage (Figure 8.6). Folly and related rocks 1. Fig. 8.7: Share metamorphism and sandstone clay cushions produces a variety of metamorphic rocks fell according to the extension of the deformation (metamorphic degree). 2. Fig. 8.8: Follection due mainly to the orientation of platy minerals form a series of defined metamorphic rocks, in increasing order of metamorphic degree, slate (lower degree) - Phyllite - Schist. Schist form inside the high-level metamorphism P-T field at medium level. The increase in the degree of metamorphism is accompanied by an increase in the size of the PLATY crystals. Slate platy minerals are too small to be seen. In Phyllite, the flakes have become larger as highlighted by a luster increase. In Schist, Platy minerals are clearly visible for the naked eye. 3. Schist is often named for their more abundant minerals. So there are quartz scist, garnet-mica schist (figure 8.10), scist muscovita and actinolite shots. 4. Figs. 8.7 and 8.8: High degrees of metamorphism, Gneiss forms. Gneiss is a high quality metamorphic rock composed of lightweight and dark minerals that are segregated in groups, lenses or strips. In general, mafically minerals such as biotite mica and amphibole are concentrated in dark bands while bright minerals such as quartz and feldspar are concentrated in luminous bands. Gneiss is coarse grain and generally shows a poor folly due to the increase in the abundance of non-plated minerals such as quartz and feldspar. 5. The Anfibole is largely composed of long and thin crystals of amphibiles aligned in a common direction. Sometimes they are apparent separate lights of feldspar. Forms of anopholelate through the metamorphism of the muffic Ignose rocks. 6. If metamorphism reaches a temperature> 700 OC, rocks can start to partially melt. The resulting silica-rich liquid will invade the rock partially melted as a series of veins and strings to produce a migmatite. 7. The granulite is a high-quality high-quality metamorphic rock that shows a granular structure usually composed of quartz, plagiochlases, piroxene, garnet and an al-silicate mineral called silliminite. The crystals are Equitations (the same diameter longitudinally and wide) and rarely show the foliation. Shapes of granules through the metamorphism of Shale, Greywacke and many types of ignea rocks. 8. Figure 8.11: Shale's metamorphism produces some index minerals that characterize different metamorphic grades. These minerals can be used to estimate the sequence and the degree of metamorphism in the Rock record. This is done on the mapping field of the first first of an index mineral and the construction of Isograd lines. Isograde are used to determine the type and entity of metamorphism within a particular region. Another nonFoliated Rocks 1. Metamorphism of quartz rich sandstone produces quartzite (fig. 8.9), very difficult, nonfoliated metamorphic rock constituted almost entirely of silica. 2. Metamorphism of limestone and dolomite causes recrystallization of calcitas marble products (fig. 8.9). Calcite marble crystals are generally between grown and uniform sizes. 3. Hornfels are formed through metamorphism contact (fig. 8.15). Hornfels are essentially cooked in place with an adjacent magmatic intrusion without deformations. The textures therefore reflect simple recrystallization and are usually granular. Any platy minerals in Hornfels are randomly oriented. 4. Greenstone shapes through low degree of basalt metamorphism typically involve hot, which filters sea water or other solutions. The mineral chlorite gives green stone its characteristic green color. Greenstone shapes near ocean dorsal expansion centers (fig. 22.25) and on continents where sepulted mandiche magmatic rocks react with warm groundwater. groundwater.

an example of a rock formed by wood subjected to pressure and heat is. a rock that has been formed by heat and pressure. a melted rock formed by heat and pressure deep inside earth. a rock formed by the processes of heat and pressure