Petrology Capstone Research Paper

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Quartz Rocks!

Mount Ida, Arkansas is known as the quartz capital of the world. This dazzling crystalline mineral can be found all over the Ouachita National Forest and surrounding areas, but how did a small area in the Midwest gain such an impressive title? Why is quartz so abundant along the Ouachita Mountains and not in other places in the U.S.? These are questions rock hounds may have wondered. The answers date back over half a billion years ago during the Ordovician Period of the Paleozoic Era. During the Paleozoic Era all of Arkansas was covered by ocean. The northern part of present day Arkansas had a rather shallow ocean body which would often leave certain areas rising above water level then declining again. Over time and with the right pressure and chemical conditions, the shells and skeletons of dead marine life became limestone, sand became sandstone, silt became siltstone, and clay became shale (McMillan). The ancient ocean floor was buried by younger sediments, covering "the future quartz hosting rocks to about a mile thick" (Robert Beauford). Slowly, the buried loose sediments were converted into solid sedimentary rocks and remained for over 200 million years until the continental collision known as Pangaea occurred. Due to this collision, a bit further south the Ouachita Mountains were formed from a belt of sea floor that was squeezed together causing faults and folds. While sandstone and shale are typical rocks created from former sediments, more unique rocks were also formed of quartz crystal and novaculite. This collision also generated heat. Because much of the water was trapped and could not be released as steam, it reached extremely high temperatures, dissolving much of the sandstone and shale around it. The water continued

flowing through cracks and spaces deep below the surface. As the water "cooled, dissolved silica in the water came back out of solution and formed crystals on the walls of the cracks" (Beauford). This process continued in a stacking pattern creating clear crystal quartz. Sometimes other minerals interfered with the process causing quartz to form with colors and milky appearances. Other activity in the earth, such as volcanoes, caused crystals to crack and become fractured. Still, some of these fractured crystals continued to reform through the deposition of more silica which led to rather interesting new formations.

Quartz is the most common mineral found in the earth. It is made up of, not surprisingly, the two most abundant elements in the earth's crust: oxygen and silicon. When the atoms of these two raw materials are given the right conditions of space and time, they arrange themselves into a pattern that then becomes the formation of quartz. Due to the many factors that can affect the color and growth of quartz mineral, it can be categorized by type, group or even formation. Quartz is generally a hard white, colorless mineral, but when other impurities interfere with the pattern process, quartz can sometimes be found in other colored types and varieties, including the gemstones amethyst, rose quartz, and citrine (Garlick).

The three major groups of quartz are macro-crystalline quartz, micro-crystalline quartz, and crypto-crystalline quartz. Macro-crystalline varieties develop visible crystals and are made of large, inter grown crystals. Amethyst and rose quartz fall into this group. Micro-crystalline quartz, such as jasper, makes up compact varieties that are made of tiny crystal grains that are visible in an optical microscope. Crypto-crystalline quartz are dense varieties whose structure cannot be resolved in an optical microscope. Agate and carnelian fall into this group of quartz.

Quartz can also grow into a plethora of different formations due to strange patterns that develop on the surface of crystals. When the crystal splits at the ends into separate individuals it

is referred to as split growth. This formation is very common and is found in other minerals, such as stibnite and epidote, and rocks as well as quartz. Sprouting quartz is caused when daughter crystals grow from the prism faces of a crystal. In an artichoke quartz formation, the crystals divide like the leaves on an artichoke head. In some cases this can be seen on the prism faces of the daughter crystals. There is usually a large central crystal and appears as a sheaf like formation altogether. When a large central crystal is surrounded by a lot of cone shaped smaller ones it looks like a tower on a cathedral, so it is referred to as Babylon quartz. Bent quartz occurs when a crystal suffers mechanical stress. It might break perpendicular to its C axis. Cactus quartz is encrusted by a second generation of small crystals. They grow on its prism face and point away from it. Changes in temperature or increasing pressure can lead to a partial or complete dissolution of a crystal. Most corroded quartz may show signs of healing. This will lead to interesting patterns on the surface of the crystal which can cause different growths. Still, there are many more types of formations that occur due to irregular pattern developments during the growing process.

Ever since the first known humans set foot on the Ouachita Mountains in Mt. Ida Arkansas, it is presumed that quartz existed. Early reports from Spanish explorer Hernando de Soto state that Native Americans chipped points of quartz for arrowheads and blades. The use and discussion of quartz continued to progress from there. Until World War II, quartz mining was relaxed and had a sort of free-for-all operation system. Although land was owned by the federal government, patented claims of leases were rarely needed for quartz miners so long as they left timber and land undamaged. Once the US became involved in WWII, however, the mining process became stricter due to a higher demand for quartz in communications equipment in the war. Eventually, the Federal government and private mining companies created a quartz

buying station in Hot Springs, Arkansas. Due to the increasing demand for quartz, General Electric created a method for creating synthetic quartz in the 1950s which decreased the demand for natural Arkansas quartz, aside from tourist, museum, and some jewelry purposes.

Quartz is generally mined through open pit mining. Open pit mining is used to extract rock and mineral deposits found near the surface of the earth. There are also a variety of other forms of mining used for deeper underground mining such as in situ leach mining and underground tunnel mining, heap leaching, and brine mining. Hand tools may be used for open pit mining, but sometimes explosives are used to expose pits of quartz. Explosives, however, could damage the crystals if there is a sudden change in temperature near the underground minerals (McMillan).

The mining of minerals and rocks can sometimes present environmental concerns and impacts depending on the material and method of mining. Open pit mining can be damaging to the land due to the fact that minerals are often found in small amounts, so more ore is needed to be mined to extract large amounts of a particular mineral (McMillan). Open pit mining of hard rock can also lead to metallic dust particles and radioactive elements produced in the environment that may also leach into bedrock if not properly controlled. Other forms of mining have the potential to have major environmental impacts such as underground tunnel collapses, large-scale land removal, air pollution, water waste, and toxic contamination of our natural resources. These impacts can be catastrophic for surrounding ecosystems and humans alike (Environmental Risk of Mining) if efforts are not made to protect and restore the mined land and surrounding environment. In the Ouachita National Forest, permission must be granted from the Forest Service in order to do small scale mining with hand tools or large scale underground mining (McMillan).

Quartz may be plentiful throughout the earth and Arkansas, but it is still a unique mineral in its own right. If the fact that pairing silicon with oxygen and the right amount of heat and pressure can create such a prismatic stone isn't dazzling enough, consider the numerous uses for quartz, such as the ancient arrowheads and spears Native Americans chiseled from quartz and the development of the quartz crystal oscillator during World War II. Today you can find quartz all around in your daily life in items such as abrasives, fillers, specialized lenses, watches, clocks, televisions, radios, and other electronics, just to name a few. Some people even believe that quartz holds metaphysical properties that can amplify one's energy and thought clarity, calling it the "master healer." Finally, for those people who simply like the pretty things in life, quartz often makes an exquisite gemstone when cut and polished. From historical tools to modern day electronics and gadgets to dazzling stones that sparkle and shine, quartz is a brilliant mineral that has played and will continue to play a necessary role in our ancestor's lives and ours, alike.

Works Cited

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