

ROSE QUARTZ

State Mineral of South Dakota

What Is A Mineral?

A strict definition of the term mineral is difficult to formulate! Generally speaking, most minerals have the following characteristics:

- They are usually naturally occurring - (however, some can be made or grown in a laboratory);
- They are usually *inorganic* (but some, such as apotite and calcite, are made by a living organisms);
- They are usually *homogeneous*, the same throughout; and
- They are usually *crystalline* substances with their atoms bonded together in a regular order. For example, in pyrite there are two sulfur atoms for every one iron atom and they are connected like a Tinker Toy set.

It has been said that, "If it can't be grown, it has to be mined." Minerals play a major role in the way humans live, particularly with respect to a standard of living. That is a true statement in the United States because we depend on minerals for many things including toothpaste, fiber optics, concrete roads and skyscrapers, television, satellites, and automobiles. A few minerals are mined primarily for their aesthetic value, rather than for their use in industry.

What Is Quartz?

Quartz is a very common mineral. Ideally, quartz is made of silicon (Si) and oxygen (O) combined together as SiO_2 . Many varieties of the quartz family are found in nature. Ignoring classification schemes, all varieties of quartz have essentially the same chemical composition and *crystalline* structure. The differences between varieties depend on the method of formation, the grain size, and the impurities in the mineral, which give rise to varying colors and color patterns. Quartz is generally *transparent* to *translucent*. Agate is another type of quartz (refer to the State Gem-stone fact sheet).

Most quartz can be characterized by its glass-like appearance (*shiny luster*), its *conchoidal fracture* pattern (when broken, the surface has a shape like a half clam-shell, as in a chip in a glass windshield), and its relative hardness (it will scratch glass).

What Is Rose Quartz?

As one might guess, rose quartz is light to darker rose or pinkish-colored quartz. Small amounts of the element titanium probably give rose quartz its pink color. Usually rose quartz is coarsely *crystalline* (meaning the crystals are quite large). Generally, the crystals do not have

external faces because of interference from other growing crystals.

In South Dakota, the color of rose quartz ranges from pale shades of pink to rose-pink to rose-red. Occasionally it has a faint purplish or lavender cast. Rose quartz from certain localities in South Dakota exhibits distinct *asterism*. *Asterism* refers to a rayed or star-shaped figure of light on the surface of a mineral sample. If a rose quartz sample exhibits *asterism*, it is called star rose quartz. Usually star rose quartz can only be seen on cut and polished pieces of rose quartz. It is virtually impossible to recognize *asterism* in an unpolished specimen.

How Does Rose Quartz Form?

Rose quartz is an *igneous* mineral that originates deep within the earth's crust. It forms from the solidification of granitic *magma* (molten rock). Within the earth, *plutons* (huge masses of *magma*) slowly migrate upward toward the surface of the earth. A *pluton* is driven upward because *magma* is less dense than surrounding solid rock. This is analogous to a mixture of oil and water. When mixed, the oil always seeks the higher elevation. Over time, the *plutons* cool off and completely solidify. *Plutons* generally

solidify miles beneath the earth's surface. In contrast, volcanoes and volcanic rocks are formed by *magma* that erupts onto the surface of the earth, producing lava flows.

Near the end of its upward migration, a *pluton's* temperature has been lowered. Some of the *magma* has crystallized into solid minerals. The fluid *magma* remaining near the fringe of the *pluton* tends to be rich in *volatiles*, water, silica, oxygen, and some other elements. This *magma* may squirt and intrude into the surrounding and overlying rocks, fingering outward from the main mass of the *pluton* along zones of weakness or fractures (see Figure 1). As the molten rock in these *intrusions* (*pegmatites*) continues to slowly cool, rose quartz crystals may begin to form. Quartz crystals will continue to form and grow larger until all the *magma* has crystallized. Other minerals, feldspar and mica, also are found commonly in *pegmatites*.

The term *pegmatite* refers to an exceptionally coarse-grained *crystalline* rock. A *pegmatite* is defined by its coarse texture rather than by a specific chemical composition. In general, the individual minerals in *pegmatite intrusions* are larger than 1 centimeter (2.54 centimeters = 1 inch).

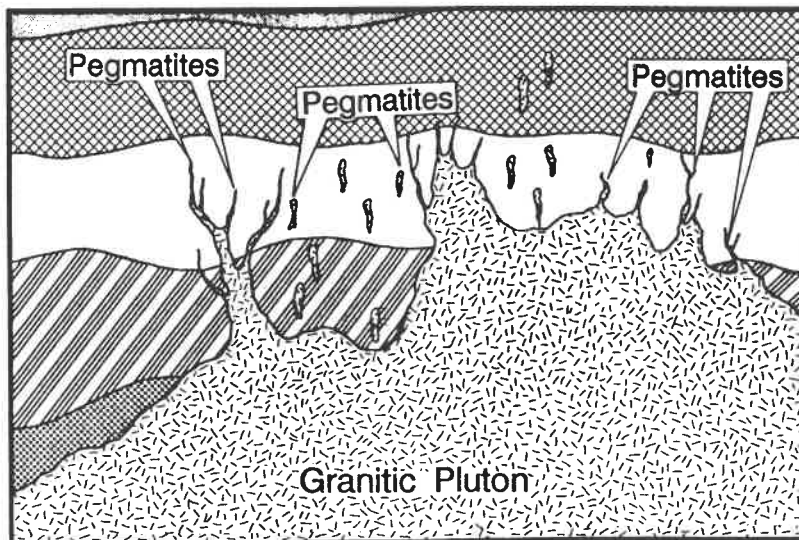


Figure 1: Cross Section Illustrating a Hypothetical Pluton With Pegmatites.

Where Is Rose Quartz Found In South Dakota?

In South Dakota, rose quartz is found in *pegmatites* in the Southern Black Hills area. These *pegmatites* are associated with the Harney Peak granite mass (which is now exposed at the surface of the earth because of erosion). It has been estimated that there are about 24,000 *pegmatite intrusions* in the Black Hills region (Norton and Redden, 1990). These *pegmatites* formed during the Precambrian, and are about 1,700 million years old.

How Is Rose Quartz Mined In South Dakota?

Of the thousands of *pegmatites* present in the Black Hills area, it has been estimated that only 300 or so are well suited for mining. However, of these 300, probably fewer than 10 have sufficient quantities of rose quartz to make mining worthwhile. All production is currently located near the city of Custer in the Southern Black Hills. The individual *pegmatites* in the Black Hills that have minable concentrations of minerals are generally less than 48.7 feet (15 meters) thick and between 32.5 and 325 feet (10 and 100 meters) long (Norton and Redden, 1990).

Pegmatites are mined in an open pit type of quarry. Generally, the rock is drilled using jack hammers. The holes are filled with explosives and blasted. The *pegmatite* minerals are then separated and sorted by hand, a labor intensive process. End loaders and picking belts increase the rate of production.

Because the amount of rose quartz mined in South Dakota is quite small compared with other mineral resources, the South Dakota Department of Environment and Natural Resources (DENR) does not keep statistics specifically on rose quartz production. One *pegmatite*, known as the Rose Quartz Mine or Scott's Rose Quartz Mine, located about 8 miles SE of

Custer, has probably produced more high quality rose quartz than any other *pegmatite* (J. Redden, pers. comm.). The DENR includes rose quartz production with all other *pegmatite* mineral production. A telephone survey of the four companies that reported mining *pegmatite* minerals during 1992 found that a total of approximately 1,400 tons of rose quartz was mined in 1992. This total accounts for much less than one percent of the total amount of nonmetal, non-fuel industrial minerals and rocks mined in South Dakota annually.

What Is The Value Of Rose Quartz?

Rose quartz was designated as South Dakota's state mineral on February 11, 1966. Rose quartz is currently mined in South Dakota primarily for use as decorative pieces, in landscaping and interior decorating, as mineral specimens, in tiles, and in *lapidary* work. Since rose quartz is a semi-precious gemstone, some use in jewelry is also reported.

A telephone survey of the four companies who mined rose quartz during 1992 concurred that a current estimate of the average value of rose quartz is \$1,000 to \$1,200 per ton. Representatives from all four companies agreed that the value of rose quartz primarily depends on what is done to the material after it is extracted from the ground. The price also depends on the quality and color (a very subjective measure) of the stone. Most people seem to prefer the darker hues of rose quartz.

Small chips of rose quartz that are tumbled and polished have a retail value of \$10 to \$12 per pound. A 10-pound, medium-sized pair of bookends sells for \$45 to \$75. A perfectly polished sphere of rose quartz an inch and a half in diameter may cost \$30, but if it displays *asterism*, its value may increase to \$125. Gem quality rose quartz sells for 50 cents to \$1.00 per gram (a golf ball weighs about 100 grams). A boulder the size of a large desk of good quality and

with good color may sell for \$15,000.

In 1991, a new company began mining rose quartz from *pegmatites* near Custer. This company's production moved South Dakota from the 25th to the 4th largest gem material producer in the country (Peterson and Hammond, 1993). For each ton of rose quartz mined, approximately one-half of one percent is gem quality material.

What Regulations Apply To Collecting Rose Quartz?

Common sense dictates that safety should be the first consideration. If a rock is hit with a hammer, safety glasses should be worn. Watch out for other individuals and for falling rocks.

New legislation states that no more than one square meter of land may be disturbed by people collecting for their own

enjoyment. In general, permission must be received before any samples are collected, and no collecting is allowed on state or federal lands. For example, collecting is not allowed in Custer State Park. Small samples may be collected along South Dakota's roads and highways after permission has been granted from the nearest Regional Department of Transportation (DOT) office (Table 1). The DOT's concern is that rock removal may hasten erosion and road cut instability. Permission must be obtained from the landowner before collecting begins on private lands. Permission must be granted from tribal authorities before collecting begins on Indian lands. Collecting is, however, permitted in the Buffalo Gap National Grasslands and in the Black Hills National Forest (E. Fritsch, S.D. School of Mines and Technology, personal communication, 1993).

Table 1. Regional Department of Transportation Offices

Aberdeen Regional DOT Office
Box 1767
Aberdeen, SD 57402-1767
Phone: (605) 622-2244

Mitchell Regional DOT Office
Box 1206
Mitchell, SD 57301-7206
Phone: (605) 995-4737

Pierre Regional DOT Office
104 South Garfield
Pierre, South Dakota 57501
Phone: (605) 773-3464

Rapid City Regional DOT Office
Box 1970
Rapid City, SD 57709-1970
Phone: (605) 394-2244

Glossary

Definitions are adapted from Bates and Jackson (1987).

- Asterism** - an optical phenomenon of a rayed or star-shaped figure of light displayed by some crystals.
- Conchoidal fracture pattern** - the broken or fractured surface of the mineral is smooth and curved.
- Crystalline** - said of a mineral particle of any size, having the internal structure of a crystal but lacking well-developed crystal faces or an external form that reflects the internal atomic structure.
- Homogeneous** - of uniform structure or composition.
- Igneous** - rocks or minerals formed by solidification from a molten or partially molten material. Can either be formed beneath the earth's surface (plutonic), or by volcanic activity.
- Inorganic** - pertaining or relating to a compound that contains no carbon.
- Intrusion** - the process of emplacement of magma in pre-existing rock.
- Lapidary** - refers to the art of cutting, grinding, polishing, and engraving precious stones.
- Luster** - the reflection of light from the surface of a mineral as described by its quality and intensity.
- Magma** - extremely hot, mobile, and mostly liquid rock, deep in the earth, from which *igneous* rocks form.
- Pegmatite** - exceptionally coarse, *igneous* rocks that form underground as intrusions from masses of magma.
- Pluton** - a huge mass of magma deep within the earth; it may be mostly liquid or completely solidified.
- Translucent** - capable of transmitting light but the light is diffused so that objects seen through it cannot be distinguished.
- Transparent** - capable of transmitting light and through which an object may be seen.
- Volatiles** - material in a magma (such as water or carbon dioxide) that may be concentrated in a gaseous state.

References

- Bates, R.L., and Jackson, J.A., 1987. Glossary of geology (3d ed.).
- Norton, J.J., and Redden, J.A., 1990. Relations of zoned pegmatites to other pegmatites, granite, and metamorphic rocks in the southern Black Hills, South Dakota: *American Mineralogist*, v. 75, nos. 5-6, May-June 1990, p. 631-655.
- Peterson, E.K., and Hammond, R.H., 1993. South Dakota 1991 Annual Report: U.S. Department of the Interior.
- Roberts, W.L., and Rapp, G., Jr., 1965. Mineralogy of the Black Hills: Rapid City, South Dakota, South Dakota School of Mines and Technology Bulletin Number 18.

Selected Resources For Teachers

Rock and Mineral Boxes, a collection of labeled, common rocks and minerals (including some S.D. specimens) available from the USD Geology Club, University of S.D., Vermillion, SD 57069.

South Dakota Mineral and Rock Club addresses:

BADLANDS-SANDHILLS EARTH SCIENCE CLUB

Contact: Donald Ormesher, HCR Box 61, Valentine, Nebraska 69201

BROOKINGS AREA GEM AND MINERAL SOCIETY

Contact: Pat Cheeseman, PO Box 494, Brookings, South Dakota 57006

CORN PALACE ROCK CLUB

Contact: Rodney Dodge, 1020 Palmer Place, Mitchell, South Dakota 57301

COTEAU DES PLAINES GEM AND MINERAL SOCIETY

Contact: Gary Witcher, 1105 4th Street NE, Watertown, South Dakota 57201

CUSTER CITY ROCK CLUB

Contact: Custer City Rock Club President, RR 1, Box 105, Custer, SD 57730

LEWIS AND CLARK GEM AND MINERAL SOCIETY

Contact: Ludwig Bertsch, 203 Pine, Box 153, Avon, South Dakota 57315

ROBERTS MICROMOUNTERS

Contact: Museum of Geology, South Dakota School of Mines and Technology, Rapid City, South Dakota 57701-3995

ROSEBUD GEOLOGICAL SOCIETY

Contact: Lloyd Meyer, RR 3, Box 114, Carter, South Dakota 57526-9200

SIOUX EMPIRE GEM AND MINERAL SOCIETY

Contact: Eugene Aldrich, 709 South Maple Avenue, Hartford, South Dakota 57033

WESTERN DAKOTA GEM AND MINERAL SOCIETY

Contact: Larry Lehr, PO Box 4096, Rapid City, South Dakota 57709-4096

Outreach (Resource Agency Personnel)

Earth Sciences Department, University of South Dakota, Vermillion, SD 57069.
Geology Department, S.D. School of Mines and Tech., 501 E. St. Joseph, Rapid City, SD 57701.
Museum of Geology, S.D. School of Mines and Tech., 501 E. St. Joseph, Rapid City, SD 57701.
South Dakota Geological Survey, Akeley Science Center, USD, Vermillion, SD 57069.
U.S. Geological Survey, Rm. 408 Federal Bldg., 200 4th Street SW, Huron, SD 57350.

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