



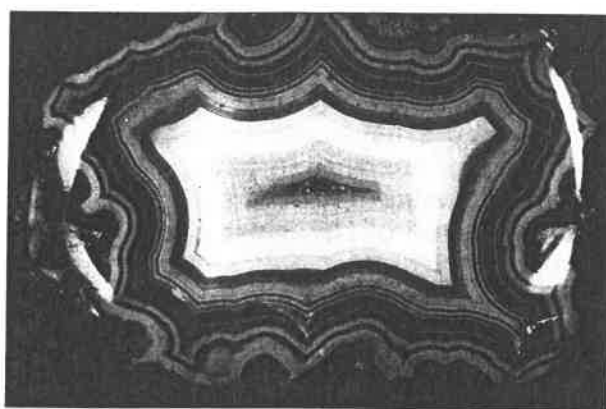
FAIRBURN AGATE

State Gemstone of South Dakota

What Is A Gemstone?

A *mineral* or rock, after it has been cut and polished, and that is pretty and hard enough to be worn as jewelry, is called a gemstone. Only 70 of more than 3,800 known *minerals* are considered gemstones. About 20 of these 70 gems are commonly found. All gemstones have one thing in common - beauty. Beauty, however, is a rather intangible thing. The perception of beauty varies from person to person, and from culture to culture. Beauty in a *mineral* may mean color, *luster*, *transparency*, or *brilliance* resulting from skillful cutting and polishing.

Silica is a *mineral* that in some forms is considered a gemstone. Silicon (Si) and oxygen (O) combined together in a regular way forms silica (SiO₂). All varieties of silica have essentially the same chemical composition and crystal 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. Silica is a relatively hard material. It is generally *transparent* to *translucent*. It has a glass-like appearance with a shiny *luster*, and a *conchoidal fracture* pattern (when broken, the surface has a shape like a half clam-shell, such as in a chip in a glass windshield). Silica is divided into two groups: coarsely *crystalline* varieties (often called quartz), and fine-grained, *crypto-crystalline* varieties (which are grouped under the name *chalcedony*). *Chalcedony* silica has a pearly



luster that looks like pearly, frozen milk bubbles. Rose quartz is a type of silica that forms under *igneous* conditions (refer to the State *Mineral Fact sheet*), while agate is *chalcedony* that forms under *sedimentary* conditions, sometimes lining a *geode*.

What Is A Geode?

A *geode* is simply a hollow, irregularly rounded rock with inward-pointing crystals. The term may also be used to describe a crystal-lined cavity. The origin of *geodes* is a two-fold process: first, the origin of the cavity; and second, the filling of the cavity. *Geodes* may form in virtually any rock type. For example, in *igneous* (volcanic) rocks, cavities are created by gases. Volcanic lava contains dissolved gases that are held in the molten rock by confining pressure. As with soda pop, as soon as the pressure is reduced (when the magma erupts) the gases begin to escape. As the lava quickly cools and hardens, the cavities may remain as "frozen" pores in the rock.

Cavities can range from the size of a pea to openings 10 feet by 30 feet (3 by 9.1 meters) (Sanborn, 1976).

In all cases, the cavity in a rock may be slowly filled with *mineral* material. *Mineral* growth proceeds inward toward the center. Therefore, the youngest crystals are near the middle (Hayes, 1964). The original hollow area may be completely filled with *mineral* matter (thereby forming a *nodule*) or partially filled, forming a *geode*.

The *mineral* matter that fills the cavities comes from ground water passing through the rock. Water contains dissolved matter such as silicon, oxygen, calcium, and carbonate. Under certain conditions, these chemicals precipitate out of the water, forming a solid *mineral* that is deposited inside the cavities. (This is the same manner in which lime builds up on a *stalactite*, or on the inside of a tea pot.) One of the most common types of *mineral* matter filling *nodules* and *geodes* is silica, in the form of agate.

What Is A Fairburn Agate?

Agates, in *nodules* and *geodes*, are some of the most popular varieties of silica. Agate forms under sedimentary conditions. Whitlock (1946) states as an analogy that the quartz varieties are like six-sided snow crystals, and agates are like rounded icicles of freezing water. Agates consist of alternating layers of fibrous *chalcedony* with circular to semicircular layers, patterns, or bands like rings of targets. These layers may be composed of different thicknesses and colors. The layers are usually concentric and parallel to the walls of the rock cavity in which they are deposited. Fairburn agates are formed in this way.

Fairburn agates are noted for their strikingly contrasted, thin bands of wonderful natural colors (Sanborn, 1976). Roberts and Rapp (1965) state that the color patterns are generally yellowish-brown with narrow opaque white bands, or dark red with white bands. However, another beautiful combination shows salmon-pink bands alternating with white bands. Other colors included in these

agates are black, yellow, grayish-blue and milky-pink.

Where Are They Found?

These agates were originally named after a prolific locality 10 miles east of Fairburn, South Dakota, in the southern Black Hills area. According to Roberts and Rapp (1965), Fairburn agates occur in a broad elliptical belt extending from

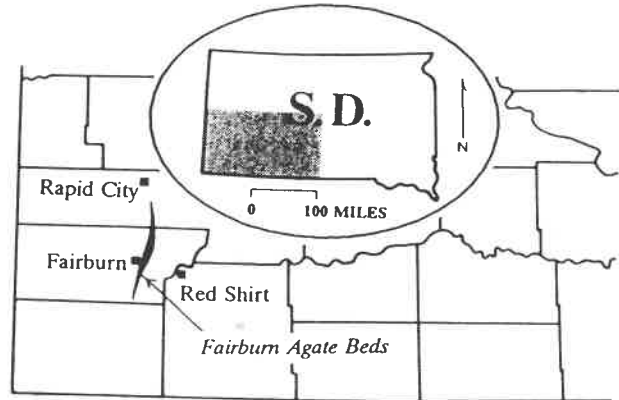


Fig. 1. Location of Fairburn Agate Beds

Creston in Pennington County, South Dakota, to near Orella in Sioux County, Nebraska, with the maximum width approaching 15 miles near Red Shirt, South Dakota. According to Fritzsich (S.D. School of Mines and Technology, personal communication, 1993), the area is more restricted (Figure 1). The Fairburn agate fields cover thousands of acres of very stony land and most of it is rugged terrain, well decorated with cactus, weeds, and cedar trees (Zeitner, 1964).

Fairburn agates may be collected around the Fairburn area where they are scattered on the ground surface. There is no company that collects and markets Fairburn agates.

What Is The Value Of Agate?

The Fairburn agate was designated as South Dakota's state gemstone on February 11, 1966. The S.D. Department of Environment and Natural Resources (DENR) does not keep statistics on the Fairburn agate. In the literature, Fairburn agates are reported as quite scarce, and highly prized by collectors (Campbell and Roberts, 1985). The price

of a Fairburn agate ranges up to \$150, depending on the size and quality of the *geode* (Eric Fritsch, Geology Museum, South Dakota School of Mines and Technology, personal communication, July, 1993). As with other agates, a larger Fairburn agate is not necessarily a better-quality agate. Agates are primarily used as decorative pieces, as *mineral* specimens, and in *lapidary* work.

What Regulations Apply To Collecting Agates?

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 from privately owned land, and no

collecting is allowed on state or federal lands. For example, collecting is not allowed at 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 granted from tribal authorities before collecting begins on Indian lands.

Collecting is currently allowed on Bureau of Land Management land, in the Buffalo Gap National Grasslands, and in the Black Hills National Forest. The Buffalo Gap National Grasslands has a designated area northeast of the town of Fairburn to promote agate collecting (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

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

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

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).

Brilliancy - the total amount of light reaching the eye after being reflected from both exterior and interior surfaces of a gemstone in the face-up position.

Chalcedony - cryptocrystalline silica with a pearly luster that looks like pearly, frozen bubbles.

Conchoidal fracture - a broken or fractured surface of a mineral that is smooth and curved.

Cryptocrystalline - said of the texture of a rock consisting of crystals that are too small to be recognized and separately distinguished even under the ordinary microscope.

Crystalline - 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.

Geode - a hollow rock or cavity containing inward pointing crystals.

Igneous - rocks formed by solidification from a molten or partially molten state. 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.

Lapidary - pertaining to the cutting, grinding, and polishing of precious stones.

Luster - the reflection of light from the surface of a mineral as described by its quality and intensity.

Mineral - a naturally occurring, inorganic, crystalline substance with the same atomic structure throughout.

Nodule - an irregularly-rounded rock shape, or lump of material that contains a solid mineral mass.

Sedimentary - mineral deposits and sediments that accumulate in layers, which are changed into rock.

Stalactite - a conical mineral deposit that hangs from the ceiling of a cave.

Translucent - said of a mineral that is capable of transmitting light but is not transparent.

Transparent - capable of transmitting light and through which an object may be seen.

References

- Bates, R.L., and Jackson, J.A., 1987. Glossary of geology (3d ed.).
Campbell, T.J., and Roberts, W.L., 1985. Mineral Localities in the Black Hills of South Dakota: Rocks and Minerals. May/June 1985, p. 109-118.
Hayes, J.B., 1964. Geodes and Concretions from the Mississippian Warsaw Formation, Keokuk region, Iowa, Illinois, Missouri: Journal of Sedimentary Petrology, v. 34, no. 1, p. 123-133.
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.
Sanborn, W.B., 1976. Oddities of the Mineral World. Van Nostrand Reinhold Company.
Whitlock, H.P., 1946. The Story of the Gems. Emerson Books, Inc. New York.
Zeitner, June Culp, 1964. Midwest Gem Trails, (3d ed.). Gembooks, Mentone, California.

Selected Resources For Teachers

- Midwest Gem Trails: Prairie States* by June Culp Zeitner, 1989, available from: Oxcart Minerals, 48148 Conley Road, Vida, Oregon 97488 for \$8.10 shipping included, 503-896-3201.
The Book of Agates by Lelande Quick, 1963, Chilton Book Company.

South Dakota Mineral and Rock Club Addresses

BADLANDS-SANDHILLS EARTH SCIENCE CLUB

- Contact: Donald Ormsher, 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, South Dakota 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, S.D. School of Mines and Technology, Rapid City, SD 57701

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)

- Geology Museum, S.D. School of Mines and Technology, 501 East St. Joseph, Rapid City, SD 57701
Geology Dept., S.D. School of Mines and Technology, 501 East St. Joseph, Rapid City, SD 57701.
Geology Dept., S. D. State University, Brookings, SD 57007.
Geology Department, University of South Dakota, 414 East Clark St., Vermillion, SD 57069.
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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