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State gem

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Minnesota Department of Natural Resources

State Gem: The Lake Superior Agate

Its wide distribution and iron-rich bands of color reflect the state gemstone's geologic history in Minnesota

In 1969 the dream of Mrs. Jean Dahlberg was realized: The Lake Superior agate was designated by the Minnesota Legislature as the official state gemstone.

The late Mrs. Dahlberg, long-time rock hound and ardent fan of the agate, testified before the state legislative committee considering the bill. She knew how perfect the Lake Superior agate was for the state gemstone.

However, there were other logical candidates. The brazen red Binghamite and blazing yellow silkstone, both iron-rich jaspers found in the Cuyuna iron range area, were logical selections. Thompsonite, the beautiful and popular zeolite mineral found only in Minnesota on an isolated stretch along Lake Superior, was another strong candidate. Pipestone, crafted into peace pipes by Indians in Pipestone, was another possibility.

But a closer look at the history of the Lake Superior agate proves that it was the best choice. The agate reflects many aspects of Minnesota. It was formed during lava eruptions that occurred in our state about a billion years ago. The stone's predominant red color comes from iron, the major industrial mineral in our state. Finally, the widely distrib-

uted agate reveals the impact of glacial movement across Minnesota a mere 10,000 to 15,000 years ago.

Geologic History

More than a billion years ago, the North American continent began to split apart into two separate continents. This catastrophic event, spurred by molten rock moving deep within the earth, poured out massive, iron-rich lava flows. These flows now are exposed along the north and south shores of Lake Superior.

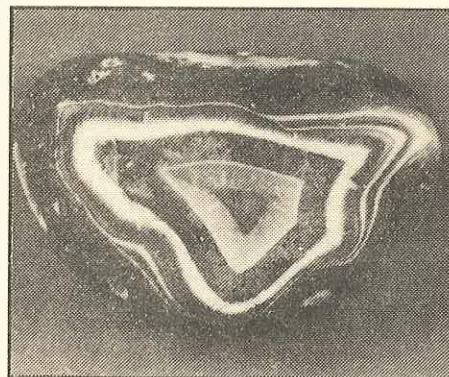
The tectonic forces that attempted to pull the continent apart, and which left behind the lava flows, also created the Superior trough. The trough eventually became the basin of Lake Superior; the lava flows became the birthplace of Lake Superior agates.

Water vapor and carbon dioxide became trapped within the solidified flows in the form of millions of bubbles, called gas pockets or vesicles. Later, groundwater carrying ferric iron, quartz, and other dissolved minerals passed through the trapped gas vesicles. These quartz-rich groundwater solutions crystallized into concentric bands of fine-grained quartz called chalcedony.

Over the next billion years, some of these quartz-filled, banded vesicles -- agates -- were freed by running water and chemical disintegration of the lavas, since the vesicles were now harder than the lava rocks that contained them. The vast majority, however, remained lodged in the lava flows until the next major geologic event that changed them and Minnesota.

About 2 million years ago, the world's climate grew colder signaling the be-

ginning of the Great Ice Age. A lobe of glacial ice, the Superior lobe, moved into Minnesota 10,000 to 15,000 years ago. It followed the agate-filled Superior trough. The glacier picked up surface agates and carried them south. Its crushing action and cycle of freezing and thawing at its base also freed many agates from within the lava flows and transported them, too. The advancing glacier acted like an enormous rock tumbler, abrading, fracturing, and rough-polishing the agates.



This Lake Superior agate, weighing 2.02 pounds, was found along a water-main excavation in the 1960s.

Description

The Lake Superior agate differs from other agates found around the world in its rich red, orange, and yellow coloring. This color scheme is caused by oxidation of iron. Iron leached from rocks provided the pigment that gives the agate its beautiful array of color. The concentration of iron and the amount of oxidation determine the color within or between its bands.

Agates come in various sizes. The gas pockets in which they formed were primarily small, about the size of a pea. A few Lake Superior agates weigh more than 20 pounds, about

the size of a bowling ball. Such giant agates are extremely rare, but no doubt others are yet to be discovered.

The most common type of Lake Superior agate is the fortification agate with its eye-catching banding patterns. Each band, when traced around an exposed pattern, connects with itself like the walls of a fort, hence the name fortification agate.

A common subtype of the fortification agate is the parallel-banded onyx-fortification or water-level agate. Perfectly straight, parallel bands occur over all or part of these stones. The straight bands were produced by puddles of quartz-rich solutions that crystallized inside the gas pocket under very low fluid pressure. The parallel nature of the bands indicates the agate's position inside the lava flow.

Probably the most popular Lake Superior agate is also one of the rarest. The highly treasured eye agate has perfectly round bands or "eyes" dotting the surface of the stone.

Occasionally, collectors find a stone with an almost perfectly smooth natural surface. These rare agates probably spent a long time tumbling in the waves along some long-vanished, wave-battered rocky beach. They are called, appropriately, "water-washed" agates.

Finally, the rarest Lake Superior agate is the one that recurs in a collector's dreams but is discovered in reality perhaps once in a lifetime. On average, only one out of every 10,000 agates fits this description. They are the ones weighing 2 pounds or more and having perfect shape, color, and banding quality. They are the ones called "all-timers."

Treatment

The word "gemstone" implies that a stone can be used as a jewel when cut and polished. The Lake Superior

agate certainly qualifies, although only a fraction of the stones are of the quality needed for lapidary – the art of cutting and polishing stones. During glacial movement, most were badly fractured by tremendous pressures within the ice and by repeated freezing and thawing.

Three lapidary techniques are used on Lake Superior agates. The most common technique is tumbling. Small gemstones are rotated in drums with polishing grit for several days until they are smooth and shiny.

Medium-size "lakers" (one-quarter pound to 1 pound) often are cut with diamond saws into thin slabs, which then are cut into various shapes. One side of the shaped slab is polished, producing fine jewelry pieces and collectible gems called cabochons. Cabochons can be set in rings, bracelets, belt buckles, and tie clasps.

A technique called face polishing is less commonly used on the state gemstone. It involves polishing one curved portion of the stone and leaving the major portion in its natural state.

Distribution

One of the most appealing reasons for naming the Lake Superior agate to be the state gemstone is its widespread availability. The Superior lobe spread agates throughout north-eastern and central Minnesota and extreme northwestern Wisconsin.

Glaciers dispersed Minnesota's official rock around the state into various settings where hikers, campers, hunters, and outdoor enthusiasts can readily collect them. Many beautiful specimens have been found in gravel banks along rivers and streams. Popular hunting grounds include the Mississippi River and waters that empty into Lake Superior along the North Shore. The beaches along Lake Superior and hundreds of

Clues to Finding the State Gem

You have decided to hunt for Lake Superior agates, but how do you know what to look for? There is no simple answer. Usually, the richly colored banding pattern is not well exposed and prospectors must look for other clues to the presence of agates.

The following characteristics will help you identify agates in the field.

- * Band planes along which the agate has broken are sometimes visible, giving the rock a peeled texture. It appears as though the bands were partially peeled off like a banana skin.

- * Iron-oxide staining is found on nearly all agates to some degree, and generally covers much of the rock. Such staining can be many different colors, but the most common are shades of rust-red and yellow.

- * Translucence is an optical feature produced by chalcedony quartz, the principal constituent of agates. The quartz allows light to penetrate, producing a glow. Sunny days are best for observing translucence.

- * A glossy, waxy appearance, especially on a chipped or broken surface, is another clue.

- * A pitted texture often covers the rock surface. The pits are the result of knobs or projections from an initial layer of softer mineral matter deposited on the wall of the cavity in which the agate formed. Later, when the quartz that formed the agate was deposited in the cavity, these projections left impressions on the exterior.

other lakes have produced many gems. Virtually any place with exposed gravel and rocks offers the chance of finding Lake Superior agates.

This report is adapted from an article by Scott F. Wolter that appeared in The Minnesota Volunteer. Photo by Scott Wolter. Wolter is the author of a book called The Lake Superior Agate.

