





# Minnesota Gem: The Lake Superior Agate

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

Scott F. Wolter

**I**N 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 violent, fiery 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 distributed agate reveals the impact of glacial movement across Minnesota 10,000 to 15,000 years ago.

The Lake Superior agate is intimately related to two prominent geologic features of Minnesota: the majestic and rugged lava flows exposed along the shoreline of Lake Superior and the lake-freckled glacial debris that covers nearly all the state.

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 thousands of lava flows. These flows now



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are exposed along the north and south shores of Lake Superior.

**Quartz-rich.** If this drastic event had not stopped shortly after it began, what is now Minnesota might have comprised parts of two separate continents. When the continental parting did stop, the remaining thick, heavy lava pile pressed down on the earth's crust producing a long trough — the Superior trough, which eventually became the Lake Superior basin. These lava flows also became the birthplace of Lake Superior agates.

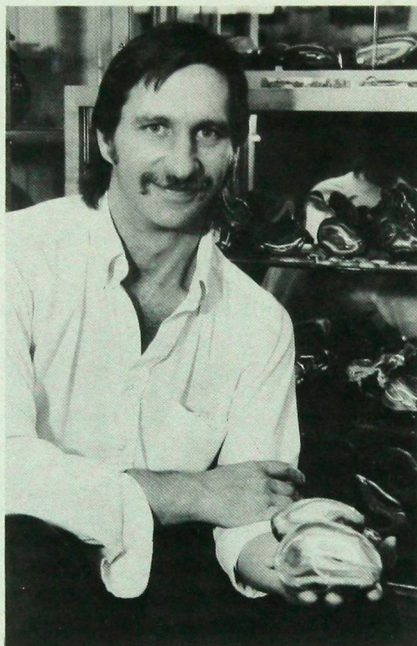
Water vapor and carbon dioxide became trapped within the solidified flows in the form of millions of bubbles or pockets. Later, groundwater carrying ferric iron, quartz, and other dissolved minerals passed through the trapped gas pockets or vesicles. These quartz-rich groundwater solutions crystallized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

Over the next billion years, a few of these quartz-filled, banded vesicles — agates — were freed by running water and chemical disintegration of the lavas. 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

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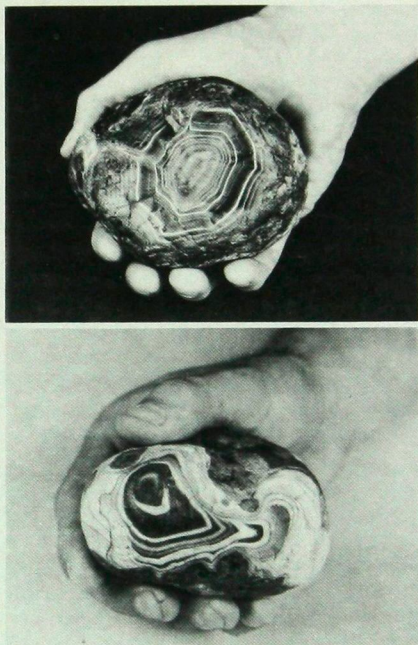


**Beaver Bay Agate Shop owner James Haase displays North Shore agates.**

the beginning of the Great Ice Age. A vast sheet of ice formed over what is now Hudson Bay in Canada and expanded. Eventually it sent lobes of mile-thick ice into Minnesota and other parts of North America.

One particular lobe of 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 the surface agates and carried them south. Its crushing action and cycle of freezing and thawing at its base freed many agates from within the lava flows and transported them, too. The advanc-





**Top: Octagonal patterned 2.5-pound agate.**  
**Bottom: Two-pound red and white agate.**

ing glacier acted like an enormous rock tumbler, abrading, fracturing, and rough-polishing the agates.

**Eye-catching Patterns.** The Superior lobe spread agates and other debris throughout northeastern and central Minnesota and extreme northwestern Wisconsin. A period of warmth triggered melting and retreat of the lobe, leaving the large body of freshwater now called Lake Superior. Abrasion of the agates, however, was not yet complete.

Along the margins of the glacier were ridges of ice-transported mate-

rial called "moraines." Cutting into these moraines were rivers and streams swollen with water from melting glacial ice. The streams carried sand and gravel, including agates, and deposited these sediments as "outwash." These streams performed the final abrasion and rough polishing of the agates.

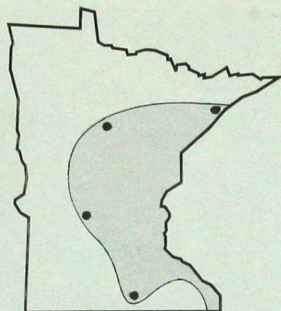
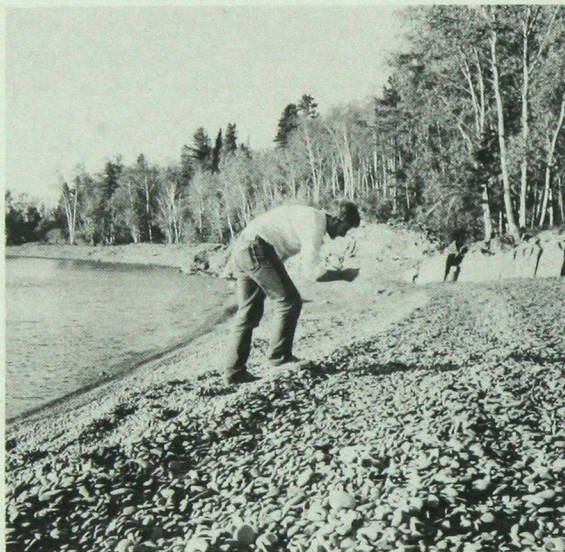
The Lake Superior agate differs from other agates found around the world in its rich, red, orange, and yellow coloring. This color scheme is caused by the oxidation of iron. Iron from Minnesota's iron range provided the pigment that gives the gemstone its beautiful array of color. The concentration of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

The gemstone comes in various sizes. The gas pockets in which the agates 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 lie waiting 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 or "face," 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





**Left:** Agate hunter on Lake Superior beach. **Above:** Gray area on map shows approximate distribution of agate in Minnesota — Little Marais in northeast, Walker in north-central, Willmar in west-central, Albert Lea in south.

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 also indicates the agate's position inside the lava flow.

**All-timers.** 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 gemstone with an almost perfectly smooth natural surface. These rare agates are believed to have spent a long time tumbling back and forth in the waves along some long-vanished,

wave-battered rocky beach. We call these, appropriately enough “water-washed” agates.

My favorite Lake Superior agate has only two colors, fire-engine red and snow-white alternating bands. I call these agates “candystripers.”

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.”

A few all-timers have been collected and displayed at rock and gem shows. The possibility of finding one keeps agate hunters searching.



## 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 looks as if the bands were partly 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 com-

mon 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.

Of course, 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 of the agates 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.

**Wide-ranging.** 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, and tie clasps.

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

One of the most appealing reasons for naming the Lake Superior agate to be the state gemstone is its widespread availability. Many state rocks are found only in remote areas, or they are commercially mined and available only in jewelry stores or rock shops.



## Minnesota Gemstone

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

Anyone can find a Lake Superior agate. Collecting can be enjoyed at any age, alone, as a family, in large groups, or in a club. □



### *Number of Hunters in Minnesota*

EACH YEAR, 566,000 people hunt in Minnesota; 543,000 are Minnesotans, 23,000 are visitors to Minnesota. About 17 percent of all Minnesotans hunt compared with 9.5 percent of all Americans. — *DNR Division of Fish and Wildlife*

### *In One Year, 41 Trumpeter Swans Arrive in Minnesota*

THE BROOKFIELD ZOO in Chicago donated three 16-week-old trumpeter swans to the DNR's Nongame Wildlife Program. The swans, called cygnets, weighed 15 pounds. Eventually they will weigh 30 pounds. Last year, 41 swans were obtained as part of a project to restore the large white waterfowl to Minnesota. Donations to the Nongame Wildlife Checkoff on Minnesota's income tax and property tax forms support the program. — *DNR News Service*

### *Does Minnesota Need a State Fossil?*

SIXTEEN STATES have named a state fossil. Examples: New York — extinct giant sea scorpion. California — saber-toothed cat. Georgia — shark's teeth. Mississippi — prehistoric whale. Nebraska — mammoth elephant. North Dakota — teredo petrified wood. Maryland — the shell of an extinct snail. Minnesota has a state tree (Norway pine), flower (pink and white lady's-slipper), gemstone (Lake Superior agate), grain (wild rice), bird (loon), and fish (walleye). But no state fossil. — *The News Service of the National Geographic Society*

### *The Still Reality of a Winter Morning*

"THE SNOW lies warm as cotton or down upon the window sill; the broadened sash and frosted panes admit a dim and private light, which enhances the snug cheer within. The stillness of the morning is impressive. The trees and shrubs rear white arms to the sky on every side; and where were walls and fences, we see fantastic forms stretching in frolic gambols across the dusky landscape, as if Nature had strewn her fresh designs over the fields by night as models for man's art." — *Henry David Thoreau, "A Winter Walk" (1843)*