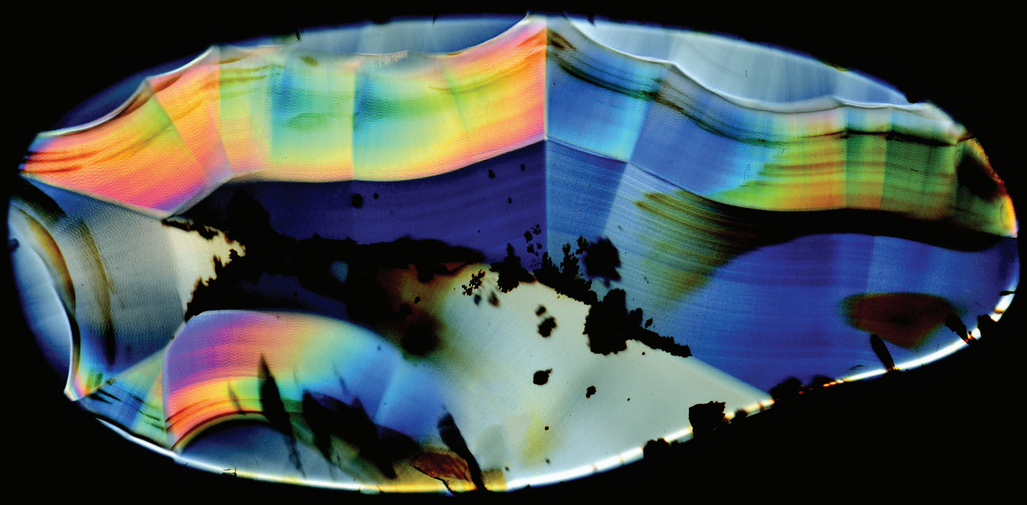
Montana Moss Agates



Montana moss agate exhibiting the rainbow iris effect (Harmon, 2016; photo by Thomas P. Shearer).

Montana Geology 2023

January

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Montana moss agate cabochon from the Montana Tech Mineral Museum collection (photo by Simon Bierbach, MBMG).

February

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

Montana Moss Agate showing moss, banding, white plume structures (along the bottom), and tube and eye formations (left side) collected near Hysham, MT (photo by Simon Bierbach, MBMG).

March

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
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19	20	21	22	23	24	25
26	27	28	29	30	31	

April

Su	Mo	Tu	We	Th	Fr	Sa
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16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

Montana moss agate carved to show an unusual dendritic pattern (Harmon, 2016; photo by Thomas P. Shearer).

May

Su	Mo	Tu	We	Th	Fr	Sa
	1	2	3	4	5	6
7	8	9	10	11	12	13
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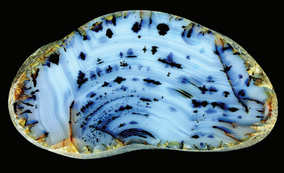
21	22	23	24	25	26	27
28	29	30	31			



Montana moss agate (Harmon, 2016; photo by Thomas P. Shearer).

June

Su	Mo	Tu	We	Th	Fr	Sa
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4	5	6	7	8	9	10
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18	19	20	21	22	23	24
25	26	27	28	29	30	

July

Su	Mo	Tu	We	Th	Fr	Sa
						1
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23	24	25	26	27	28	29
30	31					

August

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27	28	29	30	31		

September

Su	Mo	Tu	We	Th	Fr	Sa
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17	18	19	20	21	22	23
24	25	26	27	28	29	30

October

Su	Mo	Tu	We	Th	Fr	Sa
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8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

November

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

December

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

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MONTANA MOSS AGATES

by Gary Icopini, MBMG

In 1969, the Montana Legislature declared the Montana agate and the sapphire the State Gemstones. Rock hounds from all over the world come to Montana in search of Montana agates. Although agates are found in many parts of the State, the most sought after is the Montana moss agate, which is found in gravels of the Yellowstone River Valley (fig. 1) and its tributaries. The Montana moss agate gets its name from black (manganese) or reddish-brown (iron) dendritic structures found within these agates. These dendritic structures (multi-branching, tree- or moss-like) are what make the Montana moss agates special and unique in the world of agates (figs. 2–9). Classic agate characteristics such as banding, plume structures, tube or eye formations, and visible quartz crystallization are also found in Montana moss agates (see photos on front). The less common prismatic light scattering effect (iris agate) is also observed in some Montana moss agates (main photo on front). The background color of Montana moss agates is often clear to slightly cloudy, or even bluish.

Figure 1. Yellowstone River near Savage, MT showing gravel bars (photo by Gary Icopini).

Figure 2. Large uncut Montana moss agate from the Montana Tech Mineral Museum collection (11 pounds, 7 ounces) showing a large quartz pocket, moss, banding, and white weathering rind (especially on the bands above the quartz pocket; photo by Simon Bierbach, MBMG).

Figure 3. The same large uncut Montana moss agate from the Montana Tech Mineral Museum (11 pounds, 7 ounces) showing the drab appearance and the small semi-circular fracture pattern (photo by Simon Bierbach, MBMG).

Agates

An agate is one of the many forms of chalcedony. Chalcedony is a rock composed of microcrystalline (visible with an optical microscope) and cryptocrystalline (too small to be seen with an optical microscope) quartz crystals (mindat.org, 2022). Quartz is a mineral composed of silicon and oxygen. Other forms of chalcedony include chert, jasper, and flint. Agate differs from these other types of chalcedony by being translucent (light can pass through it) and containing multi-colored banding and/or colored inclusions (e.g., dendrites).

Figure 4. Montana moss agate core stone showing the edge worked by a Native American flint knapper (Sarpy Creek, MT; photo by Simon Bierbach, MBMG).

Most of the world's agates form in volcanic areas (Götze and others, 2020). The near-surface magma of volcanic areas provides a heat source for infiltrating meteoric water (rain or snow). Hot water is more effective at dissolving silica from rock than cold water; this hot water dissolves silica from nearby rock. Volcanic rock is usually silica rich. This hot silica-laden water then migrates away from the heat source, flowing through cracks and voids (empty spaces) in the rock. The hot water cools as it flows away from the heat source. The cooling, along with possible changes in water chemistry, causes the silica to precipitate in void spaces within the rock. Many Montana moss agates have central areas partially or fully filled with macroscopic (visible with the eye) quartz crystals (see fig. 2). These crystals formed from solutions with lower silica concentrations than the solutions that formed the surrounding agate (Götze and others, 2020).

Agates form in voids within and between rocks. Vein-filling agates form by precipitating along the walls of cracks or fractures in rock. Many Montana moss agates have a natural round or oval shape, visible as circular or oval banding patterns that follow the shape of the cavity in which they precipitated. Agates that formed in volcanic rock often filled void spaces (vesicles) left by gas bubbles trapped in, and sometimes deformed by, the lava as it solidified (Götze and others, 2020). These vesicles are often elongated tube or teardrop-shaped cavities when viewed from the side and oval or circular when viewed from the front or tail end (Götze and others, 2020). However, Montana moss agates that are elongated or oval-shaped are often referred to as "limb cast" agates by Yellowstone River agate hunters. They are interpreted to be formed by filling voids left by trees that were engulfed by volcanic rock and subsequently burned or dissolved, leaving a tree-limb-shaped void (Harmon, 2000). The "limb cast" interpretation is bolstered by an abundance of petrified wood and agatized wood in the Yellowstone River Valley gravels. Whether these elongated and/or oval-shaped voids were formed by gas bubbles in volcanic rock or parts of trees, or both, may never be known with certainty, because the source rock from which Montana moss agates originate has not been found. Geologists hypothesize that the source for Montana moss agates may be the ~45- to 50-million-year-old Absaroka Volcanics located in and near Yellowstone National Park (Hyndman and Thomas, 2020).

Figure 5. Montana moss agate cabochon from the Montana Tech Mineral Museum collection (photo by Simon Bierbach, MBMG).

Figure 6. A polished slab of Montana moss agate, side view, from the Montana Tech Mineral Museum collection (photo by Simon Bierbach, MBMG).

How to Find Montana Moss Agates

Agates can be found in Yellowstone River Valley gravels from north of Yellowstone National Park to the North Dakota border. Some experts suggest that the best stretch for hunting classic Montana moss agates is between Custer and Sidney (Harmon, 2000). Most people find agates in the gravel bars along the active Yellowstone River channel. There are numerous public fishing and recreational access sites along the river. Right-of-way corridors at bridge crossings are also potential public access points to the river. Once on the river, Montana's stream access law allows for anyone to walk or boat anywhere on the river, as long as they remain below the high-water mark.

Agates can also be found in the "terraces" above the active river channel. Terraces (bench-like landforms that extend along the sides of river valleys) were deposited by the river in the geologic past, before the river eroded down to its present-day elevation. Rock hounds have found many agates in gravel pits (mined areas) in these terrace deposits. These terrace gravels can be found tens of miles away from and 1,000 feet in elevation above the nearest active river channel, indicating the vast meanderings of the river throughout geologic time. The tributary drainages to the Yellowstone often contain agates that likely eroded from these terrace deposits. Much of the land with terrace gravels is privately held, so make sure to ask permission before agate hunting on private land. That said, many eastern Montana landowners are happy to allow agate hunters to cart off as much rock as they can carry.

The outward appearance of a Montana moss agate can often hide the beauty within. The outer surface of an unbroken agate can appear drab brown or black to the casual observer. The surface of these drab-colored rocks may be covered with small (<1 cm in diameter) semicircular fractures, which is a texture that can aid in finding agates (fig. 3). Other agates may have irregular surfaces and can be quite pitted. Some agates will have a prominent interior band of quartz crystals that is lighter than the rest of the rock. Agates that have been exposed to the sun for a long period of time develop a distinctive, highly visible white crust (fig. 2). This white crust is often the easiest way to spot an agate in undisturbed terrace gravels. Although the banding or moss is readily apparent in many specimens, some agates are difficult to identify until they are wet. For this reason, serious agate hunters carry a spray bottle to wet their finds before lugging them home.

The references below contain numerous photographs of natural agates, and many YouTube channels are devoted to finding agates along the Yellowstone River.

Montana moss agates are a beautiful and unique Montana rock that is accessible to everyone. Go out and find your own Montana treasure!

Figure 7. Montana moss agate pendants (Harmon, 2016; photo by Thomas Shearer).

Figure 8. Montana moss agate ring and earrings (photos by Simon Bierbach, MBMG).

Acknowledgments

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YouTube Channels:

https://www.youtube.com/c/TheoKellison

https://www.youtube.com/channel/UCaJOoBb8yKPhr8iHR3m-s0g

Figure 9. A hand-carved Montana moss agate (Harmon, 2016; photo by Thomas Shearer).

MONTANA BUREAU OF MINES AND GEOLOGY

Montana Technological University

Scope and Organization

The Montana Bureau of Mines and Geology (MBMG) was established in 1919 as a non-regulatory public service and research agency for the State of Montana, to conduct and publish investigations of Montana geology, including mineral and fuel resources, geologic mapping, and groundwater quality and quantity.

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