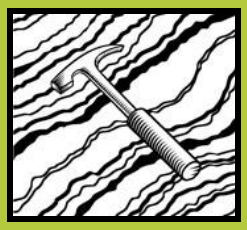
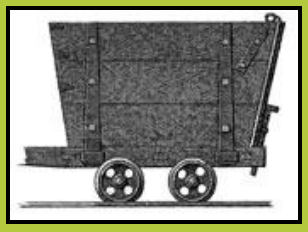
Gem Hunter – The Prospector's Newsletter





Vol 3, No 4, July-Aug. 2011 *Newsletter from the GemHunter*

COMMERCIAL GOLD IN RATTLESNAKE HILLS

According to the Casper Journal, Evolving Gold intersected commercial amounts of gold west of Casper, Wyoming. Evolving Gold's CEO, Bill Gee reported that the company's gold play in the Rattlesnake Hills, *"... has some similarities in the overall geology to Cripple Creek, in terms of its association with the age of rocks, and kind of rocks,"* Gee said, in reference to the gold mine in that produced over 2-million ounces of gold between 1994 and 2005, and is projected to produce another 3.5 million by 2016.

The Casper Journal wrote … *a comparison to Cripple Creek was also noted by former Wyoming Geological Survey Geologist W. Dan Hausel who explored the area for the state in 1981. "This was an economic geologist's dream" Hausel wrote of his finds 30 years ago. "The geology couldn't be any better for discovery of major gold deposits, and it was unexplored in modern history.... It is likely that some 1 million ounce gold deposits will be outlined in the near future."*

According to information released on Evolving Gold's website, the company is drilling deeper than previous companies and test cores show strong gold mineralization between 0.044 to 0.38 ounces per ton as compared to Cripple Creek's reported average ore grade of 0.02 ounces per ton. Additionally,

commercial operating gold mines in Nevada mine ore that ranges from 0.15 to 0.02 ounces per ton. Thus the intercepts by Evolving Gold to date are very impressive.

Author's note: No other geologist in the history of the Wyoming Geological Survey or its predecessor, the Wyoming Territorial Geological Survey found any commercial deposit of any kind. I was lucky to have a job that allowed me the freedom to search for new deposits and follow my ideas leading me to discover the Rattlesnake Hills gold district. I was also one of seven geologists recognized for discovery of the Donlin Creek gold deposit by the Prospectors and Developers Association in Canada, which has turned out to be one of the largest gold deposits found in North America during the past one hundred years.

Typically, it takes a unique combination of CEOs, directors, bureaucrats, investors, economy, etc to put a mine together. It is not an easy task. Many commercial deposits remain undeveloped for decades. This is true of Donlin Creek, where we discovered a $64 billion (at today's gold price) deposit in 1988 and it still has not produced a single ounce from a mine! As for the Rattlesnake Hills, I discovered this district 30 years ago and no gold has been mined from this district to date. In the old days, there was little government interference and little to no permitting. Today, there are mountains of unnecessary paperwork, much duplication, and bureaucrats are in charge of making decisions over all aspects of mining and milling that they have little expertise in many cases. These and other bureaucratic roadblocks make it nearly impossible for any individual, let alone a mining company, to open a mine.

QUARTZ & CHALCEDONY (PART 2)

In the last *GemHunter newsletter* (*May-June, 2011*) we discussed **crystalline** quartz and veins. In this issue we focus on another variety of quartz known as **cryptocrystalline quartz** or **chalcedony**.

It's unfortunate, but mineralogists and rock hounds provide confusing categories for chalcedony – these are even confusing for me and I taught mineralogy at one time and have been a geologist for many years. The problem arises from usage of numerous names applied to the same mineral such as ***agate, carnelian, chrysoprase, onyx, sard, jasper, chert, flint, youngite,*** etc. These are all chalcedony and are all composed of silica (SiO_2) just like quartz; but unfortunately they have been given different names based on color, geographical location, color banding and even namesakes.

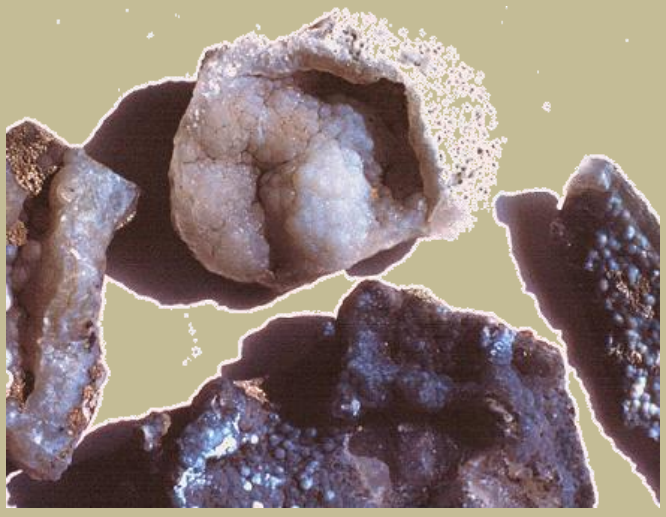
Botryoidal texture seen in ironstone concretions.

It would have been a lot easier to simply call all cryptocrystalline varieties of silica ***"chalcedony"*** and add a color modifier – such as ***'red chalcedony'*** for ***'jasper'***, ***'green chalcedony'*** for ***'chrysoprase'*** etc. It's like sapphire and ruby. These are the same mineral, but have different colors due to trace metals in ruby verses sapphire. And then there are several colors of sapphire, but these are

typically called "*green sapphire"*, *"pink sapphire"*, etc. But unfortunately, the names of the varieties of chalcedony are ingrained in the literature and local rock hound and mineral collecting clubs.

Some chalcedony consists of ***microscopic*** *fibrous* quartz crystals with minute pore spaces filled with water, air, or minute colored particles that produce attractive colors and bands that have been referred to as ***agate*** (Sinkankas, 1975). Other forms are *granular* and thought to be made of roughly equidimensional rather than fibrous microcrystals such as ***jasper, flint, and chert*** (Hurlbut and Switzer 1979). The distinction between fibrous and granular cryptocrystalline quartz is not universally recognized and differences are microscopic and not readily recognizable in the field. The two types (fibrous and granular) are lumped together as ***chalcedony*** (Schumann 1997). Personally, I recommend calling all of these cryptocrystalline varieties ***chalcedony***. But because so many names are entrenched in the literature, it will be almost impossible to change. So, I'll provide both forms of terminology in this newsletter in hope it will help both of us to understand what mineral we are dealing with.

Let's look at ***white chalcedony*** (known as ***chert***) and black chalcedony (known as ***flint***). ***Flint*** is dark-brown to almost ***black chalcedony*** due to impurities; and ***chert*** is opaque light gray to white chalcedony that grades into flint. So we can think of these two as the *Yin and Yang* of chalcedony – opposites – one black and the other white. These have limited use as ornamental stone simply because they are just plain unattractive to most people.



Left - Botryoidal quartz from the Casper Formation near Marshall, Wyoming. Botryoidal is a textural term for globular structures that give the appearance of the surface of a bunch of grapes (see also the photo of iron concretions on the previous page). Mixed in with the quartz is white and black chalcedony.

Below - Zebra flint (black, banded chalcedony) from Shirley Basin, Wyoming.

Chalcedony occurs as cavity fillings, linings, replacements and fracture fillings. It may also be found with quartz crystals and drusy quartz (very fine, tiny quartz crystals) in geodes. It is also found as fracture fillings and replacements of organic material such as petrified wood. Pure chalcedony has no cleavage and will break with uneven rough to conchoidal fracture similar to glass and quartz (Sinkankas 1959; Bauer 1968; Hausel, 1986, 2009; Schumann 1997).

The hardness of chalcedony is 6.5 to 7 on Moh's hardness scale (Hausel, 1986, 2005, 2009; Schumann, 1997). Bauer (1968) reports hardness at 6.5. Sinkankas (1959) explains the hardness may appear to be lower than quartz (H=7) depending on porosity and purity as related to its fibrous structure. In other

words, the mineral will be able to scratch your car's windshield (unless you have bullet proof glass) (I realize some people think only diamond will scratch a windshield, but if you have ever been in a dust storm, you should be aware that quartz dust, better known as sand, will scratch glass. I don't recommend scratching your car's windshield to test hardness, this makes it difficult to see).

The specific gravity of chalcedony is 2.58 to 2.64. This is slightly lower than coarsely crystalline quartz because of slight porosity in chalcedony (Sinkankas 1959; Hurlbut and Switzer 1979). Thus it will easily wash out of a gold pan as will quartz. Chalcedony can vary in size from grains to large masses weighing tons.

Jasper is the ***deep red, reddish-brown to yellow-orange chalcedony***. It is often indistinguishable from yellow-orange chalcedony known as ***Sard*** or ***Carnelian***. About the only distinguishing feature is that **jasper** is **opaque** while **sard** and **carnelian** are **transparent** to **translucent**. Thus, sard and carnelian are lapidary and gemology terms. Some opaque jasper cabochons are every bit as attractive as sard and in many cases, more attractive. **Sard** is considered to be reddish to reddish-brown and **carnelian** reddish-orange to orange.

Jasper cabochon cut from material collected in the Hartville uplift of eastern Wyoming.

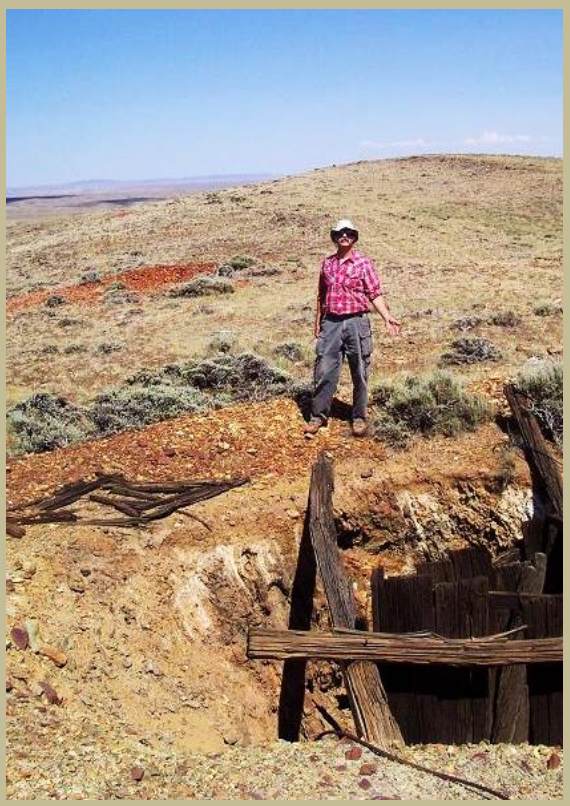
The color in jasper is due to presence of trace iron oxide (rust), whether it occurs as hematite, limonite or goethite (Hurlbut and Switzer 1979).

Wiggins Fork chalcedony with light projected from the backs. This specimen is essentially opaque in thicker slices, but is translucent when cut into thin slabs. Is it sard, carnelian, jasper or agate? All of these terms can be applied to this specimen.

Jasper and agate are locally found in large quantities in Wyoming. At one deposit, Hausel and Sutherland (2000) and Hausel (2009) described tons of jasper and carnelian sitting adjacent to Dry Creek Road leading into the Rattlesnake Hills gold district. This material caps the low-lying hills known as *Jasper Knob* and *South Jasper Knob* and potentially could be used to produce lapidary jewelry, statuary, decorative stone and even countertops. The *Knobs* are formed of considerable red, reddish-brown, tawny, to yellow-orange chalcedony and some of the jasper has fossil leaf imprints (Hausel, 1996, 2009; Hausel and Sutherland, 2000). These rocks were never tested for gold, but because of their close proximity to the Rattlesnake Hills they should be tested, particularly because the fossil leaf imprints suggest the material was deposited as a silica-rich mud from a hydrothermal spring. Go to *"Dry Creek Rd, Sweetwater, Wyoming"* on ***Google Earth*** and this will take you 15 miles northwest of the *Jasper Knobs*.

Left - Banded jasper from Jasper Knobs, and Right - banded chalcedony (onyx) from Tin Cup.

The Rattlesnake Hills gold district has considerable interest for gold – a major gold deposit has now been intersected at depth by drilling. The area is now heavily claimed with many people and companies speculating on gold, so the jasper at Jasper Knobs could easily be staked.



My former field assistant prior to 2007, Wayne Sutherland, stands adjacent to an abandoned shaft in the Tin Cup district. Behind him is a prospect pit dug in jasper. The jasper continues for several hundred feet along trend and is intersected by the shaft in front of him and continues over the hill behind him (if you look close, you will see a small exposure of red jasper on the hill more than 50 yards behind Wayne. Most of the deposit remains unexplored, yet it represents a potential resource for lapidary jewelry.

Another deposit of red chalcedony (jasper) is found in the Tin Cup district northwest of Jeffrey City in central Wyoming. To visit this area on ***Google Earth***, search for *'Jeffrey City, WY'*. The district is about 11 miles north-northwest of Jeffrey City (*42°38'55.40"N; 107°53'06"W*) in the middle of jade country. The Tin Cup district was prospected in the 19th century and promoted as a gold district. However, during my investigation of all of the old prospects, I found no detectable gold. Even so, the district has considerable red chalcedony and red-brecciated chalcedony with a potential to produce large tonnages of jasper as well as possibilities for finding new jade deposits.

Pure chalcedony may fluoresce blue to white. Fluorescence in other varieties may range from null to strong yellow to blue-white depending on the presence of chemical impurities or mineral inclusions (Schumann 1997). Some popular Sweetwater moss agates from the Granite Mountains in central Wyoming fluoresces brilliant yellow due to presence of hydrous uranium arsenate (Hausel and Sutherland, 2000) and opal and agate from the Cedar Rim opal field tend to fluoresce lavender to white.

Agate and opal breccia from Cedar Rim, central Wyoming, showing strong fluorescence.

The refractive index for chalcedony is about 1.53 (Hurlbut and Switzer, 1979). Sinkankas (1959) reported refractive indices to be 1.533 and 1.539, and Schumann (1997) reported the range for pure chalcedony to be 1.530 to 1.540 with slight double refraction of 0.004 and no dichroism.

Chatoyancy is another characteristic seen in some varieties of chalcedony. Adularescence is rare in chalcedony. However, violet adularescent chalcedony is described in specimens found in Iran by Douman and Quinn (2004).

Agate is defined as *banded chalcedony* that is primarily formed in nodules. It has the same chemical composition as jasper, flint, chert, petrified wood, etc, and sometimes found in association with opal. Agate is defined to be different from ***onyx*** chalcedony in that agate has curved or irregular banding in contrast to straight parallel layers in ***onyx***. Typically agates have a variety of color bands and will tend to grade into other forms of chalcedony.

Left - Beautiful banded chalcedony (agate) geode filled with drusy quartz in open space at the center (undisclosed location).

Most agates originate as cavity linings and fillings in a variety of host rocks. However, common usage of *agate* applies to many varieties of chalcedony including those that show no banding, such as the popular moss agate (Sinkankas 1975).

Right - A mystery that may never be solved. Sweetwater moss agates from the Granite Mountains, Wyoming. These popular agates were found in the middle of a dirt road north of Tin Cup.

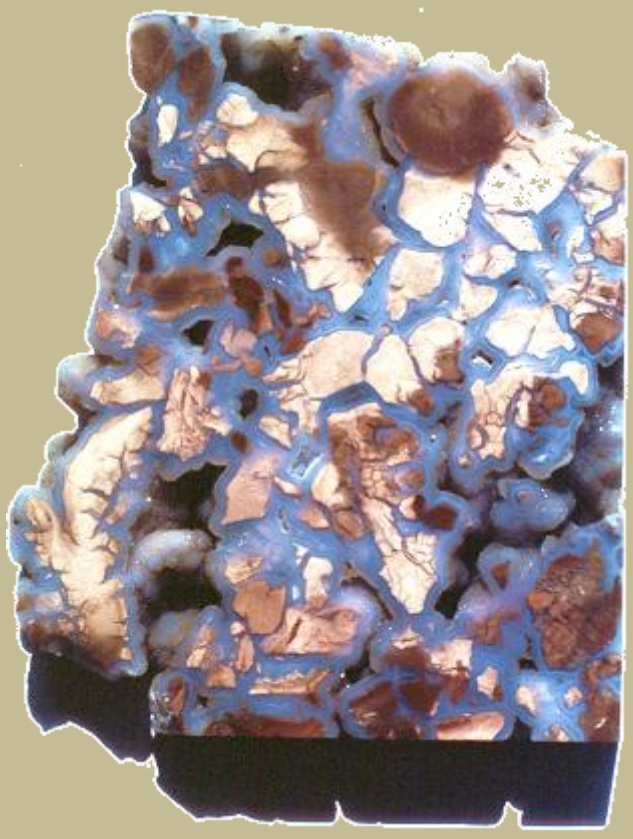
After drinking too much coffee, my field assistant and I stopped to see a man about a horse in a two track road that looked like it had not been used since the last wagon train passed through in the 19th century. As I got out of our vehicle, I saw a polished dendritic agate in the dirt a few feet from the two tracks, then another and another. Before we left, we had more than three dozen Sweetwater agates (most had been tumbled) sitting within throwing distance of the dirt road. We

still have no idea who had discarded these specimens, or why. A few years later, while investigating the Cedar Rim opal field south of Riverton, I found the source beds of the Sweetwater agate.

There are many names applied to this form of chalcedony, referred to as agate. Here are a few:

- *banded agate* –agate with distinct color banding (this is the primary definition of agate).
- *fortification agate* –agate with banding that flows outward into several points within a nodule to provide the appearance similar to a medieval fortress.
- *eye agate* – agate with concentric banding surrounding a point in the center that gives the appearance of an eye.
- *agate breccia* – an agate formed of broken lithic fragments that are rehealed by chalcedony and or quartz such as the popular Youngite agate found north of Wheatland.
- *moss (dendritic) agate* - a translucent chalcedony that encloses moss-like manganese or iron oxide dendrites such as the Sweetwater agates.
- *botryoidal agate* – agate that exhibits botryoidal texture. An external hummocky to rounded form similar to bunches of grapes.
- *flame agate* - a dendritic agate with red to orange flame-shaped dendrites
- *iris agate* – agate with spectral display of colors due to microscopic diffraction grating caused by alternating bands of material that has higher and lower refractive indices.

Right - Slab of Youngite agate from the Hartville uplift, eastern Wyoming. This would be known as agatized breccia, but has been given a local name.



Some agates are given local names, such as *Youngite* (pink to cream limestone breccia clasts rehealed with bluish-gray chalcedony and drusy quartz) from Hartville area, southeastern Wyoming, or the previously mentioned *Sweetwater moss agates* (Hausel and Sutherland, 2000; Hausel, 2009). Others such as the *Fairburn agate* from South Dakota are also popular banded agates.

Bloodstone agate is a green opaque chalcedony with red spots that is also known by its earlier Greek name, *heliotrope* (Mason and Berry 1968; Hurlbut and Klein 1977; Schumann 1997).

Translucent pale orange, orange-red and deep brownish-red chalcedony is known as ***carnelian agate***. Carnelian grades into ***sard***: these two terms are often used interchangeably since there is no distinct difference between the two. Some specimens of carnelian can be cut from jasper. According to Vanders and Kerr (1967), India is the principal source for *carnelian*, but other sources include Wyoming, Washington, Colorado and Michigan (Hausel, 2009). *Sard* is chalcedony that is primarily colored by goethite (hydrated iron oxide). It is gradational with carnelian and also found in many jaspers. *Sard* should be translucent to transparent brown,

brownish-red, and brownish-yellow chalcedony by definition (Hurlbut and Switzer 1979; Schumann 1997).

Wyoming carnelian agate (photo courtesy of Mike Turner).

Apple-green to light-turquoise green chalcedony colored by garnierite (nickel silicate) (Sinkankas, 1975) is referred to as ***chrysoprase agate***. Chrysoprase forms in veins in nickel-rich host rocks such as serpentinite. Localities in the US where chrysoprase has been recovered include Riddle, Oregon, Tulare County, California and Wyoming (Hausel and Sutherland, 2006), typically in regions where one finds considerable serpentinite.

Chrysoprase agate (emerald agate) from Wyoming. Photo courtesy of Mike Turner.

Onyx is made up of alternating dark and light colored straight parallel bands or layers of chalcedony. Such hard *chalcedony onyx* is similar in appearance to soft *marble onyx or Mexican onyx.* Mexican onyx is considerably softer and easily scratched (Hausel, 1986; 2009). Beautiful specimens of *onyx marble* were first described in Wyoming in the Hartville uplift (Hausel and Sutherland, 2000), and the first discovery of chalcedony onyx in Wyoming was found by the author on the top of Quaking Asp Mountain south of Rock Springs.

Left – Onyx from Quaking Asp Mountain, south of Rocks Springs, Wyoming.

Petrified wood, known as fossilized wood is produced by silica-rich groundwater replacing buried organic material. The silica-rich solutions are supersaturated in silica and tend to slowly replace organic material of entire plants and trees with silica leaving a hard and resistant pseudomorph that can contain extraordinary details of the original tree all the way down to cellular structure. Cryptocrystalline quartz of many types, including agate and jasper, may be found in petrified wood.

Petrified wood is found on all continents of the world with one of the most spectacular examples located in the Petrified Forest National Monument and surrounding areas in northern Arizona where Triassic Shinarump and Chinle Formations contain numerous petrified wood tree trucks scattered all over the surface. Petrified wood is also found in the Eden Valley and Blue Forest areas of southwestern Wyoming, from the Wiggins Fork area in Absaroka Mountains of Wyoming, and from Yellowstone National Park in northwestern Wyoming.

Right – Petrified sequoia preserved in the Wasatch Formation near Buffalo Wyoming in 1979.

Left – blue forest agatized wood from Big Sandy south of the Wind River Mountains – (photos courtesy of Wayne Sutherland).

Tiger's Eye is defined as agate that expresses chatoyancy with a golden yellow color on a brown background. Depending on the background or base color, such agates receive various gemological and rock hound terms. When the background color is greenish-gray or green the gem may be known as *cat's eye quartz*. When it is a blue-gray to blue, it is known as *hawk's eye quartz*, and a stone with mahogany color base is called *bull's eye quartz*. The chatoyancy is usually enhanced in rounded, polished, ornamental stones or cabochons.

Tiger's eye from an undisclosed location. Photo courtesy of Tom Nissen.

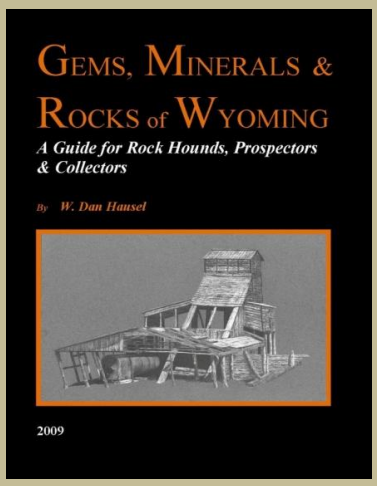
The chatoyancy in *tiger's eye* is often cited as being caused by pseudomorphic replacement of asbestos-form minerals such as crocidolite (Hurlbut and Klein 1977; Cipriani and Borelli 1986). Heaney and Fischer (2003) proposed that *'tiger's eye'* is developed by a vein-filling process in which crocidolite asbestos fibers are cracked apart and resealed by overgrowths of columnar quartz. The quartz provides a relative hardness, and the crocidolite is responsible for the chatoyance found in tiger's eye. Both processes may produce chatoyancy in different environments.

Most tiger's eye comes from South Africa although it also occurs in lesser deposits in California (USA), Australia, India, Myanmar, and Namibia (Schumann 1997).

More in the next newsletter.

GEMS, MINERALS & ROCKS OF WYOMING

Gems, Minerals and Rocks of Wyoming – A Guide for Rock Hounds, Prospectors and Collectors **is available from Amazon.**



Book reviews rate this book as 4.6 out of 5 by Amazon customers.

Buy it, you will like it
Kurt Kephart (Billings, Montana)
If you are into rocks & minerals of Wyoming, this book gives you a 30 year short cut. The author has combined his expertise, experience and passion for geology into a no-nonsense, x marks the spot, book. I recently took several trips to Wyoming from my home state of Montana and found the Sweetwater agates and white opals in the location given in the book. I am looking forward to my next adventure to Wyoming.

Paulette Dilks Dan puts in more information than the casual reader might be able to assimilate. However I believe the book is useful and interesting to all readers. He literally tells you where to go (you may have to climb a mountain) to find gemstones and his history (and I have followed him on his free blog and on CanadianRockhounder) bears out his personal success at this.

Cecil C. Chittenden This is the best book I have ever read on Rockhounding, For detailed info on specific areas of Wyoming this book can't be beat. Dan Hausel is an expert in this area.

Jill Randolph I was surprised that diamonds aren't always found in coal! This was very informative on different minerals.

GOLD - A Field Guide for Prospectors & Geologists
(Book 1 - Wyoming & Nearby Regions)

Want a gold deposit? Our book, written for the prospector tells you exactly how to find gold and where to find it. This is the first of two books submitted to the publisher in mid-July and should be available soon at Amazon, so watch for it.

The GemHunter Newsletter
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