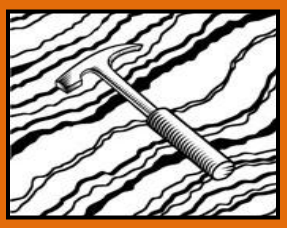
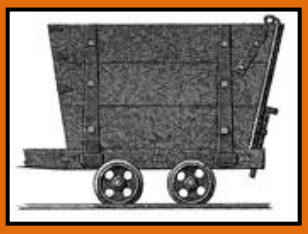
Gem Hunter – The Prospector's Newsletter





Vol 1, No 2 July, 2009 *Newsletter from W. Dan Hausel*

GOLD, GOSSANS & BOXWORKS

In the historical past, many rich gold and silver lodes (veins, shear zones, faults, massive sulfides) were found by prospectors and miners in association with gossans. Today, many of the obvious gossans have been found and explored. Or have they? The photo below shows an extensive gossan at Red Mountain, Colorado with gold mines in the foreground. Much of the distinct gossan (reddish to tawny-stained hills) in the background is only partially explored and mine dumps in the foreground suggest that some gossans led to minable gold ore.

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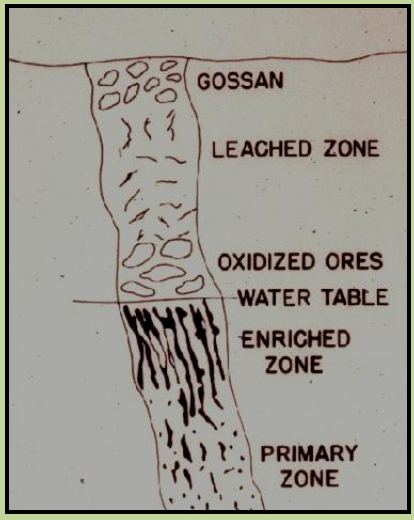


So what is a gossan? A gossan is the oxidized and weathered cap that often sits on a mineralized lode, whether it be a distinct vein or a bulk minable disseminated deposit. Gossans appear as rusty, iron-rich caps over sulfide-rich calcite-quartz veins, massive sulfides, sulfide-rich shear zones and faults, quartz veins with disseminated sulfides and large porphyries (like the great Bingham Canyon copper mine in Utah) with disseminated sulfides. Some gossans are so obvious that they are used as a guide to ore deposits, particularly those that contain considerable sulfide minerals such as pyrite (iron sulfide), chalcopyrite (copper iron sulfide), arsenopyrite (arsenic iron sulfide), stibnite (antimony iron sulfide), galena (lead sulfide), sphalerite (zinc sulfide), etc. For more information on these minerals, see *Gems, Minerals and Rocks of Wyoming (*http://wygemstones.blogspot.com/). Some gossans may not be so distinctive yet may still cap undiscovered mineral deposits.

A wiki site that describes gossans (http://en.wikipedia.org/wiki/Gossan) can be misleading as it hints that gossans were something found in the past (19th and 20th century) when in fact, they have been found throughout history and are still periodically found. One geologist I worked with in Alaska in the 1980s was on the discovery team of the Voisey Bay nickel-copper deposit in eastern Canada in 1993. This group was searching for diamonds but instead found an impressive gossan cap covering a world-class nickel-copper deposit that is thought to be the largest nickel deposit in the world.

Photo of metakomatiite (magnesium-rich volcanic flow) from the Seminoe Mountains, Wyoming. This rock has a subtle gossan (brown-colored limonite) staining the rock only at the base of the flow, where one would expect to find enriched nickel sulfide zones. Such gossans can be used in this geological setting to lead to nickel and gold deposits.

The *classic* gossan or *iron cap,* essentially appears as a rusty outcrop with a variety of colors ranging from deep red, dark brown, tawny and yellow in decomposed rock with some quartz and *boxworks*. Much of the material that makes up a gossan inlcudes minerals such as limonite, jarosite, goethite, hematite and quartz (most are iron oxides or hydrated iron oxides – essentially rust). Dig down to the water table in one of these leached caps and one will often find primary sulfide minerals that may or may not contain gold.

Gossans provide an important guide to buried ore deposits as they often cap primary mineral deposits. If the sulfides that were oxidized to produce the gossan had any gold, searching the

gossan and particularly *boxworks*, may led to excellent gold specimens. So important are gossans that an entire book was written on them *Interpretation of Leached Outcrops* that was published by the Nevada Bureau of Mines.

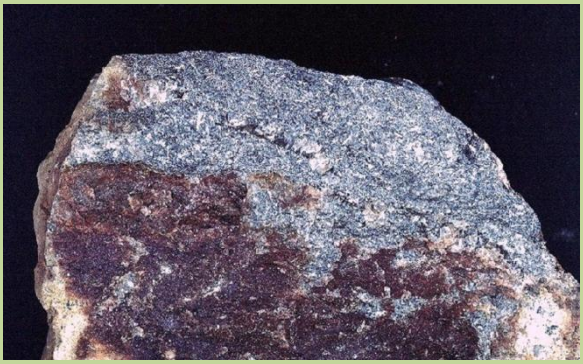
Boxworks

Gossans provide excellent places to search for gold using metal detectors, since the iron oxides produced by oxidation of gold-bearing sulfides may contain specs, rods, or masses of visible gold. Some of the better places to look for visible gold in a gossan are web-like, honeycomb, vuggy and pitted material known as boxworks. Boxworks result from oxidation and removal of pyrite (or other sulfides) leaving behind silicified ridges that are essentially the outlines of the former crystals that were oxidized and removed by weathering. Gold, being essentially inert, often remains in place and can sometimes be found on boxwork ridges or within the boxwork pits.

Boxworks from in the Seminoe Mountains, Wyoming.

Other sulfide minerals found with gold may include arsenopyrite, chalcopyrite, berthierite, stibnite, tetrahedrite, stephanite, etc. When some of these produce gossans, the resulting oxidized outcrops may have their own distinctive color (or odor). One mineral of note is arsenopyrite. Arsenopyrite is a brittle, silver-metallic, mineral that oxidizes to a light lemon-yellow limonite known as scorodite.

When arsenopyrite is struck with a rock hammer, a detectable garlic odor is noted. This is due to arsenic (which has a garlic odor) in the sulfide. Most arsenopyrite in Wyoming is poor in gold but typically has silver. But this may not be true elsewhere since arsenopyrite can contain as much as 1,000 ppm (parts per million) gold in the crystal lattice. When I worked in Alaska, we used arsenopyrite as a guide to higher grade gold zones at Donlin Creek in the Kuskokwim Mountains, southwestern Alaska.



Left - berthierite from Garrett, Wyoming.

Another sulfide found with gold, is berthierite (iron-antimony-sulfide). Berthierite is rare. I identified

only one site in Wyoming several years ago near Garrett in the Laramie Mountains. Here it forms prismatic, brittle, silver-colored, metallic crystals with a dark-brown, limonite and has some gold.

Chalcopyrite (copper-iron-sulfide) can also contain gold (as much as 20 ppm) without exhibiting evidence of the precious metal in hand specimen. Chalcopyrite is a brassy-orange, brittle, metallic mineral that weathers to limonite with a variety of copper minerals including malachite, tenorite and cuprite. These secondary minerals are relatively easy to recognize especially if you have a bottle of dilute (10%), hydrochloric acid. Muriatic acid, a very weak acid, will also work (although not as well).

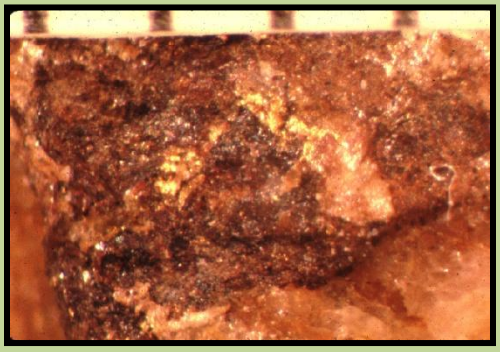
Malachite, a light- to dark-green copper carbonate, will react with the acid by emitting bubbles of carbon dioxide, similar to the fizz in soda pop. If you place the same acid on tenorite and cuprite; a thin plate of native copper will replace a well-used rock hammer when rubbing the hammer in the acid.

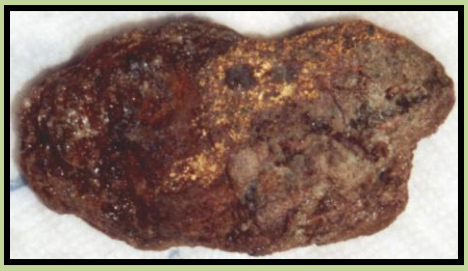
The gold content of chalcopyrite is generally not as high as pyrite, but again, it is worth examining the secondary copper minerals and limonite for visible gold or have some assayed.

Vein sample from the Kurtz-Chatterton property in the Sierra Madre showing chalcopyrite (orange brassy material) with malachite (green), limonite (yellow) and specular hematite (silver metal).

HIGH-GRADE GOLD

The phrase *'high-grade gold'* has been used to describe enriched gold pockets within a gossan or immediately below a gossan at the water table. Such high-grade pockets are restricted in size. Most lodes which enclose high grade pockets contain trace to moderate amounts of gold throughout much of the lode with sporadic pockets of high-grade ore. When the gold content of the entire lode is considered, the lode may not contain enough gold to mine at a profit until prices rise making mining feasible. Even if such deposits are not minable on a large scale, some high-grade pockets may contain specimen-grade gold samples that are feasible to prospect by gophering (site-specific mining). Many specimen-grade samples sell for many times the spot price of gold to mineral collectors.





High-grade gold samples from the Mary Ellen Mine, South Pass, Wyoming.

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Not only are high-grade pockets found in gossans, they are also localized in some veins in what geologists' term 'ore shoots'. Some ore shoots may be deep in the earth, or localized by unique structures in a vein. Thus for the specimen collector, it is important to learn how to recognize gossans as well as geological structures and conditions necessary for the formation of ore shoots.

Classical lodes include veins that are narrow sheets of quartz, and also include shear zones (faults) that consist of vertical to near vertical sheets of intensely deformed rock with deformed quartz veinlets and boudins (lenses). When mineralized, gold values in such lodes are erratic along much of their length. Random sampling may yield trace amounts of gold with periodic ore shoots enriched in gold. A few ore shoots may average more than one ounce per ton (opt) gold. At such high grades, the gold will often be visible to the naked eye (or with a 10x hand lens) and individual pieces of rock may produce specimen-grade samples when grades run >1 opt.

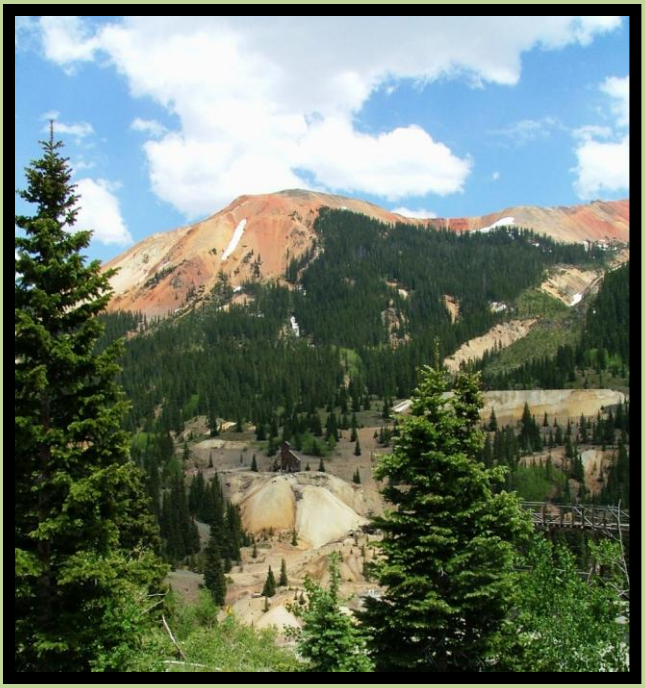
Most auriferous veins consist of milky quartz or light- to dark-grey, translucent, quartz with some pyrite. These latter veins usually are dark due to the presence of microscopic tourmaline or due to intense shearing (or factures) known as mylonitization. Pyrite tends to fool many people as it is brassy and at first may give the novice an impression of gold. It is called 'fool's gold' because it often fool's one into thinking they have gold. Gold is very distinct. It is very heavy, malleable, and has a distinct, warm, golden-yellow metallic color. The specific gravity of pure native gold is 19.3. Pyrite has a specific gravity of 5 (it is 5 times heavier than water) and quartz has a specific gravity of 2.87. Geologists and seasoned prospectors speak of *heft*. This is simply a relative measurement of a mineral's weight. For instance, a gold nugget would have very high heft and a specimen of pyrite would have moderate heft.

Massive pyrite sample containing individual cubic pyrite crystals from the Lost Muffler prospect, Rattlesnake Hills, Wyoming. Note the difference in color between this photo and the gold specimens on the previous page.

Pyrite forms brass-colored brittle crystals that sometimes have cubic or pyritohedral (12-sided) habit. Most specimens are massive. Unlike gold, pyrite is not malleable and will crush to a dark, greenish-grey powder with a rock hammer or mortar. Scratching a streak plate (a rough, white, piece of tile) with pyrite will also leave a distinct black streak of powder on the tile. Scratching gold will leave a very nice gold-color streak.

Pyrite can doubly fool people. It can sometimes enclose gold within its crystal structure. Statistics indicate that the mineral can hide as much as 2,000 ppm gold (this would be

equivalent to a ton of pyrite containing about 60 ounces of gold). Gold in most pyrite is not visible to the naked eye and requires the mineral to be oxidized and replaced by limonite (a hydrated iron-oxide that is essentially rust) to see the hidden gold. In such cases, the gold will be visible as tiny specs in boxworks. It is worthwhile to collect samples of pyrite and have them assayed by a legitimate assayer. In the old days, prospectors would crush considerable pyrite to a powder and pan this powder for native gold.



I highly recommend taking a dirve to Red Mountain, Colorado along US Highway 550 near Guston Colorado east of Telluride, south of Ouray and north of Silverton so you can see for yourself, what an excellent gossan looks like.

Photo of the Idarodo gold mine, Read Mountain district, Colorado with gossan in background.

The San Juan Mountains form a distinctive Tertiary age caldera (collapsed volcanic terrain) with the Silverton-Telluride-Ouray mining district along the western end of the complex that also encloses the Red Mountain district.

The pass at Red Mountain is 12,000+ feet above sea level. Don't take any potato chips! While driving along this highway, we purchased a bag of potato chips at a lower elevation. When we reached the pass, the pressure difference from where the potato chips were packaged compared to this high elevation was so great that the bag of chips exploded. It sounded like a shotgun blast inside my truck. If you want to look at this area before you drive, access *Google Earth* and type in Red Pass, Colorado or San Juan, Colorado and you will enjoy several good photos of gossans. You can also get some information on the Idarodo mine at Red Pass at the wiki site http://en.wikipedia.org/wiki/Idarado_Mine.

It is unfortunate that when the Idarodo mine is mentioned, it is accompanied by the term hazardous waste. This tends to give an erroneous impression that the gold mine caused the hazardous waste. The hazardous waste is the highly enriched sulfide ore that converts to sulfuric acid through time because of oxidation and leaching of sulfides. We need to realize that good o' mother nature placed that gossan there with the sulfides, so it was already producing sulfuric acid long before the miners came along.

The gossans are so extensive at Red Mountain that I can guarantee there are undiscovered gold deposits in this area, even though most people will try to tell you that everything has already been discovered and mined out. In my experience, it is extremely rare that any

deposit, particularly gold or copper, is mined out. There is always some ore left behind and there are hundreds of deposits to be discovered.

Many examples of mines that were not mined out are described in two of my books *(1) The Geology of Wyoming's Precious Metal Lode and Placer Deposits,* and *(2) Copper, Lead, Zinc, Molybdenum and Associated Metal Deposits of Wyoming* (http://danhauselauthor.pbworks.com/Some+books). A very good example is the Ferris-Haggarty Mine in the Sierra Madre. This was once considered to be a world-class copper deposit in the late 1800s to early 1900s, but was only mined for a few years. The Boston-Wyoming Copper Company which operated the property declared bankruptcy for a number of reasons including high capitalization. They built a 16-mile long tramway to haul ore from the mine to a mill-smelter complex. In addition to this debt, the mill and smelter complex at Encampment burned down twice within about a 1-year period and this was accompanied by a 30% drop in copper prices. This was too much bad luck for one company to recover, and the mine shut down and never reopened.

A geologist from Encampment named Ralph Platt mapped the mine when it was still relatively accessible during the second world war and indicated that support columns left behind to keep the back (roof) from caving typically assayed 5% copper with gold and silver values and a large volume of ore remained unmined. In the early 1980s, Exxon Minerals identified a significant gold resource associated with the deposit. It is amazing that such a world class property can still remain unexplored after all of these years, but this is the rule rather than exception. Other examples include mines in the Kirwin district in the Absaroka Mountains east of Yellowstone. This district encloses major copper-silver-gold-lead-zinc deposits that were mined on a small scale at several different locations. Some of these old mines contain incredibly high silver values making one wonder why mining ended. AMAX Exploration collected samples at the mine face in the Little Johnnie and Mendota mines that yielded more than 100 opt in silver (one assay ran 156 opt silver) with some gold! The mine face is the last place mined in a tunnel meaning there is still more mineralized vein beyond the mine workings. So, keep your eyes open for gossans, they are a great guide to gold deposits.

GEOLOGISTS PRESENTED THE THAYER LINDSLEY AWARD FOR A MAJOR GOLD DISCOVERY

On March 2, 2009, a group of 7 geologists were recognized for discovery of the Donlin Creek gold deposit in Alaska. This hydrothermal gold deposit has been described as *"one of the largest untapped gold deposits in the world"* and the *"largest undeveloped gold deposit in North America"* by the *Northern Miner*. The presentation of the ***Thayer Lindsley Award for a major international mineral discovery*** was made at the PDAC Conference in Toronto, Canada. The group included Bruce Hickok, Paul Graff, W. Dan Hausel, Robert Retherford, Richard Garnett, Mark Bronston & Toni Hindeman. Donlin Creek is reported to contain identified resources and reserves at more than 29.3 million ounces (>$27 billion in gold). for

discovery of the Donlin Creek-Snow Gulch epithermal gold deposit! (http://geologicalconsultant.webs.com/inthenews.htm).

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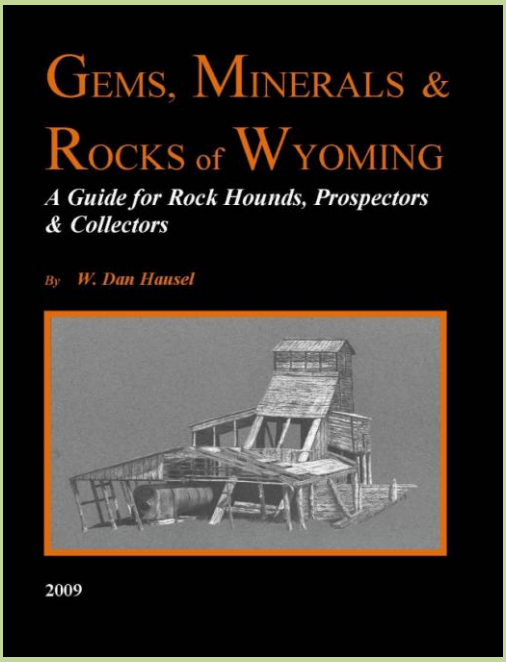
While searching the wilderness and hills of Wyoming, one geologist explored hundreds of minerals (some which had never been reported in Wyoming), a variety of rocks, and found a King's Ransom in gemstones. Imagine colored gemstones >24,000 carats with some remaining in outcrops that likely weigh >1 million carats. Imagine another hill that could host more than 2 trillion carats of sapphire-blue gemstones. Imagine an opal field with millions of opal cobbles, some >75,000 carats. Now imagine hundreds of diamond deposits, high quality gem garnet and emerald-colored diopside. Imagine several ruby and sapphire deposits, some of the higher quality peridot in the world, helidor, aquamarine, gold nuggets and literally hills of jasper. This one geologist found these in a state that prior to 1975 only had a few known jade, and agate occurrences. Wyoming went from one of the poorest gem states in the US to the most endowed in gems, only because someone looked.

These gems, minerals and rocks are described in a book published in 2009. *Gems, Minerals & Rocks of Wyoming – A guide for Rock Hounds, Prospectors & Collectors* (ISBN 1-4392-1856-0) is available at Amazon.com (http://www.amazon.com/Gems-Minerals-Rocks-Wyoming-Prospectors/dp/1439218560/ref=sr_1_1?ie=UTF8&s=books&qid=1246469071&sr=1-1) .



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