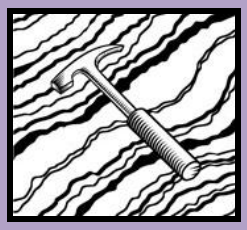
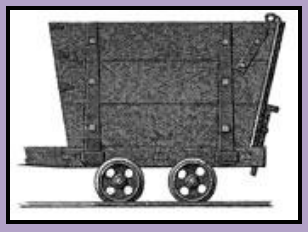
Gem Hunter – The Prospector's Newsletter





Vol. 4 No2, March-April, 2012 *Newsletter from the GemHunter*

DIARY OF A DIAMOND GEOLOGIST (Part III) – The Australian Outback

Continued from the Jan-Feb 2012 GemHunter newsletter. Thanks to the efforts of Gary Glass who was the State Geologist and Director of the Wyoming Geological Survey and to the late Dr. Don Blackstone Jr., who was the president of the Survey Advisory Board in 1986, I was preparing to leave Wyoming for a month to visit Australia and see the new, extremely rich, diamond discoveries made in the outback.

Many of the Australian discoveries occurred either as alluvial placers or were found *in situ* in one of the rarest rock types on the earth's surface, a rock known as lamproite. A few places on earth where equivalent rocks were known to exist at that time included India (where diamonds had been mined from lamproite on a small scale), Murfreesboro, Arkansas (where

diamonds had also been recovered from lamproite, although the rock type had been reported as peridotite and kimberlite) and in one of the largest fields of lamproites in the world: the Leucite Hills of Wyoming that to this day remains untested for diamonds. What were the possibilities of a major diamond discovery in similar rocks in Wyoming? I hoped to find answers in Australia.

Before I left for Australia, I began to ponder where the diamonds had been found in the Australian lamproites? Were they in breccias, lavas, or both? Could they survive the intense heat of the lava flows?

In this photo by Sharon Hausel on one of my last field trips at the Wyoming Geological Survey, I'm (white hat & khaki shirt) standing under basal rubble (breccia) of a lamproite flow at Zirkel Mesa in the Leucite Hills. Note the shale beneath the basal rubble of the thick lamproite flow is baked red

from the intense heat from the lava when it erupted 900,000 years ago. Could diamonds survive in such a hot magma?

The exposed volcanoes and flows in the Leucite Hills were very young geologically (1.3 to 0.9 million years old). The volcanoes are formed of volcaniclastic breccias and extensive flows. The *liquidus* and *solidus* temperatures of the Wyoming lamproites was not well established (*note - rocks are composed of several minerals and each type of mineral has a different melting temperature. The temperature at which the first mineral begins to melt in a rock is known as the solidus as the rock is still a solid. When the last mineral melts, this temperature is known as the liquidus*). So there was a lot of guess work involved in predicting if these could contain diamond if they had even originated from depths great enough to have diamonds in the first place.

Photo – Diamonds from the Aussie Outback. Display of raw diamonds at the Argyle Mine (photo by the author).

So I was looking for answers to many questions including: (1) Did the Wyoming rocks originate deep enough in the earth's mantle where diamonds were likely found and could the diamonds be captured by the magma and brought to the surface? (2) If they did trap diamonds at depth would those diamonds burn in the hot magma as they erupted into the oxygen-rich atmosphere? (3) What was the possibility for hidden lamproites in the volcanic field?

Where would I look for diamonds in these rocks. These were very hot magmas that originated at great depth within the mantle, and if they did pick up diamonds, how could the gem survive in such a hot magma at atmospheric pressure where the atmosphere was rich in oxygen? Kimberlite was different. Kimberlite also erupted as a hot magma, but it

quickly froze when it erupted into the oxidizing atmosphere because of abundant carbon dioxide gas under pressure. Gaseous emplacement temperatures for kimberlites are thought to be about 32°F, cool enough to preserve most diamonds and to keep a six pack of beer cold. What more would a geologist need? Even so, many kimberlites contained resorbed diamonds and diamonds that were partially converted to graphite indicating that there was some destruction of diamonds in kimberlite. Many years later, peridotites (serpentinites) that originated from the earth's mantle, would be found in what was known as the Beni Bousera and Rhonda areas in Spain and Morocco. These rocks were locally filled with graphite thought to have originally been diamond. But all of the former diamonds were altered and burned during the emplacement of these hot rocks.

Diamond bearing kimberlite from the Colorado-Wyoming State Line district.

The blue kimberlite intruded the pink granite millions of years ago. There is no evidence of baking of the granite suggesting the kimberlite magma was relatively cool when it erupted (photo by the author).

Diamonds are carbon – sort of like shiny, extremely hard and dense coal (although they do not burn easily). Coal is easier to burn and is composed of 75 to 90% carbon with some hydrogen, nitrogen, sulfur, oxygen, moisture and ash. Diamond is just carbon, but with very strong atomic bonds.

Today, scientists believe there are two general sources for the carbon that make up diamond. These two different diamonds are known as P-type diamonds and E-type diamonds. Primeval carbon (found in a rock type known as peridotite) forms P-type diamonds while organic carbon (from a rock type known as eclogite) is found in many E-type diamonds. These two diamonds are indistinguishable except for tiny mineral inclusions found in the diamonds and their carbon isotopes, which are unique.

In other words, primeval carbon is the stuff left over from stars and nebula, but organic carbon was modified by organic processes and at one time was a piece of algae or bacteria. Since we ourselves are mostly carbon, there is a possibility some of us could form diamonds one day. So when someone says *"you're a real gem"* – they are probably referring to the fact you will make a very nice diamond someday.

When part of California falls off of the San Andreas fault into the ocean and is subducted down the Benioff zone, billions of years in the future we might find kimberlite and lamproite volcanoes erupting in Arizona, Nevada, Colorado that have large diamonds with nose rings. And, believe it or not, there are diamonds in existence right now that are made from the remains of Californians. A company called LifeGem will take your great grandma's ashes and compress them into diamond, facet the resulting stone, and give you a shiny ring and you can carry grandma around on your finger, or insert her into the side of your nose.

Diamond requires very high temperatures to burn. It requires 3,583^{o}F to burn diamond in a vacuum (with no oxygen). But this temperature has little meaning when we talk about burning diamonds at the surface of the earth where we have an oxidizing atmosphere and no pressure to speak of to counteract the effects of heating. By adding oxygen (and lowering pressure), the temperature of transformation of diamond to graphite is lowered to 1,300^{o}F and diamonds will ignite at temperatures of around 1,300^{o}F to 1500^{o}F in pure oxygen, and 1,560 to 1,830^{o}F in air (for comparison, steel will melt at 2,500^{o}F and a match will ignite at 1,100 to 1,500^{o}F). In other words, your diamond might be safe around matches unless you get a draft of air to raise the temperature a little, but I wouldn't even put a match on a diamond because diamond is not stable on the earth's surface since it lost all of the confining pressure from those mountains of rock that were once sitting on them. They are just waiting for the right excuse to convert to graphite.

When diamonds are transported to the earth's surface in kimberlite magma, lamproite magma, or some other magma, will they burn? This is something I needed to know in 1986 before I wasted time searching the Leucite Hills for diamonds.

Magmas (or molten rock) are produced over a wide range of temperature. This is because each magma is chemically different from other magmas and each rock is made up of a variety of minerals, each with a different melting temperature. Some minerals melt at relatively low temperature, others at very high temperature.

On the earth's surface magmas are hot! Basalts (the black lava rock seen all around the Hawaiian Islands) erupt at temperatures around 1,800 to 2,200 ^{o}F (probably similar to

olivine lamproites at Argyle, Australia). This means such lavas would likely burn diamonds unless they were quickly quenched (cooled); andesite magmas erupt at lower temperatures of 1,500 to 1,800°F (andesites are found in many volcanic mountain ranges such as the Absaroka Mountains and Yellowstone in northwestern Wyoming), and rhyolite (equivalent to granite) erupts at around 1,200 to 1,500°F (rhyolites are less common other than in places like Arizona, where rhyolite flows and volcanoes are common in the south half of the state). So, diamond would likely survive in rhyolite magma, but, rhyolites are produced at relatively shallow depth in the earth's crust, too shallow to accidentally pick up diamonds. So don't waste your time trying to find diamonds in the Superstition Mountains of Arizona. Silica- and potassium-rich lamproites like those at Middle Table Mountain in the Leucite Hills of Wyoming are estimated to erupt at only 930 to 1,100°F. So diamond may be safe in these magmas if the magma cools rapidly.

In 1986, I didn't have a lot of information, so I wondered in diamond could survive in a hot lava. I did an experiment in my lab. I took a small industrial diamond and attempted to burn the diamond in an oxygen-rich Bunsen burner flame. A Bunsen burner can produce temperatures of **2,000 to 2,200°F**, high enough to burn diamond I was soon to discover. I placed the diamond in a crucible and directed the flame on the diamond. After several seconds, the diamond violently exploded (if you try this, be sure to wear safety goggles to protect yourself from diamond shrapnel). The residual of the explosion included tiny shards of diamond, many that were partially converted to graphite. I suspect that some of the diamond also produced CO_2 gas.

(*A note of interest - The Obama Administration's EPA recently listed CO_2 as a pollutant. Human and animal life also pollutes the atmosphere with every breath we take, but plant life must have our CO_2 for photosynthesis to grow and in the process produce oxygen for us to breathe. The concern is increases in CO_2 are causing global warming.*

A problem with this concept is there is a distinct correlation between sunspot activity and global warming and cooling; suggesting that variations in the temperature of our heat source (the sun) is the cause of global climate change. Another concern is what does carbon dioxide increases do to the planet? Does the gas trap significant amounts of heat in our atmosphere, or does the carbon dioxide fertilize more rain forests and coral reefs – we don't have all of the facts (actually we have few facts) and many facts have been distorted by scientists and politicians to promote their agenda and to make money, receive grants and put more controls and taxes on people.

In the past, our planet underwent several episodes of global warming and freezing long before humans arrived to drive cars and produce electricity from burning oil and coal, and long before greedy politicians discovered they could make a buck off of global warming. I'm no expert on global warming, but I can see there are concerns with both sides of this argument and not enough research that is independent of government contracts).

So, as I was getting ready to pack for Australia, I had only part of my questions answered. Diamonds do burn at temperatures close to magma temperatures. But could they survive the lamproite lavas? Based on the temperatures of the magmas and the temperatures of the ignition of diamond, it appeared some should survive in the hot temperatures of the magma (*Continued in the next issue*).

T he Vulture Gold Mine, Arizona

Not too long ago, after we moved to Arizona, my wife Sharon and I visited the historical Vulture gold mine. My first thought was that it was very likely past miners missed some gold in the operation. Let's look at this old mine.

When prospectors and treasure hunters think of gold in Arizona: it is the Lost Dutchman and/or the Vulture mine they think of first. The Lost Dutchman gold mine is just that, a myth chalked full of holes that has been embellished over time as any good legends should be. According to this legend, a rich gold vein was discovered by Jacob Waltz, a German immigrant, while prospecting in the Superstition Mountains east of Phoenix Arizona. If you've never been to Phoenix, the Superstition Mountains are a very impressive volcanic plateau, which rise from the valley floor at an average elevation of 1,100 feet to produce vertical cliffs that rise to more than 5,000 feet above sea level. Viewed from Apache Junction, the Superstitions are impressive. To see these first hand, search *Google Earth* for *'Superstition Mountains,*

Arizona'. These rugged mountains are part of a 25 million year old, resurgent, rhyolite dome.

When you back out of Google Earth to an eye altitude of 30 to 35 miles, you will see evidence of a circular structure that is 8 to 10 miles in diameter. This is the dome of an old caldera. The dome is formed primarily of rhyolite, a volcanic rock that is the fine-grained equivalent of granite. Rhyolite is found in a variety of colors, most notable are light gray to white or reddish-brown to pink.

According to historical documents, Jacob Waltz (the Dutchman) prospected the Bradshaw Mountains north of Phoenix from 1863 to 1867 and later died at his home in the Salt River valley (Phoenix area) in 1891. The legend suggests a box was discovered under his death bed that contained 48 pounds of high-grade gold ore consisting of quartz with considerable visible gold. An alleged sample of this gold was made into a match box, and the woman who provided care to Waltz in his last days came into possession of a map of the gold discovery, which some sources report she sold copies of for $7 each (a relatively high price in 1891).

Is there any truth to the Lost Dutchman? I'm no expert on the legend, but as legends go, they are best left for treasure hunters, the Obama Administration, parapsychologists and dowsers. Why waste one's time on myths when there are many other promising prospects in the state, such as the Mammoth mine and the Bulldog mine in the Goldfield district west of the Superstition Mountains, many mines in the Bradshaw Mountains, the Potato Patch, Rich Hill, and of course, the Vulture mine near Wickenburg. The Vulture gold mine, Arizona's historical large gold producer, may have a connection to the Lost Dutchman gold mine.

A tree for high-graders at the Vulture mine, Arizona (photo by the author).

The Vulture mine became known in the West for high grade gold ore. History reports that many people

made a living from high-grading ore from the mine (*today, we call these people Congressmen*) and some who were caught were hanged to try to stop theft. Following discovery of gold, the precious metal was mined over the next three years from high grade ore milled in a primitive arrastre constructed to the east at the nearby Hassayampa River. In 1866, a 40-stamp mill was constructed on the Hassayampa River 12 miles northeast of the mine (other sources report the mill was a 20-stamp mill) and gold was recovered from high-grade ore reported to assay 1.2 to 4.5 ounces per ton of gold (opt Au). To see the Vulture mine and ghost town area, visit the following coordinates on Google Earth - (33°49'N; 112°50'W) (***to be continued in the next issue of the GemHunter***).

LARGE PINK DIAMOND RECOVERED FROM AUSTRALIA

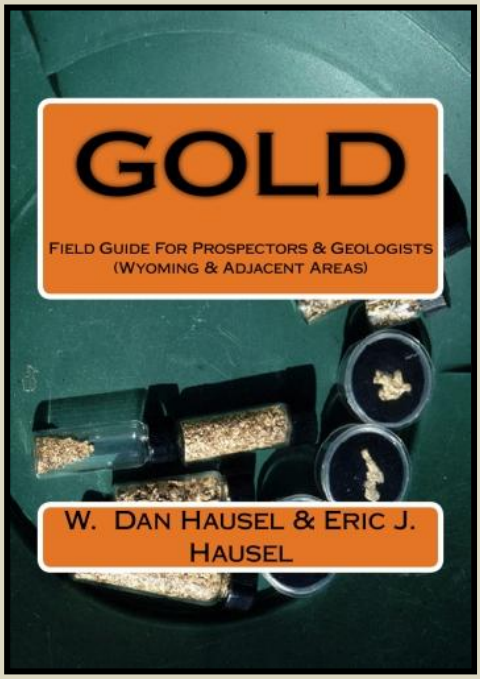
Argyle Pink diamonds are worth many times a similar weight in gold. They include some of the most expensive diamonds ever found per carat weight and are very rare. On my trip to Australia, I was unaware at just how expensive these gems were until I stopped in a jewelry store in Perth where they had a tiny, raw, uncut pink diamond less than 0.5 carat for sale. Now remember, to cut such a diamond into a finished gem could mean a loss of as much as half to 75% of the original stone. At this time in 1986, this raw diamond with several mineral inclusions was on sale for any collector crazy enough to spend $5,000. As a comparison, many raw, *uncut* white gem diamonds mined around the world at that time were selling for $50 to $150/carat.

Today, some faceted pink diamonds sell for as much as $1 million per carat! And pink diamonds of any size much larger than one carat are extremely rare. The recent recovery of the Pink Jubilee diamond at the Argyle Mine in northern Australia hit the news last month. The diamond is the largest pink diamond found at the mine and weighs 12.76 carats. Sounds large? Not really. The largest diamond ever found was the Cullinan diamond that weighed 3,106 carats.

GOLD – Field Guide for Prospectors & Geologists

Want to strike it rich? Our **new 366-page book** (***rated 5 out of 5 stars on Amazon***) is based on more than 30 years geological and prospecting experience by my son Eric and myself and designed to lead you to a gold prospect.

Since 1980, a few hundred previously unrecognized and ignored gold anomalies were identified in Wyoming and nearby areas, some of which could lead to a gold mine.



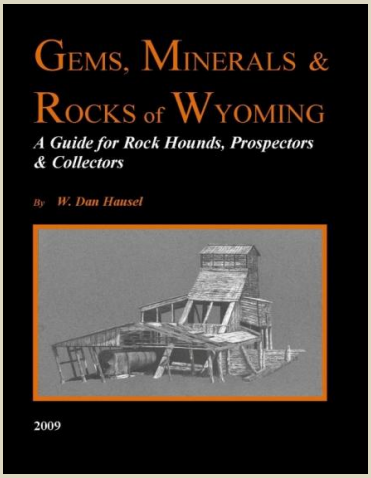
As an example, in 1981, I found a dozen specimens of quartz with visible gold on mine dumps near Bradley Peak. One sample with no visible gold but some pyrite and limonite assayed 2.87 ounces per ton in gold (*considered to be a very high gold assay*). A nearby iron formation sample assayed 1.15 ounces per ton in gold. Then the news was released and Wyoming's first gold rush in nearly a hundred years followed with dozens of exploration teams and claim staking groups rushing to the area. Believe it or not, this area and nearby drainages were held by a promoter who did practically nothing with the property and years later, the district again has been forgotten and remains mostly unprospected. In our book, we tell you where these samples were taken and describe nearby unexplored deposits that must contain some gold and probably some nuggets.

In that same year, I discovered a previously unknown gold district west of Casper. Gold anomalies were detected in a variety of rock types in the Rattlesnake Hills. I was positive this would lead to another gold rush – it didn't. This surprised me as I figured the Rattlesnake Hills had the best potential for economic gold deposits in Wyoming other than the Absaroka Mountains, which had all been quietly withdrawn and incorporated into wilderness, primitive, roadless areas, etc.

The Rattlesnake Hills was also highly recommended by me for drilling and research by the University of Wyoming Mining and Mineral Resource Research Institute, but the university didn't think much of the discovery and dropped funding for the project! But a mini gold rush occurred in the following year and led to exploration by a few companies. After 30 years, another company drilled deep in the one of the highly recommended prospects and hit rich gold at depth that is comparable to Cripple Creek! The deposit will likely become Wyoming's first hard rock gold mine in decades.

In our book, we also tell you how to recognize gold, where to look for it and what kind of rock it occurs in. We even tell you how to use a gold pan. Not only do we tell you exactly where most of these anomalies, mines and prospects are located, we also tell you what additional publications will assist you in finding more anomalies.

GEMS, MINERALS & ROCKS OF WYOMING



Gems, Minerals and Rocks of Wyoming – A Guide for Rock Hounds, Prospectors and Collectors **is available from Amazon: or order it from your local bookseller.**

Book reviews (*rated 4.6 out of 5 by Amazon customers*).

When I wrote this book, I wrote it for the amateur prospector, rock hound and mineral collector. I included photos of minerals, rocks and gemstones and made sure they were not world-class specimens simply because authors of most other gem and mineral books spent too much time looking in museums for perfect specimens which are seldom found in the field. Most photos are of common samples that I collected over the years. While working in Wyoming, I discovered dozens of previously unrecognized gemstone deposits, some that may be world class and some that were world-class. I found evidence for many other gemstone deposits in the Cowboy state that remain unexplored. I also discovered more than a hundred gold anomalies, found at least two major gold deposits, and identified more than 300 anomalies that appear to be kimberlite pipes most within known diamond districts or are located near known kimberlite deposits.

Unfortunately, any scientific book, even those written for the layman, can be challenging to anyone without scientific knowledge. In this book, I've tried to keep the information basic while including a little information for mineralogists. In other words, I've tried to satisfy people with many backgrounds. Hope you find this book useful.

Buy it, you will like it
By
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 - Gems, Minerals & Rocks of Wyoming: A Guide for Rock Hounds, Prospectors & Collectors
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 Gems, Minerals & Rocks of Wyoming: A Guide for Rock Hounds, Prospectors & Collectors
This is the best book I have ever read on Rouckhounding, For detailed info on specific areas of

Wyoming this book can't be beat. Dan Hausel is an expert in this area.

Jill Randolph **Gems, Minerals & Rocks of Wyoming: A Guide for Rock Hounds, Prospectors & Collectors**
I was surprised that diamonds aren't always found in coal! This was very informative on different minerals.

LINKS

The Gem Hunter
Geological Consultant
Prospecting for Diamonds
Ruby & Sapphire
World-Class Iolite-Ruby-Sapphire-Kyanite deposits
South Pass Gold
ICMJ Prospecting and Mining Journal
Books
Art by Dan

Gold Hunter
Gemstone Prospecting
Wyoming Gemstones
Diamonds
Jade
National Rock Hound Hall of Fame
University of Wyoming Awards
Wyoming Authors
WikiBin

GEMSTONE LINKS

Chromian Diopside
Commerical Gold Deposits at Rattlesnake Hills
Giant Opal Deposit
Peridot
World Class Iolite
Gemstones Minerals and Rocks
Guide to Quartz and Agate
Rock Hounding
Geology & Gemstones
PhotoBucket Diamonds

Garnet
Leucite Hills Peridot
Barite
Sloan Ranch Kimberlite & Diamonds
Diamond Mineralogy
Rockhounding for Garnet
Gemstone Capitol of the US
Tin Cup Jasper
Panoramio Photos
Gemstones Book

GOLD LINKS

Alaska Gold
Arizona Gold
Mountain of Gold
Colorado Gold
Rattlesnake Hills Gold
Douglas Creek gold & diamonds
Carisa Gold Mine
Prospectors' Guide to Gold
Montana Gold
HOW to Operate a Gold Pan
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Donlin Creek, Alaska
Seminoe Gold District
Copper King Gold deposit
Copper & Gold in Arizona
Ferris-Haggarty Copper Mine
Discovery of Nickel & Palladium
How to Find a Gold Prospect
Field Trip to Snowy Range
Past GemHunter & Keystone News
Mining Books

Wyoming State Gem & Mineral Society
Gold Prospecting Clubs

Prospecting Clubs
Prospecting Groups