

Where To Find Diamonds

by W. Dan Hausel

It is somewhat common for gold prospectors to find diamonds in black sand concentrates and not recognize them. I receive several inquiries each year from prospectors who believe they have diamonds in their concentrates, but can't find anyone to verify them. Diamond is not that difficult to identify with a microscope or hand-lens, but it is difficult to find someone with experience in raw diamonds who can confidently identify the gem.

During my first year as a research geologist for the Geological Survey of Wyoming, as it was known in 1977 (the agency changed its name periodically and is now referred to as Wyoming State Geological Survey), I was contacted by a prospector who asked if I could identify suspected diamonds in his black sand concentrates from a long-tom built on the side of Cortez Creek in the northwestern Medicine Bow Mountains of southeastern Wyoming. He found them during the previous winter while looking at his concentrates for gold, palladium and platinum, but couldn't find anyone at the university who could identify diamonds. So, right after I was hired by the Survey, he contacted me and I was able to verify them visually. To be 100% positive, I followed up with an XRD (x-ray diffraction) test. The diamonds were genuine with few flaws.

The original source for these diamonds has never been found, and most likely lies buried somewhere nearby. This is because Cortez Creek has a limited drainage basin and the only glaciers in this region during the last ice age were Alpine glaciers restricted to nearby high peaks, so it is unlikely that the diamonds were carried into the region by glaciers.

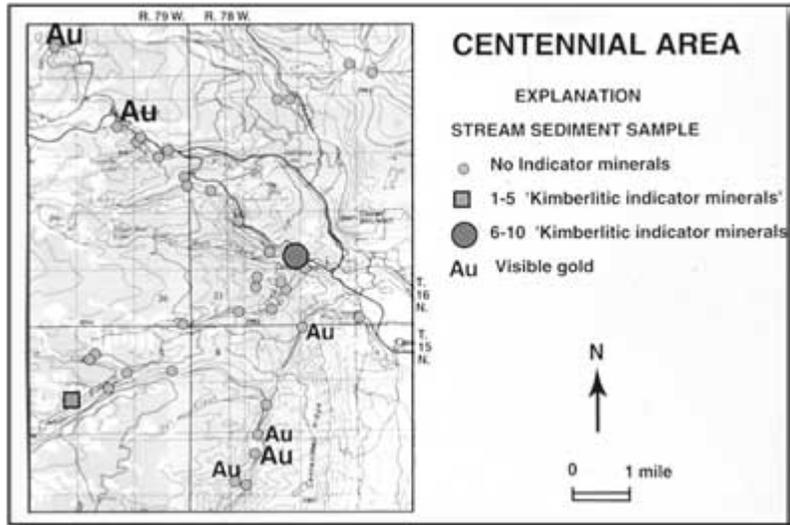
This part of Wyoming has many diamond-related anomalies. On one of my public field trips 8 years ago, some prospectors panned dozens of diamond indicator minerals (pyrope garnets) from a drainage located 15 miles east of Cortez Creek in the Middle Fork of the Little Laramie River of the Centennial Ridge district (Figure 1). Several years prior to this trip, some of our diamond research at the university led to identification diamond-indicator mineral anomalies in this area based on some of my past research.



Figure 1. Prospectors at Centennial Ridge search for gold, but only find diamond indicator minerals in the Middle Fork of the Little Laramie River. So many indicators were found in 2000 that it even surprised the author. Earlier research at Centennial Ridge showed visible gold in black sand concentrates (see Au on map below) at some sample sites, as well as a group of kimberlitic (diamond) indicator mineral anomalies. These anomalies suggest the presence of undiscovered kimberlite pipes in the region.

Follow-up exploration by Superior Minerals Company in the 1980s to find the source of the Cortez Creek diamonds,

identified a diamond-indicator mineral trail in the Iron Creek/South French Creek region to the south. This area is known for many gold and platinum mining scams because of the prominent massive pyrite in graphitic schist gossan, but the source for the diamond-indicator mineral trail was never found. More recent examination in the Medicine Bow Mountains using aerial-photos resulted in nearly 100 anomalies classified as cryptovolcanic structures with characteristics similar to kimberlite (one of the principal host rocks for diamonds). However, these all remain unexplored even though any one could be a significant diamond deposit. Even more recently, I was able to find more than 300 other cryptovolcanic structures within and adjacent to a known diamond district (State Line) and some of these may represent some of the larger kimberlite pipes found in the world.



Cortez Creek lies between the State Line district, the Iron Mountain kimberlites, the Green River diamond indicator mineral anomaly and the Leucite Hills lamproites, areas that have received diamond exploration activity (Figure 2). Most anomalies identified, to date, are marked on maps available to the public and provide an excellent starting point

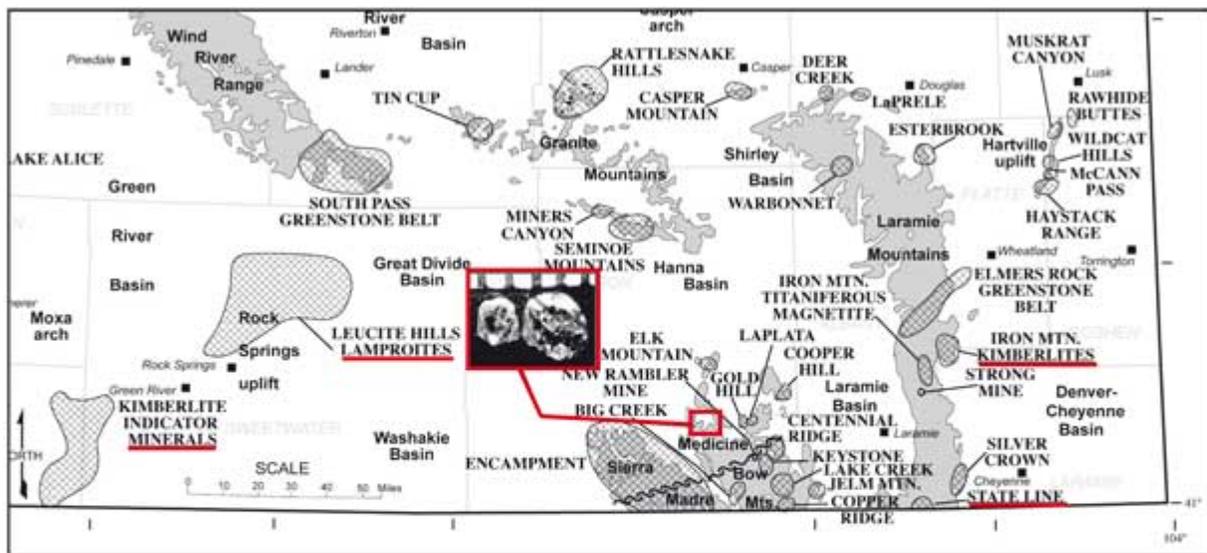


Figure 2. Map of Wyoming showing principal gemstone, precious and base metal mineralized areas and mining districts showing the two Cortez Creek diamonds recovered west of Gold Hill in the Medicine Bow Mountains. Areas underlined in red are mentioned in text. Diamonds and indicator minerals have also been found near Pinedale, in the Granite Mountains, north of Thermopolis, near Gillette, in the Haystack Range, in the Iron Mountain district, and throughout much of the Laramie and Medicine Bow Mountains. Several hundred anomalies have been identified and >130,000 diamonds have been recovered in this region with little exploration effort. This suggests to the author that this region probably encloses a major diamond province.

for diamond prospecting.

It is hard to imagine that nearly all of these anomalies remain unexplored. And with so many anomalies, one can almost guarantee that a major diamond discovery(s) will be made in this province in the future, when the right company invests in exploration, or when that one persistent prospector spends the necessary time to find the source of many of the anomalies.

Since diamonds are the hardest naturally occurring mineral on the surface of the earth, they are resistant to damage

during stream transport. This means that diamonds (unless they have internal flaws, such as many industrial stones) can be carried in streams over great distances.

The best model for diamond placers is southern Africa. The Orange River basin in southern Africa drains a region with more than 3000 kimberlite pipes including some of the richest diamond pipes in the world. Erosion of these pipes over the past 140 million years resulted in liberation of millions of diamonds. Many were captured by the Orange River and its tributaries and carried 700 to 1000 miles downstream to the Atlantic Ocean. River sediments from Kimberley to the Atlantic Ocean, and beach sands extending from Port Nolloth, Namaqualand at the mouth of the Orange River northward to Luderitz, Namibia, and southward to Mitchell Bay are enriched in diamonds eroded from the kimberlites.

Off-shore marine and beach placers in this region provide a seemingly endless supply of small gem-quality diamonds. The diamond placers extend along the shore to the north and south over a distance of 300 miles and are mined along the beach and in the ocean. Diamonds have been traced all the way to the edge of the continental shelf many miles from shore. The process of stream transportation and stream abrasion served to eliminate many flawed industrial diamonds, such that the placers are formed primarily of relatively small gem-quality diamonds.

Diamonds have moderate specific gravity (3.5) that is favorable for concentration with black sands. When found in streams, diamonds may have been liberated from nearby kimberlites, lamproites, or related lamprophyric pipes or dikes, or may have come from diamond pipes many tens of miles (even hundreds of miles) away. However, if the diamonds are found with the classical kimberlitic indicator minerals (pyrope, chromian diopside, picroilmenite, chromite) then the source of the diamonds must be much closer as these minerals do not survive large transportation distances. For example, pyrope may only be transported 1 to 3 miles before it is completely disaggregated in most streams. Chromian diopside typically does not survive transportation distances much greater than 0.25 to 0.5 mile. There may be many opportunities for prospectors to mine placer diamonds in the US, most notable is the Pacific Coast and the Colorado-Wyoming region.

Pacific Coast

Most geologists would not consider the Pacific Coast as a target for diamonds because the geology is not consistent with exploration models that indicate only very old crustal regions of the world are favorable for diamonds. However, this thought needs to be reappraised as there have been many discoveries made in younger geological terrains considered unconventional, such as California. The simple fact that many diamonds have been found along the Pacific Coast supports that some primary diamond pipes are likely to be found in this region.

California. California has been the third most productive region in the US for diamonds following the Colorado-Wyoming region and Murfreesboro, Arkansas. Placer diamonds were discovered at Placerville in the vicinity of Sacramento in 1849. Three years later, diamonds were found in the Cherokee placer gold mine near Oroville.

Between 1853 and 1918, about 400 diamonds and 600,000 ounces of gold were recovered from various placer mines along the Feather River near Oroville. It makes one wonder how many diamonds were not recognized by the gold miners. Drainages and tailings in the area likely have many hundreds (if not thousands) of diamonds. This area is dominated by Round Mountain which forms a prominent flat-topped mountain capped by basalt. The basalt overlies gold-bearing conglomerate. According to Mary Hill, diamonds were initially washed from conglomerate along the north end of Round Mountain at Cherokee placer and also found in gravel along the west bank of the Feather River at Thompson Flat, Yankee Hill, and Morris Gulch.

The largest diamond found in the area, known as the Moore diamond, weighed 2.25 carats. However, local folklore according to Rosenhouse claims that a diamond of 6 carats was found outside the entrance of the Spring Valley mine at Thompson Flat. Heylmun reported that a larger diamond of 7.25 carats was found to the southeast at French Corral.

Streams south of Placerville also yielded diamonds. Hill described more than 60 (the largest was 1.5 carats) at Jackass Gulch. At Fiddletown, diamonds were recovered from gravel under volcanic ash at Loafer Hill (the largest was 1.33 carats). At least 50 diamonds were recovered from the Placerville area from Live Oak Mine Reservoir Hill, Smiths Flat, Spanish Ravine, White Rock Ravine, Webber Hill, Wisconsin Flat, Texas Hill, Newtown, Fairplay and Prospect Flat. The diamonds were described as white, canary yellow, greenish, and blue, weighing from 0.1 carat to 1.82 carats. At least 13 stones weighed >0.95 carat. The primary source for the diamonds remains unknown, but the author believes that the most likely source is serpentinized breccia pipes to the east in the Sierra Nevada, which may be related to subduction of the Pacific plate riding under the continental plate.

Kunz reported that diamonds were found in the Trinity River region of northern California; in the vicinity of Coos Bay,

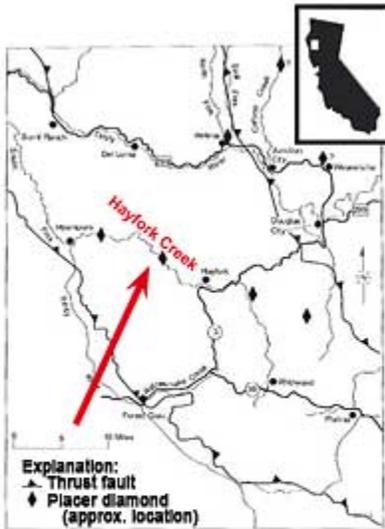


Figure 3. Diamond localities along the Hayfork Creek and Trinity River, northern California (after Kopf and others, 1990).

Oregon; and on the banks of the Smith River. Five large diamonds were recovered from a tributary of the South Fork of the Trinity River (Hayfork Creek). One was the 4th largest in the US and weighed 32.99 carats: it was a yellowish-brown opaque aggregate that would be unlikely to survive great transportation distances in a stream or river (Figure 3) according to work by Kopf and others.

At least four other large diamonds were recovered from Hayfork Creek: 17.83 carats, 14.33 carats, a poorly documented diamond estimated to weigh between 10 to 15 carats, and a 3.9 carat diamond. These, all being industrial diamonds, suggest minimal transport distance from the relatively nearby source rock.

Oregon. Kunz reported reported diamonds in black sands near Coos Bay, Oregon. Blank indicated that the number of recovered diamonds was estimated to be about 100—most yellowish in color and included some good quality diamonds up to 3 carats in weight.

Washington. Microscopic diamonds have also been described in black sands along the coast in the northwestern part of Washington. In 1932, a diamond of a little more than 4 carats was found in a Skamania County gold placer. The stone was a pale yellow octahedron.

Colorado-Wyoming Region

In the State Line district of Colorado-Wyoming, more than 40 diamondiferous kimberlite pipes and dikes were partially eroded during the past 300 to 600

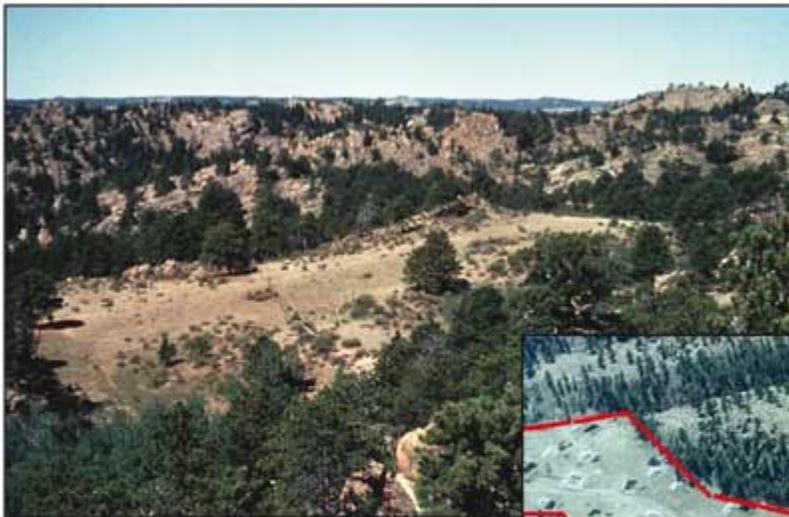


Figure 4. The Schaffer 15 kimberlite in Wyoming (left) forms an open park in the forest. The same is true for the diamond-rich Sloan 1 kimberlite.

(Right) The shape of these kimberlites shows a distinctly elongated morphology suggestive of deep erosion supporting that a considerable amount of the diamond-bearing kimberlite column has been removed by past erosion.



million years. In addition to the known kimberlites, the author found evidence for another 300+ probable pipes in this region, thus there are considerable primary source rocks to supply some potentially rich diamond placers.

The geology provides evidence that essentially all streams draining the State Line area to the south into Colorado should contain many hundreds of thousands to potentially millions of diamonds, yet practically no placer mining has occurred in the district.

Kimberlites in the State Line are 600 million and 350 million years old. Elsewhere, diamondiferous intrusives are found to the west, which are about 50 million years old. Diamondiferous kimberlite in eastern Montana is also 50 to 60 million years old. Thus, there has been ample time for considerable erosion.

Kimberlite magma erupts from unusual volcanoes known as pipes that are circular in morphology (Figure 4). However, at about 1,000 to 2,000 feet deep, the kimberlite pipe will take on the characteristic shape of the feeder fractures that it migrated along at depth. The fractures being linear results in the kimberlite having a more elliptical morphology at depth that progressively become more and more linear until a feeder dike is intersected at depths of 2,500 to 4,000 feet.

Interpretations based on morphology and kimberlite type (facies) suggest that 2,000 to 3,000 feet of upper diamond pipe column was eroded in the past. The many hundreds of thousands of diamonds from the upper parts of the kimberlite pipes thus lie somewhere downstream within a few feet to many miles.

Hundreds of thousands (if not millions) of diamonds were probably carried downstream from kimberlites in the State Line district. According to McCallum and Mabarak, the state line diamond pipes may have lost 2,000 feet of vertical column of diamond-bearing rock and the Iron Mountain district to the north could have lost as much as 4000 to 5000 feet due to erosion. Why no diamonds were found in this region in the 1800s as in California is simply due to the fact that the Californian diamonds were found as a by-product of considerable gold mining. In the State Line district, where the country rock is unmineralized granite, there was little to no placer gold mining in past years. Even so, a few diamonds were accidentally found by Frank Yaussai while placering for gold on the North Fork of Rabbit Creek adjacent to the Sloan kimberlite in the past, but few people believed him at the time.

During some of the early testing of the Kelsey Lake kimberlites along the Colorado-Wyoming border, a 6.2-carat diamond (and other smaller diamonds) was found in Fish Creek according to Howard Coopersmith. Using only a gold pan, another prospector (Vic Norris) panned a diamond in a very short time from the Poudre River. Superior Minerals Company also recovered placer diamonds downstream from the George Creek kimberlite dike. Diamonds from the district have ranged from microdiamonds to gemstones up to 28.3 carats. One diamond fragment came from an estimated >80 to 90 carat diamond.

Summary

Essentially, every kimberlite in the State Line district is diamondiferous. The George Creek kimberlites yielded the greatest number of diamonds: during testing, these produced more than 89,000 diamonds in the 1980s. These diamond-rich dikes undoubtedly supplied tens of thousands of diamonds in George Creek and Poudre River to the east. Another good source for placer diamonds is the Sloan kimberlites adjacent to Rabbit Creek. These yielded about 40,000 diamonds during bulk sampling tests in the early 1980s, including stones as large as 5.51 carats. But like all of the diamond mining operations in this district, the recovery mills were poorly designed which resulted in many of the diamonds not being recovered from samples during testing, and the rejection of essentially all large diamonds. As unthinkable as it may seem, the North Fork of Rabbit Creek was not tested for diamonds—yet some diamonds were found in this drainage at the Yaussi placer. Fish Creek, George Creek, Rabbit Creek, the Poudre River will all contain diamonds. Since about 30 to 50% of the diamonds have been gem quality from the kimberlites, a fortune in diamonds awaits the right, persistent prospector.

As a final note, when searching the BLM records of mining claims in this area, it is apparent that some of my past research is getting noticed. I was surprised to see all of the claim blocks that are now tied up in the State Line district. However, there appears to be a considerable area that is open to leasing or claim staking – to search the claim records—access (<http://www.geocommunicator.gov/NILS-PARCEL2/map.jsp>). If you decide to prospect in this area, I found many land owners are difficult to deal with and the rattlesnakes in the valleys should be avoided (along with some landowners).

In an upcoming issue, I will show the reader a method that can be used to find diamond pipes from your home computer.

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