

WHAT ARE DIAMONDS?

Diamonds are formed from pure carbon, one of the most abundant elements on planet Earth. Diamonds, even from ancient times, have been sought for their extraordinary hardness (they are the hardest substance known) and their brilliance, especially in the colorless transparent gemstone variety. Ironically the other form of pure carbon is graphite, which is very soft with a soapy feel and a dull gray color. Graphite is commonly the “lead” in a pencil.

The Mohs Hardness Scale of minerals starts at 1 (talc) and ranges to 10 (diamond). That does not mean that diamonds are ten times harder than talc; mineral number 9 on the Mohs scale is corundum, a class of minerals which includes rubies and sapphires. Diamonds can be from ten to hundreds times harder than corundum.

Diamonds themselves vary in hardness; for example, stones from Australia are harder than those found in South Africa.

The four main optical characteristics of diamonds are transparency, luster, dispersion of light, and color. In its pure carbon form, diamond is completely clear and transparent. As in all natural substances, perfection is nearly impossible to find. Inclusions of other minerals and elements cause varying degrees of opacity. The surface of a diamond can be clouded by natural processes, such as the constant tumbling and scraping in the bed of a river.

Luster is the general appearance of a crystal surface in reflected light. Luster of a smooth crystal face of diamond is strong and brilliant. It is intermediate between glass and metal and has its own special term—adamantine.

The process of white light breaking up into its constituent colors is called dispersion. Diamonds have strong dispersion, which along with their strong luster, causes the beautiful play of colors so often referred to as the “fire” of a diamond.

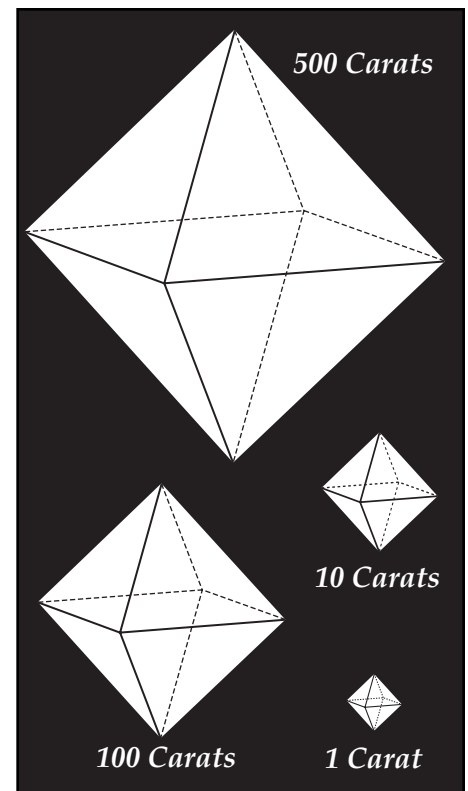
Gemstone varieties of diamond are usually clear and colorless, often containing minor inclusions

and imperfections. Yellow or yellowish-brown and even brilliant yellow diamonds have been found. Very rarely, diamonds are blue, black, pale green, pink, violet, and even reddish.

The most famous blue diamond, the Hope Diamond, is intertwined with Colorado’s mining history. Thomas Walsh, discoverer of the rich Camp Bird Mine near Ouray, purchased the Hope Diamond for his wife in the early 1900s; it was later given to his daughter, Evelyn Walsh McLean who wore it almost continuously until the 1940s. The 45.5-carat Hope Diamond now resides at the National Museum of Natural History in Washington, D.C.

Diamonds, in their perfect cubic crystal form, occur as isolated octahedral (eight-sided) crystals (see figure below). Many variations on the cubic form are found in

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Actual size of octahedral diamond crystals from 1 to 500 carats.

MODIFIED FROM BAUER, 1968

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nature, including twelve-sided crystals and a flattened triangular shape known as a macle. Gemologists recognize three main varieties of diamonds: ordinary, bort, and carbonado. Ordinary diamonds occur as crystals often with rounded faces, from colorless and free from flaws ("the first water"*) to stones of variable color and full of flaws. Bort diamonds occur in rounded forms without a good crystal structure. They are generally of inferior quality as a gemstone. Carbonados are black opaque diamonds usually from the Bahia Province of Brazil. They are crystalline but do not possess the mineral cleavage found in ordinary diamonds.

* An expression which refers to the highest quality diamonds and has come to mean the highest quality of just about anything.

WHERE DO DIAMONDS COME FROM?

Diamonds form in nature only under the extreme conditions found in the upper mantle at depths of 150 to 200 kilometers (possibly down to 300 kilometers): pressures of greater than 50 kilobars (50,000 × normal atmospheric pressure) and temperatures of 900 to 1,300°C and possibly higher. The diamonds form as minerals within rocks of the upper mantle called *eclogite* and *peridotite*. Eclogite is a coarse-grained rock consisting of red garnet (almandine-pyrope) and a green pyroxene (omphacite). Peridotite is believed to be the most common rock of the upper mantle; it contains varying amounts of three minerals, olivine, orthopyroxene and clinopyroxene. The olivine rich peridotite is called *dunite*, and the pyroxene rich rock is called *websterite*. The rock *harzburgite* contains up to 40 percent orthopyroxene and 60 to 90 percent olivine and is thought to be the most common host rock for diamonds.

If diamonds are formed at depths of 150 to 200 kilometers in the upper mantle, how do they get to the surface of the earth? They are brought to the surface in a peculiar igneous rock called *kimberlite* (named after the diamond-bearing region of Kimberly, South Africa where these rocks were first identified.) Kimberlites are intrusive bodies that originate in the upper mantle and are injected upward through the upper mantle and the lower and upper crust, eventually reaching the earth's surface as a small volcanic complex (see figure on p. 3). Kimberlites have three facies correlative to their position in the mantle and crust: the root facies, the diatreme facies, and the crater facies. The shape of the kimberlite shown in the figure is similar to that of a carrot or a pipe; a comparatively wide upper zone, up to several hundred meters in diameter, in the diatreme and crater facies; to a lower zone, which narrows into a thin intrusive dike, possibly only a meter thick, in the root facies. The forceful intrusion of the kimberlite brecciates* the surrounding rocks of the upper mantle and crust and incorporates them as xenoliths (xenolith literally means "foreign rock"). Often these xenoliths of the upper mantle peridotites or eclogites contain diamonds.

Diamonds, being mostly pure carbon, are not amenable to modern methods of age-dating rocks (Carbon 14 dating methods are useful with materials less than about 50,000 years. Most rocks are millions to billions

* means to break apart into smaller angular fragments. A rock composed of angular fragments is referred to as a breccia.

years old). With recently developed age-dating techniques, the small inclusions of other minerals in diamonds (such as garnet) can be dated. Recent dating of inclusions in diamonds from kimberlite pipes, mainly in South Africa and Australia, indicate that diamonds formed as early as 3,300 million years ago to as late as 990 million years ago, an extended period of the earth's history. Diamonds can be vastly older than their host kimberlites. Diamonds from the Kimberly Mine in South Africa were dated at 3,300 million years. The kimberlite, which carried the diamonds to the surface and is the present host rock, was intruded only about 100 million years ago.

Kimberlites ascend rapidly to the earth's surface at rates thought to be on the order of 10 to 30 kilometers per hour. There is usually no evidence of any substantial thermal reaction with the surrounding country rock. In the near-surface environment, velocities may increase to several hundreds of kilometers per hour because of gas expansion in the ascending magma and reaction with water. Craters, tuff rings, and maars form as the highly charged kimberlite magma erupts at the surface (see figure below).

Kimberlites, though rare, are widespread throughout the surface of the earth. Most well known diamond-producing pipes are small, 12 to 75 acres, and they generally occur in clusters of six to forty pipes. Almost all diamond-bearing kimberlites are found in the ancient stable cratons of the continents, never in oceanic crust or in younger mountain belts, like the Alps or the Sierra Nevada in California (see map on p. 4).

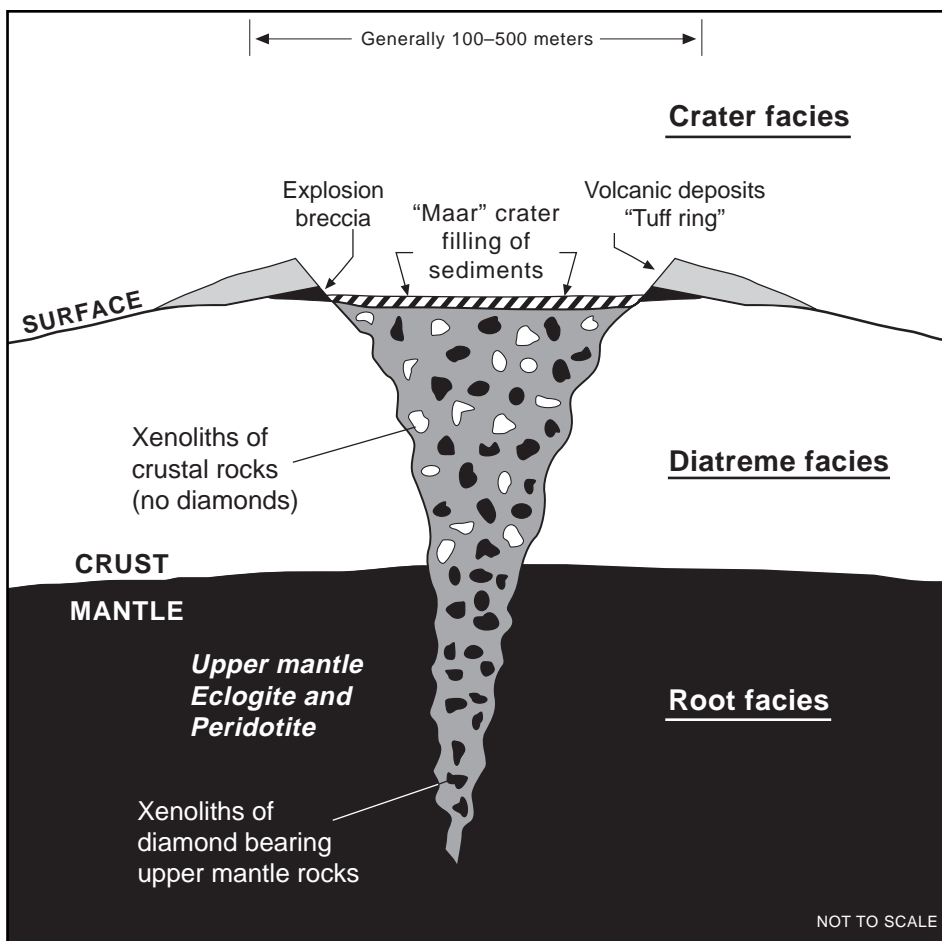


Diagram of an idealized kimberlite intrusion.

Field Notes from the Director



The Colorado Geological Survey (CGS) obtains a portion of its funding from its share of the Operational Account of the Severance Tax Trust Fund. This fund was established in 1996 through the passage of Senate Bill 170 and received wide support from our advisory committees, geological associations, and trade organizations. The law allocates 25 percent of the severance tax collections to the Department of Natural Resources Operational Account. The CGS may request up to 20 percent of the annual funds in the Operational Account for programs related to mineral and mineral fuel development, critical geological hazards, water quality data, and, as of fiscal year 1999-2000, to partially support the Colorado Avalanche Information Center.

Severance taxes are special excise taxes on the nonrenewable natural resources that are removed from the earth and sold for private profit. Because the value of the resource is irretrievably lost to the State of Colorado, the General Assembly imposed the severance tax in 1978. All of Colorado's neighboring states have similar

Field Notes continued on page 10

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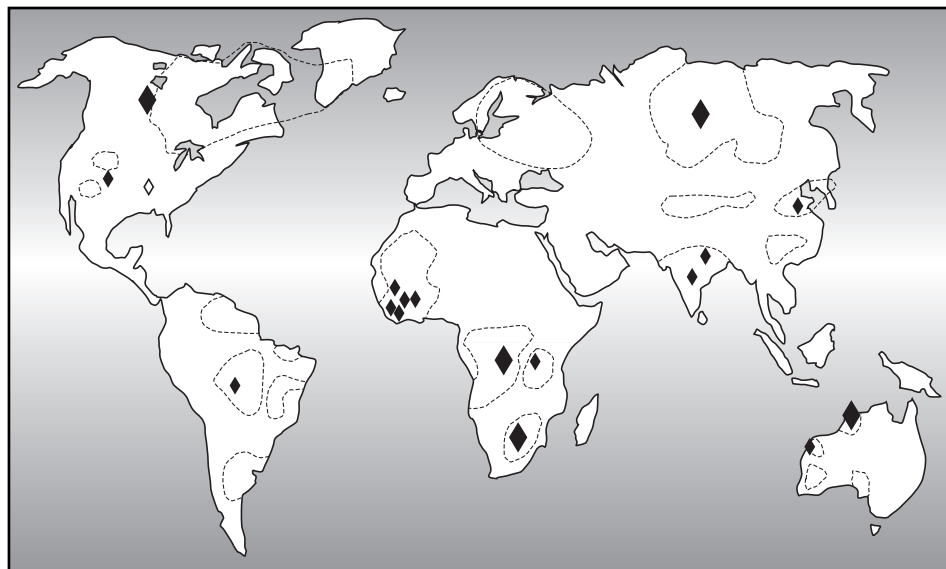
DIAMOND MINING

Commercial diamonds occur in *lode* or primary deposits, like the kimberlites described in the previous article, or in *placer* deposits. Lode or primary deposits are occurrences where the valuable minerals are found in the rock in which they were formed (in the strictest sense kimberlites are not the rocks in which diamonds form—they are just the transporting agent). Placer deposits are formed where minerals with high density, like diamonds or gold, are worked from lode deposits, like kimberlites, by the forces of erosion (water, ice, wind, etc.) and carried by streams or glaciers to sites where they are deposited such as riverbeds or beaches. Because of their high density, these “heavy” minerals are deposited near the base of a section of beach sand or stream gravel. Diamonds, because of their hardness and density, are well preserved in placer deposits.

The first known diamond mines were in India and date from about

2,000 years ago. The Indian diamond occurrences are in placer deposits formed in ancient streambeds. There is no known primary kimberlite source for these diamonds. Some of the world’s most fabulous diamonds come from India including the Koh-I-Noor (literally means “mountain of light”—now a 109 carat cut stone that is part of the British Crown Jewels on display at the Tower of London) and the Hope Diamond, a blue diamond, which was discussed earlier.

In the 17th century, diamonds were discovered in Brazil, again in placer deposits. In 1870, lode deposits of diamonds were discovered in the rich kimberlite pipes of Kimberly, South Africa. As in all mineral rushes, prospectors later found many diamond-bearing kimberlites in other parts of South Africa. Very rich placer deposits in beach sands along the coast of Namibia (southwest Africa) were discovered during this period of



Diagrammatic world map of primary lode diamond deposits showing cratonic areas (dashed lines) with major economic diamond deposits (large solid diamonds), minor economic deposits (small solid diamonds) and subeconomic deposits (small open diamonds). MODIFIED FROM KIRKLEY, GURNEY, AND LEVINSON, 1992

time as well. Later, placer and lode diamond deposits were discovered in Congo and several other central African countries, and in all other continents except Antarctica.

In the United States, there are a few scattered and isolated placer diamond occurrences in Nevada, California, the southeast, and upper Midwest states. These occurrences are in glacial deposits from the Ice Age (about one million years to about 10,000 years ago). These diamonds are thought to have originated in primary lode deposits in Canada and then carried far south in glaciers and rivers. Just a few years ago, rich diamond-bearing kimberlites, a probable source for the glacially deposited diamonds, were discovered in the Northwest Territory of Canada following a persistent and determined prospecting program.

Kimberlites are known from several localities in North America. Diamonds of commercial interest were first found in 1906 in Murfreesboro, Arkansas. Attempts to mine these lode deposits were not commercially successful and today the area is an Arkansas State Park where anyone, for a small fee, can go and prospect for diamonds. Diamonds from the State Line kimberlite district along the Colorado–Wyoming border were not recognized until 1975 and will be discussed later.

Most of the economic value from diamond-bearing kimberlites lies in the fraction of diamonds that are of gem quality. Most economic kimberlite ore bodies contain about 20 to 40 percent gem-quality diamonds. Non gem-quality diamonds are called industrial-quality diamonds. They are used in a variety of industrial applications including core drilling bits and other special applications. The grade of typical ore bodies, which includes industrial to gem-quality diamonds, varies from 10 to 20 carats per 100 metric tons up to hundreds of

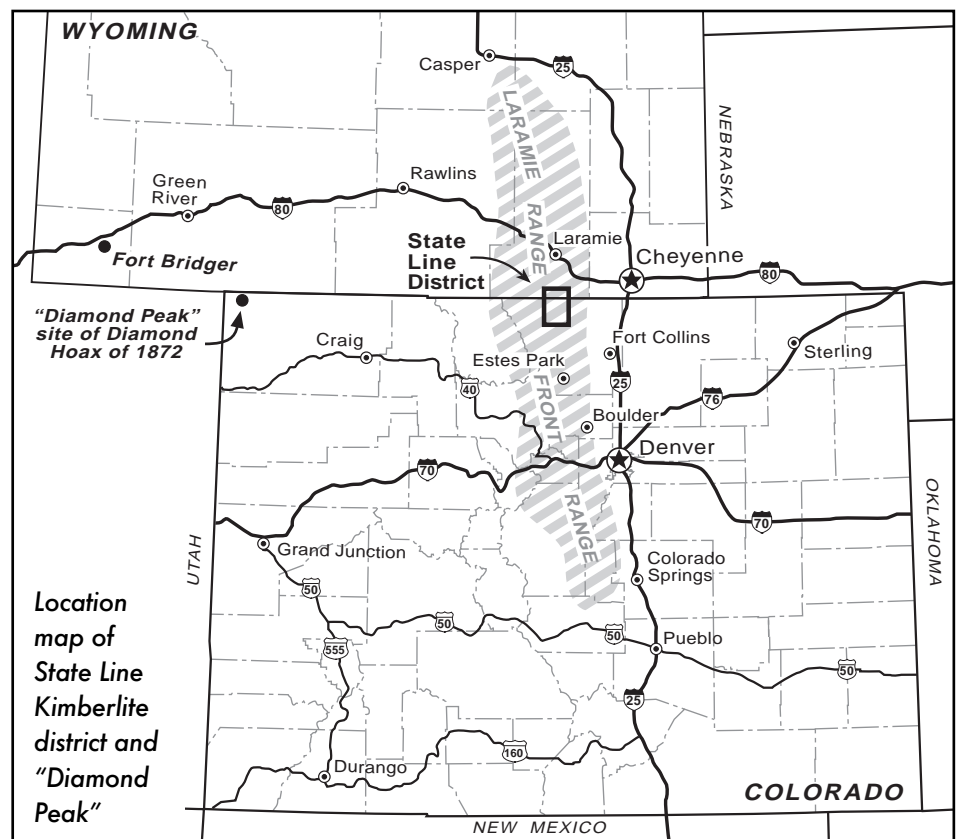
carats per 100 metric tons. The low grade of most commercial diamond deposits means that over 25 tons of material must be mined to obtain five carats of diamond (a carat, the nominal commercial unit of measurement of diamonds is equal to 0.2 gram).

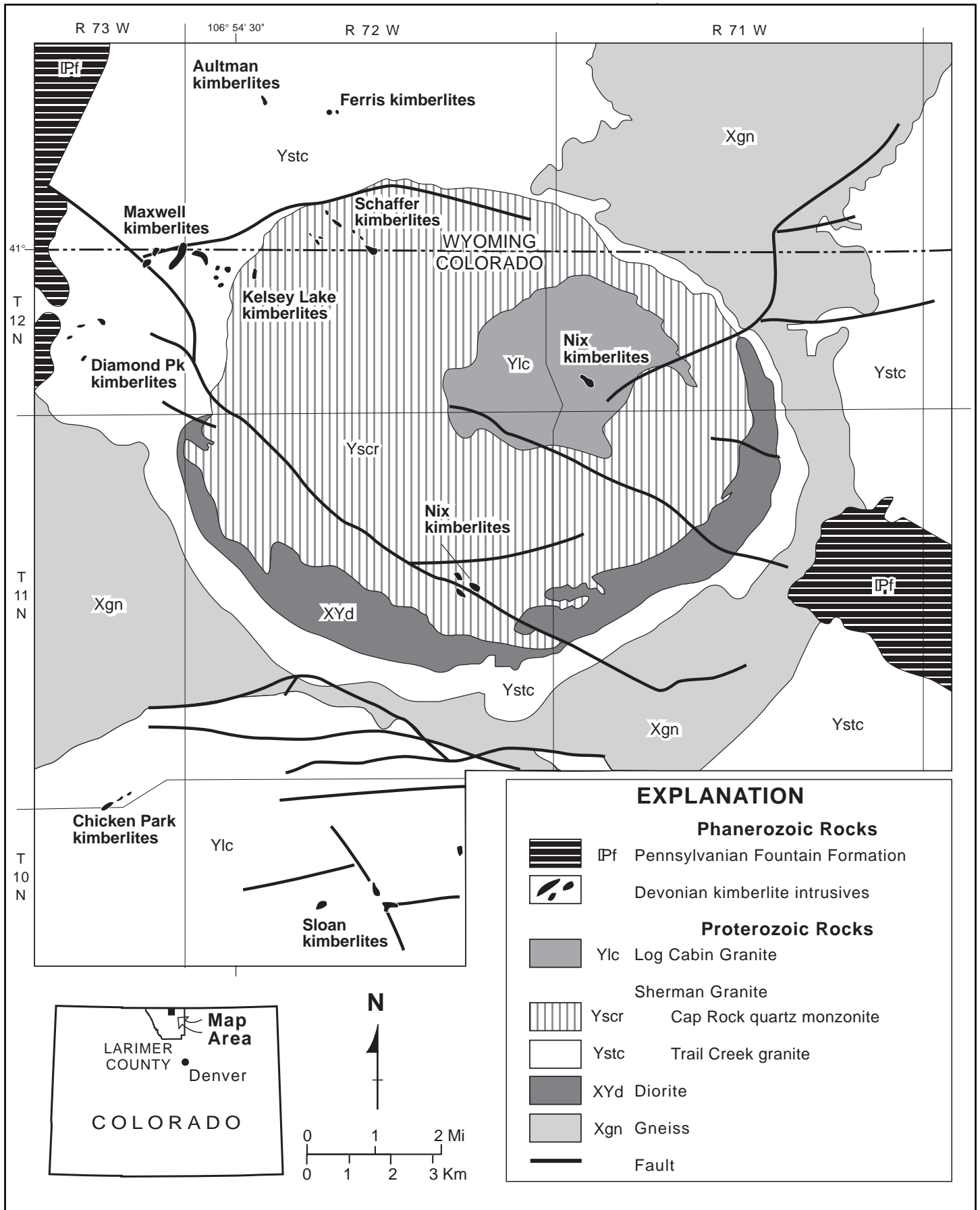
Most diamond mines operate by essentially the same simple method. The diamond-bearing material, either kimberlite or placer gravel, is mined and broken apart in a mill or crusher. This material is then washed and placed in centrifugal diamond pans—essentially a large version of a typical prospector’s gold pan. Because diamonds are denser than most other minerals, they are concentrated at the bottom of the pan. The “tailings” are washed off and the water-saturated concentrate of heavy minerals and diamonds is passed over a greased vibrating table. The diamonds stick to the grease while the other minerals flow off in the sheet of water. The diamonds are then recovered from the grease.

DIAMONDS IN COLORADO

It was not until 1964 that the odd “breccias” around the Wyoming–Colorado state line in the Front Range and Laramie Range were recognized as kimberlites. Over the ensuing years, about 100 kimberlites have been discovered in the area from Green Mountain west of Boulder to the north end of the Laramie Range in Wyoming (map below). There are approximately 40 known kimberlite pipes in the State Line district (map on p. 6)). They range in size from a few feet to nearly 1,800 feet in diameter and generally have an ellipsoidal to elongate shape.

Kimberlites from the State Line district contain significant numbers of xenoliths (see photo on p. 7) that include Lower Paleozoic sedimentary rocks; Proterozoic crystalline rocks, including granites



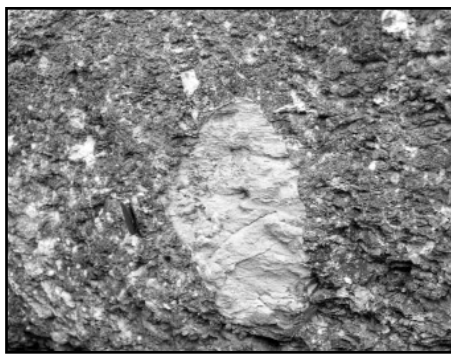


Generalized geologic map of the State Line district, Larimer County, Colorado. FROM CAPPA, 1998

and schists; and upper mantle nodules of spinel and garnet peridotite, garnet clinopyroxenite and websterite, dunite, eclogite, and solitary large crystals. The xenoliths, along with olivine crystals, are set in a fine-grained matrix of serpentine, carbonate, iron and titanium minerals, and other secondary minerals.

The Schaffer number 3 kimberlite was dated at 377 million years—during the Devonian Period (see map on p. 6).

Kimberlite from the Green Mountain area west of Boulder differs from the State Line district kimberlites in that the Green Mountain kimberlite has larger crystals of ilmenite and olivine, up to a centimeter in diameter. The Green Mountain kimberlite was dated at 367 million years.



A xenolith of a light-colored Lower Paleozoic sedimentary rock at the Kelsey Lake Mine. Note pocket knife for scale. Dark colored rock surrounding the xenolith is kimberlite.

The Estes Park kimberlite is a short distance south of the town of Estes Park and was discovered in 1975. The dike is one to two yards wide and trends in a northerly direction for approximately a quarter mile. Like most of the other kimberlite bodies in the Wyoming–Colorado region, it has an age of 377 to 395 million years. Recent age dating by the University of Colorado suggests that some of the kimberlites in the district were emplaced as early as 640 mil-



High wall of an open pit at the Kelsey Lake Mine. CGS staff are inspecting the kimberlites and looking for some diamonds.

lion years ago—during the Late Proterozoic.

The Kelsey Lake kimberlites form a small group of eight irregular pipes and fissures mostly of diatreme facies kimberlite (see map on p. 6). The pipes intrude the Proterozoic Sherman granite and are structurally controlled by joint patterns in the granite. The Kelsey Lake 1 kimberlite consists of multiple phases of diatreme and possible crater facies kimberlite. The Kelsey Lake 2 pipe is a multi-phase diatreme facies kimberlite complex.

Diamonds in the kimberlites of the State Line district were discovered in 1975 when a U.S. Geological Survey technician was having difficulties making a thin section of a garnet peridotite nodule from one of the State Line district kimberlites. After noting deep scratches on a grinding plate used in preparing the thin sections, the technician found that a tiny white diamond crystal, less than 1 millimeter in diameter, made the scratches. Generally most diamonds from the State Line district show well-developed octahedral faces. The diamonds are predomi-

nately colorless to white, though some are grayish-black owing to inclusions of graphite.

Shortly after the discovery of diamonds in the kimberlites of the State Line district, mining companies began a vigorous exploration campaign in the district. Superior Oil Company extensively tested the Sloan kimberlite during the early 1980s (see map on p. 6). The grade of the Sloan kimberlite varied from 8 to 20 carats per 100 metric tons. Fifteen percent of the diamonds were gem-quality, 65 percent were near-gem, and 20 percent were industrial. However, the economic potential of the prospect was limited by a lack of large stones; the average weight of the diamonds was 0.01 carat and the largest was only 1.24 carats. More recently, in 1995, a small mining company drove a test adit in the Sloan kimberlite and, again, conducted test processing; however, this program was not an economic success.

Cominco American, Inc. completed similar testing programs at the Schaffer and Aultman kimberlites (map on p. 6). Approximately 8,000 metric tons of kimberlite

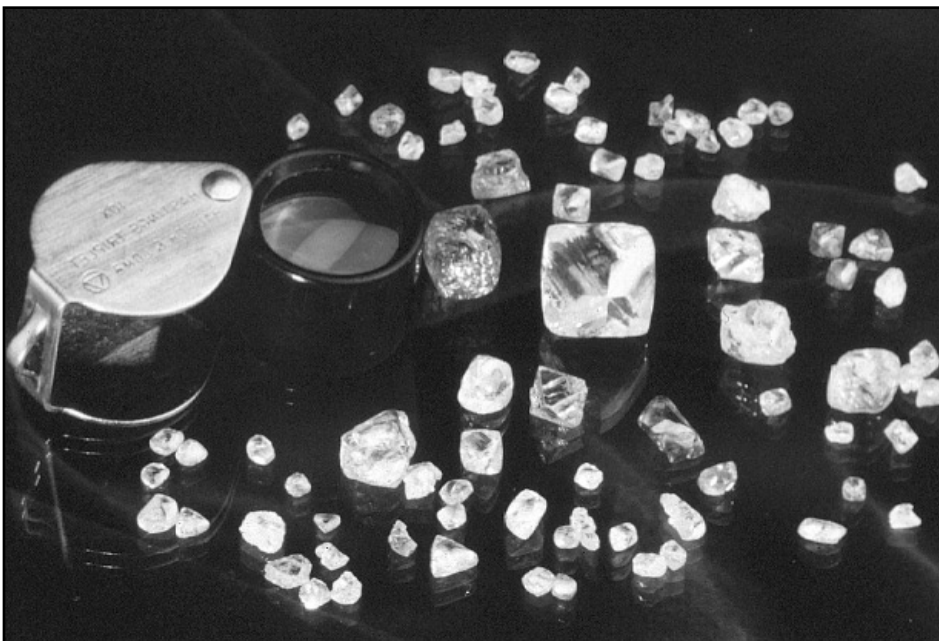


Diamond processing plant at the Kelsey Lake Mine, Larimer County

were bulk sampled and the grades ranged from 0.5 to 1.0 carat per 100 metric tons; gem quality stones were about 20 percent of the sample—about the same as commercial diamond mines in South Africa.

The Kelsey Lake prospect consists of eight kimberlite pipes. In 1995, Colorado Diamond Co., a subsidiary of Redaurum Red Lakes

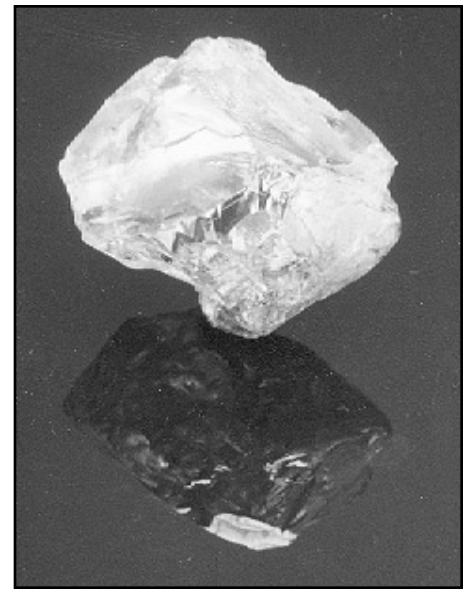
Mines Ltd. of Toronto, announced a 300,000-ton per year trial mining program on their Kelsey Lake kimberlite prospect. Open pit mining began in late 1996 on the Kelsey Lake 1 and Kelsey Lake 2 kimberlites, the two largest pipes, which have a surface area of about 20 acres. The \$2 million processing plant began production in the spring of 1996 (see photo above).



Sample of diamonds from Kelsey Lake Mine. The 14.2 carat diamond is the large octahedral diamond near the center of the photograph. COURTESY OF HOWARD

The Kelsey Lake Mine was North America's first commercial diamond producer. In late 1998, a second diamond mine, much larger than Colorado's Kelsey Lake Mine, commenced production from kimberlite pipes in Canada's Northwest Territory.

A 14.2-carat, gem-quality white diamond was recovered from the Kelsey Lake kimberlite during bulk sample testing in 1994 (photo at bottom left). During the summer of 1996, a 28.3-carat, gem-quality yellow diamond was unearthed. These two diamonds



Raw 28.3 carat yellow diamond recovered from the Kelsey Lake Mine, Larimer County. Approximate size is 10 mm by 14 mm. COURTESY OF HOWARD COOPERSMITH

were the largest ever recovered from the State Line district. The 28.3 carat yellow diamond is the fifth largest found in the United States.

In July 1997, the company recovered two gem-quality stones weighing 28.2 and 16.3 carats (even though these Kelsey Lake diamonds are large, they do not even compare to the largest diamond ever found; the Cullinan

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THE GREAT DIAMOND HOAX OF 1872

In mid-1872, the financial and mining barons of San Francisco were excited about a new diamond field discovered somewhere in the American West, most likely Arizona, so the speculation went. Two prospectors, Philip Arnold and John Slack, were showing off a bag of diamonds and other gems from their secret claim. Arnold and Slack were able to gain the interest of William Ralston, the influential President of the Bank of California.

Ralston formed a new company and hired well known mining experts Henry Janin and George Roberts to accompany Arnold and Slack to the secret location of the diamond field to validate their claims of discovery. Amidst much secrecy, Janin and Roberts went off with the two prospectors by train to Fort Bridger, Wyoming (see map on p. 5) and returned with 286 diamonds, which they had discovered on Arnold and Slack's snow-covered claim. Janin staked other claims in the area to protect Ralston's financial interests.

Affirmation of the presence of diamonds in the West, especially coming just two years after the discovery of the fabulously rich Kimberly diamonds fields in South Africa, fueled a mania of speculation and intrigue concerning the location of the diamond field. Arnold and Slack sold their interest in the claim to Ralston for \$360,000 cash and a stock interest in Ralston's new company, which they later sold for \$300,000.

Clarence King was a geologist, working in California at that time (see photo above), who had conducted geological surveys for the federal government along the Fortieth Parallel in northern Colorado and Wyoming. However, in the fall of 1872, he was recuperating in California from the rigors of field work when news of the new diamond discovery came to him. King reviewed the facts from Janin and Roberts' reports. He deduced that the secret diamond discovery lay not in

Arizona, as many had thought, but along the area of his recently completed Fortieth Parallel survey.

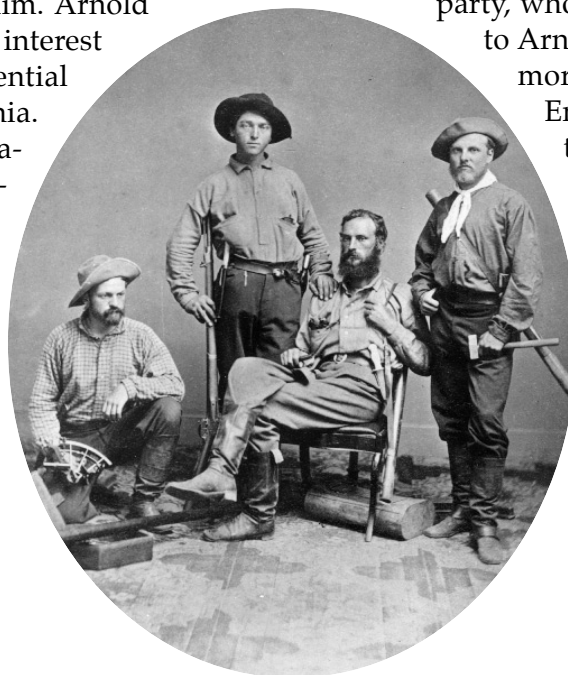
Some of King's colleagues, including Samuel F. Emmons and James Gardiner, from the Fortieth Parallel Survey happened to be on the same train from Wyoming as the secretive Roberts and Janin

party, who were returning from their visit to Arnold and Slack's claim. A few more pieces of evidence led King, Emmons, and Gardiner to place the diamond fields within a radius of 15 miles near the northeastern edge of the Uinta Mountains and Browns Park along the Colorado–Wyoming border. Emmons, Gardiner, and Clarence King took the train to Fort Bridger, Wyoming and then headed south into the Browns Park region of northwestern Colorado—an area now known as “Diamond Peak” (map on p.5).

On November 3rd, in bitter weather, the party reached the suspected diamond area, and they almost immediately found a claim

notice signed by Henry Janin. They came up on a shelf of sandstone jutting out from a mesa where they found several rubies and a few diamonds. Needless to say, the “diamond fever” swept the party hard and by evening, they were all believers in the veracity of the new diamond field.

The next day, the party continued to find more rubies and diamonds; however, King and Emmons were bothered by the fact that rubies and diamonds always seemed to occur in a twelve to one ratio. King's doubts increased when he found a precious stone perched precariously on a knob of the sandstone. (Harpending, in his book on the subject, reported that one of King's party was a German lapidarist who found a cut stone, sure evidence of a hoax). Further work by the party unearthed amethysts, emeralds, sapphires, garnets, and spinels—



Clarence King (far right) and company. USGS LIBRARY

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minerals that never occur in nature together. King and his colleagues determined that the “new Golconda*” had been “salted**” and was, in fact, a huge swindle.

King hastened back to San Francisco, arriving on November 10th, and reported the results of his investigation to Janin and Ralston—“the new diamond fields on which are based such large investments and brilliant hope are utterly valueless, and your selves and your engineer, Mr. Henry Janin, are the victims of an unparalleled fraud.” Ralston wished to confirm King’s findings and with winter hard on their heels, King and several of Ralston’s men went back to the diamond fields and confirmed that it was indeed a bitter hoax.

The diligent scientific and forensic work of Clarence King and his colleagues unearthed the great diamond hoax. The notoriety of this hoax propelled King to the directorship of the U.S. Geological Survey in 1879. The great California entrepreneur, William Ralston, committed suicide after the Panic of 1875. One of the prospectors, Phillip Arnold, was eventually traced to Kentucky and, under threat of a lawsuit, returned \$150,000 of the swindled money. John Slack and his share of the money were never seen again.

*A source of great riches—from the ruined city in western India, the capital of a former Moslem kingdom.

** Salt—in the mining sense—to purposely introduce extra or foreign amounts of a valuable substance into a sample to be assayed.

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Field Notes continued from page 3

severance taxes on their natural resource industries as well.

In Colorado severance taxes are imposed upon the production of oil, natural gas including coalbed methane, and carbon dioxide. There are provisions for the collection of severance tax from oil shale; however, there is no oil shale production in Colorado at present. The coal industry pays severance tax as well, although the rates are different for underground and open pit mines. Severance taxes are collected for the production of metallic minerals, which include gold, lead, zinc, silver, and molybdenum ore. Certain commodities like “rock, sand, gravel, stone products, earths, limestone, and dolomite” are specifically excluded from severance tax collection [Colorado Revised Statutes 39-29-102 (5)]. The actual severance tax that a particular

industry pays or does not pay is variable and several exclusions are applied, including some related to local government taxes that are, in a philosophical way, similar to state severance taxes.

The objective of the Mineral and Mineral Fuels Section of the CGS is to provide basic geological information that essentially invests the severance tax back into the ground in order to encourage future development of mineral and mineral fuel resources. Some of these information products are: geological maps in mineralized areas; annual reports on mineral and mineral fuel industry activity; county reports on geology and mineral resources; topical studies on oil and gas, coal, and minerals; and educational materials for junior high and high school teachers. The publication of the study discussed in this issue of *RockTalk* would not have been possible without Severance Tax funding.

The Advisory Committee determined that the main function of the CGS share of the Severance Tax is to provide a stable, long term funding base for programs related to all minerals regardless of current economic and business conditions. For example, even though the state’s sole producer of base metals (lead and zinc), the Black Cloud Mine in Leadville, closed in January of this year, CGS should continue to provide information about these types of mineral deposits.

As we have seen in the past, economic conditions change and new uses for commodities are discovered. The history of natural resource development is replete with cycles—booms and busts. Stable funding for the CGS Mineral and Mineral Fuels programs ensures that information will be available to encourage the next cycle of mineral and mineral fuel development.

NEW PUBLICATION ON GOLD, DIAMONDS, AND TITANIUM

New Report Describes Mining Districts in Colorado

The Colorado Geological Survey (CGS) has released a new report on mineral deposits in Colorado, *Alkalic Igneous Rocks of Colorado and Their Associated Ore Deposits* (Resource Series 35), by James A. Cappa. The deposits discussed in this report are related to alkalic igneous rocks, a special class of igneous rocks that has excess amounts of sodium and potassium. The main body of the report contains descriptions of the geological setting, geochemistry, economic geology, exploration and production history, and a reference list of the major mining districts in Colorado that are associated with alkalic igneous rocks.

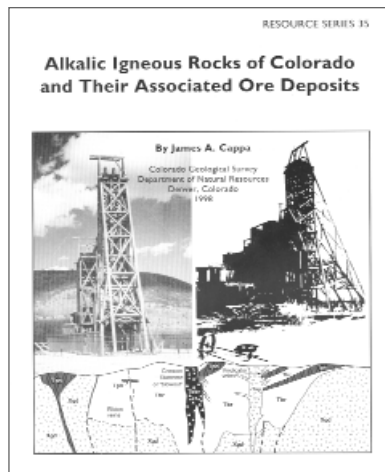
The mining districts covered by the report include the Central Front Range mineral belt, Gilpin, Boulder, and Clear Creek Counties; the Cripple Creek district, Teller County; the State Line Kimberlite district, Larimer County; the La Plata district, La Plata County; the Hahns Peak district, Routt County; the

Iron Hill-Powderhorn district, Gunnison County; the Silver Cliff and Rosita Hills district, Custer County; the Wet Mountain Alkalic complexes, Fremont County;

and the Ralston Buttes district, Jefferson and Boulder Counties. Other alkalic complexes that are not related to significant mineralization are also briefly described.

Mineral deposits associated with alkalic rocks are of major economic importance to Colorado's mineral industry. The Cripple Creek district is still an important gold producing area in Colorado. In 1997 the Cresson Mine in the Cripple Creek district produced approximately 230,000 ounces of gold. Production

in 1998 is estimated to be approximately the same. The State Line Kimberlite district gained recent fame, as the Kelsey Lake Mine became the first commercial diamond mine in North America. During 1996 and 1997 gem quality diamonds of 28.3, 28.3, and 16.3 carats were produced at that mine.



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diamond from the Premier Mine in the Transvaal of South Africa weighed in at a whopping 3,116 carats. It was cut into nine major stones including the world's largest cut stone—the 530-carat Star of Africa—and 96 minor stones). Up to 1997, about 65 percent of the recovered diamonds from the Kelsey Lake Mine were of gem-quality. In 1998, Redaurum decided to liquidate its diamond properties in Colorado and Africa. The Kelsey Lake Mine has been on a limited production status since that business decision.

REFERENCES

- Bauer, Max, 1904, Precious stones (Dover edition, vol. 1, 1968): New York, Dover Publications, 260 p.
- Cappa, J.A., 1998, Alkalic igneous rocks of Colorado and their associated ore deposits: Colorado Geological Survey Resource Series 35, 138p.
- Harpending, Asbury, 1913, The Great Diamond Hoax and other stirring incidents from the life of Asbury Harpending: University of Oklahoma Press.

Upcoming Events Involving CGS

July 16

Colowyo Coal Mine Tour and Landslides along Hwy. 13, CGSAC and MEGA Board Meeting, Craig, Colorado, field trip leaders, Anissa Olguin, (303) 866-3520

September 11

"Front Range Geologic Hazards", RMAG "On the Rocks" Field Trip, Boulder to Ken Caryl Ranch, field trip leader, Dave Noe, (303) 866-2432

September 17–19

Denver Gem and Mineral Show, Denver Merchandise Mart, exhibit and pub sales, Carol Smith, (303) 466-5863

October 10–16

Earth Science Week, Katie Kellerlynn, (303) 866-3330

October 24–28

Geological Society of America Annual Meeting, Colorado Convention Center, Denver, exhibits, field trip leaders, Tammy White, (303) 447-2020,

Correction

In the April 1999 issue of *RockTalk*, a sentence at the top of page 10 incorrectly stated, "Uranium and vanadium ores were mined from sandstones of the Cretaceous Morrison Formation". The Morrison Formation in the Four Corners area is Jurassic in age, not Cretaceous. Our apologies for this time "transgression" and thanks to Charles D. Snow for alerting us to our mistake.

Kirkley, M.B., Gurney, J.J., and Levinson, A.A., 1992, Age, origin and emplacement of diamonds: a review of scientific advances in the last decade:

Canadian Institute of Mining Bulletin, v. 84, no. 956, p. 48–57.
Wilkins, Thurman, 1958, Clarence King: New York, the Macmillan Company, 441 p.



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