MINES, COLLECTORS, AND THEIR MINERALS

A SYMPOSIUM

Sponsored by

FRIENDS OF MINERALOGY

COLORADO CHAPTER

SEPTEMBER 9, 1984

Held in Conjunction with the
Denver Council of Gem and Mineral Societies
18th Annual Gem and Mineral Show
Denver Merchandise Mart
Denver, Colorado

MINES, COLLECTORS, AND THEIR MINERALS

A SYMPOSIUM

PROGRAM

10:45 AM - 11:00 AM	Introduction	Mark Jacobson
11:00 AM - 11:25 AM	Gem topaz of the Tarryall Mountains. Colorado	Thomas C. Michalski
11:30 AM - 12:30 PM	Frontier Mining in Leadville	Ed Raines
12:30 PM - 1:00 PM	lunch break	
1:00 PM - 1:25 PM	Minerals of Gilpin County -- An historical approach	John M. Shannon
1:30 PM - 1:55 PM	Gahnite and other unusual minerals in northern Colorado -- indicators of metamorphosed sulphide deposits	Michael S. Allen
2:00 PM - 2:25 PM	Mining the Blue Jay azurite deposit near La Sal, Utah	Michael E. Madson
2:30 PM - 2:55 PM	Copper, vanadium, and arsenic minerals of the Skull Creek area, Colorado	Michael Brownfield Isabelle Brownfield Bruce Barnum
3:00 PM - 3:25 PM	Mineralogy and geology of the red beryl occurrence in the Wah Wah Mountains, Utah	Eugene E. Foord James E. Shigley
3:30 PM - 3:55 PM	Wulfenite from Arizona	Edward Pedersen
4:00 PM - 4:25 PM	Zeolites of the Table Mountains, Golden, Colorado	Robert Cobban

GEM TOPAZ OF THE TARRYALL MOUNTAINS, COLORADO

Thomas C. Michalski
U. S. Geological Survey
Denver Federal Center
Denver, Colorado 80225

Topaz was first discovered in the state of Colorado in 1880. Since that time, crystals of gem quality have been reported from numerous Colorado localities. One of the most productive areas for gem-quality topaz is near the Spruce Grove Campground, in the Tarryall Mountains, southern Park County. Although discovered in 1909, this locality was not extensively worked until 1929. Since that time, the area has become quite well known, and several hundred pounds of topaz have been extracted from crystal-lined cavities in the Redskin and Pikes Peak Granites as well as from Quaternary colluvial deposits.

The Proterozoic Pikes Peak Granite in this area consists of two batholithic masses which include the main Pikes Peak batholith and the much smaller Tarryall batholith. The younger Proterozoic Redskin Granite intrudes the Tarryall batholith along its southern edge. The topaz-bearing cavities occur mainly in a series of horizontal pegmatites at the northern edge of the Redskin stock near its contact with the Tarryall batholith. Most cavities are less than 15 inches in diameter and contain variable amounts of smoky and clear quartz, pink microcline, biotite, muscovite, hematite, fluorite, and topaz. Cavities that contain little or no biotite are most likely to contain topaz. Most topaz occurs as single crystals embedded in a red clay layer at the bottom of cavities. Crystal clusters and matrix specimens are seldom found. Although single crystals are not large, the combined weight of all topaz crystals extracted from a single cavity can approach several pounds. Hill slopes below topaz-bearing pegmatites often contain scattered topaz crystals which can be extracted from the weathered colluvial material by sifting it through a screen.

Individual topaz crystals are generally less than 1 1/2 inches in length and exhibit a blocky prismatic habit. Most crystals show development of simple prisms, pinacoids, and dipyramids. The terminations on most crystals are highly lustrous and exhibit complex etch marks. Prism faces are either smooth and lustrous or frosted and iron stained. The lustrous faces are generally coated with a fine-grained white clay which appears to have protected them from late stage dissolution and iron staining. Most crystals exhibit extremely clear interiors and are generally colorless, light blue, and, occasionally, yellow or golden. Crystals of the different colors commonly occur together in the same cavity. Crystals that are found on the ground's surface, where they have been exposed to sunlight for long periods of time, are usually colorless.

Gems cut from Tarryall topaz are very lustrous and generally contain few, if any, flaws. Although some crystals contain small inclusions of albite, phenakite, and fluid-filled negative crystal cavities, these can generally be avoided by proper cutting. Although individual crystals are usually not very large, their high degree of clarity often allows for the production of gems in excess of 10 carats in weight.

FRONTIER MINING IN LEADVILLE

Ed Raines
11902 Queensbury
Houston, Texas 77024

In the summer of 1858, Green Russell's prospecting party found placer gold deposits near the present site of Denver. The ensuing "Pike's Peak Rush" of 1859 culiminated in the establishment of several mining camps in the Front Range near Denver. By autumn of that year most of the promising ground had been staked, forcing newcomers deeper into the mountains in their search for gold. In the spring of 1860, several such parties made significant discoveries in California Gulch at the site of what would become Leadville. Soon the fledgling camp (then called Oro City) added another dot to the map, beginning the first phase of Leadville's long and illustrious mining history.

A second phase began so quietly that it was hardly noticed when California Gulch was all but abandoned in 1865. The richer ore had played out and the following decade saw a few stubborn prospectors trying to eke out a living by working lower grade deposits. The discovery of silver-bearing lead carbonate ore in 1874-75 issued in a third phase which was the famous Leadville "boom". After the bonanza strikes on Fryer Hill in 1877, the growth of the camp was simply phenomenal. By the end of 1879 the population was estimated to be from 25,000 to 30,000. Mine production reached $11,000,000 that year. The following years saw Leadville grow into a complete city with all of the necessary accoutrements. Leadville silver financed much of Colorado's early economic growth, especially the development of Denver.

The repeal of the Sherman Silver Purchase Act caused a crash in silver prices in 1893. The fourth phase of mining had already begun in 1891 with the discovery of gold-bearing vein deposits in the northeastern part of the mining district. The silver crash greatly accelerated prospecting for gold ores with peak production reached in 1900 at $2,500,00. Actually two metals dominated this fourth phase of mining : gold and zinc. Zinc ores had gone unnoticed for many years, but their discovery in the 1890's began production that reached its zenith in the years immediately preceding World War I.

The entry of the United States into the War closed the frontier mining years in Leadville as well as in the rest of the American west. During these frontier days Leadville's mines produced over $400,000,000, making it one of the wealthiest of the mining camps. Leadville's first half century is perhaps the quintessential example of the mining frontier. To quote one of the city's early newspaper editors:

> "There has been but one Leadville.
> Never will there be another."

MINERALS OF GILPIN COUNTY -- AN HISTORICAL APPROACH

John M. Shannon
Geology Museum
Colorado School of Mines
Golden, Colorado 80401

Gilpin County was the site of the first gold lode discovery in Colorado. That discovery was responsible for a continuing interest in gold and mining after the earlier placers had been exhausted. It was also the training ground for the miners and other prospectors who left the Central City area to try other locations in Colorado. The development of mining and specific mines in the Central City area was accompanied by the discovery of a number of fine mineral species, some of which are unique to Gilpin County. The history and development of Gilpin County, some of its mines and the minerals they produced will be explored.

GAHNITE AND OTHER UNUSUAL MINERAL IN NORTHERN COLORADO -- INDICATORS OF METAMORPHOSED SULPHIDE DEPOSITS

Michael S. Allen
U. S. Geological Survey
P. O. Box 25046
Denver Federal Center, M. S. 905
Denver, Colorado 80225

Gahnite, the green zinc spinel, occurs in large concentrations within certain horizons of an amphibolite- to granulite-grade metamorphic terrane of Proterozoic age, located near the townsite of Pearl in Jackson County, Colorado. Favorable horizons are clearly identified by chemical or binocular microscope analyses of heavy mineral concentrates collected from streams of the area.

Gahnite-bearing horizons are garnet-biotite-feldspar-quartz gneisses, with local concentrations of gahnite occurring in quartzite or in white to light green fibrous amphibolite. Gahnite ranges from small [2 mm] anhedral grains in quartzite to large [2 cm] euhedral crystals in gneiss and amphibolite. Associated minerals include : magnesium-rich aluminosilicates -- eckermannite, anthophyllite. edenite, pink almandine garnet, and chlorite; sulphides -- pyrite, chalcopyrite, galena, sphalerite, and molybdenite; pink manganiferous clinozoisite; and sillimanite. Recent advances in the study of metamorphosed ore deposits have shown gahnite and many of the magnesium- and aluminum-rich silicates to be products of metamorphism of sulphide deposits and their associated chlorite/sericite-rich alteration zones. High base-metal [zinc, lead, and copper] contents of silicate minerals, such as biotite, eckermannite, garnet, and amazonite, from the rocks of this area support the conclusion that these occurrences are metamorphosed sulphide deposits. The zinc deposits are currently not considered economic resources, due to low zinc prices and the refractory nature of gahnite. However, gahnite and associated minerals are potentially very important guides to undiscovered sulphide deposits in the metamorphic terranes throughout the Rocky Mountains.

MINING THE BLUE JAY AZURITE DEPOSIT NEAR LA SAL, UTAH

Michael E. Madson
3201 Snowberry Court
Grand Junction, Colorado 81501

Upper Lisbon Valley, San Juan County, Utah, in which the Blue Jay deposit is located, has been better known for the uranium deposits at the Alice, Rio Algom, Rattlesnake, and MiVida mines than for azurite. Although the Blue Jay is located about 1/2 mile north of the famous MiVida uranium mine, it contains only traces of uranium. The Blue Jay and adjoining claims were discovered in the late 1800's. They were mined for copper from the mid-1950's to the early 1960's when the commercial ore bodies were exhausted. The Blue Jay is one of 17 patented claims covering the Big Indian Mine and owned by Big Indian Resources, Denver, Colorado. "Blue Jay" is the correct name for the claim.

Mineral specimens have been collected from the Big Indian mine area for over 30 years. Collectible azurite crystals and nodules first became available from the Blue Jay Claim in limited quantities in 1980. Larger discoveries were made in 1981. The most recent major discovery occurred in the fall of 1983 by our mining. The total amount of azurite recovered from the Blue Jay since 1980 certainly makes the Blue Jay one of the most important producers of crystalline and nodular azurite in the United States for the last several decades. The material produced includes mineral specimens, bulk pigment material, and jewelry material.

COPPER, VANADIUM, AND ARSENIC MINERALS OF THE SKULL CREEK AREA, COLORADO

Michael Brownfield, Isabelle Brownfield, and Bruce Barnum
U. S. Geological Survey, Box 25046
Denver Federal Center, M. S. 972
Denver, Colorado

Commerical production of radioactive minerals in northwest Colorado began in 1903 when a property near Skull Creek, Moffat County, Colorado yielded several tons of ore which was shipped to France for radium extraction. The property lay idle until the 1920's when a small amount of ore was mined for vanadium. The claims again became inactive until 1953, when the claims were relocated as the Blue Mountain Group, and development drifting was initiated for uranium minerals. This effort was soon abandoned and the prospects have since remained inactive.

The deposit is located on the southern limb of the Skull Creek or Midland anticline in rippled, thin-bedded sandstone at or near the contact between the Entrada Sandstone and the overlying Curtis Member of the Stump Formation, both of Middle Jurassic age. The mineralized zones occur as lenses, up to several feet thick, parallel to the bedding and associated with organic matter.

The prospects contain an interesting assemblage of secondary minerals containing copper, vanadium, arsenic, and uranium. Previously unreported minerals, including conichalcite, cornubite, and metatyuyamunite, were identified by modern techniques. Other minerals identified in the deposit include azurite, brochantite, calciovolborthite. calcite. carnotite, geothite, malachite, and volborthite. Most of the carnotite previously reported is metatyuyamunite.

The origin of the Skull Creek deposit appears to be similar to that of other Colorado Plateau deposits. The metals were probably originally present in accessory minerals in tuffaceous beds within the overlying Morrison Formation. Alkaline and carbonate bearing water later selectively leached the metals, which were then precipated as fine-grained primary minerals where the solutions encountered organic matter. Oxidation of the primary minerals produced the secondary minerals present today. Deposits similar to those of Skull Creek occur at Richardson, Utah and Garo, Colorado.

GEOLOGY AND MINERALOGY OF THE RED BERYL OCCURRENCES IN THE WAH WAH MOUNTAINS, BEAVER COUNTY, UTAH

Eugene E. Foord
U. S. Geological Survey, M. S. 905
Denver Federal Center
Denver, Colorado 80225

and

James E. Shigley
Gemological Institute of America
1660 Stewart Street
P. O. Box 2110
Santa Monica, Calif. 90406

While a number of papers have been published on the rare and distinctive red beryls from the Wah Wah Mountains, Utah, only partial geological and mineralogical data have been presented. Our studies have attempted to extend and refine the knowledge of the geology and mineralogy of the red-beryl-bearing rhyolite at the Violet Claims, and surrounding area, Wah Wah Mountains.

The host rock varies from rhyolite to alkali rhyolite, and contains by weight, 3.53 to 4.15% potassium oxide, 1.17 to 1.61% sodium oxide, and about 0.3 % fluorine, but no detectable chlorine. All the chemical data indicate that the rhyolite is very similar to other topaz-bearing rhyolites in the western U.S.A. The red beryls occur principally along fractures which formed late in the cooling of the rhyolite. The fractures contain black manganese oxides and hydroxides, and clay minerals in addition to the beryls. Some crystals occur imbedded in the rhyolite, and these crystals frequently contain abundant inclusions of quartz and feldspar. The fractures are typically only a few millimeters at most wide and rapidly pinch and swell. The best crystals of beryl are enclosed within a white- to pink-colored mixture of smectite and kaolinite. Bixbyite often forms 'seed' cores of the red beryls. The beryl crystals are distinctly color-zoned and complete chemical data has been obtained for core to rim portions of several crystals. Crystals cut perpendicular to c show cores that are pale to medium orange and rims are burgundy-violet red. "Hourglass" zoning is shown in crystals cut parallel to c. Many crystals show this type of color zonation, but others are all red. The red color of the rim portions of the beryls correlates directly with an increased content of manganese and titanium. Specific determinations for water yielded only about 0.2 wt. % total water, demonstrating that the beryls are essentially anhydrous. Unit-cell dimensions were measured for core and rim portions: Core - a 9.229(1)A, c 9.212(1)A; rim - a 9.234(1)A, c 9.204(3)A. Refractive indices determined for core and rim portions were within the following ranges: epsilon - 1.567 to 1.568, omega - 1.574. Beryl crystals are seldom completely free of inclusions of other minerals, but when free of inclusions and also free of flaws, are spectacular specimens and make excellent and striking gemstones. Most crystals of red beryl are several millimeters to one centimeter long and one to several millimeters wide. The largest fine crystal found to date is in excess of 2 cm in length and more than 1 cm wide. Cut stones are generally a carat or less in weight, but larger stones have occasionally been faceted.

The characteristic features of the red beryl result from its formation within a rhyolite host rock under low pressure and high temperature conditions, in a volcanic environment. A similar trace-element chemistry, for example, manganese, titanium, magnesium, lead, zirconium, and others. of both the rhyolite and the red beryl substantiate their common origin. Red beryls occur in 'topaz-bearing' rhyolites, a class of silica-rich volcanic rocks that are distinguished by the presence of topaz and the high content of fluorine and other elements, including niobium, beryllium, zirconium, manganese, lead, cesium, rubidium, lithium, and others. Topaz-rhyolites are derived from magmas that originate in the lower portions of the earth's crust, in an anorogenic environment. The low pressure, high temperature [about 800 degrees centigrade and less], and low water content, but with its relatively high fluorine content, favored release of a gas phase from the rhyolite; from which the gem-quality beryl crystallized in cavities, along fractures, or within the rhyolite itself.

Wulfenite from Arizona

Edward P, Pedersen
11582 Ash Circle
Thornton, Colorado 80233

In the minds of mineral collectors, the state of Arizona has long been associated with quality wulfenite specimens. Most mineral books illustrate the chemical compound, lead molybdenium oxide, with specimens from either Arizona or Mexico. Mines such as the Red Cloud, Mammoth-St. Anthony, Glove, and Defiance are among the best known localities. However numerous other localities produce specimens that demonstrate a wide array of crystal morphology, color, and association.

SPEAKERS

Thomas C. Michalski. Mr. Michalski is the geologist-curator in charge of the U. S. Geological Survey - Branch of Oil and Gas Resources, Core Library. He received his B. S. degree and did graduate work at Wayne State University in Detroit. He has been collecting minerals for 19 years and has studied and collected at the copper deposits of Northern Michigan, pegmatite and metamorphic minerals deposits near Bancroft, Ontario, various New England pegmatite areas, and several calcite-celestite producing areas in Michigan and Ohio. He is a member of the Friends of Mineralogy, Littleton Gem and Mineral Club, and the Rocky Mountain Association of Geologists.

Ed Raines. Mr. Raines is an oil exploration geologist in Houston, Texas. His special interests include both the history and economic geology of Colorado ore deposits. He has worked on identification and verification of minerals for the Friends of Mineralogy update of Minerals of Colorado: 100 year record. His personal collection includes over 1300 specimens from Colorado and he has given numerous lectures on Colorado mining districts including Leadville, Cripple Creek, Creede, Gilman, Aspen, Silverton, and Ouray. He has co-authored a paper on the Cresson Vug at Cripple Creek and is presently working on a paper about Leadville for the Mineralogical Record.

John M. Shannon. In 1976, Mr. Shannon was appointed to the faculty of the Colorado School of Mines as an Assistant Professor of Geology serving as the Director of the Geology Museum and the Director of the Mines Band. Under his direction the Geology Museum has installed a number of new exhibits and has become very active in presenting special exhibits of minerals at various mineral shows throughout Colorado and in Arizona, Nevada, California and Indiana. Mr. Shannon has previously lectured at mineral shows and club meetings in California, Nevada, and Colorado.

Michael S. Allen. Mr. Allen is a geologist with the U. S. Geological Survey -- Branch of Central Mineral Resources. His work has included interpreting geochemical exploration data from Saudi Arabia and Colombia. He received his B. S. degree in Geological Engineering in 1976 at the Colorado School of Mines and his M. Sc. degree in exploration geochemistry in 1983 from Queen's University, Ontario. Mr. Allen is a Colorado native and has been a mineral collector from an early age.

Michael E. Madson. Mr. Madson is a geologist specializing in geochemical and geophysical exploration for mineral deposits and is employed by Bendix Field Engineering Corporation, Grand Junction, Colorado. He is owner and operator of Mike Madson Minerals, which is a wholesale supplier of mineral specimens to domestic and foreign mineral dealerships. During the last 15 years Mr. Madson has mined and marketed minerals from Wyoming jade properties, the Amethyst Queen Mine, Colorado, the Hawthorne, Nevada epidote locality [with Dick Jones], and the Blue Jay deposit, Utah. He is a member of several professional geological and mineralogical societies and has given field-collecting oriented presentations at several shows in the western United States including the Tucson Gem and Mineral Show.

Isabelle K. Brownfield. Mrs. Brownfield has been working for the U. S. Geological Survey, Branch of Energy Minerals since 1975. She is the supervisor for the Branch's mineral identification laboratories in Golden. Mrs. Brownfield has co-authored several reports and publications on uranium, thorium, and the rare-earth elements in the U. S. and is currently working on rare-earth bearing granites in the Saudi Arabia.

Eugene E. Foord. Dr. Foord is a geologist-mineralogist at the U. S. Geological Survey - Branch of Central Mineral Resources. He received hs A. B. degree from Franklin and Marshall College, his M. S. from Rensselaer Polytechnic Institute and his Ph. D. in 1976 from Stanford University. Dr. Foord's research has involved the study of quartz-huebnerite veins in Nevada, mineralogy of the Himalaya dike system in California, the cause of coloring in amazonite, and the mineralogy of niobium and tantalum. He has written more than 30 articles formineralogical journals, including the American Mineralogist, Canadian Mineralogist, and the Mineralogical Record. He has also been both vice president and president of the Colorado Chapter of Friends of Mineralogy. For the last seven years Dr. Foord has been in charge of the Friends of Mineralogy committee to update the U.S.G.S. bulletin 1114: Minerals of Colorado: a 100 year record.

Edward P. Pedersen. Mr. Pedersen is a Staff Geophysicist with Amoco Production Company. He received his B. S. degree from the University of Nebraska in 1966 and his M. S. degree in geology from Arizona State University in 1969. Mr. Pedersen has collected minerals since 1966 and has specialized in secondary lead-zinc-copper minerals and minerals of Arizona. He served as Chairman of the Mineral Study Section of the Houston Gem & Mineral Society from 1972-1978 and also served on the Society's Board of Directors.