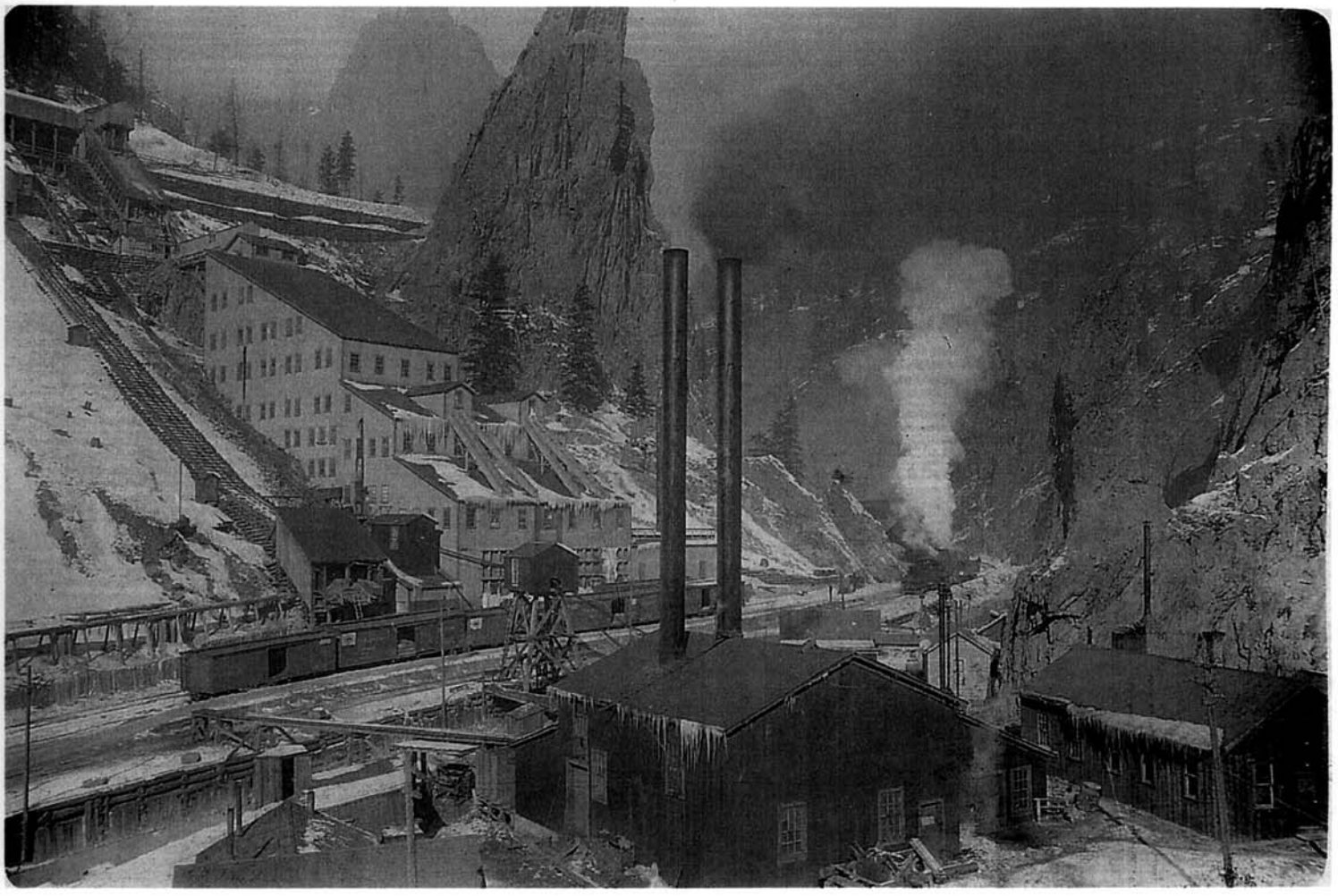
CREEDE MINING HISTORY

SYMPOSIUM

Sept. 10,11,12

2010



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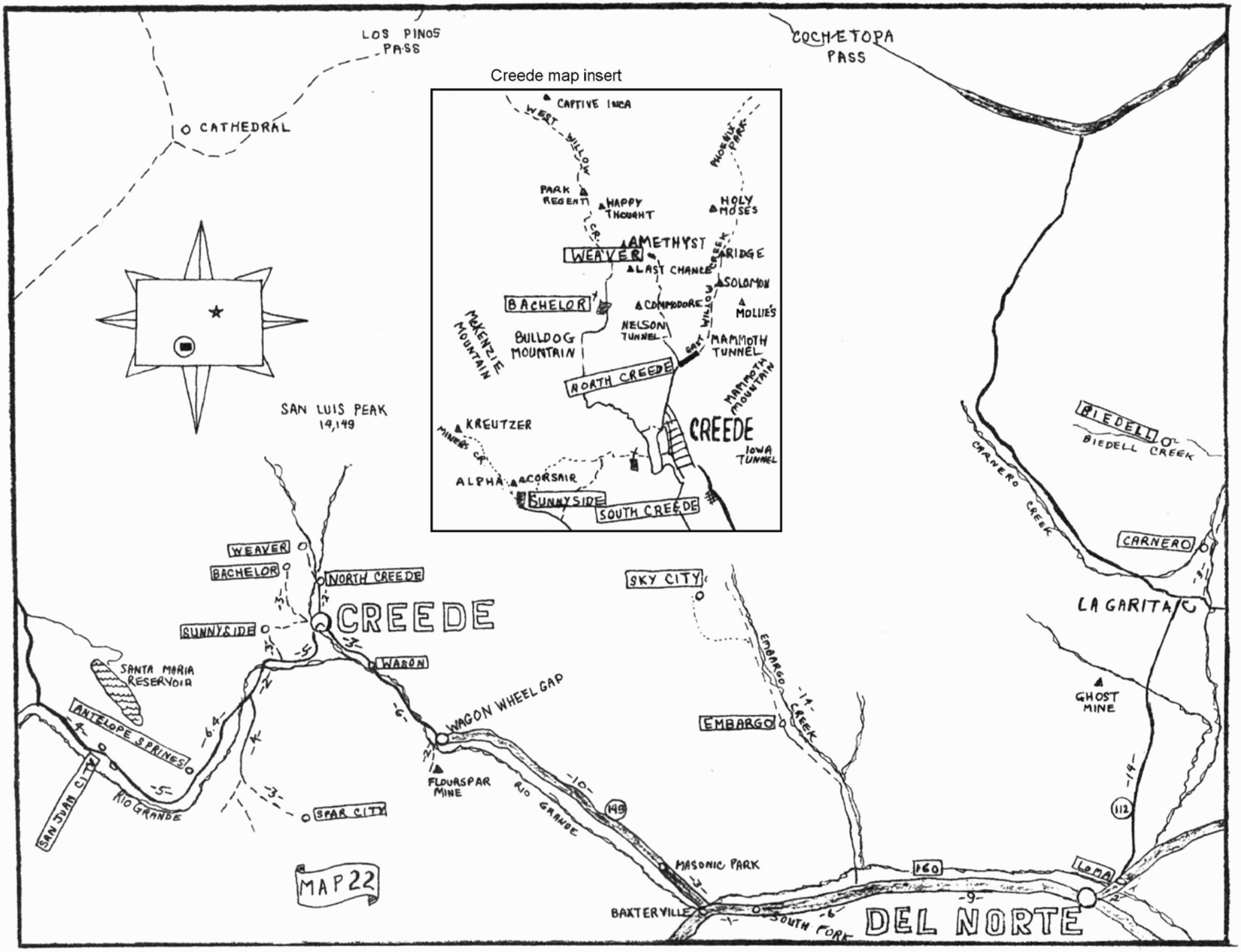
Friends of the Colorado School of Mines Geology Museum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Creede map insert
CAPTIVE INCA
WEST WILLOW
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HAPPY THOUGHT
HOLY MOSES
C.R.
AMETHYST
WEAVER
RIDGE
LAST CHANCE
SOLOMON
BACHELOR
COMMODORE
MOLLIE'S
MCKENZIE MOUNTAIN
BULLDOG MOUNTAIN
NELSON TUNNEL
EAST WILLOW CREEK
MAMMOTH TUNNEL
NORTH CREEDE
MAMMOTH MOUNTAIN
KREUTZER
MINERS CR.
CREEDE
IOWA TUNNEL
ALPHA
CORSAIR
SUNNYSIDE
SOUTH CREEDE
BIEDELL
BIEDELL CREEK
CARNERO CREEK
CARNERO
WEAVER
BACHELOR
NORTH CREEDE
CREEDE
SUNNYSIDE
WAGON
SANTA MARIA RESERVOIR
ANTELOPE SPRINGS
SAN JUAN CITY
RIO GRANDE
SPAR CITY
WAGON WHEEL GAP
FLOURSPAR MINE
SKY CITY
EMBARGO CREEK
EMBARGO
LA GARITA
GHOST MINE
MASONIC PARK
BAXTERVILLE
SOUTH FORK
RIO GRANDE
160
149
112
LOMA
DEL NORTE
MAP 22

PROGRAM

FRIDAY

5:00 PM Symposium opens with cash bar and dinner.
7:00 PM Ed Raines: The Creede Mining District, Mineral Co, Colorado

SATURDAY

9:00 A.M. – Chuck Harbert: Creede, Colorado History
9:45 A.M. – Warren Andrews: Creede and the Last Chance

10:30 -11:00 A.M. – Break

11:00 A.M. – Pete Modreski: Creede Geology and Minerals
11:45 A.M. – Bruce Geller: Creede Specimens in the Colorado School of Mines Geology Museum

12:30-2:00 P.M. – Lunch Break

2:00 P.M. – Bill Atkinson: Magmatic-Hydrothermal Origins of the Creede Deposit
2:45 P.M. – Ken Wyley: Mining the Mineral Veins of Creede, A History in Pictures

3:30-4 P.M. – Break

4:00 P.M. – Zeke Ward: Willow Creek Reclamation Project
4:45 P.M. – Randy McClure: Current exploration drilling in the Creede District by Rio Grande Silver Inc.

6:30 PM Cash bar opens at the Rio Grande Club in South Fork

7:00 PM Banquet begins

8:00 PM Auction and door prizes.
Tom Steven: Casual Remarks

SUNDAY

Field Trips 8:30 A.M. Meet at the Museum.

The Creede Mining District, Mineral Co, Colorado

Ed Raines

ABSTRACT

The Creede District is located in the eastern portion of the San Juan Mountains, one of the continent's largest volcanic fields. Eruptions beginning about 35 million years ago culminated about 7 million years later with the formation of several nests of overlapped collapse-calderas that were the result of a series of immense pyroclastic eruptions. The veins of the district occupy faults that roughly follow the keystone graben of the Bachelor caldera. Some two million years after the collapse and resurgence of the Creede caldera, hydrothermal waters deposited a mineral filling in the faults.

In 1876, John C. McKenzie discovered silver mineralization at Sunnyside, three miles southwest of Creede. In 1878, McKenzie located the Bachelor Claim on Bachelor Mountain, just west of West Willow Creek. Neither of these discoveries caused much excitement, as all of Colorado was completely focused on the Leadville discoveries. In 1889, Nicholas C. Creede and several other prospectors located the Holy Moses Claim on East Willow Creek. When the miners shipped a large lot of ore later in the year, people took notice. Well-known banker, railroad and mining man David Moffat hired Creede as a "contract" prospector.

The best known and most profitable claims, especially the Bachelor, the Commodore, the Last Chance, and the Amethyst were all located along the Amethyst Vein System (which runs roughly parallel to West Willow Creek). Creede Camp boomed into one of the last of Colorado's "rip-roaring" mining towns. The Denver and Rio Grande Railroad extended its line from nearby Wagon Wheel Gap to Creede and ran two passenger trains each way between Creede and Denver from 1890 through 1893. It took the railroad just four months to recover their construction costs.

Production in Creede's early days was mainly from the rich oxidized zone, reaching a peak in 1893 of almost 4.9 million ounces. During the summer of 1893 the world silver market crashed, ushering in a depression that ended Creede's boom days. Mining continued, but by 1900 the ores remaining were mainly sulfides carrying a lesser silver content, so the district began a severe economic belt tightening. Consolidation of properties, concentration of ore values by milling, and more efficient haulage and drainage through deep tunnels helped keep the town alive. While World War I provided a short upturn in mining, silver prices remained generally low through the first half of the 20th century.

Several concealed veins were discovered branching off from the Amethyst vein during the 1930s, but when the price of silver dropped to an all time low of $.25 per ounce in the Great Depression years, mining came to a halt. Mining resumed several years later when the silver price was fixed by presidential decree at 65.65 cents per

ounce. By the 1960's, Emperius Mining Co. controlled 50 patented claims along the middle and southern portions of the Amethyst Vein System, while Creede Mines, Inc. controlled many claims along the northern portion of the vein.

US Geological Survey research during the late 1950's and early 60's brought to light much new information on the veins of the district, ultimately leading to the discovery of an ore body in the deeper portions of the Bulldog Mountain Fault system. Homestake Mining Company operated the Bulldog until 1985, and the site was reclaimed in 1994.

The Creede District has always been well regarded by Colorado mineral collectors. It is perhaps best known for specimens of alternating bands of chalcedony and amethyst known as sowbelly agate. Fine specimens of sphalerite, galena, chalcopyrite, silver, cerussite, barite, and acanthite after argentite are prized treasures in many collections.

Ed Raines is Collections Manager for the Geology Museum at the Colorado School of Mines. Ed has written numerous papers on the mining history, geology, and mineralogy of various mining districts and mineral deposits. Three times he has been recognized by the Friends of Mineralogy for Author of the Year's Outstanding Paper in the journal Rocks and Minerals. He has coordinated conferences for the Mining History Association, leading field trips and presenting papers at each conference at Leadville, Creede, and Gold Hill. Ed served on the Boulder County Historic Preservation Advisory Board for nine years and chaired the board for two years. In 2000, he received an award for his historic preservation work at Leadville. Prior to 1988, he worked as a petroleum geologist.

Creede, Colorado History

Charles A. (Chuck) Harbert

ABSTRACT

The topography and mineralization in the Creede area is the result of volcanic activity that took place approximately 25 million years ago. The area lay untouched by humans until Folsom Indians camped here around 10,600 years ago. Following decline of the Anasazi culture in the fourteenth century, Ute Indians inhabited the area seasonally. A succession of explorers and trappers traveled through the area in the 1700s and early 1800s, but none settled. The area was opened up to settlement in the 1870s when stage and wagon routes were established from the railroad terminus at Del Norte to the mining camps in Silverton and Lake City. Some people traveling this route stopped to explore the Creede area for homesteading and mining opportunities. John MacKenzie, a prospector from Nova Scotia, was the first to establish a sustained presence in the area. He discovered the Alpha claim near Sunnyside in 1883 and the Bachelor claim in 1884 at the south end of the Amethyst Vein. Early homesteaders such as Major Martin Van Buren Wason and the Soward family established large ranches in the area beginning in the 1880s. Following the MacKenzie discoveries, mining activity remained dormant until Nicholas C. Creede and two fellow prospectors discovered the Holy Moses claim on East Willow Creek in August 1889. The Creede mining boom began in the summer of 1890 when word spread that Creede had sold the Holy Moses claim to a group of Denver investors, including David Moffat, for $70,000. Hundreds of prospectors streamed into the area in the fall and winter of 1890, establishing the town of Creede near the junction of East and West Willow Creeks. The following summer, discoveries of the rich Amethyst, Last Chance, and Commodore claims on the Amethyst vein further fueled the boom. The Denver and Rio Grande Railroad extended its line to Creede in late 1891, allowing easy passenger transportation and transfer of ore from the mines to smelters in other parts of Colorado. Creede and nearby Bachelor grew rapidly until silver prices crashed in 1893, ending the Creede boom. While mining continued at a varied pace for nearly another one hundred years, the population declined dramatically after 1893 and Bachelor became a ghost town. The Emperius Mining Company (1934-1972) and the Homestake Mining Company (1964-1985) kept mining alive in Creede until 1985 when Homestake abruptly ceased operations and laid off nearly 150 miners. This dealt a devastating blow to the economy, but Creede has gradually recovered by focusing on tourism opportunities. Excellent fishing, the Creede Repertory Theatre, local guest ranches, and a thriving artist community attract thousands of visitors each year. Formation in 2008 of Rio Grande Silver, a joint venture between the Hecla Mining Company and the Emerald Mining and Leasing Co., has sparked interest in the possibility of a new Creede mining boom.

Charles A. (Chuck) Harbert – Brief Biography

Chuck grew up in Pueblo, Colorado and graduated from the University of Colorado in 1962. After receiving his PhD in organic chemistry from the University of Missouri, followed by two years of postdoctoral research at Stanford University, he joined Pfizer Central Research in 1969. He became the head of US Medicinal Chemistry Research at

Pfizer in 1991, and is one of the inventors of the antidepressant Zoloft. Chuck and the Zoloft discovery team received the Team Innovation Award from the American Chemical Society in 2006. He is author or co-author of approximately twenty scientific publications and thirty-five patents. In addition to chemistry, Chuck has always had a keen interest in Colorado history, having accumulated one of the largest collections of antique Colorado photographic postcards. He retired from Pfizer in 1999 and since has written three Colorado history books. He and his wife, Kay, live in Creede in the summers. They spend their winters in Arizona. His hobbies include fly fishing, hiking, and collecting photographic postcards. His latest book, *Creede, Colorado History: Insights and Views through Postcards and Photographs*, is the subject of today's presentation.

Creede and Last Chance

Warren Andrews

ABSTRACT

The talk will describe Mineral County and where it came from politically and geographically. A few of the colorful characters of Creede's heyday will be mentioned. The legal problems of the Last Chance Mine will be described and illustrated.

Engineer of Mines, Colorado School of Mines, 1963. Bachelor of Arts in History, Metropolitan State College of Denver, 1994. Mine Safety Engineer, USBM-MESA-MSHA, 1966-1996. Member of Mining History Assn. and Society of Mining Law Antiquarians. Registered Professional Safety Engineer No. SF1295 in California and Registered Professional Land Surveyor No. 5240 in Colorado. Now retired and living at1942 Mt. Zion Dr., Golden, Colorado 80401. (Tel 303-279-1277)

Creede Geology and Minerals

Dr. Peter J. Modreski

ABSTRACT

The Creede mining district is located just north of the Creede Caldera, the youngest in a cluster of about six overlapping volcanic calderas, termed the Central San Juan Caldera Cluster (Lipman, 2000). The Creede Caldera erupted 26.7 million years ago producing the Snowshoe Mountain Tuff, a welded ash-flow tuff of mafic dacite amounting to more than 500 cubic kilometers (about 120 cubic miles) of ash deposits. This eruption was truly catastrophic for the area but not by any means the largest in the San Juans. The greatest eruption had come earlier, at 27.6 million years, from the 35 x 75 km elliptical-shaped La Garita Caldera to the north, producing the Fish Canyon Tuff, which represents over 5000 cubic kilometers (1200 cubic miles) of erupted rhyodacite magma. The volcanic history of the central San Juans is documented by the many maps and research papers by Peter Lipman of the USGS (for example, Lipman 2000, 2006).

After the eruption of the Snowshoe Mountain Tuff, renewed intrusion of magma produced a central uplift, a *resurgent dome* now forming the topographic high of Snowshoe Mountain. The perimeter of the caldera, termed a *moat*, ponded water to form a large lake, Ancient Lake Creede, in which the sediments of the Creede Formation accumulated. Most of the Creede Caldera itself does not contain rich mineral deposits, except at its north edge where an unexposed intrusion of magma is believed to have been emplaced beneath a downdropped fault zone (a *graben*). Heated groundwater migrating into the fault zone interacted with saline water from in Lake Creede, forming the Creede mineral deposits. These are veins along the predominately north-south faults, roughly paralleling East and West Willow Creeks. The age of the mineralization has been found to be about 25.1 million years, hence about 1.6 million years after the tuff eruption and caldera collapse.

Much research has been published over the past 90 years on the Creede ore deposits, including the reports and maps by Emmons and Larsen (1923), Steven and Ratte (1960, 1973), the series of papers in six parts published in Economic Geology from 1976 to 2005, and the summaries of recent research published in the Geological Society of America Special Paper 346 volume on Ancient Lake Creede (Bethke and Hay, 2000).

The first discoveries were made and claims staked at Creede in 1876. The heyday of mining was between 1890 and 1894, with major mines including the Amethyst, Bachelor, Commodore, Holy Moses, and Last Chance mines. The Bulldog Mountain mine was a more recent discovery; it operated from 1969 until 1985. The mines are all closed now, but exploration for new deposits continues.

Some 90 different mineral species, plus many varieties, are reported from the various mines in the Creede district. Aside from its fame for native silver and amethyst, other abundant minerals include sphalerite, galena, chalcopyrite, argentite (more accurately, acanthite paramorphs after argentite), cerussite, and barite. Good descriptions

of the Creede mineralogy are given by Ed Raines (1988, 1992) and in the just-published article by Tom Rosemeyer in the September-October issue of Rocks & Minerals (Rosemeyer 2010).

An unusual mineral occurrence in the district is that of calcite believed to be pseudomorphic after the unusual mineral found in saline lakes and ponds, ikaite, $CaCO_3 \bullet 6H_2O$; these pseudomorphs occur in the sedimentary rock of the Creede Formation (see Larsen, 1994).

Dr. Peter J. Modreski has been a geochemist with the U.S. Geological Survey (USGS), Lakewood, Colorado, since 1979. He is presently part of the USGS Central Region, Office of Communications team responsible for public information and community outreach. His research interests have included mineralogy, gemstones, Rocky Mountain geology, ore deposits, and igneous petrology; his areas of past field and laboratory study include Colorado, Idaho, Montana, New Mexico, Arizona, Hawaii, and Poland. He is the USGS geologic resource specialist for abrasives, gemstones, quartz, beryllium, cesium, and rubidium. He has a BA (chemistry) from Rutgers College and an MS and PhD (geochemistry) from Penn State. He was a coauthor of *Minerals of Colorado* (1997) and is a research associate with the Earth Sciences Department, Denver Museum of Nature and Science. His related interests include hiking and camping, caves, volcanology, astronomy, photography, nature, and the environment.

Dr. Modreski, an executive editor of *Rocks & Minerals* since 1988, has written several articles on Colorado mineral localities for the magazine.

Mineral County Specimens in the Colorado School of Mines Geology Museum Collection

Bruce Geller, Director
CSM Geology Museum

ABSTRACT

The Colorado School of Mines (CSM) Geology Museum, started in 1874 by Arthur Lakes, contains extensive mineral, mining artifact, meteoritic, fossil and gemstone collections. The approximate number of catalogued specimens is 40,000. One of our Museum's missions is to "serve as a State repository for Colorado's mineral heritage and promote its importance and understanding to our University community and the general public." Over the years, we have amassed 151 specimens from Mineral County, primarily from the Creede mining district, as well as a minor number from Wagon Wheel Gap, and some random calcite, quartz, and native sulfur specimens from elsewhere in the county.

According to our database, donations and acquisitions to our Museum from Mineral County have been documented from 1945 through 2008. By far, the most Creede specimens arrived in 1965, when our Museum received a collection from the Colorado State Historical Society. Other significant donations include specimens from the Hurr, Melickian, and Herfurth collections in the 1980s and 1990s.

Mineralogically, our Creede specimens are what one would expect from a large Ag-base metal producing district: several native silver, galena, sphalerite, and cerussite specimens, in a gangue of quartz (generally amethystine) and barite. Curiosities in the collection include two azurite specimens, two pyromorphite (which could really be mimetite), a rhodochrosite, a kutnahorite, and our only ktenasite specimen in the entire collection. Our collection has roughly one quarter of the minerals listed on Mindat.org for Creede, but their list lacks four of the minerals found in our Creede collection. The principal mines that our specimens originated from were the Bulldog, Bachelor, Amethyst, Commodore, and the Last Chance. The Last Chance was the reported source of the silver used in the Wolcott pitcher and platter, remarkable historic pieces dedicated to Colorado's U.S. Senator Wolcott.

Our Wagon Wheel Gap specimens are representative of an epithermal fluorite deposit: fluorite in gangue comprised of quartz and barite. Unusual minerals from this locale include creedite (and this is the type locale for this mineral) and gearksutite. Our collection has one half of the minerals listed on Mindat.org for Wagon Wheel Gap. All these specimens originate from the CF&I Fluorspar mine.

Bruce Geller became the Director of the CSM Geology Museum in August, 2007. His B.A., M.A., A.M., and Ph.D. degrees are in geology. Since arriving in Colorado in 1981, he has worked as an explorationist, journalist, geology professor, and economic geology consultant.

Magmatic-Hydrothermal Origins of the Creede Deposit

W.W. Atkinson, Jr. Sept. 2, 2010

ABSTRACT

The Creede silver- zinc-lead veins belong to a classic type of magmatic-hydrothermal mineral deposit, one that is derived from an igneous source and transported by hot water. In this talk, its origin is traced back to the production of mineralizing igneous intrusions by plate-tectonic activity. The story begins at oceanic rifts, where the earth is spreading apart and basaltic magma is erupting. Oceanic water enters fractures created where the oceanic crust is pulled apart. Hot basaltic magma rises, erupting in lava flows, forming new crust. The oceanic water reacts with the solidified hot basalt, forming hydrous minerals, and converting sulfate to sulfide in the water, which is much later deposited as sulfide minerals as seen at Creede. The oceanic crust moves outward, until it collides with a continent. There, the heavy basalt of the oceanic crust slides downward under the lighter granitic crust of the continent (the process of subduction). As it descends, it heats up, eventually partially melting to form andesitic or basaltic magmas. This melted rock is now lighter than the surrounding rocks of the mantle and these lighter basaltic magmas rise, forming a pool of molten rock beneath the continental crust. The extremely hot pool of basaltic magma partially melts the granitic crust, forming granitic magmas, which rise to form batholiths. As this granitic magma cools and crystallizes, water and heavy metals are separated from the minerals crystallizing in the remaining magma. This fraction, enriched in water, silica, alkalis, reduced (sulfide) sulfur and heavy metals, crystallizes to form a mineralizing intrusion. The superheated water remaining after crystallization exerts pressure to fracture the surrounding solidified rock. Heavy metals such as copper and molybdenum, along with sulfur and silica enter the fractures to form the sulfide-rich quartz veinlets of a porphyry Cu-Mo deposit. The other metals that came from the mineralizing intrusion continue moving outward through fractures in the surrounding rocks and are deposited in zones surrounding the intrusion, in the order of copper, zinc, lead, silver, and mercury. The Creede deposit is characteristic of the silver zone. Gold is deposited around the intrusions in one of these zones depending on the abundance of sulfur in the solution, which transports the gold as a complex, Au(HS¬-)2. If sulfur is low, gold is deposited near the intrusion; if it is high, gold is carried farther away, even up to the hot springs at the surface.

A common and convenient indicator of the sulfur content in solution is the amount of iron in sphalerite, which is responsible for its brown color. Minor amounts of iron in sphalerite make it a light, honey yellow; increasing amounts a caramel color, reaching deep brown to black. Low sulfur in the transporting hydrothermal fluid allows higher concentrations of iron in solution; the lower the sulfur content, the higher the iron content and the darker the sphalerite. Conversely, high sulfur results in low iron, and light sphalerite. This, in turn, is important to the transport of gold: the higher the sulfur content of the solution, the farther gold is transported from the mineralizing intrusion. Thus, dark sphalerite indicates that the solution contained less sulfur so that gold was not transported as far from the source as would be indicated by light sphalerite. At Creede,

light sphalerite is common, and the gold content of the ore is very low. Apparently gold was carried to higher levels, which have eroded away. Of course, other factors may influence gold deposition. The mineralizing intrusion may have contained very little gold, and there may be none at higher levels above the silver zone!

A study of the processes of plate tectonics and comparisons of many mining districts reveal that the Creede deposits resulted from quite a complex chain of events!

William Atkinson Jr Born 1935, Albuquerque, New Mexico.
B.S., Chemistry, University of New Mexico, 1957.
M.S., Geology, University of New Mexico, 1960. Thesis: Geology of the San Pedro Mountains, New Mexico.
Graduate study, Hamburg University, Germany, 1960-61.
Ph.D. Geology, Harvard University, 1973. Thesis: Hydrothermal synthesis and properties of high-purity quartz.

Exploration Geologist, Anaconda Company, Salt Lake City, 1967-1977. Assignments at Carr Fork, Bingham District; Victoria Mine, Nevada; Sar Cheshmeh, Iran.

Associate Professor, Economic Geology, University of Colorado, Boulder, 1978-2004. Taught courses on ore deposits, mineral resources, physical geology. Presented over 20 seminars on geochemistry of gold and other heavy metals in Chile, Bolivia, Peru, Spain, in Spanish. Advised 50 graduate students for M.S. and Ph.D. Consulting in Chile, Mexico, Spain, Alaska, Colorado, Utah, Nevada.

Retired, 2004-present. Consulting in Chile, Arizona.

Mining the Mineral Veins of Creede, A History in Pictures

Ken Wyley

ABSTRACT
A presentation of the photographic history of Ken Wyley's life as a miner of the Amethyst and Bulldog veins. This slide show walks you through the 1960s and 1970s as Ken worked as a motorman then hoist man then miner in the Creede mining district. Over forty color slides will take you though the last days of active mining of that era.

Willow Creek Reclamation

Zeke Ward

Outline:

I. Welcome and Intro to WCRC
   A. In the beginning
      1. Superfund
      2. There must be a better way
      3. WCRC Formed
II. The Plan
   A. Characterization
      1. Collect existing data
      2. Base line Conditions 3 year plan
      3. Cultural resource inventory
   B. Watershed Management Plan
      1. Start at the top
      2. Low hanging fruit
      3. Continued monitoring
III. Best laid plans
   A. "Lawyers guns and money"
   B. Superfund and Emergency Response
   C. Accomplishments
      1. 5 mines
      2. Last Chance, Amethyst 5
      3. Commodore
      4. Lower reach of Willow Creek

Marvin Kirby Ward "Zeke"

Born 1950, in Pueblo, Colorado, to Elsie Maxine, and William Kirby Ward. Graduated from Monte Vista High School in 1968 and attended Rochester Institute of Technology for one year before enlisting in the US Air Force. Honorably discharged after 4 years of service, one of which was served in Viet Nam. Was accepted into the apprenticeship program with the United Brotherhood of Carpenters and Jointers. Received journeyman status in 1975. Returned to Monte Vista, Colorado in 1977, and relocated in Creede, Colorado in 1979.

Since moving to Creede, has served the community in various capacities; past Chairman of the City Planning and Zoning Commission, former representative to the San Luis Valley Regional Planning and Development Commission, Founding Chairman of the Creede/Mineral County Chamber of Commerce, past School Board Member, Past Chairman Days of 92 committee, Chairman of the City/County Master Plan Steering Committee, Chairman Airport Advisory Committee, Past Chairman Mineral County Fairgrounds Association, Past Chairman Mineral County Board of Adjustments, Chairman Willow Creek Reclamation Committee, former Chairman Mineral County Republicans, former Mineral County Commissioner, board member Creede Mining Heritage Preservation Inc. Presently employed by Bright Idea Energy Solutions as a project manager for wind and solar installations.

Current exploration drilling in the Creede District by Rio Grande Silver

Randy McClure

ABSTRACT

Current exploration drilling in the Creede District by Rio Grande Silver, Inc. includes surface core drilling of miles of strike length of prospective structures including the north extensions of the Bulldog and Amethyst Veins, the Equity/N. Amethyst area, the Alpha Corsair, and other targets. This widely spaced surface drilling and a total district geologic evaluation is aimed towards gaining enough encouragement through coring to warrant eventually going underground to prove up 100 million + plus ounces Ag (or Ag-Au equiv.) with Pb-Zn-Cu values. There are no underground plans or mill plans at present, and a total of 3 diamond drill rigs are currently at work. We are looking at underground, vein deposits only at present, not the sediment hosted/disseminated Creede Fm. deposits.

The multiyear program is contained within a large, contiguous block of patented and unpatented ground and has been approved through an EA by the USFS after several years of permitting efforts.

Randy McClure or Jonathan Moore will be giving the talk. There are 5 geologists working here, including Randy and myself, in charge of the program, Brian Morris, VP and Project Manager, Kate Falconer, in charge of the database work. Jonathan Moore, various geotechs and drillers, helpers and support people, totaling maybe 30 people working in Creede.

Dean Misantoni
EXPLORATION & MINING GEOLOGIST
CPG #11276

P.O. Box 19
Alma, CO USA 80420
(719) 839-5008
dmisantoni@hotmail.com

POSTER ABSTRACTS

Early happenings at the Commodore Mine 1928 & 1929 per the Mining engineer.

Jim Hurlbut

Transient calcite fracture fillings in a welded tuff, Snowshoe Mountain, Colorado

Michael M. Reddy, US Geological survey, WRD National Research Program, Denver federal Center, Lakewood, Colorado

ABSTRACT

The core from two boreholes (13.1 and 19.2 m in depth) drilled 500 m apart in the fractured, welded tuff near the summit of Snowshoe Mountain, Colorado ((47° 30' N, 106° 55' W) had unique petrographic and hydrodynamic properties. Borehole SM-4 had highly variable annual water levels, in contrast to SM-1a, whose water level remained near the land surface. Core samples from both boreholes (n=10 and 11) were studied petrographically in thin sections impregnated with epoxy containing rhodamine to mark the pore system features, and were analyzed for matrix porosity and permeability. Core from the borehole sampling the vadose zone was characterized by open fractures with enhanced porosity around phenocrysts due to chemical weathering. Fractures within the borehole sampling the phreatic zone were mineralized by calcite and had porosity characteristics similar to unweathered and unfractured rock. At the top of the phreatic zone petrography indicates that calcite is dissolving, thereby changing the hydrogeochemical character of the rock (i.e. permeability, porosity, reactive surface area, and mineralogy). Radiocarbon ages and C and O stable isotopes indicate that calcite mineralization occurred about 30 to 40 ka ago and that there was more than one mineralization event. Results of this study also provide some relationships between primary porosity development from three types of fractures in a welded tuff.

Creede Specimens
Denver Museum of Nature and Science

Larry Havens

This poster paper shares images of the better Creede specimens housed in the various venues of the Denver Museum of Nature and Science. The Creede collection is best represented in the Coors Hall of Minerals in the Colorado section, displaying fine examples of barite, amethyst, sphalerite and galena. In the gold display, an exceptional cluster of wire silver crystals can be found. The Creede specimens housed elsewhere in the museum are, at best, representative study samples. Of the Colorado mining districts presented in the Hall of Minerals, Creede, the last, great, silver boom town, is probably the least well-represented in number and quality of specimens.

Poster author, Larry Havens (BS, MA, Northwestern University), taught Speech and English at Arvada West HS for 33 years, and has been an avid mineral hobbyist since the early '70's. Since 2000 he has been a volunteer in the Geology Department of the museum, primarily assisting in curating the extensive micro mount collection.

CREEDE, COLORADO

By Beth Simmons

When Arthur Lakes, Colorado's premier geologist, made his first trip through what is now the Creede valley in 1881 on his way to Engineer Pass for the summer, he made NO notice or mention of the possibility of ore deposits in the obvious volcanic terrain through which he traveled. The science of the relation between volcanism and ore deposition was in its infancy, based on Whitman Cross' observations at Leadville and the American West. Lakes had studied with and assisted Cross and Emmons in their studies of Aspen and Leadville but somehow Lakes missed the association in what is now the Creede valley.

In 1881, the stage road from Del Norte to Lake City sailed upstream along the Rio Grande valley, through the broad river valley south of what is now Creede, ascended Spring Creek Pass, dropped onto and crossed the Slumgullion landslide (which wasn't named) and dropped into the Lake Creek valley and Lake City. Many types of overnight accommodations were available along the route; the finest were at Wagon Wheel Gap Hot Springs which was called Pagosa Springs at the time. Lakes stayed in a cabin along the river. He did suggest that the presence of nearby volcanism might be the source of the heat for the hot springs.

Neither the ore deposits nor the fossils of ancient Lake Creede had been discovered. The Rio Grande valley was peaceful farmland abloom with beautiful mountain wildflowers.

That all changed in 1890.

The story of Nicholas Creede's silver discovery and the immediate building and bustle of the ramshackle towns along the tight confines of the Willow Creek canyons will be told numerous times during the symposium. There were many "camps" – Lower Creede (Jimtown), North Creede (where the fire department is today), and others up East and West Willow Creek canyons as far as Bachelor. They were hurly burly Wild West villages where civilization took on a dimension unknown (perhaps fortunately) in today's Colorado. Few Colorado towns exemplify the repeated boom (and bust) of mining quite like Creede.

In 1944 and 1945 in *Colorado History Magazine*, Mrs. A.H. Major, wife of the long-time postmaster of North Creede, captured the essence of Creede's boom days. She wrote stories, not told anywhere else, of life in the early days in Creede during the Soapy Smith dominance, of the days when fire was the biggest threat to a family's existence when everyone pitched together to fight the fires and evacuate the buildings.

Alexander H. and Jessie Major and Alexander's brother-in-law, Finley Frazee, started a log store in Creede in May of 1891, then built a substantial two-story building in North Creede in 1892. In the spring of 1893, Alexander was appointed the local agent for the Continental Oil Company in Creede, a position he held until he died in February of 1933. The petroleum products, used to power motors in the mines and lamps in homes and businesses, were hauled from Del Norte in 10-gallon cans, freighted in heavy wagons drawn by mule teams.

Soapy Smith and his band of renegades ruled the camp. Mrs. Major told of the time when Parson Uzzell, of the Denver Tabernacle, first visited the camp. The Parson preached from a pool table in a newly constructed pool hall. Soapy's men listened respectfully, but that night some of them cut a hole in the tent where the Parson was sleeping, reached in and stole his trousers and the collection hidden under his pillow. When Soapy learned of the incident, he compelled them to return the pants with more money in the pockets than when they were stolen!

In North Creede, families of respected people lived in cabins and cottages next door to licensed houses and saloons – all doors opening on the one and only street (Figure 1). Jessie Major suggested that probably such conditions were never obtained anywhere else, unless possibly in some other new mining camp.

Figure 1. "A Street in Creede, Colo." 1892 (The only street in Creede!) (DPL Western History Collection 20004709

Civilization of sorts came in on the trains that brought men by the car loads, filled to capacity. Men clung to the sides and on top of every box car of the long freight trains. Other incoming miners drove teams, came on horseback, and even on burros; many "counted the ties." To accommodate the crowds, the Pullman Company sidetracked a string of sleeping cars, but they were far inadequate.

Those lucky enough to have a blanket roll gladly paid a dollar per night for the privilege of spreading their bed on a floor anywhere under shelter. Many times, Alexander Major loaned blankets to traveling salesmen, who slept on the store counters. One night Alexander, Finley, and their two guest salesmen were awakened by the rattle and ping of bullets against the logs of the store building, indicating some sort of trouble in the saloon next door. The two traveling salesmen rolled off the counter, declaring that never again would night overtake them in Creede!

Indeed, there "was no night in Creede." Business houses, hotels, and restaurants were open nearly all night; saloons and gambling houses did not close at all. Gambling reigned in the saloons. Interestingly, three of the most successful gamblers were women: Poker Alice Tubbs, Calamity Jane Bourke, and Killarny Kate, who all smoked mammoth stogey cigars while conning men out of money.

Ladies of the houses of prostitution, called the "demi-monde," were active in community affairs, helpful in crises, and then would disappear back into the houses in "normal" times. Jessie Major reported that the "people of the half world" were never presumptuous, loud or

boisterous in public places; they visited the stores to do their shopping, but never in an intoxicated condition.

The highlight of the day was the incoming mail, even in the hurry and scurry of events, big deals pending on every street, and excitement every moment. The original post office was a log cabin with homemade pigeonholes for the letters (Figure 2). The papers frequently fueled the fire, while hundreds of people waited in line for that letter from home. Seeing pieces of paper sailing out of the stove pipe, someone would call out, "There goes my letter." Another would yell back, "No it was mine. I saw the post-mark." So they hit on a plan of having the mail come in by express for five cents per letter. The mail came in sacks and was emptied into a big box outside the depot. Each person sorted out his own mail! Can you imagine the pandemonium?

In 1892, Alexander Major was appointed postmaster of North Creek and obtained a larger building and then installed proper lock-boxes.

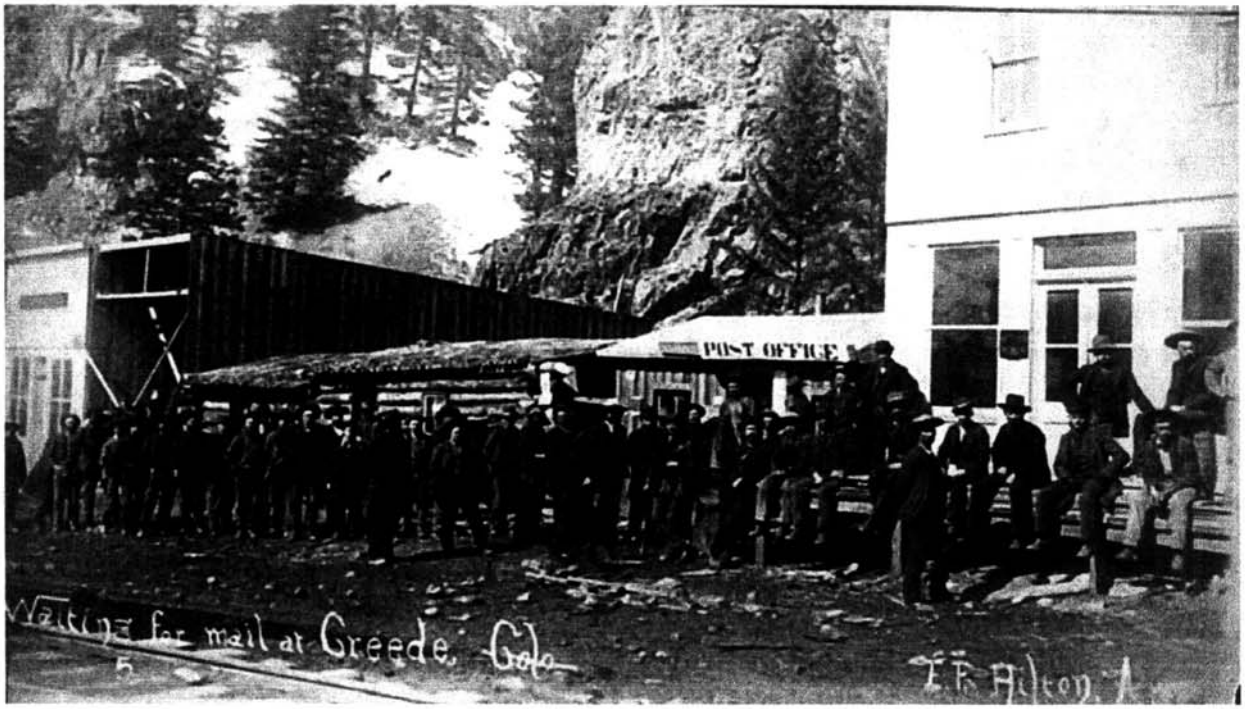

Figure 2. Waiting for the mail at Creede, Colo, 1893, DPL Western History Collection 11001536

Jessie Major told the cause of the many fires – arson – and the response of the citizens to the alarm (Figure 3). Ponder this scene as you sit underground next to the modern Creede fire station carved out of the fire-proof mountain.

"The silver crash brought down the town. Property values rapidly declined in Creede. To some people fire seemed the way out. One winter night the fire alarm rang out – or rather tooted and shrieked out, as the railroad engine gave the alarm – and even then a two-story building, a short distance down the street from where we lived, was in flames and the breeze was sweeping up the narrow canon. In a very few minutes a bucket brigade was formed-the only means of fight fire at that time. Men, and women, too, quickly responded to the fire call, and in an incredibly short time a long line was formed, the ice in the creek was broken, and pails and even cooking kettles were pressed into service to carry water. But the fire jumped from one building to another-all dry wood and built close together-so it seemed for a time that nothing would be left of the camp but ashes. Mr. Major ran up the stairs and called to me that our time had come – to save what I could.

First our young son [Finley A.] *was warmly dressed in mittens and a cap with ear protectors and given his new book. The trunks and satchels, a basket, some boxes, even a dishpan, were quickly lined up against the wall in the narrow hallway, and filled with the most prized household possessions, favorite books, warm bedding and clothing-especially for that little boy! Then the packed belongings were carried to the freight cars, which the railroad company always ran up when a fire alarm was given, to carry the belongings of North Creede folk out of the fire zone.*

A great surprise came when the street door opened and three women of the "demi-monde" came up the stairway! They had come to help me, and carried all the belongings, even the heavy trunks to the waiting freight cars. Down the stairs, across the street, across the narrow foot bridge over Willow Creek, they then lifted all the belongings onto the flat cars where they then stood guard over my possessions.

The street was filled with swearing men and weeping women, some with babes in arms, little children carrying favorite toys and dolls, one child clinging to a pair of red shoes – all running from the fire which threatened their homes. Furniture of all kinds had been tossed into the street to be carried to the flat cars. There was bedding, clothing, rugs, even bric-a-brac and dishes. One couple, who had parted, got into a quarrel over a feather bed. He was pulling on end of the bed, she on the other. Suddenly he let go; suddenly she sat down. Mrs. Stephenson, the charming wife of the railroad agent at North Creede, created a bit of merriment even in all the excitement by appearing at the fire clad in her best suit, hat, and veil. In the hysteria of the moment she had not realized she had put on her hat and veil.

The fire was finally under control. Then those women carried our belongings back to the house! There was help available for the return of things, but at first everyone else was fighting fire. I felt most grateful to the poor outcasts, and would gladly have treated them with kindness, but they never saw me again and gave me no chance to speak to them.

Figure 3. Hotel Vaughn (and side tents) in Creede, 1893. Sign reads "Good Accommodations and NO danger of Fire!" Colorado Magazine, November 1944, p.213

The Creede area was a wild and rank region. In 1899, a 30-year-old Jefferson County man caught the gold bug and went to Bachelor to work as a miner. "Red Murphy" Rooney (Charles Thomas Rooney, son of Alexander and Emeline Rooney) was shot in the back by Bachelor's town marshal. Rooney was never known to drink or gamble and the Jefferson County law enforcers decried his murder. The Bachelor/Creede law enforcers felt justice was done for whatever crime Rooney had committed. "Red" Rooney's body was shipped home and buried in the Golden Cemetery, not interred in Bachelor's boot hill!

Such were peoples' daily lives in Creede in the early days, where all walks of life interacted peaceably or not, because of the wealth in the ground. Creede's silver deposits occur because of an ancient volcano that erupted numerous times including a resurgent central dome that grew surrounded by a picturesque moat lake. Deciduous trees and herbaceous plants grew along the shores of the lake; "volcaniclastic sediments" in the lake enclosed leaves from the surrounding countryside, with an occasional insect and even bird feathers! That natural history combined to create the historic human hubbub, the myths and legends of this peaceful flower-bedecked valley.

The FM Symposium will teem with history and mining and mineral facts and figures speckled with rock unit terms such as "intracaldera ash-flow tuff" and "tuffaceous siltstones." Should you get mind-boggled with all the various local town and mine names, the accompanying map from Perry Eberhart's *Guide to the Colorado Ghosts Towns and Mining Camps* might help. Should you have a question about the geology, ask any of the experts who are in attendance!

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Symposium Field Trips

On Sunday, Sept. 12, the symposium will offer a choice of taking part in one or both of two field trips; to Wagon Wheel Gap and to the Last Chance mine. Wagon Wheel Gap, located about 7 miles southeast of Creede, is the site of an historic fluorite ("fluorspar") mine. The patented mining claims were operated from 1911 until 1950 to provide fluorite used as a smelter flux at the Colorado Fuel and Iron Steel Corporation (CF&I) steel mill in Pueblo, Colorado. The fluorite deposit consists of several closely spaced veins within a fault zone trending up the hillside above Goose Creek, near the east margin of the Creede Caldera. The article by Korzeb (1993) gives a good description of the Wagon Wheel Gap deposit and its minerals.

Some 12 minerals are reported from the deposit, of which the most common are fluorite and barite. The barite forms blocky crystals up to about 4 cm in length, and the fluorite is most noted for its occurrence in distinctive "cones", with a concentric banded interior and a surface of drusy, pale lilac-colored crystals. Wagon Wheel Gap is the type locality for the mineral creedite, a hydrous calcium aluminum fluoride-sulfate-hydroxide, $Ca_3Al_2(SO_4)F_8(OH)_2 \bullet 2H_2O$. Creedite was discovered and described from the fluorite deposit in 1916 but the mineral, typically as white crystals, is very uncommon at the deposit and can rarely be found there today; in recent years, creedite is best known for its purple crystals found at Santa Eulalia, Mexico, as well as at Cripple Creek and the Henderson mine in Colorado, plus localities in Nevada, China, and elsewhere. Another distinctive mineral at Wagon Wheel gap is also a calcium aluminum fluoride mineral, gearksutite, $CaAl(F,OH)_5 \bullet H_2O$, occurring as solid white, chalk-like masses.

The surface property rights over the mining claims are now owned by the 4UR Guest Ranch at Wagon Wheel Gap, and we will be visiting courtesy of them. We will visit the old mill buildings, and the mine dumps near the base of the hill should provide abundant specimens of fluorite and barite. Those who are sufficiently ambitious and energetic may wish to climb higher up the hill (some 500 vertical feet) to examine the upper workings and look for specimens there.

Our second and alternative field trip is to visit the Last Chance mine, a deposit along the Amethyst Vein just north of downtown Creede. The mine is owned by Jack Morris, Last Chance Mining Company, and is operated as a fee collecting area for rock hounds and tourists; specimens can be collected on the abundant mine dumps for a $2/pound charge. The mine and its dumps are particularly noted for the "sowbelly agate", interbanded white chalcedony with pale crystalline amethyst, one of the mineral combinations for which Creede is famous, although any of the other ore and gangue minerals occurring at Creede, including silver, sphalerite, galena, chalcopyrite, amethyst, etc., can potentially also be found in the mine dump. The mine is described on their website, http://www.lastchancemine.com/lcm.html .

On the Sunday of our symposium, attendees have a choice of going to the Last Chance mine on their own instead of the Wagon Wheel Gap trip, or to visit the Last Chance mine later in the afternoon after the first trip is finished.

We will meet at the museum at 8:30 am.
Waivers will be signed at each of the two collecting localities.

Dr. Peter J. Modreski

NOTES:

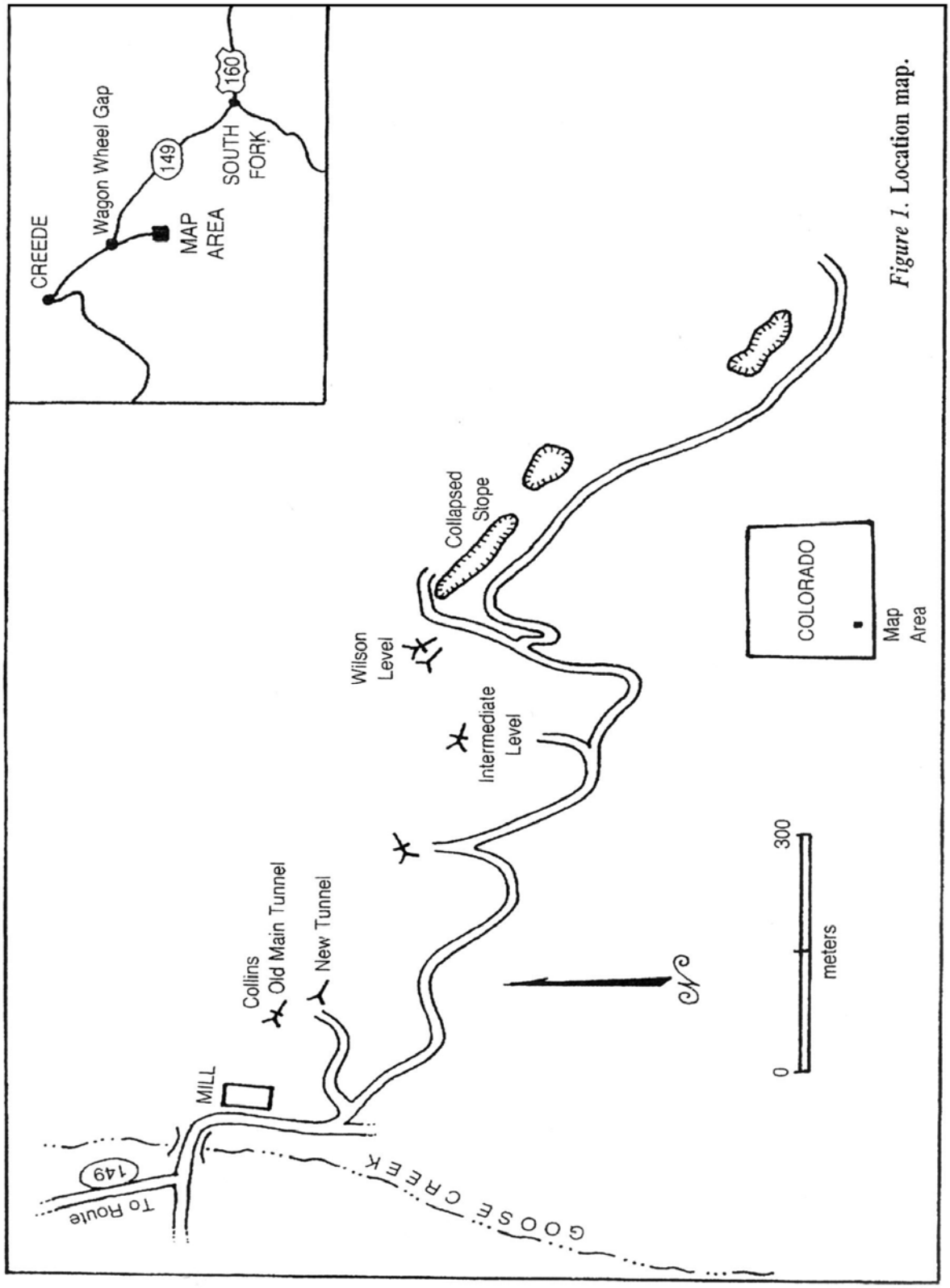
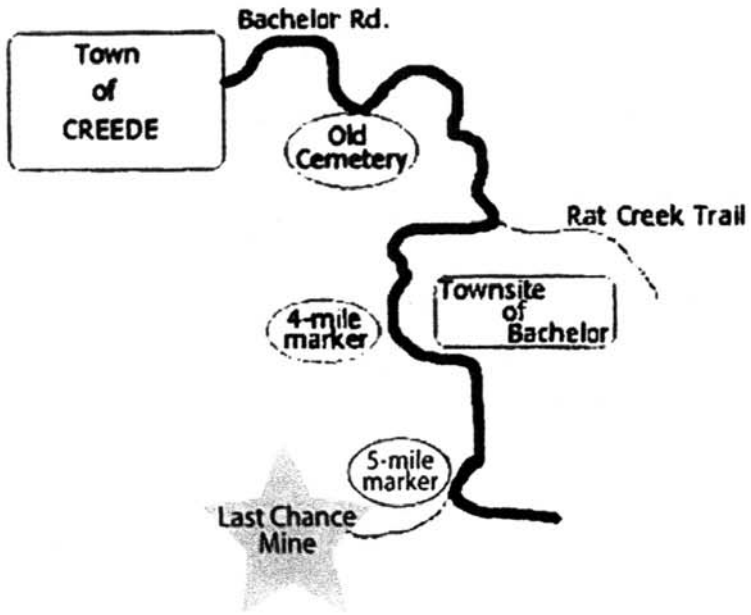


Figure 1. Location map.

Location map of the Wagon Wheel Gap fluorspar mine workings; Fig. 1 from Korzeb, 1993, The Wagon Wheel Gap Fluorspar mine, Mineral County, Colorado.

How to get to the Last Chance Mine



Creede is located about 125 road miles northeast of Durango and 300 miles southwest of Denver.

From the town of South Fork:

On U.S. Highway 160, the main east-west route through southwestern Colorado, follow state Route 149 north for 21 miles to Creede.

From the town of Creede:

Turn on Bachelor Road across from the Creede ballfield, stay on the main road, when you reach the **Townsite of Bachelor** on your left, you will see the **4-mile marker**, a small green sign on your right. Continue over the mountain for 1 mile, you will see the **5-mile marker**, turn right on to the Last Chance Mine Road.

From the Last Chance website at

http://www.lastchancemine.com/lcm.html

Hours Sunday Sep 12th 8:00 am - 3:00 pm

Phone: 719-238-7959

Minerals reported from the Creede mining district

Acanthite
Alabandite
Alunite
Analcime
Anglesite
Ankerite
Apjohnite
Aragonite
Barite
Beidellite
Beudantite
Biotite
Bornite
Bournonite
Brochantite
Calcite
Caryopilite
Celadonite
Cerussite
Chabazite
Chalcanthite
Chalcocite
Chalcopyrite
Chamosite
  var: thuringite
Chlorargyrite
"Chlorite group"
Chrysocolla
Clinochlore
Clinoptilolite
Copper
Covellite
Cristobalite
Cuprite
Erionite
Famatinite
Fluorite
Galena
Gold
  var. electrum
Goslarite
Greenockite
Gunningite
Halotrichite
Hematite
Hemimorphite
"Heulandite"
Heulandite-Na
Illite
Inesite
Jalpaite
Jarosite
Kaolinite
Ktenasite
Kutnohorite
Langite
Lepidocrocite
Levyne
Limonite
Magnetite
Manganite
Marcasite
Mckinstryite
Melanterite
Miargyrite
Mimetite
Montmorillonite
Mordenite
Natrolite
Nontronite
Opal
Orthoclase
  var. adularia
Plumbojarosite
Polybasite
"Psilomelane"
Pyrargyrite
Pyrite
Pyrolusite
Pyromorphite
Pyrostilpnite
Pyroxmangite
Quartz
  var. amethyst
  and other types
Rhodochrosite
Rhodonite
Rosasite
Rozenite
Saponite
Serpierite
Siderite
Silver
"Smectite group"
Smithsonite
Sphalerite
Stephanite
Stibnite
Stromeyerite (?)
Talc
Tennantite
Tetrahedrite
Turquoise
Uytenbogaardtite
Wellsite
Wulfenite
Xanthoconite

Minerals reported from the Wagon Wheel Gap fluorspar mine

Barite
Beidellite
Calcite
Covellite
Creedite (TL)
Fluorite
Gearksutite
Gypsum
Halloysite
Hematite
Pyrite
Quartz

source = mindat.org

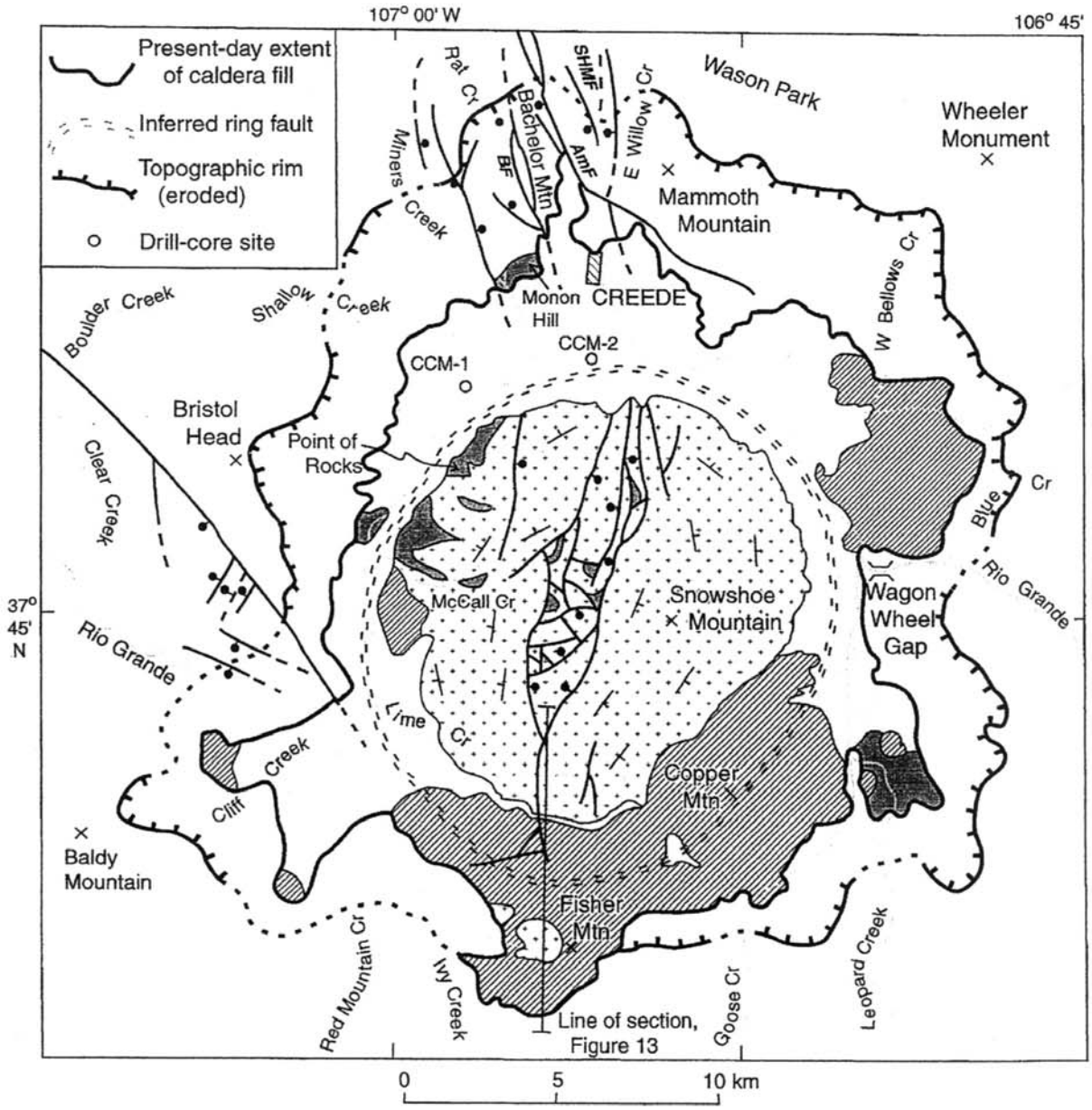


Figure 12. Generalized geologic map of Creede caldera, showing approximate location of eroded topographic caldera rim, present-day extent of caldera-fill deposits, inferred buried ring fault, and late normal faults during resurgent doming (Deep Creek graben) and mineralization (Creede graben). Faults of Creede graben: BF, Bulldog Mountain fault; AmF, Amethyst fault; SHMF, Solomon–Holy Moses faults. Modified from Steven and Ratté (1973) and Steven and Lipman (1973).

Geologic map of the Creede caldera; Fig. 12 from Lipman, 2000, Central San Juan caldera cluster; regional volcanic framework.

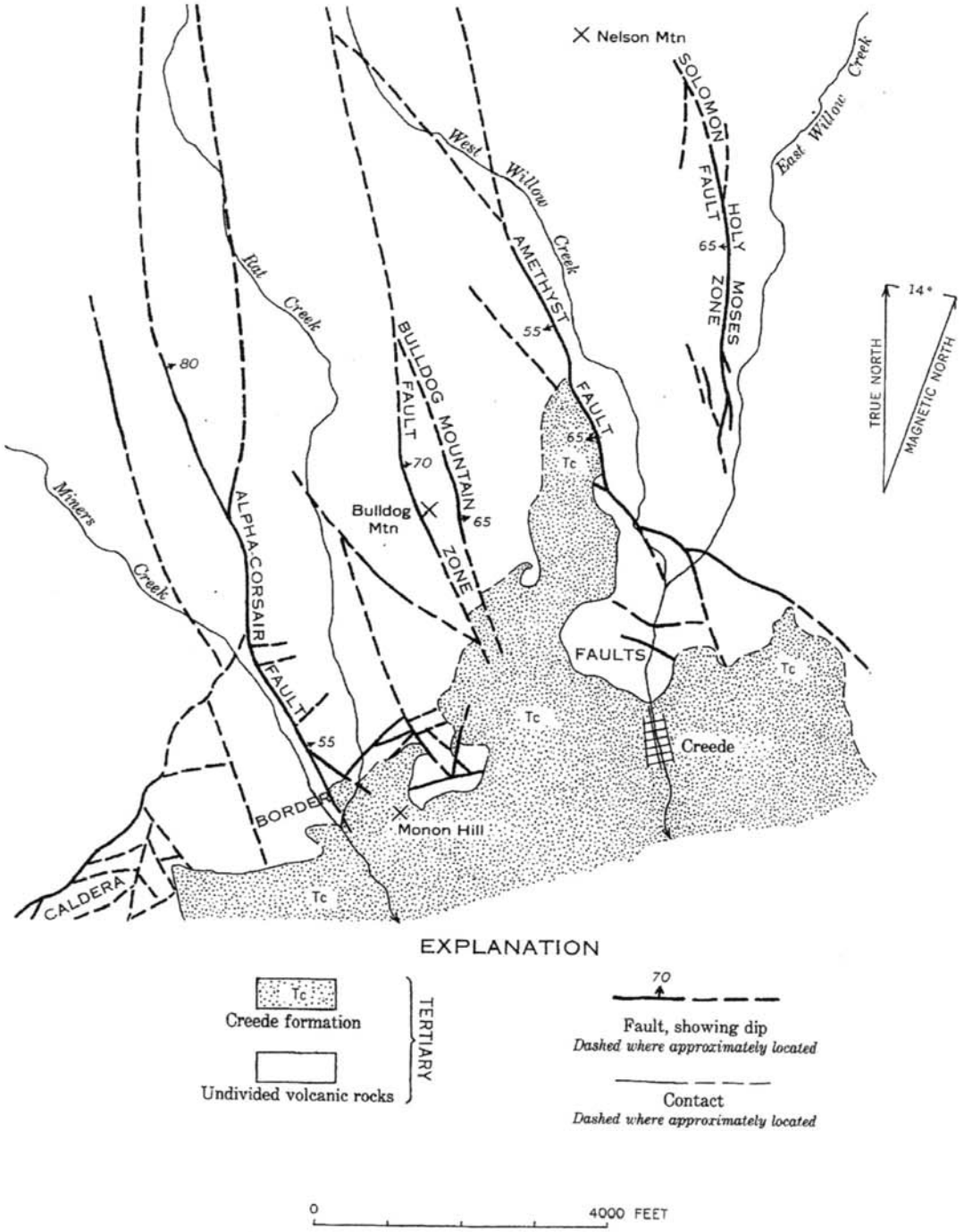


FIGURE 8.2.—Fault pattern in the Creede district, Colorado.

Fault pattern in the Creede district; Fig. 8.2 from Steve and Ratté, 1960, Relation of mineralization to caldera subsidence in the Creede district, San Juan Mountains, Colorado.

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