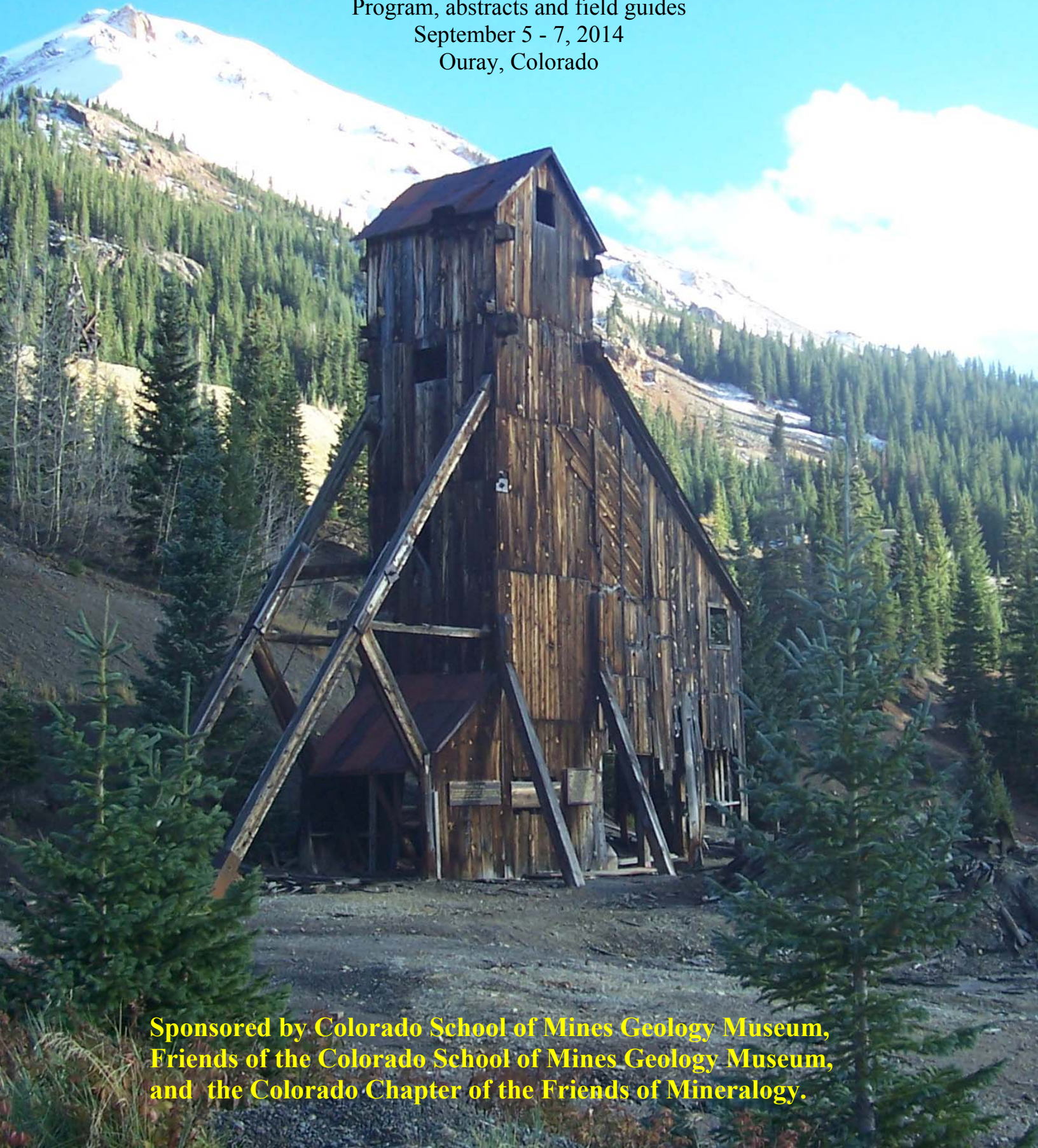


Ouray-Silverton San Juan Mountains Mineral Symposium

Program, abstracts and field guides
September 5 - 7, 2014
Ouray, Colorado



**Sponsored by Colorado School of Mines Geology Museum,
Friends of the Colorado School of Mines Geology Museum,
and the Colorado Chapter of the Friends of Mineralogy.**

Ouray-Silverton San Juan Mountains Mineral Symposium

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Front cover photograph: Hoist house of the Yankee Girl mine, Red Mountain District. Photographed by Jeff Self on November 1, 2012. Copyright © by Jeff Self.

Back cover photograph: Zunyite from the type locality, Zuni mine, San Juan County, Colorado. Colorado School of Mines Geology Museum specimen. Photographed by Dan Wray, August 2014. Copyright © by Dan Wray.

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The Symposium was held at the Ouray Elks Lodge, BPOE 492, 421 Main St, Ouray, CO 81427, Friday evening, September 5 to Saturday evening, September 6, 2014. Guided field trip events were held on Sunday, September 7, 2014.

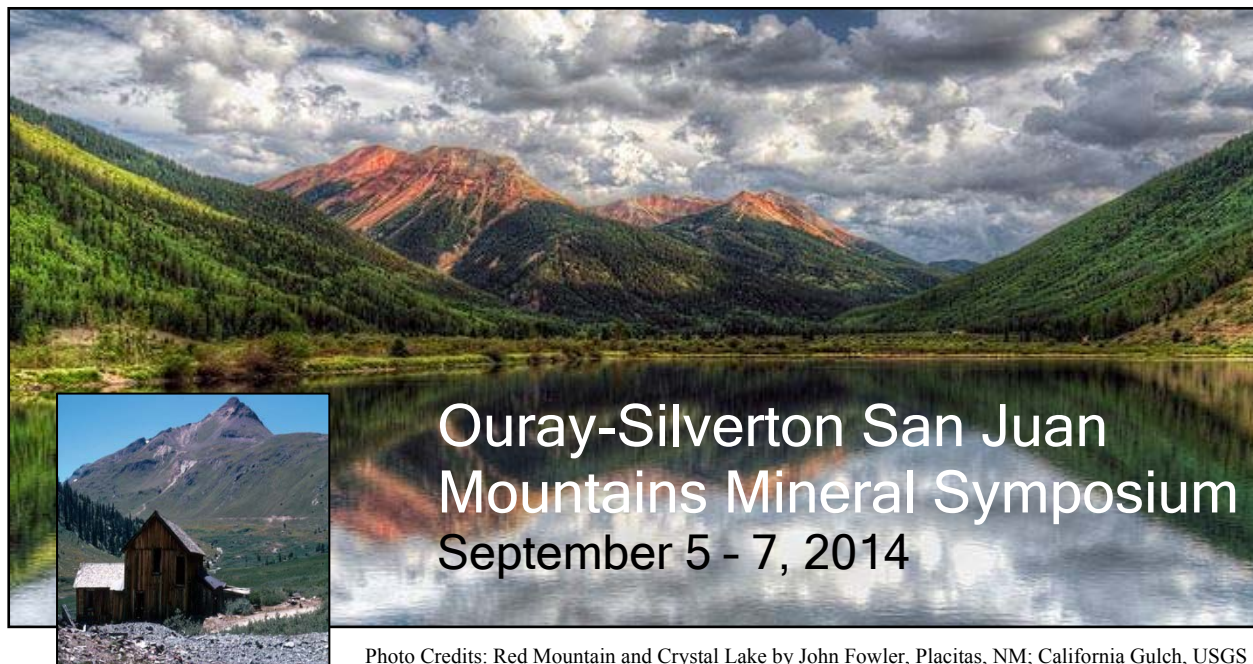


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Ouray-Silverton San Juan Mountains Mineral Symposium

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Ouray-Silverton San Juan Mountains Mineral Symposium

Participants and guests,

Welcome to Ouray! I am so glad you are here to enjoy the splendor of our area.

Please take advantage of the many events and attractions we have - The museum, historic buildings, trails, pool, water falls, jeeping and shopping. There will be several opportunities provided in your sign-in packet.

If there is anything The City of Ouray can do or questions I can answer, please do not hesitate to contact us.

Again, Welcome, and thanks for coming,

Pamela J. Larson
City of Ouray Mayor
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Ouray-Silverton San Juan Mountains Mineral Symposium

Symposium Guests,

It is a true pleasure welcoming you to the Ouray-Silverton San Juan Mountains Mineral Symposium. Some of you remember how great the Creede Symposium was in 2010 and I can honestly say that this one will be even better for several reasons. First, Ouray and Silverton possess more diverse mineral deposits than Creede. Second, the area is immensely larger and better known to non-Coloradoans. Most importantly, the planning committee is much larger for this Symposium, and it includes two residents of Ouray, Pam and Robert Larson, whose input we are extremely grateful for.

Planning for this Symposium started roughly a year ago and has involved monthly meetings, several hours long, of the following people: Lou Conti, Mike Dempsey, Mark Jacobson, Ken Kucera, Bob and Pam Larson, Larry Meckel, Pete Modreski, Jack Murphy, Richard Parsons, Jeff Self, Mike Smith, Norma Swanson, Donna Ware and me. I apologize if I've unintentionally forgotten to mention any of them. I would also be remiss if I didn't acknowledge the help provided by our co-sponsoring organizations, the Friends of Mineralogy Colorado Chapter, and the Friends of the Colorado School of Mines (CSM) Geology Museum.

Lastly, the impetus for organizing this Symposium was not merely masochism. In reality, it was the prodding by Baird Brandow, whose love of the San Juans prompted numerous conversations over the past few years.

Cordially,
Bruce Geller, Director
CSM Geology Museum

Symposium Guests,

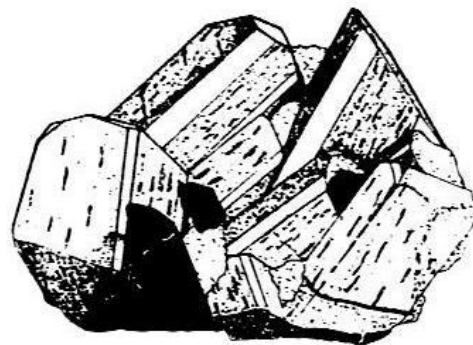
On behalf of the Friends of the Colorado School of Mines Geology Museum, I am pleased to welcome you to the Ouray-Silverton San Juan Mountains Mineral Symposium. Through a collaborative effort with the Museum and the Friends of Mineralogy, Colorado Chapter, we are pleased to bring you what we hope will be a most rewarding weekend in the San Juans.

As a native of the San Juans, I may be biased, but few places on earth can surpass the spectacular scenery, fascinating geology, exciting mining history and beautiful minerals of the San Juans (including eight species previously unknown to science).

Enjoy!

Richard Parsons, President
Friends of the Colorado School of Mines Geology Museum

**F
M** friends of
mineralogy
colorado chapter



Greeting Symposium Guests,

Welcome to the Ouray-Silverton San Juan Mountains Mineral Symposium. This symposium has been organized by a committee composed of Ouray and Silverton citizens, as well as members of the sponsoring organizations. We have put considerable effort in bringing to you the best speakers, those most knowledgeable about the San Juan Mountains, their history, geology, and mineralogy. We hope you enjoy the symposium, the towns of Ouray and Silverton, the scenery and of course the mines and minerals of the region.

The Friends of Mineralogy is a national service organization dedicated to the advancement of serious interest in minerals and related activities. We are mineral collectors, professionals, and curators who share a love of mineral specimens and the desire to promote understanding and appreciation of mineralogy. The national society was founded in 1970 in Tucson, Arizona whereas the Colorado Chapter was founded in Denver in 1978. At that time, our primary goal was as a support group for the Denver Museum of Natural History, and its curator, Dr. Jack A. Murphy. Our first project was the updating and re-issuing of Ed Eckel's 1961 book, *Minerals of Colorado*, which the chapter completed in 1997.

We participate in and are members of the greater community of Colorado mineral clubs, museum support groups, mining historical societies and the Greater Denver area Gem and Mineral Council, which is responsible for staging the annual Denver Gem and Mineral Show.TM

We engage in activities that support but do not conflict or compete with those of the numerous Colorado mineral clubs. We organize field trips to locations that mineral clubs can not obtain access, sponsor and publish mineral publications, and organize mineral symposiums. Our first symposium was in September 1982 at the Denver Gem and Mineral Show.TM Later symposiums were often at two year intervals, held at the Denver Museum of Natural History, Denver; or the Colorado School of Mines, Golden. Our last two symposiums were 2007 in Leadville and 2010 in Creede. This symposium is a continuation of working with local groups. Scheduling symposiums at locations outside of Denver allows us to offer presentations by local experts.

Mark Ivan Jacobson, President
Friends of Mineralogy, Colorado Chapter



Yellow Jacket Mine boarding house. Located approximately 5 miles up the Bear Creek trail. Photographed by Donna Ware during the fall 2011. Copyright © by Donna Ware,

Proceeding of the Ouray-Silverton San Juan Mountains Mineral Symposium

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Acknowledgements

The three sponsoring organizations have had the support and assistance of many different people, groups, organizations and businesses. Some museums, businesses and organizations in Ouray and Silverton have provided discounts to their facilities for symposium participants if they show their registration badge at purchase. This kindness is much appreciated. Some of these groups are the San Juan Historical Society in Silverton with the Heritage Pass, the Ouray Historical Museum and the Bachelor-Syracuse mine.

Symposium Schedule

Attendance at the Friday evening icebreaker, symposium talks and field trips is restricted only to registered participants. The symposium badge is to be worn at all times during the symposium and guided field trips. Participation in the banquet is restricted to registered participants and their guests, whether registered or not. Some pay attractions in Ouray and Silverton have a discount available for symposium attendee's who should show their symposium badge to the business. A list will be available at registration.

Friday, September 5, 2014

3.00–6.45 PM: Registration and symposium badge pickup, Elks Lodge, 421 Main Street, Ouray

5.30-6.45 PM: Icebreaker gathering- snacks and cash bar drinks at the Elks Lodge

7.00-8.00 PM: P. David Smith (keynote address) - Mountains of Silver: A History of the Red Mountain Mining District

Saturday, September 6, 2014

7.00-8.30 AM: Continental breakfast – coffee, tea, rolls, juice, water

8.30-8.45 AM: Welcome, introductions, and announcements

8.45-9.35 AM: Robert Stoufer - Mineral Collecting in the San Juan Mountains

9.45-10.35 AM: William R. Jones - The Liberty Bell and Shenandoah Mines in Photographs: 1899 – 1953

10.45-11.00 AM: Break

11.00-11.50 AM: Robert A. Larson - Silverton Caldera Mines & Minerals – Idarado, Camp Bird, Revenue-Virginus Mines

12.00-1.00 PM: Catered lunch at the Elks Lodge, provided by the Symposium

1.00-1.30 PM: Beverly Rich - Local Economic Impact of Heritage Tourism

1.40-2.30 PM: Kenneth Sloan - The Forgotten Champion Basin of the Red Mountain Mining District

2.40-3:30 PM: John Dreier - Regional Structural Control and Mineral Zoning in the Silverton Mining District, Southwestern Colorado U. S. A.

3.40-3.55 PM: Break

3.55-4:45 PM: Don Paulson - Wire Rope Aerial Tramways in the Mountains above Ouray and Silverton, Colorado

4.55-5:15 PM: Richard Parsons – Type Minerals of the San Juan Mountains

5.15-7:00 PM: Socializing, book signing, and cash bar

7:00-8.00 PM: Banquet dinner, Elks Lodge

8.00-9.00 PM: Camp Bird Mine: Thomas F. Walsh, impersonation presentation by John Stewart

Speakers Abstracts

Regional Structural Control and Mineral Zoning in the Silverton Mining District, Southwestern Colorado U. S. A.

John E. Dreier
jedreiergeo@comcast.net

The Silverton Mining District (Silverton as defined here includes Ironton, Camp Bird, Telluride, and South Animas – but not Lake City) has a cumulative mineral production of about 45M tons of ore, 8.4M oz Au, 174M oz Ag, 140k tons Cu, 900k tons Pb, and 625k tons Zn. The district is located within the San Juan Volcanic Field, of late Oligocene - mid Miocene age, which covers 6,000 sq miles and is the erosional remnant of a volcanic province that once covered much of southwest Colorado. Volcanic rocks in the San Juan Volcanic Field range from andesite to rhyolite and were erupted as flows from central cones and fissures and as ash flow tuffs from high-level felsic to intermediate composition magma bodies. Roof rock collapse during ash flow tuff eruption produced the 20 or so identified and inferred calderas within the volcanic field. Spatially (but not temporally) associated with some of the calderas are base and precious metals systems, among them, Platoro- Summitville, Creede, Bonanza, Lake City, Rico, and Silverton. Collectively the mineral deposits of the San Juan Volcanic Field have produced about 60M tons of ore containing 9.3M oz Au, 290M Oz Ag, 170k tons Cu, 1.8M tons Pb, and 920k tons Zn. The great majority of production from the San Juan Volcanic Field has come from epithermal veins and associated bedding replacements. Although fractures and faults related to caldera formation and magma emplacement trend in every direction of the compass, >90% of mine production in the San Juan Volcanic Field is from post-caldera veins or vein systems that trend NW to WNW and fill normal faults, some with a component of right lateral offset. The above observations about structural control of mineralization are especially true for the Silverton District, where the bulk of mine production is from a NW trending mineral belt about 4 miles wide and 18 miles long. Within the mineral belt, veins fill faults that have undergone normal and right lateral offset. The structural control to mineralization in the San Juan Volcanic Field coincides with the regime of northwest directed extension superimposed on western North America beginning in the late Oligocene. Notable features related to the northwest directed extension of western North America include the Gulf of California, the San Andreas Fault System, and the Basin and Range province.

The mineral belt within the Silverton District, as defined by the distribution of the great majority the mine production, is superimposed on a three-dimensionally zoned mineral system as follows:

1) Core Zone: located in the area of Ironton on the west flank of Red Mountain. Mines of the inner zone, including the Yankee Girl, Guston Robinson, Genesee-Vanderbilt, Silver Bell, Congress, San Antonio, and National Belle, exploited high-grade pipe-like deposits averaging 20 – 30 ft in diameter (up to 100 ft) and 500 to 1300 feet in vertical extent. Ore minerals include cosalite, kobellite, matildite, schirmerite, aikinite, bournonite, huebnerite, enargite, proustite, pyrargyrite, chalcocite, bornite, and tennantite among others. Wall rock alteration minerals include kaolinite, alunite, zunyite, sericite and dickite. The pipes are vertically zoned with Pb and precious metals enriched at the tops, base metals, and particularly copper, increasing with depth to roots of pyrite. As an example of ore grade in the upper zone, in 1891 the Guston Robinson produced 12,000 tons of ore grading 3 oz/t Au and 1,500 oz/t Ag.

2) Intermediate Zone: Includes the Idarado, Camp Bird, and Sunnyside mines (among others). Individual vein deposits were up to 8,000 ft long, >3,000 ft in vertical extent and averaged 3 – 10 ft wide.

The lower part of the Idarado and Camp Bird mines had replacement deposits within the Telluride Conglomerate. Veins of the intermediate zone are vertically zoned from Au-rich at the top (>1 oz/t Au) - to Pb-Ag rich (0.1 – 0.3 oz/t Au) - to Pb-Zn rich – and, at depth, to Zn-Cu rich (0.04 – 0.00x oz/t Au). Sulfide/ore minerals include native gold, petzite, calaverite, galena, sphalerite, chalcopyrite, huebnerite, pyrite, marcasite, and tetrahedrite. In the upper mine levels, sulfide minerals tend to be fine-grained and disseminated within quartz but with depth, become more coarse-grained and concentrated in sulfide bands. Gangue minerals include quartz, epidote/zoisite, adularia, barite, rhodonite, pyroxmangite, rhodochrosite, fluorite, calcite, and specularite. Minor minerals are alabandite and anhydrite among others. Wall rock alteration is vertically zoned, with chlorite and illite at the top and sericite, actinolite, anhydrite, and andradite at depth. Garnet skarn occurs in Paleozoic limestone beneath the Idarado mine.

3) Outer zone: Includes the Virginius, Shenandoah-Dives, Golden Fleece, Silver Lake, Smuggle-Union and others. The veins of the outer zone grade 0.1 to 0.5 oz/t Au, 2 – 15 oz/t Ag, up to 6% Pb, and <0.5% Cu and Zn. Ore minerals consist dominantly of galena, sphalerite, chalcopyrite, and tetrahedrite/tennantite. In deep parts of the Outer and Intermediate Zones, tetrahedrite becomes an important mineral and Cu and Ag values tend to increase. Principal gangue minerals are quartz, adularia, calcite, and epidote. Wall rock alteration consists of chlorite and sericite (illite?) with associated disseminated pyrite. In the Virginius and adjacent veins in the Telluride quadrangle, the veins are characterized by fine-grained sulfide minerals dispersed in quartz, whereas in the South Animas area, the ore minerals are moderate to coarse-grained and irregularly distributed in the veins as sulfide-dominant masses and in some areas and veins as replacements of wall rocks and rock fragments.

4) Peripheral Zone: Includes prospects south of Arrastra Basin and northwest of the Virginius vein. These veins are similar in mineralogy to those of the Outer Zone but have spotty and very low-grade metals values. Overall, the Peripheral Zone is characterized by barren quartz +/- calcite +/- barite veins.

Geologic work has demonstrated that the high-grade ore pipes and widespread and intense sericite-pyrite wall rock alteration of the Core Zone were produced by magmatic fluids and vapors expelled from a source located directly beneath the Core Zone. The three-dimensional zoning of metals, gangue minerals, and wall rock alteration suggests that mineralization in the Silverton District as a whole has a common and contemporaneous origin in an intrusive located at depth beneath the Core Zone. However, this simple picture is at odds with data from various studies, which together suggest that mineralization is the product of multiple individual magmatic/meteoritic sources that were active over a time span of > 5 my. Given the contradictory evidence implied by the foregoing discussion, an unimpeachable genetic model for the ores of the Silverton Mining District awaits further geologic work.

The Liberty Bell and Shenandoah Mines in Photographs 1899 – 1953

William R. Jones

Follow the development of two famous San Juan gold and silver mines with these rare “insider’s” photos from the collection of the mine’s general manager, Charles A. Chase, who was an avid amateur photographer. Taken between 1899 and 1953, the photographs show the incredible work done by our forefathers to mine the rich (and not so rich) veins at altitudes well above timberline.

The Liberty Bell was the smallest of the big three gold mines in Telluride at the turn of the 20th century along with the Tomboy and Smuggler. The original portal, above 11,500 feet, was destroyed by a deadly avalanche in 1902. A lower safer tunnel was built but still required a spectacular aerial tramway to access the portal. The mill was located adjacent to the Telluride cemetery and its foundations are all that remain today.

Five years after the closure of the Liberty Bell, a group of Kansas City investor’s hired Chase to find another successful gold mine in the San Juan’s. While inspecting the moribund Old Hundred Mine, he saw a large outcrop on ridge to the southwest, the Shenandoah-Dives vein. A new mine was born, opening in the fall of 1929 just as the stock market crashed and the depression began. The mine faced challenge after challenge but sharp management, technical innovation, and a loyal crew kept the mine going and the town of Silverton alive during the darkest days of the Depression and WW-II, and was even responsible for preventing the early abandonment of the narrow gauge train!

These rare and amazing photos show close-up the lives of the men and their mines during the glory days of San Juan mining.



Left: Shenandoah – Dives Mine
circa 1900.

Silverton Caldera Mines & Minerals – Idarado, Camp Bird, Revenue-Virginus Mines

Robert A. Larson
P. O. Box 85
Ouray, CO 81427

The mines and minerals associated with the northwest trending vein systems of the Silverton Caldera have been well defined over the past history of exploration, development and mining. Work that began in the 1870's is continuing today, at some locations, associated with three of the most prominent producers; Idarado, Camp Bird and Revenue-Virginus Mines. As defined by Fred Fisher in his USGS Bulletin 1857, approximately 22 million tons of ore has been produced, exceeding \$300 million in value at the time of production, from these radial vein systems. The total amount of gold produced has been about 6.2 million ounces.

In addition to the base and precious metals that are being mined and processed, associated gangue-minerals are also present. The recent publication titled "The San Juan Triangle of Colorado – Mountains of Minerals" documents some of the specimens and crystals that are associated with these Silverton Caldera vein systems. Tom Rosemeyer, in his Rocks and Minerals article on the "Camp Bird Mine – Colorado's Golden Bonanza" provided examples of typical quartz, calcite, pyrite and chalcopryrite, and then he added photographs of more unique scheelite, ankerite, huebnerite, and telluride gold ore. Beautiful specimens of the ever-popular mineral, rhodochrosite, is also found in certain locations within these vein systems.

Unique and beautiful mineral specimens will continue to be mined and brought to the surface, along with the base and precious minerals, as mining continues in these San Juan Mountains. Historic mine dumps still possess some collectible minerals. A guide to these locations can be found in George Moore's "Mines, Mountain Roads, and Rocks" available at the Ouray County Historical Society and Buckskin Booksellers. As always, be aware of Private Property since most of these areas are on patented mining claims, still possessed and controlled by individuals and/or mining companies. Have a great time exploring our mineral-rich San Juan Mountains.

Type Minerals of the San Juan Mountains

Richard Parsons
Pine, CO

The early days of mineral exploration in Colorado were focused on the pursuit and exploitation of economically viable precious metal deposits, later expanding to the development of base metal ores. In this process, unfamiliar minerals were found, some of which were believed to be new to science. Of those proposed, some were ultimately determined to be examples of known species and some, while new, were found to have first been found more or less contemporaneously at locations outside Colorado.

Those new species that have (so far) stood the test of time are considered to be Colorado "type species", and the localities from which the original material was obtained are designated "type localities" for these species.

At the time of the publication of the updated Minerals of Colorado, Colorado had been credited for 63 type species, plus three additional proposed species on which no ruling had yet been made. A list of those species plus 21 that had been discredited may be found in that publication, pages 6-7. Fifteen

of these species came from the San Juan Mountains; we will focus on the nine found in the area bounded by Lake City, Silverton and Ouray.

Wire Rope Aerial Tramways in the Mountains above Ouray and Silverton, Colorado

Don Paulson,
Curator for the Ouray County Historical Society

Mining in the San Juan Mountains was never an easy proposition. The best ore was often located at elevations of over 10,000 feet in the most inaccessible areas far from railroads or good wagon roads. Due to the high cost of transporting freight by burro or mule over narrow mountain trails, only the richest ore could be shipped from the mines.

Mining engineers of the late 19th century solved the problem of moving lower grade ore by the use of wire rope aerial tramways. Aerial tramways typically ran from steep cliff faces down to lower elevation valleys where either a mill was located or cheap rail or wagon transport was available. The loaded ore buckets going downhill pulled the empty ore buckets back up.

There were two basic types of aerial tramways employed in the mountain west. The earliest type was known as the single rope “Hallidie” or “Huson” tramway in which a single endless wire rope ran continuously in one direction. This rope served the dual purpose of supporting the ore bucket and moving it from mine to mill or loading bin. The second type of tramway was the double rope “Trenton-Bleichert” continuous system. One rope pulled the ore buckets and the second rope supported the ore buckets.

This presentation will look at the history of wire rope tramways through the many mines that used them in the mountains above Ouray and Silverton, Colorado.

Local economic impact of Heritage Tourism

Beverly Rich
Silverton, CO

Over 400,000 visitors ride the historic Narrow Gauge train from Durango, Colorado to Silverton every year and enjoy our back country recreation. This type of tourist demographic is proven to stay longer in an area and infuse more dollars into the local economy through meals, accommodations and admissions. Heritage tourism is the life-blood of Silverton’s economy and the preservation of San Juan County’s historic assets is critical to our future success, strengthening our educational mission and promoting heritage tourism to the public in rural Colorado. Beverly Rich talks about what the San Juan County Historical Society has done to further Heritage Tourism in the area.

The Forgotten Champion Basin of the Red Mountain Mining District

Kenneth Sloan
Ridgway, CO

The Champion Basin is located between Red Mountain Town and Red Mountain Three and terminates just above the once existing Guston town site. Champion Gulch is included as a part of Champion Basin. The distance from the northeast end of Champion Gulch to the back of the Champion Basin is one and a quarter miles and a maximum of four tenths of a mile wide. The elevation in the basin ranges from 10,400' at the mouth of the gulch to 12,065' at the back of the basin. The ridge around the edge of the basin ranges from 11,000 to 13,000 feet. The terrain is moderate to difficult. There are no roads or hiking trails within the basin. Because the Champion Basin is so isolated there have been very few human visitors over the years. While hiking in this area, you may see mule deer, elk, bear, foxes, snowshoe rabbits, grouse, and ptarmigan.

Due to the red-colored talus slopes, the surface geology is nearly covered up except for near the bottom along the gulch. Beneath the talus and in the gulch, the tuffs and flow breccias of the Henson Member of the Silverton Volcanic Group are present. Widely scattered small intrusive pipes of porphyritic quartz latite occur in the basin. One large rhyolite pipe occurs near the mouth of the gulch.

Along the northeast side of the basin are several unnamed small mines, prospector tent camp sites and an interesting log cabin. The most interesting of all is a small abandoned mine at the back of the basin. The adit of this small mine is at 12,400 feet elevation, facing Cork Screw Gulch on the ridge dividing it from Champion basin. The adit goes back to a vertical shaft excavated in an intrusive pipe. Later, a second adit was made on the Champion Basin side of the basin at 12,145 feet. There have been many interesting artifacts found at this site including a drinking shot glass.

Mineral collecting at the dump has been very good. Minerals that have been found are: alunite, argentite, enargite, pyrite, sphalerite, and tetrahedrite. Enargite and argentite are present as small collectable crystals. Chunks of massive pyrite with enargite have also been found on the dump which may mean the near-surface, weathered oxide and water-table enriched zones have already been removed and the mine has "bottomed out." It is estimated that the mine was active from 1889 to 1893. A well worn mule trail, used for delivering ore, starts at the mine ore box, crosses the basin floor and goes along the southeast side of the basin to end at the railroad terminal in Red Mountain Town. This trail is a very scenic hike-able route today.

Mountains of Silver: A History of the Red Mountain Mining District

P. David Smith

About 125 years ago, the Red Mountain Mining District was the scene of a silver rush with an output of the precious metal that was second only to Leadville at the time. From 1881 to the end of that century, more than thirty million dollars in gold, lead, zinc, copper, and mainly silver were taken from the rich deposits on Red Mountain Divide.

P. David Smith's talk is based on his book *Mountains of Silver*, the only book written on the area. It tells the story of a true boom mining district – its many towns, its roads including the Million Dollar Highway, the famous Silverton Railroad, the fierce competition between Silverton and Ouray for the district's business, its world famous mines, and the men and women who worked, played, and died on the Divide. His talk focuses on the excitement that drew thousands of men, all hoping to strike it rich through rich strikes, land speculation, merchandising, lawsuits, prostitution and liquor, or transportation of the rich ore from the remote area.

Camp Bird Mine: Thomas F. Walsh, as portrayed by John Stewart

John Stewart
Denver, CO

Thomas F. Walsh was born in Ireland and emigrated to America in 1869, at age nineteen. He came west to look for gold two years later, but found little of it. Nevertheless, the prudent Walsh used his Irish millwright's training to work in more stable jobs such as carpentry, and later as the owner of a hotel, while searching for riches on the side. He also learned as much about mining and geology as possible. In 1896 he found his bonanza near Ouray, Colorado. It was a rich gold vein in a tunnel at 11,800 feet which had been overlooked by others for nineteen years.

Tom Walsh's Camp Bird Mine made him very rich. Unlike many other mining millionaires, he used his wealth wisely. He made sound investments while engaging in philanthropy, not just in Ouray but throughout the nation, and in his native Ireland. The Walsh family eventually moved to Washington, DC and lived in style in a mansion which is now the Indonesian Embassy. Walsh met some of the nation's and the world's most influential citizens, but remained humble and still welcomed old friends from his mining days in the West. He died in 1910, at age sixty. One year after his death, his daughter Evalyn Walsh McLean used her inheritance to purchase the Hope Diamond, widely believed to be cursed. While the conservative Walsh might not have approved of the purchase, a rare weakness of this otherwise strong man was his willingness to bestow riches on his children, which led them to expect more. Evalyn later correctly identified the curse on her family as wealth, not her famous diamond.

During his research on Thomas F. Walsh, John Stewart was reminded that the two look somewhat alike (five degrees of separation?). John has now been portraying Tom Walsh for ten years. His first "Walsh gig" was in Ouray, and he has since been able to add book signings to the act with the publication of *Thomas F. Walsh: Progressive Businessman and Colorado Mining Tycoon* (2007, University Press of Colorado).

Mineral Collecting in the San Juan Mountains

Robert Stoufer
Buckskin Booksellers, Ouray, CO

Mineral collecting has been part of my life since moving to Ouray in 1977. I have been fortunate enough to explore many of the mines and prospects in the Ouray-Silverton areas with friends and other mineral collectors during my time here. The small world of mineral collectors congregate, support and enjoy the company of each other while digging, tramping and exploring the vast mineral wealth of this unique environment. Minerals have been collected and/or acquired from historic mine dumps, accessible mine workings (with permission from mine owners), outcrops and surface vein exposures. At times, minerals have been purchased from other collectors, miners or rock shop owners. Many opportunities still exist to discover and collect unique mineral specimens that are prevalent in the San Juan Mountains of Colorado.

Speaker Biographies

John E. Dreier, 13790 Braun Rd., Golden CO 80401 USA, jedreiergeo@comcast.net



I was born in Houston Texas and grew up in the New York City area and on a farm in the Hudson Valley, where I developed a love of the outdoors and geology. I received a bachelors degree in geology from Union College, a Masters in geology from the University of Wyoming, and a Ph. D. in economic geology and geochemistry from the University of Arizona. My career as an economic geologist began in northern Manitoba and the Northwest Territories of Canada where I explored for nickel deposits for Inco. After completing my M. S., I went to work for Bear Creek Mining Co. looking for sediment hosted copper deposits in the northwest U. S. and porphyry copper deposits in Arizona and New Mexico. At Bear Creek, I also worked as a

mine geologist at Ray, Arizona, where I was introduced to copper leaching. At the University of Arizona I became interested in the application of thermodynamics to geological problems. Because thermodynamic data of the time went up only to about 300° C, an epithermal deposit presented the best choice for study. Spence Titley mentioned the Pachuca Real del Monte district located in central Mexico and Spence and John Guilbert obtained funding from Guillermo Salas, Director of the Consejo de Recursos no Renovables de Mexico. With the promise of funding and Spanish 1A and 1B under my belt, I drove down to Pachuca, camping out on the way to save money. I worked at Pachuca, then milling 2,500 T/D from epithermal silver veins underlying an area of about 80 sq. km, on and off for about two years. After Arizona, I co-founded Sage Associates with Dave Hackman and Perry Durning to explore for epithermal silver deposits in the Western U. S. Early in the program, in the mid 1970s, we began work in the San Juan Mountains - at Bonanza, Creede, Platoro and Silverton. My interest in mineral deposits of the region continues to the present. At SAGE, we also explored for Carlin deposits and helped develop a placer gold mine in Alaska.

Starting in the mid 1980s I became a principal in a series of junior companies variously focused on Carlin systems, development-stage porphyry copper deposits, a disseminated silver/gold deposit on Red Mountain, and epithermal veins in Colorado and Mexico. During this period my geographic horizon expanded to South America, the Caribbean, Australia, and Asia. For a number of years I worked for Newcrest Mining, where I managed a program to acquire oxide copper deposits in the Chilean Coast Ranges and gold deposits in the Andes. My interest in oxide copper leaching, developed at Ray back in the 1960s, lead me to a study of the geochemistry and geometallurgy of copper leaching, to designing and managing copper leach metallurgical test programs, and to working as a consultant to copper leaching projects and operations. I have taught the chemistry and geometallurgy of copper leaching in the SME Copper Heap Leach short course since 1990 and am presently the course organizer.

William R. Jones, Silverton, CO

Bill is a 37 year veteran in the mining industry whose focus has been laboratory management, mining project management, and water treatment plant construction and operation. A licensed Professional Assayer, he operated Root & Norton Assayers in Silverton, Colorado for many years. In 2007 he joined Kinross Gold Corporation for the start of their Buckhorn Mine operations in Washington USA as Chief Assayer. In 2009 he became supervisor of the mine water treatment plant and Chief of Process Services.



He has a long time interest in the railroad and mining history of the San Juan mountains and is a life member of the San Juan County Historical Society. He started his career as an assayer at the Mayflower Mill in 1977. In 1992 he co-founded the Old Hundred Gold Mine Tour in Cunningham Gulch, near Silverton which is today one of the premier historic mining attractions in Colorado.

In 2002 Bill was asked by the U.S. Geological Survey to update the full 120 year mining production history of San Juan County which had last been published in 1921! The research was published as the “History of Mining & Milling Practices & Production in San Juan County 1871-1991” being Chapter C of *Integrated Investigations of Environmental Effects of Historical Mining in the Animas River Watershed, San Juan County, Colorado*. U.S. Geological Survey Professional Paper 1651, (2007). This report can be found on the internet at <http://pubs.usgs.gov/pp/1651/>.

Robert A. Larson, Monadnock Mineral Services, LLC, 342 7th Avenue, Ouray, CO 81427



Robert A. Larson is a Certified Professional Geologist and a Registered Land Surveyor with more than 45 years of experience in mining, exploration and surveying in the United States, Canada, Mexico and the Caribbean. Mr. Larson’s mining experience includes base and precious metal mining, engineering and management for both surface and underground operations. His exploration experience includes precious metals, base metals, uranium, and industrial minerals in various geological environments. Mr. Larson’s operating experience includes geology, mining and production duties at the Idarado Mine, Project Manager at the Revenue-Virginus mine, and consultant to the Camp Bird Mine. In addition, he has provided numerous mineral property evaluations, mineral resource determinations and technical reports as a consultant for Monadnock Mineral Services, LLC, Ouray, Colorado. Mr. Larson graduated with an Engineer of Mines degree from the Colorado School of Mines in 1968.

Richard Parsons, Pine, CO



Richard Parsons is a lifelong mineral collector retired from a career in human services and public administration. His academic background includes a BA in Anthropology with minors in chemistry and Spanish, and an MA in Public Administration.

Richard has been active in local gem and mineral clubs since the 1960's (with something of a hiatus for raising a daughter and a son). He has served as an officer in several clubs including terms as President of the Mile High RAMS (ca. 1970), North Jeffco, Lake George, Friends of Mineralogy Colorado Chapter and the Rocky Mountain Micromineral Association.

While serving as President of the North Jeffco Gem and Mineral Club, Richard established a Mineral Study Group, in which he still participates. In this context he has developed numerous presentations for the group, with an emphasis on crystal symmetry. He has presented programs on crystal symmetry to several clubs in the Denver area, plus Colorado Springs and Lake George.

In 2008, Richard co-founded and served as first President of the Rocky Mountain Micromineral Association, dedicated to encouraging and promoting the study and enjoyment of minerals under the microscope. To promote this goal, Richard has made presentations on micromounting to numerous clubs.

Richard has been a volunteer at the Colorado School of Mines Geology Museum since 2008, working on the Museum's extensive micromount collections and preparing specimens for sale in the Museum's Gift Shop. He is member number 3 of the Friends of the CSM Geology Museum, and currently serves as President of that organization.

Donald Paulson, P. O. Box 1168, Ouray, CO 81427

Dr. Donald R. Paulson graduated from Monmouth College in 1965 and completed his Ph.D. in Organic Chemistry at Indiana University in 1968. Following work as a post-doctoral fellow for the National



Institutes of Health, he joined the faculty of California State University, Los Angeles in 1970. He chaired the Department of Chemistry and Biochemistry from 1982 through 1990. He administered more than 30 grants from the National Institutes of Health and the National Science Foundation in the areas of Models for Oxygen Binding Proteins and Active Learning in the College Classroom. He has published more than 50 scientific papers.

He retired from California State University at Los Angeles in 2006. He and his wife Beth built their house in Ouray in 1999. Don has a passion for mining and railroads. He serves on the Board of the Ridgway Railroad Museum where he edits their monthly newsletter and co-wrote and edited their recent publication *Railroading in the San Juan Triangle*. He lectures widely on southwestern Colorado history and writes a monthly history column for the *Ouray Plaindealer*. In 2012 he co-authored with Jeff Burch *Peaks of the Uncompahgre* which provides the stories behind the names of the area peaks as well as stunning photographs of the peaks.

He is on the Board of the Ouray County Historical Society and serves as the museum curator and is also the editor of the *Ouray County Historical Society Journal*. In his spare time he enjoys photography, hiking and jeeping in search of yet another mine or railroad right-of-way.

Beverly Rich, Silverton, CO



Beverly was born and raised in Silverton, Colorado. After graduation as valedictorian in 1968 from Silverton High School, she obtained a degree from Fort Lewis College, Durango. Her father was a miner as was her late husband, Bill. With her love of the mountains, she still resides in an old Victorian-era house with her dog, Annie. She has been the San Juan County Treasurer for 24 years and is looking forward to retirement. She is also the chairman of the San Juan County Historical Society and has been an administrator of the museum operations for 26 years. She has been very

active in the community for most of her adult life, having raised over 10 million dollars in grant funds for historic preservation projects in Silverton and San Juan County. She was the recipient of a National Honor Award from the National Trust for Historic Preservation in 2005 for her work in the preservation field.

Member of: Colorado County Treasurer's Association, San Juan Regional Planning Commission, National Historic Landmarks Stewards Association, Colorado Preservation, Inc., Silverton Chamber of Commerce, Committee for directing the archaeological remediation for the Animas-La Plata Dam Project, State Historical Fund Advisory Board, and the Red Mountain Task Force.

Kenneth Sloan, Ridgway, CO



Kenneth Sloan is a petroleum geologist who received his BS (1962) and MS (1963) degrees at Kansas State University. He started his career as a hydraulic fracturing engineer for the Dowell division of Dow Chemical for two years and then went to work for Phillips Petroleum for the next 13 years. He worked for Phillips Petroleum as a reservoir and an exploration geologist in the Permian Basin, Sacramento Valley, Powder River Basin and North Slope, Alaska. For three years he represented Phillips on the Prudhoe Bay Geological Subcommittee. In 1978 he quit Phillips and over the following years was Exploration Manager for Celeron Petroleum and International Paper. In 1999 he retired and moved to Ridgway, Colorado where he hikes,

explores old mine sites and studies the geology of the San Juan Mountains in the Silverton and Ouray areas. His other interests are hiking the Dolores River drainage system of the Paradox Basin studying its geology and doing volunteer work for the BLM, checking Indian petroglyphs.

P. David Smith, Lake City, CO



P. David Smith graduated with a business and law degree from the University of Texas at Austin in 1968 and practiced law for twelve years before being appointed the Ouray County Judge, a position he held for twenty years. He and his wife Jan lived in Ouray for twenty-five years and have many fond memories of jeeping and hiking in the area. He has authored eleven books on Southwest Colorado history and is the owner with his wife, Jan, of Western Reflections Publishing Co., which has published more than 200 books on Colorado history and lore. David has also written numerous short articles and given many talks throughout Colorado.

John C. Stewart, Denver, CO



A native of Lincoln, Illinois, John Stewart received his Bachelor's Degree in History and his Law Degree from the University of Illinois. John started his legal career in Chicago, but after only a few years heard Colorado calling and has now called Denver home for 34 years. His first job in Denver was with a mining company, and John developed a deep interest in mining history. While still practicing law, John decided to add a Master's Degree in History from the University of Colorado at Denver. His thesis topic became the subject of his first book, a biography of mining millionaire Thomas F. Walsh. When not engaged in either the law or writing, John spends as much time as possible with his family (wife Carol, daughter Emilie, son-in-law Paul, granddaughter Madeleine), and volunteers at his church and with various groups who promote the understanding of history and historic preservation.

Robert Stoufer, Ouray, CO



Robert Stoufer is a noted authority on minerals and mining in the San Juan Mountains. He was born in Mississippi and starting mineral collecting at age 5. After receiving his BS in geology from Millsaps College he pursued geologic graduate work at the University of Kansas. Following his move to Ouray in 1977, he and his wife became proprietors of Buckskin Booksellers in Ouray which since November of 2001 offers specialized books on mining history and minerals from Colorado and the American West. In addition, he attends and offers his books at numerous gem and mineral shows in Colorado and adjacent states.

He started Coloradominerals.com in 2004, with Collector's Edge and became sole owner/proprietor of Coloradominerals.com in 2008.

Field Trips

The guided field trips, 1 through 5 will be held on Sunday, September 7, 2014. The self guided field trips, 6 through 12 can be followed by the participants at any time, using roadlogs that can be found in the book 'MINES, MOUNTAIN ROADS AND ROCKS' by George E. Moore. This guidebook is locally available for purchase in Ouray and Silverton. Only one guided field trip, no. 1, has an additional fee. The other guided field trips are covered by your symposium registration fee.

A 4WD vehicle is required for the guided field trips 2 through 5, as well as self guided field trips 7 through 11. All participants for field trips 2 to 5 will need to sign the field trip leader's liability release form and also possess third party liability insurance which the registrants did obtain from their Rocky Mountain Federation club or through membership either in the Friends of Mineralogy, Colorado Chapter or Friends of the Colorado School of Mines Geology Museum.

Field trip participants will need to bring their own lunch (a box lunch can be purchased in Ouray, information as to where to purchase was provided with the registration packet), cameras, raingear, coats (it **will** get cold and rain in the afternoon at the higher elevations we will visit), water (at least 2 quarts per person), and sun protection (hat, long-sleeved shirt and sunscreen) even if cloudy.

Some pay attractions in Ouray and Silverton have a discount available for symposium attendee's who should show their symposium badge to the business. A list will be available at registration. Symposium badges are to be worn at all times during the symposium and guided field trips. Participation in field trips is restricted to only registered participants due to liability insurance.

List of Guided Field Trips

- 1 The Yankee Boy Basin Trip- Ouray to Camp Bird millsite to Yankee Boy Basin (fee trip)
- 2 The Red Mountain Trip - Ouray to Red Mountain Town, National Belle Mine to Guston Mine
- 3 The Sunnyside Mine Trip - Silverton to Eureka to Sunnyside Mine
- 4 The Silver Wing Mine Trip - Silverton to Pride of the West Mill (Howardsville) to Silver Wing Mine
- 5 Highland Mary Mine Trip - Silverton to Cunningham Gulch to Highland Mary Mine

Recommended Self Guided Field Trips

Trip guides to Field Trips 7 to 10 can be found in *Mines, Mountain Roads, and Rocks* by George E. Moore.

6. Silverton town field trip - See the town map at the end of this volume, page 52.
7. Silverton to Animas Forks to Placer Gulch to Picayune Gulch loop
(guidebook: refer to Moore, Road Log 14, pp 203-212).
8. Ironton to Animas Forks
(guidebook: refer to Moore, Road Log 13, pp 187-202).
9. Ouray to State Bridge to Mineral Point.
(guidebook: refer to Moore, Road Logs 10, 11, 12 pp 155-186).
10. Ouray to State Bridge to Engineer Junction to Mineral Point to
Animas Forks (guidebook: refer to Moore, Road Logs 10, 11, 12, 13, pp 155-202).
11. Ouray to Silverton. See pages 48-51 in this volume.
12. Ouray town field trip – See the town map at the end of this volume, page 53.

Field Trip 1. Ouray to Yankee Boy Basin Field trip

GEOLOGY & MINING OF OURAY AREA (OURAY TO YANKEE BOY BASIN)

Field Trip leaders: Larry Meckel (San Juan Geology)
Rick Trujillo (Mining History-Geology-Ore Deposits)

7:15 AM. Gather in front of the Western Hotel (210 Seventh Ave, Ouray, CO 81427, phone: 970-325-4645). Prior to leaving Ouray, a safety review regarding walking along narrow roads and other situations will be given so please come on time. Vehicles left during the day can be parked adjacent to the hotel. The jeep (an open-air, twelve passenger 4WD vehicle) is provided and driven by San Juan Jeep Tours (P.O. Box 25, Ouray, CO 81427, Phone: 970-325-0089 or 1-888-624-8403, ourayjeeptours@yahoo.com). Their office is located in the Western Hotel, Ouray. The field trip will last till 5 PM. Since the tour vehicle driver will be with us all day, a tip to the driver is suggested of approximately \$10 per person.

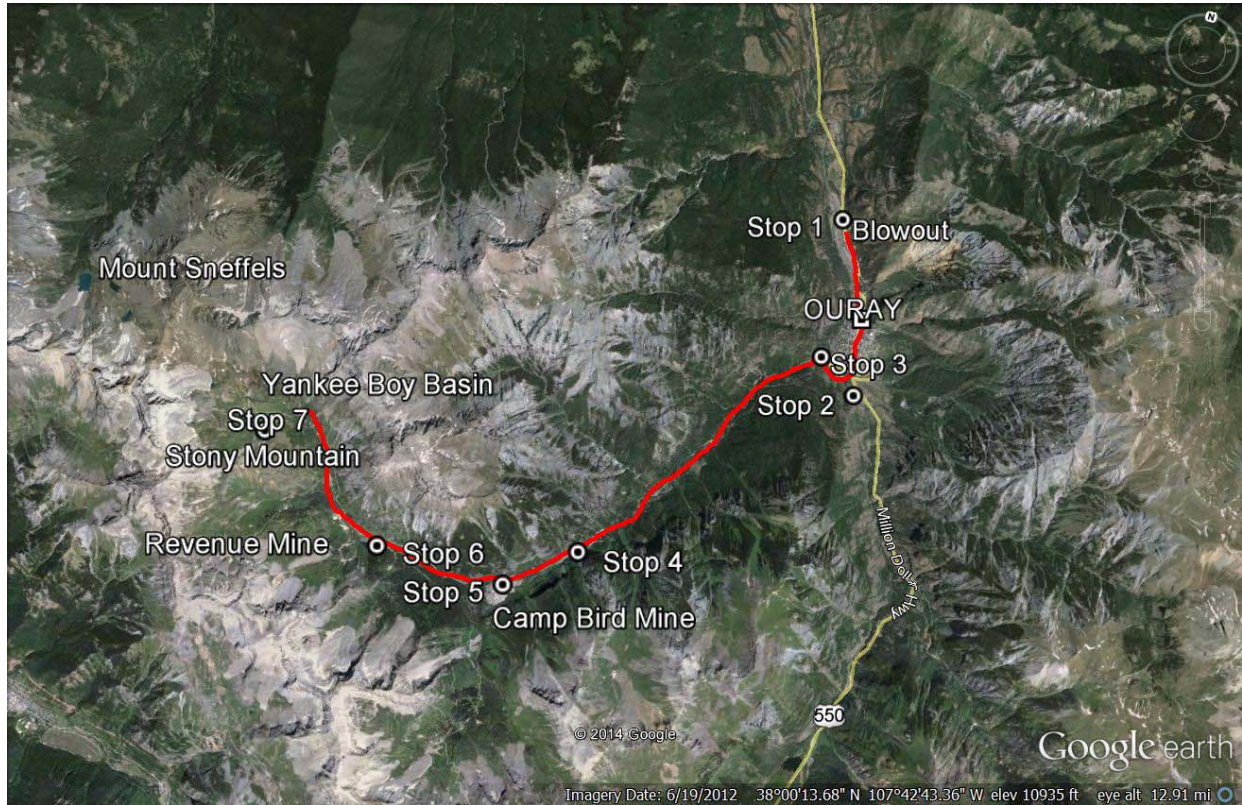
Expected weather conditions: It will be cool to cold (40-50 degrees C) riding in this vehicle, so dress with cold weather clothing, bring rain gear since it frequently rains in the afternoon, sun screen, hats and gloves. Elevation at the end of the field trip is above 11,000 feet so expect to feel light-headed and please moderate the speed as which you attempt activities. In addition bring your own lunch, which can be pre-ordered the day before (Saturday) as a box lunch in town. Businesses which provide this service are listed in your registration package.

- STOP 1 **North Edge of Ouray:** The Blowout
Mineralization during this event
Associated Mines – American Nettie, Jonathan, Wanakah, Bright
Diamond, Memphis
- STOP 2 **Overlook on US 550**
History of Ouray
Lower Paleozoic Stratigraphy
- STOP 3 **Box Canyon Park**
Ouray Fault
Mineralization and Mines along Fault
Angular Unconformity
- Lunch
- STOP 4 **Oligocene-Paleozoic Contact:** On Camp Bird Road
Telluride Conglomerate
Lower Volcanic Units in Oligocene
- STOP 5 **Camp Bird Mine**
Mining History, Geology, Ore Deposits, Current Status
- STOP 6 **Revenue Mine**
Mining History, Geology, Ore Deposits, Current Status

STOP 7

Yankee Boy Basin – Stony Mountain
Upper Volcanic Units in Oligocene
Igneous Stock

AERIAL VIEW OF THE TOUR AREA: OURAY TO YANKEE BOY BASIN



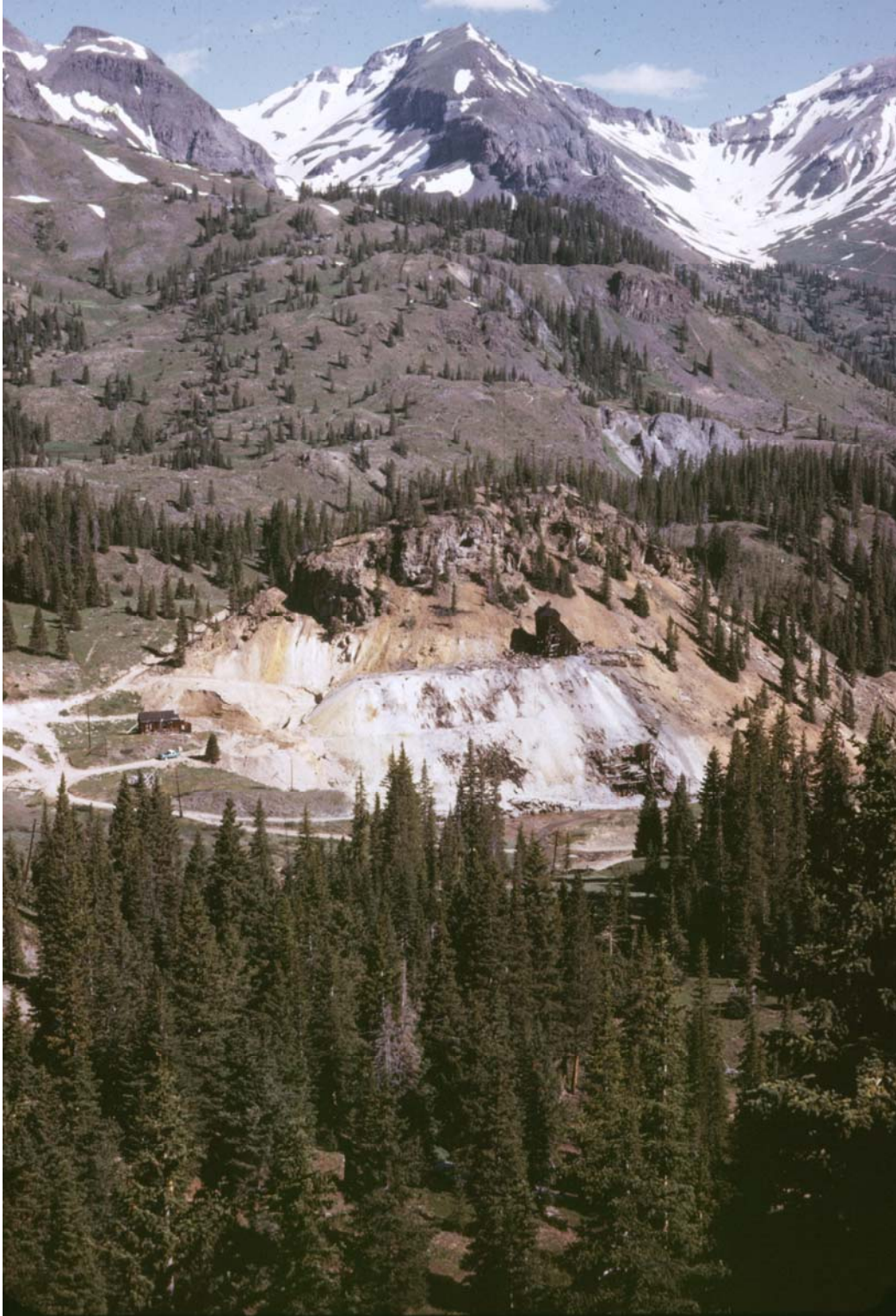
The vehicle you will be riding in will look like the above. Photograph courtesy of San Juan Jeep Tours.

Further details of the tour itinerary can be obtained by purchasing the following books:

Moore, George. 2004. *Mines, Mountain Roads, and Rocks: Geologic Road Logs of the Ouray Area*. Ouray County Historical Society Guidebook Series. Published by the Ouray County Historical Society. 250 p. Road Logs 2 and 3 (especially an overview on pages 1-23, and the road logs 2 and 3 on pages 73-100). This book can be purchased in Ouray at either Buckskin Booksellers or the Ouray Historical Society museum.

Ouray-Silverton San Juan Mountains Mineral Symposium

Meckel, Lawrence and Stoufer, Robert. 2014. *Geologic tour guide of the Northwest San Mountains*. Privately printed in Ouray. (general information pages 1-20, mining ore information pages 21-27 and overlook descriptions pages 32-37). This newly published book can be purchased in Ouray at either Buckskin Booksellers or the Ouray historical Society museum.



View looking to the northwest at the National Belle Mine in 1968, with the Silverton Volcanic Series in the background, beyond the Silverton Caldera boundary. Photograph Copyright © by Robert Larsen.

Field Trip 2. The Red Mountain Field trip

Field trip leaders: Don Paulson (Railroad & Mining History)
Robert Larson (Mining, Geology, Minerals)

Field trip from Ouray to Red Mountain Pass (Longfellow mine); Red Mountain Town (National Belle mine); to Yankee Girl, Guston-Robinson, Cora Belle, American Girl, Corkscrew Turntable(?).

Detailed Road Log and Descriptions in George Moore's *Mines, Mountain Roads, and Rocks*, Guidebook No.1, Ouray County Historical Society, pages 43-68 and pages 137-146. The latitude and longitude values are referenced to North American Datum of 1983.

Meet at the Elks Lodge in Ouray at 7:30 AM, Sunday, September 7. Departure at 8:00 AM.

- STOP 1 **BEAR CREEK FALLS** 2.7 miles 37°59'58.8" N 107°39'37.1" W
Observe glaciation, Precambrian ripple marks, folding, unconformity, Sutton Mine and mill, and mineralization.
- STOP 2 **IRONTON PARK** 6.3 miles 37°57'36.7" N 107°39'40.4" W
(Crystal Lake)
Silverton Caldera, Red Mountains, Saratoga Smelter, St. Germaine Foundation, Kullerstrand/Condotti Ski Area.
- STOP 3 **IDARADO OVERLOOK** 11.0 miles 37°54'53.2"N 107°42'05.0"W
Idarado Mine (Treasury Tunnel), Overview of Red Mountains, Silverton Caldera, Breccia Pipe Mineralization, Railroad system.
- STOP 4 **RED MOUNTAIN PASS** 13.0 miles 37°53'55.2"N 107°42'41.8"W
Ouray-San Juan County Boundary, Silverton Railroad System, Directions to Longfellow Mine, second left, at 13.2 miles from Ouray, leaving Highway 550.
- STOP 5 **LONGFELLOW MINE** 0.2 miles 37°53'49.2"N 107°42'39.7"W
Kohler Pipe (quartz latite) and associated mineralized chimneys: Carbon Lake, Congress and Longfellow Mine that was discovered in 1953 during highway construction. (Lead-Copper ore with exceptional enargite crystals)
- STOP 6 **RED MOUNTAIN TOWNSITE (NATIONAL BELLE MINE)**
1.1 miles 37°54'13.6"N 107°42'09.5"W
(Continuing on railroad grade from Red Mountain to Corkscrew Turntable) Silicified breccia pipe approximately 400 ft in diameter. Ore found in caves with abundant clay minerals. Quartz crystals, cerussite with galena, oxidized copper mineralization with enargite crystals still found on the mine dump.
- STOP 7 **GENESSEE-VANDERBILT MINE**
2.3 miles 37°54'43.6"N 107°41'44.1"W
Approximately 6000 ft of cross-cut accessing the Genessee pipe, continuing on under Red Mountain No.3. Pyrite, enargite, chalcopyrite, covellite in underground workings. More recently large tonnage, low-grade gold mineralization blocked-out by surface drilling.

Ouray-Silverton San Juan Mountains Mineral Symposium

- STOP 8 **YANKEE GIRL MINE** 2.5 miles 37°54'52.6"N 107°41'43.9"W
Typical Silverton caldera breccia pipe. Elliptical in plan (400ft-500ft) >1000 feet deep, carrot-shaped with ore chimneys within pipe. Extremely rich silver mineralization with unique minerals including cosalite, alaskaite, bournonite, stromeyerite with more common galena, sphalerite, tetrahedrite-tennantite, bornite and enargite.
- STOP 9 **ROBINSON MINE** 2.8 miles 37°54'57.0"N 107°41'37.3"W
(Via "Guston Road")
Southern Mine of the Guston-Robinson breccia pipe complex. High grade silver with associated base metals. One specimen in an early collection was considered a "half-breed", one-half native silver – one-half native gold.
- STOP 10 **PARKING AREA** Approx. 3.0 miles 37°55'06.1"N 107°41'29.8"W
Walk to American Girl Mine – Continue walking to Corkscrew Turntable with Don Paulson.

OR

Back-Track on "Guston Road" to County Road 31 near the Yankee Girl and proceed to Guston Mine with Bob Larson for additional collecting.

- STOP 11 **GUSTON MINE** Approx. 3.5 miles 37°55'1.9"N 107°41'36.1"W
Northern Mine of Guston-Robinson breccia pipe complex. Incline shaft extended down 1300 ft on 14 Levels. Near surface galena with high-grade silver, transitioning into copper mineralization with some gold. Minerals known from the mine include galena, sphalerite, cosalite, tetrahedrite-tennantite, and stromeyerite.

Continue along County Road 31 to the north to the intersection with Highway 550, approximately 0.7 miles from the Guston in order to return to either Ouray, to the north, or Silverton, to the south.



View of the Animas Forks from the north, August 2013. Photograph Copyright © by Donna Ware.

Field Trip 3. The Sunnyside Mine Field trip

SILVERTON AND THE SUNNYSIDE MINE TOUR

Field Trip leaders: Jeff Self and Donna Ware

The group field trip starts at the SILVERTON VISITOR'S CENTER

414 Greene Street, Silverton (at the "Y" as you enter Silverton, 970-387-5654 or 800-752-4494)

- | | |
|-----------------------|--|
| 7:30 a.m. – 8:15 a.m. | Ouray to Silverton via Million Dollar Highway |
| 8:15 a.m. – 8:30 a.m. | Meet at Silverton Visitor's Center – Proceed to Eureka |
| STOP 1: 3.0 miles | Arrastra Basin Tram Line Overlook
Description of various Tram Lines from Silver Lake to mill |
| | Mayflower Mill and Silver Lake Mill Overlook
Historical Signs/Descriptions
(Mayflower Mill Tour for later individual scheduling) |
| STOP 2: 4.95 miles | Cunningham Gulch/Howardsville– Pride of the West Mill
(Comprehensive Mill Tour part of Field Trip 4) |
| STOP 3: 8.7 miles | Eureka Townsite-Historic Sunnyside Mill

Terry Tunnel – Access to Sunnyside Vein systems
Recent Reclamation of Mine Waste and Mining Activities |
| | U.S. Mineral Monument Ben Franklin
Collecting site for vein material, sulfides, ore samples |
| STOP 4: 12.8 miles | Sunnyside Basin – Lake Emma
Site of Sunnyside Mine complex and Stamp Mill
Lake Emma collapsed into Mine Workings in 1978
Recent Reclamation of Mine Waste and Mining Activities
Collecting site for vein material, sulfides, ore samples from existing mine dumps, vein outcrops and prospects in the cliffs to the north of Lake Emma for rhodonite ($MnSiO_3$) - now called "pyroxmangite". |
| After 4:00 p.m. | Return to Ouray - Alternate Routes Back (?), Continue Touring/Collecting (?), On Your Own |

Location map of the Silverton Visitor's Center on the west side of Silverton.



Field trip to Silverton and the Sunnyside mine, San Juan County, Colorado

Jack A. Murphy

Geology Curator Emeritus, Denver Museum of Nature and Science
and member of the Colorado School of Mines Geology Museum Advisory Council.

Contents

1. Red Mountain Pass to Silverton
2. Silverton
3. San Juan County Historical Society and Silverton Heritage Museum
4. Mayflower Mill
5. Howardsville
6. The Old Hundred Mine (Mine tour)
7. Stony Pass
8. Eureka and regional Pleistocene glaciations
9. Sunnyside mine, tram and mill

Introduction

Welcome to the trip. This guide will provide brief geological and historical highlights, plus references, for a trip from Red Mountain Pass to Silverton and on to the Sunnyside Mine site above Eureka. Mineral localities along the way that produced specimens mentioned in articles from *Mineralogical Record* or *Rocks & Minerals* are mentioned. Descriptive articles in these mineral magazines have enhanced the scientific and historical literature. Groups such as the Friends of the Colorado School of Mines Geology Museum extend educational opportunities with exhibits, lectures and field trips. Topographic maps are indispensable when roaming around on the four-wheel drive roads in the San Juan's. I do not think there is a substitute for a paper copy of the U.S. Geological Survey 7.5' Quadrangles; Ironton, Silverton, Howardsville and Handies Peaks cover this trip. A good map showing the Silverton area including the Needle Mountains plus the Rio Grande watershed to Lake City, is the USGS Silverton 30 x 60 topographic sheet (1:100,000). An excellent geologic map is Yager and Bove (2002); a summary of the geologic history is in Yager and Bove (2007).

There are many excellent references to consider if you want to know more about the mines and minerals in the San Juan's. The best reference to the minerals is *Minerals of Colorado* (Eckel and others, 1997). The impressive 2004 book, *Mines, Mountain Roads and Rocks* by the late George E. Moore (1946-2014) is particularly well done and efficient for identifying the regional geology and locating hard to find mines. The elegant *San Juan Triangle of Colorado* (2011), contains updated information for collectors and fine mineral photography.

An indispensable field guide (with road logs) emphasizing geology for the Million Dollar Highway, from Durango to Silverton consists of a compilation of subjects by experts in their fields, edited by Rob Blair (1996). The informative guidebook for exploring the back roads (mainly in Ouray County) is Butler and Smith (1981). Overall, for the Silverton region there is a lot of good reading about history and people's experiences, for example: Marshal and Zanoni (1996), Duane Smith (1982, 2002, 2009) and Wyman (1993) and the references cited below.

Mileage: 0.00 Red Mountain Pass. Ouray-San Juan counties line.

Proceed south on Hwy. 550 (Million Dollar Highway). Elevation: 11075 ft. Mileage numbers are referenced to the above county line and are approximate.

Looking ahead, to the south, we leave the Red Mountain district and follow the curved structural margin of the Silverton caldera. The rocks on the east, including Anvil Mountain, are classified as Oligocene-age “Silverton Volcanics” (some 1000 meters thick) and include the Henson and Burns members. Deposition of the “Silverton Volcanics” was closely followed by eruption of the Crystal Lake Tuff at 26.6 million years ago (Ma), which subsequently resulted in formation of the Silverton Caldera, one of several in the San Juan volcanic field (Yager and Bove, 2007). The “Silverton Volcanics” are host to the gold, silver and base-metal sulfide mineralization in the Silverton area. Mineralized solutions were emplaced when fracturing and faulting occurred associated with subsidence of the Silverton caldera and subsequent resurgent doming.

Mile 2.45

Imagine bumping along the old wagon road that came up Mineral Creek valley before the train transportation arrived in 1887. Today’s Million Dollar Highway is a breeze unless there is a blizzard. The Chattanooga mining camp was along the base of the steep hill at the head of Mineral Creek; it was at its population peak in the 1880s when prospectors were arriving to stake claims on Red Mountain district mines – some thought this region would be the next Leadville. In winter, goods and ore were often packed on sleds. Transportation costs ate away at the mine owners profits since the complex ore had to be packed down to the smelter in Durango, or sometimes even further. Coal and all the necessary provisions were packed all the way back up here. The lively history of the area is well described by P. David Smith (1994).

The sharp horseshoe curve near the valley floor at Chattanooga shows the train grade [a 200 degree turn, then a five-percent grade uphill for 1-3/4 miles, according to P. D. Smith (1994)]. In the middle of this curve is a good place to pull over if you want to hike up to the Silver Crown and Silver Cloud mines visible up the valley of Mill Creek.

Here, on the north side of the creek you will find another rock type, the Sultan Mountain stock, which has a light greenish-grey color due to weathering.

Mile 4.3

Browns Gulch and the trailhead to the Brooklyn Mine are on the east side of the highway. Old mine dumps are scattered over the hills—up onto Ohio Peak (12,603’) –where prospectors originally hoped to find more of the rich Red Mountain-type chimney deposits.

Tom Rosemeyer, formerly geologist at the Camp Bird mine, had good luck collecting at the Brooklyn mine. In one of his informative “Through the ‘Scope” columns in *Rocks & Minerals* (Rosemeyer, 1989a) showed photos of the old mine buildings and a color photo with the enticing caption:

“A 5-mm leaf of crystallized gold on sphalerite and rhodochrosite. Small petzite crystals are scattered on the gold leaf. The specimen is from the Richardson gold stope, 1 level, Brooklyn mine.”

Other photos in this article show a 2-mm spray of quartz crystals on sphalerite and pyrite and another of bright, rounded 4-mm galena crystals on sphalerite from the Richardson gold stope. This locality should not be confused with the old Ransome (1901) Brooklyn tunnel in Ouray County.

Mile 5.05 Turn off to Ophir Pass (four-wheel drive).

Burro Bridge crossed Mineral Creek here in the early days. Notice that the shape of the glacial valley is not exactly U-shaped anymore. This area shows the extent of landslide slumping that has

modified the topography of the valley after the glaciers melted. In addition, rocks carried down avalanche chutes contribute to covering the valley floor. The subject was studied and described by USGS geologist Ernest Howe (1909). He is not too well known despite the fact that he worked with the USGS geologist Whitman Cross on the noteworthy, large-size folios with topographic and geologic maps that brought attention to the San Juan Mountains. These were Silverton Folio No. 120 (1905), Needle Mountains No. 131 (1905), Ouray folio No. 153 (1907), and Engineer Mountain folio No. 171 (1910).

Mile 7.31 Zuni Mine and Brobdignag prospect.

For those interested in uncommon minerals a trip to the zunyite locality on Anvil Mountain (12124') may be rewarding if the mine is open to collecting. Noteworthy zunyite (Colorado type species) crystals have been collected and they are not found at many other places in the region.

Access to the trail up Zuni Gulch is about one mile northwest of Silverton on Hwy. 550, just north of the junction with Road 585 up South Mineral Creek. The only map I know of that shows the mine location, other than Ransome's 1901 map, is in Moats and others (1996) showing the mine adit below the Irene mine. The Brobdignag is in the next gulley to the west at some 11,400'.

Zuni Mine is the first authenticated occurrence of zinkenite in the U.S. according to Grybeck (1976). Other minerals of interest are jordanite, guettardite, boulangerite, semseyite, enargite, barite and an unconfirmed tin mineral once thought to be kuramite (Eckel and others, 1997). Species reported from the Brobdignag prospect (¼ mile west of the Zuni mine) are discussed by Grybeck (1976).

Mile 7.71 Turn off to South Mineral Creek (Road 585). Access to the Bandora Mine.

Anyone who read Martin Jensen's article on discovering choice chalcopyrite crystals on showy quartz at the Bandora Mine (Jensen, 1988) was surely ready to take off and see what else lay undiscovered in this long-closed mine. Interestingly, wulfenite crystals were also reported by Jensen at the Bandora—a San Juan rarity.

Regional geology

The geologic map (Yager and Bove, 2002) shows we are on the structural margin of the Silverton Caldera. It's a great curving feature that controls the topography of the region. Here it is not broken up into many smaller faults and mineralized as much as in the Eureka district. At this location, we are lower in the section of rocks of the region—notice that if you proceed west up South Mineral Creek you will see the contact between the Tertiary volcanic rocks and the underlying Paleozoic sedimentary rocks that were buried by the volcanic rocks.

Glaciation of the Animas River Valley.

This is a good place to wonder about the Pleistocene glaciers that filled these valleys several times in the last 2 million years. Quaternary geology in these high mountains at southern latitude is complex and still being investigated. During the last glacial maximum, according to Zackry and others (2007) a 5,000 km² ice cap covered the San Juan Mountains and the Animas Valley glacier flowed more than 40 miles from Silverton to Durango where terminal and lateral moraines are identifiable. Deglaciation lasted for 7.2 thousand years and it was completed at about 12.3 thousand years ago.

In between the glacial advances, during warming periods, glaciers retreated and weathering, erosion and down cutting of surfaces created the topography that is part of today's landscape. The mid-Pleistocene "Florida interglacial" leveled off the upland areas we see today on four-wheel drive trips. George Moore (2004) summarizes this subject and has an excellent illustration showing the extent of glaciation and there is an excellent review of the Pleistocene in Blair (1996a).

Mile 9.71 Junction Highway 550 and Highway 2 at the Silverton Visitors Center. Mileage numbers are referenced to the visitors center and are approximate.

Silverton (a National Historic Landmark).

I think the best time to arrive in Silverton is just before eleven in the morning when the first train arrives from Durango (a second train arrives at noon). You can hear the distinctive train whistle echo through the Animas River Valley as the train approaches Silverton. Historians and train-buffs love this spot because they can get close to the tracks to watch the train arrive. This is the Silverton Branch of the Denver & Rio Grande narrow-gauge railroad and it was completed in July 1882. In its day, it contributed to the success of many mines in this region because ore could be shipped to the smelter in Durango via train.

The train was used in some Hollywood movies, *Ticket to Tomahawk* (1950—Dan Dailey, Ann Baxter and Marilyn Monroe) and *Night Passage* (1957—James Stewart and Audie Murphy) being two of the more noteworthy. In “*Denver & Rio Grande*” (1952—Edmond O’Brien and Sterling Hayden) the movie producers wrecked two locomotives in a head-on crash; not at Silverton, but in a flat area closer to Durango.

Geology south of Silverton.

Looking south down the Animas Canyon is the impressive Needle Mountains (on the right) and the Grenadiers Range (on the left); favorites of seasoned mountain climbers and back packers. Here we find the oldest rocks, Precambrian crystalline igneous and metamorphic rocks that are at the southern margin of the San Juan Mountains. For a better view of this magnificent range, you can drive a few miles south of Silverton on Hwy. 550 to Molas Lake or Molas Pass. Perhaps the best review of the geology for the Precambrian rocks is Ellingson (1996).

Grand Imperial Hotel.

Every mining town had a noteworthy old hotel—in Silverton, it’s the Grand Imperial Hotel. Edna Frecker, long-time proprietor, had a little mining museum in the back room. When my family visited Silverton in the summers I would always make a beeline for Edna’s museum because there were always high-grade gold specimens from local “old timers.” Many of these men, mostly old hard rock miners, gathered in front of the hotel on sunny afternoons to visit. I met some of them, especially Charlie Thomas who cared for the coal furnace in the hotel. They would tell stories and tall-tales and sometimes you couldn’t tell when reality departed to fantasy; for example, once they told me about a big strong talkative Swede, who, one day was sitting on one of the motors (electric locomotive) boasting about how much ore he had mucked that day when his shovel accidentally hit the overhead electric line and there was a bright flash of light followed by an eerie silence. It was not like the Swede to be quiet for long, but when they looked over at him they realized that he could not open his mouth and speak because all of the fillings in his teeth were welded together.

Edna Frecker wrote a short article on the history of the Grand Imperial Hotel in the 1957 New Mexico Geological Society Eighth Field Conference guidebook. The hotel, then as now, was the most prominent building on the main street (Greene Street). It was built for some \$60,000 by W.S. Thompson, from London, England. He had gained his wealth from selling perfume in England and Europe and he invested in mining properties in the Silverton area. The hotel opened as “the Grand Hotel” July 1, 1883 and was said to be the finest and most elegantly furnished hotel outside of Denver, noted for artwork, fine furnishings and plush carpets. The name was changed to Imperial Hotel or Grand Imperial Hotel in 1905 or 1906.

Edna’s father, Henry Frecker, purchased the hotel in 1921, then, after his death, in 1944, Edna took over. Edna’s hobby was photography and she made her own 8-mm home movies when they filmed Hollywood movies in Silverton. She liked to dress up in Victorian-style dresses and be cast, with some of her friends, as an extra in the movies. In 1951 a wealthy Dallas man, Winfield Morten bought the

hotel. Edna reports in her 1957 article that Morten originally visited Silverton with General Charles H. Corlett while looking over mining properties for investment and that he was impressed with the town and its 75-year old hotel with Ednas' mining museum. He bought the hotel and started a major remodeling project and the museum did not survive.

Mile 0.8

Silverton Heritage Museum.

A must-see attraction in Silverton is the new museum operated by the San Juan County Historical Society. Until a few years ago, the museum was in the old jail across from the Court House. The Museum has recently excelled with new facilities and exhibits and it contains an invaluable historical and photographic archive -- the Allan Nossaman collection. Allan owned the *Silverton Standard* newspaper for many years and he was a respected county judge. He published a noteworthy history of the Silverton area -- "Many More Mountains," in three volumes.

Mile 0.90 At the road split where County Road 110 (to Gladstone) separates from County Road 2 (to Eureka). Drive to the right.

The 1874 Green smelter erected by George Greene was near this intersection on Cement Creek. Mills and smelters were crucial to the mining industry; the ore from the mines had to be crushed, separated and concentrated as much as possible to reduce transportation fees before further smelting at the New York and San Juan Smelter in Durango. The machinery was packed on burros and hauled 250 miles from Pueblo over Stony Pass (then called "Stoney") according to Ridgway (1939). The Greene smelter contributed to the success of mining in the Silverton area but eventually failed to accomplish its purpose and closed in 1879. Other mills and treatment plants were erected through the years in Silverton (Twitty, 2009).

The ten-mile long Silverton-Gladstone & Northerly railroad was completed to Gladstone in 1899; it was controlled by the owners of the Gold King mine. The mine also built its own mill, at first a 20-stamp mill, and then expanded to 80-stamps.

Gladstone is the location of the American Tunnel, a project started in 1959 that energized mining in Silverton after World War II. The American Tunnel was originally part of the old Gold King workings, then when Standard Metals took over the Sunnyside Mine in 1959, the tunnel was put to use and driven a mile further under Bonita Peak (13,286') to intersect the high-grade gold ore in the Sunnyside Mine that had previously been worked from the surface at Lake Emma.

When Lake Emma broke through the upper workings of the Spur vein in the Sunnyside Mine on Sunday, June 4, 1978 the flood waters gushed out of the portal of the tunnel here in Gladstone and rushed down Cement Creek to Silverton, and beyond.

Gold nuggets and placer mining.

All along the way, we have wondered about gold nuggets and placer mining in the Silverton area. If someone offers to sell you a gold nugget from Silverton or Eureka—call the sheriff! There is no historical precedence for such discoveries plus the geology of the region is not right for producing and preserving nuggets. Interestingly, the placer-like gold discoveries worth mentioning are below old stamp mills, especially the big mill at the Gold King Mine in Gladstone (Parker, 1968).

Hillside Cemetery

On the north side of County Road 110, after crossing Cement Creek, on the lower slope of Boulder Mountain, you will see Silverton's picturesque Hillside Cemetery where some 2000 people are buried. The property hardly contains any level ground and old-timers in Silverton will tell you that nobody wants to be buried there because it is too much work trying to keep from sliding downhill.

An informative 1996 book by Freda Carley Peterson tells the stories of some of the pioneers buried here. Be sure to read the section on Peter McEnay who died because of his heroic efforts to rescue miners after a disastrous fire at the Gold King Mine at Gladstone in June, 1908.

An excellent view of Silverton and the Animas valley may be found here—across the valley on the south is Kendall Mountain (13,338') and to the west are two big glaciated peaks, Sultan Mountain (13,368') on the north, and Grand Turk (13,148') on the south. The Million Dollar Highway cuts across the lower slopes of Grand Turk toward Molas Pass.

Mile 3.00 Opposite the Mayflower Mill at the Arrastra Gulch Overlook

Mayflower mill (National Historic Landmark).

This historic mill (earlier known as the Shenandoah-Dives mill), was built in 1929 and then gradually expanded until it had a capacity to mill 750 tons of ore per day (in 1937). The mill was vital to processing the generally low-grade ores that came from several veins at high altitude in Arrastra Basin, including, Silver Lake, at 12,186'. You can see what is left of the mines at the end of Arrastra Gulch; on the left side, the Mayflower Mine clings to a cliff, the only place it was protected from snow slides. The Shenandoah-Dives mine, at the end of the valley, was one of the largest operations in the Silverton region. Looking south to the head of Arrastra Gulch you can't help but be impressed by the rugged glacial topography—cirques and hanging valleys.

The mines and mill here survived the grim economic conditions of the Depression in the 1930's; they are an example of the importance of applied technology that improved ore processing and increased productivity for the mine owners. The mines up on top finally closed but the mill took in ore from other mines around Silverton. The Mayflower mill operated for 42 years, not closing until 1991 when the Sunnyside Mine closed. The machinery is intact and the mill is functional, the only one its kind.

The mine to mill aerial tramway (can be seen crossing over County Road 110) was quite an accomplishment; it is some 2 miles long with a vertical elevation change of 2,000 feet. The tramway was constructed of several metal towers to protect it from snow slides. Imagine going to work every day in one of these ore buckets! Besides taking miners to work, the buckets were filled with supplies going up to the mine and they returned to the mill filled with the silver ore. The mill finally closed down when the Sunnyside Mine closed in 1991. Since then it has been an important historic preservation effort by the San Juan County Historical Society to keep the site open for educational purposes (Rich, 1997).

When I was a kid and my family visited Silverton in the summers the tram was still operating and in the afternoons you could watch the miners coming down in the buckets—just like a ski tow. One of these miners told me that riding the tram was no big deal unless there was a lightning storm. The Hollywood movie “Night Train” showed the buckets coming into the mill in an exciting gunfight and chase scene. Several books go into detail on the history of this mine and the mill, especially Marshall and Zanoni (1996) and Duane Smith (1982, 2009) and Twitty (2009).

Arrastra Creek (County Road 52)

Arrastra Gulch is one of the oldest localities in the valley and important because the veins in this vicinity (the Little Giant mine) were gold bearing rather than containing silver with lead and zinc. There are collecting opportunities in the area. Rosemeyer (1994, 1995) described minerals found at the Titusville and Oyama mines. The Titusville vein, a Ransom (1901) locality on the NW side of Kendall Gulch was earlier reviewed by Varnes (1963) who described the complex underground workings associated generally with Silver Lake mines. Anglesite and cerrusite with galena were collected from a dike atop Kendall No. 2 Peak.

Mile 5.2

Howardsville.

After the Civil War, in 1871, George Howard organized an expedition of hearty prospectors to return to the Animas River valley (then called Bakers Park). They traveled from Del Norte, Colorado and ventured over 100 miles west up the Rio Grande River into the uncharted rugged mountains on the Continental Divide. Howard wanted to relocate gold deposits that he had seen ten years earlier when he first visited the Animas River valley with a promoter, Charles Baker. Howard and his party came across Stony Pass into Cunningham Gulch, the very route of today's trip. The prospectors built their cabins on the Animas River where it curves toward the west at the foot of Cunningham Gulch--Howardsville. Rubin McNutt, a friend of Howard's, built a cabin for himself a few miles north at Eureka. Most of the miners in Howard's party, according to one account, had come from the California gold camps and were more experienced in placer mining than lode mining. Nevertheless, the miners got to work locating and marking out lode claims in veins; this is when the gold veins of the Sunnyside Mine were discovered. The group formalized property ownership in 1873 according to existing mining laws and named the place the "Eureka Mining District."

For details about Cunningham Gulch, see field trip 5 to the Highland Mary mine.

Junction: County Road 4 to Cunningham Gulch.

Old Hundred Mine. (Mine tour).

Cunningham Gulch.

Osceola mine.

Pride of the West and Buffalo Boy mines.

Stony Pass.

Mile 8.7 Eureka

Eureka, a pretty little park in the Animas River valley was the location for the Sunnyside mill and terminus for the 3½ mile aerial tramway up to the mine. George Howard and R.J. McNutt discovered the rich veins at Lake Emma and staked claims, including the Sunnyside Mine (Bird, 1986). They did not work the claims however; as was common practice, they sold them to the Frank and Louis Thompson and Milt Engleman from Cañon City.

Looking north from Eureka, we have an excellent view of the upper canyon, truly the headwaters of the Animas River. The rugged cliffs visible in the valley and on the mountain slopes east of Eureka, are made up of one of the most interesting rocks on this field trip, the Oligocene-age Picayune megabreccia, the intracaldera member of the Sapinero Mesa Tuff, the rock erupted from the San Juan and Uncompahgre calderas some 28 million years ago (Yager and Bove, 2002). The megabreccia consists of rocks that slumped into the collapsing San Juan caldera and subsequently underwent multiple stages of mineralization, ultimately forming the veins in the Sunnyside Mine and adjacent areas, nicely summarized by Jack Ellingson (1996).

Mile 12.8 Sunnyside mine

We are now nearing our destination, it may seem as though we are nearly at the top of the mountain, but its not so—the top of Hanson Peak is 13,454'. We passed timberline about 12,500 feet altitude near "Midway," located just below a large "hanging valley," the former level of the land in a previous glacial period.

The spot is significant because it was the location for the Sunnyside mine's early stamp mill. An aerial tramway was built to the site in 1897 by the next mine owner, Judge John Terry (Bird, 1986). The tram was later extended to the valley floor.

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This part of the mines complex history is well told in Bird (1986, p.30-32), mainly because he was the superintendent of the Sunnyside Mine in the 1970s. He had access to the mines records that were unavailable to others. See also Rosemeyer (1998) and Murphy (2011).

We make the steep ascent to the old Sunnyside mine, detouring the building foundations to visit Lake Emma, a tarn from the Ice Ages. It was Lake Emma (long ago dammed up to hold more water) that broke through the old upper workings of the mine, flooded down through the Washington Shaft and into the adjacent underground workings that damaged most everything. The water gushed out the mine entrance at Gladstone on the other side of the mountain.

Luckily, very luckily, no one was killed or injured the day of the flood because it was Sunday and the mine was closed. It was an unfortunate accident for the many people who lived in nearby Silverton because they were suddenly without jobs. It was end of mining at the Sunnyside, although the mine was in the process of closing down.

We are now at the old mine, (elevation 12,400') built next to Lake Emma (12,280'). One story says that Lake Emma was named after the wife of one of the early mine owners, Milt M. Engleman (as noted in Bird, 1986). Also, a letter from Helen Thompson, in Wolle (1977) said Lake Emma was named for the sister of Louis C. Thompson, one of the mine owners and that she later married Milt Engleman.

The mine was not productive at first but an infrastructure was built on the shore of Lake Emma, including boarding houses, shops and mine buildings. These are often seen in early day photographs. Railroad tracks from the mine adits had to be covered to protect from heavy snowfalls and avalanches. The mine was purchased and operated by Judge John Terry and his family until 1917 and they experienced many problems and never realized the wealth that the mine contained.

Eventually the Sunnyside became Colorado's largest operating gold mine; it was at that time (1970s) that I started a mineral collecting initiative for the Denver Museum of Natural History mineral exhibits (Murphy, 1979b). Unfortunately, the mine closed when Lake Emma broke through the upper workings on June 4, 1978, and flooded the mine.

Our trip to Lake Emma has been worthwhile—it is open for touring in one of the most scenic spots in the San Juan Mountains and there is no restriction on mineral collecting on the big outcrops or old mine dumps. We can mainly hope to find some rosy pink pyroxmangite ($Mn SiO_3$)—formerly called rhodonite. The best specimens have associated free gold.

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Sunnyside Millsite at Eureka, August 2013. Photograph Copyright © by Donna Ware.

Field Trip 4. Silverton to Silver Wing Mine Field trip

PRIDE OF THE WEST MILL AND SILVER WING MINE TOURS

Field Trip leader: Steve Fearn

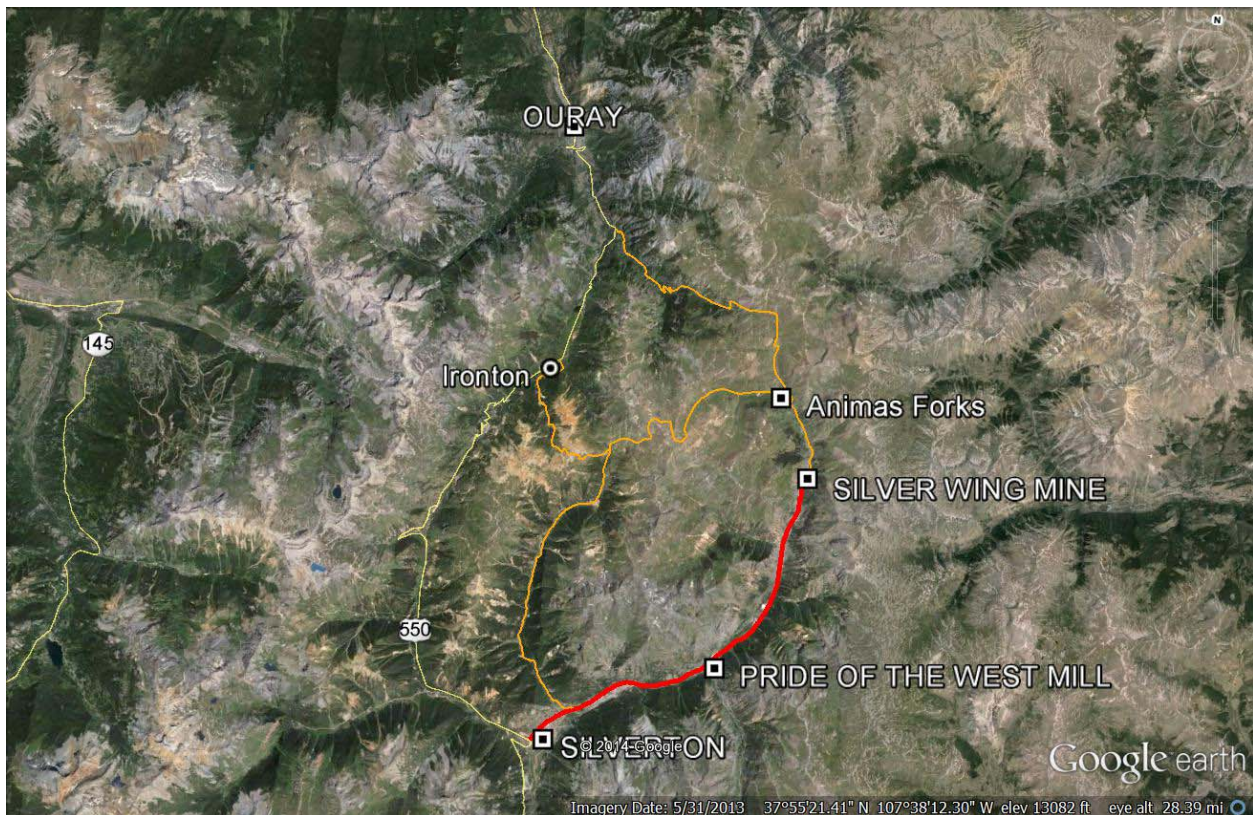
Appreciation to Colorado Goldfields & Jo Grant Mining Company

The group field trip starts at the SILVERTON VISITOR'S CENTER

414 Greene Street, Silverton (at the "Y" as you enter Silverton, 970-387-5654 or 800-752-4494)

7:30 a.m. – 8:15 a.m.	Ouray to Silverton via Million Dollar Highway
8.15 a. m.	Meet at the Silverton Visitor's Center.
8:15 a.m. – 8:30 a.m.	Silverton to Howardsville via CR 1
8:45 a.m. – 11:45 a.m.	Pride of the West Mill tour – History, Equipment, Mill Flow Sheet
12:00 p.m. -12:30 p.m.	Lunch
12:30 p.m. – 1:00 p.m.	Travel to Silver Wing Mine
1:00 p.m. – 4:00 p.m.	History of Mine, Geology and Minerals, Collecting from Mine Dump and Adjoining Outcrops
After 4:00 p.m.	Return to Ouray - Alternate Routes Back (?), Continue Touring/Collecting (?) – On Your Own.

AERIAL VIEW OF THE TOUR AREA: SILVERTON TO SILVER WING MINE



Field Trip 5. The Highland Mary Mine Field trip

SILVERTON VIA CUNNINGHAM GULCH TO THE HIGHLAND MARY MINE

Field Trip leader: Baird Brandow

Meet at Silverton Visitor Center, on the south end of town, at 8:30 A.M. (Allow one hour minimum travel time from Ouray.) Departure from Visitor Center at 9:00 A.M.

Mileage
Interval Cumulative

0.00	0.00	Visitor Center. Turn right, North, through Silverton on Greene Street.
0.90	0.90	Right on County Road 2.
2.10	3.00	STOP - Pullout opposite the Mayflower Mill, at the Arrastra Gulch overlook. Note tram buckets overhead. See plaques explaining tram lines and location of Silver Lake basin. Note especially the Mayflower mine, used as a portal and tram loading station for the Shenandoah-Dives consolidation. This portal is the north end of the two mile long Shenandoah vein system, whose southern end is the Highland Mary Mine (although the Highland Mary stayed out of this consolidation).
2.00	5.00	Howardsville. Identified by several buildings and the modern Pride of the West mill. Soon after crossing the bridge turn right to enter Cunningham Gulch on County Road 4.
0.20	5.20	Road forks, take right fork. Left fork goes to Old Hundred Mine and eventually rejoins main road. Along the road can be seen the remnants of the Old Hundred mill and the Green Mountain mill as well as other mining structures.
1.55	6.75	Where the road rejoins there are again two forks, take right fork (left goes to Stony Pass). Look back and up 2000 ft. and the Old Hundred boarding house can be seen clinging to the face of Galena Mountain.
2.00	8.75	Pass Osceola and Pride of the West mines on way to Highland Mary millsite, at the end of Cunningham Gulch. Note the exposure of the near-vertical Precambrian schist - a rather unique occurrence for the Silverton area. Just past the creek crossing stay to the right and switchback past the schist up into a higher basin.
0.75	9.50	Road forks at mine dump (from the #7 level of the Highland Mary). Take right fork. Ford creek twice.
0.65	10.15	Road end at the Highland Mary dump (#1 level). Parking is limited and may be occupied by hikers (as this is also the trailhead for the Spencer Basin). Overflow parking is available at the last two switchbacks.

Sulfide minerals: Tetrahedrite is clearly the dominant sulfide at this mine (though it is actually a sulfosalt). In order of decreasing abundance are: galena, chalcopyrite, sphalerite, pyrite and bornite.

Gangue minerals: Massive calcite, not found with the sulfides so probably from an intersecting vein, the “spar vein” of the miners. Barite is uncommon, but associated with the sulfides. Fluorite is very rare, may be from the spar vein.

Vugs and crystals: Vugs are uncommon and are mostly just comb quartz. Sulfide crystals in vugs are very rare and just mm in size.

AERIAL VIEW OF THE TOUR AREA: SILVERTON TO HIGHLAND MARY MINE



Details shown below about Cunningham gulch was extracted from Murphy (2014) Field trip to Silverton and the Sunnyside mine, San Juan County, Colorado, field Trip 4. References cited below can be found in his article.

Junction: County Road 4 to Cunningham Gulch.

What captures the imagination here is the rickety old buildings we can see high on the steep face of Galena Peak--the upper workings of the Old Hundred mine. The mill level and main adit to the Old Hundred Mine is our next stop. As we turn south and start up the good road to Cunningham Gulch you will see the turn off to Stony Pass (four-wheel drive)—this is a whole different trip and a good one to take if you are headed to Lake City.

On the lower slopes of Galena Mountain, we once again see rocks from the intrusion of the Sultan Mountain stock. We last saw it in the slopes of Zuni Gulch and on the slopes of Bear Mountain and Sultan Mountain west of Silverton (Yager and Bove, 2002).

County Road 4 takes us to some interesting stops, ending with the Highland Mary Mine (see separate road log by Baird Brandow). In the meantime, we want to go a short distance to the parking area for the underground tour of the Old Hundred mine.

Old Hundred Mine (Mine tour).

The best description of the history and geology of the Old Hundred Mine is in Scott Fetchenhier's 1999 book, *Ghosts and Gold, The History of the Old Hundred Mine*. It's hard to stop looking up high at the old mine buildings on the cliff of Galena Mountain and imagining what it was like to live in the boarding house up there, then work underground every day.

The mine tour will take a couple of hours. You put on water proof "diggers" and a hard hat and are transported underground—pulled by a tram with ore cars converted to hold passengers. You arrive at the adit and ride into the working face where a vein is exposed. Here is a chance to learn all about hard rock mining from the expert tour guide.

Cunningham Gulch

Descriptive articles in popular rock and mineral magazines tell of collecting trips to some of the old mines in this area. When some of the mines were reopened for exploration in the 1950s and 1960s there was the opportunity for acquiring some crystallized specimens. The Dixilyn Mining Company opened some old workings on the Osceola and Pride of the West properties (Eveleth, 2013). Fortunately, collectors like Tom Rosemeyer (photo p. 14 in Stabler, 2011) lived in the region and did an excellent job of documenting the minerals. Dealers like Ed McDole (died at 58 years old in 1970 and is buried in the Hillside cemetery), Benji Kuehling, Columbine Minerals, Ouray (photo and biographical information on p. 42, Staebler, 2011), and others, acquired and labeled specimens that were dispersed to collectors and curators around the world. Gary McWilliams (2011) gives a good account of collecting in the 1970s.

Osceola mine

The mine is up the valley a short distance from the Old Hundred Mine tour level and is a short distance north of the Pride-of-the-West mine, both places discussed by Muntyan and Muntyan (1988). Details on location, ownership and workings are in King and Allsman (1950). Crystallized calcite from this locality was described and illustrated by Muntyan (1995).

Pride of the West and Buffalo Boy mines

The Buffalo Boy Mine had veins of coarse galena and for a time in the 1960s collectors could scour the ore piles on the dump and find crystallized specimens—for beginners it was a treasure trove. If, in the 1960s, you bought mineral specimens from the kids that met the narrow-gauge train in Silverton with beer flats full of quartz, galena, sphalerite and rhodochrosite crystals for sale (Murphy, 2011) there is a good chance that some of it came from the Pride of the West or the Buffalo Boy mines.

Stony Pass

This is a lesser-known four-wheel drive road (Road 3) across the Continental Divide (south of Galena Mountain) to the Rio Grande country—down to Creede and Lake City. It is a splendid trip and very historical; it is the original trail into Bakers Park from Del Norte (Kindquist, 1987). Imagine, besides the bedraggled prospectors that made their way over this pass, the early government pack trains of the Wheeler and Hayden Surveys that clip-clopped down this rocky trail to Howardsville. It was originally called "Stoney" Pass according to Ridgeway (1939) who interviewed Henry Forsyth, who had lived at Howardsville for 62 years (he was the postmaster there for 35 or 40 years) and had first come across the pass when he was a lad, in 1878 or 1879. This was the route over the mountains used by

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geologist Fredrick Endlich in 1873 when he examined the area on the Hayden Survey (Jacobson and Murphy, 2014).

There are prospects seen on the hillsides from the early days. One crystal collecting locality, summarized by Rosemeyer (1995) is the Oyama mine, just below Stony Pass. It is known for crystallized quartz vugs found on the dump with crystals of siderite and pyrite—good micromounts.

Self Guided Field Trip 11. Ouray to Silverton

Ouray to Silverton, Self Guided Field Trip

Peter J. Modreski
U.S. Geological Survey, Denver CO

This drive, via U.S. Highway 550, the “Million Dollar Highway”, is a classic scenic and historic route through the heart of the San Juan Mountains mining districts. It runs 13 miles from Ouray (7800’) to the summit of Red Mountain Pass (11,018’), then 10 more miles down to Silverton (9300’). The highway is suitable for any vehicle, but cautious driving is always required on this sometimes steep and winding, 2-lane mountain highway.

Another road log for the first half of this trip, Ouray to Red Mountain Pass, is included in this symposium volume as Field Trip 2, The Red Mountain Field Trip. The drive from Red Mountain Pass on to Silverton is also described in Field Trip 3, The Sunnyside Mine Field Trip by Jack Murphy. More detailed logs can also be found in Moore (2004), Road Log 1, pp. 43-72, covering Ouray to Red Mountain Pass; in Blair (1996), pp. 275-293, Silverton to Ouray (written for travel south to north); and in two New Mexico Geological Society Field Conference guidebooks, the 8th (1957), pp. 53-71, Silverton to Ouray, plus an introductory section by Frank E. Kottlowski, pp. 14-22, Geology along the Million Dollar Highway; and the 19th (1968), pp. 104-117, Ouray to Silverton. Both of these field conference guidebooks are still in print and can be ordered from the NMGS, \$5.00 each plus postage; see their website, <http://nmgs.nmt.edu/publications/guidebooks/home.cfm?ListBy=Number>.

As noted elsewhere in the field guides within this volume, the best available geologic map covering most of the Silverton-Ouray area is USGS Map MF-2377 by Doug Yager and Dana Bove, Generalized Geologic Map of Part of the Upper Animas River Watershed and Vicinity, Silverton, Colorado (Yager and Bove, 2002). This map covers the entire Silverton caldera and much of the surrounding area. It is *still available* (as a print-on-demand product) from the U.S. Geological Survey as Product #113264, and can be ordered from the USGS for delivery by mail only, by calling 1-888-ASK-USGS (1-888-275-8747) to place an order; the cost is \$9.00 for each copy of the map, plus a single \$5.00 postage & handling charge for the order.

Following is a short road log, adapted from the guidebooks above, to the most notable geologic and scenic features along the route from Ouray to Red Mountain Pass to Silverton. The original field guides, especially Moore (2004, 2007) are highly recommended for all their additional details! The road log in Blair (1996) is especially useful because it gives milepost locations for the sites along the highway as well as showing their location on a topographic map.

Mileage

Int. Cum.

0.00 0.00 Elks Lodge, Ouray. Go south on Main Street (U.S. highway 550).

0.30 0.30 Box Canyon is on the right, carved by Canyon Creek in Precambrian quartzite of the Uncompahgre Formation. Near the course of Canyon Creek is the Ouray Fault zone, separating the Precambrian rocks on the south from Upper Paleozoic rocks to the north. Overlooking Ouray on the southeast is The Amphitheater, the bowl-shaped valley formed by a large landslide, and surrounded by cliffs of volcanic breccias and tuffs of the San Juan Formation. Along the highway there are several roadcuts and outcrops of Leadville Limestone (Mississippian age).

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- 0.15 0.45 Camp Bird Road is on the right, toward the Camp Bird Mine and Yankee Boy Basin, with a fork up Imogene Creek leading to Imogene Pass (13,114') and Telluride.
- 0.85 1.30 Small parking area on right, with a good scenic view of Ouray
- 0.80 2.10 You will see at least one "Falling Rock" sign along this stretch of the road. Believe it! Along here is the site (reported to have been around milepost 90) of a large rockslide that occurred just this winter, on Jan. 12, 2014, and caused great disruption and economic distress to the Ouray-Silverton communities. The rock came down from the "Ruby Walls" cliffs 900 feet above, when "a slab or rock the size of a football field" fractured apart and "rocks began tumbling onto the road Sunday evening, and by Monday the rock fall was described as continuous". Highway 550 remained completely closed for two and a half weeks between Ouray and Ironton Park as workers scaled and blasted the unstable rocks, turning the Ouray-Silverton drive into a ~200-mile detour. Intermittent road closures continued throughout the spring.
- 0.30 2.40 Tunnel through the Bear Creek Slate Member of the Uncompahgre Formation; "driven prior to World War I to eliminate a steep grade on the Otto Mears toll road".
- 0.30 2.70 Parking turnout for Bear Creek Falls. Glacial polish and grooves can be seen in the exposed surfaces of the Precambrian Uncompahgre quartzite, as well as giant ripple marks on its bedding surfaces.
- 1.05 3.75 "State Bridge" (built by the State, original bridge in 1920) over the Uncompahgre River. On the left is the 4WD road to Poughkeepsie Gulch, Mineral Point, and Engineer Pass.
- 0.25 4.00 The "Mother Cline Slide", an avalanche chute, often active; a snowplow was swept off the road here in 1975. Named after the Mother Cline Lode, the mining claim filed in 1875 by Captain Milton Cline, Ouray's first mayor.
- 0.35 4.35 Across the canyon in Silver Gulch is the Dunmore mine. The Dunmore vein extended from Precambrian quartzites into breccias of the San Juan Formation (Lower Oligocene), a widespread formation, seen in the canyon walls as we leave the Precambrian rocks and head toward Ironton. It is a greenish-gray to purplish coarse, angular conglomerate (a "fanglomerate", deposited in alluvial fans) with a sandy, tuffaceous matrix; the formation also includes lava flows and mudflow breccias (lahars).
- 0.20 4.55 Moore (2004, p. 53) notes a breccia pipe in the roadcut on left, "composed of rounded and angular fragments of Precambrian quartzite and slate, cemented by pyrite".
- 0.60 5.15 A roofed snowshed takes the highway beneath the worst section of the Riverside Slides, dangerous avalanche chutes that are active every winter and spring. Six people, including three snowplow operators, have been killed in snowslides here between 1963 to 1992; two memorial monuments are located near milepost 88. According to the Colorado Avalanche Center there are said to be some 101 avalanche chutes along the two sides of US 550 in the vicinity of Red Mountain Pass, of which 57 are active enough that they have been given names.
- 0.80 5.95 Entering Ironton Park. The glacially carved valley, filled with lake sediments after the retreat of the glaciers, has landslide deposits forming hummocky topography along the base of the mountains. The heyday of mining here was between 1888 and 1893, with more than a

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thousand people living and working between the towns of Ironton, Guston, and Red Mountain. Refer to the Red Mountain Field Trip in this volume and to Moore (2004) for detailed descriptions of the mines. Volcanic rocks are on both sides of the valley and the western boundary of the Silverton Caldera runs through it.

- 2.55 8.50 Looking up Corkscrew Gulch to the southeast is what is said to be the second-longest suspension bridge in Colorado, built for the Silverton narrow-gauge railroad.
- 2.60 11.10 Turnoff on the right for a scenic view of the historic Red Mountain mining district, with interpretive signs. The portal of the Treasury Tunnel of the Idarado Mining Company is to the left and extends westward underneath the highway, connecting to the Pandora Mine and the Black Bear and Argentine veins at Telluride, six miles to the west.
- 1.55 12.65 Ouray County Road 31 on the left leads about 0.4 mile to the Red Mountain townsite and the National Belle mine; take a side trip, if it looks like your vehicle is suitable for it. Field Guide 2 describes the National Belle Mine and its minerals; it was a mineralized breccia pipe or “chimney”.
- 0.35 13.00 Summit of Red Mountain Pass, elev. 11,075’, milepost 80. The pass is the boundary between Ouray and San Juan Counties, and the drainage divide between the Animas-San Juan and the Uncompahgre-Gunnison drainages. Red Mountain (it has three summits, the highest, 12,747’) is to the east. It is composed of rhyolite and latite flows and tuffs, part of the Silverton Volcanics, the Oligocene volcanic rocks that were erupted just before the collapse of the Silverton caldera, plus quartz latite porphyry intrusives, all extensively hydrothermally altered. The valley walls on both sides at the pass consist of the Burns Formation, an altered hornblende latite, part of the Silverton Volcanics. Summits to the west are composed of ash-flow tuffs from the Silverton caldera, which erupted and collapsed at about 27.6 Ma (27.6 million years ago). In the 1880s, wagons carrying silver ore first crossed the pass on Otto Mears’ toll road, and then on his Silverton Railroad which reached from Silverton to Ironton in 1888; a planned extension to Ouray was never completed. The road down to Silverton follows Mineral Creek, curving along the western margin of the Silverton caldera. Refer to Field Guide 3 in this volume, The Sunnyside Mine, for additional descriptions of portions of this route.
- 2.20 15.20 Chattanooga, a mining town established in 1883. After an 1884 avalanche and an 1892 fire, the town was abandoned.
- 2.40 17.60 Junction of Mineral Creek with the Middle Fork of Mineral Creek coming from the west. The road to Ophir Pass (11,789’), thence to the town of Ophir, south of Telluride, leads up the north side of this valley.
- 2.80 20.40 Junction with the South Fork of Mineral Creek. The road (Forest Road 585) up South Mineral Creek leads to the Bandora mine, famous among mineral collectors for excellent chalcopyrite crystals on a matrix of quartz crystals. Looking up South Mineral Creek, one can see red beds of the Permian Cutler Formation, capped by gray volcanic conglomerate of the San Juan Formation. North of us, east of the highway, Anvil Mountain, 12,537’, exhibits brilliant yellow and red colors from oxidation of iron minerals by acid sulfate waters that percolated along the faults on the western rim of the Silverton caldera after its collapse. Not far below the summit of Anvil Mountain are the Irene and Zuni mines, the latter being the type locality for the mineral zunyite, a complex aluminum fluorosilicate, $\text{Al}_{13}\text{Si}_5\text{O}_{20}(\text{OH})_{14}\text{F}_4\text{Cl}$. Ahead on the right, to the southwest, Bear Mountain (12,987’) and Sultan Mountain (13,368’) are composed of an

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intrusive stock of Oligocene (~26 Ma) quartz monzonite, capped by Telluride Conglomerate (Eocene) and the San Juan Formation (Oligocene). Remains of the North Star-Sultan Mine can be seen on the right as you approach Silverton; the mine produced lead-silver ore from pyrite and galena veins in the quartz monzonite. To the east, Storm Peak (13,487'), north of Silverton, is composed of volcanic rocks (quartz latite), the Henson and Burns Formations, part of the Silverton Volcanics within the caldera.

2.00 22.40 Junction of U.S. 550 with State Highway 110/County Road 2 at the edge of Silverton.

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Sound Democrat Mill. Placer Gulch west of Animas Forks, August 2012. Photo Copyright © by Donna Ware.

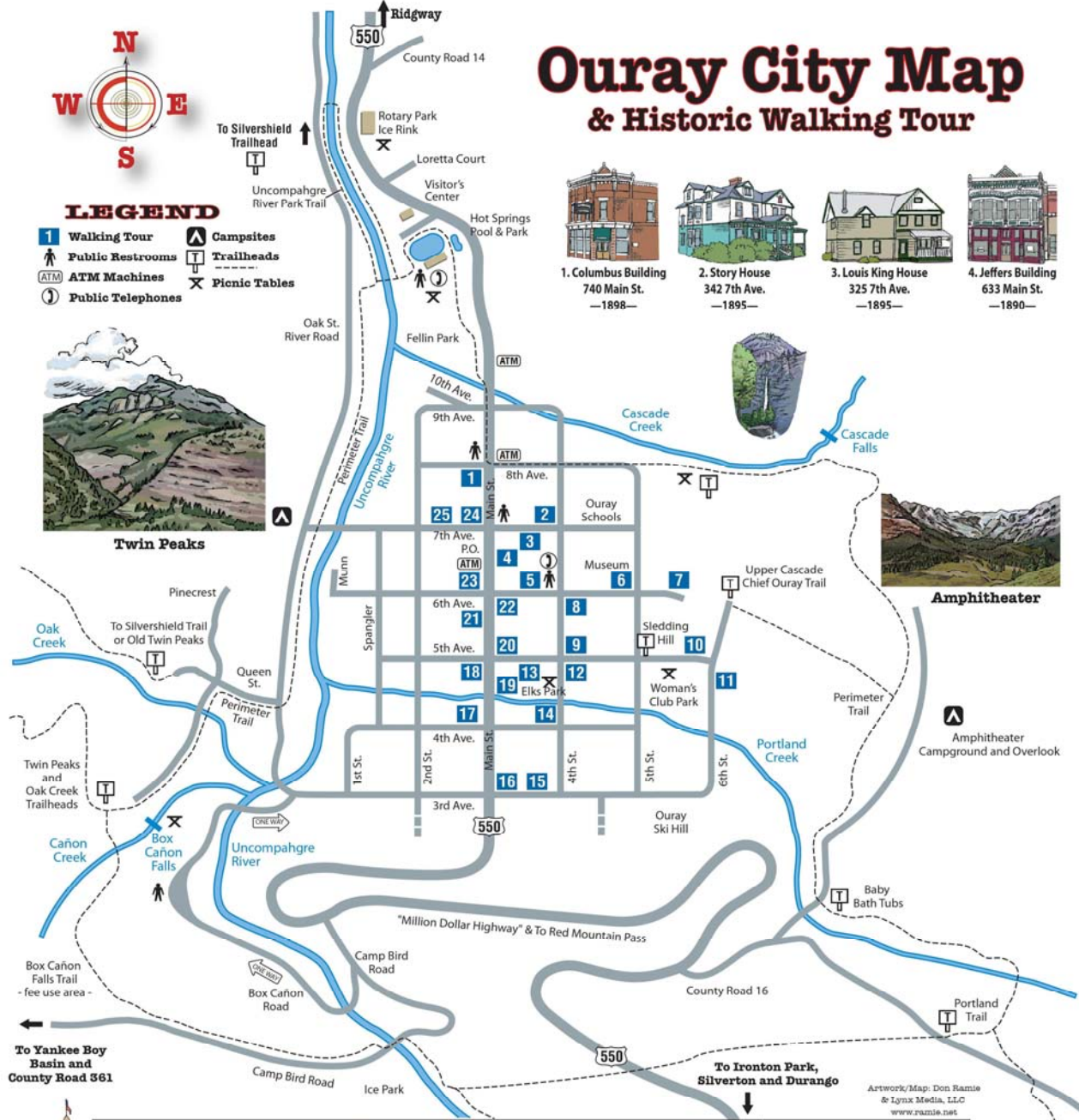
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6. Ouray County Historical Museum 420 6th Ave. —1886—
7. Chief Ouray's Cottage Site North End Of 6th Ave. —1878—
8. Ouray County Courthouse 541 4th St. —1888—
9. Ashley House 505 4th St. —1891—
10. Kullerstrand/Reynolds House 510 5th Ave. —1898—
11. Carney House 439 6th St. —1877—
12. Hurlburt House 445 4th St. —1895—
5. Ouray City Hall 320 6th Ave. —1899—
13. St. John's Episcopal Church 334 5th Ave. —1880—
14. First Presbyterian Church 336 4th Ave. —1890—
15. Tanner House 300 4th St. —1901—
16. Whinnerah/Idarado House 305 Main St. —1902—
17. St. Elmo's Hotel 426 Main St. —1897—
18. Wright Opera House 472 Main St. —1888—
19. Elk's Lodge #492 421 Main St. 1904
20. Beaumont Hotel 505 Main St. —1886—
21. Powell Grocery 512 Main St. —1895—
22. Hess-Stanislawski Building 6th Ave. & Main St. —1893—
23. Prevost Building 600 Main St. —1899—
24. King-Story Building 700 Main St. —1892—
25. Western Hotel 210 7th Ave. —1891—



Intergrown zunyite crystals from the type locality, Zuni Mine, Silverton district, San Juan County, Colorado. From the micromount collection of Arnold G. Hampson. Hampson's entire micromount collection of over 8386 micromounts in four cabinets, and his 360 page catalogue was donated to the Colorado School of Mines Geology Museum in 2010. The collection is available for research use and photography. Field of photographic view 2.0 mm, specimen size 5.0 mm. Photograph Copyright © by Dan Wray.



Snowy Mountains. View down valley (south) towards Silverton taken from the Animas Forks townsite, October 2013. Photo Copyright © by Donna Ware.