Northwest
Micro Mineral
Study Group

MICRO PROBE

SPRING, 2005 VOLUME X, Number 1

SPRING MEETING . .. . .HILLSBORO, OREGON

Saturday, May 7, 2005 9:30 am to 5:00 pm

Rice NW Museum of Rocks and Minerals
26385 NW Groveland Drive
Hillsboro, Oregon

The May meeting will in the NW Gallery at the Rice Museum. A lot of progress has been made since the last meeting. The display cases will be finished by the meeting date, although displays will not be in yet. The giant scolecite pocket will be underway and a few displays will be finished by the meeting date. The gallery will be open to the public this summer. We will have less space than at last year's meeting since there are three petitions with displays on both sides that protrude into the room. We will have to rearrange the tables to find a suitable working area. We will have tables for the potluck lunch as we did last year and space for trading, selling, and microscopes. Bring along plenty of minerals for the free tables, trading, or selling. We might be short of tables, so if you have some please bring them to the meeting.

PROGRAM:

Morning: 11 am We are pleased to have Joe Marty from Salt Lake City with us for the day. He will be talking and showing pictures of "The Minerals of the Colorado Plateau". Joe is an avid collector and is scheduled to be inducted into the Micromounters Hall of Fame later this year.

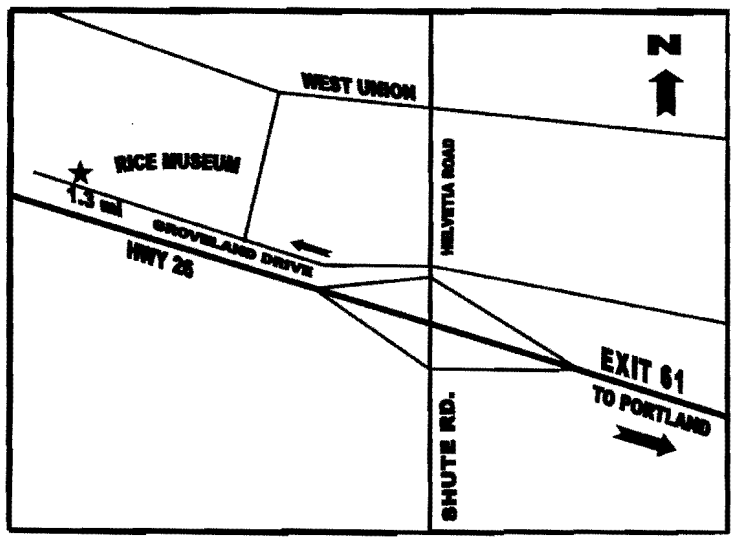
Afternoon: 2 pm Our usual short business meeting and review of the collecting status of locations in the Northwest. Since Joe is interested in field collecting while he is here, we will also be discussing field trips for Sunday and intothe following week.

* * *

Restaurants are available in the local area. Some of us will get together to eat dinner, so please plan to join us if at all possible.

* * *

To reach the Rice Museum, take the Sunset Highway (US 26) west from Portland. Exit at Helvetia Road (exit 61). Jog right 100 feet, then left onto Groveland Drive. The museum is in the trees 1.3 miles to the west.



IN MEMORY OF PHILIP JOHNSON

1923 – 2005

Northwest mineral collectors lost another long-time enthusiast. Philip Johnson, 82, died March 8, 2005, of heart failure. He had lived in the Portland area for the last 23 years, and was a member of our group for a substantial portion of that time.

Phil had served for three years in the U.S. Army during World War II, including 11 months of combat duty in Europe. Following the war, he enrolled in the Michigan Technological University, where he received a bachelors degree in mechanical engineering in 1949. In the years following, he worked as a mechanical engineer for various Michigan firms, finally to retire to the Portland area in 1981. During his time in Michigan, he studied the copper deposits of that area and collected at a number of them. He loved the upper Michigan peninsula and talked often of the scenery, geology and mineralogy.

Phil was a regular at our meetings in Vancouver for a number of years, and he was one of the group of Portland mineral collectors that gather monthly at Phil and Beulah Murphy's. He always had a cheery word, and often brought with him colorful minerals from Michigan to examine and share.

Phil's three children are scattered around the country: Karen Wisniewski of Wendell, Idaho, Jim Johnson of Atlantic Mine, Michigan and Dan Johnson of Spring Creek, Nevada. He was inordinately proud of his 12 grandchildren and 4 great grandchildren.

His interest in mineral and mining was something that he liked to share with schools and civic groups in the area. His curiosity and interest will be missed in mineral collecting circles and in our future meetings.

Donald Howard

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Donald G. Howard, Editor
356 S. E. 44th Avenue
Portland, Oregon 97215
e-mail: pogoette@hei.net

DUES: $15 per year per mailing address, payable for each calendar year at the Spring meeting or by mail to the Secretary-Treasurer:
Don Lown
80770 Turkey Run Rd
Creswell, Oregon, 97426
e-mail: donlown@earthlink.net

IN MEMORY OF GERALD WOOD

1932 – 2005

One of NWMMSG's long-time members and supporters passed away just as this issue of the Microprobe was in composition. Gerald Wood, 73, died March 25, 2005 after being in a coma for several days following a fall and hitting his head.

Jerry was a native Oregonian. His early years were spent in Lowell, just east of Eugene, and later attended High School in Bend. He was in the first anthropology class to graduate from San Diego State University.

Following graduation, Jerry was employed for many years in the U.S. Park Service in Arizona. He spent a good deal of his time at Mesa Verdi and Van Bandelier, and had occasion to interact with the Native Americans of that area. Being in that very rich area gave him opportunity to exercise his already well developed love of collecting minerals, and he added to that an interest in collecting anthropologic artifacts. He was also an avid photographer, and some of his pictures appeared in print in National Geographic associated with articles about the Cliff ruins of that area.

After he left the Park Service, Jerry became a travel agent and tour guide, allowing him to travel about the country and enabling him to meet a variety of collectors in different areas. It also let him collect in numerous places. He maintained contact with many of those people over the years. Later, in the mid-1980's, when he returned to Oregon to take care of his ailing mother, he kept up a wide correspondence and traded minerals with people far and wide. Wherever he went, he checked out both the minerals and the mineral collectors.

Jerry was active in our group over many years. In addition, he was a part of Friends of Mineralogy and Oregon Agate and Mineral Society. He was one of the regulars at the monthly gatherings at the Murphy's house. He was interested in all sorts of minerals, especially oddities and rare minerals. But he always had a special love for crystals of quartz in all its many forms. And he loved and cherished the carved turtles that he gathered from all over the world. Everyone knew that the perfect gift for Jerry was to bring back a turtle from wherever they happened to be traveling. Over the years, he accumulated over 300 turtles made of stone and wood in all sizes and colors.

Jerry was valued as a consultant on the value of collections that were to be sold. He was especially good friends with Gordon Gilbertson and Ray Schneider during their collecting days, and oversaw disposing of their collections after their deaths. He accumulated a considerable collection several times and sold it off to meet expenses only to begin again.

Jerry was always a field collector, and very knowledgeable about minerals and their occurrences. He was really sad when his health began to deteriorate and he could no longer actively participate in our local collecting trips. But he was active in the hobby right up to the final few days, trading, sharing and corresponding. He made many, many friends, all of whom will miss him very much.

Donald Howard

4.

Recent rare mineral finds in Southern California and Nevada Desert Mines

Robert M. Housley
210 S. Catalina Ave. #3, Pasadena CA 91106
rhousley@its.caltech.edu

During the last few years a number of rare mineral finds have been made at Southern California and Nevada desert mines. Each undoubtedly deserves a detailed write-up. Lacking such write-ups, it seems worthwhile to at least mention the occurrences.

California Mines Aga Mine, Baker, San Bernardino County

In January of 2004 the rare Cu/Pb tellurate parakhinite was discovered associated with anglesite, pyromorphite, and gold at this mine. Subsequently besides vanadinite, mottramite, and cerussite the additional tellurium minerals plumbotellurite, fairbankite, khinite, burckhardtite, and moctezumite have been found, although the later two can only be recognized in the SEM.

Bagdad-Chase Mine, Ludlow, San Bernardino County

In January of 2003 exceptionally fine crystals of the Bi/Pb oxychloride perite were found associated with colorless mimetite and wulfenite at this mine. Other minerals occurring here include duftite, hedyphane, malachite, goethite, hematite, and cerussite.

Nevada Mines Boss Mine, Goodsprings (Yellow Pine) District, Clark County

Nissonite from the Boss Mine is listed in "Minerals of Nevada", (Castor and Ferdock, 2004). In February of 2004 two more good quality samples of this Mg/Cu phosphate were found on the 200-foot level dump of the mine. This brings to four the total number of pieces of nissonite that have been found there during the last 10 years. This latest nissonite is on gossan and is associated with dendritic malachite pseudomorphs, probably after cuprite.

Quo Vadis Mine, Alunite District, Clark County

Abundant mimetite, willemite, and fornacite were noticed at the Quo Vadis Mine in November of 2003. Later in February of 2004 very nice murdochite crystals associated with mimetite and fornacite were found. Also found were a couple of light yellowish green sprays of the Pb silicate creaseyite. Later conichalcite was also found.

Winter Prospect, El Dorado District, Clark County

This location is listed as being 9 miles NW of Nelson in "Minerals of Nevada" and several minerals are listed as being found there including the rare chromates hemihedrite and iranite. Even though this area is small and difficult to access during February of 2004 additional samples of hemihedrite and iranite along with mimetite, willemite, and wulfenite were obtained.

Acknowledgements

These finds were a joint result of the combined efforts of Tish Hunter, Walter Margerum, Dick Thomsson, Joe Marty, Jim Soboleski and myself. The fact that I have written this listing should not imply that my role was greater.

References

Minerals of Nevada (2004), Stephan B. Castor and Gregory C. Ferdock , Nevada Bureau of Mines and Geology special publication 31, University of Nevada Press.
than any of the others.

Zeolites near King Hill, Elmore County, Idaho

Donald G. Howard

A few zeolite minerals are to be found along the North BLM Road just north of King Hill, Idaho. King Hill, a small settlement along the Snake River, was a stop along the Pony Express route, and later a railroad yard for the Union Pacific. Now it is not even on the main highway – Interstate 84. It is located about 70 miles east of Boise on a loop of "Business 84" and can be reached by coming off the freeway at Glenn's Ferry and staying on the north side of the Snake River for about 5 miles. The North BLM Road comes off just east of the town and wends its way up into the hills north of the loop highway. The BLM road is a well-graded gravel road.

Zeolites begin to appear in shallow road cuts 4 or 5 miles from the paved road. This is one area to collect. They also outcrop in rock along the east side of a gully west of the road. There is ample room to park – indeed, there isn't anything for miles, not so much as a tree! The gully is perhaps a half mile walk across the grass and sage brush covering rolling hills.

The minerals observed (in the order of their formation) are chabazite, thomsonite, mesolite, aragonite, and opal.

Chabazite – is the base mineral, forming clear pseudocubes that are often interpenetrating. It varies from finely crystalline crusts to distinct individuals several millimeters on a side.

Thomsonite – forms hard, grayish balls with just a hint of the characteristic parallel lines on top that represent individual terminations. It is much more abundant in the gully material, where it usually has tufts of mesolite growing from it. The thomsonite is typically embedded in the chabazite, but often is shaped around the individual pseudocubes, indicating that chabazite continued to grow while the thomsonite was forming, but that the chabazite was clearly first.

Mesolite – was found only in the material collected along the side of the gully. The tufts grow out from thomsonite. The crystals appear to all be about the same length, approximately 2.5 mm, so that the sprays have a rather flat top like a brush.

Aragonite – forms clusters of parallel clear to white blades in the material along the road. There it intergrows with opal to form odd growths that resemble mushrooms, with sturdy stems flaring above to a flat-topped dome. These come in a variety of sizes. Some can easily be mistaken for sprays of crystals, possibly thomsonite. All the thomsonite, however, appears to be in the form of hard, nearly smooth hemispheres. Where free of opal, the aragonite forms small sprays on top of the zeolites.

Opal – tends to coat things along the road, and is not very distinct in itself. Some late-forming clay is probably also present.

This location is fun and different. If you happen to be driving past, you can collect representative material in a few hours. But if you do go, make sure that you leave any Indian artifacts exactly where they are. The BLM Rangers are watching!

The author wishes to thank Larry Bosio for bringing this site to his attention, and for Larry and Roger Beck for a great day collecting in sunny Idaho.

The Hidden Treasure Mine

Dry Canyon, Tooele County, Utah

Joe Marty

Introduction. The Hidden Treasure mine sits at the top of Dry Canyon in the Oquirrh Mountains with spectacular views of the Stansbury Mountains and Rush Valley to the west. Many world-class specimens of aurichalcite, suites of beautiful secondary copper-zinc minerals and the rare and spectacular cadmium sulfate mineral, niedermayrite, were collected there. Ore was first discovered in the Ophir mining district in 1864. During the last 20 years, the mines in Dry Canyon were some of the more prolific mineral specimen-producing areas in Utah. Numerous enthusiasts avidly collected there, especially at the Hidden Treasure mine. The majority of specimens were gathered from oxide zones.

Photograph inside the Hidden Treasure mine, taken about 1917. From the Shipler Commercial Photographers Collection. Utah State Historical Society.

Mineralization occurred in pipes, fissures, and blanket replace-ment deposits in the Madison limestone that lies beneath the Deseret limestone. Values from lead,silver, zinc, copper and gold were obtained in both oxide and sulfide ores. The oxide ores were mainly lead, copper and zinc carbonates with chlorargyrite. In places the ore bodies were 100' high and 50' wide. Galena and sphalerite were the main sulfide ores with pyrite and chalcopyrite. However, very few esthetic sulfide specimens have been preserved or collected.

In 1989, a Boy Scout became lost in the Hidden Treasure mine. Due to the adverse publicity the mine entrance was sealed shut with cement, rebar, and rubble. The mine was repeatedly reopened but in 2000, all of the mines in the area were recently reclaimed by the State of Utah.

The Hidden Treasure mine is located about a 90-minute drive from Salt Lake City, Utah. From Salt Lake City, you travel west and then south to Stockton, Utah. The mine is south and west of the town of Stockton.

Geology. Dry Canyon is located in the southwest Oquirrh Mountains. These mountains are composed of Paleozoic sedimentary rocks and Tertiary igneous and sedimentary rocks. The prominent folding and faulting is similar to what is seen in other ranges in the Basin and Range province. These structures provided channels for hydrothermal solutions, which produced mostly replacement deposits and some fissure veins. Both sulfide and oxidized ore were present which produced values of lead, silver, zinc, and copper.

Mines. The Chicago, Hidden Treasure and Sacramento are located at the top of Dry Canyon and since all of these mines were eventually interconnected they are now known as the Hidden Treasure mine. The lower tunnel was known as the Sovereign adit, the middle adit was the Granite tunnel and the upper adit was known as the Hidden Treasure incline. The Hidden Treasure mine also connects to the Buckhorn mine which is in Ophir Canyon above the Ophir Hill mine. The mine tunnels and inclines are in excess of 15,000 feet. The majority of the ore was silver-bearing galena with sphalerite and chalcopyrite. Most of the minerals specimens were collected in oxide zones (rinds) above and below the sulfide zone. Collecting was very treacherous and involved navigating steep and partially collapsed inclines while avoiding dangerous loose ceiling rocks, rotten timber and deep shafts.

In 1989 a Boy Scout on a field trip became lost in the underground workings. The mine was searched for 5 days. Authorities had given up on finding the boy, but on the last day before they were scheduled to seal the mine, he was found. After this incident, the last remaining open adit, the Sovereign tunnel, was closed at its portal with cement, rebar, and rubble. Until then the Hidden Treasure mine was the most productive mine in the district for mineral specimens. World-class specimens of aurichalcite (plates up to 8 cm-12 cm) were first collected by Phil Richardson and Solan Hammack. In addition, plates of smithsonite, peppered with rosasite were sold by Jim McGlasson of the Collector's Stope during the 1999 Tucson show. Other fine specimens collected included plattnerite, hemimorphite, and calcite (see Mineralogy for a more complete list).

Specimens may be seen at the University of Utah in the Natural History Museum and in private collections. Presently, the mine is closed and dump collecting is not productive.

The **Cliff mine** is located on the north slope of Ophir Canyon about a mile northwest of the town of Ophir and about 1,000 feet below the Dry Canyon divide. Because of the remote location and the condition of the workings, very little in the way of mineral specimens has been collected except for a few calcite crystal clusters. The middle level of the Cliff mine (Buckhorn) was connected to the Sovereign tunnel level of the Hidden Treasure mine.

The **Kearsarge mine** is across the canyon from the Hidden Treasure mine, about 150' above the road to the Granite tunnel of the Hidden Treasure mine. The mine was located in 1871. The extent of the underground workings was very small but the ore was very rich, some assays reaching $10,000 a ton in silver. The ore was chiefly oxidized. However some sulfides were mined in the Callahan stope and at lower levels. A few oxide minerals have been collected from the dumps. This mine has been intriguing to mineral collectors because of the report by Bullock that hessite occurred at the mine. However, no tellurium minerals from the mine are known to exist in collections.

The **Mono mine** is on the north side of Dry Canyon at an elevation of 8,459 feet, below the access road to the Hidden Treasure mine. The mine was reported caved as early as 1927. Production was started before 1880. There are no known mineral specimens from this location.

The **Queen of the Hills mine** is on the north side of Dry Canyon or northwest of the Hidden Treasure mine. The mine was located in 1870 and has several miles of workings. The ore contained as much as 60 ounces of silver per ton. The dumps are large but not productive for mineral specimens. The mine workings are collapsed and have not been accessible for many years.

The **Surprise Tunnel** is just below the Sovereign adit of the Hidden Treasure mine. The purpose of the tunnel was prospecting and little ore was recovered. Very little mineralization was present and no specimens from this location exist.

Very little is written regarding the **Wandering Jew Mine**, which is directly across the canyon to the north from the Hidden Treasure mine. Total workings are about 1 mile. The ores contained lead with silver. A boulder the size of a car blocks the inclined shaft of this mine. The air in this mine is reportedly bad (oxygen deficient) at depth. A few specimens have been observed from this mine that included azurite and malachite with very small cuprian adamite crystals.

Mineralogy. The majority of the mineral specimens recently collected in this district were of secondary origin. However, both primary and secondary minerals were mined. The primary minerals were predominantly, lead, zinc, copper and silver sulfides. The secondary minerals were mostly zinc, copper, and lead carbonates with hemimorphite, but a few copper sulfates do occur.

Primary Minerals

Acanthite, Ag_2S, is reported to be the source of silver as inclusions or blebs in the galena-bearing ores of the district. It was probably present in all of the mines and may occur along with silver in a quartz vein with scheelite and fluorite in the Hidden Treasure mine.

Arsenopyrite, FeAsS, was present in small isolated quantities in the sulfide ores. It was identified associated with the alteration product scorodite at the Wandering Jew mine and was probably the source for the arsenic in the cuprian adamite.

Chalcopyrite, $CuFeS_2$, is present in small quantities in most of the galena sulfide ores in the district. Chalcopyrite is most likely the source of copper present in the colorful secondary copper minerals, present in oxide zones.

Cuprite, Cu_2O, rarely occurs as octahedral crystals and fibers (chalcotrichite) in a quartz vein with scheelite and fluorite in the lower Hidden Treasure mine. Much of this cuprite is coated with cerussite. In an oxide area of the upper levels of the mine there is a zone where both rosasite and malachite appear to have replaced cuprite.

Fluorite, CaF_2, in the Hidden Treasure mine (Color Figure 1). The fluorite recently collected has been secondary in occurrence. However, fluorite was reported to be widespread with primary ore mineralization in the district.

Galena, PbS, is present in many of the unmined pillars in the Hidden Treasure mine. Because of galena's silver value much of it has been mined out. The rinds of remnant galena pods often contain beautiful secondary minerals including cerussite, anglesite, and linarite. Yellow hexagonal crystals of mimetite associated with primary galena and secondary cerussite may be found.

Gold, Au, has never been observed in the native form although it is present in some of the ores.

Hübnerite, $MnWO_4$, is present in the Ophir Hill mine as red prismatic crystals associated with chalcopyrite, fluorite, scheelite, and calcite.

Pyrite, FeS_2, is the most abundant and widespread sulfide to be found in the district. The presence of pyrite was important in the genesis of oxide zone mineralization.

Primary **quartz**, SiO_2, is relatively uncommon in the Ophir district. Large quartz crystals have been found at an undisclosed locality in Dry Canyon embedded in calcite. The crystals occur in clusters with individual crystals up to 12 cm long.

Native **Silver,** Ag, has been found in a quartz vein with scheelite and fluorite in a level below a sulfate zone in the Hidden Treasure mine. The silver occurs as small isolated fracture fillings within the vein.

Scheelite, $CaWO_4$, occurs as isolated crystals with fluorite in a quartz vein in a lower level of the Hidden Treasure mine. Scheelite is much more common in the Opir Hill mine in Ophir Canyon and varies from colorless, tan, yellow, and brown to red in color. In a calcite cavern in the Ophir Hill mine, many specimens of scheelite were recovered after removing the calcite coating with dilute hydrochloric acid.

Sphalerite, ZnS, is an essential feature of the sulfide ore deposits in the district. Sphalerite provided the necessary zinc for the smithsonite and hemimorphite found in the upper and lower oxide zones of the Hidden Treasure mine. Since sphalerite is often embedded in galena and one of the more easily oxidized sulfide minerals, very few crystals have been recovered. Many of the blocks containing massive sphalerite also were coated with orthoserpierite and niedermayrite. Traces of cadmium in the sphalerite may have been the source of the secondary cadmium mineralization.

Secondary Minerals

Cuprian **adamite**, $Zn_2AsO_4(OH)$, as small, green crystalline clusters up to 2 mm. with arseniosiderite were identified on azurite specimens with malachite from the Wandering Jew mine directly across the canyon from the Hidden Treasure mine.

Anglesite, $PbSO_4$, with linarite on galena was identified from the lower oxide zone in the Hidden Treasure mine. The colorless equant crystals are approximately 2 mm. in size. Linarite is rare but commonly associated with anglesite.

Apatite, $9CaO.3P_2O_5.Ca(F,Cl)_2$, was reported to occur in the upper workings of the Hidden Treasure mine. The phosphate probably came from the phosphatic shale layer at the base of the Deseret limestone. Upper workings of the Hidden Treasure mine are inaccessible and therefore apatite has not been identified in any collected samples.

Aragonite, $CaCO_3$, is present in many of the mines in the district occurring in limestone caverns exposed during mining operations, and as fracture coatings on limestone blocks.

Arseniosiderite, $Ca_2Fe_3O_2(AsO_4)_3 \cdot 3H_2O$, is present in the Wandering Jew mine associated with cuprian adamite. The small, less than 1 mm. crystals form a golden-yellow druse.

Very small yellow crystals, 0.6 mm., of **arsentsumebite**, $CuPb_2(AsO_4)(SO_4)(OH)$, were tentatively identified in a specimen from the Kearsarge mine.

Aurichalcite, $(Zn, Cu)_5(CO_3)_2(OH)_6$ is common in the district and occurs as blue-green masses of individual 3-4 mm. flattened, needle-like crystals associated with smithsonite, rosasite, hemimorphite and plattnerite. On occasion, specimens were collected with plattnerite crystals perched on individual aurichalcite crystals. World-class specimens as large as 8 by 12 cm have been collected at the Hidden Treasure mine in oxide zones. Because of the delicate nature of the crystals, collecting and preserving specimens requires a great deal of care. Specimens of aurichalcite have also been found at the Kearsarge mine.

Azurite, $Cu_3(CO_3)_2(OH)_2$, occurs in most of the mines in the district as druses of small crystals. Individual crystals seldom exceed 4 mm. Azurite is commonly perched on white smithsonite affording beautifully contrasting specimens.

Barite, $BaSO_4$, as golden-yellow platy crystals up to 3 mm. occur with hemimorphite at the Hidden Treasure mine (Color Figure 7). Because of the golden-yellow color, these crystals were initially confused with wulfenite.

Brochantite, $Cu_4SO_4(OH)_6$, as emerald green crystals up to 3 mm., is one of the few prominent copper sulfates that occur in the district (Color Figure 9). Brochantite has been found in the lower oxide zone of the Hidden Treasure mine with smithsonite.

Calcite, $CaCO_3$, is present in all of the mines in the district. Calcite may be found with the ore minerals and in the many limestone caverns that were intersected during mining. Individual crystals up to 15 cm occur. The author has observed large scalenohedral crystals formed in breccia zones in prospect tunnels.

Post mining **chalcanthite**, $CuSO_4 \cdot 5H_2O$, is present as blue coatings on the tunnel walls in the lower copper sulfate zone in the Hidden Treasure mine. In the same location, pillars with residual ore often contain fibrous aggregates of water-clear blue crystals up to 25 mm. long.

Chalcoalumite, $Cu^{2+}Al_4SO_4)_2(OH)_{12} \cdot 3H_2O$, has been tentatively identified as blue green platy 1 mm. crystals from a small outcrop near the Ophir Hill Consolidated mine associated with cyanotrichite, spangolite, malachite, linarite, brochantite, hydrozincite, schulenbergite, aurichalcite, and rosasite.

Cerussite, $PbCO_3$, is a very common mineral in the oxide zone of all of the mines in the Ophir District (Color Figure 2). Cerussite may occur as "sand", as "jack-straws" and as small v-shaped, twinned, striated crystals up to 5 mm. long often associated and coated with many of the secondary minerals. Most

of the crystals are colorless to white in color. Early ore rich in cerussite contained 15-40 ounces of silver/ ton and 20-25 per cent lead.

Chlorargyrite, AgCl, was present in all of the oxide zone ore deposits. It is not unusual to find small microscopic, 2 mm., euhedral crystals and coatings associated with many of the secondary mineral species, usually later in paragenesis.

Small coatings of **covellite**, CuS, are found in the Hidden Treasure mine associated with chalcanthite coating chalcopyrite suggesting that it formed at a very late stage. Covellite is also reported to have occurred in the Kearsarge mine.

Cotunite, $PbCl_2$, may be present. A single specimen from the Beau Gordon micromount collection was observed by the author.

Cuprite, Cu_2O, is reported to have been present in the oxide ores of Dry Canyon. Pseudomorphs (1-2 mm) of rosasite and malachite after cuprite occur in the upper oxide zones of the Hidden Treasure mine.

Duftite, $PbCuAsO_4(OH)$, is very rare in the district and a small number of green crystals less than 0.5 mm. in length were found in the lower oxide zone of the Hidden Treasure mine associated with cerussite, rosasite, and mixite. A pillar in an adit close to and east of the Queen of the Hills mine contained duftite with hemimorphite and mimetite.

Fluorite, CaF_2, is widespread in the district (Color Figure 1). Most of the secondary crystals are small and some crystals reveal color zoning with a light purple color. A green 2 cm. crystal was recovered in the Hidden Treasure mine in the lower oxide zone. Also, small aesthetic purple fluorite crystals up to 2 mm. have been found perched on hemimorphite crystals in the Hidden Treasure mine and perched on calcite in the Cliff mine

Goethite, α-FeO(OH), is most prevalent in the oxide zones of the Hidden Treasure mine. These zones are the most productive areas to find the more interesting secondary minerals.

Gypsum, $CaSO_4 \cdot 2H_2O$, is common in the Hidden Treasure. In the lower oxide zone gypsum is very common as a late stage mineral coating hemimorphite. Individual crystals to 5 mm. are present coating fracture surfaces.

Hemimorphite, $Zn_4Si_2O_7(OH)_2 \cdot H_2O$, occurs as colorless, prismatic, crystals, up to 8 mm. long, associated with aurichalcite, smithsonite, rosasite, purple fluorite, calcite, plattnerite, yellow barite, chlorargyrite and gypsum (Color Figure 3). The lower oxide zone of the Hidden Treasure mine has been the most productive area for specimens in the district and plates up to 8 by 12 cm have been recovered.

Hydrozincite, $Zn_5(CO_3)_2(OH)$ as white fibrous needles, 1-2 mm, have been collected at the Hidden Treasure mine in the oxide zone, but is relatively uncommon.

Jarosite, $KFe_3(SO_4)_2(OH)_6$, is common in the district but is difficult to recognize because well developed crystals are rare. A few golden yellow platy crystals up to 0.5 mm. were collected in the lower oxide zone of the Hidden Treasure mine associated with brochantite.

Ktenasite, $(Cu,Zn)_5(SO_4)_2(OH)_6 \cdot 6H_2O$, 0.4 mm., as the typical platy trigonal light blue-green crystals has been identified in the lower oxide zone with other copper sulfate minerals including niedermayrite and brochantite (Color Figure 6). In contrast to niedermayrite, ktenasite crystals usually lie flat on the matrix and do not project into cavities as does niedermayrite.

Leadhillite, $Pb_4(SO_4)(CO_3)_2(OH)_2$, as very rare colorless to white 1mm. hexagonal crystals were recovered as surface coatings on a galena pod associated with linarite in the Hidden Treasure Mine.

Linarite, $CuPbSO_4(OH)_2$, is rare and has only been found in close association with galena as small, blue 1 mm. acicular crystals. Associations include spangolite, cerussite, brochantite, and anglesite.

Malachite, $Cu_2CO_3(OH)_2$, is less common than rosasite in the Hidden Treasure mine but still plentiful where it occurs as small acicular crystals up to 3 mm, and coatings. Associations include rosasite, and

Hidden Treasure mine speckled with blue-green balls of rosasite and needles of hemimorphite. Large plates of drusy smithsonite were commonly collected in the 1980's. Individual rice-grain crystals also exist usually associated with hemimorphite. Individual crystals vary in size from 1-3 mm.

Spangolite, $Cu_6AlSO_4(OH)_{12}Cl{\cdot}3H_2O$, is rare but can be found in the Hidden Treasure mine as 1-2 mm. 6-sided blue green crystals. Spangolite is closely associated with galena and linarite.

Sulfur, S, was observed as yellow micro-crystals, 1-2 mm. associated with scorodite at the Wandering Jew mine.

Topaz, $Al_2SiO_4(F,OH)_2$, has been reported to occur at the Hidden Treasure and most likely was a constituent of ore vein mineralization. Rhyolite dikes occur in the district but the author has not seen any topaz bearing rhyolite.

Wulfenite, $PbMoO_4$, which is easily overlooked occurs as small, 2 mm., yellow crystals in the lower oxide zone of the Hidden Treasure mine associated with mimetite, aurichalcite, hydrozincite and hemimorphite. A few crystals have also been found in the upper oxide area closely associated with galena, smithsonite and goethite. Yellow barite crystals in the lower oxide zone were initially confused with wulfenite. However, close examination of symmetry makes identification straightforward.

Discussion. Dry Canyon has produced some world-class mineral specimens. However, the probability of additional mining in the Ophir district in the near future is unlikely. In 1998, Kennecott did exploratory drilling in areas north of the Hidden Treasure mine in search of an economical porphyry copper deposit. No encouraging results have been published. There are no identified or significant silver reserves present in the Hidden Treasure mine. There are limited zinc reserves but the price of zinc appears to preclude any profitable mining operation. Low-grade gold deposits have not been identified. The adjacent Mercur district low-grade gold deposits have been depleted. Therefore, considering the condition of the existing workings, the State of Utah's desire to eliminate mine access, and the lack of any immediate mining plans of operation, the future for additional production of mineral specimens for the Ophir district seems bleak. This is very disappointing for mineral collectors and those interested in studying secondary minerals, some of which are very complex and beautiful to observe.

Claim Status. The Hidden Treasure mine is a patented claim, private property, and sealed shut with concrete by the State of Utah and thus closed to further collecting. The current owner has spent significant time preserving historical information on the district and involvement in the exhibition of mining memorabilia in the town of Ophir.

Acknowledgements

The author is indebted to the owners of the Hidden Treasure mine who provided access to the mine before it was closed. Also, the author would like to thank all of the many collectors, especially Solan Hammack and Phil Richardson, who have provided specimens for examination and information regarding the mineral occurrences. Also, thanks are extended to Dana Wilson who reviewed the article and provided useful suggestions.

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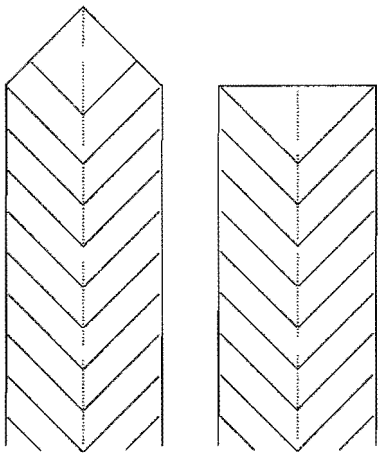
Loughlin, G. F., 1918, Zinc carbonate and related copper carbonate ores at Ophir, Utah: United States Geological Survey Bulletin 690, pp. 1-14.

azurite. Malachite tends toward green while rosasite is bluer with less distinct individual crystals.

Mimetite, $Pb_5(AsO_4)_3Cl$, occurs as well developed yellow crystals up to 3 mm. in the lower oxide zone of the Hidden Treasure mine closely associated with galena.

Mixite, $Cu_6Bi(AsO_4)_3(OH)_6.3H_2O$, 0.2 mm, as light blue acicular crystals were found in association with duftite and rosasite in the lower oxide zone of the Hidden Treasure mine. Although microprobe analysis was not performed, it is likely that this single specimen represents the calcium variety of mixite, or possibly zalesiite.

Niedermayrite, $Cu_4Cd(SO_4)_2(OH)_6.4H_2O$, occurs as well formed light blue individual crystals up to 1.5 mm. in length, as twinned and untwinned crystals (Color Figure 5). Untwinned niedermayrite occurs as plates with steeply angled (~40 degrees) terminations giving crystals a diamond-shaped aspect. Twinned niedermayrite occurs as very thin laths. They appear to be simple contact twins on a plane parallel to elongation and perpendicular to the broad face (presumably 010), The {010} faces usually have striations at a steep angle (~40 degrees) to the elong-ation yielding a chevron-like pattern. The laths can have pointed, fishtail or nearly flat 90-degree terminations. Niedermayrite crystals are usually erect in contrast to flattened ktenasite.



Drawings of twinned Niedermayrite from the sulfate zone in the Hidden Treasure mine (Figure and description courtesy of Anthony Kampf).

Orthoserpierite, $Ca(Cu^{2+}, Zn)_4(SO_4)_2(OH)_6.3H_2O$, crystals were found in the lower copper sulfate zone of the Hidden Treasure mine intimately associated with blocks containing primary sphalerite (Color Figure 8). Much of the orthoserpierite has a vivid blue color possibly because of cadmium present in its crystalline structure. These blue distinct crystals average 1 mm. in length and occur as coatings associated with niedermayrite, spears of brochantite, and flattened plates of ktenasite.

Plattnerite, PbO_2, is very common in the Hidden Treasure mine in the oxide zones (Color Figure 4). These black prismatic crystals are less than 1 mm. long and are typical oriented on hemimorphite and rarely on aurichalcite and smithsonite.

Plumbojarosite, $PbFe^{3+}{}_6(SO_4)_4(OH)_{12}$, was reported to be plentiful in the oxide ores and most likely has been overlooked by collectors.

Secondary **quartz**, α-SiO_2, as small clear and colorless secondary crystals up to 4 mm. are common in the district in oxide zones associated with all of the secondary mineralization.

Rosasite, $(Cu,Zn)_2(CO_3(OH)_2$, occurs as blue-green balls up to 4 mm. closely associated with smithsonite and aurichalcite. Occasionally, chlorargyrite crystals may be found perched on rosasite.

Schulenbergite, $(Cu,Zn)_7(SO_4,CO_3)_2(OH)_{10}3H_2O$, has tentatively been identified as 0.5-1 mm. light-green platy crystals in the lower sulfate zone associated with ktenasite, orthoserpierite, niedermayrite and brochantite.

Smithsonite, $ZnCO_3$, occured as a rind on the long since mined galena ore body in the Hidden Treasure mine. For a limited time, while zinc prices were high, smithsonite was mined for its zinc content. Significant amounts of light green smithsonite still occur in the lower and upper oxide zones of the

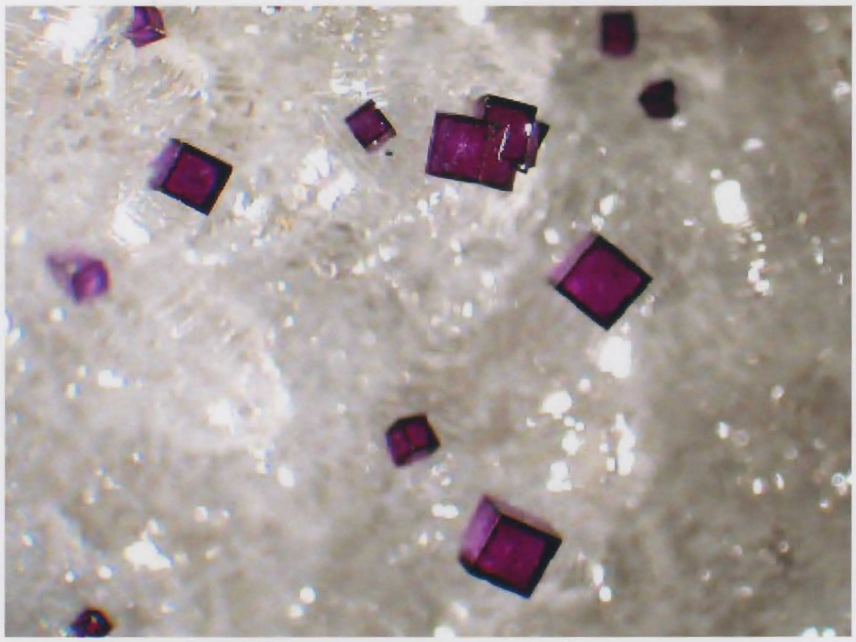


Figure 1.

Fluorite

HiddenTreasure Mine,
Tooele Co., Utah

Figure 2.

Malachite on
Cerussite

HiddenTreasure Mine,
Tooele Co., Utah

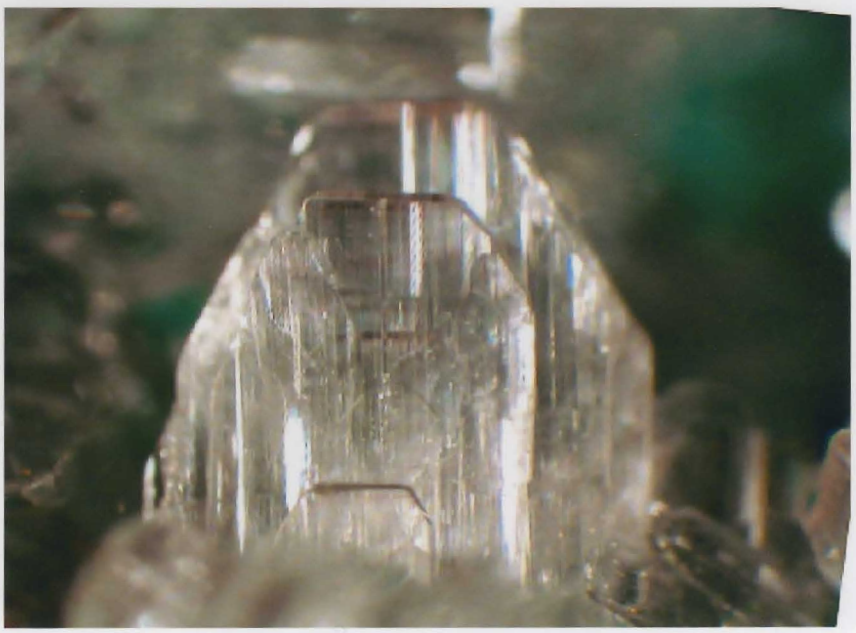


Figure 3.

Hemimorphite

HiddenTreasure Mine,
Tooele Co., Utah

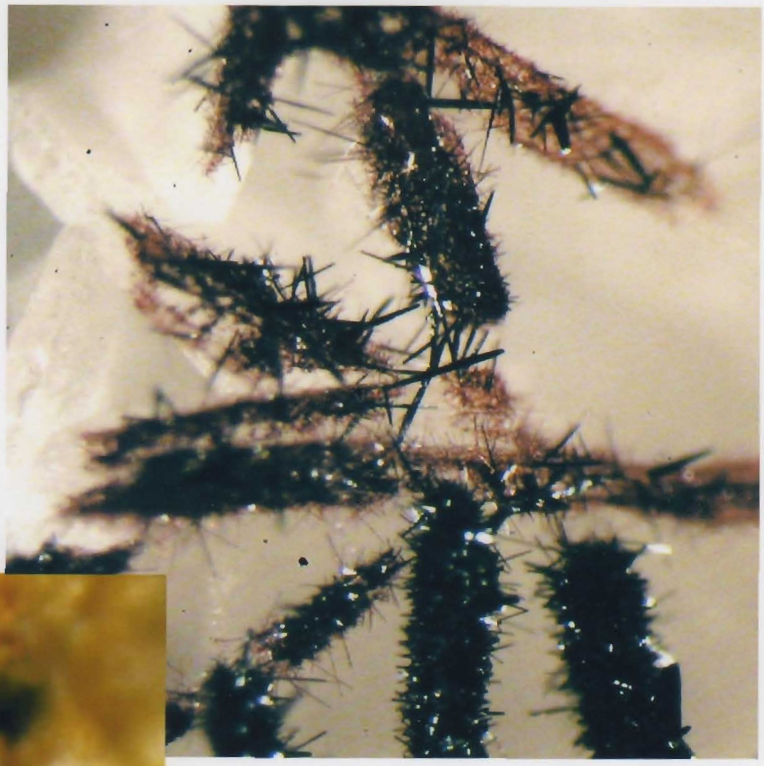


Figure 4.

Plattnerite

HiddenTreasure Mine,
Tooele Co., Utah

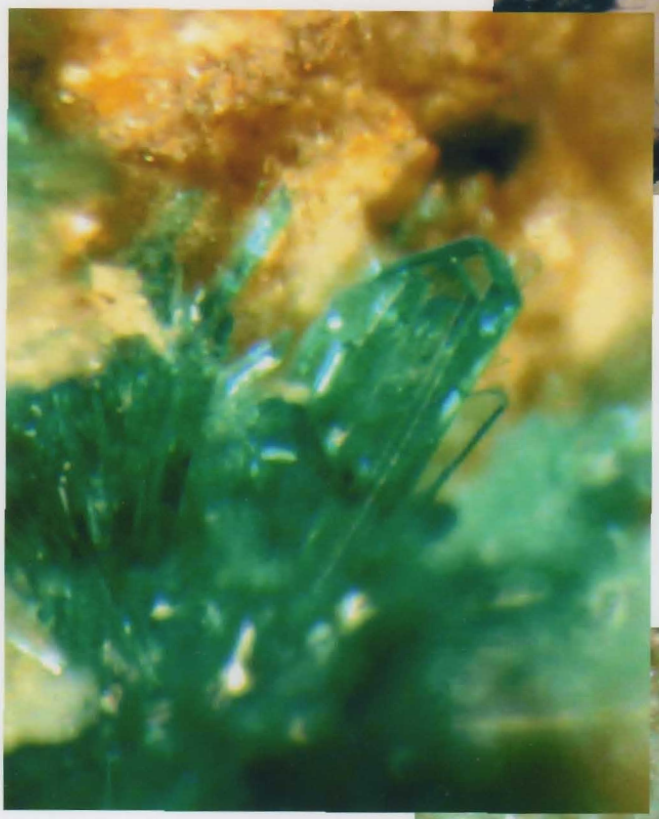


Figure 5.

Niedermayrite

HiddenTreasure Mine,
Tooele Co., Utah

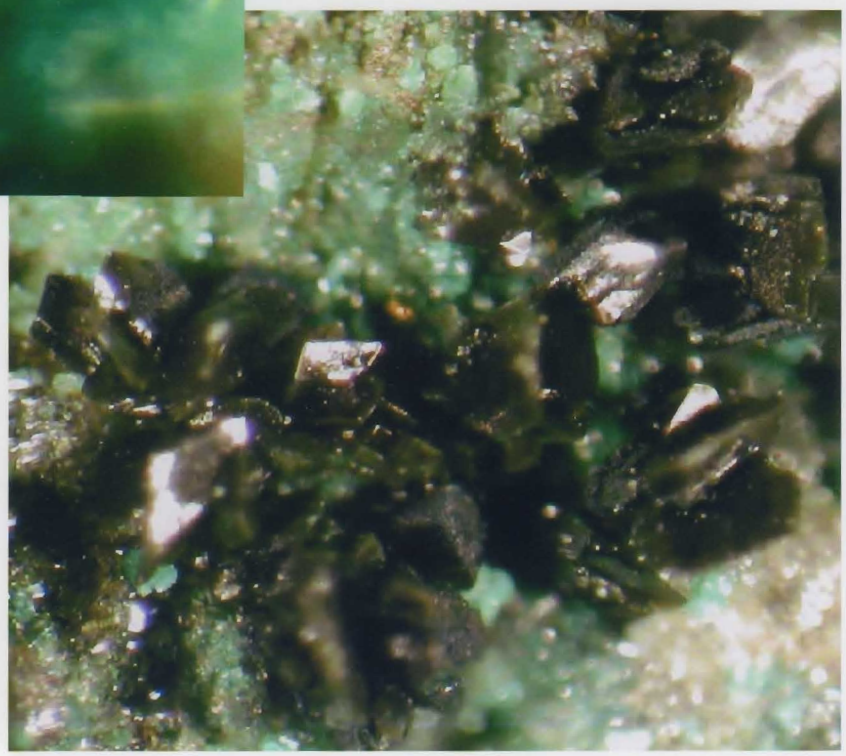


Figure 6.

Ktensaite

HiddenTreasure Mine,
Tooele Co., Utah

Figure 7.

Barrite

HiddenTreasure Mine,
Tooele Co., Utah

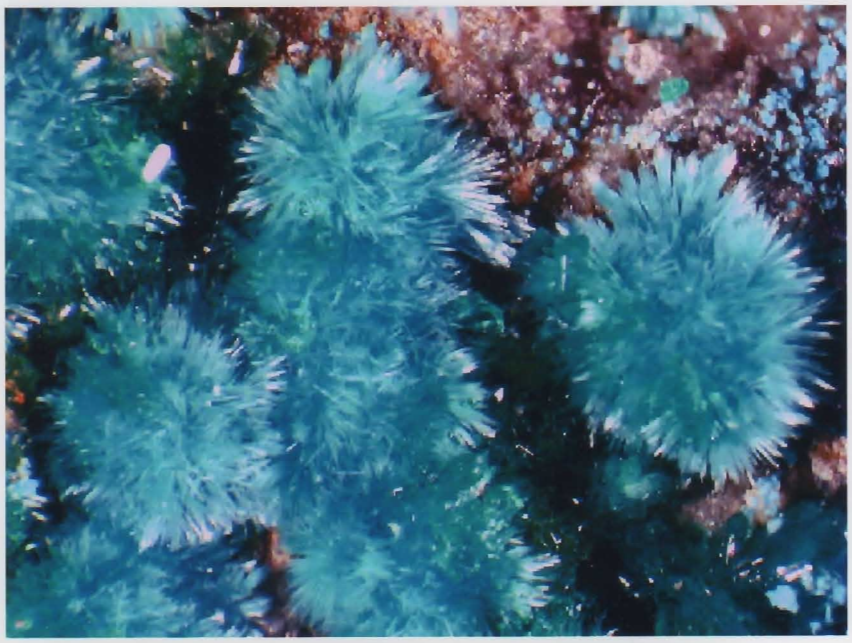


Figure 8.

Orthoserpierite

HiddenTreasure Mine,
Tooele Co., Utah

Figure 9.

Brochantite

HiddenTreasure Mine,
Tooele Co., Utah