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Geology and Mineralogy of Some Mines and Prospects North of Hazelton, British Columbia.

by

Donald Gregory Sampson.

- -

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CONTENTS.

Illustrations

Acknowledgments

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Many helpful suggestions came from Mr. John Gower, who is also the collector of the suite of ores upon which the mineralogy of this report is based.

Mr. James Donnan, laboratory technician of the Department of Geology and Geography gave much valuable assistance in the making of the polished sections.

Fellow students aided in many ways and to them the author also extends his gratitude.

Abstract

This is primarily a mineralogical study of six small (with the exception of the American Standard Mine) properties none of which have had any important production. They are in the Hazelton district of Northern British Columbia.

The deposits for the most part consist of sulphide-bearing quartz veins occuping fissure, fault or shear zones in or near granodiorite intrusions.

The Mohawk, Sunrise, and Comet properties contain mostly boulangerite and sphalerite. The American Standard, Surprise and Pole Star properties contain arsenopyrite, sphalerite, galena, and chalcopyrite.

With the present good market for base metals some of the properties could probably become small producers if milling facilities were available.

Previous Work and Sources of Information.

In 1909 and 1910 W. H. Leach while preparing a topographic map of the region, did geological reconnaissance work in the Hazelton district; his report is in the Summary Reports of Geological Survey of Canada for those years.

G. S. Malloch made a cursory examination of the ore deposits in the vicinity of Hazelton in connection with his work in the Groundhog region to the north.

In 1938 J.E.Armstrong and J. G. Gray of the Geological Survey of Canada wrote notes on the Geology of the Hazelton region.

The first detailed geology of the area was written by J. J. O'Neill, who covered both the economic geology and the mineralogy of the known deposits.

E. D. Kindle of the Geological Survey in 1939, wrote a comprehensive report on the economic geology of the area.

A geological map complete with notes was written in 1944 by J. E. Armstrong of the Geological Survey.

Detailed reports have appeared in the British Columbia Minister of Mines Report from 1905 to 1949.

The publications mentioned above and others in the "General Bibliography" have been consulted frequently and free use of the material available has been made.

Location, Area and Physiography.

The district under investigation is referred to in The British Columbia Minister of Mines Reports as the Hazelton sub district of the Omineca mining division. It is 180 miles east of Prince Rupert by Canadian National Railway, at the confluence of the Skeena and Bulkley rivers. The area of about 100 square miles includes Nine Mile, Four Mile, and Glen Mountains.

The district lies to the east of the Coast Range Mountains. The region appears to be made up of isolated hills and mountains. The main valleys have been eroded in rocks that are much softer than the rock that form the cores of the mountains and hills. Glaciation has further accentuated the topographic contrast in the valleys. Recent glaciation at the higher levels has left a very serrated appearance.

Accessibility.

The Canadian National Railway is within six miles of all the properties. They are all within easy access of usable roads; in addition numerous trails bisect the area. A small but usable airport is at Hazelton.

History of Mining in the Nine Mile Mountain Area.

This district has been for many years on the main trail to the Omineca placer diggings to the east but little attention was paid to it. In 1880, G. M. Dawson was the first person to draw attention to the mineral possibilities of this area. In 1905 Wm. Fleet Robertson, the provincial mineralogist, payed the area a short visit to inspect a few prospects. But it was not until the Grand Trunk Pacific Railway was nearing completion and W. W. Leach was doing some detailed geology in the area, that interest was developed in the Nine Mile mountain area and vicinity.

The Sunrise Group are probably the oldest claims in the area, staked in 1904. Work has been done on this group up to the present day, with some shipments of high grade from 1911 to 1915 and again in 1933.

The American Standard (American Boy) and the Mohawk have made some shipments of high grade ores to the smelters but only very intermittently.

Between 1913 and 1917 the Silver Standard shipped about 3000 tons of selected silver-lead-zinc ore. A mill was installed and from 1919 to 1922- 9000 tons of Silver Standard and American Standard ore was treated, having a gross value of $500,000, but insufficient ore reserves forced closure.

In 1946 the Silver Standard was again activated. Great success came from an intensive development program and much high grade ore was developed. In the district generally there

has been a revival of interest due to the success of the Silver Standard Mine and the high prices for base metals.

General Geology Nine Mile Mountain Area.

Bedrock is only well exposed above 4500 feet; elsewhere in the map area the outcrops are scarce. Glacial drift covers the gentler slopes of the mountains and spreads out deeply in the valleys.

The rocks of the area belong mostly to the Hazelton group (named by G.M. Dawson).They consist of an apparently conformable succession about 10,000 feet thick, of interbedded sedimentary and volcanic rocks ranging in age from Upper Jurassic to Lower Cretaceous or later.

The two groups shown on the accompanying geology map are (1) Upper Jurassic and Lower Cretaceous consisting of 5,000 feet of interbedded marine and continental strata. The other group, (2), a lower Cretaceous or later volcanic division.

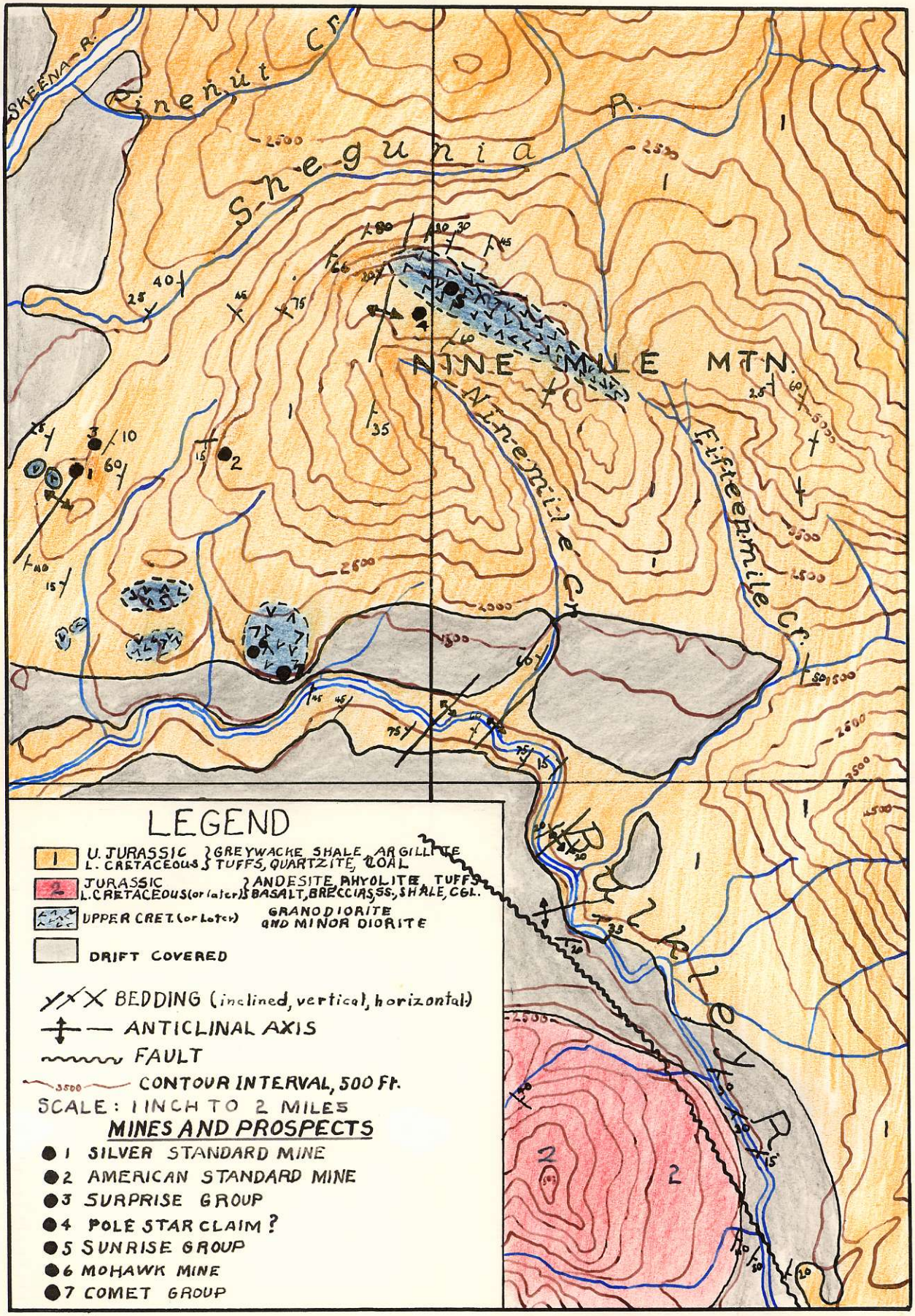
The granodiorite bodies cut Lower Cretaceous strata and probably were intruded at the close of the Mesozoic Era.

Dykes of andesite, dacite, rhyolite, aplite and lamprophyre cut the granodiorite and older rocks.

All of the metalliferous deposits studied consist of sulphides, quartz and siderite. They are veinlike replacements occupying fissures and faults or shear zones in or near granodiorite intrusions.

GENERAL GEOLOGY NINE MILE MTN., HAZELTON

127°30' W.



AFTER G.S.C. — J.E. ARMSTRONG.

Surprise Group.

General Description.

The Surprise claims are immediately north of and adjoin the Silver Standard Property. In 1912 and 1913 some exploration work was carried out but no commercial values were found. The vein developed is nowhere wider than six inches on the property and tapers to a one inch stringer at the face of the drift. The vein is a continuation of the rich number four vein of the Silver Standard Mine.

The rocks exposed in the workings are a series of gently folded sedimentary rocks ranging from coarse grey, impure sandstones and greywacke to finely laminated, grey to green argillites. The sandstones contain numerous rounded fragments of lava and by admixture of material of direct volcanic origin graduate into tuff beds.(Hazelton series). Some of the sandstone is highly feldspathic and grades into arkose. The nearest intrusive bodies are two small stocks of granodiorite approximately 2500 feet to the south.

Mineralogy.

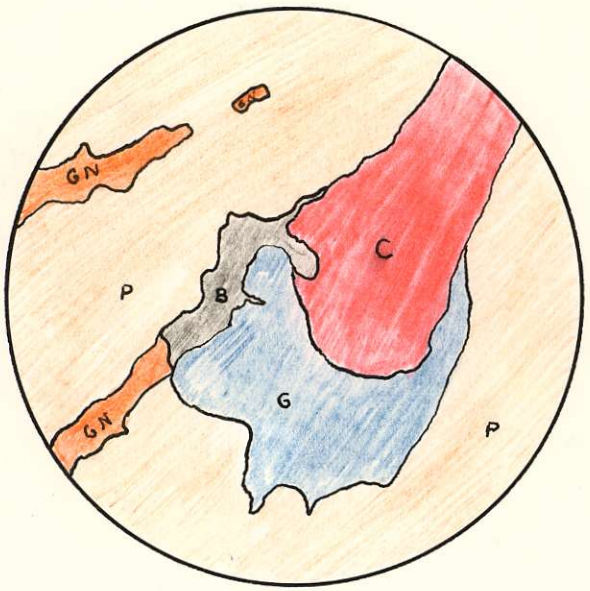
Macroscopic description:

The specimens were taken from the dump at the mine portal. One of them is a complete cross section of the vein. The main mineral in this section of the vein is massive quartz.Sphalerite occupies a band in the center about one quarter inch wide.Chalcopyrite,galena and arsenopyrite occur as irregular fillings along the sphalerite-quartz

Macroscopic description (cont'd)

boundary. Minor amounts of copper and limonitic stain cover portions of the quartz and siderite.

Microscopic description:



X 210

B Covellite

C Chalcopyrite

G Galena

P Pyrite

GN Gangue

The metallic minerals found in the polished section were pyrite, sphalerite, arsenopyrite, galena, chalcopyrite, and covellite. These minerals occur as bands in fractures in the quartz and siderite.

The pyrite is present in large irregular masses closely

associated with arsenopyrite and sphalerite. The massive sphalerite is dark brown with good internal reflection. The chalcopyrite and galena fill spaces in the sphalerite and quartz in small irregularly distributed patches. The covellite is only present in one small patch adjoining galena and chalcopyrite.

Paragenesis.

Quartz was the first mineral formed with manganiferous siderite filling fractures in the quartz and replacing it. Arsenopyrite followed by pyrite; sometimes the arsenopyrite and pyrite appear to have been deposited simultaneously, but in most instances the pyrite replaces the arsenopyrite. Sphalerite replaces the pyrite and the arsenopyrite and in turn is replaced and veined by the chalcopyrite, and galena. Galena replaces the chalcopyrite. Covellite replaces the galena and the chalcopyrite and is probably of secondary origin.(?)

Paragenetic order:

1. Quartz
2. Siderite(Manganiferous)
3. Arsenopyrite (FeAsS)
4. Pyrite (FeS_2)
5. Sphalerite (ZnS)
6. Chalcopyrite ($CuFeS_2$)
7. Galena (PbS)
8. Covellite (CuS)

The Pole Star Claim(?)*

The Pole Star claim is on the south side of the peak of Nine Mile mountain. The veins are in sedimentary rocks; interbedded greywacke, sandstone, and argillites; striking about 10 degrees west and dipping 15 degrees east. The nearest intrusive body is a granodiorite stock 900 feet to the south. There is no record of any production from the claim.

Mineralogy

Macroscopic:

The specimens studied were taken from the dump at the mine portal. They are composed mainly of massive quartz, with a small amount of manganiferous crystalline siderite and ankeritic carbonate. The visible ore minerals are galena and sphalerite. These occur as bands and "plums" in the gangue. "Limonitic" stain coats the siderite.

Microscopic:

The metallic minerals in the polished section are arsenopyrite, chalcopyrite, galena, tetrahedrite, and sphalerite. The arsenopyrite is in large irregular masses. The chalcopyrite occurs mainly along the cleavage of the siderite and in the sphalerite. The sphalerite is jet black

(?)* The identity of the claim was somewhat in doubt by Mr. Gower. It was probably the Pole Star claim, but there is a possibility that it was the Barber Bill Group. They are close and are in a similar geological setting.

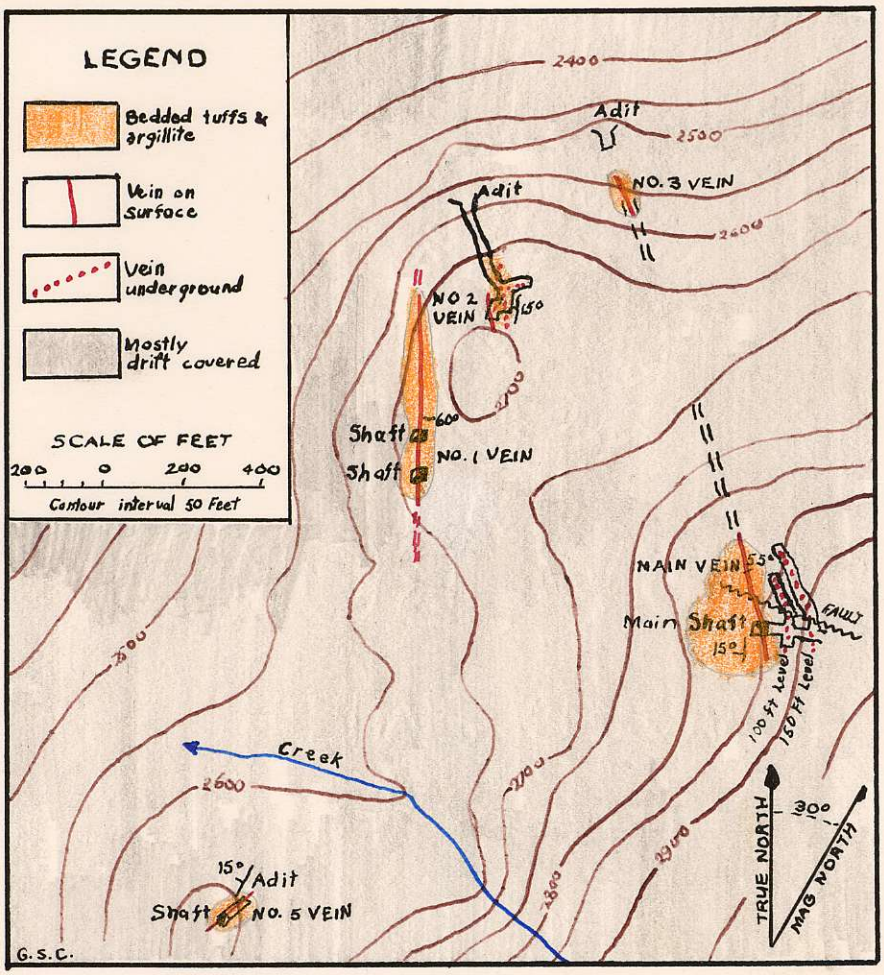
in colour with poor internal reflection. The galena and tetrahedrite are closely intergrown.

Paragenesis:

The arsenopyrite replaces the quartz. The sphalerite replaces the arsenopyrite. Chalcopyrite veins and replaces the sphalerite. Galena and tetrahedrite replace the chalcopyrite. Tetrahedrite and galena appear to have been in solid solution; they show smooth regular curving contacts without any veining or replacement.

Paragenetic order:

1. Quartz
2. Arsenopyrite FeAsS
3. Sphalerite ZnS
4. Chalcopyrite $CuFeS_2$
5. Tetrahedrite and Galena
   $(Cu,Zn)_{12}(Sb_4S_{13})$; PbS



AMERICAN STANDARD

American Standard Mine (American Boy)

The American Standard Mine is on the southwest slope of Nine Mile mountain. The claims were first staked in 1910. Some high grade ore was shipped to the smelter during its early history and an attempt was made to mill some lower grade material in the Silver Standard mill in 1919, but it apparently was not a success.

The Hazelton rocks in this area are well bedded, sedimentary rocks striking north and dipping about 15 degees west. A grey clastic, bedded rock which has the appearance of an impure sandstone is most common. A thin section examined by E. D. Kindle showed this rock to be composed of volcanic ash, crystallites, devitrified glass grains and magnetite shreds, with a strong development of calcite, so that the rock is a calcareous tuff. The tuffs are interbedded with fine grained argillites. There are a few small dykes of granodiorite which were earlier than the mineralization.

Mineralogy.

Macroscopic:

The specimens were selected from open cuts near the shaft on the main vein. The gangue consists mainly of massive quartz and minor manganiferous siderite. Crystals of comb-like arsenopyrite are found in poorly formed crystals up to 12 mm. in length. A light green crystalline arsenic mineral, scorodite ($FeAsO_4 2H_2O$) encrusts some of the

arsenopyrite. Limonitic stain covers portions of the quartz and siderite.

Microscopic:

The minerals identified in the polished section are arsenopyrite, sphalerite, pyrite, boulangerite, tetrahedrite and galena. The arsenopyrite which makes up one third of the sections is distributed irregularly in the quartz beside the sphalerite and pyrite. Only one small grain of pyrite was identified.The sphalerite was a medium brown color with good internal reflection. The galena and tetrahedrite occur in fractures in irregularly intergrown masses. The boulangerite under crossed nicols showed an alignment of grains, possibly in the direction of flow.

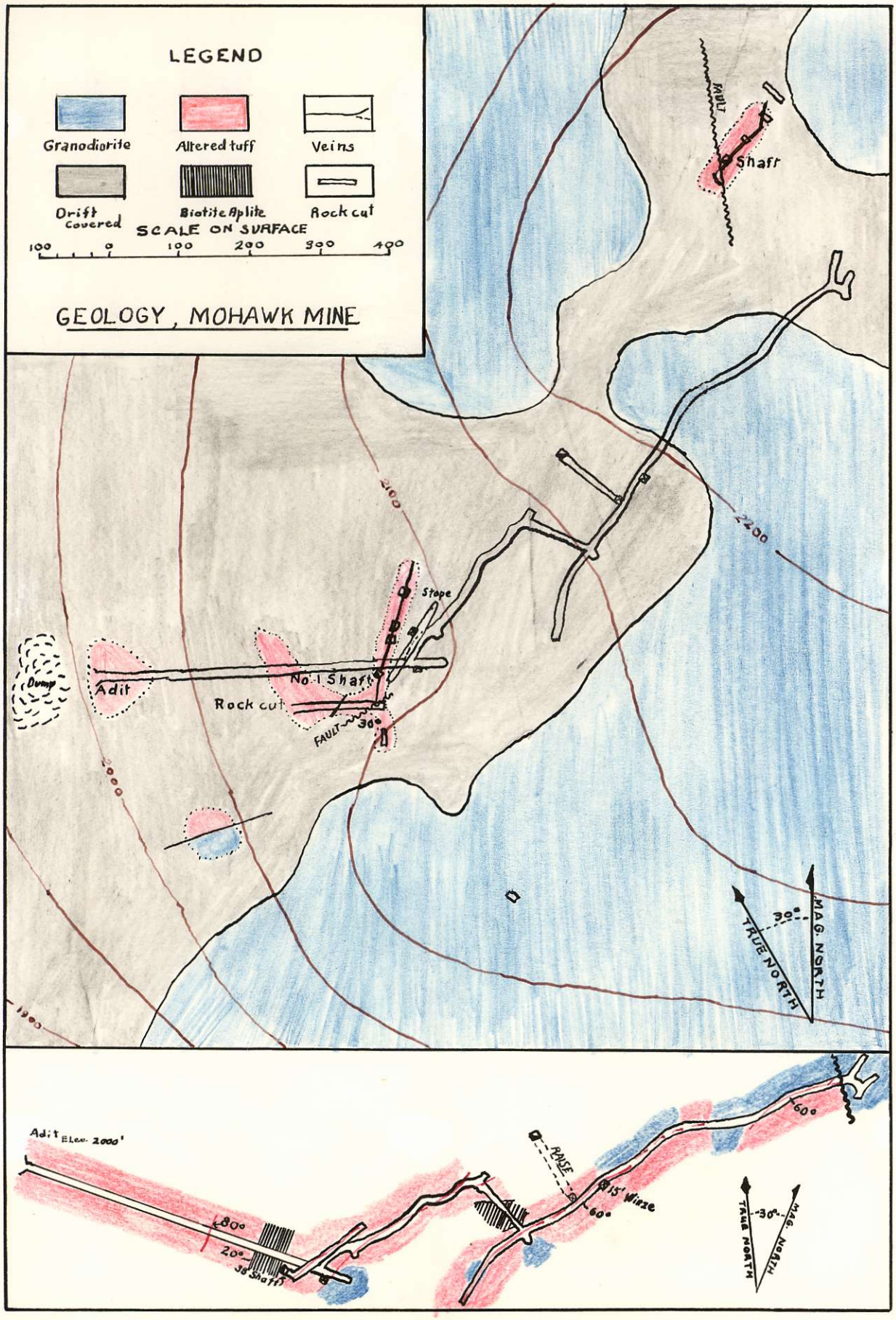
Paragenesis:

The quartz was the earliest formed followed by siderite which replaces the quartz. The arsenopyrite and pyrite replace the quartz. The pyrite is only present in the siderite which it replaces. The arsenopyrite replaces the siderite and quartz. The pyrite and arsenopyrite are not in contact. The sphalerite replaces the arsenopyrite and is in turn replaced and veined by the galena and tetrahedrite. The galena and tetrahedrite have smooth regular contacts without any sign of veining, replacement or any of the other criteria that indicate the time of deposition. The boulangerite replaces the tetrahedrite and galena.

American Standard (Cont'd)

Paragenetic order:

1. Quartz
2. Siderite (Manganiferous)
3. Arsenopyrite (FeAsS)
4. Pyrite ? (FeS_2)
5. Sphalerite (ZnS)
6. Tetrahedrite $(Cu,Zn)_{12}(Sb_4S_{13})$ and Galena (PbS)
7. Boulangerite $(Pb_5Sb_4S_{11})$



After G.S.C. E.D. KINDLE

Mohawk Mine (Erie Group)

The Mohawk Mine is on the west side of Four Mile mountain. The claims were staked in 1908. In 1928 and 1929 ninety-nine tons of hand sorted silver-lead-zinc ore were shipped to a smelter.

The veins occur along faults in intensely altered and recrystallized tuff and sandstone beds, which are intruded by coarsely crystalline, grey granodiorite. Some of the veins lie in faults along the contact of the altered sediments and the intrusive granodiorite or in the altered sediments close to the granodiorite and narrow considerably upon entering the intrusive. The granodiorite is part of the boss shaped body that forms the heart of Four Mile mountain. The sediments are cut by a few small dykes of biotite aplite.

Mineralogy.

Macroscopic:

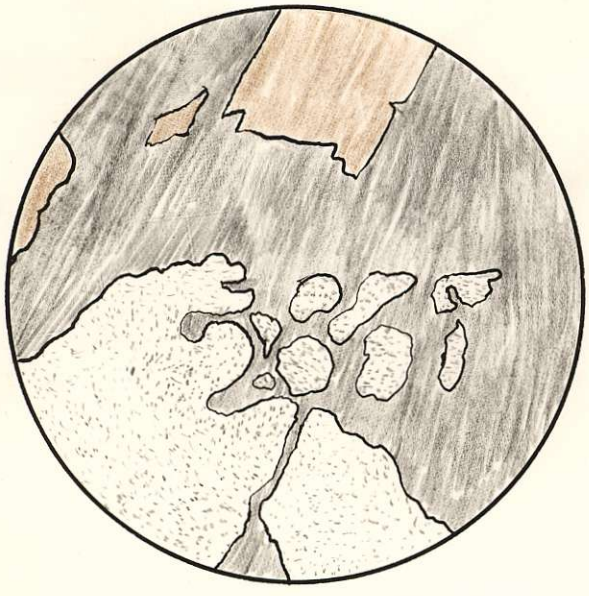
The hand specimens consist of massive quartz with some manganiferous, crystalline siderite. The quartz contains pieces of altered wallrock and some crushed quartz. The tetrahedrite, boulangerite and sphalerite occur as bands and irregular masses in the quartz. Yellow spots of antimony ochre are deposited on the boulangerite.

Microscopic:

The metallic minerals are boulangerite, sphalerite, pyrite, a tetrahedrite and an unknown. The sphalerite is dark brown in colour and shows poor internal reflection. The

pyrite occurs in small irregular masses throughout the quartz gangue. The tetrahedrite occurs with the boulangerite in irregular masses. Under crossed nicols the boulangerite grains are aligned in one direction; probably in the direction of flow. The unknown mineral occurs as small elongated specks in the boulangerite and appears under crossed nicols to be aligned in one direction. The properties of the unknown mineral are as follows:

colour----------white
anisotropic-------polarization colours light grey to dark grey
Hardness----------from B to C???
The particles were so small that it was impossible to do any microchemical tests on ~~it.~~ them.



X 55

Boulangerite

Tetrahedrite

Gangue (Siderite)

Mohawk Mine (Cont'd)

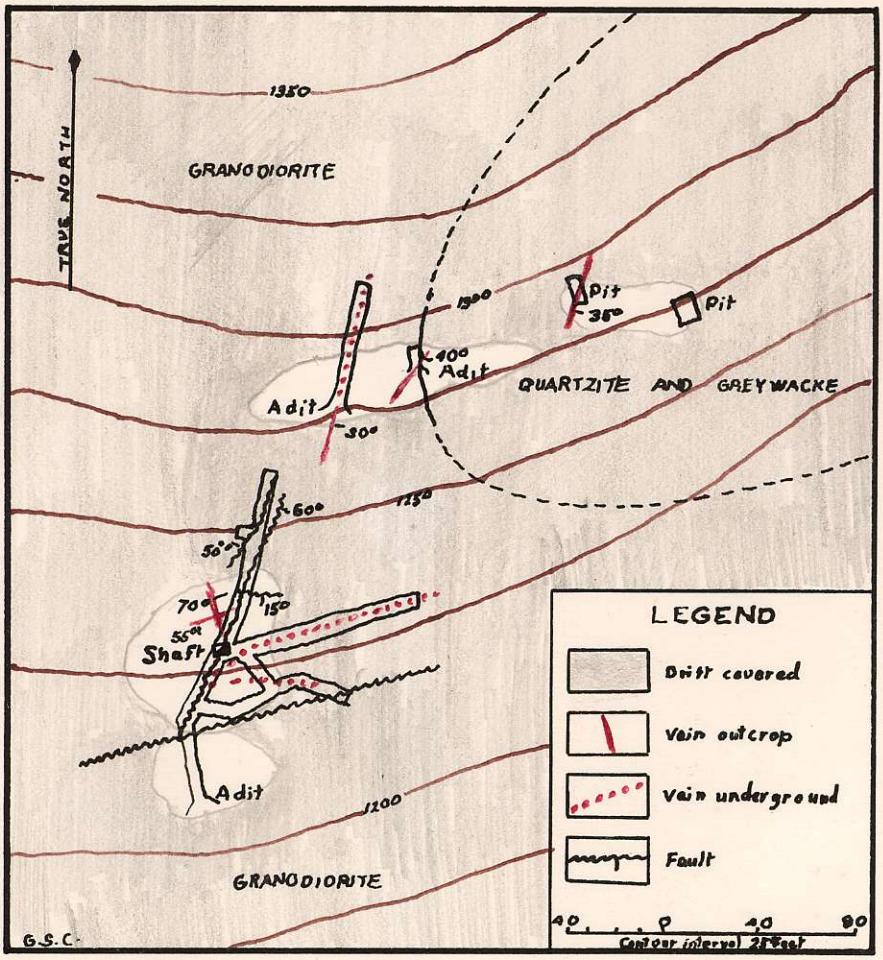
Paragenesis:

The quartz was the the first mineral formed, but it is not in contact with any metallic minerals and so its order of deposition was impossible to determine. Sphalerite, omitting pyrite, came after the quartz. Sphalerite is veined and replaced by tetrahedrite and boulangerite. Boulangerite veins and replaces the tetrahedrite. The unknown mineral appears to have been deposited simultaneously with the boulangerite.

Paragenetic order:

1. Quartz (pyrite)
2. Sphalerite (ZnS)
3. Tetrahedrite $(CuZn)_{12}(Sb_4S_{13})$
4. Boulangerite $(Pb_5Sb_4S_{11})$

   and unknown.


TRUE NORTH
1350
GRANODIORITE
1300
Pit
35°
Pit
400
Adit
Adit
QUARTZITE AND GREYWACKE
30°
1250
60°
50°
70°
150
55°
Shaft
Adit
1200
GRANODIORITE
G.S.C.
LEGEND
Drift covered
Vein outcrop
Vein underground
Fault
40 0 40 80
Contour interval 25 feet

COMET GROUP

Comet Group.

The Comet group is on the south side of Four Mile mountain. The claims were staked in 1920. There is no record of any production.

The veins occur in coarsely crystalline grey granodiorite, quartzite and greywacke. The granodiorite is traversed by numerous intersecting faults and shear zones that strike chiefly from northwest to northeast and dip from 15 to 60 degrees. The quartz veins occur along some of these faults and some sheared zones. The veins in the quartzite and greywacke consist almost entirely of siderite.

Mineralogy::

Macroscopic:

The samples were taken from the upper level of the mine workings. The minerals occur as fillings in the quartz-siderite gangue. Fine hairlike crystals of boulangerite occur in the dark brown manganiferous siderite.

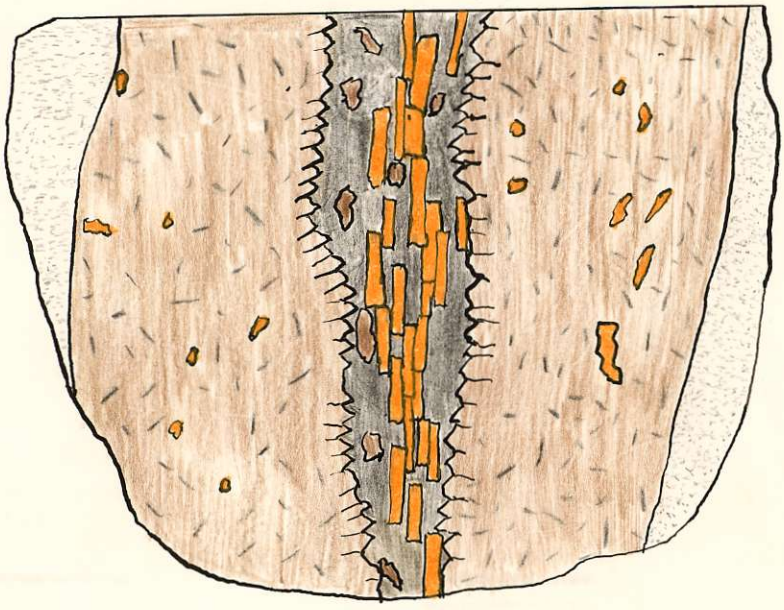
One of the hand specimens which consists mainly of siderite, boulangerite, and minor sphalerite illustrates the idea of fissure filling very well.

(Description of hand specimen)

The crystalline quartz is elongate down the center of vein. The quartz in the center is surrounded by boulangerite. The walls of the center band are formed by comb-like siderite. This siderite contains small hair-like

crystals of boulangerite. The quartz in the center may have been formed in a comb structure on the original wallrock and in a later period of mineralization siderite, followed closely by boulangerite, carried the then broken comb quartz up the fissure causing the already crystallized quartz to be elongate to the vein walls.

Hand Specimen.



X 1

Siderite

Quartz

Boulangerite

Wall rock

Microscopic:

X 55

Gangue (quartz)

Gangue (siderite)

Boulangerite

Pyrite

The minerals found in the polished sections were boulangerite, sphalerite, pyrite and hematite.Boulangerite is in large irregular masses in the manganiferous siderite. Under crossed nicols it appears elongate to the vein. The pyrite is in small irregular masses in the siderite. The sphalerite is a light brown with good internal reflection. The hematite is found as coatings on the siderite cleavages.

Paragenesis:

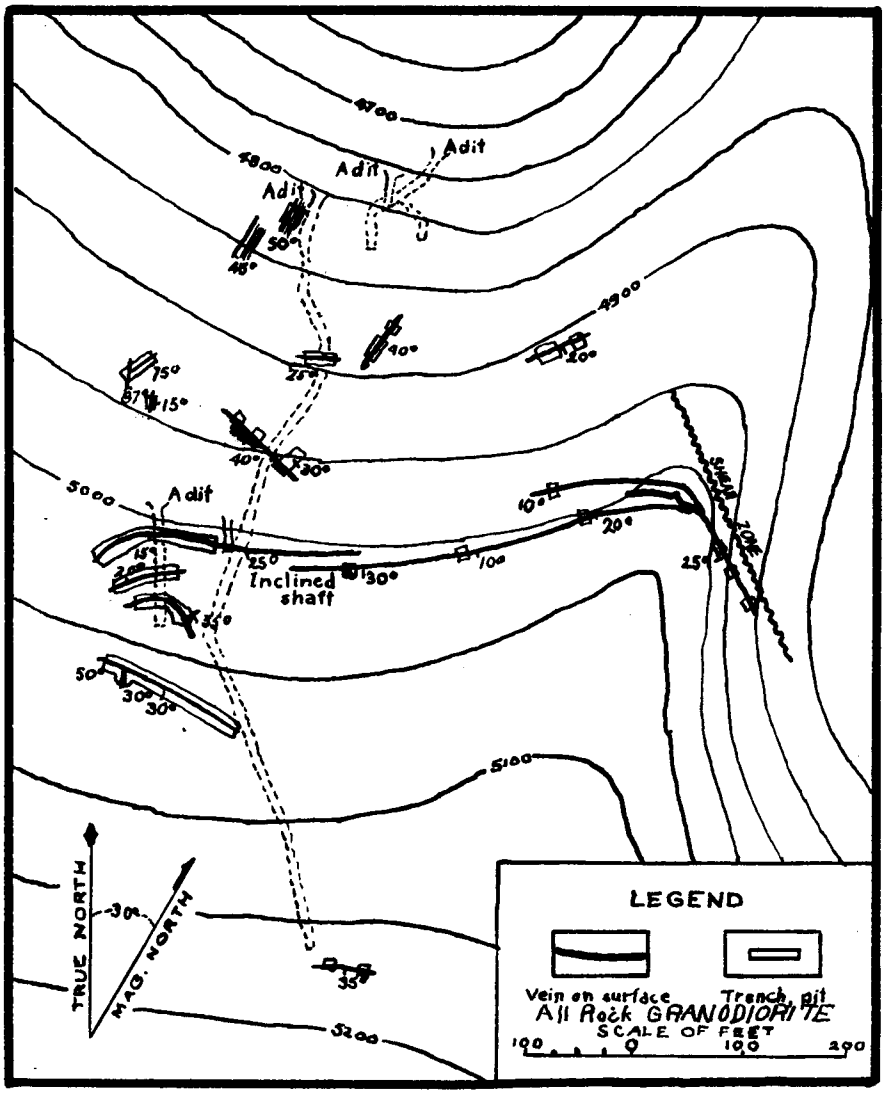
The pyrite replaces the siderite but is not in contact with boulangerite or sphalerite.Boulangerite replaces and

veins the sphalerite. Hematite is probably due to weathering.

Paragenetic order:

1. Siderite
2. Sphalerite (ZnS)
3. Boulangerite ($Pb_5Sb_4S_{11}$)
4. Hematite (Fe_2O_3)

Pyrite???



SUNRISE GROUP

Sunrise Group.

The Sunrise Group of claims is on the north slope of Nine Mile mountain. The claims were staked in 1904 and are the oldest claims in the area. Some seventy-four tons of highgrade ore was shipped to the smelter in 1915 but no other production is recorded.

The veins occur entirely in coarsely crystalline grey granodiorite, in intersecting fault fissures along which there has been minor displacement. The granodiorite forms a stock three miles long from east to west and 3000 feet in width. It intrudes the Hazelton sediments.

Mineralogy.

Macroscopic:

The hand specimens are mainly massive quartz and manganiferous siderite with banding by tetrahedrite, boulangerite and sphalerite. One of the specimens has a shiny face of metallic minerals that were crushed and polished in post ore movement.

Microscopic:

The minerals found in the polished specimens were boulangerite, sphalerite, tetrahedrite and pyrite. The tetrahedrite occurs as closely interwoven masses with boulangerite. The sphalerite is massive and light brown in colour, with good internal reflection. The pyrite occurs as small euhedral crystals in the siderite.

Paragenesis:

The position of the pyrite was impossible to determine as it is not in contact with any metallic minerals. Sphalerite is replaced by tetrahedrite and boulangerite. Boulangerite veins and replaces the tetrahedrite.

Paragenetic order.

1. Pyrite FeS_2 ???
2. Sphalerite ZnS
3. Tetrahedrite $(CuZn)_{12}Sb_4S_{13}$
4. Boulangerite $Pb_5Sb_4S_{11}$

Conclusions

The six properties studied could be divided into two groups of temperature formation. Those properties having a gangue essentially of manganiferous siderite and minor quartz and with a large amount of boulangerite and tetrahedrite were probably formed at a much lower temperature than those having quartz with minor siderite as the main gangue. The major minerals in the latter deposits are; arsenopyrite, chalcopyrite, galena, and pyrite.

	Arseno.	Boul.	Chalco.	Galena	Tetra.	Sphal.
Mohawk		*			*	*
Comet		*				*
Sunrise		*			*	*
Surprise	*		*	*		*
Amer.Stan.	*	*			*	*
Pole Star	*		*	*	*	*

* ----mineral present.

All of these properties are within reasonable distances of transportation and with the present demand for their products, some of these prospects may develop into producing mines. Information received from Mr. Gower indicates that development of some of the properties is being held up by a general lack of co-operation between the owners of the small properties concerned.

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