

MINERALOGRAPHY OF A SUITE OF MINERALS FROM A
DEPOSIT AT MOUNT WASHINGTON,
VANCOUVER ISLAND, BRITISH COLUMBIA

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Introduction

The purpose of this report is to describe the mineralography of a suite of mineral specimens from the Mt. Washington Copper Co. The property is on Mt. Washington, some 15 miles northwest of Courtenay, in the Nanaimo Mining Division of British Columbia. Over the last twenty years diamond-drilling and other exploration work has been done by various companies on numerous, varied in nature, mineral outcrops. This led to bulk shipments (in 1961) of ore material from an open pit to the Howe Sound Co. for milling, and to the A.S. & R. Co. smelter at Tacoma for direct smelting tests. The property is not yet in production, but is undergoing further exploration by other interested parties.

General Geology

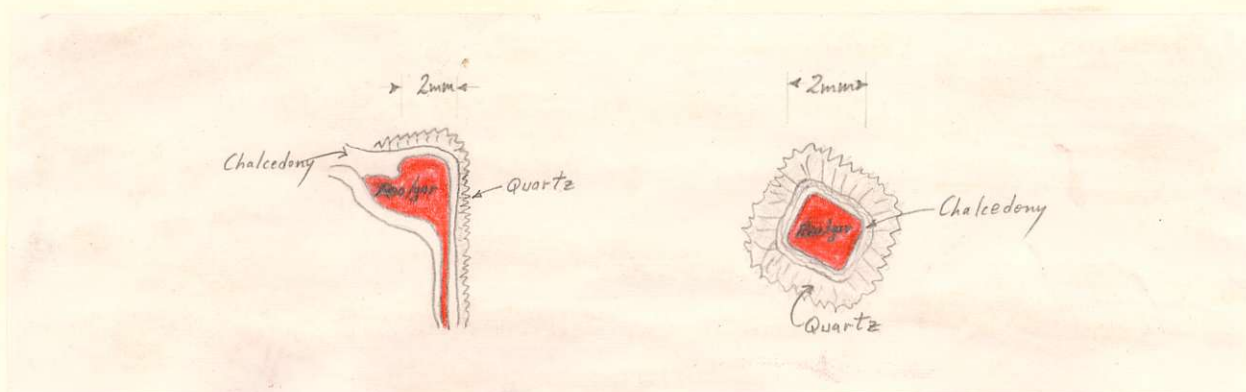
The Mt. Washington area is a combination of Upper Cretaceous sediments underlain by Triassic volcanics through which stockworks have intruded. It is probably up these stockworks through which mineralizing fluids have ascended, they tending to spread out laterally upon reaching the relatively soft sedimentary beds surrounding the stockworks. The principal types of deposits are, in order of economic importance to this time: 1) Silicified beds up to 15 feet thick consisting principally of chalcopryrite, pyrite, arsenic and realgar mineralizations; 2) Quartz veins with arsenopyrite, pyrite, gold, and silver; 3) Breccias cemented by chalcopryrite and pyrrhotite; and 4) Veins of quartz containing chalcopryrite and some bornite, covellite, and chalcocite. The suite of minerals studied was of the first type, more specifically from the particularly rich intersection of two vertical faults.

Megascopeic Observations

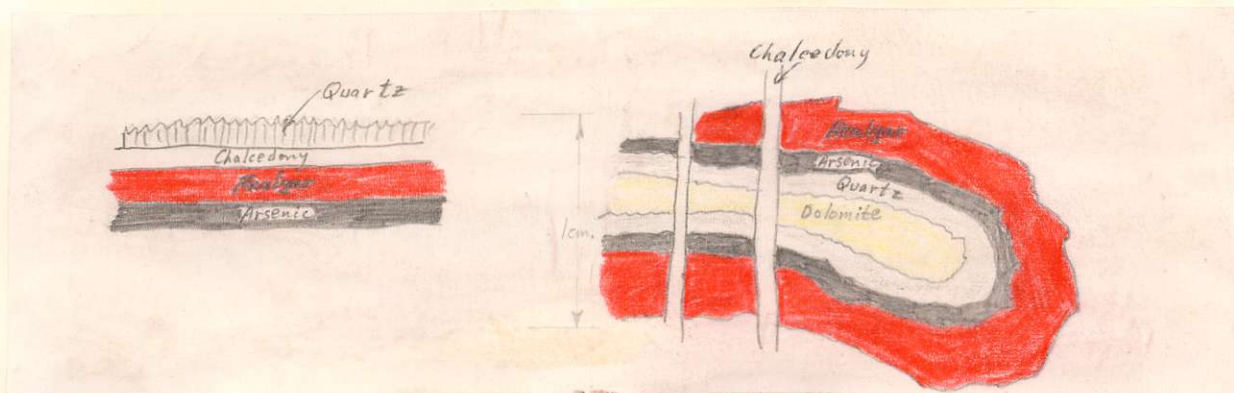
The principal gangue mineral is silicified (limestone?) and in the specimens examined, realgar in both massive and crystalline form was the predominant sulfide mineral. Some of the red realgar had disintegrated to a powdery orange

material and some had oxidized to yellow orpiment on old surfaces. Massive realgar is nearly always surrounded by a layer of arsenic which is identified by brownish-black coloured, moderately hard, botryoidal masses. This was particularly noticeable where chalcopyrite was nearby. In some specimens a lot of pyrite cubes were observed within the chalcopyrite.

There exist many vugs in this material. They are generally of two types. The most common type of vug is where realgar crystals have grown out into the space, to be covered with a layer of white (sometimes pink) chalcedony, and often afterwards by a layer of -quartz crystals. Some realgar crystals were covered with colloform textured (instead of smooth) chalcedony.



In some places late chalcedony is seen as veinlets cutting through previously deposited minerals.



As can be seen from the diagrams above, there are at least two periods of quartz deposition, one after chalcopryrite and one after chalcedony.

In some places there exists massive pink chalcedony in close association with realgar. The colour is probably due to inclusions of fine-grained powdered realgar. Some pink chalcedony is as colloform nodules which are covered with a limonitic crust. In some places are found crystals of first deposition quartz which were afterwards coated thinly with white chalcedony. Some of the second deposition quartz crystals had crystals of orpiment (pseudomorphic rhombs after realgar) coaxially within themselves.

In some places within the gangue, bands of very fine-grained needles of arsenopyrite were observed. A lot of fine-grained pyrite was general within the gangue.

A few crystals of tennantite-tetrahedrite (long triangular faces on tetrahedrons) were observed within the less common type of vug, that is, that within chalcopyrite and the more massive, first deposited, quartz. These were verified by X-ray determinative methods to be tennantite-tetrahedrite crystals.

Microscopic Observations

Characteristics of Minerals Identified

1. Chalcopyrite - CuFeS_2 - Brass yellow color, $H = C$, slightly anisotropic.
2. Tetrahedrite-tennantite - $5 \text{Cu}_2\text{S} \cdot 2(\text{Cu,Fe})\text{S} \cdot 2(\text{Sb}_2, \text{As}_2)\text{S}_3$, Color grey, $H = D$, isotropic.
3. Arsenopyrite - FeAsS - Color galena white, $H = F+$, anisotropic.
4. Chalcostibite - $\text{Cu}_2\text{S} \cdot \text{Sb}_2\text{S}_3$ - Color whitish grey, $H = C$, anisotropic.
5. Pyrite - FeS_2 - Color pale brass yellow, $H = F$, isotropic.
6. Realgar - AsS - Black under reflected light, $H = B$, gives red internal reflection under crossed nicols.
7. Orpiment As_2S_3 - Color grey, $H = B$, yellow interval reflection, weakly anisotropic
8. Arsenic - As - Color grey, $H = C$, weakly anisotropic.
9. Impure dolomite - $\text{CaMg}(\text{CO}_3)_2$ - dull yellow color, fine-grained powder.

Tetrahedrite-tennantite was recognized by it being isotropic and by etch tests in which all of HgCl_2 , KOH , KCN , MCl , FeCl_3 , HNO_3 , were negative, and aquaregia, positive.

Chalcostibite was noticed because it was slightly whiter in color than tetrahedrite-tennantite, had less pitting, and was anisotropic. Identification was accomplished by X-ray techniques. A fine-grained yellow powder was identified as being impure dolomite by X-ray techniques.

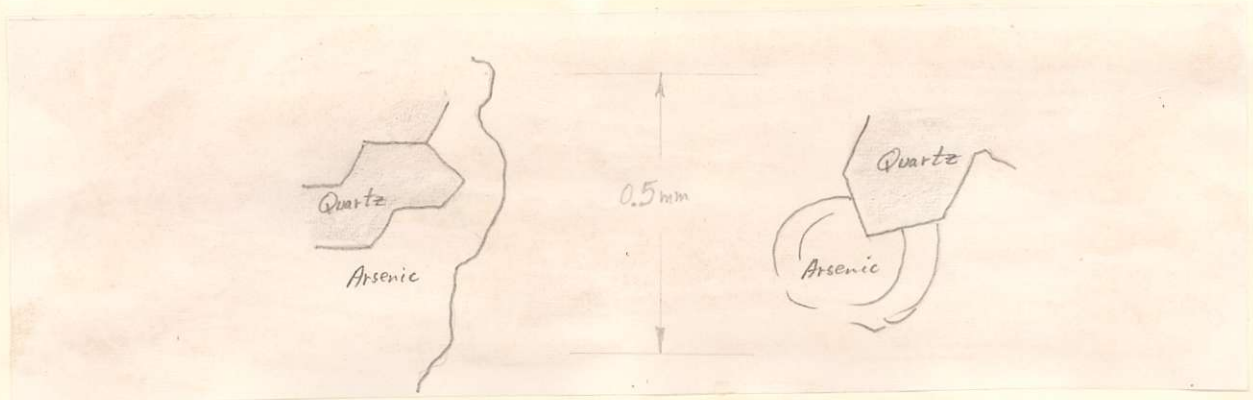
Primary Minerals in Decreasing Amount of Abundance

Realgar and Orpiment (secondary)	30%
Chalcopyrite	25%
Quartz and Chalcedony	35%
Pyrite	5%
Dolomite, Arsenic, Chalcostibite, Tetrahedrite-Tennantite	5%

Textures

Tetrahedrite or tennantite (depending on whether it was more closely associated with chalcopyrite or arsenic) had an intimate boundary with chalcopyrite. Tetrahedrite-tennantite appears to replace arsenic, as revealed by a caries texture in the arsenic. It also replaces chalcopyrite as revealed in a like manner.

Arsenic is replaced by second deposition quartz crystals as shown below.



Chalcostibite, of which very little exists in the specimens, has an intimate boundary with chalcopryrite. Chalcopryrite replaces pyrite as shown by the caries texture in remnant pyrite cubic structures.

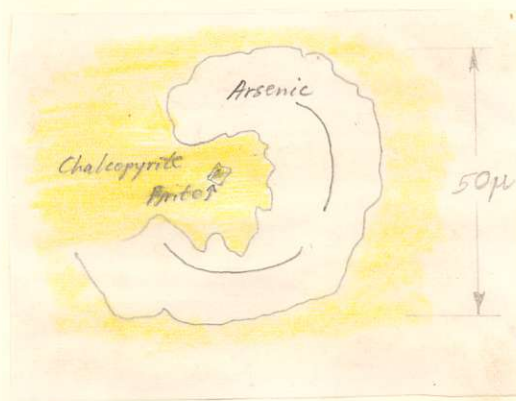
Tetrahedrite-tennantite is grey, pitted and isotropic, whereas chalcostibite is light grey, lightly pitted and anisotropic, and arsenic is white, relatively unpitted and anisotropic.

Chalcopryrite is replaced by second deposition quartz crystals and by veinlets running through the massive chalcopryrite. These veinlets have small blebs of arsenic within them in places. There are also approximately 50 microns wide veinlets of quartz with tetrahedrite blebs in them. Side veinlets approximately five microns wide shoot off at angles up to 90 degrees from main veinlets, and are of either quartz and/or tetrahedrite. Intergrowth replacements

of chalcopyrite by tetrahedrite occurs as below.



Arsenic is found to be shot through with fine veinlets of second deposition quartz. There are also areas of even textures of botryoidal arsenic with realgar filling spaces between the spheroids. Spheroidal forms of arsenic are noticeable where they have almost formed by replacement of chalcopyrite as below.



Paragenetic Sequence

- as determined from megascopic and macroscopic examinations

- 1) Arsenopyrite
 - 2) Pyrite
 - 3) Chalcopyrite, chalcostibite
 - 4) Tennantite-Tetrahedrite
 - 5) Quartz 1
 - 6) Arsenic
 - 7) Realgar
 - 8) Chalcedony Impure dolomite somewhere here
 - 9) Quartz 2
- Secondary **orpiment**

Type of Deposit

The deposit is an epigenetic hydrothermal type probably deposited at various temperatures from high to low as shown by the range required for deposition of pyrite to the deposition of realgar. It has been latterly an epithermal deposit and was possibly a mesothermal or even hypothermal type. The variation in types of mineralization of the individual deposits suggests varied genetic sequences.

References

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Edwards, 1954, "Textures of the Ore Minerals"
J. T. Carson, 1960, "Geology of Mount Washington"