REPORT ON MICROSCOPIC EXAMINATION OF ORE MINERALS FROM THE GEM AND SILVER BOW CLAIMS AND THE VICTOR GROUP, KLEANZA MOUNTAIN, SKEENA DISTRICT, BRITISH COLUMBIA.

I could not see these "tellurides". I don't see how you can determine a mineral through a layer of quartz. Were Au + Te tests checked by instructors?

Geology 409

No sections kept
June 1950
R.M.T.

W. S. Cooper

April, 1950

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1937 ....Kindle,E.D.:"Mineral Resources of Terrace Area,Coast District,British Columbia"; Geological Survey of Canada,Memoir 212,1937.

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Introduction

This report deals with a mineralogical examination of picked specimens from the Gem ~~and~~, Silver Bow ~~claims~~ and the Victor Group of mineral claims, all of which are situated on Kleanza Mountain about 10 miles west of Terrace, B. C., in the Skeena District. The specimens from the Gem and Silver Bow claims were contributed by Arthur Clore, prospector, and the specimens from the Victor Group were contributed by S. G. Cooper, Forest Ranger and former owner of the last-named property, to both of whom the author wished to express his thanks for their cooperation.

The specimens were examined with a view to discovering with what minerals the often-spectacular gold values were associated, and to determine those mineralogical characteristics affecting ore-dressing techniques. Each ef these three claims have at various times yielded phenomenal assays from picked specimens; Specimens from the Victor Group have yielded assays of over $300.00 per ton in gold, silver, and copper (at 1939 prices), with the gold assaying as much as 6 to 8 oz. per ton;[1] specimens from the Gem claim have yielded some very high assays in gold, although exact figures are not available;[2] specimens from the Silver Bow have assayed up to 100 oz. per ton in silver.[3] The examination also included a study of the manner of

1. Personal Communication
2. Ibid.
3. Kindle, E. D. 1937

occurrence of the different minerals; their distribution, and their paragenesis.

The specimens were first examined macroscopically, and minerals and general features noted; this examination was supplemented by microchemical analyses, when these were required to make mineral identification more certain. Polished sections were made, and were examined under a reflecting microscope. Superpanning of crushed fragments was resorted to where needed, in order to yield a "tip" of heavy minerals that could be mounted in bakelite for microscopic examination. X-Ray examination was used as the need arose.

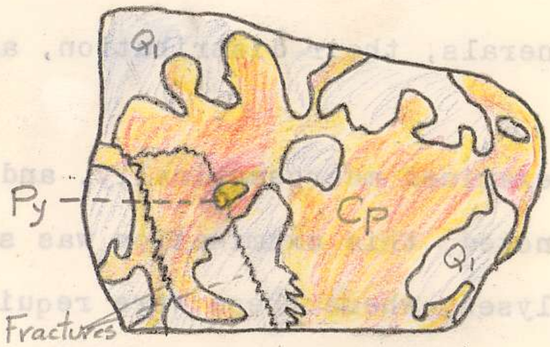
Macroscopic Examination

The hand-specimens, subsequently cut apart with a diamond-saw, consisted of 2 specimens from each of the three mineral properties. The specimens, of approximately uniform size, averaged about 10 cubic inches in volume, and for convenience were designated as follows: Numbers V(1) and V(2) represented the specimens from the Victor Group; G(1) and G(2), the Gem claim; and SB(1) and SB(2), the Silver Bow claim. The same nomenclature was later applied to polished sections cut from these specimens:

Victor Group

No. V(1) consisted of a piece of gossan-stained, somewhat-fractured milky vein quartz, with two small seams of pyrite

Specimen No. V(2)



× 1

Quartz, Pyrite, Chalcopyrite, & fractures

Abbreviations:

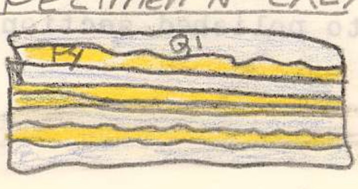
- Pyrite ---------- Py
- Quartz (early-formed) --- Q_1
- Quartz + carbonate ------ Q_2
- Chalcopyrite -------- Cp
- Sphalerite --------- Sp
- Galena ------------- Gal.
- Covellite ------------ Ct

Specimen N° G(1)

Banding of Qtz & Sulphides

× 1

Specimen N° G(2)



Banded Qtz & Pyrite

× 1/2

occupying open fissures in the quartz. The pyrite appeared not to fill entirely the openings in the host quartz, perhaps because the specimen was extensively oxidized. The pyrite was also fractured, and almost entirely coated with a dark-blue mineral which was presumed to be covellite; fragments of the coating gave a strong microchemical test for copper.

No V(2) consisted of a heavily-oxidized, fractured, and coherent piece of gosson-stained vein-quartz containing rust tarnished chalcopyrite which appeared to be replacing the quartz. A few small grains of another mineral were tentatively identified as pyrite. This identification and that of the chalcopyrite were later substantiated by microchemical tests. The ore minerals were cut by later fractures; these and other features are illustrated in the sketch on the opposite page.

Gem Claim

No. G(1) consisted of a banded quartz-pyrite specimen, illustrated opposite. The pyrite was very friable owing to innumerable cross-fractures, but the quartz was some what more compact, though much-fractured. The pyrite, to some extent oxidized, contained stringers of chalcopyrite, and was noted to occur in open pores in the quartz. The quartz was glassy, sericitized along fracture-surfaces, and slightly gossan-stained. The main fractures in the quartz were sub-parallel to the banding and to the wall-rock, altered sheets of which adhered to one face of the quartz.

A 30-gm. sample, containing about 70% sulphides and 30% quartz, was taken from the specimen and crushed with a pestle and mortar to - 100 mesh. The product was then superpanned, and yielded a tip that contained several dozen flakes of gold, the largest of which were about ½ mm square. These flakes were very thin, possibly because the crushing had been too thorough. However the square outline suggested a thin and tabular occurrence. Accompanying the gold was a fine "sand" of unidentified bluish, rather dull, mineral, which was collected with the gold. Both were mounted in bakelite for subsequent microscopic examination.

No. G(2) was tabular and sandwich-like, with alernating layers of gossaned, sericitized, white quartz about 3/8 in, thick, and sheared, exceedingly friable, fine-grained pyrite of similar thickness. The tabular outline of the quartz-layers is determined by the banding and by two mutually-perpendicular sets of fractures perpendicular to the banding. Rough handling caused the pyrite to crumble freely from the specimen, a sketch of which appears ~~on the~~ opposite page three.

Silver Bow

No. SB (1) was a compact, oxidized specimen of irregular shape. A rude sort of banding involved a ¼-in band of galena adjacent to a much gossaned quartz face of the specimen, a ½ - in. layer of pyrite adjacent and parallel to the galena, followed by another ½-inch layer of pyrite, with some chalcopyrite, parallel to the rest. Shearing was inconspicuous, but a few vugs and openings were noted. One of these vugs contained a clump of well-developed quartz crystals consisting of hexagonal prisms with rhombic terminations suggestive of tri-rhombohedral quartz. The sulphides comprised most of the volume of the speimen.

No. SB (2) was originally of the same approximate size as the other specimens, i. e. its volume was about 10 cubic in., but it was broken into four fragments to aid in the macroscopic examination. The fragments showed banding, again involving galena and pyrite with included chalcopyrite. A minor amount of quartz was noted. The specimen was granular, compact, though somewhat oxidized, and showed little evidence of fracturing.

Microscopic Examination

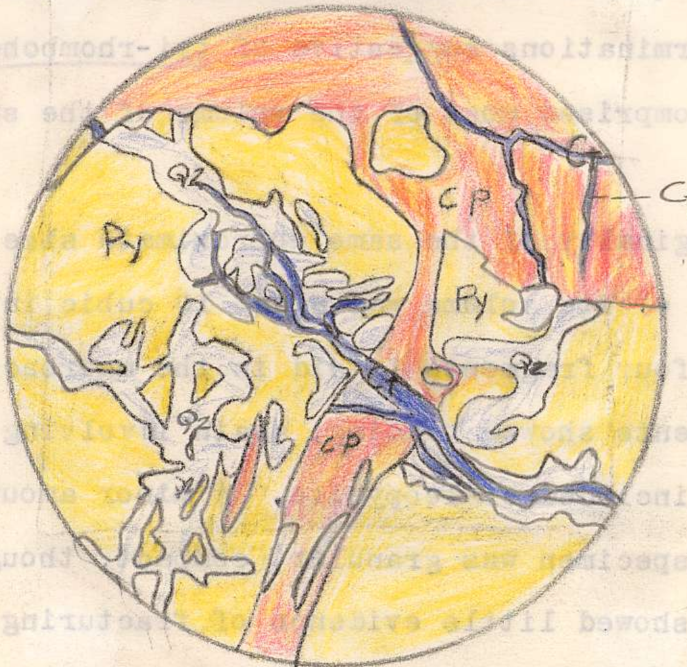
Victor Group

Two sections, one from each of the two specimens, were mounted in optical pitch in a brass box and polished. The physical and optical properties of the minerals in the sections were examined, with the following results: Two gangue minerals were noted. The first, a very hard, dark-grey mineral, was identified as quartz. Fractures in the quartz were filled with a lighter-colored gangue mineral that was brittle and of varying harness. This mineral was presumed to be a mixture of quartz and calcite, for etching with 1:5 HCl gave strong effervescence.

Three ore minerals were also seen. The first and most abundant was disposed as masses, had a good polish and a brass-yellow colour and was moderately soft and markedly anisotropic.

Section N° 1, Victor Group

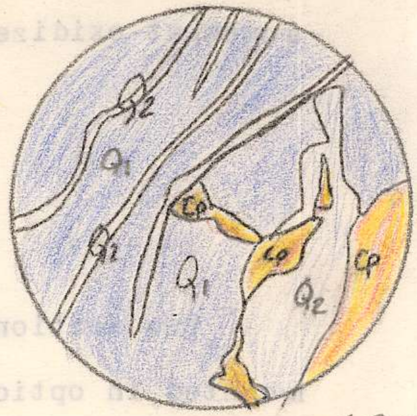
{Abbreviations as on Page 3}



Pyrite, replaced by Chalcopyrite, which is replaced by Q_2 & Covellite.

x 300 (approx)

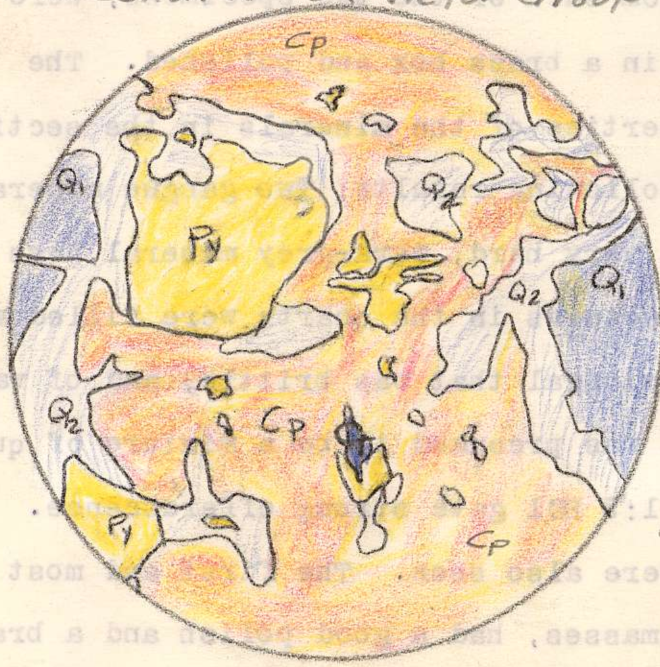
Section N° 1 Victor Group



x 100 (Approx)

Q_1 is replaced by Q_2 and Cp. Q_2 appears to be replacing Cp.

Section N° 2 Victor Group



Py is replaced by Cp & Q_2. Q_1 is replaced by Q_2, and Cp is replaced by Ct (covellite).

x 300 (Approx)

On the basis of these properties, and upon consideration of the fact that much chalcopyrite was present in the corresponding hand specimens, this mineral was identified as chalcopyrite. The next most abundant ore mineral had a pitted appearance, was barely marked by the needle, was isotropic, and had a greyish-yellow colour. These characteristics, and its presence in the hand-specimen, were considered diagnostic of pyrite.

The grain size of the pyrite was more variable than that of the chalcopyrite. Whereas the latter occurred almost wholly massive, the pyrite tended to occur in grains ranging in size from 2 to 3 microns to macroscopic. The third ore mineral was indigo-blue, and disposed as fine veinlets and grains averaging less than 2 microns in length. The veinlets of the mineral transected both the other ore minerals, but favoured the chalcopyrite. Owing to the small dimensions of the grains and the narrow (less than ½ micron) width of the veinlets, optical properties could not be observed. However, it was possible on one grain to determine that the mineral was soft and somewhat sectile, and these properties together with the colour and association were considered sufficient evidence to identify the mineral as covellite.

The occurrence and relations of the gangue and ore minerals are illustrated in the sketches on the opposite page. Covellite is associated with the quartz-carbonate generation of gangue, and as already noted, transects the other ore-minerals. Chalcopyrite, which appears to be present mainly as a "continuous phase", contains grains of pyrite and quartz, occurs as veins in both pyrite and quartz, and tends also to " rim" the latter two minerals.

Gem Claim

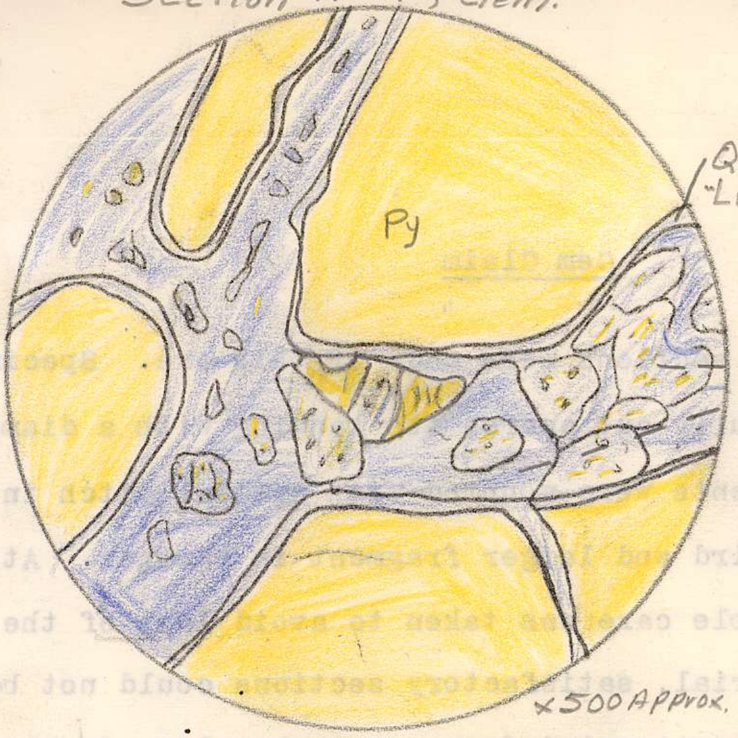
Four polished sections were made of this ore. Specimen No. G(1) was carefully cut accros the banding with a diamond-saw, and two fragments were mounted with optical pitch in one brass box and a third and larger fragment in another. Athough the greatest possible care was taken to avoid loss of the exceedingly friable material, satisfactory sections could not be made. A third section was attempted from a somewhat less-friable piece of the ore chipped from the centre of the specimen where oxidation had presumably been less extensive, but this, too, proved unsatisfactory. A fourth section, mentioned under "macroscopic features", consisted of a bakelite-mount of a "tip" obtained by superpanning crushed (to-100 mesh) sulphides and quartz that had been extracted from specimen No. G (2). This procedure was resorted to because the specimen possessed no coherence whatever, and could hardly have been examined microscopically in any other way.

Although the sections were difficult to study, owing to the numerous cavities and unsatisfactory polish, pyrite and quartz were identified by their optical and physical properties. Other minerals were also noted, but could not be examined directly because they were apparently too soft and friable to acquire a polished surface in a pyrite and quartz environment.

In these sections, a dark-grey and rather coherent quartz appeared to be the most continuous "phase" present, and occurred in a massive form. However, a few isolated grains of the dark

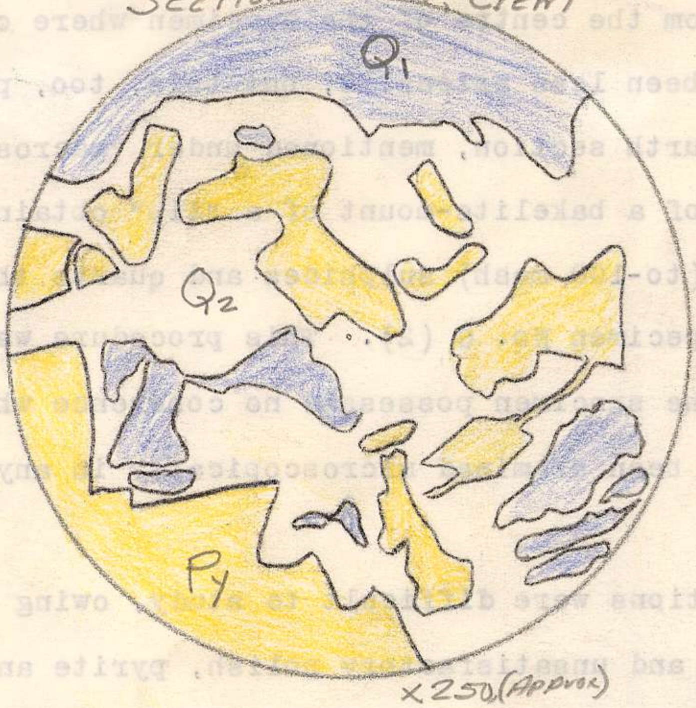
{Abbreviations as on P. 3 (opp.)}

Section No. 1, Gem.



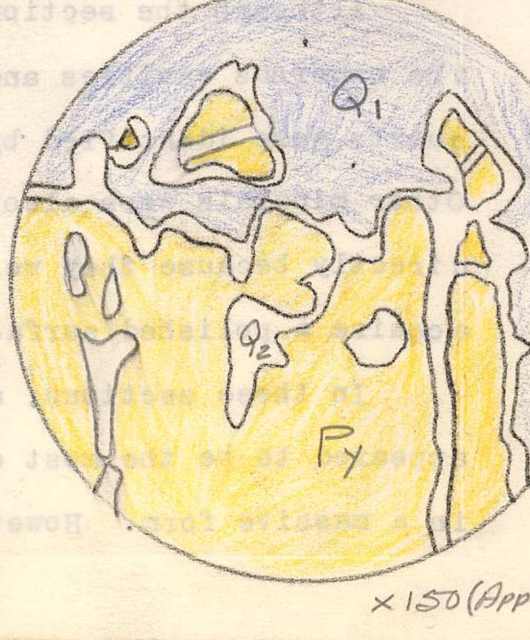
x500 Approx.

Section No. 4, Gem



x250 (Approx)

Section No. 2, Gem



x150 (Approx)

quartz, all larger than 10 microns, were observed. A lighter quartz occurred as veings replacing both pyrite and the dark quartz, and as "linings" in fractures through pyrite. These "liners" were filled with two, and possibly three, metallic minerals, and were pipe-like in form, i.e,. the metallic minerals, appeared to be encased by thin transparent tubes of light quartz. Where this layer of quartz was removed by polishing, the metallic minerals were lost. Hence, examination of these minerals could only be accomplished by lowering the focus to a plane below that of the quartz layer, and by excavating the veinlets with a needle for microchemical examination. Colour was the only physical property that could be studied, and this was probably unreliable owing to the presence of the intervening quartz. However, a yellow mineral, possibly gold, could be seen as flattened grains varying from 1 to 100 microns in size, disseminated through a bluish, lustrous, white mineral. These features are illustrated in the sketch opposite. A quantity of this "vein filling", large enough for two separate microchemical tests, was extracted with a fine needle. The standard procedure for microchemical tests, as outlined in the text book[1] were used. The first sample gave a strong reaction for gold and tellurium and a somewhat weaker reaction for silver. All three of these, elements reacted positively to the confirmatory tests. The second sample gave a strong reaction for tellurium, a somewhat weaker test for gold, and none for silver. These results were also substantiated by confirmatory tests. Other elements were not tested owing to the lack of material with which to work, but indications of iron, lead, and copper were noted.

may be FeS or anything

1 Short, M.N.

The bakelite-mounted "tip", examined under the microscope, was found to contain flakes of gold with impurites consisting of flecks of a light blue material, pyrite, a few grains of what appeared to be a dark blue mineral in grains of almost sub-microscopic size, and several grains of a white, anisotropic mineral, occurring as rhombs with an acute rhombic angle of about 75º The flakes of gold, some what rectangular, ranged from about 1 to 150--microns in their largest dimensions. They were very thin and typically sectile. The blue flecks, comprising up to up to 150--microns in their largest dimensions. They were very thin and typically sectile. The blue flecks, comprising up to 20% of the volume of the gold particles, could not be identified. The pyrite mainly anhedral, consisted of fragments whose sizes varied from sub-microscopic to macroscopic. The dark blue grains could not be identified owing to their extremely small size. The identity of the white mineral, whose size range varied from less than 2 or 3 microns to about 50 microns, was in doubt until one of the larger particles was removed and X-rayed; it was found to be galena with anomalous form and optical properties.

due to method polishing?

Silver Bow Claim

Two polished sections of this ore were prepared by mounting fragments of the ore with optical pitch, in brass boxes. Both sections were taken nearly perpendicular to the banding

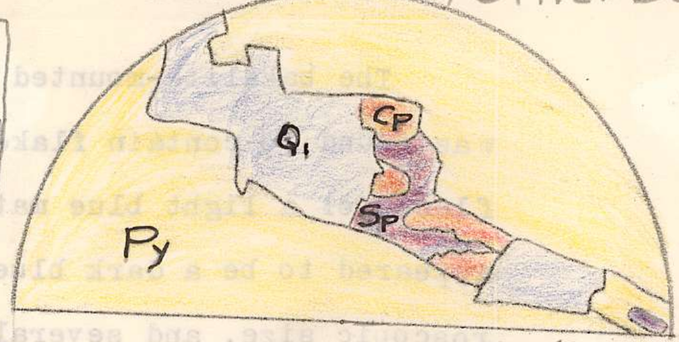
{Abbreviations as on Page 3.}

Section N°1, Silver Bow

Q1 replaces Py, & both are replaced by Q2.

×150 (Approx)

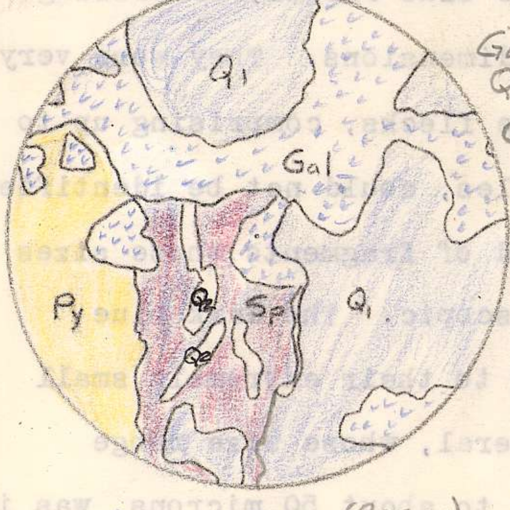
Section N°2, Silver Bow



×200, (Approx)

Py is replaced by Q1, Q1 by Cp, and Cp by Sp.

Section N°2, Silver Bow

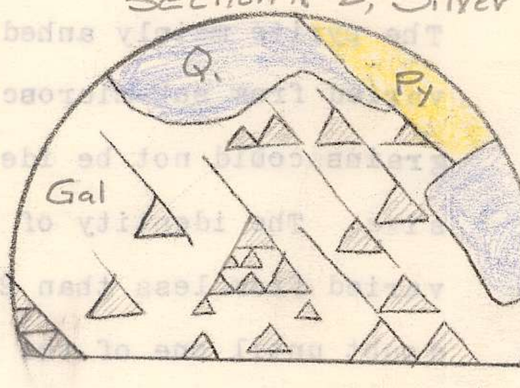


Galena replaces Q1, Py, & Sp.

Q2 replaces Sp, which replaces Q1

×150, (Approx)

Section N°2, Silver Bow



Shows development of oriented △ pits in Galena

×200 (Approx.)

mentioned under "Macroscopic Description".

Physcial and optical examination of the sections showed five minerals to be present. The first ore-mineral to be identified was pyrite, which showed the typical pale-yellow colure, isotropism, pitted surface, and hardness. The second was chalcopyrite, identified by its brass-yellow colour, anisotropism, high polish, and moderate hardness. The third was identified as galena; it had the typical white colour, isotropism, high polish, softness, and triangular pits, characteristic of this mineral. The triangular pits in the galena were exceptionally well-developed, as shown in the sketch on the opposite page. The fourth ore-mineral had a pinkish-blue colour, was pitted, soft, isotropic, and showed feeble internal reflection of uncertain colour. These properties, combined with the results of subsequent etch-tests, identified this mineral as sphalerite.

The gangue-minerals consisted of a dark, compact, quartz with few fractures, and a light-coloured mixture of quartz and calcite. identified by its variable hardness, friability and effervescence under a 1:5 HCl etch.

The pyrite occurred mainly as large grains, and tended to be massive in habit, but a few fragments as small as 10 microns were observed to be surrounded by other minerals. Chalcopyrite also occurred almost wholly in massive form, but some grains, ranging from five to twenty microns, were associated with pyrite, galena, and quartz. Galena also occurred chiefly in massive form, but some grains of 5 to 20 microns were found associated with pyrite, sphalerite and quartz. ~~The galena showed a remarkable development of oriented triangular pits, illustrated opposite~~

~~page 9~~. Sphalerite occurred as small veinlets in the other mineral minerals, and as inclusions of generally less than 15 microns,

With the exception of pyrite, which showed several rectangular boundaries with quartz, and galena which showed oriented triangular pits the ore minerals were subhedral in form. The gangue minerals also lacked euhedral development. The dark quartz was massive except for a few grains of about 30 micorns, and the light quartz occurred as veinlets intersecting all the other minerals, The mode of occurrence of the various minerals, and their mutual relations, are illustrated opposite page 10, and further described under paragenesis.

Paragenesis

Victor Group

The sketches on the opposite page show those portions of both sections best illustrating the mineral relationships. Pyrite and dark quartz, both fractured, appear to be the earliest-formed minerals, and lacking evidence to the contrary, are assumed to be contemporaneous. Chalcopyrite, also fractured replaces pyrite and dark quartz, and is replaced by covellite, whi and light-coloured quartz-carbonate mixture. The last named also replaces pyrite and quartz and is in turn replaced by covellite, which is of probably supergene origin, as suggested by the oxidized nature of the hand-specimens. The sequence is therefore, dark quartz and pyrite, chalcopyrite, fracturing, quartz-carbonate, covellite.

Gem Claim

The sketches on the opposite page illustrate the relationships between the various minerals in the specimens of the Gem ore. Pyrite and dark, massive quartz appear to be the earliest-formed minerals, and appear to be contemporaneous. A light-coloured quartz-carbonate mixture has replaced both pyrite and dark quartz, and appears to be lining fractures in the pyrite. These linings, already described, are filled with two, and possibly three, undetermined minerals, whose principal elements appear to be gold and tellurium. These "fillings" are probably the latest-formed minerals. Hence, the sequence of deposition is as follows:

Pyrite and dark quartz, fracturing, quartz carbonate, gold-tellurium "fillings". Little evidence for this.

Silver Bow

The relations between the minerals of the Silver Bow ore are illustrated on the opposite page. The two sections examined show a definite relationship (lacking in the sections from the Victor and Gem ores) between quartz and pyrite: Quartz occurs in fractures in pyrite and psuedomorphous after pyrite, and hence appears to have replaced pyrite. Light-coloured quartz and carbonate appears as veinlets in quartz, pyrite, chalcopyrite, and sphalerite. Chalcopyrite replaces pyrite and possibly quartz, and is replaced by sphalerite.Galena replaces pyrite,chalcopyrite, sphalerite,and quartz.Sphalerite replaces quartz and pyrite, and is associated with,and replaced by,light-coloured quartz and carbonate.The paragenesis,therefore,appears to be as follows: Pyrite,quartz,chalcopyrite,sphalerite,light-coloured quartz and carbonate,galena.Unfortunately,it was not possible to place the sub-microscopic,unidentified mineral in the paragenetic sequence,but its occurrence suggests contemporaneity with galena. If this be true,and if the unidentified mineral is argentiferous,the high silver assays become explicable on the basis that silver minerals occur as minute disseminations within galena.

Conclusions

Victor Group

The Victor Group ore-specimens contained pyrite,chalcopyrite, and covellite as ore-minerals,and a "two-phase" gangue consisting of early-formed dark quartz and a later-formed mixture of light-coloured qartz and carbonate.No free gold was observed; although hand-specimens examined by the writer a number of years ago showed readily-visible grains of gold,the average assays are not high enough to ensure the presence of this element in sections taken at random. The principal ore minerals below the oxidized zone probably are pyrite and chalcopyrite,with the addition of supergene covellite nearer to the surface, but this conclusion cannot be substantiated until the deposit is explored in depth. Channel samples,taken by the writer,across vein-quartz barren of sulphides gave returns of less than 0.01 oz. of gold per ton,but selected specimens of sulphides from the same face assayed up to six oz.

of gold per ton.Hence, it is reasonable to assume that the gold occurs in close association with the pyrite,but to determine the exact nature of this association,a suite of fresh, carefully-selected specimens should be examined microscopically.

Such a study will be mandatory in developing a satisfactory milling process for these ores,which are similar to those on the property of the now-liquidated Columario Gold Mines Ltd., whose flotation concentrator lost 0.04 oz. of gold per ton in tailings[1]. The presence of a "second-generation" quartz-carbonate gangue,with which the gold may have been introduced into the pyrite,is clearly indicated in the specimens from the Victor Group,and appears to represent the last stage in the formation of the ore.If these relations hold true for the Columario ores,they may explain,in part at least,the poor recovery mentioned above.

Gem Claim

The clearly-defined quartz-pyrite banding of the Gem ores indicates that deposition was probably accompanied by progressive re-opening of the vein-fissure, and the friable nature of the pyrite shows that a considerable amount of post-pyrite movement has occurred within the vein.Fractures in the pyrite later became filled with second-generation quartz,and the results of this examination indicate that the gold,was deposited, possibly as one of the gold-telluride minerals,in close association with this later gangue-mineral.Fresh specimens,less difficult to work with than those presently available, would probably yield more accurate information upon further and detailed microscopic study. Although it is unlikely that further study of this interesting material could be put to immediate economic use, because the occurrence seems to be too limited in extent to be classed as ore, the findings might well serve as a useful guide to better understanding of the mineralization of some of the more promising mineral occurrences contiguous to the Gem claims.

Silver Bow

"Second-generation" quartz-carbonate gangue also occurred in the specimens from the Siver Bow Claim, but though less prominent, showed a greater degree of replacement of earlier-formed minerals by later gangue than was noted in the specimens from the Gem and Victor properties. This increase in replacement was probably caused by the weak development of post-pyrite fracturing, which forced the silica and carbonate solutions to corrode their way into the earlier-formed minerals. Conversely, it seems probable that numerous and large fractures in the early-formed minerals of the other two ores gave easy access to the later solutions, and thus inhibited replacement. It appears likely that this second-generation gangue has economic significance as a possible "carrier" of silver-bearing minerals and galena. The ore is similar to many other copper-silver-lead-zinc ores in that its treatment would involve differential flotation to produce separate lead and zinc concentrates. This separation would offer few difficulties because the mineral grains are sufficiently large that fine grinding would not be required.

In summary, it appears evident that the principal gold and silver values of the ores examined were introduced during a late phase of mineralization,and that this feature may be characteristic of many of the other mineral occurrences on Kleanza Mountain.This late phase of hydrothermal activity may be in some way connected with Tertiary vulcanicity;lava flows from which are prominent in this part of British Columbia,and whose waning activity is still represented by numerous hot-springs in the Skeena District.