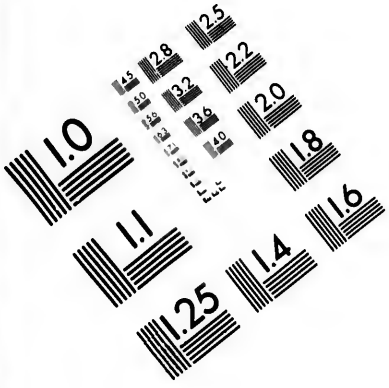

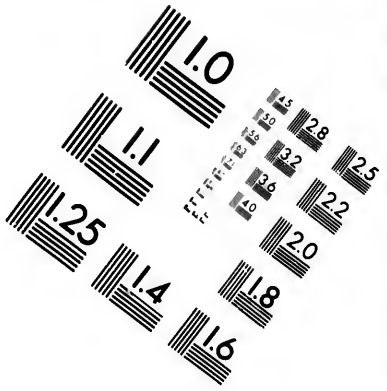

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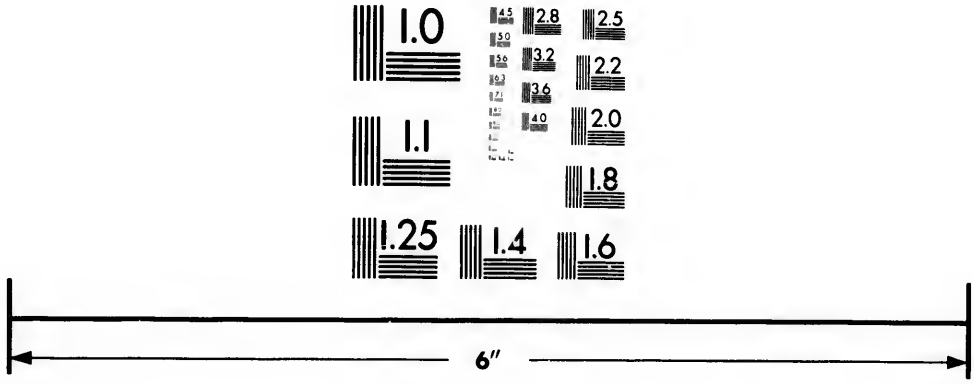

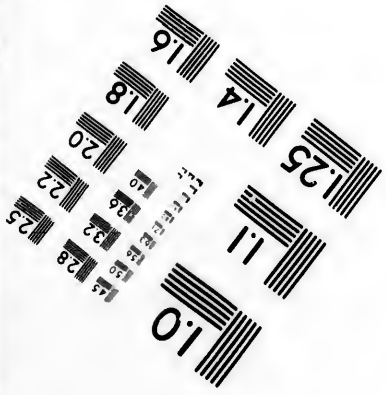

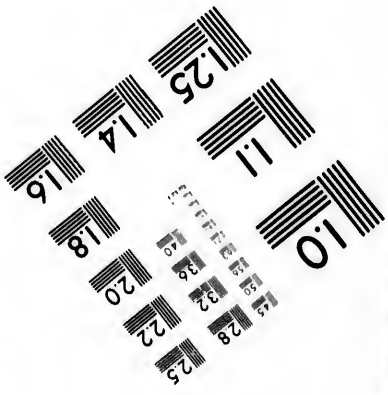

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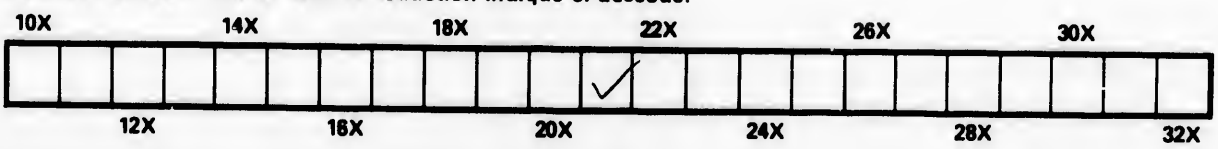

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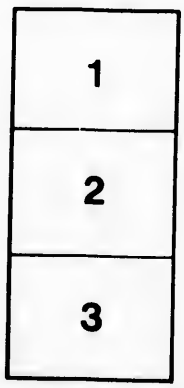

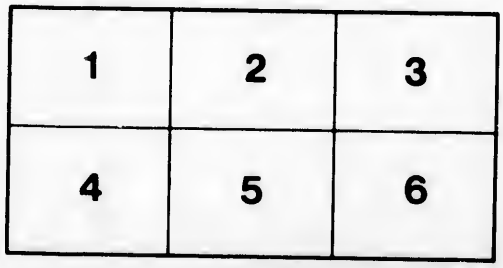

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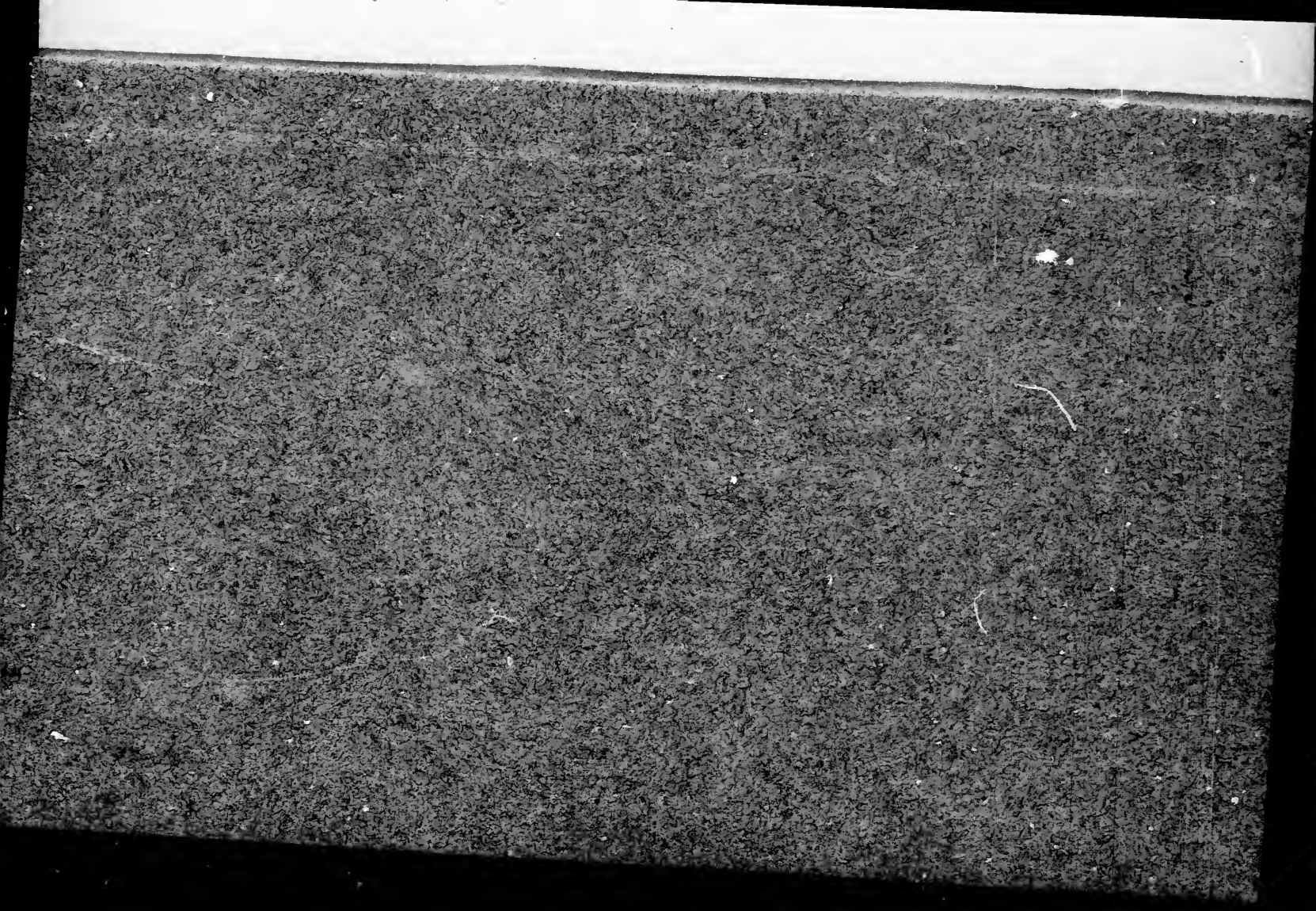
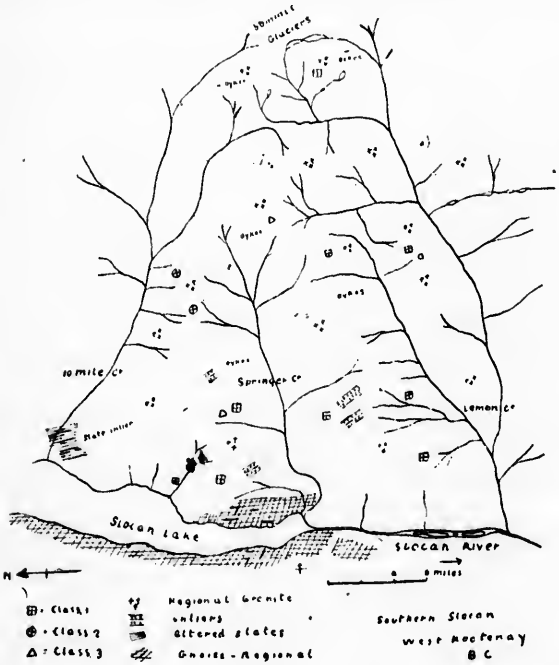


Some Ores and Rocks of Southern Slocan Division, West Kootenay, British Columbia.

By J. C. Gwillim, B.A.Sc., and W. S. Johnson, B.A.Sc.,
Slocan City, B.C.

The section of country taken up by this paper is a part of the Slocan Mining Division of West Kootenay, British Columbia.

As may be seen from the accompanying sketch map, this particular area lies in the drainage basins of Ten



Mile, Springer and Lemon Creeks, west of the divide between Kootenay Lake and Slocan Lake and River.

This area, therefore, lies immediately south of the rich silver-lead district of the Slocan proper, and it is, in itself,

a richly mineralized district. In the study of the characteristic rocks of this district the writers were much aided by the kindness of Dr. F. D. Adams, of McGill University, to whom they are indebted for the microscopical examination of a number of rock sections and as well as for suggestions upon the nature and origin of various specimens sent to him.

The country rock of this district is a granite. It is bounded to the north, some six miles above Ten Mile Creek, by the Slocan Slates of McConnell, in which occur the rich silver-lead mines now being so extensively and profitably worked.

To the west there is a contact with a great region of gneissoid rocks and dark schists, which, for the most part, lie west of the great trough formed by Slocan Lake and Slocan River, but which also cross over to the east side of the Lake at a point somewhat south of Twelve Mile Creek, and continue along the east shore, at least, until Springer Creek is reached, and probably occur along the lower slopes of the mountains further south. To the south and east the characteristic granite continues towards Kootenay Lake and the western arm of Kootenay Lake.

The contact of the gneissoid rocks with the mineral-bearing granites to the east of it is not well defined, excepting the fact that the block of gneiss and schists which lies east of the Lake forms a low bench, and the hills which rise above this bench are of a different nature and are *well mineralized*, which cannot be said of any portion of the gneisses so far prospected.

Between the gneiss and the granite proper, however, there usually intervenes a wide band of a highly silicious somewhat cleavable rock, which may possibly be a felsite. This band is mineralized, but is considerably broken.

With the exception of a few isolated patches of a highly silicious metamorphic rock of a dark color, the

district under consideration is composed of a granite having the following characters.

This granite is of a dark grey color and is composed of quartz, feldspars, biotite and hornblende, with a good deal of accessory sphene.

Its striking visible feature, however, is the occurrence in it of large crystals of impure orthoclase, giving it a porphyritic appearance. These crystals are usually a half to one inch long, and are commonly twinned parallel to the orthopinacoid. Small scales of biotite are scattered through the crystals, and the analysis, as here given, shows a good deal of lime and soda for an orthoclase.

SiO_2	59·86
$Al_2 + Fe_2O_3$	20·26
K_2O	12·39
Na_2O	5·76
CaO	2·90
MgO	0·78
Total	101·95

The lime is probably present as calcium carbonate.

An analysis of the granite gave :—

SiO_2	60·09
Al_2O_3	17·20
Fe_2O_3	6·73
CaO	8·24
Na_2O	2·45
K_2O	6·23
MgO	·47
Total	101·41

A microscopical examination of a specimen of this granite, taken from within a few feet of a quartz vein, was made by Dr. Adams. It was found to be a crushed

biotite granite containing a good deal of plagioclase. The quartz and feldspar show marked indications of great pressure. Much biotite, partially altered to chlorite is present and is associated with epidote, perhaps also an alteration product, having, however, in one case a core of allanite.

This specimen was considerably decomposed, being from near a vein and also near the surface. Two other specimens, one of them from a granite horse in a quartz vein, and the other from a cross-cut tunnel several miles distant, showed much the same characteristics, especially in the evidence of great crushing. The hand specimens do not show this crushing to any great extent, though the feldspar crystals are not very regular in outline at times. In this granite, which by the way, differs a good deal from the intrusive granites which break through the Slocan Slate series, near Three Forks, to the north, there are several distinct classes of mineral-bearing veins. These classes of veins differ both in origin and in the nature of the material filling them, but all occur in this typical porphyritic granite.

Class I. The most common and the most characteristic consists of irregular veins of coarsely crystallized opaque quartz. They vary quite rapidly in width, both laterally and in depth; their usual width is under four feet; their dip is very low, being from 10° to 50° from the horizon. No one of these veins has yet been explored to a greater depth than 100 feet. Hence all observations are confined to little more than surface showings.

Where shafts have been sunk a good deal of displacement is revealed along slickensided planes, more or less parallel to the strike of the vein, *i.e.*, usually parallel to the hill-slope wherever it may be.

The displacements are seldom more than a few feet, and the plane of faulting carries a good deal of gouge or selvage matter. Where the vein ends abruptly it is

commonly found again by following the rule of normal faulting. The broken off, or rather the abrupt endings of the quartz veins, have a smooth and rounded appearance, which is hardly warranted by the slight throw, and, moreover, the vein when found again does not always correspond in thickness to where last seen.

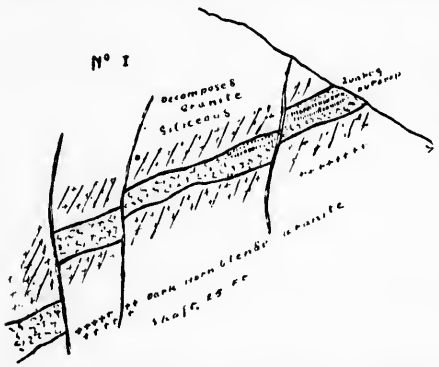
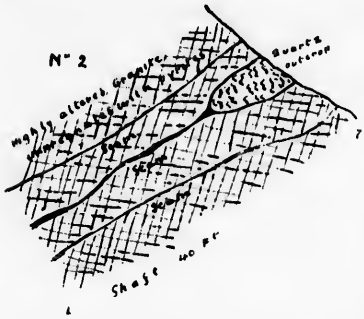


Figure 1 illustrates this faulting. It represents an actual section, as seen in a prospect shaft. A curious feature of these veins is the general tendency to pitch in towards the centre of any given mountain, ridge or range from all sides of that mountain. Possibly this may be only a result of easier discovery of veins so situated, and there may be other ones dipping outwards with the mountain slopes, as, indeed, they do in a few cases.

There is no general direction for these veins, this being a distinction from the silver lead veins, immediately north of this district, which have some tendency toward a north-easterly strike. Generally speaking, the veins are free from the granite walls and have more or less selvage matter along these walls, but it is not uncommon to find the decomposed granite and quartz firmly "frozen" or cemented together even on walls which, in other places, are quite free along the vein.

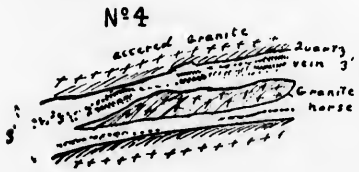
Figure 2 illustrates the sudden pinching out of a quartz vein. The quartz, which carries a high value in gold, suddenly rounds off like a boulder, and only a seam of selvage matter is left, whilst on either side of the seam

the granite has been decomposed to a soft greenish silicious matter, which is impregnated with large crystals of pyrite. In all faulting and sudden ceasing of the ore bodies there is little evidence of dragging aside of the vein matter or other indication of which way the continuation may be found.



Aside from displacements and rapid variations in width, these quartz veins show great persistence both in reappearance and in mineralization.

The mineralization of these veins is sporadic, or chute-like, with a tendency to banding where the ore body is of regular width. Usually the enlargements give rise to a more cellular and comb-like structure, and in such places the richest minerals are found.



Horses, such as shown in Figure 4, are common. The one figured shows marked evidence of great crushing, probably anterior to the forming of the vein matter. An analysis of this horse gave :—

SiO_2	71·70
Al_2O_3	18·25
Fe_2O_3	3·18
MgO	2·12
CaO	3·36
Total	98·61

The alkalies were not determined, but are evidently much lower than the normal granite.

The precious metals, gold and silver, are found in such veins in a native state. The silver in leaf form along cleavage lines, th gold in coarse particles, sometimes crystallized; also as a natural alloy of gold and silver where the gold and silver are nearly equal in per cent., and associated with the loose granular iron pyrites occurring in these veins. This pyrites often occupies little cells in the apparently massive quartz; when the quartz is broken the pyrites falls out, leaving a clean little cell, with often some black powder, which is probably argentite.

The pyrites contains ½ oz. of gold and 200 oz. of silver, to 2 oz. of gold and 50 oz. of silver. They sometimes present a more massive or crystallized form, being still rich in silver. The locality seems to determine their richness.

The chief mineral distinctive of these veins, however, is argentite, either as a coarse aggregation of crystals, at times weighing over a gramme, which fill interstices in the quartz or as a very finely disseminated powder, which gives the quartz a bluish black appearance. The coarsely crystalline variety is more common where the powdery form is absent. The crystals appear often to fill in the spaces between well developed crystals of quartz.

A good deal of iron oxide, rich in free gold and argentite, occupies the central combed cavities of some of the veins, also iron oxide, as limonite and haematite fills up some of the interstices and cells, appearing thus to be crystallized.

Referring to the map, it will be seen that the veins of Class I. occupy a small area between Twelve Mile and Springer Creeks, nearly all the country between the Springer Creek and first north branches of Lemon Creek, and also in some very typical cases they are found south of these branches.

As one goes to the south, the gold and silver ratios of value change from about 1 to 10 to equality along the north branch of Lemon Creek, and finally further south the gold value becomes the greater.

Although the argentite, as far as known, carries little or no gold, there appears to be a direct ratio between the value of gold and silver in any one vein, or part of it. In the area defined as belonging peculiarly to this class of ores, there are few veins of any other character, save some doubtful replacement zones of low grade galena, and some quartz veins which carry mixed crystallized pyrites and galena; in these the gold and silver values are low, yet they are in the heart of the richer ore bodies.

Class II., of ore bodies, is not largely represented as yet, but it is a very distinct one, and consists of narrow veins dipping at high angles to the horizon. The ore body is mixed quartz and secondary limestone. The ore itself is galena and a very dark zinc blende, both rich in silver, and almost devoid of gold. This ore is singularly well collected along the walls of the vein, the outside slickensided portions of which consist often of the fine grained galena, called steel galena, the inner portions being a coarser galena and dark blende. Usually in this district the zinc blende is low grade in silver; here it is not so.

This class of veins has not been seen in immediate association with those of Class I. It is more distinctive of the Ten Mile slopes. The country rock is the same to all appearances.

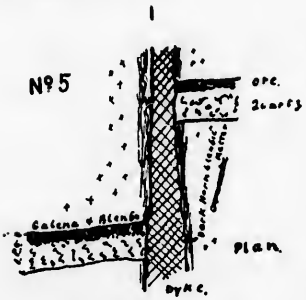


Figure 5 represents one of these veins, also the interference of the vein by a narrow dyke of a soft, soapy and grey matter, probably a micaceous trap. A very dark hornblendic biotite granite occurs in patches along this dyke also.

Class III. Some veins of this class are remarkable for

their richness in silver. Though in nature and structure they appear quite common, the veins of this class show evidence of a replacement of the granite country rock by ore. These veins, or ore bodies, are nearly perpendicular.

The replacement seems to have taken place along a line of decomposed granite, often along two parallel seams, which give the impression of being the walls of a vein.

The intervening granite is penetrated by ramifying stringers of quartz and patches of galena and zinc blende. In some cases the galena is exceptionally high grade in silver. When this is the case, argentite is probably present along the cleavages of the galena. At other times the galena is low grade, far below the general average of Slocan galenas, which is somewhat over 100 oz. per ton. The blende is low grade. A case of dyke interference also occurs with one of these ore bodies. This is a narrow band of rock very similar to the one described before, only of a darker color. Under the microscope it shows itself to be a much decomposed basic "mica trap" allied to the minettes.

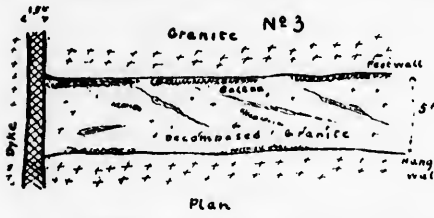
Such dykes, together with others rich in hornblende, are common in all this district.

An assay of rock from this dyke gave 4 oz. silver to the ton. This may have been accidental, being from an exposure in a tunnel. An analysis gives:—

SiO_2	39·38
CaO	13·44
Al_2O_3	22·94
Fe_2O_3	11·33
MgO	9·93
K_2O	Not det.
Na_2O	"
Total	97·02

On passing through this dyke, which cuts the ore body

at right angles, no more ore is found. It may be that the dyke appeared before the ore did, though at first sight this seems unlikely. The dyke walls are slickensided. Figure 3 illustrates this occurrence.



In addition to these three main classes of ore bodies there are many modifications in filling material and in structure. These, however, are not important, with the exception of a widely represented class, which occurs along the upper waters of Lemon Creek. They are low grade, patchy galena bodies in a silicious gangue. At times these may be very rich in silver also. They have little or no gold.

Another more important class is a sugar grained quartz vein, which carries some pyrites and galena as well as a fair proportion, say, 40% of free milling gold. These ore bodies are physically like Class I. They occur south of Lemon Creek. In one place on Lemon Creek there is an occurrence of free gold and galena intimately associated, but this is rare.

Concerning the small areas of dark cleavable rock, microscopical examination goes to show that they are very finely grained, altered sedimentaries. An analysis of one gave :—

SiO_2	61·74
Al_2O_3 and Fe_2O_3	19·66
CaO	14·00
MgO	2·28
K_2O	Not det.
Na_2O	"
Total	97·68

Iron pyrites is also present.