Geology & Mineralization
Salal Creek Area B. C.
Lillooet Mining Division

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NORPAX NICKEL MINES LTD.

SALAL CREEK MOLYBDENUM

LILLOOET MINING DIVISION

Bridge River, B.C.

GEOLOGY AND MINERALIZATION OF THE SALAL CREEK AREA

H. W. Agnew

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GEOLOGY AND MINERALIZATION
OF THE
SALAL CREEK AREA

GENERAL GEOLOGY

The Salal Creek area lies near the eastern flank of the Coast Range Batholith but entirely within the igneous complex which makes up the eastern fringe of the batholith.

This intrusive complex is made up of rocks of various compositions and ages.

The main mass of the batholith was emplaced during mid to late Jurassic and lower Cretaceous times.

Younger intrusives, upper Cretaceous to early Tertiary occur as plugs, stocks and small batholiths along the eastern fringe of the main batholith and extend in a northwest direction throughout the western Cordillera.

These younger intrusions range in composition from gabbro to granite. In B.C. at least, the more acidic intrusives of Upper and Post Upper Cretaceous age are frequently mineralized with copper and/or molybdenum minerals.

The occurrence of molybdenum in the Salal Creek area is an example of mineralization occurring in a late, acidic, stock like intrusion. Other, like, intrusions are known to occur within the general area.

LOCAL GEOLOGY

With the exception of minor scattered recent volcanic debris and aqueoglacial sedimentary material which unconformably overlie the intrusives, the area is entirely underlain by crystalline rocks of the Coast Range Batholithic complex.

The crystalline rocks which underlie the claim group consist of granodiorite and diorite of the main batholithic mass. Into these a stock of quartz monzonite has been intruded and later related dikes have intruded both the older and younger crystalline rocks.

Batholithic Rocks

The older diorites and granodiorites are typical of the rocks of the main mass of the batholith - light to dark grey, drab, massive, mostly coarse grained rocks. Along the upper portion of the East Fork of Salal Creek the diorite has been altered to a horneblende gneiss - the gneissic structure being well developed as the contact between the older and younger intrusives is approached.

Nowhere has this contact been observed. In general it follows the valley floor of the East Fork throughout the claim group and is therefore obscured by talus and/or stream gravels.

Quartz Monzonite

Much the greater part of the claim group is underlain by the quartz monzonite stock. The stock is roughly square shaped in its surface expression. It occupies an area of about 16 square miles.

It is a portion of this stock which is the host rock for the molybdenum mineralization.

The stock is composed of fine (felsitic) and coarse grained quartz monzonite. The composition of each is similar with one exception; the amount of quartz appears to be greater in the fine grained variety.

The relationship of the two varieties to each other has not been determined. Mapping of the areas occupied by each has not yet been attempted. The occurrence of the fine grained variety appears to be quite irregular.

The average composition of both varieties appears to be (on the basis of the examination of 6 or 8 thin sections) as follows:

10 - 20% quarts
30 - 40% potash feldspar
20 - 30% oligodase (feldspar)
0 - 5% biotite
plus minor amounts of alteration products; i.e. muscovite, sericite, epidote and chlorite.

Into the stock have been intruded quartz veins, pegmatite and dacite (?) dikes and still later volcanic activity injected basalt dikes into the stock and provided the basalt flows and volcanic fragmental rocks which uncomformably overlie the quartz monzonite.

Quartz Veins

Numerous quartz veins occur throughout the quartz monzonite. They vary in size from veinlets (1/16") to quartz veins up to 3-4 ft. wide though veins of this width are rare. The quartz is usually glassy. The vein are not all mineralized but most contain molybdenite in varying quantities.

Generally the veins are small (1/2" to 2") and widely spaced (50-100 ft.). Their length is difficult to determine even though they occur in exposed areas as the rugged nature of the terrain makes it impossible to progress any great distance in any directions. Some have been traced for a distance of at least 100 ft.

Some, described as quartz veins ? are rather the silicification of fault or shear zones. These "zones" vary in width from 2 inches to 4 feet.

A typical zone of this type occurs on the west side of Trail Creek at an elevation of 5900 ft. A fault zone 2 feet wide has been silicified and the silicification extends into the wall rock for one foot on either side of the fault zone. No hangwall or footwall to the silicification is established but the total width of silicification is about 4 feet, the quartz having completely replaced country rock over this width.

Dikes

Numerous fine grained, light colored dikes occur throughout the stock. They are probably docite. Some contain minor molybdenite mineralization. The dikes are short, though again it is hard to trace them in any direction due to the precipitous nature of the ground, and narrow 2 to 4 feet.

Pegmatite dikes, or a better description would be pegmatitic

masses, consisting of quartz, feldspar and minor biotite occur as short lenses or irregularly shaped masses with poorly defined borders. Frequently these "dikes" contain minor molybdenite. They occur more frequently towards the eastern part of the claim group.

Aqueoglacial Deposits

A bed of water sorted glacial debris uncomformably overlies the quartz monzonite on the claim group. The section is best observed at the headwaters of Float Creek. Here the section has a thickness of 175 feet (the maximum thickness) which becomes less both to the east and west until it pinches out in both directions.

The bed consists of a basal conglomerate of poorly sorted boulders in a matrix of sand and silt. Boulders consist of an assortment of rich types horneblende gneiss and diorite predominating. Above the coarse conglomerate are conglomerates consisting of sand and pebbles and interbedded sands and silts. All are poorly indurated.

Basalt

Two small basaltic plugs thought to be volcanic vents occur on the claim group, one near the head of Float Creek, the other about one mile further west and near the head of Trail Creek. Volcanic activity has provided these plugs and numerous related basaltic dykes.

Overlying the aqueoglacial deposits described above is a series of basaltic flows with a total maximum thickness of 1,000 feet.

STRUCTURAL GEOLOGY

Only the structural features of the quartz monzonite can be described as no detailed work was done elsewhere on the claim area.

Faulting: Although faulting is not a conspicuous feature within the monzonite, minor faults occur in abundance within some areas of the stock. Major faulting represented by the lower part of the East Fork and by "Float" and Trail creeks is, for the most part, obscured by talus, stream gravels and glacial debris.

Three distinct sets of faults have been noted. First, an east-west set of faults represented by the valley of lower East Fork but exposed on the north side of the valley near the point at which the East Fork changes its direction of flow from south to west. This fault zone is made of up to 2 or 3 and possibly more parallel faults striking east-west and dipping at 90°.

A second set strikes within a few degrees east or west of north and dip steeply (75-85°) to the east or west. Examples of this set are seen in Trail and Float creeks.

The most predominate direction of faulting is the third set which strikes N55 to 65°E and dips 50 to 65° to the northwest. Based on some rather slim evidence it appears that this set of faults might terminate against the north-striking set of faults. Nevertheless faults of this set are the most frequently encountered in the area.

Faults vary in width and movement. Most of the zones are narrow and of course cannot be traced due to nature of the topography. Sometimes 1 to 2 inches of gouge has developed, at other times faulting is indicated only by a shattered and at others a resilicified zone from a few inches to 4 feet wide.

Jointing: By far the most conspicuous structural feature of the quartz monzonite stock is the extensive jointing. Jointing throughout the stock varies from relatively wide spaced (4 ft.) to close, 2-3 per foot to intricate fracturing with 10's of joints or fractures per foot.

The attitude of the joints indicates three main sets with attitudes similar to the three sets of faulting with the exception of the east-west set of joints which dips from near horizontal to 20 degrees to the north - unlike the east-west faulting which is near vertical.

The most prevalent set of joints strikes N60 - 65°E and dips northwest 60 to 70°. A second set strikes northerly and dips steeply to the west. A third set, the east-west set is mentioned above.

Close jointing in three directions has produced a rubble which

has covered most of the outcrop area and provided extensive talus slopes. Only the near vertical cliffs are rubble free. The close jointing also makes progress throughout the area extremely hazardous. Also it contributes to extremely rapid erosion and weathering of the rock.

Jointing varies in intensity; i.e. joints per foot apparently from the perimeter of the stock towards the core. Where the average number of joints along the periphery might average 2 per foot closer to the core the average would be closer to 5 to 10 per foot with sections providing 20 to as high as 50 fractures per foot. Such sections, so far noted, are relatively small, up to twenty feet to eighty feet in length and many of shorter length, width unknown.

Intricately fractured sections such as described above have been noted at the headwaters of Float Creek and the upper portion of both Cornice and Big Creek.

The attitude of dikes and veins is similar to the three sets of jointing and faulting described above.

MINERALIZATION

Molybdenite occurs in both the fine grained and coarse grained varieties of quartz monzonite exposed on the Salal Creek claims.

It occurs in quartz stringers and veins associated with pyrite, minor magnetite, graphite, hematite and rhodonite.

Molybdenite also occurs as fracture-plane mineralization within the quartz monzonite and associated with the same minerals as found in the quartz veins. The fracture plane mineralization varies from a thin "paint" of molybdenite on the fracture surfaces to massive fracture fillings up to 1/4 of an inch in thickness.

Molybdenite occurs within fault zones again as a film along the fault planes and where the fault zones are silicified, the mineral occurs disseminated throughout the siliceous zone.

Disseminated molybdenite mineralization within the monzonite is not evident but some of the fractures noted (with hand lens) are near

micro-fractures and contain molybdenite which gives the appearance of disseminated mineralization but this is not a common feature.

Pyrite mineralization is widespread and occurs with or without molybdenite in quartz veins, pyrite veins ? up to 1/2 inch wide and on fracture planes. Though pyrite occurs in abundance throughout the monzonite it appears to decrease in quantity towards the central portion of the stock though this might be due to more thorough and faster leaching within the central area of the stock because of the increased density of the fractures per foot towards the core.

Distribution of the molybdenite mineralization within the claim group has been described by Dr. Campbell.

Molybdenite is found in all three sets of jointing which have been described above.

OXIDATION AND LEACHING

The occurrence of molybdenite within the stock is everywhere accompanied by its oxidation product ferrimolybdite (molybdic ocher) and the former presence of molybdenite in the rock is often indicated solely by the bright canary yellow color of the ocher which is all that remains of the former sulphide mineralization.

Oxidation and leaching of the mineralis is extensive throughout the entire stock and only in the creek bottoms where mechanical erosion exceeds chemical transfer is molybdenite mineralization of "ore" grade found on the surface.

Frequently molybdenum filled fractures are evident only upon breaking several inches to several feet into the host rock.

Diamond drilling has indicated that oxidation and leaching is extensive to depths of up to 50 feet and more.

Oxidation of the widely scattered pyrite has created one of the most striking features of the area. The oxidation of pyrite has everywhere stained the rocks with yellow, brown and maroon colors to provide a large and extremely vivid "gossan" visible from the air for great distances.

The entire surface of the stock is to some degree colored by the limonite "stain".

The manganese mineral rhodonite which occurs sparingly associated with the molybdenite has provided extensive black manganese stain along many of the fracture planes.

ALTERATION

From the examination of a limited number of thin sections the dominant alteration of the rock appears to be the sericitization of the feldspars in the quartz monzonite. In some areas of the stock the alteration has proceeded far enough to give the rock the appearance of a porphyry. This is due to the alteration of the feldspars to sericite in part or totally, leaving the quartz as conspicuous grains in a dense groundmass. None of the thin sections have shown a porphyritic texture though the quartz monzonite is mainly inequigranular.

Both the coarse and fine grained varieties of the monzonite display this alteration with, on the basis of a limited number of thin sections examined, the fine grained variety having the more extensive alteration. Further alteration of the rock is represented by minor amounts of epidote and chlorite.

SAMPLING

Extensive sampling of areas of mineralization outcropping on the surface is not warranted as pointed out in previous reports, due to the extensive leaching. Nevertheless an area of better mineralization located at the headwaters of Float Creek was sampled as well as could be done under difficult circumstances.

Float Creek heads in three forks called locally "West Fork", "Middle Fork", and "East Fork".

Middle Fork and East Fork have exposed near and in their creek bottoms better than usual concentrations of molybdenite mineralization occurring in fractures which over a distance of 250 feet average at least 12 joints per foot.

The zone is exposed over a width of 250 feet in both mid and east forks of Float Creek which at the point of mineralization are about 400 feet apart. It is assumed that the same zone extends at least the distance between creeks but the interval between the two forks is too precipitous to investigate. The zone is open at both ends but not prospected for the same reasons that the interval between the two forks has not been investigated.

Continuous sampling across the full width of 250 feet was not possible.

Discontinuous samples were taken for a total length of 84 feet across the exposure in the Middle Fork.

Three continuous samples starting at the top of the zone assayed as follows.

Number	Width	% Mo
80551	7 feet	0.12
80552	7 feet	0.01
80553	8 feet	0.09

Continuing down the creek for an interval of 65 feet three more continuous samples provided the following results.

Number	Width	% Mo
80554	11 feet	0.13
80555	35 feet	0.08
80556	16 feeteet	0.02

No further sampling was attempted during the prospecting part of the 1964 season with the exception of a grab sample taken by Dr. Campbell from Float Creek number 80126 which assayed 0.15% Mo. Assay results are low but extensive leaching in the area prevents obtaining higher values. Nevertheless the surface sampling at this point indicates the tenor of material that might be obtained in fresh unleached rock.

CONCLUSIONS

The geological environment in the area for the occurrence of economical molybdenum mineralization appears excellent.

Most of the features common to all molybdenite deposits of the Climax type are to be found in the Salal Creek area.

i.e. 1. The apparent association of molybdenite with a relatively small intrusive center of usually porphyritic rock grading in composition from monzonite to granite.

2. Quartz veins ranging from very small veinlets to large veins either closely spaced or widely spaced.

3. Intricate fracturing with two or more sets of fractures which are mineralized.

4. Alteration - mild to intense alteration - probably the most common being sericitization (Climax) or alteration of plagioclase to orthoclase as at Endako.

5. Association of molybdenite with pyrite. Pyritization is usually extensive and minor sericite, flourite and carbonites, but distribution of these minerals can be misleading.

Intense leaching has removed much of the molybdenite from the surface. This fact together with the precipitous nature of the terrain which makes progress in any directions hazardous or even impossible also makes surface sampling impractical and any further sampling of the surface could serve no practical purpose.

Diamond drilling appears to be the only useful method of further testing the ground.

Drilling is going to be difficult. The very feature which could provide an ore body, the intricate fracturing, could make drilling and core recovery difficult.

Areas of better mineralization and fracturing on the east-west portion of Salal Creek are located high on the valley wall and in an extremely rugged portion of the stock.

Diamond drill set-ups will be hard to locate closer than 500 to 1000 feet from the targets. In any event these set-ups will be high up on the side of the valley.

Drill sites in the Big Creek area can be more readily located as the terrain is not so rugged and slopes are relatively more gentle.

The quartz monzonite stock occupies an area of about 16 square miles. Only about 5 square miles have been prospected in detail, that is all of the stock which is exposed within the claim group. The balance of the monzonite has been prospected by single traverses along ridge tops and across the slides which bound the valley of all the creeks which drain the area of the monzonite stock.

Nowhere beyond the claim boundaries has molybdenite mineralization been found in place but minor molybdenite mineralization has been noted in float but such float is not abundant.

Detailed prospecting in the balance of the area is warranted. In view of the intense leaching which often leaves little or no evidence, on the surface, of former molybdenite mineralization, careful prospecting is required and might disclose additional area of mineralization within the quartz monzonite.

The Salal Creek molybdenum occurrence is well worth further extensive development.

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