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INVESTIGATIVE REPORT

on the

ADMIRALTY MINE

by

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INVESTIGATIVE REPORT on the ADMIRALTY MINE

SUMMARY

General

The investigation was made in the fall of 1958 at the request of Mr. W. S. Pekovich to determine type and trend of mineralization at the Alaska Admiralty Gold Mine at Funter Bay, eighteen miles out of Juneau, Alaska.

The claims consist of a solid block of claims covering more than 1,500 acres of largely valuable timber land extending from the southeast shore of Funter Bay to high on the slope of Mt. Robert Barron.

The area lies in the temperate coastal rainy belt inducing a vigorous growth of spruce, hemlock, fir and cedar.

The Problem and Its Earlier Interpretation

In 1955 a sulphide-bearing irregular injection at elevation 1456 was projected, on somewhat skimpy evidence of trend, to the 393 elevation in the Pekovich tunnel. The total projected distance was from just under, to just above, a half mile depending on a strike direction not clearly defined. The general trend of the zone does not appear to have been soundly founded. The projected distance was far too great, and the hypothetical "ore body" was not located.

Limitation of Ore Projection

A mineral vein, zone, bed or any other type of mineral occurrence is emplaced under some type of structural control. To project a mineral occurrence the structural controls which governed its origin must be determined. The distance over which an ore body can be projected varies with the type, but is usually less for the irregular occurrence.

Scope of Investigation

A basic survey was made to enable accurate structural projection.

Local geological detail was compiled and interpreted on the background of regional structures and orogenic forces.

Tunnel Accessibility and Service

Except to the lower tunnel access is by foot. The service by tram line is precarious and limited in scope. It does not facilitate direct interchange of men and equipment between levels.

Geologic Formation

The general structure lies along the northeast limb of the Funter anticline, which has been deformed in the mine area by the action of regional forces. The deep-rooted mountain slope of Mt. Robert Barron caused a lag in folding and induced a lifting effect with the dual result of deflecting the structural axis and forming a local dome structure modified by faulting.

Intrusives

A series of older intrusives by varying degrees of metamorphism form a rough geologic clock indicating orogenic activity by intervals. The oldest intrusives were subjected to considerable folding and metamorphism along with the rock intruded. Younger intrusives show varying degrees of induration. A set of late intrusives show no appreciable metamorphism. The "mineralizing agent" a late ultrabasic intrusive shows only slight crystal alignment and is deemed to be an emanation from the last orogenic movement.

Injection Controls

The injection controls under which the "mineral agent" entered the metamorphic series are believed to be structurally weak zones brought about by the factors which deflected the structural axis and helped form the above mentioned low dome.

Faults

There are two major fault systems present, one striking northwest and the other northeast. Both systems are post mineralization and younger than the ultrabasic intrusive.

No great offsets were noted; but the deflection of the axis is reflected in a corresponding change in strikes in both fault systems.

Mineralization and Orogenesis

The coarsely crystalline sulphides from the DMEA tunnel shows that the nickeliferous pyrrhotite and chalcopyrite formed about the same time. Distinct suturing of pyrrhotite around chalcopyrite is easily noted; but a closer study shows that occasionally the reverse is true. The much greater mass of pyrrhotite naturally would tend to show more frequent suturing. The assay values reported are about 1% nickel to 2% copper.

Similar sulphides in like proportion were noted in many places along bedding planes of the metamorphic series.

The sulphides are considered to have originated from the ultrabasic intrusive as a segregation after partial crystallization. Their segregation into a massive state is probably a result of a squeeze-filter process from a final orogenic spurt near the closure of crystallization.

Ore Pockets vs. Dissemination

The anomaly of dissemination on a large scale along bedding planes of sulphides similar to the massive occurrence suggest the possibility that the dissemination occurred at the same time and as a result of a massive orogenic squeeze. It is possible that the major portion of this rich mass was lost through dissemination leaving only relatively small amounts with the parent stock forming irregular pockets in structurally weak zones in the folded rock.

EXPLORATION

Proposed Tunnels

Two tunnels were laid out on the maps at locations which enables exploration in the probable zone locations. The proposed placement of these is such that future use of the lower level is feasible. Different ways of connecting the lower with the upper tunnels was discussed.

The possibility of core drilling from the surface was rejected in favor of tunnelling followed by subsequent drilling.

It is urged that driving No. 3 tunnel 1,200 feet should have precedence over any other development work with the possible exception of one final core hole in the face of the Pekovich tunnel.

Road vs Cable Tram

The shortcomings of the tram were pointed out as being incompatible with modern requirements. A good road has no adequate substitute.

A Pioneer Road

On an accompanying map a two and a half mile long road has been ploted at an average grade of just under seven percent. Access by front-wheel-drive vehicles to the No. 3 level by this road is believed to offer the best service possible for the least cost.

Proposed Diamond Drilling

It is proposed that a final 500-foot hole bearing N25°E at +45° to +65° be drilled in the face of the Pekovich tunnel.

Additional core drilling should await completion of the No. 3 tunnel.

Buildings

The main camp buildings and general facilities are adequate to take care of a large crew.

Equipment and Tools

The equipment and tools on the property are nearly adequate to proceed with the suggested exploration program.

Additional Equipment Needed:

1. A small jeep for emergency and general use.
2. A power wagon, Willys-pickup, or other front-wheel-drive truck.
3. Pipes, rails, ties, vent pipes, fan and other general requirements for driving a 1,200 foot tunnel.
4. A small jumbo will speed the job considerably.

Conclusion

The property is considered a good prospect.

A. H. Girard

INVESTIGATIVE REPORT
on the
ADMIRALTY MINE

Introduction

At the request of Mr. W. S. Pekovich, General Manager of the Alaska Admiralty Gold Mining Company the investigation was made between Sept. 19 and October 19, 1958, for the purpose of determining the type and trend of mineral occurrence.

Specifically it is imperative to determine if a downward extension of the known occurrence on the two upper levels can be successfully explored from the lower or Pekovich tunnel. If so, how? What is the next immediate step in an exploration program?

Claims, Location and Accessibility

The accompanying claim map supplied by Mr. Pekovich shows the mining property as a solid block of claims covering the southeast side of Funter Bay for a distance of 8,000 feet and stretching southeasterly 9,000 feet toward Mt. Robert Barron, the highest point on Admiralty Island. Funter Bay is located on the west coast of Admiralty Island somewhat south of west from Juneau a distance of eighteen miles.

From Juneau there is a regular boat service once a week to the fish cannery about a mile across the bay. The Alaska Coastal Air Service have two flights per week to both the cannery and the mine. The Coastal Air Service can be called by radiophone from the mine and, weather permitting, special flights arranged.

Physiography

From the camp at sea level a gently rising slope encloses a swampy area at the base of a steeply rising mountain slope. This heavily wooded slope is marked by several northerly trending faults which formed benches subsequently modified by stream erosion. Transverse faults show up in creeks both north and south of the mine area and above the 3,000 foot elevation; they are traceable across the mountain which terminates in Mt. Robert Barron at an altitude of 3,475 feet.

Climate and Vegetation

The local climatic conditions are typically coastal and are marked by the heavy rainfalls common to a broad coastal belt of that region. Temperatures are moderate both summer and winter. The winter snows on low coastal plains is slight but increases rapidly with altitude. Snow slide areas from the highest point on the island fingers into the scrubby timber at the 3,000 foot altitude and extends in places down to the 2,000 foot altitude.

The vegetation is lush on the mountain slopes, moderate to poor on low-lying swampy areas where the well-known Admiralty Brown Bear has his first spring feed on a prodigious growth of skunk cabbage. An abundant growth of salmonberry, huckleberry, blueberries, and others were noted. The salalberry bush was notably absent in the area covered; but the obnoxious devil's club made its presence felt.

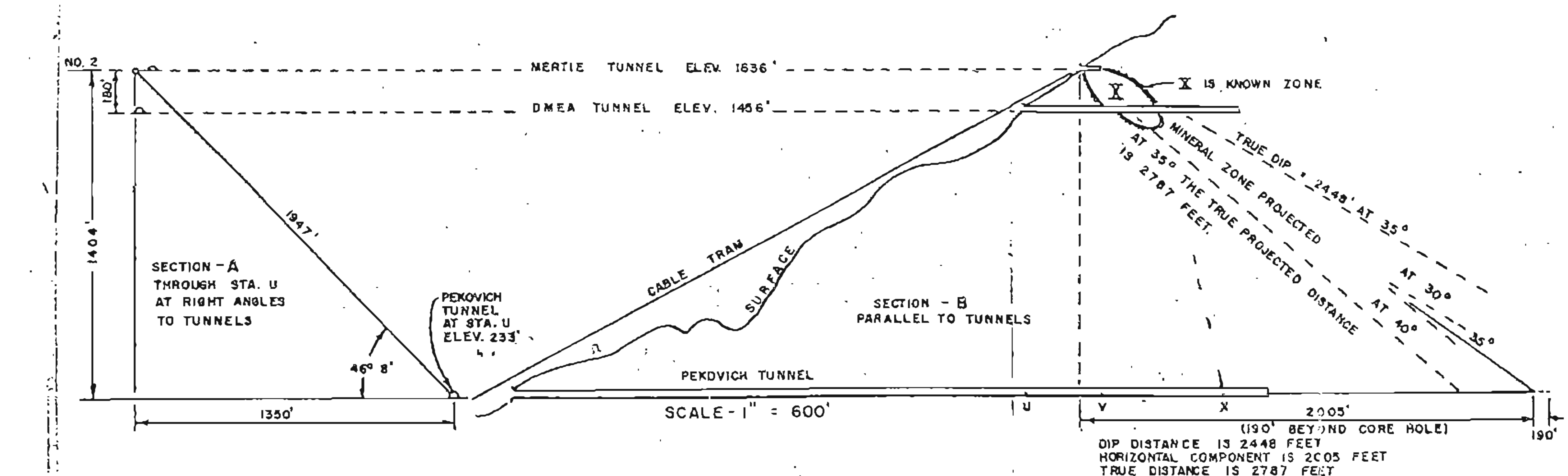
The treasure-trove of valuable trees which cover most of the area include cedar, fir, hemlock and spruce. The latter are more numerous than the other three combined. Both in individual sized (5,000 to 7,000 B. F.) and collective numbers the spruce is king of this forest.

THE 1956 INTERPRETATION

THE DIFFICULTY INVOLVED IN THE EARLIER PROJECTION OF A MINERALIZED ZONE THROUGH AN OVERLY GREAT DISTANCE IS PARTIALLY SHOWN BY THE FOLLOWING SECTIONS:

NOTE THAT:

1. SECTION B IS AT RIGHT ANGLES TO SECTION A
2. THE UPPER AND LOWER TUNNELS ARE MORE THAN 1900 FEET APART WITH A LATERAL SEPARATION OF 1350 FEET.



3. The mineral-bearing ultrabasic rock marked "X" in Section B is an irregular intrusive with no confining walls to suggest directional trend. From exposures in the upper tunnels and from data of core holes below the DMEA tunnel a rough outline of the intrusive was derived as shown at "X". The apparent axis of this irregular body suggested a dip of 30° to 40° in the direction of the tunnel bearing.

4. Frank A. Metcalf, on a map dated March, 1956, submitted a proposed exploration program. He projected an ore body on a 35° dip to the lower tunnel. His plat shows a series of ore pods plotted along a line, designated strike of the Mertie tunnel. It further shows that an extension of the Pekovich tunnel, driven, presumably on Metcalf's recommendation, should intersect his hypothetical ore body at 2,200 feet. Corrected elevations applied to Metcalf's map shows this point to be 266 feet beyond face. A diamond drill hole, still in progress on September 19 of this year was drilled horizontally along the direction of the tunnel center line. This core hole at a distance of 1,024 feet beyond the face had not traversed an ore body.

5. If a strike normal to the lower tunnel is assumed for Metcalf's "ore body", as shown in Section B, then the dip distance to the lower tunnel level is 2,448 feet and the actual distance is 2,737 feet. The two horizontal components are 2,005 feet and 1,350 feet. The Metcalf "ore body" should then be encountered by the diamond drill hole at (1,024 + 190) or at 1,214 feet beyond the present tunnel face.

6. Plotting the Metcalf data, (i.e. 35° dip along trend of the Mertie tunnel), on a recent survey map by the writer places the hypothetical ore body squarely on the horizontal core hole at 858 feet from the tunnel face. The core at this point is a dense silicious metamorphic rock devoid of mineralization.

Limitation of Ore Projection

In order to project an ore body of any kind even one hundred feet beyond its known occurrence, by means other than simply following the ore, structural control governing its mode of emplacement must be established.

A simple vein system is most easily projected; but the distance of accurate projection is limited to the area within which it is known how other structural factors affected the plane in which the vein lies. A vein may disappear for any one of a dozen reasons. For example, it may pinch out to a matterless fissure in much less than a hundred feet.

Among the various types of ore emplacement the irregular injection is obviously governed by the most obscure structural control or combination of structural controls. If the necessity for determining what these controls are is compelling enough a reasonably complete story will eventually emerge.

At the Admiralty Mine, from the original discovery at the Mertie tunnel to the latest exploration on the Pekovich tunnel, an irregular injection of deep-seated origin has been explored in accordance with a conception of how and where it extends beyond its proven dimensions.

If it so happened that the conception upon which the exploration program is based is in some respect at variance with the actual situation it follows that the exploration will not accomplish the anticipated end.

It should be clear that projecting such an occurrence a half mile or much less than a quarter mile is not good practice.

Scope of Investigation

Sooner or later the question "what, where, why" were bound to be asked.

1. Does the Admiralty Mine offer a reasonable chance to develop an ore body?

2. The ore minerals are known; but what type of occurrence is it? Is is vein, contact replacement, a pipe or chimney type? Is it disseminated mineralization along belts of brecciation or weakened zones forming ore horizons in otherwise normal country rock?

3. What are trends, dimensions, and probable volume and grades of this ore?

4. What exploration and development is required to put this property into production?

5. Does the property have any value other than for mining?

The scope of this report is aimed at answering as fully as possible the above questions. In order to do this a detailed examination of all geologic factors was necessary. A complete survey tying the known workings together was a basic necessity and as many as possible of the scant surface exposures from the beach to the top of the mountain had to be examined.

The survey, using the tramline extending in a straight line from elevation 139 feet to elevation 1,633 feet above sea level as a reference line, is the fundamental structure to which all other details are tied. The existing tunnels at altitudes 203 feet, 1,450 feet, and 1,636 feet were all surveyed and tied to the reference line by turning transit angles. The resultant maps are indispensable in geologic interpretation.

The mechanics of recording underground dips and strikes was slowed by the necessity of making corrections for magnetic anomalies.

Tunnel Accessibility and Service

The Pekovich tunnel is reached from the beach camp by a good road trending S38°E for 3,600 feet across a flat area. Transverse culverts drain swampy spots under the road which has been surfaced throughout its length with rock from the mine dump.

A cable tram stretches a distance of 3,200 feet from a point below the Pekovich dump to the sill elevation of the Mertie tunnel. The Mertie tram station is too low for direct service to the tunnel. The DMEA station is more conveniently located twenty feet above the tunnel sill and about ninety feet from the track. At the lower end the tram station is sixty-five feet below and 450 feet from the Pekovich tunnel.

The tram is not very well placed for convenient interchange of material and equipment from level to level. It is not safe for transporting men. Before it can be used advantageously for an ore transport, repairing, clearing the line, and construction of ore chutes are necessary.

From the Pekovich tunnel the DMEA and the Mertie tunnels are reached by a foot path which could be re-routed and suited to the use of pack horses with a relatively small amount of work.

The trail is three to three and a half miles long. Normal travel time up the trail is one hour forty-five minutes to two hours. The return trip can be made in one hour when travelling lightly.

GEOLOGY

Geologic Formation

A mile or two north of the mine area the formation is well described by Mr. Fred Barker * who calls it the Retreat Group and assigns it to the Upper Triassic or Lower Cretaceous geologic age.

The formation from Peckovich Point to Mt. Robert Barron, was originally laid down as a multimember series of variegated sedimentary deposits. It has been folded and altered as a unit and is here treated as such.

Outcrops along the beach supplemented by outcrops along the hillside at the Pekovich adit constitutes total exposures of the coastal flat which is effectively covered by musky and associated scrubby growth.

Except for an outcrop at Pekovich Point of a fine-grained quartz diorite intrusive strongly gneissic and enclosing shoots of biotite chlorite schist the rocks noted were all silicic sericite chlorite schist, variants of which extended into the 4,199-foot long Pekovich tunnel. A gradation from chlorite to silicious sericite schist marks the next few hundred feet. Zones of chloritized schist reoccur but a change toward more intense silicification is reasserted then the sequence is broken by a greywhacke member which is a much stronger rock than the foregoing, and is therefore noticeably less schistose. The metamorphism, however, was considerable. Original feldspar altered to kaolinite and muscovite suggests a somewhat arkosic original. The silicious remnant shows angular quartz grains re-cemented with silica.

The greywacke member is followed by more chlorite and sericite schist, the latter grading into a quartzitic schist containing bands recognizable as original argillite which has been recrystallized with some sulphide inclusions. In the process the quartz formed a series of detached lenses on bedding planes. This quartzitic zone grades into quartzose graphite schist and in turn into black silicious graphite schist. The high content

*Geology of the Juneau (B-3) Quadrangle, Alaska of rounded quartz grains in this jet black graphite rock is surprising. No other minerals were identified in this rock. Slippage between bedding planes is in evidence throughout all the schists described above; but the shiny graphite slickensides are particularly distinct. They suggest the possibility that the quartz in the graphite schist may have been rounded, or kept round, by the gliding motion along the bedding planes. The absence of minerals other than quartz grains also suggest the possibility that the graphite base may have been originally introduced into relatively pure sandstone in a petroliferous form. However, it should be noted that the writer was not equipped to make the necessary microscopic studies to back up these speculations.

In the adjoining rocks the graphite lessens and the quartz content increases. This is followed by a section containing scant opalized limestone lenses and a few pinkish calcite crystals more or less enclosed in opal.

The lime is deemed to be from an original thin-bedded limestone member the counterpart of which passes through the Kittens northwest of Funter Bay. The eastern fold of this bed should lie about 1,500 feet northeasterly from Funter. Though its presence is not indicated there, its extension beyond the bay is likely. This would correspond roughly to the location in the tunnel where this limy member is found.

Throughout this zone constant pressure, inducing slippage across the dome structure is startlingly expressed in the form of weird schlieren-like and augen structures. This is followed in the succeeding chlorite schist by the graduated accordion-like folds, mentioned under structures. The area of intense pressure found relief in a series of faults and the identical rock beyond the faults, which were offset an undetermined amount, clearly show that they were not subjected to the same intense pressure.

Marked by the presence of several faults the quartzose black schist continues to the face.

The direction of the tunnel from survey point "S" to the face and the extension by coring an additional 1,024 feet is toward a point which on the surface above would be 1,800 feet northwesterly from the high point of Mt. Robert Barron.

The end of the diamond drill hole lies 570 feet northwest of a group of small lakes located above the 3,000-foot contour. One or more of these lakes is the probable source of water entering the core hole through two faults traversed by the hole.

The core shows eight feet of black silicious schist, a seven-foot thickness of light gray, fine-grained, gneissic, amphobolite diorite dike, followed by a thick section of extremely silicious metamorphic rock, in which dark minerals are virtually absent. This rock extends to foot 522 where minor iron sulphides are present. At 562 are eight feet of silicious hornblende-diorite-gneiss with scant sulphides. At 714 is a thirty-four foot thick schistose hornblende dike with minor sulphides. The intense induration of this rock indicates it was folded with and metamorphosed along with the rock it intruded. At 920 to 988 graphitic schist predominates. The presence of iron sulphides including pyrrhotite smeared along bedding planes suggest post mineral adjustments. The succeeding rocks are similar but show localized increase in sulphides. At 989 is an eighteen inch light diorite gneissic dike.

From there to the end of the hole at 1,024 are more or less silicious graphitic schists.

The upper levels traverse much the same rock. The DMEA tunnel shows the same silicious, chlorite, sericite schist. The greywacke member, also present, is followed by a section of ultra basic intrusive rock. A twenty-foot wide zone of intense faulting adjoining this intrusive rock is followed by a most unusual brecciated section in which angular fragments range in size from an inch to a couple of feet. The random arrangement of the breccia fragments is accentuated by the fact that they retain their original bedding laminations. The brecciated zone is completely healed with a dense basaltic matrix and now constitute the strongest rock encountered in the mine area. Beyond this sixty-foot brecciated zone a section of black graphite schist extends to the face.

On the mountain above the tunnels the outcrops are scant until the 3,000-foot altitude is reached. At this elevation a saddle marks the presence of a fault. On both sides of the fault vertically dipping beds strike north. The rock consists of strong quartzite members three to eight inches thick interlaminated with chlorite schist. The uniformity of interlaminations and the fact that the quartzite laminae vary constantly in thickness made it impossible to correllate the rock across the thirty foot span between fault walls. The fault offset could therefore not be determined.

Geologic Structures

From the spit (designated "Pekovich Point" on the accompanying map) jutting into Funter Bay about 500 feet west of the Admiralty Mine camp to the high saddle beyond Mt. Robert Barron lies a belt of folded and highly metamorphosed rocks. In the area of the Pekovich adit and for about 3,000 feet in the tunnel multiple folding is present. Both the regional folding and localized minor folding is strongly marked by undulating folds which in one sector of the tunnel exhibits an unusual graduated increase in the fold depth from one foot to eight feet in a distance of fifty feet. Horizontal beds or curving beds persist for hundreds of feet along the tunnel. Occasionally weaker rocks are crumpled and folded below a stronger gently curving roof rock with lateral slippage along the roof rock and minor steep dipping faults abutting the overlying stronger rock.

The structure is an extension of the Funter Anticline described by Fred Barker in the adjoining quadrant to the north. The mine area lying to the northeast of the Funter anticlinal axis should be within a series of northeasterly dipping beds; but the area is actually a dome surrounded by beds dipping gently away from that dome. Minor folds within the dome appear erratic; but have occasional due south trends such as the undulating structure explored by the crosscut at F in the Pekovich tunnel.

The tunnel trending S53°E for more than 2,000 feet and then N75°E for another 2,000 feet follows bedding strikes for considerable distances on both these trends. Beds of sharp easterly dips are also present in both sections and a few zones have minor folding of such intensity that the beds are densely compressed and overturned. This effect seems to be the result of eastward slippage of the overlying dome. Evidence of this horizontal slippage is present in both the DMEA and the Pekovich Tunnel.

For the completion of the overall picture more field studies of a wider range are necessary; but from the limited local field studies and supporting evidence from distinct physiographic features indicated by the U.S.G.S. contour maps a definite picture emerges.

The inner portion of the Pekovich tunnel trends N75°E and a horizontal core hole extended in that direction beyond the face for 1,024 feet traverses structures with angles that range from 45 degrees to 82 degrees. These angles cannot be interpreted in terms of dips and strikes but beyond the end of the core hole at the 3,000-foot elevation the formation strikes north and has a vertical dip.

The fault system of the mine vicinity and the larger scale areal faulting point to regional forces active from the southwest.

In a continental study of such forces it is seen that deflections are common. That deeply-rooted mountain systems with a crystalline core offer resistance capable of deflecting both folding and overthrusts, has been ably discussed by Billingsley and Locke. *

Such a condition is present here. The resistance of Mt. Robert Barron to the forces that acted from the southwest resulted in forming a domelike structure in the Admiralty Mine area. The structure, though well established by strike-dip readings, is somewhat confused by minor faulting and by folds within folds on undulating axes, such as shown by the crosscut at "F" which trends south on one of many minor folds.

Northwesterly from this irregular dome the Funter anticlinal axis bears north twenty-four degrees west. Southeasterly from this dome the axis bears south ten degrees west, showing a deflection through thirty-four degrees.

The main tunnel is terminated well into the northeast anticlinal limb of the Funter Anticline or the southwest synclinal limb of the Shelter Island syncline. The bending and subfolding noted throughout the area appear to record the gradual swing of the anticlinal axis from its northwest trend to a nearly due north trend at Mt. Robert Barron where strong, distinctly--bedded metamorphics are vertical in altitude and strike north. This deviation from the general trend is probably local judging by a twelve-mile long physiographic feature east of the mountain from Barlow Cove to beyond Hawk Inlet. Along this line lies a remarkable trough probably marking the presence of a hidden fault which trends N30°W parallel to the Shelton Island synclinal axis.

This axial deviation may be significant in determining probable trends of sulphides tending to form on sills. It will be further discussed under a different heading.

The structural evidence is satisfied by the position of the stress-zone in the DMEA tunnel but it also calls for a similar stress zone of less intensity approximately 5,000 feet to the south of survey point "S" in the Pekovich tunnel. Regrettably at the time of the investigation this conjectured position was not visualized and no surface evidence of the conjectured zone was sought.

* Structure of Ore Districts in the Continental Framework, AIME, 1939.

These zones should exhibit local dips in conformance with bedding planes; but in depth, which ought to be considerable, a rake in the opposite direction is probable. This rake to the west of the DMEA Tunnel Zone will not be found on a continuous wall of a pipe-like injection but most likely on a series of offset injections with a semblance of a rake along the western edge of the series.

Intrusives

In the metamorphic section from Pekovich Point to the end of the core hole in the Pekovich Tunnel all intrusives noted with the exception of three are more or less metamorphosed along with the rock intruded. Some of the earliest intrusives are folded along with the rock intruded. With judicious use this affords a rough chronological scale of dating. It is therefore possible to determine that certain dikes which appear petrologically related to the mineralizing agent are of an older generation.

Thus the occurrence of silicious quartz diorite, amphibole quartz diorite, and olivine augite gabbro dikes are considered to be products of one or more earlier orogenies.

The three exceptions are: a minor andesite dike approximately 1,000 feet from the Pekovich adit and a cluster of basalt dikes in the face of the same tunnel. The basalt dikes are injected on the bedding planes of the quartzose graphitic schist. In the DMEA tunnel the sixty-foot breccia zone is healed by the same rock. The two basalt occurrences are of the same apparent age and source.

The third exception, an ultrabasic complex, is the largest of the younger dikes. It occurs in the DMEA main tunnel where it is exposed for a distance of about 180 feet.

The first exposure lies in the face of a 44-foot crosscut driven due south from survey point M5.

This rock, a dark grey fine-grained member of the gabbro-diorite-basalt family containing olivine and plagioclase, is here, for lack of microscopic determination, called simply an olivine gabbro. (It could possibly be a norite. However, when the determination has been made a corrective statement will be appended hereto.) The dike strikes due E with a 69 degree S dip.

Erratic shoots of the same dike rock crops out in the main tunnel wall. Fifteen feet on the portal side of survey point M7 a quartz lens strikes N56°E and dips 25°SE. Directly above this quartz lens the gabbro forms a sill which increases in massiveness towards M7. At M7 the dike rock has been blasted away exposing a massive sulphite core. The exposure of the inner sulphide sill measures roughly eleven feet by twelve feet. The middle of the sill, pierced by blasting, shows a sulphide thickness of about eighteen inches. Its periphery has jagged projections which interfingers with massive hornblende crystals. On the whole the sulphides are free of hornblende crystals in its internal structure but along the rough edges some hornblende crystals lie wholly within the sulphides and vice versa some small sulphide clots lie wholly within the hornblende which forms a coat around the sulphides. The hornblende in turn appears to be more or less enclosed by the gabbro. In the southeast wall a small jagged fissure juts down from the sulphides but no definite continuation therefrom could be determined. The gabbro is irregularly exposed in the tunnel as far as survey point M10 where is was explored by several diamond drill holes and a further downward extension determined. The core and its assay value is held by the U.S.B.M. and no information is available. The intrusive shows an extremely irregular contact with the surrounding rocks.

Injection Controls

This irregular-walled intrusive cannot be projected unless its injection controls are clear. Let us therefore examine the meager possibilities.

The regional geo-forces at work slowly folding the layered rocks from southwest to northeast met resistance at depth and possibly climbed a deep-lying shoulder of old crystalline rock in the Admiralty Mine Area which is nearly centered on massive Mt. Robert Barron. A primary dual effect of creating a moderate dome structure and deflecting the anticlinal axis resulted. The secondary result was to create a compression breccia zone along one line and a stress zone along another line. The stress zone became the repository of the sulphide bearing gabbro in the DMEA tunnel. A second and similar stress zone of lesser intensity is suggested by the same structural evidence with a probable location at about 7,000 feet further south.

The stress zone is not confined to the one limited horizon explored in the DMEA tunnel. The dip and rake possibilities discussed under structures hold true; but they are most likely arranged in echelon along the line called the rake.

Because inherent strength of the rocks forming individual beds vary, and because slippage between beds is unequal neither the interval of stress-zone location nor the exact rake achieved can be precisely determined. In other words, no exact projection can be made. Only a general broad zone of probability can be outlined. But, there is no incentive for exploring for such zones unless a reasonable expectation of finding ore is supported by fact. See evaluation under mineralization.

Faults

The general fault pattern of the locality is well expressed by the physiographic pattern indicated by the U.S.G.S. quadrangles of the area.

There are two major fault systems. One strikes northwesterly parallel to bedding planes and structural axis; the other trends across this structure striking northeast. Both systems are post mineralization.

The amount of offset on the first mentioned set could be considerable without ready detection. Offset on the second set of faults should show up in a relatively short distance. However, the faults comprising this set are numerous with minor movement on each succeeding block to the northeast. No measurable amount of offset was found on the several faults in the tunnels. The total movement is probably considerable but individual fault movement very slight. Considerable thrust movement is indicated along bedding planes; but no indication was found that this movement broke through the anticlinal fold to produce overthrust. Some of the faults formed benches on the mountain slope parallel to the structural axis. The bending of the structural axis discussed above is substantiated by a change in angles of a number of the faults to the south of Mt. Robert Barron. The eastern sector of the island reflects this tendency only weakly but the central high portion indicates a series of cross faults swinging from northeast to nearly due south and the axial fault system shows a similar trend striking northwesterly with a reduced west angle.

Mineralization and Orogenesis

From a brief view of some microscopic photographs it is clear that a thin section study has been made of the ore. Regretably, the result of previous work is not available at this writing. According to Mr. Pekovich, the presence of pentlandite was established. The iron-nickel sulphide, pentlandite, is commonly associated with pyrrhotite and pyrite. It is also known to occur in economic quantity with chalcopyrite. Its association with the Admiralty Mine sulphides is therefore not surprising. The following discussion is based on megascopic study only.

The sulphides in the sill at M7 in the DMEA tunnel consist of a preponderance of nickeliferous pyrrhotite associated with minor chalcopyrite. The assay values are about 1% nickel to 2% copper, but by volumetric ratio the pyrrhotite is many times that of the chalcopyrite. The gabbro from which this is segregated averages nickel .63%, copper .54%. Minor cobalt is also present.

The origin of the sulphides, in chronological sequence, starts with a plutonic common solution which, during one of the several orogenies, discussed under "Structures", penetrated axial fractures to reach stress zones along the structural axis. Crystallization, forming fine-grained gabbro, proceeded from the cooler outer periphery towards the center of solution mass. Governed by the principles of techtonics the order of crystallization robbed the solution of the plagioclase forming minerals in the first stage of crystallization. This stage must have come close to completion for the plagioclase matrix entrapped a part of the solution carrying sulphur, iron, copper and nickel. Nickeliferous pyrrhotite and chalcopyrite was disseminated through the fine-grained rock in a simultaneous crystallization in which pyrrhotite tended to suture chalcopyrite probably due to its greater quantity. The final crystallization of sulphides in the outer walls had not been completed, and in the central portion of the injection a siliceous solution rich in sulphur, iron, copper and nickel was suspended, when renewed pressure from a succeeding orogeny squeezed the newly formed repository and the unsolidified portion filtered out to escape along the lines of least resistance, or was left under a condition of arrested crystallization. A slight alignment of crystals in the outer walls is indicative of the pressure. A portion of the solution entrapped under high temperature conditions formed a second segregation. A slowed down crystallization resulted in forming an inner sulphide core surrounded by coarsely crystalline hornblende.

It is a moot question how much of this solution escaped to be redeposited elsewhere. Did it form ore pockets in similar structures up and down the rake of the structurally weak zone, or did it penetrate along bedding planes on a grand scale of dissemination?

Ore Pockets vs Dissemination

One of the most striking features of the country rock traversed by all development

Mill Tests

The results of mill test by Quebec Metallurgical Industries Ltd. were submitted by Mr. Pekovich.

Because sampling for the tests were not done by the writer, the results cannot be considered a legitimate part of this report. However, a partial copy of the results are given below to show proportional relationship of nickel, copper, and cobalt.

Result of fifteen samples:

	Head		Concentrate		Recovery	
	Ni	Cu	Ni	Cu	Ni	Cu
Average	.81	.61	2.17	2.04	84.26	95.21

Average by analysis Ni .81% Cu .59%

The bulk concentrate will contain about 0.10 cobalt.

tunnels is the anomaly presented by an abnormal metallic sulphide content along the bedding planes of the entire metamorphic series. The values/are slightly higher in frequent lenses of recrystallized quartzite. In most places the mineralization is in rough agreement with that of the mineralized gabbro, discussed above. It carries nickeliferous pyrrhotite saturing minor chalcopyrite. The pyrrhotite is present almost throughout the country rock. In some places the chalcopyrite is either absent or present in extremely minor quantities. It is conjectured that even where the chalcopyrite was not megascopically detected some is actually present wherever the pyrrhotite is found. The sulphides in the country rock, in addition to nickel and copper, carry a small amount of gold which is proportionately much greater than the trace of gold found in the sulphides at M7. The difference in gold content is to be expected because the escaping remnant solution in the last described orogeny should carry the greater concentration of gold. If a large portion of the enriched solution actually did escape and disseminated along the bedding planes of the entire metamorphic complex then the chance of finding pockets of concentrated sulphides of ore proportions is not good. If, however, enrichment along the bedding planes came about under different orogenic circumstances, then the late gabbroic intrusion is more likely to have formed ore in stress zones. It should be noted that the values in the country rock referred to herein are not high enough to be considered ore, and, also, that the mineralized gabbro does not itself carry a sufficient concentration of metallic sulphides to be ore, except where segregation of the metallic sulphides occur in a massive state in large quantity.

Under a government exploration program a series of core holes were drilled downward from the sill of the DMEA tunnel. The cores and assay values are said to be still retained by the government agency which managed this work. The information held by the government should be taken into account in the evaluation of this occurrence. Additional information about the amount of massive sulphides said to have been found below the level could be important.

EXPLORATION

Proposed Tunnels

On the maps and sections submitted herewith two tunnels have been laid out at elevations 648 feet and 1,053 feet above sea level. The numbers 1 to 5 have, for simplicity's sake, been assigned to the tunnels as follows:

Tunnel Name	Number	Elevations Portal	Elevations Sta. U	Distance Between Levels
Mertie	1	1636		180 feet
DMEA	2	1456		403 feet
W.S.	3	1053		405 feet
W.S.	4	648		415 feet
Pekovich	5	203	233	

The tentative layout is aimed at placing new tunnels below the known outcrop in such a way that an inter-connecting raise can be run on the same incline from bottom to top and yet be directly connected with each level. A raise much below a seventy-degree incline lowers efficiency. The most efficient for general use is the vertical raise. But with the existing tunnels spread far apart it is not practical here. Even with a through raise on a seventy degree slope it will be necessary to drive an 880-foot service tunnel from the Pekovich Tunnel to the starting point of the raise. Another aim is to place the tunnels as far to the northward as practical in order to be within exploring distance of probable zone locations beyond No. 2 tunnel.

The W.S. No. 3 tunnel at elevation 1,053 feet is plotted 1,600 feet long on the maps, but an actual length of 1,200 feet is plenty long for preliminary exploration.

Lateral exploration by core drilling from this tunnel will give excellent coverage of the zone in question.

The opinion that the No. 3 level should, in any additional exploration program, come first is based on a long established practice of proceeding from the known to the unknown. The possibility that core drilling could be used to accomplish the same purpose has been considered. It is concluded that surface drilling would not be effective because the angle of impingement on the probable trend is too small and the chance of missing the zones by drilling between them is too great.

Coring would be reasonably effective from a point 600 feet underground on the 1,053 level, but indications are that completion to the full 1,200 feet is desirable.

If an attempt were made to explore the zone from Pekovich No. 5 tunnel it would require a 1,200 foot crosscut from survey point "V" with a 90° right turn extended for 300 feet. Or, alternatively, extend the cross cut at survey point "R" N18°10'E for 1,220 feet whence turn right 47° and drift for 300 feet.

However, either way would place the drift 1,224 feet below the zone and 821 feet too low for effective exploration.

Proposed tunnel W.S. No. 4 at the 648-foot elevation is laid out as part of the same system. It is plotted 2,400 feet long on the map. Driving this tunnel should not be contemplated until exploration is completed on the No. 3 level.

In contemplating further exploratory work, driving No. 3 tunnel should come first with the possible exception of venturing an additional core hole in the face of the Pekovich tunnel.

For service to No. 3 adit three possible ways were examined. Two of these by tunnelling and raising from the No. 5 level (see layout on map) were rejected as being too costly unless further future use for these were assured. The third means, "Surface Access", is not only the least costly, but also the one which has a future economic application beyond mining.

<u>Road vs Cable Tram</u>

The driving of, and subsequent exploration from No. 3 level could run into a two year program. Servicing a project no longer means simply supplying equipment and materials to a site; but also transporting men to the place of work.

Cable trams, except as a temporary aid in construction where they are in constant use for a short period, are a thing of the past. As a means for transporting men, equipment and ore they are unsafe, unreliable and too slow for modern methods. There are exceptions which need not be pointed out here; but for a large scale low-grade operation they are inefficient. High labor costs eliminate all but the most efficient methods of transportation.

A tram subjected to the rigors of a wet coastal climate deteriorates and becomes unsafe during a short time of disuse. Other objections could be listed.

The simple fact is that there is no substitute for a good road. This road can later be used for a logging operation as it opens up access to valuable timber.

A Pioneer Road

Pioneering a rough mine road suitable for jeeps and other front-wheel-drive vehicles will neither take longer nor be more expensive than building a tram which will pass specifications to haul both men and equipment.

The proposed road is shown on the accompanying district map. As drawn on the map a short take-off to No. 4 tunnel is indicated but from knowledge of actual conditions this leg can be eliminated somewhat shortening the total road distance required. The total road length won't, in any case, be over three miles.

The distance to No. 4 tunnel is 7,392 feet or 1.4 miles. To No. 3 tunnel it is 13,200 feet or 2.5 miles. The overall grade is just under seven percent.

A large tractor in good condition now at the mine is suitable for this construction work.

Proposed Diamond Drilling

The important exploration accomplished by driving the Pekovich tunnel did not fully live up to expectations, in that, the projected ore body did not materialize, and while it has been proved that a very large section of metamorphic rock in the area carry usually high values on bedding planes no zone of concentration high enough to reach ore proportions was found. The horizontal hole beyond the face shows a considerable section of dense barren rock. However, an area above and to the left of the face has a possibility of lying within the structurally weak zone. Compared to the initial outlay the cost of an additional hole is very small. Before this phase of the exploration is abandoned a hole trending north twenty-five degrees east on a plus angle of forty-five to sixty degrees should be drilled a minimum of five hundred feet from the tunnel face.

Buildings

The facilities for accommodating a good sized crew includes about ten cabins suitable for married couples and two large bunkhouses for single men. In addition the combination cookhouse, mess hall and storeroom has a number of rooms upstairs.

Bathrooms, showers, etc., a laundry room, and a room for the two electrical generators serving the camp, are all housed in a long rambling structure.

One of the cabins, now used for an office, houses the radio telephone equipment.

The mill building is the largest single structure. It is now, along with a couple of quonset huts, used for storing extra mine and general supplies. The blacksmith and general repair shop is also housed in a quonset hut.

On the mine road to the Pekovich tunnel is a large powder house, and at the portal are a compressor shed and a shop and tool building. At the DMEA portal there is a small combination compressor and tool shed.

Equipment and Tools

Much of the equipment, though more or less in working order, is obsolete and uneconomic for a continuous operation.

Considerable new or good equipment is on hand, enough, except for transportation, for the immediate exploratory needs.

A compressor and a generator at the Pekovich portal are both new. The two generators at the camp are both in good shape. Stored in a separate metal building is a brand new generator which hasn't been used.

At, and in, the Pekovich tunnel is a battery motor, a mucking machine and a string of new three-quarter ton muck cars all in excellent shape. The pneumatic drills include two jack legs (in fair shape), a couple of stopers, and two or more water leiners.

The variegated assortment of tools and equipment scattered about the tunnels, adits, and main camp includes a tugger, jack bars, cross arms, cross bars, jim crows, blacksmith's forges, anvils and drill steel.

At base camp a D4 tractor in good working order is in constant use. Another much larger tractor on the property is not a part of the mine equipment. This tractor, comparable in size to a D10, is suitable for the proposed road construction. It has been used but very little and is in excellent shape. It is assumed arrangements could be made for its use.

A dilapidated 1950 Ford three-quarter ton pickup truck is currently in use for transportation to the Pekovich tunnel.

A considerable stock of lumber is on hand suitable for building the necessary compressor and tool shed at the proposed tunnel site.

Equipment Needed

The transportation needs for the proposed tunnel is first of all a power wagon or a similar front-wheel-drive truck. In addition a small jeep of any kind should be on the job for emergency and general use. A considerable saving will also be made by using the smaller vehicle when possible.

The use of a small jumbo for drilling the tunnel rounds is not a necessity, but it will be found an important labor saving device.

Other necessities for the project includes the following: Air, water, and vent pipes; a ventilation fan; rails, ties and accessories.

Acknowledgement

Through the courtesy of Mr. W. S. Pekovich's ready help, in running the survey lines and in making many other trips up the mountain, was available at all times.

The men at the mine, Messrs. Todd, Levinson, Sam Pekovich, Jr., and R. L. Pekovich gave their time unstintingly. Especial thanks are due to R. L. (R for Rado) Pekovich for making my stay at the Admiral Mine a real pleasant one.

Valuable suggestions and other help rendered by Mr. Phill Holdsworth and his staff was much appreciated.

Conclusion

From the foregoing pages it should be clear that the writer has found no conclusive proof that the additional exploration as outlined will pay off.

The amount of nickeliferous copper-bearing sulphide disseminated throughout both the gabbroic intrusive and the metamorphosed sediments is such, that, while ore grade is not achieved, its presence makes the property a good prospect.

A. K. Guard

A. K. Guard - Geologist

Salt Lake City, Utah
November 29, 1958

PHIL R. HOLDSWORTH, P.E.

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October 2, 1978

Mildred Brown, Geol. Inf. Tech.
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Dear Mildred:

Many thanks for the text of the Alton K. Guard report (MR 112-15). A copy of the maps mentioned in your letter of September 19th would be appreciated. I realize that you would have to go outside the office to have this done, and the cost of reproduction should be at the requester's expense. In Juneau we find that the Dept. of Transportation (Highways) is the only one who is capable of doing this kind of work. They may also be so equipped in Fairbanks.

I will be leaving Juneau October 4th and returning on the 13th to attend the American Mining Congress annual Convention in Las Vegas, so there is no big rush on this. Prompt payment for reproduction cost will be made upon receipt of billing.

Thanks again for your assistance in this matter.

Sincerely,

Phil R. Holdsworth

Phil R. Holdsworth