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GEOLOGICAL SURVEY

PRELIMINARY REPORT

ECHIMAMISH AREA,
NORTHERN MANITOBA

BY
T. L. Tanton

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INTRODUCTION

An area along Echimamish river, northern Manitoba, in which some two hundred mining claims had been recently staked, was examined by the writer in September 1936. This area extends for 20 miles east and west along the river with a width up to 5 miles; a point near the middle of the area is 45 miles northeast of Norway House, the nearest settlement.

From Winnipeg to Norway House a regular boat service is maintained during the navigation season (early June until mid-October) by the Selkirk Navigation Company, and airplane service is available throughout the year. Canoes are used from Norway House to Echimamish river. This river forms part of the canoe route between Norway House and York Factory on Hudson bay, and the traffic in the region is commonly borne by canoe trains--a leading freighter canoe with outboard motor towing other canoes.

From Norway House the route goes north-northeast for 6 miles across Little Playgreen lake and down the East channel of Nelson river for 14 miles to Sea River falls, with a 5-foot drop where there is a portage 3 chains long across a rocky island; thence it is down Nelson river northerly for 6 miles to the High Rock, a greenstone ridge nearly 40 feet high, where the river divides to the east and west. The route leads east for 4 miles through a braided channel, and then turns abruptly north for 1 mile; at this place Nelson river, which is characterized by muddy, grey water, turns west, and is joined from the east by the sluggish, clear, dark brown waters of Echimamish river. The Echimamish for some distance is 50 feet wide and about 8 feet deep

and is entrenched in a low plain of light-coloured clay in which are swampy areas. Four miles upstream Hairy lake, 3 miles long and $1\frac{1}{2}$ miles wide, and for the most part shallow and densely grown with reeds and other aquatic plants, is the only lake expansion along the river. Around the shores of the lake are low rock ridges and muskegs. A portage about $3\frac{1}{2}$ miles up the river from Hairy lake leads north to Butterfly lake. Two miles farther up Echimamish river a dam was constructed in September 1936 to improve navigation and fourteen miles in a straight line east is the second or upper dam across the river. These may be passed by lift-overs and there is no other obstruction to canoe navigation on the river. Painted Stone portage, 80 feet long, is $4\frac{1}{2}$ miles east of the upper dam and leads with a descent of 5 feet across smooth, bare rock in a depression in an east-west trending ridge between Echimamish river and Hayes river. A small creek that is not navigable flows from Echimamish river, around the rocky hill east of the portage, into Hayes river. The route continues easterly down Hayes river and is free of obstructions for the first 16 miles.

About 6 miles east of the lower dam on Echimamish river, Halfway creek joins from the north and is navigable by canoe for $1\frac{1}{2}$ miles to Birch lake; north of which a route continues along Fairy creek to Fairy lake. About 2 miles east of Halfway Creek junction a portage leads north to a group of small lakes. East of this portage about one-half mile is the site of a flooded dam at an abrupt bend in the river, and from this point a trail leads north to a small lake that drains into Pine river, which enters Echimamish river from the northwest 2 miles in a straight line east of the flooded dam at the bend and is unnavigable.

The dock and camp buildings of Echimamish Gold property are on the north side of Echimamish river about one-quarter mile east of Pine River junction.

The geological information on the map accompanying this report is in part taken from manuscript map-material representing field work in 1932 by H.C. Horwood, and in part represents data collected by the writer in 1936. All directions mentioned in the report are astronomic; the magnetic declination is about 11 degrees east.

The writer was assisted in the field by J. Woolfenden and received courteous co-operation from J.E.R. Wood, manager of the Echimamish Gold property, and several prospectors.

The history of events leading to the intense prospecting and extensive staking in Echimamish area in 1936, according to Mr. J.W. Low of Norway House, and others, may be regarded as having commenced in 1925. In that year Mr. Morrison while returning along Hayes and Echimamish rivers from a prospecting trip collected from Painted Stone portage, for subsequent examination, a loose piece of rock in which he noticed some metallic mineral. This mineral was later identified as pyrite and an assay is said to have revealed the presence of gold in the specimen. In 1926 the ground around Painted Stone portage was staked and prospected, and samples of pyrite-bearing rock were blasted out and assayed for gold. The results have not been reported, but they are presumed by the writer's informants to have been negative. The activity at Painted Stone portage led to the staking by several parties of claims that extended progressively outward from the original stakings for a short distance east and a few miles west along the belt of schistose rocks. No discoveries of interest are known to have been made on the claims staked at this time and they were allowed to lapse.

Prospecting was carried on from time to time, by various individuals, in the belt of altered sedimentary and volcanic rocks extending westerly from the stakings and it is reported that in 1929 an Indian found gold-bearing sulphides in an outcrop on a creek about 9 miles west of Painted Stone portage; and in 1934 Mr. Herbert S. Cowen found visible gold in a small exposure of a quartz vein about 3 miles farther west near the shore of Birch lake. In 1935, he and associates found gold-bearing sulphide deposits east of Birch lake along Echimamish river and in the autumn of that year staked an extensive block of claims. In the spring of 1936 Mr. Stewart Reid while engaged in adjusting claim lines on the Cowen property discovered, in an outcrop of a few square feet, rock richly mineralized with zinc blende, galena, and chalcopyrite. A specimen of this rock is reported to have assayed 500 ounces of silver and 0.05 ounce of gold. The block of twenty-five claims, known as Echimamish Gold property, embracing this discovery and sulphide-bearing zones, was optioned to Mr. R.J. Jowsey in July 1936. Items regarding this discovery were published in the press and during the following few weeks numerous prospectors visited the area and claims were staked in an area extending over 20 miles.

GENERAL CHARACTER OF THE AREA

The surface of the area, with a local relief of 100 feet, is characterized by a succession of hummocky, glaciated, rocky hills and ridges rising from a swampy plain that is underlain, for the most part, by stratified sand and clay. In an east-west trending zone, varying in width from $\frac{1}{2}$ to at least 3 miles, and lying on either side of Echimamish river, there appears to have been a depression on the bedrock surface, for in this zone there are few rocky elevations projecting above the

drift plain. The rocky areas north and south of Echimamish river contain numerous lakes of various sizes and irregular shapes. The waters from the north drain into Echimamish river by streams flowing southeast, those from the south flow northeast into the main stream, and the drainage pattern formed by Echimamish river and its tributaries is such as would characterize a stream draining east, but the waters brought together in the river now flow with gentle current toward the west into Nelson river.

The hilly and well-drained part of the area is forested with second growth poplar, birch, and a variety of coniferous trees; the swamps and clay plains are sparsely forested and support a dense growth of small bushes. The area in the vicinity of the mineral finds has been fire-swept in recent years.

GENERAL GEOLOGY

Echimamish area is underlain by an assemblage of consolidated rocks of Archaean (Early Precambrian) age that have been classified by Horwood in two major groups, namely, Hayes River group, consisting chiefly of altered sediments and lavas, and a younger group of batholithic intrusives composed chiefly of granites.

Overlying the consolidated rocks are deposits of Pleistocene age.

Hayes River Group

West of Echimamish area, along the route, rocks representative of the Hayes River group are exposed at the High Rock on Nelson river and, as shown on The Pas sheet, they occur in a belt $\frac{3}{4}$ mile wide and about 8 miles long extending to the junction of Echimamish river. It is possible that this belt

continues farther toward the east-northeast in Echimamish River valley where there are few outcrops. The rocks in this narrow belt where observed by the writer consist of dark green and black, glistening hornblende schists. Near the shore of Hairy lake south of the inlet there is an outcrop about 500 feet in diameter of coarse-grained, red, biotite granite cutting a grey, granular rock of variable composition; part of this rock appears to be anorthosite, part is crystalline limestone. A specimen of the latter collected by the writer contained a grain of chalcopryrite surrounded by green copper stain in an area one-half inch in diameter. Adjacent to it on the north is an exposure of fissile, calcite-sericite schist.

In Echimamish area the Hayes River group occurs in a belt 20 miles long with widths ranging from $1\frac{1}{2}$ to 4 miles, and extends east and west along the valley of Echimamish river above the lower dam. This belt is part of a narrow belt that has been mapped easterly from Cross lake for a distance of 110 miles, with an average width of 2 miles. Between Birch lake and Pine lake the belt appears to widen where a tongue of these rocks extends northerly. This tongue has not been traced in the drift-covered area west of Lawford lake, and it is not known whether it connects with the narrow belt of schistose greenstone that occurs a few miles farther north at Fairy lake. About a mile east of the tongue it is reported that a mass of greenstones about $\frac{1}{4}$ mile wide and at least 1 mile long occurs.

The Hayes River group consists essentially of schistose and highly metamorphosed strata, and throughout the area underlain by these rocks are numerous small masses of hybrid rocks and intrusives that can be differentiated only on a large scale map. The strata along the northern part of the belt consist of an altered volcanic assemblage composed chiefly of massive and

schistose greenstones and ellipsoidal andesites, with interlayered groups of beds of schistose, stratified tuffs, greywacke, and banded iron formation. These rocks in a zone ranging in width from nearly 4 miles to a few hundred feet form half or more than half of the width of the belt on and west of Echimamish Gold property; farther east they form narrower parts of the belt and pinch out in the vicinity of Painted Stone portage. The largest development of iron formation known in the area is on claim 6937 near the south shore of Pine lake, where it is 40 feet wide and traceable for 1,000 feet. It consists of magnetite banded with chert or other highly siliceous rock that makes up the greater part of the volume.

The southern part of the belt adjacent to the altered lavas is underlain by altered, schistose sediments. Where least metamorphosed they are identifiable as thinly bedded greywackes and slates; the more extensively developed members are banded mica schists and hornblende schists. These rocks in a zone ranging in width from $\frac{1}{4}$ to $1\frac{1}{2}$ miles form the greater part of the belt at the east end of the area and are traceable westerly along the valley of Echimamish river with decreasing width toward the west.

West of Birch lake the northern part of the belt of Hayes River rocks has not been examined in detail, and though sediments have been reported along the north boundary it may be that they are part of the succession interlayered with lavas.

In an area about $\frac{1}{4}$ mile across and 1 mile or more in a northwest-southeast direction, separated by $\frac{1}{2}$ mile from the main belt of Hayes River rocks north of Pine lake, Mr. Nicholas Babi reports the occurrence of greenstones and interlayered sediments invaded by diorite and porphyry.

The rocks of the Hayes River group have been metamorphosed; some to a much greater extent than others. Along the northern side of the belt where the greenstone assemblage lies adjacent to batholithic intrusives the rocks are hornblende gneisses, diorite, and amphibolite intimately injected with dykes of quartz porphyry and granite. Along the southern side of the belt where sediments lie adjacent to batholithic intrusives the rocks are mica schists with lit-par-lit injections of granite and pegmatite, and banded porphyry and granite-gneisses. In some of the gneisses the schistose and granitic components of the rock are readily distinguishable, though too intimately intermixed to be separately mapped; in others the schist or original rock appears to have been pervaded by, and partly replaced with, granite-forming constituents, giving rise to a hybrid rock of uniform character in masses of considerable size.

Within the belt remote from the batholith contact the rocks in the volcanic assemblage commonly show alteration to chlorite schists. Garnets have been observed locally in both types. There are also within the belt at several widely distributed localities dykes and bosses of varying size of quartz porphyry and hornblende gabbro, and these minor intrusives are commonly adjoined or bordered by hybrid rocks of igneous aspect including porphyritized schist, felsitized schist, metadiorite, metaporphyrite with an anorthosite phase, and amphibolite. In some of the zones of felsitized schist that are intimately associated with quartz porphyry intrusives the rock has been locally mineralized with disseminated sulphides carrying gold and silver and is of economic interest.

The strata of the Hayes River group, where bedded, show steep dips to the south or are nearly vertical, and presumably the whole succession has been steeply folded. Areal mapping

across the belt shows that there is no recognizable repetition of strata that would admit of the interpretation of a major synclinal or anticlinal structure. The stratification in the sediments varies from place to place and the average strike throughout the greater part of the belt is a few degrees north of east; in the northern part of the belt in the vicinity of Birch lake the strike is northeast. At several places across the belt within a few miles east of Pine lake and north of Echimamish river it was found possible to interpret the attitude of the steeply folded sediments showing texture gradations, and ellipsoidal andesites; at all these places the stratigraphic top of the bed is toward the south. The phenomena suitable for making attitude determinations were not observed in the altered sediments south of Echimamish river. Available information indicates that the strata of the Hayes group in the belt of this area form part of a continuous succession, the older formations at the north with successively younger layers toward the south.

The strata of the Hayes River group have been rendered schistose in varying degrees at different places. In general the sedimentary members are more highly schistose than the greenstones; there are, however, zones up to several feet in width in which fissile schists have been developed with a foliation that in some places does, and in other places does not, coincide with the regional schistosity found in the adjacent rocks. The schistosity strike, in the principal outcrops observed, varies from place to place and throughout the greater part of the belt averages east and west, coinciding with the trend of the belt itself. In the northern part of the belt in an area near Birch lake the schistosity strike is northeast; east of Pine lake the schistosity strike is southeast, conforming

in both cases to the trend of the batholith contact nearby. The foliation in the zones of fissile schists strikes at various angles in different zones and is probably due to localized movements in the rocks that occurred subsequent to the development of regional schistosity.

The schistosity dip everywhere is at a steep angle and nearly vertical.

At several places in the area it was observed that the schistose planes cross the stratification of sediments at various angles up to 20 degrees. In the zones of fissile schists the schistosity strike, where observed, is a few degrees contraclockwise from that of the stratification; elsewhere the reverse angular relations were noted.

Faults with displacements up to a few feet were observed at several places. Faults with considerable, but unmeasured, displacements may be inferred in zones of fissile schists.

The Hayes River group is the oldest group of Archaean rocks recognized in this region in Manitoba. They are lithologically similar to Keewatin rocks in Ontario.

Intrusives

Adjoining the long, narrow belt of Hayes River strata on the north and south are extensive batholithic areas of granites and granite-gneisses. These rocks are for the most part medium-grained and massive; the foliation in the gneisses where observed is apparently due to inclusions of schistose country rock and has not been induced by pressure since the formation of the granitic constituents. Biotite granite predominates; and along the contact zone north of the Hayes River group hornblende granite, granodiorite occurs locally. Pink and grey varieties of granite occur with merging contacts in both the north and south parts of the area.

In addition to the batholithic intrusives there are relatively small masses of intrusive rock that are irregularly and widely distributed through the belt of ancient strata.

Dr. F.D. Shepherd reports the occurrence of granite in a small boss west of the lower part of Pine creek. The most abundant of the minor intrusives is a dark green, massive, granular rock of variable texture and composition consisting essentially of hornblende and plagioclase that has been referred to as hornblende gabbro and as diorite. No considerable area within the volcanic assemblage of this area is devoid of outcrops of these rocks, but as yet they have not been differentiated in mapping from the greenstones. Dioritic intrusives have been observed also in the sediments. Dykes of porphyry and quartz porphyry are widely distributed and are locally numerous; some of them are homogeneous between well-defined walls; others are heterogeneous, with quartz porphyry, porphyry, and pale grey felsite phases, with boundaries that in some places are sharply defined and at other places vague, due to silicification of the rock along the contact zone. The acidic dykes of composite lithological character are commonly accompanied by metamorphic rocks and locally by gold and silver-bearing sulphide replacement bodies.

Lamprophyre dykes were observed at a few localities. They include dark grey and dark green, fine-grained rocks in narrow dykes with sharply defined walls, except in the vicinity of dioritic masses. About 500 feet south of the dock at Echimamish Gold property a lamprophyre dyke 3 inches wide strikes east and west through contorted, banded hornblende schist. In the middle of the dyke is an isolated oval mass 3 inches by 1 inch in a section composed of grey, binary granite; a few inches west of this in the middle of the dyke are a few isolated grains, 1/6 inch in diameter, of feldspar; the rest of the dyke is of fine-

grained, massive, dark green rock. The origin of the granite mass in the lamprophyre is not fully understood.

The intrusive rocks have not been metamorphosed, though at some places they are intimately associated with metamorphic rocks formed presumably at the time of intrusion.

The intrusive rocks are essentially massive and where they contain inclusions or partly replaced masses of foliated country rock they show a foliated structure usually parallel to, or continuous with, that of the adjacent country rock.

All of the several intrusive rocks cut the strata with which they have been found in contact, and presumably all of the intrusives are younger than the rocks of the Hayes River group. The dioritic intrusives are locally cut by dykes of quartz porphyry. It is possible that all of the minor intrusives formed during the time of batholithic invasion, the basic intrusives marginal to, and above, the batholith being cut by later acidic differentiates.

Pleistocene

The area was overridden by continental glaciers during Pleistocene time. Erosion forms that can be attributed to their advance are prominent throughout the area; the solid rocks have been scoured to a fresh surface; the hills and ridges are characterized by smoothed, hummocky surfaces, with occasionally low cliffs on the lee side; chatter marks, grooves, and glacial striae recording the direction of the last advance or later advances have been observed at many places. All of the striae indicate movement in a southwesterly direction and the average of the several recorded directions is south 45 degrees west. There is a relatively thin deposit of glacial till found in irregular-shaped areas on the uplands, and it is probable that deposits of this sort are relatively thick in the lowlands. At

some places the till occurs overlying consolidated bedrock and presumably it occurs also in this position in the lowlands. Deposits of varved lake clays and silts occur in the lowlands adjacent to Echimamish river and on small, isolated plains observed within a mile of it to the north and south, and at elevations up to 30 feet above the upper part of the river. These deposits have been exposed in sections a few feet in thickness; they form continuous deposits many miles in length along the river valley and it is probable that they attain a thickness measurable in scores of feet. In pits dug on Echimamish Gold property it was observed that the bedding in the varved clay, for a thickness of several feet, undulates in a succession of folds. There are no stones in these disturbed beds, but above them is a deposit a few feet thick of boulder clay. At several places in the area glacial erratics were observed lying on stratified deposits.

When the ice retreated from this area a glacial lake formed, due, presumably, to the ponding of water along the margin of the ice-sheet. The former boundaries of glacial Lake Agassiz, as mapped by McInnes, extended beyond Echimamish area; and the lacustrine deposits in the area were presumably laid down in it. The present distribution of these deposits indicates that the floor of the lake at one time was approximately 30 feet higher than the elevation of the "divide" at Painted Stone portage between Echimamish and Hayes rivers, and that the lake extended beyond Echimamish River basin for some distance into Hayes River basin.

Following the deposition of varved clays in the lake in this area there was a readvance of the ice-sheet. The readvancing ice deposited the upper till sheet and folded or crumpled the varved clay deposits over which it rode. When the ice-sheet finally receded and the ponded waters at its margin began to give

place to the subsequently formed drainage system it is inferred from a study of the topography and the present drainage pattern that a river flowed easterly through the major depression now occupied by Echimamish and Hayes rivers. At that time the tributary streams incised their channels in the lacustrine silts and clays, those coming from the south brought their waters to the main stream in a northeasterly direction and those from the north in a southeasterly direction. It was presumably during the existence of this easterly flowing river that the present valley of the upper Echimamish river was incised and the drift deposits other than large boulders were swept away from the present site of Painted Stone portage, which would then be the site of a rapids and falls.

Subsequently the present drainage conditions were established, due probably to continental warping, the eastern part of the area rising somewhat higher than the west, and the upper stretches of both Hayes and Echimamish rivers assuming the character of lakes in the river channel that had been incised. Part of the water ponded west of Painted Stone portage still finds its way easterly into Hayes river, but the flow of the greater part has been reversed toward the west.

ECONOMIC GEOLOGY

General Statement

In reports by officers of the Geological Survey, published in 1910 and 1913, mention was made of the belt of the Hayes River group of rocks in Echimamish area, and from experience gained in areas of similar rocks elsewhere in Canada the opinion was expressed that this belt afforded a promising field for the search for valuable minerals.

The results of recent prospecting have disclosed the occurrence of precious metals in deposits of two types; (2) gold-bearing quartz veins, and (b) sulphide replacements in felsitized zones. Both types of deposits are found in the area underlain by altered strata of the Hayes River group and in the vicinity of dykes and small bodies of intrusive rocks. The principal occurrences are in the relatively wide part of the belt and along its northern part where altered lavas occur. In the marginal zones of the belt adjacent to batholithic intrusives, within which crystalline schists and gneisses occur, there are pegmatite dykes and also numerous quartz veins that appear to be unmineralized, and are not known to carry precious metals.

Near the east shore of Birch lake, about 2 miles north of Echimamish river, a quartz vein containing visible gold was discovered by Mr. Herbert S. Cowen; and by September 1936 it had been discontinuously traced in a narrow, felsitized zone through andesite and chlorite schist for about 400 feet, in which distance its width varies from a fraction of an inch up to 4 feet. At several places in the belt, between $1\frac{1}{2}$ and 5 miles east of Birch lake and north of Echimamish river, gold and silver occurrences have been found in sulphide-bearing felsitized zones. The felsitized zones are tabular bodies, of various widths up to several yards, and lengths up to thousands of feet, standing in nearly vertical attitudes. At some places they occur in beds of steeply inclined, schistose sediments and at other places follow schistose shear zones that do not coincide with the structure of the enclosing strata. They are of composite lithological character and consist chiefly of felsite with which are intimately associated masses, with poorly defined boundaries, of quartz porphyry and siliceous replacement bodies, in all of which there are, at places, inclusions of sericite and chlorite schist and rarely hornblende schist and amphibolite.

The felsitized zones are irregularly mineralized with disseminated grains, and seamlets up to $\frac{1}{10}$ inch wide, of either pyrrhotite, chalcopyrite, arsenopyrite, pyrite, or a combination of some or all of them. Locally, sphalerite occurs in siliceous replacement bodies that appear to have been formed somewhat later than the previously mentioned minerals. In one of the felsitized zones, in an area 10 feet long and with an average width of 6 inches, there is a lenticular replacement body of sphalerite with intimately associated galena, chalcopyrite, jamesonite, and freibergite. A sample of this material contained silver at the rate of 200 ounces to the ton and gold 1 ounce to the ton; this association of minerals has not been found previously in the region. Subsequent drilling operations revealed the occurrence of this unusual association of sulphides to a depth of 88 feet beneath the surface exposure, and available information suggests that it may occur in the form of an irregularly bounded pipe.

The sulphide deposits are integral parts of hybrid rocks of composite lithological character, the schistose components of which are identified as remnants of the original country rock, and the felsite, quartz, and sulphides are believed to have been introduced by magmatic solutions rising from a deep-seated source and to have been emplaced by a process of metasomatic replacement. At some localities small bodies of quartz porphyry occur in the mineralized felsitized zones. Where they are present it seems probable that the magmatic emanations that brought about the sulphide replacements were related in origin to the quartz porphyry intrusives, and that the latter rocks are probably apophyses from large granitic bodies that at depth may be continuous with the granite batholiths of the region. The relatively wide and sharp-walled dykes of quartz porphyry that have been observed well within the belt of ancient schists are characteristically barren and with no sulphides adjacent to

their walls. It seems probable to the writer that these dykes have been truncated and exposed at the present erosion surface at great depth below their original upper termination. The relatively small masses of quartz porphyry and the accompanying feldspar and replacement bodies, on the other hand, may be regarded as dykes that have been truncated near their apex. The magmatic emanations rising along the dyke channels from a differentiating magma at depth presumably changed in composition during the period of intrusion, the earlier mineralized solutions depositing disseminated sulphides and later solutions causing localized replacements with distinctive minerals carrying notable concentrations of gold and silver.

The gold-bearing quartz veins are fissure fillings, with materials presumably derived, as an end product of differentiation, from a granitic magma at depth.

Both the sulphide deposits and the gold-bearing quartz veins are of primary magmatic origin, and there is no indication of secondary concentrations of minerals in them. Subsequent to the time of their emplacement the rocks of the area have not been structurally deformed. It is inferred, therefore, that the mineralized bodies found at the surface extend downward to considerable depth.

The mineralized area is in the initial stage of exploratory development, and a considerable part has yet to be prospected. Exploratory development, including systematic drilling, sampling, and assaying, was conducted on the Echimamish Gold property. By the end of September 1936 available information regarding the distribution and richness of the precious metal content in the deposits was insufficient to indicate the presence of ore-bodies of commercial value in any of them, but it is possible that deposits of gold ore occur in the area.

Properties

Sungod

The Sungod group of twelve claims is in an area about $1\frac{1}{4}$ miles east and west by $\frac{3}{4}$ mile north and south, and crossed by Echimamish river between $\frac{1}{2}$ mile and $1\frac{1}{2}$ miles above the lower dam. The group was staked during the summer of 1936 and is owned by J.W. Low, Norway House, and associates. Exploratory work on the property during the summer included the sinking of a test pit on a zone of rust-stained, fissile schists.

The property is underlain by altered lavas and sediments striking east and west and dipping steeply south, and intrusive dykes of quartz porphyry. It is reported that on the most northeasterly claim of the group a dyke of quartz porphyry 50 feet wide has intruded the sediments parallel to the bedding at a place about 100 feet south of their contact with lavas. The sediments in a zone several yards wide adjacent on the north side of this dyke have been altered to sericite schist and are rust-stained at the surface. A pit marked 1 on the map was sunk in this rust-stained schist to a depth of 9 feet. It is probable, as in the case of other zones of rust-stained schists in this area, that iron sulphides, possibly accompanied by other metallic minerals, may occur in the rock beneath the rusty weathering material near the surface. East of the pit there is a drift-filled depression a few hundred feet wide in which there is an inferred fault. The lavas and sediments east of this depression appear to have been offset to the south a hundred feet or more; and on the lava outcrop that rises on the west side of the depression a zone of fissile chlorite schist strikes north and south and dips vertically.

Pine Lake Gold Mines, Limited

The property of Pine Lake Gold Mines, Limited, includes four blocks of claims as follows: Birch No. 2 group (three claims); O'Day group (eight claims); Pine Lake group, including seven of the originally staked Echimamish Gold claims and ten subsequently staked, adjacent claims marked Beaver Dam (seventeen claims); and the Selkirk-Mackenzie group (nineteen claims).

Birch No. 2

Birch No. 2 group embraces an area at the junction of Halfway creek and Echimamish river; two of the claims are adjacent to and south of the river and one is north.

The greater part of the area is drift-covered. A few exposures of rocks of the Hayes River group were observed. No features of economic interest have been reported.

O'Day

The O'Day group of eight claims embraces the east bay of Birch lake and an adjoining area north and east of it. The property is accessible from Echimamish river by an unobstructed canoe route leading up Halfway creek.

In 1934 Mr. H.S. Cowen discovered gold in a small exposure on a quartz vein, one-eighth mile northeast of the east bay of Birch lake. The property was staked by Mr. Cowen and in 1936 acquired by Pine Lake Gold Mines, Limited.

In 1936, the vein marked 2 on map, adjacent to the discovery was exposed in a stripping 90 feet long, and about 100 feet east of this stripping an extension of the vein was found and discontinuously traced. The reported total length is approximately 400 feet.

The claims in the vicinity of the vein are underlain by massive greenstone or andesite, lenticular masses of amphibolite and metadiorite, and chlorite schist. The general strike of the schistosity is north 45 degrees east and the dip is vertical. Locally the schists have been bent and show drag-fold structures.

Through this assemblage of rocks there is a zone up to 4 feet wide striking north 82 degrees east and dipping 85 degrees south, composed of fissile calcite-chlorite schist locally replaced by nodular aggregates of epidote and fine-grained feldspathic material and sparingly mineralized with disseminated grains of arsenopyrite. Within this zone, and locally occupying the greater part of its width, is a lenticular quartz vein varying in width from a fraction of an inch to 4 feet, composed of finely granular, white and blue quartz. The blue quartz over a length of at least 20 feet is visibly mineralized with grains of gold up to $\frac{1}{20}$ inch in diameter. At some places along the vein there are platy inclusions of chloritic schist in the quartz, and the rock in and near these inclusions contains sparsely disseminated grains of arsenopyrite, pyrrhotite, and chalcopyrite.

A channel sample taken across the vein where it is 4 feet wide is reported to have shown upon assay gold at the rate of 2.25 ounces to the ton.

On the shore of Birch lake where the trail leading to locality 2 (See Map) starts, there is an outcrop of schistose andesite in which there is, naturally exposed, a composite quartz vein. It strikes north 45 degrees east and dips vertically, conforming to the schistosity of the enclosing rock; and its average width is 3 feet over a length of 60 feet. The quartz in this vein resembles that in the vein at locality 2; no metallic minerals, however, were observed in it.

Pine Lake

Pine Lake group includes seven of the originally staked Echimamish Gold group of claims extending north, with a width of about one-half mile, from Echimamish river and embracing the lower part of Pine creek, and also ten adjacent claims, marked

Beaver Dam, extending north to, and west of, Pine lake.

During 1936 test pitting and stripping were done on several mineralized, felsitized zones.

The property is underlain by altered volcanic rocks and intercalated groups of beds of stratified tuffs. These rocks are intruded by small masses of diorite and by dykes of quartz porphyry and felsite. Silicified schists, at some places associated with dykes, are locally mineralized with sulphide replacement bodies.

Near the middle of claim 6274 (Locality 3 on Map) a zone of silicified hornblende schist exposed for a width of 10 feet and a length of a few yards, striking east and west, contains several, irregular-shaped replacement bodies, a few inches wide and a few feet long, of quartz and disseminated grains of pyrite, pyrrhotite, and chalcopyrite.

About 350 feet northwest from this locality (4 on Map) a quartz porphyry dyke 36 feet wide has intruded, parallel to the stratification, beds of tuff, striking east-west and dipping vertically, that are adjoined on the north and south by greenstones. The tuffs adjacent to both walls of the dyke have been felsitized in zones varying from 4 to 7 feet wide that have been stripped for 80 feet. Parts of the felsitized zone along the south wall, in widths up to 2 feet, contain nodules up to 1 inch diameter of pyrite showing radial fibrous structure and disseminated grains of pyrrhotite, chalcopyrite, and arsenopyrite. It is reported that gold has been panned from mineralized rock at this locality. The felsitized zone north of the dyke is traversed by a few veinlets one-tenth inch wide of quartz containing pyrrhotite.

About one-quarter mile west of this occurrence, (Locality 5 on Map) on claim 6285, pits have been sunk in a zone of fissile chlorite schist, striking east-west and dipping vertically, bordered by masses of ellipsoidal andesite. Along the

central part of the schist zone is a replacement body of quartz 3 feet wide and at least 20 feet long, bordered on either side for a width of 2 feet by grey, silicified, sericite-chlorite schist. The quartz body contains nodules up to 1 inch in diameter of pyrite with radially oriented crystalline structure, and also small amounts of pyrrhotite and chalcopyrite and at one place zinc blonde.

North of the previously mentioned 36-foot dyke at intervals of about 500 feet (Localities 6, 7, 8, on Map) are three east-west trending zones, up to 10 feet wide, in which sulphides have been found. The most southerly of these as exposed in two shallow pits consists of felsitized tuff abundantly mineralized with disseminated acicular crystals of arsenopyrite.

Solkirk-Mackenzie

The Solkirk-Mackenzie group of nineteen claims embraces the area about 2 miles east and west by $\frac{3}{4}$ mile north and south around Nightowl lake and farther east, on both sides of Echimamish river.

The claims are underlain by rocks of the Hayes River group and small bodies of intrusive rocks. No mineral occurrences have been reported.

Birch

The Birch property includes a group of nine claims on Birch lake. It lies between 1 and 2 miles north of Echimamish river, and is accessible from this river by an unobstructed canoe route leading up Halfway or Birch creek. The property, owned by A.S. Bellingham and associates, was staked in 1936, and by September a small amount of stripping had been done.

On the west headland of the southeast bay of the lake, (Locality 9 on Map) about 200 feet south of Witness post No. 1 of Birch No. 1 (7036) schistose ellipsoidal andesite is cut by

two quartz veins that are 5 feet apart at the lake shore. The northwesterly vein is 1 foot wide and strikes in conformity with the regional foliation of the rocks, north 45 degrees east, and dips vertically. The southeasterly vein is $1\frac{1}{2}$ feet wide, and strikes north 63 degrees east, and dips vertically. Both veins can be traced on land that rises only 1 foot above lake-level in a southwesterly direction from the shore for a distance of 10 feet. The position of their probable further extension and junction is concealed by drift in a narrow depression. The veins consist of white and blue, finely crystalline quartz containing, locally, platy inclusions of silicified chlorite schist and are mineralized with small amounts of disseminated pyrrhotite and chalcopyrite. Mr. H.S. Cowen reports that gold has been observed in these veins. A representative sample taken across the southeasterly vein showed upon assay by the Bureau of Mines, Ottawa: gold, trace; silver, trace.

Contact

The Contact property consists of a group of seventeen claims. It adjoins the O'Day group on the southeast and extends south for $1\frac{1}{2}$ miles to Echimamish river and east along the river valley for $1\frac{3}{4}$ miles.

The claims were staked in 1936 for Dr. McGregor, H.T. Hurley, H.M. Shortt, and Fred Johnson. During the summer exploratory work was carried on under the direction of H.M. Paull.

On the west side of the portage to Paull lake there is a cliff 40 feet high composed of amphibolite. On the cliff face 450 feet north of Echimamish river prospecting has been done (Locality 10 on Map) on a natural exposure of a composite vein 8 feet wide striking north 80 degrees east and dipping vertically. The composite vein is made up of interlacing veinlets, $\frac{1}{2}$ inch to 4 inches wide making up a total width of 1 foot, of blue and white quartz, both fine- and coarse-grained, and a small amount of

calcite. The quartz is sparingly mineralized with pyrrhotite. The vein is traceable for only a few feet on the high land above the cliff, and drift conceals its extension. About 250 feet north of the vein there is a porphyry dyke 15 feet wide striking east and west, no mineralization was observed in or adjacent to it.

On claim 6906 on the right bank of Echimamish river, about 100 yards southeast of the submerged dam at the bend, an outcrop of porphyry contains segregations of quartz and veinlets of quartz and calcite. No metallic minerals were observed. Eighty feet east of this exposure, (Locality 11 on Map) a zone 15 feet wide of fissile, calcite-chlorite schist, striking north 70 degrees east and dipping vertically, is exposed in a pit south of an outcrop of porphyry. A zone a few feet wide in the schist is rust-stained. Checked assays taken from the rock at this locality are reported by Mr. Paull to have shown no gold content.

Northeast of Paull lake (Locality 12 on Map), on claim 6917, it is reported that in a layer of stratified tuffs a felsitized zone 10 feet wide strikes east and west and dips vertically. Within the felsitized zone highly siliceous replacement bodies, rust-stained and presumably mineralized with sulphides, occur.

Russet

The Russet property consists of eighteen claims, which were staked in 1936 and are owned by Eldon L. Brown and associates. Six of the claims are in a block west of the Contact group, and twelve are east of this group in the area between Paull and Pine lakes. Some stripping, trenching, and test pitting were done on mineralized, felsitized zones that were discovered on the eastern block of claims.

The property is underlain by andesite that locally shows ellipsoidal structure, and intercalated groups of beds of

stratified tuffs, and at one locality near the south shore of Pine lake there is a belt of banded iron formation up to 40 feet wide, traceable for 1,000 feet. These rocks have been intruded by small masses of diorite and dykes of quartz porphyry. Felsitized zones occur associated with the latter at two localities, in beds of stratified tuffs.

The principal felsitized zone (Locality 13 on Map) is reported to have been found in an outcrop near the southeast end of Henderson lake and to have been traced discontinuously east for nearly $\frac{3}{4}$ mile across claims 6923, 6931, and 6935. At the western end near the lake it is said to be 12 feet wide, about 1,000 feet east the width observed by the writer is 27 feet, and at the most easterly exposure it is said to be 5 feet wide. The rocks in the felsitized zone are locally rust stained in irregular-shaped areas on the surface, and at a few places where pits have been blasted small amounts of pyrite, pyrrhotite, chalcopyrite, and arsenopyrite have been found, in grains disseminated through the rock. In a pit 235 feet south of No. 1 post of claim 6923 the writer observed a few grains of zinc blende in a small replacement body of quartz within the felsitized zone. Zinc blende is reported by Mr. N. Babiy as occurring also at the most easterly exposure on this zone in claims 6935.

A second felsitized zone (Locality 14 on Map) is reported as occurring in claim 6923 about 800 feet south of that previously described. It is said to strike east and west and dip vertically.

No occurrences of gold have been reported on this property.

MacDonald

The MacDonald group of six claims, staked in 1936 by J. MacDonald, embraces a rectangular area about one-half mile north and south by three-quarters of a mile east and west,

lying south of the eastern claims of the Russet group and north of Echimamish river.

The property is underlain by altered strata of the Hayes River group and by small bodies of intrusive rocks.

No information was obtained by the writer regarding the results of prospecting on these claims.

Stella

The Stella group of four claims adjoins on the south the eastern part of the Contact group, and embraces an area north and south of Echimamish river. The property, staked in 1936, is owned by George C.M. Collins of Norway House. A small amount of test pitting and stripping was done on a sulphide-bearing zone (Locality 15 on Map) found by M. Ulland 500 feet south from a point on Echimamish river 1 mile below the junction of Pine creek.

A zone of sediments altered to hornblende and biotite schist, striking east and west and dipping 85 degrees to the south, is intruded by pink hornblende-biotite gneiss and grey felsite in lenses up to a foot wide and several yards long. The schists, 3 feet wide, lying between pegmatite and felsite, are cut by quartz veinlets mineralized with pyrite in disseminated grains and in seamlets up to $\frac{1}{10}$ inch wide. Chalcopyrite is reported to have been found in this locality. Thirty feet easterly from this occurrence an exposure 2 feet wide of rust-stained, silicified mica schist carries disseminated grains of arsenopyrite in small amounts.

Echimamish Gold

The group of thirty-two claims recorded on the mineral claims blue print as Echimamish Gold occupies an area up to 1 mile north and south, by $2\frac{1}{2}$ miles east and west, along the valley

of Echimamish river, the greater part of the area lying on the north side. These claims were staked in 1935 by Herbert S. Cowen and associates. In 1936, twenty-five of the claims, forming the eastern part of the block, were optioned to Robert J. Jowsey and associates and have been referred to distinctively as the Echimamish Gold group; the remaining seven form part of the property held by Pine Lake Gold Mines, Limited.

Prior to 1936 sulphide replacement bodies carrying gold were discovered by H.S. Cowen on the Echimamish Gold group.

In the spring of 1936, after the claims had been staked, a discovery was made by Stuart Reid on claim 6277 of a mineral occurrence rich in zinc blende and galena, which upon analysis was found to carry high values in silver and a notable amount of gold. In July 1936, after the property had been taken under option by R.J. Jowsey and associates, a systematic exploration of the deposits, including a diamond drilling program, commenced under the management of J.E.R. Wood. In this work fourteen men were engaged in addition to a crew of five diamond drillers. A fully equipped assay plant in charge of J.W. Anderson was installed by September 9 and a radio station established.

In mid-September the principal development work accomplished was as follows:

On claim 6273 test pitting and stripping over a distance of 300 feet along a quartz vein; test pitting and stripping over a distance of one-quarter mile extending easterly into claim 6270 along felsitized zone A.

On claims 6268, 6269, 6266, and 6264 test pitting and stripping over a distance of 2,000 feet along felsitized zone B, also referred to as the main break.

On claim 6267 and 250 feet north of the east end of zone B test pitting and stripping over a distance of 450 feet along felsitized zone C.

On claim 6267 and 450 feet north of the east end of trench 15 test pitting and stripping over a length of 200 feet along felsitized zone D.

On claim 6277 test pitting and stripping over 1,000 feet along felsitized zone E.

Along the felsitized zone B eleven diamond drill holes were bored to an aggregate depth of 1,780 feet.

Along the felsitized zone E eight diamond drill holes were bored to an aggregate depth of 593 feet, and on September 20 the operation was being continued along this zone.

The property is underlain by a succession of altered lavas and sediments with a general east strike and a dip of 85 degrees to the south. The groups of beds of sediments predominate in the southern part of the area and the volcanic members are more abundant on the northern part of the property, which lies north of Echimamish river. The effects of regional contact metamorphism are to be seen throughout the belt of strata and become progressively more prominent as the batholithic intrusions of granite-gneiss are approached that lie short distances both north and south beyond the property. Throughout the zone of strata, at irregularly spaced intervals, a variety of minor intrusives and hybrid rocks of the following types occur; diorite and metadiorite, anorthosite and metaporphyry, quartz porphyry and felsitized schists, and lamprophyre dykes.

These several types of rocks occur at some localities singly, intruding or invading the ancient strata, at several localities two or more are intimately associated, and in the vicinity of silver-bearing lead-zinc concentration, on claim 6277 all of them are represented within an area of a few hundred square yards. All of these minor intrusives are regarded as being of the same geological age, the same as that of the intrusive batholithic masses of granite.

Zone A (Locality 16 on Map)

The most easterly exposure on zone A is in a pit on claim 6270 in which a zone of felsite, 4 foot wide, striking south 60 degrees east and dipping vertically, has partly replaced chloritic schists lying between exposures of ellipsoidal andesite. Within the felsite zone, distributed over a width of between 1 foot and 18 inches, there is a swarm of narrow lenses of blue quartz, which with the adjacent rock are sparingly mineralized with disseminated pyrite, pyrrhotite, and arsenopyrite. An assay of a sample taken across a width of 3 feet is reported to have shown gold to the value of \$21 to the ton. This felsitized zone has been traced in a succession of nine pits and strippings for a distance of one-quarter mile on to claim 6273 where, at some places, it can be observed that the felsitization of the rock has been less complete and that the residual rock in the schistose zone is thinly stratified tuff varying in width from 4 to 6 feet. At some places the felsite extends beyond the tuff zone into the adjacent andesite, in general it varies but little from its average width of 4 feet throughout the exposed length. The mineralization of the rock revealed by rust stains on the weathered surface varies in intensity and width from place to place. It consists of the same assemblage of minerals where exposed in the several test pits, namely, pyrite, pyrrhotite, and arsenopyrite.

Zone B (Locality 17 on Map)

Felsitized zone B occurs one-quarter mile north of Echimamish river along the boundary line between claims 6266 and 6264, and its westerly extension continues into the adjacent claims 6269 and 6268. It strikes south 80 degrees east, dips 85 degrees south, and has been traced for a length of 1,800 feet, with an average width of about 20 feet. On the surface it has

been exposed in twelve trenches distributed over a length of 1,320 feet, and it has been explored at depth by eleven diamond drill holes drilled from the south at an angle of 45 degrees. The felsitized zone consists of a composite assemblage of; quartz porphyry, felsite, felsitized tuffs and lavas, quartz replacement bodies, and quartz veins, in all of which platy inclusions of sericite, chlorite, and hornblende schists occur locally. The regional strike of the sediments that are interbanded with lavas in this vicinity is north 88 degrees east. The felsitized zone with its inclusions of highly schistose material striking across this structure at an angle of about 12 degrees is evidently following an old fault zone along which the porphyry, felsite and accompanying quartz have been introduced.

The surface of the felsitized zone is rust stained at many places and the underlying rock, where exposed in trenches, is mineralized in a succession of bands of variable widths ranging from a few inches to several feet and having an aggregate width along the zone of approximately 10 feet with disseminated pyrite, pyrrhotite, and arsenopyrite.

The surface of the felsitized zone is irregularly banded with rust stains ranging in width from a few inches to several feet and having an aggregate average width, throughout the zone as exposed, of approximately 10 feet. The rock beneath the rust stains, as exposed in pits, is irregularly mineralized with disseminated grains of pyrite, pyrrhotite, and arsenopyrite, and locally small amounts of chalcopyrite. At a depth of 80 feet, where penetrated by drill hole No. 7, the felsite and sericite schists carrying disseminated grains of pyrite, as displayed for a length of a few inches in the core, are netted with narrow seamlets of zinc blende. It is reported that assays indicate low values in gold to be widely distributed through the mineralized

part of this zone, and that a relatively high concentration of gold occurs in the rock mineralized with zinc blende.

Zone C (Locality 18 on Map)

On claims 6267 and 6266, 250 feet north of their southern boundary, test pitting and stripping over a distance of 450 feet have revealed a mineralized felsitized zone with an average width of 13 feet striking south 80 degrees east and dipping 85 degrees south. The section from north to south across trench No. 15 where the mineralization is most prominently exposed is, as follows: andesite, 2 feet; stratified tuff invaded by felsite and in part replaced by fine-grained quartz, and locally cut by a network of quartz veinlets $\frac{1}{4}$ inch wide spaced from 1 to 3 inches apart, carrying finely disseminated pyrite and pyrrhotite and bordered in a zone $\frac{1}{4}$ inch wide by rosettes of muscovite, 16 feet (within this zone 12 feet south of its north end there is a 3-inch quartz vein containing pyrite, pyrrhotite, chalcopyrite, and arsenopyrite; through the sericite schist 6 inches wide to the north of it there is disseminated arsenopyrite and a seamlet $\frac{1}{4}$ inch wide and 3 inches long of sphalerite); andesite, 3 feet; stratified tuff, 2 feet; chlorite schist, 4 feet (this is cut by a vein of quartz 6 inches wide). The schistose rocks and veins exposed in this trench strike south 71 degrees east and dip 85 degrees southerly. At a trench 300 feet east of trench 15 arsenopyrite and zinc blende in small amounts are reported. No information is available regarding the gold values along this zone.

Zone D (Locality 19 on Map)

Felsitized zone D, locality marked 19 on map, is 450 feet north of zone C.

A dyke of quartz porphyry 9 feet wide, striking south 64 degrees east and dipping vertically, is bordered for a length

of 200 feet along both walls by felsitized zones and siliceous replacement bodies, with an aggregate width of 4 feet, that replace the locally schistose, ellipsoidal andesite, country rock. Irregularly distributed through the felsitized zones are several lenses up to 1 inch wide and 1 foot long of blue quartz. The quartz lenses and other siliceous rocks are sparingly mineralized with pyrite. It was not known at the time of examination whether the mineralized rock contained precious metals.

Zone E (Locality 20 on Map)

The west end of felsitized zone E is 1,100 feet north 80 degrees east from the east end of zone C, and is in the southwest part of claim 6277. The zone strikes south 75 degrees east and dips 85 degrees south. It has been traced by stripping and trenching over a distance of 1,000 feet and has an average width of 10 feet.

It is in this zone that the greatest concentration of precious metals has been found on this property. The rocks at this locality, Figure 1, include a group of beds of stratified tuffs with an average width of 5 feet, lying between layers of andesite and ellipsoidal andesite. North of the stratified tuff about 50 feet there is a dyke of quartz porphyry striking approximately south 75 degrees east and dipping 85 degrees southerly, averaging 5 feet wide and at one locality expanding to a width of 15 feet with a salient towards the south. This dyke is bordered by metaporphry in zones about 5 feet wide, and this rock and the adjoining ellipsoidal andesite are cut by dykes up to 1 foot wide of lamprophyre striking southeasterly. In the andesite between the quartz porphyry and the stratified tuffs there is also a lenticular mass of anorthosite about 10 feet wide and at least 50 feet long.

The tuffs have been differentially replaced by a composite group of rocks with gradational boundaries, including quartz porphyry, porphyry, and felsite, referred to collectively as the felsitized zone.

Locally the felsitized zone expands to a width of 15 feet and includes the zone of schistose lava 10 feet wide adjacent on the north to the schistose tuffs. Within the felsitized zone there are shreds and irregular-shaped masses up to 10 feet long and 4 feet wide in which the unreplaced schist is plainly discernible, showing a general schistosity strike of north 80 degrees east and vertical dip. Drag-folds in this schistose material are of the type of the letter S reversed. The fracture cleavage within the felsitized zone is along planes following the trace of the partly replaced schists; the strike of which varies between north 50 degrees east and north 80 degrees east, and also crosses in a direction south 35 degrees east. Lenticular quartz veins, up to a few inches wide and a few feet long, occur at intervals through the less completely replaced part of the felsitized zone, striking parallel to the planes of the included schists. The included schists, varying in colour from white to dark green, consist chiefly of sericite and chlorite.

Metallic minerals occur in the felsitized zone in replacement bodies, and also locally in disseminated form in some of the narrow quartz veinlets. Their presence is revealed on the weathered surface by a rust stain. The greater part of the felsitized zone is barren. In seamlets up to an inch or two wide scattered at irregular intervals and following closely the positions of schist inclusions, finely disseminated grains of pyrrhotite, arsenopyrite, and a small amount of pyrite occur, and within an area 12 feet long and 4 feet wide where contorted sericite schists appear as inclusions in the felsite there is in

addition to these minerals a system of intersecting lenticular replacement bodies, a few inches wide and a few feet long, consisting of an intimate association of finely crystalline zinc blende, galena, chalcopyrite, jamesonite, and freibergite, containing blebs of blue quartz. The terminations of the lenticular bodies are commonly followed in alinement by veinlets of blue quartz; one such veinlet 3 inches wide and 8 feet long contains, at a point 10 feet west of the main sulphide concentration, a few grains of galena. The diamond drilling operations have shown the apparent downward extension of the zinc blende and associated minerals in concentrations a few inches wide at depths of 19, 38, and 65 feet below the surface and alined beneath the surface showing along a plane dipping 85 degrees south. In drill hole No. 19 an additional occurrence of similar material was encountered about 40 feet deeper in the hole lying to the north and at a depth of approximately 88 feet below the surface.

In the diamond drill cores the writer found it impossible to recognize the position of the stratified tuffs as distinct from the andesite where replaced by felsite. It is possible that the occurrences of zinc and associated sulphides that are alined and dipping south 85 degrees beneath the surface exposure are in the zone of replaced tuffs. The deeper occurrence, however, is in felsitized andesite in a zone that locally carries thin streaks charged with disseminated, fine-grained arsenopyrite.

Assays taken from this zone are said to have revealed the presence of concentrations of precious metals; silver at the rate of several hundred ounces to the ton, and gold up to over 1 ounce to the ton in material including the concentrations of zinc blende, galena, chalcopyrite, jamesonite, and freibergite. The identification of jamesonite and freibergite was made by H.V. Ellsworth of the Geological Survey.

On claim 6273 (Locality 21 on Map) there is a quartz vein striking north 73 degrees east and dipping vertically through andesite adjacent to a quartz porphyry dyke 15 feet wide. The vein has been followed for a distance of 132 feet in a succession of pinches and swells with a maximum width of 2 feet. It consists of white and blue quartz and contains locally finely disseminated pyrite and chalcopyrite in small amounts. On the same claim about 500 feet west of the west end of this vein a lenticular quartz vein 5 feet wide and 35 feet long strikes south 20 degrees east and dips 80 degrees easterly, cutting andesite on the south side of a quartz porphyry dyke. The vein itself consists of fine-grained, sugary quartz; the silicified hornblende schist adjacent to it in a zone up to 6 inches wide is mineralized with disseminated pyrite and arsenopyrite. No gold has been reported at this locality.

Maple Leaf

The Maple Leaf group of nine claims is in an area about $1\frac{1}{4}$ miles east and west and $\frac{1}{2}$ mile north and south, and adjoins Echimamish Gold property on the north. It was staked in 1936 and is owned by J. Gordon Reahil.

The property is underlain by altered volcanic and sedimentary rocks of the Hayes River group, by small bodies of dioritic rocks, and by dykes of quartz porphyry.

On claim 6959 and about one-quarter mile west of the south bay of Loon lake (Locality 22 on Map) an exposure of andesite is cut by a dyke-like mass with an average width of 3 feet of felsite, the western part of which may be traced north for 10 feet and thence around a sharp bend and west for 20 feet to a rounded termination. Adjacent to this western termination of the felsite and along its northern side there is a lenticular replacement body

3 feet long and $1\frac{1}{2}$ feet wide of quartz, bordered in part by hornblende schist, and mineralized with disseminated grains of arsenopyrite, pyrite, and pyrrhotite.

Delo-Porcupine

The Delo-Porcupine Trust's property embraces two groups of claims: the C.C. group of nine claims in an area about $\frac{3}{4}$ mile by $\frac{5}{4}$ mile lying adjacent to and north of the Maple Leaf group, and the Delo group of nine claims in an area 2 miles east and west by $\frac{1}{2}$ mile north and south, north of the upper dam on Echimamish river and between $3\frac{1}{2}$ and $5\frac{1}{2}$ miles west of Painted Stone portage.

The C.C. group is underlain in its northeastern quarter by granite intrusives and elsewhere by strata of the Hayes River group and minor intrusives.

On claim 7053 (Locality 23 on Map), near the middle of the west boundary, J. Arnold Hughes reports that in 1936 he found at the site of a discovery of gold-bearing sulphides made by an Indian in 1929 a zone of siliceous, massive hornblende-bearing rock 3 feet wide. The zone, which is traceable for 100 feet in an east-west direction, contains long, narrow lenses, up to 3 inches wide, of rust-stained rock mineralized with disseminated grains of pyrrhotite, chalcopyrite, and arsenopyrite. This mineralized zone is bordered on the south by schistose andesite and on the north by massive diorite. Dykes of quartz porphyry are exposed east of the occurrence.

The Delo group is underlain in its northern part by granite and in its southern part by strata of the Hayes River group and minor intrusives.

On claim 7063, near the southeast corner of the group (Locality 24 on Map), a series of quartz lenses up to 4 inches wide occur in a zone 4 feet wide of banded, greenstone schist striking east and west and dipping vertically, which has been

exposed by a pit and stripping for a length of a few yards. Pyrite occurs sparingly in the quartz and the adjacent schist.

Low-Healy

The Low-Healy group of eight claims embraces an area about 1 mile east and west by $\frac{1}{2}$ mile north and south, lying on both sides of Echimamish river in the vicinity of the bend north of the upper dam. It is owned by J.W. Low, T. Healy, and associates.

The property is underlain by rocks of the Hayes River group and minor intrusives.

On a rocky knoll, rising from a clay plain, about 700 feet north of the river on claim 7022 (Locality 25 on Map), a mass of andesite and chlorite schist is cut parallel to the schistosity by a swarm of dykes of quartz porphyry and felsite varying in width from 1 foot to 12 feet, striking south 80 degrees east and dipping steeply south. Some of the dykes have sharply defined boundaries, others merge into marginal hybrid rocks of various textures and compositions that commonly contain some hornblende and epidote. In all of these several rocks there are lenses of quartz up to a few inches wide and a few feet long. Crossing this complex assemblage of rocks, as exposed by natural outcrop and stripping, numerous rust-stained patches and streaks of irregular size and shape and varying intensity are to be seen in an area extending 96 feet north from the south end of the knoll and for 50 feet west of its eastern margin. Rust-stained rocks occur also 350 feet farther west beyond a drift-covered area. In a part of the rust-stained area 12 feet square where a fresh surface had been made accessible for examination it was observed that felsite, hybrid rocks, and schists are mineralized with disseminated grains of pyrite and pyrrhotite.

Mr. J.A. Hughes states that chalcopyrite, in small amount, has been observed also at this locality. He reports the discovery of an outcrop of rust-stained schists and intrusives at a position about 600 feet easterly from this locality, the intervening area being drift-covered.