ONTARIO
DEPARTMENT OF MINES

GEOLOGY OF PICKLE CROW GOLD MINES LIMITED AND CENTRAL PATRICIA GOLD MINES LIMITED, No. 2 OPERATION

By
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Miscellaneous
Paper MP-4

November, 1966

Publications of the Ontario Department of Mines

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Abstract

The geology, structure and mineral deposits of the eastern part of the Pickle Crow property and part of the Central Patricia property are discussed in this report. The map-area is the eastern part of the Crow River area where mining and milling operations have been continuous since 1935 at Pickle Crow, and ore was obtained from this part of the Central Patricia property from 1938 to 1940 inclusive.

The oldest group of rocks are metabasalts which are overlain by ash-flow tuffs. Iron formation is interbedded with both these rock types. Porphyry stocks and dikes intrude the metavolcanics and metagabbro and lamprophyre dikes cut all the earlier rocks.

The major axial trends are northeast but some fold axes curve across the major axes. The folds have an isoclinal dip and are overturned on the southeastern limbs.

Gold deposits occur as veins, and as quartz-sulphide deposits within iron formation. Practically all the production has been from the former type of occurrence.

GEOLOGY OF PICKLE CROW GOLD MINES LIMITED

AND

CENTRAL PATRICIA GOLD MINES LIMITED No. 2 OPERATION

District of Kenora, Patricia Portion

By

Stewart A. Ferguson[1]

Introduction

These adjacent properties are located at approximately 51° 30' North latitude and 90° West longitude. The centres of population in the vicinity are at Pickle Crow, Central Patricia and Pickle Lake which are the most northerly white settlements in Ontario and they are 90 miles north of Savant Lake station on the Canadian National railway.

Gold and silver has been in continuous production from the Pickle Crow property since 1934 and Central Patricia Gold Mines Limited formerly produced these metals from its main operation and from the No. 2 Operation. The No. 2 Operation is adjacent to the Pickle Crow property but the main operation was $3\frac{1}{2}$ miles to the west and is not dealt with in this report. The total production of the three mines to the end of 1964 is 2,010,267 ounces of gold and 222,640 ounces of silver with a combined value of $73,111,665. Of this production 70 percent has come from the Pickle Crow and the

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Central Patricia No. 2 Operation. The dividends paid by Central Patricia from 1936 to 1949 amount to $4,575,000 and the dividends paid to date by Pickle Crow are $12,375,000.

It was considered desirable to collect and publish information on the Pickle Crow property as the mine has been much enlarged and a great deal of geological information has been assembled by Company staff since the last government report was published in 1939. The management of Pickle Crow agreed to cooperate with the Ontario Department of Mines in providing information. Surface geological and magnetic maps at a scale of 1 inch to 400 feet were provided by the Company and this map was used as the base map for surface and subsurface information. It has been reduced from a scale of 1 inch to 100 feet and shows the claim lines, picket lines, shafts, buildings, outcrops, drill hole locations, trenches and many topographic features. The writer was resident at the property for 5 weeks in 1965 in order to collect the plans and sections, to become familiar with the surface geology and to visit points of geological interest in the underground workings. A few additional claims on adjacent properties were plotted on the base map, and, in the area beyond the established picket lines, outcrops were located using aerial photographs supplemented by pace-and-compass traverses.

Drill hole information on the Central Patricia property, and in the nine southeastern claims held by Pickle Crow, were taken from an unpublished map by E.G. Pye, and additional topographic detail was taken from aerial photographs.

Traverses were made along selected picket lines, claim boundaries, bush roads, etc. in order to check the geology in all large outcrop areas. The rock units used on the underground plans have been coordinated with the rock units established on surface.

Acknowledgments

The management and staff of Pickle Crow Gold Mines Limited were most cooperative in supplying the writer with surface and underground geological plans, drilling plans and sections as well as a surface magnetic plan. They also allowed the writer to use their enlargements of aerial photographs at the same scale as the base map. Use of a house in the mine townsite was provided for working and living accommodation. L.M. Shaff, geologist at the mine, took the author on underground trips, assisted in finding geological information in the mine files, and provided prints of selected underground plans and sections. He has been most considerate in helping the author to become familiar with the mine geology and has patiently responded to inquiries on particular points of interest as the work progressed. C.G. MacIntosh, Vice President, has checked the underground plans and sections and read the part of the report dealing with Pickle Crow Gold Mines Limited.

The management of Central Patricia Gold Mines Limited has given permission to publish a subsurface plan and section from their No. 2 Operation, as well as releasing company data relating to the production of this part of their property.

It is a pleasure to thank these companies for their consideration as without their help it would have been impossible to assemble this information in its present form.

Production statistics for the Pickle Crow mine and for the total production of Central Patricia was obtained from the statistical files, Ontario Department of Mines. A.G. Coombs, a staff member of the Ontario Department of Mines, assisted in the field.

Means of Access

The settlements adjacent to the mines are 160 miles in a direct line northeast of Ignace on the Trans-Canada highway. A gravel surfaced highway, No. 599 leads northeast from near Ignace to Savant Lake on the Canadian National railway and to Central Patricia. During the summer of 1965 this road was completed to the northern end of Badesdawa Lake which is 40 miles beyond Central Patricia. Pickle Crow is 5 miles east of Central Patricia on highway 646 and Pickle Lake is 2 miles west of Central Patricia on this highway. Aircraft equipped with floats land at Pickle Lake and light aircraft equipped with wheels use a gravel surfaced landing strip at Central Patricia. A daily bus and freight service operates between Pickle Crow and Savant Lake.

When it was decided to bring the mines into production passenger traffic into the area was almost entirely by aircraft from Sioux Lookout or other stations on the railway. During the winter heavy freight was taken in by tractor train

from Savant Lake. In 1934 a summer transportation system route for heavy equipment was established using scows and boats from Hudson (Thomson 1938a, p.4). This route was via Lac Seul, the Root River, portages by marine railway on parts of the Root River and across Lake St. Joseph to Doghole Bay. The Lake St. Joseph Transportation Company was incorporated in 1936 as a jointly owned subsidiary of the two mines. This company completed a road from Doghole Bay to the mines in 1937 and also operated the Root River railway and trucked materials from Doghole Bay.

In 1956 highway 599 was completed from the mines southwest to Savant Lake. An industrial road from Savant Lake provided access from this point to the Trans-Canada highway. In the Fall of 1965 highway 599 which was being extended southwest of Savant Lake was completed to the Trans-Canada highway near Ignace.

Previous Geological Work

Geological work in the area by government geologists has been described in a number of reports (McInnes 1912, p.112, 126; Hurst 1930, p.1-50; Thomson 1938, p.1-65; Duffell, MacLaren and Holman 1963, p.1-15; and Prest 1963, p.1-23). McInnes made a micrometer survey of the Crow (Kawinogans) River and noted the existence of a belt of volcanic rocks. Hurst made the first map of the area when prospecting became active and the first mine development commenced, and Thomson did more detailed mapping after the mines came into production. Pye

(1956) revised the published map by adding additional drilling information and described the mining and exploration activities up to that time. Duffell et al conducted a reconnaissance survey of a large area and issued a preliminary report on the geology and associated geophysical and geochemical results and Prest described and mapped the surficial geology in the same area. Holman later issued a map showing the analyses of copper in the bedrock.

Geographic Names

The river which is officially called the Kawinogans River is called the Crow River. Local names have also been given to the lakes and creeks as Powderhouse Lake, Pumphouse Lake and Powderhouse Creek, Pumphouse Creek and Crowshore Creek. The shaft at Central Patricia No. 2 Operation is called the Springer Shaft and the surface shafts at Pickle Crow are the No. 1, No. 3 and Albany Shafts. The Springer (No. 6) vein and the Hook (No. 5) vein on the Central Patricia property are called the Springer and Hook Veins, respectively. The veins in the underground workings at Pickle Crow are referred to by number rather than by name and the vein formerly called the Howell vein is called No. 1 Vein. The surface veins at Pickle Crow have been given names as the Big Dome Vein, Cohen Vein, Lake Shore Vein, MacArthur Vein, Riopelle Vein and Sawmill Vein.

Drainage and Topography

The area lies immediately to the north of the Albany River basin and drains by the Attawapiskat River system into James Bay. The Crow (Kawinogans) River flows by a circuitous route into the Badesdawa Lake, and within the map-area, this river is shallow and fast flowing and generally is from 100 to 150 feet in width. At Kishkap Falls and at Kukuku Rapids the river falls 5 feet and 3 feet respectively. The three major creeks which drain the area have been given local names as Powderhouse Creek, Pumphouse Creek and Crowshore Creek all of which flow northeastward to the Crow River.

The elevation of Lake St. Joseph on the Albany River system is 1,219 feet above sea-level (O.D.M. Map No. 1958B), which is 20 miles south of Central Patricia. To date elevations have not been taken relative to sea-level for the highway north of Lake St. Joseph (Personal Communication, February 25, 1966, A.E. Kay, Ontario Department of Highways), but the general elevation is about 1,200 feet above sea-level.

Within the area mapped the ridges are all at a fairly uniform level and Highway 646 follows a broad outcrop ridge which extends northeast from the Springer shaft on the Central Patricia property to beyond the Albany shaft on the Pickle Crow property. Other areas of high ground are to the north, east, and south of Powderhouse Lake. The maximum relief on the Pickle Crow and adjacent properties is about 50 feet. Swampy areas occur between the ridges and one of the large swamp areas is adjacent to the Crow River with the exception of the

higher ground adjacent to Kishkap Falls. Another extensive area of swamp is adjacent to the central part of Crowshore Creek.

Natural Resources

The higher areas are covered with jackpine and poplar with spruce in the lower areas. Timber cutting for mine use and construction and formerly for use as firewood has been in progress since the mines came into production. Consequently, the better stands of timber that are close to the settlements and to transportation routes have been cut over.

The writer did not see any moose, deer or bear, during his visit to the property, and no beaver dams were seen in the area traversed. Some pike and pickerel are present in the Crow River and in some of the smaller streams there are brook trout.

Inhabitants and Employment

The average number of employees at the Pickle Crow mine in 1964 was 190 of which 101 were employed underground. Most of these employees live at the mine townsite or at Central Patricia. A large part of the population at Central Patricia consists of Ojibway Indians some of which are employed at Pickle Crow mine and others work in a fish-packing plant at Central Patricia. Central Patricia serves as an operating base for a company handling freight during the winter months by tractor train to points farther north.

General Geology

In the area mapped the Precambrian country rocks are divided into two major rock units. The metavolcanics are cut by acid intrusive rocks which occur as dikes and as the Pickle Crow and Albany River stocks. Dikes of metagabbro and biotite lamprophyre cut all the earlier rocks.

Table of Formations

CENOZOIC

Recent: Peat, tailings, sand.

Pleistocene: Sand, gravel, till.

Unconformity

PRECAMBRIAN

Late Dike Rocks: Lamprophyre, metagabbro.

Acid Plutonic and Dike Rocks: Quartz-feldspar porphyry, feldspar porphyry.

Intrusive contact

Acid to Intermediate Metavolcanics: Porphyritic dacite, dacite containing over 10 percent mafic minerals, fine-grained dacite, chloritic dacite, dacite breccia, iron formation, argillite.

Basic Metavolcanics: Fine-grained, uniform basalt, medium-grained uniform basalt, pillowed basalt, iron formation.

Precambrian

Basic Metavolcanics

The oldest group of rocks consists of basalt (metabasalt) flows which are overlain by a group of more acidic rocks which formed as ash-flow tuffs from pyroclastic materials. Little direct evidence for these relationships can be observed in the field but from combined surface and underground mapping the relationship is fairly well established.

The basic metavolcanics occur in the anticlinal areas, which are long, relatively narrow, northeast-trending belts. No reliable estimate of the thickness of the basalts is known but on Section No. 2, which is adjacent to No. 1 Shaft, the anticlinal zone is 1,340 feet in width and the stratigraphic thickness represented would be not more than one half this amount or 670 feet.

Types of Metabasalt

All the darker coloured rocks are mapped as basalt and no flows of intermediate composition have been observed. The basalt weathers to a greenish-grey colour and generally is fine-grained. Pillowed phases are associated with the uniform basalt and in most localities it has not been possible to separate the bands of pillow lava from the uniform fine-grained lava, or to map individual flows. Some flow contacts are marked by the presence of beds of iron formation. One flow top breccia was observed on an outcrop located south of the hospital and

900 feet northeast of the Pickle Crow No. 1 shaft. This breccia is about four feet in width and contains light coloured, angular fragments up to one foot in diameter. The pillows range in size from $1\frac{1}{2}$ to 3 feet and have narrow rims about a half inch in thickness and generally there are no amygdules in the pillows. The pillows display a variety of shapes and in only a few places on surface has it been possible to make top determinations using the shape of pillows.

Parts of the flows are medium-grained with individual crystals up to 1.5 mm. in diameter. These rocks are of medium grey colour with small light grey feldspars. All these medium-grained rocks have been included with the volcanic rocks and no dikes or sills have been mapped separately on surface. A persistent band of these rocks outcrops along the north shore of the small lake on the north branch of Crowshore Creek for a distance of 1,100 feet. Another band of these rocks about 50 feet in width outcrops for 800 feet to the northeast of the Springer shaft. Other less continuous bands are associated with the other varieties of basalt. Leucoxene-bearing basalt is present in an outcrop on the south side of highway 646 and 1,300 feet northeast of where Pumphouse Creek intersects the highway.

Pye (1956, p.19) gave the following description of the medium-grained metabasalts:

" consist essentially of fibrous amphibole, chlorite, and highly altered plagioclase with small amounts of carbonate, epidote, saussurite and quartz, and subordinate leucoxene,

apatite, sphene and sometimes pyrrhotite. The most abundant constituent appears to be amphibole, which makes up from 35 to 60 percent of the rock. "

An alteration zone in the basalt near the contact of a dike of Albany River porphyry on the 750-foot level of the Pickle Crow mine at coordinates 4,230 north and 3,920 east contains clusters of reddish-brown garnet up to 20 mm. (0.7 inches) in diameter. Some individual garnet crystals are 5 mm. in diameter, zoned, and are weakly birefringent and contain inclusions of carbonate and quartz. Hornblende, epidote and pyrite are interstitial to the garnets and remnants of feldspar along a veinlet are strongly saussuritized. Mineralogical examination of the garnet by the Laboratory Branch, Ontario Department of Mines indicated that the refractive index is about 1.84. A spectroscopic analysis and an X-ray determination of the unit cell indicated that the garnet is composed principally of andradite ($Ca_3Fe_2(SiO_4)_3$) with a lesser amount of almandite ($Fe_3Al_2(SiO_4)_3$) and minor spessartite ($Mn_3Al_2(SiO_4)_3$) and pyrope ($Mg_3Al_2(SiO_4)_3$).

Magnetite-Carbonate Iron Formation

One main band of iron formation is known to be interbedded with the basalts adjacent to the workings of the Pickle Crow mine but in places there are additional local bands. On the north limb of this fold this iron formation band has been traced from surface exposures and by drilling for 9,000 feet and ranges in thickness from a few feet up to 80 feet or where it

has been thickened by folding to 150 feet. On the southern limb of the structure two adjacent bands about 6 feet in width are present in the central area and this zone of iron formation persists along the strike for 6,000 feet. On No. 1 shaft section the iron formation is known to persist down the dip for 3,350 feet and no doubt persists to much greater depths. The main band of iron formation is generally from 250 to 400 feet stratigraphically below the top of the basalt flow sequence, but appears to be at a greater stratigraphic distance in places due to variations in the thickness of the flows or to thickening of the rock units during folding.

The iron formation is prominently banded with alternate layers varying in thickness from thin laminae up to 2 inches. The more siliceous layers may be light grey in colour or may be a dark grey laminated chert, and no jasper bands were observed. Some of the darker layers contain a high proportion of magnetite but the magnetite content varies along the strike and consequently magnetic surveys have been only partially successful in tracing these beds. The weathering of some of the iron formation beds produces an iron oxide and this rusty alteration is typical of the iron formation outcrops.

Hurst (1930, pp.9-10) gives the following description: " The microscope shows the iron formation to be composed of bands consisting chiefly of cryptocrystalline quartz and siderite, varying amounts of magnetite and pyrrhotite, and occasional streaks of chlorite. Some bands are made up entirely of small, sharp-cornered quartz grains which seem to be interlocked with

one another rather than cemented together. In other bands tiny, more or less angular particles of iron carbonate predominate. In most of the layers both quartz and siderite are intimately mixed together but in variable proportions. Some of the bands are composed almost wholly of magnetite in small, angular grains. Pyrrhotite occurs as patches, streaks, or grains replacing iron carbonate and chlorite or as veinlets traversing the various bands. It was obviously formed during a later period of mineralization and may possibly owe its origin, in part, to the interaction of hydrogen sulphide (H_2S) with the ferrous carbonate ($FeCO_3$) of the iron formation. Streaks of chlorite, which probably represent inclusions of schistose greenstone, are often associated with the carbonate bands. "
(see Table 1).

Table 1 Analysis of iron formation containing the No. 1 (Howell) vein at Pickle Crow mine (Hurst 1930, p.10)

			Calculated Mode	
		percent		percent
SiO_2		32.13	Siderite	49.31
Al_2O_3		1.43	Quartz	31.80
FeO		31.14	Pyrrhotite	5.62
Fe_2O_3		9.60	Magnesite	4.22
CaO		2.28	Calcite	3.97
MgO		2.17	Rhodochrosite	2.30
Na_2O		.08	Magnetite	0.93
K_2O		.14	Sericite	0.59
H_2O	(-100°C.)	.01	Albite	0.52
H_2O	(+100°C.)	.39		
CO_2		18.98		
TiO_2		.14		
MnO		.13		
P_2O_5		.16		
S		2.09		
Total		100.87		99.26

Specific Gravity 3.488

Acid to Intermediate Metavolcanics

The southeastern part of the Pickle Crow property appears to be entirely underlain by acid to intermediate metavolcanic rocks and elsewhere on the property they occur in narrower, complex synclines. The stratigraphic thickness of these rocks is not well known but the thickness of this unit with the associated interbedded sedimentary rocks is not more than 670 feet in the syncline to the northwest of Pickle Crow No. 1 Shaft.

These rocks are believed to be ash-flow tuffs which are the consolidated deposits resulting from an ash flow. Ash-flow tuff is a general term for consolidated ash flow deposits which may have been unconsolidated or may have been partly welded during deposition. Ross and Smith (1961) have given the following definitions and descriptions of rocks of this type:

"Ash flow. - A turbulent mixture of gas and pyroclastic materials of high temperature, ejected explosively from a crater or fissure, that travels swiftly down the slopes of a volcano or along the ground surface. The solid material in an ash flow, although unsorted, is dominantly of particles of ash size (less than 4 mm in diameter) but generally contains different amounts of lapilli and blocks." (p.3)

"The pyroclastic nature of ash-flow tuffs is generally discernible in the field. In unaltered non-welded tuffs there is no problem because the presence of unconsolidated pumice fragments, ash, volcanic dust, and the ubiquitous foreign rock fragments would indicate pyroclastic origin for any tuff. These features are discernible through milder types of induration and alteration, and become obscure only when advanced stages of welding and devitrification have been reached. However, even in advanced and extreme examples of welding and devitrification a careful search will generally reveal rock fragments which, even if not diagnostic in themselves, should cast doubt on the rock being a lava, and together with other features to be discussed, should give the correct answer." (p.18)

"A principal characteristic of ash-flow tuffs is their common occurrence in thick units (tens of feet) of typically nonsorted or nonbedded materials. This characteristic is in direct contrast to ash-fall tuff deposits of comparable thickness, in which pronounced bedding is nearly always present.

Ash-flow tuffs commonly show a wide range in size and relative amounts of constituent materials. However, the dominant material is generally ash or fine ash size (< 4 mm) although some types are composed predominantly of pumice lapilli or blocks of different sizes, and for these the term "pumice flow" may be more suitable than ash flow. Dust or fine ash-size material is nearly always present. All gradations exist between those deposits that consist primarily of ash and dust and those that are predominantly pumice lapilli or blocks, although the ash-size types seem to be the most common. Included accidental rock fragments, that commonly add to the heterogeneous appearance of the ash-flow tuffs, may range from microscopic size to large boulders, but are most often 1 inch or less in diameter. They are generally present in amounts less than 5 percent of the whole, but the authors have observed as much as 20 percent in some ash-flow tuffs and this figure is probably much less than the maximum amount." (p.19)

"Ash flows tend to have very even upper surfaces and very low angles of dip except where deformation has modified their original attitude. When erupted upon uneven topography the ash flows show evidence of having flowed around obstacles and down drainage channels. They may therefore have a very uneven base and nearly level top in contrast to the blanketing of topography as with ash-fall tuffs. Neither do normal ash-flow tuffs show steep primary dips such as exhibited by many lava flows." (p.23)

Dacite

In rocks of this type individual rock units have gradational contacts with the adjacent types of dacite and most rock units are lenticular in shape and in many cases cannot be correlated between adjacent outcrops. The presence of beds containing breccia fragments is a widespread and characteristic feature. There is no known interbedding between the basic metavolcanics and the acid to intermediate metavolcanics, and in places this contact is marked by a bed of sedimentary rock which would indicate that the sequence of basic lava flows was not followed immediately by the phase of explosive volcanism.

Porphyritic dacite containing feldspar phenocrysts is widely distributed in association with other types of dacite in the southeastern part of the Pickle Crow property. In the northwestern part of the property such rocks outcrop or have been recorded in drill core from claims Pa.736, 746, 750 and 751. Quartz phenocrysts are less abundant and have been observed on claims Pa.736, 751 and 1,139 and generally are associated with feldspar phenocrysts. These rocks are usually light grey or greenish on the weathered surface and medium grey on the fresh surface. Neither quartz nor feldspar crystals can be seen on the weathered surface of these rocks where the rocks are strongly weathered to clay minerals for a depth of up to a half inch. The surface of such rocks has a pitted appearance presumably due to the removal of the larger quartz grains. Quartz phenocrysts are present in the weathered zone below the surface and both types of phenocrysts can be seen on the freshly

broken surface where they are about 1.5 mm. in diameter. Quartz phenocrysts consist of individual crystals and the feldspars are considerably altered to white mica with a small amount of carbonate. The feldspar is probably oligoclase as it has an index higher than balsam. Some of these rocks contain about 5 percent biotite and pyrite in small stringy masses. The matrix consists of fine-grained quartz and altered feldspar with scattered small flakes of biotite. In other locations the mafic content may be somewhat more abundant with spindle-shaped masses of mafic minerals up to 2 mm. in length in a preferred orientation. Some of the mafic minerals are clusters of hornblende which is altered in part to brown and green biotite with a small amount of epidote.

Of the rocks containing over 10 percent mafic minerals some are light coloured and contain clusters of mafic minerals up to 2 mm. in diameter in a fine-grained matrix. Other varieties of the more mafic rocks were formerly called "diorite" and contain hornblende crystals about 1 mm. in diameter with associated light grey feldspar. A thin section of one of these rocks contained an estimated 50 percent nearly equidimensional hornblende crystals, 30 percent interstitial masses of saussuritized feldspar, about 15 percent quartz and 5 per cent pyrite.

The fine-grained dacites are generally similar to the porphyritic phases except that no phenocrysts are present. These rocks are generally light grey or buff in colour and may be quite siliceous or may be considerably altered to sericite.

Where these rocks are greenish due to the presence of chlorite it is difficult to distinguish them from the fine-grained, uniform basalts. Rocks described in diamond drill logs as volcanic rocks or as schist, that in the writer's opinion belong to the acid to intermediate group of metavolcanics, are shown on the map as fine-grained chloritic dacite. Pye (1956, p.20) gives the following description of a thin section of the more acidic type:

" Microscopic examination shows that their principal constituents are altered feldspar, quartz, and sericite, and that there are subordinate amounts of chlorite, epidote and leucoxene present. "

A partly carbonatized, light coloured, sericitic dacite outcrops on the northwestern part of the Pickle Crow property on claim Pa.740. A residue of hydrated iron oxide is left from weathering of this carbonate.

Dacite Breccia

Dacite breccia is widely distributed on surface, particularly in the southeastern part of the Pickle Crow property and similar rocks have been intersected in drilling and in underground workings. Most of these breccias consist of scattered, light coloured, angular, felsic fragments, with individual fragments less than 2 inches in diameter enclosed in a fine-grained light grey or greenish matrix. An outcrop of breccia on the east side of the road near the southeast corner of Pa.726 is unusual as it appears to be bedded. At this location light

coloured fragments about a $\frac{1}{4}$ inch in diameter form three narrow parallel beds for the exposed distance of about 10 feet. An outcrop with more abundant and larger, felsic fragments than known to exist elsewhere is found to the northeast of the Albany shaft on claim Pa.63. This breccia consists of about 50 percent fragments in a light green, fine-grained matrix. A few of the fragments are more than a foot in maximum diameter with a large number of fragments in the size range from 2 to 4 inches. Many of these fragments are angular but others are fairly well rounded.

An underground examination of the breccia was made on the 750-foot level from coordinates 1,400 North to 2,500 North and from 650 East to 1,450 East. At this location the boundaries of the breccia zone are gradational and no bedding features were observed except that the fragments have a parallel orientation. Fragments were estimated to form about 10 percent of the rock and the most abundant fragments are tabular pieces of dark grey chert generally not larger than 3 inches by 1 inch. Some rounded fragments of light coloured felsic or porphyritic rocks could be seen in the back of the drift at a distance of from 2 to 3 feet from the observer.

These rocks were also examined on the 2,900-foot level of the Pickle Crow mine by G.D. Jackson of the Geological Survey of Canada (Donaldson and Jackson 1965). Jackson agrees with the writer that some of the rock units shown on the company maps as conglomerate are of pyroclastic origin (Donaldson, personal communication) but at the locality described below he

considered the rock to be conglomerate and made a megascopic modal analysis of the rock constituents (see Table 2). The published description of this conglomerate from the 2,900-foot level of the Pickle Crow mine from coordinates 2,200 North to 2,700 North and 1,100 East to 1,400 East is as follows:

Table 2 Volumetric abundances for constituents of conglomerates at Pickle Crow mine (Donaldson and Jackson 1965, p.633)

	Percent
Leucoporphyrites [Porphyritic dacite, less than 10 percent mafic minerals]	2.3
Mesoaphanite [Basalt, aphanitic]	12.7
Chert	23.2
Matrix	61.8

A description of the material from this locality is as follows (Donaldson, Personal letter, January 24, 1966):

" A review of the material that we have in hand supports the conglomerate designation. One cut and polished slab shows very well rounded clasts of several compositions. Most abundant are volcanic clasts, and quartz mosaic clasts that range from cryptocrystalline to macrocrystalline. The volcanic clasts show a wide variety of textures and compositions; all appear to be derivatives of older units- recognizable bombs and lapilli are lacking.

Appreciating the problem of differentiating conglomerates derived mainly from volcanic terrain from volcanic agglomerates and breccias containing exotic fragments, we attempted to choose a scattering of samples from clearly epiclastic conglomerates. Our Pickle Crow samples fall closest to the boundary ..... "

Donaldson and Jackson (1965, pp.643 and 635) give modal analyses and a chemical analysis for porphyritic phenoclasts from the conglomerate of the Pickle Crow mine, and Pye (1956, p.35) gives an analysis by the Provincial Assay Office of a specimen collected north of the Central Patricia shaft which he described as quartz-sericite schist (see Table 3). The writer considers it to belong to the dacite group of rocks.

Table 3 Dacites, modal and chemical analyses.

Modal Analyses			Chemical Analyses		
	1	2		3	4
Plagioclase			SiO_2	73.0	68.25
phenocrysts	28.3	26.4	TiO_2	0.10	0.24
Quartz			Al_2O_3	14.9	14.55
phenocrysts	5.9	0.3	Fe_2O_3	0.1	0.54
Plagioclase	26.4	27.7	FeO	0.2	1.84
Quartz	23.1	28.9	MnO	0.01	0.05
Muscovite	11.4	16.4	MgO	0.5	1.12
Chlorite	3.8	0.1	CaO	2.7	2.50
Epidote	0.1		Na_2O	4.7	3.68
Carbonate	0.3	0.2	K_2O	0.7	2.00
Opaques	0.7	Tr.	H_2O	0.5	2.01
			P_2O_5	0.01	0.36
			CO_2	0.2	2.69
			V_2O_3		Tr.
			Cr_2O_3		Tr.
				97.0	99.83
			Loss on ignition		4.89

1. Porphyritic dacite, light grey, leucocratic, massive (JD-P40/1-62).
2. Porphyritic dacite, greyish white, leucocratic,massive(JD-P40/2-62).
3. Same as 2.
4. Quartz-sericite dacite,north of Central Patricia shaft(Pye 1956, p.35).

Interbedded Sediments

Argillite

A bed of argillite occurs at the contact between the metabasalts and dacite on the northern side of the Pickle Crow anticlinorium. An exposure of this argillite about 15 feet in width and 150 feet in length is located about 2,000 feet southwest of No. 1 Shaft on the boundary between claims Pa.729 and 30. This bed has been located by drilling 1,300 feet southwest of the outcrop and at intervals for 2,500 feet northeast of the outcrop. On the 750-foot level it extends for 5,000 feet northeast of the outcrop. The same bed has been intersected down the dip by drilling near No. 1 Shaft on the 3,350-foot level. Over this distance the argillite has a stratigraphic thickness of about 50 feet with individual beds ranging in thickness from a fraction of an inch up to 6 inches. The logs of some surface drill holes indicate that in places the argillite is overlain by iron formation and also that in places iron formation is present in the same stratigraphic position.

Pye (1956, p.27) gives the following description: " Under the microscope thin sections of the rock show that it consists of thin laminae made of tiny grains and fragments of quartz and plagioclase in a schistose matrix of sericite, chlorite, carbonate and leucoxene. "

Magnetite-Carbonate Iron Formation

One main band of iron formation, with some less persistent adjacent bands, is associated with the dacite in the northwestern part of the map-area, in the vicinity of the Albany Shaft and on claim Pa.762 to the southeast of the Pickle Crow anticlinorium. The most persistent iron formation bed is at a stratigraphic distance of from 50 to 200 feet above the base of the dacite unit and has a thickness ranging from 20 to 80 feet, but in places appears to have greater width due to folding. The iron formations are rusty weathering, thin bedded rocks with individual beds from thin laminae up to 2 inches in thickness. The chert bands vary in colour from black to light grey and are associated with magnetite and carbonate. Parts of the iron formations are strongly magnetic and other parts are weakly magnetic due to variations in the magnetite content.

A small amount of calcite is considered to be present as specimens immersed in cold, dilute hydrochloric acid effervesce along minute fractures perpendicular to the bedding planes. The Laboratory Branch, Ontario Department of Mines made an X-ray examination of a specimen of iron formation collected near the Sawmill vein on claim Pa.737. This determination indicated that the specimen contained a considerable amount of siderite. Small amounts of pyrite and pyrrhotite are associated with the iron formation, but on claims Pa.630, 751 and 627 part of the iron formation contains abundant sulphides.

Carbonate Iron Formation

Carbonate iron formation is exposed in outcrops and trenches on Pickle Crow claims Pa.774 and 777. This zone of iron formation is about 1,800 feet in length with individual widths of iron formation up to 30 feet in width. The iron formation has sharp contacts, and abundant carbonate is not present in the adjacent rocks although limonite from the weathering of the iron formatinn has stained these rocks. At the northeastern end of this zone some outcrops are typically banded iron formation but elsewhere the more siliceous bands do not weather in relief and the weathered surface of the rock has a uniform surface. The fresh surface of the rock varies in colour from light grey to dark grey and some specimens of the iron formation are very hard and siliceous. The Laboratory Branch, Ontario Department of Mines determined the carbonate to be ankerite from the refractive indices combined with an X-ray examination and chemical tests.

Acid Plutonic and Dike Rocks

Quartz-Feldspar Porphyry, Feldspar Porphyry

There are two porphyry stocks and several porphyry dikes within the map-area. The Pickle Crow porphyry stock is located to the northwest of No. 3 Shaft and the Albany River porphyry stock outcrops near the Albany shaft. Dikes have been mapped on claims Pa.729, 1139 and 2011.

The Pickle Crow porphyry is elliptical in plan and is 6,000 feet in length by 650 feet in width. The major axis strikes N55°E and appears to be generally conformable in strike and dip with the enclosing rocks, but on the 750-foot level plan can be seen to cut across the trend of the volcanic rock units at a small angle. The complete outline of the stock has not been established on the 2,850-foot level but over this vertical distance the porphyry appears to maintain its shape, become slightly wider, dips at 77°NW and does not appear to plunge. A few porphyry dikes or sills are present near the stock but the outline of the stock is regular without apophyses extending outward from the main part of the intrusion. On the 750-foot level the southern contact of the intrusion with the adjacent country rocks is sharp.

The Albany River porphyry is 2,200 feet in length by 400 feet in width the sides of the body striking N60°E. This stock is somewhat irregular at the ends with lobes and dike-like apophyses. Some of the associated dikes are parallel with the trend of the enclosing rocks but others are crosscutting. From surface to the 625-foot level the stock dips 65°NW. On surface the major axis of the stock makes a small angle with the strike of the enclosing rocks. The stock appears to maintain a similar shape and extend down the dip with no known plunge.

A porphyry dike outcrops 1,400 feet south-west of Pickle Crow No. 1 Shaft on claim Pa.729, is about 10 feet in width, and strikes N20°W. This rock is a light buff colour and contains scattered phenocrysts of feldspar from 2 to 4 mm. in

diameter in a fine-grained matrix. The dike on claim Pa.2,011 strikes N25°E and weathers to a light grey colour with some phenocrysts weathering in relief. On the fresh surface the rock can be seen to consist of about 50 percent phenocrysts of light grey feldspar in a medium grey, fine-grained matrix. The dike on claim Pa.1,139 has been stripped by prospectors and is about 3 feet in width with scattered feldspar phenocrysts in a fine-grained buff matrix.

Types of Porphyry

The Pickle Crow porphyry is a distinctive rock because of the presence of large phenocrysts of quartz. It weathers to a light grey colour. The quartz phenocrysts ranging in diameter from 2 to 10 mm. are rounded to oval in cross-section, but a few are rectangular with rounded corners. Individual feldspar crystals cannot be identified on the weathered surface as the quartz phenocrysts are enclosed in a matrix of kaolinized feldspar. Pye (1956,p.32-33) (see also Table 4) gives the following mineral description: " However, when the rock is examined microscopically it is found to contain, in addition to rounded to ovate phenocrysts of quartz, many small, stout, well-formed but fractured crystals of albite. These crystals are smaller than those of quartz, with lengths up to about three eighths of an inch. In general, they are somewhat more numerous, for Rosiwal analyses of typical sections indicated that all phenocrysts make up about 35 percent of the rock whereas those of quartz only constitute about 10 percent

or less. The matrix of the rock is an aggregate of tiny anhedral grains of quartz and altered plagioclase with accessory amounts of magnetite-ilmenite, leucoxene, apatite, sphene, and rutile. In every thin section examined the groundmass was found to be schistose, and although the primary constituents of the rock themselves in most cases exhibit no linear parallelism, the structural feature is made quite evident by parallel wisps, flakes, and patches of sericite and chlorite. Chlorite occurs only sparingly in most sections. But locally it becomes prominent, where it imparts to the rock a distinct greenish cast. Its association with sericite indicates that the quartz albite porphyry, like the greenstones enclosing it, was subjected to only a low grade of regional metamorphism. Carbonate is also an abundant constituent, and like the sericite and chlorite replaces both the albite phenocrysts and the groundmass feldspars. "

The Albany River porphyry is a rock of faintly pinkish colour with abundant feldspar phenocrysts, scattered quartz phenocrysts and a few biotite crystals all of which are about 2 mm. in diameter. In thin section the feldspar is without albite twinning, has an index higher than balsam and is considerably altered to white mica and in some local areas to saussurite. Some of the quartz phenocrysts are individual crystals but other phenocrysts consist of clusters of crystals. Quartz and carbonate occur as trains of interstitial material between the larger feldspar phenocrysts. Small crystals of apatite are enclosed within the large biotite crystals.

Table 4 Chemical analyses of porphyries at Pickle Crow property (Pye 1956, p.33,35,38)

	1	2	3
	Percent	Percent	Percent
SiO_2	64.10	70.50	68.95
Al_2O_3	14.35	16.21	14.21
Fe_2O_3	1.26	0.21	0.60
FeO	1.73	1.35	1.08
MgO	1.10	1.64	1.17
CaO	3.41	2.43	2.50
Na_2O	4.88	1.79	3.88
K_2O	1.91	1.38	2.06
H_2O	1.40	2.85	0.80
CO	4.47	1.22	4.21
TiO_2	0.49	0.18	0.18
V_2O_3	0.01	Tr.	Tr.
P_2O_5	0.29	0.07	0.08
Cr_2O_3	0.006	0.01	Tr.
MnO	0.06	0.02	0.02
Total	99.46	99.86	99.75
Loss on Ignition	5.48	3.78	3.78

1. Albany River porphyry.

2. Pickle Crow porphyry, 550-foot level.

3. Pickle Crow porphyry adjacent to No.2 Vein, 550-foot level.

Late Dike Rocks

Metagabbro

Narrow, fine-grained metagabbro dikes which resemble the fine-grained phases of the metabasalts have been intersected in the workings and by underground drilling at the Pickle Crow mine. One dike occurs in the hangingwall of the No. 1 vein and appears to be earlier than the vein, but another dike of similar appearance cuts this vein on the 1,350-foot level (Pye 1956, p.44).

Metagabbro dikes also occur in the Pickle Crow porphyry, and on the mine plans they are called "Horizon Markers." Although some of these dikes are parallel to the margins of the stock others are at angles of from 20° to 40° with the contact of the stock. These dikes are shown on Subsurface No. 1 and No. 3 plans and on No. 1 section, and they also have been shown on the 975-foot level and have been described by Monette (1949, p.102,105). Three of the dikes which trend N65° to 85°E and dip 75°N have been traced from the 750-foot to 1,225-foot level, and Monette (1949, p.102) shows one of the dikes extending beyond the porphyry into the adjacent volcanic rocks. A fourth dike which strikes N50°E and dips steeply to the northwest intersects the other dikes and also has been found to extend between the same levels. All these dikes within the porphyry are cut by the veins.

Pye (1956, p.44) (see also Table 5) gives the following description of the dikes associated with the No. 1 (Howell) vein:

" The one along the Howell vein is made of a matted aggregate of chlorite, sericite, carbonate, magnetite and secondary quartz, and, on the lower mine levels, brown biotite. The post-vein dike is less altered. It consists of plagioclase, quartz, chlorite, carbonate, sericite, magnetite, and a little epidote. "

Table 5 Chemical analyses of metagabbro dikes and an average gabbro

	1	2	3
	Percent	Percent	Percent
SiO_2	46.26	46.50	48.36
Al_2O_3	15.88	14.34	16.84
Fe_2O_3	0.83	Nil	2.55
FeO	7.32	10.70	7.92
MgO	3.92	5.00	8.06
CaO	8.42	8.45	11.07
Na_2O	3.24	1.99	2.26
K_2O	2.44	0.44	0.56
H_2O +	3.16	3.65	0.64
H_2O -	0.23	0.07	
CO_2	6.53	7.07	Nil
TiO_2	1.10	1.55	
V_2O_3	0.07	0.02	
P_2O_5	0.14	0.21	0.24
Cr_2O_3	0.03	0.02	
MnO	0.18	0.17	0.18
Total	99.75	100.22	100.00
Loss on Ignition	8.96	9.82	

1. Metagabbro dike in hangingwall of No.1 (Howell) vein, 2,400-foot level, Pickle Crow mine (analysis from Pye 1956, p.45).

2. Metagabbro dike in Pickle Crow porphyry, 1,600-foot level, Pickle Crow mine (analysis from Pye 1956, p.45).
3. Average gabbro (analysis from Nockolds 1954, p.1020).

Lamprophyre Dikes

A dike of biotite lamprophyre outcrops along the southern side of the rock exposures on claim Pa.760 in the northwestern part of the Pickle Crow claims, and a dike of similar composition occurs in the Pickle Crow porphyry and cuts the vein indicating its later age. Monette (1949, p.102) shows the lamprophyre dike cutting the rocks called metagabbro in this report indicating that he considered these dikes to be the younger, and also he gives the following description (Monette 1949, p.105):

" A large lamprophyre dyke, some 15 feet in width having an almost vertical dip, strikes across the porphyry in a general S.80°E. direction, cutting the vein at the east end of the 750 level, and the 850 and 975 levels at more westerly points. A smaller dyke also cuts the vein on the 975 level further to the east. "

The following description of the lamprophyres is taken from Pye (1956, p.46-47):

" The lamprophyres are massive, dark grey to black, medium-grained rocks with a distinct porphyritic texture due to crystals of biotite that in places exceed a quarter of an inch in length. Two varieties have been recognized. One, which cuts the Howell vein, is composed chiefly of biotite, orthoclase, chlorite, and carbonate, and may be an altered minette. A second post-ore dike, which cuts the vein system [No. 2 vein] at Pickle Crow No. 2 Operation, is made up of biotite, andesite, quartz, subordinate clinopyroxene, and accessory apatite and zircon."

Cenozoic

Pleistocene

The thickness of the Pleistocene deposits is variable with bare rocky ridges alternating with swampy areas where the overburden is as much as 100 feet in depth. Glacial striae are not abundant and are best preserved where they have been protected by a cover of soil until they have been exposed by trenching. Four glacial striae were recorded in the map-area and vary in direction from S45°W to S50°W. Some outcrops near the eastern boundary of the map-area on claims Pa.66 and 2,069 have a kaolinized surface zone extending to a depth of $\frac{1}{4}$ inch and in places to a $\frac{1}{2}$ inch, which suggests that the glacier did not have a strong scouring action. Ridges of gravel and boulders, up to 2,000 feet in length and with a relief of about 30 feet, have their long axes parallel to the direction of ice movement. A sandy boulder till forms a crag-and-tail structure on the southwestern end of the outcrop area on claim Pa.2,011. No glacial sections were seen by the writer along roads or creeks and the glacial section was not examined in the gravel pit to the west of Pickle Crow townsite. The surficial geology of the area has been described by Prest (1963). There is no known evidence of an early ice movement in the area and the drumlinoid ridges and crag-and-tail features all reflect the last ice movement. G.S.C. Map No. 5-1963 shows that the area adjacent to Pickle Crow was not affected by extensive glacial lake action.

Recent

Peat deposits are forming in the swampy areas and stream action is forming gravel bars along the Crow River. Deposits of mine tailings have been placed in swampy areas adjacent to the mine.

Magnetic Surveys

A plan of the Pickle Crow property showing magnetic contours, dated January 1960, by Geophysical Engineering and Surveys Limited, was supplied to the writer by the management of Pickle Crow Gold Mines Limited. This plan was at a scale of one inch to 400 feet with magnetic contours at 100 gamma intervals or at 1,000 gamma intervals in areas of steep magnetic gradients. In the central part of the property the picket lines were at 200-foot intervals but to the southeast of the "old south tie line" and the "new south tie line" and in some other small areas the line spacing was at 400-foot intervals. Generally magnetic readings were taken at 100-foot intervals but in parts of the area the readings were at 50-foot intervals.

On this plan the general magnetic level in areas underlain by metabasalt and dacite is about 500 gammas with a very few local magnetic highs of about 1,000 gammas. Magnetite-carbonate iron formation is the only strongly magnetic rock with a maximum magnetic relief of over 10,000 gammas above the general magnetic level. The magnetic intensity of a bed of iron formation varies along the strike, and in plan some iron formation beds have a series of discontinuous oval zones of

higher magnetic intensity. In other areas the 1,000 or 2,000 gamma contours enclose a ridge of higher magnetic intensity and within this area are the more strongly magnetic zones.

Geochemical Investigations

A reconnaissance survey of copper in the bedrock which covered a large area and includes the Pickle Crow vicinity was made by officers of the Geological Survey of Canada. The analyses obtained were compiled by R.H.C. Holman on the Lake St. Joseph geological map sheet at a scale of one inch to 4 miles (G.S.C. Map 50-1963). This survey showed that the copper content of the rocks is related to the rock type and that the highest average content of copper is in the metavolcanic rocks which are chiefly metabasalt and that the least average copper content is in massive granitic rocks. The analytical results are given in parts per million (ppm) and less than 5 ppm is the detection limit of the analytical method (Table 6).

Table 6 Copper content of bedrock in Lake St. Joseph area

(compiled from G.S.C. Map 50-1963)

Rock Type	Range of Copper Content ppm	Arithmetic Mean	No. of Analyses
Metavolcanic Rocks, chiefly metabasalt	less than 5 to 700	56	234
Metasedimentary Rocks	less than 5 to 500	27	81
Basic Igneous Rocks	less than 5 to 370	57	40
Massive Granitic Rocks	less than 5 to 145	6	622

Holman (Duffell et al 1963, p.12) notes that the specimens analyzed for copper have also been analyzed for zinc. Studies are in progress of the major elements and the alkali content of some of the leucocratic granitic bodies and the distribution of major, minor and trace elements in selected belts of volcanic rocks.

Structural Geology

Structural determinations using the shape of pillows in basalt to indicate the tops of beds have been possible in a few places. Generally on surface it has not been possible to map particular parts of flows as continuous rock units and in underground workings the particular parts of flows have been mapped separately but in many parts of the mine it has not been possible to correlate these small rock units in adjacent workings. One persistent magnetite-carbonate iron formation bed forms an important marker unit in the metabasalt.

Within the dacite group no determinations of the tops of beds have been possible and individual rock units are generally lenticular. In local areas the porphyritic dacite containing over 10 percent mafic minerals has proved to be a mappable unit. A bed of argillite which lies between the metabasalt and dacite rock unit also forms a mappable local unit. Pye (1956, p.66) notes that grain gradation in a few of the beds of the only outcrop of this rock type suggests that the beds face north. The interbedded magnetite-carbonate iron formations have proved to be particularly useful as some beds

persist for long distances and some lenticular beds are assumed to occupy the same stratigraphic position. Magnetic surveys have provided additional information on the continuity of particular beds.

The rocks of the dacite group are presumed to overlie the metabasalts and from this assumed superposition of beds a structural pattern can be established which is consistent with the known surface and subsurface data. Differentiation of these two rock units can be particularly difficult in the fine-grained chloritic phases or in the medium-grained higher mafic phases. Pillows occur exclusively in basalt, and the porphyritic and breccia phases are characteristic of the dacite. From the established structural pattern certain outcrops have been arbitrarily assigned to one or other of the rock types.

The general strike is northeast and the dip is 75° to 80°NW. One plunge determination on lineation on Central Patricia claim Pa.625 gave a plunge of 35° in a direction N46°E. The plunge of folds in the iron formation near No. 1 Shaft is due north at 75° to 80°. The rake of the three productive veins in the No. 1 Shaft area is 70° in a direction N20°E. The Pickle Crow porphyry stock and the Albany River stock both extend down the dip and do not appear to plunge. Several of the anticlines narrow and plunge beneath the younger rocks in a pattern that would be consistent with a plunge to the northeast. Some other anticlines maintain a constant width for considerable distances and some anticlines have a shape in plan which suggests a plunge to the southwest. Along some fold axes the stratigraphic sequence is repeated in reverse order

which would indicate plunge reversals.

Folding

The major anticlines are the Pickle Crow anticlinorium, Albany Shaft anticline, Pumphouse Lake anticline, Sawmill anticline, Pumphouse Creek anticline, Powderhouse Lake south anticline, Powderhouse Lake central anticline and the Powderhouse Lake north anticline. The major adjacent synclines are the Albany Shaft syncline, the Township Line syncline, No.3 Shaft syncline, Pickle Crow No.1 syncline, Pickle Crow No.2 syncline and the Pumphouse Lake syncline.

The general trend of the fold axes is northeast but the Pickle Crow No.2 syncline, the Pumphouse Creek anticline, and the Township Line syncline have fold axes which curve across the major fold axes. The folds which strike northeast dip steeply northwest so that they are isoclinal folds which are overturned on the southeastern limbs. On many of the folds all the known information is shown on the surface map but subsurface information exists for the Pickle Crow anticlinorium, the Albany Shaft anticline and the Albany Shaft syncline.

Pickle Crow Anticlinorium and Albany Shaft Anticline

The Pickle Crow anticlinorium is one of the larger and better known structures in the map-area as part of the Pickle Crow workings are within it. In the map-area the anticlinorium is 10,000 feet in length and 2,700 feet in width at the Springer shaft and 1,550 feet in width at No.1 shaft. On Section No.2 the northern limb of this anticlinorium dips at 75°NW from surface to the 2,450-foot level and from this point the dip is almost vertical to the 3,350-foot level, with the iron formation generally conformable with the dip of the basalt-dacite contact. On surface the iron formation forms a marker bed which is present on both limbs of the anticlinorium for a considerable distance. There is a series of small, chevron folds on the southeastern side of the anticlinorium, and the presence of these minor folds at an angle of 20° to 30° to the general trend of the anticlinorium increases the complexity of the fold pattern. Some minor folds within the iron formation may be due to these fold axes rather than to drag folding on the limbs of the major fold. The minor fold axes do not appear to extend completely across the anticlinorium as they are not shown in the trend of the basalt-dacite contact of the anticline on the northwestern side.

The Albany Shaft anticline is a narrow structure that is along strike from the Pickle Crow anticlinorium and appears to be a continuation of one of the fold axes of the anticlinorium. There are buckles in this fold due to cross

folds at angles of about 30° to the main fold axis.

Albany Shaft Syncline

The Albany Shaft syncline has a gently curving structural axis which extends completely across the map-area for a distance of 20,000 feet. This syncline is in dacite with some associated iron formation beds and one lens of interbedded argillite. On Section No.1 the main body of the rocks of the syncline extend to a depth of 2,100 feet below surface with one narrow keel of dacite extending for at least another 700 feet down the dip on this section. Near No.3 shaft on this section there are numerous facings by the shape of pillows in the metabasalt from surface to the 1,475-foot level, which supports the contention that the dacite overlies the basalt.

Shearing

A well developed schistosity is present in the volcanic rocks and on the limbs of folds this schistosity conforms with the dip of the bedding and with the axial plane cleavage of the latest period of folding. The porphyries are not strongly sheared but the platy minerals developed in the matrix are aligned in conformity with the schistosity of the adjacent volcanic rocks. No zones of strong shearing are known to occur within the map-area.

Faulting

No major faults are known to be present in the area and faulting has not been a problem in mining operations. Bothwell (1938, p.138) makes the following comment:

" There are numerous small faults in which the (Howell) vein has been moved for a few inches up to a foot or two. The fault plane in all the faults strikes northwest, and in most cases the eastern portion has moved south with respect to the western portion. "

In most places no displacement can be seen along the walls of a vein but Monette (1949, p.102) shows a segment of a metagabbro dike, called No.2 inclusion in the Pickle Crow, which is offset as much as 75 feet along the vein fracture.

Economic Geology

The prospecting carried out in 1928 resulted in the discovery of the No.1 (Howell) vein on what later became the Pickle Crow property and in the following year the Springer vein which became the Central Patricia No.2 Operation was also located. The ore shoot at the Central Patricia No.2 Operation was mined out in a few years but Pickle Crow has been in continuous production since 1935. The value of the gold and silver produced until the end of 1964 amounts to $50,669,394 from which $12,375,000 was paid in dividends. Because of the presence of gold orebodies the surface has been intensively prospected and a good deal of surface drilling has been done.

A small amount of scheelite was taken from the Pickle Crow mine during World War II. The iron formation bands are not known to contain concentrations of iron that approach economic grade. One gravel and sand pit has provided material for road building and for local construction uses.

Production statistics for Pickle Crow Gold Mines Ltd. and Central Patricia Gold Mines Ltd., No.2 Operation are shown in Tables 7 and 8 respectively.

Table 7 Production statistics Pickle Crow Gold Mines Limited 1935-1964

Year	Gold Ounces	Silver Ounces	Tons Milled	Total Value Dollars	Dividends Dollars
1935	24,925	2,572	37,277	878,745	
1936	45,975	5,032	63,758	1,612,451	600,000
1937	64,790	7,290	98,063	2,270,113	1,050,000
1938	78,565	8,440	115,915	2,769,291	1,200,000
1939	79,572	8,708	126,959	2,902,154	1,200,000
1940	74,704	8,396	141,992	2,879,222	1,200,000
1941	70,990	8,225	146,375	2,736,169	1,200,000
1942	51,285	5,702	107,951	1,976,684	900,000
1943	34,464	4,335	70,575	1,328,548	300,000
1944	37,699	4,897	63,338	1,453,312	300,000
1945	33,489	4,674	60,227	1,291,181	300,000
1946	37,664	4,944	73,209	1,390,576	313,685
1947	38,653	5,381	86,227	1,356,687	313,685
1948	46,461	6,747	107,309	1,631,195	313,685
1949	48,897	7,128	117,372	1,776,736	313,685
1950	46,812	7,249	108,176	1,783,108	313,685
1951	45,783	6,858	105,645	1,690,082	313,685
1952	41,030	5,782	108,275	1,407,074	313,685
1953	42,106	5,449	85,831	1,453,117	313,685
1954	46,705	6,010	110,711	1,594,445	313,685

Year	Gold Ounces	Silver Ounces	Tons Milled	Total Value Dollars	Dividends Dollars
1955	46,293	5,942	124,240	1,604,535	313,685
1956	42,079	4,988	108,620	1,451,083	313,685
1957	44,077	5,548	117,624	1,483,700	338,685
1958	42,166	5,411	110,316	1,434,721	169,342
1959	32,432	4,319	112,045	1,092,533	166,483
1960	39,663	5,067	120,345	1,351,064	166,483
1961	48,447	5,000	124,821	1,722,644	
1962	40,328	4,110	111,781	1,513,458	
1963	34,983	3,389	100,209	1,325,285	
1964	27,404	2,147	84,739	1,031,507	
Total	1,388,461	164,291	3,070,975	50,191,429	12,375,000
Average per Ton	0.452	0.054		16,34	

Table 8 Production statistics Central Patricia Gold Mines Limited No.2 Operation 1938-1940

(Information supplied in 1951 by J.T. Ward, Central Patricia Gold Mines Limited to E.G. Pye, Ontario Department of Mines)

Year	Gold Ounces	Value Dollars	Tons Milled	Tons Sorted
1938	4,287.99	150,079.65	5,966	1,534
1939	6,333.64	230,218.68	8,483	1,348
1940	2,536.79	97,666.41	4,437	629
Total	13,158.42	477,964.74	18,886	3,511
Average per Ton	0.696	25.31		

Gold

Description of the Veins

Shape of the Veins and Structure Within the Veins

The veins are long, narrow and curving with pronounced minor irregularities in plan but with a uniform or gently curving dip. Because of the uniform dip the irregularities in strike persist down the dip for considerable distances. The largest vein is over 1,600 feet in length and varies in width from a few inches up to several feet and persists down the dip from surface to the 3,200-foot level. The veins are believed to have been formed by the filling of dragfolded zones, and that the present shape of the vein is due to the shape of the opening. The banding within the veins conforms with the curves of the vein boundaries and there is no brecciation of the vein at the bends to suggest that the vein had been folded.

Most of the veins within the metabasalt are distinctly banded due to the occurrence within the quartz of zones of altered rock up to 2 inches in thickness and ribbons of chlorite and sericite. These inclusions and ribbons of micaceous minerals are generally parallel to the walls of the vein. However, some zones of altered rock, over a distance of several feet, extend across a narrow vein, and short crinkled ribbons of micaceous minerals are oriented at a large angle to the walls of the vein. The inclusions have gradational mineralogical and colour boundaries and have been partially replaced by carbonate, sericite and tourmaline. Microscopic examination of the quartz

has shown that in places the quartz adjacent to the walls of the veins has the crystals oriented perpendicular to the wall which suggests that the crystals grew outward from the wall of the fracture.

Structural and Stratigraphic Relationships of the Veins

Generally there is no close grouping of the veins with each productive vein in the upper levels of the mine at least 1,000 feet from the next vein. In the lower levels of the Pickle Crow mine the No.5 and 9 veins and the No.6, 7 and 8 veins are grouped in the same locality. Three of the productive veins within the layered rocks strike at an angle of about 30° to the bedding, but the strike of these veins and of other veins varies from being nearly parallel to nearly perpendicular to the bedding. The vein within the Pickle Crow porphyry stock extends across the stock at an angle of about 30° to the contact and another vein, which is partly within the stock has the same general strike.

The largest number of veins and some of the most productive veins are in anticlinal areas associated with metabasalt and iron formation. The veins in the Pickle Crow anticlinorium are generally parallel to the minor fold axes. One vein is within an intrusive stock and one vein is partially within the stock and another vein is in a syncline within dacite and iron formation. This variety of host rocks suggests that a favourable structural environment was more important to vein formation than the type of host rock.

Wall Rock Alteration

The veins within the metabasalt have sharp contacts with the enclosing wallrock and the rock adjacent to the vein is altered to a grey, chloritic schist with little pyrite or carbonate. Where veins intersect iron formation the iron-bearing minerals may be metamorphosed to produce abundant pyrrhotite. The parts of the vein within the Pickle Crow porphyry that consist of a single fracture do not appear to have a wide alteration zone but where the vein consists of several branches the adjacent wallrock is strongly bleached and sericitized. The analysis of the altered Pickle Crow porphyry adjacent to No.2 Vein (Analysis No.3, Table 4) generally is little altered from the fresh rock. The amount of carbon dioxide has increased and there has been a slight increase in the potash and soda content. Silica and water have decreased slightly.

Ore Shoots

Only a part of the productive veins contain gold in economic amounts and parts of the veins or other veins are unmineralized or contain gold mineralization below ore grade. White (1943, p.512-532) studied the mechanism and environment of gold deposition in veins. He pointed out (White 1943, p.519, 520) that in the late stages of vein formation while still at high temperature the vein quartz undergoes a process of cataclasis. The original larger quartz crystals break down along grain boundaries, into loosely packed small crystals.

Cataclasis of the quartz is most pronounced at rolls and crenulations in veins and brittle materials such as sulphides, tourmaline, and scheelite are broken and slightly offset. Ore shoots occur in the zones of cataclastic quartz and in the fractures of the associated brittle minerals. The parts of the vein are barren where no fracturing has taken place.

The ore shoots within the veins of this area are relatively short in horizontal extent but have their greatest persistence down the rake of the ore shoot so that this direction is from 4 to 15 times the horizontal length. Most of the veins have only one stope and where separate but adjacent shoots occur they have been mined as one unit.

Company drawings of composite level plans for the No.1, No.5 and No.9 veins show that within ore shoots zones of a particular grade, for horizontal lengths as short as 10 feet, persist for distances from 150 to 600 feet down the rake of the ore shoot. This zoning of the gold content of the vein in lath-like bodies would appear to be the result of the migration of gold-bearing solutions along channelways in the vein. These channelways could have resulted from structural adjustments which produced varying amounts of cataclasis of the quartz along the direction of movement.

Minerals of the Veins and Mineral Relationships

A considerable amount of study has been directed to the minerals present in the veins and their relationships. However, there is little precise data about the amounts of the various minerals present with the exception of gold and silver. Two partial analyses are available which give an idea of the mineral content of the vein material (Table 9).

Table 9 Composition of vein material at Pickle Crow mine.

	1	2
	percent	percent
Copper	Trace	Trace
Iron	11.78	2.54
Arsenic	0.02	0.02
Sulphur	3.24	0.70
Total	15.04	3.26
Pyrite	6.0	1.3
Pyrrhotite	4.4	1.0
Siderite	12.7	2.9
Total	22.1	5.2

1. Vein material containing sulphides. Partial analysis by Mines Branch (1935, p.14).
2. Mill feed containing little sulphides. Partial analysis in Brown (1938, p.151).

The writer has not made a study of the veins and vein minerals and the following description is largely taken from previous writers particularly from Pye (1956, p.76-90):

Quartz. Quartz is by far the most abundant mineral of the veins and two generations of quartz are found in many veins. The quartz in No.1 vein and in other veins in the metabasalt is a light grey colour and is banded due to the presence of inclusions of schist and dark coloured minerals but No.2 vein consists of white quartz. A vein which is largely formed of coarse-grained quartz is somewhat glassy but as the proportion of fine-grained quartz increases it grades over into sugary textured quartz. Microscopic examination of the quartz shows that one part consists of coarse, angular to subangular fragments which are highly fractured and filled with minute liquid inclusions. The other part is a fine-grained mosaic of anhedral grains which occur along small fractures and surround the larger grains.

The second generation of quartz consists of veinlets generally less than a half inch in thickness which are approximately at right angles to the veins and extend completely across the veins but rarely extend into the wallrock. These veins consist of quartz with abundant white or pink calcite.

Carbonates. The next most abundant constituent of the veins after quartz is carbonate. Siderite is an original constituent of the iron formation and is found adjacent to the vein. In places the siderite is replaced by ferruginous dolomite which is found in the wallrocks and in addition forms ribbons within the veins and is one of the early vein minerals. Calcite occurs

with the quartz in the late, transverse veinlets.

Albite, Chlorite, Sericite. Albite is present near the walls of No.2 vein but is erratically distributed and difficult to identify macroscopically. It also occurs in quartz stringers in diamond drill core and is abundant in a mineralized zone near the northeast corner of claim Pa.774.

Chlorite is present in all the veins and is particularly abundant in inclusions within the veins. It is considered to be an early mineral and has been replaced by ferruginous dolomite.

Sericite occurs as a product of wallrock alteration except where the walls are iron formation and also occurs within the veins and is particularly abundant in No.2 vein. The sericite and chlorite ribbon structures within the veins are probably the last remnants of wallrock inclusions.

Tourmaline, Scheelite. Tourmaline is widespread in minor quantities and occurs as aggregates of tiny crystals replacing inclusions of wallrock and associated with the chlorite and sericite of the ribbon structures. Broken tourmaline crystals cemented by quartz and tourmaline inclusions within quartz are most abundant near the boundaries of inclusions.

Scheelite is a minor constituent of many of the veins. It is a straw-coloured variety and many of the crystals are fractured and cemented by quartz.

Pyrrhotite and Pyrite. Pyrite and pyrrhotite are the most abundant sulphides and both are about equally abundant in the veins in the metabasalt but pyrite is more abundant in No.2 vein, and only pyrite occurs in No.14 (Albany) vein. In the

metabasalt and iron formation wallrocks pyrrhotite occurs as irregular masses, disseminated grains and narrow seams. It occurs in fractures in either the veins, the wallrock or both and as grains healing broken crystals of arsenopyrite and pyrite. The pyrrhotite is later than the quartz and the late variety of pyrite but is replaced by sphalerite, chalcopyrite and galena.

Pyrite is the most abundant sulphide in the No.2, No.14, and Springer veins. An early variety of pyrite has been identified in the No.14 vein where it is fractured and generally contains gold. A later pyrite occurs along fractures in No.1 and No.2 veins and generally does not contain gold. Both ages of pyrite are replaced by pyrrhotite.

Arsenopyrite, Magnetite. Small amounts of arsenopyrite are present in most of the veins but it is more abundant where the wallrocks are iron formation. This mineral occurs in crystals up to $\frac{1}{4}$ inch in length within iron formation, in smaller crystals in metabasalt, and as euhedral crystals within the veins. In many places the crystals are fractured and healed by quartz, pyrrhotite, chalcopyrite and gold but rarely by pyrite. Arsenopyrite is believed to be the first metallic mineral deposited and was followed closely by pyrite which was deposited adjacent to the arsenopyrite.

Magnetite occurs in the parts of the veins which are adjacent to iron formation, and in small grains as inclusions in pyrite. It appears that magnetite is an original wallrock mineral that has been included in the veins.

Chalcopyrite, Galena, Sphalerite. Chalcopyrite occurs in very small amounts in irregular blebs and grains and generally is associated with pyrrhotite which it replaces and in a few places is associated with sphalerite. It is found either in the wallrocks or along fractures in the quartz.

Galena is also found in very small amounts and has been observed in No.1, No.2, and No.14 veins where it forms tiny grains along minute fractures in the quartz and encloses or is associated with gold. In a specimen from No.1 vein it appeared to replace sphalerite and is considered to be a late mineral.

Sphalerite has been identified only in No.1 and No.14 veins. In No.1 vein it occurs in narrow fractures in quartz and as a replacement in pyrrhotite. It is replaced by galena and gold.

Gold. Gold is present in many of the quartz veins and occurs in economic amounts in eight veins within the area. Visible gold occurs locally in small quantities but generally cannot be identified macroscopically except in the ore from No.2 vein which contains spectacular amounts of free gold. Gold has been deposited as a late mineral accompanied by galena and the late carbonate. Gold is molded upon or fills fractures in quartz, pyrite and arsenopyrite and it replaces pyrrhotite, sphalerite and chalcopyrite.

Sequence of Mineral Deposition

Because the veins are widely separated it seems unlikely that the process of vein formation was identical in each vein and the paragenetic sequence is necessarily generalized.

Where mineral names are given in a series in the following account the sequence corresponds to the sequence of deposition. The following account is taken from Pye (1956, p.91, Table 8):

In the earliest stage of mineralization carbonate, arsenopyrite and pyrite were deposited. These early minerals were fractured and the next minerals to be deposited were scheelite, tourmaline, quartz and albite, although scheelite may belong to the earlier group of minerals. A second period of fracturing was followed by the deposition of pyrite, pyrrhotite, sphalerite, chalcopyrite, galena, carbonate and gold. Late fractures were filled by quartz and calcite.

Quartz-Sulphide Zones

These deposits are located within iron formation where there are stringers and discontinuous lenses of quartz. The iron-bearing minerals of the iron formation have been converted to sulphides adjacent to the veins and gold is present in the veins and in the associated sulphides. The orebody at the main operation at Central Patricia was of this type but other zones of similar mineralization have been found by surface drilling as well as underground at the Pickle Crow mine.

Tungsten

Production of tungsten ore given in Table 10 is taken from the Statistical Files, Ontario Department of Mines. The shipment of scheelite received from Pickle Crow Mines Ltd. was a high quality product which would appear to have been hand cobbed.

Table 10 Production of tungsten from Pickle Crow mine

Tungsten ores received by the Bureau of Mines, Ottawa, during the Calendar Year 1943, from Pickle Crow Gold Mines Ltd.

Weight Pounds	Assay WO_3 Percent	Weight of WO_3 Contained Pounds
120	75.10	90.12

Description of Properties

Central Patricia Gold Mines Limited

No. 2 Operation

Location and Ownership

Central Patricia Gold Mines Limited was incorporated in 1931 and took over the properties of Central Patricia Mines Limited and the adjacent Springer group of 25 claims. No. 2 Operation is on claims Pa.625 and 647 of the Springer group.

The discovery of gold in the Springer (No.6) vein of this property was made by John McCallam in 1929 and in that year the property was optioned to F.M. Connell and later became part of the Central Patricia property.

Development and Production

Stripping of the Springer vein on surface indicated a zone in the vein 70 feet in length, 7 feet 9 inches in width at a grade of $24.55 (0.70 ounces) per ton (Pye 1956, p.130). The shaft was sunk to a depth of 175 feet in 1935, and in 1937 it was deepened to 420 feet, and in 1939 to 1,024 feet. Seven levels were established with a distance of 150 feet between most levels. Tower et al (1941, p.22) gave the development footages on each level with the total amount of drifting 3,741 feet, crosscutting 1,785 feet and raising 1,965 feet. The two most extensive levels were the 150-foot lever where the drifting and crosscutting amounted to 1,294 feet and the 1,000-foot level

where the drifting and crosscutting amounted to 1,305 feet. Sixteen diamond drill holes with a combined length of 1,970 feet were drilled from underground.

The mine was in production from 1938 to 1940. The ore was hoisted to surface, passed over a picking belt and trucked to the Central Patricia mill. The ore milled amounted to 18,886 tons from which 13,158.42 ounces of gold was recovered valued at $477,964.74. The average amount of gold recovered per ton was 0.696 ounces.

Tower et al (1941, p.21-22) make the following statement: " During the early months of 1940 the development on the four lowest levels was completed and several hundred feet of exploratory drifting was done beyond the ore zone on the 1,000-foot level. The results of this work were not satisfactory, and operations were suspended in June. "

Geology

On surface the rocks associated with the Springer vein are metabasalts with pillows in many places. Thomson (1938, Insert map facing page 48) shows porphyry adjacent to the vein at 120 to 165 feet east of the shaft on the 150-foot level and from 185 to 205 feet on the 400-foot level. The general strike of the vein is slightly north of east in the vicinity of the shaft but farther to the west the strike changes to a northwesterly direction, and the dip is 65^{o}N. The trend of the vein is parallel to the axes of several minor folds in the Pickle Crow anticlinorium and is near the axial plane of a minor anticline.

Description of the Veins

The Springer vein is exposed on surface for a length of 220 feet and on the 400-foot level has been drifted upon for 450 feet in a direct line, but has a considerably longer strike length due to irregularities. The vein is irregular in width with pinches and swells but the average width is 14 inches. The dip of the vein is fairly regular but in plan it has a curving, folded shape and the folds changes direction for distances from 10 to 60 feet before resuming the general strike. The fracture which the vein occupies is presumed to have been folded before the vein was introduced.

Thomson (1938, p.49) gives the following description:

> "Vein material consists of white quartz, tourmaline, chlorite, carbonate, and small amounts of sulphides, including pyrite, pyrrhotite, and arsenopyrite. The wall rock is sheared near the vein but is otherwise unaltered; gold values are confined to the quartz. Native gold occurs in spectacular amounts along certain parts of the vein, but its distribution is erratic. Ore sections occur along the drag folds in the quartz at some places. The gold is largely confined to fractures in the quartz, which follow seams of chlorite and tourmaline. Thin sections of the vein material also show gold along fractures in pyrite and arsenopyrite. It is quite evident that the precious metal was introduced later than the quartz and sulphides. Carbonate material is frequently associated with native gold along fractures in the quartz, and must have been introduced at about the same time as the gold."

The upper part of the main ore shoot extends from the 550-foot level upward, and between the 275- and 400-foot levels has a stoping length of 150 feet. Within the ore shoot the lower grade sections have been left as pillars and the upper and lower parts end in irregular lobes. The lower part of the main ore shoot begins at a depth of 500 feet below surface and extends to a depth of 900 feet. It is somewhat irregular in shape with a maximum horizontal length of 50 feet. Both these ore shoots rake at N.20°E.

The vein was very narrow but high grade,and Sinclair et al (1936, p.91) describe the ore zones on the 150-foot level as follows: " Four ore shoots, varying in length from 25 feet to 90 feet, were found to the west of the main crosscut, giving a total ore length of 198 feet, averaging 2.35 ounces over a width of 14 inches. "

Due to a minimum mining width of three feet about two feet of wallrock was included with the vein material which reduced the average grade to 0.696 ounces per ton for the 18,886 tons which were milled, No record is available for the amount of silver recovered but the production of gold amounted to 13,158.42 ounces.

Hook (No.5) Vein: This vein is in claim Pa.625 and has been described by Thomson (1938, p.48) as being practically without sulphides and consisting of white quartz with streaks of black tourmaline, calcite and ankerite. A further description of the vein is taken from Pye (1956, p.140):

" The No.5 or Hook vein lies in greeenstone about 1,000 feet northwest of the Springer shaft. It is the strongest of the several veins found on the property, averaging over 3 feet in width throughout an exposed length of 470 feet. However, like the other veins, it is contorted in places and variable in thickness. Throughout the greater part of its length it strikes a few degrees west of north and dips 62°E., but at its north end it curves sharply to the west and at its south end sharply to the east, so that in a general way it superficially resembles an open "Z"-shaped flexure. In general appearance and composition the Hook vein does not differ greatly from the No.6 described

above. Values are generally low, the best assays being obtained from samples cut from the north-south section of the vein within 70 feet from the sharp westerly bend. Four diamond drill holes have been bored to intersect this vein at its south end, but these served to confirm the surface sampling in indicating only a low gold content. "

Quartz-Sulphide Deposit

This zone of mineralization is on claim Pa.627 and was investigated by diamond drilling. Pye (1956, p.140-141) gives the following resume of the exploration activities and the results obtained:

" Diamond drilling in 1949 from the surface of claim Pa.627 disclosed the presence of a small body of quartz-sulphide mineralization, in fractured iron formation in the trough of a minor dragfold at or near the nose of the regional Pickle Crow syncline. This deposit was found to be similar to the ore at the No.1 Operation in that area, as at the No.1 mine, quartz veinlets, auriferous sulphides (pyrrhotite, arsenopyrite, and pyrite), and some chlorite occur along fractures that strike normal and obliquely to the bedding of the rock. According to the management, drilling indicated, at a depth of 90 feet, 120 tons of ore per vertical foot averaging 0.361 ounces per ton over a width of 8.0 feet (D.B. Angus, personal communication). Originally, it was thought that this body was a northwest-trending structure dipping steeply northeast, and when drilling near its south extremity indicated a flattening and decrease in

grade with depth, work was suspended. Later re-investigation of plans and sections, however, indicated that the deposit is a saddle-shaped body in the trough of a syncline and plunges east-northeast, and that the flattening of the dip was only an apparent one because of intersection in the drill holes of the mineralized zone along the south limb of this fold beyond the limit of the "ore" section. Further drilling in 1951 corroborated this interpretation and showed the deposit to plunge 65°E. and its bisecting plane to dip about 75°N. But again the drill intersections were disappointing, and once more work on the deposit has been suspended. "

Pickle Crow Gold Mines Limited

Location and Ownership

Pickle Crow Gold Mines Limited holds a group of 96 claims most of which are south of the Crow River and within Connell township, although a few claims extend into McCullagh township. Two of the original claim groups were staked by H.H. Howell and John MacFarlane of Northern Aerial Minerals Explorati on Limited (N.A.M.E.) in 1928. Northern Aerial Minerals Canada Golds, Limited purchased the assets of N.A.M.E., and Pickle Crow Gold Mines Limited, incorporated in 1934, in turn purchased the property from the previous company. In 1958 Teck Corporation Limited purchased a large group of shares and took over control of the company.

Twenty-two claims of the Cohen-McArthur group were purchased by Pickle Crow in 1942. Albany River Mines, Limited

held a group of eight claims which were staked in 1928 and were the first claims recorded in the area. Albany River Gold Mines, Limited, incorporated in 1938, took over the Albany River Mines property and purchased the adjoining 9 claims held by Winoga Patricia Gold Mines, Limited. This property became part of the Pickle Crow group in 1947 by an exchange of shares.

Discovery

The No.1 (Howell) vein was discovered by H.H. Howey and John MacFarlane who were employed by N.A.M.E. The diary of John MacFarlane for the day of the discovery, Monday, September 10, 1928 is as follows (Candian Mining Journal, Vol. 56, 1935, p.563): " Worked northeast nn ridge. Iron dikes [iron formation] with greenstone. Went east to end of and crossed creek to another ridge south about 8 to 10 chains. Found a quartz vein [No.1 (Howell) vein] alongside magnetite dike [iron formation]. Traced 100 feet. Four feet wide at swamp and two feet on top of hill. Found visible gold, and the rust pans. "

No.2 vein was located in a drift-covered area by surface drilling in 1937 and 1938, and in 1940 it was investigated on the 750-foot level by a drive from No.1 shaft. The other productive veins on the property No.5, No.6 and No.9 were discovered from underground drilling from mine workings.

Development

The mine is developed by three surface shafts No.1 shaft, No.3 shaft and the Albany shaft. No.2 shaft is a subsurface shaft in the vicinity of the No.2 vein which extends from the 750-foot level to the 1,500-foot level. No.4 shaft is also a subsurface shaft and is adjacent to No.1 shaft with a depth below surface of 4,038 feet and provides access to the deeper levels of the mine from the 3,050- to the 3,800-foot levels. In the vicinity of No.1 shaft 26 levels have been established to a depth of 3,800 feet with the level interval 125 feet to a depth of 750 feet and generally at 150 feet for the deeper levels. In the No.3 shaft area 21 levels have been established to a depth of 3,000 feet. The No.3 shaft area was first developed underground from the 750-foot level driven from No.1 shaft. The 2,900-foot level has been driven northeastward to within 1,100 feet of the 2,850-foot level from No.3 shaft, but on other levels the workings are more restricted. The Albany shaft is 652 feet in depth with five levels at 125-foot intervals. The 625-foot level is the most extensive with 2,215 feet of drifting and the total amount of development work in the Albany shaft workings consists of 8,215 feet of drifting, crosscutting and raising (Tower et al 1942, p.67).

Mining Methods, Gold Recovery and Production

Shrinkage stoping and a cut-and-fill method using waste rock as backfill are used in the wider sections of the veins. In the narrower, richer sections a resuing method was used (Monette 1949b, p.109-110).

Milling began in 1935 at a rate of 125 tons per day and with the installation of an additional crushing unit the mill capacity became 200 tons per day. In 1937 duplicates of the crushing and milling machines already installed were purchased so that the mill could handle about 400 tons per day. The ore presents no major milling problems and the gold can be extracted by grinding 80 percent of the mill feed to minus 200-mesh. Recovery of the gold is by a combination of amalgamation and cyanidation methods and Brown (1938, p.157) showed that 98 percent of the gold was recovered of which 44 percent was by cyanidation.

Production has been continuous since 1935 and to the end of 1964 some 1,388,461 ounces of gold and 164,291 ounces of silver have been recovered from 3,070,975 tons of ore. The average recovery of gold per ton milled was 0.452 ounces and of silver 0.054 ounces with a combined value of $16.34. The gross value of the bullion was $50,191,429 from which $12,350,000 was paid in dividends.

Ore Reserves

The statement of ore reserves is taken from the Pickle Crow Gold Mines Limited, Annual Report 1965.

" Ore reserves at year-end totalled 333,300 tons with a grade of 0.329 ounces of gold per ton. Completion of the lateral development on the Nos.5 and 9 veins, No.4 shaft area, added appreciably to reserves during the year. Grade of this is lower than previously indicated due to an increased allowance being made for dilution during stoping operations.

	January 1, 1965		January 1, 1964	
	Tons	Gold at $35 per oz.	Tons	Gold at $35 per oz.
Broken ore	10,650	$11.86	31,770	$ 9.80
Developed ore	312,900	11.34	290,550	13.72
Probable ore	9,750	16.62	3,000	11,20
Totals	333,300	$11.51	325,320	$13.02 "

Veins and Mineralized Zones

No.1 (Howell) Vein

No.1 vein is over 1,800 feet in length and an ore shoot within the vein persists to a depth of 3,200 feet and presumably the section of the vein containing gold mineralization that is below ore grade is considerably more extensive. The part of the vein east of No.1 shaft is highly contorted but has a general strike of N80°E and dips 73°N. The western section is smoothly curving in plan, strikes about N68°E and dips at 75° to

the northwest. The parts of the vein with a folded shape plunge at about 70° in a direction N20°E and zones of a particular grade within the ore shoot also generally plunge in a direction N20°-30°E.

The country rocks adjacent to the vein are metabasalt and iron formation. The iron formation is adjacent to the vein for a length of 180 feet on surface and for 60 feet on the 3,200-foot level, and the central part of the ore shoot is along the intersection with the iron formation. A metagabbro dike which appears to be older than the vein and varies in width from a few inches up to several feet is present on the north side of the vein in both iron formation and metabasalt. On the 1,350-foot level a dike of similar appearance occurs in the footwall and curves to cut across the vein, and a lamprophyre dike also cuts the vein.

Bothwell (1938, p.138) makes the following statement: " There are numerous small faults in which the vein has been moved for a few inches up to a foot or two. The fault plane in all the faults strikes northwest, and in most cases the eastern portion has moved south with respect to the western portion. "

The vein varies in width from a few inches up to 15 feet and averages about three feet. Monette (1943, p.103) notes that the part of the vein east of the iron formation maintains its width but the gold content decreases. However, in the western part, the vein maintains a uniform grade but the width of the vein decreases so that it no longer is ore. The ore shoot within the vein rakes at 70° at N20°E.

Pye (1956, p.178) has compiled the following information on the ore section of the vein from information published in the annual reports of the Company (Table 11).

Table 11 Dimensions and grade of the ore in No.1 Vein, Pickle Crow mine. (Pye 1956, p.178)

Level	Ore Length	Average Width	Oz. Au/Ton
125	1,092 feet	32 inches	0.68
250	1,120 "	25 "	1.12
375	1,306 "	27 "	1.01
500	1,093 "	29 "	0.63
625	1,114 "	34 "	0.69
750	1,388 "	32 "	0.63
900	1,120 "	31 "	0.64
1,050	1,166 "	35 "	0.66
1,200	1,235 "	29 "	0.52
1,350	1,147 "	29 "	0.50
1,500	1,113 "	32 "	0.46
1,650	972 "	40 "	0.41
1,800	1,005 "	36 "	0.37
1,950	831 "	36 "	0.35
2,200	709 "	42 "	0.23
2,450	590 "	36 "	0.20

No. 5 Vein

No.5 vein was located by drilling on the 1,350-foot level and was developed on this level in 1947. Later the vein was stripped on surface and drilled from underground so that in 1951 an ore shoot was known to be present between surface and the 1,350-foot level that was estimated to contain a minimum of 100,000 tons averaging at least 0.29 ounces of gold per ton (Northern Miner, October 11, 1951, p.1). Since that time much of the ore shoot has been stoped above the 2,900-foot level and it has been developed to the deepest levels of the mine. The vein has an average width on surface of three feet and the ore shoot has a maximum horizontal length of 400 feet and a developed vertical extent of 3,800 feet. Drilling below this level has shown that the ore shoot persists for at least another 400 feet (see Table 12).

Table 12 Dimensions and grade in No.5 vein drilling below 3,800-foot level, Pickle Crow Gold Mines Limited (Annual Report 1964)

Hole No.	Value	True Width	Vertical Depth
32	2.40 oz.	1.5'	4,070'
33	1.82 oz.	2.0'	4,278'
34	0.23 oz.	0.9'	4,465'

Table 13 Dimensions and grade in No.9 vein drilling below 3,800-foot level, Pickle Crow Gold Mines Limited (Annual Report 1964)

41	4.49 oz.	1.5'	3,961'
	0.45 oz.	1.0'	3,971'
42	1.84 oz.	2.5'	4,092'
43	0.20 oz.	1.6'	4,212'

No. 9 Vein

No.9 vein is adjacent to No.1 and No.4 shafts and lies between No.1 and No.5 veins. The strike of the vein is approximately at right angles to the trend of the metabasalt and curves from N35°W to N75°W. The ore shoot within this vein has been stoped above the 3,050-foot level and developed to the 3,800-foot level. The maximum horizontal length of the ore shoot is 200 feet and the vertical extent is 1,750 feet above the 3,800-foot level. The extension of this ore shoot below this level has been established by drilling (see Table 13).

No. 2 Vein

No.2 vein has been followed by drifting for a length of 900 feet on the 750-foot level and in a zone for a length of 1,100 feet on the 975-foot level where it is considerably longer because of irregularities. The general strike is N80°E and the average dip 45°N. Monette (1949, p.102) gives a plan of the 975-foot level which shows that the vein is not a single continuous structure. In the western part the vein is fairly regular but in other parts it separates into branches and may form a continuous loop or partial loop around blocks of country rock, or it may form a stockwork. This vein is entirely within the Pickle Crow porphyry stock. Where the structure is fairly uniform the vein is about three feet in width and rarely is more than five feet in width. The ore shoot within the vein rakes to the northeast at 40°. The greatest horizontal length is 1,150 feet with a length of 2,150 feet down the rake.

Table 14 is taken from Pye (1956, p.197):

Table 14 Dimensions and grade of the ore in No.2 vein, Pickle Crow mine

Level	400	550	750	850	975	1,100	1225	1475	1600
Ore length, feet	545	854	810	1045	1954	755	360	531	459
Av.width, inches	34	33	69	48	64	39	30	32	17
Oz. Au per ton	0.45	0.26	0.57	0.51	0.53	0.38	0.37	0.29	0.29

Quartz-Sulphide Zone

This zone was found by underground drilling and was drifted on during 1949 and 1950. It was first investigated on the 2,450-foot level at a distance of 290 feet north of No. 1 shaft and later was also stoped above the 2,600-and 2,900-foot levels. Some 2,452 tons of ore from the drift on the 2,450-foot level contained an average of 0.17 ounces of gold per ton and 16 drill holes from this level contained an average of 0.29 ounces of gold per ton over a width of 13.0 feet (Pye 1956, p.206). This zone of mineralization is within iron formation and has been described by Pye (1956, pp.207-208) as follows: " It is highly irregular in outline, and consists of highly contorted iron formation and occasional conformable strips of chlorite schist, both of which have been impregnated with sulphides and cut by small quartz veins and stringers.

The quartz veins in the zone tend to be localized along the limbs of minor drag folds or along east-west zones of shearing and fracturing. Those associated with the chlorite schist interbanded with the iron formation are highly lenticular in form, attaining widths of 3 feet or more but pinching out in short distances, and contain irregular patches, short books, and diversely oriented ribbons of altered wall rock. However, in the iron formation they are narrower and more persistent, and somewhat more uniform in width, and locally contain, in places of book structure , angular fragments of wallrock suggesting pre-vein brecciation. Associated with the quartz are small amounts of scheelite, carbonate, and tourmaline. The gold is localized for the most part in the accompanying sulphides (pyrrhotite and

pyrite), which occur as : (1) irregular streaks and small masses replacing both iron formation and chlorite schist within and along the walls of the veins; (2) thin seams localized along bedding laminae in the iron formation and planes of foliation in the chlorite schist; (3) stringers healing fractures of various attitudes that cut both the quartz and the wallrocks; and (4) fine disseminations in the iron formation. It is of interest to note that a few feet from the quartz veins the wallrocks are only sparsely mineralized with finely divided pyrrhotite and pyrite, so that, considering the zone as a whole, the sulphides collectively do not make up more than about 10 to 15 percent of the whole. "

Surface Veins and Mineralized Zones

Big Dome Vein

This vein has been described by Pye (1956, p.213) as follows: " The Big Dome vein system occurs near the west boundary of claim Pa.706, where it has been uncovered by trenching for a length of about 150 feet. It consists of contorted veins and patches of barren quartz along a zone striking N2^{o}W. through schistose and sparingly pyritized greenstone. The quartz contains a little gold, for samples assaying up to 0.40 ounces per ton across widths up to 4 feet 8 inches have been reported by the management, but the zone as a whole is below ore grade. To the south it may have been cut off by an east-fault, for it terminates abruptly at the contact between sheared greenstones and iron formation. "

Cohen Vein

The Cohen vein is in the northeastern part of claim Pa.774 where a number of irregular veins and stringers are contained within schistose dacite. Thomson (1938, p.49) has described the occurrence as follows:

" The vein quartz contains carbonate, albite, and seams of chlorite and tourmaline. It is mineralized with arsenopyrite and contains some visible gold. Values have been obtained in the surface trenches over a length of 150 feet, and are confined to the vein quartz with included schist and to areas of arsenopyrite mineralization. The arsenopyrite is largely massive and unfractured. "

Lake Shore Vein

The Lake Shore Vein is on claim Pa.705 to the south of Powderhouse lake and has been described by Pye (1956, p.214):

" It was discovered in 1928 and during that and the following year it was opened up by trenching and sampled for a total length of 450 feet. This vein is highly lenticular in character, and varies in width from a few inches in some places to a maximum of 3 feet at one point. It is quite similar to other veins in the area in that it is twisted and contorted, but here the vein "folds" are "S"-shaped in plan, and hence differ from those characteristic of the Howell and other veins discovered on the Pickle Crow property. These contortions reflect a much larger one which controls the overall attitude of the vein. To the east the vein strikes about N45°E, roughly parallel to the regional schistosity in the enclosing greenstones, and dips 52°NW. Going west it swings

sharply and assumes a strike of N45°W and a dip of 50°NE. However, this attitude is maintained for only about 45 feet, after which the vein again curves sharply, this time to the south, thus tending to complete a large "S"-shaped pattern compatible with the smaller contortions mentioned above.

The Lake Shore vein consists of white banded quartz with some chlorite, carbonate, tourmaline, and subordinate pyrite and pyrrhotite. Visible gold has been reported, but the grade of the vein as a whole is below ore standards, the average of scattered surface samples being 0.17 ounces of gold per ton across a width of 31 inches for a length of 350 feet (Unpublished company report, 1935). During September, 1935, five diamond drill holes, aggregating 661 feet, were bored to test the downward extension of the vein, but these also indicated only low gold values. The best intersection assayed 0.23 ounces per ton over a core length of 12 inches. (unpublished company report, 1935).

MacArthur Vein

Thomson (1938, p.49) described the vein as follows:

"A gold discovery was made on the east boundary of claim Pa.773 by J.A. MacArthur in March, 1933. This was developed by surface-trenching and test-pitting in the summer of 1934. Fourteen drill-holes were put down along the vein zones in 1936.

The original discovery on the east boundary of claim Pa.773 consists of discontinuous sheared zones, which contain silicified schist with quartz stringers in places. These are mineralized with traces of arsenopyrite, and visible gold has been found. A section across 85 inches in a trench on the claim line is reported to assay $9.00 per ton in gold."

Riopelle Vein

This description of the Riopelle vein is taken from Thomson (1938, p.62).

"The Riopelle vein is on claim Pa.730 and lies about half a mile southwest of the mine shaft. On the surface it consists of two separate parts with different strike. One part of the vein strikes northeast and dips 75°N.W. This is roughly parallel to the Howell vein but offset about 400 feet south of its projected strike. The quartz has a maximum width of about one foot. The other section follows a fracture through massive greenstone in a northwesterly direction and is much twisted and drag-folded (see photograph on page 26). The vein quartz is white and banded with chlorite and tourmaline. It ranges from a mere stringer to a vein more than 3 feet wide. To the northwest the vein disappears under swamp. A few particles of visible gold have been observed on the surface of the vein.

Drill-holes were put down on the extension of the Riopelle vein in 1937 and cut gold-bearing vein material. According to a report covering mine operations during the early part of 1937, four of the holes showed values as high as $15.00 over 24 inches. One intersection assayed $12.25 over 30 inches; others gave $4.90 over 36 inches, $9.80 over 30 inches, $22.05 over 6 inches, and $14.70 over 6 inches."

Sawmill Vein

The following description of this occurrence is given by Thomson (1938, p.63).

"A gold discovery was made in 1936 about 2,000 feet northwest of the mine shaft, near the south boundary of claim Pa.737. Two small parallel veins about 10 feet apart occur in greenstone and iron formation. The larger vein follows along the contact between iron formation and greenstone. Both veins have been drag-folded. The total length of the quartz veins on the surface is less than 50 feet, and the width ranges from 4 to 20 inches. The filling is quartz and carbonate with a little visible gold. The vein was drilled in 1936. Mine officials reported that the two veins carried values over an aggregate length of 70 feet."

Quartz-Sulphide Zone

The following description of mineralization within iron formation on claim Pa.729 is taken from Thomson (1938, p.63), who in turn quoted it from Pickle Crow Gold Mines Limited, Annual Report 1937: " Two interesting areas with ore-making possibilities were outlined. The first lies west and south of the shaft about 2,000 feet, and consists of quartz lenses in mineralized iron formation. Gold occurs in the quartz and in the iron formation adjacent to the quartz. Assays were erratic. It is possible that the quartz does not occur as veins but in lenses, which are difficult to correlate from one hole to the next... "

Selected References

Texts

Bothwell, S.A.

1938: Geology of the Pickle Crow Gold Mine in Operations at Pickle Crow Gold Mines Limited; Trans. Canadian Inst. Min. Met., Vol. XLI, 1938, p.132-140.

Brown, E.E.

1938: Mining and Milling Operations at Pickle Crow in Operations at Pickle Crow Gold Mines Limited; Trans. Canadian Inst. Min. Met., Vol. XLI, 1938, p.140-158.

Chisholm, E.O.

1950: Crow River area geology; Canadian Mining Jour., November 1950, p.112-113.

Corking, W.P.

1948: Pickle Crow mine in Structural geology of Canadian ore deposits (Jubilee Volume); Canadian Inst. Min. Met.

Donaldson J.A. and Jackson G.D.

1965: Archaean sedimentary rocks of North Spirit Lake area, northwestern Ontario; Canadian Jour. of Earth Sciences, Vol. 2, No. 6, p.622-647.

Duffell, S, MacLaren, A.S. and Holman, R.H.C.

1963: Red Lake-Lansdowne House area, northwestern Ontario, Bedrock geology, geophysical and geochemical investigations; accompanied by Map 2-1963 and Map

3-1963; Geol. Surv. Canada, Paper 63-5,p.1-15 (published 1963).

Hammel, J.E.

1938: Introduction in Operations at Pickle Crow Gold Mines Limited; Trans. Canadian Inst. Min. Met., Vol. XLI, 1938, p.125-126.

1949: Early history of Pickle Crow; Canadian Mining Jour., November 1949, p.96-98.

Hattie, A.G.

1938: Property and early development in Operations at Pickle Crow Gold Mines Limited; Trans. Canadian Inst. Min. Met., Vol. XLI, 1938, p.126-132.

Hurst, M.E.

1930: Pickle Lake-Crow River area, District of Kenora (Patricia Portion); accompanied by Map 39a; Ontario Dept. Mines, Vol. XXXIX, pt. 2, p. 1-35 (published 1931).

Low, C.M.

1949: Lake St. Joseph Transportation Company; Canadian Mining Jour., November 1949, p.121-122.

McInnes, William

1912: Report on part of the North-West Territories of Canada drained by the Winisk and Attawapiskat Rivers; accompanied by Map of the District of Patricia, Province of Ontario; Ontario Bur. Mines, Vol. XXI, pt. 2, p.108-138 (published 1912). This report 1080 is based on surveys made for the Geological Survey

of Canada in the seasons 1903, 1904 and 1905. Preliminary or summary reports accompany Vol. XV, pt. AA, p.100-108 and Vol. XVI, pt. A, p.153-160 of the Geological Survey of Canada.

McLellan, W.M.

1949: Milling at Pickle Crow; Canadian Mining Jour., November 1949, p.113-116.

Mines Branch

1935: Ore dressing and metallurgical investigation No.554, gold ore from the Pickle Crow mine, Patricia District, Ontario in Investigations in ore dressing and metallurgy 1934; Department of Mines Canada, p.14-21.

Monette, H.H.

1945: Geology of the Pickle Crow gold mine, Ontario; The Precambrian, October 1945, p.6-10.

1949a: Geological outline of Pickle Crow; Canadian Mining Jour., November 1949, p.99-105.

1949b: Mining at Pickle Crow; Canadian Mining Jour., November 1949, p.105-113.

Nockolds, S.R.

1954: Average compositions of some igneous rocks; Bulletin Geol. Soc. America, October 1954, Vol. 65, p.1007-1032.

Prest, V.K.

1963: Red Lake-Lansdowne House area, surficial geology; accompanied by Map 4-1963 and Map 5-1963; Geol. Surv. Canada, Paper 63-6 (published 1963).

Sinclair, D.G., Keeley, E.C., Cooper, D.F., Weir, E.B. and Webster, A.R.

1936: Central Patricia Gold Mines Limited No. 2 Operation (Springer) in Mines of Ontario 1935; Ontario Dept. Mines, Vol. XLI, pt. 1, p.91 (published 1937).

Thomson, J.E.

1938a: The Crow River area; accompanied by Map 47b; Ontario Dept. of Mines, Vol. XLVII, pt. 3, p.1-65 (published 1939).

1938b: Structure of gold deposits in the Crow River area; Trans. Canadian Inst. Min. Met., Vol. XLI, p.358-374.

Tower, W.O., Cave, A.E., Taylor, J.B., Little, E.S., Hargrave, W.G., Bayne, A.S., Cooper, D.F., Weir, E.B., and Douglass, D.P.

1941: Central Patricia Gold Mines Limited, Springer or No. 2 Operation in Mines of Ontario 1940; Ontario Dept. Mines, Vol. L, pt. 1, p.21-22 (published 1942).

Tower, W.O., Smith, R.L., Cave, A.E., Cooper, D.F., Taylor, J.B., Bawden, W.E., Little, E.S., Weir, E.B. and Douglass, D.P.

1942: Albany River Gold Mines Limited in Mines of Ontario 1941; Ontario Dept. Mines, Vol. LI, pt. 1, p.67. (published 1946).

Maps

Geol. Surv. Canada

Map 8-1951. Geology, Miminiska, Ontario. Scale 1 inch to 4 miles. (N.T.S. sheet 52P) Geology by G.D. Jackson; published 1961.

Map 51-1960. Geology, Lake St. Joseph, Ontario. Scale 1 inch to 4 miles. (N.T.S. sheet 52 O) Geology by R.F. Emslie; published 1961.

Map 2-1963. Geology, Red Lake-Lansdowne House area, Ontario. Scale 1 inch to 8 miles. (N.T.S. parts of 42,43 52,53). Compilation by S. Duffell. Accompanies G.S.C. Paper 63-5; published 1963.

Map 3-1963. Aeromagnetic-Geological interpretation, Red Lake-Lansdowne House area, Ontario; (accompanies G.S.C. Paper 63-5). Scale 1 inch to 8 miles. Aeromagnetic interpretation by A.S. MacLaren; published 1964.

Map 4-1963. Bedrock-Drift Distribution, Red Lake-Lansdowne House Area, Ontario. Scale 1 inch to 8 miles. (N.T.S. parts of 42,43, 52,53). Compilation by V.K. Prest and J.A. Donaldson; published 1962.

Map 5-1963 Surficial Geology, Red Lake-Lansdowne House area, Ontario. Scale 1 inch to 8 miles. (N.T.S. parts of 42,43, 52,53). Geology by V.K. Prest; published 1963.

Map 50-1963. Geochemistry (copper in bedrock), Lake St. Joseph, Ontario. Scale 1 inch to 4 miles. (N.T.S. 52 O) Geochemical compilation by R.H.C. Holman; published 1964.

Ontario Dept. Mines

Map of the District of Patricia, Province of Ontario. Scale 1 inch to 35 miles. (Accompanies O.B.M. Vol. XXI, pt. 2); published 1912.

Map 39a Pickle Lake-Crow River area. Scale 1 inch to 1 mile. (Accompanies O.D.M., Vol. XXXIX, pt. 2). Geology by M.E. Hurst; published 1931.

Map 47b Crow River Area, Scale 1 inch to 1,000 feet. (Accompanies O.D.M., Vol. XLVII, pt. 3). Geology and additional geophysical surveys by J.E. Thomson; published 1939.

O.D.M.-G.S.C.

Maps 923G, 924G Aeromagnetic Series; scale 1 inch to 1 mile. Ontario Dept. Mines - Geol. Surv. Canada; published 1960.

Other Sources

Canadian Mining Journal

1935: Discovering a mine (the diary of John MacFarlane), December 1935, p.562-566.

Marvin, E.H.

1952: Ore bodies of the Pickle Crow Gold Mines; unpublished B.Sc. thesis, Queen's University, Kingston, Ontario.

Northern Miner

1951: News item, New ore for Pickle, funds for Hasaga, 11 October 1951 (Vol. XXXVI, No.29, p.1217).

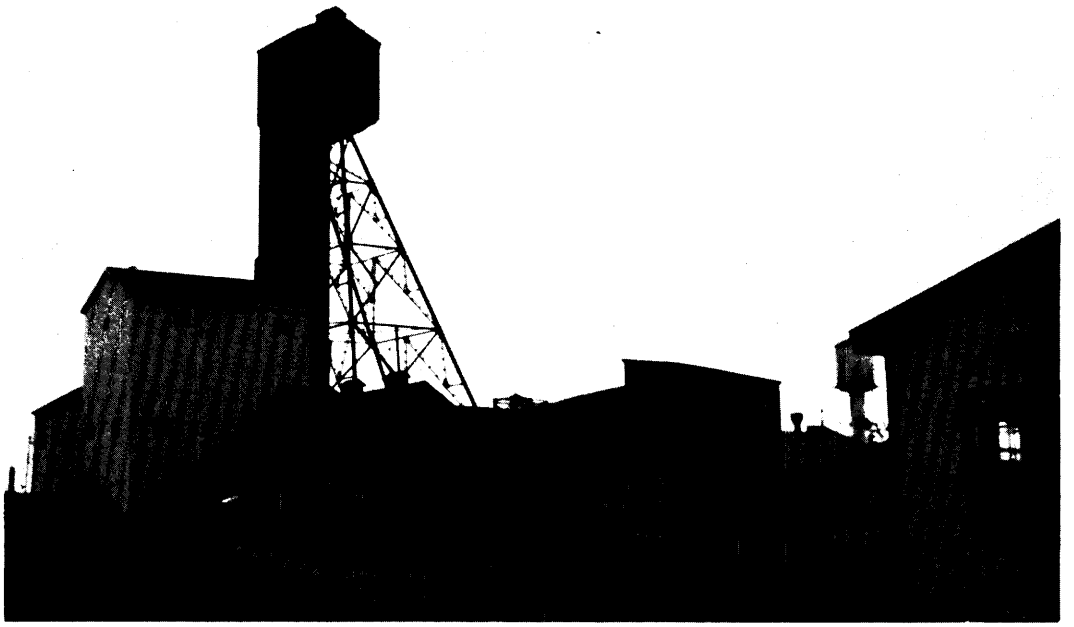
Pickle Crow Gold Mines Limited

1937: Annual Report.

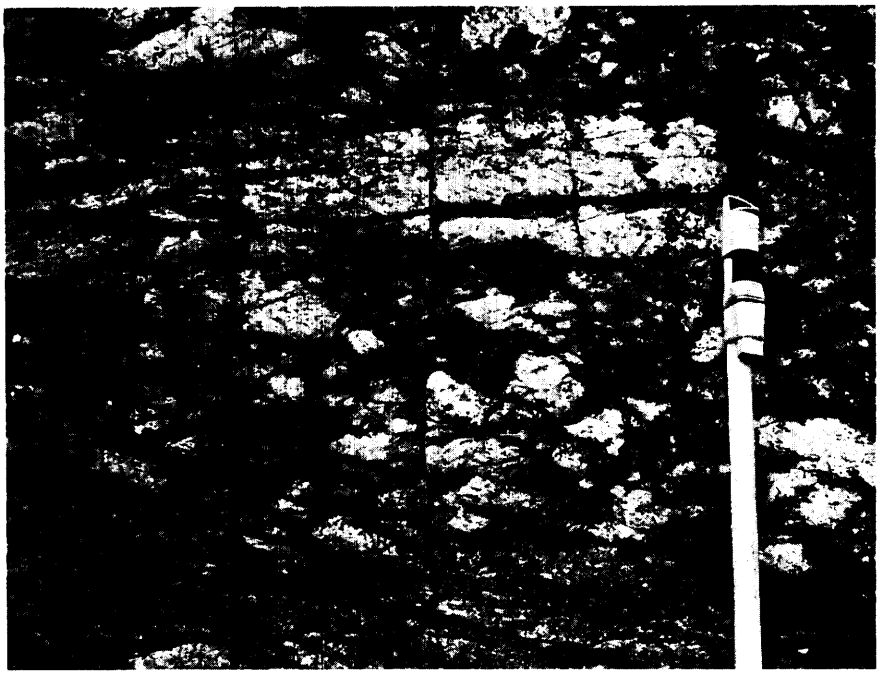
1964: Annual Report (for Annual meeting 24 June, 1965).

Pye, E.G.

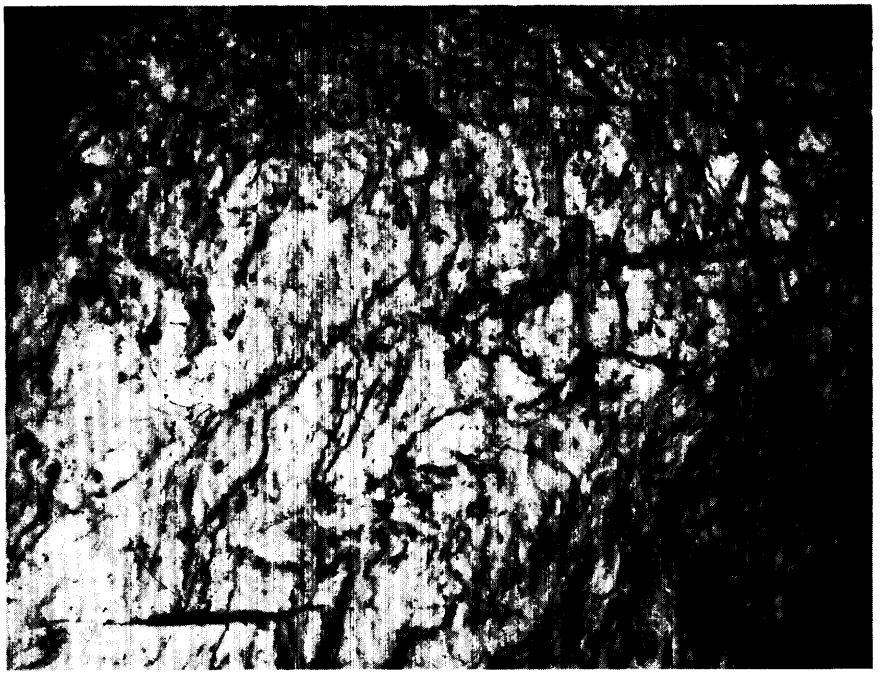
1956: Geology and mineral deposits of the Crow River area; accompanied by Map 47b revised 1956; private report to the Ontario Department of Mines, p.1-239.



View of the headframe and mill, Pickle Crow Gold Mines Limited



Dacite breccia, claim Pa.63, Pickle Crow Gold Mines Limited



No. 9 Vein Pickle Crow Gold Mines Limited, 3,200-foot level

PICKLE CROW GOLD MINES LIMITED
Eastern Part of Property

AND

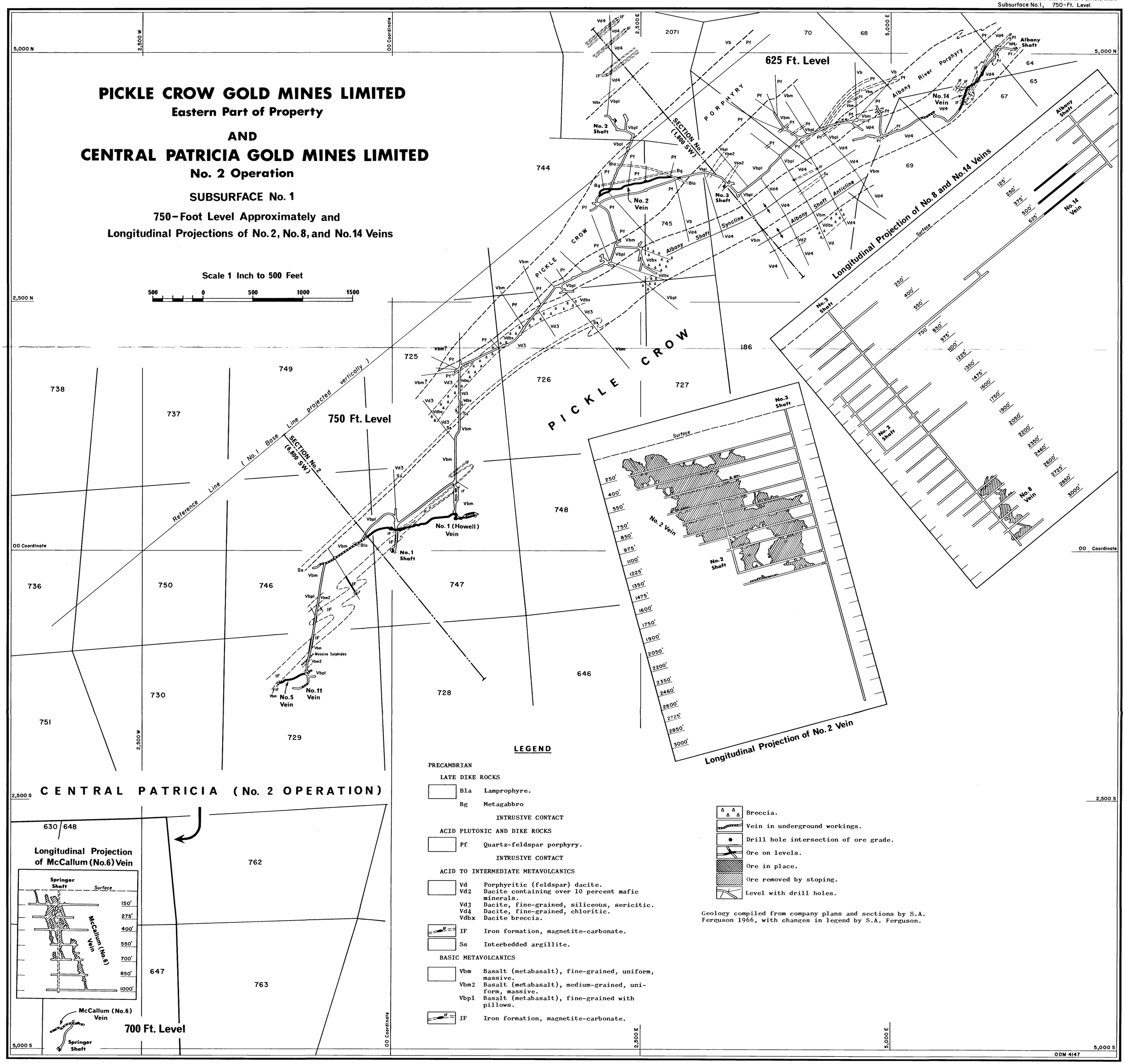
CENTRAL PATRICIA GOLD MINES LIMITED
No. 2 Operation

SUBSURFACE No. 1

750-Foot Level Approximately and Longitudinal Projections of No. 2, No. 8, and No. 14 Veins

Scale 1 Inch to 500 Feet

500 0 500 1000 1500



Longitudinal Projection of No. 8 and No. 14 Veins

Longitudinal Projection of No. 2 Vein

Longitudinal Projection of McCallum (No.6) Vein

LEGEND

PRECAMBRIAN

LATE DIKE ROCKS

- Bla Lamprophyre.
- Bg Metagabbro

INTRUSIVE CONTACT

ACID PLUTONIC AND DIKE ROCKS

- Pf Quartz-feldspar porphyry.

INTRUSIVE CONTACT

ACID TO INTERMEDIATE METAVOLCANICS

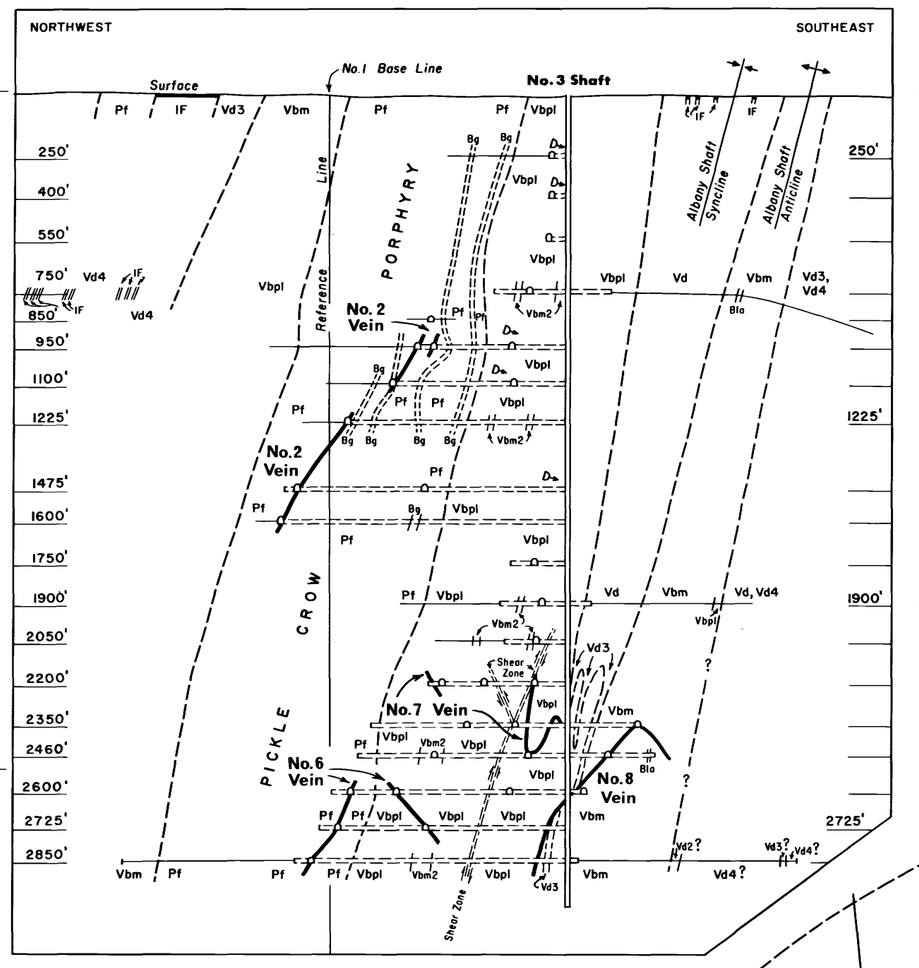
- Vd Porphyritic (feldspar) dacite.
- Vd2 Dacite containing over 10 percent mafic minerals.
- Vd3 Dacite, fine-grained, siliceous, sericitic.
- Vd4 Dacite, fine-grained, chloritic.
- Vdbx Dacite breccia.
- IF Iron formation, magnetite-carbonate.
- Ss Interbedded argillite.

BASIC METAVOLCANICS

- Vbm Basalt (metabasalt), fine-grained, uniform, massive.
- Vbm2 Basalt (metabasalt), medium-grained, uniform, massive.
- Vbpl Basalt (metabasalt), fine-grained with pillows.
- IF Iron formation, magnetite-carbonate.

- Breccia.
- Vein in underground workings.
- Drill hole intersection of ore grade.
- Ore on levels.
- Ore in place.
- Ore removed by stoping.
- Level with drill holes.

Geology compiled from company plans and sections by S.A. Ferguson 1966, with changes in legend by S.A. Ferguson.



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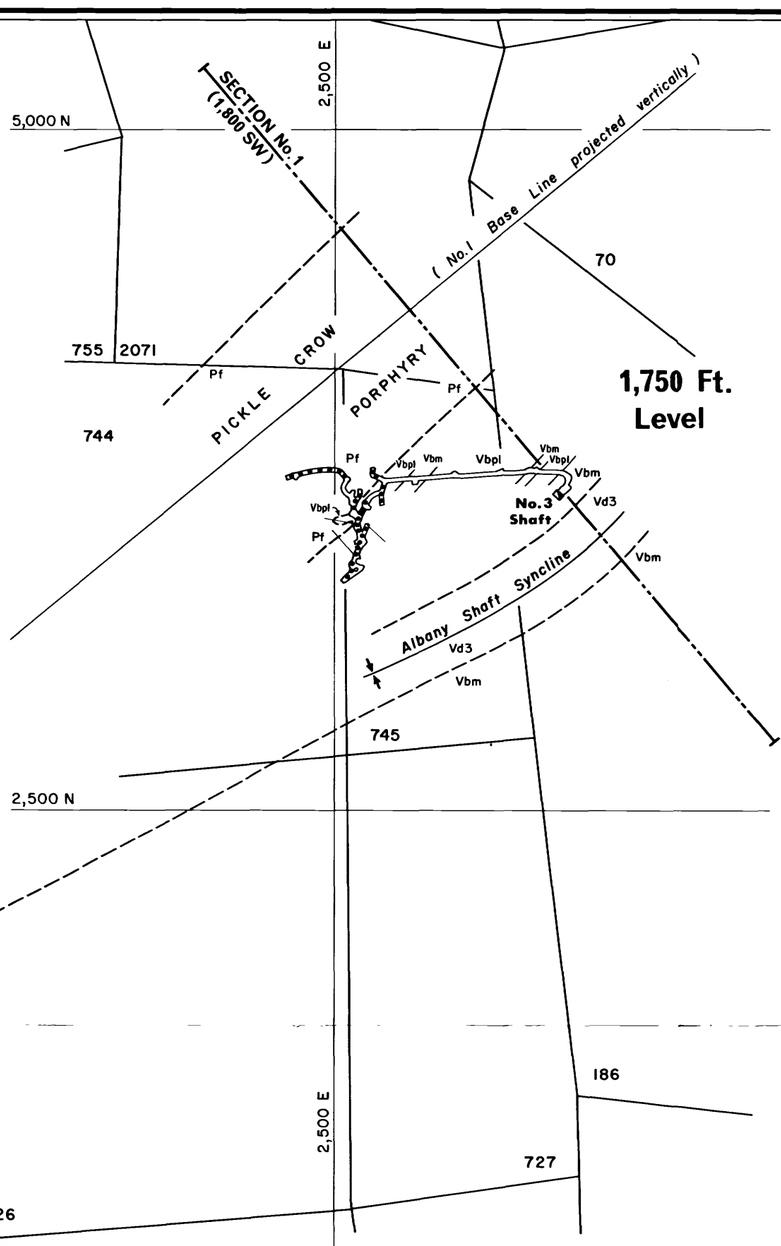
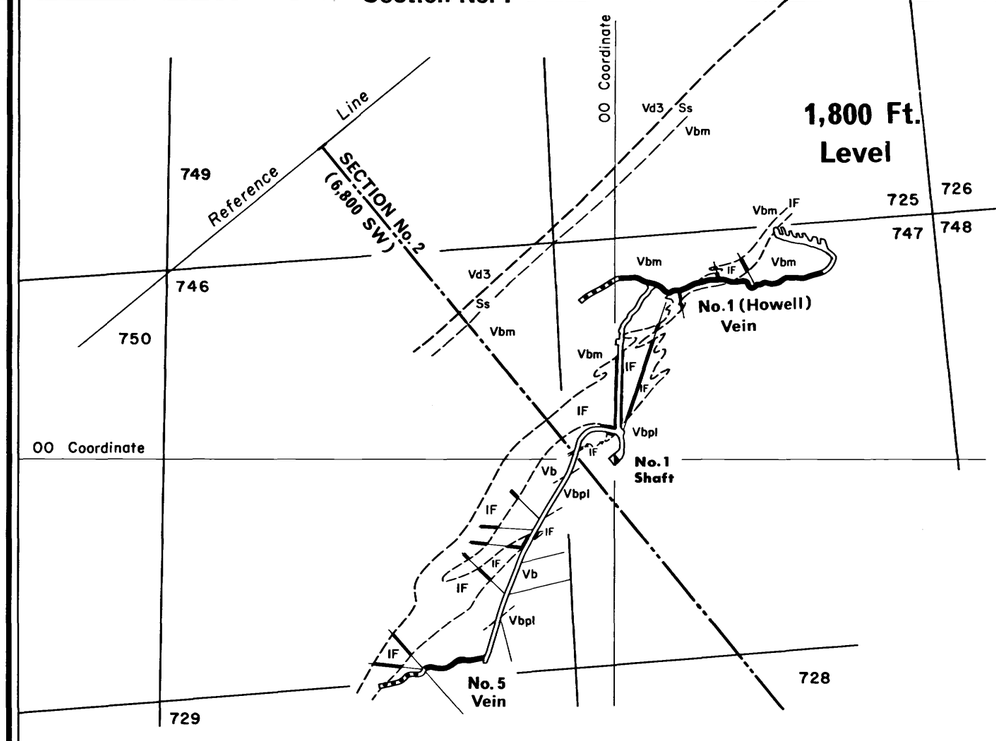
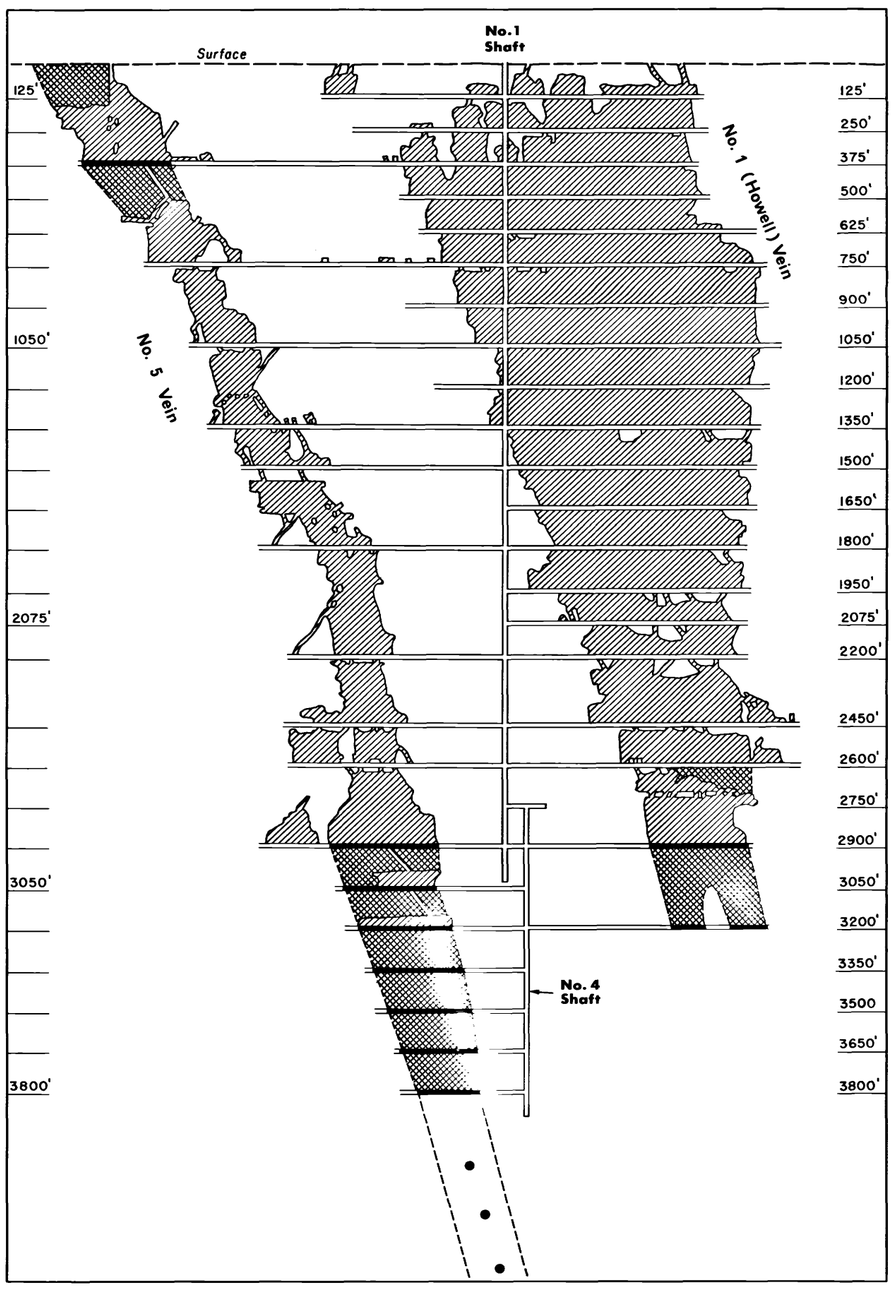




Longitudinal Projection of No.1 and No.5 Veins



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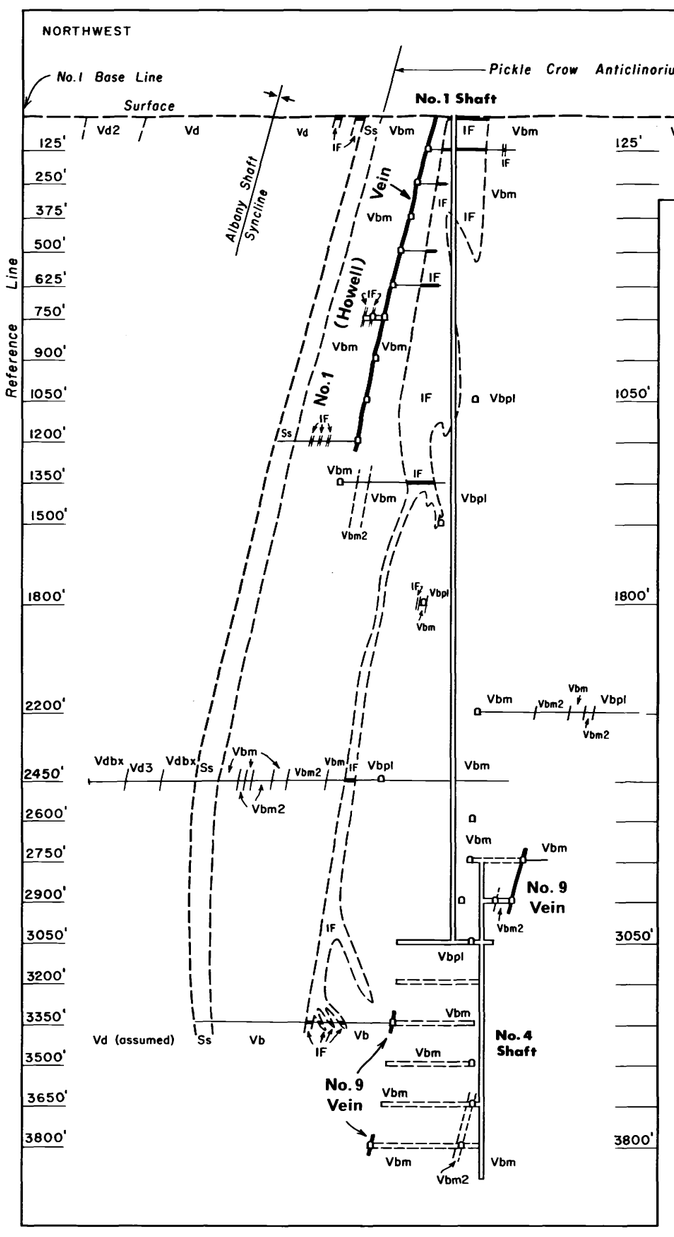

LEGEND

PRECAMBRIAN

LATE DIKE ROCKS

- Bla Lamprophyre.
- Bg Metagabbro

INTRUSIVE CONTACT

ACID PLUTONIC AND DIKE ROCKS

- Pf Quartz-feldspar porphyry.

INTRUSIVE CONTACT

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- Vd2 Dacite containing over 10 percent mafic minerals.
- Vd3 Dacite, fine-grained, siliceous, sericitic.
- Vd4 Dacite, fine-grained, chloritic.
- Vdbx Dacite breccia.
- IF Iron formation, magnetite-carbonate.
- Ss Interbedded argillite.

BASIC METAVOLCANICS

- Vbm Basalt (metabasalt), fine-grained, uniform, massive.
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- Vbpl Basalt (metabasalt), fine-grained with pillows.
- IF Iron formation, magnetite-carbonate.

- Breccia.
- Vein in underground workings.
- Drill hole intersection of ore grade.
- Ore on levels.
- Ore in place.
- Ore removed by stoping.
- Level with drill holes.

Geology compiled from company plans and sections by S.A. Ferguson 1966, with changes in legend by S.A. Ferguson.

PICKLE CROW GOLD MINES LIMITED

Eastern Part of Property

SUBSURFACE No. 2

1,800-Foot Level Approximately, and Sections No.1 and No.2 and Longitudinal Projection of No.1 and No.5 Veins

Scale 1 Inch to 500 Feet

500 0 500 1000 1500

ODM 4148

PICKLE CROW GOLD MINES LIMITED

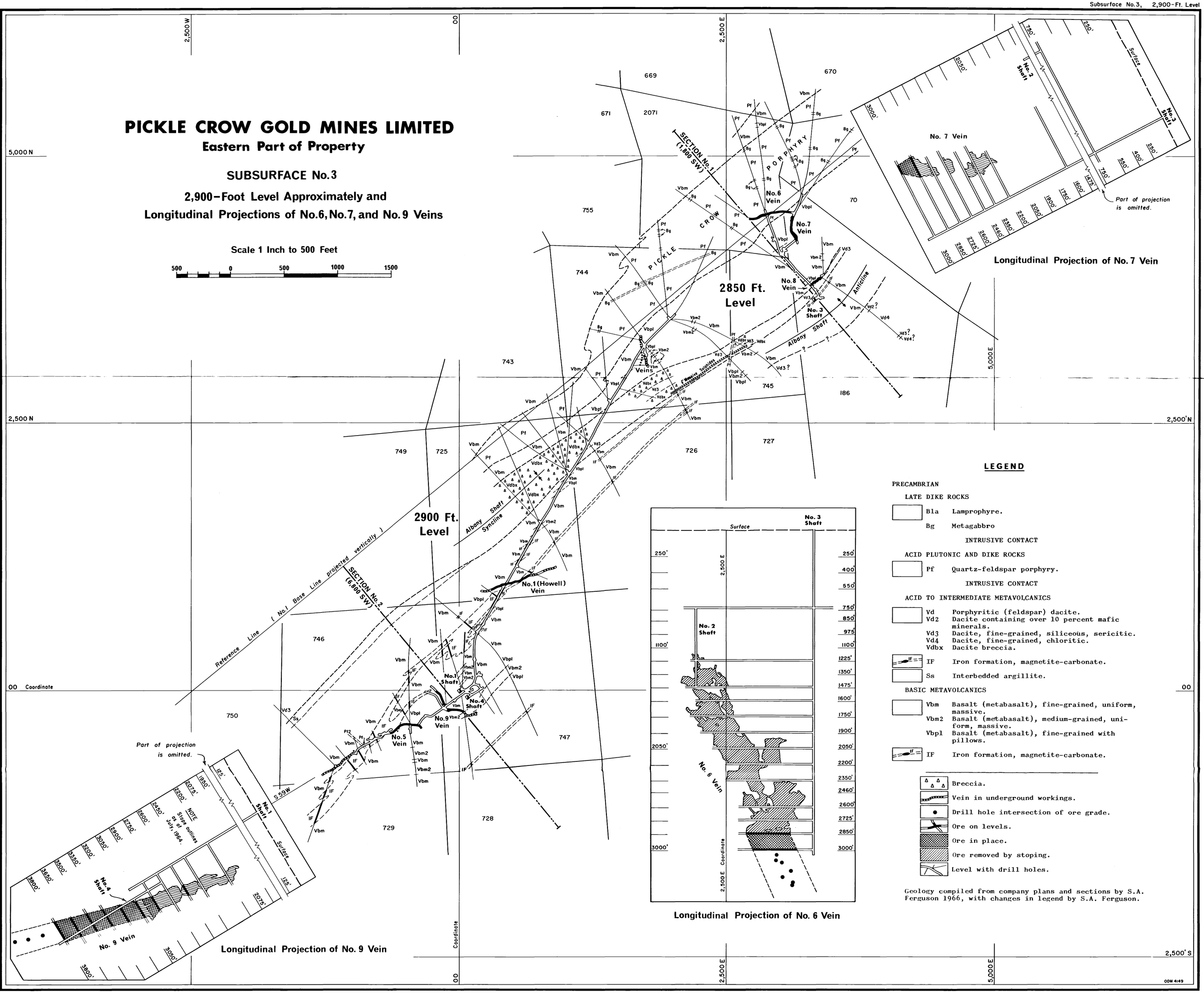
Eastern Part of Property

SUBSURFACE No.3

2,900-Foot Level Approximately and Longitudinal Projections of No.6, No.7, and No.9 Veins

Scale 1 Inch to 500 Feet

500 0 500 1000 1500



LEGEND

PRECAMBRIAN

LATE DIKE ROCKS

- Bla Lamprophyre.
- Bg Metagabbro

INTRUSIVE CONTACT

ACID PLUTONIC AND DIKE ROCKS

- Pf Quartz-feldspar porphyry.

INTRUSIVE CONTACT

ACID TO INTERMEDIATE METAVOLCANICS

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- Vd2 Dacite containing over 10 percent mafic minerals.
- Vd3 Dacite, fine-grained, siliceous, sericitic.
- Vd4 Dacite, fine-grained, chloritic.
- Vdbx Dacite breccia.
- IF Iron formation, magnetite-carbonate.
- Ss Interbedded argillite.

BASIC METAVOLCANICS

- Vbm Basalt (metabasalt), fine-grained, uniform, massive.
- Vbm2 Basalt (metabasalt), medium-grained, uniform, massive.
- Vbpl Basalt (metabasalt), fine-grained with pillows.
- IF Iron formation, magnetite-carbonate.

- Breccia.
- Vein in underground workings.
- Drill hole intersection of ore grade.
- Ore on levels.
- Ore in place.
- Ore removed by stoping.
- Level with drill holes.

Geology compiled from company plans and sections by S.A. Ferguson 1966, with changes in legend by S.A. Ferguson.

ODM 4149

PICKLE CROW GOLD MINES LIMITED

Eastern Part of Property

Gold Content of No.1 (Howell) Vein shown on Composite Level Plan

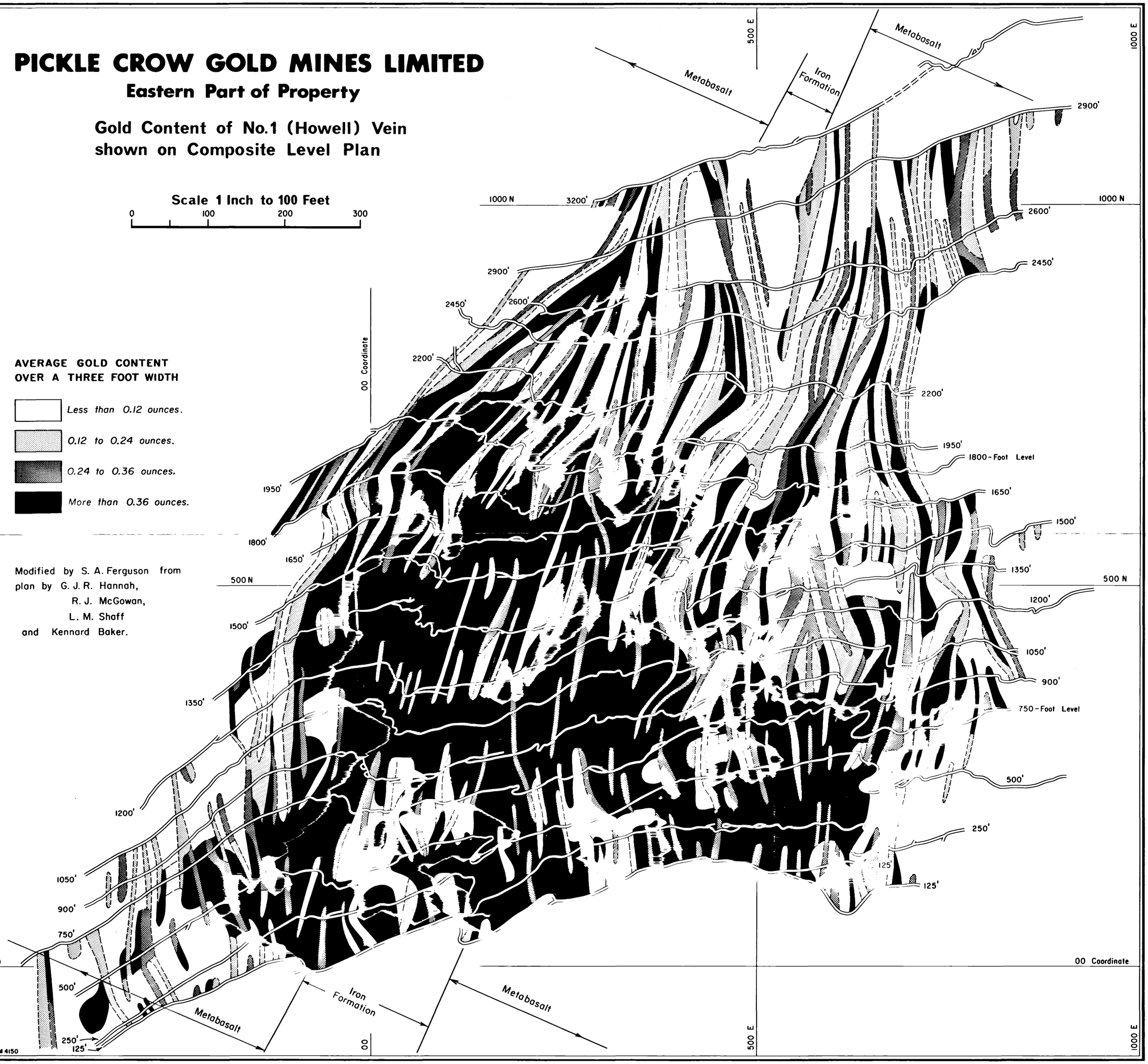
Scale 1 Inch to 100 Feet

0 100 200 300

AVERAGE GOLD CONTENT OVER A THREE FOOT WIDTH

- Less than 0.12 ounces.
- 0.12 to 0.24 ounces.
- 0.24 to 0.36 ounces.
- More than 0.36 ounces.

Modified by S. A. Ferguson from plan by G. J. R. Hannah, R. J. McGowan, L. M. Shaff and Kennard Baker.



ODM 4150

PICKLE CROW GOLD MINES LIMITED
Eastern Part of Property
AND
CENTRAL PATRICIA GOLD MINES LIMITED
No. 2 Operation

SURFACE GEOLOGICAL MAP

Scale 1 Inch to 500 Feet

500 0 500 1000 1500

CENTRAL PATRICIA (No. 2 OPERATION)

PICKLE CROW TOWNSHIP

CONNELL TOWNSHIP

McCULLAGH TOWNSHIP

CROWPAT

Map A — Pickle Crow Area

Key Map

ODM 4102

ODM 405

LEGEND

PRECAMBRIAN

LATE DIKE ROCKS

Bla Lamprophyre.

INTRUSIVE CONTACT

ACID PLUTONIC AND DIKE ROCKS

Pf Quartz-feldspar porphyry.
Pf2 Feldspar porphyry.

INTRUSIVE CONTACT

ACID TO INTERMEDIATE METAVOLCANICS

Vd Porphyritic (feldspar) dacite.
Vd2 Dacite containing over 10 percent mafic minerals.
Vd3 Dacite, fine-grained, siliceous, sericitic.
Vd4 Dacite, fine-grained, chloritic.
Vdbx Dacite breccia.
Vdch Dacite, partly carbonatized.

IF Iron formation, magnetite-carbonate.
IF2 Iron formation, carbonate.
Ss Interbedded argillite.

BASIC METAVOLCANICS

Vbm Basalt (metabasalt), fine-grained, uniform, massive.
Vbm2 Basalt (metabasalt), medium-grained, uniform, massive.
Vbpl Basalt (metabasalt), fine-grained with pillows.

IF Iron formation, magnetite-carbonate.

Breccia

cv Carbonate vein.

qv Quartz vein.

Geology compiled from company plans and sections by S.A. Ferguson 1966, with changes in legend by S.A. Ferguson.

GEOLOGICAL AND MINING SYMBOLS

- Glacial striae.
- Small bedrock outcrop.
- Area of bedrock outcrop.
- Bedding, top unknown; (inclined, vertical).
- Lava flow; top (arrow) from pillows shape and packing.
- Schistosity; (inclined, vertical).
- Lineation with plunge.
- Geological boundary, observed.
- Geological boundary, position interpreted.
- Magnetic contour, value in gammas.
- Anticline, syncline.
- Drill hole; (projected vertically, projected up dip).
- Drill hole, inclined.
- Shaft.

SOURCES OF INFORMATION

Base map supplied by Pickle Crow Gold Mines Limited from a compilation of Company surveys and claim surveys.

Magnetic survey provided by Pickle Crow Gold Mines Limited.

Geological plan showing outcrop and diamond drill hole locations for most of the Pickle Crow property provided by Pickle Crow Gold Mines Limited.

Drill hole locations and the rock types encountered in drilling on the Central Patricia Gold Mines property and in the southeastern part of the Pickle Crow property were taken from a map of the Crow River Area by E.G. Pye, 1956.

Geology by K.C. McMurchy, Consulting Geologist, Pickle Crow Gold Mines Limited, 1959, and by N.B. Keevil Jr., Staff Geologist, Pickle Crow Gold Mines Limited, 1959, 1960.

Geology revised by additional surface mapping and by compilation of surface drilling information by S.A. Ferguson, Geologist, Ontario Department of Mines, 1965. Additional outcrop locations taken from aerial photographs by S.A. Ferguson.

The designating letters "Pa" have been omitted on this map from the numbers marking the mining claims recorded at the office of the Patricia Mining Division.

Magnetic declination is 1 to 2 degrees East, 1965.