GEOPHYSICAL REPORT

on

AIRBORNE MAGNETIC, VLF-EM, AND RADIOMETRIC SURVEYS

over the

NICKEL CLAIMS

ROCK CREEK AREA, GREENWOOD M.D., B.C.

49° 119° SE Nickel Claims

N.T.S. 82E/3E

Nickel 1 & 2 - at confluence of Baker Creek and Rock Creek

Nickel 3 - 1 km NW of Bridesville, B.C.

Written for Ayerok Petroleum Ltd.,

2763 West 11th Avenue,

Vancouver, B.C.

David G. Mark, Geophysicist Ву

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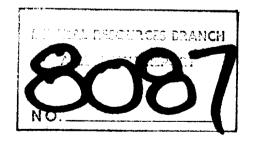
Columbia Geophysical Servi Surveys By

7050 Halligan Street,

Burnaby, B.C.

Dated June 11th, 1979

180-#246-#8081





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VANCOUVER, CANADA

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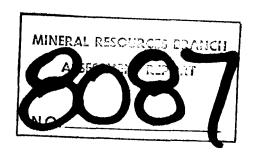


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Claim Map	Figure 1	1:50,000
Airborne Magnetometer Survey	Sheet 1	1:10,000
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VLF-EM and Radiometric Surveys, Contours	Sheet 3	1:10,000

SUMMARY

Airborne magnetometer, VLF-EM and radiometric surveys were carried out over the three Nickel claims owned by Ayerok Petroleum Ltd. of Vancouver, B.C. during May, 1979.

The claims are located in the Bridesville area of Rock Creek in terrain varying from gentle to steep with vegetation being scrub grass and fir trees. Access is easily gained by Highway 3. The purpose of the surveys was to aid in the mapping of geology as well as locate probable areas for the exploration of nickel mineralization, and, possibly, uranium mineralization.

The claims are almost entirely underlain by metasediments of the Anarchist Group which is intruded by ultra-basics, and, subsequently, acidics of the Nelson Plutonics. Structure on the property is complex with faults and folds trending in several different directions. The nickel mineralization, which seems to be related to the ultra-basic dykes occurring on the property, occurs in the form of pentlandite and is closely associated with pyrrhotite and pyrite.

The airborne surveys were flown at about a 30-meter terrain clearance on east-west lines with a separation of about 200 meters. One tie line was run across the survey area. The instruments used were a Sabre Electronics proton precesion magnetometer, a Sabre Electronics VLF-EM receiver, and a Precision Instruments scintillometer with a 2-inch sodium iodide crystal. The magnetic and radiometric data were picked from the strip charts, plotted on a survey plan, and contoured. The VLF-EM anomalies were picked from the strip charts, and their centers plotted on a survey plan.

CONCLUSIONS

- 1. The magnetic high on the southern part of the Nickel/ Nickel 2 property is probably caused by an altra-basic intrusive that is related to the nickel mineralization.
- 2. A similar magnetic high within the northeastern part of the survey area correlates with a radiometric high indicating the magnetic causitive source contains potassium. It is probably an ultra-basic phase of the Nelson Intrusives, or possibly, a volcanic of Cenozoic age. However, there is a possibility as well that the radiometric high is caused by uranium.
- 3. Lineal-type magnetic highs on the western part of the survey area indicate the causitive source to be ultra-basic dykes. There is therefore a possibility of related nickel mineralization.
- 4. A VLF-EM anomaly in the southeastern part of the survey area correlates with a small magnetic high strongly suggesting the causitive source to be pyrrhotite. Nickel mineralization could well occur with the pyrrhotite.

RECOMMENDATIONS

- 1. The data to date should be carefully correlated onto maps containing the Nickel claims. This may save on exploration cost by precluding repititious work.
- 2. The various anomalies discussed above should be checked on the ground in order to determine the causitive sources. The 2 areas of prime interest are the lineal-type magnetic highs on the western part of the survey area and the VLF-EM/magnetic anomaly on the southeastern part of the survey area. The ground should be staked and the anomalies located by ground magnetics and VLF-EM.

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NICKEL CLAIMS

ROCK CREEK AREA, GREENWOOD M.D., B.C.

INTRODUCTION AND GENERAL REMARKS

This report discusses the survey procedure, compilation of data and the interpretation of airborne magnetic, VLF-EM, and radiometric surveys carried out over the three Nickel claims during the first part of May, 1979. The surveys were carried out by T. W. Rolston instrument operator and project manager, and N. Newsom, navigator, who both are of Columbia Geophysical Services Ltd. The survey data were brought to the writer, already compiled and contoured, for interpretation.

The Nickel claims were staked for nickel mineralization. A fairly large tonnage of low grade nickel is found on the Nickel claims.

The object of all three surveys was to aid in the geological mapping of lithology and structure for the purposes of nickel

exploration. An additional object of the magnetic survey was to directly locate probable areas of nickel mineralization since it occurs with pyrrhotite. That of the VLF-EM survey was to locate conductive zones of sulphide hopefully containing nickel mineralization, and that of the radiometric survey was to locate any possible areas of uranium mineralization since the additional cost is negligible and since much is being found in southern British Columbia.

PROPERTY AND OWNERSHIP

The claims form two separate properties with the Nickel and Nickel 2 claims forming one and the Nickel 3 claim forming the other. The claims are shown on Figure 1 and are described below as follows:

Name	No.Units	Record No.	Tag No.	Expiry Date
Nickel	16 (4 x	4) 1453	36218	April 11, 1980
Nickel 2	12 (4 x	3) 1558	50342 ·	June 1, 1980
Nickel 3	16 (4 x	4) 1559	50351	June 1, 1980

It is understood the claims are wholly owned by Ayerok Petroleum Ltd. of Vancouver, B.C.

LOCATION AND ACCESS

The Nickel and Nickel 2 claims are located to the immediate south of Highway 3 at the confluence of Rock Creek and Baker Creek. The geographical coordinates are 49° 1.5' to 3.0' N latitude and 119° 4' to 7' W longitude.

The Nickel 3 claim is located about 1 km to the northwest of Bridesville and about 3 kms west of the Nickel and Nickel 2 claims. Its geographical coordinates are 49° 3' to 4' N latitude and 119° 10'to 11' W longitude.

Access to both properties is easily gained by Highway 3 and a series of logging roads. The Nickel and Nickel 2 claims are about 37 highway kms east of Osoyoos and the Nickel 3 claim is about 34.

PHYSIOGRAPHY

The property is found within the physiographic division known as the Okanagan Highlands close to its eastern boundary with the Monashee Mountains. It includes rounded mountains and ridges and gentle open slopes on upland surfaces. The major drainages such as Rock Creek on the northern part of the Nickel and Nickel 2 claims are deeply eroded and incised. The elevation on the Nickel and Nickel 2 claims varies from 735 meters in Rock Creek on the eastern edge of the Nickel 2 claim to 1200 meters on the south center of the Nickel claim. That of the Nickel 3 claim varies from 1000 meters in the northeast corner to 1250 meters in the south west corner.

Water is found on the Nickel and Nickel 2 claims in the easterly draining Rock Creek and its northerly draining tributary, Budy Creek. The closest source of water to the Nickel 3 claim is the easterly-draining McKinney Creek found about 400 meters to the north.

Vegetation consists mainly of scrub grass and extensive stands of fir trees.

HISTORY OF PREVIOUS WORK

The claims were recently staked and therefore no other work has been done on them. However, during the period from 1966 to 1970 when the NICKEL/NICKEL 2 property was known as the Old Nick claims and subsequently held by Utica Mines, Copper Ridge Mines, and the Newmont Mining Corp. of Canada Ltd. considerable development work was done. This was in the form of geological mapping, stream sediment geochemistry surveys soil geochemistry surveys, ground magnetic and EM surveys, an airborne magnetic survey, cat trenching, diamond drilling,

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percussion drilling, and metallurgical testing. The Nickel 3 claim was covered by airborne magnetics, ground magnetics soil geochemistry and stream sediment geochemistry.

GEOLOGY

Only a cursory description of the geology and mineralization of the property will be given here but a much more detailed description is given in the Newmont report by Coppe, et al.

The geology of the general area was mapped by Little of the G.S.C. during 1958 and 1959. Both properties are wholly underlain by the Permian and/or Triassic Anarchist Group which consists of greenstone, quartzite, greywacke, limestone; locally paragneiss.

To the immediate north of the properties, it is intruded by the Cretaceous (?) Nelson Plutonic rocks which consist of granodiorite, quartz diorite, diorite; granite, quartz monzonite, syenite, monzonite. Throughout the area and on the two properties, ultra-basic dykes of an early magnetic phase of the Nelson Intrusives, intrude the Anarchist Group in a number of locations.

Also to the immediate north are found Cenozoic sedimentary rocks and volcanics.

Coope, et al, has described the structure of the area as being complex with the bedding being tightly folded and cut by several fault trends. The dominant fault trend on the Nickel/Nickel 2 property is NW with a secondary trend being north. That on the Nickel 3 property is north with the secondary trend being north east.

Mineralization on the Nickel/Nickel 2 property was described by Coope, et al, as follows:

"Nickel sulphides occur in two rock types:

- 1. In peridotitic dunite rocks as pentlandite occluded in pyrrhotite. Pentlandite and pyrrhotite both occur in amphiboles, serpentine, and talc in the altered dunite. Nickel occurs in the form of silicate nickel in relic olivine in very minor amounts.
- 2. In a pyrometasomatic quartzite comprising Unit 2 of the Anarchist Group, pentlandite occurs as minute inter-growths with pyrrhotite and pyrite, in fine sericitic-chloritic veinlets."

The pentlandite mineralization occurs in the pyrometasomatic quartzite, as a band, "2,600 feet long and approximately 400 feet wide, and in adjacent perioditic-dunite dykes. Petrological work on the mineralized quartzite has revealed the presence of minute injections of basic rock into the sediments. The pentlandite is closely associated with these injections."

"Nickeliferous zones, grading 0.15 to 0.25% nickel, were found to be remarkably uniform and continuous within the quartzite horizon."

GOVERNMENT AEROMAGNETIC SURVEY

The aeromagnetic survey was flown for the government by Geoterrex Limited from October, 1969 to April, 1972, at a terrain clearance of 300 meters. (See Selected Bibliography).

A prominent magnetic high-low dipole occurs on the Nickel/Nickel 2 property which probably reflects the west-trending peridotite-dunite dyke system. North of the property, the Cenozoic volcanics are reflected by thumbprint-size anomalous highs and lows. The Nelson intrusive is reflected by a larger, but

lower amplitude high.

The writer has interpreted aeromagnetic lineations on and around the Nickel claims as shown on the claim map, Figure 1. These lineations very likely reflect major faults. The most prominent direction trends about N60W with a second trend being about N20W and a third trend being N30E.

INSTRUMENTATION AND THEORY

1) Magnetic Survey:

The magnetic data was detected using a nuclear free precession magnetometer, made by Sabre Electronics of Burnaby, B.C. This measures the absolute value of the earth's magnetic field intensity. The sensitivity is 1 gamma and the absolute calibration is governed by a crystal-controlled oscillator so that it cannot drift.

The magnetic data as well as the VLF-EM data were recorded on an MFE model M-22 CAHA recorder.

Only two commonly occurring minerals are strongly magnetic; magnetite and pyrrhotite. Hence, magnetic surveys, both ground and airborne, are used to detect the presence of these minerals in varying concentrations. Magnetic data are also useful as a reconnaissance tool for mapping geologic lithology and the structure since different rock types have different background amounts of magnetite and/or pyrrhotite.

2) VLF-EM

A VLF-EM receiver manufactured by Sabre Electronics of Burnaby, B.C. was used for the VLF-EM survey. This instrument is designed to measure the current induced, in a vertical coil, by the primary and secondary fields of the very low frequency electromagnetic field (VLF-EM) transmitted at 18.6KHz from Seattle, Washington.

In all electromagnetic prospecting, a transmitter produces an alternating magnetic field (primary) by a strong alternating current usually through a coil of wire. If a conductive mass such as a sulphide body is within this magnetic field, a secondary alternating current is induced within it which in turn induces a secondary magnetic field that distorts the primary magnetic field. It is this distortion that the EM The VLF-EM uses a frequency range from 16 receiver measures. to 24 KHz, whereas most EM instruments use frequencies ranging from a few hundred to a few thousand Hz. Because of its relatively high frequency, the VLF-EM can pick up bodies of a much lower conductivity and therefore is more susceptible to clay beds, electrolyte-filling fault or shear zones and porous horizons, graphite, carbonaceous sediments, lithological contacts as well as sulphide bodies of too low a conductivity for other EM methods to pick up. Consequently, the VLF-EM has additional uses in mapping structure and in picking up sulphide bodies of too low conductivity for conventional EM methods and too small for induced polarization (in places it can be used instead of IP). However, its subsceptibility to lower conductive bodies results in a number of anomalies, many of them difficult to explain and, thus, VLF-EM preferably should not be interpreted without a good geological knowledge of the property and/or other geophysical and geochemical surveys.

3) RADIOMATRIC SURVEY

The instrument used to carry out this survey was a Model 118 Royal Scintillator manufactured by Precision Radiation Instruments Ltd. The detecting element used with this scintillator is a 2-inch sodium iodide crystal. The data was recorded on a Bausch & Lomb 6-inch strip chart recorder. The complete airborne system was installed as close as possible to the rear of the aircraft to ensure against radiation from the plane's navigational equipment.

All radiometric surveys, ground or airborne, work on the principle of gamma-ray emission from radioactive sources. The most common sources incurred in geophysical prospecting are radioactive isotopes of uranium (\mathbf{U}^{238}), thorium (\mathbf{Th}^{232}) and potassium (\mathbf{K}^{40}). These isotopes disintegrate spontaneously into daughter elements emitting alpha and beta particles, and gamma rays. The alpha and beta particles travel no more than 1 to 2 feet through air and thus are little use for geophysical detection. On the other hand, the gamma ray travels hundreds of feet through air and thus is of prime importance. These gamma rays, in a radioactive survey, are generally detected by thallium-activated sodium iodide crystals.

The gamma ray can be shielded by two feet of water or rock and thus over large lakes there is a minimum signal. Thus, also radiometric surveying is essentially surveying for outcrop expression of rocks containing radioactive minerals. However, around uranium showings, if the rock and overburden is porous and fractured enough (and not water-soaked), the uranium can be detected at greater depths because of the uranium daughter product, radon gas, seeping upwards.

The main sources of error are topographic noise and cosmic noise.

Topographic noise is in the form of anomalous highs or lows and is produced by the terrain clearance becoming correspondingly lesser or greater. A related type of noise is a variable amount of snow cover wherein a few feet of snow would completely eliminate gamma rays from the ground.

Cosmic noise is only exhibited by anomalous highs and is caused by bursts of cosmic showers, which are radioactive particles from outer space. However, a constant low background of cosmic noise continually exists.

SURVEY PROCEDURE

A Bell 206B Jet Ranger helicopter flown at a speed of about 120 kph, was used to fly the survey. The magnetometer head and the VLF-EM receiving antenna were towed in a bird at the end of a 20-meter cable. The scintillometer detector crystal was placed in the floor of the helicopter. The flight lines were flown in an east-west direction with a separation of about 200 meters. The bird was flown at a terrain clearance of about 30 meters. The points were made over prominent topographic features. They were numbered, recorded, and plotted on the flight-line and data sheets. There were considerable topographic features to serve as visual tie points so that the flight lines can be considered to be plotted fairly accurately. The survey extended to the western edge of Nickel 3 claims.

The magnetic readings were taken with the magnetometer set on a 1.2 second recycling period which corresponds to readings taken at intervals of about 40 meters.

The magnetic diurnal change was not monitored but the survey was done in short enough time so that any possible error would be minimal. As for magnetic storms, which are frequent at this time, there were none on the day of the survey. This was checked with the monitoring station at Victoria. One tie line was flown as a check on the data.

All radiometric readings were taken with the scintillometer set on a 5-second response time whereby the meter would respond to the average count of gamma particles received over a 5-second interval of time. Therefore the sample length averaged about 160 meters.

COMPILATION OF DATA

The magnetic and radiometric data were picked off the strip charts at equal intervals of length of 100 meters. In some

instances, variations were made in this sampling interval to more accurately define isolated areas of change.

The magnetic data were then plotted on Sheet 1 at a scale of 1:10,000 (1 cm = 100 m) and contoured at a 100-gamma interval. The background contour of 1600 gammas was not drawn in since its variations seemed to be produced only by noise. The mean background value of 1600 gammas is approximately equivalent to 56,000 gammas total field.

The VLF-EM data on the strip chart were first examined for anomalies which were then plotted on Sheet 2. The center of each anomaly is shown by a crossline since this is the best indication of the location of the causitive source.

The radiometric data were plotted on Sheet 2, as well, with each plotted value having been multiplied by 1,000 (i.e. 5 reads as 0.005 MR/Hr). The data were then visually scanned in determining the background value of 0.006 MR/Hr. The anomalous highs were then determined to be 0.008 MR/Hr which were then contoured at a 0.002 MR/Hr interval.

DISCUSSION OF RESULTS

The magnetic values run from a minimum of 1050 gammas to a maximum of 3700 gammas to give a range of 2650 gammas. This is a rather wide range and is certainly indicative of there being basic and/or ultra-basic rocks occurring within the survey area.

In general, the airborne magnetic results of this survey correlates quite well with the government aeromagnetic results except that the former is much more detailed.

The most prominent feature is the fairly large 3700-gamma high occurring along the southern edge of the Nickel/Nickel 2 property. It seems to be related as a dipole to the 1050-gamma

low to its immediate north. This feature was pointed out by the writer in the discussion of the government aeromagnetic survey in which it was felt that the causitive source was the peridotite-dunite dyke system. However, with the scale of this survey affording greater detail, it appears that the area of mineralization as well as the dyke system correlates more with the magnetic low. The high, therefore, probably reflects more directly an ultra-basic intrusive of the Nelson Plutonic rocks that seems to be ultimately related to the mineralization.

North of the highway and the property occurs another magnetic high of similar size but of lower intensity. This anomaly is different in that it correlates directly with a radiometric high. In correlating with the GSC geology map, it would appear the causitive source is an ultra-basic phase of the Nelson Intrusives of a volcanic of the Cenozoic volcanic group. The radiometric high indicates the rock to contain potassium. The possibility should not be overlooked, however, that the radiometric high is reflecting uranium contained within sediments possibly associated with the volcanics.

Strong lineal-shaped magnetic anomalies of a fairly good intensity occur in the southwestern corner of the survey area and strongly suggest ultra-basic dykes as being the causitive source. Therefore, quite possibly, nickel mineralization could occur in this area.

In addition, lineal-shaped anomalies occur to the north and northwest, but of lower intensity, and cut across the Nickel 3 claim. Nickel soil geochemistry values are found in this area suggesting the possible causitive source to be ultra-basic dykes as well.

The major cause of VLF-EM anomalies, as a rule, are geologic structures such as fault, shear and breccia zones. It is, therefore, logical to interpret VLF-EM anomalies to likely be caused by these structural zones. Of course, sulphides may also be a causitive source. But in the writer's experience when VLF-EM anomalies correlate with sulphide mineralization, the anomalies are usually reflecting the structure associated with the mineralization rather than the mineralization itself.

Pyrrhotite occurs on this property, however, which is a good conductor and therefore a VLF-EM anomaly is more apt to be reflecting sulphides.

The most interesting EM anomaly is found in the southeastern corner of the survey area since it occurs on two adjacent lines and since it correlates with a small magnetic anomaly. The strongly suggested causitive source is, therefore, pyrrhotite, occurring with nickel mineralization, with a possibly accompanying ultra-basic dyke.

A number of VLF-EM anomalies occur in the northeastern part of the survey area basically to the south of the radiometric and magnetic anomaly. These anomalies may be reflecting fault and shear zones associated with the causitive source of the radiometric/magnetic anomaly.

The radiometric results of any interest consist of the northeastern anomalous area that correlates with a magnetic high and was discussed above. The rest of the survey area is quite flat.

Respectfully submitted, GEOTRONICS SURVEYS LTD.,

June 11, 1979

Geophysicist

SELECTED BIBLIOGRAPHY

- Aeromagnetic Map, Osoyoos, B.C., Map 8508G, Geol. Surv. of Canada, Sheet 82E/3, 1973.
- Coope, J.A., Dolan, W.M., Costin, C.P. Geological, Geochemical and Geophysical Reports on Exploration of the Nickel Ridge Property (Old Nick Option) Bridesville, B.C., Newmont Mining Corp of Canada Ltd. May 7, 1968.
- Little, H.W. Geology Kettle River (W.Half), Brit. Columbia., Map 15-1961 Geol. Surv. of Can. Sheet 82E(W.Half), 1961.

GEOPHYSICIST'S CERTIFICATE

I, David G. Mark, of the City of Vancouver, in the Province of British Columbia, do hereby certify:

THAT I am a Consulting Geophysicist of Geotronics Surveys Ltd., with offices at 420-890 West Pender Street, Vancouver, British Columbia.

I further certify:

- I am a graduate of the University of British Columbia (1968) and hold a B.Sc., degree in Geophysics.
- I have been practising my profession for the past eleven years and have been active in the mining industry for the past fourteen years.
- I am an active member of the Society of Exploration Geophysicists and a member of the European Association of Exploration Geophysicists.
- This report is compiled from data obtained from a combined airborne magnetic, VLF-EM and radiometric survey carried out by Columbia Geophysical Services Ltd., under the supervision of T.W. Rolston during the first part of May, 1979.
- I have no direct or indirect interest in the Nickel Claims nor in Ayerok Petroleum Ltd., Vancouver, B.C. nor do I expect to receive any interest therein.

David G. Mark

June 11, 1979

COST BREAKDOWN

I certify that the airbore magnetic, VLF-EM, and radiometric surveys carried out over the Nickel, Nickel 2, and Nickel 3 mineral claims located in the Rock Creek Area of the Greenwood M.D. during May and June, 1979, were done to the value of the following:

FIELD:

Geophysical technician & navigator 20 hours @ \$45/hour (including mob. & demob.)	\$	900
Helicopter rental, 7.5 hours @ \$400/hour	3	,000
Photographic blow-up		150
Room & board, 3 days @ \$70/day/2 men		210
Truck rental and gas		325
Instrument rental	5	700 ,285
OFFICE:		
Geophysicist, 15 hours @ \$35/hour		525
Geophysicial technician, 60 hours @ \$25/hour	1	,500
Drafting and printing		500
Typing and compilation		190
	2	,715
Grand Total	\$8	,000

Columbia Geophysical Services Ltd.

T.W. Rolston Manager

