83-#943 - 12575
12/84

# GEOPHYSICAL SURVEY
# HELICOPTER-BORNE
# DETAILED
# MULTIFREQUENCY
# ELECTROMAGNETIC AND MAGNETIC

## THE STEEPLES CLAIMS
## 3-10 & 15-30

FORT STEELE M.D. B.C.

NTS: 82G/11
49°32; 115°23

5-12-83 : 21-12-83

Alfred R. Allen, P.Eng.

January 31, 1984.



For:
R.H. Stanfield
350 - 4723 1st. Street. S.W.
Calgary, Alberta

By: A.R. Allen
Allen Geological Engineering
503 - 1985 Bellevue Avenue
West Vancouver, B.C.

CONTENTS

DETAILED AERIAL SURVEY

MULTI FREQUENCY

ELECTROMAGNETIC AND MAGNETIC

STEEPLES 3-10 and 15-30 CLAIMS

FORT STEELE M.D., B.C.

## INTRODUCTION

The Steeples claims are 25 kilometres east of Cranbrook and 13 kilometres southeast of Fort Steele, B.C.

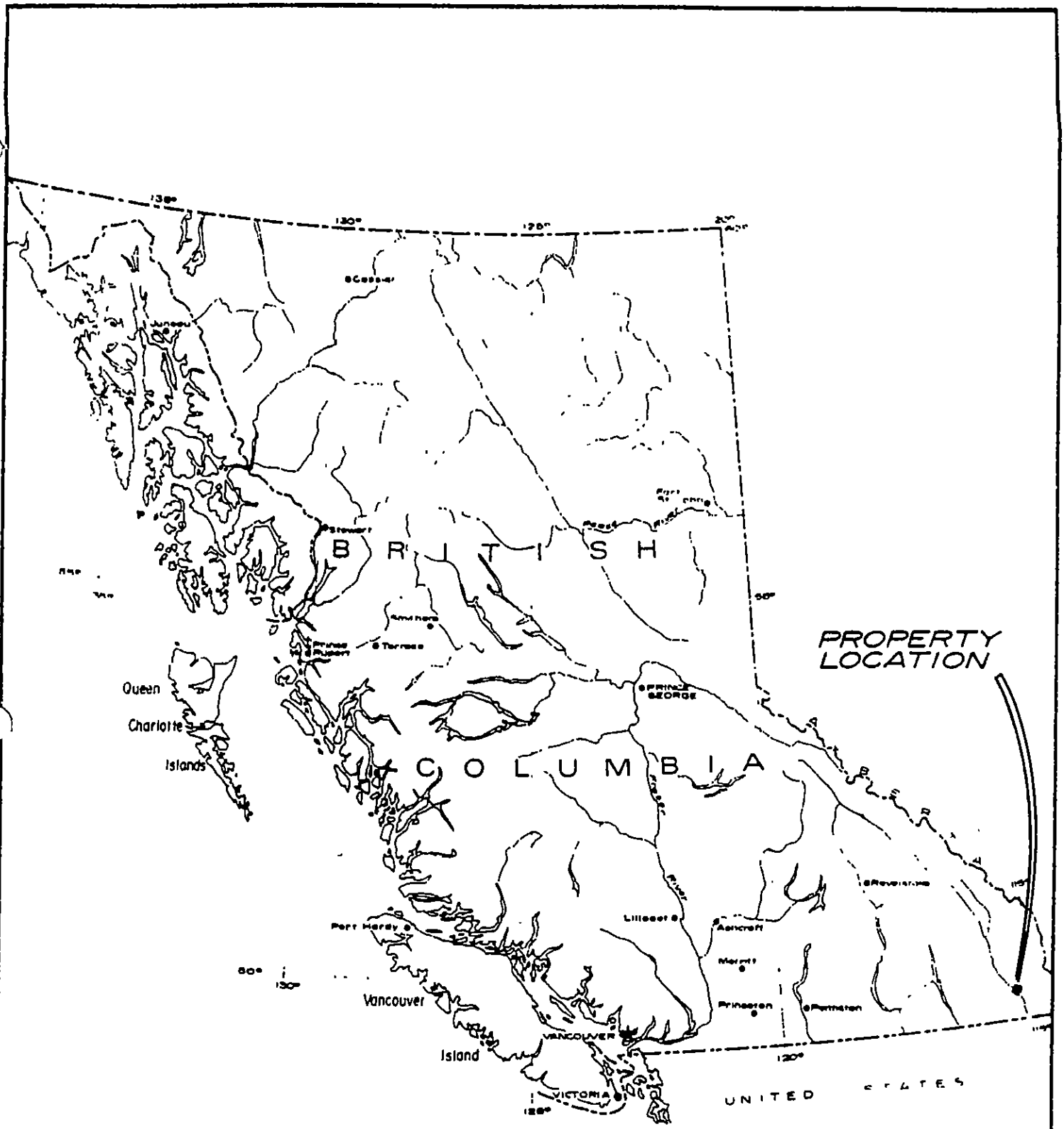
Access is via Highway #3 and the Canadian Pacific Railway.

The 24 claims, comprising 480 units, are held by R.H. Stanfield.

Between December 3 and 22, 1983, a detailed helicopter-borne electromagnetic and magnetic survey was flown over the claims area by Apex Airborne Surveys Ltd. A report on this has been prepared by Ronald F. Sheldrake, geophysicist, of 512-625 Howe Street, Vancouver, B.C.

Field assistance was provided by R. Stanfield Jr. and Brent Skene, employees of R.H. Stanfield. Consulting and report preparation was provided by Alfred R. Allen, P.Eng.

The purpose of the survey was to provide detailed geophysical information in preparation for mineral exploration over the area.




R.H. Stanfield

# LOCATION MAP

SCALE: 1" = 136 Mls.

| | | |
|---|---|---|
| Drawn by | Date JAN. 31/84 | Alfred R. Allen |
| Checked by | Drg no. 1 | |

ALTAIR drafting services ltd

## LOCATION AND ACCESSIBILITY

The Steeples claims are located between latitude 49°-30' and 49°-35'-24" and longitude 115°-17'-15" and 115°-29'-30".

They are on the southerly Steeples Range, on the westerly flank of the Rocky Mountains.

The property extends from the Rocky Mountain Trench easterly to the east side of the Bull River, and north from the Bull River mine claims to the headwaters of Sunken and Dibble Creeks.

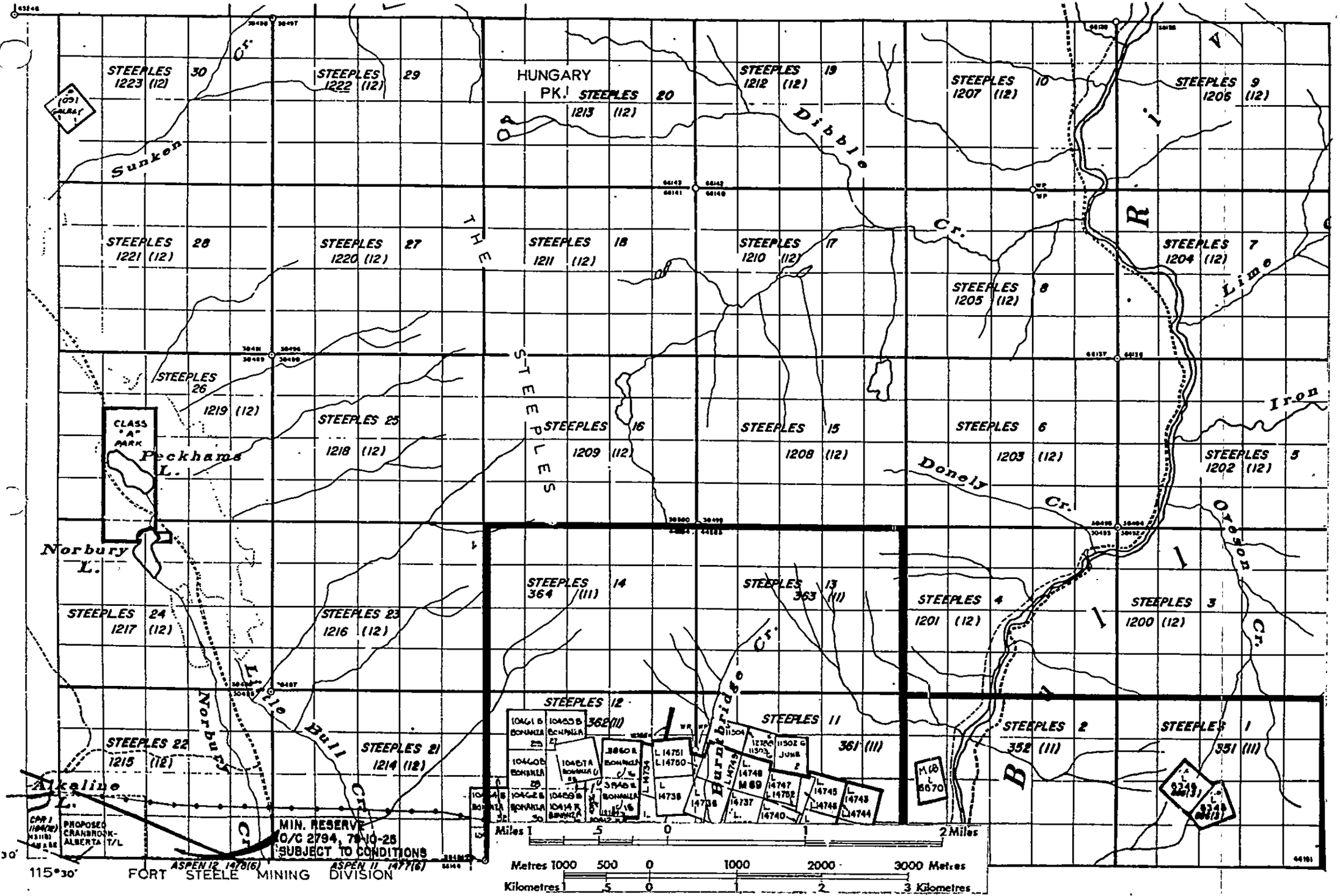
Access is by Canadian Pacific Railway and highway, 22 kilometres northwest from Galloway and 13 kilometres southeast from Fort Steele.

Access roads are located over the east and west areas of the property.

## HISTORY

Placer gold was discovered in the Wild Horse and Bull River gravels by the early prospectors, as was also sulphide mineral deposits in the Precambrian rocks on the southwest flank of the Rocky Mountains. Subsequently some production was attained from both placer and hardrock deposits to the northwest and southeast of the Steeples property.

The Estella and Kootenay King mines, to the north, were silver, lead, zinc, gold producers.




Allen Geological Engineering
Per Clifford B. Allen P.Eng.
January 31, 1984

CLAIMS

Steeples 3-10 & 15-30
Fort Steele M.D., B.C.
N.T.S. 82G/11 1:50,000

More recently the Placid Oil Company operated the Bull River mine from 1972 to 1974. Copper, silver and gold concentrates were shipped to Japanese smelters.

This mine is located on the southcentral area of the Steeples group. The Steeples 1, 2, 11, 12, 13 and 14 claims have been involved with exploratory investigations on the Bull River group.

To the southeast, several smelter shipments of copper, silver, gold ore were made from the Strathcona Empire property.

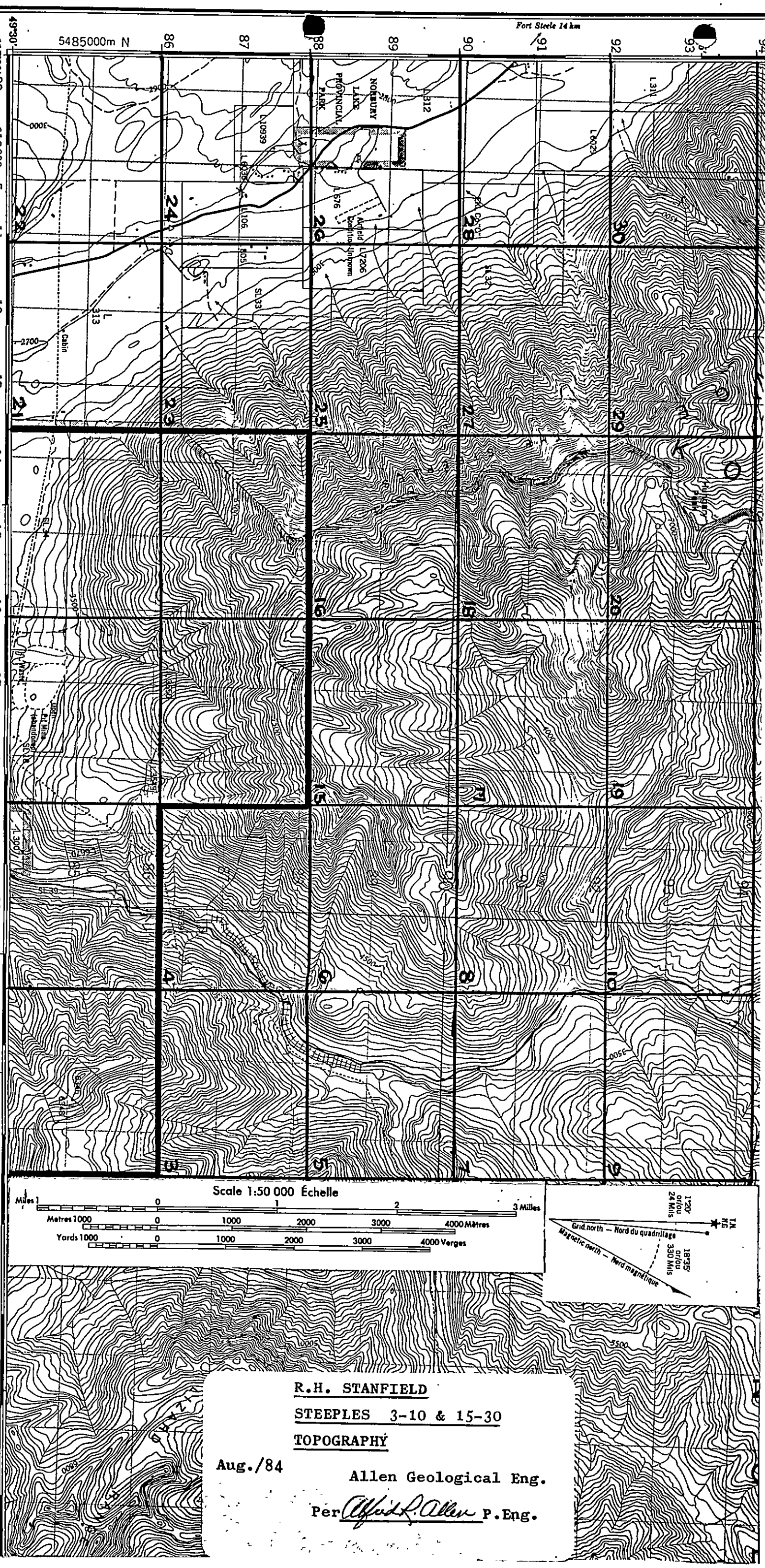
Numerous showings of copper-silver-gold and silver-lead-gold on the Stanfield holdings, southeast of the Bull River have been exposed by shallow workings.

## TOPOGRAPHY

The Steeples 3-10 and 15-30 claims lie on the southerly Steeples and northerly Lizard ranges and extend onto the Rocky Mountain trench.

Elevations range from 750 metres in the Trench to 2400 metres on the ridges and summits.

Near the north boundary Sunken creek drains westerly and Dibble creek easterly. On the westerly slopes of the Steeples, eight small creeks drain westerly into the talus and overburden of the Kootenay River valley. The east half of the property is drained by the Bull River and tributory streams.


Fort Steele 14 km
5485000m N
610000m. E.
49°30'
115°30'09
Bull River 4 km
NORBURY LAKE PROVINCIAL PARK
Airfield condition Unknown
Cabin
Mine
Scale 1:50 000 Échelle
Miles 1 0 1 2 3 Miles
Metres 1000 0 1000 2000 3000 4000 Mètres
Yards 1000 0 1000 2000 3000 4000 Verges
Grid north — Nord du quadrillage
Magnetic north — Nord magnétique
120' or/ou 24 Mils
18°35' or/ou 330 Mils
R.H. STANFIELD
STEEPLES 3-10 & 15-30
TOPOGRAPHY
Aug./84
Allen Geological Eng.
Per Alfred L. Allen P.Eng.

The Bull River flows south to southwest into the southerly flowing Kootenay River.

## PROPERTY

The following claims of the Steeples group are included in this report.

| | |
|---|---|
| Mineral claims: | Steeples 3-10 and 15-30, 480 units. |
| Record numbers: | 1200 - 1223 |
| Expiry date: | December 22, 1984 |
| Owner: | R.H. Stanfield |

## GEOLOGY

The geology of the area was mapped in 1957 by the Canadian Geological Survey on a scale of two miles per inch.

Stratigraphic and structural trends coincide with the general topography. From the Rocky Mountain Trench to the Bull River - Dibble - Iron creeks drainage area, Purcell period Precambrian rocks trend northwesterly and dip generally northeasterly. There is, in general, minor folding. The Precambrain formations are traversed by major faults on the west and east. On the west the geology is blanked by talus and overburden and on the east the Precambrain is faulted against Palaezoic formations.

The Aldridge is the lowest Precambrian formation exposed. It is made up of well bedded rusty weathering argillite, argillaceous quartzite and quartzite. The formation is estimated to be about 2,400 metres thick. The overlying Creston formation is composed of grey, green, brown and purple argillite, brown, purple and white argillaceous quartzite and quartzite. The thickness has been estimated at 1,500 metres. Ripple marks are preserved in some strata.

The Kitchener and Siyeh have been mapped as one formation in the Steeples area. The Kitchener overlies the Creston. It is composed of grey and green argillite, dolomitic argillite and grey quartzite at the base. This is overlain by grey sandy dolomite and quartzite. The bedding is uniform and weathers buff to brown. The Siyeh, uppermost of the formation, is composed of grey and green argillite with purple and brown facies. The sedimentary beds are overlain by andesitic flows, pillow lava and tuff. The total thickness of the Kitchener-Siyeh formation has been estimated at 2,000 metres.

Intrusive rocks have not been mapped in the Steeples claims area. Diorite and granite dikes have been exposed to the south on the Bull River mine property and Stanfield holdings.

The geology of the northeast corner of the property has not been mapped. This area may include the southeasterly extension of the Dibble Creek fault and the contact betwwen the Precambrian Kitchener-Siyeh and the younger Rooseville or Upper Devonian alexo, Fairhold, or Palliser formations, or it may be underlain by the Kitchener-Siyeh and Cambrian Eager and/or Cranbrook formation.

The complicated structural features of the Trench, exposed on the southwest claims area indicate horst and graben movement, exposing Upper Devonian and Mississippian strata and granitic dikes.

## DETAILED HELICOPTER-BORNE MULTI FREQUENCY ELECTROMAGNETIC AND MAGNETIC SURVEY

The survey was conducted over the Steeples 3-10 and 15-30 mineral claims by Apex Airborne Surveys Ltd., Vancouver, B.C., December 16-21, 1983.

The Steeples claims are located in the Bull River area, Fort Steele Mining Division, southeastern British Columbia.

Room and board facilities were made available at the Stanfield camp for the field crew.

Mr. Ronald F. Sheldrake, B.Sc., president of Apex Airborne Surveys, interpreted and reported the survey.

The survey was conducted for Mr. R.H. Stanfield, owner and operator of the property.

Preparations were started in early December by the Stanfield crew in order that winter problems were reduced to a minimum for the airborne survey.

The Stanfield camp and the Bull River millsite were prepared and access roads kept open.

Helicopter pads and fuel storage were provided.
A wood constructed stand was made for the bird.
Heating coils were provided.
A 3/4 ton pick-up truck and a panel truck were provided and used as service vehicles during the survey.

Surveillance was provided for the helicopter and fuel. This was necessitated because of past vandalism of company property, including the burning of a camp building located adjacent to company propane storage tanks. There was also partial destruction of a Longyear 44 diamond drill by fire.

Close cooperation with the pilot was maintained with flight plans organized and maintained for safety purposes.

Messages and supplies were sent and received from the Cranbrook airport.

Clean-up was made at mill and camp after the survey.

Arrangements were made for the return of one truck to Vancouver.

## SUMMARY AND CONCLUSIONS

A detailed geophysical helicopter-borne, multi-frequency electromagnetic and magnetic survey by Apex Airborne Survey Lgd., was conducted over the Steeples 3-10and 15-30, 20 unit claims.

A series of high frequency magnetic variations were detected in a northeasterly trending zone across the central area of the property. An electromagnetic response on the Steeples #10 claim indicated the presence of a narrow conductor, or possibly a massive fractured conducter which may contain non-conductive gangue and/or sulphide minerals.

It is concluded that geological and geophysical surveys, over selected areas of the Steeples claima are necessary to evaluate the mineral potential of the area.

## RECOMMENDATIONS

Geological and electromagnetic ground surveys are recommended over conductor and anomalous zones detected by the helicopter borne electromagnetic and magnetic surveys.

Submitted,

Allen Geological Engineering Ltd.

Per Alfred R. Allen P.Eng.
Alfred R. Allen

January 31/84

# COST STATEMENT

## R.H. Stanfield Account

Consulting,
Alfred R. Allen, P.Eng. 503-1985 Bellevue Ave.
West Vancouver, B.C. V7V 1B6
Planning, finalizing, reporting, fees $350/day
November 8, 1983 to February 9, 1984. $3,968.00

Field Assistants,
Ross Stanfield, Jr., 3/12-22/12, 1983, $8/hr
Galloway, B.C. $1,216.00

Brent Skene, 3/12-22/12, 1983, $8/hr
Galloway, B.C. $1,216.00

1 panel truck @ $30/day
1 pick-up truck @ $30/day $1,140.00

## Apex Airborne Surveys, Vancouver, B.C.

Ronald F. Sheldrake, B.Sc., Geophysicist,
Vancouver, B.C.

Michael Magee, Field Technician,
Mt. Albert, Ontario

Herman Lorenz, Helicopter pilot,
Calgary, Alberta

Board and lodging, 15 many days, @$40/day 600.00

By contract @ $85.97/km $30,175.00

Total Costs $38,315.00

Note:
Board, lodging and transportation charges are not included for Stanfield employees.

## REFERENCES


Leech, G.B., G.S.C. Fernie Map-Area Papers 58-10 & 60-11

Allen, Alfred R., Geology and Ore Potential, Stanfield Holdings in Southernstern British Colembia 1976

Allen, Alfred R., The Bull River Copper-Silver Gold Mine 1976

Sheldrake, R.F., Helicopter-Borne Electromagnetic and Magnetic Survey on the Stepples and Iron Creek Claims in the Bull River area, B.C. 1981

Sheldrake, R.F., Reconnaissance Helicopter-Borne V.L.F. Electromagnetic and Magnetic Survey on The Kootenay River Project in the Galloway Area, B.C. 1983

Map 8464G Geophysical Series (Aeromagnetic) G.S.C.
8465G
Elko & Fernie, British Columbia 82 G/6-G/11 1971

503 - 1985 Bellevue Avenue
West Vancouver, B.C. V7V 1B6

(604) 926-4785

# CERTIFICATE

January 31, 1984.

I, Alfred R. Allen, certify that:

I am a graduate of the University of British Columbia and hold the following degrees therefrom:

BASc Geological Engineering 1939

MASc Geological Engineering 1941

I am a Life Member of the Association of Professional Engineers of the Province of British Columbia.

I have practised my profession for the past thirty-seven years.

I hold no interest in the properties or securities of R.H. Stanfield, or affiliates thereof, nor do I expect to receive any directly or indirectly

The report on the Geophysical Survey, Helicopter-borne Detailed Multifrequency Electromagnetic and Magnetic on the Steeples Claims, Fort Steele, M.D.,B.C., is based on consulting by the writer from December 12, 1983 to February 3, 1984.

I consent to this report being filed with the British Columbia Securities Commission.

Alfred R. Allen P.Eng.

Alfred R. Allen

503 - 1985 Bellevue Avenue
West Vancouver, B.C V7V 1B6

(604) 926-4785

January 31, 1984.

British Columbia Securities Commission
Vancouver, B.C.

Dear Sirs:

Re: R.H. Stanfield

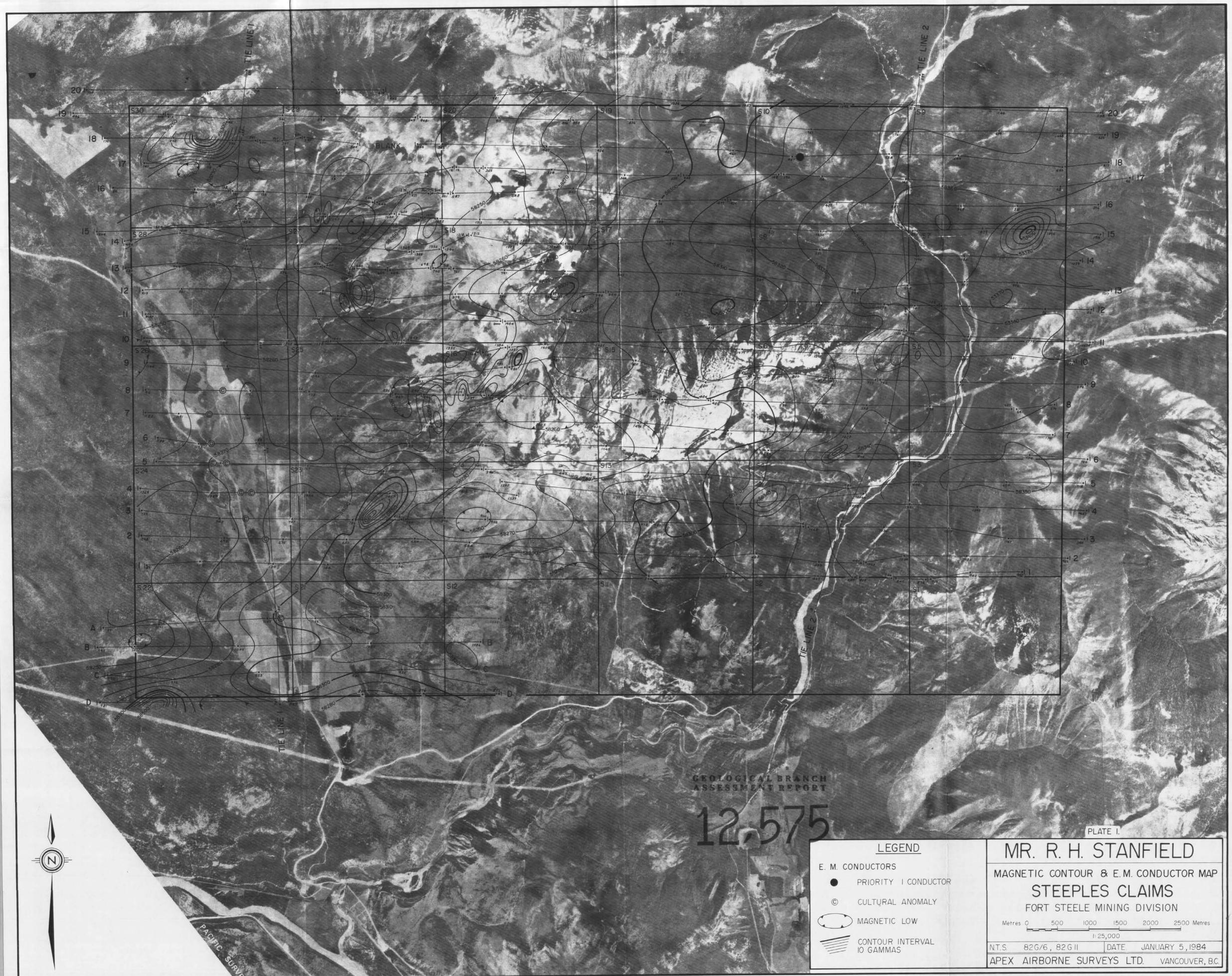
I hereby consent to the use of my report dated January 31, 1984, on the Geophysical Survey, Helicopter-borne Detailed Multifrequency Electromagnetic and Magnetic on the Steeples Claims, Fort Steele M.D., B.C., in any prospectus or statement of material facts or other material to be filed with the British Columbia Securities Commission or the Vancouver Stock Exchange by R.H. Stanfield.

Yours very truly,

Alfred R. Allen P.Eng.

Alfred R. Allen

ARA/JC




GEOLOGICAL BRANCH
ASSESSMENT REPORT

12,575

PLATE I.

## LEGEND

E. M. CONDUCTORS

- PRIORITY I CONDUCTOR
- © CULTURAL ANOMALY
- MAGNETIC LOW
- CONTOUR INTERVAL 10 GAMMAS

# MR. R. H. STANFIELD

MAGNETIC CONTOUR & E.M. CONDUCTOR MAP

## STEEPLES CLAIMS

FORT STEELE MINING DIVISION

Metres 0 500 1000 1500 2000 2500 Metres

1:25,000

N.T.S. 82G/6, 82G/11 | DATE JANUARY 5, 1984

APEX AIRBORNE SURVEYS LTD. VANCOUVER, B.C.

# REPORT ON A DETAIL HELICOPTER BORNE MULTIFREQUENCY ELECTROMAGNETIC AND MAGNETIC SURVEY ON THE STEEPLE CLAIMS IN THE BULL RIVER AREA BRITISH COLUMBIA

FOR OWNER AND OPERATOR

MR. ROSS H. STANFIELD

CLAIMS: Steeples 3 - 10
Steeples 15 - 30

Latitude 49° 32' N LONGITUDE 115° 23' W
N.T.S. 82 G 6 & 11 - FERNIE AND ELKO MAPSHEETS

SURVEY DATES: DECEMBER 16, TO DECEMBER 21, 1983

January 5, 1984
Vancouver, B.C.

Apex Airborne Surveys Ltd.
Ronald F. Sheldrake, B.Sc.

# TABLE OF CONTENTS

## 1. SUMMARY

The HELICOPTER ELECTROMAGNETIC and MAGNETIC SURVEY has identified an anomalous E.M. response in the Steeples 10 Claim that may be due to metalliferous sulphide materials. The anomaly is discussed and recommendations for follow-up have been made.

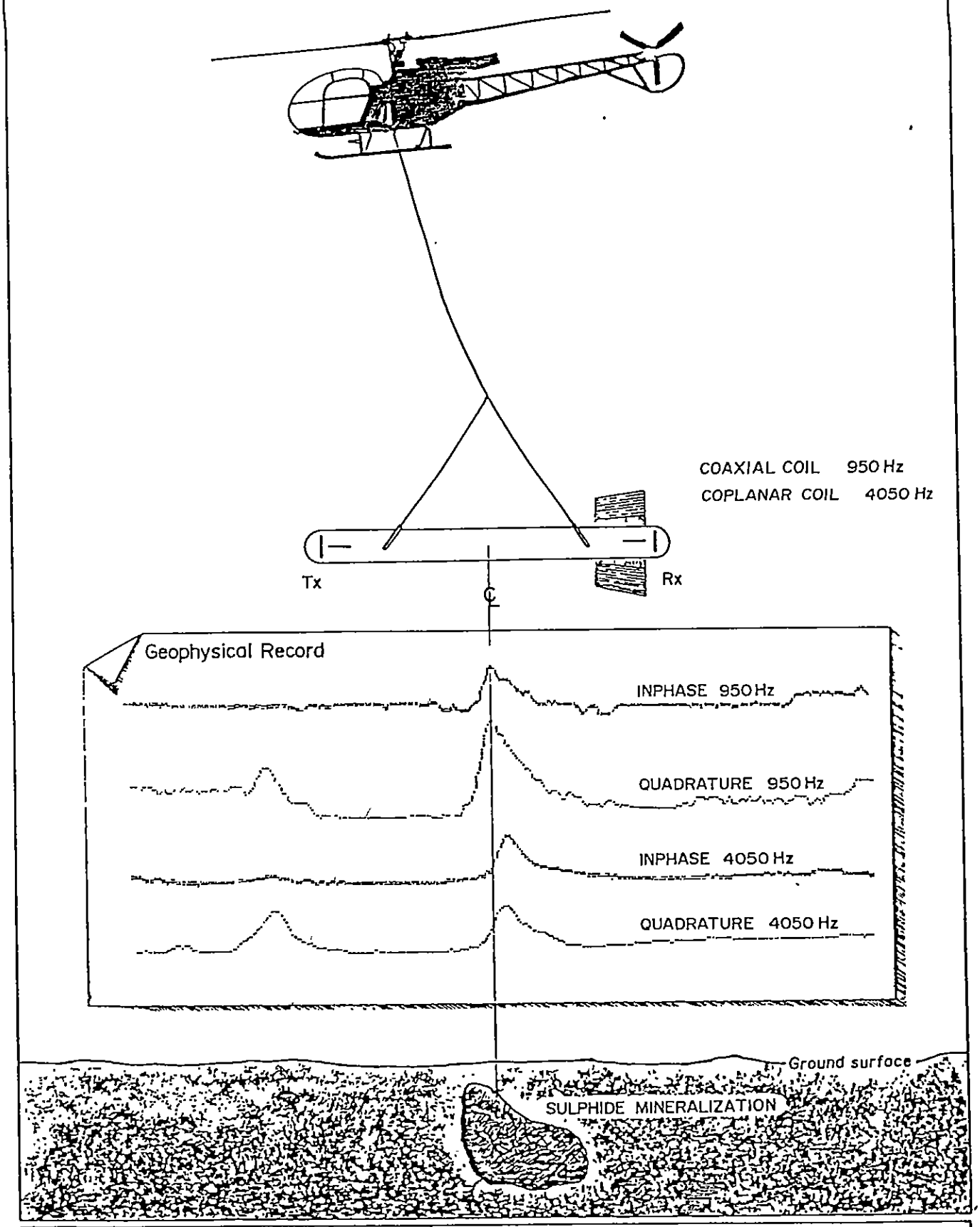



FIGURE 1

SCHEMATIC OF TWO FREQUENCY-CONFIGURATION H.E.M. SYSTEM

APEX AIRBORNE SURVEYS LTD.

## 2. INTRODUCTION

This report discusses the results of an airborne geophysical survey (E.M. and Magnetic) that was flown between December 16 and December 21, 1983 on behalf of Mr. R.H. Stanfield. The survey area is located in extremely rugged terrain immediately east of the Rocky Mountain Trench.

A previous survey by Apex Airborne Surveys Ltd.[1] was flown over the claims in 1981 at an interline spacing of 1 kilometer. The present "detail" survey was flown at 1/3 kilometer spacings using ortho-photo mosaics for positioning. The purpose of both of these surveys was to locate concentrations of metallic sulphide mineralization.

A case history that shows the competence of the Apex Instrumentation to detect metallic sulphide conductors is included in FIGURE 2.[2] The data displayed in FIGURE 2 were collected in October 1983 over the SCOTTIE GOLD MINE which is located about 30 miles North of Stewart, B.C. The data identify the massive pyrrhotite-pyrite veins (under 30 meters of glacier) which are host to the gold and silver ore[3] (conductor A). The strong anomalies (C and D) are responses from veins that are outcropping. Conductors B and E are considerably weaker and may indicate either veins that have lower conductivity-thickness values, shorter strike length, or they may indicate conductive material at a greater depth.

The terrain within the present survey area ranged from 820 meters to above 2700 meters. An Aerospatial Gazelle Helicopter was used as a survey platform.

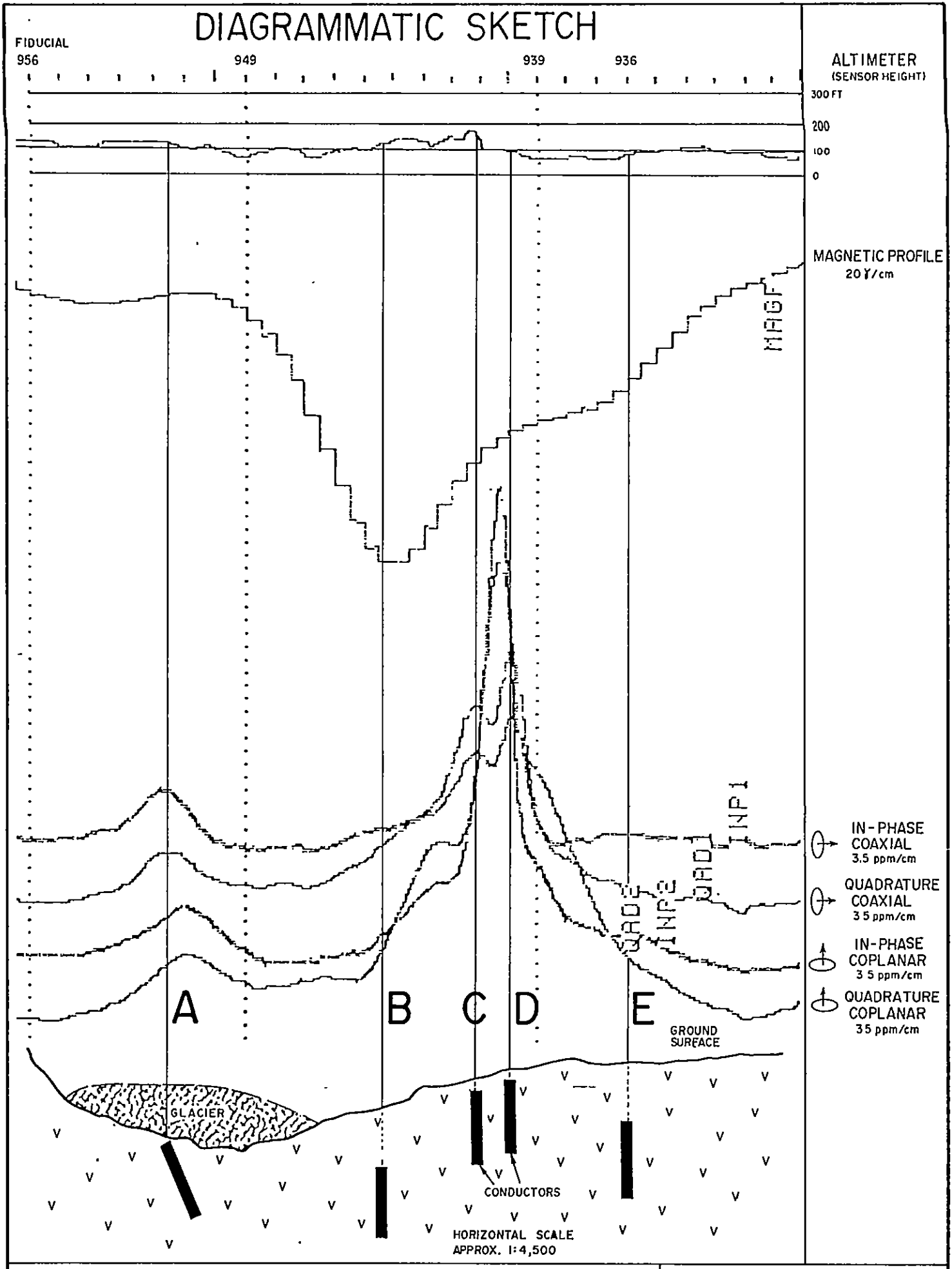
---

1 SEE REPORT: Ronald F. Sheldrake "REPORT ON A HELICOPTER BORNE TWO FREQUENCY ELECTROMAGNETIC AND MAGNETIC SURVEY ON THE STEEPLES AND IRON CREEK CLAIMS IN THE BULL RIVER AREA, BRITISH COLUMBIA", Nov. 20, 1981

2 NOTE: Permission to use this data has been generously granted by SCOTTIE GOLD MINES LTD.

3 Personal communication - Mr. Fred Hewitt, Geologist, Scottie Gold Mines

# DIAGRAMMATIC SKETCH




| | |
|---|---|
| CASE HISTORY : SCOTTIE GOLD MINES LTD. | FIGURE 2 |
| APEX AIRBORNE SURVEYS LTD. | OCTOBER 1983 |

The electromagnetic equipment used for this survey (also used in the 1981 survey) consists of an in-phase out-of-phase system comprising of two sets of transmitters and receivers operating at different frequencies and configurations. See FIGURE 1 -SCHEMATIC OF TWO FREQUENCY/CONFIGURATION H.E.M. SYSTEM.

The E.M. data measurements are recorded every 0.1 second (which is about every 3 meters on the ground at survey flight speed). Magnetometer data are recorded at 1.0 second intervals with a sensitivity of 1 gamma ($10^{-5}$ oersted).

APPENDIX I gives the details of the geophysical equipment used for this survey. APPENDIX II describes the flight record and flight path recovery process.

## CLAIMS:

The claims covered for assessment purposes include the following:

STEEPLES 3 to STEEPLES 10
STEEPLES 15 to STEEPLES 30

## LOCATION AND ACCESS:

The STEEPLES CLAIMS are located immeditely east of the Rocky Mountain Trench and are centered on 49° 34' N Latitude and 115° 23' W Longitude. Although the claims are located in very rugged terrain the group is easily accessible by road near where Highway No. 3 crosses the Bull River.

GEOLOGY:

The mineral deposits of the R.H. STANFIELD PROPERTIES are located on the flank of the Rocky Mountains in the Precambrian Aldridge Formation.

Normal faults strike northwesterly and dip southwesterly. Subsidiary faults strike northeasterly and dip northwesterly. Extensive displacement produced by the faulting brings Devonian and Mississippian formations into contact with the Precambrian strata. Sulphide mineralization discovered to date contains lead-silver and copper-silver mineralization in strong fissure veins within Aldridge quartzite and argillites.

## 3. DATA PRESENTATION

A contour map of the total field magnetic values has been provided at a scale of 1:25,000 (PLATE 1). The magnetic data have been corrected for diurnal variations but are uncorrected for regional gradient. The contour interval is 10 gammas.

The electromagnetic anomalies are displayed on PLATE 1 and are identified as either cultural responses (9 cases) or bedrock conductors (1 case).

Computer plots (in-flight records) of each of the traverses that comprise this survey are included in a separate binder and submitted to the client with this report. The profiles display the following:

| | |
|---|---|
| Magnetic profile | 60 gammas per centimeter |
| E.M. 1 coaxial coil in phase | 5 ppm/cm |
| E.M. 2 coaxial coil quadrature | 5 ppm/cm |
| E.M. 3 coplanar coil in phase | 5 ppm/cm |
| E.M. 4 coplanar coil quadrature | 5 ppm/cm |
| Radar altimeter (helicopter height) | 275 ft/cm |
| Sferics and powerline monitors | |

## 4. DISCUSSION OF RESULTS

Magnetic and Electromagnetic Maps can be interpreted to reveal areas underlain by different rock types and lineaments which could indicate fault zones. Magnetic maps can reveal the location of ore bodies which contain higher percentages of magnetite or pyrrhotite than the surrounding rocks.

Conductivity-thickness (conductance) is the parameter pair measured with the electromagnetometer. Materials which conduct electronically, metallic sulphides and graphite, have higher conductivity-thickness values than electrolytic conductors such as clays (in overburden) and ion rich streams or sloughs, however there is considerable overlap.

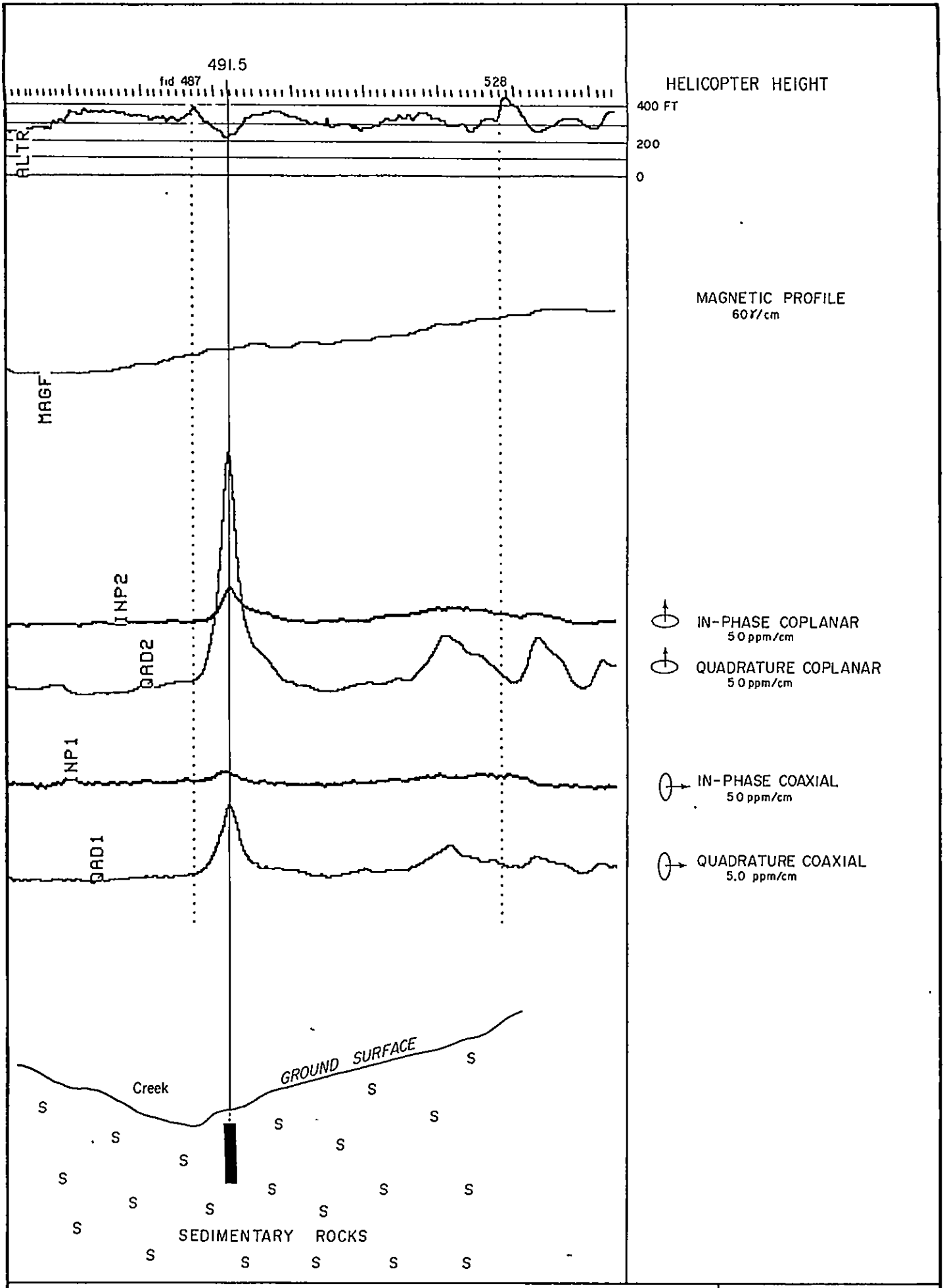
The geological electromagnetic responses encountered by an electromagnetic survey are of four main types.

1. BEDROCK CONDUCTORS: including formational graphitic responses and massive sulphide targets. The E.M. responses can be interpreted for depth, conductance, strike, dip and thickness.

2. SURFICIAL CONDUCTORS: overburden and lake sedimentation responses. These are flat lying, "broad" responses.

3. COMBINATION OF 1 AND 2: When a conductive material overlays a bedrock conductor the response due to the bedrock layer is superimposed on the response of the overburden or lake response. Depending on the conductivity contrasts, and the thickness of the overburden, some bedrock conductors can be recognized through the surficial layer.

4. NEGATIVE MAGNETIC EFFECTS (permeability effect): When conductors are also magnetic the electromagnetic responses can become distorted. The distortion tends to decrease the in-phase response, often reversing the sign of the E.M. anomaly. Apparent depths and conductivity-thickness products, in this case, are generally not representative.




| | |
|---|---|
| DIAGRAMMATIC SKETCH: LINE 18 FID 491.5 | FIGURE 3 |
| APEX AIRBORNE SURVEYS LTD. | JANUARY 1984 |

Other E.M. responses are evident from the data that are not due to geological sources and come under the general heading of "Cultural". These include responses from pipelines, powerlines, buildings, culverts, and fence lines, etc. These are normally indicated by the powerline monitor or otherwise evident from their location.

The Apex system recorded 10 distinct conductors that could be interpreted as concentrations of metallic sulphide minerals. However 9 of the conductors are coincident with cultural features such as road culverts, powerlines, pipelines and buildings and are not thought to be due to geological sources.

The E.M. conductor that is apparently due to geological sources was recorded on Line 18 at Fiducial 491.5. FIGURE 3 displays the data from the traverse and provides an interpretational sketch. The data have been levelled and corrected for variations in the speed of the aircraft.

The data indicate a narrow conductor with a very low apparent conductance. It should be noted however, that if a massive sulphide conductor has been fractured or contains non-conductive sulphide minerals (sphalerite for example) so that the conductor is not continuously conductive, over meters of tens of meters, then the apparent conductance (or geophysical response) will be lower than expected. However, this response is anomalous for this environment and may indicate the presence of mineralization.

The MAGNETIC DATA show more detail than the previous survey which for the most part was flown at larger interline spacings.

REMARK: the magnetic data that was collected on Flight 7 of the present survey was excessively noisy and was not used for making the magnetic map. The areas where the magnetic data have not been used are in the lower right hand corner and the upper left hand corner of the mapsheet. The magnetic contours are missing in these areas. The data was extrapolated between Line 15 and Line 17 to substitute the missing data on part of Line 16.

The most interesting feature that is evident from the data is the N.E. - S.W. zone of disturbance near the centre of the mapsheet.

The feature is characterized by a number of "high frequency" variations in the magnetic values.

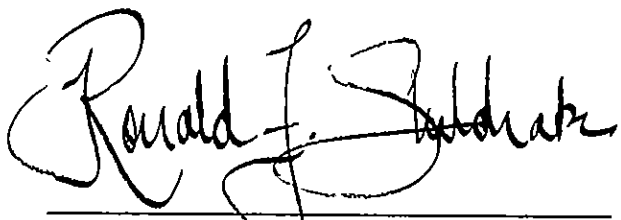
This may indicate nothing more than a fault zone but, also, it may indicate a zone of alteration or enrichment and may be a marker to a mineralized zone.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The geophysical survey has identified one anomaly that may be due to massive sulphide mineralization.

It is recommended that geological and geochemical examination be made of the area, followed up with a MAX-MIN[1] (or equivalent) Survey to identify a location for a drill hole.

Respectfully submitted



Ronald F. Sheldrake
APEX AIRBORNE SURVEYS LTD.

---

1 MAX-MIN is a ground horizontal loop electromagnetometer.

## BIBLIOGRAPHY


Geonics Ltd. (Toronto) - Technical note TN-4 - "Interpretation Aids for E.M. 33 Helicopter Electromagnetic System".

M.K. Gosh and G.F. West - A.E.M. Analogue Model Studies, produced by Norman Paterson & Associates Limited, Toronto.

Vacquier V., Steenland, N.C. and Henderson, R.G. - Interpretation of Aeromagnetic Maps, Geological Society of America, Memoir No. 47.

Douglas C. Fraser - The Multicoil II Airborne Electromagnetic System, Geophysics, Vol. 44, No. 8, August 1979, pp. 1367 - 1394.

Mr. Alfred Allen, P.Eng. - Personal communications, December 1981 and June 1982.

Ronald F. Sheldrake - Report on a Helicopter Borne Two Frequency Electromagnetic and Magnetic Survey on the Steeples and Iron Creek Claims in the Bull River Area, British Columbia, Nov. 20, 1981.

Mr. Fred Hewitt - Personal communication, September 1983.

## APPENDIX I

## INSTRUMENTATION

The electromagnetic instrumentation that was used on this survey utilized both coplanar and coaxial coil configurations, as well as two frequencies.

The system is comprised of two sets of receivers and transmitters as follows:

(1). COAXIAL PAIR - The coaxial transmitter-receiver pair are separated by 6 meters and utilize a "low frequency" signal of 950 Hz. This configuration couples best with vertical dike-like targets.

(2) COPLANAR PAIR - The coplanar transmitter-receiver pair are separated by 5.5. meters and utilize a "high frequency" signal of 4050 Hz. This configuration couples best with flat lying and tabular targets.

The transmitter and receiver coils for the two frequencies are located at the ends of the six meter sensor that is commonly called a "bird". The bird is towed 30 meters below the helicopter by means of a suitable cable which also carries the electric signals to and from the bird.

Changes in the alternating magnetic field at the receiver coil, caused by eddy currents in the subsurface rock are recorded. These changes are expressed in ratios of the normal undistorted primary field. They are so small as to be expressed in parts per millions (p.p.m.).

The electromagnetic instrument is manufacured by GEONICS LTD. of Mississauga, Ontario and is model E.M. -33/2.

## MAGNETOMETER

The magnetometer that was used on this survey was a Geometrics Corp. model 803. It is a total field nuclear precession instrument which measures the magnetic field strength with a resolution of 1 gamma. The sensor is a toroidal coil and is positioned half way between the helicopter and the E.M. bird.

The measuring technique of the proton magnetometer can be understood by making the proton analogous to a tiny bar magnet spinning about its longitudinal axis, which has the properties of both a magnetized needle and gyroscope. The spinning magnet tries to align itself along the lines of force but the gyroscopic properties oppose this and the spinning magnet gyrates. The essential characteristic of the system is that the rate of gyration is proportional to the ambient magnetic intensity. This rate is measured electronically, multiplied by a suitable factor then displayed on the chart and recorded on magnetic tape.

The data are normally corrected for diurnal variations, digitized and then contoured.

## ANCILLARY EQUIPMENT

UDAS data acquisition system with digital printer.
Geocam 35 mm flight path camera
Bonzer radio altimeter
Geometrics G 826 magnetic base station and recorder

## HELICOPTER

The Aerospatiale Gazelle helicopter was supplied by Highwood Aviation Ltd., Calgary, Alberta.

## APPENDIX II

## THE "ANALOGUE" CHART AND FLIGHT PATH RECOVERY

The in-flight chart is a roll of heat sensitive paper which moves through the digital printer at a speed of 5.48 cm per minute.

The digital printer chart facilitates the use of a full alpha-numeric system. All "header" sensitivity and fiducial information is printed automatically.

The chart is 18.5 centimeters wide as follows:

FROM THE BOTTOM OF THE CHART

| | | | | |
|---|---|---|---|---|
| 0 | cm to | 3.5 | cm | QAD2 - low frequency coaxial 5 ppm/cm |
| 3.5 | cm to | 7.0 | cm | INP2 - low frequency coaxial 5 ppm/cm |
| 7.0 | cm to | 10.5 | cm | QAD1 - high frequency coaxial 5 ppm/cm |
| 10.5 | cm to | 14.0 | cm | INP1 - high frequency coplanar 5 ppm/cm |
| 14.0 | cm to | 17.0 | cm | MAG - magnetics 30 gammas per cm. |
| 17.0 | cm to | 18.5 | cm | ALTR - helicopter terrain clearance 280 ft/cm |
| 17.0 | cm to | 17.5 | cm | PRWL - power line monitor |
| 17.0 | cm to | 17.5 | cm | SFRS - Sferics (Lightning) monitor |

The helicopter flight path is recovered from 35 mm film, which is exposed at 2.0 second intervals while the helicopter is on survey. After processing and anotating, recognizable fiducials (pictures) are pin-pointed on a photomosaic map.

# APPENDIX III

## APEX FLIGHT LOGS

AEX FLIGHT LOG

AEX FLIGHT LOG
13 32 22 ACFT C-GUXC PN STANFIELD FLTN 001 DTE 16 12 83 SURALT 200 F

| LINE NO | TIME | START FID | |
|---|---|---|---|
| LN TEST | 1332 | FN00000 | |
| LN TEST | 1332 | FN00000 | |
| LN 01 | 1341 | FN00089 | |
| LN 02 | 1356 | FN00440 | |
| LN 03 | 1406 | FN00709 | |
| LN 03-1 | 1411 | FN00840 | |
| LN 03-2 | 1415 | FN00902 | |
| LN 03-3 | 1418 | FN00978 | |
| LN 04 | 1421 | FN01061 | SCRUB. |
| LN 04-1 | 1423 | FN01065 | |
| LN 04-2 | 1427 | FN01174 | |
| LN 04 (west) | 1435 | FN01368 | |
| LN 05 | 1444 | FN01538 | SCRUB |
| LN TEST | 1447 | FN01611 | |

X FLIGHT LOG
TM 12 00 20 ACFT C-GVWC PN STANFIELD FLTN 02 DTE 17 12 83 SURALT 200 F

| LINE NO | TIME | START FID |
|---|---|---|
| N | 1200 | FN00000 |
| LN 05 | 1223 | FN00116 |
| LN 05-1 | 1232 | FN00388 |
| LN 06 | 1244 | FN00719 |
| LN 07 | 1300 | FN01184 |
| LN TEST | 1321 | FN01769 |

FLIGHT LOG

T 4 01 04 ACFT C-GVWC PN STANFIELD FLTN 03 DTE 17 12 38 SURALT 200 F

| LINE NO | TIME | START FID | |
|---|---|---|---|
| LN TEST | 1401 | FN00000 | |
| LN 08 | 1409 | FN00090 | |
| LN 08-1 | 1412 | FN00171 | |
| LN 08-2 | 1417 | FN00267 | |
| LN 08-3 | 1418 | FN00293 | |
| LN 08-4 | 1420 | FN00334 | |
| LN 08-5 | 1421 | FN00351 | |
| LN 08-6 | 1425 | FN00445 | |
| LN 08-7 | 1426 | FN00463 | SCRUB |
| LN 08-8 | 1428 | FN00486 | |
| LN 08-9 | 1433 | FN00638 | |
| LN 09 | 1436 | FN00675 | |
| LN 09-1 | 1439 | FN00772 | |
| LN 09-2 | 1441 | FN00809 | |
| LN 09-3 | 1443 | FN00844 | |
| LN 09-4 | 1449 | FN00983 | |
| LN 10 | 1455 | FN01148 | |
| LN 10-1 | 1458 | FN01240 | |
| LN 10-2 | 1501 | FN01292 | |
| LN 10-3 | 1503 | FN01366 | |
| LN 10-4 | 1505 | FN01386 | |
| LN 11 | 1514 | FN01627 | |
| LN 11-1 | 1518 | FN01735 | |
| LN 11-2 | 1525 | FN01945 | |
| LN 11-3 | 1528 | FN01987 | |

AEX FLIGHT LOG
TM 13 51 07 ACFT C-GVWC PN STANFIELD FLTN 04 DTE 18 12 83 SURALT 200 F

| LINE NO | TIME | START FID |
|---|---|---|
| LN TEST | 1351 | FN00000 |
| LN 12 | 1403 | FN00062 |
| LN 12-1 | 1406 | FN00132 |
| LN 12-2 | 1413 | FN00298 |
| LN 12-3 | 1415 | FN00339 |
| LN 13 | 1422 | FN00520 |
| LN 13-1 | 1425 | FN00599 |
| LN 13-2 | 1427 | FN00638 |
| LN 13-3 | 1429 | FN00660 |
| LN 13-4 | 1431 | FN00703 |
| LN 13-5 | 1433 | FN00719 |
| LN 14 | 1443 | FN01021 |
| LN 14-1 | 1451 | FN01242 |
| LN 14-2 | 1453 | FN01269 |
| LN 14-3 | 1455 | FN01316 |
| LN 14-4 | 1457 | FN01348 |
| LN 14-5 | 1459 | FN01363 |
| LN 15 | 1504 | FN01501 |
| LN 15-1 | 1508 | FN01597 |
| LN 15-2 | 1511 | FN01645 |
| LN 15-3 | 1512 | FN01669 |
| LN TEST | 1521 | FN01922 |

FLT 04 18 Dec 83
STANFIELD ROBERT.

AEX· FLIGHT LOG
TM 14 47 24 ACFT C-GVWC PN STANFIELD FLTN 05 DTE 19 12 83 SURALT 200 F

| LINE NO | TIME | START FID | |
|---|---|---|---|
| LN TEST | 1447 | FN00000 | |
| LN T/L 2 | 1454 | FN00058 | |
| LN 16 | 1506 | FN00306 | |
| LN 16-1 | 1513 | FN00477 | |
| LN T/L 1 | 1524 | FN00589 | |
| LN D | 1533 | FN00779 | |
| LN C | 1537 | FN00897 | |
| LN B | 1541 | FN00993 | |
| LN A | 1545 | FN01088 | |
| LN 17 | 1553 | FN01188 | SCRUB |
| LN 17-1 | 1557 | FN01270 | SCRUB |
| LN TEST ALT | 1600 | FN01288 | AVERAGE READING ON TERMIREX 26.5° |
| LN TEST | 1602 | FN01313 | |

FLT 05 STANFIELD
19 Dec 83

REX FLIGHT LOG
TM 14 20 17 ACFT C-GVWC PN STANFIELD FLTN 06 DTE 20 12 83 SURALT 200 F

| LINE NO | TIME | START FID | |
|---|---|---|---|
| LN TEST | 1420 | FN00000 | |
| LN TEST | 1420 | FN00000 | |
| LN 17 | 1429 | FN00046 | |
| LN 17-1 | 1434 | FN00195 | |
| LN 17-2 | 1437 | FN00261 | — SCRUB. |
| LN 17-3 | 1438 | FN00275 | |
| LN 17-4 | 1443 | FN00000 | EXIT OJ WAS HAD TO RESTART. |
| LN 17-5 | 1445 | FN00013 | |
| LN 18 | 1451 | FN00167 | |
| LN 18-1 | 1454 | FN00250 | |
| LN 18-2 | 1456 | FN00266 | VERY TURBULENT & |
| LN 18-3 | 1457 | FN00282 | — SCRUB. −32° C. |
| LN 18-4 | 1458 | FN00291 | VERY COOL ! MA |
| LN 18-5 | 1507 | FN00346 | |
| LN 19 | 1517 | FN00623 | |
| LN 19-1 | 1526 | FN00869 | |
| LN 20-1 | 1529 | FN00949 | SHOULD BE LINE 20. |
| LN TEST | 1538 | FN01205 | |

APEX FLIGHT LOG

LN TEST 132605FN000 FLT 007 DECEMBER 21, 1983

| LINE NO | TIME | START FID | |
|---|---|---|---|
| LN TEST | 1326 | FN00000 | |
| LN TEST | 1327 | FN00016 | |
| LN 16 | 1338 | FN00067 | part line |
| LN 16-1 | 1340 | FN00141 | |
| LN 16-2 | 1345 | FN00252 | |
| LN 16-3 | 1346 | FN00276 | |
| LN 16-4 | 1348 | FN00302 | |
| LN 19 | 1352 | FN00322 | Scrub |
| LN 19 | 1356 | FN00432 | |
| LN 19-1 | 1359 | FN00512 | |
| LN 20 | 1405 | FN00657 | |
| LN 01 | 1418 | FN00796 | Scrub |
| LN 01 | 1419 | FN00804 | |
| LN 01-1 | 1420 | FN00845 | |
| LN 01-2 | 1422 | FN00880 | scrub |
| LN 01-3 | 1423 | FN00898 | scrub |
| LN 01-4 | 1424 | FN00913 | |
| LN 02 | 1427 | FN00982 | |
| LN 03 | 1438 | FN01132 | |
| LN 04 | 1447 | FN01316 | |
| LN 04-1 | 1448 | FN01344 | |
| LN TEST | 1452 | FN01441 | |

MAG 05 THIS FLIGHT

## APPENDIX IV

**Survey Personnel:**

| | | |
|---|---|---|
| Field Geophysicist: | - | Ronald F. Sheldrake<br>1271 W. 22nd Street<br>North Vancouver, B.C. |
| Field Technician: | - | Mr. Michael Magee<br>#1 Stokes Road<br>Mount Albert, Ontario<br>P.O. Box 457, L0G 1M0 |
| Helicopter Pilot | - | Mr. Herman Lorenz<br>c/o Highwood Aviation<br>Calgary, Alberta |

## CERTIFICATION

I, RONALD F. SHELDRAKE, of the City of Vancouver, Province of British Columbia, hereby certify as follows:

1. I am President of **Apex Airborne Surveys Ltd.** a company incorporated under the laws of the Province of British Columbia.

2. The Vancouver Office of **Apex Airborne Surveys Ltd.** is located at Suite 514 - 625 Howe Street, Vancouver, British Columbia.

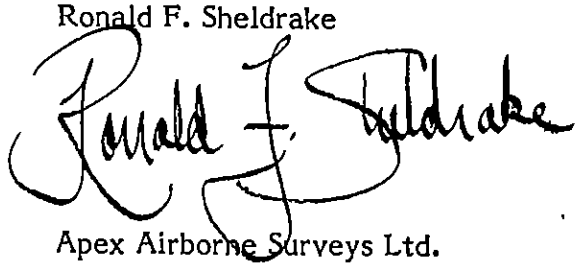
3. I received my B.Sc., in Geophysics from the University of British Columbia in May, 1974.

4. I have practised my profession since that date.

5. I have no interest, direct or indirect, in the properties or claims of Mr. R.H. Stanfield nor do I expect to receive any.

6. I consent to the use of this report in or in connection with engineering reports or in a Statement of Material Facts.

Ronald F. Sheldrake



Apex Airborne Surveys Ltd.

January 5, 1984

January 5, 1984

## STATEMENT OF COSTS

| | |
|---|---|
| Type of Survey: | Helicopter Electromagnetic-Magnetic |
| Date(s) of Fieldwork: | December 16 to December 21, 1983 |
| Survey Kilometers: | 351 Kilometers |
| Cost per Linear Kilometer: | $85.97 |
| Additional Charges: | None |
| Total Cost of Survey: | $30,175.00 |