AIRBORNE GEOPHYSICAL SURVEY

ON THE

PAULSON PROJECT

BRITISH COLUMBIA

ORION GROUP

BONANZA GROUP -

Map Sheet 082E 01E
UTM Zone 11

TRAIL CREEK AND GREENWOOD

MINING DIVISIONS

Prepared for

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APPENDICES

1.0 INTRODUCTION

This report describes the electromagnetic, resistivity, magnetic and V.L.F. surveys flown for Crownex Resources Ltd., a wholly owned subsidiary of Crown Resources Corp., Seventeenth Street Plaza, 1225 17th Street, Suite 1500 Denver, Colorado 80202. Flight data was gathered from May 5 to May 11, 1992 over the Paulson Project survey block located 40 km east of Grand Forks, B.C. The survey coverage consisted of approximately 288 line-km flown in an azimuth direction of 0°/180° with a line separation of 200 meters.

1.1 SUMMARY

Literature search and reconnaissance geology, geochemistry, and ground geophysics in April and May 1991, prior to land acquisition, indicated geology favorable to the development of bulk tonnage gold drill targets existed in the area around the old Canadian Pacific rail station at Paulson, some 40 km east of Grand Forks.

Minor high grade gold production west south west of Paulson, has been associated with sulfide and magnetite bearing, siliceous skarnification of select limestone beds. East of Paulson, gold silver ore has been obtained from quartz monzonite hosted quartz veins.

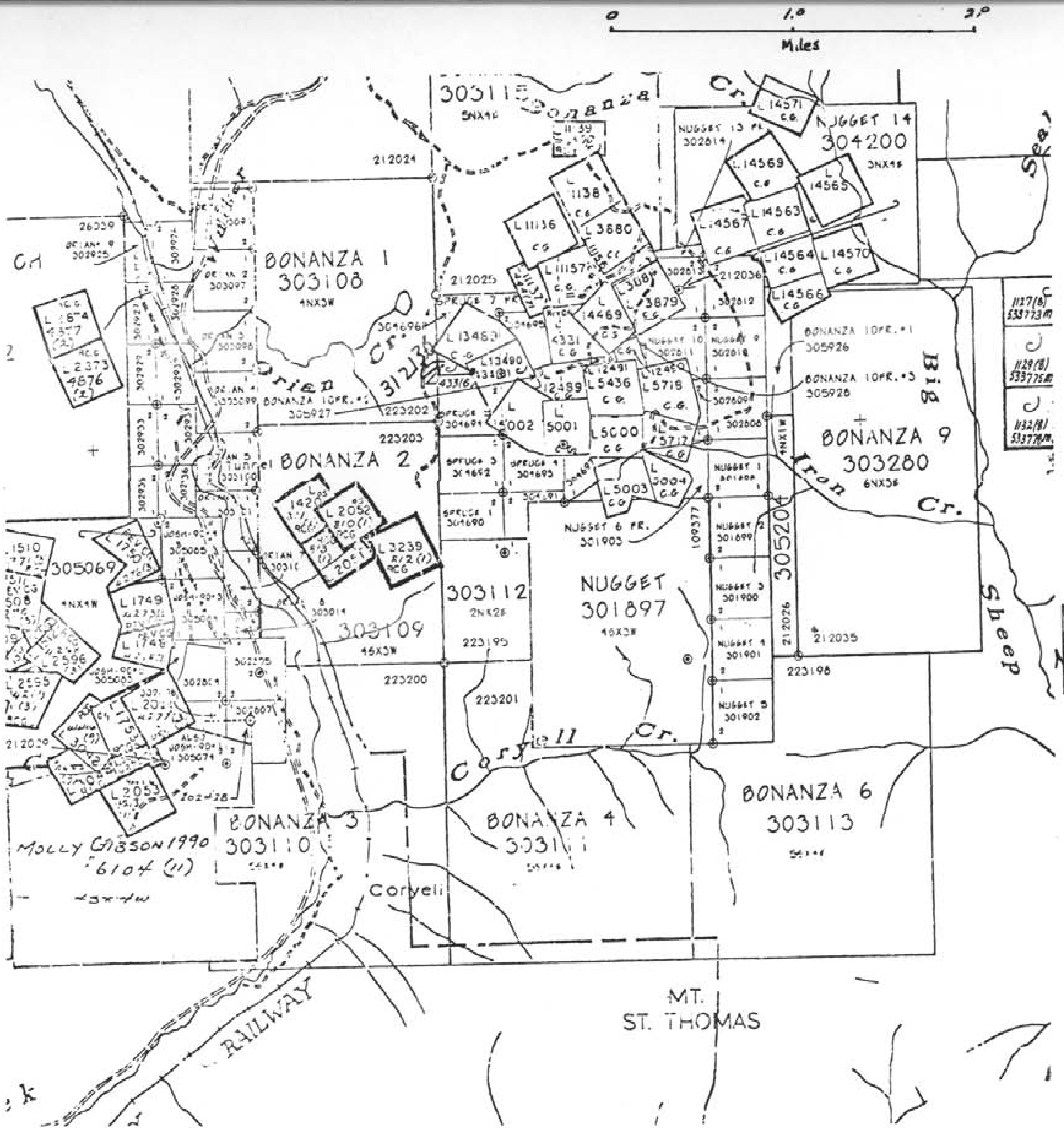
The Dighem airborne geophysical survey was selected as the most efficient initial exploration tool as steep-rugged terrain, abundant overburden, heavy vegetation, and difficult local access hampered the ground based gold exploration data collection.

A number of well mineralized gold and base metal occurrances fall within the Paulson survey block, producing a comparative data base aiding in the interpretation and extrapolations of the Airborne geophysical information.

Crown Resources' Bonanza and Orian claim groups lie within the boundaries of the Paulson Airborne geophysical survey block.

1.2 PROPERTY AND OWNERSHIP

The properties are comprised of 14 two post claims and 6 M.G.S. claims totalling 100 units and are owned by Crownex Resources Ltd. a wholly owned subsidiary of Crown Resources Corp., 17th Street Plaza, 1225 Seventeenth Street, Suite 1500 Denver, Colorado 80202. The properties are located in the Trail Creek and Greenwood Mining Divisions. (Figure #1) The following table summarizes the pertinent claim data.



CROWN RESOURCES
Paulson Project
Claim map
Scale 1:50,000

FIGURE 1

REM

BONANZA GROUP

CLAIM NAME	RECORD	UNITS	EXPIRY DATE*
Bonanza 2	303109	12	August 9, 1993
Bonanza 6	303113	20	August 15, 1993
Bonanza 9	303280	18	August 16, 1993
Bonanza 10	303115	20	August 11, 1993
Bonanza 10	305204	4	October 9, 1993
Nugget 7	302808	1	July 30, 1993
Nugget 8	302809	1	July 30, 1993
Nugget 9	302810	1	July 30, 1993
Nugget 10	302811	1	July 30, 1993
Nugget 11	302812	1	July 30, 1993
Nugget 12	302813	1	July 30, 1993
Nugget 13 FR	302814	1	July 30, 1993
Nugget 14	304200	12	Spetember 13, 1993
Spruce 2	304691	1	September 28, 1993
Spruce 3	304692	1	September 28, 1993
Spruce 4	304693	1	September 28, 1993
Spruce 5	304694	1	September 28, 1993
Spruce 6	304695	1	September 28, 1993
Spruce 7 FR	304696	1	September 28, 1993
Spruce 8	304697	1	September 28, 1993

*Pending acceptance of this report

1.3 LOCATION, ACCESS AND PHYSIOGRAPHY

The Bonanza claim group is situated in the Trail Creek and

ORION GROUP

CLAIM NAME	RECORD	UNITS	EXPIRY DATE*
Orion 1	303096	1	August 8, 1993
Orion 2	303097	1	August 8, 1993
Orion 3	303098	1	August 8, 1993
Orion 4	303099	1	August 8, 1993
Orion 5	303100	1	August 9, 1993
Orion 6	303101	1	August 9, 1993
Orion 7	303102	1	August 9, 1993
Orion 8	303014	1	August 9, 1993
Orion 9	302925	1	August 11, 1993
Orion 10	302926	1	August 11, 1993
Orion 11	302927	1	August 11, 1993
Orion 12	302928	1	August 11, 1993
Orion 13	302929	1	August 11, 1993
Orion 14	302932	1	August 11, 1993
Orion 14	302933	1	August 11, 1993
Orion 16	302934	1	August 11, 1993
Orion 17	302935	1	August 11, 1993
Orion 18	302936	1	August 11, 1993
Lafferty 1	302804	1	August 8, 1993
Lafferty 2	302805	1	August 8, 1993
Lafferty 3	302806	1	August 8, 19993
Lafferty 4	302807	1	August 8, 1993
Bonanza 1	303108	12	August 9, 1993
Bonanza 3	303110	20	August 13, 1993
Bonanza 4	303111	20	August 13, 1993
Bonanza 5	303112	4	August 8, 1993
Bonanza 7	303114	20	August 12, 1993
Spruce 1	304690	1	August 28, 1993

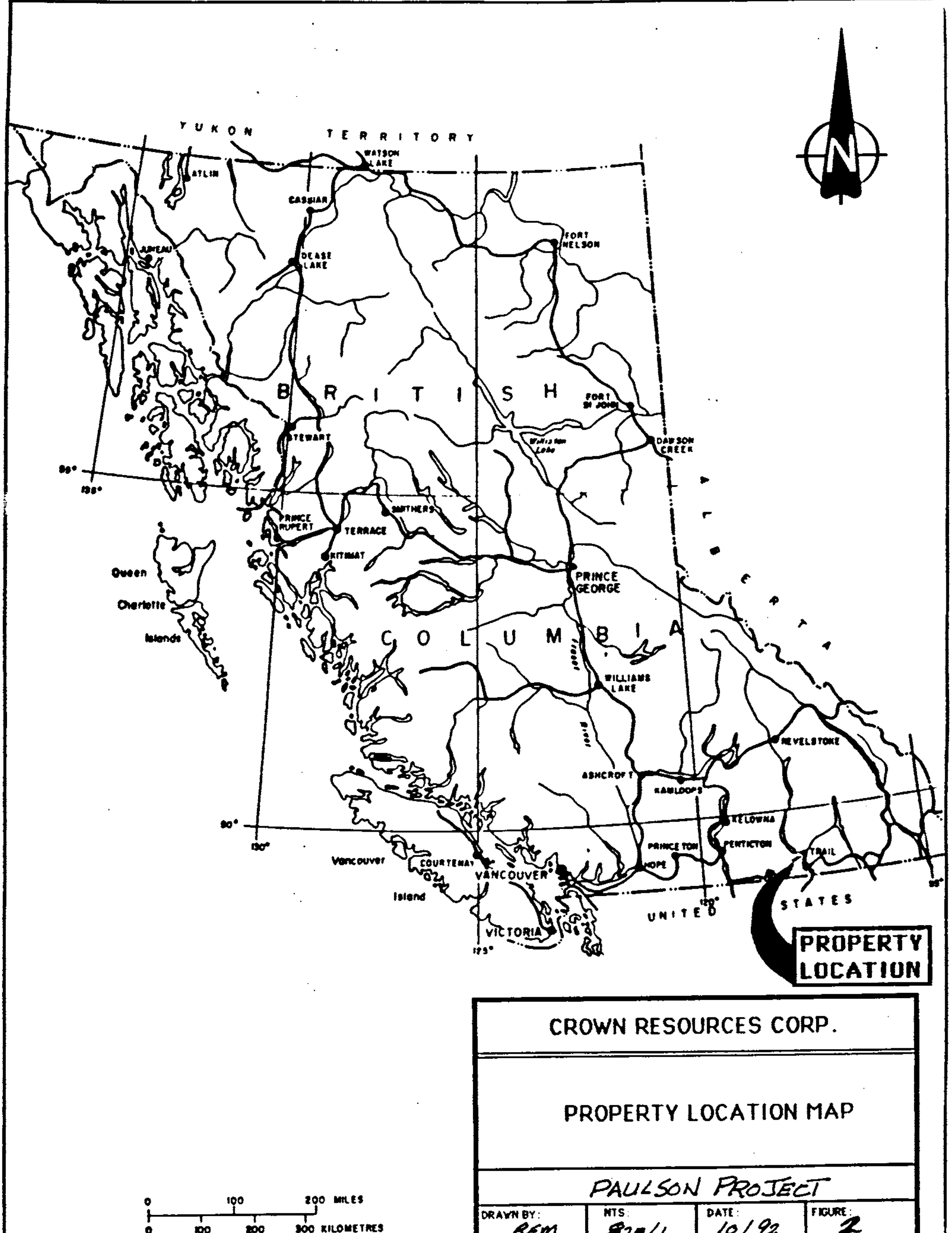
*Pending acceptance of this report

Greenwood Mining Division of Southern British Columbia adjacent to Highway #3 at Paulson, an old Canadian Pacific rail station. Grand Forks is approximately 40 km to the west and Castlegar about 35 km to the east. Granville Mountain is near the center of the property at Latitude 49° 11' N Longitude 118° 4' W. McRae Creek is near the west boundary of the property and Big Sheep Creek is near the east boundary edge.

Access is via the Bonanza Creek road off of Highway #3 some 7.0 km east of the Paulson Bridge. (Figure #2) Numerous logging, mining, and bush roads provide excellent access to most of the property.

Granville Mountain is the main topographical feature on the property at a height of 1800+ meters (5838 feet). The low point on the property is located south of Paulson near the old railroad stop at Coryell. It is 1025 meters (3177 feet) in elevation for an approximate relief of 675 meters. Mount St. Thomas, just to the south of the property, is some 2100+M(6500 feet) in elevation and is the most prominent point in the immediate area. (Figure #3)

Topography varies from gentle rolling hills in the central up-lands, to precipitous cliffs south along Coryell Creek, east along Big Sheep Creek, and to the west along McRae

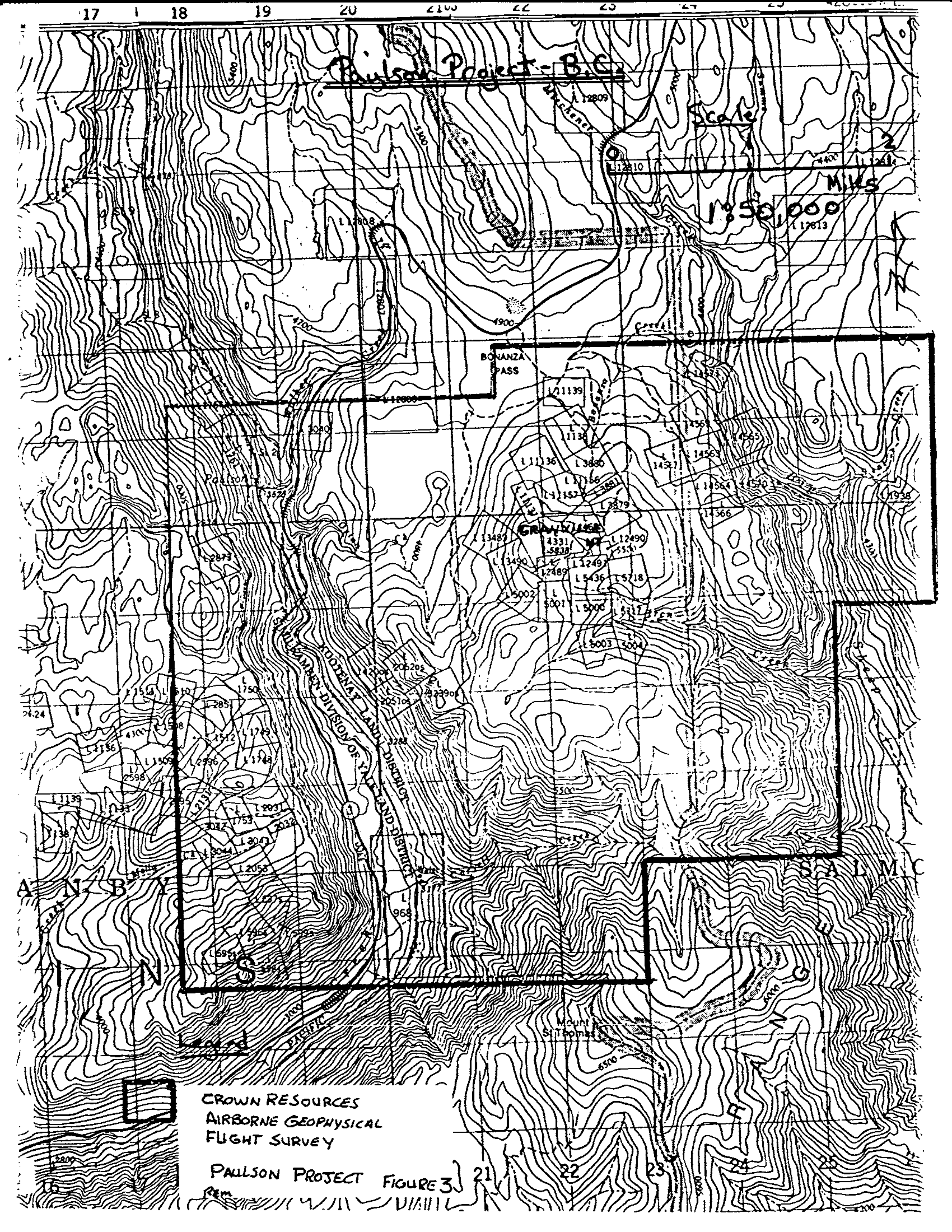


CROWN RESOURCES CORP.

PROPERTY LOCATION MAP

PAULSON PROJECT

DRAWN BY:	NTS:	DATE:	FIGURE:
REM	82E/1	10/92	2



Paulson Project - B.C.
Scale
0 1 2
Miles
1:50,000
BONANZA PASS
Paulson
KOOTENAY LAND DISTRICT
SIMILKAMEEN DIVISION OF YALE LAND DISTRICT
Mount St Thomas
PACIFIC
SALMO
CROWN RESOURCES
AIRBORNE GEOPHYSICAL
FLIGHT SURVEY
PAULSON PROJECT
FIGURE 3

Creek.

Vegetation consists mainly of conifers and scrub bush. Numerous old clear cut logging areas are located within the group.

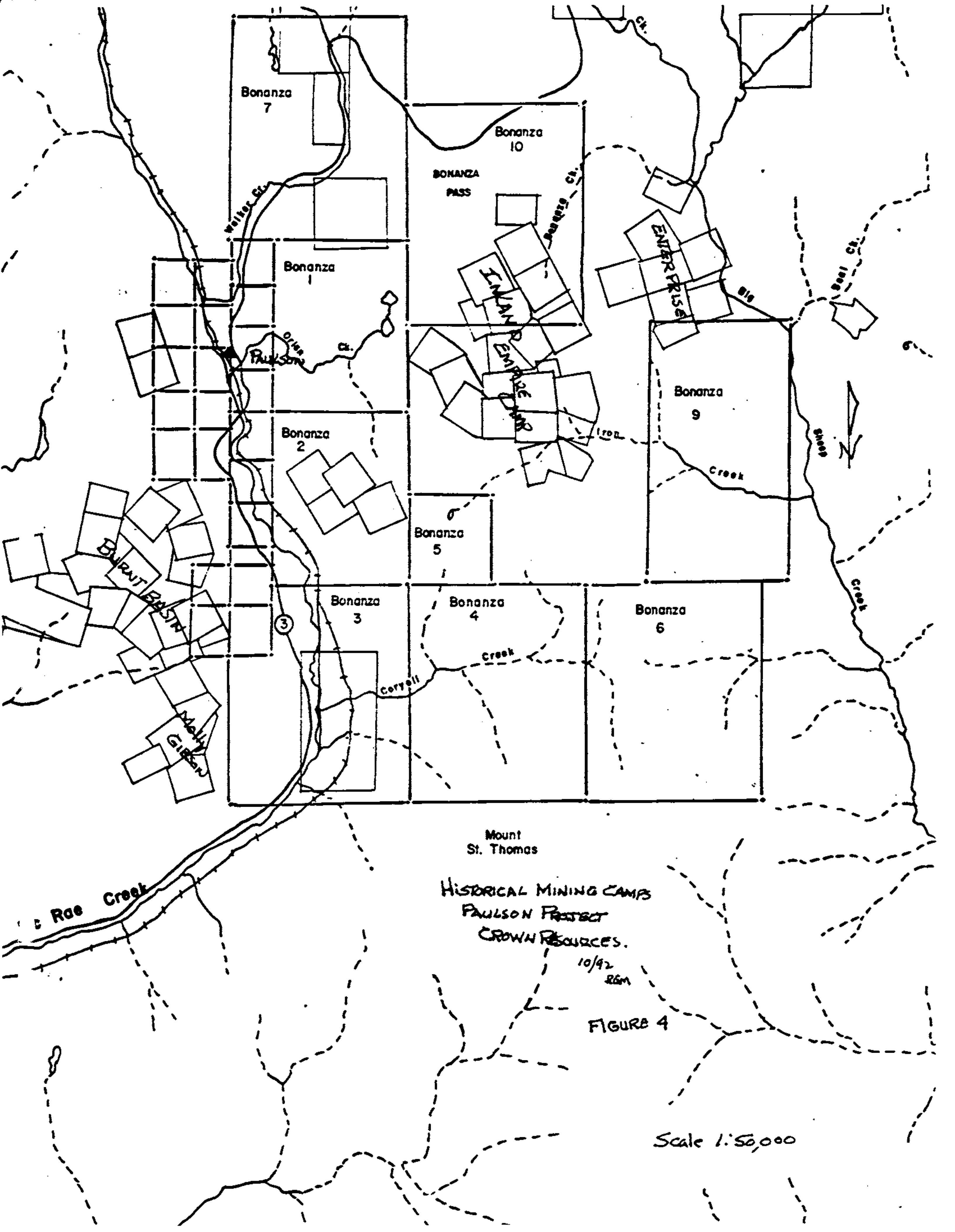
1.4 HISTORY

Most of the previous work, near or within the Bonanza claim group, has been associated with the Burnt Basin and Inland Empire mining camps of which Paulson was the jumping off point along the old railroad. (Figure #4)

Historical mining efforts in the Burnt Basin Camp started in the late 1890's centering around lead, zinc, silver, copper "replacement bodies" in the central portion of the camp, and gold mineralization at the Molly Gibson claim and Motherlode claim south and northwest of the central showing.

Base metal production in the camp has been sporadic and no production records are readily apparent until 1948 when the Minister of Mines Report states that 14 tons of base metal ores were shipped from the Halifax claim to the smelter at Trail.

Direct shipments of mine run ore, mainly from the Eva Bell



HISTORICAL MINING CAMPS
PAULSON PROJECT
CROWN RESOURCES.
10/92
RGM

FIGURE 4

Scale 1:50,000

and Halifax claims were made from 1972-1977. Lack of concentration facilities on site to up-grade the mine run ore resulted in marginal economics and production ceased. The following table summarizes the recent base metal data, exploration efforts, and production history at Burnt Basin.

TABLE I

1927	Minister of Mines Report; per ton Silver 10.8 oz; Lead 17.8%; Zinc 20.5%.
1948	Minister of Mines Report: 14 tons shipped; Silver 10.5 oz; Lead 18.1%; Zinc 18.3%, per ton.
1965	Christina Lake Mines - geological, geochemical and magnetometer surveys were completed. Some diamond drilling - data not available.
1968	Dalex Mines - an induced polarization survey, considerable stripping and trenching on Burnt Basin and Ajax claims. Geochemical survey, trenching and stripping and seven drill holes totalling 2,142 feet.
1972-75	Donna Mines, reports by E.O. Chisholm and H.H. Shear, line cutting and magnetometer surveys on the Eva Bell and Halifax, and five short diamond drill holes on the Eva Bell, cat trenching and percussion drilling. Shipped a total of 1,488 tons to Trail, H.B. Mines, Re-Mac Mines and Kam-Kotia.
1975-76	Alviija Mines Ltd- produced 1,750 tons from the Eva Bell claim and shipped 535 tons yielding 3.1 oz. Ag/ton, 4.45% Pb, 6.75% Zn with 21.5% magnetite to the H.B. Mine at Salmo.
1977	Paulson Mines Ltd. completed 1,500 feet of diamond drilling on the Halifax claim and published intercepts of up to 6" grading 12.4 oz. Ag/ton, 19.7% Lead and 14.9% Zinc. (note: Details not available)
1978	Oliver Resources completed a vector Pulse E.M. Survey, I.P.Survey with about 10 km completed.

1979	Granges Exploration Ltd. completed 291 m of diamond drilling on the Eva Bell and BP No. 2 (adjoins Eva Bell to the east).
1986-87	West Rim Resources carried out extensive soil geochemical surveys in the Halifax-Eva Bell area.

The following Table II summarizes the gold exploration and production history at Burnt Basin.

TABLE II

1909 - 1933	Shafts, tunnels and trenches on the Molly Gibson Group produced 260 tons containing 285 oz. gold and 119 oz. Silver
1909 - 1936	Molly Gibson Group an up-dated production total of 316 tons yielding 332 oz. gold.
1986 - 1987	West Rim Resources completed 420 meters of diamond drilling at the Motherlode prospect.
1988	John Worthing - Salt Lake City, Utah drilled at least 4 core holes on the Molly Gibson. (data unavailable)
1991	Orvana completed small geochemical grid on Molly Gibson.

Other gold claims in the Burnt Basin camp include the Kittie, Aldeen, Contact, Tammany and Tunnel group.

Historically, production in the Inland Empire camp, east of Paulson near Granville Mountain has been from shafts, tunnels and open cuts from which small tonnages of gold and silver ore have been produced. The following table lists some of the more pertinent data by claim.

TABLE III

INLAND EMPIRE GROUP:
Albion Claim

1950	shipped 25 tons containing 8 oz. gold and 48 oz. silver.
1962	shipped 152 tons containing 16 oz. gold, 147 oz. silver, 309 lbs. lead, and 309 lbs. zinc.
1964	shipped 25 tons containing 70 oz. gold, 23 oz. silver, 50 lbs. lead, and 50 lbs. zinc.

Alice L./Berlin Claims

1917	59 tons valued @ $90-100 in gold and silver.
1918	142 tons assaying 3.0 oz/ton gold, 15.0 oz/ton silver, and 0.6% copper.
1919	65 tons containing 26 oz. gold, 83 oz. of silver and 117 lbs. copper.
1938	541 tons shipped containing 121 oz. gold, 1,142 oz. silver.
1939	467 tons yielding 80 oz. of gold and 145 oz. silver.

Inland (Inland Empire) Claim

1912	2,200 tons milled. 43 tons shipped.

Minor production has been reported from the Cascade - Bonanza and Nugget claims on the south east side of the camp and in addition, the Enterprise group (Nugget 14) to the north east of Inland Empire also has a record of shipments, probably less than 50 tons.

Recent efforts in the area had centered around the gold bearing quartz veins until Prominent Resources Corp's more comprehensive exploration in 1985 which focused on the viability of gold targets adjacent to the traditional camp, as well as trying to evaluate the quartz vein targets within the intrusive.

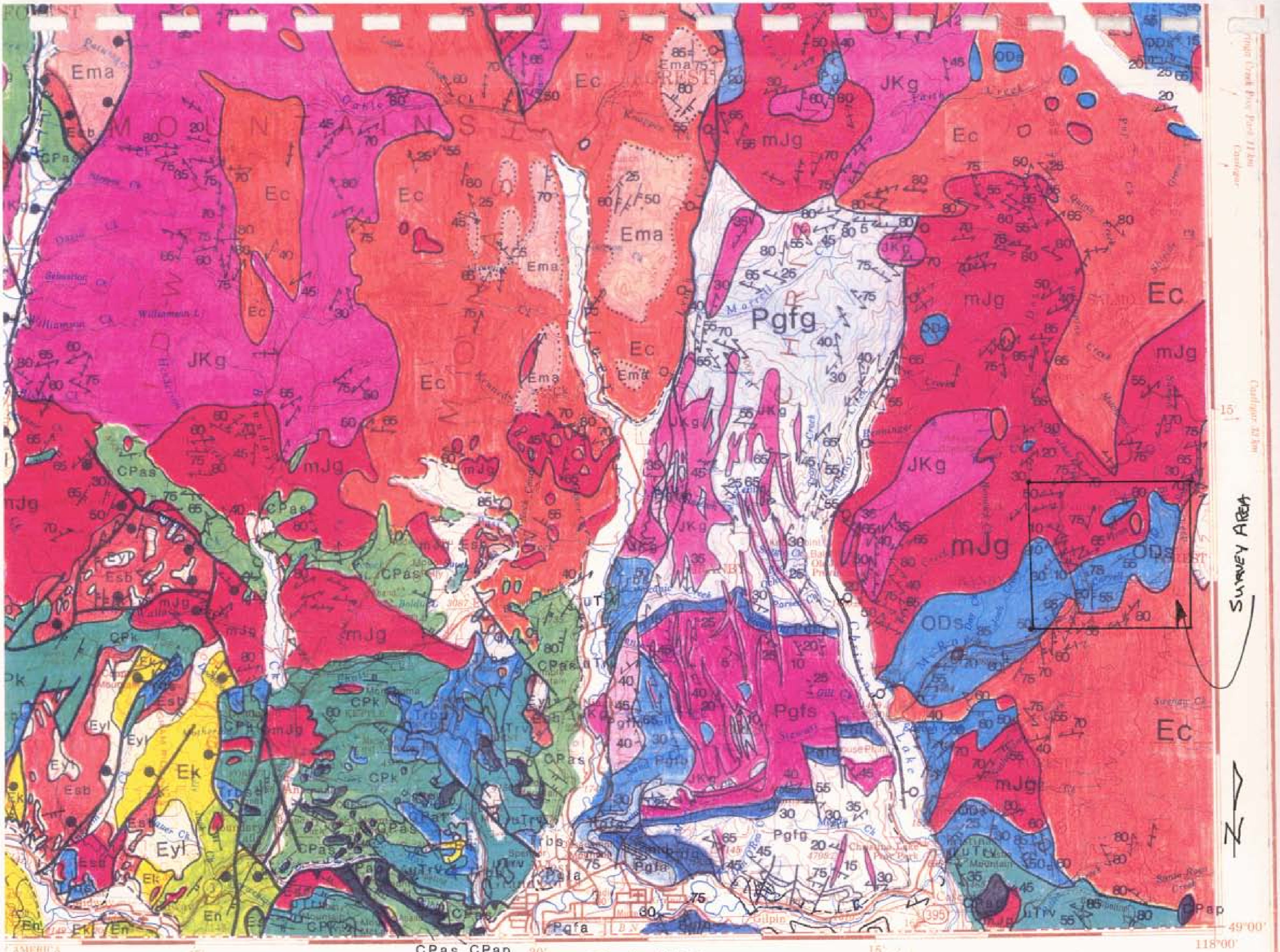
2.0 GENERAL GEOLOGY

2.1 REGIONAL GEOLOGY

Carboniferous or older rocks, possibly equivalent in part to the Pennsylvanian-Permian Mt. Roberts Formation and Lower Jurassic Elise Formation of the Rossland Group, have been intruded by Late Jurassic Early Cretaceous Nelson and Middle Eocene Coryell plutonic rocks. (Figure #5a & 5b)

Mt. Roberts Formation rocks form an elongate east west roof pendant in the central part of the project area. The pendant consists mainly of limestone, argillaceous limestone, chert, slate, pebble conglomerate and andesitic volcanics. Rocks within the pendant strike roughly north west 320 to 340 dipping 40 to 85 east and are cross cut by north trending shear zones.

Limestone and argillites are generally light gray to black in color and relatively unaltered except where skarned. Volcanic rocks are typically dark green and "intrusive dykes and sills" are typically light colored.



Scale 1:250,000

FIGURE #5a

FIG. 5b

LEGEND

CENOZOIC

QUATERNARY

PLEISTOCENE

QPl LAMBLY CREEK BASALT: rusty weathering black basalt, with hornblende, biotite and pyroxene phenocrysts to 5 mm in an aphanitic black matrix; occurs as columnar jointed flows, a few metres thick above Mesozoic strata; K-Ar age of 0.762 Ma determined by Church, 1981

TERTIARY

MIOCENE

PLATEAU BASALT: andesite and basalt with augite and hornblende phenocrysts to 5 mm in a black aphanitic matrix; forms massive flows to 20 m thick; locally underlain by poorly sorted boulder conglomerate and pebbly sandstone; K-Ar cooling ages of 2.9 and 14.9 Ma; includes Daves Creek Basalt (14.9 Ma) and Carrot Mountain alkali basalt (11.8 Ma)

EOCENE

Eor OLALLA RHYOLITE: rhyolite breccia, massive obsidian and related dykes

Ema MARRON GROUP
undifferentiated andesite, dacite and trachyte of the Marron Group; may include minor epiclastic rocks equivalent to Ewl and Esb

Es SKAHA FORMATION: brecciated greenstone (Old Tom Formation), brecciated chert (Shoemaker Formation, Es1), and brecciated granite (Oliver Granite, Es2) resting as fault slices hundreds of metres across, above the White Lake Formation on gently dipping faults; includes undifferentiated polymictic fanglomerate and arkose resting unconformably on these brecciated rocks; near Rock Creek includes heterogeneous epiclastic breccia (Klondike Mountain Formation)

Ewl WHITE LAKE FORMATION: massive to thick bedded volcanic breccia and pyroclastic rocks with clasts of Trapanier Rhyolite and Kitley Lake and Yellow Lake formations; includes interbedded medium and thin beds of brown sandstone and clayey siltstone; minor carbonaceous seams; includes minor trachyte and andesite. Palynomorphs from Powers Creek indicate a Middle Eocene or older age

Em MARAMA FORMATION: medium brownish grey, flow banded dacite with subhedral plagioclase, hornblende and biotite phenocrysts to 5 mm in an aphanitic ground; forms the top of Black Knight Mountain, Mount Boucherie, Aeneas Butte, Mount Law

En MARAMA FORMATION-NIMPIT LAKE MEMBER: recessive, reddish weathering, amygdaloidal, trachyandesite with minor intercalated pyroclastic deposits; includes undifferentiated intrusive equivalents

Ek KITLEY LAKE FORMATION: massive, yellowish to buff, trachyte to trachyandesite, plagioclase and biotite glomerophenocrysts to 3 cm (10 % of the rock) in a finely crystalline groundmass; includes ash flow tuff and minor mudstone; includes undifferentiated intrusive equivalents. Church determined K-Ar ages between 52.9 (biotite) and 44.2 Ma (whole-rock)

Eyl YELLOW LAKE FORMATION: massive to thick, tabular flows of buff to light tan pyroxene-rich, mafic phonolite locally with rhomb anorthoclase phenocrysts and primary analcite; abundant zeolite fills cracks and amygdules; includes undifferentiated intrusive equivalents

Etr TREPANIER RHYOLITE: white and locally pink, greenish or light grey, flow banded rhyolite with subhedral quartz, hornblende and biotite phenocrysts to 3 mm in an aphanitic matrix; K-Ar ages of 47.7 and 46 ± 2 Ma were determined by Church (1981) west of Trepanier

Esb SPRINGBROOK FORMATION: poorly sorted, massive to thick bedded, immature, coarse boulder and pebble conglomerate. Clasts to 50 cm are rounded, but of low sphericity and are locally derived (chert, greenstone, granite, and other pre-Eocene rocks with fewer Marron Group clasts, mainly Yellow Lake and Kitley formations). Near Rock Creek this unit consists of white to light grey, medium bedded, feldspathic sandstone, siltstone and shale with coaly partings, named the Kettle River Formation

Ec CORYELL SYENITE: alkalic to calc-alkalic, high level, pink and buff syenite and quartz monzonite and trachytic pink feldspar porphyry dykes; plutonic equivalent of the Marron Group especially the Kitley Lake Formation; gradational to peralkaline and to Shingle Creek Porphyry; probably includes JKg undifferentiated in East half of map area; poorly dated

SHINGLE CREEK PORPHYRY: massive, buff and pink, fine grained porphyritic granite and felsite with euhedral phenocrysts of K-feldspar to 10 cm across; occurs as dykes under, and feeders to, the volcanic rocks of the Marron Group, especially the Kitley Lake Formation; a shallow level equivalent of the Coryell Syenite; includes mom porphyries and related rocks

Egn "OKANAGAN GNEISS": massive, medium grey weathering, resistant hornblende-biotite granodiorite orthogneiss; strongly foliated; grades to mylonitic gneiss, mylonite and blastomylonite; minor amphibolite and paragneiss; minor schist; minor pegmatite and aplite; strongly cataclasized along Okanagan Fault; grades eastward (and up the structural succession) to JKg, mJg and Pm units of which it is presumed as to the sheared equivalent; probably also includes sheared equivalents of the Anarchist Group; presumed sheared and thermally overprinted during the Eocene; Egn1- quartz chlorite microbreccia and related altered rocks close to the Okanagan Fault

Egng Massive, light grey weathering, biotite granite gneiss and granodiorite gneiss with pegmatite veins and sills

Eg Hornblende granodiorite: massive, resistant, grey weathering, coarse grained, equigranular mesocratic with euhedral fresh black hornblende crystals; locally weakly foliated; age poorly constrained

MESOZOIC

CRETACEOUS AND/OR JURASSIC

JKg OKANAGAN BATHOLITH: massive, light grey weathering, medium- to coarse-grained, equigranular to porphyritic, unfoliated to weakly foliated, fresh biotite granodiorite and granite; includes undifferentiated granodiorite of the Nelson suite; age poorly constrained

OLIVER PLUTON: massive, unfoliated, medium grained porphyritic biotite granite with weakly foliated, equigranular hornblende granodiorite along the southern border; includes Jod, biotite-hornblende biotite agmatite and Jog, massive garnet-muscovite granite; age poorly constrained

OSOYOOS GRANODIORITE: recessive, pasty greenish, hornblende granodiorite; pervasively saussuritized, chloritized, sheared and fractured; age unknown

MIDDLE JURASSIC

NELSON PLUTONIC ROCKS: massive, generally moderately foliated, medium grey weathering, medium- to coarse-grained, equigranular, hornblende-biotite granodiorite, quartz diorite and granite; includes undifferentiated biotite granite of the Valhalla suite; age poorly constrained

OLALLA PYROXENITE: black, fresh, massive, medium- to coarse-grained pyroxenite, hornblendite, serpentinite and peridotite

Jod KRUGER SYENITE: massive, medium grained, biotite hornblende granodiorite with a marginal zone of megacrystic, mesocratic coarse grained hornblende syenite

MESOZOIC

UPPER TRIASSIC AND/OR LOWER JURASSIC

ROSSLAND AND NICOLA GROUPS

uTrv Massive greenstone, andesite, tuffs, agglomerate and volcanic breccia of greenstone fragments locally with limestone clasts; minor greywacke; minor interbedded limestone; includes lenses of silicified equivalents; may include undifferentiated Lower Jurassic volcanics of similar lithology

uTrns Rusty weathering, black pyritic slate, phyllite and argillite, locally silicified or "cherty"; minor quartzite, minor interbedded argillaceous limestone; includes undifferentiated greenstone lenses

PALEOZOIC TO MESOZOIC

ORDOVICIAN TO UPPER TRIASSIC

uTrot OLD TOM FORMATION: massive andesitic greenstone and greenstone breccia; locally includes large, extensive, strongly silicified equivalents in irregular bodies and lenses with gradational boundaries, which are undifferentiated; includes a few small lenses of undifferentiated limestone; minor diorite; unit is poorly understood; known to contain Ordovician, Carboniferous and Triassic fossils; undifferentiated relations to Shoemaker Formation are gradational

uTrs SHOEMAKER FORMATION: massive, greyish green silicified volcanic rocks, including "cherty" tuff and breccia; includes undifferentiated massive greenstone; may include chert; generally fractured and broken by irregular spaced cleavage; may be largely the silicified equivalent of the Old Tom Formation

INDEPENDENCE FORMATION: massive greenstone- volcanic breccia with greenstone fragments- includes large undifferentiated silicified lenses; includes lenses of undifferentiated limestone; resembles the Old Tom and Shoemaker formations

MESOZOIC

MIDDLE AND LOWER TRIASSIC (?)

Trbs BROOKLYN LIMESTONE AND "SHARPSTONE CONGLOMERATE": white weathering, thick bedded, light grey limestone commonly with rounded to angular detrital "chert" grains; minor greenish siltstone and massive resistant, breccia with angular, roughly equant clasts to 10 cm across of "chert" and greenstone and locally limestone in a matrix of coarse sand and grit of the same material; grades to "chert" sandstone and "chert" grit by decrease in grain size; minor green and black argillite, partly a fine grained tuff; grains and matrix strongly silicified; "chert" and andesitic greenstone fragments derived mainly from the Knob Hill Group; limestone mostly from the Brooklyn Formation, and locally from the Attwood Group; limestone contains Middle Triassic fossils

PALEOZOIC

CARBONIFEROUS OR PERMIAN

CPk KNOB HILL GROUP: massive "chert" (largely silicified greenstone), greenstone and amphibolite; minor limestone or marble; minor "sharpstone"; age unknown

CPat ATTWOOD GROUP: light grey limestone with minor interbedded chert; contains Carboniferous fossils

CARBONIFEROUS

Cbc BLIND CREEK FORMATION: medium bedded grey limestone and calcareous argillite; lacks penetrative fabrics, low greenschist facies metamorphism

Cb BARSLOW FORMATION: thin bedded, brown, silty slate and argillaceous siltstone; lacks penetrative fabrics, low greenschist facies metamorphism

CARBONIFEROUS OR OLDER

CPa ANARCHIST GROUP: dark grey weathering, recessive, amphibolite greenstone, quartz-chlorite schist, quartz-biotite schist; minor serpentinized peridotite; "chert" breccia that resembles Trbs is locally included; CPap- peridotite and serpentinized equivalents; CPaa amphibolite; age unknown

CPko KOBAU GROUP: undivided amphibolite, greenschist, quartzite, mica schist, greenstone; minor marble; strongly foliated with penetrative flaser fabrics; age unknown

ORDOVICIAN (?) TO DEVONIAN (?)

ODs Schist, thin bedded argillaceous limestone, slate and limestone; includes metamorphosed equivalents mostly biotite-diopside-quartz skarn and marble; age unknown

PROTEROZOIC AND PALEOZOIC

PROTEROZOIC (?) AND PALEOZOIC (?)

GRAND FORKS GNEISS

Pgfm Mylonitic biotite leucogranodiorite. Preto unit X

Pgfo Medium crystalline, well foliated biotite hornblende granodiorite orthogneiss. Preto unit IX

Pgfa Amphibolite, amphibolitic gneiss, minor marble. Preto unit IV

Coarsely crystalline garnet-biotite schist, interfoliated quartzite; minor marble, abundant pegmatite and leucogneiss. Preto unit III

Pgfq Coarsely crystalline, thick layered quartzite, minor marble and pegmatite. Preto unit II

Pgfg Sillimanite-biotite-quartz paragneiss, amphibolite and amphibolitic gneiss, marble, biotite schist and gneiss, garnet-biotite-quartz schist, micaceous quartzite; includes minor leuco-orthogneiss Preto unit I

Pm MONASHEE GNEISS: grey, massive, biotite granodiorite gneiss gradational westward with Egn, but not overprinted by the Eocene event that affected the rocks nearer the Okanagan Fault; may be equivalent or related to Pgf; may include equivalents of ODs; age unknown

Outcrop boundary .... — — —

Probable stratigraphic contact, location approximate .... ———

Geological contact, relations unknown, possibly faulted ....

Strike and dip of bedding ....

Strike and dip of foliation ....

Trend and plunge of lineation and minor folds ....

Inferred fault, age and displacement unknown ....

Inferred normal fault, age unknown, circle on downthrown side ....

Inferred Eocene normal fault, circle on downthrown side ....

Slide- inferred fault in metamorphosed rocks, roughly parallel to foliation ....

Recommended citation:
Tempelman-Kluit, D.J.
1989: Geology, Penticton, British Columbia; Geological Survey of Canada, Map 1736A, scale 1:250 000

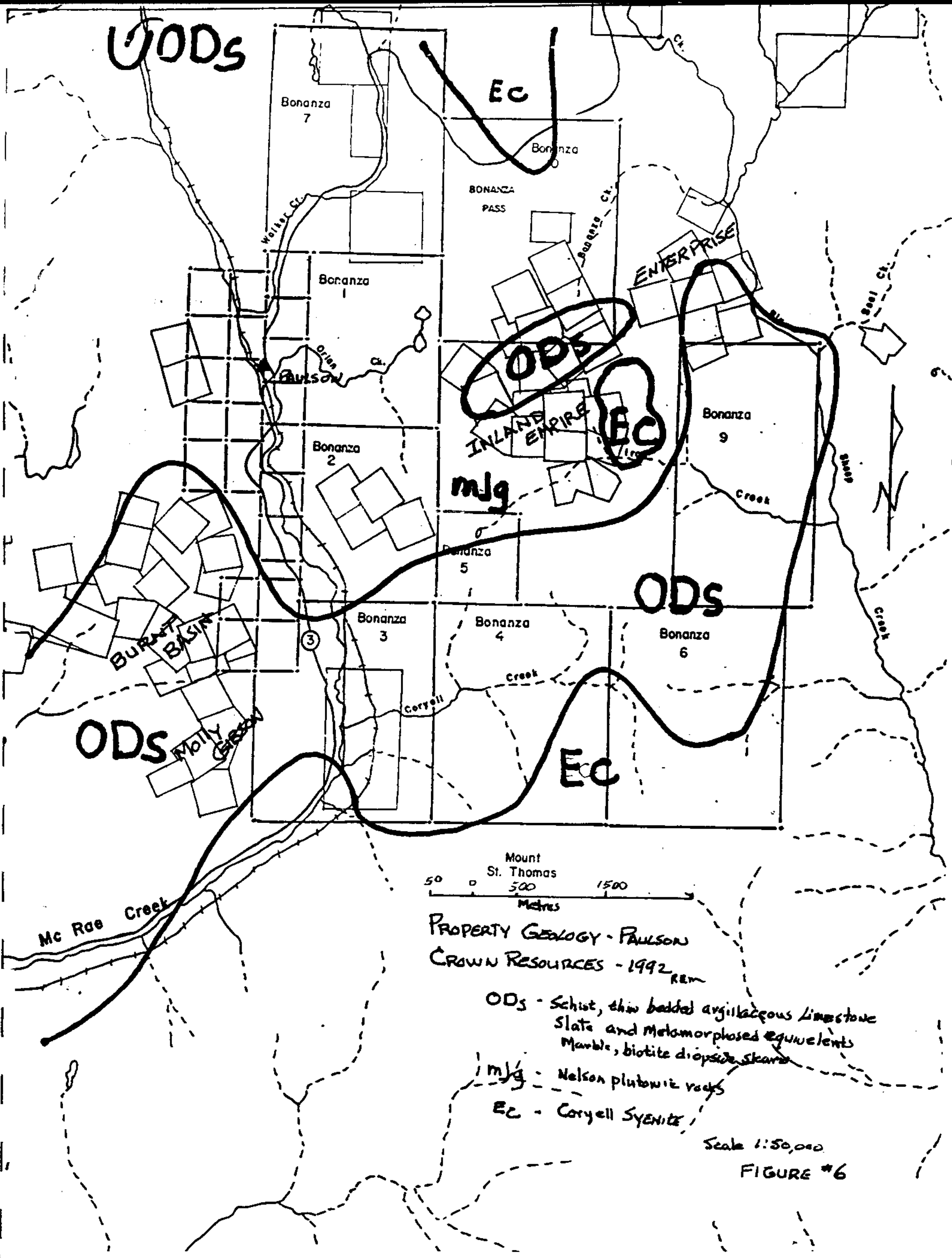
Rocks equivalent? to the Rossland Group, consisting of flow breccias, volcanic breccias, andesites, basalts, agglomerates, tuffs, black laminated siltstones, and augite porphyry, outcrop throughout the property.

Biotite hornblende granodiroite of the Late Jurassic - Early Cretaceous Nelson intrusives cut both the Rossland Group and the Mt. Roberts Formation.
Nelson intrusive rocks have been subsequently intruded by Middle Eocene Coryell, coarse grained syenite, and quartz monzonite. Granites and monzonites of Coryell age are also common along with numerous hypabyssal porphyritic phases.

2.2 GENERAL GOLD MINERALIZATION

Gold bearing fissure quartz veins have been found on the Burnt Basin side at the Motherlode, Kittie, Aldeen, Tammany and Tunnel group claims. Reported gold values have ranged from a trace to 22 grams per ton.
Most of the Burnt Basin (Figure #6) gold production has come from sulfide rich calc-silicate skarn bodies in a silicious limestone unit at the Molly Gibson group claims. Sulfides include pyrrhotite, pyrite and chalcopyrite. Magnetite is also present in the skarn aureole, but is usually a minor constituent.

East of Paulson the gold mineralization at the Inland


ODs
Ec
Bonanza 7
Bonanza 10
BONANZA PASS
Walker Ct.
Bonanza Ct.
ENTERPRISE
Bonanza 1
Orion Ct.
Paulson
ODs
Ec
INLAND EMPIRE
Bonanza 9
Sheep Creek
Bonanza 2
mJg
Bonanza 5
ODs
Bonanza 3
Bonanza 4
Bonanza 6
Coryell Creek
BURNT BASIN
ODs
MOLLY GIBSON
Ec
Mount St. Thomas
50 0 500 1500
Metres
Mc Rae Creek
PROPERTY GEOLOGY - PAULSON
CROWN RESOURCES - 1992 REM
ODs - Schist, thin bedded argillaceous Limestone Slate and Metamorphosed equivelents Marble, biotite diopside skarn
mJg - Nelson plutonic rocks
Ec - Coryell Syenite
Scale 1:50,000
FIGURE #6

Empire camp is related to north trending quartz veins cutting quartz monzonite and related intrusive bodies. These veins are usually: polymetallic, strike within 10 degrees of north, dip steeply, faulted, and discontinuous along strike.

Alteration halos associated with the veins tend to be narrow and either propylitic or argillic. Some quartz veins exhibit epithermal banding and/or mineralogy while others appear to have mesothermal characteristics. Sulfide pods and disseminations within the quartz vein or at its contact with the wall rock, consist of all or one of the following: pyrite, arsenopyrite, chalcopyrite galena, pyrhotite, and sphalerite. Magnetite bearing quartz veins have been found within the Rossland? volcanics.

Skarn mineralization that occurs at the south end of the claim group and at the Enterprise group to the north east, is predominantly base metal enriched. However, selective sampling of the skarn can produce economic gold assays. Skarnification evidenced in the limestone of the Mt. Roberts Formation and Rossland volcanic units, appears to be intensely telescoped. It is common to go from coarse marble to magnetite within a few meters along strike of the limy beds and from calcite epidote skarn to garnet magnetite skarn in less than one meter within the highly fractured volcanics.

2.3 1991 EXPLORATION PROGRAM

Following a literature review in March-April, field work began in May with geologic orientation and rock chip sampling. Samples were collected from the Molly Gibson and Eva Bell claims on the Burnt Basin side and the Inland, Washington, Saginaw FR, and Amazon claims on Granville Mtn. (Figure #7)

The following rock chip sample list reflects part of the initial reconnaissance data collected in the Paulson project area. Detailed assays are contained in Appendix D.

TABLE IV

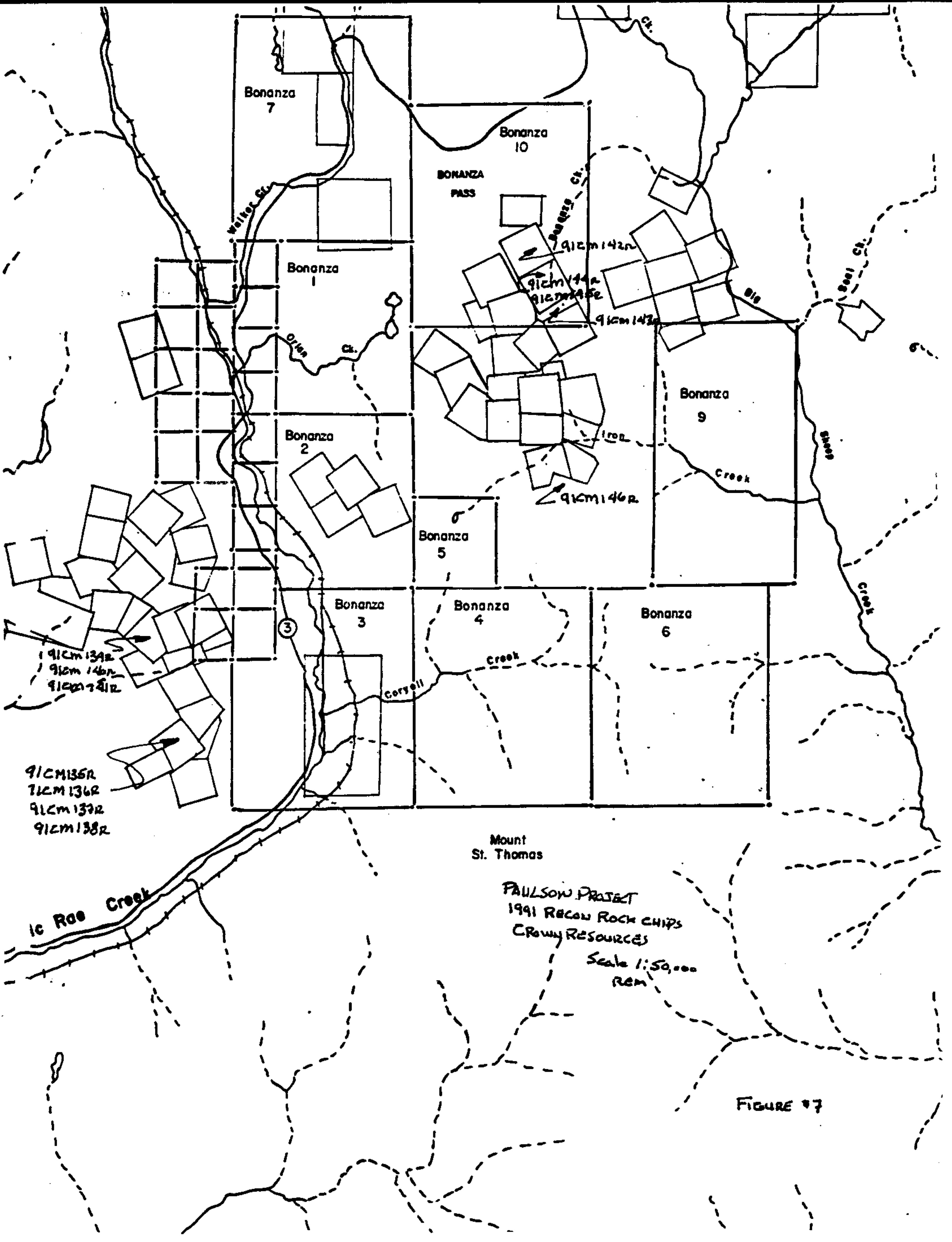
BURNT BASIN

Molly Gibson

Sample No	Rock Type	Au ppb	Ag ppm	Bi ppm	Cd ppm
91CM135R	skarn	1380	<0.2	44	<0.5
136R	qtz vnlet	10	0.2	<2	<0.5
137R	skarn	4470	<0.2	12	<0.5
138R	skarn	135	<0.2	<2	0.5

Eva Bell

Sample No	Rock Type	Au ppb	Ag ppm	Bi ppm	Cd ppm
91CM139R	massive sulfide	1080	>200	42	>100
140R	" "	310	27.2	<2	82
141R	" "	245	70.6	18	>100



Bonanza 7
Bonanza 10
BONANZA PASS
Bonanza Ck.
Walker Cr.
Bonanza 1
Orlen Ck.
Bonanza 9
Bonanza 2
Iron Creek
Bonanza 5
Bonanza 3
Bonanza 4
Bonanza 6
Coryell Creek
Big Sheep Creek
Seel Ck.
Ck.
3
Mount St. Thomas
Mc Rae Creek
91CM142R
91CM144R
91CM145R
91CM143R
91CM146R
91CM139R
91CM140R
91CM141R
91CM135R
91CM136R
91CM137R
91CM138R
PAULSON PROJECT
1991 RECON ROCK CHIPS
CROWN RESOURCES
Scale 1:50,000
REM

FIGURE #7

INLAND EMPIRE GROUP

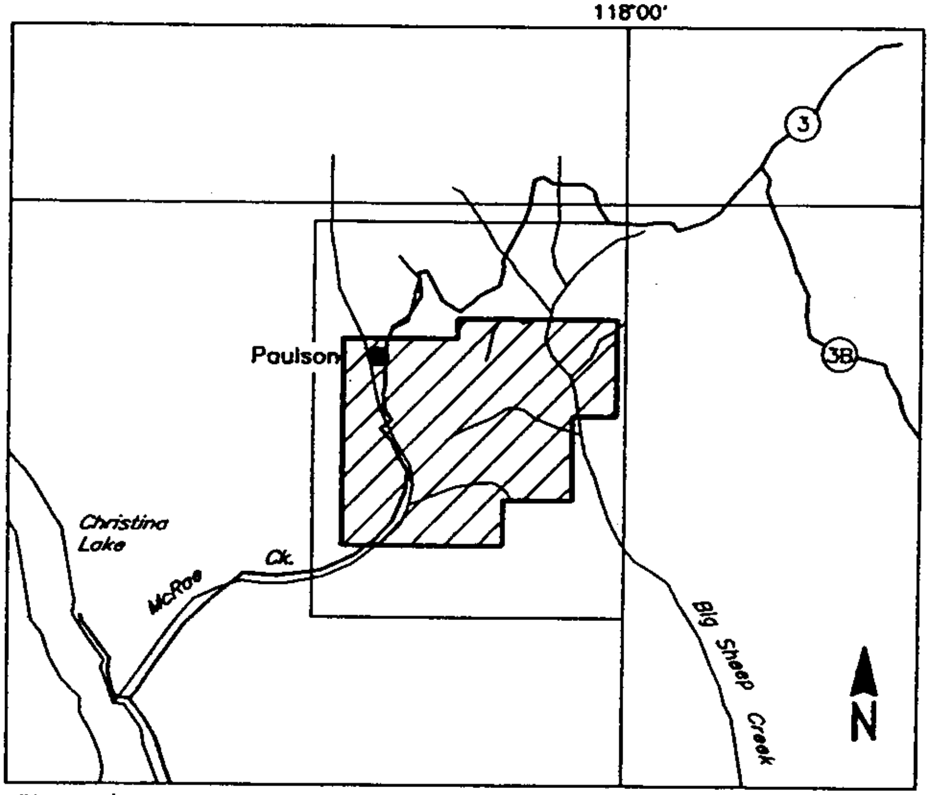
Sample No	Rock Type	Au ppb	Ag ppm	Bi ppm	Cd ppm
WASHINGTON					
91CM142R	phyllite	5	0.2	<2	3.0
SAGINAW FR					
91CM143R	volcanic	5	0.2	<2	0.5
INLAND					
91CM144R	silic volcanic	660	14.8	38	2.0
145R	quartz vein	1140	24.6	30	<0.5
AMAZON					
91CM146R	wall rock qtz vein	60	0.2	2	<0.5

2.4 1992 EXPLORATION PROGRAM

Dighem Surveys and Processing Inc. Mississauga, Ontario was contracted to conduct an airborne geophysical survey over Crown Resources Paulson Project in British Columbia. (Figure #8) This survey was carried out from May 5 to May 11, 1992 covering 288 line-km.

The survey, centered at approximately 49° 11' North Latitude and 118° 4'West Longitude, employed the Dighem electromagentic system with support equipment consisting of: magentometer, radar altimeter, video camera, analog and digital recorders, a V.L.F. receiver, and an electronic navigation system. Data developed from the airborne systems, provided electromagnetic, resistivity, magnetic and V.L.F. coverage of the Paulson survey block.

LOCATION MAP



NTS: 82E/1

SCALE 1: 250,000

▨ AREA SURVEYED

FIGURE #8

A detailed reporting of the survey and instrument specifications, data processing, and interpretation with conclusions and survey costs are contained Appendix E. Supporting maps are contained in Appendix F.

2.5 CONCLUSION

Approximately 50% of the anomalous geophysical signatures outlined by the Dighem program have been ground located and investigated. Of those investigated, magnetic anomalies were found to be associated with intrusives and/or volcanics and/or skarn. Both magnetite and pyrrhotite were noted near or within mag highs.

Conductors with related resistivity lows have been difficult to assess. Most investigations to date indicate that conductors may be closely associated with surface features ie. conductive overburden, water-land edges and swamps or lakes.

V.L.F. anomalies have been associated with pyritic volcanic rocks and sulfide bearing shear zones.

Map control of the geophysical data has been excellent, making ground locating and investigation easy to facilitate.

2.6 RECOMMENDATIONS

Favorably located between the two historical gold mining camps in Burnt Basin and Inland Empire, the Bonanza group claims are worthy of continued geological, geochemical, and geophysical (both ground and airborne) gold exploration. It is recommended that the programs presently in place be continued in order to develop a series of potential drill targets, the most promising of which should be drilled.

Respectfully submitted

R.E. Miller

R.E. Miller

APPENDIX A

COST ESTIMATES

STATEMENT OF COST

CROWN RESOURCES CHARGES

A.	Pre Survey Planning	
	M.Sawiuk District Geologist	
	3 days @$300.00/day	$ 900.00
	R.Miller Geologist	
	3 days @$250.00/day	750.00
B.	On Site	
	R.Miller Geologist	
	7 days @$250.00/day	1750.00
	Vehicle 7 days x $65.00/day	455.00
C.	Post Survey Ground Checks	
	R. Miller Geologist	
	2 days @$250.00/day	500.00
	K. Anschetz Assistant	
	3 days @$100.00/day	300.00
	M. Fenwick-Wilson Assistant	
	3 days @$100.00/day	300.00
	Vehicle 5 days x $65.00/day	325.00

DIGHEM SURVEY CHARGES	36,800.00
SUB TOTAL	$42,110.00
BONANZA GROUP PORTION 100/199 x $42,110.00	21,160.00
Report and Reproductions	900.00
BONANZA GROUP TOTAL	$22,060.00

STATEMENT OF COST

CROWN RESOURCES CHARGES

A.	Pre Survey Planning	
	M.Sawiuk District Geologist	
	3 days @$300.00/day	$ 900.00
	R.Miller Geologist	
	3 days @$250.00/day	750.00
B.	On Site	
	R.Miller Geologist	
	7 days @$250.00/day	1750.00
	Vehicle 7 days x $65.00/day	455.00
C.	Post Survey Ground Checks	
	R. Miller Geologist	
	2 days @$250.00/day	500.00
	K. Anschetz Assistant	
	3 days @$100.00/day	300.00
	M. Fenwick-Wilson Assistant	
	3 days @$100.00/day	300.00
	Vehicle 5 days x $65.00/day	325.00

DIGHEM SURVEY CHARGES	36,800.00
SUB TOTAL	$42,110.00
ORION GROUP PORTION	
99/199 x $42,110.00	20,949.00
Report and Reproductions	900.00
ORION GROUP TOTAL	$21,849.00

APPENDIX B

STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

I ROBERT E. MILLER, of Oroville, Washington U.S.A., DO HEREBY CERTIFY:

1. THAT I am a geologist with Crown Resources Corporation, with a business address of Star Route 85, Oroville, Washington 98844.
2. THAT I am a graduate from Brigham Young University with a Bachelor of Science degree in Geological Engineering (1969).
3. THAT I have practised my profession continuously since graduation.
4. THAT I personally conducted the 1992 exploration program discussed in this report.

DATED this 23rd day of October, 1992.

Robert E. Miller

Robert E. Miller
Geological Engineer

APPENDIX C

REFERENCES

REFERENCES

British Columbia Minister of Mines Annual Report, 1901; pg. 106, 1904; pg, 299.

Crowe, Gregory G. M.Sc. P.Geol. and Forbes, Jonna R. B.Sc., 1985 Geological, Geochemical and Geophysical Report on the Granville Mountain Property of Prominent Resources Corporation B.C. Assessment Report 14733.

Ruzicka, Stan, Personal communication, Maps, and Records 1991.

Shear, H.H., 1973 Progress Report on Donna Mines, November 1973.

Templeman-Kluit, D.J., 1989: Geology, Penticton, British Columbia, Geological Survey of Canada, Map 1736A. Scale 1:250,000.

Von Einsiedel, C.A., 1989, Prospecting Report Josh Claim Group, Assessment Report 18560.

APPENDIX D

ASSAYS

Chemex Labs Inc.
Analytical Chemists * Geochemists * Registered Assayers
994 West Glendale Ave., Suite 7, Sparks,
Nevada, U.S.A. 89431
PHONE: 702-356-5395

To: CROWN RESOURCE CORPORATION
SEVENTEENTH STREET PLAZA
1225 17TH ST., STE. 1500
DENVER, COLORADO
80202

A9122287

Comments: ATTN: CHRIS HERALD CC:R. MILLER CC:J. SHANNON CC:M. SAWIUK

CERTIFICATE A9122287

CROWN RESOURCE CORPORATION

Project: MIDWAY
P.O. # :

Samples submitted to our lab in Vancouver, BC.
This report was printed on 2-OCT-91.

SAMPLE PREPARATION

CHEMEX CODE	NUMBER SAMPLES	DESCRIPTION
201	3	Dry, sieve to -80 mesh
298	3	ICP - AQ Digestion charge
* NOTE	1:	

The 32 element ICP package is suitable for trace metals in soil and rock samples. Elements for which the nitric-aqua regia digestion is possibly incomplete are: Al, Ba, Be, Ca, Cr, Ga, K, La, Mg, Na, Sr, Ti, Tl, W.

ANALYTICAL PROCEDURES

CHEMEX CODE	NUMBER SAMPLES	DESCRIPTION	METHOD	DETECTION LIMIT	UPPER LIMIT
100	3	Au ppb: Fuse 10 g sample	FA-AAS	5	10000
922	3	Ag ppm: 32 element, soil & rock	ICP-AES	0.2	200
921	3	Al %: 32 element, soil & rock	ICP-AES	0.01	15.00
923	3	As ppm: 32 element, soil & rock	ICP-AES	5	10000
924	3	Ba ppm: 32 element, soil & rock	ICP-AES	10	10000
925	3	Be ppm: 32 element, soil & rock	ICP-AES	0.5	100.0
926	3	Bi ppm: 32 element, soil & rock	ICP-AES	2	10000
927	3	Ca %: 32 element, soil & rock	ICP-AES	0.01	15.00
928	3	Cd ppm: 32 element, soil & rock	ICP-AES	0.5	100.0
929	3	Co ppm: 32 element, soil & rock	ICP-AES	1	10000
930	3	Cr ppm: 32 element, soil & rock	ICP-AES	1	10000
931	3	Cu ppm: 32 element, soil & rock	ICP-AES	1	10000
932	3	Fe %: 32 element, soil & rock	ICP-AES	0.01	15.00
933	3	Ga ppm: 32 element, soil & rock	ICP-AES	10	10000
951	3	Hg ppm: 32 element, soil & rock	ICP-AES	1	10000
934	3	K %: 32 element, soil & rock	ICP-AES	0.01	10.00
935	3	La ppm: 32 element, soil & rock	ICP-AES	10	10000
936	3	Mg %: 32 element, soil & rock	ICP-AES	0.01	15.00
937	3	Mn ppm: 32 element, soil & rock	ICP-AES	5	10000
938	3	Mo ppm: 32 element, soil & rock	ICP-AES	1	10000
939	3	Na %: 32 element, soil & rock	ICP-AES	0.01	5.00
940	3	Ni ppm: 32 element, soil @ rock	ICP-AES	1	10000
941	3	P ppm: 32 element, soil & rock	ICP-AES	10	10000
942	3	Pb ppm: 32 element, soil & rock	ICP-AES	2	10000
943	3	Sb ppm: 32 element, soil & rock	ICP-AES	5	10000
958	3	Sc ppm: 32 elements, soil & rock	ICP-AES	1	10000
944	3	Sr ppm: 32 element, soil & rock	ICP-AES	1	10000
945	3	Ti %: 32 element, soil & rock	ICP-AES	0.01	5.00
946	3	Tl ppm: 32 element, soil & rock	ICP-AES	10	10000
947	3	U ppm: 32 element, soil & rock	ICP-AES	10	10000
948	3	V ppm: 32 element, soil & rock	ICP-AES	1	10000
949	3	W ppm: 32 element, soil & rock	ICP-AES	10	10000
950	3	Zn ppm: 32 element, soil & rock	ICP-AES	2	10000

Chemex Labs Ltd.

Analytical Chemists * Geochemists * Registered Assayers
212 Brooksbank Ave., North Vancouver
British Columbia, Canada V7J 2C1
PHONE: 604-984-0221

To: CROWN RESOURCE CORPORATION
SEVENTEENTH STREET PLAZA
1225 17TH ST., STE. 1500
DENVER, COLORADO
80202

Project : MIDWAY
Comments: ATTN: CHRIS HERALD CC: J. SHANNON CC: R. MILLER CC:M. SAWIUK

Page Number : 1-A
Total Pages : 1
Certificate Date: 27-JUN-91
Invoice No. : I9116499
P.O. Number :

CERTIFICATE OF ANALYSIS A9116499

Paulson Molly Gibson Eva Belle Inland Empire

SAMPLE DESCRIPTION	PREP CODE		Au ppb FA+AA	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %	La ppm	Mg %	Mn ppm
91CM135R	205	294	1380	< 0.2	5.13	10	200	< 0.5	44	2.27	< 0.5	27	115	510	9.35	10	< 1	1.39	< 10	1.59	335
91CM136R	205	294	10	0.2	2.21	35	20	< 0.5	< 2	0.79	< 0.5	39	69	275	14.40	10	< 1	0.12	< 10	0.86	335
91CM137R	205	294	4470	< 0.2	3.59	5	90	< 0.5	12	0.82	< 0.5	33	101	768	11.95	10	< 1	1.54	< 10	1.82	425
91CM138R	205	294	135	< 0.2	4.64	< 5	80	< 0.5	< 2	>15.00	0.5	20	45	163	3.69	< 10	< 1	0.44	< 10	0.62	725
91CM139R	205	294	1080	>200	0.38	100	10	< 0.5	42	1.03	>100.0	21	13	44	14.65	10	< 1	0.07	< 10	0.82	>10000
91CM140R	205	294	310	27.2	0.69	455	10	< 0.5	< 2	1.42	82.0	< 1	10	80	>15.00	10	< 1	0.05	< 10	1.48	>10000
91CM141R	205	294	245	70.6	1.31	135	80	< 0.5	18	2.36	>100.0	14	53	237	12.85	10	< 1	0.28	< 10	1.26	9000
91CM142R	205	294	5	0.2	0.57	< 5	190	< 0.5	< 2	1.28	3.0	2	71	13	1.90	< 10	< 1	0.32	30	0.19	605
91CM143R	205	294	5	0.2	0.92	< 5	30	< 0.5	< 2	0.73	0.5	12	53	25	2.76	10	< 1	0.12	10	0.45	220
91CM144R	205	294	660	14.8	0.24	5	10	< 0.5	38	1.08	2.0	4	150	544	2.78	< 10	< 1	0.06	< 10	0.26	305
91CM145R	205	294	1140	24.6	0.33	< 5	10	< 0.5	30	0.85	< 0.5	6	136	10	1.71	< 10	< 1	0.10	< 10	0.27	255
91CM146R	205	294	60	0.2	1.87	5	30	< 0.5	2	3.59	< 0.5	24	54	19	5.40	< 10	< 1	0.41	< 10	1.69	750
91CM147R	205	294	< 5	6.0	0.57	< 5	70	< 0.5	28	0.21	4.0	4	71	2100	2.49	< 10	< 1	0.28	20	0.11	555
91CM148R	205	294	< 5	5.0	0.87	< 5	190	< 0.5	26	0.23	5.0	4	85	1605	2.48	10	< 1	0.32	30	0.27	1075
91CM149R	205	294	< 5	< 0.2	0.89	< 5	290	< 0.5	< 2	1.39	< 0.5	3	46	9	1.95	10	< 1	0.24	30	0.37	860
91CM150R	205	294	15	< 0.2	2.16	10	270	< 0.5	< 2	4.99	< 0.5	13	79	622	3.72	< 10	< 1	0.26	< 10	1.35	550
91CM151R	205	294	< 5	1.4	1.81	5	50	< 0.5	194	0.78	< 0.5	15	118	79	3.82	20	< 1	0.09	10	1.41	485
91CM152R	205	294	< 5	< 0.2	1.32	5	< 10	< 0.5	2	2.89	< 0.5	29	201	35	2.12	10	< 1	0.01	< 10	0.35	225
91CM153R	205	294	< 5	< 0.2	1.52	< 5	10	< 0.5	< 2	1.73	< 0.5	28	449	16	6.31	10	< 1	0.08	< 10	1.01	485

CERTIFICATION:

Chemex Labs Ltd.

Analytical Chemists * Geochemists * Registered Assayers
212 Brooksbank Ave., North Vancouver
British Columbia, Canada V7J 2C1
PHONE: 604-984-0221

To: CROWN RESOURCE CORPORATION
SEVENTEENTH STREET PLAZA
1225 17TH ST., STE. 1500
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80202

Project : MIDWAY
Comments: ATTN: CHRIS HERALD CC: J. SHANNON CC: R. MILLER CC:M. SAWIUK

Certificate Date: 27-JUN-91
Invoice No. : I9116499
P.O. Number :

CERTIFICATE OF ANALYSIS A9116499

SAMPLE DESCRIPTION	PREP CODE		Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	Sb ppm	Sc ppm	Sr ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm
91CM135R	205	294	1	0.31	20	340	24	5	22	108	0.41	< 10	< 10	210	10	80
91CM136R	205	294	6	0.03	19	310	10	5	10	44	0.13	< 10	< 10	79	< 10	56
91CM137R	205	294	< 1	0.14	19	530	10	5	26	30	0.43	< 10	< 10	288	< 10	80
91CM138R	205	294	< 1	0.38	17	620	8	< 5	6	431	0.14	< 10	< 10	99	< 10	62
91CM139R	205	294	< 1	0.01	6	570	>10000	20	1	42	< 0.01	< 10	< 10	8	170	>10000
91CM140R	205	294	< 1	0.01	7	120	>10000	25	2	76	0.01	< 10	< 10	15	10	>10000
91CM141R	205	294	7	0.02	18	390	>10000	20	3	123	0.03	< 10	< 10	75	70	>10000
91CM142R	205	294	1	0.04	1	610	356	< 5	2	65	< 0.01	< 10	< 10	21	< 10	636
91CM143R	205	294	1	0.11	4	580	182	< 5	2	28	0.23	< 10	< 10	53	< 10	148
91CM144R	205	294	19	< 0.01	7	60	112	< 5	< 1	34	< 0.01	< 10	< 10	6	10	46
91CM145R	205	294	7	< 0.01	4	120	220	< 5	1	20	< 0.01	< 10	< 10	8	520	24
91CM146R	205	294	1	0.01	11	480	16	< 5	6	111	< 0.01	< 10	< 10	40	10	78
91CM147R	205	294	5	0.02	< 1	570	48	< 5	< 1	12	< 0.01	< 10	< 10	6	< 10	964
91CM148R	205	294	4	0.02	< 1	610	48	< 5	< 1	17	< 0.01	< 10	< 10	13	< 10	1335
91CM149R	205	294	< 1	0.05	< 1	700	14	< 5	1	71	< 0.01	< 10	< 10	21	< 10	68
91CM150R	205	294	3	0.03	15	910	4	5	5	197	< 0.01	< 10	< 10	58	< 10	48
91CM151R	205	294	6	0.03	3	380	22	< 5	14	28	0.20	< 10	< 10	140	10	40
91CM152R	205	294	< 1	0.01	52	750	4	< 5	6	102	0.16	< 10	< 10	66	< 10	6
91CM153R	205	294	< 1	0.07	100	630	6	< 5	12	33	0.22	< 10	< 10	194	20	36

CERTIFICATION: B. Cargill

APPENDIX E

DIGHEM AIRBORNE GEOPHYSICAL REPORT

CROWN - PAULSON 1992

Report #1122

DIGHEM^{V} SURVEY
FOR
CROWN RESOURCES CORPORATION
PAULSON PROJECT
BRITISH COLUMBIA

NTS 82E/1

Dighem Surveys & Processing Inc.
Mississauga, Ontario
June 17, 1992

Ruth A. Pritchard
Geophysicist

A1122JUN.92R

SUMMARY

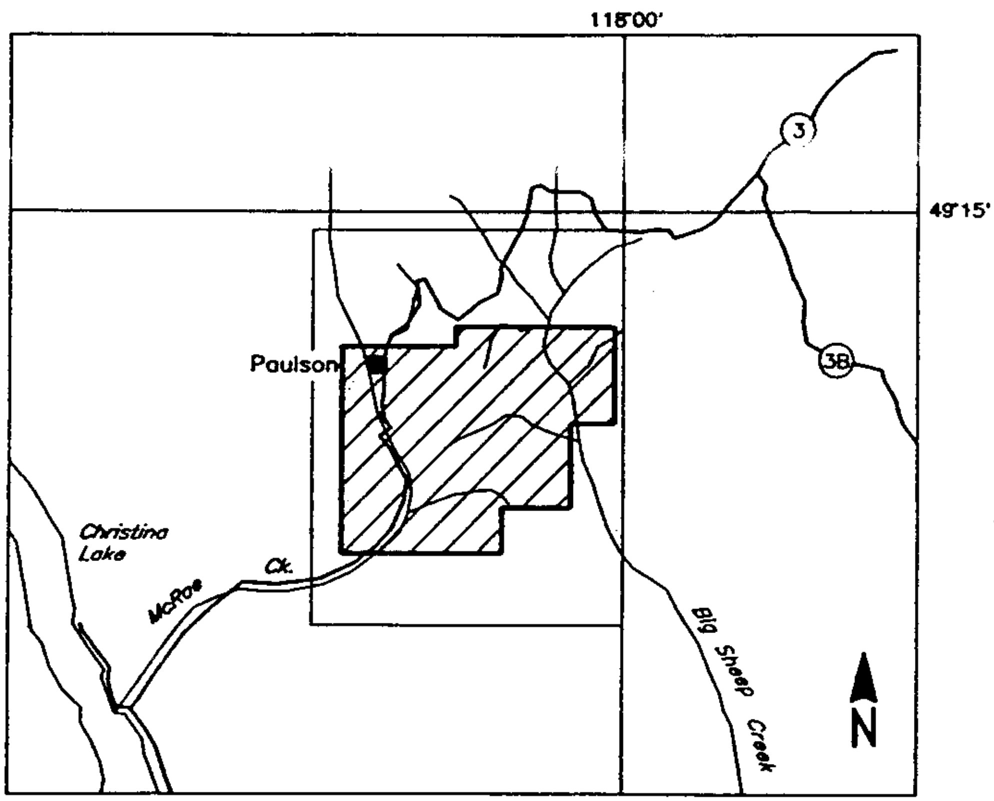
This report describes the logistics and results of a DIGHEM^V airborne geophysical survey carried out for Crown Resources Corporation over the Paulson Project, British Columbia. Total coverage of the survey block amounted to 288 km. The survey was flown from May 5 to May 11, 1992.

The purpose of the survey was to detect zones of conductive mineralization and to provide information that could be used to map the geology and structure of the survey area. This was accomplished by using a DIGHEM^V multi-coil, multi-frequency electromagnetic system, supplemented by a high sensitivity Cesium magnetometer and a two-channel VLF receiver. The information from these sensors was processed to produce maps which display the magnetic and conductive properties of the survey area. An electronic navigation system, operating in the UHF band, ensured accurate positioning of the geophysical data with respect to the base map. Visual flight path recovery techniques were used in areas where transponder signals were blocked by topographic features.

The survey property contains several anomalous features. Most of the inferred bedrock conductors appear to warrant further investigation using appropriate surface exploration techniques. Areas of interest may be assigned priorities on the basis of supporting geophysical, geochemical and/or geological information. After initial

investigations have been carried out, it may be necessary to re-evaluate the remaining anomalies based on information acquired from the follow-up program.

LOCATION MAP



NTS: 82E/1

SCALE 1: 250,000

CONTENTS

INTRODUCTION

A DIGHEM^{V} electromagnetic/resistivity/magnetic/VLF survey was flown for Crown Resources Corporation from May 5 to May 11, 1992, over the Paulson Project survey block located near Grand Forks, British Columbia. The survey area can be located on NTS map sheet 82E/1 (see Figure 1).

Survey coverage consisted of approximately 288 line-km, including tie lines. Flight lines were flown in an azimuthal direction of 0°/180° with a line separation of 200 metres.

The survey employed the DIGHEM^{V} electromagnetic system. Ancillary equipment consisted of a magnetometer, radar altimeter, video camera, analog and digital recorders, a VLF receiver and an electronic navigation system. Details on the survey equipment are given in Section 2.

The instrumentation was installed in an Aerospatiale AS350B turbine helicopter (Registration CGNIX) which was provided by Questral Helicopters Ltd. The helicopter flew at an average airspeed of 90 km/h with an EM bird height of approximately 30 m.

Section 2 also provides details on the data channels, their respective sensitivities, and the navigation/flight path recovery procedure. Noise levels of less than 2 ppm are generally maintained for wind speeds up to 35 km/h. Higher winds may cause the system to be grounded because excessive bird swinging produces difficulties in flying the helicopter. The swinging results from the 5 m^2 of area which is presented by the bird to broadside gusts.

In some portions of the survey area, the steep topography forced the pilot to exceed normal terrain clearance for reasons of safety. It is possible that some weak conductors may have escaped detection in areas where the bird height exceeded 120 m. In difficult areas where near-vertical climbs were necessary, the forward speed of the helicopter was reduced to a level which permitted excessive bird swinging. This problem, combined with the severe stresses to which the bird was subjected, gave rise to aerodynamic noise levels which are slightly higher than normal. Where warranted, reflights were carried out to minimize these adverse effects.

SURVEY EQUIPMENT

This section provides a brief description of the geophysical instruments used to acquire the survey data:

Electromagnetic System

Model:	DIGHEM^{V}
Type:	Towed bird, symmetric dipole configuration operated at a nominal survey altitude of 30 metres. Coil separation is 8 metres for 900 Hz and 7200 Hz, and 6.3 metres for the 56,000 Hz coil-pair.
Coil orientations/frequencies:	coaxial / 900 Hz coplanar / 900 Hz coaxial / 7,200 Hz coplanar / 7,200 Hz coplanar / 56,000 Hz
Channels recorded:	5 inphase channels 5 quadrature channels 2 monitor channels
Sensitivity:	0.1 ppm at 900 Hz 0.2 ppm at 7,200 Hz 0.5 ppm at 56,000 Hz
Sample rate:	10 per second

The electromagnetic system utilizes a multi-coil coaxial/coplanar technique to energize conductors in different directions. The coaxial coils are vertical with their axes in the flight direction. The coplanar coils are horizontal. The secondary fields are sensed simultaneously by means of receiver coils which are maximum coupled to their respective transmitter coils. The system yields an inphase and a quadrature channel from each transmitter-receiver coil-pair.

Magnetometer

Model:	Picodas 3340
Type:	Optically pumped Cesium vapour
Sensitivity:	0.01 nT
Sample rate:	10 per second

The magnetometer sensor is towed in a bird 20 m below the helicopter.

Magnetic Base Station

Model:	Scintrex MP-3
Type:	Digital recording proton precession
Sensitivity:	0.10 nT
Sample rate:	0.2 per second

A digital recorder is operated in conjunction with the base station magnetometer to record the diurnal variations of the earth's magnetic field. The clock of the base station is synchronized with that of the airborne system to permit subsequent removal of diurnal drift.

VLF System

Manufacturer:	Herz Industries Ltd.		
Type:	Totem-2A		
Sensitivity:	0.1%		
Stations:	Seattle, Washington;	NLK,	24.8 kHz
	Annapolis, Maryland;	NSS,	21.4 kHz
	Cutler, Maine;	NAA,	24.0 kHz

The VLF receiver measures the total field and vertical quadrature components of the secondary VLF field. Signals from two separate transmitters can be measured simultaneously. The VLF sensor is housed in the same bird as the magnetic sensor, and is towed 20 m below the helicopter.

Radar Altimeter

Manufacturer:	Honeywell/Sperry
Type:	AA 220
Sensitivity:	1 ft

The radar altimeter measures the vertical distance between the helicopter and the ground. This information is used in the processing algorithm which determines conductor depth.

Analog Recorder

Manufacturer:	RMS Instruments
Type:	DGR33 dot-matrix graphics recorder
Resolution:	4x4 dots/mm
Speed:	1.5 mm/sec

The analog profiles are recorded on chart paper in the aircraft during the survey. Table 2-1 lists the geophysical data channels and the vertical scale of each profile.

Table 2-1. The Analog Profiles

Channel Name	Parameter	Scale units/mm	Designation on digital profile
1X9I	coaxial inphase (900 Hz)	2.5 ppm	CXI (900 Hz)
1X9Q	coaxial quad (900 Hz)	2.5 ppm	CXQ (900 Hz)
3P9I	coplanar inphase (900 Hz)	2.5 ppm	CPI (900 Hz)
3P9Q	coplanar quad (900 Hz)	2.5 ppm	CPQ (900 Hz)
2P7I	coplanar inphase (7200 Hz)	5 ppm	CPI (7200 Hz)
2P7Q	coplanar quad (7200 Hz)	5 ppm	CPQ (7200 Hz)
4X7I	coaxial inphase (7200 Hz)	5 ppm	CXI (7200 Hz)
4X7Q	coaxial quad (7200 Hz)	5 ppm	CXQ (7200 Hz)
5P5I	coplanar inphase(56000 Hz)	10 ppm	CPI (56 kHz)
5P5Q	coplanar quad (56000 Hz)	10 ppm	CPQ (56 kHz)
ALTR	altimeter	3 m	ALT
CMGC	magnetics, coarse	20 nT	MAG
CMGF	magnetics, fine	2.0 nT	
VF1T	VLF-total: primary stn.	2%	
VF1Q	VLF-quad: primary stn.	2%	
VF2T	VLF-total: secondary stn.	2%	
VF2Q	VLF-quad: secondary stn.	2%	
CXSP	coaxial sferics monitor		CXS
CPSP	coplanar sferics monitor		
CXPL	coaxial powerline monitor		CXP
CPPL	coplanar powerline monitor		

Table 2-2. The Digital Profiles

Channel Name (Freq)		Observed parameters	Scale units/mm
MAG		magnetics	5 nT
ALT		bird height	6 m
CXI	(900 Hz)	vertical coaxial coil-pair inphase	2 ppm
CXQ	(900 Hz)	vertical coaxial coil-pair quadrature	2 ppm
CPI	(900 Hz)	horizontal coplanar coil-pair inphase	2 ppm
CPQ	(900 Hz)	horizontal coplanar coil-pair quadrature	2 ppm
CXI	(7200 Hz)	vertical coaxial coil-pair inphase	4 ppm
CXQ	(7200 Hz)	vertical coaxial coil-pair quadrature	4 ppm
CPI	(7200 Hz)	horizontal coplanar coil-pair inphase	4 ppm
CPQ	(7200 Hz)	horizontal coplanar coil-pair quadrature	4 ppm
CPI	(56 kHz)	horizontal coplanar coil-pair inphase	10 ppm
CPQ	(56 kHz)	horizontal coplanar coil-pair quadrature	10 ppm
CXS		coaxial sferics monitor	
CXP		coaxial powerline monitor	
		Computed Parameters	
DFI	(900 Hz)	difference function inphase from CXI and CPI	2 ppm
DFQ	(900 Hz)	difference function quadrature from CXQ and CPQ	2 ppm
RES	(900 Hz)	log resistivity	.06 decade
RES	(7200 Hz)	log resistivity	.06 decade
RES	(56 kHz)	log resistivity	.06 decade
DP	(900 Hz)	apparent depth	6 m
DP	(7200 Hz)	apparent depth	6 m
DP	(56 kHz)	apparent depth	6 m
CDT		conductance	1 grade

Digital Data Acquisition System

Manufacturer:	RMS Instruments
Type:	DGR 33
Tape Deck:	RMS TCR-12, 6400 bpi, tape cartridge recorder

The digital data are used to generate several computed parameters. Both measured and computed parameters are plotted as "multi-channel stacked profiles" during data processing. These parameters are shown in Table 2-2. In Table 2-2, the log resistivity scale of 0.06 decade/mm means that the resistivity changes by an order of magnitude in 16.6 mm. The resistivities at 0, 33 and 67 mm up from the bottom of the digital profile are respectively 1, 100 and 10,000 ohm-m.

Tracking Camera

Type:	Panasonic Video
Model:	AG 2400/WVCD132

Fiducial numbers are recorded continuously and are displayed on the margin of each image. This procedure ensures accurate correlation of analog and digital data with respect to visible features on the ground.

Navigation System

Model:	Del Norte 547
Type:	UHF electronic positioning system
Sensitivity:	1 m
Sample rate:	2 per second

The navigation system uses ground based transponder stations which transmit distance information back to the helicopter. The ground stations are set up well away from the survey area and are positioned such that the signals cross the survey block at an angle between 30° and 150°. The onboard Central Processing Unit takes any two transponder distances and determines the helicopter position relative to these two ground stations in cartesian coordinates.

The cartesian coordinates are transformed to UTM coordinates during data processing. This is accomplished by correlating a number of prominent topographical locations with the navigational data points. The use of numerous visual tie points serves two purposes: to accurately relate the navigation data to the map sheet and to minimize location errors which might result from distortions in uncontrolled photomosaic base maps.

Field Workstation

Manufacturer:	Dighem
Model:	FWS: V2.41
Type:	80386 based P.C.

A portable PC-based field workstation is used at the survey base to verify data quality and completeness. Flight tapes are dumped to a hard drive to permit the creation of a database. This process allows the field operators to display both the positional (flight path) and geophysical data on a screen or printer.

Global Positioning System

Manufacturer:	Trimble Navigation Ltd.
Type:	Pathfinder (C/A code, dual channel)
Accuracy:	25 metres (5 metres in differential mode)
Update:	Once per second

The Pathfinder system uses signals broadcast by the NAVSTAR GPS satellites to provide positional readouts in latitude/longitude or UTM coordinates. The GPS unit is placed at each UHF transponder site to determine its exact location. The system can also be used aboard the helicopter to provide real-time navigation guidance. Recorded data can be downloaded to a field computer for immediate post-survey processing, or transmitted to the central processing facility for final plotting.

PRODUCTS AND PROCESSING TECHNIQUES

The following products are available from the survey data. Those which are not part of the survey contract may be acquired later. Refer to Table 3-1 for a summary of the maps which accompany this report, some of which may be sent under separate cover. Most parameters can be displayed as contours, profiles, or in colour.

Base Maps

A base map of the survey area has been produced from published topographic maps. It provides a relatively accurate, distortion-free base which facilitates correlation of the navigation data to the UTM grid. Photomosaics are useful for visual reference and for subsequent flight path recovery, but usually contain scale distortions. Orthophotos are ideal, but their cost and the time required to produce them, usually precludes their use as base maps.

Electromagnetic Anomalies

Anomalous electromagnetic responses are selected and analysed by computer to provide a preliminary electromagnetic anomaly map. This preliminary map is used, by the geophysicist, in conjunction with the computer-generated digital profiles, to produce

Table 3-1 Plots Available from the Survey

MAP PRODUCT NO. OF SHEETS	ANOMALY MAP	PROFILES ON MAP	CONTOURS		SHADOW MAP
			INK	COLOUR	
Electromagnetic Anomalies	20,000	N/A	N/A	N/A	N/A
Probable Bedrock Conductors	-	N/A	N/A	N/A	N/A
Resistivity (900 Hz)	N/A	-	-	-	-
Resistivity (7,200 Hz)	N/A	-	20,000	20,000	-
Resistivity (56,000 Hz)	N/A	-	20,000	20,000	-
EM Magnetite	N/A	-	20,000	20,000	-
Total Field Magnetics	N/A	-	20,000	20,000	20,000
Enhanced Magnetics	N/A	-	-	-	-
1st Vertical Derivative Magnetics	N/A	-	20,000	20,000	-
2nd Vertical Derivative Magnetics	N/A	-	-	-	-
Filtered Total Field VLF	N/A	-	20,000	20,000	-
VLF Profiles	N/A	-	-	-	-
Electromagnetic Profiles(900 Hz)	N/A	-	-	N/A	N/A
Electromagnetic Profiles(7200 Hz)	N/A	-	-	N/A	N/A
Multi-channel stacked profiles	Worksheet profiles				-
	Interpreted profiles				10,000

N/A Not available
- Not required under terms of the survey contract
• Recommended
20,000 Scale of delivered map, i.e, 1:20,000

Notes:

- Inked contour maps are provided on transparent media and show flight lines, EM anomalies and suitable registration. Two paper prints of each map are supplied.

the final interpreted EM anomaly map. This map includes bedrock surficial and cultural conductors. A map containing only bedrock conductors can be generated, if desired.

Resistivity

The apparent resistivity in ohm-m may be generated from the inphase and quadrature EM components for any of the frequencies, using a pseudo-layer halfspace model. A resistivity map portrays all the EM information for that frequency over the entire survey area. This contrasts with the electromagnetic anomaly map which provides information only over interpreted conductors. The large dynamic range makes the resistivity parameter an excellent mapping tool.

EM Magnetite

The apparent percent magnetite by weight is computed wherever magnetite produces a negative inphase EM response.

Total Field Magnetics

The aeromagnetic data are corrected for diurnal variation using the magnetic base station data. The regional IGRF can be removed from the data, if requested.

Enhanced Magnetics

The total field magnetic data are subjected to a processing algorithm. This algorithm enhances the response of magnetic bodies in the upper 500 m and attenuates the response of deeper bodies. The resulting enhanced magnetic map provides better definition and resolution of near-surface magnetic units. It also identifies weak magnetic features which may not be evident on the total field magnetic map. However, regional magnetic variations, and magnetic lows caused by remanence, are better defined on the total field magnetic map. The technique is described in more detail in Section 5.

Magnetic Derivatives

The total field magnetic data may be subjected to a variety of filtering techniques to yield maps of the following:

vertical gradient

second vertical derivative

magnetic susceptibility with reduction to the pole

upward/downward continuations

All of these filtering techniques improve the recognition of near-surface magnetic bodies, with the exception of upward continuation. Any of these parameters can be produced on request. Dighem's proprietary enhanced magnetic technique is designed to provide a general "all-purpose" map, combining the more useful features of the above parameters.

VLF

The VLF data are digitally filtered to remove long wavelengths such as those caused by variations in the transmitted field strength.

Multi-channel Stacked Profiles

Distance-based profiles of the digitally recorded geophysical data are generated and plotted by computer. These profiles also contain the calculated parameters which are used in the interpretation process. These are produced as worksheets prior to interpretation, and can also be presented in the final corrected form after interpretation. The profiles display electromagnetic anomalies with their respective interpretive symbols. The differences between the worksheets and the final corrected form occur only with respect to the EM anomaly identifier.

Contour, Colour and Shadow Map Displays

The geophysical data are interpolated onto a regular grid using a modified Akima spline technique. The resulting grid is suitable for generating contour maps of excellent quality.

Colour maps are produced by interpolating the grid down to the pixel size. The parameter is then incremented with respect to specific amplitude ranges to provide colour "contour" maps. Colour maps of the total magnetic field are particularly useful in defining the lithology of the survey area.

Monochromatic shadow maps are generated by employing an artificial sun to cast shadows on a surface defined by the geophysical grid. There are many variations in the shadowing technique. These techniques may be applied to total field or enhanced magnetic data, magnetic derivatives, VLF, resistivity, etc. Of the various magnetic products, the shadow of the enhanced magnetic parameter is particularly suited for defining geological structures with crisper images and improved resolution.

Resistivity Sengpiel Sections

The apparent resistivity and approximate thickness of two or more horizontal layers can be displayed simultaneously for all coplanar frequencies. An inversion algorithm has been developed by Dr. K.P. Sengpiel* of the B.G.R., which determines the generalized skin depth, or "centroid depth" of the inphase current concentration, as a function of frequency. The centroid depth is combined with the apparent resistivity over a broad frequency range to produce resistivity-thickness pseudo-sections. A coloured presentation yields a smoothed representation of the true resistivity-depth distribution within the limits of the model used.

* Approximate Inversion of Airborne EM Data from Multilayered Ground: Sengpiel, K.P., Geophysical Prospecting 36, 446-459, 1988.

SURVEY RESULTS

GENERAL DISCUSSION

The survey results are presented on 1 map sheet for each parameter at a scale of 1:20,000. Table 4-1 summarizes the EM responses in the survey area, with respect to conductance grade and interpretation.

The anomalies shown on the electromagnetic anomaly map are based on a near-vertical, half plane model. This model best reflects "discrete" bedrock conductors. Wide bedrock conductors or flat-lying conductive units, whether from surficial or bedrock sources, may give rise to very broad anomalous responses on the EM profiles. These may not appear on the electromagnetic anomaly map if they have a regional character rather than a locally anomalous character. These broad conductors, which more closely approximate a half space model, will be maximum coupled to the horizontal (coplanar) coil-pair and should be more evident on the resistivity parameter. Resistivity maps, therefore, may be more valuable than the electromagnetic anomaly map, in areas where broad or flat-lying conductors are considered to be of importance. Contoured resistivity maps, based on the 7200 Hz and 56,000 Hz coplanar data are included with this report.

TABLE 4-1

EM ANOMALY STATISTICS

PAULSON PROPERTY

CONDUCTOR GRADE	CONDUCTANCE RANGE SIEMENS (MHOS)	NUMBER OF RESPONSES
7	>100	0
6	50 - 100	0
5	20 - 50	0
4	10 - 20	0
3	5 - 10	0
2	1 - 5	5
1	<1	11
*	INDETERMINATE	32
TOTAL		48

CONDUCTOR MODEL	MOST LIKELY SOURCE	NUMBER OF RESPONSES
D	DISCRETE BEDROCK CONDUCTOR	1
B	DISCRETE BEDROCK CONDUCTOR	10
S	CONDUCTIVE COVER	37
TOTAL		48

(SEE EM MAP LEGEND FOR EXPLANATIONS)

Excellent resolution and discrimination of conductors was accomplished by using a fast sampling rate of 0.1 sec and by employing common frequencies (900 Hz and 7200 Hz) on two orthogonal coil-pairs (coaxial and coplanar). The resulting "difference channel" parameters often permit differentiation of bedrock and surficial conductors, even though they may exhibit similar conductance values.

Anomalies which occur near the ends of the survey lines (i.e., outside the survey area), should be viewed with caution. Some of the weaker anomalies could be due to aerodynamic noise, i.e., bird bending, which is created by abnormal stresses to which the bird is subjected during the climb and turn of the aircraft between lines. Such aerodynamic noise is usually manifested by an anomaly on the coaxial inphase channel only, although severe stresses can affect the coplanar inphase channels as well.

Magnetics

A Scintrex proton precession magnetometer was operated at the survey base to record diurnal variations of the earth's magnetic field. The clock of the base station was synchronized with that of the airborne system to permit subsequent removal of diurnal drift.

The background magnetic level has been adjusted to match the International Geomagnetic Reference Field (IGRF) for the survey area. The IGRF gradient across the survey block is left intact. This procedure ensures that the magnetic contours will match contours from any adjacent surveys which have been processed in a similar manner.

The total field magnetic data have been presented as contours on the base map using a contour interval of 5 nT where gradients permit. The map shows the magnetic properties of the rock units underlying the survey area.

The total field magnetic data have been subjected to a processing algorithm to produce a first vertical magnetic derivative map. This procedure enhances near-surface magnetic units and suppresses regional gradients. It also provides better definition and resolution of magnetic units and displays weak magnetic features which may not be clearly evident on the total field map. A map of the second vertical magnetic derivative can also be prepared from existing survey data, if requested.

There is some evidence on the magnetic map which suggests that the survey area has been subjected to deformation and/or alteration. These structural complexities are evident on the contour map as variations in magnetic intensity, irregular patterns, and as offsets or changes in strike direction. Some of the more prominent linear features are also evident on the topographic base map.

Several of these linear features trend northeast across the survey area. Two prominent breaks in the magnetic contours extend northeast from the southern end of line

10030 to fiducial 1200 on line 10330 and from the southern end of line 10090 to fiducial 2980 on line 10370.

In general, the magnetic contour patterns show good correlation with the topographic features of the survey area. Topographic highs, for the most part, are associated with highly magnetic features, whereas the valleys are more commonly coincident with magnetic lows. Several topographic peaks in the southwest corner of the survey block do not exhibit this general correlation, and are associated with magnetic lows.

The mountainous central region of the survey block shows good correlation with a complex, highly magnetic feature, except at the southeastern end. This portion is associated with a relatively non-magnetic zone.

If a specific magnetic intensity can be assigned to the rock type which is believed to host the target mineralization, it may be possible to select areas of higher priority on the basis of the total field magnetic data. This is based on the assumption that the magnetite content of the host rocks will give rise to a limited range of contour values which will permit differentiation of various lithological units.

The magnetic results, in conjunction with the other geophysical parameters, should provide valuable information which can be used to effectively map the geology and structure in the survey area.

VLF

VLF results were obtained from the transmitting stations at Cutler, Maine (NAA - 24.0 kHz), Seattle, Washington (NLK - 24.8 kHz) and Annapolis, Maryland (NSS - 21.4 kHz). The VLF maps show the contoured results of the filtered total field from Annapolis for most of the area. When Annapolis was not transmitting, signals from Cutler were used to fill in the gaps, i.e. between lines 10310 and 10430.

The VLF method is quite sensitive to the angle of coupling between the conductor and the propagated EM field. Consequently, conductors which strike towards the VLF station will usually yield a stronger response than conductors which are nearly orthogonal to it.

The VLF parameter does not normally provide the same degree of resolution available from the EM data. Closely-spaced conductors, conductors of short strike length or conductors which are poorly coupled to the VLF field, may escape detection with this method. Erratic signals from the VLF transmitters can also give rise to strong, isolated anomalies which should be viewed with caution. Regardless of these limitations, however, the VLF results have provided valuable additional information, particularly within the more resistive portions of the survey area. The VLF method could probably be used as a follow-up tool in most areas, although its effectiveness will be somewhat limited in areas of moderate to high conductivity. The filtered total field VLF contours are presented on the base map with a contour interval of one percent.

The VLF trends generally strike east/west within the survey area. Several moderately strong VLF anomalies are associated with both probable bedrock and surficial sources. Linear structural features inferred from the magnetic data are seen on the VLF map as offsets or truncations of the VLF contours.

Resistivity

Resistivity maps, which display the conductive properties of the survey area, were produced from the 7200 Hz and 56,000 Hz coplanar data. In general, the resistivity patterns show some correlation with the magnetic trends. Several of the linear features seen on the magnetic map are also present on the resistivity maps. There are some areas, however, where contour patterns appear to be strongly influenced by conductive surficial material.

The survey area exhibits fairly high resistivity values. Background resistivities of over 6000 ohm-metres are inferred from both the 7200 Hz and 56,000 Hz resistivity maps.

A zone of low resistivity extends east/west from fiducial 2100 on line 10010 to fiducial 3724 on line 10090. It is approximately bounded by the 2000 ohm-metre contour on the 7200 Hz resistivity map. This zone does not appear to be affected by topography. It contains several probable discrete bedrock conductors.

Another resistivity low is located in the central region of the map over lines 10110 to 10181. This zone is bounded by the 4000 ohm-metre contour on the 7200 Hz resistivity map. This conductive zone may be affected by conductive surficial material, as it is coincident with several small lakes and a creek. It is, however, also associated with a highly magnetic, magnetite-rich zone. The resistivity low appears to be associated with the contact of this highly magnetic feature, and a relatively non-magnetic zone to the east. The conductive zone appears to be truncated at the south end by a northeast/southwest trending linear feature inferred from the magnetic data.

Electromagnetics

The EM anomalies resulting from this survey appear to fall within one of two general categories. The first type consists of discrete, well-defined anomalies which yield marked inflections on the difference channels. These anomalies are usually attributed to conductive sulphides or graphite and are generally given a "B", "T" or "D" interpretive symbol, denoting a bedrock source.

The second class of anomalies comprises moderately broad responses which exhibit the characteristics of a half space and do not yield well-defined inflections on the difference channels. Anomalies in this category are usually given an "S" or "H" interpretive symbol. The lack of a difference channel response usually implies a broad or flat-lying conductive source such as overburden. Some of these anomalies may reflect conductive rock units or zones of deep weathering.

The effects of conductive overburden are evident over portions of the survey area. Although the difference channels (DFI and DFQ) are extremely valuable in detecting bedrock conductors which are partially masked by conductive overburden, sharp undulations in the bedrock/overburden interface can yield anomalies in the difference channels which may be interpreted as possible bedrock conductors. Such anomalies usually fall into the "S?" or "B?" classification but may also be given an "E" interpretive symbol, denoting a resistivity contrast at the edge of a conductive unit.

In areas where EM responses are evident primarily on the quadrature components, zones of poor conductivity are indicated. Where these responses are coincident with magnetic anomalies, it is possible that the inphase component amplitudes have been suppressed by the effects of magnetite. Most of these poorly-conductive magnetic features give rise to resistivity anomalies which are only slightly below background. If it is expected that poorly-conductive economic mineralization may be associated with magnetite-rich units, most of these weakly anomalous features will be of interest. In areas where magnetite causes the inphase components to become negative, the apparent conductance and depth of EM anomalies may be unreliable.

It is difficult to assess the relative merits of EM anomalies on the basis of conductance. It is recommended that an attempt be made to compile a suite of geophysical "signatures" over areas of interest. Anomaly characteristics are clearly defined on the computer-processed geophysical data profiles which are supplied as one of the survey products.

A complete assessment and evaluation of the survey data should be carried out by one or more qualified professionals who have access to, and can provide a meaningful compilation of, all available geophysical, geological and geochemical data.

CONDUCTORS IN THE SURVEY AREA

The electromagnetic anomaly map shows the anomaly locations with the interpreted conductor type, dip, conductance and depth being indicated by symbols. Direct magnetic correlation is also shown if it exists. The strike direction and length of the conductors are indicated when anomalies can be correlated from line to line. When studying the map sheet, consult the anomaly listings appended to this report.

Anomalies 10020A, 10020B, 10030A, 10030B, 10040A, 10040B, 10050A, and 10050B

These anomalies are situated in the resistivity low over lines 10010 to 10090 mentioned previously. Most are indicative of moderately weak probable bedrock sources. Anomaly 10020B reflects a thin bedrock source.

Magnetic correlation varies within this group. Most flank a thin, relatively non-magnetic feature associated with this zone.

A moderately strong VLF anomaly is coincident with this zone.

Anomalies 10230C, 10230D, and 10240B

These anomalies reflect possible weak bedrock sources. They give rise to a weak resistivity low on the 7200 Hz resistivity map.

These anomalies are associated with an east/west trending VLF anomaly.

BACKGROUND INFORMATION

This section provides background information on parameters which are available from the survey data. Those which have not been supplied as survey products may be generated later from raw data on the digital archive tape.

ELECTROMAGNETICS

DIGHEM electromagnetic responses fall into two general classes, discrete and broad. The discrete class consists of sharp, well-defined anomalies from discrete conductors such as sulfide lenses and steeply dipping sheets of graphite and sulfides. The broad class consists of wide anomalies from conductors having a large horizontal surface such as flatly dipping graphite or sulfide sheets, saline water-saturated sedimentary formations, conductive overburden and rock, and geothermal zones. A vertical conductive slab with a width of 200 m would straddle these two classes.

The vertical sheet (half plane) is the most common model used for the analysis of discrete conductors. All anomalies plotted on the electromagnetic map are analyzed according to this model. The following section entitled **Discrete Conductor Analysis** describes this model in detail, including the effect of using it on anomalies caused by broad conductors such as conductive overburden.

The conductive earth (half space) model is suitable for broad conductors. Resistivity contour maps result from the use of this model. A later section entitled **Resistivity Mapping** describes the method further, including the effect of using it on anomalies caused by discrete conductors such as sulfide bodies.

Geometric interpretation

The geophysical interpreter attempts to determine the geometric shape and dip of the conductor. Figure 5-1 shows typical DIGHEM anomaly shapes which are used to guide the geometric interpretation.

Discrete conductor analysis

The EM anomalies appearing on the electromagnetic map are analyzed by computer to give the conductance (i.e., conductivity-thickness product) in Siemens (mhos) of a vertical sheet model. This is done regardless of the interpreted geometric shape of the conductor. This is not an unreasonable procedure, because the computed conductance increases as the electrical quality of the conductor increases, regardless of its true shape. DIGHEM anomalies are divided into seven grades of conductance, as shown in Table 5-1 below. The conductance in Siemens (mhos) is the reciprocal of resistance in ohms.

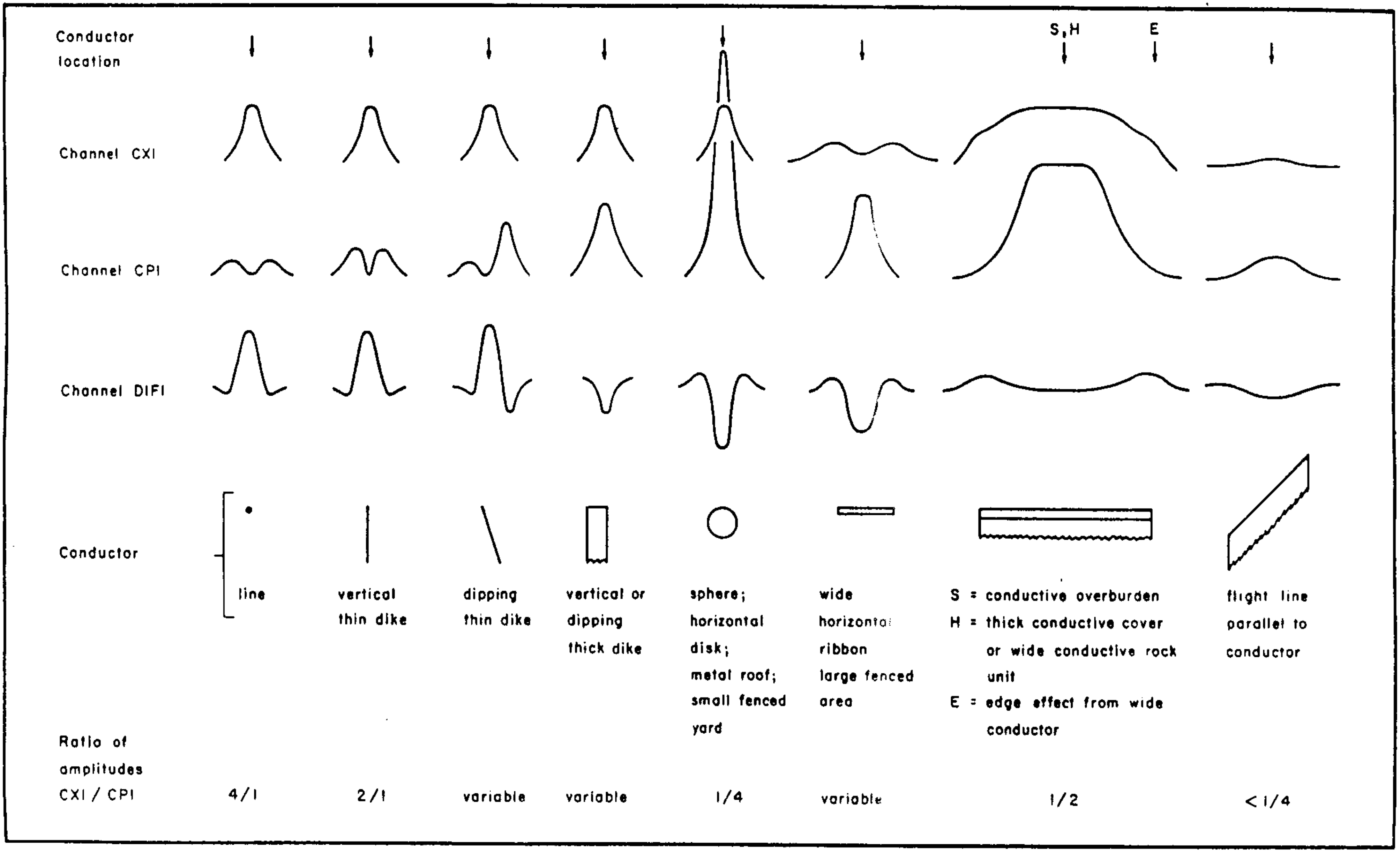


Fig. 5-1 Typical DIGHEM anomaly shapes

Table 5-1. EM Anomaly Grades

Anomaly Grade	Siemens
7	> 100
6	50 - 100
5	20 - 50
4	10 - 20
3	5 - 10
2	1 - 5
1	< 1

The conductance value is a geological parameter because it is a characteristic of the conductor alone. It generally is independent of frequency, flying height or depth of burial, apart from the averaging over a greater portion of the conductor as height increases. Small anomalies from deeply buried strong conductors are not confused with small anomalies from shallow weak conductors because the former will have larger conductance values.

Conductive overburden generally produces broad EM responses which may not be shown as anomalies on the EM maps. However, patchy conductive overburden in otherwise resistive areas can yield discrete anomalies with a conductance grade (cf. Table 5-1) of 1, 2 or even 3 for conducting clays which have resistivities as low as 50 ohm-m. In areas where ground resistivities are below 10 ohm-m, anomalies caused by weathering variations and similar causes can have any conductance grade. The anomaly shapes from the multiple coils often allow such conductors to be recognized, and these are indicated by the letters S, H, and sometimes E on the electromagnetic anomaly map (see EM map legend).

For bedrock conductors, the higher anomaly grades indicate increasingly higher conductances. Examples: DIGHEM's New Insco copper discovery (Noranda, Canada) yielded a grade 5 anomaly, as did the neighbouring copper-zinc Magusi River ore body; Mattabi (copper-zinc, Sturgeon Lake, Canada) and Whistle (nickel, Sudbury, Canada) gave grade 6; and DIGHEM's Montcalm nickel-copper discovery (Timmins, Canada) yielded a grade 7 anomaly. Graphite and sulfides can span all grades but, in any particular survey area, field work may show that the different grades indicate different types of conductors.

Strong conductors (i.e., grades 6 and 7) are characteristic of massive sulfides or graphite. Moderate conductors (grades 4 and 5) typically reflect graphite or sulfides of a less massive character, while weak bedrock conductors (grades 1 to 3) can signify poorly connected graphite or heavily disseminated sulfides. Grades 1 and 2 conductors may not respond to ground EM equipment using frequencies less than 2000 Hz.

The presence of sphalerite or gangue can result in ore deposits having weak to moderate conductances. As an example, the three million ton lead-zinc deposit of Restigouche Mining Corporation near Bathurst, Canada, yielded a well-defined grade 2 conductor. The 10 percent by volume of sphalerite occurs as a coating around the fine grained massive pyrite, thereby inhibiting electrical conduction.

Faults, fractures and shear zones may produce anomalies which typically have low conductances (e.g., grades 1 to 3). Conductive rock formations can yield anomalies of any conductance grade. The conductive materials in such rock formations can be salt water, weathered products such as clays, original depositional clays, and carbonaceous material.

On the interpreted electromagnetic map, a letter identifier and an interpretive symbol are plotted beside the EM grade symbol. The horizontal rows of dots, under the interpretive symbol, indicate the anomaly amplitude on the flight record. The vertical column of dots, under the anomaly letter, gives the estimated depth. In areas where anomalies are crowded, the letter identifiers, interpretive symbols and dots may be obliterated. The EM grade symbols, however, will always be discernible, and the obliterated information can be obtained from the anomaly listing appended to this report.

The purpose of indicating the anomaly amplitude by dots is to provide an estimate of the reliability of the conductance calculation. Thus, a conductance value obtained from a large ppm anomaly (3 or 4 dots) will tend to be accurate whereas one obtained from a small ppm anomaly (no dots) could be quite inaccurate. The absence of amplitude dots indicates that the anomaly from the coaxial coil-pair is 5 ppm or less on both the inphase and quadrature channels. Such small anomalies could reflect a weak conductor at the surface or a stronger conductor at depth. The conductance grade and depth estimate illustrates which of these possibilities fits the recorded data best.

Flight line deviations occasionally yield cases where two anomalies, having similar conductance values but dramatically different depth estimates, occur close together on the same conductor. Such examples illustrate the reliability of the conductance measurement while showing that the depth estimate can be unreliable. There are a number of factors which can produce an error in the depth estimate, including the averaging of topographic variations by the altimeter, overlying conductive overburden, and the location and attitude of the conductor relative to the flight line. Conductor location and attitude can provide an erroneous depth estimate because the stronger part of the conductor may be deeper or to one side of the flight line, or because it has a shallow dip. A heavy tree cover can also produce errors in depth estimates. This is because the depth estimate is computed as the distance of bird from conductor, minus the altimeter reading. The altimeter can lock onto the top of a dense forest canopy. This situation yields an erroneously large depth estimate but does not affect the conductance estimate.

Dip symbols are used to indicate the direction of dip of conductors. These symbols are used only when the anomaly shapes are unambiguous, which usually requires a fairly resistive environment.

A further interpretation is presented on the EM map by means of the line-to-line correlation of anomalies, which is based on a comparison of anomaly shapes on adjacent lines. This provides conductor axes which may define the geological structure over portions of the survey area. The absence of conductor axes in an area implies that anomalies could not be correlated from line to line with reasonable confidence.

DIGHEM electromagnetic maps are designed to provide a correct impression of conductor quality by means of the conductance grade symbols. The symbols can stand alone with geology when planning a follow-up program. The actual conductance values are printed in the attached anomaly list for those who wish quantitative data. The anomaly ppm and depth are indicated by inconspicuous dots which should not distract from the conductor patterns, while being helpful to those who wish this information. The map provides an interpretation of conductors in terms of length, strike and dip, geometric shape, conductance, depth, and thickness. The accuracy is comparable to an interpretation from a high quality ground EM survey having the same line spacing.

The attached EM anomaly list provides a tabulation of anomalies in ppm, conductance, and depth for the vertical sheet model. The EM anomaly list also shows the conductance and depth for a thin horizontal sheet (whole plane) model, but only the vertical sheet parameters appear on the EM map. The horizontal sheet model is suitable for a flatly dipping thin bedrock conductor such as a sulfide sheet having a thickness less than 10 m. The list also shows the resistivity and depth for a conductive earth (half space) model, which is suitable for thicker slabs such as thick conductive overburden. In the EM anomaly list, a depth value of zero for the conductive earth model, in an area of thick cover, warns that the anomaly may be caused by conductive overburden.

Since discrete bodies normally are the targets of EM surveys, local base (or zero) levels are used to compute local anomaly amplitudes. This contrasts with the use of true zero levels which are used to compute true EM amplitudes. Local anomaly amplitudes are shown in the EM anomaly list and these are used to compute the vertical sheet parameters of conductance and depth. Not shown in the EM anomaly list are the true amplitudes which are used to compute the horizontal sheet and conductive earth parameters.

Questionable Anomalies

DIGHEM maps may contain EM responses which are displayed as asterisks (*). These responses denote weak anomalies of indeterminate conductance, which may reflect one of the following: a weak conductor near the surface, a strong conductor at depth (e.g., 100 to 120 m below surface) or to one side of the flight line, or aerodynamic noise. Those responses that have the appearance of valid bedrock anomalies on the flight profiles are indicated by appropriate interpretive symbols (see EM map legend). The others probably do not warrant further investigation unless their locations are of considerable geological interest.

The thickness parameter

DIGHEM can provide an indication of the thickness of a steeply dipping conductor. The amplitude of the coplanar anomaly (e.g., CPI channel on the digital profile) increases relative to the coaxial anomaly (e.g., CXI) as the apparent thickness increases, i.e., the thickness in the horizontal plane. (The thickness is equal to the conductor width if the conductor dips at 90 degrees and strikes at right angles to the flight line.) This report refers to a conductor as thin when the thickness is likely to be less than 3 m, and thick when in excess of 10 m. Thick conductors are indicated on the EM map by parentheses "( )". For base metal exploration in steeply dipping geology, thick conductors can be high priority targets because many massive sulfide ore bodies are thick, whereas non-economic bedrock conductors are often thin. The system cannot sense the thickness when the strike of the conductor is subparallel to the flight line, when the conductor has a shallow dip, when the anomaly amplitudes are small, or when the resistivity of the environment is below 100 ohm-m.

Resistivity mapping

Areas of widespread conductivity are commonly encountered during surveys. In such areas, anomalies can be generated by decreases of only 5 m in survey altitude as well as by increases in conductivity. The typical flight record in conductive areas is characterized by inphase and quadrature channels which are continuously active. Local EM peaks reflect either increases in conductivity of the earth or decreases in survey altitude. For such conductive areas, apparent resistivity profiles and contour maps are necessary for the correct interpretation of the airborne data. The advantage of the resistivity parameter is that anomalies caused by altitude changes are virtually eliminated, so the resistivity data reflect only those anomalies caused by conductivity changes. The resistivity analysis also helps the interpreter to differentiate between conductive trends in the bedrock and those patterns typical of conductive overburden. For example, discrete conductors will generally appear as narrow lows on the contour map and broad conductors (e.g., overburden) will appear as wide lows.

The resistivity profiles and the resistivity contour maps present the apparent resistivity using the so-called pseudo-layer (or buried) half space model defined by Fraser (1978)[1]. This model consists of a resistive layer overlying a conductive half space. The depth channels give the apparent depth below surface of the conductive material. The apparent depth is simply the apparent thickness of the overlying resistive layer. The apparent depth (or thickness) parameter will be positive when the upper layer is more resistive than the underlying material, in which case the apparent depth may be quite close to the true depth.

The apparent depth will be negative when the upper layer is more conductive than the underlying material, and will be zero when a homogeneous half space exists. The apparent depth parameter must be interpreted cautiously because it will contain any errors which may exist in the measured altitude of the EM bird (e.g., as caused by a dense tree cover). The inputs to the resistivity algorithm are the inphase and quadrature components of the coplanar coil-pair. The outputs are the apparent resistivity of the conductive half space (the source) and the sensor-source distance. The flying height is not an input variable, and the output resistivity and sensor-source distance are independent of the flying height. The apparent depth, discussed above, is

[1] Resistivity mapping with an airborne multicoil electromagnetic system: Geophysics, v. 43, p.144-172

simply the sensor-source distance minus the measured altitude or flying height. Consequently, errors in the measured altitude will affect the apparent depth parameter but not the apparent resistivity parameter.

The apparent depth parameter is a useful indicator of simple layering in areas lacking a heavy tree cover. The DIGHEM system has been flown for purposes of permafrost mapping, where positive apparent depths were used as a measure of permafrost thickness. However, little quantitative use has been made of negative apparent depths because the absolute value of the negative depth is not a measure of the thickness of the conductive upper layer and, therefore, is not meaningful physically. Qualitatively, a negative apparent depth estimate usually shows that the EM anomaly is caused by conductive overburden. Consequently, the apparent depth channel can be of significant help in distinguishing between overburden and bedrock conductors.

The resistivity map often yields more useful information on conductivity distributions than the EM map. In comparing the EM and resistivity maps, keep in mind the following:

(a) The resistivity map portrays the absolute value of the earth's resistivity, where resistivity = 1/conductivity.

(b) The EM map portrays anomalies in the earth's resistivity. An anomaly by definition is a change from the norm and so the EM map displays anomalies, (i) over narrow, conductive bodies and (ii) over the boundary zone between two wide formations of differing conductivity.

The resistivity map might be likened to a total field map and the EM map to a horizontal gradient in the direction of flight[2]. Because gradient maps are usually more sensitive than total field maps, the EM map therefore is to be preferred in resistive areas. However, in conductive areas, the absolute character of the resistivity map usually causes it to be more useful than the EM map.

Interpretation in conductive environments

Environments having background resistivities below 30 ohm-m cause all airborne EM systems to yield very large responses from the conductive ground. This usually prohibits the recognition of discrete bedrock conductors. However, DIGHEM data processing techniques produce three parameters which contribute significantly to the recognition of bedrock conductors. These are the inphase and quadrature difference channels (DFI and DFQ), and the resistivity and depth channels (RES and DP) for each coplanar frequency.

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[2] The gradient analogy is only valid with regard to the identification of anomalous locations.

The EM difference channels (DFI and DFQ) eliminate most of the responses from conductive ground, leaving responses from bedrock conductors, cultural features (e.g., telephone lines, fences, etc.) and edge effects. Edge effects often occur near the perimeter of broad conductive zones. This can be a source of geologic noise. While edge effects yield anomalies on the EM difference channels, they do not produce resistivity anomalies. Consequently, the resistivity channel aids in eliminating anomalies due to edge effects. On the other hand, resistivity anomalies will coincide with the most highly conductive sections of conductive ground, and this is another source of geologic noise. The recognition of a bedrock conductor in a conductive environment therefore is based on the anomalous responses of the two difference channels (DFI and DFQ) and the resistivity channels (RES). The most favourable situation is where anomalies coincide on all channels.

The DP channels, which give the apparent depth to the conductive material, also help to determine whether a conductive response arises from surficial material or from a conductive zone in the bedrock. When these channels ride above the zero level on the digital profiles (i.e., depth is negative), it implies that the EM and resistivity profiles are responding primarily to a conductive upper layer, i.e., conductive overburden. If the DP channels are below the zero level, it indicates that a resistive upper layer exists, and this usually implies the existence of a bedrock conductor. If the low frequency DP channel is below the zero level and the high frequency DP is above, this suggests that a bedrock conductor occurs beneath conductive cover.

The conductance channel CDT identifies discrete conductors which have been selected by computer for appraisal by the geophysicist. Some of these automatically selected anomalies on channel CDT are discarded by the geophysicist. The automatic selection algorithm is intentionally oversensitive to assure that no meaningful responses are missed. The interpreter then classifies the anomalies according to their source and eliminates those that are not substantiated by the data, such as those arising from geologic or aerodynamic noise.

Reduction of geologic noise

Geologic noise refers to unwanted geophysical responses. For purposes of airborne EM surveying, geologic noise refers to EM responses caused by conductive overburden and magnetic permeability. It was mentioned previously that the EM difference channels (i.e., channel DFI for inphase and DFQ for quadrature) tend to eliminate the response of conductive overburden. This marked a unique development in airborne EM technology, as DIGHEM is the only EM system which yields channels having an exceptionally high degree of immunity to conductive overburden.

Magnetite produces a form of geological noise on the inphase channels of all EM systems. Rocks containing less than 1% magnetite can yield negative inphase anomalies caused by magnetic permeability. When magnetite is widely distributed throughout a survey area, the inphase EM channels may continuously rise and fall, reflecting variations in the magnetite percentage, flying height, and overburden thickness. This can lead to difficulties in recognizing deeply buried bedrock conductors, particularly if conductive overburden also exists. However, the response of broadly distributed magnetite generally vanishes on the inphase difference channel DFI. This feature can be a significant aid in the recognition of conductors which occur in rocks containing accessory magnetite.

EM magnetite mapping

The information content of DIGHEM data consists of a combination of conductive eddy current responses and magnetic permeability responses. The secondary field resulting from conductive eddy current flow is frequency-dependent and consists of both inphase and quadrature components, which are positive in sign. On the other hand, the secondary field resulting from magnetic permeability is independent of frequency and consists of only an inphase component which is negative in sign. When magnetic permeability manifests itself by decreasing the measured amount of positive inphase, its presence may be difficult to recognize. However, when it manifests itself by yielding a negative inphase anomaly (e.g., in the absence of eddy current flow), its presence is assured. In this latter case, the negative component can be used to estimate the percent magnetite content.

A magnetite mapping technique was developed for the coplanar coil-pair of DIGHEM. The technique yields a channel (designated FEO) which displays apparent weight percent magnetite according to a homogeneous half space model.[3] The method can be complementary to magnetometer mapping in certain cases. Compared to magnetometry, it is far less sensitive but is more able to resolve closely spaced magnetite zones, as well as providing an estimate of the amount of magnetite in the rock. The method is sensitive to 1/4% magnetite by weight when the EM sensor is at a height of 30 m above a magnetitic half space. It can individually resolve steep dipping narrow magnetite-rich bands which are separated by 60 m. Unlike magnetometry, the EM magnetite method is unaffected by remanent magnetism or magnetic latitude.

The EM magnetite mapping technique provides estimates of magnetite content which are usually correct within a factor of 2 when the magnetite is fairly uniformly distributed. EM magnetite maps can be generated when magnetic permeability is evident as negative inphase responses on the data profiles.

Like magnetometry, the EM magnetite method maps only bedrock features, provided that the overburden is characterized by a general lack of magnetite. This contrasts with resistivity mapping which portrays the combined effect of bedrock and overburden.

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[3] Refer to Fraser, 1981, Magnetite mapping with a multi-coil airborne electromagnetic system: Geophysics, v. 46, p. 1579-1594.

Recognition of culture

Cultural responses include all EM anomalies caused by man-made metallic objects. Such anomalies may be caused by inductive coupling or current gathering. The concern of the interpreter is to recognize when an EM response is due to culture. Points of consideration used by the interpreter, when coaxial and coplanar coil-pairs are operated at a common frequency, are as follows:

1. Channels CXP and CPP monitor 60 Hz radiation. An anomaly on these channels shows that the conductor is radiating power. Such an indication is normally a guarantee that the conductor is cultural. However, care must be taken to ensure that the conductor is not a geologic body which strikes across a power line, carrying leakage currents.

2. A flight which crosses a "line" (e.g., fence, telephone line, etc.) yields a center-peaked coaxial anomaly and an m-shaped coplanar anomaly.[4] When the flight crosses the cultural line at a high angle of intersection, the amplitude ratio of coaxial/coplanar response is 4. Such an EM anomaly can only be caused by a line. The geologic body which yields anomalies most closely resembling a line is the vertically dipping thin dike. Such a body, however, yields an amplitude ratio of 2 rather than 4. Consequently, an

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[4] See Figure 5-1 presented earlier.

m-shaped coplanar anomaly with a CXI/CPI amplitude ratio of 4 is virtually a guarantee that the source is a cultural line.

3. A flight which crosses a sphere or horizontal disk yields center-peaked coaxial and coplanar anomalies with a CXI/CPI amplitude ratio (i.e., coaxial/coplanar) of 1/4. In the absence of geologic bodies of this geometry, the most likely conductor is a metal roof or small fenced yard.[5] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

4. A flight which crosses a horizontal rectangular body or wide ribbon yields an m-shaped coaxial anomaly and a center-peaked coplanar anomaly. In the absence of geologic bodies of this geometry, the most likely conductor is a large fenced area.[5] Anomalies of this type are virtually certain to be cultural if they occur in an area of culture.

5. EM anomalies which coincide with culture, as seen on the camera film or video display, are usually caused by culture. However, care is taken with such coincidences because a geologic conductor could occur beneath a fence, for example. In this example, the fence would be expected to yield an m-shaped coplanar anomaly as in case #2 above.

[5] It is a characteristic of EM that geometrically similar anomalies are obtained from: (1) a planar conductor, and (2) a wire which forms a loop having dimensions identical to the perimeter of the equivalent planar conductor.

If, instead, a center-peaked coplanar anomaly occurred, there would be concern that a thick geologic conductor coincided with the cultural line.

6. The above description of anomaly shapes is valid when the culture is not conductively coupled to the environment. In this case, the anomalies arise from inductive coupling to the EM transmitter. However, when the environment is quite conductive (e.g., less than 100 ohm-m at 900 Hz), the cultural conductor may be conductively coupled to the environment. In this latter case, the anomaly shapes tend to be governed by current gathering. Current gathering can completely distort the anomaly shapes, thereby complicating the identification of cultural anomalies. In such circumstances, the interpreter can only rely on the radiation channels and on the camera film or video records.

MAGNETICS

The existence of a magnetic correlation with an EM anomaly is indicated directly on the EM map. In some geological environments, an EM anomaly with magnetic correlation has a greater likelihood of being produced by sulfides than one that is non-magnetic. However, sulfide ore bodies may be non-magnetic (e.g., the Kidd Creek deposit near Timmins, Canada) as well as magnetic (e.g., the Mattabi deposit near Sturgeon Lake, Canada).

The magnetometer data are digitally recorded in the aircraft to an accuracy of 0.01 nT for cesium magnetometers. The digital tape is processed by computer to yield a total field magnetic contour map. When warranted, the magnetic data may also be treated mathematically to enhance the magnetic response of the near-surface geology, and an enhanced magnetic contour map is then produced. The response of the enhancement operator in the frequency domain is illustrated in Figure 5-2. This figure shows that the passband components of the airborne data are amplified 20 times by the enhancement operator. This means, for example, that a 100 nT anomaly on the enhanced map reflects a 5 nT anomaly for the passband components of the airborne data.

The enhanced map, which bears a resemblance to a downward continuation map, is produced by the digital bandpass filtering of the total field data. The enhancement is equivalent to continuing the field downward to a level (above the source) which is 1/20th of the actual sensor-source distance.

Because the enhanced magnetic map bears a resemblance to a ground magnetic map, it simplifies the recognition of trends in the rock strata and the interpretation of geological structure. It defines the near-surface local geology while de-emphasizing deep-seated regional features. It primarily has application when the magnetic rock units are steeply dipping and the earth's field dips in excess of 60 degrees.

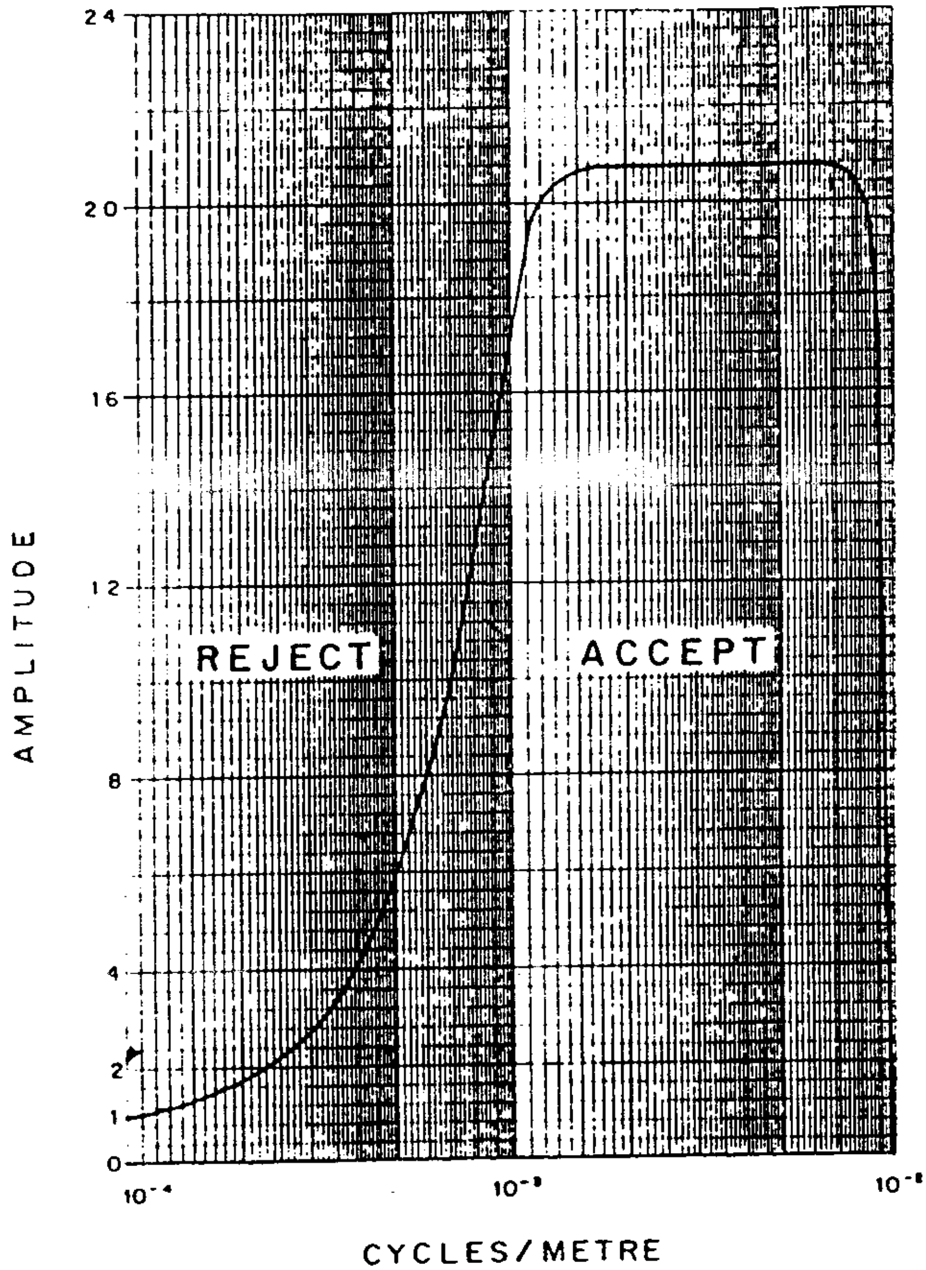

Fig. 5-2 Frequency response of magnetic enhancement operator.

Any of a number of filter operators may be applied to the magnetic data, to yield vertical derivatives, continuations, magnetic susceptibility, etc. These may be displayed in contour, colour or shadow.

VLF

VLF transmitters produce high frequency uniform electromagnetic fields. However, VLF anomalies are not EM anomalies in the conventional sense. EM anomalies primarily reflect eddy currents flowing in conductors which have been energized inductively by the primary field. In contrast, VLF anomalies primarily reflect current gathering, which is a non-inductive phenomenon. The primary field sets up currents which flow weakly in rock and overburden, and these tend to collect in low resistivity zones. Such zones may be due to massive sulfides, shears, river valleys and even unconformities.

The VLF field is horizontal. Because of this, the method is quite sensitive to the angle of coupling between the conductor and the transmitted VLF field. Conductors which strike towards the VLF station will usually yield a stronger response than conductors which are nearly orthogonal to it.

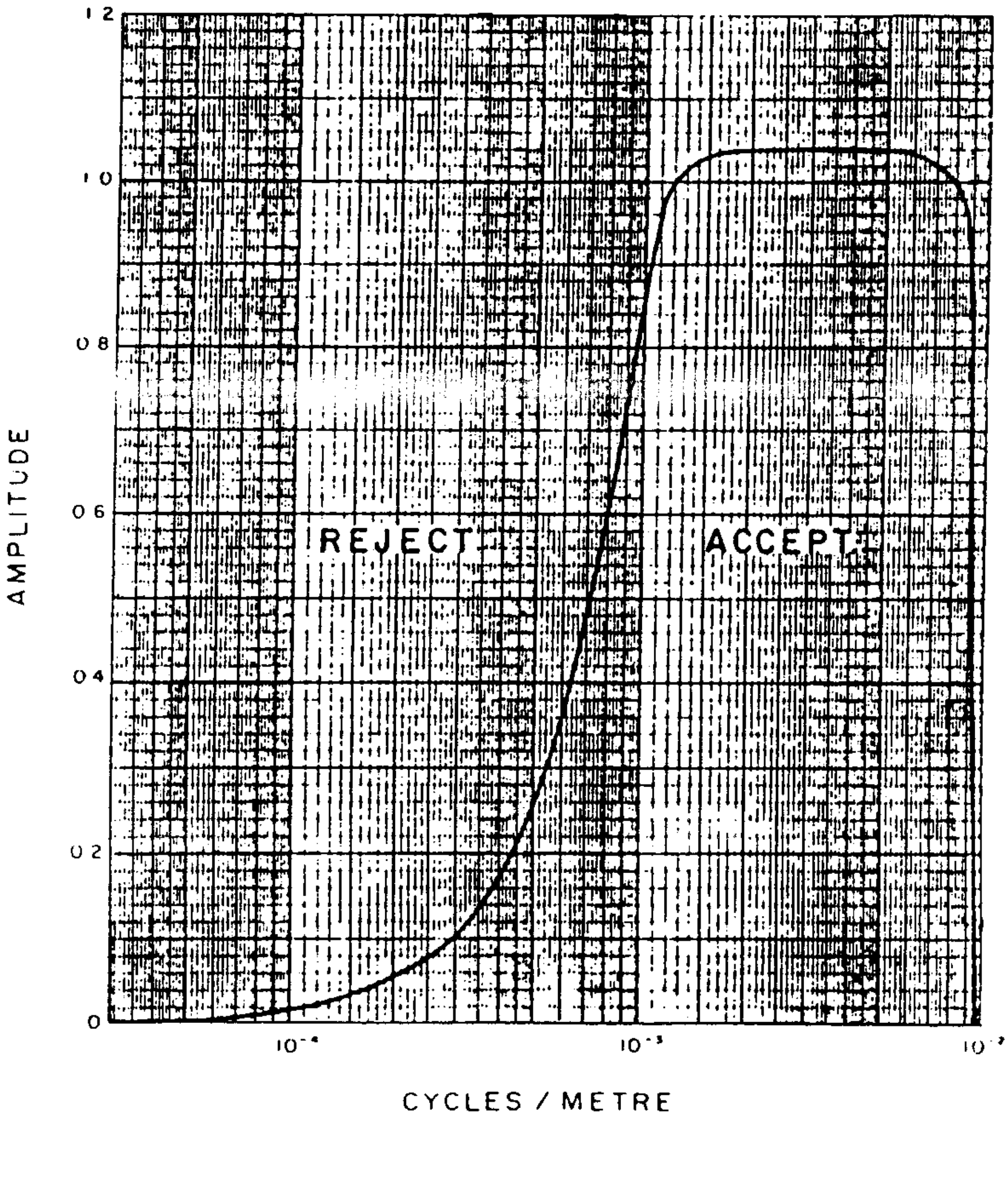

Fig. 5-3 Frequency response of VLF operator.

The Herz Industries Ltd. Totem VLF-electromagnetometer measures the total field and vertical quadrature components. Both of these components are digitally recorded in the aircraft with a sensitivity of 0.1 percent. The total field yields peaks over VLF current concentrations whereas the quadrature component tends to yield crossovers. Both appear as traces on the profile records.

The total field data are filtered digitally and displayed as contours to facilitate the recognition of trends in the rock strata and the interpretation of geologic structure.

The response of the VLF total field filter operator in the frequency domain (Figure 5-3) is basically similar to that used to produce the enhanced magnetic map (Figure 5-2). The two filters are identical along the abscissa but different along the ordinant. The VLF filter removes long wavelengths such as those which reflect regional and wave transmission variations. The filter sharpens short wavelength responses such as those which reflect local geological variations.

CONCLUSIONS AND RECOMMENDATIONS

This report provides a very brief description of the survey results and describes the equipment, procedures and logistics of the survey.

The survey was successful in locating a few moderately weak or broad conductors which may warrant additional work. The various maps included with this report display the magnetic and conductive properties of the survey area. It is recommended that the survey results be reviewed in detail, in conjunction with all available geophysical, geological and geochemical information. Particular reference should be made to the computer generated data profiles which clearly define the characteristics of the individual anomalies.

The interpreted bedrock conductors defined by the survey should be subjected to further investigation, using appropriate surface exploration techniques. Anomalies which are currently considered to be of moderately low priority may require upgrading if follow-up results are favourable.

It is also recommended that image processing of existing geophysical data be considered, in order to extract the maximum amount of information from the survey results. Current software and imaging techniques often provide valuable information on structure and lithology, which may not be clearly evident on the contour and colour maps. These techniques can yield images which define subtle, but significant, structural details.

Respectfully submitted,

DIGHEM SURVEYS & PROCESSING INC.

R Pritchard

Ruth A. Pritchard
Geophysicist

RAP/sdp

A1122JUN.92R

APPENDIX A

LIST OF PERSONNEL

The following personnel were involved in the acquisition, processing, interpretation and presentation of data, relating to a DIGHEM^{V} airborne geophysical survey carried out for Crown Resources Corporation, at the Paulson Project, B.C.

Steve Kilty	Vice President, Operations
Robert Gordon	Survey Operations Supervisor
Phil Miles	Senior Geophysical Operator
Roger Morrow	Pilot (Questral Helicopters Ltd.)
Gordon Smith	Data Processing Supervisor
Ruth A. Pritchard	Computer Processor/ Interpretation Geophysicist
Lyn Vanderstarren	Draftsperson (CAD)
Susan Pothiah	Word Processing Operator
Albina Tonello	Secretary/Expeditor

The survey consisted of 288 km of coverage, flown from May 5 to May 11, 1992.

All personnel are employees of Dighem Surveys & Processing Inc., except for the pilot who is an employee of Questral Helicopters Ltd.

DIGHEM SURVEYS & PROCESSING INC.

Ruth A. Pritchard
Geophysicist

RAP/sdp

A1122JUN.92R

APPENDIX B

STATEMENT OF COST

Date: June 17, 1992

IN ACCOUNT WITH
DIGHEM SURVEYS & PROCESSING INC.

To: Dighem flying of Agreement dated April 6, 1992, pertaining to an Airborne Geophysical Survey at the Paulson Project, Britich Columbia.

Survey Charges

288 km of flying @ $100.00/km
plus mobilization costs of
$8,000.00 $36,800.00

Allocation of Costs

- Data Acquisition	(60%)
- Data Processing	(20%)
- Interpretation, Report and Maps	(20%)

DIGHEM SURVEYS & PROCESSING INC.

R Pritchard

Ruth A. Pritchard
Geophysicist

RAP/sdp

A1122JUN.92R

APPENDIX C

EM ANOMALY LIST

ANOMALY/ FID/INTERP	919 HZ REAL PPM	919 HZ QUAD PPM	COAXIAL 804 HZ REAL PPM	COAXIAL 804 HZ QUAD PPM	COAXIAL 6866 HZ REAL PPM	COAXIAL 6866 HZ QUAD PPM	VERTICAL DIKE COND SIEMEN	VERTICAL DIKE DEPTH* M	HORIZONTAL SHEET COND SIEMEN	HORIZONTAL SHEET DEPTH M	CONDUCTIVE EARTH RESIS OHM-M	CONDUCTIVE EARTH DEPTH M	MAG CORR NT
LINE 10020	(FLIGHT		7)										
A 1877B?	1	2	1	2	2	4	-	-	-	-	-	-	0
B 1872D	4	15	3	16	31	46	1.6	0	1	22	423	0	40
C 1832S?	2	2	0	1	0	4	4.5	58	1	192	924	0	30
LINE 10030	(FLIGHT		7)										
A 1411B	0	14	0	21	49	65	0.5	0	1	64	788	0	50
B 1415B	3	14	4	21	49	65	1.1	3	1	22	462	0	40
LINE 10040	(FLIGHT		7)										
A 1068B?	0	2	1	2	2	4	-	-	-	-	-	-	0
B 1059B?	1	2	1	2	2	4	-	-	-	-	-	-	0
LINE 10050	(FLIGHT		7)										
A 650B?	0	2	1	2	2	4	-	-	-	-	-	-	0
B 664B?	0	5	2	7	11	42	0.5	1	1	55	346	10	0
LINE 10060	(FLIGHT		7)										
A 310S?	1	2	0	2	1	4	-	-	-	-	-	-	180
LINE 10070	(FLIGHT		6)										
A 4497S?	0	2	1	2	2	4	-	-	-	-	-	-	0
B 4543S?	0	1	0	1	3	10	0.5	0	1	163	924	0	0
LINE 10080	(FLIGHT		6)										
A 4125S?	0	2	0	2	2	4	-	-	-	-	-	-	70
LINE 10090	(FLIGHT		6)										
A 3746S	0	2	0	4	0	21	0.5	0	1	136	924	0	70
LINE 10110	(FLIGHT		6)										
A 3027S?	0	2	0	2	0	4	-	-	-	-	-	-	0
LINE 10120	(FLIGHT		6)										
A 2615S?	3	5	0	6	1	37	3.1	31	1	105	924	0	0
LINE 10130	(FLIGHT		6)										
A 2475S	0	5	0	8	14	44	0.5	0	1	63	756	0	0
LINE 10140	(FLIGHT		6)										
A 2100S?	1	2	0	2	2	4	-	-	-	-	-	-	0
B 2095S?	2	4	0	7	18	28	2.3	35	1	58	734	0	0

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

	919 HZ		COAXIAL 804 HZ		COAXIAL 6866 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10151 (FLIGHT 7)													
A 2502S	0	2	0	2	2	4	-	-	-	-	-	-	0
B 2441S	0	2	0	2	2	4	-	-	-	-	-	-	0
LINE 10161 (FLIGHT 7)													
A 2925S	0	2	0	2	2	4	-	-	-	-	-	-	0
B 2946S	0	3	0	6	5	33	0.5	0	1	53	725	0	0
C 2978S	0	2	0	2	0	4	-	-	-	-	-	-	0
LINE 10171 (FLIGHT 7)													
A 3084S?	0	2	0	2	0	4	-	-	-	-	-	-	70
B 3030S	0	2	0	2	1	4	-	-	-	-	-	-	0
LINE 10191 (FLIGHT 8)													
A 1532S	0	1	0	2	0	4	-	-	-	-	-	-	10
LINE 10201 (FLIGHT 8)													
A 958S	0	2	0	2	0	4	-	-	-	-	-	-	0
B 932S	0	2	0	2	2	4	-	-	-	-	-	-	6
LINE 10211 (FLIGHT 8)													
A 788S	0	2	0	2	0	4	-	-	-	-	-	-	0
B 866S	0	2	0	2	0	4	-	-	-	-	-	-	0
C 887S	0	4	0	8	0	46	0.5	2	1	61	707	0	0
LINE 10221 (FLIGHT 8)													
A 250S?	0	2	0	2	0	4	-	-	-	-	-	-	0
B 136S	0	2	0	2	2	4	-	-	-	-	-	-	0
LINE 10230 (FLIGHT 5)													
A 1490S	0	4	0	7	1	44	0.5	0	1	64	768	0	0
B 1544S	0	1	0	4	1	18	0.5	0	1	123	924	0	0
C 1582B?	0	2	0	2	2	4	-	-	-	-	-	-	0
D 1588B?	0	2	0	2	2	4	-	-	-	-	-	-	0
LINE 10240 (FLIGHT 5)													
A 1045S?	0	3	0	3	0	14	0.5	0	1	128	924	0	0
B 968B?	0	3	0	2	4	13	0.5	0	1	137	924	0	0
LINE 10250 (FLIGHT 5)													
A 821S	0	2	0	2	0	4	-	-	-	-	-	-	0
LINE 10291 (FLIGHT 8)													
A 1945S	0	2	0	2	0	4	-	-	-	-	-	-	0

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.

	919 HZ		COAXIAL 804 HZ		COAXIAL 6866 HZ		VERTICAL DIKE		HORIZONTAL SHEET		CONDUCTIVE EARTH		MAG CORR
ANOMALY/ FID/INTERP	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	REAL PPM	QUAD PPM	COND SIEMEN	DEPTH* M	COND SIEMEN	DEPTH M	RESIS OHM-M	DEPTH M	NT
LINE 10291	(FLIGHT		8)										
B 1972S	1	2	0	2	0	4	-	-	-	-	-	-	0
LINE 10330	(FLIGHT		2)										
A 1238S?	0	1	0	1	0	1	-	-	-	-	-	-	0
LINE 10360	(FLIGHT		2)										
A 2581S	1	0	0	1	0	4	-	-	-	-	-	-	0
B 2641S?	0	2	0	2	0	4	-	-	-	-	-	-	0
LINE 19010	(FLIGHT		8)										
A 3056S?	0	1	0	2	2	4	-	-	-	-	-	-	0
B 3047S?	0	2	0	2	2	4	-	-	-	-	-	-	8

* ESTIMATED DEPTH MAY BE UNRELIABLE BECAUSE THE STRONGER PART OF THE CONDUCTOR MAY BE DEEPER OR TO ONE SIDE OF THE FLIGHT LINE, OR BECAUSE OF A SHALLOW DIP OR OVERBURDEN EFFECTS.