MineQuest Report No. 260
Ref.: RM1029

MINER LAKE PROJECT
(KEN CLAIMS)

PRELIMINARY GEOLOGY AND GEOCHEMISTRY

MARCH - APRIL, 1992

South Central British Columbia
Nicola Mining Division

NTS 92H/15

Latitude 49° 54' N

Longitude 120°35' W

UTM 673000 m. E. 5530000 m. N.

for
Pacific Copperfields Inc.

by
by A.W. Gourlay

of
MineQuest Exploration Associates Ltd.

Claim Name	Record Number	Units	Record Date
KEN	2247	16	Aug. 19'89
AL 1	2246	12	Aug. 31'89
Al 2	2248	14	Aug. 31'89
Al 3	2245	20	Sep. 1'89
Al 4	2257	1	Sep. 23'89
LEY 1	2309	12	Dec. 10'89
LEY 2	2310	2	Dec. 10'89
LEY 3	2327	16	Feb. 8'90
Big Six #1	2201	1	Apr. 21'89
Big six #2	2202	1	Apr. 21'89
Big 6 #3	2203	1	Apr. 21'89
Big 6 #4	2204	1	Apr. 21'89

Vancouver, B.C. May 1992

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1.0 INTRODUCTION

1.1 Location, Access, and Topography

The Ken Claims are located 150 kilometres northeast of Vancouver and 30 kilometres southeast of Merritt, in south central British Columbia (Figure 1). The claims are situated within National Topographic System area 92H/15W and are centred at approximately latitude 49°54'N and longitude 120°35'W.

Access to the claims is by road from Merritt. The claims are crossed by a network of forestry and secondary gravel roads, and numerous old logging trails.

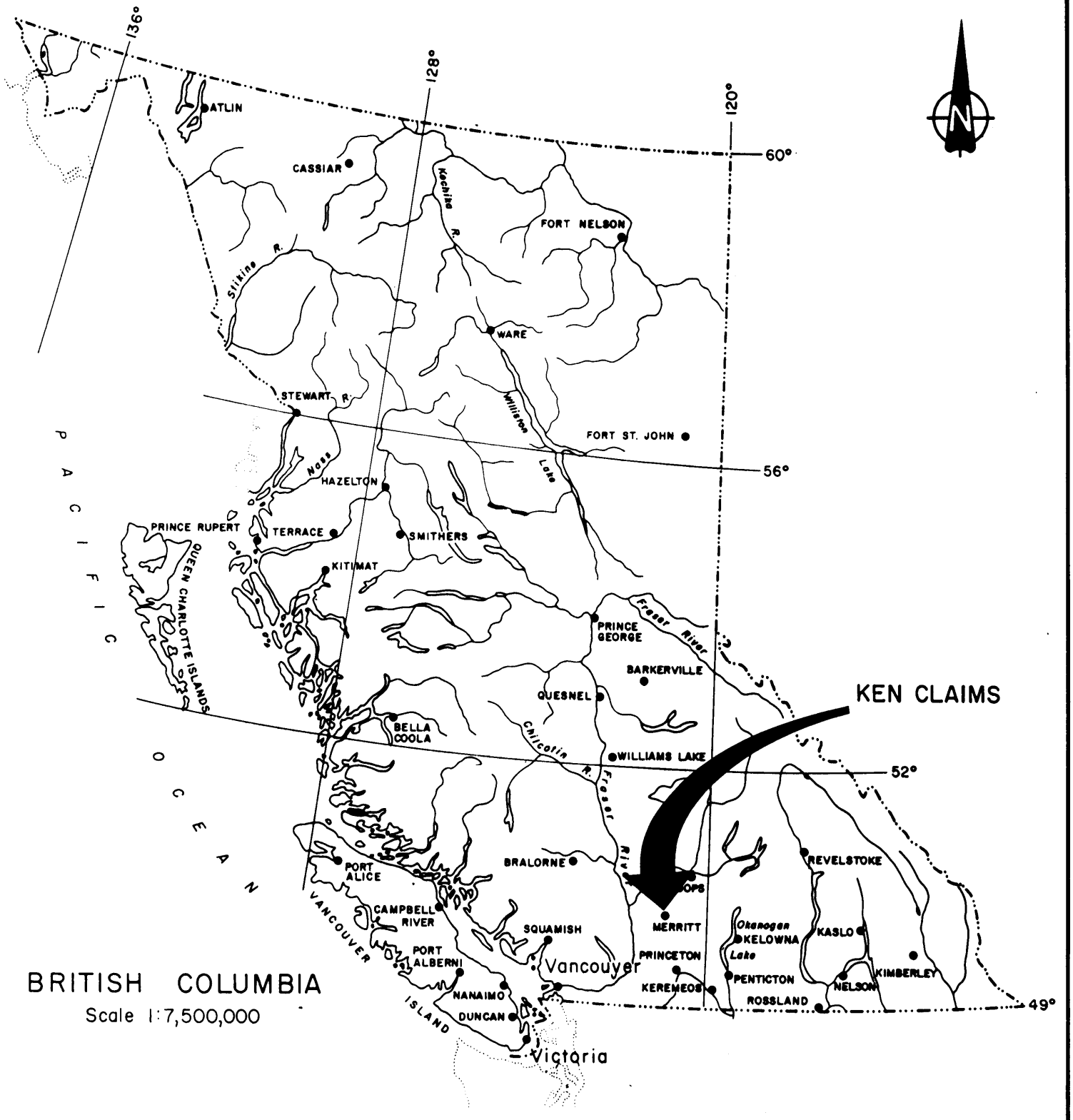
Relief within the property is about 275 metres from Alleyne Lake (1005 m) to the high ground (1280 m) at Fairweather Hills. The property covers grassland and open deciduous forest, with local thickets of dense scrub. The area has been selectively logged, and is used as rangeland.

There are several ponds and lakes that may be used as a source of water for drilling.

1.2 Property Definition and History

Interest in copper-gold alkaline porphyry systems was renewed by recognition of the potential of Mt. Milligan. George W. Vernon recognized opportunities presented by open ground and the Ken Claims, and adjoining ground, were staked by MineQuest Exploration Associates Ltd. in conjunction with Mr. Vernon during 1989 and 1990.

Although the Aspen Grove camp has been explored sporadically since the turn of the century, most reported work on the Ken Claims took place between 1969 and 1980 (MinFile References, Appendix I). That work was centred on several limited areas. Although there are references to drilling, very little is reported in publicly available documents.



KEN CLAIMS			
LOCATION MAP			
Originator	Drawn C.D.	Plan No.	FIG. 1
Revised	Date Oct.'90	NTS	

During 1990 MineQuest Exploration Associates Ltd. Carried out a limited amount of geological mapping and rock chip sampling for assessment purposes. In 1991 a small Induced Polarization survey, totalling six line-kilometres, was completed over the known mineralized showings and the Miner Lake area.

1.3 Claim Status

The claims listed below are held by MineQuest Exploration Associates Ltd.

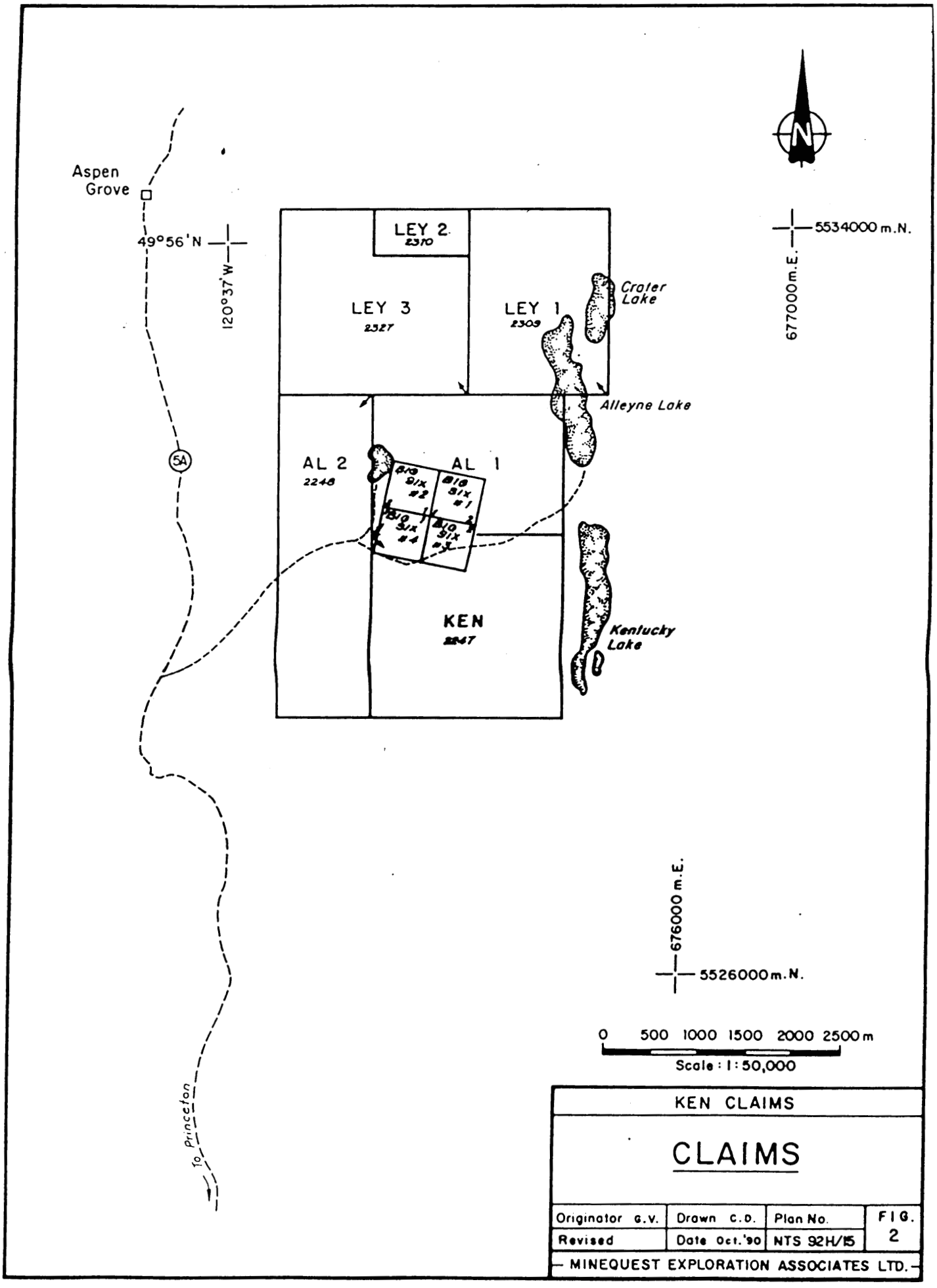
Claim Name	Record Number	Units	Due Date before submission of this report
KEN	2247	16	Aug. 19, 1992
AL 1	2246	12	Aug. 31, 1993
Al 2	2248	14	Aug. 31, 1992
LEY 1	2309	12	Dec. 10, 1992
LEY 2	2310	2	Dec. 10, 1992
LEY 3	2327	16	Feb. 8, 1993
Big Six #1	2201	1	Apr. 21, 1992
Big Six #2	2202	1	Apr. 21, 1992
Big 6 #3	2203	1	Apr. 21, 1992
Big 6 #4	2204	1	Apr. 21, 1992

1.4 Summary of Work Done - Current Program

Work carried out in this exploration program, which took place between March 23rd to April 1st, and on April 23rd and 24th, 1992, consisted of geological mapping and rock chip sampling. A total of 38 samples were collected, and fifteen of these were submitted for polished thin section descriptions.

Portions of the 1991 Induced Polarization survey grid, around the areas of known mineralization, were mapped at scale of 1:1000

The geological mapping and sampling were carried out by A.W. Gourlay, who directed the program, and George W. Vernon.


Aspen Grove
49°56'N
120°37'W
5A
LEY 2
2370
LEY 3
2327
LEY 1
2309
AL 2
2248
AL 1
KEN
2247
Crater Lake
Alleyne Lake
Kentucky Lake
5534000 m.N.
677000m.E.
676000 m.E.
5526000m.N.
To Princeton
0 500 1000 1500 2000 2500 m
Scale : 1:50,000
KEN CLAIMS
CLAIMS
Originator G.V.
Drawn C.D.
Plan No.
FIG. 2
Revised
Date Oct.'90
NTS 92H/15
MINEQUEST EXPLORATION ASSOCIATES LTD.

2.0 GEOLOGY

2.1 Regional Geology

The claims cover rocks of the Nicola Group, a sequence of upper Triassic volcanic, sedimentary, and intrusive rocks, as mapped by Preto (1979). The Nicola Group and lateral equivalents extend from the British Columbia - Washington border north, through the Quesnel Trough, to the British Columbia - Yukon border.

The Nicola Group consist of calc-alkaline to alkaline volcanic rocks and related sediments, with coeval alkaline intrusives. In the Aspen Grove area the distribution of the Nicola Group rocks is controlled by north-northwest trending faults; the Allison Fault to the west and the Kentucky - Alleyne Fault on the east. Preto (1979) defined a Western Belt composed of calc-alkaline flows and tuffs, a Central belt dominated by alkaline to calc-alkaline volcanics and intrusives with minor sedimentary rocks, and an Eastern Belt consisting of sediments, tuffs, and alkaline flows.

The majority of mineral occurrences are found in the Central Belt. While copper sulphides are found throughout the lithologies of the Central Belt, the occurrences of greatest potential are closely related to intrusives and breccias.

2.2 Property Geology

The claims lie within the Central Belt of alkaline to calc-alkaline volcanic rocks and intrusive equivalents of the Triassic Nicola Group.

2.2.1 Lithology

Three rock types were defined during the field work; massive green and maroon lahars, porphyritic basalt, and fine grained diorite (Figure 3).

The green and maroon lahars are found east of Miner Lake, and form the high ground in the east-central portion of the claims. The lahars are massive and do not display any obvious

layering. Maroon colour is most common with lesser amounts of green lahar. Differential weathering highlights fragments supported by a fine-grained matrix. Fragment shape varies from angular to subrounded, and while size reaches 12 cm, most fragments are in the one to four centimetre range. Clast lithologies include fine-grained intermediate tuff, fine-grained felsic tuff or monzonite, and fine-grained diorite. Fresh surfaces are black and featureless. Thin section descriptions suggest that the lahars are composed of basaltic andesites and high level intrusives, dykes, and sills.

Porphyritic basalt is a massive unit that is maroon colour on both fresh and weathered surfaces. A very fine-grained matrix supports up to 20% subhedral to euhedral phenocrysts, now completely altered to chlorite. Zeolite filled amygdales form about 5% of the rock. The basalt is found on the west side of Miner Lake and near the baseline on line 4600 north.

Fine-grained diorite outcrops just to the southeast of the east end of line 4600 north. Green on both fresh and weathered surfaces, this unit forms massive cliffs and distinct rounded outcrops. This rock is defined as a high-level augite diorite by thin section examination.

2.2.2 Alteration

Lahars display a variety of alteration styles at surface. North of line 5800 north, about 5500 east, is an area of mottled green alteration, with very rare quartz veinlets, less than 2mm thick. Thin section studies describe this as epidote-actinolite-albite alteration of an original andesitic or basaltic lithology.

Immediately south of this is an area of epidote veining, which decreases in intensity towards the Q-Showing. Epidote veining varies from hairline veinlets and discontinuous anastomosing networks to veins 2 cm thick. Quartz is occasionally found with the epidote veins.

Elsewhere the lahars appear to be weakly altered in hand specimen. Thin section studies indicate widespread and pervasive propylitic alteration. The association of copper mineralization and epidote-actinolite alteration is described in Sample 92019. Southwest from the Cincinatti Trench, Samples 92033 and 92034 show a close association between copper mineralization, alteration, and fracturing. This suggests that the alteration event is closely related to the mineralization, and not due to regional greenschist metamorphism.

The porphyritic basalt is weakly altered with chloritization of the mafic phenocrysts and introduction of zeolites into the amygdales.

The fine-grained diorite is weakly altered, as suggested by hand specimen and confirmed by thin section.

2.2.3 Mineralization

Mineralization is rarely seen. In places lahars are locally weakly to moderately magnetic, but magnetite has not been identified in hand specimen. Weak malachite staining is occasionally found coating fractures but no copper sulphide minerals have been observed in the field. Up to 1% disseminated pyrite was found approximately 250 metres southwest from the Cincinatti Trench. Analytical results suggest that chalcocite is the most common sulphide mineral present. This is consistent with the mineralization reported by previous workers.

Thin section descriptions show that fine-grained magnetite is ubiquitous and has been mostly oxidized to hematite. The pyrite-chalcopyrite mineralization described in Sample 92033, the chalcocite-covellite found in Sample 92034 and the close association of copper mineralization and epidote alteration in Sample 92019W all suggest that the mineralization and alteration are closely related.

3.0 RESULTS OF ROCK SAMPLING

The latest phase of rock chip sampling has extended the area of known mineralization for a minimum of 1100 metres north-south, and at least 150 metres east-west (Figure 4). The mineralization is open in all directions. Of 38 samples collected 16 returned copper values in excess of 1000 ppm.

Sample 92004 is a three metre chip across an old pit, about 700 metres northwest of the Q-Showing. Fractured and malachite-stained lahar assayed 2.81% copper. Approximately 500 metres to the southeast, a grab sample (92027) of malachite stained subcrop or frost wedged fragments returned 18565 ppm copper. The zone of green alteration between these two areas did not return any values of significance.

Immediately south of the Cincinatti Trench samples 92002 and 92003, both chip samples over five metres, returned 2.16% and 5155 ppm copper, respectively, (avg. 1.25%/10m) from an old trench. Approximately 250 metres further south, in an area known as the Sherwin Trenches, a series of five chip samples , each five metres long, returned an average of 0.29% copper over 25 metres (Samples 92013 to 92017, individual results ranged from 416 to 6658 ppm). About 15 metres to the northeast sample 92018 (5 m) ran 18806 ppm copper. Fifty metres to the north samples 92019 (5 metres chip), 92020 and 92021 (grabs) returned anomalous values of 6411 ppm, 2.16%, and 2.68% copper respectively.

Approximately 100 metres to the west sample 92034 returned 10391 ppm copper from a discontinuous chip sample over an outcrop length of about 20 metres.

Sample 92032 produced 7171 ppm copper from an old trench located between Sample 92034 and the Cincinatti Trench.

In all cases where copper values were returned the samples are of lahar outcrops that are moderately to well fractured. Malachite staining varies from very slight to moderate.

Gold values were consistently low, with a high of 50 ppb in Sample 92018, a five metre chip sample from the Sherwin Trenches.

4.0 DISCUSSION

The KEN property covers alkaline to calc-alkaline volcanic rocks and intrusive equivalents of the Triassic Nicola Group. The Nicola Group and its equivalents have proven to be prospective for copper-gold alkaline porphyry systems, from Copper Mountain near the British Columbia - Washington border, to the Mt. Milligan and Kemess deposits northwest of Prince George. Features common to these copper-gold deposits are: magnetic highs associated with high-level diorite intrusives, multi-phase intrusions ranging in composition from diorite to syenite, breccia bodies, pyrite and magnetite haloes, and K-spar alteration.

Portions of the property have been the focus of several exploration programs since the 1950's. Previous workers have defined Nicola Group volcanic rocks intruded by a diorite body, and performed a limited amount of trenching and diamond drilling within a very restricted area. Government aeromagnetic surveys have outlined several magnetic highs, suggesting that intrusive rocks may be more widespread than previously recognized. At no time has the entire property been evaluated as a complete package.

Rock chip sampling over the central portion of the claims has confirmed and expanded the area of widespread copper mineralization reported by previous workers. Geological mapping has recognized three rock units: lahar, fine-grained diorite, and porphyritic basalt. Thin section studies have identified several intrusive lithologies as clasts in the lahars, widespread propylitic alteration, ubiquitous magnetite content, and the close association between copper mineralization, epidote alteration, and fracturing. These features are consistent with relationships noted at producing copper-gold alkaline porphyry deposits.

The variety of clast types suggest several nearby intrusive phases that have been incorporated into the lahars. Study of polished thin sections has described copper mineralization associated with

altered "plutonic" clasts and with fractures that crosscut both matrix and clasts. The timing of mineralization is uncertain; either in an intrusive prior to deposition within the lahars, or within lahar after deposition. Work has yet to define the location of intrusive phases.

At present less than 15% of the property has been mapped and sampled. Areas covering and adjacent to large magnetic highs on the north portion of the claims and along the south claim boundary have yet to be evaluated. The KEN Claims remain an attractive, under-evaluated and under-tested alkaline copper-gold porphyry target.

5.0 CONCLUSIONS

1. The property is underlain by volcanic and intrusive rocks of the Triassic Nicola Group.

2. Significant copper values, ranging up to 2.812%, have been returned over an area that extends approximately 1100 metres north to south and about 150 metres east-west.

3. Three rock types have been recognized during field mapping: lahar, fine-grained diorite, and porphyritic basalt.

4. Thin section studies have recognized widespread propylitic alteration, and a close association between copper mineralization, epidote alteration, and fracturing.

5. The thin section descriptions have identified a high-level augite diorite and felsic intrusive, altered plutonic rocks, high-level dykes and sills, and basaltic andesite.

6.0 RECOMMENDATIONS

Although the Ken Claims could be drilled at present, a thorough surface exploration program of the entire property would provide better target definition. To that end the following is recommended:

Phase I

1. The property should be geologically mapped, prospected, and sampled at a scale of 1:5,000 or 1:2,500.

2. Polished thin section descriptions and K-spar staining should be an integral part of the mapping program.

3. The Induced Polarization survey should be extended beyond the small area already covered. Twenty-five line kilometres of survey on east-west lines spaced 400 metres apart would cover the claim block.

The Phase I program would take about six weeks to complete and cost about $100,000.

Phase II

Contingent on the results of Phase I above it is expected that a drill program of about 1500 metres would be recommended as an initial test, at a cost of around $150,000.

7.0 BIBLIOGRAPHY

Gourlay, A.W., 1990
Ken Claims - Preliminary Geochemistry
MineQuest Exploration Associates Ltd.
Report #243

Preto, V.A., 1979
Geology of the Nicola Group between Merritt and Princeton
B.C.M.E.M.P.R. Bulletin 69

Richards, J.B., 1990
Geological Report on the Ken Claims
Minequest Exploration Associates Ltd.
Report Number 237

Richards, J.B., 1991
Summary Report on The Miner Lake Project
Unpublished report prepared for Arthurian Resources Ltd.

APPENDIX I

Minfile References

APPENDIX I

KEN CLAIMS

LIST OF PUBLISHED REPORTS

ASSESSMENT REPORTS			
ASSESSMENT REPORT NUMBER	MINFILE NUMBER TO WHICH REPORT APPLIES	YEAR OF REPORT	TYPE OF WORK
	Prefix: 92H/NE		
AR 161		1957	Ground Magnetometry
AR 856		1966	Ground Magnetometry
AR 1850	175		Ground Magnetometry
AR 1910	005, 004		Soil Geochemistry
AR 2028		1969	Ground Magnetometry Ground EM
AR 2468	005	1970	Soil Geochemistry Ground Magnetometry Ground EM
AR 2581	175	1970	Ground EM
AR 3051	005, 004	1971	Geology
AR 3637		1972	Ground Magnetometry
AR 3686	175	1972	Ground Magnetometry
AR 3687	005,004,109	1972	Soil Geochemistry
AR 3758	079,080,083 081,084,109	1972	Soil Geochemistry Ground Magnetometry
AR 3787	172	1972	Induced Polarization
AR 3788		1972	Gravity
AR 3789	109	1972	Soil Geochemistry Ground Magnetometry Diamond Drilling (14 holes) Gravity Induced Polarization
AR 4078	004	1972	Line Cutting
AR 4079	005, 004	1972	Ground Magnetometry

ASSESSMENT REPORTS			
AR 4081	087, 089	1972	Soil Geochemistry Ground Magnetometry
AR 4082	087, 089		Ground Magnetometry
AR 4087		1972	Soil Geochemistry
AR 4089		1972	Soil Geochemistry
AR 4474		1973	Ground EM
AR 6215	109	1977	Percussion Drilling (2 holes)
AR 6302	087, 089	1976	Soil Geochemistry Ground EM
AR 6642	109	1977	Percussion Drilling (2 holes)
AR 6761	177	1978	Soil Geochemistry Ground EM
AR 6821	166	1978	Soil Geochemistry Ground EM
AR 7029	083,084,172	1978	Ground EM
AR 7050	079,080,081 084,172	1978	Ground EM Ground Magnetometry
AR 7654	084, 172	1979	Diamond Drilling (2 holes)
AR 7679	087, 089	1979	Soil Geochemistry
AR 8522		1980	Soil Geochemistry Ground Magnetometry
AR 9250		1980	Induced Polarization
AR 9251		1980	Induced Polarization
AR 14141		1985	Soil Geochemistry Geology Rock Sampling
DOCUMENTS OTHER THAN ASSESSMENT REPORTS			
EMR MRD Corp File (Payco Mining Ltd.) by S.F. Kelly	172	1963	Trenching Diamond Drilling (8 holes)
No Report Found (Mentioned in AR7654)	084, 172	1978	Diamond Drilling (14 holes)

APPENDIX II

Laboratory Methods

APPENDIX II

Laboratory Methods

The rock samples were shipped to Vangeochem Lab Limited, of Vancouver, B.C. The samples were crushed to less than 3/16 inch size, from which a 200 gram split was pulverized to 98% minus 120 mesh. A 0.50 gram sample was then subjected to a 250-element ICP (inductively coupled plasma) analytical technique, after digestion for one hour at 95° in 3:1:2-$HCL:HNO_3:H_2O$. In addition, gold contents were determined by MIBK extraction followed by atomic absorption analysis. The gold analyses used a 10 gram sample. It is important to note that for the ICP techniques the extraction process is only partial for several of the elements reported.

APPENDIX III

Laboratory Reports

VGC VANGEOCHEM LAB LIMITED

MAIN OFFICE
1630 PANDORA STREET
VANCOUVER, B.C.
V5L 1L6
TEL (604) 251-5656
FAX (604) 254-5717

BRANCH OFFICES
BATHURST, N.B.
RENO, NEVADA, U.S.A.

GEOCHEMICAL ANALYTICAL REPORT

CLIENT: MINEQUEST EXPL. ASSOCIATES LTD DATE: APR 07 1992
ADDRESS: 715 - 475 Howe Street
: Vancouver BC **REPORT#: 920029 GA**
: V6C 2B3 JOB#: 920029

PROJECT#: NONE GIVEN INVOICE#: 920029 NA
SAMPLES ARRIVED: APR 02 1992 TOTAL SAMPLES: 23
REPORT COMPLETED: APR 07 1992 SAMPLE TYPE: 23 ROCK
ANALYSED FOR: Au (FA/AAS) ICP REJECTS: SAVED

SAMPLES FROM: MR. A.W. GOURLAY
COPY SENT TO: MINEQUEST EXPLORATION ASSOCIATES LTD

PREPARED FOR: MR. A.W. GOURLAY

ANALYSED BY: Raymond Chan

SIGNED: _____

GENERAL REMARK: CLAIM CODE: AKN
RESULTS FAXED TO MR. A.W. GOURLAY @ 669-8577.
COPY SENT TO MR. G.W. VERNON.

VGC VANGEOCHEM LAB LIMITED

MAIN OFFICE
1630 PANDORA STREET
VANCOUVER, B.C.
V5L 1L6
TEL (604) 251-5656
FAX (604) 254-5717

BRANCH OFFICES
BATHURST, N.B.
RENO, NEVADA, U.S.A.

REPORT NUMBER: 920029 GA JOB NUMBER: 920029 **MINEQUEST EXPLORATION ASSOCIATES LTD** PAGE 1 OF 1

SAMPLE #	Au ppb
AKN 92001	20
AKN 92002	30
AKN 92003	nd
AKN 92004	10
AKN 92005	30
AKN 92006	nd
AKN 92007	nd
AKN 92008	nd
AKN 92009	nd
AKN 92010	nd
AKN 92011	nd
AKN 92012	20
AKN 92013	nd
AKN 92014	nd
AKN 92015	nd
AKN 92016	nd
AKN 92017	nd
AKN 92018	50
AKN 92019	20
AKN 92020	10
AKN 92021	20
AKN 92022	nd
AKN 92023	nd

DETECTION LIMIT 5

nd = none detected -- = not analysed is = insufficient sample

VGC VANGEOCHEM LAB LIMITED

MAIN OFFICE
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FAX (604) 254-5717

BRANCH OFFICES
BATHURST, N.B.
RENO, NEVADA, U.S.A.

ASSAY ANALYTICAL REPORT

CLIENT: MINEQUEST EXPL. ASSOCIATES LTD DATE: APR 07 1992
ADDRESS: 715 - 475 Howe Street
: Vancouver BC **REPORT#: 920029 AA**
: V6C 2B3 JOB#: 920029

PROJECT#: NONE GIVEN
SAMPLES ARRIVED: APR 02 1992
REPORT COMPLETED: APR 07 1992
ANALYSED FOR: Cu

INVOICE#: 920029 NA
TOTAL SAMPLES: 2
REJECTS/PULPS: 90 DAYS/1 YR
SAMPLE TYPE: 2 ROCK

SAMPLES FROM: MR. A.W. GOURLAY
COPY SENT TO: MINEQUEST EXPLORATION ASSOCIATES LTD

PREPARED FOR: MR. A.W. GOURLAY

ANALYSED BY: Raymond Chan

SIGNED: _____
Registered Provincial Assayer

GENERAL REMARK: CLAIM CODE: AKN
RESULTS FAXED TO MR. A.W. GOURLAY @ 669-8577.
COPY SENT TO MR. G.W. VERNON.

VGC VANGEOCHEM LAB LIMITED

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BRANCH OFFICES
BATHURST, N.B.
RENO, NEVADA, U.S.A.

REPORT NUMBER: 920029 AA JOB NUMBER: 920029 **MINEQUEST EXPL. ASSOCIATES LTD** PAGE 1 OF 1

SAMPLE #	Cu %
AKN 92010	0.04
AKN 92011	0.04

DETECTION LIMIT 0.01

1 Troy oz/short ton = 34.28 ppm 1 ppm = 0.0001 % ppm = parts per million < = less than

signed: _____

VGC VANGEOCHEM LAB LIMITED

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FAX (604) 254-5717

BRANCH OFFICES
BATHURST, N.B.
RENO, NEVADA, U.S.A.

ASSAY ANALYTICAL REPORT

CLIENT: MINEQUEST EXPL. ASSOCIATES LTD
ADDRESS: 715 - 475 Howe Street
: Vancouver BC
: V6C 2B3

DATE: APR 08 1992
REPORT#: 920029 AB
JOB#: 920029

PROJECT#: NONE GIVEN
SAMPLES ARRIVED: APR 02 1992
REPORT COMPLETED: APR 08 1992
ANALYSED FOR: Cu

INVOICE#: 920029 NA
TOTAL SAMPLES: 4
REJECTS/PULPS: 90 DAYS/1 YR
SAMPLE TYPE: 4 ROCK

SAMPLES FROM: MR. A.W. GOURLAY
COPY SENT TO: MINEQUEST EXPLORATION ASSOCIATES LTD

PREPARED FOR: MR. A.W. GOURLAY

ANALYSED BY: Raymond Chan

SIGNED: _____

Registered Provincial Assayer

GENERAL REMARK: CLAIM CODE: AKN
RESULTS FAXED TO MR. A.W. GOURLAY @ 669-8577.
COPY SENT TO MR. G.W. VERNON.

VGC VANGEOCHEM LAB LIMITED

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BRANCH OFFICES
BATHURST, N.B.
RENO, NEVADA, U.S.A.

REPORT NUMBER: 920020 AB JOB NUMBER: 920020 MINEQUEST EXPL. ASSOCIATES LTD

SAMPLE #	Cu %
AKN 92002	2.16
AKN 92004	2.81
AKN 92020	2.16
AKN 92021	2.68

DETECTION LIMIT 0.01

1 Troy oz/short ton = 34.28 ppm 1 ppm = 0.0001 % ppm = parts per million < = less than

signed: _____

VANGEOCHEM AB LIMITED

1630 Pandora Street, Vancouver, B.C. V5L 1L6
Ph:(604)251-5656 Fax:(604)254-5717

ICAP GEOCHEMICAL ANALYSIS

A .5 gram sample is digested with 5 ml of 3:1:2 HCL to HNO_3 to H_2O at 95 °C for 90 minutes and is diluted to 10 ml with water.
This leach is partial for Al, Ba, Ca, Cr, Fe, K, Mg, Mn, Na, P, Sn, Sr and W.

ANALYST:

REPORT #: 920029 PA MINEQUEST EXPL. ASSOC. LTD PROJECT: None Given DATE IN: APR 02 1992 DATE OUT: APR 07 1992 ATTENTION: MR. A.W. GOURLAY

Sample Name	Ag ppm	Al %	As ppm	*Au ppb	Ba ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	K %	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P %	Pb ppm	Sb ppm	Sn ppm	Sr ppm	U ppm	W ppm	Zn ppm
AKN 92001	1.5	2.99	29	20	88	<3	2.97	1.4	30	16	8272	4.79	1.01	1.44	596	<1	0.10	10	0.18	<2	<2	14	173	<5	<3	49
AKN 92002	14.3	3.78	<3	30	81	<3	4.23	1.0	46	13	>20000	5.42	0.77	1.75	1051	<1	0.08	3	0.21	<2	<2	<2	138	<5	<3	58
AKN 92003	0.7	3.34	<3	<5	81	<3	3.03	<0.1	36	15	5155	6.22	0.47	2.04	1449	<1	0.10	5	0.22	<2	2	3	91	<5	<3	110
AKN 92004	2.4	2.78	3	10	43	<3	2.68	<0.1	43	26	>20000	6.82	0.80	2.04	1080	<1	0.07	16	0.18	<2	<2	5	270	<5	<3	36
AKN 92005	0.2	4.40	<3	30	25	<3	6.50	<0.1	33	21	2306	6.13	0.66	1.55	1024	<1	0.09	1	0.20	<2	<2	<2	70	<5	<3	57
AKN 92006	0.2	4.37	<3	<5	32	<3	6.41	<0.1	33	16	400	5.59	0.43	1.53	1022	<1	0.10	<1	0.22	<2	2	<2	74	<5	<3	
AKN 92007	0.1	4.31	<3	<5	69	<3	5.95	<0.1	29	14	58	4.79	0.40	2.02	1523	<1	0.11	4	0.22	<2	4	<2	79	<5	<3	79
AKN 92008	0.1	4.41	<3	<5	61	<3	6.53	<0.1	32	15	56	5.97	0.59	1.57	1142	<1	0.10	4	0.23	<2	4	<2	65	<5	<3	63
AKN 92009	0.2	3.88	<3	<5	57	<3	5.54	<0.1	27	18	19	5.24	0.43	1.45	1118	<1	0.10	1	0.22	<2	5	<2	57	<5	<3	69
AKN 92010	0.2	3.97	<3	<5	76	<3	4.88	0.3	35	19	188	7.95	0.79	1.88	1743	<1	0.07	8	0.22	<2	<2	<2	52	<5	<3	95
AKN 92011	0.2	4.15	<3	<5	30	<3	5.47	<0.1	31	14	102	7.55	0.62	1.48	1575	<1	0.07	9	0.24	<2	<2	<2	35	<5	<3	82
AKN 92012	1.2	1.88	<3	20	20	<3	>10	<0.1	24	44	10542	2.84	0.10	0.70	799	<1	0.08	30	0.17	<2	5	<2	877	<5	<3	18
AKN 92013	0.2	3.52	<3	<5	58	<3	3.86	<0.1	39	15	599	6.30	0.16	2.55	1167	<1	0.09	8	0.22	<2	5	10	236	<5	<3	78
AKN 92014	0.4	3.38	<3	<5	63	<3	3.75	<0.1	33	9	1151	5.45	0.61	2.19	1217	<1	0.11	6	0.23	<2	3	<2	152	<5	<3	74
AKN 92015	0.5	2.85	<3	<5	76	<3	3.84	<0.1	29	26	5894	4.44	0.44	1.91	831	<1	0.10	6	0.17	<2	5	<2	317	<5	<3	58
AKN 92016	0.5	2.99	<3	<5	60	<3	3.62	<0.1	32	26	6658	5.38	0.52	2.03	937	<1	0.11	6	0.19	<2	3	<2	208	<5	<3	63
AKN 92017	0.1	3.10	<3	<5	69	<3	3.99	0.6	35	11	416	6.22	0.72	1.91	933	<1	0.09	4	0.24	<2	<2	2	154	<5	<3	56
AKN 92018	7.1	3.64	10	50	133	<3	3.98	0.5	42	55	18806	6.55	0.59	2.38	1312	<1	0.07	21	0.18	<2	<2	8	280	<5	<3	64
AKN 92019	2.4	3.79	<3	20	239	<3	2.89	0.3	40	38	6411	6.82	0.72	2.49	816	<1	0.11	16	0.20	<2	<2	8	231	<5	<3	53
AKN 92020	3.2	4.39	45	10	373	<3	5.50	<0.1	41	56	>20000	6.69	0.76	2.39	1468	<1	0.07	18	0.21	<2	<2	2	193	<5	<3	48
AKN 92021	3.2	3.64	35	20	119	<3	4.07	<0.1	41	56	>20000	6.10	0.65	2.32	1290	<1	0.10	54	0.19	<2	<2	12	205	<5	<3	55
AKN 92022	0.2	3.83	8	<5	85	<3	4.81	<0.1	48	10	1978	9.89	0.91	2.27	2312	<1	0.07	8	0.21	<2	<2	5	88	<5	<3	123
AKN 92023	0.3	3.93	18	<5	55	<3	2.38	0.7	47	6	515	>10	0.97	3.66	2344	<1	0.06	7	0.19	7	<2	7	265	<5	<3	140
Minimum Detection	0.1	0.01	3	5	1	3	0.01	0.1	1	1	1	0.01	0.01	0.01	1	1	0.01	1	0.01	2	2	2	1	5	3	
Maximum Detection	50.0	10.00	2000	10000	1000	1000	10.00	1000.0	20000	1000	20000	10.00	10.00	10.00	20000	1000	10.00	20000	10.00	20000	2000	1000	10000	100	1000	20000

< - Less Than Minimum > - Greater Than Maximum is - Insufficient Sample ns - No Sample *Au Analysis Done By Fire Assay Concentration / AAS Finish.

VGC VANGEOCHEM LAB LIMITED

MAIN OFFICE
1630 PANDORA STREET
VANCOUVER, B.C.
V5L 1L6
TEL (604) 251-5656
FAX (604) 254-5717

BRANCH OFFICES
BATHURST, N.B.
RENO, NEVADA, U.S.A.

GEOCHEMICAL ANALYTICAL REPORT

CLIENT: MINEQUEST EXPL. ASSOCIATES LTD. DATE: APR 28 1992
ADDRESS: 715 - 475 Howe Street
: Vancouver BC REPORT#: 920035 GA
: V6C 2B3 JOB#: 920035

PROJECT#: NONE GIVEN INVOICE#: 920035 NA
SAMPLES ARRIVED: APR 27 1992 TOTAL SAMPLES: 15
REPORT COMPLETED: APR 28 1992 SAMPLE TYPE: 15 ROCK
ANALYSED FOR: Au (FA/AAS) ICP REJECTS: SAVED

SAMPLES FROM: MR. ANDREW W. GOURLAY
COPY SENT TO: MR. ROBERT V. LONGE & MR. GEORGE W. VERNON

PREPARED FOR: MR. ANDREW W. GOURLAY

ANALYSED BY: Raymond Chan

SIGNED: _____

GENERAL REMARK: CLAIM CODE: AKN
RESULTS FAXED TO MR. A.W. GOURLAY @ 669-8577.

VGC VANGEOCHEM LAB LIMITED

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BRANCH OFFICES
BATHURST, N.B.
RENO, NEVADA, U.S.A.

REPORT NUMBER: 920035 GA JOB NUMBER: 920035 MINEQUEST EXPL. ASSOCIATES LTD.

SAMPLE #	Au ppb
AKN 92025	10
AKN 92026	10
AKN 92027	30
AKN 92028	10
AKN 92029	nd
AKN 92030	nd
AKN 92031	nd
AKN 92032	nd
AKN 92033	nd
AKN 92034	nd
AKN 92035	nd
AKN 92036	nd
AKN 92037	nd
AKN 92038	10
AKN 92039	nd

DETECTION LIMIT 5

nd = none detected -- = not analysed ls = insufficient sample

VANGEOCHE. LAB LIMITED
1630 Pandora Street, Vancouver, B.C. V5L 1L6
Ph:(604)251-5656 Fax:(604)254-5717

ICAP GEOCHEMICAL ANALYSIS

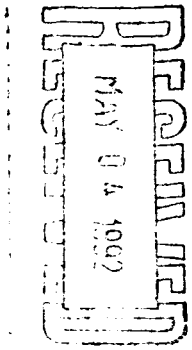
A .5 gram sample is digested with 5 ml of 3:1:2 HCL to HNO_3 to H_2O at 95 °C for 90 minutes and is diluted to 10 ml with water.
This leach is partial for Al, Ba, Ca, Cr, Fe, K, Mg, Mn, Na, P, Sn, Sr and W.

ANALYST:

REPORT #: 920035 PA | MINEQUEST EXPL. ASSOCIATES LTD. | PROJECT: None Given | DATE IN: APR 27 1992 | DATE OUT: APR 29 1992 | ATTENTION: MR. ANDREW W. GOURLAY | PAGE 1 OF 1

Sample Name	Ag	Al	As	*Au	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Mo	Na	Ni	P	Pb	Sb	Sn	Sr	U	W	Zn
	ppm	%	ppm	ppb	ppm	ppm	%	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm
AKN 92025	<0.1	2.51	24	10	96	<3	2.54	2.5	30	24	126	5.28	0.99	1.56	1355	21	0.02	12	0.18	<2	4	23	46	<5	<3	110
AKN 92026	<0.1	3.35	6	10	77	<3	3.91	0.4	34	24	135	6.21	0.86	2.09	1526	27	0.05	11	0.20	<2	4	19	49	<5	<3	146
AKN 92027	5.8	2.89	4	30	69	<3	4.17	0.2	25	23	18565	3.35	0.58	1.16	854	21	0.05	9	0.17	<2	4	12	365	<5	<3	51
AKN 92028	<0.1	3.74	16	10	72	<3	5.05	0.2	31	14	642	5.11	0.62	1.89	1319	26	0.04	7	0.20	<2	<2	18	153	<5	<3	102
AKN 92029	0.1	3.27	8	<5	337	<3	3.52	2.8	35	23	690	6.01	0.85	1.63	1171	24	0.05	12	0.20	<2	<2	17	85	<5	<3	99
AKN 92030	<0.1	3.80	<3	<5	48	<3	5.13	1.0	30	21	86	4.48	0.62	1.55	979	25	0.04	9	0.16	<2	2	13	308	<5	<3	68
AKN 92031	<0.1	3.51	6	<5	84	<3	1.24	0.9	37	11	167	>10	1.13	2.20	851	34	0.02	12	0.18	<2	<2	17	59	<5	<3	93
AKN 92032	0.3	3.01	<3	<5	299	<3	2.56	1.0	43	11	7171	6.26	0.92	1.79	885	24	0.05	8	0.19	<2	<2	6	85	<5	<3	63
AKN 92033	0.2	3.40	9	<5	132	<3	1.68	0.2	41	52	741	8.34	0.95	2.32	1326	30	0.11	5	0.19	<2	<2	16	119	<5	<3	76
AKN 92034	0.6	3.06	<3	<5	137	<3	4.12	0.5	36	23	10391	5.78	0.81	1.77	1515	26	0.05	14	0.19	<2	<2	17	201	<5	<3	69
AKN 92035	<0.1	3.36	21	<5	105	<3	3.24	0.1	36	42	457	6.56	0.80	1.95	1718	26	0.03	10	0.20	<2	<2	17	71	<5	<3	128
AKN 92036	<0.1	3.53	12	<5	96	<3	4.16	<0.1	33	19	150	6.16	0.76	2.05	1615	28	0.04	10	0.19	<2	<2	13	46	<5	<3	114
AKN 92037	<0.1	3.14	12	<5	63	7	3.92	1.1	33	69	111	7.03	0.78	1.44	1185	25	0.03	15	0.20	<2	3	10	110	<5	<3	95
AKN 92038	<0.1	3.03	11	10	70	<3	4.12	<0.1	26	21	25	4.47	0.64	1.70	1361	23	0.05	10	0.21	<2	4	11	121	<5	<3	67
AKN 92039	<0.1	3.66	9	<5	44	<3	5.98	0.2	28	83	15	4.46	0.60	1.40	1285	25	0.04	3	0.21	<2	<2	6	73	<5	<3	73
Minimum Detection	0.1	0.01	3	5	1	3	0.01	0.1	1	1	1	0.01	0.01	0.01	1	1	0.01	1	0.01	2	2	2	1	5	3	1
Maximum Detection	50.0	10.00	2000	10000	1000	1000	10.00	1000.0	20000	1000	20000	10.00	10.00	10.00	20000	1000	10.00	20000	10.00	20000	2000	1000	10000	100	1000	20000

< - Less Than Minimum > - Greater Than Maximum is - Insufficient Sample ns - No Sample *Au Analysis Done By Fire Assay Concentration / AAS Finish.



APPENDIX IV

Thin Section Descriptions

PETROGRAPHIC REPORT ON TWELVE SAMPLES OF FINE-GRAINED AND FRAGMENTAL NICOLA VOLCANIC ROCKS

Report for:
Andrew Gourlais
MineQuest Exploration Associates Ltd.
Suite 715 - 475 Howe Street
Vancouver, B.C.
V6C 2B3.

Invoice attached
P.O. # 1-102

April 20, 1992.

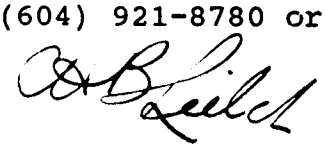
SUMMARY:

Most of the rocks in this suite are remarkably similar in appearance, being fine-grained, even-textured, pale greenish grey volcanics that have undergone propylitic alteration to an assemblage of albite-epidote-actinolite-chlorite ± minor sericite, carbonate and K-feldspar (+prehnite at Q showing). Most contain significant magnetite, largely oxidized to specular and earthy hematite. Sulphides are rare (traces of chalcocite in AKN009 and 018, significant chalcocite-covellite in 019; traces of chalcopyrite and pyrrhotite in Cincinatti #2). The association of strong epidote-actinolite alteration with copper mineralization in 019 suggests the alteration assemblage is not due merely to greenschist facies metamorphism.

The rocks were formerly composed of phenocrysts of plagioclase (possibly mainly andesine to start, variably altered to albite) and clinopyroxene (?augite), plus rare megacrysts of hornblende, and trace biotite, in a mainly phaneritic to seriate-textured groundmass of plagioclase and chlorite after mafics. Compositions are probably basaltic or basaltic andesite; textures are mainly suggestive of fine-grained high-level intrusives such as dykes or sills, although clasts are vaguely seen in places suggesting lahars or other fragmental volcanics. Only 018 is clearly fragmental at hand specimen scale. Samples 005-009 are distinguished by their unusual content of a coarse quartz matrix and apatite megacrysts, making them ?quartz andesites. Sample 010 is coarser than the rest, suggesting an augite diorite that could form a high-level stock.

Similar alteration (epidote-actinolite-albite-chlorite, with traces of sericite, K-feldspar and occasional prehnite) is seen at the Island Copper "oceanic island arc" porphyry deposit on Vancouver Island and prospects near it. However, although magnetite is common at Island Copper, it is hydrothermal rather than magmatic, as it appears to be in this suite, and sulfides (chalcopyrite rather than chalcocite) are also common at Island Copper.

Craig H.B. Leitch, Ph.D, P.Eng
(604) 921-8780 or 666-4902



AKN92001W: HORNBLENDE MEGACRYSTIC, FINE-GRAINED AUGITE DIORITE CLASTS IN HEMATITIC ANDESITIC VOLCANIC MATRIXW

Magnetic, possibly fragmental volcanic rock composed of pale greenish clasts to several cm diameter in a purplish (hematitic) matrix. Clasts are richer in feldspar, both plagioclase laths and (yellow stained) K-feldspar. In fact, the texture of the clasts is coarse enough to suggest they may be fragments of a high-level intrusive. Mineralogy in polished thin section is approximately:

Plagioclase (albitized)	50%
Clinopyroxene (?augite)	15%
Amphibole (?hornblende)	10%
Sericite (after plagioclase)	10%
?K-feldspar	5%
Chlorite	5%
Opaque	5%
Apatite	<1%

Plagioclase forms eu- to subhedral laths up to 1.8 mm long that display only occasional twinning and no compositional zoning (suggesting the grains are altered). All grains are moderately sericitized. Extinction angles Y^010 are 14° indicating albitic compostion about An_5 (or possibly An_{30} if indices were greater than quartz). There is no quartz in this rock to compare the refractive indices with, but the alteration of the plagioclase suggests it is albitized. K-feldspar is not distinguishable in thin section; the mild yellow stain in hand sample may be due to fine K-spar interstitial to plagioclase and very close in refractive index to the albite, or the stain may be due to potassium in sericite after plagioclase.

Mafic minerals include small eu- to subhedral crystals of clinopyroxene up to 1.5 mm diameter with extinction angle about 42°, (+) 2V about 60° suggesting augite. The grains are mostly interstitial to plagioclase but take the form of small phenocrysts; they are altered at margins and along fractures to amphibole and chlorite. There are also very large ragged but euhedral amphibole megacrysts to 6 mm long with dark green pleochroism and extinction angle about 15°, probably hornblende. Chlorite forms subhedral flakes to 0.05 mm and has anomalous birefringence, indicating Fe-rich composition. Opaques are mainly euhedral crystals of maghemite (magnetic hematite) to 0.5 mm, accompanied in places by flakes of hematite to 0.1 mm; no sulfides are present, and no copper minerals are seen. Fine hematite is common in the siliceous matrix of the volcanic hosting plagioclase, amphibole and augite phenocrysts as well as the high-level intrusive clasts. Rare euhedral apatite to 0.2 mm long is found.

The composition of both clasts and volcanic host is similar, suggesting originally andesitic or basaltic augite andesite that has included fragments of hornblende megacrystic augite diorite; alteration is to weak sericite and chlorite but has altered the plagioclase composition to albite.

AKN92005W: CROWDED QUARTZ-ANDESINE-AUGITE BASALTIC PORPHYRY FLOW (?CLASTS IN LAHAR) ALTERED TO EPIDOTE-ACTINOLITE

Medium green, fine-grained volcanic rock with purple hematitic matrix between altered plagioclase and mafic crystals. Described as lahar in field notes with trace malachite on fractures; only suggestion of clasts in hand sample is 3-4 cm diameter areas that do not stain for K-spar, set in or rimmed by narrow areas that stain yellow. Rock is slightly magnetic and does not react to cold dilute HCl. In polished thin section, modal mineralogy is roughly:

Plagioclase (andesine)	35%
Quartz (primary?)	15%
Clinopyroxene (?augite)	10%
Amphibole (secondary, actinolite)	10%
Epidote	10%
Matrix (siliceous, hematitic)	10%
Hematite	5%
Chlorite	3%
Sericite (after plagioclase)	2%

Plagioclase occurs as euhedral phenocrysts to 1 mm long that show twinning and mild zoning, suggesting the andesine composition (X^001=20°, relief negligible against quartz) is orginal. Lack of sericitization supports this. Cores are about An_{46}, rims about An_{40}. There is very minor flecking by fine sericite and amphibole.

Mafic minerals are mainly clinopyroxene, forming euhedral crystals rarely to 2 mm diameter but generally <0.5 mm. Extinction angle about 45° and lack of colour suggests augite. They are partly to completely altered to Fe-rich epidote (bright yellow pleochroism) and actinolite (bright green pleochroism). Epidote forms sub- to euhedral crystals up to 0.3 mm long; actinolite euhedral needles to 0.1 mm, in aggregates to 0.5 mm.

Quartz is abundant in this sample, as large anhedral grains to 1 mm across interstitial to plagioclase and augite crystals. It does not look secondary, and is penetrated along margins by fine needles of actinolite.

About 10-15% of the rock consists of a fine hematitic siliceous matrix that is too fine-grained and altered to determine the composition of accurately. Hematite forms sub-to euhedral grains up to 0.5 mm across composed of laths and flakes to 0.3 mm intergrown with silicates. These probably represent the alteration of former ?magnetite and ilmenite grains. Very fine (<5 μm) grains are also found as a reddish stain in the matrix of the rock.

The composition of the slide is uniform; there is no suggestion of a matrix to lahar clasts on the scale of a thin section. The rock appears to be a fine, but phenocryst-rich andesine-augite porphyritic flow rock of probable basaltic composition, although these could be clasts in a lahar. The quartz looks primary, suggesting an unusual composition. It is crossed by a thin quartz-epidote veinlet, suggesting the propylitic epidote-actinolite alteration is hydrothermal, although there are no sulfides.

AKN92006W: QUARTZ-RICH, APATITE MEGACRYSTIC, EPIDOTE-ACTINOLITE ALTERED ?ANDESITIC HIGH LEVEL INTRUSIVE

Light grey-green, fine-grained ?volcanic rock characterized by greenish areas, possibly clasts, to several cm diameter in a ?matrix that is more purplish. Described in field notes as selected grab, quartz veinlets and sulfides, but these are not seen in hand sample. No stain for K-feldspar; not magnetic. In polished thin section, the composition is similar to 005W:

Plagioclase (oligoclase-andesine)	40%
Quartz (?primary)	20%
Secondary amphibole (tremolite-actinolite)	15%
Clinopyroxene (?augite)	10%
Epidote (after pyroxene)	5%
Hematite	5%
Apatite	2%
Clay (after plagioclase)	2%
Sphene	1%

As in 005W, plagioclase forms euhedral laths to 0.8 mm long with extinction angles Y^010 of 10-14° and relief negligible against quartz indicating oligoclase-andesine, about An_{27-32} with slight zoning highlited by zones replaced by amphibole and in places clay.

Clinopyroxene phenocrysts are generally smaller, less than 0.5 mm, and found between the plagioclase. They ar similar to the ?augite found in 005W, and are similarly altered to epidote and secondary amphibole. The epidote is Fe-rich (bright yellow pleochroism), but the amphibole lacks the green colour and is Fe-poor tremolite-actinolite. In places the amphibole completely replaces the mafic minerals and quartz (as incipiently seen in 005W), leading to the appearance of a volcanic rock with fine groundmass hosting plagioclase crystals, but gradations to the unaltered rock show this is not the case.

Quartz forms anhedral grains hosting the plagioclase, and is variably (to completely) altered by fine amphibole. Megacrysts of apatite to 1 mm diameter are present, as well as finer grains. Neither quartz nor apatite appear to be secondary.

In reflected light, only hematite is visible as abundant euhedral-outlined 0.25 mm aggregates of 0.1 mm flakes. Cores to some grains may be subhedral 0.05 mm sphene, suggesting both original magnetite and ilmentite have been oxidized to hematite. Most of the hematite is probably hypogene.

Although there is a suggestion in this rock of clasts that are holocrystalline, and areas that are distinctly different in texture, in thin section it appears that the latter are merely more altered equivalents of the former. The rock thus appears to be a fine-grained, high-level intrusive of most unusual (quartz and apatite-rich) augite andesitic composition, propylitically altered to tremolite-actinolite and epidote.

AKN009N: STRONGLY EPIDOTE-AMPHIBOLE ALTERED ?HIGH-LEVEL QUARTZ RICH CLINOPYROXENE ANDESITE SIMILAR TO 005/6

Light grey-green, finely porphyritic rock lacking visible fragmental texture. Rock is not magnetic, but shows weak yellow stain for K-feldspar. Described in field notes as "Green Altered" lahar, 2-3% sulfides but in polished thin section only hematite is present. Mineralogy is roughly:

Epidote	35%
Plagioclase (oligoclase-andesine)	30%
Amphibole (tremolite-actinolite)	15%
Quartz (relict primary)	10%
Hematite	5%
K-feldspar (?)	2%
Sericite	2%
Apatite	1%
Chalcocite (?)	<1%

Plagioclase occurs as relict euhedral crystals up to 1.3 mm long that are largely altered to epidote and minor amphibole ± traces of ?sericite. Twinning and zoning in these crystals indicates oligoclase-andesine compositions about An_{30} based on extinction angles Y^010 of about 15° is original or only slightly decalcified. As in 005 and 6, concentric zones are defined by alteration to fine-grained epidote and amphibole. In some grains, coarse epidote to 0.5 mm replaces most of the plagioclase crystal.

Mafic crystals are completely replaced in this sample by epidote and lesser amphibole; they were probably originally 0.5 mm clinopyroxene. Epidote forms sub- to anhedral grains lacking strong pleochroism, indicating moderate Fe contents. Secondary amphibole is much less abundant and virtually colourless, indicating low Fe content; it forms euhedral needles to 0.05 mm long.

Quartz is only rarely seen as anhedral interstitial grains to 0.5 mm across; most is presumably completely replaced by secondary amphibole and epidote. It is not clear in thin section that there is any K-feldspar, as indicated by staining tests; if so, it is minor, fine-grained, and in the matrix between alterd plagioclase and mafic grains.

Opaque minerals are basically hematite, as described for 005 and 006. Some grains appear isotropic and thus could be chalcocite (if this sample assays significantly for copper), although they also could be basal sections of hematite. The latter would be my guess. Apatite is found as small euhedral grains to 0.2 mm long with hematite staining.

This rock is similar to 005 and 006 but more altered: it consists of the same euehdral plagioclase, clinopyroxene and minor apatite set in a matrix of quartz, with quartz and mafics, and in places plagioclase, largely altered to epidote and amphibole. There is no evidence in thin section to suggest a lahar; it appears to have been a high-level intrusive (or thick flow) of unusual quartz- and apatite-rich andesite or diorite composition.

AKN010W: CARBONATE-CHLORITE-AMPHIBOLE-EPIDOTE ALTERED, HIGH-LEVEL ?AUGITE DIORITE

Dark grey-green, distinctly coarser-grained ?high-level intrusive rock characterized by 1-2 mm dark mafic crystals and scattered magnetite; rock is strongly magnetic and shows no stain for K-feldspar, but does react to cold dilute HCl after powdering. Vaguely fragmental character weakly developed. Field notes list it as ?diorite, very fine-grained, trace native Cu. In the polished thin section, modal mineralogy is:

Plagioclase (oligoclase-andesine)	35%
Clinopyroxene (?augite)	25%
Chlorite	15%
Secondary amphibole (?tremolite-actinolite)	10%
Carbonate (?dolomite)	5%
Magnetite	5%
Epidote (?zoisite)	3%
Sericite	2%
Apatite	tr

In thin section, this rock is composed principally of pyroxene crystals set in a plagioclase matrix (where least altered). Plagioclase forms subhedral grains about 0.5 mm long that interlock. They are twinned with extinction angles Y^010 of 10-14° indicating oligoclase-andesine compositions about An_{27-31}. There is minor flecking by carbonate, ?amphibole, and traces of sericite.

Clinopyroxene forms euhedral crystals or aggregate grains up to 2 mm long. Most show incipient alteration along fractures and at margins to green needles of amphibole and greenish-browm mats of fine scaley chlorite/ hydrobiotite. The pyroxene is colourless, with extinction angle about 42°; it is probably augite. The amphibole could be actinolite; it forms grains to 0.1 mm long. Chlorite mostly shows pale green colour and bright blue anomalous birefringence, suggesting an Fe-rich variety; a finer, scaley brownish variety is also present. However, the brown colour may be due to limonite staining, since it appears to spread out from fractures. Fine euhedral grains to 0.05 mm long with anomalous birefringence, distinct from the chlorite by lacking green colour, may be Fe-poor epidote (zoisite or clinozoisite).

Patches of carbonate up to 0.5 mm across, composed of anhedral ragged grains to 0.2 mm diameter, may be dolomite after former mafic minerals; some may also replace plagioclase. In reflected light, subhedral to euhedral grains of magnetite show minor alteration at their margins to 0.1 mm flakes of hematite, or contain inclusions of ?maghemite to 0.2 mm long.

The vaguely fragmental texture is derived by shearing and alteration leading to areas with a finer, secondary matrix mainly of amphibole and epidote. The original ?diorite consisted of interlocking plagioclase laths hosting euhedral clinopyroxene and magnetite; quartz as seen in 005-009 is absent, and apatite is rare.

AKN014W: EPIDOTE-?ACTINOLITE-ALBITE ALTERED HIGH-LEVEL DIORITE OR CROWDED PORPHYRY (MINOR K-SPAR FRACTURES)

Light green, fine-grained ?volcanic rock cut by fracture network that takes a mild yellow stain. Field notes list malachite and 1-2% disseminated pyrite but neither is visible in hand sample. Rock is not magnetic. In polished thin section, the modal mineralogy is:

Plagioclase (albite)	50%
Epidote	20%
Secondary ?amphibole	20%
Hematite	7%
K-feldspar (secondary)	2%
Chlorite	1%
Sphene	<1%

Plagioclase is abundant, forming ragged altered subhedral to anhedral grains and composites up to 0.75 mm long. Most are twinned, with Y^010 up to 15° indicating albite, An_0 but this is not likely an original composition; it is probably due to propylitic alteration. Most grains are also 10-30% altered to grains of a pale green secondary mineral too fine (25 μm) to identify with certainty: it could be chlorite or amphibole (actinolite) as seen in other specimens. I favour the latter: a tendency to prismatic grains and fibrous nature is suggestive, although the birefringence is low.

Epidote is also abundant, forming the irregular veinlets and fractures cutting this rock and as scattered masses up to 0.3 mm across, located along microfractures. Moderate yellow pleochroism suggests moderate Fe content. In a few veinlets, which are up to 0.2 mm thick, there are minor quantities of sub- to anhedral ?K-feldspar up to 0.2 mm long alternating with epidote. Some grains display grid twinning of microcline; others are clear and may be quartz. Note that there are no sulfides with this veining, and they cut hematite crystals.

Hematite forms sub- to euhedral grains up to 0.5 mm diameter, possibly mainly after former magnetite; minor sphene mixed with some grains suggests ilmenitemay also have been present. Rare chlorite is seen interstitial to the plagioclase; it has blue anomalous birefringence. Apatite forms stubby prismatic crystals up to 0.2 mm long.

There is no dicernible groundmass to the crowded plagioclase crystals; I suspect former clinopyroxene has gone to epidote, and that this originally was a fine high-level intrusive (dioritic to basaltic dyke or sill?) before extensive albite-epidote-?actinolite-chlorite alteration and veining by epidote±K-feldspar and ?quartz. Most of the opaque grains are strongly anisotropic and have bright red internal reflections on thin edges, suggesting if chaclcite is present it is minor. A few rare grains of malachite to 0.05 mm are present. In some grains specular hematite is set in a matrix of earthy hematite, probably due to supergene oxidation. There is no suggestion of fragmental nature.

AKN92018W: FRAGMENTAL OF ALBITE-EPIDOTE-ACTINOLITE-CHLORITE-CARBONATE ALTERED PYROXENE PORPHYRITIC ?BASALTIC FLOW CLASTS

This is a strongly fragmental volcanic rock, containing a wide variety of clasts ranging from brick-red (hematized) to green (propylitic altered). A few clasts display yellow stain for K-feldspar. Clasts range up to about 2 cm across and are subrounded; the rock is moderately magnetic but does not react to cold dilute HCl even when powdered. Modal mineralogy is approximately:

Plagioclase (?albitized)	30%
Clinopyroxene (?augite)	20%
Epidote	15%
Amphibole (?actinolite)	10%
Chlorite	5%
Carbonate (?ankerite)	5%
Biotite (?secondary)	5%
Hematite (specular and earthy)	5%
Sericite	3%
Magnetite	2%
Chalcocite (?)	<1%

Clasts are composed of crowded 1.5 mm euhedral clinopyroxene and plagioclasse phenocrysts in a seriate matrix of the same minerals. Clasts are less altered than the matrix containing them, which consists largely of plagioclase and pyroxene shards altered to epidote, chlorite, and amphibole.

Plagioclase crystals show traces of zoning, with small extinction angles to 10° suggesting oligoclase, An_{25} or albite, An_{10}. The altered nature of the feldspar (flecked by fine sericite and sieved by fine ?amphibole) suggests albite is more likely (no quartz present to compare refractive indices with). Clinopyroxene are either fresh, with minor magmatic zoning, or altered to epidote, minor carbonate and rare biotite. In some areas of the matrix, pyroxene is replaced by 30 μm scaley chlorite.

Epidote forms subhedral crystals up to 0.5 mm across with strong yellow pleochroism (moderate Fe content) that replace former pyroxene. The secondary amphibole has distinct green pleochroism and forms fine prisms or fibres up to 0.1 mm long with anomalous blue-green birefringence (extinction masked by colour and angle difficult to determine). It is likely actinolite. Although some bent and crinkled biotite flakes are subhedral and up to 0.5 mm across, suggesting they are primary, most are very fine (50 μm) and appear secondary. They may not be hydrothermal, though (possibly late magmatic).

Opaques comprise large eu- to subhedral grains of magnetite up to 1.5 mm diameter that are strongly fractured, as well as abundant finer (to 0.8 mm) subhedral to rounded compositoe grains of specular hematite. Earthy hematite is common disseminated in silicate grains. Rare anhedral 0.9 mm long grains with bluish colour may be chalcocite (no anisotropism seen, possibly due to overpolishing). Blades of specular hematite are intergrown with the ?chalcocite, and earthy hematite surrounds it.

AKN92019W: ALBITE-EPIDOTE-CHLORITE-SERICITE ALTERED BASALTIC ?FRAGMENTAL WITH CHALCOCITE-COVELLITE AND MINOR MALACHITE

Light green, strongly epidote altered ?volcanic rock with traces of malachite. Fragments subrounded, to 1 cm, of variety of rocks including diorite like 10W. No stain evident for K-feldspar; slightly magnetic. Mineralogy in polished thin section is:

Plagioclase (?albite)	35%
Epidote	25%
Chlorite	25%
Sericite (after plagioclase)	10%
Hematite (earthy; rare specular)	2%
Magnetite	1%
Covellite, chalcocite	1%
Malachite	<1%

Plagioclase laths are euhedral and up to 1 mm long; they are moderately flecked by fine sericite. Extinction angles Y^010 of 15°, Z^001 of 10° suggest albite about An_5.

There is no clinopyroxene evident; apparently it has all been altered to secondary minerals, including epidote, chlorite and opaques. Minor brown spots could be biotite or Fe-stained chlorite. Chlorite has strong blue anomalous birefringence and is likely Fe-rich; it forms subhedral flakes to 0.1 mm in aggregates up to 1 mm across. There is another bright green secondary mineral with birefringence too high to be chlorite; it may be amphibole, or possibly epidote mixed intimately with chlorite. This green mineral tends to form rims around massive epidote-opaque rich areas that are up to 7 mm across.

Opaques are rounded subhedral magnetite grains to 0.5 mm diameter, and finer, anhedral to subhedral hematite, chalcocite and minor covellite. Chalcocite grains are up to 0.2 mm across, rimmed in places by 10-20 μm flakes of covellite. Copper mineralization is clearly associated with epidote alteration; parts of this sample are rich in copper. Magnetite in this sample appears to be primary.

The matrix to plagioclase shards and occasional recognizable volcanic clasts is largely altered to chlorite as fine flakes to 25 μm diameter, mixed with opaques (hematite and sphene after former ?magnetite and ilmenite).

This is a strongly epidote-albite-chlorite altered sample with significant related copper mineralization. It may have originally been a fragmental volcanic rock of basaltic composition.

Cincinnati #1: MILDLY ALBITE-CHLORITE-SERICITE-ACTINOLITE-EPIDOTE ALTERED FRAGMENTAL BASALTIC VOLCANIC

Dark grey-green fragmental volcanic rock consisting of about 40-50% subangular lighter-coloured fragments to 1.5 cm diameter in a dark fine-grained matrix. The rock is strongly magnetic; fragments show a pale yellow stain for K-feldspar. Modal mineralogy in polished thin section is:

Plagioclase (?andesine)	45%
Clinopyroxene (?augite and salite)	15%
Magnetite (variably oxidized to hematite)	10%
Sericite	10%
Chlorite	10%
Secondary amphibole (?actinolite)	5%
Epidote	3%
Carbonate	2%

Plagioclase occurs as abundant euhedral (in places broken) crystals up to 1.7 mm long. Most are mildly to moderately flecked by fine sericite flakes, making determination of composition difficult. However, extinction angles of Y^010 up to 20°, X^010 5° suggest andesine about An_{40}. In veiw of the altered appearance of the grains this is not entirely supportable; possibly some cores of crystals retain a primary An40 signature which would fit with the abundance of clinopyroxene, while rims are mainly albitized. Potassium in sericite probably accounts for weak yellow stain

Clinopyroxene forms small euhedral crystals generally 0.5 mm long but rarely to 1.5 mm that are either clear (?augite) or moderately brownish-green (salite). Alternately, the brown colour, which is most comnom at margins, could be caused by incipient alteration of part of the crystals. Both types have extinction angles of about 43°, are closely associated with small grains of opaque, and are mildly altered to secondary amphibole, chlorite and minor epidote. Amphibole forms minute prisms to 50 μm long with bright green pleochroism; this alteration could be late magmatic. Chlorite is pale green, with moderate Fe content indicated by anomalous birefringence, and forms fine sub- to anhedral flakes to 25 μm diameter; epidote shows moderate to weak yellow pleochroism and forms anhedral grains to 50 μm.

Clasts and matrix have very similar characteristics; clasts are crowded, with seriate-textured to almost holo-crystalline phenocrysts in 10-15% fine groundmass, whereas matrix contains similar crystals in 40% dark, opaque- and chlorite-rich groundmass. Rare carbonate occurs as thin veinlets to 0.1 mm thick and scattered anhedral grains to 0.25 mm diameter' there is not enough present to determine if it is calcite or dolomite/ankerite. Opaques are mainly sub- to euhedral magnetite crystals to 0.75 mm diameter, variably altered to flakes of specular hematite and rims of earthy hematite (nore noticeable in the clasts). Minor 100 μm sphene is associated with opaque grains, but only rare traces of chalccite/covellite to 20 μm, in magnetite, are seen. This rock was a fragmental volcanic of ?basaltic composition before propylitic alteration.

Cincinnati #2: MILDLY SERICITE-CHLORITE-EPIDOTE ALTERED AUGITE-ANDESINE PHYRIC ?BASALTIC SILL OR DYKE ROCK

Fine, even-grained, relatively homogeneous plagioclase-phyric ?flow or high-level intrusive; texture unaffected by alteration. Slightly magnetic, no yellow stain for K-feldspar. Modal mineralogy in polished thin section is:

Plagioclase (andesine)	50%
Clinopyroxene (?augite)	15%
Chlorite	15%
Sericite (after plagioclase)	10%
Martite (hematite after ?magnetite)	5%
Epidote	2%
Sphene, leucoxene	2%
Apatite	<1%
Chalcopyrite, pyrrhotite	tr
Malachite(?)	tr

Plagioclase forms euhedral laths up to 1.5 mm long with traces of concentric zoning outlined by alteration to sericite. Cores of crystals are mainly affected, with narrow clear rims less so. Extinction angles X^010 of 11° for the core to -1° for the rim suggest mainly andesine compositions (An_{45} cores to An_{25} rims).

Clinopyroxene crystals are euhedral and up to 1 mm long, with extinction angle close to 45°, possibly augite. The crystals are generally clear but with brown colouration (?uralite - a secondary amphibole) at rims and along fractures. Margins outboard of the brown areas are altered to chlorite as fine pale green flakes to 25 μm diameter with blue anamalous birefringence suggesting moderate Fe contents. Epidote, possibly replacing whole pyroxene crystals, forms sub- to anhedral grains up to 0.4 mm across with bright yellow pleochroism indicating Fe-rich composition.

The groundmass is phaneritic, consisting of fairly equidimensional plagioclase averaging 0.1 mm and interstitial chlorite, clinopyroxene, opaques, and sphene. Chlorite forms eu- to subhedral flakes up to 0.1 mm long; clinopyroxene crystals are subhedral and of similar size. Sphene forms sub- to anhedral grains <50 μm in diameter; patches of ?leucoxene with skeletal outlines to 0.4 mm across probably represent the sites of former ilmenite. Apatite is found as subhedral prisms to 0.35 mm long.

In reflected light, opaque grains are mainly subhedral 0.5 mm or less ?martite (magnetite altered to hematite). Hematite is variably crystalline from specularite to earthy. There is also considerable fine, more earthy hematite in the groundmass. Rare, very fine (1-10μm) to fine (0.1 mm) anhedral chalcopyrite grains are found in clusters associated with the martite grains, and one similar grain of pyrrhotite was seen. One patch of possible malachite was noted.

This rock represents an augite-bearing fine dyke or sill of basaltic composition, mildly altered to sericite, chlrite and epidote.

GRN ALT: EPIDOTE-ACTINOLITE-ALBITE ALTERED, FINE DYKE OR SILL OF ?BASALTIC COMPOSITION

Somewhat varicoloured rock consisting of purplish (hematitic) and light greenish (propylitized) areas. These could represent clasts in a fragmental rock such as a lahar. Only traces of magnetism remain, and faint yellow stain may not indicate K-feldspar. Mineralogy in polished thin section is:

Plagioclase (albite)	40%
Epidote	20%
Amphibole (?actinolite)	20%
Clinopyroxene (relict)	10%
Hematite (after magnetite)	10%
Sphene, leucoxene	<1%

Plagioclase occurs as eu- to subhedral crystals generally less than 1 mm in diameter. Most crystals have an altered appearance (somewhat vague twinning, flecked by fine alteration minerals such as ?epidote and amphibole). Extinction angles of Y^010=15°, Z^001=12°, X^001=20° suggest albite, An_{3-4}, and this fits with the general level of alteration in the sample.

Clinopyroxene crystals are up to 1 mm long and are variably altered from fresh to 100% replaced by epidote or mixtures of epidote and amphibole. Epidote forms sub- to anhedral crystals up to 0.5 mm across with moderate yellow pleochroism indicating appreciable Fe content. The secondary amphibole is difficult to distinguish in palces from the epidote, but where well developed has distinct lath- to needle-like habit, green pleochroism, and extinction angle up to 12 °; grains are up to 0.1 mm long. It is likely actinolite.

The groundmass of the rock consists principally of fine-grained intergrown actinolite and epidote that have replaced both pyroxene and plagioclase, suggesting an original rock similar to Cincinnati #2. Thus this may also have been originally an augite-phyric high-level intrusive (dyke or sill rock) of possible basaltic or andesitic basalt composition.

Opaques are principally specular and earthy hematite, probably mostly representing sites of former magnetite and lesser ?ilmenite grains (some specularite flakes enclose areas of leucoxene and earthy hematite). Magnetite crystals were eu- to subhedral and up to 0.7 mm across. Sulfides and copper minerals are absent.

Q showing: ALBITE-CHLORITE-PREHNITE-ACTINOLITE ALTERED, PYROXENE BASALT ?FLOW

Medium- to fine-grained, green-grey volcanic or high-level intrusive rock similar to the foregoing specimens. Sample displays very weak magnetism and no stain for K-feldspar. Modal mineralogy in polished thin section is:

Plagioclase (albite-oligoclase)	40%
Clinopyroxene (?augite)	15%
Chlorite (2 varieties)	15%
Prehnite (mainly after plagioclase)	15%
Amphibole (?actinolite)	10%
Opaque (martitized magnetite)	5%
Sphene	<1%

Plagioclase forms euhedral crystals to 1.5 mm long with extinction angles Y^010 about 10° suggesting composition of albite-oligoclase, An_{10} or oligoclase, An_{27}. It is difficult to choose between these alternatives as there is no quartz to comp;are refractive indices with. Traces of zoning are present, but most crystals are moderately altered by fine flecks of sericite and even finer ?clay; others are partly to completely replaced by prehnite. Although forming separate subhedral grains to 0.5 mm long, the prehnite commonly is found as large optically continuous masses up to 3 mm diameter

Clinopyroxene forms subhedral crystals up to 1.5 mm across that range from virtually fresh (clear), magmatically zoned through stages of replacement along fractures and rims to pseudo-morphs. Alteration is to two varieties of chlorite, one with very pale colour and one with greenish-borown colour (more like a hydrobiotite; some of this material up to 0.25 mm in diameter looks as if it could be after former biotite crystals). Rims are commonly brownish due to incipient alteration. In places, very elongate 4 mm long former phenocrysts (?possibly originally hornblende) are replaced by fine-grained secondary amphibole fibres up to 0.1 mm long with distinct green pleochroism, possibly actinolite. Minor specular hematite and sphene as subhedra to 25 μm are found in these altered mafics.

The groundmass is mostly made up of the colourless chlorite, as subhedral flakes up to 50 μm in diameter. In places, coarse prehnite replaces the former matrix. Epidote is not seen in this sample.

Opaque grains are mainly hematite (?after former magnetite) as sub- to euhedral crystals up to 0.4 mm in diameter. In places the specular hematite is further oxidized to amorphous limonite, probably mostly earthy hematite. Some ilmenite was probably originally present, as minor leucoxene is mixed with hematite in some grains.

This rock appears to have been a plagioclase-augite phyric ?flow of probable basaltic composition before propylitic alteration to ?albite, chlorite, prehnite, and actinolite, and magnetite to hematite. There are no sulfides visible in the section.

PETROGRAPHIC REPORT ON THREE SAMPLES OF FINE-GRAINED AND FRAGMENTAL NICOLA VOLCANIC ROCKS

Report for:
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P.O. # 1-102

May 2, 1992.

AKN92025: PYROXENE PHYRIC HIGH-LEVEL INTRUSIVE CLASTS IN SERICITIZED HEMATITIC MATRIX OF SIMILAR BASALTIC COMPOSITION

Fragmental volcanic rock, described in field as lahar (58N, 5450E), containing light green clasts to 3 cm diameter in a purplish hematitic matrix. Rock is strongly magnetic, does not react to cold dilute HCl. Mineralogy in polished thin section is approximately:

Plagioclase (Oligoclase)	45%
Clinopyroxene (?augite)	30%
Sericite (after plagioclase)	10%
Chlorite	5%
Magnetite	5%
Hematite	5%

Although the mineralogy in both clasts and matrix is similar there are differences in texture and level of alteration. Clasts are made up of euhedral up to 5 mm clinopyroxene phenocrysts in a groundmass of 0.1-0.2 mm subhedral plagioclase laths and 0.05-0.1 mm subhedral clinopyroxene. The phenocrysts are highly fractured and mildly altered to ?uralite (fine secondary amphibole) along fractures and rims which show magmatic zoning. Groundmass pyroxene is about half altered to similar brownish ?uralite. Plagioclase is fresh except distinctly sericitized at the margins of clasts. Opaques are subhedral magnetite microphenocrysts up to 0.5 mm diameter.

The purplish matrix is composed of crowded sub-euhedral pyroxene and plagioclase crystals up to 2 mm and 1.2 mm respectively in a groundmass of sericitized plagioclase and hematite plus minor chlorite. Alteration is noticeably more intense than in clasts; alteration to clast margins suggests alteration was roughly contemporaneous with formation of the matrix. Pyroxene crystals are colourless, with extinction angle 43° and may be augite; plagioclase has extinction angle of about 11-12° for Y^010, suggesting oligoclase about An_{27}. Pyroxene shows the same brownish ?uralite alteration and is also altered to bright green chlorite in places as subhedral flakes to 0.2 mm diameter.

In reflected light, opaques appear to be almost entirely iron oxides (magnetite variably altered to hematite and fine earthy hematite in the matrix). Alteration to hematite is noticeably stronger in the matrix as opposed to the clasts. No copper minerals are seen.

AKN92033: CHLORITE-SERICITE ALTERED FINE FRAGMENTAL VOLCANIC OF BASALTIC COMPOSITION CUT BY THIN CHLORITE-CALCITE VEINS

Dark grey fragmental volcanic rock, described in field as maroon lahar with 1% disseminated pyrite, 100 m east from 92992/3, containing many fine clasts to 1 cm diameter of variable lithology (reddish hematitic to light green ?sericite altered). Cut by light green veinlets to 1 mm thick. Rock is moderately magnetic; there is minor reaction to cold dilute HCl, especially along the veins; not stained for K-feldspar. Mineralogy in polished thin section is approximately:

Plagioclase (andesine)	50%
Chlorite (after mafics)	15%
Clinopyroxene (?augite)	10%
Sericite (after plagiclase)	10%
Magnetite, hematite	10%
Veins: prehnite, chlorite, hydrobiotite, calcite	2%
Basaltic hornblende	2%
Pyrite, chalcopyrite	1%
Biotite, actinolite	<1%

Clasts and host matrix in this specimen are mostly similar in composition and alteration. Plagioclase crystals are eu- to subhedral, up to 1 mm across, and show primary twinning and oscillatory zoning with extinction angles X^001 ranging from 19 to 1° (core to rim) indicating compositions ranging from cores of andesine An_{45} to narrow rims of oligoclase An_{29}. Most crystals are mildly to moderately altered to fine sericite. Pyroxene phenocrysts are subhedral, highly fractured, and altered along fractures and margins to bright green (Fe-rich) chlorite and brown ?uralite. Extinction angle is about 45°, suggesting augite. A second, minor mafic phenocryst phase to 1.0 mm long with dark brown to greenish-brown pleochroism, amphibole cleavage and extinction angle about ?25° may be basaltic hornblende (lamprobolite). Ragged subhedral flakes of brown ?biotite to 0.5 mm diameter and subhedral tremoltie-actinolite to 0.25 mm are rare.

The groundmass to phenocrysts (in both clasts and matrix) is mainly chlorite, with minor sericite and some earthy hematite giving the maroon colour to the rock.

Veins are composed of a variable mineralogy: bright green chlorite, brownish green ?hydrobiotite both as fine subhedral flakes and scales to 25 μm diameter; subhedral prehnite crystals to 0.25 mm long, scattered calcite to 0.1 mm, and rare chalcopyrite (rare anhedral grains to 0.1 mm).

Opaques are mainly magnetite and lesser ilmenite as euhedral crystals to 0.5 mm diameter, variably altered to specular and earthy hematite. In contrast to most samples of this suite, sulfides including pyrite, less chalcopyrite and rare pyrrhotite as anhedral grains to 0.5, 0.02 and 0.05 mm respectively are found disseminated in silicates and associated with magnetite. This confirms that the mild propylitic alteration (chlorite-sericite-prehnite) is associated with copper mineralization.

AKN92034: FRAGMENTAL VOLCANIC WITH HIGH-LEVEL AND ?PLUTONIC INTRUSIVE CLASTS VARIABLY ALTERED TO 1) EPIDOTE-CHLORITE-ACTINOLITE-CALCITE-SERICITE±CHALCOCITE/COVELLITE-MALACHITE; 2)MAGHEMITE; AND 3)SECONDARY BIOTITE (NO COPPER MINERALOGY)

Maroon lahar containing variable clasts to 3 cm across ranging from dark green (with abundant malachite on fractures) to pink ?granitic and reddish hematitic. Rock is magnetic but reacts to cold dilute HCl only in dark green clasts; it was not stained for K-feldspar. Mineralogy in polished thin section is roughly:

Plagioclase (sericitized oligoclase?)	30%
Clinopyroxene (?augite)	10%
Sericite	10%
Epidote	10%
Chlorite	10%
Calcite	10%
Maghemite, magnetite	10%
Biotite (secondary)	5%
Prehnite (?)	2%
Chalcocite, covellite	2%
Malachite	1%

There is a wide variety of alteration and rock types amongst the clasts in this rock. Of particular interest to porphyry copper exploration are 1) high-level relatively felsic intrusives, composed of subhedral 1 mm laths of plagioclase with interstitial mafics completely replaced by secondary biotite (subhedral, 0.1 mm pale brown flakes, mixed in palces with similar sized but clear subhedral ?prehnite and subhedral magnetite-maghemite; no copper minerals); 2) ?plutonic rock composed of coarse (1 mm) clinpyroxene, plagioclase, magnetite and ?prehnite (no copper minerals); 3) highly altered rock composed of 1 mm pyroxene phenocrysts (?) in a matrix of epidote, actinolite, calcite, sericite and abundant copper minerals; 4) plagioclase laths in hematitic matrix. The matrix volcanic to the clasts is composed of seriate-textured sericitized plagioclase and lesser pyroxene crystals in a groundmass of sericite, hematite, chlorite and carbonate.

Clinopyroxene is faintly but distinctly green, forming eu to subhedral crystals to 1 mm that may be augite. Distinctly clear crystals of similar size and lower relief may be ?prehnite. Plagioclase forms subhedral laths to 1 mm long that are mainly moderately sericitized, making determination of composition difficult; extinction angles of 12° suggest oligoclase.

Epidote shows brilliant yellow pleochroism, suggesting a very high Fe content; it forms aggregates of fine anhedral crystals to 0.5 mm across closely associated with opaques including copper minerals. Carbonate, mainly calcite, forms anhedral crystals up to 0.25 mm across. Minor secondary amphibole forms subhedral crystals up to 0.3 mm long with pale greenish pleochroism suggesting Fe-poor actinolite. Chlorite forms fine subhedral flakes with weak anomalous

blue pleochroism and length-slow character suggesting moderate Fe content.

Magnetite, maghemite and copper minerals are abundant in this sample, especially in dark green clasts. Chalcocite, with rims of covellite, is found with malachite mainly along narrow fractures crossing the rock. Chalcocite forms anhedral interstitial grains to 0.2 mm across; covellite forms euhedral flakes to 25 μm diameter and malachite anhedral crystals to 0.05 mm across. Subhedral magnetite crystals are up to 0.5 mm diameter, variably replaced by ?maghemite (gamma-Fe_2O_3) which has reflectance similar to hematite but is isotropic; it forms an oxidaton product of magnetite. In places further oxidation has produced earthy hematite, and one grain of relict pyrite was seen enclosed in limonite.

Copper mineralization appears to be strongly controlled by certain clasts with intense propylitic (epidote-chlorite-calcite-sericite-actinolite) alteration; other very interesting clasts include plutonic rocks of similar basaltic (clinopyroxene-plagioclase-magnetite) composition and felsic but pyroxene-magnetite-bearing high-level intrusives altered to a potassic assemblage of secondary biotite. The difference in these assemblages suggests that alteration and therefore ?mineralization took place before fragmentation. Alternatively, copper mineralization may have been preferentially emplaced in receptive (reactive) clasts, as suggested by concentration of chalcocite near fractures. Malachite on these fractures may be due to supergene processes. A nearby porphyry copper ocurrence, comagmatic and contemporaneous with basaltic volcanism is sugggested by the mineralization and alteration relationships seen in this rock.

Craig H.B. Leitch, Ph.D, P.Eng.

(604) 921-8780 or 666-4902

C.H.B. Leitch

APPENDIX V

STATEMENT OF QUALIFICATIONS

APPENDIX V

STATEMENT OF QUALIFICATIONS

I, Andrew W. Gourlay, hereby certify that:

1. I am presently employed by MineQuest Exploration Associates Ltd. as Senior Geologist.

2. I am a graduate of the University of British Columbia (B.Sc. Hons., 1977, in geology).

3. I am a Professional Geologist in good standing with the Association of Professional Engineers, Geologists and Geophysicists of Alberta, and a Fellow of the Geological Association of Canada.

4. I have practised my profession as geologist for 15 years.

5. The information used in this report is based on reports, maps, and data lists on file at MineQuest Exploration Associates Ltd., familiarity with the project area, and personal involvement with the fieldwork.

Signed _____
Andrew W. Gourlay

Dated this 30th Day of April, 1992 at Vancouver, B.C.

APPENDIX VI

Cost Statement

APPENDIX VI

Cost Statement
Miner Lake Project
March - April, 1992

FEES

A.W. Gourlay	34.75 hrs. @ $ 75.00	$ 2,606.25	
A.W. Gourlay	3.00 dys. @ $450.00	1,350.00	
G. Vernon	12.00 dys. @ $260.00	3,120.00	
R.V. Longe	1.25 hrs. @ $ 96.00	120.00	
		---	$ 7,196.25

DISBURSEMENTS

Equipment Rental	160.00	
Food & Accommodation	652.68	
Fuels & Lubricants	429.84	
Groceries	26.81	
Rental Vehicles	500.00	
Supplies	36.38	
Taxi\Parking	89.28	
Telecommunications	1.40	
Analyses	1,812.00	
Courier	7.50	
	---	3,715.89

		$10,912.14
		==========

LEGEND

ROCK TYPES

3 Porphyrytic Basalt

2 Diorite

1 Lahar

SYMBOLS

Fracture

Vein

Geological contact, approximate

Outcrop

Road

Legal cornerpost

Claimline identification post

Pit/shaft

Portal

Trench

92028 Sample site/number

GEOLOGICAL BRANCH
ASSESSMENT REPORT

22,382

Scale: 1:2,500

0 100 200 300

metres

PACIFIC COPPERFIELDS INC

MINER LAKE PROJECT

GEOLOGY

	Originator	Drawn	Date	PLAN NO.	FIGURE
Originator	A.W.G.	J.B.R.	May 1992	1664	3
Revision				N.T.S. 92H/15	
Revision					

MINEQUEST EXPLORATION ASSOCIATES LTD.

MQ DRAWING FILE: ASGN MINERLK.DWG

Sample Number	Au(ppb)	Cu(ppm)	Cu(%)
92001	20	8272	
92002	30	>20000	2.16
92003	<5	5153	
92004	10	>20000	2.81
92005	30	2306	
92006	<5	400	
92007	<5	98	
92008	<5	56	
92009	<5	19	
92010	<5	188	0.04
92011	<5	102	0.04
92012	20	10542	
92013	<5	599	
92014	<5	1151	
92015	<5	5894	
92016	<5	6658	
92017	<5	416	
92018	50	18806	
92019	20	6411	
92020	10	>20000	2.16
92021	20	>20000	2.68
92022	<5	1978	
92023	<5	515	
92024	No sample	-	-
92025	10	126	
92026	10	135	
92027	30	18565	
92028	10	642	
92029	<5	690	
92030	<5	86	
92031	<5	167	
92032	<5	7171	
92033	<5	741	
92034	<5	10391	
92035	<5	457	
92036	<5	150	
92037	<5	111	
92038	10	25	
92039	<5	15	

Note: - All samples prefixed AKN.
- Complete results tabulated in Appendix III

LEGEND

ROCK TYPES

3 Porphyrytic Basalt

2 Diorite

1 Lahar

SYMBOLS

Fracture

Vein

Geological contact, approximate

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92028 Sample site/number

GEOLOGICAL BRANCH
ASSESSMENT REPORT

22,382

Scale: 1:2,500

0 100 200 300

metres

PACIFIC COPPERFIELDS INC

MINER LAKE PROJECT

GEOCHEMISTRY
ROCK SAMPLE LOCATIONS & RESULTS

	Originator	Drawn	Date	PLAN NO.	FIGURE
Originator	A.W.G.	J.B.R.	May 1992	1665	4
Revision				N.T.S. 92H/15	
Revision					

MINEQUEST EXPLORATION ASSOCIATES LTD.

MQ DRAWING FILE: ASGN MINERLK.DWG