104B General

018906

APPENDIX 2

for main portion of report by

BRIDGE and MELNYK, 1983

(1982 EXPLORATION ON THE SULPHURETS PROPERTY)

Near Shore Appendix 3 p 3
" 4 p 2,4
West Apdx 3 p 8
Apdx 4 p. 2

Breccia Zone Appendix 5 p 11

TABLE 3: DESCRIPTION OF SANDSTONE FORMATION

Member	Unit(s)	Matrix	Crystals	Lithics	Bedding	Field Characteristics
ARKOSE MEMBER	Arkose to Arenite	--	90-100% 10-50% Qtz, subangular moderate sorting 90-40% feldspar	0-10% lithics mainly felsic minor shale	laminated to thin where well exposed	-occurs as low humocky outcrops, -cross-bedding, normal grading
	Shale	--	--	--	locally laminations seen	--
	Pebble Conglomerate	40-15% matrix usually a wacke	included in matrix	60-85% lithics -heterolithic variable lithologies between beds; creamy chert, feldspar and/or hornblende porphyry which may be of intrusive or extrusive origin, black shale. -mainly rounded -generally up to 10 cm locally up to 20 cm wide	generally very thick (100 cm) to medium (30 cm) beds	-rare poor grading

TABLE 3: DESCRIPTION OF SANDSTONE FORMATION (contd.)

Member	Unit(s)	Matrix	Crystals	Lithics	Bedding	Field Characteristics
LITHIC ARKOSE MEMBER	Lithic Arkose and Lithic Arkosic Wackes	0-80% argillaceous matrix	0-90% crystals generally less than 50% crystals and less than 20% quartz	10-50% lithics 0-15% black shale usually 1% up to 7 mm long 0-50% buff qtz-feldspar lithics up to 3.5 cm long	generally not preserved	-readily altered -generally posess good cleavage
	Shales	--	--	--	--	-generally weather black locally a reddish weathering color

TABLE 3: DESCRIPTION OF VOLCANIC FRAGMENTAL FORMATION

Deposit	Matrix (ash, 2mm)	Lithics	Crystals (includes crystals 2 mm)	Bedding	Field Characteristics
High Matrix Member Lapilli-Tuff to Tuff	70-45% matrix does not include crystals	10% Black chloritic, plag porphyritic, rounded to stretched fragments which usually range up to 8 cm long but locally to 15 cm -may have originally been glass rather than a lithic	Trace-1% qtz ? 20-45% feldspar, generally difficult to estimate due to cleavage, requires thin section work	None	-the unit occurs throughout the map area and forms a mappable unit, well-developed cleavage often makes the unit indistinguishable from other tuff-breccias. -origin, almost certainly an ash flow tuff. -lacks lapilli and blocks toward the base of the deposit. -no welding observed

TABLE 3: DESCRIPTION OF VOLCANIC FRAGMENTAL FORMATION (contd.)

Deposit	Matrix (ash, 2mm)	Lithics	Crystals (includes crystals 2 mm)	Bedding	Field Characteristics
LOW MATRIX TUFF-BRECCIA TO LAPILLI-TUFF	80-30% matrix which includes abundant dark red lithics	20-70% lithics 20-70% dark red, mainly angular fragments mainly 10-20 cm long, rarely up to 1 metre, aphyric and feldspar phyric, equant to rectangular shapes, weather negatively 0-50% creamy phyric and hornblende phyric fragments, usually 40%, mainly sub-rounded to rounded, up to 30%, 1-2 mm weathered hornblende prismic, usually up to 5 cm long locally up to 50 cm, weather positively 0-15% plagioclase phyric fragments 30-50%, plagioclase 1-5 mm felted, mainly rounded, 50- 100 cm long, restricted occurrence. -no vesicles observed in lithics.	up to 15% feldspar, usually not distinguished due to cleavage and alteration	-usually none -locally bedded sequences	-where cleavage is well developed the unit is distinguished by an even weathering pattern and a matrix bearing a fragmental texture. -Creamy fragments are most abundant in thick bedded sequences which may be lahars or conglomerate

TABLE 3: DESCRIPTION OF INTRUSIVE ROCKS

Unit(s)	Color Fresh	 Weathered	Phenocrysts	Groundmass	Foliation of Phenocrysts	Field Characteristics
UNDIFFERENTIATED HORNBLENDE-FELDSPAR PORPHYRY SYENITE	medium grey	buff	1-25% hornblende, usually 10% 1-10 mm long, usually 1-5 mm 0-35% feldspar, usually about 15%, 1-4 mm long.	50-75%, not visible	usually absent locally hornblende near the margin of the intrusions	-variable abundance of phenocrysts in mapable plugs -locally internal vesicular chilled margins -generally occurs as block outcrops -generally lacks cleavage and alteration
ALKALE FELDSPAR PORPHYRY SYENITE	light grey	buff yellow or buff	40-55% alkale feldspar and plagioclase, 1-35 mm long, 1-3% alkale feldspar 0.5-2.5 cm long 1-4% hornblende, 1-12 mm long, usually 1-5 mm long	41-60% not visible	usually absent, locally feldspar near the margins of the intrusions	-may possess good cleavage and substantial silicification, pyritization and sericitization.

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TABLE 3: DESCRIPTION OF INTRUSIVE ROCKS (contd.)

	Color				Foliation	
Unit(s)	Fresh	Weathered	Phenocrysts	Groundmass	of Phenocrysts	Field Characteristics
"andesite" dikes	dark green	green	0-40% hb, usually 1-4 mm long	100-60% not visible	locally hornblende	-usually 1-2 metres wide -possess internal chilled margins which resemble bedding, usually variable phenocrysts abundance between chilled margins
EQUI-GRANULAR SYENITE DIKE	dark grey	buff	absent	60% hornblende 40% feldspar all crystals 1-3 mm long	none	-locally amygules near margins -thickness varies from 1-3 metres -traceable the length of the map area -texturally a distinctive dike
OTHER hornblende syenite (includes several feldspar varieties)	various shades of grey or green	buff	0-10% usually hornblende rarely feldspar	90-100% not visible	none	-usually about 1 meter wide -cross cuts alkale feldspar porphyry syenite

APPENDIX 3 MV 7763 Revised

for main portion of report by

BRIDGE and MELNYK

MV-7763 Revised

Nov 9, 1982

NEAR SHORE ZONE

Summary

The Near Shore Zone in the Brucejack Peninsula Area is an unexposed quartz-sulphide-electrum vein zone. It varies from a quartz vein zone to a quartz stockwork to a single, 1-2 cm thick, quartz-electrum vein. The zone contains minor to about 20% sulphides, and electrum in thin quartz veins. Most drill hole intersections in the zone contain greater than 0.1 oz/t Au. The best intersection is 2.~~47~~52 oz/t Au and 6.~~58~~75 Ag over an apparent true thickness of 6.7 m.

Size

The Near Shore Zone strikes 140° and is mainly sub-vertical to steeply dipping to the northeast. It has been drill indicated by 22 holes along a length of 265 m with intersections in excess of 0.5 oz/t Au occurring over 225 m of strike length. Most drill holes penetrate the zone from 20 to 60 m below the surface of Brucejack Lake. Only one deeper hole was drilled which intersected the zone at about 140 m below the lake level. The apparent true thickness of the portions of the zone with at least 0.1 oz/t Au varies from 0.5 to 9.8 m, and averages ~~2.2~~ 2.4 m in ~~15~~ 17 drill holes.

The zone is open in all directions but is not seen at surface because it projects about 5 to 20 m offshore along the north shore of the Brucejack Peninsula. Alteration along the north side of Brucejack Peninsula indicates that the zone could have a strike length of 470 m with an unknown additional length to the southeast under the lake.

Grade

Seventeen ~~Fifteen~~ of the 22 drill intersections assayed at least 0.1 oz/t Au. Six of the 22 holes drilled in the zone had intersections in excess of 0.5 oz/t Au. The 6 higher grade intersections are summarized as follows:

Section	DDH	Thickness in metres ~~drilled~~		Grade	
		~~Apparent~~ Drilled	~~True~~ Apparent True	oz/t Au	oz/t Ag
110.2 W	43	2.08	1.5	.90 0.~~27~~	2.18 ~~2.72~~
130.0 W	41	9.30	6.7	2.52 ~~2.47~~	6.75 ~~6.58~~
150.0 W	63	5.41 ~~2.20~~	3.7 ~~1.5~~	0.92 ~~0.77~~	2.13 ~~2.81~~
170.0 W	28	1.87	1.5	2.62	2.81
263.6 W	74	1.30	0.7	2.09	2.40
318.0 W	71	3.00	1.9	0.60	0.86

No estimate of grade and tonnage will be attempted at this time because:

1) The zone is geologically extremely variable and complex. The orientation and significance of gold in cross structures within the main 140° structure is unknown.

2) It has been drilled in only one direction from the shoreline of Brucejack Peninsula. The drilling was done into the steep dip of the zone rather than across the dip.

3) A significant proportion of the Au in the higher grade intersections is from quartz-electrum veins which are sub-parallel to the drill holes.

The Au content in 4 (DDH 28, 41, 63 and 74) of the 6 higher grade holes in coming mainly from electrum in 1 to 2 cm thick quartz veins. The quartz-electrum veins are commonly parallel to or within 20° of the core axis. The holes have inclinations of -40° to -60° in the quartz-electrum vein sections. Thus it appears that quartz-electrum veins dipping at 40° to 60° occur within the Near Shore Zone. The strike of the quartz-electrum veins can not be determined from the drilling done to date. The veins probably strike between 090° and 140°. The high frequency of quartz-electrum vein intersections in drill core indicates that the veins are relatively abundant and may occur as sheeted stockworks or gash fillings at an undetermined orientation within the main vein structure.

Geology

The Near Shore Zone is part of a multiple quartz-calcite vein system which occurs along the north shore of the Brucejack Peninsula. The vein system occurs within a large, linear area of intensely sericitized volcanic rocks. The vein system is within or adjacent to a parallel fault and the axis of an overturned anticline.

The Near Shore Zone is extremely variable. It varies from a quartz vein zone to a quartz stockwork to a single, 1-2 cm thick, quartz-electrum vein. Calcite is commonly present in the quartz veins as a later fracture filling and pyrite, sphalerite, tetrahedrite, galena and chalcopyrite occur in trace amounts to about 20% combined. The paragenisis of the zone as interpreted from drill core is approximately:

1) at least two stages of quartz veins
2) at least one stage of quartz-electrum veins
3) at least two stages of quartz-sulphide veins
4) at least one stage of barite veins

The vein zone occurs adjacent to, and northeast of, and locally overlaps, a wide zone of massive quartz and calcite veins and stockworks which outcrops along the north shore of the peninsula. This outcropping zone is weakly and erratically mineralized and does not appear to have any economic potential. Two weak and narrow quartz-sulphide stockwork or sheeted zones occur parallel to and northeast of the Near Shore

Zone. These vein zones, called the ~~First~~ Second and ~~Second~~ Third Off Shore Zones, have some good Au and Ag intersections and possibly have economic potential.

WEST BRUCEJACK ZONE

Summary

The West Brucejack Zone constitutes a mineralized Au-Ag structure extending 310 m, trending 138°, and dipping steeply to the southwest. The Au-Ag bearing structure is a quartz-sulfide vein zone of variable width and complex nature. Seven fences totaling 21 diamond drill holes have been drilled across the mineralized structure. Electrum has been observed in 12 holes and varying amounts of silver minerals, mainly pyrargyrite and argentite, have been detected in all drill holes. The best intersection to date has been encountered in DDH 58 where a 2.25 m interval ran 3.81 oz/t Au and 285.72 oz/t Ag.

Size

The West Brucejack Zone strikes 138° and dips steeply southwest. The zone has been drill intersected along a strike length of 310 m with seven drill hole fences totaling 21 diamond drill holes. The zone has been tested to a depth of 35 m in five fences while two sections tested the zone at a depth of 60 m.

The zone is terminated to the northwest by an intrusive unit immediately northwest of section 1+09.8N. However, the zone remains open to the southeast.

The zone is readily observed on surface and is identified by intense quartz veining or quartz flooding accompanied by sulfide minerals including pyrite, tetrahedrite, pyrargyrite, sphalerite and minor amounts of chalcopyrite and galena. The intensely silicified zone extends at least 100 m to the southeast and remains to be examined.

Grade

Assays received to date from five out of seven sections indicates that the mineralized zone is continuous for 148.5 meters from section 1+09.8N to 0+38.7S. The higher grade intersections derived from each section are summarized below:

Section	DDH	Thickness in metres ~~drilled~~		Grade	
		~~Apparent~~ Drilled	~~True~~ Apparent True	oz/t Au	oz/t Ag
1+09.8N	81	2.20	1.2	.127	3.73
0+49.3N	60	3.50	1.9	.374	6.86
0+20N	84	3.00	1.6	.075	6.15
0+03.3N	54	2.00	1.1	.741	53.20
0+38.75	58	2.25	1.2	3.81	285.72
	or	17.65	9.6	0.52	38.88
0+38.7S	59	1.78	0.6	2.72	286.00
	or	8.93	2.6	0.70	62.04

Geology

The West Brucejack Au-Ag zone occurs within a sequence of intensely sericitized fragmental volcanic rocks including thinly bedded tuffs, agglomerates and flows. The mineralized zone is coincident with a gently arcuate silicified zone trending approximately 138°, and dipping steeply southwest. The host structure varies in character from a loose, weak quartz-vein zone, to an intense quartz stockwork zone, to a quartzitic mass representing pervasive quartz flooding. Carbonate content increases considerably to the northwest particularly in the vicinity of section 1+09.8N which is within 25 m of the hornblende syenite contact. A narrow band of brecciated, silicified, dark grey to black siltstone or argillite parallels the mineralized zone and occurs in the hanging wall immediately above the mineralized zone.

A second quartz vein-stockwork zone occurs semi-parallel to the mineralized zone and 70 m to the southwest. Linear quartz masses up to 10 m wide form prominent resistant exposures within volcanic host rocks similar to those of the West Brucejack zone. This second vein zone with related intense silicification is barren of sulfides and presumably does not carry Au-Ag values.

The precious-metal zone is a complex structure whose gross geometry is basically understood although the distribution of Au-Ag mineralization within the structure is yet to be determined. Diamond drilling has established a widespread distribution of gold with significant proportions of silver along the length of the structure. Au-Ag mineralization is hosted in vein systems which vary in complexity. The quartz veins with electrum grains are the simpleist of the mineralized veins. The increased complexity of vein systems is characterized by an increase in quartz veining to the point of boxwork development, pervasive flooding and silicification. Vein complexity is further typified by the progressive introduction of sulfides including tetrahedrite, pyrargyrite, sphalerite, galena, pyrite, and chalcopyrite.

Significant assays in gold and silver invariably correspond to zones which contain elevated sulfide contents particularly those sulfides other than pyrite. DDH 58 contains a 0.97 m section of 40% sulfides and runs 8.60 oz/t Au and 600 oz/t Ag. Isolated narrow quartz veins containing disseminated grains of electrum invariably produce low assays, less than .1 oz/t Au.

MEMORANDUM

ESSO MINERALS CANADA – EXPLORATION

January, 1983

MV-7763 Revised

File: 2153

TO: C. Aird

FROM: D. Bridge

RE: Preliminary Evaluation of the Two Potentially Economic Gold-Silver Vein Zones at Sulphurets

Introduction

Esso Minerals did 4633 m of diamond drilling in 53 holes and 560 m of trenching from July to September, 1982. Exploration was concentrated in the Brucejack Lake area at the south end of the Sulphurets property. Drilling and/or trenching was done mainly in twelve areas:

Four parallel vein zones in the Peninsula Area
*Discovery Zone
West Zone
5.9 Vein
Galena Showing
0.5 Vein
Stockwork Zone
Electrum Zone
Iron Cap Area (north part of property)

Nineteen of the 53 drill holes penetrated the Near Shore Zone in the Peninsula Area, discovered in 1981, and 21 holes were in the West Zone discovered in 1982. This memo summarizes the Near Shore and West Zones. The memo has been updated from November 9, 1982 to include all assays.

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The precious-metal zone is a complex structure whose gross geometry is basically understood although the distribution of Au-Ag mineralization within the structure is yet to be determined. Diamond drilling has established a widespread distribution of gold with significant proportions of silver along the length of the structure. Au-Ag mineralization is hosted in vein systems which vary in complexity. The quartz veins with electrum grains are the simpleist of the mineralized veins. The increased complexity of vein systems is characterized by an increase in quartz veining to the point of boxwork development, pervasive flooding and silicification. Vein complexity is further typified by the progressive introduction of sulfides including tetrahedrite, pyrargyrite, sphalerite, galena, pyrite, and chalcopyrite.

Significant assays in gold and silver invariably correspond to zones which contain elevated sulfide contents particularly those sulfides other than pyrite. DDH 58 contains a 0.97 m section of 40% sulfides and runs 8.60 oz/t Au and 600 oz/t Ag. Isolated narrow quartz veins containing disseminated grains of electrum invariably produce low assays, less than .1 oz/t Au.

APPENDIX 4 Mv 7853

for main portion of report by

BRIDGE and MELNYK

Near Shore Zone:

The Near Shore Zone in the Brucejack Peninsula area has potential for 370,000 tonnes of possible ore shoots within a vein zone of 740,000 tonnes. Individual ore shoots have potential for 105,000 tonnes of possible ore each or 700 tonnes per vertical meter.

Drill indicated tonnage is confined to a 50 m vertical section of one zone shoot with 35,000 tonnes of indicated ore at 1.08 oz/tonne Au and 2.88 oz/tonne Ag, uncut and diluted.

Two ore shoots at 110-170 w and 263-318 w are interpreted to occur within the drilled portion of the Near Shore Zone. The ore shoots have uncut and diluted grades of 1.08 oz/tonne Au and 2.88 oz/tonne Ag and 0.31 oz/tonne Au and 0.54 oz/tonne Ag respectively. The ore shoots have optimistically indicated grades of 2.09 oz/tonne Au and 4.98 oz/tonne Ag and 0.47 oz/tonne Au and 0.60 oz/tonne Ag respectively, if the high frequency of high-grade intersections in each shoot is assumed to indicate the actual grade of the ore shoots.

West Zone:

The central portion of the West Zone contains a high-grade Ag-Au vein in a mineralized stockwork with potential for 920 tonnes of possible ore per vertical meter. A vertical extent of at least 100 m is possible for the ore shoot which has a conservative strike length of 67 m within a main structure at least 310 m long.

A drill indicated zone of 25,000 tonnes of 0.46 oz/tonne Au and 38.9 oz/tonne Ag occurs at the top of the ore shoot based on four drill holes and one trench. This tonnage uses a very low cut-off of 0.10 oz/ton Au or 5.0 oz/ton Ag, grades are uncut and undiluted but include only sections with ≥ 3.0 m true width.

Recommendations:

If the possible tonnage and grades for the Near Shore Zone are considered to be a feasible target, the following drilling is recommended:

1) Fill-in drilling in the two possible ore shoots in the Near Shore Zone to provide intersections on 20 m centers to a depth of 150 m vertically below the lake surface.

2) Wide-spaced drilling in the southeast portion of the zone to search for new ore shoots.

The above drilling would have to be done from the ice on Brucejack Lake during March and April.

If the above drilling produced grades and widths similar to those already indicated, a summer drilling program would consist of:

1) Wide-spaced drilling in the northwest portion of the Near Shore Zone to search for new ore shoots.

2) Drilling on 20 m centers in the central portion of the West Zone to a vertical depth of 100 m.

D. Bridge

DB/dk

cc: E. Pekar
M. Berthelsen

Near Shore Zone

Assumptions:

Strike Length: 600 m

The zone has been drill indicated for 265 m and intersections of ≥ 0.60 oz/ton Au occur over 225 m. Adjacent veining and alteration occurs for 470 m and up to 550 m if the south end of peninsula is projected to the vein trend. Assuming that the vein extends another 50 m under Brucejack Lake, a strike of 600 m is possible.

Vertical Extent: 150 m

The zone is mainly drilled from 20 to 60 m below the lake surface and one hole intersects it at 140 m below the lake surface. High-grade intersections in the adjacent vein stockworks have been made as deep as 128 m vertically below the lake level.

Width: 3.0 m

The 17 intersections with ≥ 0.10 oz/ton Au have an average true width of 2.4 m. The four high-grade intersections in the 110 to 170 w ore shoot average 3.3 m true width. The actual vein zone is commonly 5 to 12 m in true width.

Geological:

The vein zone consistently (17 out of 21 intersections) has ≥ 0.10 oz/ton Au. Two ore shoots appear to exist in the drilled section based on the frequency of high assays and the occurrence of the two adjacent mineralized vein zones. One shoot is between 110 and 170 w and about 85 m long. The second shoot is based on only 4 intersections 56 m apart between 263 and 319 w. If the second shoot is also assigned a 85 m strike then the gap between the two shoots is 85 m. The shoots are probably sub-vertical and if spaced as indicated, 50% of the total vein zone would be ore shoots.

Grades for Indicated Case:

The grades for the indicated case are the weighted average grades based on two ore shoots. The 110-170 w shoot has nine intersections in it and the 263-318 w shoot has four intersections. The grades are averaged rather than calculated on a block or polygonal basis because of the erratic distribution of data. The grades are uncut and diluted to 3.0 m using a zero grade for dilution. The assays are all in oz/ton. The final average grade is factored by 1.1 to give oz/tonne for ease in applying a value to the ore.

Grades for optomistic case:

The two ore shoots have a high frequency of relatively high-grade intersections. The 110-170 w ore shoot has 4 of 9 intersections grading 0.90 to 2.62 oz/ton Au. The 263-318 w shoot has 2 of 4 intersections grading from 0.60 to 2.09 oz/ton Au. The optomisic assumption assumes that this high frequency of high-grade intersections indicates that the shoots will have an actual grade which is similar to the grade indicated by the higher grade intersections.

Specific Gravity: 2.75

The specific gravity has been calculated assuming that the ore is mainly quartz or sericitized wallrock with an average of 10% sulphides, mainly pyrite.

Tonnage:

Tonnage in entire vein zone: 600 m x 150 m x 3 m x 2.75 =	740, 000 tonnes
Ore shoot tonnage assuming shoots comprise 50% of vein:	370,000 tonnes
Tonnage per individual shoot:	105,000 tonnes
Tonnes per vertical meter in individual ore shoots:	700 tonnes/m

Grade:

Indicated grade in the 100-170 w ore shoot:

1.18 oz/ton Au, 3.14 oz/ton Ag undiluted
0.98 oz/ton Au, 2.62 oz/ton Ag diluted
1.08 oz/tonne Au, 2.88 oz/tonne Ag diluted

Indicated grade in the 110-170 w ore shoot using the optomistic assumptions:

1.90 oz/ton Au, 4.53 oz/t Ag for both diluted and undiluted since the average width of the higher grade intersections is 3.3 m.

2.09 oz/tonne Au, 4.98 oz/tonne Ag

Indicated grade in the 263-318 w ore shoot:

0.50 oz/ton Au, 0.85 oz/ton Ag undiluted
0.29 oz/ton Au, 0.49 oz/ton Ag diluted
0.31 oz/tonne Au, 0.54 oz/tonne Ag diluted

Indicated grade in the 263-318 w ore shoot using the optomistic assumptions:

1.00 oz/ton Au, 1.27 oz/ton Ag, undiluted
0.43 oz/ton Au, 0.55 oz/ton Ag, diluted
0.47 oz/tonne Au, 0.60 oz/tonne Ag, diluted

West Zone

Assumptions:

Strike Length: 67 m

The high-grade zone drilled on section 0+40S is open to the southeast and partly closed on the northwest. Ore was projected no more than 17.5 m beyond a drill intersection.

Vertical Extent: 100 m

Ore-grade intersections have only been drilled to maximum depths of 12 to 36 m on two sections. Indicated tonnage is based on a steeply plunging zone projected vertically to maximum depths of 17 to 41 m. Possible tonnage is based on a 100 m vertical extent.

Width: 3 to 6 m

Indicated tonnage was calculated using core lengths on cross sections which gave average true widths from 3 to 6 m.

Grade:

The total intervals from four holes were used which contained high-grade sections and sections of ≥ 0.10 oz/ton Au and 5.0 oz/ton Ag separated by very low grade material. The grades are uncut and no rigorous cut-off was used because so little data is available. The grades and tonnage were not diluted because the core intervals produced true widths of 3 to 6 m.

Much higher average grades and proportionally smaller tonnages could be calculated. However, the presence of a number of thin, high-grade veins and the necessity of a 3.0 m mining width makes it reasonable to include all the mineralization within the stock work zone.

The grade and tonnage was calculated using the cross sectional method and an average specific gravity of 2.75. Data from four drill holes and one trench were used. The grades applied to each block ranged from 0.04 to 0.57 oz/tonne Au and 9.66 to 68.24 oz/tonne Ag.

Grade and tonnage calculated by sectional method:

25,000 tonnes of 0.46 oz/tonne Au, 38.9 oz/tonne Ag

Average vertical extent of drill indicated area: 27.6 m

Tonnes per vertical meter for indicated tonnage: 920 tonnes

Tonnes in ore shoot about 67 m long,
3 to 6 m wide, and extending to 100 m
vertically at a 60° plunge: 92,000 tonnes

APPENDIX 5

for main portion of report by

BRIDGE and MELNYK

Some Characteristics of Gold-Rich Porphyry Deposits, March, 1982, Revised March, 1983

Dane Bridge

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TABLES AND FIGURES

Summary

Silver:gold ratios may be a potentially useful method of distinguishing gold porphyry and gold-rich porphyry copper prospects from prospects without significant gold contents. Gold-rich prospects and deposits commonly have low Ag:Au ratios of less than 10:1. Gold-poor deposits commonly have much higher Ag:Au ratios. The characteristics of gold-rich porphyry copper deposits discussed by sillitoe (1979) can be excellent discriminants but can not be universally applied.

The features that characterize the porphyry gold areas at Sulphurets and which can be used on a mapping and sampling basis are:

1) Areas of pervasive sericite-quartz-pyrite alteration with only very minor to absent quartz veining and no magnetite.

2) High pyrite contents, commonly 15 to 40%.

3) Gold grades in excess of 1 g/tonne.

4) Low Ag:Au ratios, commonly less than 10:1 in areas with greater than 0.15% Cu, and from 0.4 to 2.4:1 in areas with very low copper contents. Porphyry copper and copper-molybdenum occurrences at Sulphurets have Ag:Au ratios of 30 to 42:1.

5) Very minor copper-molybdenum mineralization occurs within the porphyry gold areas but copper-molybdenum mineralization approaching porphyry grades occurs adjacent to the porphyry gold areas. The only explored porphyry Au area at Sulphurets with 2-3 g/t Au (the Breccia Zone of the Sulphurets Gold Zone) is a pyritic alteration area peripheral to copper-molybdenum occurrences.

Introduction

This study was undertaken in an attempt to evaluate and develop exploration guides for Sulphurets. A recent publication of updated metal contents for Western Canadian porphyry deposits by Sinclair et. al. (1981) provides better data and indicates that silver may have some usefulness in discriminating gold-rich from gold-poor deposits. The author has taken this one step further and proposes that Ag:Au ratios may provide a useful but not perfect discriminate for gold-rich and gold-poor deposits.

This study may provide some framework for evaluating the gold potential of Sulphurets, deposits in the Iskut River area and possibly porphyry-type or porphyry-related mineralization in Western Canada.

Significant Features Associated with Au-rich Porphyry Deposits

1) Au correlates closely with Cu in chalcopyrite bornite zones.

2) Mo is commonly present in minor amounts. Porphyry Mo deposits have very low Au contents and in Western Canada. The volcanic class porphyry deposits of alkaline affinity are notably deficient in Mo.

3) Log transformed mean grades of Au and Ag can be used to classify deposits as plutonic or non-plutonic with the relatively Au-rich and some of the Au-poor deposits being in the non-plutonic category.

4) Most Au-rich deposits, with Au-rich being arbitrarily chosen as ≥ 0.3 g/t Au, have Ag:Au ratios of < 7.0:1. Deposits with Ag:Au ratios < 20.0:1 may contain economically significant Au but deposits with Ag:Au ratios > 20.0:1 appear to contain no Au of economic significance.

5) There is some correlation on a world wide basis with Au-rich porphyry deposits in host rocks of alkaline affinity. However, intrusive rocks of alkaline affinity do not appear to be a controlling factor. Average Au grades are essentially the same in porphyry Cu deposits of alkaline and calc-alkaline classes in Western Canada. However, alkaline or subalkaline suites are still considered as having better Au potential by some explorationists.

6) Porphyry deposits which formed within the upper continental crust (classic or phallic classes) are Au-rich relative to deeper plutonic deposits which are Au-poor. Hence depth-zone classifications and features indicative of depth of emplacement can be useful for distinguishing the Au potential of porphyry deposits.

7) Au correlates with K-feldspar stable alteration, especially biotite and/or K-feldspar. Chlorite and other propylitic assemblage minerals commonly accompany the Au-bearing zones in Western Canadian deposits.

8) Abundant replacement quartz of replacement origin, commonly as stockworks, is abundant except in the Western Canadian deposits.

9) Sericitic alteration may or may not be present and carries substantially less Au than K-feldspar stable zones.

10) The occurrence of magnetite in unusually high amounts (3 - 10%) is a common feature of the Au-rich porphyry Cu deposits.

11) The pyrite content of the Au-bearing zone is usually low but there does not appear to be a direct relationship between Au and pyrite.

The following features have no obvious or direct relationship to Au-rich porphyry deposits. Items 1 to 3 have been discussed in the preceeding section:

1) Petrologic affinity.

2) Host rock composition.

3) Pyrite content.

4) Geotectonic setting. The observation that porphyry deposits generated in island arcs may be richer in Au and poorer in Mo than those in continental margins may be generally true but does not seem to be a critical factor in controlling Cu-Mo-Au relative abundances.

5) Skarn Association. Au-rich or Au-bearing porphyry deposits do not appear to be more or less closely related or associated with skarns than Cu-Mo porphyry deposits. However, magnetite-bearing skarns should not be overlooked as a possible guide to the commonly magnetite-rich, Au-rich porphyry deposits. Epidote skarns may be Au-bearing relative to plagioclase-clinopyroxene skarns.

6) Age.

7) Wallrock composition. Shoshonitic volcanic rocks and also coeval·volcanic rocks are common but any wallrock is possible.

8) Size.

9) Erosion level.

Au-Rich Porphyry Deposits

Numerous authors have attempted to classify porphyry-type deposits on the basis of relative amounts of contained Cu, Mo and Au and relate the divisions to geological features.

Kesler (1973) divided porphyry deposits into Cu-Mo and Cu-Au classes. Sinclair et. al. (1981) conclude that Western Canadian porphyry deposits do not divide into Cu-Mo and Cu-Au categories. Rather they find a complete and somewhat gradational range of relative Cu-Mo-Au values in Western Canadian deposits (Figure 1) as observed by Titley (1978) for porphyry deposits in the southwestern and western Pacific. Au and Ag grades of Western Canadian porphyry deposits group with an existing depth-zone classification and with petrologic affinity of related plutonism.

The following is a discussion of some of the divisions and classifications with emphasis on features which may be useful as exploration guides, especially in Western Canada, for Au-rich deposits.

Divisions by Copper

There is no obvious relation between Cu and Au contents in porphyry Cu or porphyry Mo deposits. However, Au correlates closely with Cu in Au-rich porphyry deposits. Sillitoe (1979) observed that Au correlates closely with Cu in Au-rich porphyry deposits on a world-wide basis. He defined Au-rich porphyry Cu deposits as those with ≥ 0.4 g/t Au. Porphyry deposits in Western Canada with negligible Cu (or negligible Mo) have relatively low combined Au and Ag values (Sinclair et. al., 1981).

Sinclair (1982) has observed that in the Matachewan area, Ontario, Cu and Au do not correlate in trachytic syenite associated with syenite-hosted Au deposits and Cu and Au do correlate in syenite porphyries from the porphyry Cu-Mo occurrences. The Matachewan area Au deposits possibly represent pyritic alteration zones related to Cu-Mo occurrences which are Au-rich (Table 5).

The Au-bearing deposits in the Matachewan area include:

- syenite-hosted Au deposits
- volcanic-hosted Au deposits
- porphyry Cu-Mo occurrences
- quartz veins

The porphyry-type syenite-hosted Au deposits have very low Cu-Au correlations but Cu and Au correlate well in the porphyry Cu-Mo occurrences.

The shared characteristics of the Matachewan syenite, volcanic and porphyry Cu-Mo deposits include:

- extensive disseminated and/or stockwork-controlled mineralization
- pyrite contents of about 5%
- significant K-enrichment
- sparse Cu mineralization
- calc-alkaline to alkaline, high-level felsic intrusive rocks

Divisions by Molybdenum

Sillitoe's (1979) Au-rich porphyry Cu deposits are poor in Mo and commonly do not contain 30 ppm Mo. In Western Canada, porphyry deposits containing negligible Mo (or negligible Cu) have relatively low combined Au + Ag values, whereas porphyry Cu deposits with at least a small Mo content (Figure 2) have the highest combined precious metal contents. The plutonic group of porphyry deposits and porphyry Mo deposits form a category that is abnormally low in mean Au contents (Sinclair et. al, 1981).

Divisions by Gold and Silver

Sillitoe (1979) has arbitrarily chosen 0.4 g/t Au to distinguish Au-rich porphyry Cu deposits. Simple statistical tests by Sinclair et. al. (1981) show that for Western Canadian deposits there are two Au populations corresponding to the plutonic and non-plutonic categories of Sutherland Brown's (1976) depth-zone classification. The plutonic and non-plutonic categories are clearly separable at a threshold of about 0.034 g/t Au with the relatively Au-rich deposits being in the non-plutonic class.

Ag is important in distinguishing deposits of alkaline and calc-alkaline affinity. A threshold of 2.35 g/t Ag clearly separates a relative Ag-rich group of alkalic deposits from lower Ag values for calc-alkalic deposits. However, the average Au grades are essentially the same in porphyry Cu deposits of the alkaline and calc-alkaline classes providing plutonic deposits are omitted from the comparison (Sinclair et. al., 1981).

Sinclair et. al. (1981) propose a depth zone classification scheme (Figures 3 and 4) based on the 0.034 g/t Au threshold for Au-rich deposits and the 2.35 g/t Ag threshold for Ag-rich alkalic deposits. Plotting log transformed mean grades of Au and Ag classifies the deposits as plutonic or non-plutonic. The Au-rich deposits and many of the Au-poor deposits all are within the non-plutonic category.

The data on Tables 2 and 3 may indicate that Ag:Au ratios can be used as exploration guides to distinguish Au-rich from Au-poor porphyry Cu deposits. From Table 2 it is apparent that eight out of ten of the Western Canadian Au-rich porphyry deposits, with Au-rich arbitrarily chosen as ≥ 0.3 g/t, have Ag:Au ratios ≤ 6.7:1. The other two have ratios of 10.3:1 and 19.2:1. No Au-rich deposits have Ag:Au ratios ≥ 19.2:1.

Limited data for porphyry deposits in the southwestern Pacific on Table 3 shows that the Au-rich deposits, and one Au-poor deposit, have Ag:Au ratios 10.4:1. Three of the four deposits for which both Au and Ag grades are available have Ag:Au ratios 10.4:1. These three deposits are all Au-poor. Limited data for porphyry deposits in the western United States on Table 4 shows that the Au-rich deposits commonly have low Ag:Au ratios. A notable exception is the Magma Mine which was the sixth largest U.S. gold producer in 1979.

The Quesnel River Au deposit in B.C. and other showings in the area associated with alkaline or calc-alkaline syenites to diorites have low Ag:Au ratios and minor associated Cu-Mo. Limited data indicates that Quesnel River has a Ag:Au ratio of 1:1 and a few samples from a low-grade peripheral zone have ratios of 3.7:1 to 17.5:1. Two other prospects in the area, the Megabuck and Ta Hoola Lake prospects, have indicated Ag:Au ratios of 1.1 to 7.2:1 based on samples from a few trenches.

Gold deposits in the Matachewan area possibly represent pyritic alteration zones related to Cu-Mo occurrences (Sinclair, 1982). The syenite-hosted Au deposits have very low Cu-Au correlations and have low Ag:Au ratios, 0.08 to 0.23:1. The porphyry Cu-Mo-Au occurrences where Cu and Au correlate have high Ag:Au ratios, 13.6 to 26.7:1 (Table 5).

At Sulphurets Cu and Au do not correlate in the potentially economic Breccia Zone but correlate closely (.96 correlation coefficient) in the uneconomic Lake Zone. Cu and Au probably correlate in the porphyry Cu-Mo occurrences. Areas in the disseminated Au zones with very low Cu contents have Ag:Au ratios of 0.4 to 2.4:1. Areas in the disseminated Au zones with ≥ 0.15% Cu have Ag:Au ratios generally between 1 to 10:1. The porphyry Cu-Mo occurrences at Sulphurets have high Ag:Au ratios from 30.3:1 to 42.4:1.

Divisions by Petrologic Suites or Classes

Sillitoe's (1979) Au-rich porphyry Cu deposits are commonly in shoshonitic (alkaline affinity) intrusive rocks and less commonly in calc-alkaline granodiorites to ademellites and latite porphyries. Sillitoe (1979) concludes that a high Au content is not directly related to the composition of the intrusive. Hollister's (1975) relation of Au-rich porphyry deposits to the diorite model does not appear to be valid.

The porphyry deposit host rocks in Western Canada are quartz-poor, alkalic or shoshonitic intrusive rocks ranging in composition from diorite to syenite. They intrude coeval volcanic rocks.

In Western Canada the deeper plutonic deposits are Au-poor relative to the shallower classic (phallic) and volcanic classes using the classification of Sutherland Brown (1976) and McMillan and Panteleyev (1980). Both alkaline and calc-alkaline suites of porphyry Cu-Mo deposits have relatively high Au contents (Sinclair et. al, 1981). The interpretation that the deposits of the alkaline suite are Au-rich relative to the calc-alkaline suite (Barr et. al, 1976) does not appear valid according to Sinclair et. al. (1981). However, correlations of higher Au contents with alkalic or subalkalic suites are still being made (Peatfield, 1982) and may be useful as an exploration guide.

Divisions by Geotectonic Setting

Recent studies indicate that the geotectonic setting is not a critical factor in controlling Cu-Mo-Au abundances in porphyry deposits. Rather, local environments of formation of porphyry deposits has exerted a controlling influence on precious metal contents.

Kesler (1973) concluded that deposits generated in island arcs tend to be richer in Au and poorer in Mo than those in continental margin orogens. Hollister (1979) has taken this relationship as evidence for a basement control of metal contents. This relationship may be generally true (Sillitoe, 1979) but conditions conducive to a high Au content are likely to have developed in porphyry systems at or near their present sites within the upper continental crust rather than at deeper levels during magma generation and ascent. This opinion concurs with Tilling et. al.'s (1973) conclusion that for Au deposits in general the geochemical conditions of Au transport and deposition are the major factors controlling the concentration of Au.

Sinclair et. al. (1981) find that local environments of formation of porphyry deposits has exerted a controlling influence on the precious metal content of Western Canadian deposits. Higher Au contents correlate with deposits formed at relatively shallow depths and high Ag contents correlate with deposits of alkaline affinity.

Divisions by Alteration and Associate Minerals

Gold in the Au-rich porphyry Cu deposits (Sillitoe, 1979) is in a feldspar-stable potassium silicate alteration assemblage with biotite and subordinate K-feldspar. The Au-bearing zone is centrally located within a concentric zoning pattern. In general the significant minerals are biotite, quartz, magnetite and lesser K-feldspar, anhydrite and chlorite. Minor or absent minerals in the Western Canadian deposits are epidote, diopside, garnet and scapolite. A sericite zone may or may not be present and no significant Au occurs with sericitic alteration. Abundant transparent quartz of replacement origin occurs as stockworks and intervening silicification except in the Western Canadian deposits.

A notable exception is the Salave Au prospect in Spain (Harris, 1980) where the Au is located in the core zone of a concentric sequence of hydrothermal alteration corresponding to increased carbonitization, desilicification, sericitization, albitization, and sulphidization inward from unaltered granodiorite to areas of disseminated Au.

Magnetite is extremely common in Au-rich porphyry deposits. The deposits described by Sillitoe (1979) commonly contain 3 - 10% magnetite. However, some of the Western Canadian deposits have very low magnetite contents. Magnetite is absent in the Cu-Au zone at Butte, Montana. Western Canadian deposits may have hematite replacing magnetite or only hematite.

Gold is commonly in the native state and associated with a low pyrite content. Pyrite is even uncommon in some of the Au-rich porphyry Cu deposits (Sillitoe, 1979). There is no obvious relationship between Au and pyrite.

Au-Rich and Au-Poor Skarn Deposits

The relation of Au-rich and Au-poor skarn deposits to Au-rich and Au-poor porphyry deposits is uncertain and has not been researched. However, some observations on the relationship between Au-rich skarns and intrusive rocks for the circum-Pacific region may be useful in exploration for Au-rich skarns or porphyry deposits.

Ishihara (1977) correlates W-Au mineralization and porphyry Cu deposits with magnetite granitoids verses ilmenite granitoids in the circum-Pacific region. The magnetite granitoids have the characteristics of I-type granitic rocks.

Shimazaki (1980) finds that in Japan Au-bearing skarn deposits tend to be associated with magnetite-bearing granitoids. A specific skarn assemblage is associated with the magnetite-bearing granitoids. Epidote skarn is associated with the magnetite-bearing granitoids while plagioclase-clinopyroxene skarn is associated with the ilmenite-bearing granitoids.

Shimazaki (1980) concludes that there is a correlation between high oxygen fugacity in the system, magnetite-bearing granitoids, Au-bearing skarn deposits and calc-silicate mineral assemblages formed under relatively high oxygen fugacities. These correlations support Sillitoe's (1979 and 1981) interpretation that internal physiochemical parameters such as high oxygen fugacity in the hydrothermal system control relative abundances of Au, Cu and Mo in Au-rich porphyry deposits.

Porphyry Gold Deposits

Porphyry Au deposits without Cu may exist such as Porgera, New Guinea (Cotton, 1975 and Beams, 1981), Salave, Spain (Harris, 1980) and Vunda, Fiji (Lawrence, 1978). The Sulphurets prospect has Au-rich and Cu-poor zones closely associated with Cu-rich and Au-poor, Mo-bearing zones. The mineralization is related to fine-grained syenodiorites and diorite porphyries and is intimately associated with intrusive breccias of possible monzonitic composition.

Sulphurets

The Breccia Zone of the Sulphurets Gold Zone is essentially a Au-bearing pyritic zone peripheral to a Cu-Mo occurrence. The relatively unexplored Snowfields Gold Zone has no known associated intrusive rocks, a lower (5-10%) pyrite content, less silicification and undetermined Cu-Au correlations. The following compares and contrasts Sulphurets gold zones with Sillitoe's general characteristics of gold-rich porphyry copper deposits:

SULPHURETS PORPHYRY GOLD ZONES	GOLD-RICH PORPHYRY COPPER DEPOSITS
subalkaline? host rock, syenodiorite and diorite porphyry	alkaline quartz diorite host rock, occasionally calc-alkaline adamellite or latite porphyry
sericite-quartz-pyrite alteration assemblage with minor K-feldspar and tourmaline and rare biotite and albite	biotite and subordinate K-feldspar plus quartz and magnetite, sericite is absent to abundant
strong silicification, minor quartz-pyrite to pyrite-quartz veins	abundant quartz as stockworks and intervening silicification
no magnetite	3-10% magnetite
high pyrite, 15-40%	low pyrite, 1-4%
Cu-Au do not correlate	high Cu-Au correlation
low Mo	Low Mo
Cu-Pb-Zn zonation, with increasing Pb-Zn outwards from the Cu-Mo core	unknown

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	Deposit	tonnes[1]	Cu%	Mo%	Average Grades[2] Au ppm	Ag ppm	Deposit Class [4]	Alteration Class [3]	Source
1.	Bethlehem, Jersey-Iona	54	0.420	0.010	0.010(a)	0.10(a)	PLUT	5	1979 Annual Report Bethlehem Copper
2.	Bethlehem Lake Zone	190	0.420	0.017	0.010(b)	0.10(b)	PLUT	5	1979 Annual Report Bethlehem Copper
3.	J.A.	260	0.430	0.017	0.010(b)	0.10(b)	PLUT	5	1979 Annual Report Bethlehem Copper
4.	Lornex	477	0.410	0.015	0.006(a)	1.20(a)	PLUT	5	Lornex Staff
5.	Valley Copper	800	0.480	0.003	0.006	1.90	PLUT	5	CIM Spec. Vol. 15
6.	Highmont	135	0.280	0.031	0.004(a)	0.90(a)	PLUT	5	CIM Spec. Vol. 15 and Teck Staff
7.	Brenda	160	0.180	0.050	0.013	0.63	PLUT	3	CIM Spec. Vol. 15
8.	Gibralter	327	0.370	0.010	0.007(b)	1.03(b)	PLUT	5	CIM Spec. Vol. 15
9.	Island Copper	254	0.520	0.018	0.094	0.63	VOLC	5	CIM Spec. Vol. 15
10.	Schaft Creek	330	0.400	0.022	0.320	1.50	VOLC	3	CIM Spec. Vol. 15
11.	Granisle	85	0.430	0.009	0.120	1.12	PHAL	3	
12.	Bell Copper	66	0.480	0.006	0.350	1.00	PHAL	3	CIM Spec. Vol. 15
13.	Morrison	86	0.420	0.017	0.340	1.00	PHAL	4	CIM Spec. Vol. 15
14.	Berg	400	0.400	0.030	0.050(b)	5.00(b)	PHAL	3	CIM Spec. Vol. 15 and Placer Staff
15.	Huckleberry	85	0.410	0.015	0.025	0.93	PHAL	5	CIM Spec. Vol. 15
16.	Fish Lake	50	0.300	0.002	0.470	2.30	PHAL	4	CIM Spec. Vol. 15, and Bethlehem Staff
17.	Poison Mountain	175	0.330	0.015	0.300	3.10	PHAL	4	CIM Spec. Vol. 15 and Long Lac Min. Expl. Staff
18.	Casino	162	0.370	0.023	0.320(b)	1.75(b)	PHAL	3	CIM Spec. Vol. 15 and Teck Staff
19.	Copper Mountain	142	0.570	0.001	0.170	3.90	VOLC	6	CIM Spec. Vol. 15 and Newmont Staff
20.	Ingerbelle	52	0.430	0.002	0.160	0.63	VOLC	6	CIM Spec. Vol. 15 and Newmont Staff
21.	Afton	32	1.030	0.001	0.600(a)	4.00(a)	VOLC	6	CIM Spec. Vol. 15 and Teck Staff
22.	Cariboo-Bell	50	0.490	0.001	0.680	4.50	VOLC	6	CIM Spec. Vol. 15 and Teck Staff
23.	Galore Creek	125	1.100	0.001	0.400	7.70	VOLC	6	CIM Spec. Vol. 15
24.	Red Chris	41	0.560	0.003	0.320	1.50	VOLC	6	Texas Gulf Staff
25.	Endako	232	0.002(b)	0.081	0.005(b)	0.70(b)	PLUT	3	Placer Staff and 1979 Placer Annual Report
26.	B.C. Moly (Kitsault)	105	0.004	0.120	0.010(b)	4.60	PHAL	3	Amax Staff
27.	Bell Molybdenum	32	0.003	0.066	0.005(b)	0.80	PHAL	3	CIM Spec. Vol. 15 and Amax Staff
28.	Adanac	101	0.001(a)	0.080	0.010(b)	0.20(b)	PLUT	3	CIM Spec. Vol. 15 and Placer Staff

1. Millions of tonnes
2. (a) Production
(b) Estimated
3. Alteration: 3 K-spar-Biotite 5 Sericite
4 Biotite 6 K-spar-Biotite/Chlorite (Diorite model type)
4. PHAL = CLASSIC (McMillan and Panteleyev, 1980)

Table 1: Tonnage, metal grades, deposit classification and dominant alteration category for principle porphyry-type deposits in the Canadian Cordillera.

Deposit	Ag:Au	g/t Au	Deposit Class	Alteration Class
12. Bell Copper	2.9:1	.350	PHAL	3
13. Morrison	2.9	.340	PHAL	4
20. Ingerbelle	3.9	.160	VOLC	6
10. Schaft Creek	4.7	.320	VOLC	3
24. Red Chris	4.7	.320	VOLC	6
16. Fish Lake	4.9	.320	PHAL	3
18. Casino	5.5	.470	PHAL	4
22. Cariboo-Bell	6.6	.680	VOLC	6
9. Island Copper	6.7	.094	VOLC	5
21. Afton	6.7	.600	VOLC	6
11. Granisle	9.3	.120	PHAL	3
1. Bethlehem, Jersey-Iona	10.0	.010	PLUT	5
2. Bethlehem Lake Zone	10.0	.010	PLUT	5
3. J.A.	10.0	.010	PLUT	5
17. Poison Mountain	10.3	.300	PHAL	4
23. Galore Creek	19.2	.400	VOLC	6
19. Copper Mountain	22.9	.170	VOLC	6
15. Huckleberry	37.2	.025	PHAL	5
7. Brenda	48.5	.013	PLUT	3
14. Berg	100.0	.050	PHAL	3
8. Gibralter	147.1	.007	PLUT	5
4. Lornex	200.0	.006	PLUT	5
6. Highmont	225.0	.005	PLUT	5
5. Valley Copper	316.7	.006	PLUT	5

Table 2: List of the principle Cu porphyry deposits (omits Mo deposits) in the Canadian Cordillera arranged in order of increasing Ag:Au ratios. For data on deposit and alteration class see Table 1. Deposits with ≥ .3 g/t Au (arbitrarily chosen) are underlined.

Deposit	Ag:Au	Au g/t
Frieda (Horse-Ivaal)	2.9:1	0.3 - 0.4
Panguna	4.5:1	0.51
Marcopper	4.5:1	0.35
Porgera	4.5:1	2.67 (2.3)
Frieda (Koki Creek)	6.7:1	0.23
Endeavour 37, N.S.W.	7.0:1	0.50
Ertsberg (skarn)	10.4:1	0.85
Mbina	15.6:1	0.066
Arie	17.2:1	0.099
Yandera	21.6:1	0.10

Table 3: Porphyry deposits in the Southwestern Pacific for which both Au and Ag average values are available. The deposits are listed in order of increasing Ag:Au ratios. Deposits with ≥ .3 g/t Au (arbitrarily chosen are underlined. Except for Porgera and Endeavour the data is from Titley (1978). The Mining Journal, Oct. 9, 1981, p. 2 & 5 reports 100,000,000 tonnes of 2.3 g/t Au for Porura. Beams (1981) reports 30,000,000 tonnes of 2.67 g/t Au and 11.99 g/t Ag. The Endeavour 37 prospect is reported (Mining Journal, Nov. 13, 1981, p. 365) to have .50 g/t Au and 3.49 g/t Ag.

Deposit	Au g/t	Ag g/t	Ag:Au
Butte, Montana (porphyry Cu deposit) (Ag:Au based on 1979 production)	--	--	0.7:1
Spotted Horse Mine, Montana (disseminated in intrusive)	68.6	137.1	2.0
Copper Flats New Mexico (alkalic porphyry Cu deposit)	0.7	1.7	2.5
Zortman, Montana (disseminated-alkalic deposit)	2.3	13.7	6.1
Bingham, Utah (porphyry Cu deposit)	0.4	2.8	7.5
Lundusky, Montana (disseminated-alkalic deposit)	1.3	12.7	9.7
Battle Mountain, Nevada (Cu-Au skarn)	1.0	12.3	12.4
Magma Mine, Arizona (porphyry Cu deposit)	1.0	65.1	63.3

Table 4: List of porphyry-type deposits in the western United States for which Chuchla and Fellows (1981) give both Ag and Au contents.

Deposit	Ag:Au	Au g/t	Ag g/t
Syenite-hosted Au deposits:			
Matachewan-Consolidated	.08:1	9.2	0.7
Lake Shore Mine	.23:1		
Young-Davidson	.23:1	3.3	0.75
Porphyry Cu-Mo-Au deposits in porphyritic syenite:			
Stancop bulk sample, 0.5% Cu	13.6:1	0.22	3.0
Ryan Lake, 1.5% Cu	26.7:1	0.27	7.2

TABLE 5: Matachewan, Ontario syenite-hosted Au deposits and Cu-Mo-Au deposits. Data is from various sources compiled by Sinclair (1982).

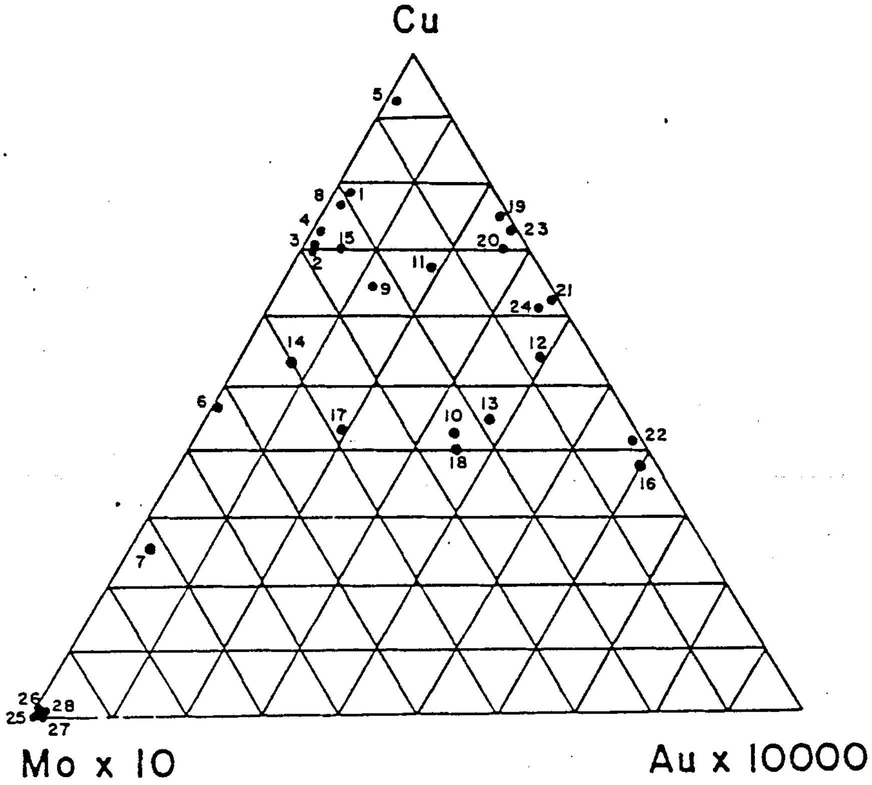

Figure 1:

Copper-molybdenum-gold triangular graph for Western Canadian porphyry-type deposits. Multiplication factors are those of Kesler (1973) for ease of comparison with precious work. Numbers correlate with order of listing in Table 1.

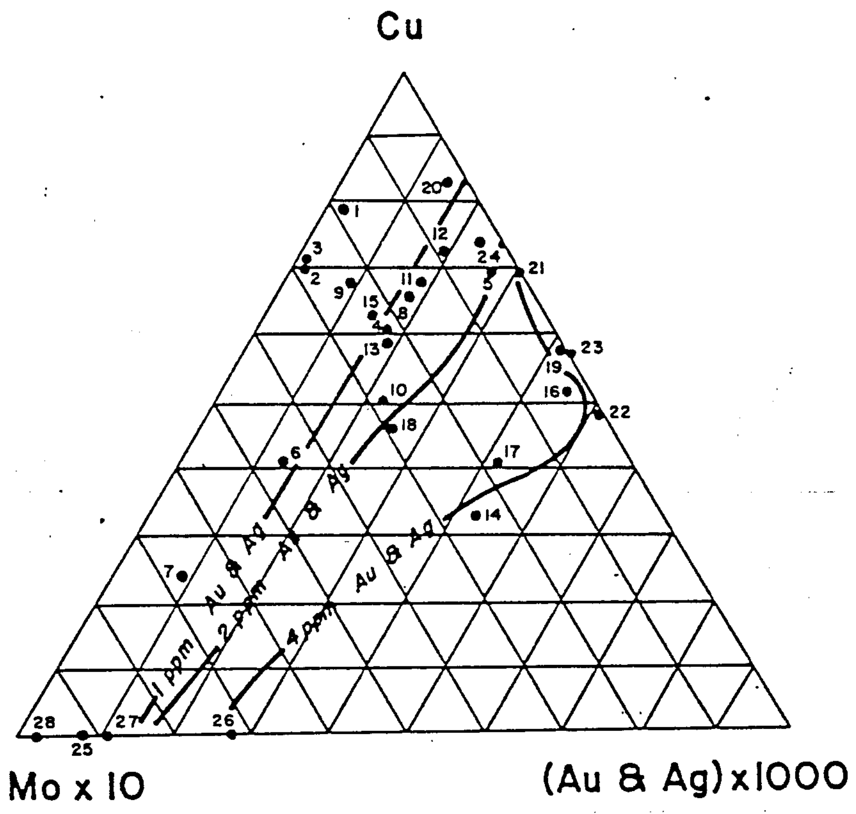

Figure 2: Copper-molybdenum-(gold plus silver) triangular graph for Western Canadian porphyry-type deposits. Note change in multiplication factor for precious metal vertex compared with Fig. 5. Contains one absolute combined (gold plus silver) average grades in g/t (ppm). Numbers are order of listing of deposits in Table 1.

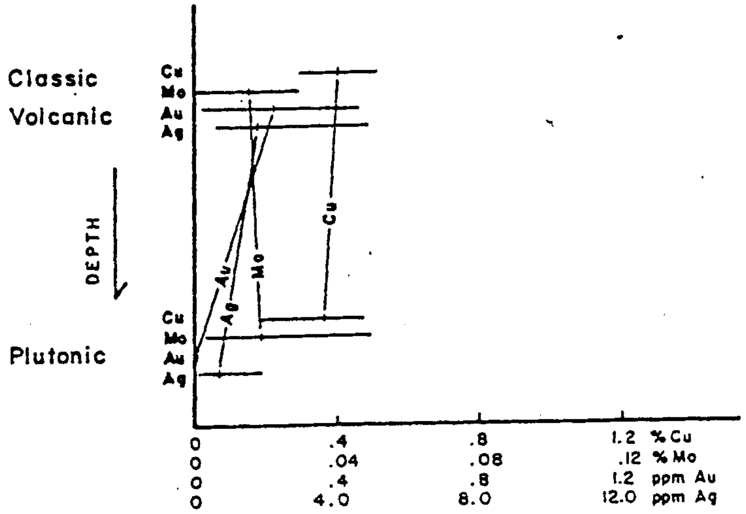

Figure 3: Variations in mean metal grades as a function of depth-zone category. The "depth": scale is arbitrary. Note that the scale for metal abundances differ for each metal. Plot is for porphyry copper deposits only from Table 1.

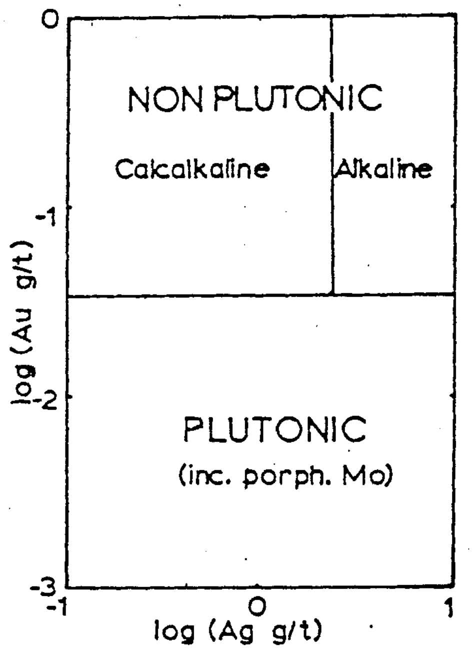

Figure 4: Tentative empirical two-way classification scheme for Western Canadian porphyry-type deposits based on log transformed mean grades of gold and silver.