

Current

**ANVIL RANGE LEAD-ZINC-SILVER DISTRICT
GEOLOGICAL LEGEND
(for 1"=2000' and 1"=1000' compilation series)**

MT. MYE FORMATION: Hadrynian to Lower Cambrian main Amphibolite Facies:

(943)	1C	Banded quartzofeldspathic biotite, muscovite, garnet, staurolite schist/gneiss
(947)	1D	moderately carbonaceous biotite, muscovite, andalusite schist
(908)	1F	metabasite/amphibolite
(901)	1G	marble/silicated marble
(913)	3D	cal-silicate schist

mainly Greenschist Facies some Amphibolite Facies:

(941)	3G	non-calcareous medium grey phyllite
(908)	3C	metabasite
(963)	3E	graphitic phyllite
(916)	3I	micaceous quartzite

VANGORDA FORMATION: Middle or Lower (?) Cambrian to Early (?) Ordovician Amphibolite Facies:

(913)	3D	calc-silicate schist
(908)	3C	metabasite
(912)	3A	transition zone = graphitic phyllite/chlorite phyllite/calc-silicate
(946)	3B	chloritic phyllite
(906)	3F	marble/silicated marble

Greenschist Facies:

(936)	5A	variably calcareous graphitic phyllite
(920)	5B	variably calcareous medium grey phyllite
(908)	5C	metabasite
(910)	5D	banded tuff *(Note: 5D as mapped included 5B80, 5D0 and 5F0 used in the subsurface)
(904)	5E	phyllitic marble
(910)	5F	chloritic phyllite*
(949)	5G	graphitic phyllite

MENZIE CREEK FORMATION: Early Ordovician to Silurian

(911)	5H	pillowed basalt/basalt breccia
(965)	5I	graphitic slate

EARN GROUP AND ANVIL RANGE GROUP: Mid Devonian to Permian

(966)	6A	black shale/siltstone/black chert
(905)	6E	bioclastic limestone-Mid Devonian fossils
(921)	6C	chert pebble conglomerate/sandstone
(940)	6D&B	barite (upper and lower horizons respectively)
(948)	6F	green, black and beige phyllitic chert
(930)	6G	red phyllitic chert
(931)	7A	epidotized massive basalt
(933)	8A	serpentinite
(924)	8B	rodingite
(933)	8C	gabbro
(933)	8D	diabase
(933)	8E	harzburgite
()	8F	basalt
()	8G	eclogite

MESOZOIC CLASTICS: Upper Triassic and Younger (?)

(914)	9	siltstone/sandstone/shale/limestone/greywacke/chert/minor basalt- upper Triassic fossils
(942)	10	polymictic conglomerate and sandstone

YUKON CATACLASTIC COMPLEX/KLONDIKE SCHIST: Mainly Palaeozoic?

(915)	OB	micaceous quartzite/quartzite/graphitic phyllite-commonly cataclastic
(908)	OE	amphibolite/garnet amphibolite
(922)	OG	eclogite (same as 8G)

INTRUSIVE ROCKS: Cretaceous

Anvil Batholith

(928)	11A	granodiorite - equigranular
(929)	11B	quartz monzonite - porphyritic

Dyke Suite

(939)	11C	quartz monzonite pegmatite dikes
(956)	11D	equigranular hornblende biotite quartz diorite*
(934)	11E	porphyritic hornblende biotite quartz diorite*
(937)	11F	quartz feldspar porphyry, commonly with smoky quartz
(932)	11G	pyroxenite, serpentinized pyroxenite (maybe a phase of 5C)

* does not conform to current subsurface usage

CURRAGH RESOURCES INC. – NUMERIC ANVIL LITHOSTRATIGRAPHIC CODE

ROCK CODES (OLD CODES INCLUDED FOR COMPARISON)		MINERAL IDENTIFIERS
DISSEMINATED QUARTZITES		Carbonates c calcite k ankerite v carbonate–non specific w dolomite Micas b biotite j "fuchsite" l chlorite m muscovite s sericite t talc Felspars – Quartz f feldspar q quartz (fine grained) y kaolinite (clay minerals) p potash feldspar Q quartz (vein) Calc Silicates a actinolite e epidote h hornblende i diopside Alumino–Silicates/Pelites d andalusite n garnet r fibrolite u staurolite z chloritoid Oxide/Sulphide/Sulphates A Arsenopyrite B Barite C Chalcopyrite G Galena L Limonite (iron oxides) M Magnetite P Pyrite R Pyrrhotite Z Sphalerite F Marcasite Other g carbon x noncalcareous
2	4A Ribbon banded carbonaceous quartzite	
3	4C/4D Pyritic quartzite (<30% pyrite)	
SEMI MASSIVE SULPHIDE (Generally low grade)		
4	4EC/4E1/4C3 Siliceous pyritic sulphides (30–60% pyrite)	
MASSIVE SULPHIDES		
5	4E/4F Massive pyritic sulphides (60–100% pyrite)	
6	4K Massive pyritic sulphide with clasts of dolomite/ankerite	
7	4G Baritic pyrite sulphides (> 10% barite)	
8	4H Pyrrhotitic sulphides	
9	4J Nonpyritic sulphides & oxides – pyrite poor	
METASEDIMENTS		
20	3G Noncalcareous, muscovite–chlorite, medium grey phyllite	
22	1C/1CD/1D Noncalcareous, blo–musc–qtz staurolite+andalusite+garnet+fibrolite schist	
30	5A/5G/3E/1E Carbonaceous phyllite/schist	
32	5E/3F/1G Marble + calc–silicate bands	
33	1B Skarn and 'silicated' marble	
36	3D Calc–silicate	
40	5B Calcareous, silvery grey, muscovite chlorite phyllite	
44	5C/3C/1F Metabasite, poorly foliated greenstone (relict igneous texture)	
45	5C/3C/1F Pyroxinite – commonly serpentinized (relict bastites)	
46	5C/3C/1F Amphibolite – blue–green hornblende + plagioclase + quartz	
47	5D/3B/1H Chloritic phyllite/schist – pale green, homogenous	
ALTERED ROCKS		
52	4L0 Muscovite>chlorite quartz phyllite/schist – light cream to white	
54	4L6 Chlorite>muscovite quartz phyllite/schist – pale green	
CRETACEOUS INTRUSIVES		
60	10O Quartz vein – white bull quartz	
61	10AB Anvil Batholith – Mt Mye phase of Anvil plutonic suite. Musc–blo granite	
65	10C Pegmatite	
66	– Aplite	
68	10E Hornblende–biotite quartz diorite – massive & unfoliated	
69	10F Smokey quartz–feldspar porphyry – massive and unfoliated	
FAULT ROCK (use only if parent not recognized)		
72	Gouge	
74	Tectonic breccia	
76	Mylonite	
OVERBURDEN		
82	Unclassified – general	
84	Triconed – no recovery	
86	Till – silt – sand	
88	Ferricrete	
99	Air	
OTHER		
0	No Recovery	
&	+/-	
GRADE MODIFIERS		
N	no visible grade	
W	1–3% Pb+Zn	
L	3–5% Pb+Zn	
H	5–10% Pb+Zn	
V	+10% Pb+Zn	
		ROCK TEXTURES + equigranular ! foliated = laminated/ribbon banded > coarse–grained ^ medium grained < fine grained \ clotted : porphyroblastic % porphyritic · Interstitial @ porous * weathered ~ fault gouge X fault breccia (tectonic) ? mylonite # altered \$ 'stringered' o spotted

Current

**ANVIL DISTRICT
DETAILED LOGGING LITHOSTRATIGRAPHIC CODE
MAIN DEPOSIT AREA**

Unconsolidated Overburden

Unit 11	11	A	Triconed, no recovery
	11	B	Till, silt, sand - all unconsolidated

Intrusive Rocks

Unit 10	928	10	AB	Granite - Anvil Batholith	
				10AB _{mm} Mt. Mye phase	biotite-muscovite
				10AB _o Orchay phase	biotite-hornblende
				10AB _m Majorie phase	biotite-hornblende
	939	10	C	Pegmatite	
	934	10	E	Biotite-hornblende granite porphyry	
	925	10	F	Smokey quartz-feldspar porphyry	
	938	10	Q	Bull qtz veins/pods	
				1 Foliated/lineated	
				2 Porphyritic	
				3 Aphanitic	
				4 Smokey qtz-bearing	
				5 Muscovite-bearing	
				6 Kspar-bearing	
				7 Biotite-bearing	
				8 Amphibole-bearing	
				9 Altered (kaolinite, montmorillonite)	
				0 Normal (equigranular)	

Vangorda Formation

Unit 5	936	5	A	Variably calcareous, graphitic phyllite (= 1E, hosts Units 2/4)	
		5	A*	Graphitic fault rock with shear band fabric and vein quartz, altered metabasite clasts	
	920		B	Calcareous muscovite-chlorite +/- biotite phyllite (greenschist equivalent of 3D)	
	908		C	Metabasite (includes pyroxenite)	
	910		D	Chloritic phyllite (also logged as 5F locally)	
	904		E	Phyllitic marble and silicated marble	
	949		G	Variably calcareous, graphitic phyllite (above basal graphitic unit)	
				1 Siliceous	
				2 Carbonaceous	
				3 Calcareous	
				4 Altered, pyritic (white mica envelope)	
				5 Banded/laminated	
				6 Non-calcareous	
				7 Chlorite laminations	
				8 Chloritic	
				9 Sulfide-bearing	
				0 Normal	
				* Carbonate-bearing	

Vangorda Formation
 Unit 3 913 3 D Calc-silicate phyllite/schist (amphibolite facies equivalent of 5B)

Faro, Grum, Vangorda, DY Deposits Conformable Contact

Unit 2/4	922	2/4	A	Sulfide-bearing, ribbon-banded, graphitic quartzite
	915		B	Pyrite-free quartzite (may contain base metal sulfides)
	916		C	Base metal-poor, pyritic quartzite
	942		D	Base metal-bearing, pyritic quartzite
	918		E	Massive pyritic sulfides
	923		F	Buckshot facies, massive pyritic sulfides
	928		G	Baritic facies, massive sulfides/sulfates (> 10% BaSO ₄)
	924		H	Pyrrhotitic facies, massive sulfides
	949		J	Non-pyritic, massive sulfides/oxides (vein type sulfides)
	921		K	Dolomite-bearing, massive pyritic sulfides
			1	Siliceous
			2	Fine pyrite/marcasite-bearing
			3	Coarse, porphyroblastic pyrite-bearing
			4	Sphalerite and/or galena-bearing
			5	Carbonaceous
			6	Barite-bearing
			7	Pyrrhotite-bearing
			8	Magnetite-bearing
			9	Chalcopyrite-bearing
			0	Normal
			*	Carbonate-bearing

Alteration Facies for Metapelite Units

Unit 2/4L				White muscovite > qtz-chl-bio-phyllite (generally sulfide-bearing)
			1	Siliceous
			2	Pyrite-bearing
			3	Talc/kaolinite-bearing
			4	ZnS and/or PbS-bearing
			5	Carbonate-bearing
			6	Chl-bio > qtz-musc phyllite
			7	Pyrrhotite-bearing
			8	Magnetite-bearing
			9	Chalcopyrite-bearing
			0	Normal

Mt. Mye Formation (Greenschist Facies)

Unit 3	916		3-I	Graphitic quartzite in non-calcareous phyllite/schist
	941		G	Non-calcareous muscovite-chlorite+/biotite phyllite/schist (= 1C, 1D)
	906		F	Marble and silicated marble (= 1G)
	963		E	Graphitic phyllite/schist (= 5A)
	913		D	Calc-silicate phyllite/schist
	908		C	Metabasite (includes pyroxenite)
	946		B	Chloritic phyllite/schist (c.f. 5D)
	912		3-A	Transition zone with Unit 1 (interbanded chloritic phyllite, graphitic phyllite, and pelites of Vangorda and Mt. Mye Fms.)

- 1 Siliceous
- 2 Non-calcareous
- 3 Calcareous
- 4 Altered, pyritic (wme)*
- 5 Banded/laminated
- 6 Sulfide-bearing
- 7 Chlorite laminations
- 8 Chloritic
- 9 Carbonaceous
- 0 Normal

Mt. Mye Formation (Amphibolite Facies)

Unit 1	902	1-B	Tactite and silicated marble (=3F)
	943	C	Quartzo-feldspathic, biotite-muscovite gneiss/schist (= 3G)
	947	D	Carbonaceous biotite-muscovite-andalusite schist (= 3G)
		1CD	Biotite-muscovite-andalusite schist (= 3G) transitional between 1C and 1D
	967	E	Graphitic schist (=5A)
	908	F	Metabasite (=3C), chloritic schist/amphibolite
	901	G	Marble and silicated marble (= 3F)
	910	1-H	Chloritic schist (c.f. 5D)
		1	Siliceous
		2	Carbonaceous
		3	Calcareous
		4	Altered, pyritic (wme)*
		5	Banded
		6	Clotted
		7	Staurolitic
		8	Chloritic
		9	Sulfide-bearing
		0	Normal

*(wme) White mica envelope

Carbonates

- * carbonate
- # calcite
- \$ dolomite
- @ ankerite

lute pigage/lithocod
March 9, 1990

To

Copy to

C. J. JILSON

Handwritten signature

From Gregg Jilson

Date November 17, 1983

Subject LITH CODES FOR COLUMN LABELED " ROCK UNIT"

This will help sort through the alphabet soup we use for rock names - Gram ore is called 4 rather than 2 as at Faro, everything else is basically the same:

4 designates an ore type as opposed to 3 or 5 which designates a host rock. A letter following indicates type of ore and any further numbers are modifiers as outlined below:

4A is ribbon banded graphitic quartzite.

common modifiers:

4A0 means less than 5% Pb + Zn

4A4 means more than 5% Pb + Zn

4A3 means more than 30% pyrite

4A34 means greater than 5% Pb + Zn and greater than 30% Pyrite

note: 1 occurs as a modifier commonly but does not mean anything much.

4B, 4C and 4D are quartzose ore types without graphite.

4B has less than 2% pyrite and is relatively rare

4C is pyrite bearing and less than 5% Pb + Zn

4D is pyrite bearing and more than 5% Pb + Zn

common modifiers:

4C0 means normal and less than 5% Pb + Zn

4C4 means 4D, therefore should not be used

4B4 means no pyrite but more than 5% Pb + Zn

4D4 means pyrite and more than 10% Pb + Zn

4D0 means normal and 5 - 10% Pb + Zn

5 means minor graphite

7 means pyrrhotite bearing

9 means chalcopyrite

3 means more than 30% pyrite

4E is massive sulphide (note 4F is a textural variant that simply means very high grade 4E and is not used at Grum due to metamorphic grade)

4E1 means siliceous (60 - 80% pyrite)

4E4 means more than 5% Pb + Zn

4E6 means has visible barite but less than 10%

4E0 means normal and less than 5% Pb + Zn

4E7 means pyrrhotite bearing

4E8 means magnetite bearing

4E9 means chalcopyrite bearing

*#\$\$ means the rock contains carbonates of one sort or another

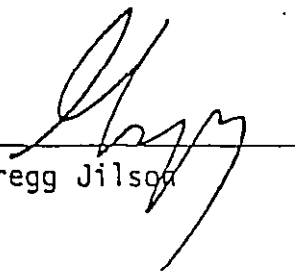
4G barite bearing massive sulphides
4G4 means greater than 10% Pb + Zn
4G8 means magnetite bearing
*\$# or @ are simply carbonate minerals

4H pyrrhotite bearing massive sulphides
4H1 means siliceous (greater than 20% quartz)
4H2 means also has pyrite
4H4 means more than 5% Pb + Zn
4H9 means chalcopyrite bearing

4K carbonate bearing massive sulphides
4K0 means less than 5% Pb + Zn
4K4 means greater than 5% Pb + Zn

4L is alteration in wallrock
4L0 means normal
4L1 means siliceous
4L2 means pyrite bearing
4L3 means talc bearing
4L4 Pb + Zn bearing (no cut-off)
4L5 means carbonate bearing
4L6 means chlorite bearing
4L7 means pyrrhotite bearing
4L9 means chalcopyrite bearing

4CA, 4CE etc. mean both 4C and 4A or 4C and 4E are present



Gregg Jilson

MAIN DEPOSIT AREA
LITHOSTRATIGRAPHIC CODE

Intrusive Rocks

Unit 10	928	10-A	Granodiorite (kspars-plag. quartz-10:)
	929	B	Adamellite (qtz monzonite)
	930	C	Pegmatite
	936	D	Quartz diorite (kspars-plag. qtz-10:)
	934	E	Diorite (kspars-plag. qtz-10:)
	925	F	Monzonite (kspars-plag. qtz-10:)
	932	G	Pyroxenite
	937	H	Granite (kspars-plag. qtz-10:)
	930	I	Syenite (kspars-plag. qtz-10:)
	938	Q	Bull qtz veins/pods

- 1 Foliated/lineated
- 2 Porphyritic
- 3 Aphanitic
- 4 Smokey qtz-bearing
- 5 Muscovite-bearing
- 6 Kspars-bearing
- 7 Biotite-bearing
- 8 Amphibole-bearing
- 9 Altered (kaolinite, montmorillonite)
- 0 Normal (equigranular)

Yangorda Formation

Intrusive Contact

Unit 5	936	S-A	Variably calcareous, graphitic phyllite (hosts Unit 4; i.e., hosts Unit 2)
	920	B	Calcareous muscovite-chlorite:biotite phyllite (greenschist equivalent of 3D)
	908	C	Metabasite
	910	D	Chloritic phyllite
	904	E	Phyllitic marble and silicated marble
	910	F	Laminarily banded, variably calcareous, chloritic phyllite (associated with 5C)
	949	G	Variably calcareous, graphitic phyllite.

- 1 Siliceous
- 2 Carbonaceous
- 3 Calcareous
- 4 Altered, pyritic (white mica envelope)
- 5 Banded/laminated
- 6 Non-calcareous
- 7 Chlorite laminations
- 8 Chloritic
- 9 Sulfide-bearing
- 0 Normal
- * Carbonate-bearing

Fero, Grum, Yangorda, DT Deposits

Conformable Contact

Unit 2/4	922	2/4-A	Sulfide-bearing, ribbon-banded, graphitic quartzite
	915	B	Pyrite-free quartzite (may contain base metal sulfides)
	916	C	Base metal-poor, pyritic quartzite
	942	D	Base metal-bearing, pyritic quartzite
	918	E	Massive pyritic sulfides
	923	F	Buchstot facies, massive sulfides
	928	G	Baritic facies, massive sulfides/sulfates (>10% BaSO ₄)
	924	H	Pyrrhotitic facies, massive sulfides
	949	J	Non-pyritic, massive sulfides/oxides
	921	K	Carbonate-bearing, massive pyritic sulfides
	914	L	

2/4L Muscovite-qtz-chl-bio-phyllite
(generally sulfide-bearing)

- 1 Siliceous
- 2 Coarse, porphyroblastic pyrite-bearing
- 3 Fine pyrite/marcasite-bearing
- 4 Sphalerite and/or galena-bearing
- 5 Carbonaceous
- 6 Barite-bearing
- 7 Pyrrhotite-bearing
- 8 Magnetite-bearing
- 9 Chalcopyrite-bearing
- 0 Normal
- * Carbonate-bearing

- 1 Siliceous
- 2 Pyrite-bearing
- 3 Calc/kaolinite-bearing
- 4 ZnS and/or PbS-bearing
- 5 Carbonate-bearing
- 6 Chl-bio-qtz-musc phyllite
- 7 Pyrrhotite-bearing
- 8 Magnetite-bearing
- 9 Chalcopyrite-bearing
- 0 Normal

Mt. Mye Formation

Conformable Contact

Unit 3	916	J-I	Graphitic quartzite in non-calcareous phyllite/schist
	913	H	Tuffaceous calc-silicate phyllite/schist (assoc. with 3D; identical to 5F)
	941	G	Non-calcareous muscovite-chlorite:biotite phyllite/schist (i.e., 1D)
	904	F	Marble and silicated marble (i.e., 1G)
	963	E	Graphitic phyllite/schist (i.e., 5A)
	913	D	Calc-silicate phyllite/schist (i.e., greenschist to amphibolite facies equiv. of 5B)
	908	C	Metabasite
	946	B	Chloritic phyllite/schist (c.f., 5D)
	912	J-A	Transition zone with unit 1 (interbanded chloritic phyllite, graphitic phyllite and pelites of Yangorda and Mt. Mye Fms.)

- 1 Siliceous
- 2 Non-calcareous
- 3 Calcareous
- 4 Altered, pyritic (ume)*
- 5 Banded/laminated
- 6 Sulfide-bearing
- 7 Chlorite laminations
- 8 Chloritic
- 9 Carbonaceous
- 0 Normal

	907	I-B	Tactile and silicated marble (i.e., 3F)
	943	C	Quartz-feldspathic, biotite-muscovite gneiss/schist (i.e., 3G)
	947	D	Carbonaceous biotite-muscovite-andalusite schist (i.e., 3G)
	967	E	Graphitic schist (i.e., 5A)
	908	F	Metabasite (i.e., 3C)
	901	G	Marble and silicated marble (i.e., 3F)
Unit 1	910	I-H	Chloritic schist (c.f., 5D)

- 1 Siliceous
- 2 Carbonaceous
- 3 Calcareous
- 4 Altered, pyritic (ume)*
- 5 Banded
- 6 Clotted
- 7 Staurolitic
- 8 Chloritic
- 9 Sulfide-bearing
- 0 Normal

* (ume) white mica envelope

Sulphide Lithofacies and Alteration Assemblages

There are numerous sulphide lithofacies which comprise all Anvil district deposits. The same facies in variable proportions form each deposit suggesting a consanguineous origin for all deposits. The appearance of sulphide facies in different deposits varies primarily as a function of metamorphic grade. Two principal subdivisions are recognized in the Anvil ores, massive and quartzose disseminated sulphides. Brief descriptions of the rock types in each of these major subdivisions are given below.

Massive Lithofacies

Massive Pyritic Sulphides: (Unit 2E/4E) banded (fig. 16A) to homogenous, (fig.16B) usually weakly foliated and/or lineated, massive pyrite with lesser sphalerite and galena. Total sulphide content is at least 80% and is commonly nearly 100%. Gangue consists of quartz and/or barite and/or carbonates (calcite, dolomite, ankerite). Accessory minerals include pyrrhotite, chalcopyrite, magnetite, arsenopyrite and marcasite. At amphibolite facies metamorphic grade, this rock type commonly develops a buckshot porphyroblastic texture of pyrite in a matrix of dark reddish brown to black base metal sulphides (fig. 16D). This texture usually is restricted to rocks with economic lead-zinc grades. (Unit 4F/2F)

The remaining massive lithofacies are essentially variants of massive

pyritic sulphides.

Baritic, Massive Pyritic Sulphides: (Unit 2G/4G) strongly and thinly banded (fig. 16E) massive sulphide/sulfate rock consisting of pyrite, galena, sphalerite and commonly magnetite in a gangue of off-white barite and lesser carbonates (calcite, dolomite, ankerite and probably barytocalcite). The amount of barite may be as high as 50%; non-sulfidic, massive barite does not occur in the Anvil deposits. There is a complete gradation between this and the above facies with 10% visible barite by volume being the dividing line. This facies is usually quite high grade (10-15% combined lead-zinc). Sphalerite is characteristically honey coloured to reddish brown. Pyrrhotite is not commonly seen in the baritic facies.

Carbonate-bearing, Massive Pyrite Sulphides: (Unit 2K/4K) similar to massive pyritic sulphides but contains 10% carbonate (calcite, dolomite, ankerite) either as interstitial gangue or as coarse patches and irregular blebs. This is a minor facies and is not known with certainty to always be an original composition variant. The most common occurrence of coarse beige to tan, ankerite patches may represent recrystallized original matrix carbonate or re-worked pre/syn-metamorphic veins.

Pyrrhotitic Massive Sulphides: (Unit 2H/4H) massive, finely crystalline, usually well foliated pyrrhotite with less than 50% pyrite

porphyroblasts and highly variable amounts of sphalerite and galena. Minor chalcopyrite is characteristic of this relatively copper-rich facies. Rounded to angular, rotated, foliated quartzite or quartz-vein clasts 2 cm or less in diameter are typical. This is a minor facies and is not known with certainty to be primary as some pyrite in the massive facies may invert to pyrrhotite during regional metamorphism.

Breccia textures are more common in the massive pyritic and pyrrhotitic facies than in the barite or carbonate-bearing facies. Pyritic breccias generally involve fragments of more quartzose or lower grade pyritic facies in a massive pyrite plus base metal sulphide matrix. Fragments can be angular to subrounded, poorly sorted and may be in either clast or matrix support. In some cases, margins of fragments can be fit back together. In all cases, the breccias are post-metamorphic since they involve variably oriented, foliated clasts. The origin of the breccias appears to relate to ductility contrasts between the affected lithologies during sulphide flowage induced by deformation and metamorphism. These are clearly not primary breccias related to feeder zones or paleoslumps prior to sulphide lithification.

Friable and porous massive sulphides are relatively common and when strongly developed often degenerate to pyrite sand. The porous massive sulphides are commonly carbonate or barite bearing and originate by post-metamorphic groundwater leaching especially near faults.

Quartzose Disseminated Lithofacies

- Ribbon banded, graphitic, pyritic quartzite: (Unit 2A/4A) dark grey to black, well banded, sulphide-bearing quartzite (metamorphic usage). Bands are: (a) dark grey, very fine grained carbonaceous phyllitic quartzite to siliceous phyllite (presumed metachert), and (b) light grey, quartz-sulphide (pyrite-sphalerite-galena) bands (fig.17A). These bands are usually 2 mm to 2 cm thick with a total sulphide content usually between 10 to 30% and ranging from 2% to 60%. Pyrite is usually the dominant species but higher grade examples have sub-equal to base-metal dominant variants. Strong sulphide species differentiation between bands is common such that barren pyrite bands can be found, adjacent to or nearby sulphide-bearing bands rich in sphalerite or galena.

Pyritic quartzite: (Units 4B, C, D/2B, C, D) light grey, generally poorly banded, moderately to weakly foliated, micaceous quartzites (presumed metacherts) with highly variable base metal and pyrite contents; pyrite contents are generally 10% to 40% ranging between 5% and 80%. Although there is a complete gradation from massive to quartzose ores there is usually little problem in separating this facies from the massive pyritic sulphides as the vast majority of examples have less than 40% total sulphides. A minor variant of this facies (unit 2B/4B) shows low pyrite (5%) content with base metal sulphides predominant. Barite in major amounts is absent from this facies and carbonate species are not typical but locally are abundant. Chalcopyrite, pyrrhotite and magnetite-bearing varieties are

common. Sphalerite in the high grade examples is characteristically a vibrant reddish brown.

Post-metamorphic breccias are also common in the disseminated sulphide lithofacies. Pyritic quartzite breccias are often spectacularly developed in the sphalerite-rich high grade facies where again ductility contrasts between the heavily developed sulphides and quartzite bands dictate ductile flow in the sulphides and brittle failure, rotation and brecciation on the quartzite. Where less intensively developed the breccias grade into examples of sulphide mobilization into D_2 or later cleavages.

Alteration

Both wallrocks and certain ore facies of the Anvil deposits are overprinted by a prominent, easily recognized, light beige, white mica-dominant alteration assemblage (Unit 4L). This overprint facies is not a depositional unit and may form as a reaction product between wallrocks and deposit forming hydrothermal fluids, or as a metamorphic reaction envelope or as combination of these processes. In the multi-layered deposits, this alteration overprint appears discontinuous and often best developed in the footwall of a given lens or deposit as a whole (fig. 96). At Faro, a continuous envelope of this lithology encloses the entire deposit with local (especially Zone 1) best development in the hanging wall (fig. 9a).

Many mineralogical variants of the alteration facies are recognized including siliceous, carbonate-bearing, talcose, chloritic, pyritic,

pyrrhotitic, chalcopyrite-bearing, magnetite-bearing and base metal-bearing species. Careful attention has been paid to the distribution of these facies in an attempt to define feeder zones for all deposits. To date, little success has been had in this regard as no unequivocal feeder zones have been recognized. Several instances of suspected pre-D₁ quartz-chlorite-pyrrhotite-chalcopyrite veins or stringers have been observed in the altered stratigraphic footwalls of several horizons (Swim deposit in particular) but not in sufficient abundance to define a stringer or feeder zone comparable to volcanogenic deposits. Recognition of a feeder zone is considerably hampered in this terrane by the polydeformational overprint. It may be that Anvil deposit feeder zones are simply broad and diffuse, not focussed and funnel shaped as in volcanogenic massive sulphide deposits. Alternatively, the extensive strata bound nature of the alteration envelope may imply its formation by downward percolation of pooled hydrothermal brines or by lateral migration along a permeable horizon laterally from a feeder.

In the multi-layered deposits at greenschist facies grade, all mineralogical variants of the alteration facies are commonly recognized, often with best degree of development in the footwall of a mineralized horizon. The only amphibolite-grade example, the Faro deposit, shows a much less varied phase assemblage (muscovite, quartz, pyrite ± marcasite) in altered rocks with development of a substantial hanging wall as well as footwall alteration envelope. This simplified phase assemblage may be due to re-equilibration of the greenschist alteration assemblages at higher grades of metamorphism. The prominent hangingwall alteration may be due to continued post-depositional hydrothermal activity or to sulfurization

or other metasomatic reactions in the wallrocks during metamorphism perhaps caused by mobile sulfur from the inversion of pyrite to pyrrhotite in the deposit. It is interesting to note the development of massive pyrrhotitic facies is greatest in the Faro deposit which also shows the most well defined broadest and most symmetrically developed alteration envelope.

Numerous examples of alteration are seen particularly in the ribbon banded, graphitic, pyritic quartzites of the Anvil deposits. None of the other sulphide lithofacies show appreciable visible alteration. The ribbon banded graphitic quartzites however, are locally "bleached" to the same light beige colour as other altered rock types. Alteration fronts have been seen cutting across and preserving the typically well developed banding of this facies. Altered examples differ only in their absence of carbonaceous or graphitic material retaining textural identity to their unaltered counterparts. At Grum this bleaching of carbonaceous ore is commonly seen adjacent to carbonated metabasite bodies but no such association applies to the bleached rock as a whole. It is this preservation of texture which is the most diagnostic feature in the discrimination of altered ore facies from weakly disseminated base metal occurrences in altered wallrocks.

ROCK UNITS

CRETACEOUS

INTRUSIVE ROCKS

10F	Smokey quartz-feldspar porphyry
10E	Hornblende-biotite granite
10AB	Anvil Batholith
	10AB _{MM} Mount Mye phase: biotite-muscovite granite
	10AB _O Orchar phase: biotite-hornblende granite
	10AB _M Marjorie phase: biotite-hornblende granite
	10AB _p Pegmatitic granitic dykes

PENNSYLVANIA - PERMIAN

ANVIL RANGE GROUP

7A	Epidotized, massive basalt
6G	Red phyllitic chert
6F	Green, black and beige phyllitic chert

data / package / legend

Anvil Dist. Faro Mine
Geology

INTER-OFFICE MEMORANDUM
CURRAGH RESOURCES INC.

TO: Dave Tenney
Chief Geologist
Faro, Yukon

FROM: Lee Pigage
Senior Geologist
Whitehorse, Yukon

CC: Gregg Jilson, Vice-President, Exploration
Cam Reed, Geologist
Whitehorse Office

RE: NUMERIC CODE FOR ROCK UNITS

DATE: May 3, 1990

ROCK TYPES

Table 1 contains my suggested list of rock codes for the different units. This coding is similar to that currently being used with the different PCMINE models. It does reduce the number of rock types by shifting some units into the modifier category and sharing some units between the Mount Mye and Vangorda formations.

MINERAL MODIFIERS

Table 2 lists additional mineral identifiers that I consider important when logging core in the Anvil District. "Fuchsite" is useful as a means of identifying altered metabasites. The different carbonates allow for greater detail in distinguishing possible fault zones or dolomitic intervals in the Vangorda formation.

I would also suggest that K-feldspar and potash feldspar are the same and only require a single code. The code for kaolinite should perhaps be expanded to include all clays.

TEXTURE MODIFIERS

Table 3 lists additional textural terms which are important. Porphyroblastic and buckshot texture are identical. Laminated, banded, and ribbon-banded also refer to very similar textures. A fault would have one of 3 different possible modifiers depending on whether it was gouge, breccia, or mylonite (i.e. coherent fault rock).

The symbols chosen for textures will be difficult to use when

plotting or viewing on the screen because they tend to be small and not readily readable. You might consider the possibility of using letters for the textures as well as the minerals. In this case you just continue to arrange your descriptive modifiers in a specific order (as you are suggesting) and separate them by an identifiable character (such as /).

GRADE MODIFIER

Cam suggests that you separate out the grade modifier as a distinct variable in your PCXPLO database. A value can then be entered from the visual log until you receive assay values. Also with a separate variable, you wouldn't have to edit the descriptive modifiers for the logged ore intervals once the assays are received.

SUMMARY

Now you have had some familiarity with PCXPLO and with drill hole logging in the Anvil District. In terms of the logging, the Anvil District presents a problem with intimately interbanded rock-types on a fine scale. Through "custom" we have evolved a system of handling this variation by using parentheses in the description variable to indicate subordinate rock types.

With PCXPLO, the fastest and most complete extraction is accomplished using strictly numeric variables. Otherwise you have to use string matching which does not readily allow for minor variations. Numeric matching does present problems, however, when modifiers are used to differentiate major rock types within the lithostratigraphic code variable.

The above comments and suggestions try to follow your ideas and still preserve the distinctions between major rock types present in the District. After mulling over this memo, you should call me and we can discuss some of the different ideas. I also plan to be in Faro for awhile in late May and early June.

Cheers!

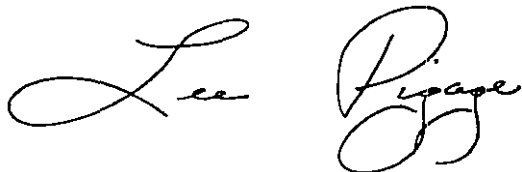
The image shows two handwritten signatures in cursive. The first signature on the left is 'Lee' and the second signature on the right is 'Page'. Both are written in black ink on a white background.

Table 1 - Lithostratigraphic Code - Anvil District

ORE TYPES

20	Carbonaceous ribbon banded quartzite
30	Noncarbonaceous pyritic quartzite
40	Very pyritic quartzite to siliceous, semi-massive, pyritic sulphides
50	Pyritic massive sulphides
55	Carbonate-bearing pyritic massive sulphides (typically clasts of pinkish dolomite)
60	Baritic massive sulphides
70	Pyrrhotitic massive sulphides
80	Base metal-or magnetite-rich, nonpyritic sulphides

MT. MYE FORMATION

100	Noncalcareous muscovite-chlorite phyllite
110	Noncalcareous muscovite-biotite schist

MT. MYE / VANGORDA FORMATIONS

130	Carbonaceous phyllite /schist
140	Marble
150	Unfoliated dark green chloritic metabasite w/ relict igneous texture
160	Serpentinized pyroxenite w/ relict igneous texture
170	Foliated, pale green, homogeneous chloritic phyllite
180	Foliated, dark green, amphibolite

VANGORDA FORMATION

200	Pale silvery grey, calcareous muscovite-chlorite phyllite with thin siltstone interbeds
210	Striped cream to pale green and dark brown biotite calc-silicate

ALTERED ROCKS

250	Pale white muscovite-quartz phyllite/schist
260	Pale green muscovite-chlorite-quartz phyllite/schist

INTRUSIVES

300	Quartz vein
310	Anvil Batholith
320	Pegmatite
330	Aplite
340	Equigranular hornblende-biotite quartz diorite
350	Quartz-biotite +/- feldspar porphyry

OVERBURDEN

400	General
410	Triconed
420	Till/Silt/Sand
430	Ferricrete
500	Air

TABLE 2

ADDITIONAL IMPORTANT MINERAL MODIFIERS

"Fuchsite"
Fibrolite
Carbonate (non-specific)
Ankerite
Dolomite

TABLE 3

ADDITIONAL IMPORTANT TEXTURAL MODIFIERS

Mylonitic
Skarn
Porous
Weathered

CURRAGH RESOURCES INC
INTEROFFICE MEMORANDUM
FARO OFFICE

G. Wilson

*Faro Mine
Geology
rock codes*

(also Anvil District)

Date: May 15, 1990

TO: LEE PIGAGE
SENIOR GEOLOGIST
FROM: DAVE TENNEY
CHIEF GEOLOGIST
SUBJECT: ROCK CODES

=====

This is a comment on your memo dated May 3, 1990. As a result of our discussion on Friday I wonder if you would consider the following modifications to the lithostratigraphic code?

OK

OK

done

OK

- 1) Keep rock code lithologic only, by removing references to stratigraphy. (A separate stratigraphic table showing rock types could, however, be useful for reference).
- 2) Include a rock code number for all rock types (or hybrid rock types) characteristic of the Faro mine areas. (These will be of known stratigraphic significance but should be kept to a minimum).
- 3) Provide a set of notes for all those lithologic characters which you consider must be recorded to determine stratigraphic position, in as far as possible removing the need for "2" above. These notes would, of course, only be needed for rock types where errors are likely to occur, or some critical parameters may be missed. I note that we should routinely do tests for calcite (10% HCL) and ankerite (20% HCL) so I assume these would be included in your notes.
- 4) Could you change all lithologic numerical codes to one or two digit numbers by removing the trailing "zero". This would also mean finding a new number for your current # "55", carbonate bearing pyritic massive sulphide. Perhaps it could be recorded using a mineral identifier and the rock type number for massive sulphide eg: "50c" (c=calcite) or "50k" (if k= ankerite).

4K

This won't
work at
Gamm.

5) Faults, clay gouge, fault breccia ought to have a numerical identifier if possible, and if the parent rock type can be determined a slash "/" may be used to indicate both fault and rock type. I am not sure faults should be modeled for grade so I would prefer to see the code number for the fault, gouge, etc come first and be recorded in the database along with "rock types".

depends purpose
of the
rock code -
this flexibility
is not to be
allowed.

6) Since some rocks will not fit into a predetermined rock code plan as precise as the one we now use could generic rock terms also be included; eg: schist, phyllite, skarn, quartzite, silstone etc.

7) If you could agree to implement the above generic rock types (with suitable guidelines mentioned in "3") then it would be possible to simplify the rock coding system considerably.

No

8) If generic rock types are used, the definition of stratigraphic units, and rock units for mine modelling would have to be done later on plotted and interpreted sections. If you could agree to this procedure I see the way paved to a very simple and easy to administer rock coding system with far fewer rock type numbers than now exist. (see large attachment under column "preferred". Of course a set of notes would be needed to ensure that all critical information needed to designate stratigraphic position is recorded (as noted under "3").

NO -
Integer codes must
be done this
way

9) I agree with additional textures but would like to see "skarn" as a rock type. Weathered (i.e oxidised) is a very necessary description when dealing with core from which we wish to prepare metallurgical test samples. Textures used to describe faults (mylonite, clay gouge, brecciated) may also be important for correlative purposes.

OK w/
Skarn

10) The mineral descriptors required for "Table 2" do not look as though they will present a problem. If we run out of available characters any character which can be plotted can be used (e.g. Greek alphabet), but legibility may become a problem.

*all
must
be
highly
important*

A mixture of "locally important rock types" mixed with "generic rock types" with suitable appended descriptors will provide a sound basis for geological interpretations on section without the need for constant reference to the drill logs. It looks as though we are approaching the point where we will have something suitable for both our purposes.

D. Tenney.

Dave Tenney
Chief Geologist

DT:cc

encl.

- cc: G. Jilson
- W. Weymark
- B. Pisony
- B. Dunn
- D. Basso
- M. Wasel
- C. Reed

1990 code

Tas Mine
Galaxy
Rock Codes

ROCK CODE SUMMARY

ATTACHMENT # 1

QUARTZITES:

- | | | |
|---|-------|--------------------------------------|
| 2 | 4A | Ribbon banded carbonaceous quartzite |
| 3 | 4C/4D | Pyritic quartzite (<30% pyrite) |

SULPHIDES:

- | | | |
|----|-------------|--|
| 4 | 4EC/4E1/4C3 | Semi-massive siliceous pyritic sulphides sulphides (30-60% pyrite) |
| 5 | 4E/4F | Massive pyritic sulphides (60-100% pyrite) |
| 6 | 4K | Massive pyritic sulphides with clasts of dolomite/ankerite |
| 7 | 4G | Baritic pyrite sulphides (> 10% barite) |
| 8 | 4H | Pyrrhotitic sulphides |
| 9 | 4J4 | Nonpyritic sulphides pyrites - pyrite |
| 10 | 4J8 | Massive magnetite
poor high grade |

METASEDIMENTS:

- | | | |
|----|-------------|---|
| 20 | 3G | Noncalcareous, muscovite-chlorite, medium grey phyllite |
| 22 | 1C/1CD/1D | Noncalcareous, biotite-muscovite-quartz ± staurolite ± andalusite ± garnet ± fibrolite schist |
| 30 | 5A/5G/3E/1E | Carbonaceous phyllite/schist |
| 32 | 5E/3F/1G | Marble ± calc-silicate bands |
| 33 | 1B | Skarn and "silicated" marble |
| 36 | 3D | Calc-silicate |
| 40 | 5B | Calcareous, silvery grey, muscovite-chlorite phyllite |

META-IGNEOUS ROCKS:

- 44 5C/3C/1F Metabasite, poorly foliated ^{unfoliated} greenstone with relict igneous texture
- 45 5C/3C/1F Pyroxenite -commonly serpentized - with relict bastites
- 46 5C/3C/1F Amphibolite - bluish green hornblende - plagioclase - quartz amphibolite
- 47 5D/3B/1H Chloritic phyllite/schist. pale olive green
fuchitic phyllite ?
Leopard Rock ?

ALTERED ROCKS: - (DOMINANTLY METASEDIMENTS)

- 52 4L0 Muscovite > chlorite - quartz phyllite/schist - very pale cream to white
- 54 4L6 Chlorite > muscovite-quartz phyllite/schist - pale green

CRETACEOUS INTRUSIVES:

- 60 10Q Quartz vein- - white bull quartz vein
- 61 10AB Anvil Batholith - Mt Mye phase of Anvil plutonic suite. Muscovite - biotite granite
- 65 10C Pegmatite
- 66 - Aplite
- 68 10E Hornblende-biotite quartz diorite - massive and unfoliated
- 69 10F Smokey quartz - feldspar porphyry - massive and unfoliated

FAULT ROCK:

To be used only if parent cannot be identified - use rarely!

- 72 Gouge
- 74 Tectonic breccia
- 76 Mylonite

OVERBURDEN:

- 82 Unclassified - general
- 84 Triconed - no recovery
- 86 Till - silt - sand
- 88 Ferricrete
- 99 Air

*misplaced
~~less~~ calc, no mineral*

MINERAL IDENTIFIERS

CARBONATES:

c	calcite
k	ankerite
v	carbonate - non specific
w	dolomite

MICAS: (LAYER SILICATES)

b	biotite
j	fuchsite
l	chlorite
m	muscovite
s	sericite
t	talc

FELDSPARS - QUARTZ

f	feldspar
q	quartz (fine-grained)
o	kaolinite (clay minerals)
p	potash feldspar
Q	quartz (vein)

CALC-SILICATES

a	actinolite
e	epidote
h	hornblende
i	diopside

ALUMINO-SILICATES/PELITE MINERALS

d	andalusite
n	garnet
r	fibrolite
u	staurolite
z	chloritoid

OXIDES/SULPHIDES/SULPHATES

A	Arsenopyrite
B	Barite
C	Chalcopyrite
G	Galena
L	Limonite (iron oxides)
M	Magnetite
P	Pyrite
R	Pyrrhotite
Z	Sphalerite

OTHER

q	carbon
x	noncalcareous

ROCK TEXTURES

ATTACHMENT # 3

+	equigranular
!	foliated
=	laminated/banded/ribbon-banded
>	coarse-grained
^	medium-grained
<	fine-grained
\	clotted
*	porphyroblastic (buckshot)
%	porphyritic
#	interstitial
@	porous
:	weathered
~	fault gouge - ie. mud-more than broken core
X	fault breccia (tectonic)
?	mylonite
"	altered
-	"stringered"
.	"spotted"

ATTACHMENT # 4

GRADE

N	=	no sphalerite or galena	(N = none)
W	=	1 - 3% PbS/ZnS	(W = waste)
L	=	3 - 5%	(L = low grade)
H	=	5 - 10%	(H = high grade)
V	=	10% +	(V = very high grade)

ATTACHMENT # 5

ROCK CODE CONSTRUCTION

ROCK #: MINERAL IDENTIFIERS: TEXTURE: GRADE

NOTES:

- 1) The most abundant rock type comes first if the rock is a hybrid.
- 2) Parentheses are used to separate subordinate rock types.
- 3) Textural codes are appended after the mineral identifier(s).
- 4) Baritic ore ("7") must contain more than 10% barite. If barite content is less than 10% use the appropriate rock code (Not "7") with the mineral identifier for barite ("B").
- 5) Pyritic quartzite is assumed to have no more than 30% pyrite.
- 6) The grade descriptor for zero grade (i.e. N) may be omitted.
- 7) Mineral identifiers when more than one are used are in order of abundance.
- 8) Beware of redundancies when using mineral identifiers (eg. chloritic phyllite is "47" , not "471"; though possibly the latter could be used for a rock containing extraordinarily large amount of chlorite). In general, characteristics which are normally found in a rock type should not be indicated by a mineral or textural identifier.
- 9) Not all four parts of the rock code construction shown above are necessarily used. Rock number alone is mandatory. It must be accompanied by a grade descriptor if the rock is a sulphide (ie. rock units 4-9)