2005 GEOLOGICAL REPORT

FOR THE

VULCAN PROPERTY

Fort Steele Mining Division, Southeastern B.C. Mapsheets 82F079, 82F089 Latitude 49°47' N, Longitude 116°20'W

VOLUME II APPENDICES

APPENDIX III DIAMOND DRILL LOGS APPENDIX IV CONDOR CONSULTING GEOPHYSICAL REPORT

Prepared for

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DIAMOND DRILL LOGS

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DIAMOND DRILL LOGS

3.1 Strip Logs

Hole N	ame :V	-79-1													
Hole Name :	V-79-1			Hole Azimuth :		Hole Inclina	tion :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lithologic Description			Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
25		8			Last 4 feet is chilled at the bottom of this is	unit.									-17.68
50					> > > > > > > > > > > > > > > > > > > >										-35.36
75				Quartz Wacke	Concretions from 1 x 2cm to 3 x 6cm are	common.			3						-53.03
100				Wacke							_				-70.71
125				Wacke Wacke Wacke	Convoluted bedding with some rip-up clas concretions on fof which is up to 9 x 5cm; concretion contains some phlogogpite an	sts and centre of this d galena.			1		_				-88.39
150				Wacke Quartz Wacke Wacke Wacke Wacke	bedding.				1		-			Chlorite is in healed fractures.	-106.07
175				Quartz Wacke Quartzite Wacke	Mottled, subangular fragments parallel to This is shearing across a fragmental bed conglomerate.	shear direction. or grit essory mineral.									-123.74
Scale 1:559	8 8 9 9 9 9 9 9 9 9 9 9 9 9 9	10,000 10,00000 10,0000 10,00000000		Wacke	Grit conglomerate 12cm at 184m and 46c	cm at 184.6m.		<u> </u>	<u> </u>		1: 1:	5:43:	43		

Hole N	ame :V	u-91-1													
Hole Name :	Vu-91-1			Hole Azimuth :		Hole Inclina	ition :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lithologic Description			Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
	5888888	878585856						•							
10	/			Wacke Quartz Wacke	Thickly Laminated to thin bedded.				2						2192.94
	/			Wacke											
20				Wacke	Calc-Silicate Replacement Unit. Weak to reaction throughout. Quartz-feldspar (pink)-epidote-calcite with minor chorite, t garnet.	strong HCL remolite, and			2		1				2185.90
	/			Wacke Quartz Wacke Wacke Wacke	Banded Quartz-Albite(?)-Chlorite rock.				2		2				
30	/			Wacke Wacke Wacke	Fragmental consists of 10% rounded darl strongly replaced by pyrrhotite in a light g wacke matrix.	Biotitic clasts rey fine grained			2						2178.88
				Wacke	20-30% dark Biotitic clasts in a wacke ma	ıtrix.		•	3						
40	/			Wacke Wacke Wacke	Amphibolite is replacing the Wacke.				3 4 3						2171.89
	/								2						
50															2164.91
				Wacke					2		2				
60	100,000,000,000,000,000,000,000,000,000	828828829 1088888 1088888		,											2157.96
Scale 1:183				с	2/09/06						15	5:43:	47		

Hole N	e Name :Vu-91-2															
Hole Name :	Vu-91-2			Hole Azimuth :		Hole Inclina	ition :									
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lithologic Description		1	Alt Assem	Alt	Deg	g Al	t D)eg	Alt	Deg	Alteration Notes	Elevation (m)
25				X X X X X X X X X X X X X X X X X X X					2							2147.40
50				X X X X X X X X X X X X X X X X X X X					2 4 3 2			2	-			2124.94
75											•					2102.62
100				X X										1		2080.43
125	/			× × × × × × × × × × × × × × × × × × ×					4							2058.39
150	/			Quartz Wacke Quartz Wacke Quartz Wacke Wacke Wacke Wacke	Lower-Middle Alderidge Formation Conta	ict.	-		3 2 2 4 3			2				2036.58
175	/			Wacke Wacke Wacke Wacke >>>>>> Adualities Quarteite Wacke Wacke Wacke Wacke	/Fragmental elongated imbricated clasts ir ground mass. Possibly Tremolite as well. 50% calsts in a Wacks matrix.	n fine grained	-		3 2 2 2 1 1 4			2		1		2015.00
200	/			Wacke Wacke Wacke Wacke Wacke Wacke	50% clasts in a Wacke matrix. Massive Conglomerate Wacke, <10% cla Wacke matrix.	ists overall in a			2 4		_					1993.65
225 Scale 1:679	858886	88 19 19 19 19 19 19 19 19 19 19 19 19 19		Wacke Wacke 02	/09/06							15:	:43:4	49		1972.51

Hole N	Name :Vu-91-3														
Hole Name :	Vu-91-3			Hole Azimuth :		Hole Inclina	ation :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lithologic Descriptior	I	1	Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
	878554321 878554321			× × × × × × × × × × × × × × × × × × ×	+			•				•			
				Quartz Wacke					1		1		2		
				× × × × × × × >	K										
	/			X X X X X X X X X X X X X X X X X X X	> <				4 3 2		4		2		
50				Quartz Wacke Quartz Wacke											2049.10
				Quartz Wacke Wacke					1	•					
	/			Quartz Wacke Quartz Wacke					2 5		1				
				× × × × × × × × × × × × × × × × × × ×											
100				× × × × × × × × × × × × × × × × × × ×											2003.46
					< > < > >										
				* * * * * * * * * * * * * * * * * * *											
150					<pre></pre>				2						1958.07
					<pre></pre>										
				× × × × × × × × × × × × × × × × × × ×	< > < > <										
200	/			X X X X X X X Wacke	<										1912.96
				Quartz Wacke			_	•							
				Wacke Quartz Wacke Quartz Wacke	Lower-Middle Aldridge contact at 217m		-	:	2						
				Wacke Wacke	~ 25-35% clasts, elongated and imbricate degrees	ed @ 45			3						
250	/			Wacke				••							1868.13
				Wacke Wacke				•	2		1				
	120 120 120 120 120 120 120 120 120 120			Wacke	~ 25-35% clasts imbricated at aout 40 de	egrees									
Scale 1:827					02/09/06						15	5:43:	55		

Hole N	Name :Vu-91-4														
Hole Name :	Vu-91-4			Hole Azimuth :		Hole Inclina	ation :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lithologic Descriptior	1		Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
-50					Gabbro is fine grained and appeared chi	lled at bottom of	-		4		2		1		2256.85
				Quartz Wacke Quartz Wacke Quartz Wacke Wacke Quartz Wacke	/PORPHYRITIC MAFIC DYKE PORPHYRITIC MAFIC DYKE PORPHYRITIC MAFIC DYKE Alderidge Turbidite secquence		-		2	•••••••••••••••••					
100				Quartz Wacke	PORPHYRITIC MAFIC DYKE		-		2	••••••••••••••	2		1		2214.03
150				Wacke Quartz Wacke Wacke Quartz Wacke Quartz Wacke Quartz Wacke				•	3		_				2171.53
200				Wacke Quartz Wacke Quartz Wacke S S S S Amuebibelife S S S Wacke Wacke S S S S Amuebibelife S S Quartz Wacke Quartz Wacke	 Lower-Middle Aldridge formation contact : >> 	at 191.42	-		1						2129.24
250		82.282.97.82		Quartz Wacke	Unit is laminated to 219m and then lamin	nated below.			2		2				2087.12
Scale 1:836			1		02/09/06		1				1	5:44	:00	L	

Hole N	e Name :Vu-91-5														
Hole Name :	Vu-91-5			Hole Azimuth :		Hole Inclina	ation :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lithologic Description		1	Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
	800500 800500	* 8765513200		Sactory -											
				Wacke	Lower Aldridge Formation. Alternating lig laminaions	ht-dark	-		2						
25				Wacke	High proportion of flat black mudstone ch matrix.	ips in a Wacke			3		1				2275.99
50				Wacke			-		2						2257.31
	/			Wacke	Conglomerate in Wacke matrix.		-		2						
				Wacke					4		2				
75				· · · · · · · · · · · · · · · · · · ·	Amphibolite-Biotite-Garnet Replacement	Zone	-		2						2238.97
100															2220.96
125				Wacke	Average 25% clasts component floating i matrix.	n a Wacke			2						2203.27
150		80 00 00 00 00 00 00 00 00 00 00 00 00 0													2185.92
Scale 1:475				02	2/09/06						15	:44:()3		

Hole N	ame :V	u-92-1													
Hole Name :	Vu-92-1			Hole Azimuth :		Hole Inclina	tion :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lithologic Description	n		Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
		8765563220 876556		Fred State											
	/			Quartz Wacke											
	/							•	3						
50	//			Wacke					1						2105.06
	///			Quartz Wacke					2						
	/			Wacke											
				Quartz Wacke											
100				× × × × × × × × × × × × × × × × × × ×	×,										2060.12
				x x x x x x x x x x x x x x x x x x x	×, ×,				3						
	/			× × × × × × × ×											
	/														
150	,			Quartz Wacke											2015.18
	//														
	/			* * * * * * *	×				-5-			•			
				``````````````````````````````````````	* * *										
200				× × × × × × × × × × × × × × × × × × × × × × × ×	× × ×										1970.24
				× × × × × × × × × × × × × × × × × × × ×	*										
				× × × × × × × × × × × × × × × × × × × × × × × ×	× × ×										
				× × × × × × × × × × × × × × × × × × ×	× ^ × > > >				2		2		1		
250				^ × ^ × ^ × ^ × ^ × ^ × × × × × × × × ×	^										1925.30
				× × × × × × × × × × × × × × × × × × × ×	× × ×										
				× × × × × × × × × × × × × × × × × × × ×	* * *										
				× × × × × × × × × × × × × × × × × × × × × × × × × ×	× , × ,										
300				X X X X X X X X	×				1		1				1880.36
	· /														
	86886665	86686666		Quartz Wacke					1		1				
Scale 1:990			I		02/09/06					.•	15	5:44:	05		

Hole N	ame :V	u-92-2														
Hole Name :	Vu-92-2			н	lole Azimuth :		Hole Inclina	ition :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Litho	blogic Description			Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
	10 200 200 200 200 200 200 200 200 200 2								i	2	•••					
	/				Quartzite				:		:	2	:	1		
	/															
	//				Wacke Wacke	Similar to the interval 5.0-53.3m, but turb	iditic textures		•	2						
	/				Quartzite				•	2	-	2				
100				v v	Quartzite	Localy turbiditic				2						2062.18
				^ × ^ × × × × × . × .	(` X ` X ` X ` X ` X X X X X X X X X X X					2	•	2				
	/			×××	· × × × × × × ×											
	//				Quartzite					1		1				
	/															
	//			× × × ×	× × × × × × × × × × × × × × × × × × ×					_	:					
200				× × × × × × × ×	(											1975.36
				× × × × × × × × ×	× × × × × × × × × × × × × × × × × × × × × × × × ×											
				× × × × × × × ×		Contacts are poorly defined due to chlorit lower contacts.	ized upper and			1						
				× × × × × × × × ×	× × × × × × × × × × × × × × × × × × × × × × × × ×											
				× × × × × × × × ×												
				× × × × × ×	× × × × × × × × × × × × × × × × × ×											
300	/				Quartzite	Foliation is 30 to 20 degrees to the beddi	ng.			- 010						1889.58
					Quartzita											
					Quartzite											
				× × × × ×	Wacke × × × × × × × × × × × × × × × × × ×					2	•	1				
				× × × × × × × × ×												
400				× × × × × × ×	× × × × × × × × × × × × × × × × × × ×											1806.08
				× × × × × × × ×	(					3		3		2		
				× × × × × × × × ×	× × × × × × × × × × × × × × × × × × ×											
				× × × × × × × ×												
				× × × × × × × ×	× × × × × × × × × × × × × × × × × × × × × × × × × ×											
				_×_×	Wacke	Bedding angles increasing downhole.				2		2	•			
500	80 10 10 10 10 10 10 10 10 10 10 10 10 10	8 70 10 10 10 10 10 10 10 10 10 10 10 10 10			Quartz Wacke	Conglomerate/fragmental. Matrix support making up 2-3% of interval. Clasts have v distinguishable "ghost like" boundaries.	ed with clasts veakly			1	•	1	•	1		1725.18
Scale 1:1510	)				02	/09/06						15	5:44:1	11		

Hole N	ame :V	u-92-3													
Hole Name :	Vu-92-3			Hole Azimuth :		Hole Inclina	ition :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lithologic Description			Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
	876 877 877 877 877 877 877 877 877 877	8876554320 80765543320		Quartzite	Frequent Cross Bedding		-								
				Wacke Quartzite	Weakly defined preferred grain orientation to core.	n, 45 degrees			1		1		1		
50	/			Wacke X X X Gåšbr X X X Wacke Wacke	Broken, crumbly material within 0.6m of lo Crumbly biotie/chlorite along lower contact Becomes increasingly quartzitic downhole increasing.	ower contact. e with grain size									1871.80
	/														
100	/			Quartzite											1823.88
450	/								1		1				4770.04
150				× × × × × × × × × × × × × × × × × × ×	> > > >										1776.24
200					> > > > >										1728.87
250					<ul> <li>Amphiboles are likely recrystallized, with portentiation.</li> <li>&gt;</li>     &lt;</ul>	preferred			2		1		1		1681.73
300				× × × × × × × × × × × × × × × × × × ×	> > >										1635.09
350				Wacke Wacke Wacke	Lower-Middle contact. Matrix supported clasts with fragment size over 50mm.	e from <1mm to			2		1				1589.27
Scale 1:1077	288888 12888888 128888888	10 28 10 28 28 28 28 28 28 28 29 29 20 20 20 20 20 20 20 20 20 20 20 20 20		Wacke 0	2/09/06						15	5:44:1	17		

Hole N	ame :V	u-92-4														
Hole Name :	Vu-92-4			ŀ	Hole Azimuth :		Hole Inclina	ation :								
Depth (m)	Bedding wrt CA	Joints wrt CA	Map Unit	Lith	ologic Description		<u>J</u>	Alt Assem	Alt	Deg	Alt	Deg	Alt	Deg	Alteration Notes	Elevation (m)
	8005555555 8005555555555555555555555555					Darkening downhole.		-								
50					X X X X X X X X X X X X X X X X X X X	Similar to the unti above, however there lithological at 37.7m.	is a marked	-		3		• 1 • •		-		1034.64
100	/				Quartzite											999.29
150										2		2				963.93
200					Wacke											928.58
250					Quartzite	Laminations are generally 1 to 10mm, wi	ith local									893.22
		86 57 58 58 58 58 59 50 50 50 50 50 50 50 50 50 50 50 50 50			Quartzite					1						
Scale 1:870						02/09/06						1:	5:44:	23		

## **DIAMOND DRILL LOGS**

# **3.1.2 Mineralization and Veining**

Hole Na	ole Name :V-79-1															
Hole Length :	187.00		H	ole Azin	nuth :						Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Miner	alizatic	on (%; (	).1 = T	race)			Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
25																-17.68
75		Quartz Wacke			2											-53.03
100		Wacke			1											-70.71
125		Wacke			1										6312 6313 6314 6315 6316	-88.39
		Wacke			1		0.1									
		Wacke														



Hole Na	ame	:Vu-91-1														
Hole Length :	:61.30		Ho	ole Azin	nuth :						Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Miner	alizatio	on (%;	0.1 = T	race)			Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
10		Wacke   Wacke			3					7528888					6451           6452           6453           6454           6455           6454           6455           6454           6455           6454           6455           6454           6457           6458           6459           6461           6462           6497           6409           6463           6464	2192.94
30		Wacke Quartz Wacke Wacke Wacke Wacke Wacke Wacke			1 1 1 7 10 10		0.1		0.1	-					6465           6465           6467           6468           6469           6428           6499           6500           6429           6470           6471           6472           6473           6474           6475           6476	2178.88
40		Wacke Wacke Wacke			10 2 3 0.1 2		0.1								6408 6477 6311 6478	2171.89
-50		Wacke														2164.91
60										-             だのおどた						2157.96
Scale 1:185						02/09	9/06					16:0	03:48			

Hole Na	ame	:Vu-91-2												
Hole Length :	227.13		н	ole Azin	nuth :					Hole Inclination :				
Depth (m)	Map Unit	Rock Type	Min Style	Miner	alizatio	on (%;	0.1 = T	race)		Single Vein Descriptions	Den (/m)	Vein Interval Description	Sample Number	Elevation (m)
25		<pre></pre>			3									2147.40 2124.94
75		Quartz Wacke           X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X         X <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2102.62</td></t<>												2102.62
100					5									2080.43
⁻ 125		Wacke												2058.39
150		Quartz Wacke Quartz Wacke Wacke Wacke Wacke			1 1 3 10 2		- - - -							2036.58



Hole Na	ame	:Vu-91-3														
Hole Length :	276.52		н	ole Azir	nuth :						Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Miner	alizatio	on (%;	0.1 = T	race)			Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
		Quartz Wacke			0.1		01						1111111			
50		Quartz Wacke							:							2049.10
Wacke       Quartz Wacke       1         Quartz Wacke       1       1         Quartz Wacke       1       1         100       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X       X       X         X       X						0.1									2003.46	
150																1958.07
200		X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X <td></td> <td></td> <td>1</td> <td></td> <td>1912.96</td>			1											1912.96
250		Quartz Wacke Quartz Wacke Wacke Wacke Wacke			1 5 0.1 2 1		0.1								6308	1868.13
		Wacke Wacke Wacke			1 1 0.1		0.1			- 75 					6309 6310	
Scale 1:833						02/09	9/06					16:0	03:54			

Hole Na	ame	:Vu-91-4														
Hole Length :	:279.57		н	ole Azir	nuth :						Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Miner	alizatio	on (%; (	0.1 = T	race)			Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
					0.1		1						8588888		0054 6252	
		× × × × × × × × × × × × × × × × × × ×			10.1		0.1									
50		X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X     X <th></th> <th></th> <th>2</th> <th></th> <th>2256.85</th>			2											2256.85
		Quartz Wacke Quartz Wacke Wacke Quartz Wacke	2		0.1		0.1									
100		Quartz Wacke			0		1								<del></del>	2214.03
		Wacke														
150		Quartz Wacke Wacke			0.1		0.1		-						6255	2171.53
		Quartz Wacke Quartz Wacke Wacke Quartz Wacke Quartz Wacke Quartz Wacke			1 2 1 3		0.1								8256 R284	
200		SSSSSAmphibolitesSSS Wacke Wacke SSSSSAmphibolitesSSS Quartz Wacke			<u>10</u> 5 3 5 1		0.1		0.1						8969 8169 8169 8169 8169 8169 8169 8169	2129.24
		Quartz Wacke			5										6284 6285 6286 6289 6289 6290 6291	
250		Quartz Wacke			1		1		1							2087.12
Scale 1:843			r .			02/09	9/06		<u> </u>	- 75 - 66 - 45 - 30 - 15		16:0	03:59			

Hole Na	ame	:Vu-91-5													
Hole Length :	:158.84		Ho	ole Azir	nuth :					Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Miner	ralizatio	on (%; (	0.1 = T	race)		Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
		<b>Bashny</b> Wacke										-12865888288		6292 6293 6294 6296 6296 6297 6298	
25		Wacke			3		0.1							6299 6300 6300	2275.99
50		Wacke Wacke			2		1							6436 6437 6438	2257.31
75		Wacke			2		6							6440 6339 6441 6442 6446	2238.97
100															2220.96
125		Wacke												<u>8443</u> 6445	2203.27
150									75 60 85 30 15						2185.92
Scale 1:479						02/09	9/06				16:0	04:01			

Hole Na	ame	:Vu-92-1													
Hole Length :	331.00		Н	ole Azir	nuth :					Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Miner	ralizatio	on (%;	0.1 = T	race)		Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
												12225228			
		Quartz Wacke			0.1										
50		Wacke	Ĵ		0.1		0.1		_						2105.06
		Quartz Wacke Wacke													
100		Quartz Wacke							_						2060.12
		X X X X X X X X X X X X X X X X X X X			3		0.1								
			1.11												
150		Quartz Wacke			0.1										2015.18
200															1970.24
250															1925.30
300		Quartz Wacke			0.1		0.1		-						1880.36
Scale 1.000						02/01	9/06				16.0	£888888 1111111111111111111111111111111			
Scale 1:998						02/0	3/00				16:0	J4.UZ			

Hole Na	ame	:Vu-92-2													
Hole Length :	684.60		н	ole Azir	muth :					Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Mine	ralizati	on (%;	0.1 = T	race)		Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
		Quartzite			0.1		0.1		0.1						
100		Wacke Quartzite Quartzite			1		2								2062.18
200		Quartzite			0.1										1975.36
300		x x x x x x x x x x x x x x x x x x x			0.1		0.1								1889.58
400		Wacke           ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         ×         × <th></th> <th></th> <th> 1</th> <th></th> <th>0.1</th> <th></th> <th>0.1</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th>1806.08</th>			 1		0.1		0.1						1806.08
• <b>500</b> Scale 1:1522		X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X			5	02/09	<u> </u>		<u> </u>		16:0	288999888 2111111111 004:06			1725.18

Hole Na	ame	:Vu-92-3													
Hole Length :	519.40		н	ole Azir	nuth :					Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Miner	ralizatio	on (%;	0.1 = T	race)		Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
		Quartzite										80 80 80 80 80 80 80 80 80 80 80 80 80 8			
		Wacke			0.1		0.1								
		Quartzite Wacke X X X GabbroX X X			0.1										
50		Wacke Wacke													1871.80
100															1823.88
450		Quartzite			0.1										1770 04
150					0.1										1770.24
200							0.1								1728.87
250														851 852	1681.73
300		X X X X X X X X X X X X X X X X X X X	_		2										1635.09
		Wacke			0.1		0.1							866 867 868 871 872 873	
350		Wacke			0.1							- 10 - 20 - 20 - 30 - 50 - 50 - 100 - 100		874 876 877 878 879 880 880 881	1589.27 [.]
Scale 1:1086						02/09	9/06		 		16:0	)4:12			

Hole Na	ame	:Vu-92-4													
Hole Length :	290.80		ŀ	Hole Azi	muth :					Hole Inclination :					
Depth (m)	Map Unit	Rock Type	Min Style	Mine	ralizatio	on (%; (	0.1 = T	race)		Single Vein Descriptions	Den (/m)		Vein Interval Description	Sample Number	Elevation (m)
50		X X X X X X X X X X X X X X X X X X X			0.1		0.1					-352555			1034.64
100		Quartzite			45									844	999.29
150					- 30										963.93
200		Wacke			3									VTTR-01 VTTR-02 VTTR-03	928.58
250		Quartzite			2										893.22
		Quartzite			0.1							10000000000000000000000000000000000000			
Scale 1:877						02/09	9/06				16:0	04:16			

## **DIAMOND DRILL LOGS**

# 3.1.3 Analytical Results

Hole Na	ame	:V-79-1						
Hole Length :	187.00		Ho	ble Azimuth :		Hole Inclination :		
Depth (m)	Map Unit	Lithologic Description	Sampl Numbe	e Analysis er Number		Geochemical Re	esults	Elevation (m)
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_	SAMP_ANAL	Zn_ppm Pb	_ppmAg_r	ppm Cu_ppm	Elevation
		× × × × × × × × × × × × × × × × × × ×	> > > > > >		2500 2000 1500 1000 500		- 2500 - 1500 - 1000 - 500 - 15 - 10	
25			> > > > > > > > > > > > > > > > > > > >					-17.68
50		× × × × × × × × × × × × × × × × × × ×	> > > > > >					-35.36
75		× × × × × × × × ×	>					-53.03
100		Quartz Wacke						-70.71
125		Wacke Wacke Wacke Wacke Wacke	631 631 631 631	2 3 4 5 6				-88.39
150		Quartz Wacke Wacke Wacke Quartz Wacke						-106.07
175		Quartzite Wacke Wacke						-123.74
Scale 1:570					02/09/06		15:47:16	

Hole Na	ame	:Vu-91-1									
Hole Length :	61.30		Hole	Azimuth :		Hole Inclination :					
Depth (m)	Map Unit	Lithologic Description	Sample Number	Analysis Number		Geochemic	al Resul	ts			Elevation (m)
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_SAMP	SAMP_ANAL	Zn_ppm P	'b_ppm	Ag_ppm	ı		Cu_ppm	Elevation
		- Original Control of			2500 2000 1500 1000 500	2500 2000 1500 1000 500	្រ ហ	- 15 10	00	2500 2000 1500 1000 500	
10		Wacke									2192.94
		Quartz Wacke	6451 6452 6453								
		Wacke	6454 6455 6456 6457 6458 6459 6460 6461 6462 6497								
20		Wacke	6409								2185.90
		Wacke Quartz Wacke	6464 6465 6466 6467 6468 6469		_						
		Wacke	6428 6498 6499	_							
30		Wacke	6500 6429 6470 6471	-							2178.88
		Wacke Wacke	6472 6473	-							
		Wacke	6474	-							
			6408	-							
40		Wacke	6477 6311	-							2171.89
		Wacke	6478				•				
		Wacke									
50											2164.91
		Wacke									
60											2157.96
Scale 1:187					02/09/06			15:47:19			

Hole Na	ame	:Vu-91-2								
Hole Length :	227.13		Hole	e Azimuth :		Hole Inclination :				
Depth (m)	Map Unit	Lithologic Description	Sample Number	Analysis Number		Geochemic	cal Resul	ts		Elevation (m)
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_SA	MP SAMP_ANAL	Zn_ppm	Pb_ppm	Ag_ppm	1	Cu_ppm	Elevation
25			<b>111</b> ^ ^ ^ ^ ^ ^ ^ ^ ^ ^ ^		2500 2000 1500 1000 500	2500 2000 1500 1000 500	υ σ	20 15 10	2500 2000 1500 1000 500	2147.40
50		Quartz Wacke								2124.94
75			> > > > >							2102.62
100			> > > > > > > > > > > >							2080.43
125		× × × × × × × × × × × × × × × × × × ×	>							2058.39
150		Quartz Wacke Quartz Wacke Quartz Wacke Wacke Wacke Wacke				<b>-</b>				2036.58
175		Wacke Wacke Wacke Wacke S S S Annihilo III (S S S S Quartzite Wacke Wacke Wacke Wacke Wacke	6423 6423 6424 6427 6449 6450 6301 6302			_	-			2015.00
200		Wacke Wacke Wacke Wacke Wacke								1993.65
225		Wacke								1972.51
Scale 1:693					02/09/06			15:47:19		

Hole Na	ame	:Vu-91-3							
Hole Length :	276.52		Hole	e Azimuth :		Hole Inclination :			
Depth (m)	Map Unit	Lithologic Description	Sample Number	Analysis Number		Geochemic	al Results		Elevation (m)
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_SAM	™ SAMP_ANAL	Zn_ppm	Pb_ppm	Ag_ppm	Cu_ppm	Elevation
			+ ^ _ ^ _ ^		2500 2000 1500 1000 500	2500 2000 1500 1000 500		2500 2000 1500 1000 500	
		Quartz Wacke	8						
		X X GăbbX X X X X X X X X Quartz Wacke	>						
50		Quartz Wacke							2049.10
		Quartz Wacke Quartz Wacke							
		Wacke Quartz Wacke							
		Quartz Wacke	>						
		× × × × × × × × × × × × × × × × × × × ×	>						
100									2003.46
150									1958.07
200		⊖×⊖×⊖×⊖×⊖×⊖× Wacke							1912.96



Hole Name :Vu-91-4										
Hole Length :	279.57		Hole	Azimuth :	Hole Inclination :					
Depth (m) Map Unit Lithologic Description Sample Analysis Number				Geochemical Results						
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_SAM	IP SAMP_ANAL	Zn_ppm P	b_ppm Ag_	ppm	Cu_ppm	Elevation	
50		X X X X X X X X X X X X X X X X X X X	> > 6252 > > > > > > > > >		2500 2000 1500 1000 500	- 2500 - 2000 - 1500 - 1000 500	20 15 10 5	2500 2000 1500 1000 500	2256.85	
100		Quartz Wacke Quartz Wacke Quartz Wacke		=		-			2214.03	
150		Quartz Wacke Wacke Quartz Wacke Quartz Wacke Wacke Quartz Wacke	- 6255- 		1	-		ı T	2171.53	
200		Quartz Wacke							2129.24	
250		Quartz Wacke							2087.12	
Scale 1:853					02/09/06	<b>_</b>	15:47:27			

Hole Name :Vu-91-5											
Hole Length :158.84 Hole Azimuth :						Hole Inclination :					
Depth (m) Map Unit Lithologic Description Sample Analysis Number Number				Analysis Number	Geochemical Results				Elevation (m)		
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_SAM	SAMP_ANAL	Zn_ppm P	b_ppm	Ag_ppm			Cu_ppm	Elevation
		Wacke	6292 6293 6294 6295 6296 6297 6298 6299 6300		2500 2000 1500 1000 500	- 2500 - 2000 - 1500 - 1000 - 500	் ர	- 15 10	— 20	2500 2000 1500 1000 500	
25		Wacke	6435				•			1	2275.99
50		Wacke	6436 6437 6438							1	2257.31
75		Wacke Wacke	6440 6441 6441 > 6441 6441								2238.97
100		>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>	1. N								2220.96
125		Wacke	<u>8443</u> 8445				₽-				2203.27
150											2185.92
Scale 1:485					02/09/06			15:47:28			

Hole Name :Vu-92-1										
Hole Length :	:331.00	Hole Azimuth :	Hole Inclination :							
Depth (m)	Map Unit Lithologic Description	Sample Analysis Number Number		Geochemical Results			Elevation (m)			
Depth At	Quartz Wacke	J OCH_SAMP_SAMP SAMP_ANAL	P Zn_ppm     2500 1500 500	b_ppm Ag_p       2500 500 600	opm 0       20 5 10	Cu_ppm     2500   1500 500	Elevation			
50	Wacke Quartz Wacke						2105.06			
100	Quartz Wacke	< > < > < > < >					2060.12			
150	Quartz Wacke						2015.18			
200							1970.24			
250							1925.30			
300	X X X X X X X X X X X X X X X X X X X						1880.36			
Scale 1:1010			02/09/06		15:47:29	15:47:29				

Hole Name :Vu-92-2												
Hole Length :	684.60		Hole	Azimuth :		Hole Inclination :	Hole Inclination :					
Depth (m) Map Unit Lithologic Description Sa				Analysis Number		Geochemic	Geochemical Results					
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_SAM	P SAMP_ANAL	Zn_ppm	Pb_ppm	Ag_ppm	Cu_ppm	Elevation			
100		Quartzite Wacke Wacke Quartzite Quartzite X X X X X X X X X X X X X X X X X X X	× × × ×		- 2500 - 2000 - 1500 - 1000 - 500	2500 2000 1500 1000 500	- 10 - 10 5	- 2500 - 2000 - 1500 - 1000 - 500	2062.18			
200			> > > > > > > > > > > > > > > > > > >						1975.36			
300		X X X X X X X X X X X X X X X X X X X	> > > > > > > > > > > > > > > > > > > >		L				1889.58			



Hole Name :Vu-92-3												
Hole Length :519.40 Hole Azimuth :						Hole Inclination :						
Depth (m)	Map Unit	Lithologic Description	Sample Number	Analysis Number		Geochemical Results						
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_SAM	P SAMP_ANAL	Zn_ppm F	°b_ppm	Ag_ppm	Cu_ppm	Elevation			
		Quartzite					20 15 5					
		Wacke										
		Quartzite										
50		Wacke X X XGabbro X X Wacke Wacke	>						1871.80			
100									1823.88			
		Quartzite										
150									1776.24			
200									1728.87			
250		× × × × × × × × × × × × × × × × × × × ×							1681.73			



Hole Name :Vu-92-4										
Hole Length :	290.80		Hole	Azimuth :		Hole Inclination :				
Depth (m) Map Unit Lithologic Description Sample Analysis Number				Analysis Number		Geochemical Results				Elevation (m)
Depth At	DDH_LITH_UNIT	DDH_LITH_RTYPE_MAJ	DDH_SAMP_SAM	P SAMP_ANAL	Zn_ppm	Pb_ppm	Ag_ppm	1	Cu_ppm	Elevation
			****		2500 2000 1500 1000 500	2500 2000 1500 1000 500	່	- 20 - 15 10	- 2500 - 2000 - 1500 - 1000 - 500	
50		X X X X X X X X X X X X X X X X X Gabbro X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X Wacke	> > > > > > > > > > > > > > > > > > >						•	1034.64
100		Quartzite		_	-				-	999.29
150		Wacke			I				F	963.93
200			VTTR-01 VTTR-02 VTTR-03						-	928.58
250		Quartzite Quartzite								893.22
Scale 1:887					02/09/06		1	15:47:40	<b>I</b>	

# DIAMOND DRILL LOGS

3.1.4 Strip Log Legend
Legend - Global - Alteration		Legend - Global - Lithology		Legend - Global - Mineralization
	Legend - Global - Min Style	Amphibolite	Andesite	
?		Anhydrite	Aplite	?
ALBITE		Argilliceous Dolomite	Argilliceous Limestone	anhydrite
	?	Argillite	Arkosic Grit	arcenopyrite
		Breccia	Calc-silicate	alsenopylite
BIOTITE		Casing	Collar	azurite
	BLEBBY	Dacite	Diorite	chalconvrite
		Dolomite	Dolomitic Mudstone	
CALCITE		Dolomitic Sandstone	Felsic Intrusive	Ga
	DISSEMINATED	⁽⁾ × ⁽⁾ × ⁽⁾ Gabbro	Gneiss	
CARDONATE		Granite	Granodiorite	
CHLORITE		Greenstone	Greywacke	gypsum
		Gypsum	Hornblende GranoD	hematite
		Hornfels	Intermediate Intrusive	
EPIDOTE	n subertan Series and Series	Intermediate volcanic	Lamprophyre	Ilmt
		Limestone	Mafic Dyke	Mot
	MASSIVE	Meta-siltstone	Monzonite	
FLOURITE		Mudstone	Overburden	malachite
KSPAR		Pegmatite	Phy Quartzite	Mo
		Phy Siltstone	Phyllite	
NONE		Plag-phyric Andesite	Porphyry	native sulphur
PYRITE		x x x Q Monzonite	x x x Quartz Diorite	none
	NONE	Quartz Prophyry	Quartz Wacke	
SERICITE		Quartz-Feldspar Porphyry	Quartzite	Py
SILICA		Rubble	Sandstone	Po
	SELECT	Siliceous Limestone	Siltstone	
TOURMALINE		Skarn	Tonalite	quartz

### **APPENDIX III**

### **DIAMOND DRILL LOGS**

3.2 DDH Logs 3.2.1 Alteration

DDH H Numl	Iole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Eas (NAD8	sting DDH 83) (N	Northing AD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
V-79	-1	187	100	-45	54699	96 551	6763.53		COMPLETE	7/29/1979	GL WEBBER
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree	Alteration 3	Degree	Note:			
71	114	SILICA	3								
127	132.5	SERICITE	1								
143	146	CHLORITI	≡ 1					Chlorite is in heale	ed fractures.		
146	161	SILICA	2								

DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	g DDH I (NA	Northing 4D83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-1	61.3	167	-45	547952.4	551	7396.1	2200	COMPLETE	9/13/1991	I. D. McCartney
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree Al	teration 3	Degree	Note:			
7.5	10.2	BIOTITE	2								
17.9	25	CHLORITI	Ξ 2	SERICITE	1						
25	26.45	SILICA	2								
27.05	28.65	CHLORITI	∃ 1	BIOTITE	2						
29.65	31.75	BIOTITE	2								
37.48	37.86	BIOTITE	3								
38.77	41.2	BIOTITE	3								
41.2	42.55	BIOTITE	4								
42.55	42.9	BIOTITE	3								
44.1	45.85	BIOTITE	2								
47.05	61.3	BIOTITE	2	SILICA	2						

DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Ea (NADa	sting 83)	DDH N (NA	N <i>orthing</i> 1D83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-2	227.13	167	-65	54791	1.9	5517	7508.6	2170	COMPLETE	9/15/1991	I. D. McCartney
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree	Alter	ation 3	Degree	Note:			
3.05	25.5	BIOTITE	2									
25.5	26	EPIDOTE	5									
26	37.73	BIOTITE	2									
37.73	48.28	BIOTITE	4	ALBITE	2							
48.7	124.85	BIOTITE	3	CHLORITE	2	EP	IDOTE	1				
49.77	58.7	SILICA	2	CHLORITE	1							
124.85	131.5	ALBITE	4									
140.11	145.57	BIOTITE	3	SILICA	2							
145.57	148.3	BIOTITE	2									
148.3	151.8	BIOTITE	2									
151.8	152.83	BIOTITE	4									
156.9	164.26	BIOTITE	3	SILICA	2							
164.26	165.04	BIOTITE	3									
165.04	166.68	CHLORITE	2	BIOTITE	2	SE	RICITE	1				
166.68	167.1	BIOTITE	2	SERICITE	2	S	ILICA	4				
167.1	168.58	BIOTITE	2	SERICITE	2							
168.58	169.04	BIOTITE	3	SERICITE	2							
169.04	170.96	BIOTITE	2									
173.51	174.62	BIOTITE	1									
174.62	176.1	BIOTITE	1									

DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Eas (NAD8	sting DDH 3) (N	Northing AD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-2	227.13	167	-65	547911	1.9 55 ⁻	17508.6	2170	COMPLETE	9/15/1991	I. D. McCartney
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree	Alteration 3	Degree	Note:			
176.1	176.8	SILICA	4								
183	184	BIOTITE	3								
184	187.9	BIOTITE	2								
187	192.1	BIOTITE	4								
192.1	227.13	BIOTITE	2								

DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Eas (NAD8	sting DD 3)	H Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-3	276.52	213	-67	548526	6.6 5	517489.1	2095	COMPLETE	9/17/1991	I. D. McCartney
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree	Alteration	3 Degree	Note:			
8.65	32.5	BIOTITE	1	SERICITE	1	SILIC	A 2				
32.5	39.05	CHLORIT	E 4	BIOTITE	4	ALBIT	E 2				
39.05	39.75	ALBITE	3	CHLORITE	3						
39.75	48.55	BIOTITE	2								
53.46	66.14	CHLORIT	E 1								
66.14	67.6	SERICITE	∃ 1								
67.6	75.5	ALBITE	2	CHLORITE	1						
75.5	83.8	SILICA	5	ALBITE	1						
144	156	CHLORIT	E 2								
217	223.5	BIOTITE	2								
234.54	246	BIOTITE	3								
257	261.4	SERICITE	2	BIOTITE	1						

DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Ea (NAD8	sting DDH N 83) (NA	orthing D83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-4	279.57	106	-60	54724	7.8 5516	177.4	2300	COMPLETE	9/20/1991	I. D. McCartney
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree	Alteration 3	Degree	Note:			
3.28	49.72	CHLORITE	4	BIOTITE	2	TOURMALINE	1				
49.72	51.52	SILICA	2	BIOTITE	2						
51.52	75.56	SILICA	2	BIOTITE	1						
75.56	77.65	BIOTITE	2	TOURMALINE	1						
77.65	127.2	SILICA	2	BIOTITE	2	TOURMALINE	1				
150.1	160.53	TOURMALIN	NE 3								
180.65	191.42	BIOTITE	1								
191.42	192.85	BIOTITE	1								
209.7	217.34	CHLORITE	2								
217.34	279.57	CHLORITE	2	BIOTITE	2						

DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Ea (NAD8	sting 83)	DDH Northi (NAD83)	ng	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-5	158.84	124	-50	54741	2.8	5517259.	7	2295	COMPLETE	9/22/1991	I. D. McCartney
From (m)	To (m)	Alteration 1	l Degree	Alteration 2	Degree	Altero	ation 3 Deg	ree	Note:			
7.62	13.4	BIOTITE	2									
13.4	40.67	SERICITE	E 3	BIOTITE	1							
40.67	53.5	BIOTITE	2									
53.5	60.8	BIOTITE	2									
60.8	71.8	SILICA	4	TOURMALINE	2							
71.8	80.65	BIOTITE	2									
80.65	158.84	BIOTITE	2									

Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easti (NAD83)	ng DDH	Northing AD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
2-1	331	118	-64	546750.2	2 551	7463.6	2150	ABANDONED	8/30/1992	Tim Termuende, P. Geo.
To (m)	Alteration 1	Degree	Alteration 2	Degree .	Alteration 3	Degree	Note:			
43.2	TOURMALIN	IE 3								
56.7	SERICITE	1								
72.6	BIOTITE	2								
125.2	CHLORITE	3								
172.6	BIOTITE									
172.64	TOURMALIN	IE 5								
291.1	BIOTITE	2	SERICITE	2	EPIDOTE	1				
310.7	CHLORITE	i 1	BIOTITE	1						
331	CHLORITE	1	BIOTITE	1						
	Hole ber 2-1 43.2 56.7 72.6 125.2 172.64 291.1 310.7 331	HoleDDHberLength (m)2-1331To (m)Alteration I43.2TOURMALIN56.7SERICITE72.6BIOTITE125.2CHLORITE172.64TOURMALIN291.1BIOTITE310.7CHLORITE331CHLORITE	Hole DDH DDH Azimuth   ber Length (m) (Deg)   2-1 331 118   To (m) Alteration 1 Degree   43.2 TOURMALINE 3   56.7 SERICITE 1   72.6 BIOTITE 2   125.2 CHLORITE 3   172.6 BIOTITE 2   172.6 BIOTITE 2   172.6 BIOTITE 2   172.6 BIOTITE 1   310.7 CHLORITE 1   331 CHLORITE 1	Hole berDDH Length (m)DDH Azimuth (Deg)DDH Dip (+ Down)2-1331118-64To (m)Alteration 1DegreeAlteration 243.2TOURMALINE3-6456.7SERICITE1-6472.6BIOTITE2-64125.2CHLORITE3-64172.64TOURMALINE5-64291.1BIOTITE2SERICITE310.7CHLORITE1BIOTITE331CHLORITE1BIOTITE	HoleDDHDDH AzimuthDDH DipDDH Easting (NAD83)2-1331118-64546750.22-1331118-64546750.2To (m)Alteration 1DegreeAlteration 2Degree43.2TOURMALINE3	HoleDDHDDH AzimuthDDH DipDDH EastingDDHberLength (m)(Deg)(+ Down)(NAD83)(N2-1331118-64546750.2551To (m)Alteration 1DegreeAlteration 2DegreeAlteration 343.2TOURMALINE3	Hole berDDH Length (m)DDH Azimuth (Deg)DDH Dip (H Down)DDH Easting (NAD83)DDH Northing (NAD83)2-1331118-64546750.25517463.6To (m)Alteration IDegreeAlteration 2DegreeAlteration 3Degree43.2TOURMALINE356.7SERICITE172.6BIOTITE2172.6BIOTITE3172.6BIOTITE51-172.64TOURMALINE511-310.7CHLORITE1BIOTITE1-1-331CHLORITE1BIOTITE1	Hole berDDH Length (m)DDH Azimuth (Deg)DDH Dip (+ Down)DDH Easting (NAD83)DDH Northing (NAD83)DDH Elevation (m)2-1331118-64546750.25517463.62150To (m)Alteration 1DegreeAlteration 2DegreeAlteration 3DegreeNote:43.2TOURMALINE372.6BIOTITE1125.2CHLORITE3172.6BIOTITE2172.6BIOTITE2172.64TOURMALINE51291.1BIOTITE1BIOTITE11-331CHLORITE1BIOTITE1	Hole berDDH Length (m)DDH Azimuth (Deg)DDH Dip (+ Down)DDH Easting (NAD83)DDH Northing (NAD83)DDH Elevation (m)2-1331118-64546750.25517463.62150ABANDONEDTo (m)Alteration 1DegreeAlteration 2DegreeAlteration 3DegreeNote:43.2TOURMALINE356.7SERICITE172.6BIOTITE2172.6BIOTITE3172.6BIOTITE5172.6BIOTITE2SERICITE2EPIDOTE1172.6BIOTITE1BIOTITE2EPIDOTE1172.6BIOTITE1BIOTITE1172.6BIOTITE1BIOTITE1172.61BIOTITE1BIOTITE110.7CHLORITE1BIOTITE1 <td< td=""><td>Hole berDDH Length (m)DDH (Deg)DDH Dip (+ Down)DDH Easting (NAD83)DDH Northing (NAD83)DDH Elevation (m)DDH Status DDH &amp; ABANDONEDDate Complete2-1331118-64546750.25517463.62150ABANDONED8/30/199270 (m)Alteration 1DegreeAlteration 2DegreeAlteration 3DegreeNote:43.2TOURMALINE3</td></td<>	Hole berDDH Length (m)DDH (Deg)DDH Dip (+ Down)DDH Easting (NAD83)DDH Northing (NAD83)DDH Elevation (m)DDH Status DDH & ABANDONEDDate Complete2-1331118-64546750.25517463.62150ABANDONED8/30/199270 (m)Alteration 1DegreeAlteration 2DegreeAlteration 3DegreeNote:43.2TOURMALINE3

DDH F Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Eas (NAD8	sting 83)	DDH N (NA	orthing D83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-9	2-2	684.6	120	-62	54675	0.2	5517	463.6	2150	COMPLETE	9/15/1992	Tim Termuende, P. Geo.
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree	Altera	tion 3	Degree	Note:			
5	53.2	BIOTITE	2	CHLORITE	2	SER	RICITE	1				
22.3	22.3	FE STAININ	G 4									
53.2	53.3	GRAPHITE	3									
56.7	72.9	FE STAININ	G 2									
72.9	76.8	FE STAININ	G 2	ANKERITE	2							
76.8	100.1	SILICA	2									
100.1	126.1	CHLORITE	2	BIOTITE	2							
126.1	178.8	CHLORITE	1	BIOTITE	1							
178.8	293.2	CHLORITE	1	TREMOLITE	1							
308.5	309.5	TOURMALIN	IE 3									
309.5	351.4	SERICITE	2									
310.9	308.5	SERICITE	2									
351.4	354.6	SERICITE	2	SILICA	1							
354.6	478.3	BIOTITE	3	CHLORITE	3	TOUR	MALINE	2				
478.3	501.5	SERICITE	2	TOURMALINE	2							
501.5	504.8	SERICITE	1	CHLORITE	1	BIO	TITE	1				

DDH H Numl	Iole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Eas (NAD8	sting DDH 83) (N	Northing MAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-92	2-3	519.4	106	-75	54654	7.8 55	16297.3	1920	COMPLETE	9/18/1992	Tim Termuende, P. Geo.
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree	Alteration 3	Degree	Note:			
13.9	28.9	CHLORITI	E 1	BIOTITE	1	SILICA	1				
131.6	323.2	BIOTITE	1	SERICITE	1						
161.3	313.6	BIOTITE	2	TOURMALINE	1	SERICITE	1				
335.7	348.7	BIOTITE	2	ALBITE	1						

DDH H Numl	Iole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Eas (NAD8	sting L 83)	DDH N (NA	orthing D83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-92	2-4	290.8	100	-45	545889	9.19	5509	981.1	1070	COMPLETE	11/17/1992	Tim Termuende, P. Geo.
From (m)	To (m)	Alteration 1	Degree	Alteration 2	Degree	Alterati	ion 3	Degree	Note:			
54.2	70.4	CHLORITI	E 3	BIOTITE	1							
70.4	77.3	BIOTITE	1									
80.5	227.8	BIOTITE	2	SERICITE	2							
278.4	290.8	SERICITE	E 1									

### **APPENDIX III**

### **DIAMOND DRILL LOGS**

3.2.2 Lithology

Appen	ndix 3	3.2.2 - Lith	ology										
DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	g DDH Na (NAL	orthing 083)	DDH Elevation (n	DDH n)	Status	Date	Complete	Project Geologist
V-79	9-1	187	100	-45	546996	55167	63.53		COM	PLETE	7/29	9/1979	GL WEBBER
From (m)	To (m)	Map Unit	Major Rock	Type Mino	r Rock Type Pri	mary Colour	Seconda	ry Colour	Grainsize	Primary	Texture	Secondary Te	exture Notes:
0	71		Gabbro	)									Last 4 feet is chilled at the bottom of this unit.
71	114		Quartz Wa	cke		grey				turk	pidite		Concretions from 1 x 2cm to 3 x 6cm are common.
114	118		Wacke			grey				lami	nated		
118	127		Wacke			greenish	Q	grey	fine	lami	nated		
127	132.5	i	Wacke										Convoluted bedding with some rip-up clasts and concretio phlogogpite and galena.
132.5	138		Wacke						fine	lami	nated		
138	141		Wacke							fragr	nental		Fragments orientated at 25 to 30 degrees to the bedding.
141	146		Quartz Wa	cke	Wacke	grey	c	dark	fine	lami	nated		
146	147.5	i i	Wacke										
147.5	149		Wacke			dark	Q	grey	fine	lami	nated		
149	161		Wacke			light	Q	grey					
161	172		Quartz Wa	cke									
172	172.2		Conglomer	rate	Grit								Mottled, subangular fragments parallel to shear direction.
172.2	181		Quartzite	e	Wacke								
181	184		Wacke			grey	(	dark	fine-medium	lami	nated		Phlogopite is a commonly developed accessory mineral.
184	187		Wacke		Grit	grey		buff					Grit conglomerate 12cm at 184m and 46cm at 184.6m.

ns on fof which is up to 9 x 5cm; centre of this concretion contains some

This is shearing across a fragmental bed or grit conglomerate.

Appen	ndix 3	2.2.2 - Lith	ology								
DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Nortl (NAD83	hing DDH 3) Elevation	H DDH St n (m)	tatus Dat	e Complete	Project Geologist
Vu-9	1-1	61.3	167	-45	547952.4	5517396	6.1 220	0 COMPL	.ETE 9/	13/1991	I. D. McCartney
From (m)	To (m)	Map Unit	t Major Rock	Type Mino	or Rock Type Prin	mary Colour	Secondary Colour	Grainsize	Primary Texture	e Secondary Textu	re Notes:
7.5	10.2		Wacke	)		dark	grey		laminated		Thickly Laminated to thin bedded.
10.2	13.5		Quartz Wa	acke		light	grey	fine-medium	laminated		
13.5	17.9		Wacke	2		grey			laminated		
17.9	25		Wacke	•		light	green	medium-coarse	banded		Calc-Silicate Replacement Unit. Weak to strong HCL react tremolite, and garnet.
25	26.45		Wacke	•		dark	grey	fine	laminated		
26.45	27.05		quartz		Wacke	white	green	fine	banded		Banded Quartz-Albite(?)-Chlorite rock.
27.05	28.65		Wacke	•		dark	grey				
28.65	29.65		Wacke	)							Tremolite replacement.
29.65	31.75		Wacke	•		dark	grey		laminated		
31.75	32.3		Wacke	•		grey			banded		
32.3	32.6		Wacke	)		light	grey		fragmental		Fragmental consists of 10% rounded dark Biotitic clasts st
32.6	32.75		Wacke	•		grey			laminated		
32.75	38.77		Wacke	•		light	grey	fine-medium	fragmental	massive	20-30% dark Biotitic clasts in a wacke matrix.
38.77	41.2		Wacke	2		light	grey		laminated		
41.2	42.55		Wacke	e Ai	mphibolite						Amphibolite is replacing the Wacke.
42.55	44.1		Wacke	e Qu	artz Wacke	grey		fine-medium	laminated	massive	
44.1	45.85		Amphibol	lite				medium			
45.85	47.05		Wacke	)					laminated		
47.05	61.3		Wacke	•		light	grey		massive	fragmental	

tion throughout.	Quartz-feldspar	(pink)-epidote-calcite	with minor chorite,

rongly replaced by pyrrhotite in a light grey fine grained wacke matrix.

Appen	ndix 3	8.2.2 - Lith	ology										
DDH 1 Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH E (NAL	asting DDH 083) (N	Northing AD83)	DDH Elevation (m,	DDH S	Status	Date	Complete	Project Geologist
Vu-9	1-2	227.13	167	-65	5479 ⁻	11.9 551	17508.6	2170	COMP	LETE	9/1	5/1991	I. D. McCartney
From (m)	To (m)	Map Unit	Major Rock	Type Min	or Rock Type	Primary Colo	ur Secoi	ndary Colour	Grainsize	Prima	ry Texture	Secondary Textu	re Notes:
3.05	37.73		Gabbro	Α	Amphibolite	dark		green	medium				
37.73	48.28		Quartz Wac	cke	Wacke	grey							
48.28	49.77		Amphibolit	te	Quartzite	grey		fi	ne-medium				
49.77	58.7		Quartz Wac	cke	Wacke	white							
58.7	124.85	5	Gabbro					fi	ne-medium				
124.85	139.05	5	Wacke			light		grey		tı	urbidite		
139.05	140.11	1	Quartz Wac	cke						tı	urbidite		
140.11	145.57	7	Quartz Wac	cke		grey				tı	urbidite		
145.57	148.3		Quartz Wac	cke		grey				tı	urbidite		
148.3	151.8		Wacke			grey				la	minated		Lower-Middle Alderidge Formation Contact.
151.8	156.9	I	Wacke			grey				la	minated	massive	
156.9	164.26	6	Wacke			grey				la	minated		
164.26	166.68	3	Wacke			dark		grey		fra	gmental		
166.68	167.1		Wacke			dark				la	minated		
167.1	168.58	3	Argillite		Quartzite	dark		grey		fra	gmental		Fragmental elongated imbricated clasts in fine grained
168.58	169.04	4	Wacke			dark				la	minated		
169.04	170.96	6	Wacke							fra	igmental		
170.96	173.27	7	Wacke			light		grey	Fine	la	minated		
173.27	174.62	2	Amphibolit	te	Gabbro	green			medium	n	nassive		Possibly Tremolite as well.
174.62	176.1		quartz	β	Amphibolite	white				t	anded		
176.1	179.03	3	Wacke			grey				la	minated		
179.03	183		Wacke			grey				la	minated		
183	184		Wacke			grey		brown		fra	igmental		50% calsts in a Wacks matrix.
184	187.9	1	Wacke							k	anded		
187.9	192.1		Wacke							n	nassive		
192.1	193.55	5	Wacke			grey		brown		fra	igmental		50% clasts in a Wacke matrix.
193.55	206.22	2	Wacke							n	nassive		
206.22	208.12	2	Wacke			dark				la	minated		
208 12	210.4		Wacke	Co	onglomerate					n	nassive		Massive Conglomerate Wacke <10% clasts overall in
L					5								

und mass.
/acke matrix.

Appendix	: 3.2.2 - Liti	hology								
DDH Hole Number	DDH Length (m)	DDH Azimuth 1 (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist	
Vu-91-2	227.13	167	-65	547911.9	5517508.6	2170	COMPLETE	9/15/1991	I. D. McCartney	
From (m) To (	(m) Map Un	it Major Rock Ty	ype Minor	·Rock Type Prim	ary Colour Second	lary Colour G	rainsize Primary	Texture Secondary T	Texture Notes:	
210.4 222	2.5	Wacke	A	Arenite	light	grey	lam	inated		
222.5 227	7.13	Wacke			dark	grey	lam	inated		

DDH Hole Number	l I										
<i>number</i>	Len	DDH I ngth (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Con	mplete Project Geologist	, ,
Vu-91-3	2	276.52	213	-67	548526.6	5517489.1	2095	COMPLETE	9/17/19	991 I. D. McCartney	у
From (m) To (	(m)	Map Unit	Major Rock T	Sype Minor I	Rock Type Prin	nary Colour Secon	ndary Colour G	rainsize Prin	mary Texture S	Secondary Texture Notes:	
1.52 8.6	65		Gabbro	Amp	hibolite			coarse			
8.65 32	2.5		Quartz Wack	ke		brownish	grey				
32.5 39.	.05		Gabbro			green					
39.05 48.	.55		Quartz Wack	ke Tui	rbidite				laminated		
48.55 53.	.46		Quartz Wack	ke Tui	rbidite						
53.46 61	1.5		Quartz Wack	ke Tui	rbidite						
61.5 66.	.14		Quartz Wack	ke							
66.14 67	7.6		Wacke						laminated		
67.6 75	5.5		Quartz Wack	ke Tui	rbidite				banded		
75.5 83	3.8		Quartz Wack	ke Tui	rbidite				laminated		
83.8 197	7.4		Gabbro								
197.4 203	3.3		Wacke	Tu	rbidite	light	grey				
203.3 21	17		Quartz Wack	ke Tui	rbidite						
217 223	3.5		Wacke						laminated	Lower-Middle	Aldridge contact at 217m
223.5 226	6.5		Quartz Wack	ke			fine	e-medium	massive		
226.5 230	0.05		Quartz Wack	ke							
230.05 234	4.54		Wacke			light	grey	fine	laminated		
234.54 24	46		Wacke			grey	I	medium	fragmental	~ 25-35% clas	ts, elongated and imbricated @ 45 degrees
246 254	4.45		Wacke						laminated		
254.45 257	7.7		Wacke						laminated		
257.7 26	1.4		Wacke	Congl	lomerate	dark	grey	fine	massive		
261.4 276	6.45		Wacke			grey	1	medium	fragmental	~ 25-35% clas	ts imbricated at aout 40 degrees

Appen	ndix 3	2.2.2 - Lith	ology												
DDH Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH D (+ Dow	ip DDH Ea n) (NAL	asting D83)	DDH North (NAD83)	ing Di ) Elevai	DH tion (m)	DDH S	Status	Date	Complete	Project Geologist	
Vu-9	1-4	279.57	106	-60	54724	47.8	5516177	.4 23	300	COMP	LETE	9/20	)/1991	I. D. McCartney	
From (m)	To (m)	Map Unit	Major Rock	Туре М	inor Rock Type	Primar	y Colour S	Secondary Colou	ır G	Grainsize	Primar	y Texture	Secondary Tex	ture Notes:	
3.28	49.72		Gabbro	)	Amphibolite	gre	eenish	grey		medium	ma	assive		Gabbro is fine grained and appear	ed chilled at bottom of u
49.72	51.52		Wacke	9							lan	ninated			
51.52	69		Quartz Wa	icke	Turbidite						lan	ninated			
69	69.02		null		Amphibolite									PORPHYRITIC MAFIC DYKE	
69.02	69.41		Quartz Wa	icke	Turbidite						lan	ninated			
69.41	69.58		Null		Amphibolite									PORPHYRITIC MAFIC DYKE	
69.58	70.88		Quartz Wa	icke	Turbidite						lan	ninated			
70.88	70.92		Null		Amphibolite									PORPHYRITIC MAFIC DYKE	
70.92	75.56		Quartz Wa	icke	Turbidite						lan	ninated			
75.56	77.65		Wacke			(	grey				lan	ninated			
77.65	92.8		Quartz Wa	icke	Turbidite						ba	anded		Alderidge Turbidite secquence	
92.8	92.82		null		Amphibolite										
92.82	127.2		Quartz Wa	icke	Turbidite						lan	ninated		PORPHYRITIC MAFIC DYKE	
127.2	135.4		Wacke	1							lan	ninated			
135.4	150.1		Quartz Wa	icke	Turbidite						lan	ninated			
150.1	160.53	3	Wacke	1		gre	eenish	grey			m	assive			
160.53	170.43	3	Quartz Wa	icke	Turbidite						g	lassy			
170.43	173.87	,	Quartz Wa	icke	Turbidite						ba	anded			
173.87	178.9		Wacke		Turbidite						lan	ninated			
178.9	180.65	5	Quartz Wa	icke	Turbidite						ba	anded			
180.65	191.42	2	Quartz Wa	icke	Turbidite						lan	ninated			
191.42	192.85	5	Calcaren	ite							ma	assive		Lower-Middle Aldridge formation c	ontact at 191.42
192.85	200.78	3	Wacke			(	dark				lan	ninated			
200.78	204.4		Wacke		Conglomerate					very fine	lan	ninated			
204.4	206.13	3	Calcareni	ite	Amphibolite					coarse					
206.13	209.7		Quartz Wa	icke							ba	anded			
209.7	217.34	Ļ	Quartz Wa	icke	Wacke	(	dark	grey			m	assive			
217.34	279.57	7	Quartz Wa	icke	Conglomerate									Unit is laminated to 219m and ther	n laminated below.

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Appen	dix 3	8.2.2 - Lith	ology										
DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Ea (NAD	sting DDH N 83) (NA	orthing D83)	DDH Elevation (n	DDH n)	Status	Date (	Complete I	Project Geologist
Vu-9	1-5	158.84	124	-50	54741	2.8 5517	259.7	2295	COMF	PLETE	9/22	2/1991	I. D. McCartney
From (m)	To (m)	Map Unit	Major Rock	Type Mind	or Rock Type	Primary Colour	Second	lary Colour	Grainsize	<b>Primary</b>	Texture	Secondary Texture	e Notes:
7.62	13.4		Wacke			light		dark		lamir	nated		Lower Aldridge Formation. Alternating light-dark laminaions
13.4	40.67		Wacke	Ν	Mudstone				fine	fragm	nental		High proportion of flat black mudstone chips in a Wacke ma
40.67	53.5		Wacke							mas	sive	laminated	
53.5	60.8		Wacke	Со	nglomerate	light		grey	fine				Conglomerate in Wacke matrix.
60.8	71.8		Wacke							lamir	nated		
71.8	80.65		Amphiboli	te					medium	mas	sive	banded	Amphibolite-Biotite-Garnet Replacement Zone
80.65	158.84	ł	Wacke			grey				fragm	nental	massive	Average 25% clasts component floating in a Wacke matrix.

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Appen	ndix 3	.2.2 - Lith	ology										
DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Eas	sting DDH N 83) (NAI	orthing D83)	DDH Elevation (	DDH Si (m)	tatus	Date	Complete	Project Geologist
Vu-9	2-1	331	118	-64	54675	0.2 55174	463.6	2150	ABANDO	ONED	8/30	0/1992	Tim Termuende, P. Geo.
From (m)	To (m)	Map Unit	Major Rock	Type Min	or Rock Type	Primary Colour	Secondar	ry Colour	Grainsize	Primar _.	y Texture	Secondary Tex	cture Notes:
0	6.1	С	Casing										
6.1	53.3		Quartz Wa	cke		grey			fine-medium	lan	ninated	turbidite	3
53.3	56.7		Wacke		Argillite	dark	g	rey	fine	lan	ninated		
56.7	72.6		Quartz Wa	cke		grey			fine-medium	lan	ninated		
72.6	77.2		Wacke	Qı	uartz Wacke				fine	lan	ninated		
77.2	99.9		Quartz Wa	cke					fine-medium	lan	ninated	turbidite	9
99.9	125.2		Gabbro			light	gr	een	fine	ma	assive		
125.2	179.5		Quartz Wa	cke		light	g	rey	fine-medium	tu	rbidite	laminate	d
179.5	295.1		Gabbro			light	gr	reen	fine	m	assive		
295.1	310.7		Quartz Wa	cke		light	g	rey	fine	lan	ninated		
310.7	331		Quartz Wa	cke		white				lan	ninated		



Appen	dix 3	8.2.2 - Lith	ology										
DDH I Num	Hole ber 2-2	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down) 62	DDH Ea ) (NAD) 54675	sting DDH N 83) (NA	orthing D83)	DDH Elevation (1 2150	DDH S n)	Status	Date (	Complete	Project Geologist
vu-5	2-2	004.0	120	-02	54075	0.2 5517	403.0	2150	COM		5/15	1992	
From (m)	To (m)	Map Unit	Major Rock	Type Min	or Rock Type	Primary Colour	Secon	dary Colour	Grainsize	Prim	ary Texture	Secondary Text	ture Notes:
0	5	Casing	Casing										
5	53.3		Quartzite	e	Wacke	grey			fine-medium	la	aminated	turbidite	
53.3	56.7		Wacke		Argillite	dark		grey		la	aminated		
56.7	72.9		Wacke			grey			fine-medium		turbidite		Similar to the interval 5.0-53.3m, but turbiditic textures are
72.9	76.8		Quartzite	e	Wacke	greyish			fine	la	aminated		
76.8	100.1		Quartzite	e	Wacke	grey			fine-medium	la	aminated	turbidite	Localy turbiditic
100.1	126.1		Gabbro			dark		green			massive	foliated	
126.1	178.8		Quartzite	e	Wacke	grey			fine-medium	la	aminated		
178.8	293.2		Gabbro			dark		grey			massive		Contacts are poorly defined due to chloritized upper and lo
293.2	310.9	1	Quartzite	e	Wacke	grey			fine	la	aminated	turbidite	Foliation is 30 to 20 degrees to the bedding.
310.9	351.4		Quartzite	e	Wacke	light		grey					
351.4	354.6	i	Wacke										
354.6	478.3		Gabbro			green							
478.3	501.5		Wacke			light		brown	fine-medium	la	aminated	foliated	Bedding angles increasing downhole.
501.5	504.8		Conglomer	ate		light		grey					Conglomerate/fragmental. Matrix supported with clasts ma boundaries.

more common (40%of the interval).
ower contacts.
aking up 2-3% of interval. Clasts have weakly distinguishable "ghost like"

Appen	dix 3	8.2.2 - Lith	ology										
DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Ea (NAD	usting DDH N 83) (NA	orthing D83)	DDH Elevation (m	DDH Sta	atus	Date C	Complete	Project Geologist
Vu-9	2-3	519.4	106	-75	54654	7.8 5516	297.3	1920	COMPL	ETE	9/18/	/1992 Ti	m Termuende, P. Geo.
From (m)	To (m)	Map Unit	Major Rock	Type Min	or Rock Type	Primary Colour	Secondary	y Colour	Grainsize	Primary	Texture	Secondary Textur	e Notes:
0	5.1	Casing	Casing										
5.1	13.9		Quartzite	e	Wacke	light			medium	turb	pidite	foliated	Frequent Cross Bedding
13.9	28.9		Wacke			dark	gr	rey fi	ine-medium	lamii	nated		
28.9	37.2		Quartzite	e	Wacke	light	gr	еу	medium	mas	ssive		Weakly defined preferred grain orientation, 45 degrees to co
37.2	43.1		Wacke			light	gr	rey fi	ine-medium	lamii	nated		Broken, crumbly material within 0.6m of lower contact.
43.1	45.7		Gabbro			light	gre	een	medium	mas	ssive		Crumbly biotie/chlorite along lower contact.
45.7	47.6		Wacke					fi	ine-medium	lamii	nated		
47.6	56.8		Wacke			light	gr	еу	medium	lamii	nated		Becomes increasingly quartzitic downhole with grain size inc
56.8	161.3		Quartzite	e	Wacke	light	gr	rey fi	ine-medium	lamii	nated	turbidite	
161.3	313.6		Gabbro			grey	wł	nite	fine	mas	ssive	equigranular	Amphiboles are likely recrystallized, with preferred orientatio
313.6	323.2		Wacke			light	gr	теу		mas	ssive		
323.2	331.1		Wacke			light	cre	amy					Lower-Middle contact.
331.1	335.7		Conglomer	ate	Wacke								Matrix supported clasts with fragment size from <1mm to over
335.7	348.7		Wacke			white	cre	amy	fine	lamii	nated	turbidite	
348.7	355.6		Wacke			light	gr	еу		mas	ssive		

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ncreasing.
ion.
over 50mm.

Appen	dix 3	.2.2 - Lith	ology											
DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH (+ Do	Dip DDH wn) (NA	Eastin (D83)	ng DDH No (NAL	orthing 083)	DDH Elevation (n	DDH ; n)	Status	Date	Complete	Project Geologist
<b>Vu-9</b> 2	2-4	290.8	100	-45	5 5458	89.19	9 55099	81.1	1070	COMF	OMPLETE		7/1992	Tim Termuende, P. Geo.
From (m)	To (m)	Map Unit	Major Rock	Type 1	Minor Rock Typ	pe Pi	rimary Colour	Secon	ıdary Colour	Grainsize	Prima	ry Texture	Secondary Textu	ure Notes:
0	7.3	Casing	Casing											
7.3	37.7		Gabbro				light		grey		r	assive	equigranula	ar Darkening downhole.
37.7	52.9		Gabbro				dark		green		m	assive	equigranula	ar Similar to the unti above, however there is a marked litholog
52.9	54.8		Gabbro				light		red	fine	ро	rphyritic		
54.8	70.4		Gabbro				dark		green		m	assive	equigranula	ar
70.4	80.5		Wacke				light		buff		tu	urbidite		
80.5	148.5		Quartzite	9	Wacke		light		grey		tu	urbidite		
148.5	227.8		Wacke				light		grey	fine-medium	laı	minated	turbidite	
227.8	278.4		Quartzite	)	Wacke		greyish				laı	minated		Laminations are generally 1 to 10mm, with local cross-bedd
278.4	290.8		Quartz		Arenite		buff		brown					

gical at 37.7m.
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### **APPENDIX III**

### **DIAMOND DRILL LOGS**

3.2.3 Mineralogy

DDH F Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	) I	DDH Easting (NAD83)	DDH N (NA	Northing (D83)	L Eleve	)DH ation	(m)	DDH Status	Date Complete	Project Geologist
V-79	)-1	187	100	-45		546996	5516	763.53				COMPLETE	7/29/1979	GL WEBBER
From (m)	To (m)	Mineralizat	ion Style Miner	alization 1	%	Mineralization 2	%	Mineralizat	ion 3	%	Note	25:		
71	114	DISSEMI	NATED py	rrhotite	2		0			0	Some	e concretions contain	pyrrhotite	
114	118	VEINLE	ETS py	rrhotite	1		0			0	Alteri conta	nating laminated beds ain Pyrrhotite.	s may contain up to 8% I	Fe. Some rip-up clasts
118	127	VEINL	ETS py	rhotite	1		0			0				
127	132.5	BLEB	BY py	rhotite	1	galena				0	Rip-u	up clasts contain pyrrl	notite and galena.	
143	146	VEINL	ETS py	rhotite	0		0			0	Pyrrh	notite is in healed frac	tures	
161	172	VEINL	ETS py	rhotite	5		0			0				
172.2	181	VEINLE	ETS py	rhotite	1		0			0				

DDH I Num	Hole ber	DDHDDHLength (m)(1)	Azimuth DDH Dip Deg) (+ Down	p 1)	DDH Easting (NAD83)	DDH 1 (Nz	Northing 4D83)	l Elev	DDH ation	(m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-1	61.3 ²	167 -45		547952.4	551	7396.1	2	2200		COMPLETE	9/13/1991	I. D. McCartney
From (m)	To (m)	Mineralization Style	Mineralization 1	%	Mineralization 2	%	Mineralizat	tion 3	%	Note	s:		
9.8	10.1	VEINLETS	pyrrhotite	2		0			0				
10.2	13.5	DISSEMINATED	pyrrhotite	3		0			0	Local	lly up to 10%.		
13.5	17.9	DISSEMINATED	pyrrhotite	4		0			0				
25	26.45	DISSEMINATED	pyrrhotite	1	pyrite	0			0				
26.45	27.05	DISSEMINATED	pyrrhotite	1	sphalerite	1	arsenopy	rite	0				
28.65	29.65	BLEBBY	pyrrhotite	1	pyrite	0			0				
31.75	32.3	DISSEMINATED	pyrrhotite	7		0			0				
32.75	35.02	DISSEMINATED	pyrrhotite	10		0			0				
35.02	35.52	DISSEMINATED	pyrrhotite	10	sphalerite	1	galena	a	1				
38.77	41.2	DISSEMINATED	pyrrhotite	10		0			0				
41.2	42.55	VEINLETS	pyrrhotite	2	pyrite	0			0				
42.55	42.9	DISSEMINATED	pyrrhotite	3		0			0				
42.9	44.1	DISSEMINATED	pyrrhotite	0		0			0				
45.85	47.05	DISSEMINATED	pyrrhotite	2		0			0				

DDH . Num	Hole ber	DDHDDH ALength (m)(D	Azimuth DDH Dip Deg) (+ Down,	) D	DH Easting (NAD83)	DDH N (NA	Northing 1D83)	DDH Elevation (	(m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-2	227.13 1	67 -65		547911.9	5517	7508.6	2170		COMPLETE	9/15/1991	I. D. McCartney
From (m)	To (m)	Mineralization Style	Mineralization 1	%	Mineralization 2	%	Mineraliza	tion 3 %	Notes	s:		
37.73	48.28	DISSEMINATED	pyrrhotite	3		0		0				
58.7	124.85	DISSEMINATED	pyrrhotite	5		0		0				
139.05	140.11	VEINLETS	pyrrhotite	1		0		0				
145.57	148.3	DISSEMINATED	pyrrhotite	1		0		0				
148.3	151.8	DISSEMINATED	pyrrhotite	3		0		0				
151.8	152.83	VEINLETS	pyrrhotite	10		0		0				
160	161.63	VEINLETS	pyrrhotite	2	pyrite	1		0				
164.26	165.04	VEINLETS	galena	1	pyrrhotite	1		0				
166.3	166.51	DISSEMINATED	pyrrhotite	1	arsenopyrite	1		0				
166.68	169.04	DISSEMINATED	pyrrhotite	1		0		0				
170.96	173.27	VEINLETS	pyrrhotite	1		0		0				
176.1	179.03	DISSEMINATED	pyrrhotite	3		0		0				
179.03	183	BLEBBY	pyrrhotite	3		0		0				
184	187.9	VEINLETS	pyrrhotite	1		0		0				
187.9	192.1	VEINLETS	pyrrhotite	0		0		0				
206.22	208.12	VEINLETS	pyrrhotite	1		0		0				
215.3	216	BLEBBY	pyrrhotite	1	chalcopyrite	1		0				

DDH . Num	Hole ber	DDH Length (m)	DDH Azimutl (Deg)	h DDHD (+Dow	)ip vn)	DDH Easting (NAD83)	DDH I (NA	Northing 1D83)	DDH Elevation	(m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-3	276.52	213	-67		548526.6	5517	7489.1	2095		COMPLETE	9/17/1991	I. D. McCartney
From (m)	To (m)	Mineralizatio	on Style Mine	ralization 1	%	Mineralization 2	%	Mineralizat	ion 3 %	Notes	5:		
1.52	8.65	VEINLE	TS py	vrrhotite	0		0		0				
8.65	32.5	DISSEMIN	ATED py	vrrhotite	2		0		0				
11.5	144	DISSEMIN	ATED py	vrrhotite	3		0		0	Local	ly 5-8% pyrrhotite.		
36.45	36.9	BLEBE	3Y py	vrrhotite	2	chalcopyrite	0		0				
42.54	43.43	DISSEMIN	ATED py	vrrhotite	1		0		0				
75.5	83.8	BLEBE	3Y py	vrrhotite	1	chalcopyrite	0		0				
217	223.5	DISSEMIN	ATED py	vrrhotite	1		0		0				
223.5	226.5	DISSEMIN	ATED py	vrrhotite	1		0		0				
226.5	230.05	DISSEMIN	ATED py	rrhotite	5	galena	0	sphalerit	te 0				
230.05	234.54	VEINLE	TS sp	halerite	0	galena		pyrite	0				
234.54	246	DISSEMIN	ATED py	vrrhotite	2		0		0				
246	254.45	DISSEMIN	ATED py	vrrhotite	1	pyrite	0		0				
254.45	257.7	DISSEMIN	ATED py	vrrhotite	1	sphalerite	0	galena	0				
257.7	261.4	DISSEMIN	ATED py	vrrhotite	1	pyrite	0		0				
261.4	276.45	DISSEMIN	ATED py	vrrhotite	0		0		0				

DDH Hole Number Vu-91-4		DDH DDH A Length (m) (D	zimuth DDH Dip eg) (+ Down)		DDH Easting (NAD83)	DDH N (NA	Northing (D83) Ela	DDH evation	(m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-4	279.57 10	06 -60		547247.8	5516	6177.4	2300		COMPLETE	9/20/1991	I. D. McCartney
From (m)	To (m)	Mineralization Style	Mineralization 1	%	Mineralization 2	%	Mineralization 3	3 %	Notes:			
3.28	13.78	DISSEMINATED	pyrite	0		0		0				
13.78	16.66	DISSEMINATED	pyrrhotite	10	chalcopyrite	1		0				
32.5	36.5	DISSEMINATED	pyrrhotite	1	magnetite	0		0				
39.93	41.06	DISSEMINATED	pyrrhotite	0		0		0				
49.72	51.52	DISSEMINATED	pyrrhotite	2		0		0				
51.52	75.56	VEINLETS	pyrrhotite	1		0		0				
75.56	77.65	DISSEMINATED	pyrrhotite	1		0		0				
77.65	93.3	DISSEMINATED	pyrrhotite	0	pyrite	0		0				
93.3	93.7	VEINLETS	pyrite	5		0		0				
99	103	VEINLETS	pyrite	0	pyrrhotite	1		0				
112.1	112.3	VEINLETS	pyrite	5		0		0				
135.4	150.1	DISSEMINATED	pyrrhotite	3		0		0				
150.1	160.53	DISSEMINATED	pyrrhotite	0	arsenopyrite	0		0				
160.53	170.43	DISSEMINATED	pyrrhotite	3		0		0				
170.43	173.87	DISSEMINATED	arsenopyrite	2	pyrrhotite	1		0				
173.87	178.9	VEINLETS	pyrrhotite	1		0		0				
178.9	180.65	VEINLETS	pyrrhotite	3		0		0				
191.42	192.85	DISSEMINATED	pyrrhotite	10	pyrite	0	arsenopyrite	0				
192.85	194	DISSEMINATED	pyrrhotite	5		0		0				
194	200.78	VEINLETS	pyrrhotite	3		0		0				

DDH Num	Hole iber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	D	DH Easting (NAD83)	DDH N (NA	lorthing D83)	D Eleva	DH tion	(m)	DDH Status	Date Complete	Project Geologist
Vu-9	1-4	279.57	106	-60		547247.8	5516	6177.4	2	300	C	COMPLETE	9/20/1991	I. D. McCartney
From (m)	To (m)	Mineralizati	on Style Minera	ulization 1 %	ó	Mineralization 2	%	Mineralizat	ion 3	%	Notes:			
200.78	204.4	DISSEMIN	IATED pyri	rhotite	5	arsenopyrite	1	sphaleri	te	0				
206.13	209.7	DISSEMIN	IATED pyri	rhotite	1	chalcopyrite	0			0				
209.7	217.34	SEMIMAS	SSIVE pyri	rhotite	5		0			0	Pyrrhoti	te is in bands up t	o 5cm thick.	
217.34	279.57	VEINLE	ETS pyri	rhotite	1	arsenopyrite	1	chalcopy	rite	1				

DDH H Numl	Iole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down	) )	DDH Easting (NAD83)	DDH N (NA	Northing 1D83)	DDH Elevation	(m)	DDH Status	Date Complete	Project Geologist
Vu-9′	1-5	158.84	124	-50		547412.8	5517	7259.7	2295		COMPLETE	9/22/1991	I. D. McCartney
From (m)	To (m)	Mineralizati	on Style Miner	alization 1	%	Mineralization 2	%	Mineralizatio	on 3 %	Notes:	:		
13.4	40.67	SEMIMAS	SSIVE pyr	rhotite	3	pyrite	0		0				
33	33.8	VEINLE	ETS pyr	rhotite	5		0		0				
40.67	53.5	VEINLE	ETS pyr	rhotite	2	pyrite	1		0				
60.8	60.95	DISSEMIN	IATED sph	alerite	3	pyrrhotite	5		0				
65.1	65.7	DISSEMIN	IATED pyr	rhotite	2	chalcopyrite	0		0				

DDH H Numl	lole oer	DDH Length (m)	DDH Azimuth (Deg)	DDH D (+ Dow	ip n)	DDH Easting (NAD83)	DDH I (N/	Northing 4D83)	DD Elevati	)H on (	( <i>m</i> )	DDH Status	Date Complete	Project Geologist	
Vu-92-1		331	118	-64		546750.2	5517463.6		2150		Α	BANDONED	8/30/1992	Tim Termuende, P. Geo.	
From (m)	To (m)	Mineralizati	ion Style Miner	alization 1	%	Mineralization 2	%	Mineralizati	ion 3	%	Notes:				
6.1	53.3	VEINLE	ETS p	yrite			0			0					
53.3	56.7	VEINLE	ETS ga	alena		pyrrhotite				0					
60.1	61	VEINLE	ETS pyr	rhotite	1		0			0					
99.9	125.2	VEINLE	ETS pyr	rhotite	3	chalcopyrite				0					
125.2	179.5	VEINLE	ETS pyr	rhotite			0			0					
295.1	310.7	BLEBI	BY pyr	rhotite		chalcopyrite				0					

DDH H Numl	Hole ber	DDH Length (m)	DDH Az (De	;imuth L g) (	DDH Di <u>i</u> (+ Down	).	DDH Easting (NAD83)	DDH N (NA	Northing 1D83)	Ele	DDH vation	(m)	DDH Status	Date Com	plete	Project Geologist
Vu-92	2-2	684.6	12	0	-62		546750.2	5517	7463.6		2150		COMPLETE	9/15/199	92	Tim Termuende, P. Geo.
From (m)	To (m)	Mineralizati	ion Style	Mineraliza	ation 1	%	Mineralization 2	%	Mineralizati	ion 3	%	Notes	:			
5	53.3	DISSEMIN	NATED	galer	na		pyrrhotite		chalcopyr	rite						
56.6	56.7	VEINLE	ETS	pyrrho	tite		chalcopyrite				0					
77.9	77.93	BLEB	BY	galer	na	2		0			0					
100.1	126.1	DISSEMIN	NATED	pyrrho	tite	1	chalcopyrite	2			0					
141.15	141.2	DISSEMIN	NATED	Pyrit	е		pyrrhotite		sphalerit	te						
178.8	293.2	VEINLE	ETS	pyrrho	tite			0			0					
293.2	310.9	DISSEMIN	NATED	pyrrho	tite		chalcopyrite				0					
310.9	351.4	VEINLE	ETS	pyrrho	tite		pyrite	1			0					
351.4	352.4	VEINLE	ETS	pyrrho	tite	2		0			0					
354.6	478.3	VEINLE	ETS	pyrrho	tite	1	chalcopyrite		pyrite							
407.3	408.1	DISSEMIN	NATED	pyrrho	tite	10	chalcopyrite				0					
478.3	479.3	DISSEMIN	NATED	pyrrho	tite	5	chalcopyrite		sphalerit	te						
501.5	504.8	DISSEMIN	NATED	pyrrho	tite	2		0			0					

DDH H Numb	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH 1 (NA	Northing 1D83)	L Eleve	DDH ation (	(m)	DDH Status	Date Complete	Project Geologist			
Vu-92	2-3	519.4	106	-75	546547.8	5516	6297.3	1	1920		COMPLETE	9/18/1992	Tim Termuende, P. Geo.			
From (m)	To (m)	Mineralizat	ion Style Minera	ulization 1 %	<b>Mineralization</b>	2 %	Mineraliza	tion 3	%	Notes	s:					
13.9	28.9	FRACT	JRES p	yrite	chalcopyrite				0							
43.1	45.7	SEMIMA	SSIVE pyri	rhotite		0			0	Pyrrho	otite as localized bre	ccia over 2cm.				
56.8	161.3	VEINL	ETS pyri	rhotite		0			0							
161.3	313.6	VEINL	ETS pyri	rhotite	0 chalcopyrite	0			0							
171.7	172.1	BLEB	BY pyri	rhotite	5	0			0							
313.6	323.2	DISSEMI	NATED pyri	rhotite	2	0			0							
323.2	331.1	VEINL	ETS pyri	rhotite	1	0			0							
331.1	335.7	VEINL	ETS pyri	rhotite	0	0			0							
335.7	348.7	DISSEMI	NATED pyri	rhotite	0 pyrite	0			0							
348.7	355.6	DISSEMI	NATED pyri	rhotite	0	0			0							
DDH I Num	Hole ber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	L	DDH Easting (NAD83)	DDH N (NA	Northing (D83)	D. Eleva	DH tion (m,	DDH )	Status	Date Com	plete	Project Geolog	gist
--------------	-------------	-------------------	----------------------	---------------------	----	------------------------	--------------	-------------------	-------------	----------------	----------	--------	----------	-------	------------------	--------
Vu-9	2-4	290.8	100	-45		545889.19	5509	9981.1	1(	070	COM	PLETE	11/17/19	992	Tim Termuende, P	. Geo.
From (m)	To (m)	Mineralizati	on Style Minera	lization 1 %	6	Mineralization 2	%	Mineraliza	tion 3	% N	otes:					
37.7	70.4	VEINLE	ETS P	yrite		pyrrhotite				0						
53.9	54.2	BLEB	3Y arser	nopyrite	2	chalcopyrite	1			0						
71.1	77.3	BLEB	BY p	yrite	1		0			0						
77.3	80.5	VEINLE	ETS pyrr	rhotite		chalcopyrite				0						
123.7	123.85	DISSEMIN	IATED pyrr	rhotite	15		0			0						
171.5	171.8	VEINLE	ETS pyrr	rhotite	30		0			0						
196.8	197.2	VEINLE	ETS pyrr	rhotite	3		0			0						
202.7	210.2	VEINLE	ETS pyrr	rhotite	3		0			0						
227.8	278.4	DISSEMIN	IATED pyrr	rhotite	2		0			0						
278.4	290.8	VEINLE	ETS pyrr	rhotite			0			0						

## Appendix 3.2.3 - Mineralogy

#### **APPENDIX III**

#### **DIAMOND DRILL LOGS**

3.2.4 Shear Zone

DDH Nun	Hole ıber	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DI	OH Status	Date	Complete	Pro	ject G	eologis	st		
V-7	9-1	187	100	-45	546996	5516763.53		CC	MPLETE	7/2	9/1979	Ģ	BL WE	BBER			
From (m)	To (m)	Deformation	Angle (to CA) Miner	ralogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg	Alteration 2	Deg	Alteration 3	Deg	Gauge	Clay	Oxidized	Clean	Note:
138	138	Brittle	25	0	0	0		0		0		0	0	0	0	0	
141	141	Brittle	0	0	0	0		0		0		0	1	0	0	0	
146	147.5	Brittle	0	0	0	0		0		0		0	4	0	0	0	
161	172	Ductile	32	0	0	0		0		0		0	0	0	0	0	



DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist	
Vu-91-1	61.3	167	-45	547952.4	5517396.1	2200	COMPLETE	9/13/1991	I. D. McCartney	
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg Alteration 2	Deg Alteration 3	Deg Gauge Clay Oxidized	Clean Note:

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DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist	
Vu-91-2	227.13	167	-65	547911.9	5517508.6	2170	COMPLETE	9/15/1991	I. D. McCartney	
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg Alteration 2	Deg Alteration 3	Deg Gauge Clay Oxidized	Clean Note:

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DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist		
Vu-91-3	276.52	213	-67	548526.6	5517489.1	2095	COMPLETE	9/17/1991	I. D. McCartney		
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg Alteration 2	Deg Alteration 3	Deg Gauge Clay Oxidized	l Clean Note:	

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DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist		
Vu-91-4	279.57	106	-60	547247.8	5516177.4	2300	COMPLETE	9/20/1991	I. D. McCartney		
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg Alteration 2	Deg Alteration 3	Deg Gauge Clay Oxidize	ed Clean Note:	

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DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist		
Vu-91-5	158.84	124	-50	547412.8	5517259.7	2295	COMPLETE	9/22/1991	I. D. McCartney		
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg Alteration 2	Deg Alteration 3	Deg Gauge Clay Oxidize	d Clean Note:	

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DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH S	Status	Date	Complete	Project G	eologi	st			
Vu-92-1	331	118	-64	546750.2	5517463.6	2150	ABAND	ONED	8/30	0/1992	Tim Termuer	nde, P.	Geo.			
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg A	lteration 2	Deg	Alteration 3	Deg Gauge	Clay	Oxidized	Clean	Note:	

Page 7 of 10

DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist	
Vu-92-2	684.6	120	-62	546750.2	5517463.6	2150	COMPLETE	9/15/1992	Tim Termuende, P. Geo.	
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg Alteration 2	Deg Alteration 3	Deg Gauge Clay Oxidized	Clean Note:

Page 8 of 10

DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist	
Vu-92-3	519.4	106	-75	546547.8	5516297.3	1920	COMPLETE	9/18/1992	Tim Termuende, P. Geo.	
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg Alteration 2	Deg Alteration 3	Deg Gauge Clay Oxidized	Clean Note:

Page 9 of 10

DDH Hole Number	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DD	H Status	Date	Complete	Project G	eologi	ist			
Vu-92-4	290.8	100	-45	545889.19	5509981.1	1070	CON	MPLETE	11/1	7/1992	Tim Termuer	nde, P.	Geo.			
From (m) To (m)	Deformation	Angle (to CA) Miner	alogy 1 %	Mineralogy 2 %	Mineralogy 3 %	Alteration 1	Deg	Alteration 2	Deg	Alteration 3	Deg Gauge	Clay	Oxidized	Clean	Note:	

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#### **APPENDIX III**

### **DIAMOND DRILL LOGS**

3.2.5 Structure

DDH Ho Numbe	ole er	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
V-79-′	1	187	100	-45	546996	5516763.53		COMPLETE	7/29/1979	GL WEBBER
From (m)	To (n	n) Structu	ral Measurement	Angle (to	o CA) Note:					
71	11	4	Bedding	85						
132.5	13	8	Bedding	85						
147.5	16	1 Crer	nulated Bedding							

DDH He Numbe	DDH HoleDDHDDH AzimuNumberLength (m)(Deg)		DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-91-	-1	61.3	167	-45	547952.4	5517396.1	2200	COMPLETE	9/13/1991	I. D. McCartney
From (m)	To (m	) Structu	ral Measurement	Angle (te	o CA) Note:					
12.3	12.3	3	Bedding	60						
15.5	15.8	5	Bedding							
25	26.4	5	Bedding	50						
31.3	31.3	3	Bedding	50						
42.55	42.9	)	Bedding							
45.9	45.9	)	Bedding							
46.9	46.9	)	Bedding							

DDH Ho Numbo	ole er 1	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-91	-2	227.13	167	-65	547911.9	5517508.6	2170	COMPLETE	9/15/1991	I. D. McCartney
From (m)	To (m)	Structu	ral Measurement	Angle (te	o CA) Note:					
3.05	37.73	3	Bedding	60						
39	39		Bedding	68						
44.5	44.5		Bedding	52						
49.77	58.7		Bedding	45						
50.5	50.5		Bedding	50						
57.5	57.5		Bedding	20						
130	130		Bedding							
138	138		Bedding	60						
150.5	150.5	5	Bedding	55						
152.83	156.9	9	Bedding	30						
166.68	167.1	1	Bedding	50						
176.1	179.0	3	Bedding	50						
206.22	208.1	2	Bedding	45						
213	213		Bedding	30						

## Appendix 3.2.5 - Structure

DDH Ho Numbo	ole I er Lei	DDH ngth (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH East (NAD83	ting 3)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-91	-3 2	276.52	213	-67	548526.	.6	5517489.1	2095	COMPLETE	9/17/1991	I. D. McCartney
From (m)	To (m)	Structur	al Measurement	Angle (te	o CA) Not	te:					
42.5	42.5		Bedding	60							
46	46		Bedding	68							
60	60		Bedding	52							
78	78	Bedding		50							
83	83		Bedding	55							
201.5	201.5		Bedding	45							
217	223.5	Bedding		45							
229.2	229.2		Bedding	45							
230.05	234.54		Bedding	40							
245.45	257.7		Bedding	45							

DDH Ho Numbo	ole er I	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-91	-4	279.57	106	-60	547247.8	5516177.4	2300	COMPLETE	9/20/1991	I. D. McCartney
From (m)	To (m)	Structu	ral Measurement	Angle (te	o CA) Note:					
50	50		Bedding	70						
65.8	65.8	1	Bedding	65						
72.8	72.8	5	Bedding	65						
77	77		Bedding	67						
91	91		Bedding	70						
129.4	129.4	4	Bedding	65						
135	135		Bedding	80						
150.1	160.5	3	Bedding	50						
168	168		Bedding	65						
176	176		Bedding	65						
178.9	180.6	5	Bedding	65						
199	199		Bedding	60						
210	210		Bedding	70						
217.34	279.5	57	Bedding	50						

## Appendix 3.2.5 - Structure

DDH Ho Numbe	ole er	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-91-	5	158.84	124	-50	547412.8	5517259.7	2295	COMPLETE	9/22/1991	I. D. McCartney
From (m)	To (n	n) Structur	ral Measurement	Angle (te	o CA) Note:					
61.5	61.	5	Bedding	70						
70.5	70.	.5	Bedding							

DDH Ho Numbo	ole er Le	DDH ength (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	g DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-92	-1	331	118	-64	546750.2	5517463.6	2150	ABANDONED	8/30/1992	Tim Termuende, P. Geo.
From (m)	To (m)	Structu	ural Measurement	Angle (to	o CA) Note:					
10.7	10.7		Bedding	55						
21.6	21.6		Bedding	65						
32	32		Bedding	60						
41.1	41.1		Bedding	50						
52.3	52.3		Bedding	55						
53.3	56.7		Bedding	65						
60.9	60.9		Bedding	60						
66.5	66.5		Bedding	70						
69.5	69.5		Bedding	60						
79.5	79.5	Bedding		60						
84.8	84.8		Bedding	40						
93.2	93.2		Bedding	48						
127.5	127.5		Bedding	55						
137.9	137.9		Bedding	55						
144	144		Bedding	55						
160	160		Bedding	55						
164.6	164.6		Bedding	60						
175.4	175.4		Bedding	60						
296.9	296.9		Bedding	40						
300	300		Bedding	53						
303.2	303.2		Bedding	58						
310.4	310.4		Bedding	52						

DDH Ho Numbo	ole er L	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-92	-2	684.6	120	-62	546750.2	5517463.6	2150	COMPLETE	9/15/1992	Tim Termuende, P. Geo.
From (m)	To (m)	Structu	ıral Measurement	Angle (te	o CA) Note:					
10.7	10.7		Bedding	63						
21.6	21.6		Bedding	60						
32	32		Bedding	60						
41.9	41.9		Bedding	60						
53	53		Bedding	60						
53.3	56.7		Bedding	57						
56.7	72.9		Bedding	65						
76.9	76.9		Bedding	65						
84.8	84.8		Bedding	60						
92.9	92.9		Bedding	45						
100	100		Bedding	55						
127.5	127.5	5	Bedding	55						
140.2	140.2	2	Bedding	55						
144.8	144.8	3	Bedding	57						
158.5	158.5	5	Bedding	53						
171.9	171.9	)	Bedding	55						
176.7	176.7	,	Bedding	55						
293.2	310.9	)	Bedding	52						
311.1	311.1		Bedding	48						
333.6	333.6	;	Bedding	50						
346.1	346.1		Bedding	58						
349.1	349.1		Bedding	51						
480.1	480.1		Bedding	20						
487.6	487.6	6	Bedding	45						
493.8	493.8	3	Bedding	45						

DDH Ha Numbe	ole er	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-92-	-2	684.6	120	-62	546750.2	5517463.6	2150	COMPLETE	9/15/1992	Tim Termuende, P. Geo.
From (m)	To (m	ı) Structur	ral Measurement	Angle (te	o CA) Note:					
506.2	506	.2	Bedding	40						

DDH Ho Numbo	ole er i	DDH Length (m)	DDH Azimuth (Deg)	DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-92	-3	519.4	106	-75	546547.8	5516297.3	1920	COMPLETE	9/18/1992	Tim Termuende, P. Geo.
From (m)	To (m)	) Structu	ral Measurement	Angle (to	o CA) Note:					
5.1	13.9	)	Bedding	45						
13.9	13.9	)	Bedding	50						
19	19		Bedding	50						
28.7	28.7	7	Bedding	45						
32.6	32.9	)	Bedding	50						
37.2	43.1	l	Bedding	45						
47.6	56.8	3	Bedding	50						
58	58		Bedding	50						
77.8	77.8	3	Bedding	50						
102.6	102.0	6	Bedding	50						
126.1	126.	1	Bedding	52						
147.6	147.0	6	Bedding	50						
313.6	323.2	2	Bedding	70						

DDH Ho Numbe	ole er Le	DDH DDH Azimu Length (m) (Deg)		DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	Date Complete	Project Geologist
Vu-92-	4	290.8	100	-45	545889.19	5509981.1	1070	COMPLETE	11/17/1992	Tim Termuende, P. Geo.
From (m)	To (m)	Structur	ral Measurement	Angle (to	o CA) Note:					
70.4	77.3		Bedding	65						
80.5	148.5		Bedding	65						
148.5	227.8		Bedding	55						
227.8	278.4		Bedding	67						
278.4	290.8		Bedding	65						

#### **APPENDIX III**

### **DIAMOND DRILL LOGS**

3.2.6 Veining

V-79-1187100-455469965516763.53COMPLETE $7/29/1979$ GL WEBBERDepth (m)Angle (to CA)Colour (to CA)GrainsizePrimary TextureMineralogy 1Mineralogy 2Mineralogy 3Sulphides 1%Sulphides 2%Sulphides 3%Alteration SettingAlteration 1Alteration 1Alteration 114530whiteMASSIVE $\cdot$ </th <th>DDH H Numl</th> <th>Iole I ber Len</th> <th>DDH 1gth (m)</th> <th>DDH Azim (Deg)</th> <th>outh DDHD (+Dow</th> <th>ip DDH Eastin n) (NAD83)</th> <th>g DDH Northii (NAD83)</th> <th>ng DDH Elevation (m)</th> <th>DDH Status</th> <th>5</th> <th>Date Com</th> <th>pleted</th> <th>L L</th> <th>Logged</th> <th>By</th> <th></th> <th></th>	DDH H Numl	Iole I ber Len	DDH 1gth (m)	DDH Azim (Deg)	outh DDHD (+Dow	ip DDH Eastin n) (NAD83)	g DDH Northii (NAD83)	ng DDH Elevation (m)	DDH Status	5	Date Com	pleted	L L	Logged	By		
Depth Angle Colour Grainsize Primary Texture Mineralogy 1 Mineralogy 2 Mineralogy 3 Sulphides 1 % Sulphides 2 % Sulphides 3 % Alteration 1 Alteration 1 Alteration 2   145 3 0 white MASSIVE Image: Sulphides 1 % Sulphides 2 % Sulphides 3 % Alteration 1 Alteration 1 Alteration 2   146 3 0 white MASSIVE Image: Sulphides 1 % Sulphides 2 % Sulphides 3 % Alteration 1 Alteration 1 Alteration 2 Mineralogy 3 Mineralogy 3 Sulphides 1 % Sulphides 2 % Sulphides 3 % Alteration 3 Alteration 4 Mineralogy 3 Mineralogy 3 Sulphides 1 % Sulphides 3 % Sulphides 3 % Mineralogy 3 Mineralogy 3 Mineralogy 3 Sulphides 3 % Sulphides 3 % Mineralogy 3 Mineralogy 3 Mineralogy 3 Mineralogy 3 Mineralogy 3 Sulphides 3 % Mineralogy 3 Mineralogy 3 Mineralogy 3 Mineralogy 3 Mineralogy 3	V-79	-1	187	100	-45	546996	5516763.5	3	COMPLETE		7/29/19	79	GI	L WEB	BER		
145 3 0 white MASSIVE 0 0   186 4 0 white pyrrhotite 10 galena 3 sphalerite 1	Depth (m)	Width (cm)	) Angle (to CA)	Colour	Grainsize	Primary Texture	Mineralogy 1 Min	eralogy 2 Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2
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Vu-91	1-1	61.3	167	-45	547952.4	5517396.1	2200	COMPLETE		9/13/199	1	I. D	. McCa	artney		
Depth (m)	Width (c	em) Angle (to CA)	Colour (	Grainsize Pi	rimary Texture	Mineralogy 1 Miner	alogy 2 Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

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Vu-91	1-2	227.13	167	-65	547911.9	5517508.6	2170	COMPLETE		9/15/199	)1	I. D	. McCa	artney		
Depth (m)	Width (c	cm) Angle (to CA	Colour )	Grainsize P	rimary Texture	Mineralogy 1 Miner	alogy 2 Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

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Vu-91	1-3	276.52	213	-67	548526.6	5517489.1	2095	COMPLETE	Ξ	9/17/19	91	I. D	. McCa	artney		
Depth (m)	Width (c	em) Angle (to CA)	Colour (	Grainsize P	rimary Texture	Mineralogy 1 Miner	alogy 2 Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

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Vu-91	1-4	279.5	57	106	-60	547247.8	5516177	/.4	2300	COMPLET	E	9/20/19	91	I. D	. McCa	artney		
Depth (m)	Width (	(cm) A (1	Angle (to CA)	Colour	Grainsize	Primary Texture	Mineralogy 1 M	ineralogy 2	Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

DDH H Numh	Iole ber L	DDH ength (m)	DDH Azimut (Deg)	h DDH Dip (+ Down)	DDH Easting (NAD83)	g DDH Northing (NAD83)	DDH Elevation (m)	DDH Status	5	Date Comple	eted	L	ogged	By		
<b>Vu-9</b> 1	1-5	158.84	124	-50	547412.8	5517259.7	2295	COMPLETE		9/22/199 ⁻	1	I. D	. McCa	irtney		
Depth (m)	Width (c	m) Angle (to CA)	Colour (	Grainsize Pi	rimary Texture	Mineralogy 1 Minera	logy 2 Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

DDH H Numb	lole ber 1	DDH Length (m	)	DDH Azimu (Deg)	th DDH Di (+ Down	p DDH Easting ) (NAD83)	g DDH North (NAD83)	ing ) Ele	DDH evation (m)	DDH Stati	IS	Date Com	pleted	! 1	logged	By		
Vu-92	2-1	331	-	118	-64	546750.2	5517463	6	2150	ABANDONE	Ð	8/30/19	92	Tim Ter	muend	e, P. Geo.		
Depth (m)	Width	(cm) Ang (to (	gle CA)	Colour	Grainsize	Primary Texture	Mineralogy 1 Mi	neralogy 2	Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

DDH H Numb	lole oer L	DDH Length (m)	DDH Azimı (Deg)	uth DDH Dip (+ Down)	DDH Easting (NAD83)	g DDH Northing (NAD83)	DDH Elevation (m)	DDH Statu	<b>S</b>	Date Comp	oleted		Logged	By		
Vu-92	2-2	684.6	120	-62	546750.2	5517463.6	2150	COMPLETE	Ξ	9/15/19	92	Tim Ter	muend	e, P. Geo.		
Depth (m)	Width (d	cm) Angle (to CA	Colour )	Grainsize F	rimary Texture	Mineralogy 1 Minera	logy 2 Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

DDH H Numb	lole er 1	DDH Length (m	) 1)	DDH Azimı (Deg)	uth DDH Di (+ Down	p DDH Eastin 1) (NAD83)	g DDH Nort (NAD8	thing 3) Ele	DDH evation (m)	DDH Statı	IS	Date Com	pletea	! 1	logged	By		
Vu-92	2-3	519.4	·	106	-75	546547.8	551629	7.3	1920	COMPLET	E	9/18/19	92	Tim Ter	muend	e, P. Geo.		
Depth (m)	Width (	(cm) Ang (to	gle CA)	Colour	Grainsize	Primary Texture	Mineralogy 1 M	Aineralogy 2	Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

DDH H Numb	lole L er Len	DDH gth (m)	DDH Azimuti (Deg)	h DDH Dip (+ Down)	DDH Easting (NAD83)	DDH Northing (NAD83)	DDH Elevation (m)	DDH Statu	S	Date Com	pletea	l I	logged	By		
Vu-92	2 <b>-4</b> 2	90.8	100	-45	545889.19	5509981.1	1070	COMPLETE	Ξ	11/17/19	992	Tim Ter	muende	e, P. Geo.		
Depth (m)	Width (cm)	Angle (to CA)	Colour G	Frainsize Pi	rimary Texture M	Mineralogy 1 Minera	alogy 2 Mineralogy 3	Sulphides 1	%	Sulphides 2	%	Sulphides 3	%	Alteration Setting	Alteration 1	Alteration 2

#### **APPENDIX IV**

#### **CONDOR CONSULTING REPORT**
## **REVIEW OF ST. MARY RIVER MAGNETICS AND RADIOMETRICS.**

A DIGHEM helicopter-borne EM / Magnetic / Radiometric survey was carried out by Dighem I-Power (now Fugro Airborne Surveys) over the St Mary River area in southeast British Columbia in August-November, 1995.

Magnetic and radiometric data from this survey have been imaged and enhanced to assist interpretation. The following images were produced:-

## Magnetics.

Total magnetic intensity (TMI) Reduced to pole (RTP) Reduced to pole – detrended (a linear trend has been removed from the TMI image) Reduced to pole – 1st vertical derivative (1VD) Analytic Signal ZS_Tilt ZS_Plateau

Reduced to the Pole transforms the data to appear as though it has been acquired in a vertical magnetic field, to avoid the asymmetric anomalies due to the dipping earth's field and declination. In RTP images the peak magnetic response for a vertical magnetic body is symmetric and directly over the center of the body. Thus asymmetry is normally due to dip. However, the RTP process does not consider magnetic remanence - so any negative anomalies due to reversed magnetization are not corrected and apparent dips may also be affected by remanence.

Analytic Signal (AS) is the square root of the sum of the squared X, Y and Z component gradients of the TMI. Its advantage is that it peaks directly over magnetic sources, regardless of earth's field inclination and declination and remanent magnetization. So an AS peak is produced over a negative TMI anomaly from (say) a kimberlite. Analytic Signal is most useful in low magnetic latitudes, where magnetic anomalies are severely distorted by this low inclination. It has problems in properly resolving anomalies on the flanks of broad, high-amplitude responses and deeper, broad features are also not well resolved.

The last two images were produced using Encom Profile Analyst software, using algorithms developed by Shi and Butt (2004) – see Appendix B.

The Tilt filter is also called the tilt derivative and was developed by Miller and Sigh (1994). It is defined as arctan (VDR/THDR) where VDR and THDR are the first vertical and total horizontal derivatives, respectively, of the TMI (Verduzco et al, 2004). This filter has maximum response over the top of the magnetic source (similar to 1st vertical gradient) and has the advantage that the arctan function makes the filter act like an AGC (automatic gain control) filter, and thus tends to equalize the amplitudes of strong and weak (and deep and shallow) TMI responses.

Plateau is a new linear, derivative-based filter which uses a combination of derivative and amplitude compression techniques to render the magnetic data into regions, whose edges are sharply defined and whose amplitudes have a reduced range in comparison to the original TMI (Shi and Butt, 2004). The filter "groups" adjacent similar magnetic anomalies into "units" with similar colour and thus may assist in geological mapping.

Sun-shaded (shaded-relief) images often are extremely useful in recognizing faults and other structures.

## Radiometrics

TCRAW (raw total count - there was no final TC in the database) K (potassium) eU (equivalent uranium) eTh (equivalent thorium) TH_K (eTh/K) U_K (eU/K) U_TH (eU/eTh)

K, eU and eTh have been processed to correct for the effects of variable altitude and converted into "true" ground units (%K and ppm eU and eTh). eU and eTh are "equivalent units" because the measured gamma rays come from daughter products ( 214 Bi and  208 Tl) rather than of U and Th themselves.

The ratios are useful because they remove any residual errors due to altitude corrections and calibration and also partial absorption of gamma rays due to snow cover or thick vegetation.

## COMMENTARY

A brief (one day) review was made of the magnetic and radiometric images, to assess their usefulness for geological mapping and target generation for Sullivan-type Pb-Zn-Ag deposits. Some observations follow – the geology and sample magnetic and radiometric images in the Appendix A may be useful in placing the features mentioned in context:-

## Magnetics

- The Lower Aldridge (Pa1l, Pa1q and Pa1u) sediments are somewhat magnetic, but show little contrast with the somewhat magnetic Middle Aldridge sediments (Pa2) and Upper Aldridge (Pa3).
- The Creston Formation sediments (Pc1 and Pc2) in the eastern part of the area have similar properties. However, in the west the Pc sediments exhibit strong N-S magnetic banding (best seen on the Tilt image).
- The Kitchener (Coppery Creek) Formation sediments in the southeast (Pk) exhibit very little magnetization. However in the west the Pk1 sediments appear to have some layered magnetization.
- The Purcell Supergroup rocks (Pk1, Pk3 and Pdc) in the west have quite consistent magnetic layering in a N-S direction (best seen on the Tilt image), indicating the absence of major cross faults.
- The mapped Moyie sills (Pm) do not exhibit a consistent magnetic signature sometimes they are highs, sometimes lows and often show little contrast with the enclosing rocks. This apparent lack of consistent response may be partly due to the relatively wide line spacing of 400 m, so that the gridding has limitations in correlating narrow anomalies from line to line when the magnetic trend is oblique to the flight lines, but even mapped sills trending perpendicular to the flight lines do not show good correlation with magnetic anomalies. Either the mapping is not reliable or the sills do not have consistent magnetization.

- The Upper Cretaceous intrusives (Kg) in the west exhibit magnetic lows that appear due to remanent magnetization. In the southeast a mapped intrusive just south of the St. Mary fault exhibits a strong magnetic high and other highs along this fault are likely due to other unmapped or buried intrusives.
- The Qal in St. Mary River correlates with a broad magnetic high (on the 1VD and Tilt images) from above the junction with Redding Creek eastwards almost to the survey boundary. This is interpreted to arise from magnetic material in the alluvium washed down from upstream.
- The Sullivan mine correlates with a moderate magnetic high, which appears due to the magnetite and pyrrhotite associated with the ore zone.
- Within the area of Eagle Plains Vulcan property, the mapped Lower Aldridge Formation correlates with a moderate magnetic high while the Middle Aldridge appears relatively non-magnetic, except for a number of discrete magnetic anomalies. These may arise from within this formation, but alternatively could be deeper and lie at the Sullivan Stratigraphic Horizon (see Possible Sullivan Targets below). The mapped Moyie Intrusions do not appear to have any particular magnetic signature).

# Radiometrics

- The K, eTh and U_Th images appear to best discriminate the different sedimentary units.
- As expected, very low counts for all parameters were observed over St. Mary Lake.
- The main drainage of St. Mary River (Qal) has "average" K and eTh response and does not stand out on the radiometric images.
- Lower Aldridge (Pa11 and Pa1q) has generally low K, eU and eTh, but Pa1u generally exhibits high values.
- Middle Aldridge (Pa2) has generally high K, eTh and eU.
- In the north the Upper Aldridge (Pa3) and the Creston Formation (Pc1 and Pc2) exhibit high K, eU and eTh.
- Eager Formation (Ce) in the south exhibits high eTh.
- The Upper Cretaceous intrusives (Kg) do not exhibit any particular radiometric signature.
- Moyie sills (Pm) do not exhibit any systematic radiometric signature.
- Within the Eagle Plains Vulcan property, the Lower Aldridge correlates with relatively high K and eTh, which is contrary to the generally low counts observed in the east part of the St. Mary survey area. Most of the mapped Middle Aldridge has relatively low response. The Moyie Intrusives do not appear to have any particular radiometric signature.

## **Possible Sullivan Targets**

The Sullivan ore body correlates with a discrete, moderate-amplitude magnetic anomaly (Fig.1)



Fig. 1 TMI detrended image showing outline of Sullivan ore body.

The Sullivan ore body occurs near the contact between the Lower and Middle Aldridge at what is termed the Sullivan Stratigraphic Horizon. An examination of the geology and magnetics for the area indicates a number of similar features that may be of economic interest as Sullivan analogs. These are outlined in black on Fig.2.



Fig. 2 Possible Sullivan analogs (outlines in black) superimposed on TMI (detrended) image

The same zones are shown superimposed on geology in Fig. 3.

The northernmost target lies within Eagle Plains ground and is recommended for follow-up. If geological mapping confirms the potential of this magnetic target (which may be several hundred meters deep) then a follow-up ground EM survey is recommended. The DIGHEM EM data does not indicate any good conductor at this location, but the limited depth penetration of this system (less than 100 m) does not rule out a deeper conductor.



Fig. 3 Possible Sullivan analogs (outlines in black) superimposed on geology

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# APPENDIX A

Geology and sample magnetic and radiometric images



Geology maps superimposed on TMI (detrended) image



TMI (detrended) image showing geology outlines and faults



K (Potassium) image showing geology outlines and faults

# **APPENDIX B**

Shi and Butt paper

# New enhancement filters for geological mapping

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## SUMMARY

Two types of filters have been developed for the purpose of enhancing weak magnetic anomalies from near-surface sources while simultaneously enhancing low-amplitude, long-wavelength magnetic anomalies from deep-seated or regional sources. The Edge filter group highlights edges surrounding both shallow and deeper magnetic sources. The results are used to infer the location of the boundaries of magnetised lithologies. The Block filter group has the effect of transforming the data into "zones" which, similar to image classification systems, segregate anomalous zones into apparent lithological categories. Both filter groups change the textural character of a dataset and thereby facilitate interpretation of geological structures.

The effect of each filter is demonstrated using theoretical model studies. The models include both shallow and deep sources with a range of magnetisations. Comparative studies are made with traditional filters using the same theoretical models. In order to simulate real conditions, Gaussian noise has been added to the model response. Techniques for noise reduction and geological signature enhancement are discussed in the paper.

The new approaches are applied to actual magnetic survey data covering part of the Goulburn 1:100 000 scale map sheet area, New South Wales. Some new geological inferences revealed by this process are discussed

Key words: Enhancement filters, magnetic sources, geological mapping.

#### **INTRODUCTION**

High-resolution aeromagnetic survey data represent a rich source of detailed information for mapping surface geology as well as for mapping deep tectonic structure. Traditional enhancement techniques, such as first vertical and horizontal derivatives (1VD, 1HD), analytic signal (AS), and high-pass in-line or grid filters are used in enhancing magnetic anomalies from near-surface geology.

In recent years the potential field tilt filter has been introduced (Miller and Singh, 1994) and it has achieved recognition for its value in the analysis of potential field data for structural mapping and enhancement of both weak and strong magnetic anomalies (Verduzco *et al*, 2004). The total horizontal derivative of the TMI reduced to the pole is also widely used for detecting edges or boundaries of magnetic sources (Cordell and Grauch, 1985; Blakely and Simpson, 1986; Phillips, 1998).

Several disadvantages pertain to the use of these traditional filters. They often only diffusely identify source location and

boundaries, particularly in colour image presentations. They usually emphasise short wavelength anomalies at the expense of signal from deeper magnetic sources and the range of amplitudes remaining in the filtered output may dominate the source boundary information being sought. In addition, some traditional filters emphasise noise with resultant impact on the interpretation of source boundaries.

This paper identifies new processes which have been developed to address these disadvantages and provide output which can improve map-based interpretations.

Unless otherwise stated, all filters have been operated on TMI data reduced to the pole (RTP).

### METHOD AND RESULTS

### Theoretical Model Testing

A theoretical 2D grid of total magnetic intensity (TMI) computed at the surface was created by forward 3D modelling of the TMI response from a set of theoretical magnetic sources having variable width, strike extent, depth, depth extent (DE), dip, magnetic susceptibility and strike azimuth. A list of these parameters is presented in Table 1. In two of the sources, remanence was simulated using negative magnetic susceptibility. The TMI of the theoretical models was computed at a geomagnetic inclination of -60 degrees using a notional east–west line spacing of 200 m and a grid cell size of 40 m. The TMI grid was then reduced to the pole (RTP) (Figure 1).



Figure 1. RTP image derived from multiple theoretical 3D magnetic sources, shown as wire frame outlines

A set of traditional filters was operated on the theoretical RTP grid. They include AS, 1VD, modulus of horizontal derivatives (MS) and Tilt and the results are presented in

Figure 2. The output grids variously show discontinuous trending (crossed sources in upper right of AS image), diffuse, weak edges (deep source in centre right of the MS image) and lack of precise source edge definition (1VD and Tilt).

Model Label	Depth (m)	Width (m)	DE (m)	Dip (deg)	Magnetic Susceptibility (SI)	Strike Length (m)	Azimuth (deg)
1	4000	15000	15000	120	0.010	15000	-050
2	6000	15000	10000	120	0.010	15000	-050
3	10000	15000	10000	120	0.010	15000	-050
4	1000	3000	4000	70	0.010	12000	-055
5	500	5000	2000	60	0.010	7000	-050
6	1000	800	2000	150	0.005	8000	-030
7	600	500	2000	120	0.001	20000	-020
8	200	500	2000	120	0.001	20000	-020
9	500	500	2000	120	0.003	10000	020
10	1000	500	2000	120	0.003	10000	-060
11	1000	500	2000	120	0.003	12000	040
12	200	400	2000	120	0.001	20000	-050
13	500	400	1000	40	0.002	32000	050
14	500	400	1000	140	0.001	32000	050
15	600	3000	4000	90	-0.002	8000	055
16	400	600	2000	120	0.010	8000	010

Table 1. List of parameters of theoretical magnetic sources



Figure 2. Comparison of enhancement filters of RTP: AS, 1VD, MS and Tilt filter. The models used are those depicted in Figure 1.

#### **Edge Filters**

The first avenue of development was to increase the sharpness of the anomalies used to map the edge of the magnetic sources. The MS grid yields anomaly peaks over the source edge locations, whereas these edges coincide with gradients in the 1VD, Tilt and AS filtered outputs. None of these filters produces easily interpreted edges in image form when the sources are weakly magnetised or are deep.

A new linear, derivative-based filter termed the ZS-Edgezone filter has been developed to improve edge detection in these situations. Its effect is shown in Figure 3 using the same theoretical models discussed earlier. The advantages of the filter are greatly increased anomaly sharpness over source edges and compression of the amplitude range so that differences in the original TMI amplitudes do not persist to dominate the edge interpretation. This has the ancillary effect that the method can be modified to provide automated edge conversion to vectors for use in GIS systems.

Although this filter significantly improves the precision of edge determination, it is subject to normal potential field limitations which determine that source edges cannot be resolved where the source is narrow relative to its depth. The filter also can produce a "halo" type artefact due to superposition of the response of a limited depth extent shallow source (Figure 1, Model 6) on that of deeper sources. A similar "halo" effect can be seen around the edges of remanently magnetised Model 15, also in Figure 1.

The ZS-Edge filter (Figure 4) has also been developed to map source edges. This filter differs from the ZS-Edgezone filter in that a greater contribution of the TMI anomaly amplitude over the source is retained, thereby improving anomaly characterisation at the expense of edge sharpness.

Both these filters produce edges which migrate down-dip towards the deepest edge of the source. This effect produces anomaly asymmetry that can assist interpretation of dip, although this effect is more pronounced for the ZS-Edge filter than for the ZS-Edgezone filter. Down-dip source extensions are depicted in cyan in Figure 1.



Figure 3. Anomaly edge and block enhancements using the ZS-Edgezone (left) and ZS-Block filters (right). Model positions are shown using wire frames.

#### **Block Filters**

In attempting to improve edge detection filters, an obvious progression is to highlight the magnetic regions whose edges have been mapped. To do this, a set of filters called "block" filters has been developed.

The Block filter group has the effect of transforming the potential field data into "zones" which, similar to image classification systems, segregate anomalous zones into apparent lithological categories. These filters can be imported for use in image classification systems or displayed in RGB space with other grids for empirical classification purposes.

The block filters, like the edge filters, are linear, derivativebased filters which use a combination of derivative and amplitude compression techniques to render the magnetic data into regions whose edges are sharply defined and whose amplitudes have a reduced range in comparison to the original TMI.

The ZS-Block filter (Figure 3) and the ZS-Plateau filter (Figure 4) depict the magnetic data as a 2D plan of apparent magnetic source distribution. Artefacts may occur as discussed for the edge filters.

The choice of ZS-Block, ZS-Plateau or ZS-Area filters will depend on the data characteristics of each magnetic survey and on the end-use requirement. The ZS-Plateau filter, for example, yields less variation in amplitude "texture" over a magnetic unit that either the ZS-Block or ZS-Area filters.



Figure 4. Comparison of ZS-Edge, ZS-Edgezone, ZS-Block and ZS-Plateau filtered outputs of RTP data

#### Effects of Noise

The influence of noise on the operation of these enhanced grids was tested by adding a large component of noise to the theoretical TMI profile data. This noise had a Gaussian distribution with a standard deviation equal to ten percent of the TMI standard deviation. The noise-modified TMI profile data were then de-spiked using a non-linear technique. Both the noise-affected and the de-spiked TMI data were then gridded and converted to RTP. The RTP data were then processed both with the traditional and newly developed filters.

Figure 5 shows the effect of the noise on the computations. The image of the noise-affected 1VD RTP data (top right) shows that weak and deep sources have been severely masked by the noise. Significant improvement can be achieved by using de-spiked data (lower left) or by low-pass grid filtering — for example, using an upward continuation filter (lower right).

Figure 6 shows that if real data with significant noise is encountered, a standard de-spiking or low-pass smoothing procedure may be used to achieve successful application of both the traditional and newly developed filters.

Figure 6 also depicts the use of enhanced outputs in RGB space to provide examples of how the combination of amplitude information (red colour) with edge information (green and blue colours) can be used to highlight source boundaries and remanence in a single image.



Figure 5. Comparison of 1VD of original model RTP data (top left) with noise-affected RTP data (top right) and noise-reduced RTP data (lower images)



Figure 6. ZS-Block filter using noise-reduced RTP data (top left) and examples of filter combinations in RGB space using noise-reduced RTP data

### Application to Field Data, Goulburn 1:100 000 Scale Map Sheet Area, New South Wales

Both the traditional and new enhancement filters were applied to test their suitability for geological definition to airborne magnetic survey data over the Goulburn 1:100 000 scale map sheet area (Johnson *et al*, 2003). These data were acquired as part of a joint program between the NSW Department of Mineral Resources and Geoscience Australia, with 250 m-spaced east-west flightlines. The magnetometer sensor occupied a nominal terrain clearance of 80 m. This dataset was selected since new detailed geological mapping had been recently completed. All the enhancements have been computed using TMI data reduced to the pole.

Figure 7 shows a comparison of part of the Goulburn 1:100 000 map sheet area surface geology with the ZS-Area

filter output. In the area surrounding location C, the ZS-Area filter transforms the magnetic data into separate magnetic units, which comprise the Devonian Bindook Volcanic Complex. The magnetic regions correlate closely with mapped andesites (Dkqa–cream coloured unit in Figure 7) whilst the intervening less-magnetic units correlate with rhyolitic ignimbrites (Dkqy–red unit in Figure 7)



Figure 7. Comparison of geology and ZS-Area enhancement over the Bindook Volcanic Complex

Figure 8 displays some of the advantages of the edge detection filters. At location A, ambiguity concerning the continuity of Quialigo Formation units (cream and red units in Figure 7) is resolved by the ZS-Edgezone filter. At location B, a subtle lineament is confirmed, whilst at location D, the extent of the Bullamalita Conglomerate (green unit in Figure 7) is clearly mapped by the ZS-Edge filter. Structural breaks are often more easily interpreted using these transforms, for example, immediately southwest of location D.



Figure 8. Comparison of ZS-Edge and ZS-Edgezone enhancements over the Bindook Volcanic Complex

Figure 9 shows standard RTP and Tilt transforms over the same area for reference.



Figure 9. Comparison of RTP and Tilt filters over the Bindook Volcanic Complex

#### CONCLUSIONS

Traditional filters used to enhance magnetic data, including the more recently developed potential field tilt filter, are currently used to assist in determination of the location and extent of magnetic units.

Newly developed derivative-based filters may be used to improve the precision of source edge detection and, by extension, the determination of the spatial extent of magnetic units. These filters are demonstrated to perform successfully on both strongly magnetised features as well as on weakly magnetised or deep magnetic features. Artefacts may result particularly where anomaly superposition occurs.

The impact of noise in real data may be accommodated by these new methods provided noise-reduction techniques are employed.

The new filter outputs may be used as part of regional or detailed geological mapping projects, including in classification systems or in RGB space, to improve lithological discrimination and mapping.

The speed of magnetic unit mapping can be considerably increased through reliance on edge detection filters. Further improvements in mapping speed can be envisaged through automated conversion of edge anomalies to vector files.

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