GEOCHEMICAL REPORT (ROCK AND SOIL)

ROD-STIR PROPERTY

Clinton Mining Division, British Columbia

LATITUDE 51°07' / LONGITUDE 122°15' UTM NAD 83 5663066 mN and 552495 mE. NTS: Map 092O/1

By

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Figure 1 ROD-STIRRUP PROPERTY LOCATION MAP FIGURE 1

A.) **PROPERTY DESCRIPTION**

1) Location

The Rod-Stir Property is located, on the west side of the Fraser River, 92 kilometers north of the community of Lillooet. The property is centered at 51°07' north latitude and 122°15' west longitude, UTM NAD 83 5663066 mN and 552495 mE. (Figure 1)

2) Access and Physiography

The property is accessed from Lillooet via the West Pavilion Forestry road on the west side of the Fraser River. At kilometre 92 on the West Pavilion road a secondary mining road takes off to the west and at 9 kilometres bisects the property. The closest helicopter service is located in Lillooet.

The property is on the Fraser Plateau in south central British Columbia. The topography of the property is dominated by the east-west trending 9-mile ridge with elevations ranging from 1600 to 2010 metres above sea level.

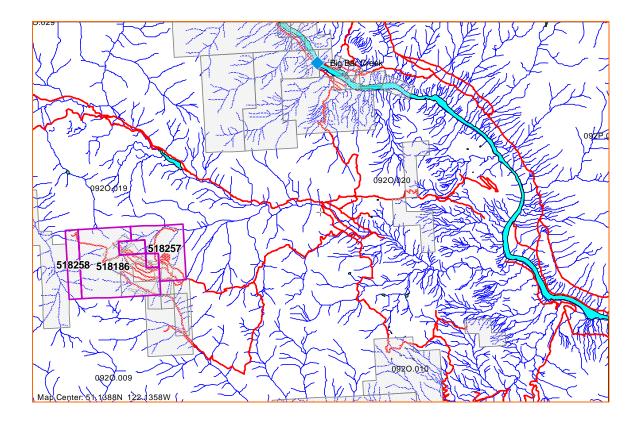
3) Claims

The Rod-Stir Property consists of 7 contiguous tenures covering some 1845.3 hectares of mineral tenure in the Clinton Mining Division. (Figure 2)

The following table lists the current status of the claims. The Good Until date reflects work that was filed as SOW Exploration and Development Work / Expiry Date Change Event Number (4160785).

ROD-STIR TENURE DATA

Tenure	Туре	Claim	Good Until	Area (ha)
Number		Name	UPDATE	
51818	6 Mineral	DAVE	2008/DEC/31	486.78
51825	7 Mineral	DAVE 2	2008/DEC/31	223.08
51825	8 Mineral	DAVE 3	2008/DEC/31	101.43
53845	5 Mineral	GAP 1	2008/DEC/31	40.56
53845	7 Mineral	GAP 2	2008/DEC/31	20.28
55081	2 Mineral	JOAN	2008/DEC/31	466.36
55081	6 Mineral	DEB	2008/DEC/31	506.81
			Total Area	1845.3



ROD-STIRRUP CLAIM LOCATION MAP

FIGURE 2

4.) Regional History (Stirrup / Roderick Creek)

Mineral claims owned by H.V. Warren and his associates, located on the ridge between the headwaters of Stirrup Creek and Roderick Creek in the Clinton Mining Division, have been investigated for the source of several thousand ounces of placer gold. Warren reports that placer gold was discovered at Stirrup Creek during World War 1 and over the following 25 years, some 3000 to 5000 ounces of gold were produced. Placer operations have continued intermittently since that time.

The 1933 B.C. Minister of Mines Report notes that a 100 foot cross-cut with an 80 foot winze and a connecting 12 foot drift were completed that year. A number of veins and lenses of stibnite were located in 1942.

Rio Tinto Explorations Ltd. optioned the property in 1969. That company carried out geochemical surveys and drilled nine percussion holes aggregating 494 metres (1622 feet). A piece of float found on the ridge saddle at this time assayed 0.66 opt gold. Placer Development Ltd. optioned the property in 1973 and undertook geochemical and trenching programs. Then Chevron optioned the property in 1974. Chevron also conducted geochemical and geological programs, trenching, and in 1975 drilled two 300 foot vertical core holes. Asarco made detailed examinations of the claims in 1980, and Placer Development are reported to have conducted a limited VLF-EM test in 1984. Interest in the property was again revived in 1986 when the high grade Blackdome gold deposit located about 30 kilometers north of Stirrup Creek was brought into production.

Chevron Canada Resources Limited again optioned the property in 1987 along with the adjacent Brent property to the west. The properties were acquired with a view to reevaluating a number of known gold showings within the Warren claims, and in particular to determine whether smaller, structurally controlled deposits may be present. In June and July of 1987, a number of old trenches were cleaned, a limited amount of new trenching was completed and sampled. In October, four shallow drill tests were completed. (Assessment Report 17336-T.E. Lisle, Dec. 18, 1987)

5.) 2007 Exploration Program

The objective of the 2007 program was:

- 1/ To prospect and soil and rock sample the upper roads.
- 2/ Confirm previously identified soil anomalies to the east of Roderick Creek by soil and rock sampling in the approximate area of previous anomalies.
- 3/ To map the observed rock types and have select samples processed by PIMA for alteration mapping.

The 2007 work is documented in this report.

B.) GEOLOGY

1) Regional & Property Geology

The claim area lies near the eastern margin of the Jackass Mountain Group, an early Cretaceous sedimentary unit. The assemblage is reported to be about 5300 metres thick consisting of volcanic-rich lithic wakes, shales and polymict boulder conglomerates that are dominantly of marine origin.

The claims lie close to the Trettin'D ' Fault, one of the major northwesterly splays of the Fraser River Fault Zone. Movement along the Fraser Fault and the Yalakom Fault further to the west has dissected the Jackass Group into several parts and has also resulted in a number of cross faults trending east to northeast between the two. A number of easterly trending parallel faults have been noted in the upper part of Stirrup Creek

Within the claims and adjoining area to the northwest and south east, the sedimentary rocks dominated by sanstone (2) and lesser siltstone and argillite (3) have been intruded by dykes and sills of granodiorite, feldspar porphyry (4a) and quartz- feldspar porphyry (4b). These intrusives are locally mineralized with fine pyrite / arsenopyrite.

Where examined, the claim area is underlain by sandstone that is medium to locally coarse grained with minor pebble conglomerate, by argillaceous siltstone and by porphyritic intrusives that grade from feldspar to quartz-feldspar porphyry. Due to limited exposure, the nature of the intrusives are not defined but are believed to be part of the sill and Dyke system present at Stirrup Creek. Some locations, the mineralized intrusions form prominent gossans on the open slopes.

Close to the northwest corner of the claim, small stibnite occurrences have been partly exposed in bulldozer trenches. The stibnite occurs as narrow seams near the contacts of a quartz-fedlspar porphyry sill that may trend west to northwest in an argillaceous siltstone host. Nearby rocks are locally highly altered, cream-coloured and clay rich with dark brown fractures. This setting and the geochemistry are similar to other occurrences on the adjacent Stirrup Creek property.

Two small hand pits near the intersection of the Sun, Shine and Brent claims reveal grey stibnite bearing quartz veins and stringers in a gossanous quartz-feldspar porphyry. The extent or trend of this zone is presently uncertain. Poorly defined quartz veins assaying up to 200 ppb gold are present near the northwest margin of the Shine claim. This material appears to mark a contact between quart-feldspar porphyry and Jackass sandstone.

(Assessment Report 16303, T.E. Lisle, Oct. 18,1987)

2) Mineralization

In the north west area of the property, the mineralized zone referred to by T. E. Lisle in Assessment Report 16303 was identified in the field. This area was prospected

further to determine the extent of the mineralization

3) Alteration

During the soil sampling a series of float of altered sediment and intrusive rocks were selected and sent to Kim Heberlein in Vancouver for PIMA Spectral Analysis. The results of her work are given as appendix II. She noted that the Rod/Stir Samples showed an alteration suite of – phlogopite, illite/sericite, smectite, chlorite (Fe-Mg), weak kaolinite, probable epidote. After comparing the alteration assemblages to the 'Temperature Stability of Hydrothermal Minerals in the Epithermal Environment' appendix II it shows that the alteration minerals define a zone of potential for epithermal ore deposition.

C.) GEOCHEMISTRY

1) Sample Collection

During the 2007 program 31 soil and 20 rock samples were collected for analysis. Soil and rock sample sites were located using the Garmin GPS and recorded the UTM location in NAD 83.

Soil sampling was conducted with a grub hoe digging pits to a minimum of .7 metres to expose the soil profile. This profile showed a light grey volcanic ash that was up to .6 metres thick overlying a well developed rusty yellow to brown B-horizon soil. Samples were taken from the B-horizon, rock fragments removed and the sand silt and clay material placed in a pre-numbered kraft sample bag. The sample number and location were entered in an XL data base to later be merged with the analytical results.

Rock samples were collected as random chips from outcrop and subcrop and placed with pre-numbered assay tags in plastic sample bags. The sample number and location were entered in an XL data base to be merged with the analytical results.

All equipment was cleaned between samples to avoid contamination.

2) Sample Analysis

Samples were shipped to Assayers Canada for analysis for fire geochem gold and 34 element ICP. The labs detailed analytical procedures are given as Appendix III. The results were received in XL format and are tabulated in Appendix 1. The rocks results are plotted with geology for gold, arsenic and antimony as figures 4, 5 and 6. The soil results are plotted with geology for gold, arsenic and antimony as figures 7, 8 and 9. The soil and rock sample locations are plotted with the geology as Figure A and B respectively.

D.) RESULTS

The rock sampling showed weak gold and silver values. A single sample of quartzstibnite-arsenopyrite vein gave 586 ppm arsenic, 59 ppm mercury and greater than 10,000 ppm antimony. The high mercury-arsenic-stibnite suggest epithermal potential at depth. The soil sampling on the western property boundary showed strongly anomalous gold (up to 396 ppb Au), with 200 to 400 ppm arsenic. The anomalous source would be upslope to the east. It was also this western property edge that the PIMA Spetral Analysis of float samples showed the alteration minerals define a zone of potential for epithermal ore deposition. Recent logging roads up Roderick Creek 500 metres west of the anomaly would provide excellent access for drilling and trenching after further target definition.

E.) COST STATEMENT

ROD - STIRRUP PROJECT

		Unit F	Rate To	otal
Geologist: RM Durfeld, P.Geo.	day			
August 9th, 17th		1.5	700	1050.00
Assistant: Guido Durfeld				
August 9th		1	250	250.00
Prospector: JM Mel Stewart	day	5	350	1750.00
July 8 to 12				
Field Equipment	day	5	60	300.00
July 8 to 12				
Powersaw rental	day	1	30	30.00
July 8 to 12	day standby	4	10	40.00
Communication rental	week	1	195	195.00
July 8 to 12				
ATV & Trailer Rental	day	5	100	500.00
July 8 to 12				
Room & Board	day	7	80	560.00
July 8 to 12 and August 9 for 2				
Compiling & Analysing Historical Data	day	3	250	750.00
John Casey Geologist				
Geochemical Analyses				
Invoice 52090 (soil)		9	21.8	196.20
Invoice 52090 (rock)		20	26	520.00
Invoice 52090 (soil)		27	21.8	588.60
PIMA Spectral Analyses				
Kim Heberlein		4	20	80.00
Report Preparation		1	1500	1500.00
Total Cost				8309.80
Transportation @ 20% of total cost				1661.96
Total Allowable Project Cost				9971.76

Dated at Williams Lake, British Columbia this 23^{rd} day of October 2007.



R.M. Durfeld, B.Sc., P.Geo.

F.) STATEMENT OF QUALIFICATIONS

I, Rudolf M. Durfeld, do hereby certify that:

1.) I am a geologist with offices at 2029 South Lakeside Drive, Williams Lake, BC.

2.) I am a graduate of the University of British Columbia, B.Sc. Geology 1972, and have practised my profession with various mining and/or exploration companies and as an independent geological consultant since graduation.

3.) I am a member Canadian Institute of Mining and Metallurgy.

4.) That I am registered as a Professional Geoscientist by the Association of Engineers and Geoscientists of B.C. (No. 18241).

5.) That this report is based on:

a.) my supervision, of Mel Stewart's work and reporting on the Rod-Stir property.

b.) compilation of the 2007 and previous assessment data.

b.) my personal knowledge of the property area and a review of available government maps and assessment reports.

Dated at Williams Lake, British Columbia this 23rd day of October 2007.



R.M. DURFELD, B.SC., P.GEO.

APPENDICES

2007 Rock Sample Location / Description

Sampla #	Northing	Easting	Elevation	Somelo Ty	Description
Sample #	Northing	Easting	Elevation	Sample Ty	Description
Carenda #	N la utla in a	Fratier	Flouration		
Sample #	Northing	Easting	Elevation		
345701	5665512.000,	552245.000,	1935.00,	Talus	Sandstone/Tuff immature, silicified
345702	5665477.000,	552210.000,	1909.00,	Talus	Quartz eye Feldspar Porphyry with hornblende
040702	5000477.000,		1303.00,		
345703	5665466.000,	552180.000,	1895.00,	Talus	Quartz eye Feldspar Porphyry
				No	
	5665688.000,	552125.000,	1927.00,	Sample	W. edge of intrusive
245704	E66EE97.000	EE2107.000	1028.00	Talua	Immeture conditions offered
345704	5665587.000,	552197.000,	1938.00,	Talus	Immature sandstone - altered
					Quartz Eye Feldspar Porphyry in grey matrix, high
345705	5665522.000,	552245.000,	1941.00,	Talus	level dyke? Minor chlorite on hbl
					Ouente Fue Felder en Demokumunitk miner
345706	5665353.000,	552307.000,	1923.00,	Float	Quartz Eye Feldspar Porphyry with minor hornblende
				Switch back-Soil	At switchbackHole 5' below surface in road cut
	5665275.000,	552314.000,	1928.00,	& Rock	lite brown soil in bott2 rocks from bottom
345707	5665275.000,	552314.000,	1928.00,	Float	Immature sandstone - silicified and altered
					Altered (qtz and clay) of coarse clastic / volcano
345708	5665275.000,	552314.000,	1928.00,	Float	clastic
045700	5005400.000	FF0004 000	4044.00		
345709	5665106.000,	552321.000,	1941.00,		Fine grained silicified sandstone.

	í .	1			
	5664977.000,	552360.000,	1963.00,	Soil & Rock	Hole 4' below surface in road cutlite brown soil i bottom (more sandy)rock from bottom
345710	5664977.000,	552360.000,	1963.00,		1 Rock
345711	5664915.000,	552483.000,	1987.00,	Rock	
345712	5664915.000,	552483.000,	1987.00,	Rock	
345713	5664869.000,	552704.000,	1999.00,	Rock	
345714	5664784.000,	553138.000,	2042.00,	Bedrock	Qtz and carbnate on slickenside
345715	5664763.000,	553198.000,	2049.00,	Bedrock	Qtz and clay altered sandstone
345716	5664733.000,	553283.000,	2056.00,	Bedrock	Feldspar Porphyry with hornblende, grandodiorite trace py
345717	5664733.000,	553283.000,	2056.00,	Bedrock	Sandstone quartz and clay altered
345718	5665500.000,	552160.000,	1890.00,	Rock	1 Rock
345719	5665160.000,	552200.000,	1880.00,	Bedrock	Quartz Eye porphyry with dis arsenopyrite and stibnite
345720	5665190.000,	552153.000,	1868.00,	Bedrock	Quartz sulphide (stiibnite / arsenopyryte) vein breccia

	AF	PEN	DIX I	2007	ANA	LYTI		RES	ULT	S																												
										-				-														-	-									
Sample # Northing	Easting	Elevation	Au ppb	3	AI %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Hg ppm			U U	Mn ppm	Mo ppm	Na %	Ni ppm	P %	Pb ppm	S %	Sb ppm	Sc ppm	Sr ppm	Th ppm	Ti %	TI ppm	U ppm	V ppm	W ppm	Zn ppm	Zr Geolo ppm Co	07
5005510.000																																						
5665512.000, 345701 5665512.000.			2	0.1	1.72	3.8	82	<1	0.1	1.05	0.2	12	32	21.5	3.19	<0.1	0.05	-	1.4	888	0.4	0.02	19	0.073	86	<0.05	14.5	21	27	0.7	0.03	0.2	0.4	52	0.2	87	2.6 S	45
5665477.000,		//	2	0.1	1.72	5.0	02		0.1	1.05	0.2	12	52	21.5	5.13	NO.1	0.05		1.4	000	0.4	0.02	13	0.073	0.0	<0.05	14.5	2.1	21	0.7	0.05	0.2	0.4	52	0.2	07	2.0 5	40
345702 5665477.000,			1	0.1	0.86	0.5	268	<1	<0.1	1.09	0.2	6.8	29	5	1.67	<0.1	0.05	2	0.79	604	0.1	0.03	10	0.064	2.3	< 0.05	0.1	1	26	0.7	0.01	0.1	0.1	31	0.1	51	4.7 QE	FP
	552180.000		-									_																										-
345703 5665466.000, 5665688.000.	552180.000), 1895.00,), 1927.00,	2	0.1	1.06	3.5	115	<1	0.4	0.24	0.6	7	24	2.2	2.41	<0.1	0.09	10	0.77	1558	0.3	0.03	8.5	0.087	4	<0.05	0.5	3	12	1.6	0.005	0.1	0.3	44	0.1	170	7.9 QE	FP
5665615.000,																																						
5665587.000,																																						
345704 5665587.000,		//	1	0.1	2.19	1.9	23	<1	0.1	1.26	0.1	12.5	48	25.6	3.17	<0.1	0.03	3	1.42	640	0.4	0.41	20.1	0.059	9.2	<0.05	0.1	3.5	18	0.8	0.026	0.1	0.2	61	0.1	68	2.1 S	iD
5665522.000, 345705 5665522.000,				0.1	1.12	1	49	<1	<0.1	1.18	0.1	8.3	22	12.8	2.37	<0.1	0.04		0.9	697	0.2	0.03	5.8	0.072	1.0	<0.05	0.1	2.3	30	0.7	0.012	<0.1	0.1	48	0.1	47	2.1 QE	ED
345705 5665522.000, 5664573.000,			2	0.1	1.12	1	49	<1	<0.1	1.18	0.1	0.3	22	12.0	2.31	<0.1	0.04	3	0.9	097	0.2	0.03	5.ď	0.072	1.2	<0.05	0.1	2.3	30	0.7	0.012	<0.1	0.1	48	0.1	47	2.1 QE	
5665353.000,																																						
345706 5665353.000,			<1	0.1	0.82	0.8	85	<1	<0.1	0.22	0.1	6.5	34	4.8	1.87	<0.1	0.05	4	0.67	671	0.2	0.04	5.7	0.058	1.6	< 0.05	0.1	1.3	12	1.3	0.009	<0.1	0.2	32	0.1	40	8.9 QE	FP
5665275.000, 345707 5665275.000.				-0.1	0.0	21.2	10	.1	0.1	0.08	.0.1	25	22	18.3	0.31	0.1	0.01		0.02	111	0.0	<0.01	7.0	0.036	0.0	<0.05	2	6.3	F	1.2	<0.005	.0.1	0.0	47	0.1	25	2.6 S	40
345707 5665275.000, 345708 5665275.000,			<1	<0.1 0.1	0.2	193.9	68	<1 <1	0.1 <0.1	0.08	<0.1	3.5	22 40	18.3	1.71	0.1			0.02	405	0.2	<0.01	7.3		9.9 6.7		27.9	6.3 3.8	5		<0.005	<0.1	0.3	17 26	0.1	25 49	2.6 S 1.7 Sd/	
5665106.000,			2	0.1	0.2	100.0	00		~0.1	0.00	0.2	7.1	-10	10.0	1.7 1	1.2	0.04		0.02	400	0.0	NO.01	20.7	0.000	0.1	~0.00	21.5	0.0		0.0	<u> </u>	0.2	0.2	20	0.2	+5	1.7 00/	10
345709 5665106.000,			<1	0.1	1.78	4.9	56	<1	<0.1	0.93	0.1	7.2	39	11.3	1.82	<0.1	0.03	6	0.71	589	0.4	0.25	17.6	0.058	2.8	< 0.05	0.3	1.7	21	1	0.017	<0.1	0.2	31	0.1	42	2.2 S	dS
5664977.000,					1.00																		17.0		10.7			-	50									
345710 5664977.000, 5664915.000.			2	0.1	1.28	16.4	50	<1	0.1	1.71	0.1	11.1	41	21.5	3.02	0.3	0.06		0.86	701	0.5	0.02	17.2	0.052	10.7	<0.05	8.2	5	53	1.3	<0.005	<0.1	0.2	46	0.1	62	2.4	
345711 5664915.000,			1	0.1	0.94	0.8	1805	<1	<0.1	0.47	0.1	10	57	30.9	2.14	<0.1	0.05	e	0.98	1078	0.4	0.04	16	0.082	3.1	0.06	0.2	3	84	1.1	0.015	<0.1	0.2	60	0.1	50	4.5	
345712 5664915.000,	552483.000	, 1987.00,	1	0.1	2.03	3.7	51	<1	0.1	0.56	0.1	9.6	39	17.8	2.56	<0.1	0.06	3	1.07	540	0.3	0.02	14.7	0.058	5.4	< 0.05	0.2	1.9	57	1	0.03	<0.1	0.2	34	0.1	54	4.2	
	552704.000		-											-																								
345713 5664869.000, 5664784.000,			2	0.1	0.89	1.2	106	<1	<0.1	0.34	0.1	6.9	28	3	1.72	<0.1	0.12	12	0.63	743	0.2	0.04	8.1	0.055	2	<0.05	1.2	1.7	19	1.6	<0.005	0.1	0.3	26	0.1	38	9.6	
345714 5664784.000,			6	0.1	0.59	53.1	41	1	0.1	1.98	0.1	17	51	33.9	3.71	0.2	0.12	7	0.07	687	0.6	0.01	84.4	0.1	6.7	<0.05	6	5.4	12	1.2	< 0.005	0.1	0.3	52	0.1	78	1.9 Q	ca
345715 5664763.000,			16	0.1	0.41	81.2	45	<1	0.2	0.25	0.1	14.2	59	90.3	4.11	0.3		E	0.04	774	0.6	< 0.01	27.9	0.041	4.6	< 0.05	3.9	15.8	8		< 0.005	0.1	0.2	88	0.1	66	2.2 Sd	
345716 5664733.000,			22	0.1	1.36	3.2	180	<1	0.1	0.66	0.1	9	52	32.5	2.76	<0.1			0.99	832	0.2	0.05	22.5		2.7	< 0.05	0.2	3.9	36	-	0.008	<0.1	0.3	64	0.1	44	1.3 FPH	
345717 5664733.000, 345718 5665500.000.			1	0.1	1.24 1.5	5.8 10.8	62 59	<1	0.1	0.33	0.1	6.3 8.4	100 60	34.1	1.88	<0.1 <0.1		-	1.25	294 737	0.4	0.05	63.2 40.7	0.041	2.2 47.4	<0.05 <0.05	0.1	3.4 2.6	19 27	0.9	0.032	0.1 <0.1	0.1	40 45	0.1	26	1.3 Sd 3.1	SA
345718 5665500.000, 345719 5665160.000,			2	0.2	0.16	10.6	59 62	<1 <1	0.2	3.23	0.2 <0.1	8.4 6.2	60 16	18.2 13.9	2.73	<0.1			0.12	493	0.4	0.03	40.7		47.4	<0.05	1.5	2.6	53		0.027	<0.1	0.2	45	<0.1	79 36	3.1 3.9 QEasp	sb
5665190.000,						-				5.20							2.10																2.0					
345720 5665190.000,	552153.000), 1868.00,	6	0.1	0.12	576.8	206	<1	<0.1	0.76	0.2	4.5	47	12.5	0.93	59.8	0.05	14	0.02	352	0.2	0.01	6.3	0.007	4.2	8.44	>10000.0	0.1	52	<0.1	<0.005	9.3	0.3	5	<0.1	60	<0.1 BxSSbA	sp
09-08-01 5664927	.0 55177	1.0																																			1 SdQE	12
00.00.04	0 55470	2.0																																			GdA	12,11
09-08-04 5664863 09-08-05 5664871																																					5 QEHFP	3.9.10
00000 0004071	00102																																				GRENT	3,9,2
09-08-08 5664723																																					SdA / HP	
09-08-12 5664823	.0 55155	5.0																																			12 HP / SdA	
09-08-15 5664954	.0 55156	2.0																																			HP / SdA	D,9,2
09-08-15 5665064																																					19 QEHFP/S	
000004	00140																																					
09-08-22 5665100	.0 55149	3.0																																			Gdgos	

		1																							1									,
		2007	SOIL	SΔN		S																												
		2001				U																												
ROD - STI	R SAMPLES July	UII Y 9-10-11	-07	Geochem	ICP	ICP	ICP	ICP	ICP	ICP I	CP ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP IC	P ICP	ICP	ICP IC	CP ICP	ICP	ICP	ICP	ICP	ICP ICP
NOD OII		0021 5 10 11	01	Au	Aq	AI	As	Ba	Be		Ca Cd	Co	Cr	Cu	Fe	Hg	K		Ma	Mn	Mo	Na	Ni	P	Pb	S Sb	Sc		Th Ti	TI	U	V	W	Zn Zr
Sample # Way Point	Northing	Easting	Elevation	ppb	ppm	%	ppm	ppm	ppm		% ppm	ppm	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	% ppm	ppm	ppm pp	om %	ppm	ppm	ppm	ppm	ppm ppm
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15,	5665512.000,																																	
16,	5665477.000,																																	
17,	5665466.000,	552180.000,																																
190P,	5665615.000,																																	
20.		552197.000,																																
21,	5665522.000,																																	
22 Mon,	5664573.000,	553528.000,	2092.00,																															
23,	5665353.000,			4	<0.1	0.86	12.1	79	<1	0.1 0.		6.4	21	18.5	2.23	0.5	0.01).47	169	0.6	0.01	18.9	0.017	5.6 <0.0		2.4		0.7 0.017	<0.1	0.2	42	0.1	41 1.1
24,	5665275.000,			10	0.1	0.95	23.2	92	<1		0.3 0.1	6.9	24	23.5	2.28	0.3	0.02		0.57	268	0.5	0.01	25.8	0.031	7.6 <0.0		5		.4 0.017	< 0.1	0.4	37	0.1	47 2.5
25, 26,	5665106.000, 5664977.000,		1941.00, 1963.00,	5	0.1 <0.1	0.93	15.2 44.2	83 76	<1 <1		25 0.1 13 0.1	6.7 7.8	24 18	19.7 20.1	2.31	0.2	0.02		0.6	269 307	0.5	0.01	22.8 19.3	0.041 0.019	5.4 <0.0 7.9 <0.0		3.3 2.7		.7 0.023 .2 0.012	<0.1 <0.1	0.3	38 33	0.1	45 3.7 47 1.6
20,	5664915.000,			5	<0.1	0.82	24.5	99	<1		0.2 0.1	7.6	24	20.1	2.34	0.2	0.02		0.5	253	0.7	0.01	26.4	0.045	7 <0.0		3.4		.6 0.03	<0.1	0.2	37	0.1	48 1.8
28,	5664869.000,			3	<0.1	0.56	11	83	<1		11 <0.1	5.2	17	17	1.83	0.4	0.03		0.32	171	0.5	0.01	17	0.032	4.5 0.0		2.3		.2 0.025	0.1	0.4	33	0.1	39 2.3
29,	5664784.000,			17	0.5	0.89	95.5	92	1	0.1	0.4 0.2	19.5	58	46	4.55	0.6	0.02	20 0	0.43	1400	1	0.01	91	0.04	12.2 <0.0	5 15	7.1	29 0	0.9 0.023	0.1	0.8	76	0.3	82 2.6
30,	5664763.000,																																	
31 OP,	5664756.000,							50				= 0	10				0.05							0.045		-						= 1		
32,	5664733.000,				0.1	1.32	80 53.4	58	<1		05 0.1	7.3	42	41.1	2.69	0.1	0.05		0.58 0.64	164	0.7	0.01	41.4 28.7	0.045	3.1 <0.0 7.3 <0.0		4		.6 0.032	0.1	0.4	54 41	0.2	31 2.3 50 3.1
E, Intrusion.	5664783.000.	552160.000,			0.1	0.92	53.4	42	<1	0.1 0.	19 0.1	1.1	27	26.8	2.41	0.2	0.02	9 (J.64	288	0.5	0.01	28.7	0.033	7.3 <0.0	5 14.3	3.3	23 1	.2 0.018	<0.1	0.2	41	0.1	50 3.1
l IIII USIOII,		552300.000,																																
<u>,</u> М.		552045.000,																																
OP,	5665056.000,																																	
sw back,	5665277.000,	552301.000,	1919.00,																															
33,	5665160.000,																																	
34,	5665190.000,	552153.000,	1868.00,																							-								
09-08-01	5664927.0	551771.0		6	<0.2	2.43	197	162	0.5	<5 0.	36 2	21	53	64	4.25	1	0.22	<10 (0.93	383	<2	0.02	50	520	2 <0.0	1 15	7	15	<5 0.18	<10	<10	90	<10	78 7
09-08-02	5664939.0			17	<0.2	2.43	115	102	< 0.5		31 1	19	55	48	3.61	<1	0.22		0.75	256	<2	0.02	52	473	<2 0.0		4		<5 0.18	<10	<10	80	<10	53 6
09-08-03	5664935.0	551785.0		14	<0.2	1.98	207	140	< 0.5		32 2	18	46	73	3.81	<1	0.15		0.71	387	<2	0.02	40	479	<2 <0.0		5		<5 0.15	<10	<10	78	<10	71 7
09-08-04	5664863.0	551798.0		39	<0.2	2.22	182	179	< 0.5	<5 0.	31 2	20	52	64	3.91	1	0.17).75	546	<2	0.02	56	703	5 0.0	1 13	5	10	<5 0.14	<10	<10	78	<10	80 10
09-08-05	5664871.0	551822.0		45	0.3	2.98	331	155	0.5		51 2	23	92	67	4.24	1	0.29		1.47	487	<2	0.03	78	574	5 0.0		9	28	<5 0.17	<10	<10	97	<10	87 7
09-08-06	5664860.0	551790.0		25	0.2	2.12	147	148	<0.5	<5 0.	38 2	18	47	73	3.69	<1	0.11	<10 (0.68	358	<2	0.02	43	511	<2 <0.0	1 13	5	19	<5 0.16	<10	<10	78	<10	59 11
09-08-07	5664913.0	551548.0				0.0	04	000	0.5			10			0.0		0.1.1	10	0.05	500	-	0.00	00	4000	4				5 0.41	40	10	07	40	100 5
09-08-08 09-08-09	5664723.0 5664811.0	551591.0 551510.0		6	<0.2	2.3	61	202	0.5	<5 0.	34 2	19	51	14	3.3	1	0.14	<10 (0.65	592	<2	0.02	63	1263	4 0.0	1 12	4	8	<5 0.14	<10	<10	67	<10	182 5
09-08-10	5664811.0	551510.0		20	<0.2	2.07	210	163	<0.5	<5 0	28 1	16	62	21	3.47	<1	0.14	<10 (0.86	363	<2	0.02	62	526	2 <0.0	1 18	5	1	<5 0.1	<10	<10	70	<10	98 4
09-08-11	5664811.0	551496.0		4	<0.2	1.96	89	142	<0.5		32 1	15	44	14	2.97	<1	0.09		0.55	401	<2	0.02	49	713	<2 <0.0		4		<5 0.12	<10	<10	61	<10	89 4
09-08-12	5664823.0	551555.0																																
09-08-13	5664968.0	551515.0		9	<0.2	2.33	85	164	<0.5		36 2	20	49	47	3.51	<1	0.17		0.82	342	<2	0.02	45	437	<2 <0.0		5		<5 0.19	<10	10	77	<10	78 7
09-08-14	5664924.0			14	<0.2	1.54	32	111	<0.5		23 1	13	-	15	2.3	<1	0.08		0.38	249	<2	0.02	29	608	2 <0.0		2		<5 0.13	<10	<10	56	<10	59 4
09-08-15	5664954.0			66	<0.2	2.09	205	201	< 0.5		33 2	16	39	42	3.4	1	0.27		0.71	447	<2	0.02	40	453	4 <0.0		5		<5 0.13	<10	<10	66	<10	108 10
09-08-16 09-08-17	5665025.0 5665028.0	551515.0 551542.0		396 30	<0.2 <0.2	2.64	107 44	167 196	<0.5 <0.5		34 2 34 1	23 18	56 37	116	4.13 3.06	<1 <1	0.26).95).54	365 801	<2	0.02	53 41	601 336	<2 0.0		6	-	<5 0.22 <5 0.15	<10 <10	<10 <10	91 72	<10 <10	130 11 94 8
09-08-18	5665047.0	551542.0		80	<0.2	2.19	44 192	196	<0.5		0.4 2	22	51	75	3.06	1	0.16).54).88	548	<2	0.02	41	264	10 0.0	-	5		<5 0.15	<10	<10	86	<10	72 11
09-08-19	5665064.0	551490.0		182	<0.2	2.13	217	123	0.5		32 2	27	55	165	4.49	1	0.27		0.89	323	3	0.02	63	417	<2 0.0		6		<5 0.16	<10	<10	88	<10	116 9
09-08-20	5665084.0			32	<0.2	2.19	161	144	< 0.5		42 2	21	48	93	3.9	<1	0.24		0.91	469	<2	0.02	39	304	<2 0.0	1 12	6	73	<5 0.18	<10	<10	89	<10	67 10
09-08-21	5665079.0			4	0.3	0.64	6	62	<0.5		0.2 1	9	12	<1	1.87	1	0.03		0.18	226	<2	0.03	12	624	2 0.0		1		<5 0.12	<10	<10	62	<10	33 3
09-08-22	5665100.0			30	0.2	2.86	110	322	0.5		44 2	23	55	97	4.06	1	0.14).75	898	<2	0.02	66	713	<2 0.0		6		<5 0.16	<10	<10	80	<10	160 12
09-08-23	5665111.0	551543.0		32	< 0.2	2.03	89	145	< 0.5		36 1	17	44	32	3.33	1	0.1		0.67	454	<2	0.02	39	256	<2 0.0		4		<5 0.17	<10	<10	78	<10	73 6
09-08-24 09-08-25	5665124.0 5565168.0	551557.0 551513.0		10 44	0.3 <0.2	2.44	69 441	188 190	0.5		34 2 63 2	20 20	43 75	24 67	3.26 3.61	1	0.1).59).92	360 691	<2 <2	0.02	53	2133 410	18 0.0 <2 0.0		3		<5 0.11 <5 0.14	<10 <10	14 <10	60 65	<10 <10	156 12 94 11
09-08-25	5665168.0			44	<0.2	1.79	229	190	< 0.5		23 2	20	75 34	31	3.61	1	0.11		0.92	992	<2	0.03	63 47	738	<2 0.0		2		<5 0.14 <5 0.11	<10	<10	65	<10	94 11 164 7
09-08-20	5665166.0			15	0.4	2.3	120	124	< 0.5		26 2	23	42	35	3.4	1	0.08		0.56	374	<2	0.02	57	687	23 0.0		2		<5 0.11	<10	15	66	<10	128 8
	0000.00.0	00.000.0	1	10	0.0	2.5	.20		-0.0			- T			V . 1		0.00			5	~~	0.02	U .	00.	0.0		0			0				

		2007 PIMA SPECTRAL ANAL	YSES	<u>I</u>				
Sample	Spectrum	Minerals	Alunite Feature	Al-OH Feature	Comment	Sample Number		
Rod/Stir 10	104C079A	probable phlogopite			Browngrey hard	1	SdQE	12
	*B	probable phlogopite, illite		2210	Browngrey hard			12,11
Rod/Stir 5	104C080A	smectite, illite, chlorite (Fe-Mg), probable epidote		2208	grey/brown mottled mod. hard	5	QEHFP	3,9,10
	*B	smectite, illite, chlorite (Fe-Mg), weak kaolinite		2206	grey/brown mottled mod. hard			3,9,2
Rod/Stir 12	104C081A	sericite, chlorite (Fe-Mg), weak kaolinite, ?possible epidote		2210	pinkgrey mod. hard	12	HP / SdA	D,9,2,10
	*B	sericite, chlorite (Fe-Mg), weak kaolinite		2209	pinkgrey mod. hard			D,9,2
Rod/Stir 19	104C082A	sericite, chlorite (Fe-Mg), weak kaolinite		2208	grey/brown mottled mod. hard	19	QEHFP/S dA	D,9,2
	*В	sericite, chlorite (Fe-Mg), weak kaolinite		2208	grey/brown mottled mod. hard			

ALTERATION MINERALS	TEMPERATURE	ALTERATION CODE
Mordentite	100-150	
Jarosite	100-150	
Smectite	100-200	1
Cristobalite	100-180	
Marcasite	100-200	
Kaolinite	100-225	2
Pyrite	100-300+s	
Laumontite	150-200	
Illite/Smectite	150-225	3
Chlorite/Smectite	150-225	4
Dickite	150-275	5
Diaspore	140-300+s	14
Alunite	100-300	15
Sulphur	100-300	16
Calcite	100-300	6
Quartz	150-300	7
Adularia	150-300	8
Wairikite	190-280	17
Chlorite	180-300	9
Epidote	190-300	10
Illite	190-300	11
Zunyite, Topaz	210-300+s	18
Biotite	290+s	12
Amphibole	290+s	13
Analcite		А
Gypsum		В
Scorodite		С
Muscovite		D
Clay		Е
Dolomite		F

	M	ineral		Те	mperature of	Stability	
			100°	150° =	200°	250°	300°
		Smectite Illite/Smectite	<		EPITHERMA	L ORE DEPOS	SITION
		Illite					>
		Chlorite/Smectl	te				
N		Chlorite					>
E		Biotite					>
U		Amphibole			*		>
т		Mordenite			,		
R		Laumontite					
A		Wairikite					-
L		Epidote <i>Adularia</i>					
n		Calcite	e				
р Н		Quartz	_				
		Cristobalite					
		Pyrite	<				>
	A	Marcasite					
	c	Kaolinite	<				
	1	Dickite					3
	D	Pyrophyllite					
		lilite					د ۲۰
	Ð	Disspere	χ				>
	М	Zunyite, Topaz	÷				>
		Sulfur	<		*************		
		Jarosite	<		3		
		Alanite	< 10C*	150°	- 200°	250°	300°

TEMPERATURE STABILITY OF HYDROTHERMAL MINERALS IN THE EPITHERMAL ENVIRONMENT

2

Absolute temperatures of first appearance of minerals is not eatisfactorily documented. The relative atability of these minerals is similar in geothermal systems throughout the world. Identifying zones of mineral assemblages may be more meaningful in indicating paraotemparatures these single minerals. (Table is from White and Hedenquist, 1995, after Henley and Ellis, 1983; Reyes, 1990; Elitzewa and M.^h ^{rel} Aoki, personal communication, 1994).

Assayers Canada Services Explained

Sample Preparation

Sample preparation procedures are normally fairly straightforward, and can be summarized as:

If a sample is wet, it will normally need to be dried
Large samples must be split, often several times, to provide a portion small enough to be handled by the analytical equipment. The size of the final sample is a function of the element being analysed and the analytical method being employed.

The size of particles within the sample must be reduced so that the elements of interest can be properly liberated from the rest of the rock.

Sample Drying

At Assayers Canada, samples of rock, stream sediments and soils are all dried in an oven at about 60 degrees Celsius. It is possible to dry the samples more quickly (i.e. at a higher temperature), but certain volatile elements (notably Hg) can be lost at higher temperatures.

Sample Size and Particle Size Reduction

The optimum mix of crushing, pulverising and splitting samples to achieve a sample that is small enough and fine grained enough to be analysed, while still giving a fair representation of the element concentrations in the original sample, is a topic about which textbooks have been written, and is a much discussed problem. While the theory and mathematics of the discussion is too complex to be included in this web site, it is advisable that all geologists at least have a cursory understanding of the issues involved here, particularly if the project in question includes very coarse grained ore minerals.

In general, the coarser and less homogenous the distribution of the ore minerals, the finer a specimen should be crushed (or pulverised) before a portion of it is split off for analysis or further sample preparation. Ideally, the entire sample (say 10kg of drill core) would be pulverised to -150 mesh before splitting off a portion for analysis. The trouble with this is that it takes a long time to pulverise a large sample, and hence this would be a very costly solution to the problem. At Assayers Canada, soil and stream sediment samples (where elements of interest are found in the fine fraction) are passed through an -80 mesh sieve, and the fine fraction is then split (if necessary) and pulverised.

Rock and drill core samples, on the other hand, are first crushed with a jaw crusher and the put through a secondary crusher so that it is 60% less than 10 mesh in size. The sample is then mixed, and a 250-gram sub sample split is taken. The sub sample is then pulverised in a ring pulverizer until 90% of the sample is less than 150 mesh, at which time it is ready for analysis.

Note that coarse gold does not pulverise well, but rather tends to become smeared along the plates of the pulverizer. If a sample is known to contain coarse gold, therefore, it should be sieved after it is pulverised to remove the coarse gold particles. The entire coarse fraction is then analysed, as is a split of the fine fraction. The two assays are then combined to give the total gold content of the original sample.

Assayers Canada Services Explained

Gold and Precious Metal Analysis by Fire Assay

Fire Assaying, a technique that has been around for centuries, is still the most generally accepted method of analysis for gold, and platinum group elements.

Though a number of variations are available (depending on the size of sample assayed and the method of final reading of the metal concentration), the basic technique in Fire Assaying for gold involves adding flux (which includes lead) and silver to the pulverised sample and fusing (melting) it. The extra silver acts as a collector of the gold, and, in very low-grade samples, ensures that at the end of the fusing there is enough precious metal to be easily handled.



At the end of the fusion process, the resultant molten material is poured into a metal mould and allowed to cool into a lead button (which contains the precious metals) at the bottom, overlain by silica glass slag. The slag is chipped off and discarded, and the lead button

is subjected to a second process called cupellation, in which the precious metals are separated from the lead.

In cupellation the lead button (containing the gold) is placed into a small porous crucible called a cupel, and heated. The lead then becomes oxidised and is absorbed into the cupel, leaving a small silver/gold bead remaining in the cupel.

It now remains only to separate the silver from the gold. To do this, the bead is placed in a test tube and nitric acid is added, which, when the test tube is put in a hot water bath, dissolves the silver, leaving a small particle of pure gold.

If the particle of gold is large enough, it is usually weighed to determine the original grade of the sample. This is called a gravimetric finish to the fire assay. For lower grade samples with very small and difficult to handle gold particles the gold is dissolved in hydrochloric acid and the gold concentration is measured using AAS.

While Fire Assaying is normally done on a 1 Assay Tonne (roughly 30 gram) split of the pulverised material, a slight cost saving is to be found in selecting a smaller (15-gram) sample size. On the other hand, high-grade samples, for which there must be a gravimetric finish, are slightly more expensive than those that are read on the AAS.



In the analysis of platinum group elements, roughly the same procedure is followed, but the final element readings are normally done using ICP.

Assayers Canada Services Explained

Trace Level Geochemistry

There are three basic options available for analysing exploration samples for geochemical levels of most elements normally of interest to the exploration geologist. Geochemical samples (i.e. those not *normally* expected to have ore grade concentrations of critical elements) can be analysed either individually by a variety of traditional wet chemical techniques, or by multi-element ICP, or by Neutron Activation Analysis.

1. Traditional Wet Geochemistry



A wide variety of techniques are employed in traditional geochemical analysis, depending on the element being analysed.

Traditional geochemical analysis basically involves getting a sample into solution, and then using an appropriate method to read the element concentration in the solution. The sample is put into solution by dissolution with mineral acids. Depending on the element being analysed a fusion process may precede this. The type of acid used in the dissolving process is again dependent on the element being assayed. The solutions are then read by AAS, ICP or occasionally some other method.

2. ICP-AES Multi-Element Analysis

The sample is put into a test tube and treated with either Aqua Regia or a cocktail consisting of nitric-perchloric-hydrofluoric-hydrochloric acids, depending on the elements and the detection limits desired.

The beauty of ICP-AES multi-element analysis is the wide range of elements that can be read simultaneously. It is important, however, to be aware of the limitations of the method, the most serious being the fact that, depending on the sample mineralogy, not all elements that are analysed by ICP will invariably dissolve in the Aqua Regia or multi-acid digests. Thus, there is a chance that ICP will underestimate



the concentrations of these elements. Another serious limitation to ICP is the fact that there can be interference between different elements. That is, the wavelength of one element's light emission will be close enough to that of another element to cause problems in reading the elements. This is particularly true if one of the elements has a very high concentration.

For the above reasons, ICP is not recommended for analyses that will be used in ore reserve calculations.

3. Instrumental Neutron Activation Analysis (INAA)

INAA has the very real advantage of not requiring the sample to be in solution (thus removing one step in the process, and eliminating any errors associated with that step), and of being able to measure many different elements, including gold, simultaneously.

One disadvantage of INAA is that many elements of interest (including copper and lead) cannot be analysed by the technique. Another disadvantage is the fact that this method requires a nuclear reactor, and there are few of these readily available in Canada.

The sample is prepared as normal and put into vials, which are then put into the reactor. Detection limits can be improved by using larger samples. This method is particularly good for analysis of panned concentrate samples, as it gives gold plus up to 34 different elements from one sample. Using a traditional fire assay (where, for panned concentrates, the entire sample is usually analysed), you can get only the concentration of gold in the sample.

Since Assayers Canada does not have direct access to a nuclear reactor, requests for INAA analysis are contracted out.

Element	Geochem	ICP AR	ICP MAD	INAA
	(Range)	(Range)	(Range)	(DL)
Antimony	0.2-1000	5-10000		0.2
Aluminum		0.01-15%*	0.01-15%*	
Arsenic	1-10000	5-10000		2
Barium	5-10000	10-10000*	10-10000*	100
Beryllium	2-1000	5-100*	0.5-100	
Bismuth	0.1-1000	5-10000	5-10000	
Boron	1-10000			
Bromine				1
Calcium		0.01-15%*	0.01-15%	1%
Cadmium	0.1-200	1-100	1-100	
Cerium				3
Cesium				2
Chlorine				100
Chromium	1-10000	1-10000*	1-10000	10
Cobalt	1-10000	1-10000	1-10000	5
Copper	1-10000	1-10000	1-10000	
Copper Oxide	1-10000			
Europium				0.2
Fluorine	10-10000			

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Gallium	5-10000 (ICP)			
Germanium	5-1000 (ICP)			
Gold				5 ppb
Hafnium				1
Iridium				5 ppb
Iron	10-10000	0.01-15%*	0.01-15%	0.02%
Lanthanum				1
Lead	1-10000	2-10000	2-10000	
Lutetium				0.05
Magnesium		0.01-15%*	0.01-15%*	
Manganese	5-10000	5-10000*	5-10000*	
Mercury	5-50000 ppb			1
Molybdenum	1-1000	2-10000	2-10000	5
Neodymium				5
Nickel	1-10000	1-10000	1-10000	50
Niobium	10-10000 (ICP)			
Phosphorous	10-10000 (ICP)	10-10000*	10-10000	
Potassium		0.01-10%*	0.01-10%	
Rubidium				30
Samarium				0.1
Scandium		1-10000		0.1
Selenium	1-100			5
Silver	0.1-200	0.2-200	0.2-200	5
Sodium		0.01-5%*	0.01-5%	0.05%
Strontium	1-10000 (ICP)	1-10000*	1-10000	0.05%
Tantalum				1
Tellurium	2-100			
Terbium				0.5
Thallium	5-10000 ppb			
Thorium	2-10000 (ICP)			0.5
Tin	2-1000	10-1000*		0.01%
Titanium		0.01-10*	0.01-10%	
Tungsten	5-1000	10-10000*	10-10000	4
Uranium				0.5
Vanadium	5-10000	1-10000	1-10000	
Ytterbium				0.2

Yttrium		1-10000		
Zinc	1-10000	1-10000	1-10000	50
Zirconium		1-10000*		

* Elements thus marked may not dissolve completely, or may experience some losses

