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/019

Prepared by:
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January 25th, 2010

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ROD-STIR PROJECT
Location Map
Fig. 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

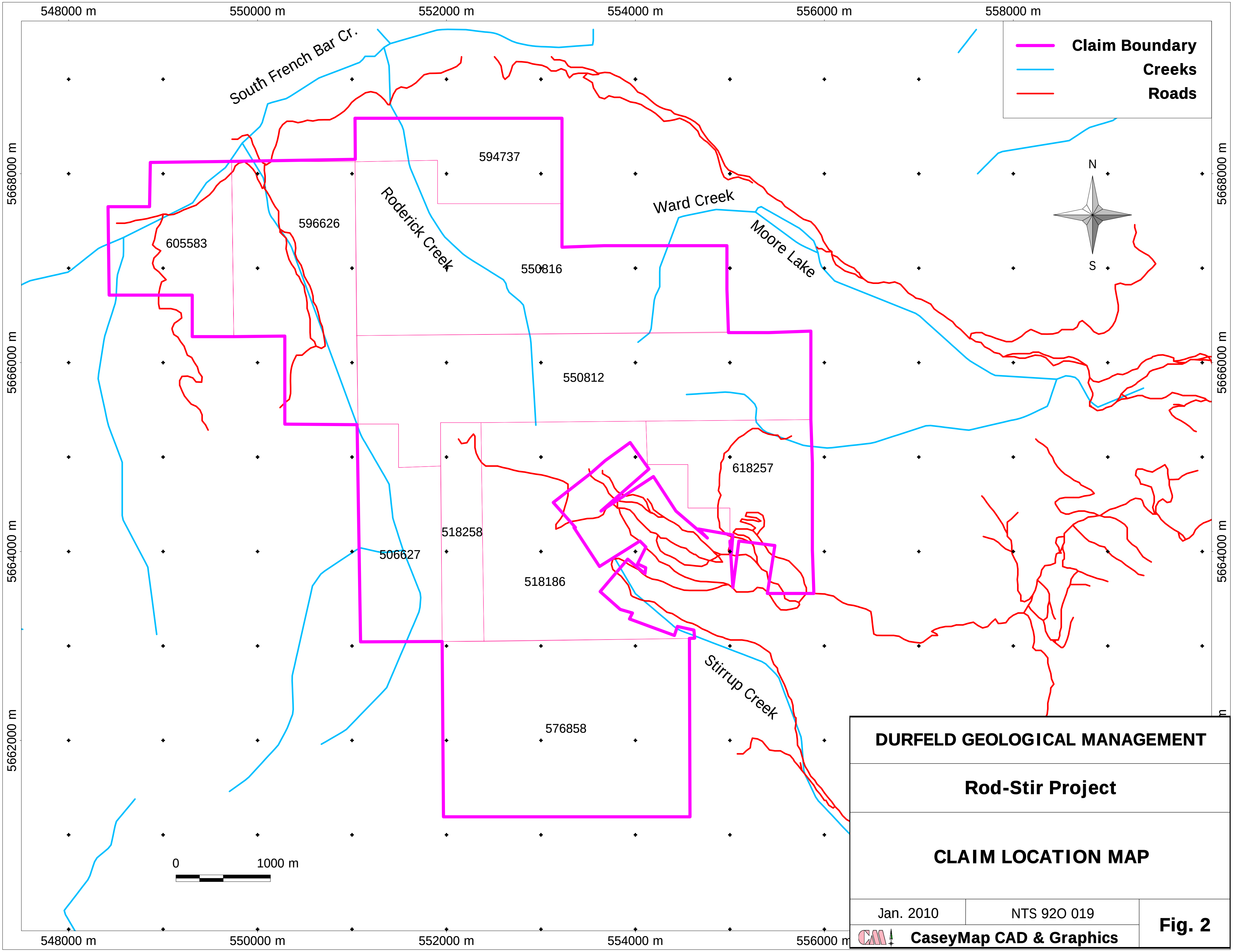
The property is accessed from Lillooet via the West Pavilion Forestry road on the west side of the Fraser River. At kilometre 92 on the West Pavilion road a secondary mining road takes off to the west and at 9 kilometres bisects the property. The closest helicopter service is located in Lillooet.

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 9 contiguous tenures covering some 2291.9 hectares of mineral tenure in the Clinton Mining Division. (Figure 2)
The following table summarizes the current claim status. The Good To Date reflects work that was filed as SOWs Exploration and Development Work / Expiry Date Change Event Numbers (4433208 and 4433808) and is documented in this report. The claims are held in the name of JM (Mel) Stewart (FMC # 125752).

Claim Tenure as Roderick Claims							
Tenure Number	Claim Name	Owner	Tenure Type	Map Number	Issue Date	Good To Date	Area (ha)
518186	DAVE	125752 (100%)	Mineral	092O	2005/jul/22	2011/jul/30	486.8
518257	DAVE 2	125752 (100%)	Mineral	092O	2005/jul/26	2011/jul/30	223.1
518258	DAVE 3	125752 (100%)	Mineral	092O	2005/jul/26	2011/jul/30	101.4
538455	GAP 1	125752 (100%)	Mineral	092O	2006/aug/01	2011/jul/30	40.6
538457	GAP 2	125752 (100%)	Mineral	092O	2006/aug/01	2011/mar/31	20.3
550812	JOAN	125752 (100%)	Mineral	092O	2007/jan/31	2011/mar/31	466.4
550816	DEB	125752 (100%)	Mineral	092O	2007/jan/31	2011/mar/31	283.8
576858	DADE	125752 (100%)	Mineral	092O	2008/feb/22	2010/mar/31	487.0
596627	JM	125752 (100%)	Mineral	092O	2008/dec/26	2010/dec/26	182.6
					Property Area		**2291.9**


548000 m
550000 m
552000 m
554000 m
556000 m
558000 m
5668000 m
5666000 m
5664000 m
5662000 m
Claim Boundary
Creeks
Roads
South French Bar Cr.
Roderick Creek
Ward Creek
Moore Lake
Stirrup Creek
N
S
594737
596626
605583
550816
550812
618257
518258
506627
518186
576858
0
1000 m
DURFELD GEOLOGICAL MANAGEMENT
Rod-Stir Project
CLAIM LOCATION MAP
Jan. 2010
NTS 92O 019
Fig. 2
CaseyMap CAD & Graphics

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 re-evaluating 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.

5.) 2009 Exploration Program

The 2009 exploration continued to expand the sampling in the northwest property area while evaluating the 2008 anomalous soil sites. Prospecting, geological mapping and rock sampling was completed on the north central ridge. The results of the 2009 program are compiled with the previous data and documented in this report.

B.) GEOLOGY

1) Regional 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.

2) Property Geology

Much of the area of the 2007, 2008 and 2009 programs is lower on the hillside and covered by overburden. The contacts on the geology map were defined by mapping rubble in soil pits and outcrop where observed. The geology is given as figure 3 and as the backdrop for all of the geochemical results.

Within the claims and adjoining area to the northwest and south east, the sedimentary rocks dominated by sandstone (2), conglomerate (2a) and lesser siltstone and argillite (3) have been intruded by dykes and sills of granodiorite, grading from feldspar (4a) to quartz-feldspar porphyry (4b). 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. These intrusives are locally mineralized with fine pyrite / arsenopyrite. The mineralized intrusions form prominent gossans on the alpine open slopes.

3) Mineralization

In the central claim area, small stibnite occurrences have been partly exposed in bulldozer trenches. The stibnite occurs as narrow seams near the contact of a quartz-feldspar porphyry sill that seems to 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 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.

4) Alteration

During the 2007 sampling program 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 showed an alteration suite of – phlogopite, illite/sericite, smectite, chlorite (Fe-Mg), weak kaolinite, probable epidote. A comparison of this alteration assemblage to the 'Temperature Stability of Hydrothermal Minerals in the Epithermal Environment' shows the alteration minerals defining a zone with potential for epithermal ore deposition.

C.) GEOCHEMISTRY

1) Sample Collection

During the 2009 program 10 soil, 17 rock and 2 silt samples were collected for analysis. The 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. Individual samples were described and the predominant lithology determined from local outcrops and rock fragments. The sample number and location were entered in an XL data base and later 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 with the lithology in the XL data base and merged with the analytical results.

The two silt samples were taken as fine silt within the active stream channel.

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 with the sample location and description as Appendix II.

D.) RESULTS

The soil and rock results were merged with the field data and are given as appendix I.

The 2009 rock sample locations are shown with the property geology as figure 3. The results for gold arsenic and antimony were merged with the previous data and plotted as figures 4, 5 and 6.

The 2009 soil sample locations are shown with the geology as figure 7 and the 2009 soil results are plotted with the soil results from previous surveys with geology for gold, arsenic and antimony as figures 8, 9 and 10.

The historic and current rock sampling has shown background gold values. A single sample of quartz-stibnite-arsenopyrite vein from the 2007 survey returned 586 ppm arsenic, 59 ppm mercury and greater than 10,000 ppm antimony. The high arsenic-stibnite suggest epithermal potential at depth. Otherwise the rock sampling has shown low arsenic and antimony values. The 2009 soil sampling continued to fill in and confirm the historic western anomaly which is developing as a strong gold-arsenic-antimony in soil anomaly that is open to the north and west. Several prospecting and rock sampling traverses at the head of Ward Creek encountered relatively unaltered sandstones and conglomerate of the Jackass Mountain Group that were not anomalous in gold or pathfinder elements. A single 2008 traverse in the northern claim area showed a single gossanous soil sample strongly anomalous in gold (149 ppb) and arsenic (149 ppm). A small grid of 10 soil samples did not show any samples anomalous in gold and only a single sample with 143 ppm arsenic in an area underlain by gossanous weakly altered sandstone. Sampling of pyritic feldspar porphyry in the west property area showed the only rock sample of the 2009 work anomalous in gold (59 ppb).

Ongoing work should continue to focus on expanding the western anomaly to define trenching and drilling targets. The logging road up Roderick Creek provides excellent access to this area for ongoing work.

E.) COST STATEMENT

RODERICK GOLD PROJECT						
JUNE 29 to AUGUST 1, 2009						
Soil Sampling, Prospecting and Geology						
Travel / Room / Board						
	Mob / Demob	20%		$8000 Project cost.	$1,600.00	
	Quad	15	day	@ $70/day	$1,050.00	
	Room and Board	16	manday	@ $85/day	$1,360.00	
Wages						
Geologist	RM Durfeld, P.Geo					
	Jul-02	1	day	@ $700/day	$700.00	
Prospector	JM Stewart					
	June 29 to July 3	5	day	@ $300/day	$1,500.00	
	July 27 to July 31	5	day	@ $300/day	$1,500.00	
Assistant	D Stewart					
	July 27 to July 31	5	day	@ $250/day	$1,250.00	
Analytical						
	2009 Sampling					
	Rock Samples	19	rock	@ $ 28.25	$536.75	
	Soil Samples	10	soil	@ $ 23.50	$235.00	
Reporting						
	Drafting and Plotting				$1,000.00	
	Report				$1,500.00	
	TOTAL 2009 PROJECT COST				**$12,231.75**	

Dated at Williams Lake, British Columbiathis 25th day of January 2010.

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

F.) STATEMENT OF QUALIFICATIONS

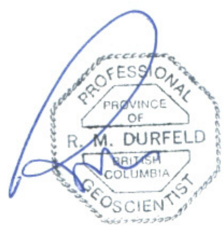
I, Rudolf M. Durfeld, do hereby certify that:
1.) I am a geologist with offices at 2029 South Lakeside Drive, Williams Lake, BC.
2.) I am a graduate of the University of British Columbia, B.Sc. Geology 1972, and have practiced my profession with various mining and/or exploration companies and as an independent 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 project supervision and geological mapping on my July 2nd, 2009 visit to the Rod-Stir mineral property.

b.) compilation of the 2009 and previous exploration data.

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

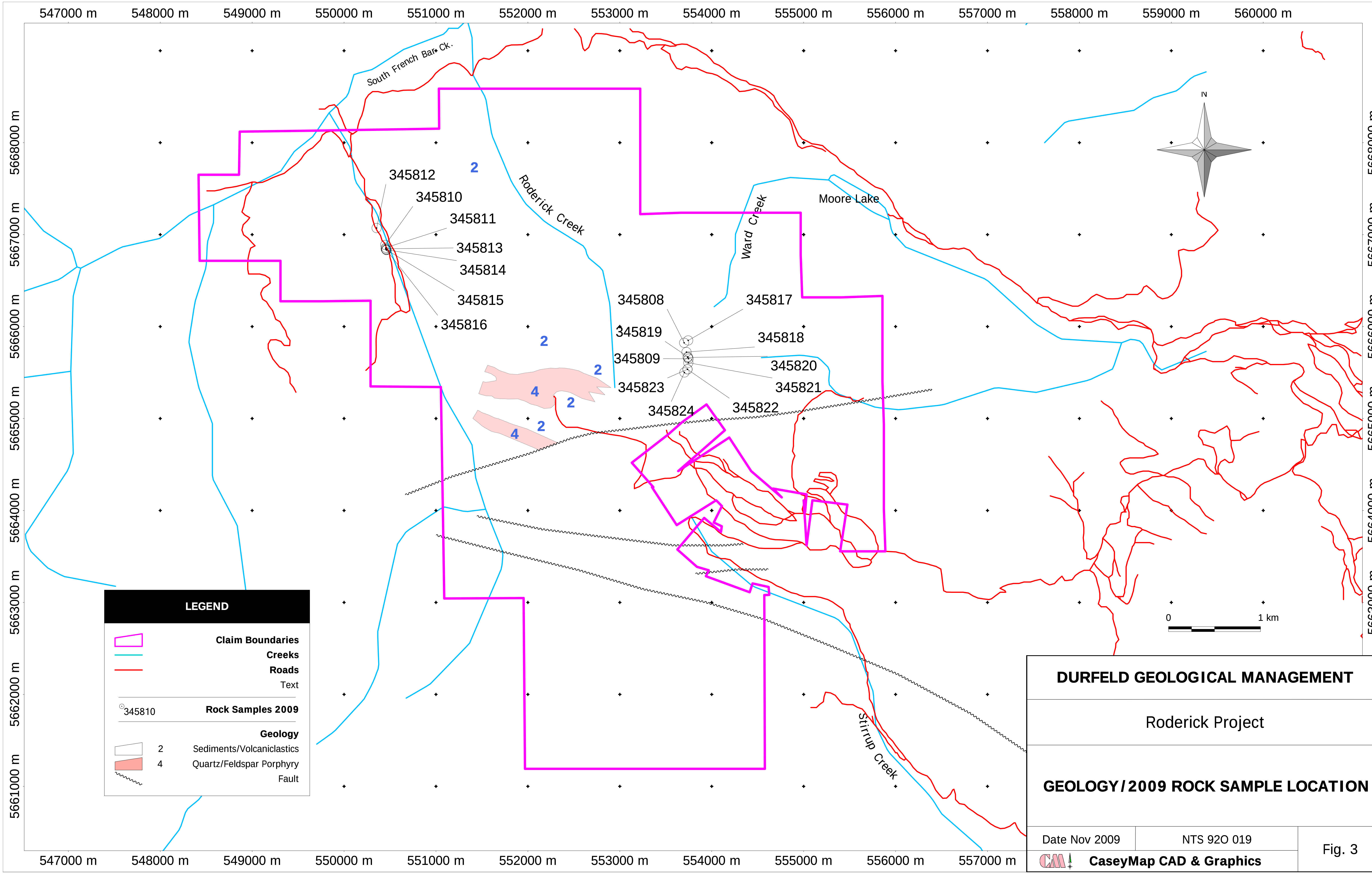
Dated at Williams Lake, British Columbia
this 25th day of January 2010.



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

APPENDICES

APPENDIX I: FIGURES



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5665000 m
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5663000 m
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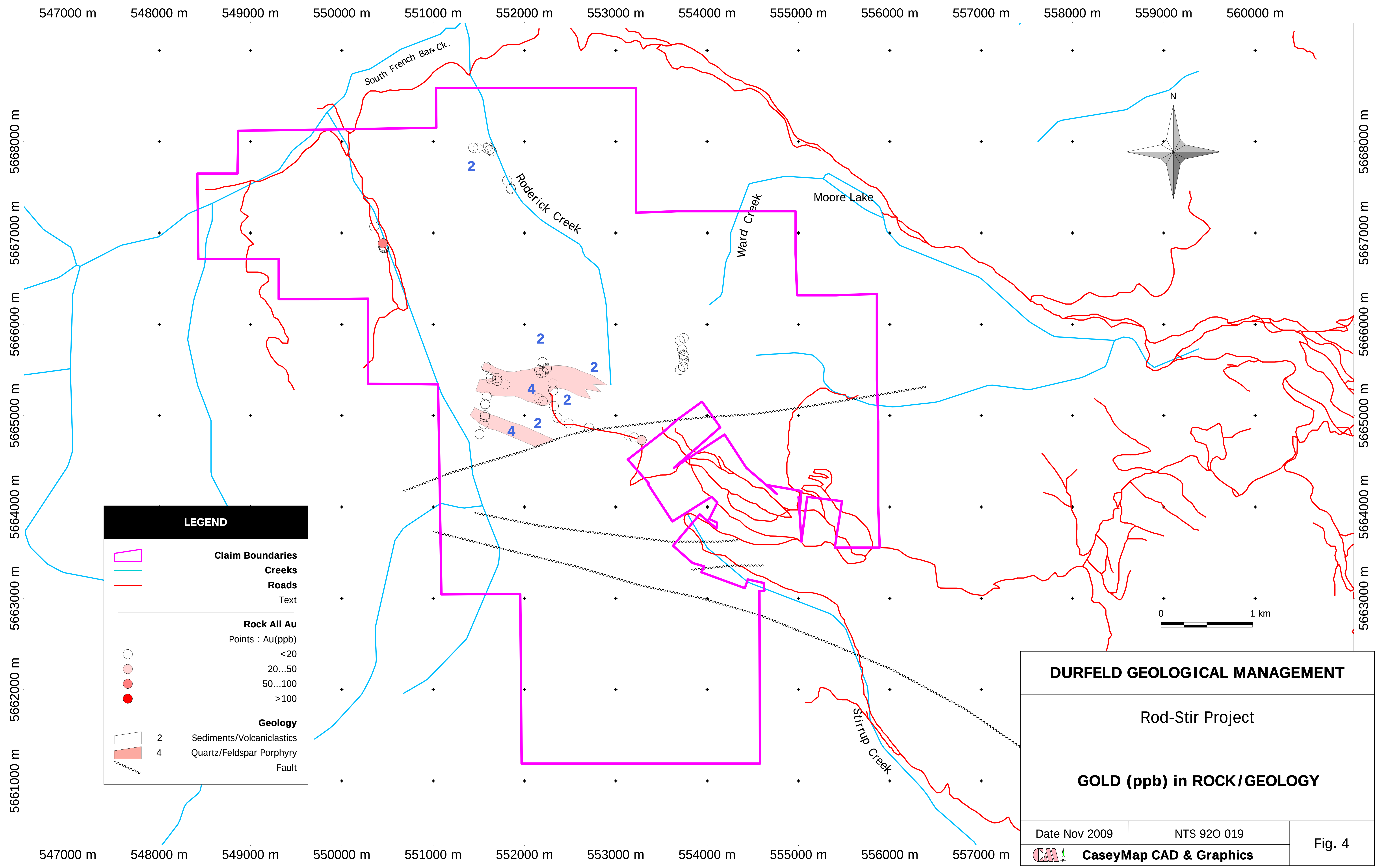
5661000 m
South French Bar Ck.
Roderick Creek
Ward Creek
Moore Lake
Stirrup Creek
N
345812
345810
345811
345813
345814
345815
345816
345808
345817
345819
345818
345809
345820
345823
345821
345824
345822
2
4
0
1 km
LEGEND
Claim Boundaries
Creeks
Roads
Text
345810
Rock Samples 2009
Geology
2 Sediments/Volcaniclastics
4 Quartz/Feldspar Porphyry
Fault
DURFELD GEOLOGICAL MANAGEMENT
Roderick Project
GEOLOGY / 2009 ROCK SAMPLE LOCATION
Date Nov 2009
NTS 92O 019
Fig. 3
CaseyMap CAD & Graphics

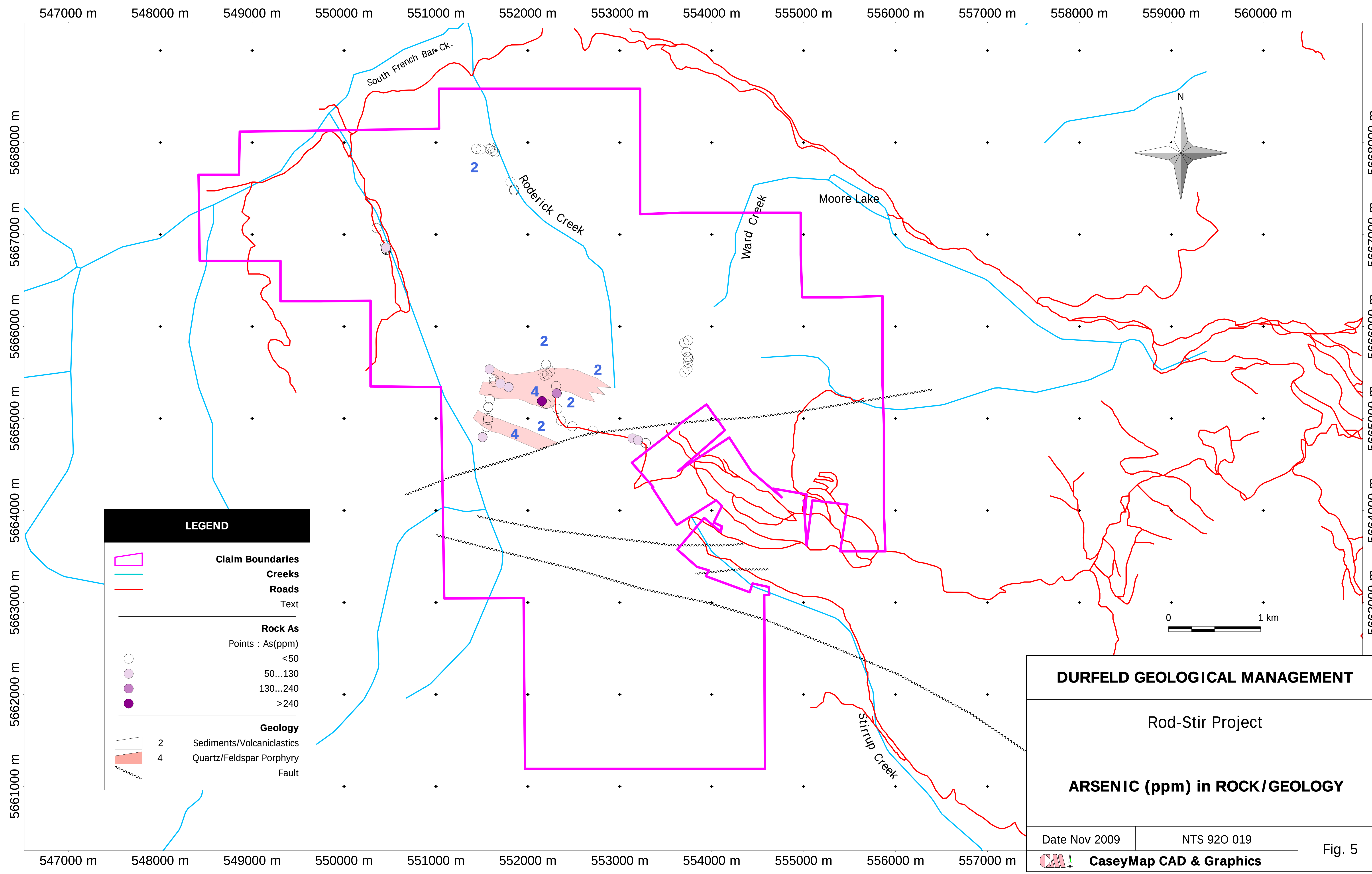


DURFELD GEOLOGICAL MANAGEMENT

Rod-Stir Project

GOLD (ppb) in ROCK/GEOLOGY

Date Nov 2009	NTS 92O 019	Fig. 4
CaseyMap CAD & Graphics		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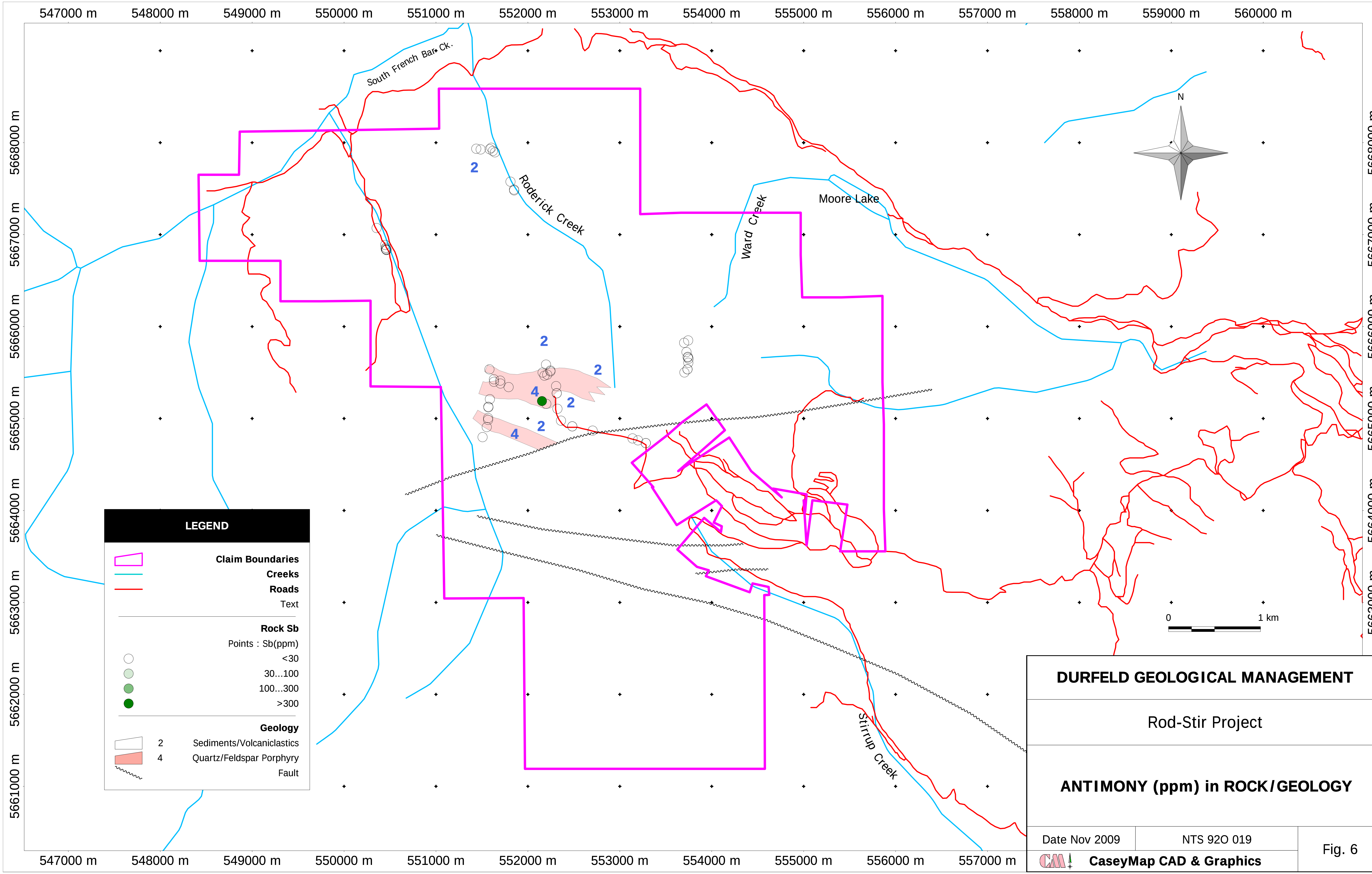
5663000 m
5662000 m
5661000 m
South French Bar Ck.
Roderick Creek
Ward Creek
Moore Lake
Stirrup Creek
N
0
1 km
2
4
LEGEND
Claim Boundaries
Creeks
Roads
Text
Rock As
Points : As(ppm)
<50
50...130
130...240
>240
Geology
2 Sediments/Volcaniclastics
4 Quartz/Feldspar Porphyry
Fault
DURFELD GEOLOGICAL MANAGEMENT
Rod-Stir Project
ARSENIC (ppm) in ROCK/GEOLOGY
Date Nov 2009
NTS 92O 019
Fig. 5
CaseyMap CAD & Graphics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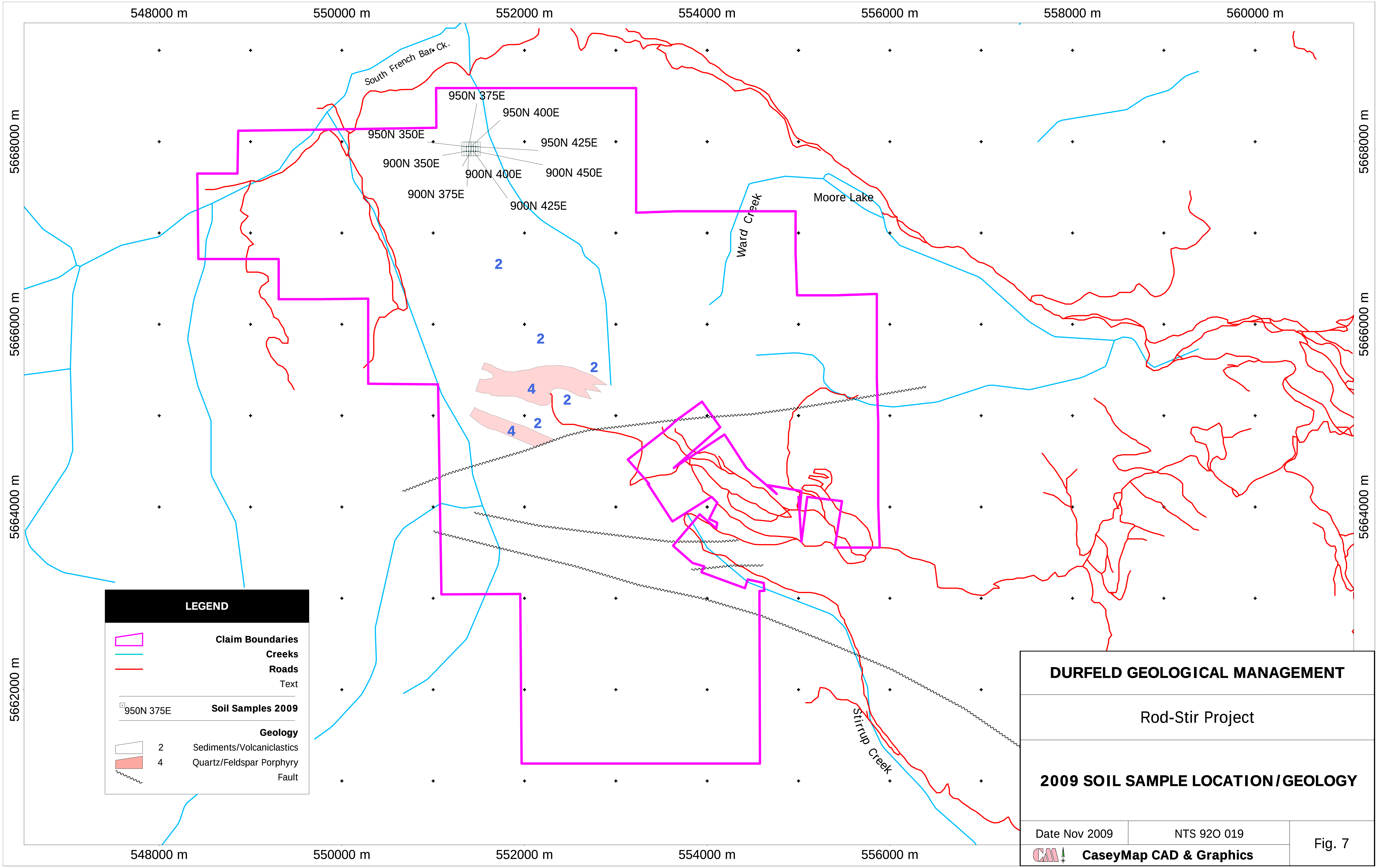
5668000 m
5667000 m
5666000 m
5665000 m
5664000 m
5663000 m
5662000 m
5661000 m
South French Bar Ck.
Roderick Creek
Ward Creek
Moore Lake
Stirrup Creek
N
0
1 km
LEGEND
Claim Boundaries
Creeks
Roads
Text
Rock Sb
Points : Sb(ppm)
<30
30...100
100...300
>300
Geology
2 Sediments/Volcaniclastics
4 Quartz/Feldspar Porphyry
Fault
DURFELD GEOLOGICAL MANAGEMENT
Rod-Stir Project
ANTIMONY (ppm) in ROCK/GEOLOGY
Date Nov 2009
NTS 92O 019
CaseyMap CAD & Graphics
Fig. 6


548000 m
550000 m
552000 m
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556000 m
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560000 m
5668000 m
5666000 m
5664000 m
5662000 m
South French Bar Ck.
950N 375E
950N 400E
950N 350E
950N 425E
900N 350E
900N 400E
900N 450E
900N 375E
900N 425E
Ward Creek
Moore Lake
Stirrup Creek
2
4
LEGEND
Claim Boundaries
Creeks
Roads
Text
950N 375E
Soil Samples 2009
Geology
2 Sediments/Volcaniclastics
4 Quartz/Feldspar Porphyry
Fault
DURFELD GEOLOGICAL MANAGEMENT
Rod-Stir Project
2009 SOIL SAMPLE LOCATION/GEOLOGY
Date Nov 2009
NTS 92O 019
Fig. 7
CaseyMap CAD & Graphics

DURFELD GEOLOGICAL MANAGEMENT

Rod-Stir Project

GOLD (ppb) in SOIL/GEOLOGY

Date Nov 2009	NTS 92O 019	Fig. 8

CaseyMap CAD & Graphics


550000 m
551000 m
552000 m
553000 m
554000 m
5667000 m
5666000 m
5665000 m
N
Roderick Creek
Ward Creek
2
4
LEGEND
Claim Boundaries
Creeks
Roads
Arsenic Soil
Points : As(ppm)
<80
80...150
150...250
>250
Geology
2 Sediments/Volcaniclastics
4 Quartz/Feldspar Porphyry
Fault
0
500 m
DURFELD GEOLOGICAL MANAGEMENT
Rod-Stir Project
ARSENIC (ppm) in SOIL/GEOLOGY
Date Nov 2009
NTS 92O 019
Fig. 9
CaseyMap CAD & Graphics

DURFELD GEOLOGICAL MANAGEMENT

Rod-Stir Project

ANTIMONY (ppm) in SOIL/GEOLOGY

Date Nov 2009	NTS 92O 019	Fig. 10
CaseyMap CAD & Graphics		

APPENDIX II: 2009 SAMPLE LOCATIONS

Merged							
		Rod Stir July 26 - Aug 1, 2009 trip NW Quarry area & GB ridge					
Certificate	Sample #	East	North	Elev	Type	Description	
Number		Quarry Area	& GB ridge				
9V1353RG	345808	553700	5665824	2073 m	Rock	Bedrock O/C- dark-fine grains Qu & ? (GB ridge area)	HbBioGDwith QE
9V1353RG	345809	553748	5665650	2095 m	Rock	4mm thick SD layer on surface of conglom (GB ridge area)	Sdgos, wk alt
9V1353RG	345810	550448	5666888	1443 m	Rock	Py in & on fface of fine grained grey rock (rubble in Quarry)	SdA,2ndbio,QE
9V1353RG	345811	550455	5666858	1441 m	Rock	Py throughout grey rock (rubble in Quarry)	Felsic QP,5% euhedral py, tr cpy
9V1353RG	345812	550354	5667072	1435 m	Rock	Bedrock in Quarry-dark metallic in fine Sd- some Py	SdA,2ndbio,QE
9V1353RG	345813	550453	5666846	1438 m	Rock	Bedrock in Quarry-dark fine metallic in Sd---Cluster of Py in assa	SdA,strong alt,py
9V1353RG	345814	550459	5666835	1440 m	Rock	Py in fine grained grey rock (rubble in Quarry)	FelHbl,Bio,dis euhedral py
9V1353RG	345815	550458	5666837	1441 m	Rock	Bedrock in Quarry--fine grained metallic in Sd	SdA,lt yellow gos mineral
9V1353RG	345816	550462	5666832	1443 m	Rock	Solid mass of soft mica like material (rubble in Quarry)	Muscovite Schist - float
		GB Ridge Visit # 2					
9V1353RG	345817	553744	5665849	2075 m	Rock	Top of rock ridge --Conglom	HbGDwith QE
9V1353RG	345818	553725	5665723	2092 m	Rock	Top of rock ridge--grey matallic in Sd	CseSdAwithQE
9V1353RG	345819	553740	5665671	2100 m	Rock	Top of rock ridge --Sd	SdA
9V1353RG	345820	553739	5665664	2100 m	Rock	Top of rock ridge -- Sd	SdA
9V1353RG	345821	553745	5665607	2103 m	Rock	Face of rock ridge--grey Sd & conglom	SdA
9V1353RG	345822	553736	5665535	2106 m	Rock	Face of rock ridge --Whitish hard rock --conglom?	HbSilGranite- in Cng?
9V1353RG	345823	553737	5665536	2106 m	Rock	Face of rock ridge -- Black & white rock	BioGD in Cng?
9V1353RG	345824	553703	5665501	2103 m	Rock	Face of rock ridge -- Sd	SdA
		Stream flowing into Stirrup @ S end of claims					
9V1353SG	345825	555670	5661917	1500 m	SSS	All season small stream--in valley--3m wide 0.1 m deep	silt
9V1353SG	345826	555661	5661933	1501 m	SSS	Upstream from 345825	silt

Sample #	Geochem	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP
	Au	Ag	Al	As	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	La	Mg	Mn	Mo
	ppb	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm
345808	<1	<0.2	1.86	<5	229	<0.5	27	1.9	3	14	64	16	3.88	<1	0.15	<10	1.4	729	<2
345809	13	<0.2	3.4	14	86	2.4	77	2.8	4	29	121	27	4.57	<1	0.1	10	2	###	<2
345810	57	<0.2	2.21	28	44	<0.5	33	2.7	4	17	76	16	4	<1	0.15	<10	1.9	###	<2
345811	<19	<0.2	1.74	109	65	0.6	17	0.3	11	14	52	64	3.87	<1	0.24	<10	1.2	745	<2
345812	17	<0.2	1.89	12	64	0.5	53	3.6	3	16	61	21	3.68	<1	0.18	10	1.4	938	<2
345813	2	0.6	2.38	48	91	<0.5	61	3.9	4	20	95	31	4	<1	0.21	<10	2	###	<2
345814	<1	<0.2	1.54	46	68	0.5	54	3.7	3	14	61	23	3.62	<1	0.22	<10	1	561	<2
345815	<1	<0.2	1.98	32	45	<0.5	60	3.1	3	17	72	23	3.52	<1	0.16	<10	1.6	###	<2
345816	<1	<0.2	1.58	<5	106	0.7	16	0.1	2	16	212	15	2.5	<1	0.76	35	0.8	175	<2
345817	<1	<0.2	1.42	<5	352	1.2	37	0.8	3	15	86	14	3.22	<1	0.17	<10	0.8	403	<2
345818	<1	<0.2	2.95	10	35	2	51	2.1	4	24	93	33	4.03	1	0.05	<10	2	790	<2
345819	<1	<0.2	3.15	11	68	2.2	36	2.4	4	28	88	32	4.39	<1	0.05	<10	2.1	###	<2
345820	<1	<0.2	3.31	12	40	2.3	39	2.8	4	29	90	33	4.56	1	0.05	<10	2.2	###	<2
345821	<1	<0.2	2.73	11	54	2.1	48	4	5	29	78	31	4.91	1	0.06	10	2.4	###	<2
345822	<1	<0.2	0.37	<5	14	<0.5	14	0.2	<1	1	87	3	0.37	<1	0.07	<10	0.1	129	<2
345823	<1	<0.2	0.85	<5	58	0.9	15	0.5	2	8	90	4	1.64	<1	0.09	<10	0.5	309	<2
345824	<1	<0.2	3.59	13	68	2.5	26	2.3	4	28	123	18	4.51	1	0.09	<10	2	740	<2
345825	<1	<0.2	2.57	91	76	1.2	10	0.9	4	24	95	45	4.08	<1	0.09	<10	1.9	927	<2
345826	29	<0.2	2.55	64	79	1.3	50	0.9	4	24	86	49	4.06	<1	0.12	<10	1.8	901	<2

Sample #	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP
	Na	Ni	P	Pb	S	Sb	Sc	Sr	Th	Ti	Tl	U	V	W	Zn	Zr
	%	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
345808	0.1	10	538	4	0.1	<5	9	70	<5	0	<10	<10	67	<10	75	3
345809	0.1	21	997	4	0.1	<5	12	66	<5	0.4	<10	<10	152	<10	92	45
345810	0	41	600	13	0.3	<5	6	76	<5	0	<10	<10	56	<10	75	3
345811	0	20	698	213	0.6	<5	4	11	<5	0	<10	<10	30	<10	1174	3
345812	0	33	703	5	0.1	<5	6	98	<5	0	<10	<10	38	<10	69	3
345813	0	57	730	7	0.2	<5	5	99	<5	0	<10	<10	63	<10	82	3
345814	0	25	658	15	1.4	<5	3	113	<5	0	<10	<10	39	<10	54	4
345815	0	39	597	3	0.1	<5	5	56	<5	0	<10	<10	59	<10	60	3
345816	0	40	523	<2	<0.0	<5	3	8	22	0.1	10	<10	29	<10	56	1
345817	0.1	6	918	<2	0	<5	3	46	<5	0.2	<10	<10	105	<10	36	4
345818	0	16	711	5	0	<5	10	45	<5	0.3	<10	<10	123	<10	76	34
345819	0	19	894	5	0	<5	11	49	<5	0.3	<10	<10	139	<10	91	48
345820	0	19	878	5	0.1	<5	11	50	<5	0.3	<10	<10	144	<10	96	43
345821	0	21	906	3	0.1	<5	13	68	<5	0.3	<10	<10	144	<10	93	47
345822	0.1	3	44	6	<0.0	<5	2	5	<5	0	<10	<10	6	<10	14	5
345823	0.1	5	379	4	<0.0	<5	2	16	5	0.1	<10	<10	45	<10	28	4
345824	0.1	22	932	5	0	<5	10	65	<5	0.3	<10	<10	133	<10	106	42
345825	0	75	791	10	0	<5	8	58	<5	0.2	<10	<10	101	<10	81	13
345826	0.1	69	744	3	0	<5	9	58	<5	0.2	<10	<10	104	<10	79	12

ICP-AES report: Aqua Regia digestion

Certificate Number	Sample Name	East	North	Description	Geo Chem Au ppb	Geo Chem Te ppm	ICP Ag ppm	ICP Al %	ICP As ppm	ICP Ba ppm	ICP Be ppm	ICP Bi ppm	ICP Ca %	ICP Cd ppm	ICP Co ppm	ICP Cr ppm	ICP Cu ppm	ICP Fe %	ICP Hg ppm	ICP K %	ICP La ppm	ICP Mg %	ICP Mn ppm	ICP Mo ppm	ICP Na %	ICP Ni ppm	ICP P ppm	ICP Pb ppm	ICP S %	ICP Sb ppm	ICP Sc ppm	ICP Sr ppm	ICP Th ppm	ICP Ti %	ICP Tl ppm	ICP U ppm	ICP V ppm	ICP W ppm	ICP Zn ppm	ICP Zr ppm
9V0839SG	9+50N 3+50E	551364	5667946	Coll. Fresh green sd	2	<0.1	<0.2	1.94	12	141	0.6	<5	0.43	<1	15	40	16	3.44	1	0.1	<10	0.71	329	<2	0.02	32	542	7	0.01	<5	5	37	<5	0.15	<10	<10	81	<10	74	9
9V0839SG	9+50N 3+75E	551389	5667946	Coll. y, r, br silt	1	<0.1	<0.2	1.56	15	148	0.6	<5	0.43	<1	14	35	23	3.62	1	0.08	<10	0.6	342	<2	0.02	30	738	8	0.01	<5	6	44	<5	0.14	<10	<10	88	<10	66	10
9V0839SG	9+50N 4+00E	551414	5667946	Coll. Alt'd sd, y,br silt	2	<0.1	<0.2	0.88	15	296	1	5	0.33	<1	17	25	29	5.98	1	0.09	17	0.18	493	4	0.01	58	519	33	0.01	<5	9	20	<5	0.01	<10	<10	50	<10	84	4
9V0839SG	9+50N 4+25E	551439	5667946	Coll. Y,r,br, silt & sd	2	<0.1	<0.2	1.09	143	159	0.8	<5	0.41	1	22	16	44	5.39	1	0.15	14	0.32	916	<2	0.01	36	546	13	0.01	20	17	36	<5	0.01	<10	<10	38	<10	82	5
9V0839SG	9+50N 4+50E	551464	5667946	Coll. R,br silt	1	<0.1	<0.2	2.54	11	381	0.7	<5	0.6	<1	18	51	13	4.07	1	0.11	<10	0.61	830	<2	0.02	40	490	11	0.01	<5	8	49	<5	0.1	<10	<10	78	<10	69	8
9V0839SG	9+00N 3+50E	551364	5667896	Coll.frsh sd,y,br silt	<1	<0.1	<0.2	2.14	80	113	0.7	<5	0.85	1	17	43	39	4.68	1	0.07	15	0.87	614	<2	0.02	38	427	11	0.01	5	12	56	<5	0.04	<10	<10	85	<10	72	11
9V0839SG	9+00N 3+75E	551389	5667896	Coll. Br silt	1	<0.1	<0.2	2.33	16	180	0.7	<5	0.62	1	24	45	28	4.15	1	0.17	<10	0.92	524	<2	0.02	35	328	7	0.01	<5	9	91	<5	0.19	<10	<10	112	<10	64	10
9V0839SG	9+00N 4+00E	551414	5667896	Coll. Frsh sd,br silt	<1	<0.1	<0.2	3.06	23	327	0.8	<5	0.86	1	21	55	22	4.24	1	0.1	16	0.79	1108	<2	0.02	56	348	11	0.02	<5	11	106	<5	0.11	<10	<10	79	<10	78	14
9V0839SG	9+00N 4+25E	551439	5667896	good br B hor. Silt/clay	<1	<0.1	<0.2	2.06	13	177	0.6	<5	0.53	<1	18	47	15	3.81	1	0.1	<10	0.74	342	<2	0.02	37	289	7	0.01	<5	5	52	<5	0.17	<10	<10	99	<10	65	9
9V0839SG	9+00N 4+50E	551464	5667896	Coll. Silt,sd,ash	6	<0.1	<0.2	2.47	16	229	0.6	<5	0.58	<1	17	43	14	3.84	1	0.1	<10	0.66	575	<2	0.02	38	341	8	0.01	<5	5	52	<5	0.11	<10	<10	89	<10	59	6
9V1353SG	345647				<1		<0.2	3.55	8	14	3.3	25	2.29	5	53	77	79	5.83	1	0.02	<10	2.6	975	<2	0.04	77	437	<2	0.04	<5	10	40	<5	0.62	<10	<10	218	<10	92	32
9V1353SG	345648				<1		<0.2	3.76	6	16	3.1	56	1.88	5	60	88	93	5.91	1	0.03	<10	2.59	1241	<2	0.03	81	489	<2	0.04	<5	11	44	<5	0.56	10	<10	202	<10	78	17
9V1353SG	345649				17		<0.2	3.49	7	14	3.2	53	2.07	5	53	75	88	5.71	1	0.02	<10	2.61	981	<2	0.04	80	454	<2	0.04	<5	10	38	<5	0.59	<10	<10	204	<10	90	31
9V1353SG	345650				2		<0.2	2.19	9	91	1.2	34	1.24	3	19	53	22	3.37	<1	0.07	10	1.09	847	<2	0.05	40	832	3	0.07	<5	7	131	<5	0.16	<10	<10	108	<10	61	7

APPENDIX III: 2009 ANALYTICAL RESULTS

Assayers Canada
8282 Sherbrooke St.
Vancouver, B.C.
V5X 4R6
Tel: (604) 327-3436
Fax: (604) 327-3423

Quality Assaying for over 25 Years

Geochemical Analysis Certificate

9V-0839-SG1

Company: **JM Stewart Surveys Ltd**
Project: ROD-STIR
Attn: Stewart

Jul-16-09

We *hereby certify* the following geochemical analysis of 10 soils samples submitted Jul-06-09

Sample Name	Au ppb	Te ppm
9+50N 3+50E	2	<0.1
9+50N 3+75E	1	<0.1
9+50N 4+00E	2	<0.1
9+50N 4+25E	2	<0.1
9+50N 4+50E	1	<0.1
9+00N 3+50E	<1	<0.1
9+00N 3+75E	1	<0.1
9+00N 4+00E	<1	<0.1
9+00N 4+25E	<1	<0.1
9+00N 4+50E	6	<0.1
*0211	2363	
*BLANK	<1	<0.1

Te:read by MS using ICP solution

Certified by ____________________

Assayers Canada

8282 Sherbrooke St., Vancouver, B.C., V5X 4R6
Tel: (604) 327-3436 Fax: (604) 327-3423

JM Stewart Surveys Ltd

Attention: Stewart

Project: ROD-STIR

Sample type: Soils

Report No : 9V0839SJ

Date : Jul-16-09

Multi-Element ICP-AES Analysis

Aqua Regia Digestion

Sample Number	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Hg ppm	K %	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	S %	Sb ppm	Sc ppm	Sr ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm	Zr ppm
9+50N 3+50E	<0.2	1.94	12	141	0.6	<5	0.43	<1	15	40	16	3.44	1	0.10	<10	0.71	329	<2	0.02	32	542	7	0.01	<5	5	37	<5	0.15	<10	<10	81	<10	74	9
9+50N 3+75E	<0.2	1.56	15	148	0.6	<5	0.43	<1	14	35	23	3.62	1	0.08	<10	0.60	342	<2	0.02	30	738	8	0.01	<5	6	44	<5	0.14	<10	<10	88	<10	66	10
9+50N 4+00E	<0.2	0.88	15	296	1.0	5	0.33	<1	17	25	29	5.98	1	0.09	17	0.18	493	4	0.01	58	519	33	0.01	<5	9	20	<5	0.01	<10	<10	50	<10	84	4
9+50N 4+25E	<0.2	1.09	143	159	0.8	<5	0.41	1	22	16	44	5.39	1	0.15	14	0.32	916	<2	0.01	36	546	13	0.01	20	17	36	<5	0.01	<10	<10	38	<10	82	5
9+50N 4+50E	<0.2	2.54	11	381	0.7	<5	0.60	<1	18	51	13	4.07	1	0.11	<10	0.61	830	<2	0.02	40	490	11	0.01	<5	8	49	<5	0.10	<10	<10	78	<10	69	8
9+00N 3+50E	<0.2	2.14	80	113	0.7	<5	0.85	1	17	43	39	4.68	1	0.07	15	0.87	614	<2	0.02	38	427	11	0.01	5	12	56	<5	0.04	<10	<10	85	<10	72	11
9+00N 3+75E	<0.2	2.33	16	180	0.7	<5	0.62	1	24	45	28	4.15	1	0.17	<10	0.92	524	<2	0.02	35	328	7	0.01	<5	9	91	<5	0.19	<10	<10	112	<10	64	10
9+00N 4+00E	<0.2	3.06	23	327	0.8	<5	0.86	1	21	55	22	4.24	1	0.10	16	0.79	1108	<2	0.02	56	348	11	0.02	<5	11	106	<5	0.11	<10	<10	79	<10	78	14
9+00N 4+25E	<0.2	2.06	13	177	0.6	<5	0.53	<1	18	47	15	3.81	1	0.10	<10	0.74	342	<2	0.02	37	289	7	0.01	<5	5	52	<5	0.17	<10	<10	99	<10	65	9
9+00N 4+50E	<0.2	2.47	16	229	0.6	<5	0.58	<1	17	43	14	3.84	1	0.10	<10	0.66	575	<2	0.02	38	341	8	0.01	<5	5	52	<5	0.11	<10	<10	89	<10	59	6

A .5 gm sample is digested with 5 ml 3:1 HCl/HNO3 at 95°C for 2 hours and diluted to 25ml.

Signed: ______________________

ASSAYERS CANADA

Assayers Canada
8282 Sherbrooke St.
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Tel: (604) 327-3436
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Quality Assaying for over 35 Years

Geochemical Analysis Certificate

9V-1353-RG1

Oct-20-09

Company: **JM Stewart Surveys Ltd**
Project: ROD-STIR
Attn: JM Stewart

We *hereby certify* the following geochemical analysis of 17 rock samples submitted Oct-14-09

Sample Name	Au ppb
345808	<1
345809	13
345810	57
345811	<19
345812	17
345813	2
345814	<1
345815	<1
345816	<1
345817	<1
345818	<1
345819	<1
345820	<1
345821	<1
345822	<1
345823	<1
345824	<1
*DUP 345808	<1
*DUP 345817	<1
*0211	2130
*BLANK	<1

Au F.A. AA finish

Certified by

Assayers Canada
8282 Sherbrooke St., Vancouver, B.C., V5X 4R6
Tel: (604) 327-3436 Fax: (604) 327-3423

JM Stewart Surveys Ltd

Attention: JM Stewart

Project: ROD-STIR

Sample type: Rock

Report No : 9V1353RJ

Date : Oct-20-09

Multi-Element ICP-AES Analysis

Aqua Regia Digestion

Sample Number	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Hg ppm	K %	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	S %	Sb ppm	Sc ppm	Sr ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm	Zr ppm
345808	<0.2	1.86	<5	229	<0.5	27	1.91	3	14	64	16	3.88	<1	0.15	<10	1.43	729	<2	0.06	10	538	4	0.05	<5	9	70	<5	0.01	<10	<10	67	<10	75	3
345809	<0.2	3.40	14	86	2.4	77	2.79	4	29	121	27	4.57	<1	0.10	10	1.99	1241	<2	0.09	21	997	4	0.05	<5	12	66	<5	0.35	<10	<10	152	<10	92	45
345810	<0.2	2.21	28	44	<0.5	33	2.68	4	17	76	16	4.00	<1	0.15	<10	1.94	1120	<2	0.03	41	600	13	0.31	<5	6	76	<5	0.01	<10	<10	56	<10	75	3
345811	<0.2	1.74	109	65	0.6	17	0.28	11	14	52	64	3.87	<1	0.24	<10	1.19	745	<2	0.02	20	698	213	0.55	<5	4	11	<5	0.01	<10	<10	30	<10	1174	3
345812	<0.2	1.89	12	64	0.5	53	3.63	3	16	61	21	3.68	<1	0.18	10	1.37	938	<2	0.02	33	703	5	0.07	<5	6	98	<5	0.01	<10	<10	38	<10	69	3
345813	0.6	2.38	48	91	<0.5	61	3.85	4	20	95	31	4.00	<1	0.21	<10	1.98	1052	<2	0.02	57	730	7	0.20	<5	5	99	<5	0.01	<10	<10	63	<10	82	3
345814	<0.2	1.54	46	68	0.5	54	3.71	3	14	61	23	3.62	<1	0.22	<10	1.01	561	<2	0.02	25	658	15	1.44	<5	3	113	<5	0.01	<10	<10	39	<10	54	4
345815	<0.2	1.98	32	45	<0.5	60	3.08	3	17	72	23	3.52	<1	0.16	<10	1.60	1258	<2	0.04	39	597	3	0.06	<5	5	56	<5	0.01	<10	<10	59	<10	60	3
345816	<0.2	1.58	<5	106	0.7	16	0.12	2	16	212	15	2.50	<1	0.76	35	0.84	175	<2	0.03	40	523	<2	<0.01	<5	3	8	22	0.10	10	<10	29	<10	56	1
345817	<0.2	1.42	<5	352	1.2	37	0.79	3	15	86	14	3.22	<1	0.17	<10	0.83	403	<2	0.13	6	918	<2	0.01	<5	3	46	<5	0.21	<10	<10	105	<10	36	4
345818	<0.2	2.95	10	35	2.0	51	2.09	4	24	93	33	4.03	1	0.05	<10	1.95	790	<2	0.03	16	711	5	0.04	<5	10	45	<5	0.28	<10	<10	123	<10	76	34
345819	<0.2	3.15	11	68	2.2	36	2.40	4	28	88	32	4.39	<1	0.05	<10	2.06	1146	<2	0.04	19	894	5	0.04	<5	11	49	<5	0.32	<10	<10	139	<10	91	48
345820	<0.2	3.31	12	40	2.3	39	2.80	4	29	90	33	4.56	1	0.05	<10	2.20	1239	<2	0.04	19	878	5	0.05	<5	11	50	<5	0.34	<10	<10	144	<10	96	43
345821	<0.2	2.73	11	54	2.1	48	3.99	5	29	78	31	4.91	1	0.06	10	2.41	2026	<2	0.04	21	906	3	0.07	<5	13	68	<5	0.32	<10	<10	144	<10	93	47
345822	<0.2	0.37	<5	14	<0.5	14	0.20	<1	1	87	3	0.37	<1	0.07	<10	0.09	129	<2	0.06	3	44	6	<0.01	<5	2	5	<5	0.02	<10	<10	6	<10	14	5
345823	<0.2	0.85	<5	58	0.9	15	0.48	2	8	90	4	1.64	<1	0.09	<10	0.46	309	<2	0.07	5	379	4	<0.01	<5	2	16	5	0.13	<10	<10	45	<10	28	4
345824	<0.2	3.59	13	68	2.5	26	2.30	4	28	123	18	4.51	1	0.09	<10	1.99	740	<2	0.05	22	932	5	0.04	<5	10	65	<5	0.34	<10	<10	133	<10	106	42
Duplicates:																																		
345808	<0.2	1.89	<5	224	<0.5	29	1.83	3	13	66	16	3.73	<1	0.15	<10	1.37	716	<2	0.06	10	489	3	0.05	<5	9	71	<5	0.01	<10	<10	66	<10	73	3
345817	<0.2	1.38	5	348	1.2	35	0.76	3	14	82	13	3.09	<1	0.17	<10	0.80	392	<2	0.13	5	918	<2	0.01	<5	3	47	<5	0.20	<10	<10	102	<10	34	4
Standards:																																		
Blank	<0.2	<0.01	<5	<10	<0.5	<5	<0.01	<1	<1	<1	1	<0.01	<1	<0.01	<10	<0.01	<5	<2	<0.01	<1	<10	<2	<0.01	<5	<1	<1	<5	<0.01	<10	<10	<1	<10	<1	<1
CH-4	2.1	1.94	12	326	1.1	7	0.58	6	33	122	2180	5.15	<1	1.44	15	1.39	375	3	0.06	54	637	14	0.66	<5	8	7	<5	0.21	<10	<10	93	<10	213	13

A .5 gm sample is digested with 5 ml 3:1 HCl/HNO3 at 95°C for 2 hours and diluted to 25ml.

Signed: ____________________

Assayers Canada
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Vancouver, B.C.
V5X 4R6
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Fax: (604) 327-3423

Quality Assaying for over 35 Years

Geochemical Analysis Certificate

9V-1353-SG1

Oct-20-09

Company: **JM Stewart Surveys Ltd**
Project: ROD-STIR
Attn: JM Stewart

We *hereby certify* the following geochemical analysis of 6 soils samples submitted Oct-14-09

Sample Name	Au ppb
345825	<1
345826	29
345647	<1
345648	<1
345649	17
345650	2
*0211	2205
*BLANK	<1

Au F.A. AA finish

Certified by

Assayers Canada

8282 Sherbrooke St., Vancouver, B.C., V5X 4R6

Tel: (604) 327-3436 Fax: (604) 327-3423

JM Stewart Surveys Ltd

Attention: JM Stewart

Project: ROD-STIR

Sample type: Soils

Report No : 9V1353SJ

Date : Oct-20-09

Multi-Element ICP-AES Analysis

Aqua Regia Digestion

Sample Number	Ag ppm	Al %	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Hg ppm	K %	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	S %	Sb ppm	Sc ppm	Sr ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Zn ppm	Zr ppm
345825	<0.2	2.57	91	76	1.2	10	0.94	4	24	95	45	4.08	<1	0.09	<10	1.91	927	<2	0.04	75	791	10	0.02	<5	8	58	<5	0.17	<10	<10	101	<10	81	13
345826	<0.2	2.55	64	79	1.3	50	0.92	4	24	86	49	4.06	<1	0.12	<10	1.79	901	<2	0.05	69	744	3	0.02	<5	9	58	<5	0.17	<10	<10	104	<10	79	12
345647	<0.2	3.55	8	14	3.3	25	2.29	5	53	77	79	5.83	1	0.02	<10	2.60	975	<2	0.04	77	437	<2	0.04	<5	10	40	<5	0.62	<10	<10	218	<10	92	32
345648	<0.2	3.76	6	16	3.1	56	1.88	5	60	88	93	5.91	1	0.03	<10	2.59	1241	<2	0.03	81	489	<2	0.04	<5	11	44	<5	0.56	10	<10	202	<10	78	17
345649	<0.2	3.49	7	14	3.2	53	2.07	5	53	75	88	5.71	1	0.02	<10	2.61	981	<2	0.04	80	454	<2	0.04	<5	10	38	<5	0.59	<10	<10	204	<10	90	31
345650	<0.2	2.19	9	91	1.2	34	1.24	3	19	53	22	3.37	<1	0.07	10	1.09	847	<2	0.05	40	832	3	0.07	<5	7	131	<5	0.16	<10	<10	108	<10	61	7
Duplicates:																																		
345825	<0.2	2.59	85	77	1.2	9	0.94	4	24	95	44	4.03	<1	0.09	<10	1.91	935	<2	0.04	75	726	10	0.02	<5	9	59	<5	0.17	<10	<10	102	<10	81	13
Standards:																																		
Blank	<0.2	<0.01	<5	<10	<0.5	<5	<0.01	<1	<1	<1	1	<0.01	<1	<0.01	<10	<0.01	<5	<2	<0.01	<1	<10	<2	<0.01	<5	<1	<1	<5	<0.01	<10	<10	<1	<10	<1	<1
CH-4	2.1	1.94	12	326	1.1	7	0.58	6	33	122	2180	5.15	<1	1.44	15	1.39	375	3	0.06	54	637	14	0.66	<5	8	7	<5	0.21	<10	<10	93	<10	213	13

A .5 gm sample is digested with 5 ml 3:1 HCl/HNO3 at 95ºC for 2 hours and diluted to 25ml.

Signed: ____________________

APPENDIX IV   ANALYTICAL PROCEDURES

Rock Sample Analyses

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

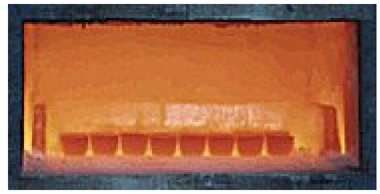
Gold and Precious Metal Analysis by Fire Assay

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.

COMPARISON OF DIFFERENT TRACE ELEMENT ANALYSIS METHODS

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	---	---	---

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