GEOLOGY, LITHOGEOCHEMISTRY AND GEOCHRONOLOGY STUDY

OF THE

GRANDUC PROPERTY

SKEENA MINING DIVISION

104B/1E, 1W, 8W

Latitude: 56°14'

Longitude: 130°20'

Owner:
Granduc Mining Corporation
2000-95 Wellington St. West
Toronto, Ontario
M5J 2N7

By:

G.L. Dawson P.Geo.[1], T.J. Barrett[2], F. Childe[2], P.D. Lewis[2] and G. Price P.Geo.[1]

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September 22, 1994

Volume 2

Cambria Geological Ltd.
Consulting Geologists

Hole No: GD147_1B
Project: Granduc
Property:
Claim:
Co-ords: N: 11899.39
(ft) E: 10360.79

Azimuth: 90.0
Dip: -65.0
Length(ft): 1995.00
Elevation (ft): 3267.28
Purpose:

Core Size: 0-780 HQ, 780-1528 NQ, 1528-1995.
Drill Name:
Contractor:
Started:
Completed:
Recovery:

Date Logged:
Logged By:
Date Re-logged: August 14/15, 1993
Re-logged By: G. Price
Report Printed: 14 Apr, 1994 10:46pm

DOWN HOLE SURVEY TESTS:

Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip
0.0	90.0	-65.0															
1200.0		-59.0	1400.0		-59.0	1600.0		-48.5									

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
.00	82.00	ANDESITE TUFF, Andesite T-LT(?) dark green, grainy, strongly broken and ground core, cave, bleached locally.										
82.00	222.00	ANDESITE TUFF, Andesite T (flow?) dark green, massive, grainy, brecciated, healed with cal.-quartz vein, strong chlorite (sericite) alteration, irregular foliation. 100.00 107.00 Bleached, strong amberite (quartz-cal.-sericite) alteration. 107.00 118.00 FAULT Fault, earthy gouge at 65-75 degrees to CA. 128.00 133.00 FAULT Fault, earthy chloritic gouge. 133.00 149.00 Bleached, strong, ak-quartz-cal. (sericite) alteration. 149.00 154.00 Broken core, earthy hematitic/geothitic. 180.00 191.00 Broken core, goethite. 206.00 216.00 Broken core, geothitie, strongly sheared at 25-35 degrees to CA. 216.00 222.00 Thin bedded at 40-50 degrees to CA.										
222.00	443.00	ANDESITE FLOW, Andesite flow with interflow cT: dark green, weak foliation at 40-50 to CA, feldspar phyric, strong chlorite alteration, cross-cut by 10-15% cal.-quartz veins. 370.00 381.50 Thin bedded at 30-40 degrees to CA. 399.00 411.00 Medium bedded at 25-35 degrees to CA.	1084	429.00	430.00	1.00						

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
443.00	561.50	CHERT, SILTSTONE, ARGILLITE, Chert-siltstone (felsic T)-(argillite): pale green, locally pale brown, very thin bedded (1-8 mm) at 40 to 50 degrees to CA, cross-cut by <3% cal-quartz veins. 555.50 561.50 Broken core, bleached with 10 cm clay sericite gouge.										
561.50	641.00	ARGILLITE, CHERT, Argillite-felsic T(chert): dark grey with brown, very thin bedded at 50-60 degrees to CA, strongly folded, loc. Graphitic alteration of argillite, mod. Sericite-chlorite-(biotite) alteration, cross-cut by <3% cal. Quartz veins.	1085	572.00	573.00	1.00						
641.00	644.00	FAULT Granduc fault: graphite gouge 2', quartz-graphite healed argillite breccia 2'.										
644.00	669.00	BASALT DYKE, Basalt dyke: medium green, <5% euh-anh stubby 1-2 mm pyroxene crystals.										
669.00	679.00	FAULT Granduc fault: graphite gouge with graphite + chlorite healed breccia.										
679.00	710.50	ANDESITE TUFF, ARGILLITE, FAULT Felsic T-argillite-fault gouge: pale green, very thin bedded at 20-40 degrees to CA, grainy 'tuffaceous' layers, strongly broken core, 25% argillite, 20% chlorite-clay-sericite gouge.										
710.50	751.00	ANDESITE TUFF, ARGILLITE, Felsic T-(argillite): pale green, thin bedded at 0-55 degrees to CA (folded, argillite 45-55 degrees), grainy tuffaceous streaky dismembered beds, local stratabound breccia, mod. Chlorite-sericite alteration, cross-cut by <5% cal.-quartz veins. 738.00 751.00 Breccia-wispy fragments healed with quartz-epidote-cal.										
751.00	775.00	ANDESITE TUFF, Andesite T(?) dark green, strongly folded at 30-45 degrees to CA, 30-50% 1-3 mm cal. Wisps (fp ghosts?) oriented parallel to fold, strong chlorite-epidote cal. Alteration, cross-cut by <3% cal. Quartz veins. 769.00 773.50 Strongly silicified, bleached. 773.50 774.00 ARGILLITE, Argillite, broken. 774.00 775.00 FAULT Fault - sericite-chlorite gouge.										
775.00	785.00	LOST CORE 4' Lost core, broken bleached, silicified, banded.										
785.00	794.00	BASALT DYKE,										

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		Bas. Dyke: fine grained, dark green, amygdules up to 1.5 cm.										
794.00	822.50	ARGILLITE, CHERT, Argillite-chert: black, fine grained, very thin bedded at 30-65 degrees to CA, argillaceous, wisps of dismembered beds, cross-cut by <3% cal-quartz veins, gradational decrease in argillite downhole.										
822.50	855.50	ANDESITE TUFF, Andesite(?) vfT-c xtal T: dark green, thin-thick bed, highly contorted/folded bedding, <1% euh 1-2 mm px crystals, local 25-40 cm beds of feldspar crystal rich (>30%, >1 mm) strong chlorite-epidote alteration.	1086 1087	829.00 852.00	830.00 853.00	1.00 1.00						
855.50	910.00	CHERT, ARGILLITE, ANDESITE TUFF, Chert-argillite-felsT: milky brown and black (20% chert), strongly folded +contorted thin beds, moderate chlorite-biotite alteration, <5% cal.-quartz veins also folded.	1088	895.00	896.00	1.00						
910.00	1107.00	MAFIC INTRUSIVE, Maf-int T, minor chert: dark green, thin band at 65-75 degrees to CA, grainy, loc. Folds +dismembered beds, <10% quartz-cal. Veins parallel to foliation banding. 1007.00 1070.00 'Gash banded' >25% cal.-quartz veins parallel to foliation. 1070.00 1075.00 Grainy cT, >60% wispy white/grey siliceous 'feldspar crystals/felsic clasts'. 1075.00 1107.00 'Gash banded' >30% cal-quartz veins parallel to subparallel to foliation.	1089 1090	1000.00 1091.00	1001.00 1092.00	1.00 1.00						
1107.00	1240.00	ANDESITE TUFF, ANDESITE FLOW, Andesite T/flow?: dark green, locally fp phyric, strong fold at 40-60 degrees to CA, epidote knots up to 25 cm, strong chl-epidote alteration, cross-cut by <10% quartz-cal. Veins, local stratabound breccia.	1091 1092	1152.00 1225.00	1153.00 1226.00	1.00 1.00						
1240.00	1530.00	ANDESITE TUFF, Andesite T-LT(?) dark green, strong fo at 35-35 degrees to CA, vague fp phyric rich layers (<2 cm thick) thin-medium banded, very strong chlorite alteration, cross-cut by <5% cal-quartz veins, 5% cal-quartz veins parallel to fo, trace coarse grained pyrite as dissem. And veins. 1416.00 1486.00 FT? finely schistose. 1486.00 1530.00 Core scrambled and 50% missing.	1093	1362.00	1363.00	1.00						
1530.00	1577.00	FELSIC BRECCIA, Sericite-quartz altered breccia: protolith unclear, dark-medium grey, subang-wispy fragments (0.1-5.0 cm), moderate foliation at 40 degrees to CA, trace dissem. Pyrite, cross-cut by <5% quartz-epidote veins. 1546.50 1549.00 QUARTZ VEIN, Quartz vein.	1094	1551.00	1552.00	1.00						

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
1577.00	1598.00	ANDESITE TUFF, Andesite T(?): very dark green, grainy fp relics(?), strong fo at 60-70 degrees to CA, strong chlorite alteration, 5% chalcopyrite in 0.5-3.0 cm bands parallel to foliation, strongly magnetic (very fine grained dissem. Magnetite).	1095	1594.00	1595.00	1.00						
1598.00	1618.00	QUARTZ VEIN, Quartz (sericite-chlorite) healed + altered breccia, amg-wispy fragments 0.1-5 cm, 60% quartz vein, trace very coarse grained pyrite + chalcopyrite, irregular foliation at 40-90 degrees to CA.										
1618.00	1995.00	ANDESITE TUFF, ANDESITE FLOW, Andesite T-flow: dark green, moderate, patchy+variable foliation, patches of fp phyric 'flow', strong pervasive chlorite alteration, patchy epidote alteration, trace dissem pyrite, cross-cut by <8% quartz-cal. Veins, patchy biotite alteration. 1618.00 1637.00 Fine grained, strong fo at 70-80 degrees to CA. 1637.00 1644.50 Bleached, silicified, breccia. 1645.00 1647.00 BASALT DYKE, Bas. Dyke, very fine grained with <5% 0.5 mm sausseritized euh. Fp crystals. 1647.00 1650.00 Bleached, silicified breccia. 1669.00 1677.00 Fp phyric. 1679.00 1693.00 Brown, strong biotite alteration, 20% 5-50 cm quartz vein. 1693.00 1722.00 Flow. 1722.00 1744.00 Brown, strong biotite alteration, 25% qaurtz vein/vein breccia, 8% very coarse grained dissem. Pyrite/vein pyrite. 1744.00 1787.00 CT, strong fo at 50-70 degrees to CA. 1787.00 1833.00 LOST CORE Core missing. 1833.00 1841.00 Bleached pale brown, 40% quartz (ksp) vein, 8% very coarse grained dissem. Pyrite. 1852.00 1861.00 Bleached medium-pale brown, broken core. 1906.00 1931.00 Broken core, drilling problems?. 1948.00 1995.00 Broken core, drilling problems?.		1697.00	1698.00	1.00						
1995.00		END OF HOLE										

Hole No:	GD153_1	Azimuth: 97.0	Core Size: 0-131 HQ, 131-340 NQ, 340-440 HQ, 440-2326 NQ	Date Logged:	
			Drill Name:	Logged By:	H. Madeirry
Project:	Granduc	Dip: -61.0	Contractor:		
				Date Re-logged:	August 14/15, 1993
Property:		Length(ft): 2326.00	Started: August , 1977	Re-logged By:	G. Price
			Completed:		
Claim:		Elevation: (ft) 5431.00	Recovery:	Report Printed:	14 Apr, 1994 10:45pm
Co-ords: N: (ft)	15320.00				
E:	10494.00	Purpose:			

DOWN HOLE SURVEY TESTS:

Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip
0.0	97.0	-61.0															
575.0	103.5	-51.0	1000.0	106.5	-44.0	1500.0	100.5	-30.5	2000.0		-25.5						

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
.00	94.00	SILTSTONE, CHERT, Siltstone-chert-: pale-medium grey green, thin bedded at 20-30 degrees to CA, broken core, cave limonite-goethite.										
94.00	377.00	SILTSTONE, CHERT, Siltstone-chert-(argillite): 85% siltstone, medium-pale brown+green, thin bedded at 20-30 degrees to CA, local stratabound breccia, moderate chlorite-sericite-biotite alteration. 126.00 131.00 Broken core with minor fe-oxide. 175.00 261.00 Fe-oxide on fractures. 261.00 274.00 FAULT Fault zone: carbonaceous with argillite gouge. 296.00 305.00 Bleached, moderate sericite alteration. 325.00 340.00 FAULT Fault zone: broken core, clay-chlorite gouge, with Fe oxide. 374.00 377.00 Broken core with Fe-oxide.										
377.00	626.50	SILTSTONE, ARGILLITE, CHERT, Siltstone-argillite (maf T?)-chert: medium dark green grey (+/- brown), thin bedded at 40-50degrees to CA, moderate strong chlorite alteration, loc. Biotite alteration, cross-cut by <5% cal. Quartz veins. 388.00 576.00 Broken core zone, minor Fe-oxide. 576.00 581.00 Bleached - ankerite altered breccia. 584.00 594.50 B.c. 594.50 599.00 Bleached, ak altered breccia.										

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		599.00 610.00 B.c., graphitic, breccia. 610.00 626.50 BASALT DYKE, Bas. Dyke: dark green very fine grained, breccia.										
626.50	708.00	FAULT Fault/alteration zone: 15% graphitic argillite 'fault slices', remainder is rusty brown and pale green breccia healed with quartz-cal.ank. Veins. 707.80 708.00 Cataclasite 3 cm at 40 degrees to CA.										
708.00	795.00	FAULT Fault/alteration zone: pale green, strong chlorite-sericite alteration, strongly b.c., >15% quartz. Cal veins, sericite-caly gouge at 759', 771' and 791'.										
795.00	801.50	CHERT, Chert-(int T?): medium brown, green, black thin bedded at 50-60 degrees to CA, >90% chert, cross-cut by <5% quartz-cal veins (hairline fractures).										
801.50	1030.00	ANDESITE TUFF, Andesite T: dark green, *coarse grained-fine grained* (90% *coarse grained*), >30% feldspar, anehdral-subhedral, weakly saussertizied, 0.5-2.0 mm, >25% 0.5-2.0 mm px replaced by biotite-chlorite, massive, thick bedded, local thin bedded fT (at 70-85 degrees to CA0, where very fine grained has <5% 1-2 mm subhedral fp, weak-moderate fo., moderate-strong chlorite (epidote-sericite) alteration, cross-cut by <3% cal. Quartz veins. 801.50 833.50 M-fT. 833.50 836.00 M-cT. 836.00 864.50 F-vfT. 864.50 935.00 C-vcT. 935.00 943.00 VfT-, thin bedded. 943.00 1001.00 M-cT. 1001.00 1011.00 F-vfT. 1011.00 1030.00 C-vcT.	63507 63508	821.00 871.00	822.00 872.00	1.00 1.00						
1030.00	1178.00	SILTSTONE, ARGILLITE, CHERT, Siltstone -(argillite-chert): pale green, pale brown, black milky green, thin bedded at 70-90 degrees to CA, weak-moderate chlorite-epidote (biotite) alteration, <3% quartz-cal. Veins parallel to bedding (foliation). 1089.00 1093.00 Resembles welded tuff, fiamme-like fragments/bed fragments. 1107.00 1155.00 Argillite 70%. 1155.00 1156.00 Breccia-graphitic gouge. 1156.00 1171.00 BASALT DYKE, Bas. Dyke, mud brown green, <15% 1-2 mm euh-subhedral px with <1% graphitic argillite breccia. 1171.00 1178.00 60% lost core, graphitic gouge, argillite breccia, tracy pyrite, cave.	63509	1091.00	1092.00	1.00						

INTERVAL (ft) From: To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
1178.00 1260.50	ANDESITE TUFF, 'Felsic T (?): pale green to pale grey (flesh) thin bedded at 60-90 degrees to CA, strongly disced. 1178.00 1204.00 Pale green, not disced, moderate chlorite-sericite alteration, grainy, loc. 'fp phyric' (<0.3 mm white crystals) cross-cut by <5% cal-quartz veins. 1204.00 1219.00 Bleached, strong quartz alteration with patchy chlorite + biotite alteration. 1219.00 1223.00 BASALT DYKE, Bas. Dyke-amygdules <1 cm (cal-quartz filled). 1223.00 1237.50 85% bleached quartz altered, 15% graphitic argillite, bc. 1237.50 1238.00 Graphitic gouge. 1238.00 1255.00 Bleached, quartz altered, strongly folded. 1255.00 1260.50 ARGILLITE, Argillite with 25% bleached silicified 'chert'.	63510	1214.00	1215.00	1.00						
1260.50 1301.50	ANDESITE TUFF, Andesite T with <5% chert beds: dark gren, fine grained with <5% 0.5-1.0 mm subhedral-subrounded px altered to biotite-chlorite, thick-thin bedded at 60-70 degrees to CA, strong perv. Chlorite (sericite) alteration, local strong biotite alteration, trace dissem po, loc strong epidote alteration.										
1301.50 1323.00	MAFIC INTRUSIVE, Maf-Int(?)T(?) breccia: dark green, strongly fo at 65-80 degrees to CA, fine grained strong chlorite-cal. Alteration, >25% cal.-quartz veins - almost matrix supported breccia, veins rotated into foliation with depth, trace-1% very fine grained dissem. Pyrite +po as lams.										
1323.00 1353.00	ANDESITE TUFF, Andesite T: dark green brown, strong chlorite-biotite alteration, strong fo at 80-90 degrees to CA, 1-3 mm bands of fp phyric (0.5-a.0 mm crystals) rich rock, strongly folded and contorted, >15% wavy chlorite wisps.										
1353.00 1451.00	FELSIC SCHIST, Chlorite shcist with <15% 'diorite'bands: dark green, strong chlorite alteration, stronlgy fo at 80-90 degrees to CA, 'diorite' is strongly silicified, bleached, weak sericite altered; patchy epidote alteration, trace pyrite. 1378.00 1397.50 70% bleached, silicified, protlith texture unclear. 1414.00 1425.00 40% bleached, silicified, protlith texture unclear. 1425.00 1451.00 95% chlorite schist.	63511 63520	1378.00 1406.00	1379.00 1407.00	1.00 1.00						
1451.00 1625.00	DIORITE, Diorite: medium pale grey, very coarse grained, 60% plag. (<1.5 cm euh/subh crystals), quarts-ksp matrix, cross-cut/ healed with 10-15%	63512 63516	1458.00 1569.00	1459.00 1570.00	1.00 1.00						

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		hairline cm chlorite veins, local sections (<20 cm) of finer grained plag (<3 mm), local <5 cm) strongly foliated chloritic sections, patchy epidote alteration, locally bleached + silicified. 1527.00 1566.00 Strong epidote alteration, brecciated, unclear protolith. 1566.00 1571.00 Strongly foliated, pale-dark green, fine grained, 'andesite'?. 1616.00 1625.00 Contact zone, 30% chlorite schist.										
1625.00	1744.00	ANDESITE FLOW, Andesite flow(?) dark green, fine grained, highly schistose at 70-90 degrees to CA, strong chlorite (epidote) alteration, 10% cal-quartz veins parallel to fo, foliation decreases downhole where px and fp crystals are visible (px 1-4 mm euh replaced by chlorite/biotite; fp <1 mm euh. Weakly suasseritized), trace chalcopyrite, po, pyrite and magnetite as discrete 1-3 cm massive veins/lams (all core split and sampled).	63513	1712.00	1713.00	1.00						
1744.00	1888.00	MAFIC INTRUSIVE, Maf-Int T(?): dark green, fine grained, strongly foliated, <10% 'fels-int' T (pale grey, sericite-quartz altered, grainy, in 1-3 cm lams parallel to fo), (pale grey, sericite-quartz altered, grainy, in 1-3 cm lams parallel to fo), fo at 70-80 degrees to CA, strong chlorite alteration, loc quartz veins boundined parallel to fo with pressure shadow growth, trace-2% chalcopyrite+po+pyrite (loc mag.) as stringers/lams + associated with quartz veins, cross-cut by <3% cal.-quartz veins. 1750.00 Assays not on previous drill log, sections shows 1.39-0.14, -.003-35' at 1750' associated with 'Fe form' (G. Price saw <0.5% Cu at this area). 1790.00 1817.00 Strongly magnetic >20% very fine grained magnetite. 1861.50 1888.00 10% chalcopyrite as stringer/mesh net texture in massive, very fine grained magnetite.	63514	1849.00	1850.00	1.00						
1888.00	2051.00	ANDESITE FLOW, Andesite -(Bas) flow(?): dark green, massive, loc. Px phyric (euh <2 mm replaced by biotite/chlorite, grainy (fp?) strong chlorite-epidote alteration, loc. Breccia healed with quartz-epidote veins, trace pyrite (chalcopyrite+po as veins). Cross-cut by <5% cal-quartz veins (-grainy=tuffaceous??), strong fo at 80-80 degrees to CA. 1944.00 1953.00 Bleached breccia healed with quartz-epidote. 1986.00 1991.00 Mealy quartz fp 'diorite' with subhedral crystals up to 6 mm, contact strongly foliated. 2030.00 2042.00 2-4% chalcopyrite, <1% po, <2% magnetite. 2042.00 2042.30 Diorite? dyke. 2042.30 2051.00 <2% chalcopyrite, <1% pyrite, <1% po, <2% magnetite.	63515 63517	1931.00 1987.00	1932.00 1988.00	1.00 1.00						
2051.00	2217.00	ANDESITE TUFF, Andesite T: dark green, fine grained, moderate fo at 80 degrees to Ca,	63518	2131.00	2132.00	1.00						

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		vague fp phyric 'lams' (beds?) 1-3 cm, massive, strong chlorite alteration, >10% px phenos (>2 mm, euhedral-subhedral) >30% 0.2-0.5 mm, subhedral plag, rare isoclinal fold, <8% quartz-epidote-cal veins <1 mm parallel-subparallel to foliation, trace chalcopyrite as veins + dissem. 2136.00 2147.00 LT-ALT - vague flow breccia texture. 2159.00 2176.00 FELSIC SCHIST, Chlorite-schist, 30% cal-quartz veins parallel to fo, 1-5 mm, folded boudined, broken core. 2182.50 2191.00 8% very fine grained dissem. Pyrite, with 1-3 cm crystals as quartz vein selvage. 2214.00 2217.00 Brown, strong biotite alteration.										
2217.00	2220.00	CHERT, Chert-vfT: pale green, massive, siliceous (flow contact?), cross cut by <5% quartz (cal. Veins) not foliated.										
2220.00	2326.00	DACITE, ANDESITE FLOW, Dacite (andesite) flow: medium green, >15% white euhedral-subhedral 0.5-1.0 mm fp crystals, <3% 1-2 mm px euhedral-subhedral crystals, massive, very hard (siliceous), mod. Epiodte-quartz alteration, cross-cut by <15% epidote quartz veins. 2280.00 2326.00 Medium dark green (andesite?), softe than above, moderate chlorite alteration.	63519	2241.00	2242.00	1.00						
2326.00		END OF HOLE										

Hole No:	GD158_1	Azimuth: 85.0	Core Size:	0-993 HQ, 993-2248 NQ, 2248-3157 BQ	Date Logged:	
			Drill Name:		Logged By:	
Project:	Granduc	Dip: -65.0	Contractor:			
					Date Re-logged:	August 5, 1993
Property:		Length(ft): 3157.00	Started:		Re-logged By:	G. Price
			Completed:	July 15, 1982		
Claim:		Elevation: (ft) 5220.00	Recovery:		Report Printed:	14 Apr, 1994 10:45pm
Co-ords: (ft)	N: 15896.00 E: 10099.00	Purpose:				

DOWN HOLE SURVEY TESTS:

Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip	Depth (ft)	Azimuth	Dip
0.0	85.0	-65.0															
1500.0	98.0	-60.0	2300.0	106.0	-51.0	2800.0	110.0	-42.0									

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.

.00 4.00

No core.

4.00 239.00 SILTSTONE, ARGILLITE,

Siltstone-argillite, minor (<2%) chert: medium-dark grey brown, well sorted, thin bedded (<1 cm) at 0-20 degrees to Ca, local isoclinal (folds parallel to bedding, weak-moderate biotite-chlorite alteration., weak carb. Alteration of argillite, Fe-oxide on fractures, <1% cal. Veins (<1 cm), slickensides on fractures, local 1-3 in. 'clastic dykes'?.

123.00 128.00 FAULT Fault zone - broken core, chlorite clay-sericite gouge.
147.00 175.00 FAULT Fracture zone - blocky, <1' broken core intervals.
175.00 181.00 FAULT Fracture zone - broken core, 8-10% cal-ankerite veins.
181.00 239.00 Dark brown-grey, moderate-strong biotite-chlorite alteration, bedding at 30-50 degrees to CA.
212.00 237.00 FAULT Fracture zone, blocky <2' broken core intervals.

239.00 322.00 CHERT, SILTSTONE, ARGILLITE,

Chert-siltstone-argillite: chert=medium dark blue-green, siltstone= dark red brown, well so, thin bedded (,1 cm) at 0-30 degrees to CA, local 'primary sed. Structures' (scour + fill, ripples), overprinted by 0.2-2.0 cm closed-isoclinal folds, boudinaged chert beds; moderate epidote-biotite-chlorite alteration (like compositional layering), <1% cal. Veins. (Note: 30% of epidote is recrystallized, in 0.1-0.8 mm

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		crystals, and in closts) Fe-oxide on fractures, and slickensides. 263.00 266.00 FAULT Fault zone - b.c., chlorite-clay-sericite gouge.										
322.00	490.00	SILTSTONE, ARGILLITE, CHERT, Siltstone-argillite-chert (<15% chert), medium-dark brown + grey, well so, thin bedded at 0-15 degrees to CA, local dismembered sheath folds, moderate biotite-epidote-(chl.) alteration. (NOTE: drilling parallel to bedding, any changes downhole are facies related), local epidote/chert breccia (stratabound); increasing fineness downhole, <5% cal. Veins. 450.00 451.00 BASALT DYKE, Basalt dyke - dark green black, fine grained, aphanitic groundmass with <3% acicular amphibole crystals < 2 mm long.										
490.00	659.00	SILTSTONE, CHERT, ARGILLITE, Siltstone-chert-argillite: dark grey-grey brown siltstone, pale grey chert, dark grey argillite, thin bedded (<0.5 cm) at 0-20 degrees to CA, closed to isoclinal 'sheath' folds, weak (loc. Mod.) biotite-chlorite alteration (diminishing biotite downhole), loc. Stratabound chert breccia, <5% cal veins with trace coarse grained pyrite on fractures. 624.00 626.00 FAULT Fracture-fault zone (bedding parallel) trace chlorite gouge. 639.50 641.00 FAULT Fracture zone. 651.50 658.00 Ankerite-(cal.-quartz) alteration, pervasive. 658.00 659.00 FAULT Fault zone, graphitic, slickensides, graphite (clay) gouge, 30-50 degrees to CA.										
659.00	777.00	ARGILLITE, CHERT, SILTSTONE, Argillite-chert-siltstone: dark grey argillite, medium-dark grey chert, dark grey-brown siltstone, thin bedded (<0.3 mm) at 0-20 degrees to CA, closed to isoclinal 'sheath' folds, weak (loc. Mod.) chlorite-biotite alteration, weak epidote alteration, <3% cal. Veins, loc dismembered beds, epidote is very fine grained, trace very fine grained dissem. Pyrite associated with ankerite-cal-(quartz) veins and vein breccia. 659.01 666.00 <8% ankerite-cal.-quartz veinlets (<0.5 cm). 726.00 728.00 Ankerite-cal. Alteration, pervasive and <15% veins + vein breccia (<2 cm thick). 775.00 777.00 QUARTZ VEIN, 10 cm ankerite-cal. Vein breccia with <10% 0.2 mm ankerite veins, trace dissem. Pyrite.										
777.00	818.00	ARGILLITE, DACITE, ANDESITE TUFF, Argillite-dacite/andesite fine tuff: dark grey-green, very thin bedded (<0.3 cm), dismembered closed-isoclinal 'sheath' folds, bedded at 0-25 degrees to CA, black-dark grey argillite, dark-medium green and./dac.T, (like compositional layering), mod. Epidote alteration (med.-fine grained-'recrystallized'), local 10-20 cm thick epidote rich beds with >10% broken angular plag. Crystals (0.5 mm), loc. Strong biotite alteration (<5%), <3% cal.-quartz veins.										

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.

808.00 812.00 Very strong epidote altered massive T.
812.00 818.00 Very strong biotite alteration.

818.00 832.50 FELSIC BRECCIA, FAULT
Breccia/fault zone: pale green, strong epidote alteration, subrounded-round fragments <10 cm, <15% matrix.
822.50 829.50 Fault zone, graphitic, bc (no gouge) abundant slickensides 0-40 degrees to CA.\.

832.50 855.00 SILTSTONE,
Siltstone (argillite): medium-dark grey, very thin bedded (<2 mm), closed-isoclinal 'sheath' folds, mod.-weak epidote-sericite?-chlorite alteration, <3% cal-quartz veins.

855.00 923.00 CHERT,
Chert (vf felsic T-siltstone): 90% chert=milky pale green and pale grey, <8% vfT=pale green, <3% grey-grey-black siltstone, (<5% pale brown biotite chert), open-isoclinal 'sheath' folds, very strong pervasive epidote alteration (+quartz alteration=chert protolith?), <4% cal. Quartz veins.
895.00 908.00 >15% 1-2 mm ankerite-cal. Veins.
901.00 904.00 Ankerite-chert breccia (stratabound).
912.00 922.00 10% chert, protolith unclear, fine grained 'grainy', laminated, trace fine grained pyrite veins (<1 mm).
922.00 923.00 >70% chert, <5% fine grained pyrite, 'stratabound'?, ptygmatic cross-cutting veins? (both).

923.00 978.00 ARGILLITE, SILTSTONE,
Argillite-siltstone: dark grey and grey-brown, thin bedded (<1 cm), strongly disrupted bedding from 0-70 degrees to CA, folded into wispy flame-like closed-isoclinal 'sheaths', mod.-strong patchy biotite alteration, mod-weak patchy epidote alteration, trace 1-2 cm wisps of chert 'beds', <5% cal. Quartz veins.
938.00 940.50 FAULT Broken core/fault zone, minor graphite, slickensides, no gouge.
968.00 978.00 FAULT Broken core/fault zone, graphitic with trace dissem. Pyrite on graphite-coated fracture planes, <1 cm graphite-clay gouge, slickensides (>1/15 cm).

978.00 1001.00 CHERT, ARGILLITE, SILTSTONE,
Chert-argillite-siltstone: med.-pale green chert + siltstone, dark grey-black argillite)<15% pale-med. Brown chert) 40% chert, 20-50% argillite, <20% siltstone, thin bedded (<1 cm) at 40-60 degrees to CA, local isoclinal to open folds, mod.-strong pervasive epidote alteration, patchy mod.-strong biotite alteration increasing with depth, <8% cal-quartz veins.
985.00 1001.00 FAULT Broken core/fault breccia zone - slickensices >1/20cm

INTERVAL (ft) From: To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
	998.00 998.20 Fault - 2 cm graphite gouge/breccia matrix. 998.20 1001.00 Breccia-healed with cal., bleached siliceous angular fragments (<5 cm).										
1001.00 1114.00	SILTSTONE, ARGILLITE, CHERT, Siltstone-argillite-chert: (equal proportions) med.-dary green, grey, brown, thin bedded <1 cm at 40-60 degrees to CA mod. Biotite-epidote alteration, loc. 1-2' chert cominant sections, local isoclinal fold, <8% cal. Quartz veins. 1024.00 1027.00 FAULT Broken core, slickensides. 1027.00 1045.00 Core out of order - box dropped?. 1088.00 1094.50 Chert (70%). 1094.50 1095.00 Fracture zone, bleached, slickensides.										
1114.00 1238.00	SILTSTONE, ANDESITE TUFF, ARGILLITE, Siltstone-andesite tuff-argillite: 45% med. Brown siltstone, 35% pale med. Green siltstone, 15% pale-med. Green plag. (<0.5 mm) phyric and fT, <5% dark grey argillite, thin bedded (0.5-1.0 cm) at 40-60 degrees to CA, rare scour mark and small scale (<5 cm) growth fault, mod.-strong biotite-epidote alteration, <5% cal. Quartz veins (<2 mm), and T locally in beds 2-10 cm thick, <20% plag. Angular broken crystals (rare plag. Crystals) in adjacent biotitic siltstone, trace dissem. Chert bed (<5 cm). 1225.00 1238.00 Andesite T-massive, fine grained, vague 0.1 mm subhedral plag. Crystals.										
1238.00 1238.10	FAULT Fault - 1 cm cal. (clay) gouge.										
1238.10 1291.00	ANDESITE TUFF, SILTSTONE, CHERT, Andesite T-siltstone-chert: 75-80% dark grey green andesite fT, 15-20% dark brown siltstone, <5% milky grey chert, thin-med. Bedded (2-25 cm) thickening downhole, streaky vague mineral lineations (<1 mm plag?), mod. Chlorite alteration increasing downhole, mod.-weak biotite alteration (siltstone) diminishing downhole. 1238.10 1250.50 Strong biotite alteration 20% chert, breccia. 1261.00 1263.00 FAULT Fault at 40 degrees to CA, 2 mm cla.-clay go, slickensides, broken core, 2 cm breccia. 1264.00 1264.50 FAULT Fault at 20 degrees to CA, 0.5 cm chlorite gouge, broken core.										
1291.00 1346.00	ANDESITE FLOW, Andesite (bas. And.) flow? fine tuff?: dark green, fine grained, grainy tuffaceous texture, vague patchy foliation (So?), strong chlorite alteration (pervasive), weak epidote alteration, <4% cal. Veins, local breccia sections with angular-round fragments <5 cm (=flow breccia?). 1311.50 1323.00 CHERT, Chert-and. FT: locally bleached, locally thin bedded at 40-80 degrees to CA, brecciated.										

INTERVAL (ft) From: To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.

1324.50 1346.00 FAULT Fracture/fault zone: broken core, 80% andT-(chert), slickensides.
1345.00 1346.00 FAULT Fault 20 cm, chlorite healed cataclasite, 10 cm chl. Gouge at 50 degrees to CA.

1346.00 1367.50 BASALT,
Bas. (bas-and.) flow with 20-30% interflow tuff + chert: dark green, fine grained massive, local hairline fractures with vague alteration frims give local clastic appearance, <2% 'pyr-amphibole' subhedral ghosts <2 mm replaced by chlorite, strong pervasive chlorite alteration, <5% cal. Quartz veins, moderately broken core throughout.

1367.50 1539.00 FAULT QUARTZ VEIN,
Fault zone: host stratigraphy variable, intensely foliated, 15-20% cal.-quartz veins parallel to foliation at 50-60 degrees to CA, strong pervasive chlorite (cal.) alteration, local ankerite, biotite alteration, moderate-strong bc.
1367.50 1374.00 Chert breccia, strong bc, slickensides.
1374.00 1393.00 AndT?? breccia, healed with cal. Veins,. Moderate biotite alteration, local strong bc with clay gouge local ankerite.
1393.00 1412.00 AndT?? increasing foliation downhole, strong ankerite alteration, vein alignment + (cal.) more pronounced, local strong bc with clay gouge.
1412.00 1428.00 AndT? fissile, laminated, pale green, moderate bc, local open folds.
1428.00 1444.00 Chert/felsic breccia, bleached pale grey, subangular-angular fragments <5 cm, banded cherty layers.
1444.00 1472.00 AndT?-chert breccia: strongly broken, 20% chert fragments <8 cm.
1472.00 1480.00 AndT? (chert) brecia: <5% chert, finely laminated andT?.
1480.00 1508.00 AndT? chert brecia: 30% chert, andT(?) fragments angular <5 cm, low-moderate bc.
1508.00 1515.50 Chert-andT? breccia: >70% chert (silicified? pale grey), increasing andT? with depth strongly bc, minor clay gouge.
1515.50 1528.50 Plag.-quartz 'porphyry flow': siliceous, medium grey green, 'globular' 1-4 mm silicified and. Weakly sausseritized fp subhedral to rounded crystals.
1528.50 1531.00 Rubble-chlorite gouge, strongly bc.
1531.00 1538.00 Chert-andT(?) breccia, healed with chlorite-quartz, andT(?) angular fragments <10 cm.
1538.00 1539.00 Chlorite-plag.(?) py cataclasite: disced, <15% fine grained pyrite, 65-75 degrees to CA.

1539.00 1549.50 CHERT, ANDESITE TUFF,
Chert-AndT(?)(argillite): med. Dark grey green, chert-argilite diminish with depth from 80% - 20%, and.(?)T is very fine grained, thin bedded at

INTERVAL (ft) From: To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.

45 degrees to CA (0.5-1.0 cm bedding thickening with depth to 5 cm) strong chlorite alteration, >8% cal-chlorite veins, local boudinaging + scour+fill.

1549.50 1580.00 ANDESITE FLOW,
And.-bas(?)fT (flow? unlikely) dark green, fine grained, clast supported breccia texture healed with discontinous unaligned cla.-quartz veins, giving subangular (wispy)/shredded clastic like/breccia appearance, 'fragments of breccia' have grainy tuffaceous texture, variable strong chlorite +/- biotite alteration, local thin bed sections, 15-20% cal.-quartz veins (chaotic to aligned with foliation to depth), trace fine grained dissem. Pyrite.
1549.50 1555.00 Strong chlorite alteration.
1555.00 1563.00 Strong biotite alteration.
1565.00 1571.00 And-basT(?) chert, thin bedded 30-40 degrees to CA, dark green with brown biotitic chert.
1571.00 1580.00 Strong biotite-chlorite alteration, 10 cm section resembles flow top breccia with hyaloclastite.

1580.00 1675.00 DACITE, ANDESITE TUFF, CHERT,
Dac.-and-chert)fT: pale-med. Grey green, thin-medium bedded (,10 cm) at 20-35 degrees to CA, plag. Phyric with 10-20 cm sections with >15% 0.1-1.0 mm euhedral-subhedral broken crystals, well so with <5% mT (0.5-a.0 mm fragments), moderate-strong chlorite alteration, local strong biotite alteration, treace rhy. Quartz crystal in 1-3mm lams (0.2 mm quartz crystals), trace leuc. 'dits' on more felsic pale green sections, trace coarse grained 1-3 mm euhedral dissem. Py <10% cal.quartz veins.
1616.00 1622.50 Strong biotite alteration.
1622.50 1623.50 FAULT Broken core - fault zone - minor chlorite gouge.
1630.00 1654.00 Aphyric, breccia healed with cal.-quartz veins (bas.-and.?).
1662.50 1665.00 Broken core + gouge (chlorite) at 20-35 degrees to CA.
1672.00 1675.00 'Flaser' like texture, moderate-strong epidote-chlorite alteration.

1675.00 1725.00 ANDESITE TUFF, DACITE, CHERT,
Andesite fT (dacite-chert): dark-medium pale ghreen, very thin bedded (<2 mm) to laminated at 35-35 degrees to Ca. <1% <0.3 mm euhedral plag. Crystals in 1-3 mm beds, local isoclinal 'sheath' folds, dismembered beds, strong chlorite alteration, patchy strong-medium epidote alteration. Local beds of strong biotite alteration (<2 cm thick), <3% cal-quartz veins, chert <5%.
1724.00 1725.00 Broken core, slickensides, trace chlorite gouge.

1725.00 1754.00 BASALT,
Bas. FT(?) breccia: dark green to bleached, very fine grained fragments up to 3 cm, rounded-angular-feathered wispy ends, breccia healed with

INTERVAL (ft) From: To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.

cal.-quartz (epidote), matrix increasing with depth to wispy matrix supported (from 10% matrix to 60% matrix), trace dissem. Euhedral pyrite, where most intensely6 altered mafic fragments are dark green withy leucoxene dissem., moderately-strongly broken core throughout.

1754.00 1787.00 ANDESITE TUFF,
Andesite fT: dark green, fine grained, plag. Phyric, fining up in >20 cm beds, well so, <0.8 mm euhedral-subhedral broken and elongate plag., trace 1-1./5 mm pyroxene euhedral replaced by chlorite, moderate-strong chlorite epidote alteration, rare local strong biotite alteration.
1780.00 1782.50 Bas.-dyke/flow: dark green, fine grained, flow/foliation.

1787.00 1803.00 ANDESITE TUFF,
Andesite-dacite mT: medium pale brown-green, well so, thick bedded (>30 cm) 0.5-2.0 mm grain/crystal size, >25% euhedral-subhedral broken/whole weakly moderate sausseritized plag. <10% dark green 'schiller' euhedral broken/whole stubby px., <15% wispy/blocky 'andesite' clasts, 90% oriented crystals + clasts, weak-moderate pervasive biotite alteration (fo 40-60 degrees to CA).

1803.00 1844.00 CHERT, DACITE,
Chert-f-very fine dacite T: pale green brown, 35% biotite-chert, thin bedded (1-8 mm) at 60-70 degrees to CA, <5% 1-2 mm plag crystals T, minor boudinaging, minor closed-isoclinal folds, local vein brecciation, pervasive moderate-strong biotite alteration, patchy moderate chlorite alteration, <3% cal.-quartz vein.

1844.00 1864.50 DACITE, CHERT, FAULT
Dacite dyke (50%)- chert/tuff (50%) fault zone: pale green dyke-plag. (>20%) pyroxene (trace) phyric (<1 mm) with moderate bc: strongly disced parallel to strong foliation, pale green brown chert-T, moderate-strong chlorite alteration, chlorite (clay) gouge, strongly bc, <3% cal.-quartz veins.

1864.50 1882.00 FAULT
Fault zone: black, carbonaceous, 40% carb. Gouge, 10% very thing laminated very fine grained black argillite, strongly contorted + folded, remainder is quart-cal. Vein breccia, strongly bc, minor 10 cm sections cataclasite.

1882.00 1889.00 DACITE,
Dacite dyke: pale green, ?25% 0.5 mm euhedral 0.5 mm px., >60% resorbed plag. (vague) massive, moderate bc, moderate sericite-chlorite alteration.
1884.00 8 cm carbonaceous cataclasite at 45 degrees to CA.
1888.80 1889.00 Fault - carbonaceous breccia, carb. Gouge 60-70 degrees to CA.

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
1889.00	1956.00	DACITE, CHERT, Dacite fT (20% chert): pale green, local pale red brown, thin bedded (0.5-1.0 cm) at 30 degrees to CA, grainy with gragments/plag. <0.1 mm, strongly foliated + boudinaged, unlikely preservation of primary texture, local folds, moderate sericite-epidote-chlorite alteration, local strong biotite alteration, <3% cal.-quartz veins (80% of which are parallel to foliation). 1889.00 1892.00 Chert-argillite, thin bedded at 60-70 degrees to CA. 1892.00 1899.50 Chert-argillite breccia, pale green-brown, increasing bc downhole. 1899.50 1900.00 Fault - chlorite-clay gouge. 1900.00 1907.50 Strongly aknerite altered, very thinly laminated brecciated-boudinaged siltstone/chert, weakly bc. 1907.50 1913.00 Strongly biotite brecciated 'siltstone', 25% cal-quartz veins. 1921.00 1925.00 Strong pervasive ankerite alteration. 1933.00 1935.00 Breccia (vein) moderate-strong biotite alteration. 1946.00 1956.00 Strongly boudinaged.	1036	1926.00	1927.00	1.00						
1956.00	2050.00	ARGILLITE, DACITE, Argillite-Dacite(?) T: black argillite, pale green dacite, thin bedded 30-40 degrees to CA, 40% argillite, local <5%) plag. Phyric (<0.5 mm) sections of dacite, moderate siliceous argillite, local 5-10 brecciated intervals, <5% quartz-cal. Veins primarily associated with breccia. 1978.00 1982.00 Dacite px.-plag. Phyric dyke, pale green, zoned, >25% >0.5 mm plag. Locally stained pyrite. 1983.00 2017.00 70% siliceous 'chert', <0.5% coarse grained dissem. Pyrite localized in 5% over 10 cm, 30% quartz vein/vein breccia. 1983.00 2050.00 VERY POORLY SPLIT, local argillite/cabronaceous argillite sheared sections (hydraulic splitter?). 2017.00 2029.00 Argilliaceous-carbonaceous, with coarse grained pyrite on fractures. 2029.00 2050.00 Possibly disced.	1037	1966.00	1967.00	1.00						
2050.00	2084.00	CHERT, DACITE, Chert-Dacite T: pale green brown, thinly bedded (205 mm) at 30-45 degrees to CA, moderate disced, strongly siliceous local isoclinal folds, moderate patchy biotite alteration, trace very fine grained pyrite + po, increaseing chert + pyrite + po with depth.	1038	2080.00	2081.00	1.00						
2084.00	2194.00	DACITE, ANDESITE TUFF, Dacite-andesite T (chert): medium dark grey green, thin bedded (1 cm) at 50-60 degrees to CA, grainy tuffaceous texture, local very fine T grey to white beds, minor isoclinal folds, 3-8% pyrite + po as stratabound thin lams, oxidized pyrite locally resembles chalcopyrite, moderate-epidote chlorite alteration, increasing chlorite alteration with depth,	1039 1040 1041	2097.00 2147.00 2183.00	2098.00 2148.00 2184.00	1.00 1.00 1.00						

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		coarsening + increasing mafic component with depth. 2118.00 2130.00 Px phyric, >20% 0.5-1.0 mm euhedral px. 2130.00 2159.00 Trace pyrite, no po found - andesite T, px phyric. 2159.00 2194.00 Strong chlorite alteration, fine grained, aphyric <3% pyrite + po stratabound in 0.5-1.5 mm lams, mod to strongly fo-streaky, increasing chlorite with depth.										
2194.00	2579.50	DIORITE, Diorite Feldspar-(quartz) with 5-10% coarse tuff: medium-light grey-white, mg-very coarse grained (1.5 cm crystals) broken, euhedral 'plag.' local with hariline fractures filled with chlorite, locally 'grades' into narrow (<30 cm) intervals of fT, moderate-strong fo at 40-50 degrees to CA, strong pervasive mineral alignment (10% unaligned), wispy augen-like feldspars with local pressure shadow growth, local strongly bleached sections (<60 cm) spatially associated with quartz veins, trace dissem. Pyrite + po, mod. Quartz alteration? with chlorite matrix. 2209.00 2216.50 FAULT Fault zone, weak pervasive ankerite alteration, 1-3 cm clay-chlorite gouge, fo at 40-60 degrees to CA. 2373.00 2376.00 FP tuff dark green, fine grained, acicular 1-3 mm feldspars (local tourmaline?). 2485.00 2506.00 QUARTZ VEIN, Quartz (cal) vein: 40% + bleached, with 1% very coarse grained pyrite. 2526.00 2528.00 CHERT, 'Chert' - strongly silicified, fine grained with <1 cm chlorite bands. 2530.00 2577.00 QUARTZ VEIN, 20% quartz (cal.) vein, bleached silicified envelope, trace coarse grained dissem. Pyrite.	1042	2199.00	2200.00	1.00						
2579.50	2746.00	BASALT, 'Bas'(?)fT: very dark green, fine grained, moderate-stronlgy schistose, loc. Vague 'lapilli tuff' clastic texture with globular 'fragments' <5 cm of paler green rx (alteration texture?), local isoclinal-ptygmatic folds,k local banding (bedding/compositional layering), 0.2-2.0% chalcopyrite, <1% magnetite as 1-2 mm thcik wisps parallel to foliation, very strong chlorite alteration with local epidote alteration. 2615.50 2665.00 Bas-andesite fT - 1-5 mm intervals of grainy fp bearing tuff (fp <0.5 mm).	1043	2598.00	2599.00	1.00						
			1044	2680.00	2681.00	1.00						
			1045	2694.00	2695.00	1.00						
			1046	2743.00	2744.00	1.00						
2746.00	2839.00	ANDESITE FLOW, Andesite (Int) flow(?): dark green with local red brown, fine grained with <10% plag. Phyric (0.3-2.0 mm crystals) massive, weak foliation, no crystal alignment except adjacent to epidote veins, strong pervasive chlorite alteration, cross-cut by 5-8% epidote (quartz-cal.)veins of which 40-50% are parallel to foliation (60-70 degrees to CA)) trace 0.2% chalcopyrite, trace po, trace magnetite as dissem. And wisps/veins parallel + cross-cutting fo. 2795.00 2804.00 Strong biotite alteration.	1047	2776.00	2777.00	1.00						
			1048	2799.00	2800.00	1.00						

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		2813.00 2839.00 Strong biotite alteration, 8-10% pyrite, 0.5-1.0% chalcopyrite, po + magnetite.										
2839.00	3157.00	ANDESITE FLOW, Andesite (bas) flow(?): dark green, fx + px phyric (<10% of total trace 0.2-1.0 mm euhedral-subhedral, trace 0.5-1.5 mm subhedral plag. Massive, weakly fo, vague flow boundaries (conc. Epidote veining and breccia), local weak-moderate foliation of aphyric 'interflow tuffs' strong pervasive chlorite alteration patchy strong epidote alteration, <2% cal.-quartz veins, <2% epidote veins.	1049	2848.00	2849.00	1.00						
			1050	2978.00	2979.00	1.00						
			1051	3061.00	3062.00	1.00						
			1052	3135.00	3136.00	1.00						
		2855.00 2871.00 Strong biotite alteration 1-2% coarse grained dissem. Pyrite, trace chalorpyrite 'splashes', weak-strong for 60-80 degrees to CA.										
		2943.00 2960.50 Strong biotite -cal. Alteration, 25-30% cal. Veins parallel to fo (<1 cm thick).										
		3021.00 3025.00 QUARTZ VEIN, Quartz vein with clost very coarse grained pyrite.										
		3025.00 3044.00 25-35% hairline fractures-chlorite-biotite filled parallel to fo.										
		3044.00 3150.00 Moderate fo with biorite-rich sections, trace dissem. Coarse grained pyrite, trace molybdenite associated with very coarse feldspar vein with apple green soft very fine grained mineral.										
		3150.00 3157.00 Cave/gouge.										
3157.00		END OF HOLE										

Hole No:	GD158_2A	Azimuth:	81.7	Core Size:	0-813 HQ, 813-2221 NQ, 2221-2684 BQ
				Drill Name:	
Project:	Granduc	Dip:	-75.4	Contractor:	
Property:		Length(ft):	2684.00	Started:	
				Completed:	
Claim:		Elevation: (ft)	5220.00	Recovery:	
Co-ords: N:	15895.83				
(ft) E:	10098.29	Purpose:			

Date Logged:
Logged By:

Date Re-logged: August 7-10, 1993
Re-logged By: G. Price

Report Printed: 14 Apr, 1994 10:45pm

DOWN HOLE SURVEY TESTS:

Depth (ft)	Azimuth	Dip
0.0	81.7	-75.4
50.0	82.1	-52.5
250.0	81.6	-52.8
750.0	84.1	-50.9
1250.0	92.9	-47.3
1750.0	98.7	-43.8
2200.0	101.5	-40.3

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
.00	4.00	No core.										
4.00	955.00	SILTSTONE, ARGILLITE, DACITE, Siltstone-argillite-dacite vfT-(chert): medium-dark brown green, black thin bedded (0.5-10 cm) at 0-20 degrees to CA, rare slump structures, closed-isoclinal folds (<10 cm), strong biotite, weak chlorite alteration, local breccia stratabound, argillite 40-70%, siltstone 40-70%, chert <3% dacite T(?) <15% (grainy grey-white T). 4.00 154.00 Iron-oxide on fractures. 154.00 158.00 Fault - graphitic gouge + breccia (not healed) at 50-60 degrees to CA, 10 cm cataclasite with trace coarse grained pyrite. 168.00 173.00 FAULT Fault at 10-15 degrees to CA, folded, strongly adjacent to bedding parallel 2-5 mm gouge, graphitic gouge. 173.00 255.00 Broken core- blocky, angular, iron-oxide on fractures. 255.00 311.00 Argillite 70%. 344.00 414.00 Argillite 80%. 432.00 434.00 Dacite m-fT, feldspathic thick bed at 40 degrees to CA, trace quartz crystals. 438.00 443.00 BASALT DYKE, Bas.-dyke - very dark mud green with <20% acicular hb crystals. 476.00 479.00 Carb. Gouge at 25-35 degrees to CA. 479.00 638.00 Dacite T 25-35%.										

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter- val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		638.00 639.00 2 cm graphitic gouge at 30-35 degrees to CA. 639.00 650.50 AndesiteOdacite T, massive medium-grained-fine grained, med. Grain- grainy 0.2-0.4 mm subhedral fp crystals. 650.50 698.50 Argillite 85-90%, bedded 30-40 degrees to CA. 698.50 788.00 Bedded 50-80 degrees to CA. 788.00 798.00 Broken core, minor graphitic gouge. 837.00 855.00 50% dacT. 873.00 898.00 Massive, with vague local bedding at 40-60 degrees to CA.										
955.00	966.50	FELSIC BRECCIA, 'Felsic' 'tuffaceous-lapilli stone' breccia: grades from mottled flesh pink and grey to black, angular to subangular oriented bleached thingly laminated fragments with very fine grained-fine grained grey siliceous matrix with angular 'shardy' clasts, 'cataclasite', strong foliation at 35-40 degrees to CA, <3% ptygmatic quartz veins, 1-2% quartz-cal. Veins parallel to foliation. 955.00 959.00 Ankerite altered 1-2% pyrite (chalcopyrite-po), bleached. 959.00 966.50 Black-grey argillite breccia.										
966.50	1072.00	ARGILLITE, Felsic tuff-agrillite: flesh tan T and black argillite, 20% argillite (siliceous) in 3-30 cm beds, very thinly laminated and streaky with 0.5-1.5 siliceous wispy bed/bed fragments, rare 1-3 mm siliceous augens with pressure shadow growth, strong fo at 25-50 degrees to CA, trace dissem. Chalcopyrite as 1-3 mm clots and discontinuous wisps/veins both cross-cutting and subparallel to bedding, trace pyrite + po dissem. Parallel to fo, strong pervasive silicification, patchy quartz-ankerite alteration, cross-cut by <10% quartz veins. Note: stained at 997' for kspar - none. 1002.00 1002.20 2 cm massive po + pyrite (trace chalcopyrite) parallel to fo with chert/quartz vein base. 1040.00 1055.50 BASALT DYKE, Bas. Dyke, dark green black, fine grained, >1% euhedral 1-2 mm px, internal breccia with angular fragments up to 5 cm, strong chlorite alteration, no fo. 1056.50 1060.00 BASALT DYKE, Bas.-dyke. 1060.00 1072.00 FAULT Sheared strongly, graphitic, 2-10 cm cataclasite, not healed with graphite gouge.	1001 1002	994.00 1002.00	995.00 1003.00	1.00 1.00						
1072.00	1106.00	FELSIC SCHIST, Sheared 'felsic schist': med-pale green, 35-55% quartz-cal vein subparallel to foliation, strongly fissile, local grainy tuffaceous sections (<20 cm), strong chl-(ser) alteration, <3% chlorite gouge, strongly broken core, minor isoclinal folds, lamianted at 30-40 degrees to CA. 1072.00 1078.00 Strongly silicified. 1102.20 1102.80 Chert/chert T, thin bedded at 35 degrees to CA. 1102.80 1106.00 Strongly broken core, strong chlorite-sericite alteration.										

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
1106.00	1112.50	RHYOLITE, Rhyolite (dacite?) T: pale grey-flesh tan, fine grained - locally grainy, thin medium bedded at 50-60 degrees to CA, <5% creamy white chert lams/beds, strong quartz-ankerite alteration, trace very fine grained dissem. Pyrite.										
1112.50	1148.00	ANDESITE TUFF, Andesite-dacite(?) T: dark green, strongly fo at 40-50 degrees to CA, <20% dacite(?) T as wispy lams/beds, local mylonite-lo=ike breccia 1-2 cm, strong chlorite alteration, >15% cal-quartz veins subparallel to fo, storngly broken core, minor chlorite gouge at 50-60 degrees to CA.										
1148.00	1222.50	RHYOLITE, FELSIC BRECCIA, Rhyolite T-LT breccia: pale flesh tan to grey, angular to stretched elongate wispy silicified fine grained framents (<5 cm), pale brown sericite-biotite altered matrix 'mylonite texture' where very coarse grained, strong quartz alteration, mod. Sericite-biotite alteration, fo at 40-50 degrees to CA, trace dissem. Pyrite, local chlorite zones, local ankerite alteration. 1167.00 1186.00 Andesite T, dark green, chloritic, strongly fo, bc, <20% rhyolite (=sheared dykes?? with ripped up rhyolite fragments-sheared also). 1204.50 1210.00 Massive, silicified breccia with trace pyrite, chalcopyrite in fractures. 1210.00 1219.00 Chloritic, broken core, strongly sheared. 1222.00 1222.50 Clay-chlorite-sericite gouge at 50 degrees to CA.	1003 1004	1166.00 1204.00	1167.00 1205.00	1.00 1.00						
1222.50	1287.00	CHERT, ARGILLITE, Chert-argillite (rhyolite): dark grey-black, thin bedded at 50-60 degrees to CA, local stratabound breccia (<10 cm) with angular crackle brecia, trace dissem. Acicular pyrite, strongly silicified. 1233.00 1246.50 Chert-rhyolite 100%, moderate biotite altered matrix. 1246.50 1282.00 FAULT Fault zone - strong chlorite alteration, strongly broken core, local gouge, cataclasite, argillite-chert blocks (<20 cm).	1005 1006	1230.00 1234.00	1231.00 1235.00	1.00 1.00						
1287.00	1382.00	DACITE, Dacite T-(argillite-chert) >80% Dacite: dark-medium green, fine grained-medium grained, thin-thick bedded (1-40 cm) at 40-50 degrees to CA, local fp phyric (crystals euhedral + broken <2 mm), where coarser = mixed crystal-lithic T with <1% 'schiller' blocky px, strong chlorite alteration with local strong biotite alteration. 1341.00 1351.00 CT, stained for Ksp. At 1350' (trace Ksp.). 1377.00 1382.00 CT.	1007 1008 1009 1010	1317.00 1347.00 1351.00 1360.00	1318.00 1348.00 1352.00 1361.00	1.00 1.00 1.00 1.00						
1382.00	1459.00	DACITE, CHERT,										

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
		Dacite T-chert: medium-pale green very strong silicification, thin bedded	1011	1385.00	1386.00	1.00						
		at 60-70 degrees to CA, grainy feldspathic (<0.2 mm) >40% chert, local	1012	1388.00	1389.00	1.00						
		brown biotitic beds (<2%), <3% cal. Quartz veins.	1013	1451.00	1452.00	1.00						
1459.00	1502.50	ARGILLITE, CHERT, DACITE,										
		Agrillite-chert-dacite fT: dark grey - pale green argillite >70%, thin	1014	1478.00	1479.00	1.00						
		bedded 70-80 degrees to CA, local thick dacite sections (<40 cm) strongly										
		silicified. Loc. Wispy/boudinaging, <2% cal. Veins.										
1502.50	1511.00	FAULT										
		Fault: graphitic-chlorite >40% gouge, strongly bc at 60-75 degrees to CA,										
		contains <5% bas.dyke fragments.										
1511.00	1525.50	BASALT DYKE,										
		Bas.-dyke: medium-pale green, px-amph. Phyric.										
1525.50	1804.00	ARGILLITE, CHERT, DACITE,										
		Argillite-chert-dacite fT (40% argillite, 30% chert, 30% dac fT); thin	1015	1585.00	1586.00	1.00						
		bedded at 55-70 degrees to Ca, black argillite, milky blue-green chert,	1016	1588.00	1589.00	1.00						
		pale green dacite, moderate chlorite-epidote alteration increasing with	1017	1599.00	1600.00	1.00						
		depth.	1018	1680.00	1681.00	1.00						
		1753.00 1804.00 Trace dissem. Pyrite-po.	1019	1776.00	1777.00	1.00						
1804.00	2154.00	DIORITE,										
		Diorite Feldspar-quartz with 10% interflow tuff: mottled dark green grey,	1020	1857.00	1858.00	1.00						
		massive very coarse grained (broken, folded angualr-subrounded feldspar	1021	1859.00	1860.00	1.00						
		up to 1 cm), 80-85% fp+quartz, 10-15% chlorite matrix, local 1-10cm very	1022	1866.00	1867.00	1.00						
		fine grained strongly fo chlorite bands/beds, cross-cut by <3% quartz	1023	1873.00	1874.00	1.00						
		cal. Veins, very siliceous, trace coarse grain tourmaline? (up to 3 mm),	1024	1875.00	1876.00	1.00						
		weak-poor crystal alignment.	1025	1925.00	1926.00	1.00						
		1964.00 1966.00 Bleached, silicified, pale grey-pink, grainy, streaked	1026	2001.00	2002.00	1.00						
		T(?).	1027	2091.00	2092.00	1.00						
		1990.00 Stained for Ksp ~30% Ksp.										
2154.00	2235.00	ANDESITE TUFF,										
		Andesite T: dark green, fine grained, thin bedded (<2 mm) strongly fo at										
		70-80 degrees to CA, very strong chlorite alteration, pervasive, patchy										
		strong epidote alteration, <1% pyrite + po as dissem. + thin lams,										
		cross-cut by <1% cal. Veins.										
2235.00	2521.00	ANDESITE FLOW, FELSIC BRECCIA,										
		Andesite flow with minor flow breccia + interflow T: dark green local	1028	2245.00	2246.00	1.00						
		feldspar phyric sections (<20 cm, >15% fp in 1-2 mm crystals), very	1029	2251.00	2252.00	1.00						
		strong pervasive chlorite alteration, patchy strong epidote alteration,	1030	2270.00	2271.00	1.00						
		local trace 1% pyrite + po as lams + dissem.	1031	2418.00	2419.00	1.00						
		2470.00 2521.00 Andesite m-cT: fo/bedded at 60-70 degrees to CA.	1032	2429.00	2430.00	1.00						
			1033	2491.00	2492.00	1.00						

INTERVAL (ft) From:	To:	DESCRIPTION	Sample No.	From (ft)	To (ft)	Inter-val(ft)	Au Oz/T	Ag Oz/T	Cu %	Pb %	Zn %	Field No.
2521.00	2684.00	ANDESITE FLOW, BASALT,										
		Andesite-Bas. Flow with minor crystal T: dark green, fine grained - fp + px phyric, local very coarse grained px (>3 mm), massive, strong chlorite alteration, moderately patchy epidote alteration, cross-cut by <10% quartz-epidote veins, local trace pyrite + po dissem.	1035	2572.00	2573.00	1.00						
			1034	2575.00	2576.00	1.00						
		2673.00 Stained for Ksp - 20% ksp.										
2684.00		END OF HOLE										

APPENDIX D: Preliminary Lithogeochemical Data for the Granduc Mine, Northern British Columbia by T.J. Barrett.

PRELIMINARY LITHOGEOCHEMICAL DATA FOR THE GRANDUC MINE, NORTHERN BRITISH COLUMBIA

T.J. Barrett
Mineral Deposit Research Unit, U.B.C.

Contents

5.1. Lithologies

<u>Upper photo</u>: General

View eastwards over South Leduc glacier, towards Scottie Peaks in distance at head of glacier. Granduc Mine Series rocks underlie MDRU members and Paul McGuigan of Cambria Geological Ltd., standing second from right. The hanging glacier on extreme left, immediately after the grassy slope, is shown in last plate in this section.

<u>Lower photo</u>: General

View westwards over South Leduc glacier, towards confluence with South Leduc glacier, showing collapsed stopes of Granduc Mine in foreground.

5.1. Lithologies (continued)

Upper photo: Mine Series strata

Mine Series strata upslope (i.e. north of) collapsed stopes of the Granduc mine. Rocks include thin- to medium-bedded metasediments (volcaniclastic sandstone and siltstone, cherty tuff? and dark mudstone) and impure magnetite-chert iron formation. View is to the west (Paul McGuigan = 1.8 metres).

Lower photo: Mine Series strata

Mine Series strata upslope (i.e.north of) collapsed stopes of Granduc mine, showing folded and schistose nature of rocks, which include sericitic and cherty volcaniclastics, dark mudstone and impure magnetite-chert iron formation. View is to the north (Fiona Childe = 1.1 metres).

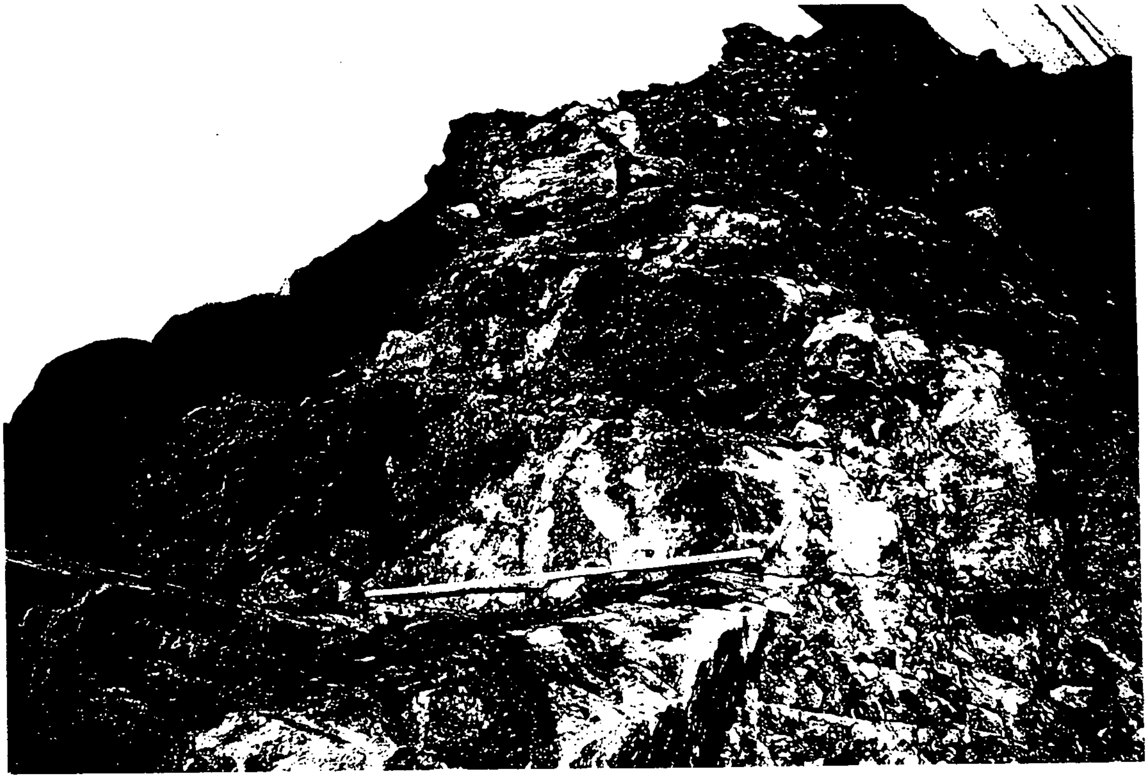
5.1. Lithologies (continued)

Upper photo: Felsic volcaniclastic strata east of Granduc mine.

Outcrop of coarse felsic volcaniclastic strata about 2 km east of collapsed stopes, on north side of South Leduc glacier. Outcrop is adjacent to hanging glacier that descends to the South Leduc glacier (just visible in top left corner of photo). One-metre rule rest against debris flow unit, detail of which is shown below. Note the gossanous appearance of the outcrop, which results from disseminated pyrite; the felsic volcaniclastic beds are also sericitized. Some felsic volcaniclastic strata at this locality contain cobble-sized clasts; others contain sand-sized material. Tuffaceous beds could be present. Grading of clasts was observed in some of the coarser beds. Lower contacts are commonly erosive into underlying beds. A sample of a possibly tuffaceous sandstone was taken with the hope of obtaining zircons for U-Pb geochronology.

Lower photo: Felsic volcaniclastic strata east of Granduc mine.

Detail of outcrop of coarse felsic volcaniclastic strata about 2 km east of collapsed stopes, on north side of South Leduc glacier. This bed, which contains flattened felsic fragments, is just visible at the right edge of the above photo, 2 cm above its base.



5.1. Lithologies (continued)

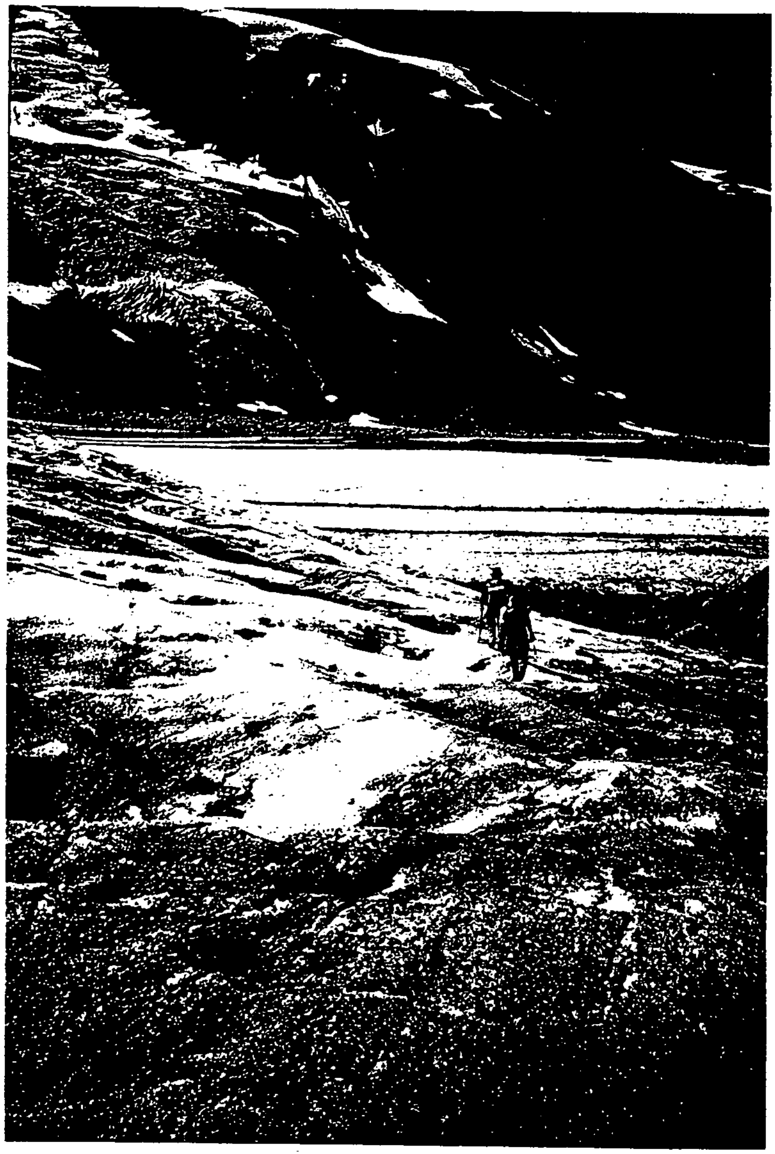
<u>Upper photo</u>: Felsic volcaniclastic unit east of Granduc mine.

View to south across South Leduc glacier (crossing photo in mid-distance). Avid geologists are descending the hanging glacier on the extreme left side of the first photo in this section. The felsic volcaniclastic strata shown in previous plate occur just off the right side of the photo, and can be traced downslope almost to the South Leduc glacier.

On the far side of the South Leduc glacier, a fine-grained, medium-bedded felsic unit was also located; it had the appearance of a flattened tuff. A geochronology sample was also taken at this locality.

On the north side of Granduc Mountain, Peter Lewis (MDRU) located a felsic breccia unit, from which a geochronology sample was also collected.

At present, the relation of this felsic unit to the mafic volcanic rocks that host the Granduc Mine Series is unknown. It appears less deformed than the Granduc rocks, and it is conceivable that it is separated from the Granduc sequence by a fault. It is therefore important to obtain an accurate age for the felsic unit, as discussed in more detail by Fiona Childe in Section 8 on Geochronological Investigations.



Lithogeochemistry, Granduc deposit

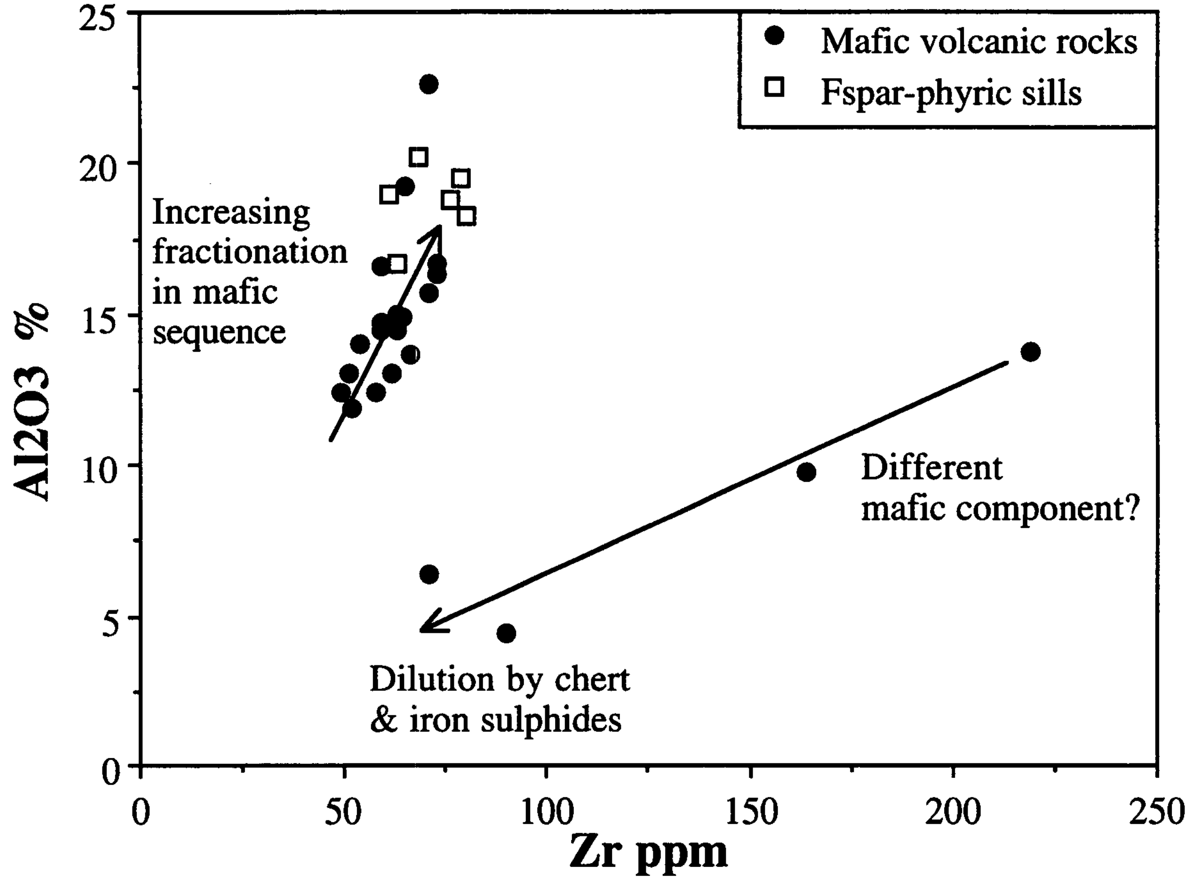
Fig. 1a: Al_2O_3 - Zr relations.

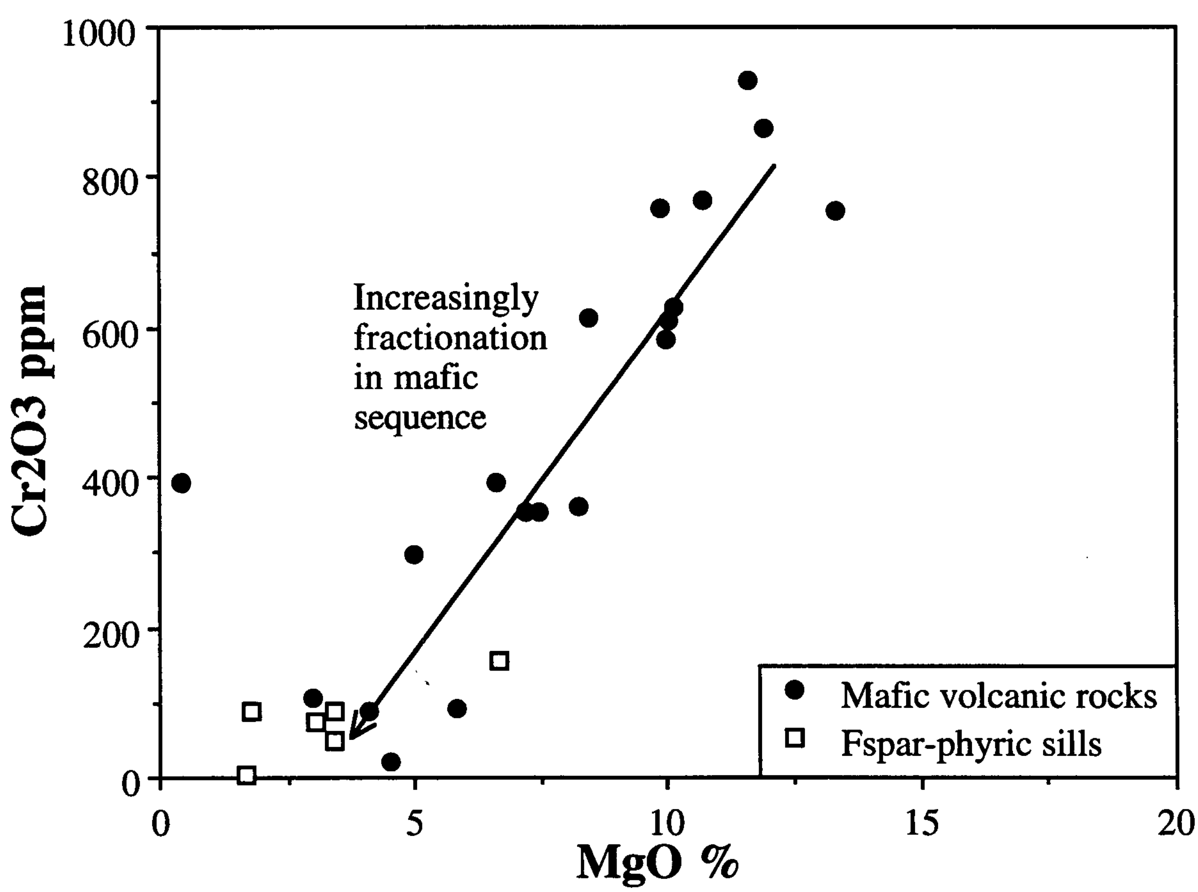
Volcanic rocks sampled mainly from long holes drilled in the North Zone show a trend of increasing Al and Zr that is interpreted as representing a mafic fractionation trend. Although samples of feldspar-phyric sill plot near the end of this trend (and also near the end of trends in following plots), the relation between the sill and the mafic volcanic stratigraphy is not clear. In drill core, the feldspar-phyric sill ranges from medium-grained to almost pegmatitic (feldspar crystals 1-4 cm across), and from little deformed to strongly sheared (whereupon grain size becomes reduced). Rocks up to several metres from to the sill are commonly sheared, very dark green, and contain up to 1% Cu (much of this core was split). Lithogeochemical data suggest that these rocks were originally mafic volcanics.

Two samples appear to be derived from a different mafic volcanic component that had a high Zr content, and also very high Ti contents of about 2.8 and 2.1% (hole 147-1b, 829' and hole 102-77, 140'). Two other samples of impure cherty iron formation may contain a component of this high Ti-Zr material that has been diluted by addition of silica and iron.

Fig. 1b: Cr_2O_3 - MgO relations.

This plot shows a trend of decreasing Mg and Cr that reflects fractionation within the mafic sequence, probably involving removal of olivine (Mg) and spinel (Cr).


Mafic volcanic rocks
Fspar-phyric sills
Increasing
fractionation
in mafic
sequence
Different
mafic component?
Dilution by chert
& iron sulphides
Al2O3 %
Zr ppm
0
5
10
15
20
25
0
50
100
150
200
250


Increasingly
fractionation
in mafic
sequence
Mafic volcanic rocks
Fspar-phyric sills
Cr2O3 ppm
MgO %
0
200
400
600
800
1000
0
5
10
15
20

Lithogeochemistry, Granduc deposit

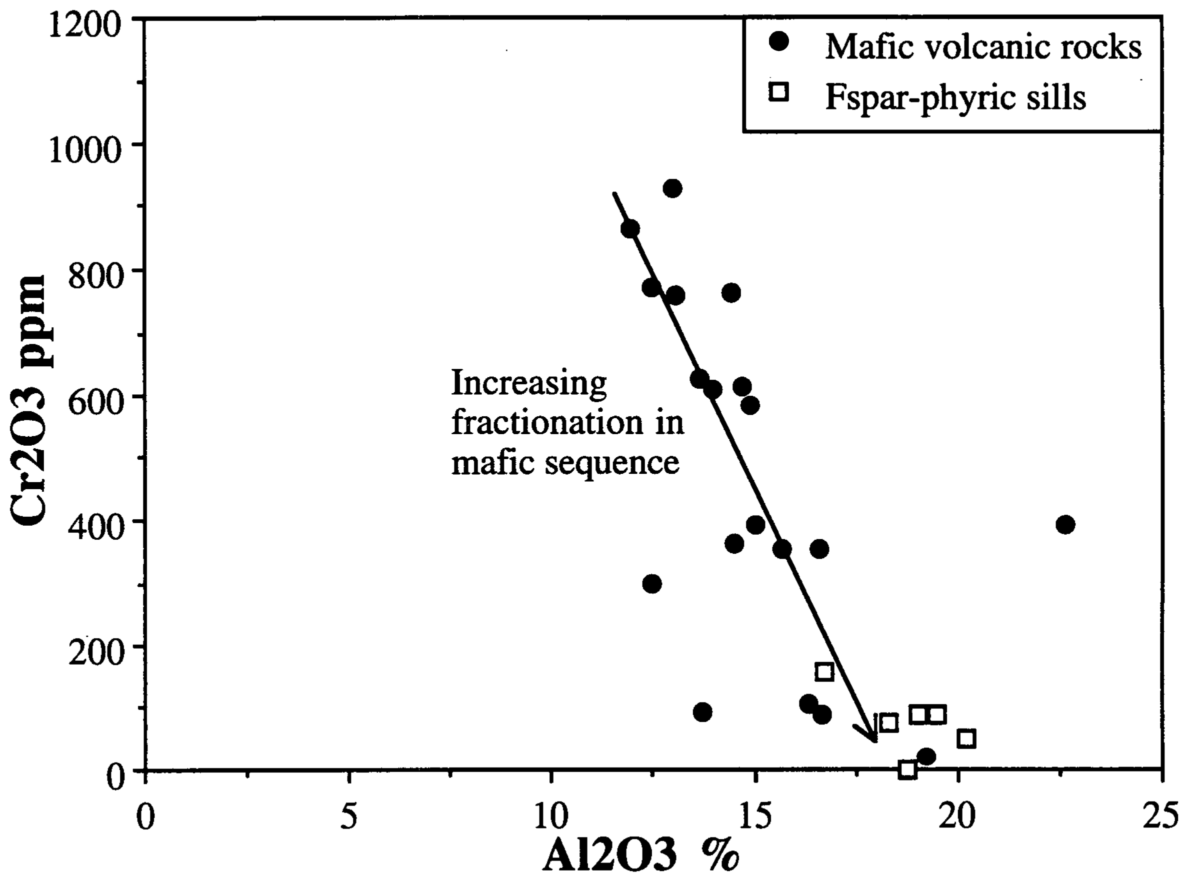
Fig. 2a: Cr_2O_3 - Al_2O_3 relations.

This plot shows a trend of increasing Al with decreasing Cr that reflects fractionation within the mafic volcanic sequence, involving increasing plagioclase content (Al) as olivine (Mg) and spinel (Cr) are relatively depleted. The feldspar-phyric sills plot near at the low Cr - high Al end of the trend, although this does not imply that they are related to the mafic volcanic rocks.

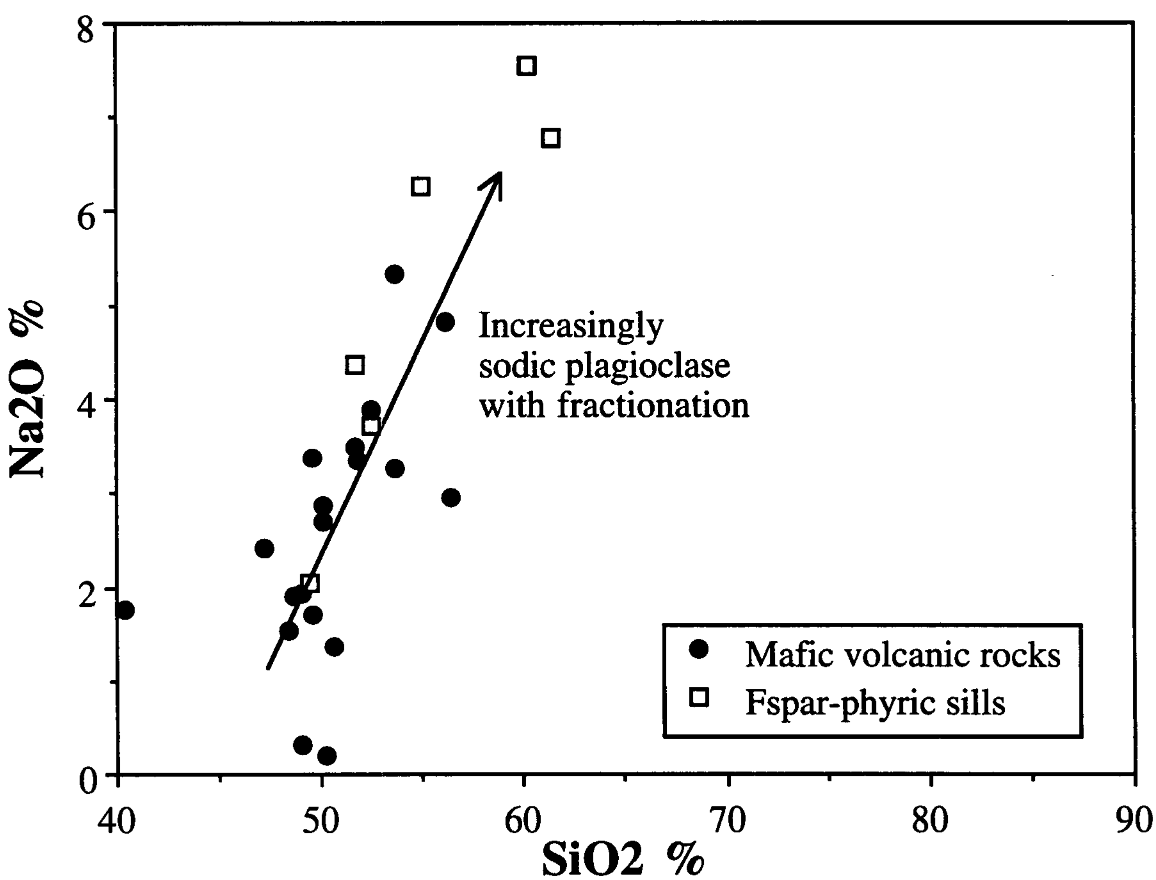
Fig. 2b: Na_2O - SiO_2 relations.

This plot shows a trend of increasing Na with decreasing Si that reflects fractionation within the mafic volcanic sequence, involving increasingly sodic plagioclase content in the SiO2 range of about 50% to 60%. Over this range, TiO_2 in the mafic volcanic sequence increases from about 0.6 to 1.0%, and Zr increases from about 45 to 70 ppm. All of these relations suggests that some primary fractionation trends have been retained, although some alteration involving sericitization and K addition has also occurred.

The mafic volcanic rocks have a fairly uniform Zr/Y ratio of about 3-4, consistent with an overall tholeiitic magmatic affinity.



1200
1000
800
600
400
200
0
Cr2O3 ppm
0
5
10
15
20
25
Al2O3 %
Mafic volcanic rocks
Fspar-phyric sills
Increasing
fractionation in
mafic sequence



8
6
4
2
0
Na2O %
40
50
60
70
80
90
SiO2 %
Increasingly
sodic plagioclase
with fractionation
Mafic volcanic rocks
Fspar-phyric sills

Lithogeochemistry, Granduc deposit

Fig. 3a: REE relations, DDH 158-1.

This plot shows that the footwall mafic volcanic sequence in the North Zone has a uniform REE composition, with La_n/Yb_n values of 3.5-5.0 suggesting a transitional chemical affinity (mid-ocean ridge basalts would have flattish to light-REE-depleted patterns). One possible origin for these mafic volcanic rocks, given their Zr/Y ratios of tholeiitic 3.4-3.8, is in the incipient stage of island-arc formation.

Fig. 3b: REE relations, DDH 146-3.

This hole drilled east from the 2600' level. A thick feldspathic sill has an REE pattern similar to, but higher than the mafic volcanic rocks of Figure 3a. The sill appears to represent a differentiated portion of an intrusion which, throughout the mine, ranges chemically from dioritic to quartz dioritic composition (its overall mafic nature is indicated by low Zr contents of <80 ppm). The coarse-grained phase of the sill has the lowest Cr and highest REE contents of the several sill samples taken in this study.

The banded 'cherty' tuff is has an REE pattern almost identical to that of the mafic volcanic rocks in the footwall of DDH 158-1 (Fig. 3a). Although this banded rock may be a tuff or a volcaniclastic sediment, its chemical composition and REE pattern suggest that it is neither cherty not dacitic, but mainly a mafic volcanic rock.

Granduc Mine Area

Fig. 3a

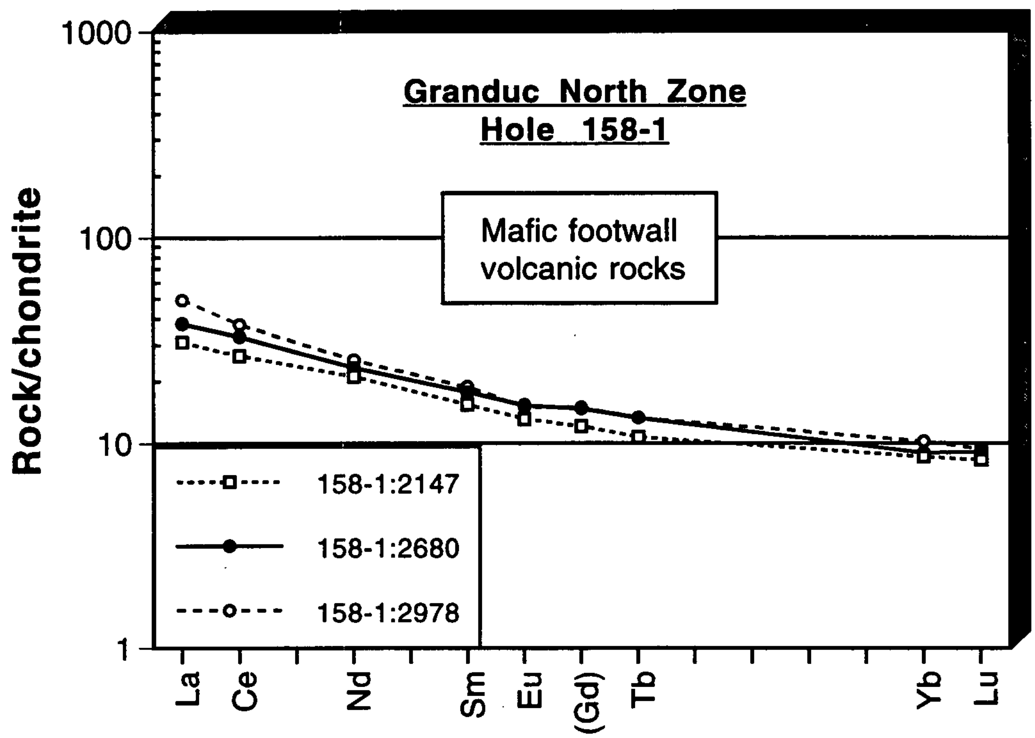
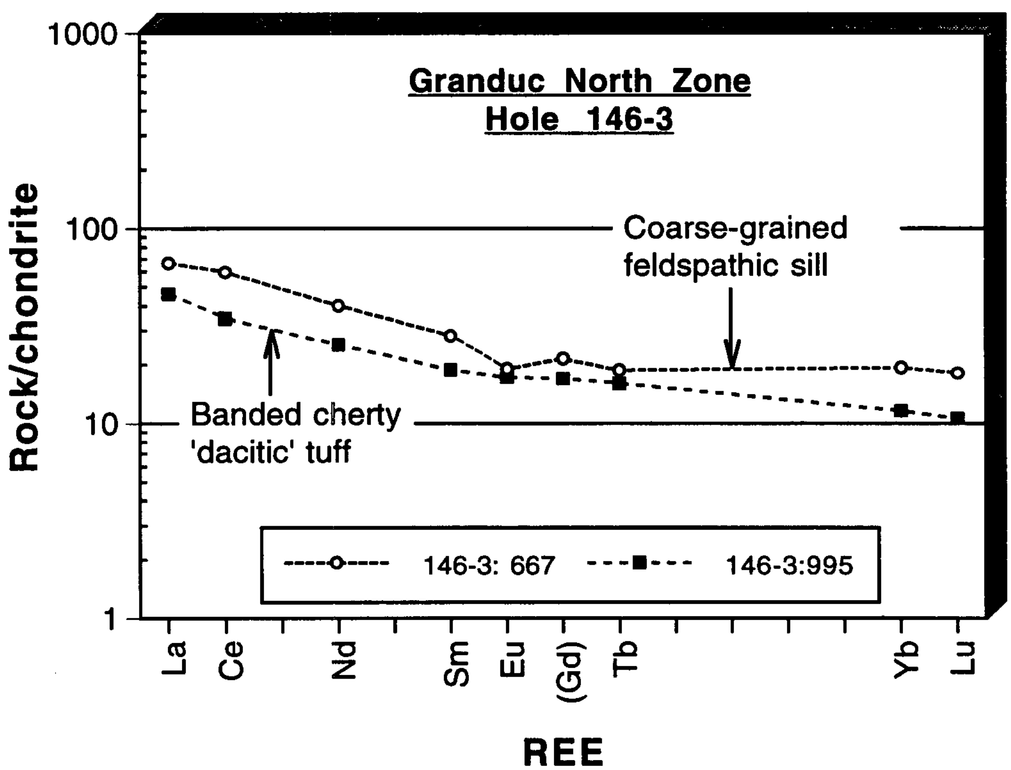


Fig. 3b



Lithogeochemistry, Granduc deposit

Fig. 4a: REE relations, DDH 147-1b.

A thick feldspathic sill and its sheared margin have REE patterns that are almost identical. Chemcially, however, the sill is more differentiated, and closer to quartz dioritte in composition. The sheared margin was probably a mafic volcanic rock, as indicated by its chemical composition, and the fact that it has notable Cu sulfide mineralization (as crude laminations of sulfide and magnetite). If so, then the close similarity of the REE patterns for the sill and the adjacent mafic volcanics suggests that they are genetically related. The rocks marginal to the main sills are commonly strongly sheared, and commonly contained ≈1-2% Cu over core lengths of 10-30 feet. This relation might have resulted if the sills intruded within zones of bedded volcaniclastic sediments and chemical sediments, with the contact zones becoming the preferred sites for subsequent shear-related deformation.

A mafic volcanic rock in the footwall has an REE pattern identical to those in the footwall of DDH 158-1 (Fig. 3a). This suggests that correlative footwall rocks were intersected downhole from the main sill in both holes, that is, to the east of the sill.

Fig. 4b: REE relations, other lithologies.

A coarse-grained feldspathic 'tuff', from the mineralized part of the mine series stratigraphy in underground hole 102-77 through the orebody, has an REE pattern similar to that of the main sill (excluding a slight, positive Eu amomaly).

A sample from North Zone DDH 147-1b is representative of a 234' thick interval of black mudstone with mm-scale calcitic laminations. This sample, which lies east of the Granduc fault and presumably within the mine series, has a distinctively light REE-enriched pattern that suggests it contains a felsic metasedimentary component.

Granduc Mine Area

Fig. 4a

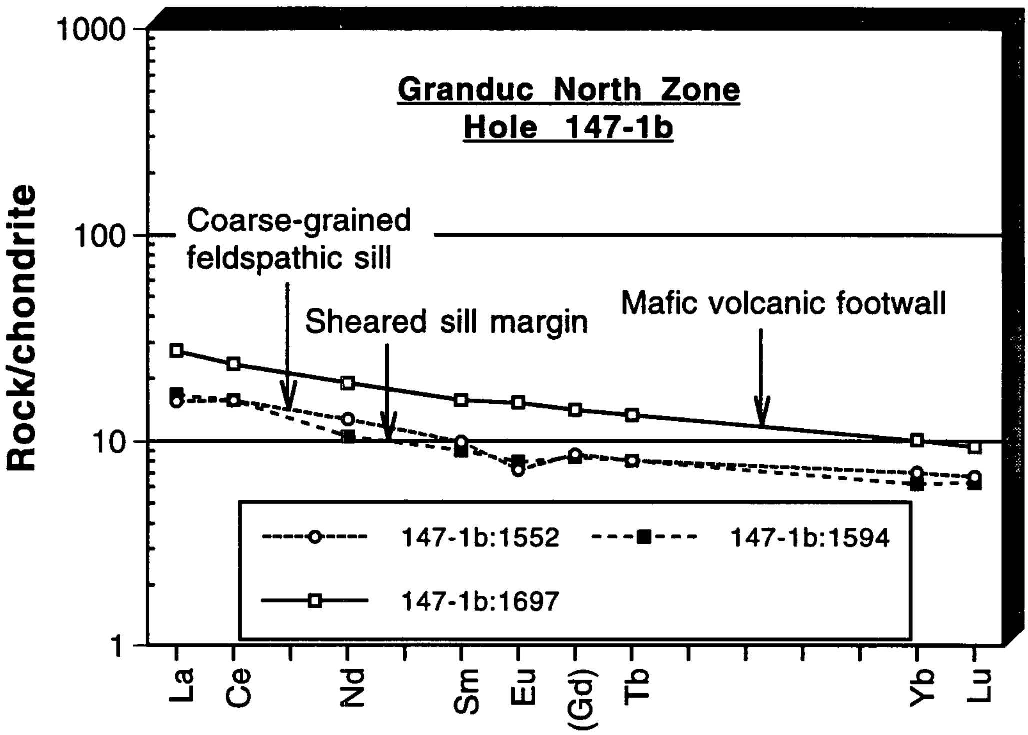


Fig. 4b

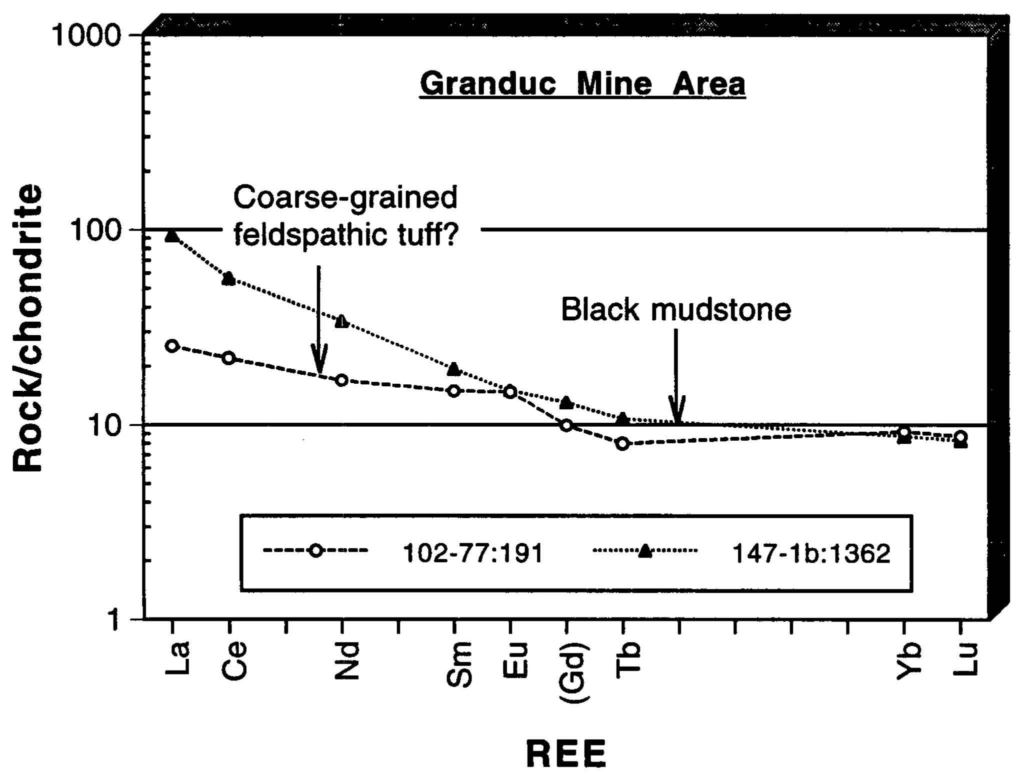


TABLE 1. Chemical composition of volcanic rocks at the Granduc deposit, northwestern B.C.

Lab (SH)	Zone	Field lithology	Hole	Depth (ft)	SiO2 %	Al2O3 %	TiO2 %	Fe2O3 %	MnO %	MgO %	CaO %	Na2O %	K2O %	P2O5 %	BaO %	LOI %	Total %
46	North Zone	Green volcanicl. and.	146-3	18	47.02	14.30	0.86	12.30	0.18	9.58	8.62	1.85	1.97	0.29	0.03	3.35	100.47
47	North Zone	Green massive and.	146-3	186	44.20	11.22	0.62	9.99	0.19	9.67	9.68	0.27	4.97	0.20	0.02	8.56	99.77
48	North Zone	Mineralized andesite	146-3	336	47.49	14.09	0.83	12.66	0.16	6.22	6.07	1.28	5.92	0.23	0.03	4.89	100.08
49	North Zone	Light altered zone	146-3	476	54.67	21.92	1.52	3.35	0.17	0.41	5.47	2.85	6.56	0.03	0.23	2.38	99.67
50	North Zone sill	Medium-grained sill	146-3	667	58.99	18.04	0.70	2.93	0.12	1.62	4.86	6.51	2.19	0.41	0.04	3.08	99.51
51	North Zone	Green massive and.	146-3	903	47.00	13.13	0.71	9.43	0.29	9.44	9.01	2.53	2.83	0.28	0.03	4.90	99.75
52	North Zone	Cherty dacitic tuff	146-3	995	50.62	15.38	0.91	10.95	0.15	7.07	8.15	3.43	2.06	0.27	0.03	1.22	100.34
55	North Zone	Cherty dacitic tuff	158-1	1926	48.14	17.66	0.92	8.60	0.16	4.17	7.42	3.58	1.69	0.25	0.03	7.87	100.54
56	North Zone	Cherty tuff	158-1	2080	88.00	4.40	0.24	1.61	0.02	1.50	1.21	0.89	0.96	0.09	0.03	1.29	100.27
57	North Zone	Andesitic tuff	158-1	2147	48.50	11.66	0.74	11.54	0.21	11.65	11.74	1.67	0.85	0.27	0.02	2.13	101.16
58	North Zone	Mafic (split) zone	158-1	2183	43.08	13.40	0.71	11.73	0.22	7.70	9.47	2.19	3.30	0.23	0.07	6.90	99.32
59	North Zone	Sheared sill?	158-1	2199	50.99	14.86	0.68	3.05	0.20	2.71	11.65	4.37	2.30	0.27	0.06	8.54	99.73
60	North Zone	Green massive and.	158-1	2680	47.66	12.77	0.71	11.10	0.22	13.06	7.88	1.87	3.34	0.23	0.03	1.63	100.67
61	North Zone	Green massive and.	158-1	2776	52.45	16.28	0.98	11.60	0.10	4.03	6.95	5.21	0.84	0.30	0.02	1.38	100.25
62	North Zone	Green massive and.	158-1	2848	50.48	14.05	0.77	9.77	0.16	9.60	8.68	3.27	1.20	0.23	0.02	2.00	100.40
63	North Zone	Green massive and.	158-1	2978	52.73	13.44	0.71	8.60	0.20	9.96	8.02	3.22	1.85	0.29	0.04	1.04	100.23
69	North Zone	Green massive and.	147-1b	829	48.54	13.44	2.78	15.52	0.28	5.70	7.66	3.32	1.58	0.42	0.06	1.38	100.77
70	North Zone sill?	Feldspathic tuff?	147-1b	852	50.03	19.59	0.88	9.06	0.14	3.28	8.49	4.23	1.42	0.49	0.06	2.40	100.13
71	North Zone	Cherty tuff	147-1b	895	82.31	6.35	0.32	4.00	0.03	1.37	0.85	0.55	3.21	0.11	0.52	0.90	100.63
72	North Zone	Green laminated and.	147-1b	1000	47.00	12.63	0.75	12.86	0.15	11.26	8.11	1.50	3.67	0.27	0.05	2.28	100.73
73	North Zone sill	Medium-grained sill	147-1b	1152	50.15	15.97	0.85	6.33	0.14	6.36	11.39	3.54	1.14	0.32	0.02	3.74	100.02
64	North Zone sill	Coarse-grained sill	147-1b	1225	58.46	18.89	0.83	3.64	0.07	1.74	4.95	7.34	1.36	0.08	0.02	2.33	99.74
65	North Zone	Black mudstone	147-1b	1362	47.13	13.59	0.84	14.41	0.16	7.74	3.97	0.20	6.68	0.30	0.12	4.34	99.59
66	North Zone sill	Coarse-grained sill	147-1b	1552	50.38	16.77	1.02	2.90	0.19	2.82	9.37	5.76	2.51	0.21	0.03	7.33	99.34
67	North Zone	Sheared sill margin?	147-1b	1594	37.80	11.63	0.59	29.89	0.10	4.65	4.87	1.64	3.96	0.27	0.02	3.45	99.91
68	North Zone	Green massive and.	147-1b	1697	46.14	15.27	0.79	9.46	0.14	6.89	8.71	2.64	2.73	0.24	0.02	7.41	100.54
53	Mine area	Green massive and.	102-77	140	44.22	9.41	2.03	23.39	0.38	5.45	10.33	1.50	1.17	0.49	0.04	0.81	99.51
54	Mine area sill?	Feldspathic tuff?	102-77	191	46.90	18.02	0.81	10.67	0.19	3.23	11.12	1.92	2.48	0.35	0.10	4.20	100.06

Geochronology samples

Lab (SH)	Zone	Field lithology	Hole	Depth (ft)	SiO2 %	Al2O3 %	TiO2 %	Fe2O3 %	MnO %	MgO %	CaO %	Na2O %	K2O %	P2O5 %	BaO %	LOI %	Total %
GC-01	North Zone sill	Medium-grained sill	158-2a	2070-2103'	57.78	16.69	0.76	5.03	0.20	1.98	4.14	5.88	2.88	0.34	0.03	4.13	99.92
GC-04	North Zone	Green massive and.	158-2a	2283-2328'	48.82	11.32	0.64	10.75	0.19	13.06	10.43	1.38	1.37	0.33	0.03	2.15	100.63
GC-05	Mine area felsic?	Feldspathic tuff?	102-77	429-453'	72.14	8.06	0.45	4.84	0.08	1.87	4.46	1.21	1.90	0.20	0.28	4.17	99.73
GC-06	North Zone	Green massive and.	158-1	2961-3009'	45.50	10.94	0.59	11.53	0.24	15.81	11.21	1.04	1.86	0.16	0.02	2.16	101.27
GC-02	Surface*	Felsic lapilli tuff			63.81	13.91	0.41	4.31	0.12	1.45	4.24	4.25	2.29	0.17	0.08	4.80	99.87
GC-03	Surface**	Felsic f.g. tuff			64.80	16.68	0.38	3.26	0.09	0.37	5.16	3.95	1.48	0.13	0.07	3.34	99.74

* 2 km southeast of mine

** 1 km south of mine

Zone	Field lithology	Hole	Depth (ft)	Cu	Zn	Co	Ni	Cr2O3	V	Sc	Ce	Zr	Y	Nb	Rb	Sr	Ga	Pb	Zr/Y
North Zone	Green volcanicl. and.	146-3	18	34	87	35	129	561	305	37	17	61	16	4	73	268	14	8	3.8
North Zone	Green massive and.	146-3	186	460	181	18	112	694	249	43	8	44	10	3	326	90	10	10	4.4
North Zone	Mineralized andesite	146-3	336	1013	120	60	130	369	314	24	6	59	12	4	403	102	15	9	4.9
North Zone	Light altered zone	146-3	476	480	92	8	11	381	42	3	30	69	7	10	236	304	11	22	9.9
North Zone sill	Medium-grained sill	146-3	667	27	71	16	6	2	90	13	22	73	29	11	87	416	19	7	2.5
North Zone	Green massive and.	146-3	903	413	168	62	181	572	266	32	32	51	13	4	178	233	13	10	3.9
North Zone	Cherty dacitic tuff	146-3	995	147	86	30	98	348	271	31	10	70	18	5	103	198	16	9	3.9
North Zone	Cherty dacitic tuff	158-1	1926	93	89	26	25	21	231	27	0	60	15	5	68	262	17	6	4.0
North Zone	Cherty tuff	158-1	2080	71	53	38	20	67	33	6	0	89	14	6	32	49	4	0	6.4
North Zone	Andesitic tuff	158-1	2147	290	90	50	175	847	261	38	7	51	14	4	23	189	12	7	3.6
North Zone	Mafic (split) zone	158-1	2183	1886	175	45	182	559	275	27	0	54	15	5	137	182	14	18	3.6
North Zone	Sheared sill?	158-1	2199	86	69	8	22	97	145	23	40	66	19	6	78	264	13	7	3.5
North Zone	Green massive and.	158-1	2680	144	183	42	230	740	259	34	6	50	14	4	163	168	12	7	3.6
North Zone	Green massive and.	158-1	2776	499	41	54	30	87	330	25	0	71	20	5	27	275	16	9	3.6
North Zone	Green massive and.	158-1	2848	342	42	38	116	740	294	36	34	57	17	4	40	176	14	9	3.4
North Zone	Green massive and.	158-1	2978	95	97	20	139	616	232	27	22	65	17	5	64	415	12	8	3.8
North Zone	Green massive and.	147-1b	829	182	58	36	74	91	400	35	47	214	41	14	49	240	21	9	5.2
North Zone sill	Feldspathic tuff?	147-1b	852	192	31	16	20	48	251	18	10	66	17	4	32	565	17	10	3.9
North Zone	Cherty tuff	147-1b	895	774	17	37	42	78	76	8	22	71	12	6	53	84	5	1	5.9
North Zone	Green laminated and.	147-1b	1000	353	265	17	184	902	249	36	31	60	11	5	131	99	15	17	5.5
North Zone sill	Medium-grained sill	147-1b	1152	46	70	10	40	149	235	36	21	60	17	4	35	371	15	9	3.5
North Zone sill	Coarse-grained sill	147-1b	1225	64	31	5	9	87	132	16	3	77	30	10	50	308	12	3	2.6
North Zone	Black mudstone	147-1b	1362	113	104	80	76	340	293	36	22	59	13	5	250	59	14	10	4.5
North Zone sill	Coarse-grained sill	147-1b	1552	106	95	16	53	70	122	12	0	73	11	6	129	227	12	5	6.6
North Zone	Sheared sill margin?	147-1b	1594	9284	102	54	120	278	481	20	0	54	7	5	277	144	21	15	7.7
North Zone	Green massive and.	147-1b	1697	117	81	14	87	327	269	33	11	54	14	3	150	228	15	69	3.9
Mine area	Green massive and.	102-77	140	1889	404	20	48	41	375	22	62	158	49	15	31	105	25	38	3.2
Mine area sill	Feldspathic tuff?	102-77	191	211	85	20	37	85	282	22	0	58	15	4	68	541	19	21	3.9

Geochronology samples

Zone	Field lithology	Hole	Depth (ft)	Cu	Zn	Co	Ni	Cr2O3	V	Sc	Ce	Zr	Y	Nb	Rb	Sr	Ga	Pb	Zr/Y
North Zone sill	Medium-grained sill	158-2a	2070-2103'	261	211	28	10	int	106	7	59	146	25	10	135	159	16	9	5.8
North Zone	Green massive and.	158-2a	2283-2328'	115	57	71	226	814	213	31	26	50	14	2	51	174	11	10	3.6
Mine area felsic'	Feldspathic tuff?	102-77	429-453'	88	52	66	50	268	133	12	41	78	19	5	57	176	8	8	4.1
North Zone	Green massive and.	158-1	2961-3009'	108	169	65	414	1176	204	31	16	48	11	2	87	128	10	11	4.4
Surface*	Felsic lapilli tuff			76	45	18	14	50	71	9	42	99	15	7	54	210	10	5	6.6
Surface**	Felsic f.g. tuff			96	44	19	20	47	45	8	32	98	10	7	35	395	16	4	9.8

* 2 km southeast of mine

** 1 km south of mine

APPENDIX E: Radiogenic Isotopic Investigations of the Granduc Volcanic Hosted Massive Sulphide Deposit by F. Childe.

Radiogenic Isotopic Investigations of the Granduc Volcanic Hosted Massive Sulphide Deposit

Fiona Childe, MDRU

Granduc, a mafic volcanic hosted Cu-rich massive sulphide deposit within the Stikine Terrane of Northern British Columbia, is thought to be hosted by the Late Triassic Stuhini Group. However, the absolute age of the deposit has not been proven by radiometric or biochronological methods. The Stikine Terrane is host to a wide age range of volcanic hosted massive and semi-massive sulphide mineralization, from the Devono-Mississippian Tulsequah Chief deposit (Sherlock et al., 1994) to the Early Jurassic Eskay Creek deposit (Childe, 1993). However, there is not yet unequivocal evidence of massive sulphide mineralization occurring within the Late Triassic volcanic sequences of Stikinia.

The goals of this study are, firstly, to determine the age of the volcanic sequence hosting mineralization at Granduc, and secondly, to characterize the sources of metal in the deposit by examining the lead isotopic signatures of the sulphides in the deposit and the igneous rocks within the mine stratigraphy.

A number of unmineralized volcanic and volcaniclastic samples were collected from outcrop on the property as well as from drill core in August, 1993 in an attempt to find zircon ($ZrSiO_4$) for U-Pb geochronology. These include samples from; (1) the andesitic footwall to the deposit, (2) a volumetrically significant sill of intermediate composition, and (3) felsic tuffs which appear on surface to the south and southeast of the deposit. The andesitic volcanic rocks which compose the stratigraphic footwall to the deposit may be too mafic to yield sufficient zircon for analysis. Zircon has been recovered from the intermediate sill and is in the process of being analyzed. The temporal relationship of the sill to the deposit is not known, but the unit appears to have experienced at least one phase of deformation. Therefore the age of the sill may constrain the minimum age of the deposit. Zircon has also been recovered from both the felsic tuffaceuos units occurring to the south and southeast of the deposit, but the stratigraphic relationship of the felsic tuffs to the mine series is still uncertain. Analysis of all zircon bearing units is in progress.

The lead isotopic composition of lead-rich and uranium- and thorium-poor minerals such as galena and potassium feldspar does not vary over geologic time and can be characteristic of style and timing of mineralization within a given region. Preliminary lead isotopic results from galena in the Granduc deposit indicate two distinctly different isotopic signatures. The results from these analyses are plotted on conventional $^{206}Pb/^{204}Pb$ vs $^{207}Pb/^{204}Pb$ and $^{206}Pb/^{204}Pb$ vs $^{208}Pb/^{204}Pb$ diagrams (Figure 1). Galena from a coarse 8 cm wide potassium feldspar-galena vein with a pyrite halo cross-cutting andesite from the North Zone of the deposit (Sample G3) displays a significantly more radiogenic signature than galena from poorly defined calcite-galena veins cross-cutting mineralization (chalcopyrite,

pyrite, pyrrhotite) in an argillaceous matrix from the B Ore body (samples G1 and G2) (Table 1). Alldrick et al. (1987) have interpreted the lead isotopic signatures from a number of deposits within the Stewart Mining Camp to be the result of two main mineralizing events, and on the basis of independent age determinations have assigned the events Tertiary and Jurassic ages. The isotopic signature of the galena from sample G3 plots within the Tertiary cluster defined by Alldrick et al. (1987), suggesting that the lead in this sample is derived from a regional Tertiary mineralizing event. In contrast, galena from samples G1 and G2 is much less radiogenic than galena attributed to the Jurassic or Tertiary mineralizing events and indicates a pre-Jurassic age. Due to the close spatial relationship between the galena and the copper and iron sulphides in samples G1 and G2, it appears that the galena in these samples may have been cogenetic with the ore-bearing phases and remobilized during a later deformational event.

Further work in this study will include lead isotopic analysis of other sulphide phases (chalcopyrite and pyrite) from the B and F Orebodies and of potassium feldspar. Lead analysis of chalcopyrite and pyrite will establish if the lead in these phases is associated with the lead in the galena from the B Ore body and if this signature is characteristic of the volcanogenic mineralization. Analysis of potassium feldspar from the vein in sample G3 and the sill sampled for U-Pb geochronology is currently underway and will establish if one or both of these units are related to the Tertiary mineralizing event.

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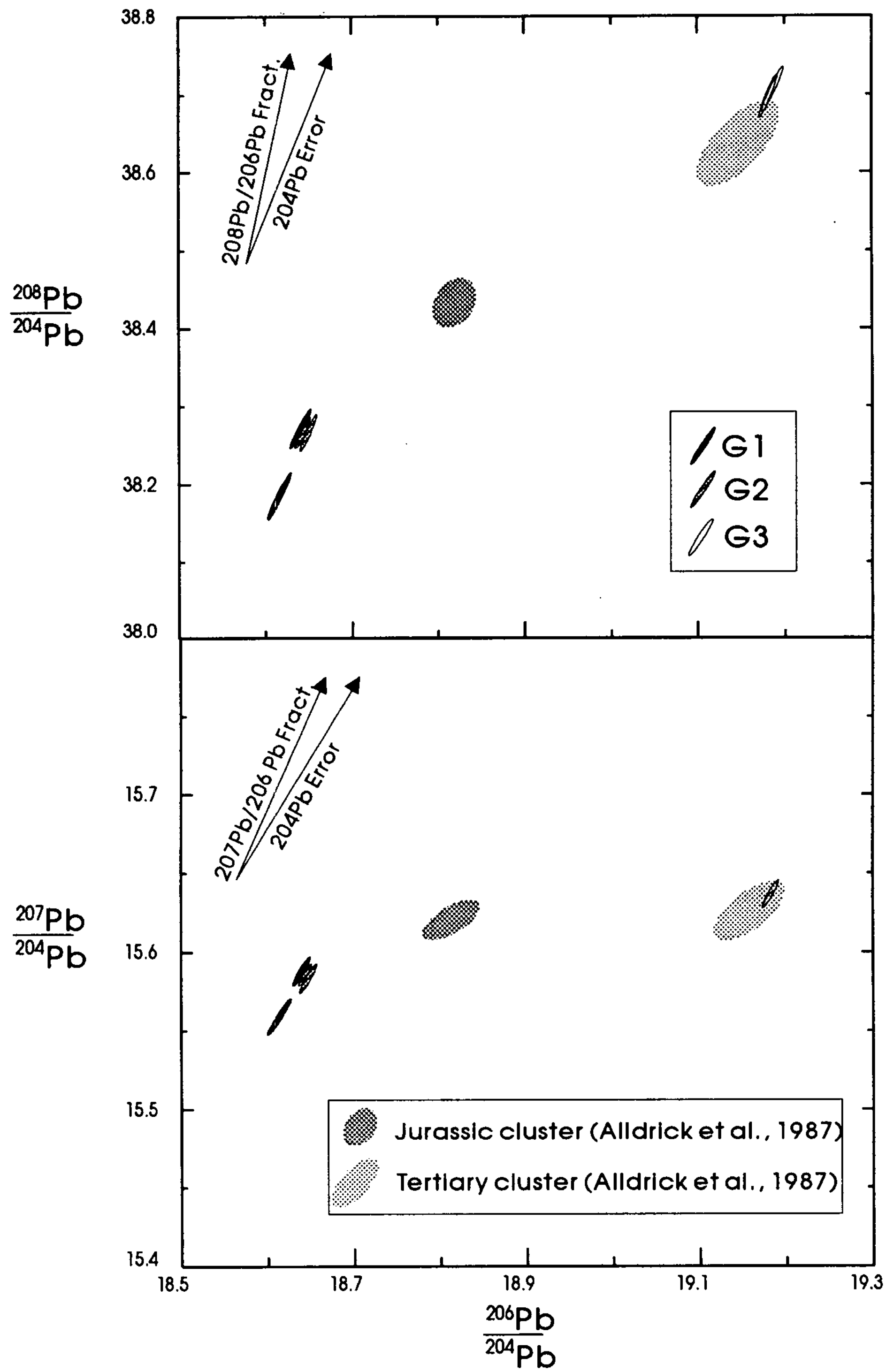

FIGURE 1.206Pb/204Pb VS 207Pb/204Pb AND 206Pb/204Pb VS 208Pb/204Pb diagrams for Granduc galena samples. Error ellipses are drawn at the 2 sigma (95%) confidence level.

TABLE 1. LEAD ISOTOPE DATA FOR GRANDUC GALENA SAMPLES

SAMPLE #	206Pb/204Pb	% error	207Pb/204Pb	% error	208Pb/204Pb	% error
G1a	18.616	0.054	15.559	0.054	38.185	0.060
G1b	18.641	0.044	15.588	0.046	38.270	0.052
G2a	18.645	0.030	15.585	0.034	38.266	0.042
G2b	18.650	0.038	15.582	0.042	38.265	0.048
G3a	19.182	0.038	15.636	0.042	38.702	0.048
G3b	19.180	0.024	15.633	0.028	38.708	0.038

G1 = 102-77, 112ft.
G2 = 102-77, 356ft.
G3 = 158-1,3135ft.
Full sample descriptions are given in text.
a, b = duplicate analyses.
Errors are listed at the 2 sigma level.
Ratios are normalized using the values of the standard NBS-981.

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GRANDUC DEPOSIT - POINT OUTLINE

FIONA CHILDE

1 Introduction

2 Geology

2.1 Regional

2.2 Mine Scale

3 U-Pb Geochronology

3.1 *Footwall Andesite* (GD-GC-04, North Zone 158-2A, 2283-2328 ft.)
Late Triassic, 230.5 +/-14 Ma
This sample will require **at least** two more fractions to constrain the age.

3.2 *Diorite Sill* (GD-GC-01, North Zone 158-2A, 2070-2103 ft.)
Late Triassic, 232 +/-3 Ma
This sample will require one or two more very well abraded fractions to obtain a concordant point.

3.3 *Felsic Lapilli Tuff* (GD-GC-02, surface sample, SE of the deposit, Homestake Property)
Early Jurassic (Pliensbachian) 185.4 +/-9 Ma
This sample has one concordant point at:

206/238 age = 185.6 +/- 0.4 Ma
207/235 age = 185.6 +/- 0.9 Ma
207/206 age = 185.4 +/- 9 Ma

one more concordant fraction will allow a much tighter constraint on the error.
The age of this unit is within error of the 186.6 +/-5.6 Ma date determined on a dacitic 'megaclast' from north of the North Leduc Glacier.

3.4 *Felsic Tuff* (GD-GC-03, surface sample, S of Granduc & the South Leduc Glacier)
this sample contains enough zircon for analysis of 2-3 fractions (i.e. very little material).

n.b. sample GD-GC-06 from the Footwall Andesite (North Zone 158-1, 2961-3009 ft.) has not yet been processed and may provide additional material for narrowing the age of the andesite.

4 Lead Isotopes

4.1 B Orebody

Galena from samples G1(102-77, 112 ft.) and G2 (102-77, 356 ft.) is contained within fine to medium-grained quartz-calcite veins cross-cutting Cu and Fe sulphides. Lead ratios are relatively non-radiogenic:

206Pb-204Pb = 18.616-18.650

207Pb-204Pb = 15.559-15.588

208Pb-204Pb = 38.185-38.265

and relative to mineralization of known age within Stikinia indicate a pre-Jurassic age for the galena in the B Orebody.

4.2 Veins Cutting the Footwall Andesite

G3 (North Zone, 158-1, 3135 ft.)coarse-grained microcline-calcite-galena pyrite vein cross cutting the Footwall Andesite

G4 (North Zone,158-2A, 2511 ft) coarse-grained microcline-calcite-sphalerite-pyrite vein with trace galena cross cutting the Footwall Andesite

Galena and microcline from sample G3, has lead isotopic values of :

206Pb-204Pb = 19.180-19.194

207Pb-204Pb = 15.622-15.636

208Pb-204Pb = 38.658-38.702

There is excellent agreement between the galena and microcline lead analyses. These values plot within the Stewart Mining Camp Tertiary cluster defined by Alldrick et al., 1987 (see figure). Tertiary mineralization in the Stewart Camp is characterized by gold-silver skarns, porphyry molybdenum deposits and silver-rich galena-sphalerite veins. Granduc samples G3 and G4 appear to be related to the third type of mineralization, Pb-Zn-Ag veins associated with Hyder Plutonism. Deposits of this type in the Stewart area include Porter-Idaho, Prosperity and Indian. *(n.b. Samples G3 and G4 have been split so there may be assay data in the original Granduc logs, if there isn't I may send a portion of these two samples for assay).*

4.3 *Diorite Sill*

As a result of the Triassic age determination for sample GD-GC-01 this unit becomes increasingly significant as it may represent a comagmatic intrusion. Therefore the intrusion may represent one of the lead reservoirs for the deposit. Duplicate analysis of the feldspar from the geochron sample GD-GC-01 produced very similar values, but had extremely high errors and will have to be re-analyzed. Sample GD-GC-01 was fairly sheared, recovery of sufficient feldspar for analysis may be easier from a less sheared and coarser-grained sample (i.e. one of the numerous litho samples). Lead isotope values from feldspar in the sill are:

206Pb-204Pb = 18.968-18.971

207Pb-204Pb = 15.591-15.625

208Pb-204Pb = 38.444-38.486

4.4 *Future lead work:*

4.4.1 Sulphide leads

Analysis of lead from pyrite, chalcopyrite +/- sphalerite (if recoverable) from:

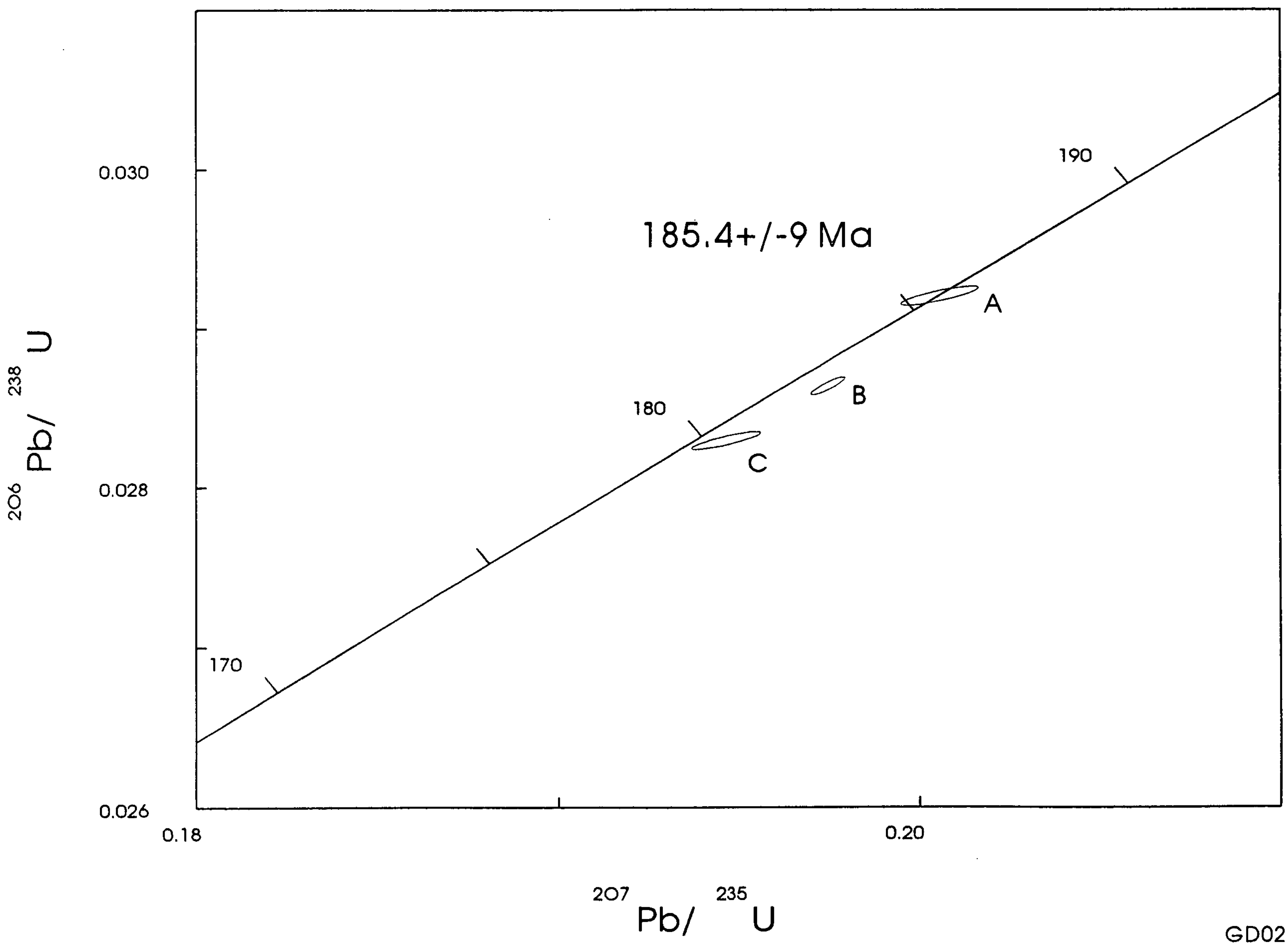
- -B orebody
- - F orebody
- - stockwork mineralization from the Footwall Andesite
- - pyrite from the diorite sill (may be localized along shears)

Analysis of trace leads from the main ore lenses is critical as the galena always appears in a cross-cutting relationship to the ore zones. It is most likely remobilized from theore zones but analysis of the trace leads may prove this hypothesis.

5 Geochemistry

6 Conclusions

GD-GC-02 FELSIC LAPILLI TUFF, GRANDUC MOUNTAIN



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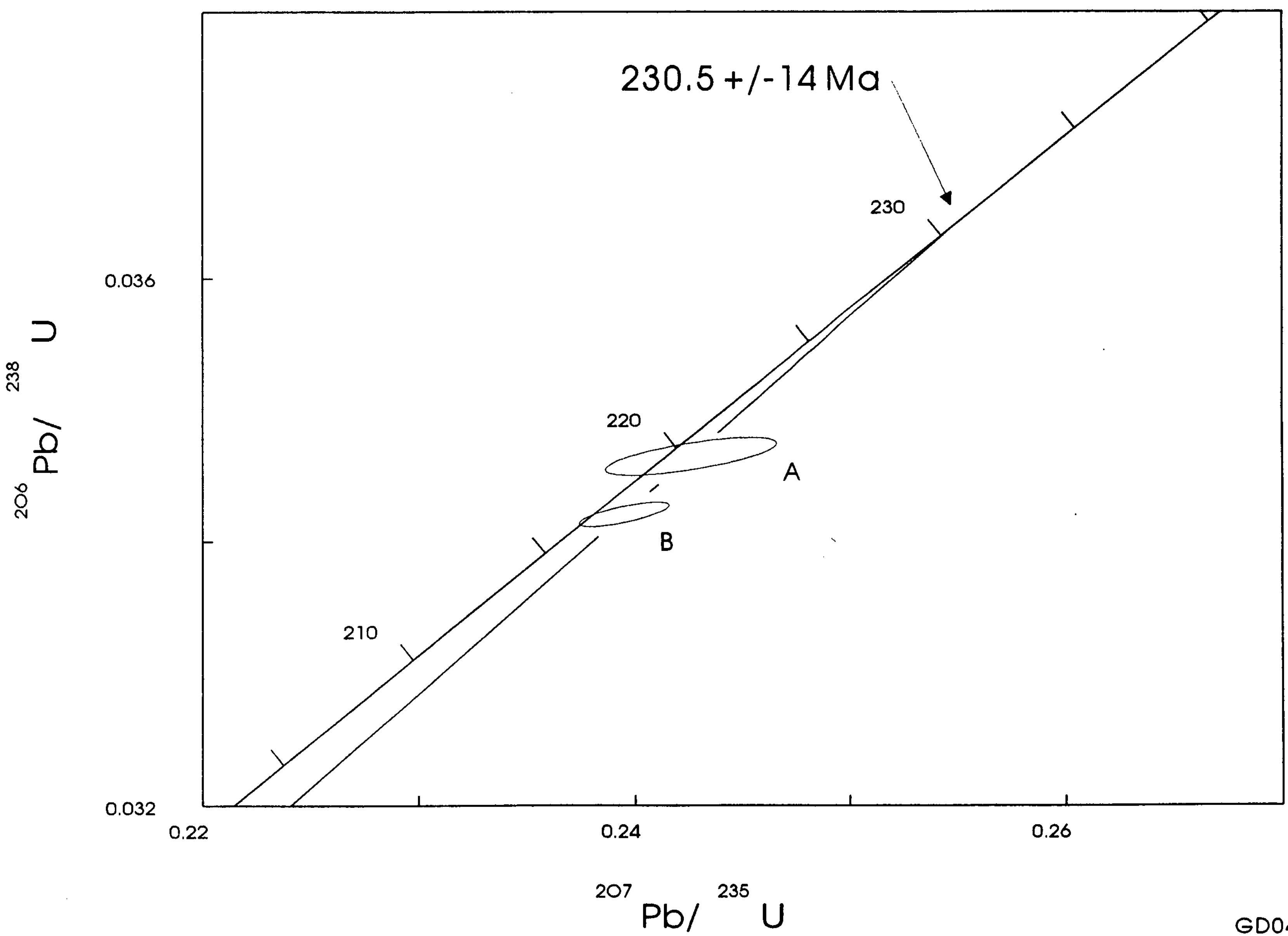
GD-GC-04 FOOTWALL ANDESITE, GRANDUC



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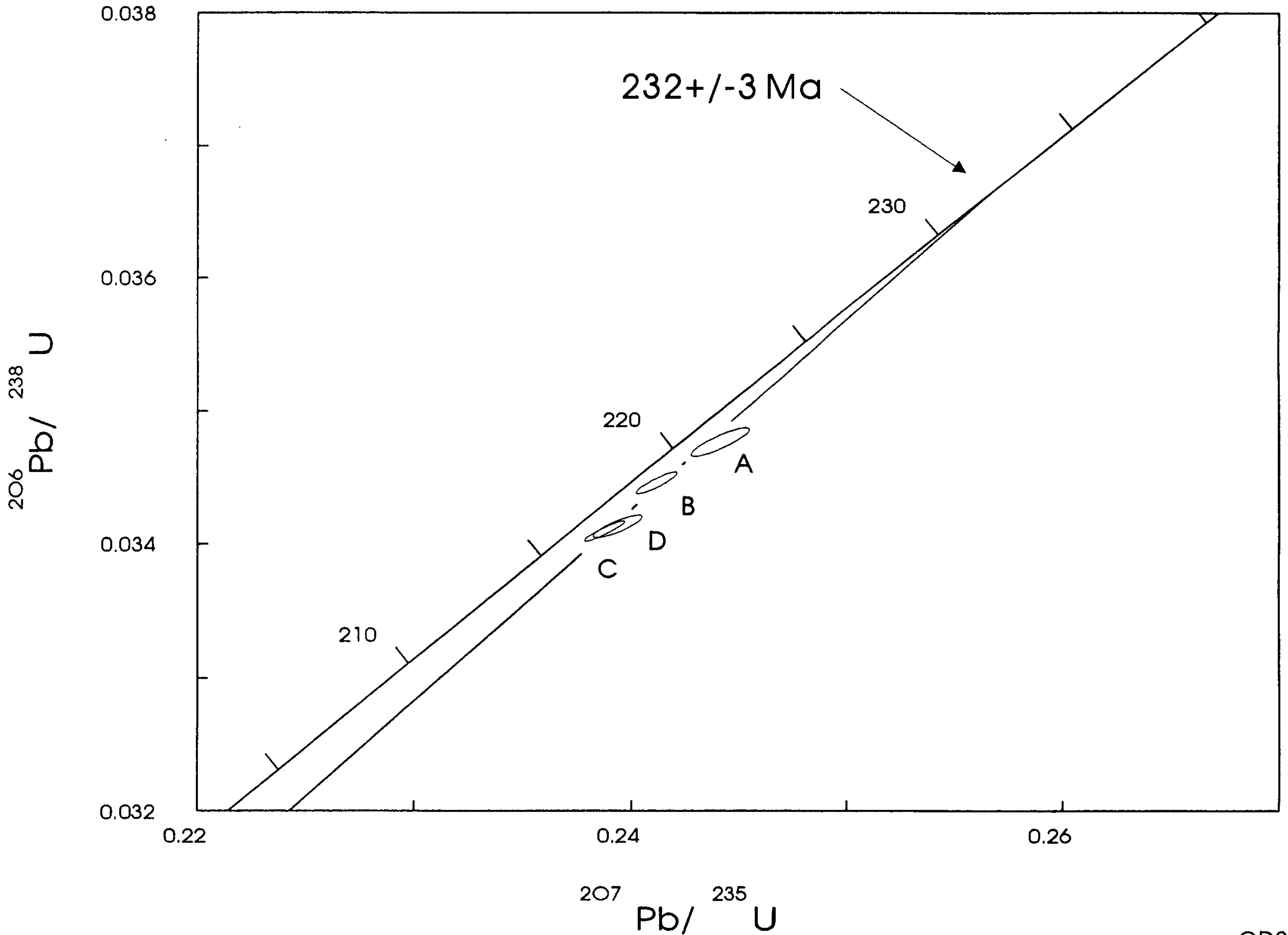
GD-GC-01 DIORITE SILL, GRANDUC



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APPENDIX F: Regional Geological Setting of the Granduc Deposit, Stewart Mining Camp, British Columbia by P.D. Lewis.

REGIONAL GEOLOGICAL SETTING OF THE GRANDUC DEPOSIT
STEWART MINING CAMP, BRITISH COLUMBIA

A field report prepared for the Mineral Deposit Research Unit

Peter D. Lewis

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Regional Geological Setting of the Granduc Deposit

Stewart Mining Camp, British Columbia

Peter D. Lewis, MDRU

Introduction:

This report presents results of a reconnaissance study of the stratigraphic and structural setting of the Granduc deposit, completed for the Volcanogenic Massive Sulphide project of the Mineral Deposit Research Unit at UBC. Specific topics addressed in the study included:

Stratigraphic problems:

1. Do Jurassic strata of the Hazelton Group extend southward as far as Granduc Mountain?
2. What is the stratigraphic setting of the mine series at Granduc Mountain? Is the conventionally regarded Triassic position, or a Jurassic position as suggested by several recent workers, more likely? Is a correlation with rocks of similar affinity at Eskay Creek possible?
3. Which (if any) strata located west of the western fault on Granduc Mountain correlate with mine series rocks?

Structural problems:

4. What is the history of deformation at Granduc, and how does it affect the distribution of stratigraphy? Does the structural report of Klepacki and Read (1981) adequately address the structural history at Granduc?
5. What role does the South Unuk shear zone play in the deformational history of Granduc? Are tectonic fabrics in rocks at Granduc related to this shear zone? What is the movement history on the shear zone?

These questions were addressed through geological mapping over a ten day period in August, 1993. Mapping was conducted north of Granduc Mountain in three areas along the east flank of the South Unuk River (from north to south, the Divelbliss, Duke, and North Leduc areas, Appendix 3). The rationale behind this approach was to attempt to extend known stratigraphic and structural constraints from areas examined in the MDRU Iskut River study southward into the Granduc mine area itself.

Field studies consisted of 1:20,000 scale mapping emphasizing structural and stratigraphic relations, and detailed measurement and analysis of structural fabrics in several locations. Due to the reconnaissance nature of this study, and the availability of existing detailed maps, no new mapping was conducted on Granduc Mountain itself; however, several traverses on Granduc Mountain examined the quality of existing structural studies and provided a basis for correlation with areas to the north.

This report summarizes the findings of the 1993 field studies in three sections. **Section One** provides a brief description of stratified and intrusive rocks at Granduc Mountain and to the north, and suggests a stratigraphic setting and age for the Granduc Deposit. **Section Two** examines the structural history of the South Unuk shear zone and of Granduc Mountain area, and provides an interpretation for structural elements at Granduc. **Section Three** reviews existing detailed structural reports for the Granduc Mine area, compares results to the present study, and identifies areas which are suited for additional research. Appendices provide compiled structural data from the 1993 field season, analytical data obtained since the field studies, a brief description of structural analysis methods, and a generalized map of the study area.

1. Stratigraphy and Intrusive Rocks

Rocks exposed in the Granduc Mountain area comprise two easily differentiable sequences, each several hundred metres to several kilometres in thickness. A western series of rocks consists of strongly foliated, greenschist facies metavolcanic and metasedimentary rocks, and include the Granduc mine series and hangingwall units at Granduc Mountain. An abrupt break in intensity of deformation and metamorphic grade occurs along a north-northeast striking postulated fault, and separates the western series from the much less deformed, dominantly volcanic eastern series. The boundary between western and eastern series rocks is easily identified north of Granduc Mountain, but on Granduc Mountain, the boundary is uncertain and merits further study. Two pre-tectonic intrusive suites of rocks occur within the western series; intrusions in the eastern series are mostly limited to the post-tectonic Lee Brant pluton.

1.1 Western Series

Western series rocks consist of moderately to highly foliated schists, phyllites, marbles, and gneisses. They outline a series of steeply dipping, north-northwest striking units which are well exposed along the east flank of the South Unuk River. The degree of metamorphism and deformation obscures original sedimentary structures which would allow determination of facing direction, and structural repetition within the sequence is likely but difficult to demonstrate. Western series rocks approximately two kilometres thick were mapped on slopes above treeline, and additional (unexamined) thicknesses to the west are great. Outside of Granduc Mountain itself, six major rock types are differentiable (referred to here and on field maps as the South Unuk Units). These units occur in no consistent stratigraphic order, and may occur at more than one level. Strongly foliated, medium grained biotite schist (Unit 1) is the dominant lithotype in the southwesternmost area examined, and does not occur elsewhere. Immediately north of the North Leduc Glacier and along strike from the Granduc Mine, thinly to medium bedded, pale green argillite and cherty argillite form a unit several hundred metres thick (Unit 2). This same unit occurs in easternmost parts of the western series to the north (Duke area). Unit 3 comprises all mappable marble intervals, which are most abundant and thickest in the northern part of the area mapped. Unit 4 consists of mafic hornblende schist and gneiss, is commonly strongly foliated, and probably has a basaltic tuff protolith. Unit 5 is transitional from unit four, and consists of intermediate composition schists and gneisses with a lower mafic mineral component than is present in unit 4. Unit 6 consists of thinly layered to laminated brown to gray, phyllitic mudstone to siltstone.

Similar rock types are present on Granduc Mountain itself (Granduc Units, 7-14), but further work is required to correlate individual units with the South Unuk units. Rock types as defined by Klepacki and Read (1981) were retained in this study, and consist of eight intercalated wacke, argillite, and metavolcanic units (see map, or Klepacki and Read report for short descriptions). The repetitive nature of these rocks types hints at structural repetition, but none has been documented in previous studies. Klepacki and Read (1981), on the basis of sedimentary facing indicators, postulated that rocks at Granduc Mountain face dominantly to the west.

1.2 Eastern Series

Eastern Series rocks consist of three lithologically distinct, volcanic dominated units. Clear sedimentary grading and pillow shapes indicate these units face southwest at the North Leduc Glacier; at other localities only the uppermost unit is exposed, and facing is equivocal. Unit 15 comprises a heterolithic volcanic breccia to conglomerate which forms the lowest unit identified in the eastern series. Clasts are dominantly green, plagioclase ± hornblende-phyric intermediate composition volcanic rocks, set in a green, fine to medium grained wacke matrix. Unit 15 is overlain conformably and abruptly by pale-weathering dacitic(?) composition bedded tuff, tuffaceous conglomerate, and breccia of unit 16. Clast size in unit 16 is highly variable, but are exclusively flow-banded aphyric dacite. Unit 16 is very well stratified, ranging from thinly to thickly bedded dust tuff, to several metre thick breccia layers with angular clasts up to 3 metres in longest dimension. Unit 17 is a brown weathering, andesitic composition pillowed flow and broken pillow breccia unit which sharply but conformably overlies unit 16 dacite. Individual pillows are spherical in shape, and range in size from 0.2 to 1 metre.

The age of the eastern series is constrained by U-Pb analyses of zircon separated from a dacitic megaclast collected from unit 16 north of Granduc Mountain. An interpreted age of 186.6 +/- 5.6 Ma (Sample 93-PL-420, Appendix 5; J. Mortensen, pers. comm. 1994) based on four fractions shows small amounts of Pb loss.

1.3 Intrusive Rocks

1.3.1 Bucke Glacier Stock and related intrusions

A large, northwesterly elongate, hornblende-biotite quartz diorite pluton intrudes western series rocks north of Granduc Mountain. This intrusion has a seriate texture, ranges from fine grained to very coarse grained, and varies compositionally from diorite to quartz diorite or monzodiorite. Alldrick and Britton (1992) mapped a compositionally and texturally similar intrusion west of the South Unuk River, which they named the Bucke Glacier stock. On the basis of this similarity, the map in appendix 3 shows continuity of the Bucke Glacier stock between these two areas, although mapping of contacts across the South Unuk River has not been attempted. The Bucke Glacier stock intrudes the South Unuk units of the western series along a sharp contact which is subparallel to regional foliation. The regional foliation in western series rocks is pervasive through all parts of the Bucke Glacier stock that were examined, although its intensity lessens within the intrusion.

Intrusive rocks on the north side of Granduc Mountain (Granduc Mountain intrusions) are described in Klepacki and Read's (1981) report as foliated diorite to quartz monzodiorite. Because of the compositional similarity to the Bucke Glacier stock elsewhere, they are considered part of the Bucke Glacier stock suite in this report.

Two U-Pb zircon dates constrain a Late Triassic age for the Bucke Glacier stock. In the Bucke Glacier area, M.L. Bevier (pers. comm., reported in Alldrick and Britton, 1992) reports an age of 221 $\pm$ 1 Ma for a foliated diorite phase of the stock. This is in close agreement with a concordant U-Pb age of 220-223 Ma obtained for a hornblende quartz monzodiorite phase in this study (sample 93-PL-413, appendix 5; J. Mortensen, pers. comm., 1994).

1.3.2 Unnamed syenite sills and dikes

Megacrystic syenite sills and dykes are common in western series rocks north of Granduc, especially in the Duke area, but are absent at Granduc Mountain. These sills are from 1 metre to several tens of metres thick, are parallel or subparallel to regional foliation and compositional layering, and contain crowded megacrystic (up to 5 cm) potassium feldspar. They contain the tectonic foliation present in surrounding country rocks, as well as a weak to strong alignment of megacrysts. .

1.3.3 Lee Brant stock

A large undeformed hornblende biotite quartz monzonite intrusion, the Lee Brant stock, cuts eastern series rocks in the northern extent of the area mapped. This intrusion was not examined in the present study. A U-Pb age of 55.6 +/- 2 Ma has been obtained from near Divelbliss Creek, on the west margin of the stock (J. Mortensen, pers. comm., 1994).

1.4 Correlation and Interpretation

Present mapping supports a Triassic age for the Granduc deposit. This is consistent with earlier age assignments based on correlation with fossil-bearing strata to the north at McQuillan Ridge, and disproves more recent speculation of a Jurassic age for Granduc. Although detailed correlation of the Granduc Mine series with units to the north has not been completed, similarities in structural style, lithologic character, and position relative to major structures indicates that Granduc rocks belong to the western series, which are themselves intruded by a 221 Ma pluton and must therefore be Late Triassic or older.

Eastern series rocks show notable similarities to Lower and Middle Jurassic, upper Hazelton Group rocks elsewhere in the Iskut River area, and are tentatively assigned to that Group. This correlation implies that a wide zone of prospective eastern series rocks follows the west side of the Frank Mackie icefield from near Eskay Creek to Granduc, and should be considered as prospective for Eskay Creek-type mineralization. The boundary between eastern series and western series rocks at Granduc Mountain remains problematic. The discovery during 1993 of dacitic rocks similar to those in the eastern series, but possibly in the footwall to the Granduc deposit, underscores the need for additional stratigraphic mapping studies.

2. Structural Geology

Granduc mountain lies near the southern mapped extent of a major northerly-striking shear zone, called by various workers the Harrymel/Melville fault (Read et al., 1989), the South Unuk Shear Zone (this report), the South Unuk cataclastic zone (Grove, 1986), and the Unuk/Harrymel Fault (Britton and Alldrick, 1992). Previous workers have disagreed heartily on the sense, magnitude, and age of offset along this structure (Read et al. 1989; Lewis, 1992; Glover, 1989). The importance of this feature at Granduc has also received varied interpretations. For example, Grove (1986) recognized that rocks at Granduc are strongly deformed within what he called the Unuk River cataclastic zone, in contrast to Klepacki and Read's (1981) structural report on Granduc which makes no mention of a major fault or shear zone.

Klepacki and Read (1981) have completed the most detailed structural analysis to date of surface exposures at Granduc Mountain. They describe a deformational sequence involving four phases of folding, followed by movement along several northerly-striking brittle faults.

2.1 The South Unuk Shear Zone

The South Unuk shear zone is the southern part of a north-south striking, subvertical fault which has been mapped from near Granduc Mountain as far north as the Iskut River (Lewis, 1993), a distance of about 60 kilometres. The character of this feature changes from north to south: in the north near Mount Shirley, it forms a narrow (10-20 metre) brittle fault zone with uncertain sense and direction of offset. South of Sulphurets creek, it widens into a zone of distributed ductile deformation a kilometre or more wide, with evidence of sinistral offset preserved (Lewis 1992). The present study was designed in part to examine the continuity of this fault system into the Granduc area, and to determine its influence on disruption of stratigraphy at Granduc Mountain. This was achieved, as noted above, through mapping structural transects on three separate ridges exposed north of Granduc Mountain and comparing structural styles and features with those observed at Granduc Mountain by Klepacki and Read (1981), and by myself during a short visit to Granduc Mountain in the 1993 field season.

2.1.1 Divelbliss, Duke, and North Leduc transects

Metamorphic rocks of the western series exposed on the Divelbliss, Duke, and North Leduc transects preserve evidence of strongly heterogenous deformation with a large component of simple shear strain in a ductile to semi-brittle environment. The degree of fabric development in these rocks, the strong strain asymmetry, and the localized nature of these fabrics warrant inclusion of western series rocks within part of a shear zone. The eastern limit of shear zone deformation is the fault boundary with eastern series rocks; the western limit is less well defined, and is gradational into poorly exposed rocks with less well-developed asymmetric fabrics near the South Unuk River. Within the shear zone itself, strain heterogeneity correlates with lithologic character; consequently packages of less-deformed, relatively competent rock (e.g., Bucke Glacier stock) are enclosed within mylonitic less competent rocks. Thus, although large bodies of rocks may be only moderately deformed and may not record simple shear deformation, they are still within the boundaries of the shear zone.

The orientation and character of fabrics varies along strike of the South Unuk shear zone, but overall define a progressive, strike-slip ductile deformation (D1) overprinted by a later episode of folding (D2). At the northernmost transect (Divelbliss), very strongly developed gneissic layering and schistose foliation (S1) is defined by metamorphic segregrated layering and parallel preferred orientation of hornblende. S1 is subvertical here, and strikes north-northwest to northerly. A moderately developed elongation lineation (L1), defined by alignment of hornblende, plunges moderately to shallowly southward. Asymmetric fabric features, such as rotated boudinaged siliceous bands are common, and consistently define sinistral asymmetry (Plate 1).

S1 foliation in the Divelbliss area is overprinted by northwest-striking, D2 crenulation cleavage and mesoscopic folds (Fig. 2.1). D2 features have downdip fold axes and consistent clockwise asymmetry. They are most strongly developed in the eastern part of the western series, close to the contact with eastern series rocks. Previous interpretations of the South Unuk shear zone which inferred a dominant dextral sense of shear were based on the interpretation that D2 asymmetry was related to shear zone formation (Glover, 1989), and thus described the overall shear zone asymmetry. However, the complete overprinting of S1 fabrics by S2 crenulation cleavage and S2 axial planar slatey cleavage is more consistent with formation as separate, unrelated deformational events.

The Duke area displays similar orientation and style S1 gneissic foliation and schistosity to that in the Divelbliss area, but the L1 mineral elongation lineation is less well developed. Where present, L1 forms a weak, down-dip lineation, with poorly defined sense of asymmetry. S1 planar fabrics dip steeply to the east in the Duke area, and strike northerly. D2 fabrics are well developed , and consist of northwesterly striking crenulation and fold fabrics similar to those in the Divelbliss area.

The North Leduc area has the best developed shear zone fabrics of any of the three transects, and a wide variety of shear sense and direction indicators yield consistent results. Mylonitic to ultramyonitic foliation and strong compositional lamination in rocks strikes northerly to north-northeasterly. Mesoscopic shear sense indicators include rotated boudinaged competent layers, both as δ and σ clasts, asymmetric extensional shear bands, antithetic shear bands, and shear-related folds (Plates 2a-d). Calculated slip directions, obtained from the geometry of asymmetric extensional shear bands and antithetic shears, define a moderately southwest plunging slip vector (Fig. 2.3, appendix 2).

Folds of mylonitic foliation at North Leduc are distinct from those further north in several respects (Fig. 2.4):

1.) Folds are disharmonic, and are commonly confined to single compositional layers or groups of less competent layers. As a result, layer shortening varies significantly within different layers of a single outcrop, necessitating significant layer-parallel slip along specific horizons.

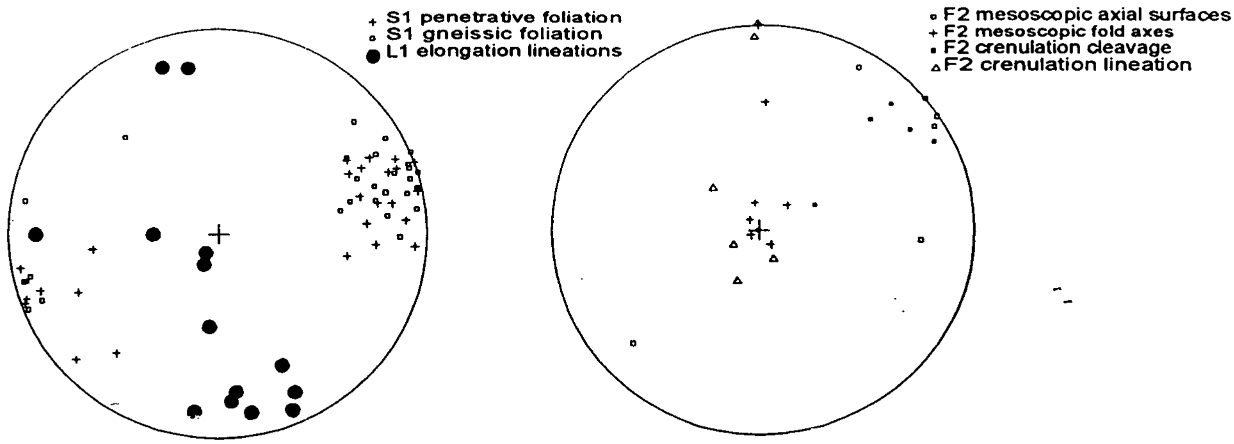
2) Fold axial surfaces strike northeasterly, and the resultant fold geometry has a strong clockwise asymmetry.

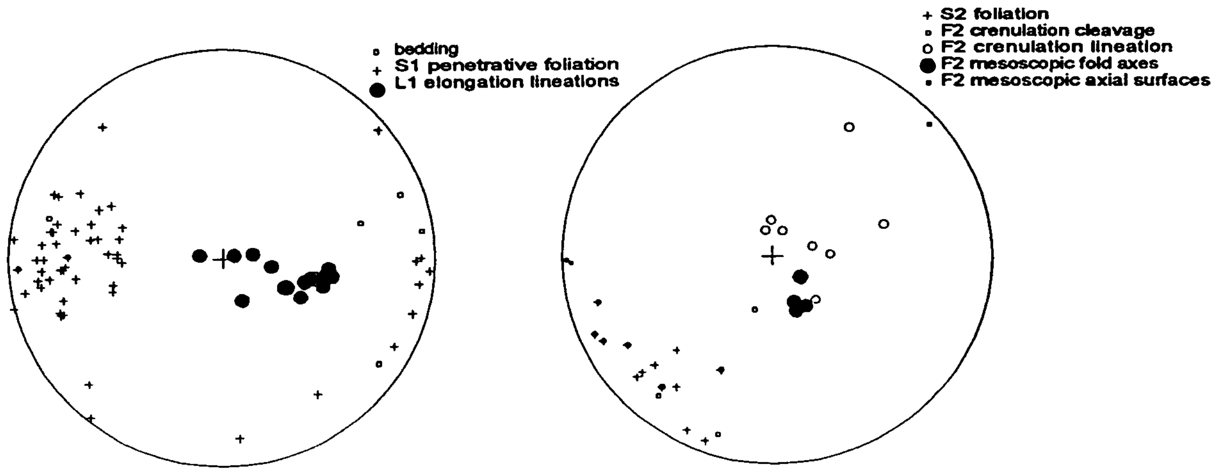
These observations are consistent with fold formation late during the simple shear event which characterizes the South Unuk shear zone, as localized drag features with asymmetry similar to the overall shear zone. Thus, they are referred to as F1' folds.

2.1.1 Granduc Mountain

Many of the fabric elements described above occur on Granduc Mountain itself, although this study has not examined them in detail. The primary S1 foliation is more variable in orientation on Granduc Mountain (S1) than it is farther north, and overall has a more northwesterly strike. This foliation has many of the features which demonstrate its genetic relationship to tectonic fabrics documented farther north, including asymmetric boudinaged layers, rootless isoclinal folds, shear bands, and mylonitic lamination (Plate 2.3). In particular, one area of laminated siliceous argillite examined within the Granduc mine series has a strong subhorizontal mineral elongation lineation, asymmetric σ siliceous boudins, and asymmetric extensional shear bands, all consistent with a large component of sinistral simple shear strain. Asymmetric microfabrics in samples from this area are characterized by dynamically recrystallized quartz subgrain fabrics, quartz ribbon grains, and δ shaped plagioclase porphyroclasts.

Klepacki and Read (1981) outlined four phases of folding (F1-F4) at Granduc Mountain. Their F1 folds are isoclinal mesoscopic structures with axial surfaces parallel to layering and consistent clockwise asymmetry. F2 folds have north- to northeasterly-striking subvertical axial surfaces, steeply plunging axes, and occur on both mesoscopic and megascopic scales. F3 folds are open, reclined structures with gentle southerly axial plunges, and F4 structures are defined by a gradual change in orientations of older features across the map area. Two younger periods of faulting are recognized, the most important being that associated with the steeply west dipping Granduc and Western Faults. The most likely correlations between structural features outlined by Klepacki and Read (1981), and those documented in the present study to the north, are addressed below.





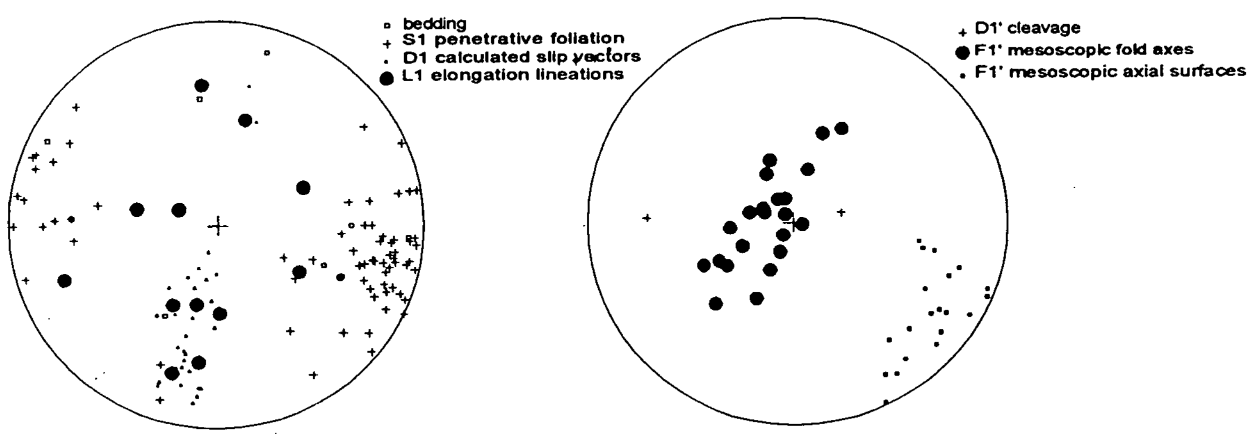


Fig. 2.1 (top): Stereographic projections of structural elements from present study in the Divelbliss region, South Unuk River

Fig. 2.2 (middle): Stereographic projections of structural elements from present study in the Duke region, South Unuk River

Fig. 2.3 (bottom): Stereographic projections of structural elements from present study in the Leduc region, South Unuk River

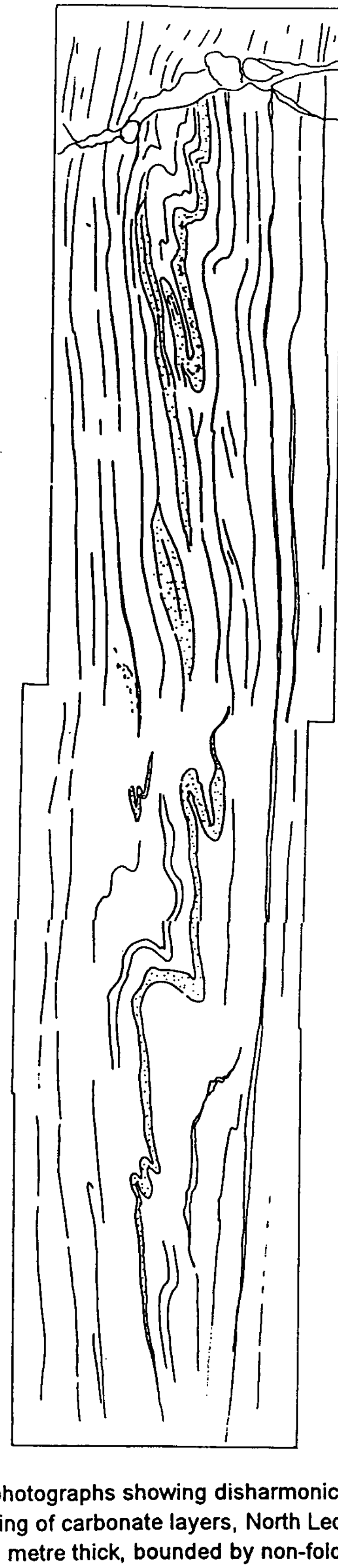


Fig. 2.4: Tracing of outcrop photographs showing disharmonic, asymmetric folds of mylonitic compositional layering of carbonate layers, North Leduc area. Folds are restricted to a layer about 1.0 metre thick, bounded by non-folded layers. Formation of folds of this geometry requires continued slip along mylonitic layering synchronous with folding within disrupted layers.

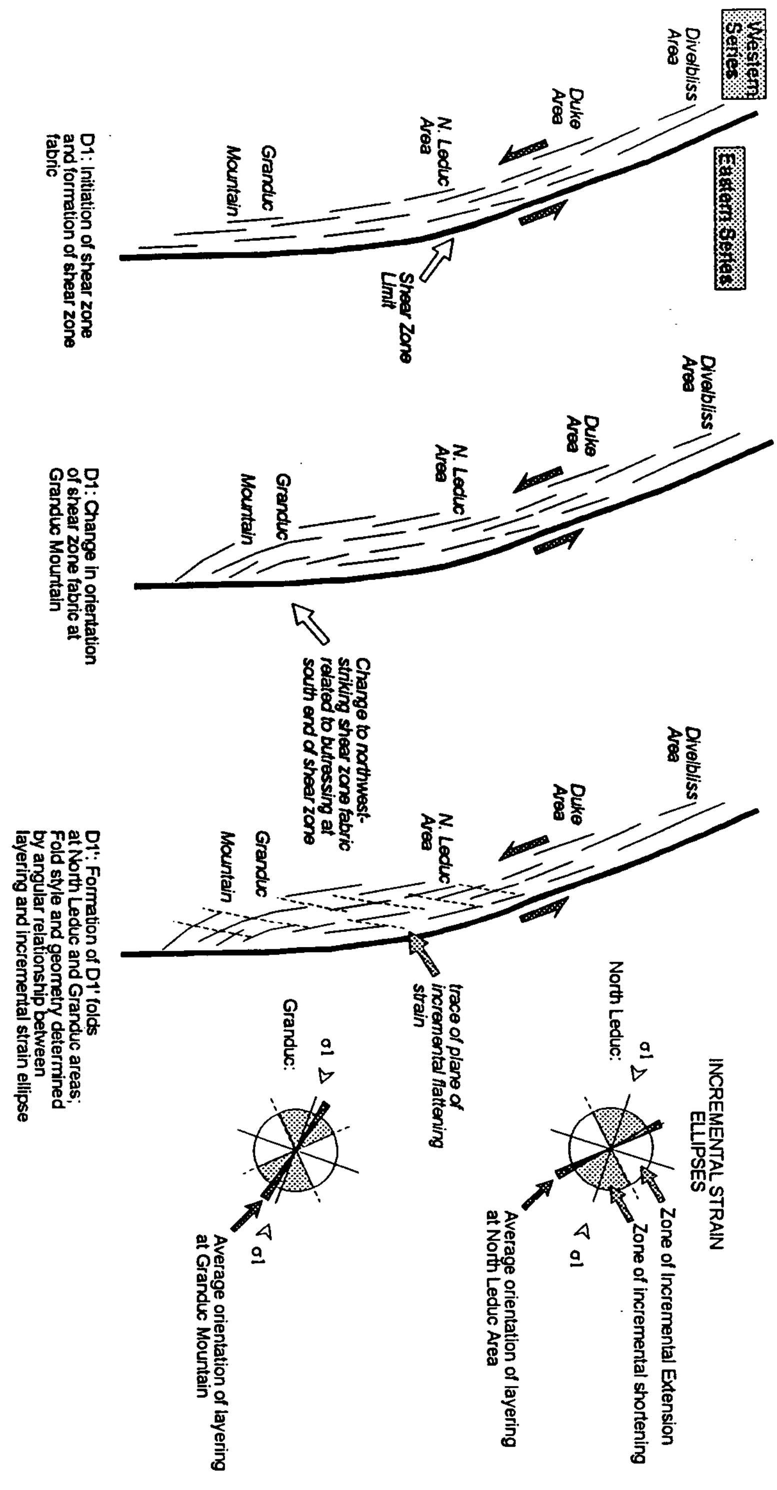


Fig. 3.1: Schematic illustration showing D1 and D1' development of the South Unuk shear zone, and factors controlling geometry of F1' structures

Plate 1: Boudinaged quartz vein transposed into regional gneissic foliation, Divelbliss Area, South Unuk shear zone. Asymmetry of boudin tails define sinistral shear sense.

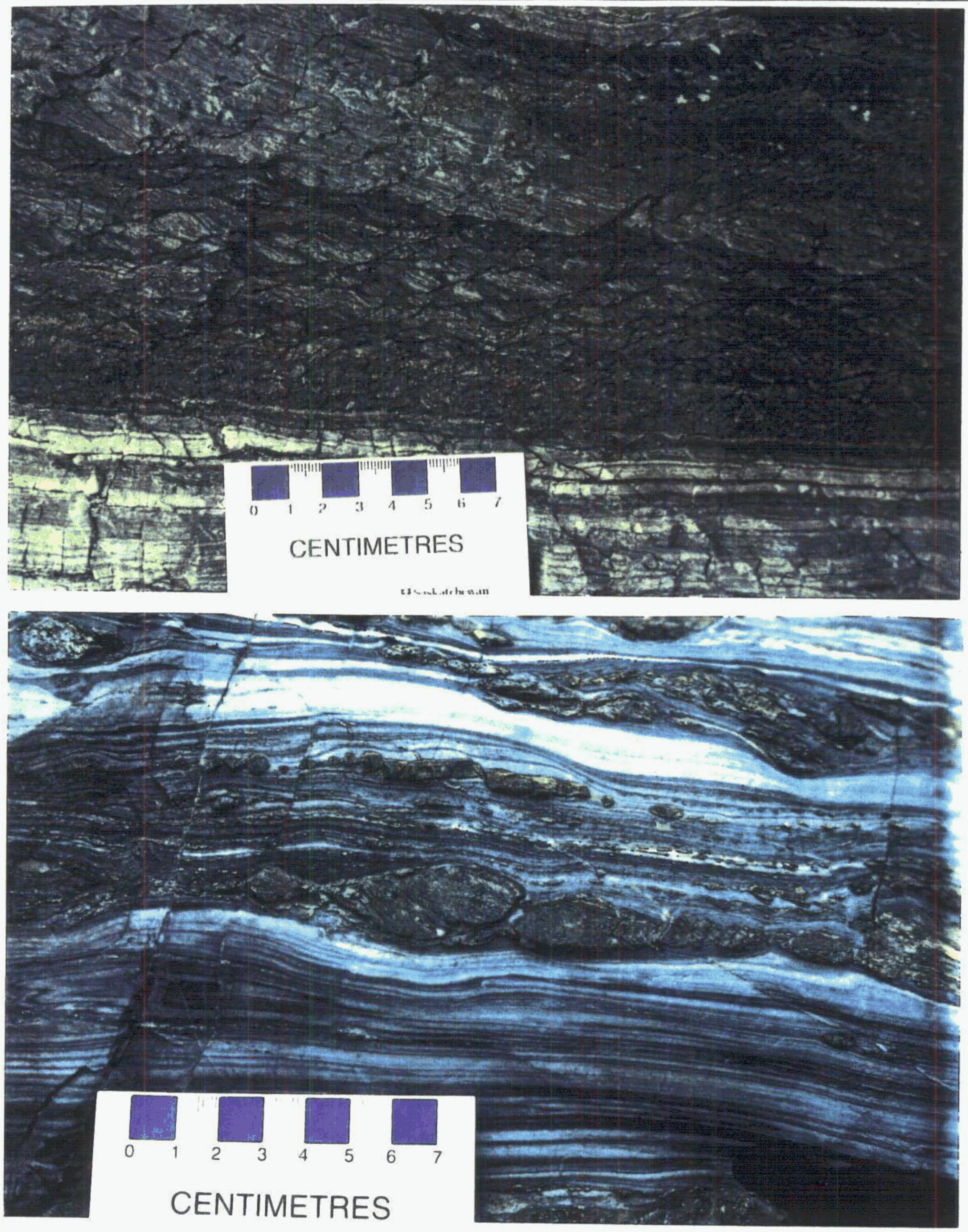
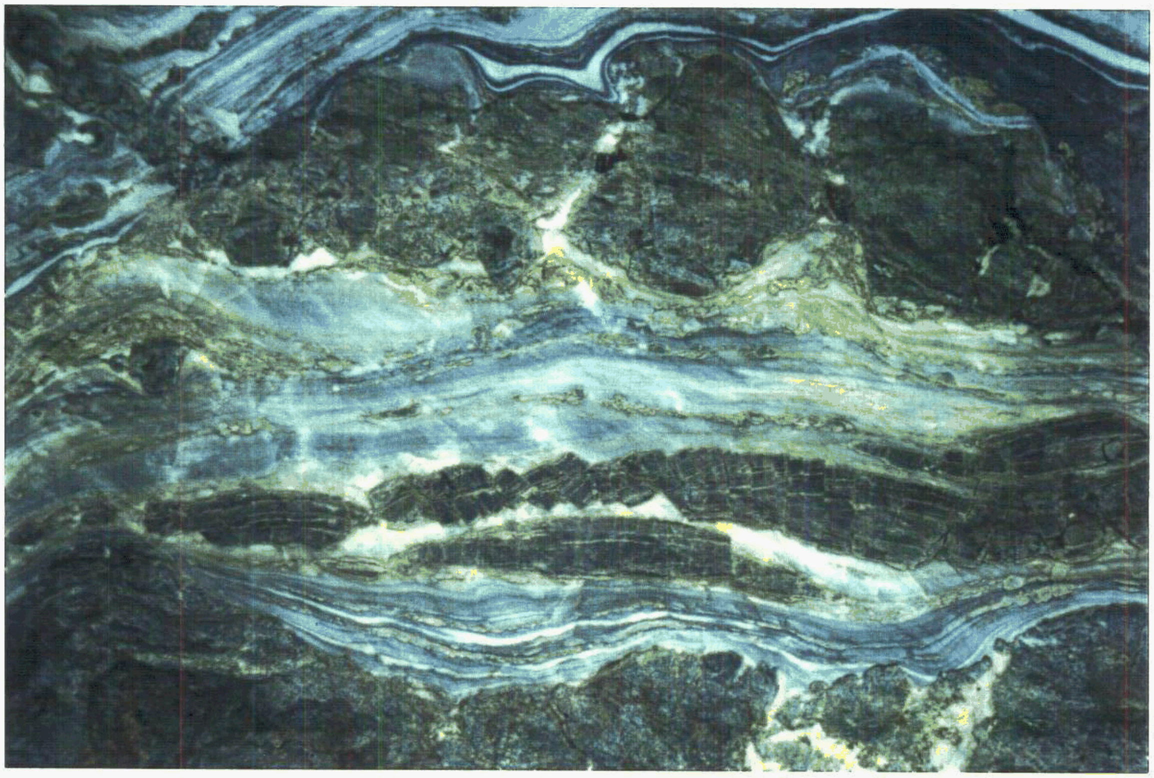


Plate 2: Mesoscopic shear sense indicators in mylonitic rocks of the South Unuk shear zone in the North Leduc area; all indicate sinistral shear sense: **a)** asymmetric extensional crenulation cleavage (C') cutting dominant mylonitic foliation; lithons between shear bands rotated clockwise, antithetic to overall shear sense. **b)** competent metatuff(?) layer within foliated carbonate matrix cut by synthetic and antithetic shear bands.



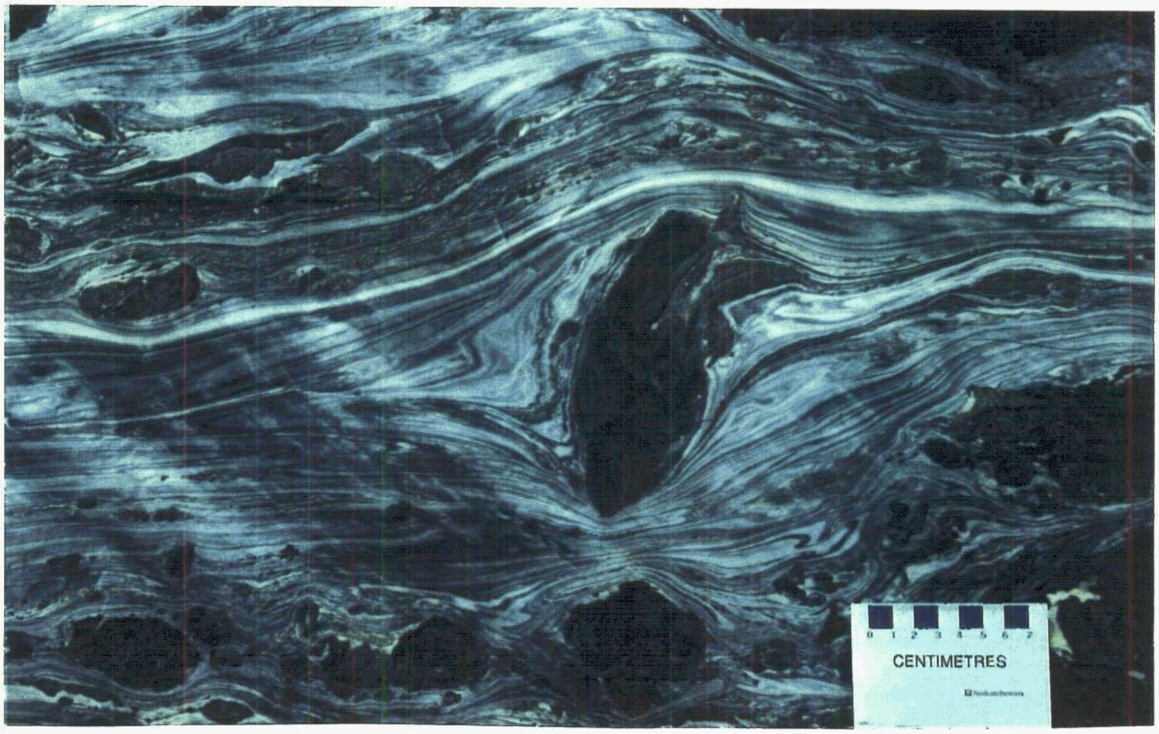


Plate 2 (continued): **c)** antithetic shear bands of metatuff layer within carbonate matrix. **d)** rotated boudinaged metatuff layer within mylonitic carbonate matrix; sinistral sense of shear given by boudin rotation direction and by minor fold asymmetry in pressure shadows adjacent to boudin.

3. Discussion

The Granduc deposit occurs within the southern part of a broad (several km wide) shear zone with a dominantly sinistral sense of motion. Unlike conventional shear zone models which feature a continuous strain gradient across the width of the shear zone, the South Unuk Shear zone is characterized by domainal, anastomosing zones of concentrated shear strain, interspersed with less deformed domains lacking strong shear fabrics. This strain partitioning is directed related to competency contrast between the widely varying lithotypes of the western series rocks. Fabrics preserved in the most highly deformed rocks record a sinistral shear sense with a subhorizontal to gently south plunging slip vector. Steep elongation lineations in the Duke area and in the eastern part of the North Leduc area suggest possible overprinting by a second period of dominantly dip-slip strain.

D1' clockwise disharmonic folds of compositional layering at the North Leduc area represent a late period of sinistral simple shear deformation superimposed on the mylonitic fabrics. F1 folds at Granduc show a similar asymmetry to these folds, but have more highly attenuated limbs and tighter profiles. Gentle northwesterly and southerly plunges of F1 fold axes at Granduc suggest progressive rotation of fold axes into the extension direction during D1 shearing, and indicate that F1 folds formed early in the deformational history. F2 folds at Granduc have axial surfaces parallel to F1' folds at north Leduc Glacier, but according to descriptions by Klepacki and Read (1981), are harmonic folds which deform early folds and layering. However, F2 fold geometry may be dictated by the more westerly strike of S1 in the Granduc area, and does not necessarily imply formation during a separate event. In this scenario, the early history of the South Unuk shear zone would be dominated by sinistral simple shear deformation, and the formation of strong mylonitic foliation. Irregularities in the strike of the shear zone and the shear zone fabric would contribute to a later episode where the localization of simple shear deformation and buckling of the early mylonitic foliation would be determined by fabric orientation (Fig. 3.1).

3.1 Previous studies

The structural report of Klepacki and Read (1981) provides a thorough analysis of the history of folding at Granduc, but has several shortcomings. Because it focuses on Granduc Mountain itself, the report does not provide a regional perspective of larger scale structures such as the South Unuk shear zone. As a result, it fails to recognize the significance of the S1 foliation in the Granduc Mountain area. The interpretation given by Klepacki and Read (1981) for the consistent asymmetry of early features is that S1 is a regional foliation on the single limb of a major, unmapped F1 folds. Major F1 folds as proposed by these authors are unlikely, and their postulated occurrence should not be used to guide to exploration in the area.

Klepacki and Read's (1981) report expends much effort describing four phases of folding, and defining structural domains on the basis of these folds. This can result in the false impression that the area is characterized by complex polyphase fold forms which need to be unraveled in order to understand the geometry of the Granduc deposit. In reality, the fold geometry is not as complex as it appears in the report, and only phases F1 and F2 significantly affect outcrop patterns in most areas. F1 fold axes, because they form early in deformation, are aligned parallel to the overall regional extension direction in the South Unuk shear zone, whereas F2 axes will plunge steeply downdip and are controlled by the orientation of the intersection between S1 layering and F2 axial planes.

3.2 Recommendations for further work.

The reconnaissance nature of the 1993 fieldwork has helped define topics for further study which will improve understanding of the Granduc deposit, as follows:

1. Regional mapping should be extended southward onto Granduc Mountain, particularly in the footwall of the deposit. This will assist in definition of both footwall stratigraphy and the eastern sequence rocks, and will locate the boundary between eastern and western series rocks on Granduc Mountain. In addition, regional mapping will help define the relative stratigraphic and structural positions of dacitic units and mine series rocks. (5 -7 days)

2. Detailed structural mapping of Granduc Mountain itself is required to define the sequence of deformation in Granduc series rocks, and to test structural models presented here. This mapping will proceed relatively quickly, as lithologic units are already outlined adequately on existing field maps, allowing new mapping to concentrate solely on structural features. (5-7 days)

3. Comparison of Granduc Mountain units with strata intruded by the Bucke Glacier stock will help correlate the northern extension of the Granduc Mine series, and will further confirm the age of the mine series. (2 days)

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4. Appendices

4.1 Structural Data

A. Divelbliss area, 1991 Data

Station	UTM east	UTM north	Bedding (tops unknown)	Phase 1 cleavage	elongation lineation	gneissic layering	crenulation cleavage	crenulation lineation	mesofold fold axis	mesoax axial plane
691	413.789	6247.139		155 68	x		141 90			
692	413.504	6247.228		168 88						
693	413.522	6247.398				160 87			048 74	318 74
694	413.59	6247.721				339 81				
695	413.49	6247.861		318 82			x			
696	413.441	6247.981				163 90				
697	413.242	6248.081				168 83				
698	413.004	6248.117		176 64	270 62					
699	412.976	6248.363				346 85			239 86	149 86
700	412.794	6248.605				167 88				
701	412.551	6248.784				164 86				
702	412.513	6248.949	167 90							
703	412.348	6248.894			176 16	174 73				
704	412.212	6248.957				161 80				
705	412.037	6248.834								
706	411.758	6250.833				169 53				
707	411.894	6250.72			170 10	166 58				
708	412.187	6250.228				163 70				
709	412.434	6250.041				157 90	153 83	156 75		
710	412.478	6250.004				010 84	146 77	236 77		
711	412.28	6249.941				346 86				
712	412.119	6249.995				168 69				
713	412.013	6249.989				161 87				
714	411.972	6249.899			174 20	173 86				
715	411.919	6249.819				150 83	156 26			
716	411.821	6249.728				153 76				
717	411.766	6249.732		153 73						
718	411.469	6249.637				047 58				
719	411.406	6249.754				181 78		359 06		
720	411.305	6250.055				002 90				
721	411.32	6250.471				338 88				
722	411.181	6250.56				140 76				
723	411.043	6250.655			350 16	347 83				
724	411.098	6250.848		184 68					003 34	184 68
725	411.066	6250.978			342 13	166 74				
726	411.184	6251.513				158 64				
727	411.241	6251.437				149 64				

B. Divelbliss area, 1993 field data

Station	UTM east	UTM north	Bedding (tops unknown)	Bedding (overturned)	Phase 1 cleavage	Phase 2 cleavage	elongation lineation	crenulation cleavage	crenulation lineation	mesoscopic fold axis	mesoscopic axial plane
306	412.44	6248.584			170 76		188 11				
					169 70		270 12				
307	412.601	6248.588			155 62		158 6				
308	412.687	6248.604			150 64		155 13				
309	412.766	6248.653			160 82						
310	412.838	6248.675			170 76	135 67	186 49	135 67	202 65		
311	412.914	6248.738		207 61	190 56						
312	412.953	6248.799	176 81		176 81	136 78		136 78	312 64		
313	413.027	6248.821			184 85	147 89				320 84	147 89
314	413.054	6248.88			350 86	141 90				141 82	141 90
315	413.127	6248.914			340 88					352 78	121 82
316	413.157	6248.917			310 68						
317	413.25	6249.007			337 65	323 48					
318	413.366	6249.057			157 83		214 80				
					160 78		206 75				
319	413.422	6249.072			353 54						
320	413.474	6249.077			342 80						
321	412.478	6248.974			341 87		155 26				
322	412.393	6248.888			165 63						
323	412.291	6248.853			160 90						

C. Duke area

Station	UTM east	UTM north	Bedding (tops unknown)	Bedding (overturned)	Phase 1 cleavage	Phase 2 cleavage	elongation lineation	crenulation cleavage	crenulation lineation	mesoscopic fold axis	mesoscopic axial plane
246	415.605	6242.833			345 69						
247	415.73	6242.693			010 53		104 52				
248	415.872	6242.673			012 44						
249	415.951	6242.668	14 75		016 57		117 53				
250	416.015	6242.707	1 65		1 65						
251	416.081	6242.68		172 85							
252	416.056	6242.804	357 86		357 86	318 78					
253	416.01	6242.898			181 82		279 80				
254	416.066	6243.057			352 62						
255	416.103	6243.146			140 86	296 84					
256	416.408	6243.157									
257	416.557	6243.09									
258	416.71	6242.972									
259	416.753	6243.107			5 76						
260	416.308	6243.191									
261	416.053	6243.238			340 72						
262	415.928	6243.357			309 88						
263	415.772	6243.354			340 71						
264	415.749	6243.207			353 78						
265	416.133	6241.983			351 77		81 77				
266	416.169	6242.036			13 71						
267	416.246	6242.065			000 75						
268	416.329	6242.142			6 88		72 85				
					208 82						
269	416.393	6242.157	215 80								
270	416.469	6242.157			197 84						
271	416.583	6242.222									
272	417.127	6242.376									
273	417.285	6242.308	165 60								
274	417.582	6241.913									
275	417.24	6242.212			180 84						
					356 76						
276	417.139	6242.195	160 80								
277	415.956	6241.881			9 56						
278	415.879	6241.867			6 70		100 69				
279	415.839	6241.674			346 47		96 45				
280	415.79	6241.511			22 74	290 85					
281	415.928	6241.8			343 48		100 46				
282	415.79	6241.604			188 84			287 81	346 78		
283	415.713	6241.512			184 88			309 78	358 74		
284	415.661	6241.498			353 73	328 73		328 73	075 73		
285	415.623	6241.491			350 84	333 81		333 81	020 78		
286	415.593	6241.456			316 78	306 70	156 70			156 68	359 88
					341 72		115 60			158 64	358 86
287	415.549	6241.449			346 90	318 75					
288	415.517	6241.368			236 71						
					000 78						
289	415.484	6241.523			49 76	317 69					
					356 68						
290	415.519	6241.604			357 66						
291	415.398	6241.777			3 44	315 58					
292	415.402	6241.968			358 42			288 25	030 26		
293	415.46	6242.082			1 44	294 54		294 54	073 42		
294	415.358	6242.781			3 48		106 46				
295	415.265	6242.939			265 78						
296	415.271	6243.216			19 44		100 43				
297	415.261	6243.586			23 56		107 54				
298	415.258	6243.668			27 52		103 50				
299	415.19	6243.951			12 63		116 61				
300	415.098	6243.964			10 73	318 78					
301	415.063	6244.034			26 66			345 77	137 64		
302	414.886	6244.139			10 72	345 77				148 64	139 86
303	414.768	6244.2			22 76	336 83				129 75	336 83
304	414.651	6244.344			26 66						
305	414.78	6244.09			356 67	310 74		310 74	088 66		

D. Leduc Area

Station	UTM east	UTM north	Bedding (tops unknown)	Bedding (overturned)	Bedding (top known)	Phase 1 cleavage	Phase 2 cleavage	elongation lineation	calculated slip dir.	mesoscopic fold axis	mesoscopic axial plane
324	415.886	6236.248				180 64		188 29			
325	415.948	6236.218				171 67					
						186 71					
326	415.999	6236.247				193 70		209 50		244 66	208 63
						238 78				242 54	192 56
										236 56	192 61
										205 53	189 54
327	416.068	6236.262				156 88				327 78	218 79
328	416.141	6236.311				184 86				317 85	209 85
						288 81					
329	416.195	6236.349				000 75				18 49	224 68
330	416.301	6236.349				292 66				015 66	202 88
331	416.338	6236.356				170 88					
332	416.451	6236.378				220 87					
333	416.645	6236.554				236 56					
334	416.273	6236.465				192 84			190 31	203 76	200 87
						8 84				205 67	046 82
						193 88					
335	416.228	6236.48				344 86			190 42	100 86	215 71
						186 87					
						9 87					
						191 85					
336	416.126	6236.513				170 80				283 71	215 71
337	415.986	6236.516				22 84			198 27		
						30 73					
						21 85					
						22 76					
338	415.884	6236.614				000 88		179 51			
339	415.774	6236.74				191 60		197 22			
340	415.702	6237.101				185 77					
341	415.704	6236.251				184 54					
342	415.874	6236.008				200 77					
343	415.852	6235.794				206 90				027 44	232 66
344	415.784	6235.704				194 77			186 27	290 77	237 80
						189 78					
345	415.888	6235.428	3 63			3 63		120 49			
346	415.967	6235.497				18 82		195 54			
347	416.044	6235.502				354 62					
348	416.123	6235.497				10 52		66 49			
349	416.187	6235.495				41 80	2 64				
350	416.306	6235.54				192 79					
351	416.39	6235.632				201 68					
352	416.645	6235.857	203 58			203 58				244 47	244 89
353	416.597	6235.617				195 66		354 28		265 63	240 78
354	416.538	6235.418				202 79		15 42		223 41	212 76
355	416.541	6235.035				180 67			192 26		
						2 70					
356	416.603	6234.939				170 85	37 90			217 83	037 90
							41 84				
357	416.65	6234.911	106 79								
			27 82								
358	416.468	6234.635				202 88					
359	416.262	6234.661				193 69					
360	416.192	6234.65				186 76				340 61	196 73
										332 66	200 70
361	416.012	6234.728				170 80					212 73
362	415.816	6234.798				185 84				342 79	222 81
363	415.655	6234.92				184 72					
364	415.856	6235.095				190 76				295 76	232 77
365	415.857	6235.206				191 78					
366	415.927	6235.771				200 81					
367	416.081	6235.91				201 85			210 53		
						207 82					
413	415.462	6234.864				216 81					
414	417.891	6235.809				146 77					
415	417.963	6235.855				200 44					
416	418.053	6235.945				206 32	168 21				
417	418.091	6236.025				215 41		250 20			
418	418.205	6236.046				170 58		282 55			
419	418.326	6236.094				193 74					
420	418.366	6236.087		184 83							
421	418.421	6236.064			300 46	196 76					
422	418.537	6235.947			180 58	205 75					
423	418.565	6235.886			82 56						
424	418.63	6235.965			201 49	196 64					
425	418.74	6235.911				203 72		293 72			
426	418.828	6235.89				221 72					

4.2 Calculation of slip directions from mesoscopic structural features

Movement directions were calculated in various locations using angular relationships between mylonitic foliation, asymmetric extensional shear bands, and antithetic shear bands. These calculations rely on the fact that the slip direction will lie on the mylonitic foliation plane, at 90o to the intersection line between the mylonitic foliation and either synthetic or antithetic shear bands (Fig. 4.1).

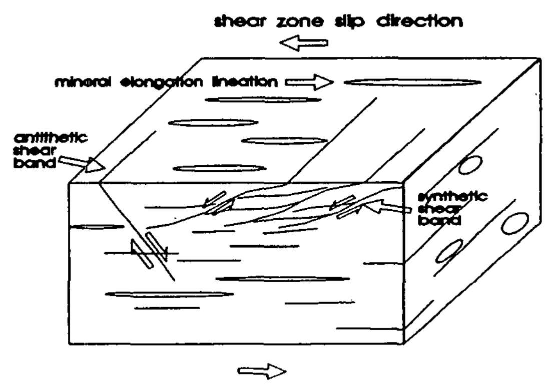


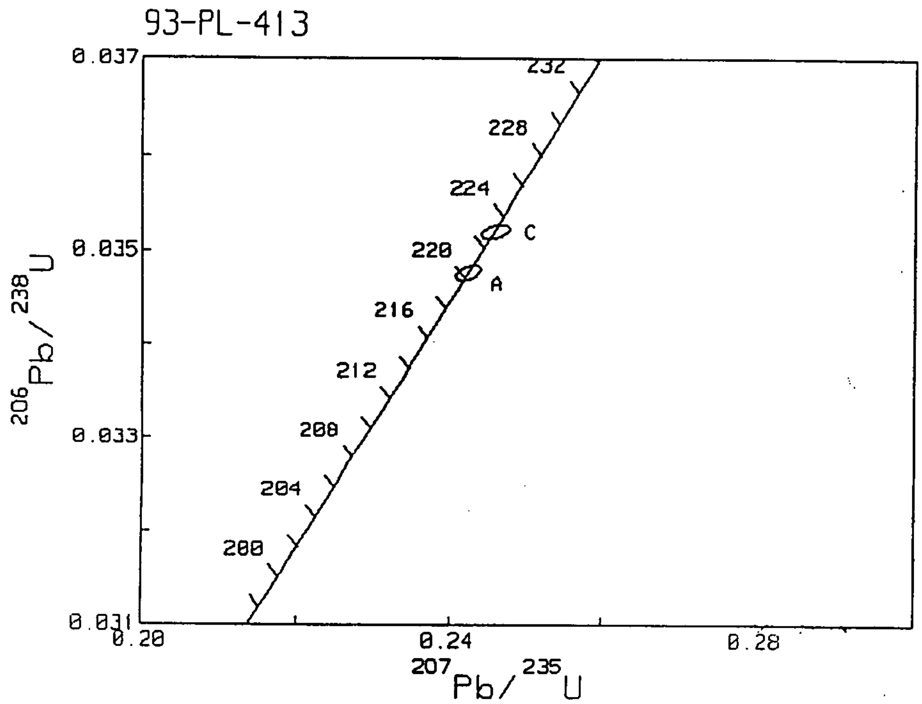
Fig. 4.1: Schematic diagram illustrating the relationship between mylonitic foliation, asymmetric extensional shear bands, antithetic shear bands, and slip direction.

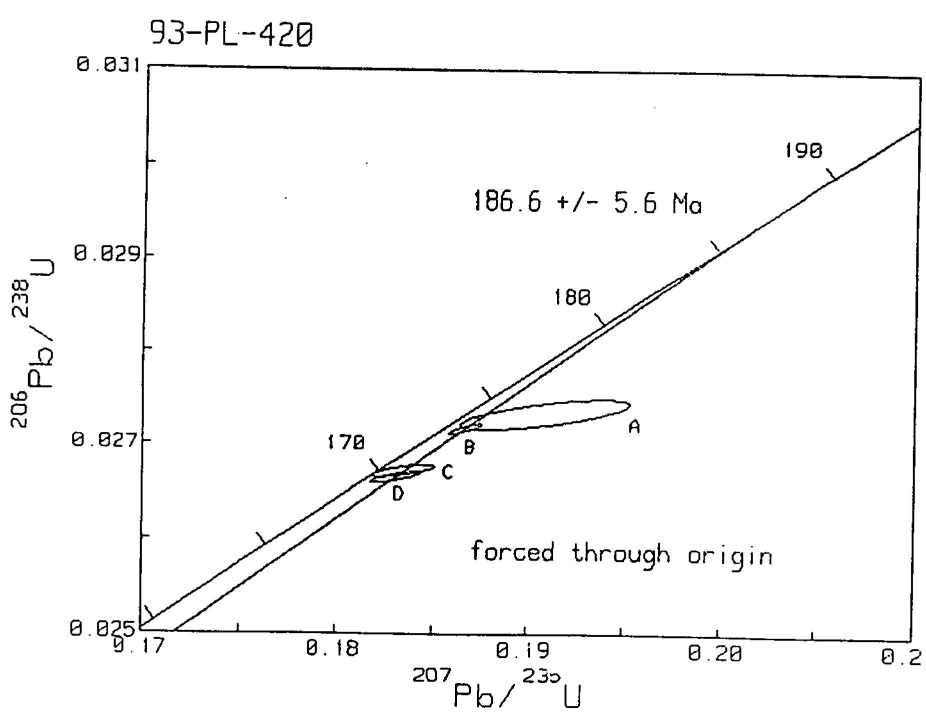
This analysis requires that mylonitic foliation and shear bands be related to the same deformational event. In the Granduc Mountain study, consistency of shear bands with other kinematic indicators, and parallelism between calculated slip directions and elongation lineation were considered evidence of coeval formation.

At each location analyzed, a minimum of three mylonitic foliation planes and three shear planes were obtained. Orientation of all calculated slip directions were quickly determined using a simple computer program to calculate intersections and slip lines.

4.4 Selected geochemical analyses from the South Unuk area

4.5 New U-Pb geochronometry for the Granduc Mountain area





APPENDIX H: Statement of Qualifications

STATEMENT of QUALIFICATIONS

Garnet L. Dawson

I, Garnet L. Dawson, do hereby certify:

* I hold a Bachelor of Science in Geology granted by the University of Manitoba, in 1981.

* I completed a Master of Science in Economic Geology at the University of British Columbia in August, 1994.

* I am a registered Professional Geoscientist with the Association of Professional Engineers and Geoscientists of British Columbia.

* I am a member of the Geological Association of Canada and the Society of Economic Geologists.

* I have worked continuously in geology with major exploration companies, government geological surveys and geological consulting companies since graduation.

* I was an employee of Cambria Geological Ltd. at the time of this work.

* I have not received, nor do I expect to receive any interest directly or indirectly in Granduc Mining Corporation Ltd.

* This report is written by me and is based on geological field work carried out by Cambria Geological Ltd. and the Mineral Deposits Research Unit (MDRU) at The University of British Columbia during August, 1993.

Dated at Vancouver, B.C., this 22th day of September, 1994.

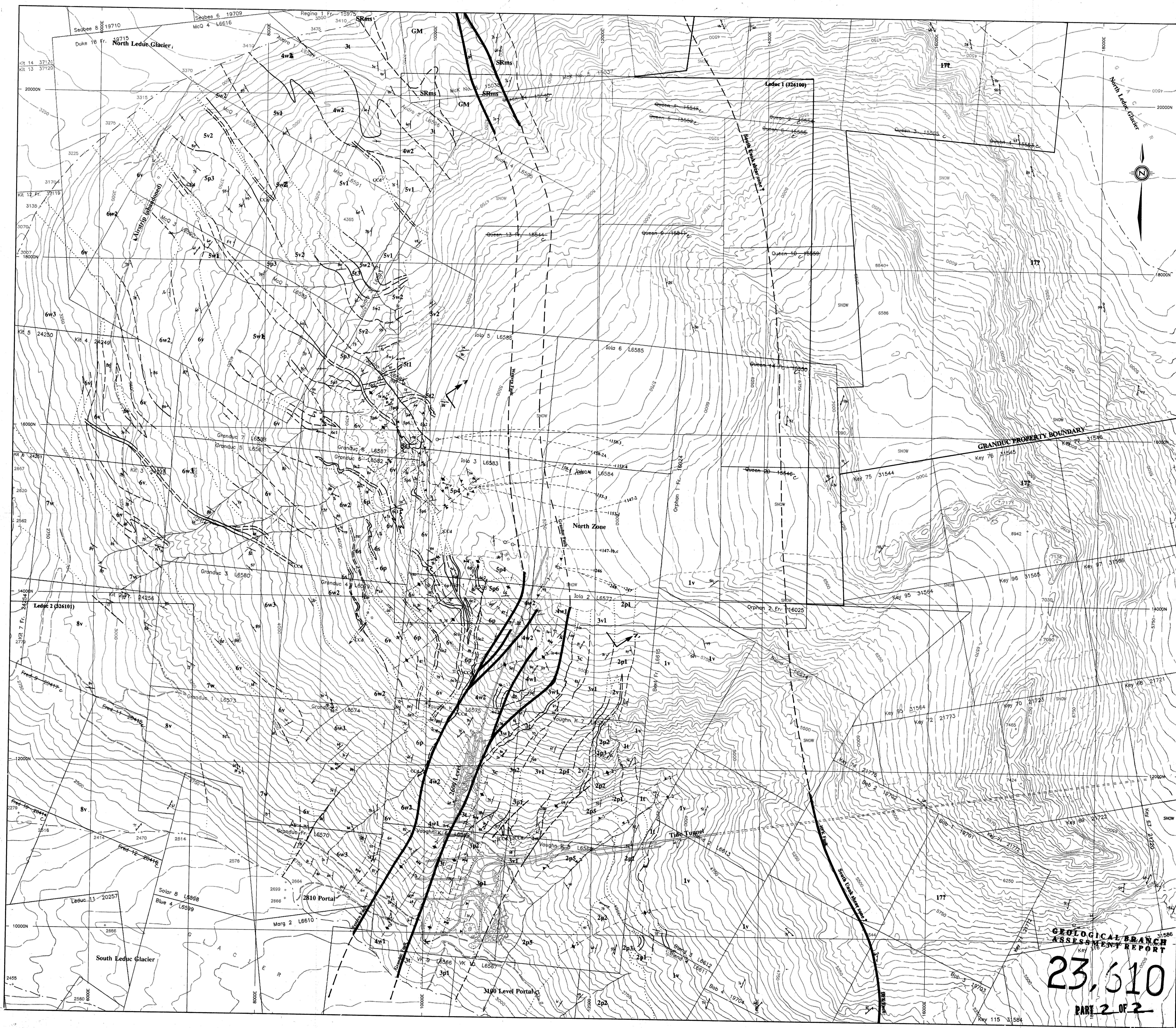
PROVINCE OF G. L. DAWSON BRITISH COLUMBIA

Garnet L. Dawson, P.Geo.

APPENDIX I: Statement of Cost

GRANDUC PROPERTY - BRITISH COLUMBIA
NTS 104/1E, 1W, 8W
1993 - 1994 STATEMENT OF COST - CAMBRIA GEOLOGICAL LTD.

A.	**Field Preparation**		
	- 1 Sr. Geologist - 5 days @ $450/day	$2,250.00	
	- 1 Assistant - 5 days @ $160/day	800.00	
	- P. McGuigan - 5 days @ $500/day	$2,500.00	
	- Map preparation, reproduction, etc.	$1,000.00	
	- Travel and Freight	$715.50	
	Subtotal	**$7,265.50**	**$7,265.50**
B.	**Field Program**		
	- 1 Sr. Geologist - 20 days @ $450/day	$9,000.00	
	- Travel & Hotel Expenses - Sr Geologist	$2,069.41	
	- 1 Assistant - 20 days @ $160/day	$3,200.00	
	- Travel & Hotel Expenses - Assistant	$307.58	
	- P. McGuigan - 7 days @ $500/day	$3,500.00	
	- Travel & Hotel Expenses - P. McGuigan	$2,046.42	
	- Truck Rental - 1 month @ $1500/month	$1,500.00	
	Subtotal	**$21,623.41**	**$21,623.41**
C.	**Report Preparation**		
	- 1 Sr. Geologist - 27.5 days @ $450/day	$12,375.00	
	- 1 CAD Technician - 10 days @ $450/day	$4,500.00	
	- P. McGuigan - 5 days @ $500/day	$2,500.00	
	- Secretarial	$1,000.00	
	- Reproduction	$1,000.00	
	Subtotal	**$21,375.00**	**$21,375.00**
	PROJECT TOTAL		**50,263.91**



GEOLOGICAL BRANCH
ASSESSMENT REPORT

23,610

PART 2 OF 2

LEGEND

Eocene

COAST COMPLEX:

- CC — Granitoid batholiths and stocks. Medium to coarse grained, biotite granite; biotite+/-hornblende granodiorite; minor quartz diorite.
- CCd — Fine to medium grained diorite and quartz diorite.

INTRUSIVE CONTACT

HAZELTON GROUP ? (LOWER TO MIDDLE JURASSIC)

- 17 — Andesite to basalt mafic flows, pillowed flows and flow breccia
- 16 — Dacite breccia, bedded tuff and epiclastic conglomerate
- 15 — Andesite tuff, volcanic conglomerate and/or breccia

SOUTH UNUK SHEAR ZONE

STUHINI GROUP (LATE TRIASSIC OR OLDER)

- BG — BUCKE GLACIER STOCK: Light grey, gneissic to foliated, medium grained hornblende-biotite quartz diorite.

INTRUSIVE CONTACT

GRANDUC HANGING WALL UNITS (units 4 to 8):

GRANDUC HANGING WALL: UPPER VOLCANIC SEQUENCE

- 8c — Grey, white, and black chert interbedded with green volcanics.
- 8v — Green foliated volcanics; feldspar and augite-bearing andesite flows, green foliated tuff.

GRANDUC HANGING WALL: SILICEOUS WACKE

- 7w — Light grey to brown bedded siliceous wacke, some pyritic clots.

GRANDUC HANGING WALL: MAFIC WACKE SEQUENCE

- 6w3 — Dark grey phyllite and wacke, minor sulphidic argillite, siliceous wacke, and minor feldspar porphyry flows.
- 6t — Light purplish-grey calcareous tuff and limestone.
- 6w2 — Dark green, grey, and purple, medium to fine grained wacke.
- 6s — Bedded cream feldspathic arenite.
- 6c2 — Cream to light green laminated chert and siliceous argillite; grades laterally into 6c1.
- 6c1 — Laminated white chert horizon.
- 6v — Dark green, foliated amphibole-bearing tuff characterized by very thin white stringers.
- 6w1 — Grey, foliated tuff and wacke; laminated chert, minor argillite.
- 6p — Light green, bedded argillite, minor black argillite.

GRANDUC HANGING WALL: VARIED SEQUENCE

- 5p6 — Light green and grey siliceous argillite, black pyritic argillite.
- 5p5 — Light green bedded argillite, local calcareous horizons.
- 5l3 — Light grey to black limestone.
- 5p4 — Light brown to dark grey, well bedded siliceous argillite.
- 5p3 — Grey siliceous argillite, locally well bedded.
- 5v2 — Dark green foliated volcanic rocks; locally with green acicular amphibole.
- 5w2 — Light grey siliceous wacke.
- 5ss — Light grey to cream, tuffaceous sandstone with a medial felsite unit.
- 5v1 — Green chloritic schist.
- 5p2 — Green bedded argillite, black pyritic argillite.
- 5l2 — Light grey limestone, local lenses of tuffaceous rock.
- 5p1 — Light brown and grey laminated siliceous argillite; minor foliated green volcanic rock.
- 5l1 — Dark grey graphitic limestone.
- 5w1 — Grey siliceous wacke; foliated tuff, plagioclase-bearing andesite; minor argillite.

WESTERN FAULT

GRANDUC HANGING WALL: GASH BANDED TUFF SEQUENCE

- 4w2 — Light green to greenish-grey phyllitic wacke, locally calcareous.
- 4l — Light greenish-yellow to grey massive carbonate, grades laterally into 4w2
- 4t — Light green tuffaceous sandstone.
- 4w1 — Light green well bedded foliated fine grained wacke.

GRANDUC FAULT

GRANDUC MINE SERIES (unit 3):

- 3v2 — Dark green lapilli tuff, chert pebble conglomerate with a black calcareous matrix; minor dark green foliated volcanics.
- 3w1 — Green chloritic phyllite, wacke; minor calcareous horizons.
- 3l — Granduc limestone: light grey to dark grey graphitic limestone, local marginal calcareous tuff.
- 3c — Black, grey, and white laminated chert and siliceous wacke.
- 3p2 — Black argillite chip conglomerate, black pyritic argillite; includes magnetite-rich horizons, and cream and brown wacke.
- 3p1 — Light grey bedded tuffaceous argillite.
- 3v1 — Green to black volcanic, and volcaniclastic rocks, dark grey and green phyllite, green foliated wacke; minor cream laminated chert. Augite and/or feldspar-bearing flows at or near the base of the unit. Includes interbedded chert, magnetite iron formation, and massive sulphides.

GRANDUC FOOTWALL UNITS (units 1 to 2)

GRANDUC UPPER FOOTWALL SEQUENCE:

- 2p5 — Dark grey to green argillite; minor volcanic rocks.
- 2ss — Light brown tuffaceous sandstone.
- 2p4 — Rusty weathering, black pyritic argillite.
- 2v — Dark green, tuffaceous argillite; minor augite bearing andesite flows.
- 2p3 — Dark grey, magnetite-bearing calcareous argillite; local pyrite and chalcopyrite(?) bearing horizons.
- 2p2 — Dark grey bedded siliceous argillite.
- 2p1 — Green siliceous phyllite; minor calcareous horizons, some lenses of epidote.

GRANDUC LOWER FOOTWALL SEQUENCE:

- 1v — Dark grey-green augite-bearing andesite flows; minor tuff.
- 1w — Light grey siliceous wacke; minor breccia and tuff.
- 1t — Green to grey lithic tuff (+/- augite phenocrysts), andesite tuff.

SYMBOLS

Geological contact:
defined
approximate
assumed
Faults:
defined
approximate
Axial surface trace:
anticline
syncline
Bedding:
inclined
vertical
measured tops
overturned
Foliation:
inclined
vertical
Lineation:
mineral lineation
minor fold axis

400 0 400 800 1200

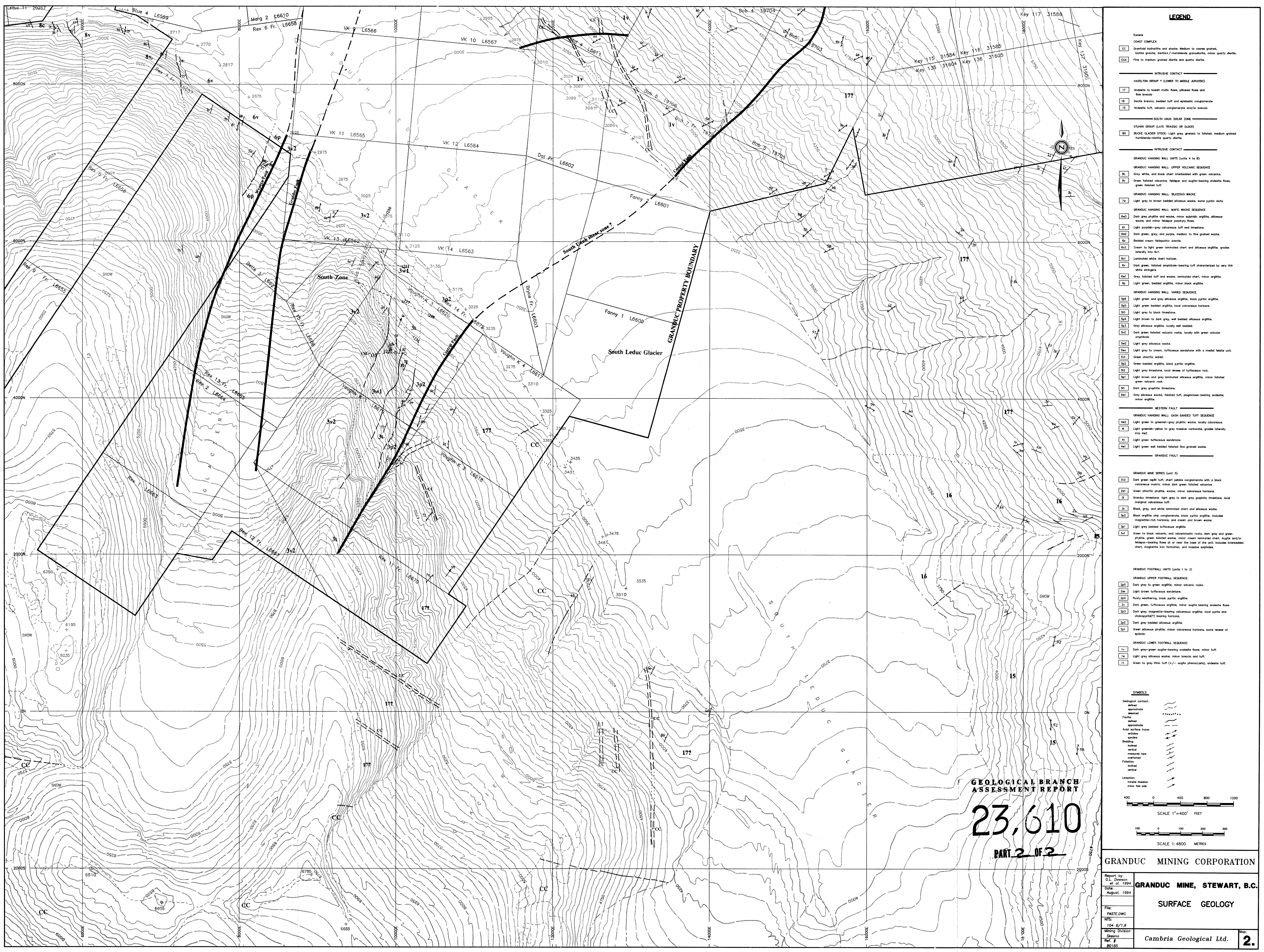
SCALE 1"=400' FEET

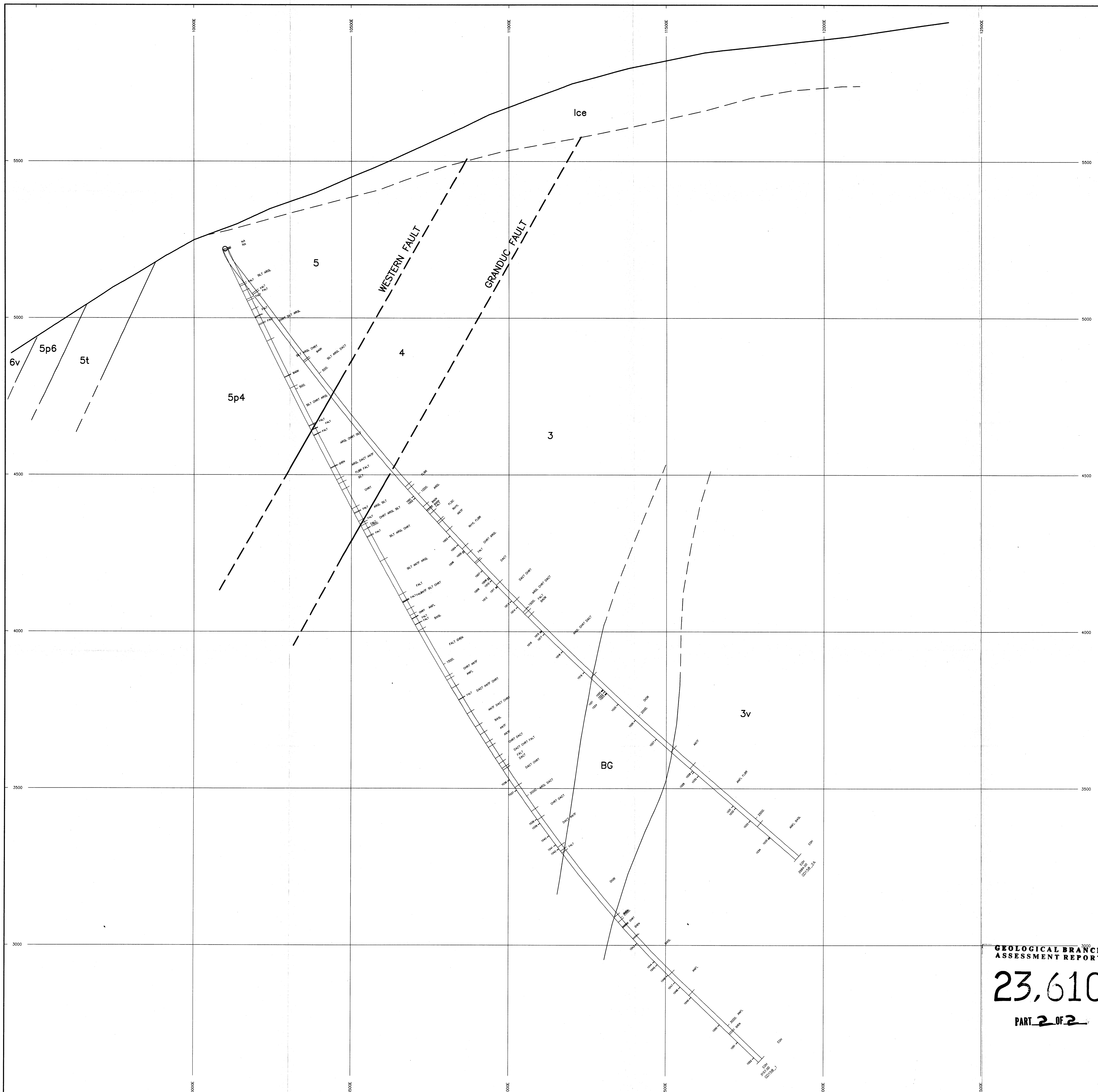
100 0 100 200 300

SCALE 1: 4800 METRES

GRANDUC MINING CORPORATION

Report by: G.L. Dawson et al. 1994	GRANDUC MINE, STEWART, B.C.
Date: August, 1994	SURFACE GEOLOGY
File: PASTE.DWG	
NTS: 104 B/1,8	
Mining Division Skeena	Cambria Geological Ltd. — Map: 1.
Ref. # B0185	


South Zone
South Leduc Glacier
GRANDUC PROPERTY BOUNDARY
South Unuk Shear zone ?
LEGEND
Eocene
COAST COMPLEX:
CC Granitoid batholiths and stocks. Medium to coarse grained, biotite granite; biotite+/−hornblende granodiorite; minor quartz diorite.
CCd Fine to medium grained diorite and quartz diorite.
INTRUSIVE CONTACT
HAZELTON GROUP ? (LOWER TO MIDDLE JURASSIC)
17 Andesite to basalt mafic flows, pillowed flows and flow breccia
16 Dacite breccia, bedded tuff and epiclastic conglomerate
15 Andesite tuff, volcanic conglomerate and/or breccia
SOUTH UNUK SHEAR ZONE
STUHINI GROUP (LATE TRIASSIC OR OLDER)
BG BUCKE GLACIER STOCK: Light grey, gneissic to foliated, medium grained hornblende−biotite quartz diorite.
INTRUSIVE CONTACT
GRANDUC HANGING WALL UNITS (units 4 to 8):
GRANDUC HANGING WALL: UPPER VOLCANIC SEQUENCE
8c Grey, white, and black chert interbedded with green volcanics.
8v Green foliated volcanics; feldspar and augite−bearing andesite flows, green foliated tuff.
GRANDUC HANGING WALL: SILICEOUS WACKE
7w Light grey to brown bedded siliceous wacke, some pyritic clots.
GRANDUC HANGING WALL: MAFIC WACKE SEQUENCE
6w3 Dark grey phyllite and wacke, minor sulphidic argillite, siliceous wacke, and minor feldspar porphyry flows.
6t Light purplish−grey calcareous tuff and limestone.
6w2 Dark green, grey, and purple, medium to fine grained wacke.
6s Bedded cream feldspathic arenite.
6c2 Cream to light green laminated chert and siliceous argillite; grades laterally into 6c1.
6c1 Laminated white chert horizon.
6v Dark green, foliated amphibole−bearing tuff characterized by very thin white stringers.
6w1 Grey, foliated tuff and wacke; laminated chert, minor argillite.
6p Light green, bedded argillite, minor black argillite.
GRANDUC HANGING WALL: VARIED SEQUENCE
5p6 Light green and grey siliceous argillite, black pyritic argillite.
5p5 Light green bedded argillite, local calcareous horizons.
5l3 Light grey to black limestone.
5p4 Light brown to dark grey, well bedded siliceous argillite.
5p3 Grey siliceous argillite, locally well bedded.
5v2 Dark green foliated volcanic rocks; locally with green acicular amphibole.
5w2 Light grey siliceous wacke.
5ss Light grey to cream, tuffaceous sandstone with a medial felsite unit.
5v1 Green chloritic schist.
5p2 Green bedded argillite, black pyritic argillite.
5l2 Light grey limestone, local lenses of tuffaceous rock.
5p1 Light brown and grey laminated siliceous argillite; minor foliated green volcanic rock.
5l1 Dark grey graphitic limestone.
5w1 Grey siliceous wacke; foliated tuff, plagioclase−bearing andesite; minor argillite.
WESTERN FAULT
GRANDUC HANGING WALL: GASH BANDED TUFF SEQUENCE
4w2 Light green to greenish−grey phyllitic wacke, locally calcareous.
4l Light greenish−yellow to grey massive carbonate, grades laterally into 4w2
4t Light green tuffaceous sandstone.
4w1 Light green well bedded foliated fine grained wacke.
GRANDUC FAULT
GRANDUC MINE SERIES (unit 3):
3v2 Dark green lapilli tuff, chert pebble conglomerate with a black calcareous matrix; minor dark green foliated volcanics.
3w1 Green chloritic phyllite, wacke; minor calcareous horizons.
3l Granduc limestone: light grey to dark grey graphitic limestone, local marginal calcareous tuff.
3c Black, grey, and white laminated chert and siliceous wacke.
3p2 Black argillite chip conglomerate, black pyritic argillite; includes magnetite−rich horizons, and cream and brown wacke.
3p1 Light grey bedded tuffaceous argillite.
3v1 Green to black volcanic, and volcaniclastic rocks, dark grey and green phyllite, green foliated wacke; minor cream laminated chert. Augite and/or feldspar−bearing flows at or near the base of the unit. Includes interbedded chert, magnetite iron formation, and massive sulphides.
GRANDUC FOOTWALL UNITS (units 1 to 2)
GRANDUC UPPER FOOTWALL SEQUENCE:
2p5 Dark grey to green argillite; minor volcanic rocks.
2ss Light brown tuffaceous sandstone.
2p4 Rusty weathering, black pyritic argillite.
2v Dark green, tuffaceous argillite; minor augite bearing andesite flows.
2p3 Dark grey, magnetite−bearing calcareous argillite; local pyrite and chalcopyrite(?) bearing horizons.
2p2 Dark grey bedded siliceous argillite.
2p1 Green siliceous phyllite; minor calcareous horizons, some lenses of epidote.
GRANDUC LOWER FOOTWALL SEQUENCE:
1v Dark grey−green augite−bearing andesite flows; minor tuff.
1w Light grey siliceous wacke; minor breccia and tuff.
1t Green to grey lithic tuff (+/− augite phenocrysts), andesite tuff.
SYMBOLS
Geological contact:
defined
approximate
assumed
Faults:
defined
approximate
Axial surface trace:
anticline
syncline
Bedding:
inclined
vertical
measured tops
overturned
Foliation:
inclined
vertical
Lineation:
mineral lineation
minor fold axis
400 0 400 800 1200
SCALE 1"=400' FEET
100 0 100 200 300
SCALE 1: 4800 METRES
GEOLOGICAL BRANCH
ASSESSMENT REPORT
23,610
PART 2 OF 2
GRANDUC MINING CORPORATION
Report by:
G.L. Dawson
et al. 1994
Date:
August, 1994
File:
PASTE.DWG
NTS:
104 B/1,8
Mining Division
Skeena
Ref. #
B0185
GRANDUC MINE, STEWART, B.C.
SURFACE GEOLOGY
Cambria Geological Ltd.
Map:
2.



LEGEND

Eocene

COAST COMPLEX:

CC	Granitoid batholiths and stocks. Medium to coarse grained, biotite granite; biotite+/−hornblende granodiorite; minor quartz diorite.
CCd	Fine to medium grained diorite and quartz diorite.

INTRUSIVE CONTACT

HAZELTON GROUP ? (LOWER TO MIDDLE JURASSIC)

17	Andesite to basalt mafic flows, pillowed flows and flow breccia
16	Dacite breccia, bedded tuff and epiclastic conglomerate
15	Andesite tuff, volcanic conglomerate and/or breccia

SOUTH UNUK SHEAR ZONE

STUHINI GROUP (LATE TRIASSIC OR OLDER)

BG	BUCKE GLACIER STOCK: Light grey, gneissic to foliated, medium grained hornblende−biotite quartz diorite.

INTRUSIVE CONTACT

GRANDUC HANGING WALL UNITS (units 4 to 8):

GRANDUC HANGING WALL: UPPER VOLCANIC SEQUENCE

8c	Grey, white, and black chert interbedded with green volcanics.
8v	Green foliated volcanics; feldspar and augite−bearing andesite flows, green foliated tuff.

GRANDUC HANGING WALL: SILICEOUS WACKE

7w	Light grey to brown bedded siliceous wacke, some pyritic clots.

GRANDUC HANGING WALL: MAFIC WACKE SEQUENCE

6w3	Dark grey phyllite and wacke, minor sulphidic argillite, siliceous wacke, and minor feldspar porphyry flows.
6t	Light purplish−grey calcareous tuff and limestone.
6w2	Dark green, grey, and purple, medium to fine grained wacke.
6s	Bedded cream feldspathic arenite.
6c2	Cream to light green laminated chert and siliceous argillite; grades laterally into 6c1.
6c1	Laminated white chert horizon.
6v	Dark green, foliated amphibole−bearing tuff characterized by very thin white stringers.
6w1	Grey, foliated tuff and wacke; laminated chert, minor argillite.
6p	Light green, bedded argillite, minor black argillite.

GRANDUC HANGING WALL: VARIED SEQUENCE

5p6	Light green and grey siliceous argillite, black pyritic argillite.
5p5	Light green bedded argillite, local calcareous horizons.
5l3	Light grey to black limestone.
5p4	Light brown to dark grey, well bedded siliceous argillite.
5p3	Grey siliceous argillite, locally well bedded.
5v2	Dark green foliated volcanic rocks; locally with green acicular amphibole.
5w2	Light grey siliceous wacke.
5ss	Light grey to cream, tuffaceous sandstone with a medial felsite unit.
5v1	Green chloritic schist.
5p2	Green bedded argillite, black pyritic argillite.
5l2	Light grey limestone, local lenses of tuffaceous rock.
5p1	Light brown and grey laminated siliceous argillite; minor foliated green volcanic rock.
5l1	Dark grey graphitic limestone.
5w1	Grey siliceous wacke; foliated tuff, plagioclase−bearing andesite; minor argillite.

WESTERN FAULT

GRANDUC HANGING WALL: GASH BANDED TUFF SEQUENCE

4w2	Light green to greenish−grey phyllitic wacke, locally calcareous.
4l	Light greenish−yellow to grey massive carbonate, grades laterally into 4w2
4t	Light green tuffaceous sandstone.
4w1	Light green well bedded foliated fine grained wacke.

GRANDUC FAULT

GRANDUC MINE SERIES (unit 3):

3v2	Dark green lapilli tuff, chert pebble conglomerate with a black calcareous matrix; minor dark green foliated volcanics.
3w1	Green chloritic phyllite, wacke; minor calcareous horizons.
3l	Granduc limestone: light grey to dark grey graphitic limestone, local marginal calcareous tuff.
3c	Black, grey, and white laminated chert and siliceous wacke.
3p2	Black argillite chip conglomerate, black pyritic argillite; includes magnetite−rich horizons, and cream and brown wacke.
3p1	Light grey bedded tuffaceous argillite.
3v1	Green to black volcanic, and volcaniclastic rocks, dark grey and green phyllite, green foliated wacke; minor cream laminated chert. Augite and/or feldspar−bearing flows at or near the base of the unit. Includes interbedded chert, magnetite iron formation, and massive sulphides.

GRANDUC FOOTWALL UNITS (units 1 to 2)

GRANDUC UPPER FOOTWALL SEQUENCE:

2p5	Dark grey to green argillite; minor volcanic rocks.
2ss	Light brown tuffaceous sandstone.
2p4	Rusty weathering, black pyritic argillite.
2v	Dark green, tuffaceous argillite; minor augite bearing andesite flows.
2p3	Dark grey, magnetite−bearing calcareous argillite; local pyrite and chalcopyrite(?) bearing horizons.
2p2	Dark grey bedded siliceous argillite.
2p1	Green siliceous phyllite; minor calcareous horizons, some lenses of epidote.

GRANDUC LOWER FOOTWALL SEQUENCE:

1v	Dark grey−green augite−bearing andesite flows; minor tuff.
1w	Light grey siliceous wacke; minor breccia and tuff.
1t	Green to grey lithic tuff (+/− augite phenocrysts), andesite tuff.

Lithology Codes

NLOG	NOT LOGGED
OVB	OVER BURDEN
EOH	END OF HOLE
NA	NA
FALT	FAULT
ARGL	ARGILLITE
BADK	BASALT DYKE
DACT	DACITE
SILT	SILTSTONE
FLBR	FELSIC BRECCIA
FLSC	FELSIC SCHIST
RHYL	RHYOLITE
ANTF	ANDESITE TUFF
CHRT	CHERT
ANFL	ANDESITE FLOW
MFIN	MAFIC INTRUSIVE
LSTC	LOST CORE
QVEN	QUARTZ VEIN
DIOR	DIORITE
BASL	BASALT

SYMBOLS

Geological contact:
- defined
- approximate
- assumed

Faults:
- defined
- approximate

Axial surface trace:
- anticline
- syncline

Bedding:
- inclined
- vertical
- measured tops
- overturned

Foliation:
- inclined
- vertical

Lineation:
- mineral lineation
- minor fold axis

100 0 100 200 300

SCALE 1"=100' FEET

25 0 25 50 75

SCALE 1:1200 METRES

GEOLOGICAL BRANCH
ASSESSMENT REPORT

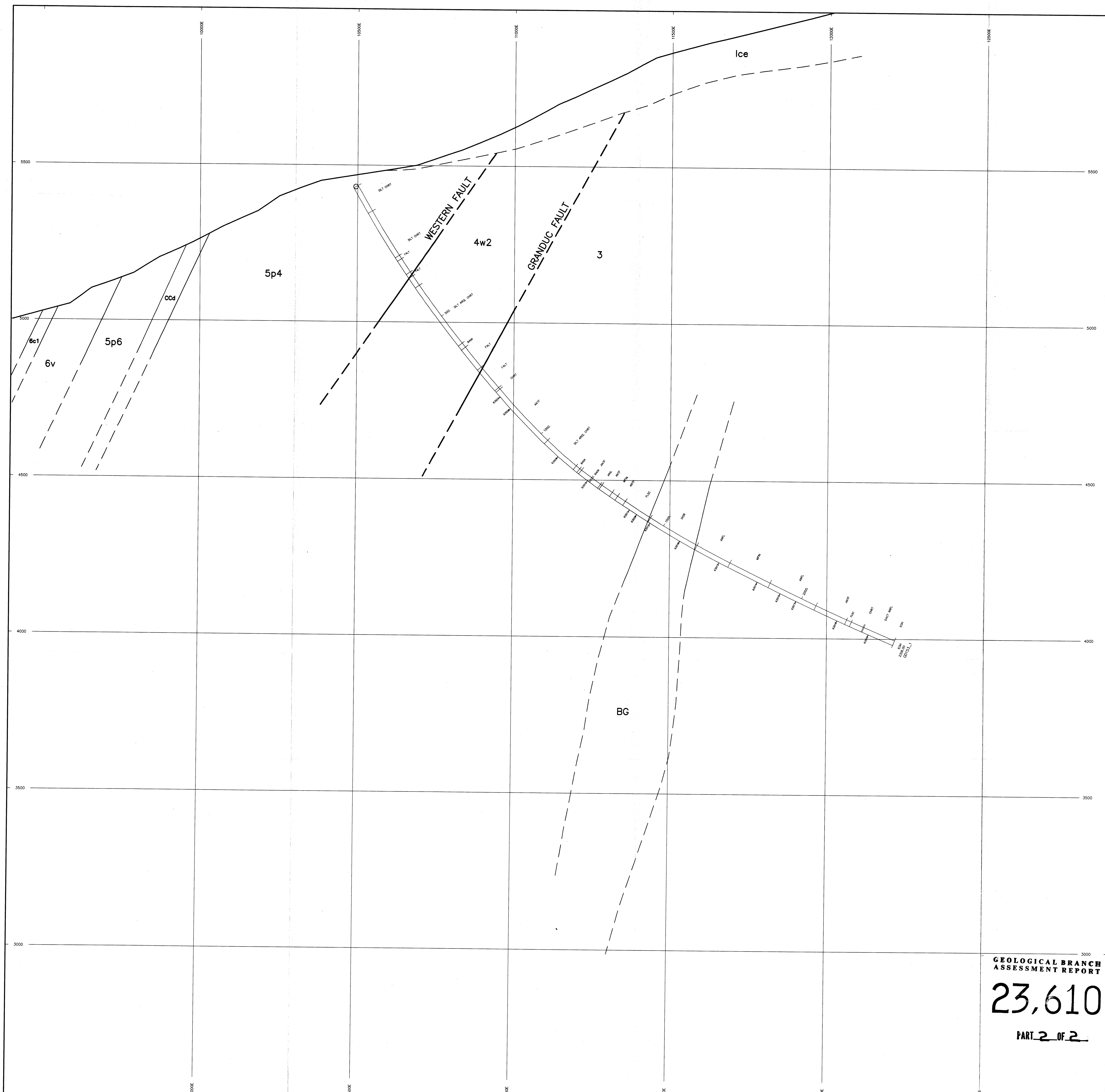
23,610

PART 2 OF 2

GRANDUC MINING CORPORATION

Report by: G.L. Dawson et al. 1994	**GRANDUC MINE, STEWART, B.C.**
Date: August, 1994	SECTION 15800N Looking North
File: SECT158.DWG	
NTS: 104 B/1,8	
Mining Division Skeena	Cambria Geological Ltd.
Ref. # B0185	Map: 3.

F:\B0185\SECT\SECT158 Thu Sep 8 15:54:21 1994 Plotted by: Cambria Data Services Ltd.



LEGEND

Eocene

COAST COMPLEX:

- CC — Granitoid batholiths and stocks. Medium to coarse grained, biotite granite; biotite+/−hornblende granodiorite; minor quartz diorite.
- CCd — Fine to medium grained diorite and quartz diorite.

INTRUSIVE CONTACT

HAZELTON GROUP ? (LOWER TO MIDDLE JURASSIC)

- 17 — Andesite to basalt mafic flows, pillowed flows and flow breccia
- 16 — Dacite breccia, bedded tuff and epiclastic conglomerate
- 15 — Andesite tuff, volcanic conglomerate and/or breccia

SOUTH UNUK SHEAR ZONE

STUHINI GROUP (LATE TRIASSIC OR OLDER)

- BG — BUCKE GLACIER STOCK: Light grey, gneissic to foliated, medium grained hornblende-biotite quartz diorite.

INTRUSIVE CONTACT

GRANDUC HANGING WALL UNITS (units 4 to 8):

GRANDUC HANGING WALL: UPPER VOLCANIC SEQUENCE

- 8c — Grey, white, and black chert interbedded with green volcanics.
- 8v — Green foliated volcanics; feldspar and augite-bearing andesite flows, green foliated tuff.

GRANDUC HANGING WALL: SILICEOUS WACKE

- 7w — Light grey to brown bedded siliceous wacke, some pyritic clots.

GRANDUC HANGING WALL: MAFIC WACKE SEQUENCE

- 6w3 — Dark grey phyllite and wacke, minor sulphidic argillite, siliceous wacke, and minor feldspar porphyry flows.
- 6t — Light purplish-grey calcareous tuff and limestone.
- 6w2 — Dark green, grey, and purple, medium to fine grained wacke.
- 6s — Bedded cream feldspathic arenite.
- 6c2 — Cream to light green laminated chert and siliceous argillite; grades laterally into 6c1.
- 6c1 — Laminated white chert horizon.
- 6v — Dark green, foliated amphibole-bearing tuff characterized by very thin white stringers.
- 6w1 — Grey, foliated tuff and wacke; laminated chert, minor argillite.
- 6p — Light green, bedded argillite, minor black argillite.

GRANDUC HANGING WALL: VARIED SEQUENCE

- 5p6 — Light green and grey siliceous argillite, black pyritic argillite.
- 5p5 — Light green bedded argillite, local calcareous horizons.
- 5l3 — Light grey to black limestone.
- 5p4 — Light brown to dark grey, well bedded siliceous argillite.
- 5p3 — Grey siliceous argillite, locally well bedded.
- 5v2 — Dark green foliated volcanic rocks; locally with green acicular amphibole.
- 5w2 — Light grey siliceous wacke.
- 5ss — Light grey to cream, tuffaceous sandstone with a medial felsite unit.
- 5v1 — Green chloritic schist.
- 5p2 — Green bedded argillite, black pyritic argillite.
- 5l2 — Light grey limestone, local lenses of tuffaceous rock.
- 5p1 — Light brown and grey laminated siliceous argillite; minor foliated green volcanic rock.
- 5l1 — Dark grey graphitic limestone.
- 5w1 — Grey siliceous wacke; foliated tuff, plagioclase-bearing andesite; minor argillite.

WESTERN FAULT

GRANDUC HANGING WALL: GASH BANDED TUFF SEQUENCE

- 4w2 — Light green to greenish-grey phyllitic wacke, locally calcareous.
- 4l — Light greenish-yellow to grey massive carbonate, grades laterally into 4w2
- 4t — Light green tuffaceous sandstone.
- 4w1 — Light green well bedded foliated fine grained wacke.

GRANDUC FAULT

GRANDUC MINE SERIES (unit 3):

- 3v2 — Dark green lapilli tuff, chert pebble conglomerate with a black calcareous matrix; minor dark green foliated volcanics.
- 3w1 — Green chloritic phyllite, wacke; minor calcareous horizons.
- 3l — Granduc limestone: light grey to dark grey graphitic limestone, local marginal calcareous tuff.
- 3c — Black, grey, and white laminated chert and siliceous wacke.
- 3p2 — Black argillite chip conglomerate, black pyritic argillite; includes magnetite-rich horizons, and cream and brown wacke.
- 3p1 — Light grey bedded tuffaceous argillite.
- 3v1 — Green to black volcanic, and volcaniclastic rocks, dark grey and green phyllite, green foliated wacke; minor cream laminated chert. Augite and/or feldspar-bearing flows at or near the base of the unit. Includes interbedded chert, magnetite iron formation, and massive sulphides.

GRANDUC FOOTWALL UNITS (units 1 to 2)

GRANDUC UPPER FOOTWALL SEQUENCE:

- 2p5 — Dark grey to green argillite; minor volcanic rocks.
- 2ss — Light brown tuffaceous sandstone.
- 2p4 — Rusty weathering, black pyritic argillite.
- 2v — Dark green, tuffaceous argillite; minor augite bearing andesite flows.
- 2p3 — Dark grey, magnetite-bearing calcareous argillite; local pyrite and chalcopyrite(?) bearing horizons.
- 2p2 — Dark grey bedded siliceous argillite.
- 2p1 — Green siliceous phyllite; minor calcareous horizons, some lenses of epidote.

GRANDUC LOWER FOOTWALL SEQUENCE:

- 1v — Dark grey-green augite-bearing andesite flows; minor tuff.
- 1w — Light grey siliceous wacke; minor breccia and tuff.
- 1t — Green to grey lithic tuff (+/− augite phenocrysts), andesite tuff.

Lithology Codes

NLOG	NOT LOGGED
OVB	OVER BURDEN
EOH	END OF HOLE
NA	NA
FALT	FAULT
ARGL	ARGILLITE
BADK	BASALT DYKE
DACT	DACITE
SILT	SILTSTONE
FLBR	FELSIC BRECCIA
FLSC	FELSIC SCHIST
RHYL	RHYOLITE
ANTF	ANDESITE TUFF
CHRT	CHERT
ANFL	ANDESITE FLOW
MFIN	MAFIC INTRUSIVE
LSTC	LOST CORE
QVEN	QUARTZ VEIN
DIOR	DIORITE
BASL	BASALT

SYMBOLS

Geological contact:
- defined
- approximate
- assumed

Faults:
- defined
- approximate

Axial surface trace:
- anticline
- syncline

Bedding:
- inclined
- vertical
- measured tops
- overturned

Foliation:
- inclined
- vertical

Lineation:
- mineral lineation
- minor fold axis

100 0 100 200 300

SCALE 1"=100' FEET

25 0 25 50 75

SCALE 1:1200 METRES

GEOLOGICAL BRANCH
ASSESSMENT REPORT

23,610

PART 2 OF 2

GRANDUC MINING CORPORATION

Report by: G.L. Dawson et al. 1994

Date: August, 1994

File: SECT152.DWG

NTS: 104 B/1,8

Mining Division: Skeena

Ref. #: B0185

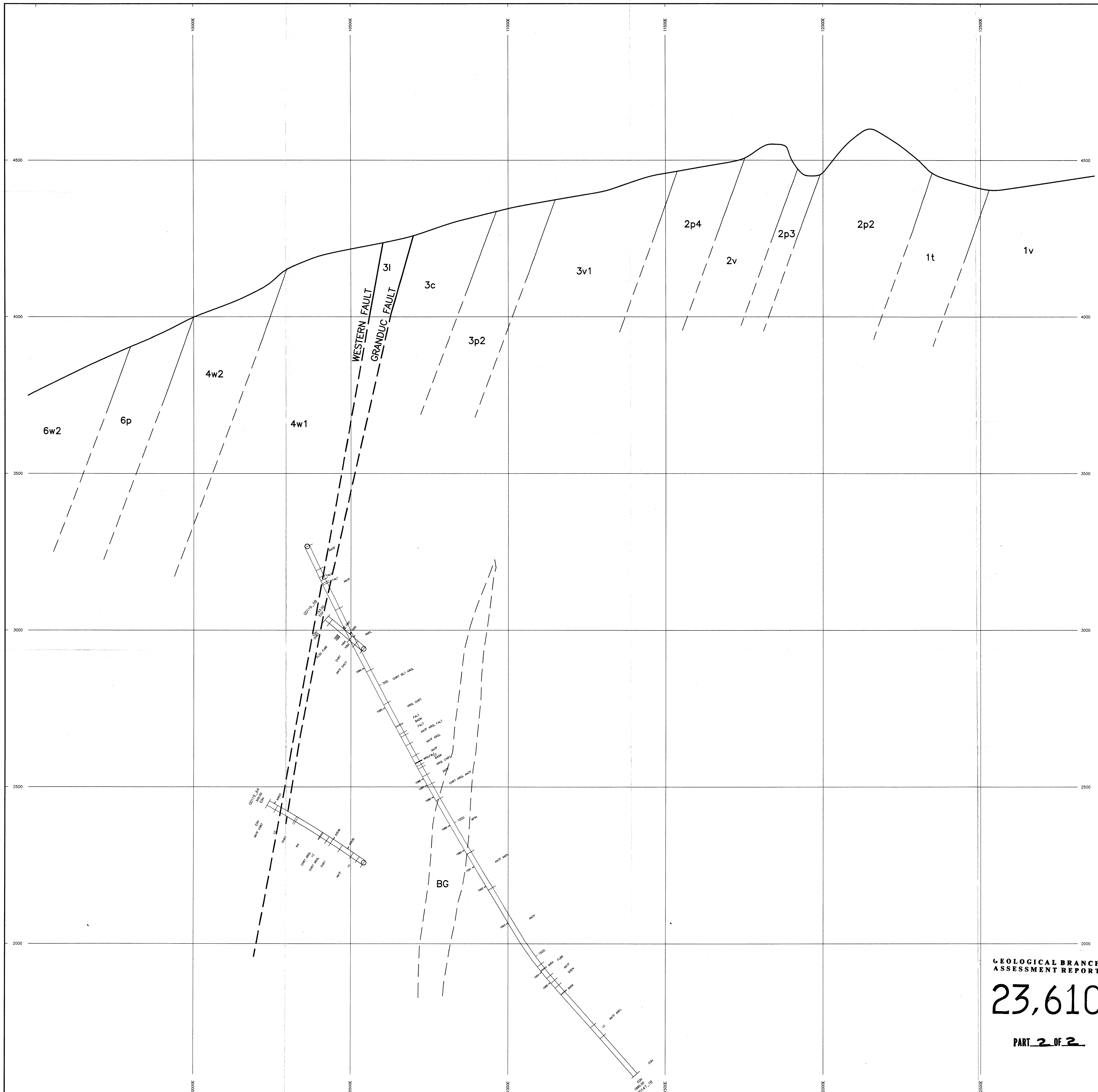
GRANDUC MINE, STEWART, B.C.

SECTION 15200N
Looking North

Cambria Geological Ltd.

Map: **4.**

F:\B0185\SECT\SECT152 Thu Sep 8 14:26:34 1994 Plotted by: Cambria Data Services Ltd.



LEGEND

Eocene

COAST COMPLEX:

- CC — Granitoid batholiths and stocks. Medium to coarse grained, biotite granite; biotite+/−hornblende granodiorite; minor quartz diorite.
- CCd — Fine to medium grained diorite and quartz diorite.

INTRUSIVE CONTACT

HAZELTON GROUP ? (LOWER TO MIDDLE JURASSIC)

- 17 — Andesite to basalt mafic flows, pillowed flows and flow breccia
- 16 — Dacite breccia, bedded tuff and epiclastic conglomerate
- 15 — Andesite tuff, volcanic conglomerate and/or breccia

SOUTH UNUK SHEAR ZONE

STUHINI GROUP (LATE TRIASSIC OR OLDER)

- BG — BUCKE GLACIER STOCK: Light grey, gneissic to foliated, medium grained hornblende-biotite quartz diorite.

INTRUSIVE CONTACT

GRANDUC HANGING WALL UNITS (units 4 to 8):

GRANDUC HANGING WALL: UPPER VOLCANIC SEQUENCE

- 8c — Grey, white, and black chert interbedded with green volcanics.
- 8v — Green foliated volcanics; feldspar and augite-bearing andesite flows, green foliated tuff.

GRANDUC HANGING WALL: SILICEOUS WACKE

- 7w — Light grey to brown bedded siliceous wacke, some pyritic clots.

GRANDUC HANGING WALL: MAFIC WACKE SEQUENCE

- 6w3 — Dark grey phyllite and wacke, minor sulphidic argillite, siliceous wacke, and minor feldspar porphyry flows.
- 6t — Light purplish-grey calcareous tuff and limestone.
- 6w2 — Dark green, grey, and purple, medium to fine grained wacke.
- 6s — Bedded cream feldspathic arenite.
- 6c2 — Cream to light green laminated chert and siliceous argillite; grades laterally into 6c1.
- 6c1 — Laminated white chert horizon.
- 6v — Dark green, foliated amphibole-bearing tuff characterized by very thin white stringers.
- 6w1 — Grey, foliated tuff and wacke; laminated chert, minor argillite.
- 6p — Light green, bedded argillite, minor black argillite.

GRANDUC HANGING WALL: VARIED SEQUENCE

- 5p6 — Light green and grey siliceous argillite, black pyritic argillite.
- 5p5 — Light green bedded argillite, local calcareous horizons.
- 5l3 — Light grey to black limestone.
- 5p4 — Light brown to dark grey, well bedded siliceous argillite.
- 5p3 — Grey siliceous argillite, locally well bedded.
- 5v2 — Dark green foliated volcanic rocks; locally with green acicular amphibole.
- 5w2 — Light grey siliceous wacke.
- 5ss — Light grey to cream, tuffaceous sandstone with a medial felsite unit.
- 5v1 — Green chloritic schist.
- 5p2 — Green bedded argillite, black pyritic argillite.
- 5l2 — Light grey limestone, local lenses of tuffaceous rock.
- 5p1 — Light brown and grey laminated siliceous argillite; minor foliated green volcanic rock.
- 5l1 — Dark grey graphitic limestone.
- 5w1 — Grey siliceous wacke; foliated tuff, plagioclase-bearing andesite; minor argillite.

WESTERN FAULT

GRANDUC HANGING WALL: GASH BANDED TUFF SEQUENCE

- 4w2 — Light green to greenish-grey phyllitic wacke, locally calcareous.
- 4l — Light greenish-yellow to grey massive carbonate, grades laterally into 4w2
- 4t — Light green tuffaceous sandstone.
- 4w1 — Light green well bedded foliated fine grained wacke.

GRANDUC FAULT

GRANDUC MINE SERIES (unit 3):

- 3v2 — Dark green lapilli tuff, chert pebble conglomerate with a black calcareous matrix; minor dark green foliated volcanics.
- 3w1 — Green chloritic phyllite, wacke; minor calcareous horizons.
- 3l — Granduc limestone: light grey to dark grey graphitic limestone, local marginal calcareous tuff.
- 3c — Black, grey, and white laminated chert and siliceous wacke.
- 3p2 — Black argillite chip conglomerate, black pyritic argillite; includes magnetite-rich horizons, and cream and brown wacke.
- 3p1 — Light grey bedded tuffaceous argillite.
- 3v1 — Green to black volcanic, and volcaniclastic rocks, dark grey and green phyllite, green foliated wacke; minor cream laminated chert. Augite and/or feldspar-bearing flows at or near the base of the unit. Includes interbedded chert, magnetite iron formation, and massive sulphides.

GRANDUC FOOTWALL UNITS (units 1 to 2)

GRANDUC UPPER FOOTWALL SEQUENCE:

- 2p5 — Dark grey to green argillite; minor volcanic rocks.
- 2ss — Light brown tuffaceous sandstone.
- 2p4 — Rusty weathering, black pyritic argillite.
- 2v — Dark green, tuffaceous argillite; minor augite bearing andesite flows.
- 2p3 — Dark grey, magnetite-bearing calcareous argillite; local pyrite and chalcopyrite(?) bearing horizons.
- 2p2 — Dark grey bedded siliceous argillite.
- 2p1 — Green siliceous phyllite; minor calcareous horizons, some lenses of epidote.

GRANDUC LOWER FOOTWALL SEQUENCE:

- 1v — Dark grey-green augite-bearing andesite flows; minor tuff.
- 1w — Light grey siliceous wacke; minor breccia and tuff.
- 1t — Green to grey lithic tuff (+/− augite phenocrysts), andesite tuff.

Lithology Codes

NLOG	NOT LOGGED
OVB	OVER BURDEN
EOH	END OF HOLE
NA	NA
FALT	FAULT
ARGL	ARGILLITE
BADK	BASALT DYKE
DACT	DACITE
SILT	SILTSTONE
FLBR	FELSIC BRECCIA
FLSC	FELSIC SCHIST
RHYL	RHYOLITE
ANTF	ANDESITE TUFF
CHRT	CHERT
ANFL	ANDESITE FLOW
MFIN	MAFIC INTRUSIVE
LSTC	LOST CORE
QVEN	QUARTZ VEIN
DIOR	DIORITE
BASL	BASALT

SYMBOLS

Geological contact:
- defined
- approximate
- assumed

Faults:
- defined
- approximate

Axial surface trace:
- anticline
- syncline

Bedding:
- inclined
- vertical
- measured tops
- overturned

Foliation:
- inclined
- vertical

Lineation:
- mineral lineation
- minor fold axis

100 0 100 200 300

SCALE 1"=100' FEET

25 0 25 50 75

SCALE 1:1200 METRES

GEOLOGICAL BRANCH ASSESSMENT REPORT

23,610

PART 2 OF 2

GRANDUC MINING CORPORATION

Report by: G.L. Dawson et al. 1994

Date: August, 1994

File: SECT119.DWG

NTS: 104 B/1,8

Mining Division: Skeena

Ref. #: B0185

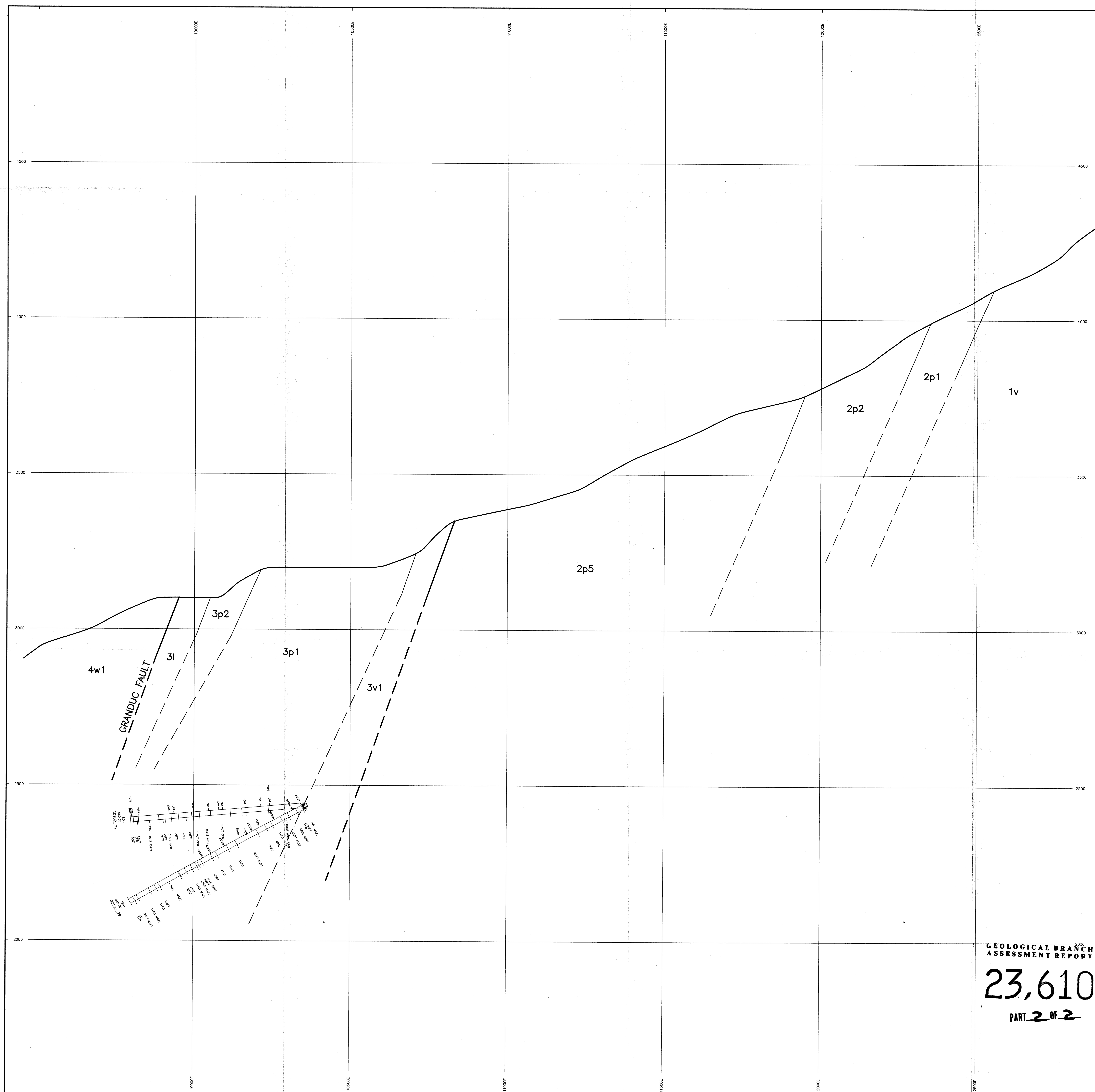
GRANDUC MINE, STEWART, B.C.

SECTION 11900N
Looking North

Cambria Geological Ltd.

Map: 5.

F:\B0185\SECT\SECT119 Thu Sep 8 15:15:22 1994 Plotted by: Cambria Data Services Ltd.



LEGEND

Eocene

COAST COMPLEX:

CC	Granitoid batholiths and stocks. Medium to coarse grained, biotite granite; biotite+/−hornblende granodiorite; minor quartz diorite.
CCd	Fine to medium grained diorite and quartz diorite.

INTRUSIVE CONTACT

HAZELTON GROUP ? (LOWER TO MIDDLE JURASSIC)

17	Andesite to basalt mafic flows, pillowed flows and flow breccia
16	Dacite breccia, bedded tuff and epiclastic conglomerate
15	Andesite tuff, volcanic conglomerate and/or breccia

SOUTH UNUK SHEAR ZONE

STUHINI GROUP (LATE TRIASSIC OR OLDER)

BG	BUCKE GLACIER STOCK: Light grey, gneissic to foliated, medium grained hornblende−biotite quartz diorite.

INTRUSIVE CONTACT

GRANDUC HANGING WALL UNITS (units 4 to 8):

GRANDUC HANGING WALL: UPPER VOLCANIC SEQUENCE

8c	Grey, white, and black chert interbedded with green volcanics.
8v	Green foliated volcanics; feldspar and augite−bearing andesite flows, green foliated tuff.

GRANDUC HANGING WALL: SILICEOUS WACKE

7w	Light grey to brown bedded siliceous wacke, some pyritic clots.

GRANDUC HANGING WALL: MAFIC WACKE SEQUENCE

6w3	Dark grey phyllite and wacke, minor sulphidic argillite, siliceous wacke, and minor feldspar porphyry flows.
6t	Light purplish−grey calcareous tuff and limestone.
6w2	Dark green, grey, and purple, medium to fine grained wacke.
6s	Bedded cream feldspathic arenite.
6c2	Cream to light green laminated chert and siliceous argillite; grades laterally into 6c1.
6c1	Laminated white chert horizon.
6v	Dark green, foliated amphibole−bearing tuff characterized by very thin white stringers.
6w1	Grey, foliated tuff and wacke; laminated chert, minor argillite.
6p	Light green, bedded argillite, minor black argillite.

GRANDUC HANGING WALL: VARIED SEQUENCE

5p6	Light green and grey siliceous argillite, black pyritic argillite.
5p5	Light green bedded argillite, local calcareous horizons.
5l3	Light grey to black limestone.
5p4	Light brown to dark grey, well bedded siliceous argillite.
5p3	Grey siliceous argillite, locally well bedded.
5v2	Dark green foliated volcanic rocks; locally with green acicular amphibole.
5w2	Light grey siliceous wacke.
5ss	Light grey to cream, tuffaceous sandstone with a medial felsite unit.
5v1	Green chloritic schist.
5p2	Green bedded argillite, black pyritic argillite.
5l2	Light grey limestone, local lenses of tuffaceous rock.
5p1	Light brown and grey laminated siliceous argillite; minor foliated green volcanic rock.
5l1	Dark grey graphitic limestone.
5w1	Grey siliceous wacke; foliated tuff, plagioclase−bearing andesite; minor argillite.

WESTERN FAULT

GRANDUC HANGING WALL: GASH BANDED TUFF SEQUENCE

4w2	Light green to greenish−grey phyllitic wacke, locally calcareous.
4l	Light greenish−yellow to grey massive carbonate, grades laterally into 4w2
4t	Light green tuffaceous sandstone.
4w1	Light green well bedded foliated fine grained wacke.

GRANDUC FAULT

GRANDUC MINE SERIES (unit 3):

3v2	Dark green lapilli tuff, chert pebble conglomerate with a black calcareous matrix; minor dark green foliated volcanics.
3w1	Green chloritic phyllite, wacke; minor calcareous horizons.
3l	Granduc limestone: light grey to dark grey graphitic limestone, local marginal calcareous tuff.
3c	Black, grey, and white laminated chert and siliceous wacke.
3p2	Black argillite chip conglomerate, black pyritic argillite; includes magnetite−rich horizons, and cream and brown wacke.
3p1	Light grey bedded tuffaceous argillite.
3v1	Green to black volcanic, and volcaniclastic rocks, dark grey and green phyllite, green foliated wacke; minor cream laminated chert. Augite and/or feldspar−bearing flows at or near the base of the unit. Includes interbedded chert, magnetite iron formation, and massive sulphides.

GRANDUC FOOTWALL UNITS (units 1 to 2)

GRANDUC UPPER FOOTWALL SEQUENCE:

2p5	Dark grey to green argillite; minor volcanic rocks.
2ss	Light brown tuffaceous sandstone.
2p4	Rusty weathering, black pyritic argillite.
2v	Dark green, tuffaceous argillite; minor augite bearing andesite flows.
2p3	Dark grey, magnetite−bearing calcareous argillite; local pyrite and chalcopyrite(?) bearing horizons.
2p2	Dark grey bedded siliceous argillite.
2p1	Green siliceous phyllite; minor calcareous horizons, some lenses of epidote.

GRANDUC LOWER FOOTWALL SEQUENCE:

1v	Dark grey−green augite−bearing andesite flows; minor tuff.
1w	Light grey siliceous wacke; minor breccia and tuff.
1t	Green to grey lithic tuff (+/− augite phenocrysts), andesite tuff.

Lithology Codes

NLOG	NOT LOGGED
OVB	OVER BURDEN
EOH	END OF HOLE
NA	NA
FALT	FAULT
ARGL	ARGILLITE
BADK	BASALT DYKE
DACT	DACITE
SILT	SILTSTONE
FLBR	FELSIC BRECCIA
FLSC	FELSIC SCHIST
RHYL	RHYOLITE
ANTF	ANDESITE TUFF
CHRT	CHERT
ANFL	ANDESITE FLOW
MFIN	MAFIC INTRUSIVE
LSTC	LOST CORE
QVEN	QUARTZ VEIN
DIOR	DIORITE
BASL	BASALT

SYMBOLS

Geological contact:
defined
approximate
assumed
Faults:
defined
approximate
Axial surface trace:
anticline
syncline
Bedding:
inclined
vertical
measured tops
overturned
Foliation:
inclined
vertical
Lineation:
mineral lineation
minor fold axis

100 0 100 200 300

SCALE 1"=100' FEET

25 0 25 50 75

SCALE 1:1200 METRES

GEOLOGICAL BRANCH
ASSESSMENT REPORT

23,610

PART 2 OF 2

GRANDUC MINING CORPORATION

Report by: G.L. Dawson et al. 1994

Date: August, 1994

File: SECT102.DWG

NTS: 104 B/1,8

Mining Division: Skeena

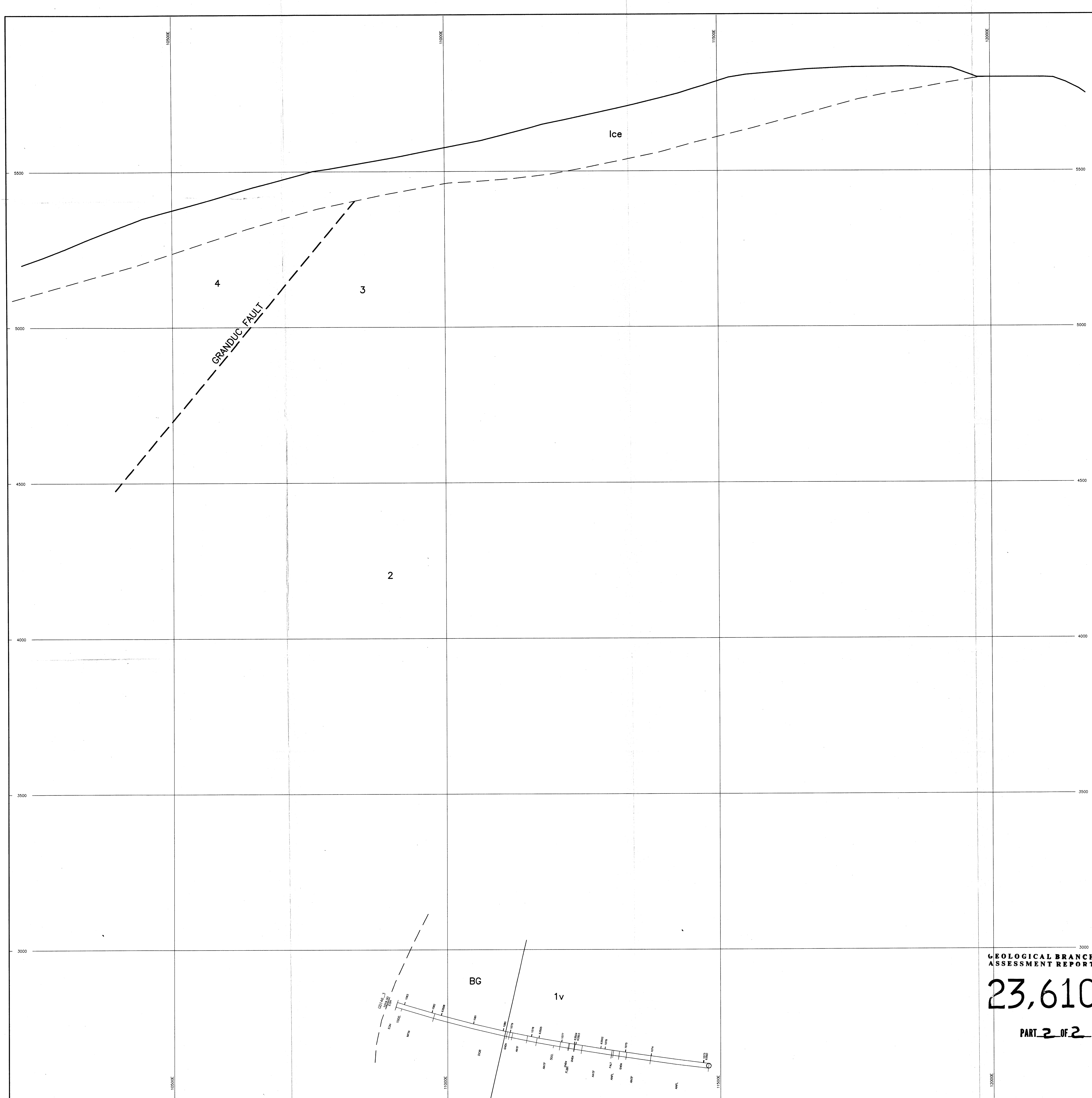
Ref. # 80185

GRANDUC MINE, STEWART, B.C.

SECTION 10200N
Looking North

Cambria Geological Ltd.

Map: 6.



LEGEND

Eocene

COAST COMPLEX:

- CC — Granitoid batholiths and stocks. Medium to coarse grained, biotite granite; biotite+/-hornblende granodiorite; minor quartz diorite.
- CCd — Fine to medium grained diorite and quartz diorite.

INTRUSIVE CONTACT

HAZELTON GROUP ? (LOWER TO MIDDLE JURASSIC)

- 17 — Andesite to basalt mafic flows, pillowed flows and flow breccia
- 16 — Dacite breccia, bedded tuff and epiclastic conglomerate
- 15 — Andesite tuff, volcanic conglomerate and/or breccia

SOUTH UNUK SHEAR ZONE

STUHINI GROUP (LATE TRIASSIC OR OLDER)

- BG — BUCKE GLACIER STOCK: Light grey, gneissic to foliated, medium grained hornblende-biotite quartz diorite.

INTRUSIVE CONTACT

GRANDUC HANGING WALL UNITS (units 4 to 8):

GRANDUC HANGING WALL: UPPER VOLCANIC SEQUENCE

- 8c — Grey, white, and black chert interbedded with green volcanics.
- 8v — Green foliated volcanics; feldspar and augite-bearing andesite flows, green foliated tuff.

GRANDUC HANGING WALL: SILICEOUS WACKE

- 7w — Light grey to brown bedded siliceous wacke, some pyritic clots.

GRANDUC HANGING WALL: MAFIC WACKE SEQUENCE

- 6w3 — Dark grey phyllite and wacke, minor sulphidic argillite, siliceous wacke, and minor feldspar porphyry flows.
- 6t — Light purplish-grey calcareous tuff and limestone.
- 6w2 — Dark green, grey, and purple, medium to fine grained wacke.
- 6s — Bedded cream feldspathic arenite.
- 6c2 — Cream to light green laminated chert and siliceous argillite; grades laterally into 6c1.
- 6c1 — Laminated white chert horizon.
- 6v — Dark green, foliated amphibole-bearing tuff characterized by very thin white stringers.
- 6w1 — Grey, foliated tuff and wacke; laminated chert, minor argillite.
- 6p — Light green, bedded argillite, minor black argillite.

GRANDUC HANGING WALL: VARIED SEQUENCE

- 5p6 — Light green and grey siliceous argillite, black pyritic argillite.
- 5p5 — Light green bedded argillite, local calcareous horizons.
- 5l3 — Light grey to black limestone.
- 5p4 — Light brown to dark grey, well bedded siliceous argillite.
- 5p3 — Grey siliceous argillite, locally well bedded.
- 5v2 — Dark green foliated volcanic rocks; locally with green acicular amphibole.
- 5w2 — Light grey siliceous wacke.
- 5ss — Light grey to cream, tuffaceous sandstone with a medial felsite unit.
- 5v1 — Green chloritic schist.
- 5p2 — Green bedded argillite, black pyritic argillite.
- 5l2 — Light grey limestone, local lenses of tuffaceous rock.
- 5p1 — Light brown and grey laminated siliceous argillite; minor foliated green volcanic rock.
- 5l1 — Dark grey graphitic limestone.
- 5w1 — Grey siliceous wacke; foliated tuff, plagioclase-bearing andesite; minor argillite.

WESTERN FAULT

GRANDUC HANGING WALL: GASH BANDED TUFF SEQUENCE

- 4w2 — Light green to greenish-grey phyllitic wacke, locally calcareous.
- 4l — Light greenish-yellow to grey massive carbonate, grades laterally into 4w2
- 4t — Light green tuffaceous sandstone.
- 4w1 — Light green well bedded foliated fine grained wacke.

GRANDUC FAULT

GRANDUC MINE SERIES (unit 3):

- 3v2 — Dark green lapilli tuff, chert pebble conglomerate with a black calcareous matrix; minor dark green foliated volcanics.
- 3w1 — Green chloritic phyllite, wacke; minor calcareous horizons.
- 3l — Granduc limestone: light grey to dark grey graphitic limestone, local marginal calcareous tuff.
- 3c — Black, grey, and white laminated chert and siliceous wacke.
- 3p2 — Black argillite chip conglomerate, black pyritic argillite; includes magnetite-rich horizons, and cream and brown wacke.
- 3p1 — Light grey bedded tuffaceous argillite.
- 3v1 — Green to black volcanic, and volcaniclastic rocks, dark grey and green phyllite, green foliated wacke; minor cream laminated chert. Augite and/or feldspar-bearing flows at or near the base of the unit. Includes interbedded chert, magnetite iron formation, and massive sulphides.

GRANDUC FOOTWALL UNITS (units 1 to 2)

GRANDUC UPPER FOOTWALL SEQUENCE:

- 2p5 — Dark grey to green argillite; minor volcanic rocks.
- 2ss — Light brown tuffaceous sandstone.
- 2p4 — Rusty weathering, black pyritic argillite.
- 2v — Dark green, tuffaceous argillite; minor augite bearing andesite flows.
- 2p3 — Dark grey, magnetite-bearing calcareous argillite; local pyrite and chalcopyrite(?) bearing horizons.
- 2p2 — Dark grey bedded siliceous argillite.
- 2p1 — Green siliceous phyllite; minor calcareous horizons, some lenses of epidote.

GRANDUC LOWER FOOTWALL SEQUENCE:

- 1v — Dark grey-green augite-bearing andesite flows; minor tuff.
- 1w — Light grey siliceous wacke; minor breccia and tuff.
- 1t — Green to grey lithic tuff (+/- augite phenocrysts), andesite tuff.

Lithology Codes

NLOG	NOT LOGGED
OVB	OVER BURDEN
EOH	END OF HOLE
NA	NA
FALT	FAULT
ARGL	ARGILLITE
BADK	BASALT DYKE
DACT	DACITE
SILT	SILTSTONE
FLBR	FELSIC BRECCIA
FLSC	FELSIC SCHIST
RHYL	RHYOLITE
ANTF	ANDESITE TUFF
CHRT	CHERT
ANFL	ANDESITE FLOW
MFIN	MAFIC INTRUSIVE
LSTC	LOST CORE
QVEN	QUARTZ VEIN
DIOR	DIORITE
BASL	BASALT

SYMBOLS

Geological contact:
- defined
- approximate
- assumed

Faults:
- defined
- approximate

Axial surface trace:
- anticline
- syncline

Bedding:
- inclined
- vertical
- measured tops
- overturned

Foliation:
- inclined
- vertical

Lineation:
- mineral lineation
- minor fold axis

100 0 100 200 300

SCALE 1"=100' FEET

25 0 25 50 75

SCALE 1:1200 METRES

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GRANDUC MINE, STEWART, B.C.

SECTION A – A'
Looking North East

Cambria Geological Ltd.

Map: 7.