

BRITISH GEOLOGICAL SURVEY

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MINERAL RECONNAISSANCE PROGRAMME OPEN FILE REPORT NO. 12

Mineral Investigations in the Scardroy Area, Highland Region, Scotland

Compilation and Geochemistry:

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INTRODUCTION

The discovery by Consolidated Goldfields of the Gairloch Cu-Zn-Au deposit in 1983 was one of the more notable successes for mineral exploration in the United Kingdom (Jones et al., 1987). Integrated exploration outlined a severly deformed, but potentially economic, volcanic-hosted massive sulphide deposit (Besshi-style) within the Loch Maree Group near Gairloch. The work was concentrated over the Gairloch Schist Belt which forms the main outcrop of the Loch Maree Group on the western side of the Loch Maree Fault. Reconnaissance studies were carried out by Consolidated Goldfields over the Loch Maree Schist Belt to the east of the fault and also in the Scardroy area further to the south east (Jones et al., op. cit.) but the results of these studies were not presented in the published paper. As Besshi-style VMS deposits are often stratigraphically controlled and extend over long distances, further exploration was warranted in rocks of similar age. This open file report gives the results of a geochemical survey of the Scardroy area which was carried out by the British Geological Survey as part of the Mineral Reconnaissance Programme (MRP) for the Department of Trade and Industry. A brief introduction to the geology and regional geochemistry of the Scardroy area is given before the results of the MRP survey.

The Scardroy area is situated about 45 km to the south-east of Gairloch and about the same distance west of Inverness. It is drained by the rivers Meig and Corrin at the head of Strathconan but extends to the south west as far as Loch Monar (Figure 1). Most of the area is mountainous moorland given over to deer forest with a few coniferous planatations in the lower valleys.

REGIONAL GEOLOGY

The Lewisian rocks were mapped by the Geological Survey in 1913 as part of Sheet 82 Lochcarron (Peach et al., 1913) and form an irregular 'mushroom-like' shape with the base of the stem pointing down the River Meig valley by Loch Beannacharain. Smaller slices occur within the Moine south-east of the Strathconan fault. The Lewisian probably forms allochthonous basement slices caught up in the later Caledonian deformation and the irregular shape is the result of interference folds. The main rock types present in the inlier are fairly typical acid and hornblende gneisses and amphibolite but small outcrops of ultrabasic rock and metalimestone are also present (Sutton and Watson, 1953). The Moine rocks are composed of psammites and pelites which form part of the Morar and Glenfinnan Divisions (Craig, 1983).

The area is cut by the major north-east - south-west trending fault zone of the Strathconan fault which extends from Loch Hourn on the western seaboard for 95 km to Carn Chuinneag. The other major fault in the area is shown as a discontinuous feature running north-west - south-east. This may be a

continuation of the similar trending Loch Maree fault and could well run down Loch Beannacharain and terminate against the Strathconan fault as suggested in the memoir (Hinxman p.83 in Peach et al., 1913) but not as shown on the geological map.

No mineralisation is recorded in the Survey memoir of the area, except for a mention of pyrite in graphitic schists in the Glen Strath Farrar inlier. Anderson states in one section of the memoir that they are comparable with pyritic graphite schist in the Dornie area which contain 'a very small amount of gold' (Sheet 71 Memoir).

REGIONAL GEOCHEMICAL DATA

Regional mapping of the Scardroy area was undertaken by the Geochemical Survey Programme (GSP) in 1974-75 as part of the systematic sampling of the Great Glen 1:250,000 map area (Johnstone et al., 1979 and BGS, 1987). On the north-east side of Loch Maree a prominent linear north-west trending zone of high Cu (up to 220 ppm) and, to a lesser extent, high Co, Ni and Zn is associated with the Loch Maree Group supracrustal schists and amphibolites. These are known to contain pyrite-chalcopyrite mineralisation on the north side of Loch Maree (Peach et al. 1907).

A possible extension of this anomalous zone south-eastward along the Loch Maree fault and into the Moine nappe can be identified from the coloured digital image presented in the Great Glen geochemical atlas (BGS, 1987). Within the 150 sq km project area, (Figure 2) six Cu values exceed 40 ppm, (maximum 102 ppm) and lie along a north-west - south-east trending linear feature. This runs sub-parallel to, but offset 1-2 km south-west of the main fault. A further anomalous site (63 ppm) directly overlies the fault [220375 852610]. The source of these copper anomalies appears to lie principally within tectonically emplaced Lewisian amphibolite and associated hornblendic gneiss. However, south-eastwards on the same trend, faulted and crushed Moine pelites give rise to a value of 89 ppm Cu at [220985 850335]. South-east of the termination of the Loch Maree fault against the Strathconon fault, two further anomalies (52, and 56 ppm) are associated with Lewisian acid and hornblende schist, and a third (61 ppm), with Moine pelites. All occur in rocks extensively crushed by movement along the Strathconon fault.

Follow-up stream sediment sampling generally confirmed the location of the original GSP anomalies, but with improved geochemical contrast and higher mean levels for most elements. In the upper reaches of the most anomalous catchment (Coire a' Bhuic), MRP sediments contain 82, 138 and 263 ppm Cu, compared with GSP samples from the same area with 43, 45, and 54 ppm Cu. This reflects in part differences in sampling and analysis, as GSP samples were dry screened to -150µm and analysed by Direct Reading Emission Spectrometry. However, some variation can be identified as the

result of sample site selection. For example, the GSP maximum Cu value of 102 ppm recorded from a poorly drained peaty area downstream of Loch Coire a' Bhuic was not reproduced in the MRP sampling (25 ppm).

MRP GEOCHEMICAL SURVEY

160 samples of heavy mineral concentrates and stream sediments were collected within the Scardroy area. Their location is shown on Figure 2. The concentrates were prepared by panning 4 litres of -2 mm sediment using the methods described by Gunn (1989). The stream sediments were prepared by wet sieving through a 150 μm nylon sieve using standard BGS techniques.

The concentrate samples were analysed for Ca, Ti, V, Mn, Fe, Co, Ni, Cu, Zn, Y, Zr, Nb, Ag, Sn, Sb, Ba, La, Ce, Pb, Th and U by X-Ray fluorescence spectrometry at the BGS Applied Geochemistry Group laboratory. Au was determined by Acme Analytical Laboratory using an AAS finish after MIBK extraction of an aqua regia attack on 10 g of sample. The stream sediment samples were analysed by XRF for Ca, Ti, V, Mn, Fe, Co, Ni, Cu, As, Zr, Nb, Mo, Ag, Sn, Sb, Ba, La, Ce, Pb, Bi, Th, and U by the same method.

Au anomalies

KLP 3559	225190	853680	220 ppb	Allt Glen Meinich
KLP 3605	223870	848110	4960 ppb	N side Strathconon fault
KLC 3571	222545	857015	67 ppb	Sgurr a'Choire rainich
KLC 3597	217812	848740	86 ppb	Meall Innis na Sine
KLC 3605	223870	848110	81 ppb	W side Strathconon fault
KLC 3642	219760	845120	54 ppb	River Orrin, E trib.
Cu anomalies				
KLP 3541	220360	852600	49 ppm	Scardroy Burn, N side
KLC 3502	217080	851780	138 ppm	Coir' a'Bhuic
KLC 3504	216770	851770	263 ppm	Coir' a'Bhuic
KLC 3505	219570	851160	57 ppm	Allt Coir' a'Bhuic
KLC 3506	216690	851870	82 ppm	Coir' a'Bhuic
KLC 3530	218940	853360	55 ppm	Scardroy Burn, N side
KLC 3606	226680	848680	63 ppm	Creagan a Chaorain
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The gold anomalies are clustered along the Strathconon fault in the streams draining into Glen Meinich (KL 3558, 3559, 3560, 3571) (Figures 3 and 4). The elevated Au levels in the Allt Gleann

Meinich probably demonstrate the effect of fluvial reworking and upgrading of glacial material. The origional source of the Au may be within the Lewisian amphibolite which forms the northern flank of Sgurr a'Glas Leathaid (shown as spot height 844 m). The Strathconon fault is marked by a mile-wide zone of crushed and hematite-stained rock (Peach et al., 1913). The Au anomalies found in the streams adjacent to the fault are probably related to these crush zones. KLC 3597 with 86 ppb Au was collected from a stream draining a north-west - south-east crush zone which contained minor sulphides and some gossanous alteration in rock samples KLR 3667 and 3668. Minor Au-bearing mineralisation is recorded by Alderton (1988) in the vicinity of the Strathconan fault system in the Ratagain complex, 45 km to the south-west.

High Cu values in stream sediments are found in the Allt Coir' a'Bhuic confirming the pattern of the regional survey. The anomaly extends for 2.5 km downstream, and the three headwater streams draining Craig Coir' a'Bhuic (KLC 3502, 3504 and 3506) contain anomalous Cu. However, none of the panned concentrates from this area are anomalous Detailed investigation of the exposures revealed the presence of chalcopyrite-bearing pyrrhotite bodies up to 4 m in thickness, hosted by Lewisian amphibolite. These sulphide bodies are strongly deformed and irregularly podiform in shape. Samples KLR 3669-3673 contain up to 2976 ppm Cu, 188 ppm Co, 176 ppm Ni, 991 ppm Zn and 12 ppm Ag. Minor Cu anomalies are found in Scardroy Burn, with values of about 50 ppm in one panned concentrate and stream sediment sample. The sample KLP 3530 was collected from a stream that drains the same amphibolite body as Allt Coir' a'Bhuic and there may be a similar sulphide body in the catchment.

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FIGURES

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- Figure 3 Distribution of Au in panned concentrates
- Figure 4 Distribution of Au in stream sediments

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- Table 2 Scardroy panned concentrate data
- Table 3 Scardroy rock data
- Table 4 Major rock type code classifications

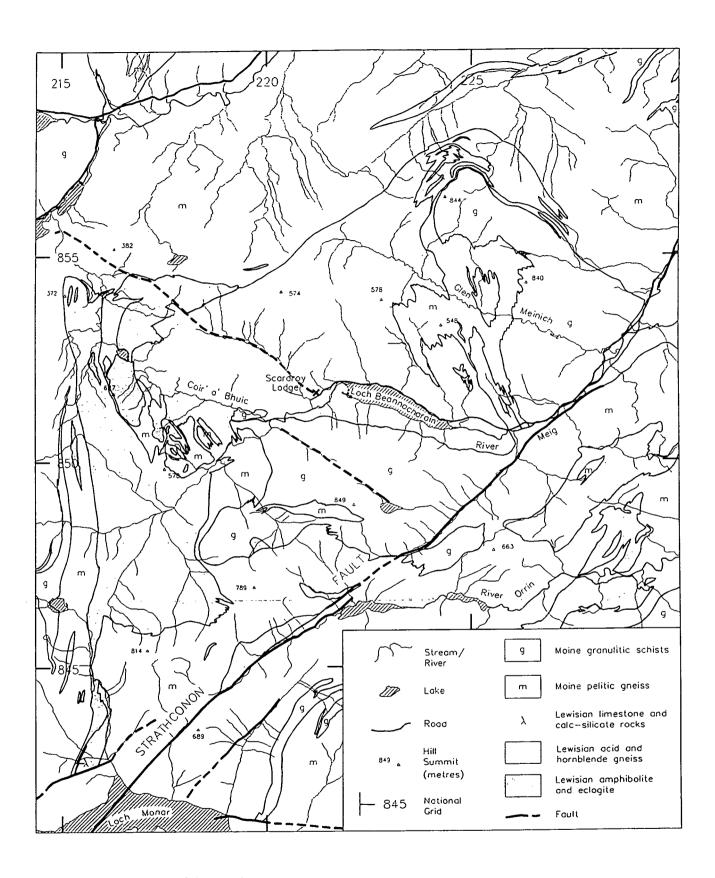


Figure 1 Geological map of the Scardroy area

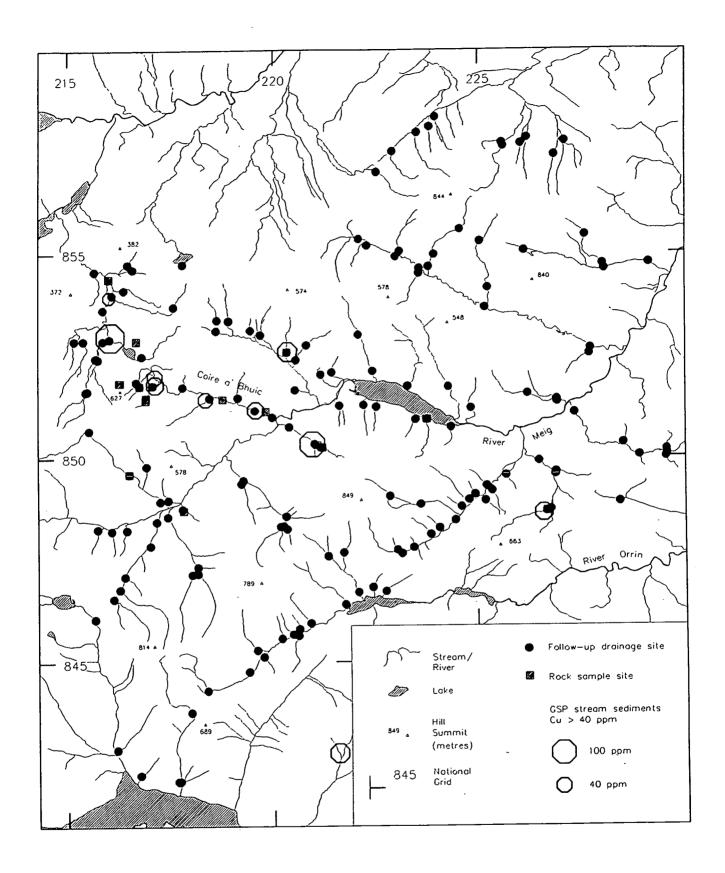


Figure 2 Location of rock and drainage sites in the Scardroy area

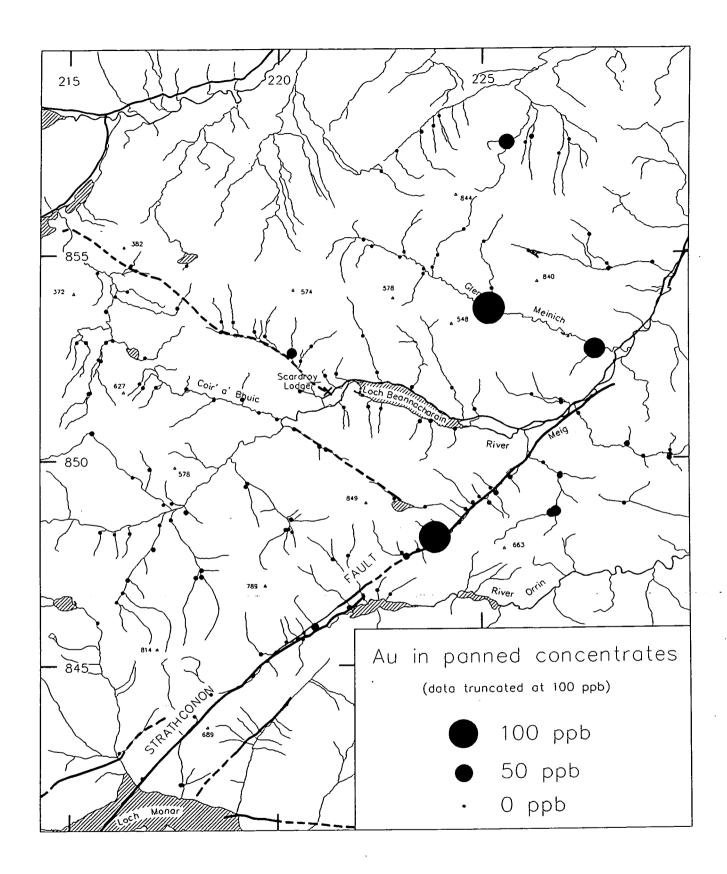


Figure 3 Distribution of Au in panned concentrates

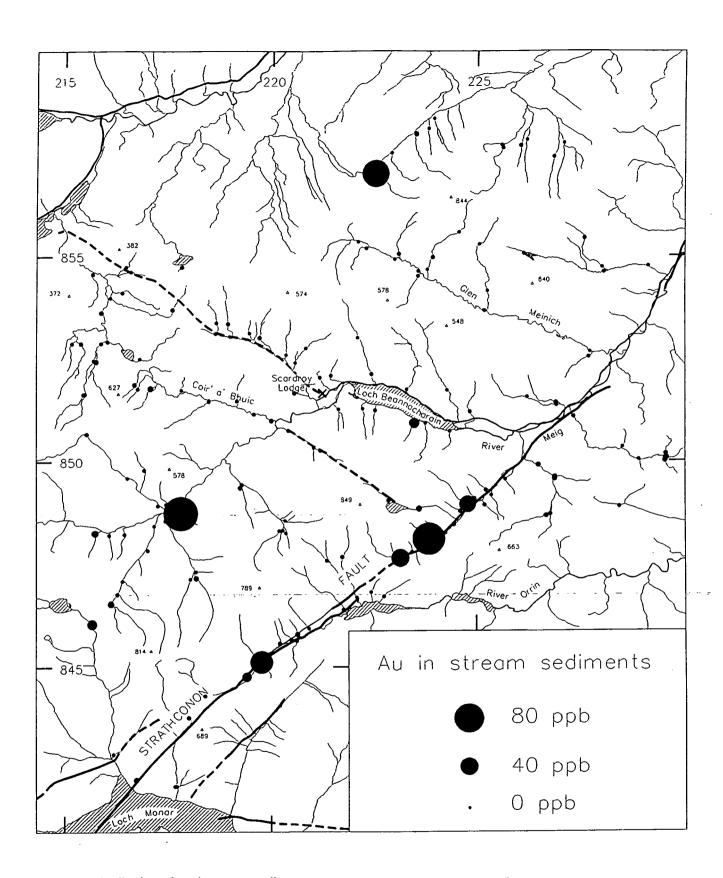


Figure 4 Distribution of Au in stream sediments

Table 1 Scardroy stream sediment data

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Scardroy Stream Sediment Data

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	220620		10900	5700	65	950	33300	13	15	14
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Sn (mdd)	
=	WWW1WWW10100004W11/0404W110000414040404040404040
Ę	1
qu qu	
Zr (ppm)	1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
As (ppm)	
(mďď)	1
hin	0849440 0849440 0849440 084849440 08484720 0848720 0848720 08447680 0847780 0847780 0847780 0850760 0850760 0848310 0848320 0850350 0850000 0850000 0850000 0850000 08477140 0850000 0850000 08850000 08850000 08850000 08850000 08850000 08871160 08871160 08871160 08871160 08871160 08871160 08871160 08871160 08871160
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As (mdd)	1 1	Zr ppm)	(mgq)	(mqq)	Ag (ppm)	Sn (mdd)	ds (mdd)	Ba (ppm)
61	m	671	11	9.0	2.0	ı m	0.0	416
137	М	1239	23	11.0	2.0	4	0.0	723
89	-1	849	14	10.0	0.0	4	2.0	437
83	ω	712	14	6.0	0.0	2	1.0	465
52	7	1111	12	13.0	0.0	4	3.0	347
103	7	1454	17	21.0	3.0	٣	2.0	419
64	11	922	14	5.0	1.0	М	2.0	417
57	7	1014	14	12.0	1.0	7	1.0	528
140	σ	452	11	7.0	2.0	0	1.0	471
52	٣	530	10	11.0	1.0	0	0.0	378
116	9	549	17	1.0	3.0	٣	0.0	598
52	ო	643	12	0.6	2.0	 1	0.0	423
78	11	663	11	18.0	2.0	7	1.0	358
42	9	1153	14	16.0	1.0	1	0.0	520
106	~	1171	16	16.0	1.0	2	0.0	452

Au (ppb)	10-4004-1000004-204-10-100-1004-1000-1004-1000-1000
n (mdd)	N4N9N9L4140AN4UN4UN4UN4UNAUNONONONOONOONOONOONO
Th (ppm)	9186786999999999999999999999999999999999
Bi (ppi	000000000000000000000000000000000000000
(mdd)	222223311011111111111111111111111111111
Ce (ppm)	1001 1000
La (ppm)	
Northing	0854970 0851780 0851780 0851770 0851160 0851870 0851870 0852880 0852880 0852880 0852480 0852480 0852480 0852460 0852460 0853120 0853130 0853130 0853130 0853130 0853130 0853130 0853130 085310 0853130 0853130 0853130 0853130 0853130 0853130 0853130 0853130 0853130 085310
Easting N	232030 222030 222030 222030 222030 222030 222030 222036 222030 222036
Sample Reference	LC3501 LC3502 LC3503 LC3503 LC3503 LC3503 LC3503 LC3503 LC3503 LC3513 KLC3513 KLC3513 KLC3513 KLC352 KLC352 KLC352 KLC352 KLC352 KLC352 KLC352 KLC352 KLC352 KLC352 KLC352 KLC352 KLC3

Scardroy Stream Sediment Data

Au (ppb)		ਜਜ ਮਜ ਹਮਜ	701103107		8 6 7 8
(wdd)		O (4 O M 4 O (O W W 4 W W 4 4 W	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	0 M M
Th (mqq)		128556 144 12856	111111111111111111111111111111111111111	8 4 7 8 8 4 7 9 9 6 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	9 14 14
Bi (ppm)					
dd (mdd)	15 26 24 21 47	108 12 12 12 12 12 12 12 12 12 12 12 12 12	120711 12077 1209 1209 1209 1209 1209 1209 1209 1209	2011	11 16 25
Ce (ppm)	രെയയാഗര	& & & & & & & & & & & & & & & & & & &	4 0 0 0 0 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0	00000000000000000000000000000000000000	79 105 85
La (ppm)	111 23 4	2000 2000 2000 2000 2000	77 4 9 8 8 1 8 1 8 1 8 1 8 1 8 1 8 1 8 1 8 1	01104041140000000000000000000000000000	34 50 44
hin	35143 35143 35110 3510 35255	355416 35568 35772 35764 35764 35764	885770 885788 885788 885778 885776	0853020 08573020 08572130 08572130 0858120 0858120 0858120 0851220 0851220 0851220 0851220 0851231 0849300 0848960 0848300 0848300 0848300 0848300 0848300	84874 84991 84936
ri.	22692 22458 22734 22507	526 777 519 560 563 563	2605 2613 2613 2610 2710 2710 2710	222110 22224931 22234932 2233436 2233320 2233320 2243863 222440 2222444 2223263 223363 223363 223360 2214460 224460 224460	178] 2649 1924
Sample Reference	0.00000		0.000000000	KLC3573 KLC3573 KLC3574 KLC3574 KLC3576 KLC3577 KLC3581 KLC3581 KLC3583 KLC3583 KLC3583 KLC3589 KLC3589 KLC3590 KLC3590 KLC3591 KLC3590 KLC3591 KLC3594 KLC3594 KLC3594	0.00

Au (ppb)) () ()	. 8 . L r	J C3		-11 5'	⊶.	(dω	1	e e	ı	, ,-			⊶ •	— с	30	3 ←	-	н,	4 C	3 M	2	_ >	0 0	Н	- С	7 ←	-	54	17	σ,	18
(mdd)		o	יסע	οω	ω (11	25	ωи	0 4	1	ന ഗ	2	90	O 4	r (2)	ማ ነ	ഹ	ე Մ) M	0	m (⊃ α	0 (4	m	۵۲	า	1	S Y	24	m	22 7	11	S)	3 /
Th (ppm)	1145	202	202	27	27	16	19	12	201	13	11	S.	10		7	21	21	12	3 00	14	4.	14	φ	. 7	סי	10	δ	ω <u>′</u>	9	σ	σα	12	ស	ω ω
Bi (ppm)	400																																	
Pp (mdd)	20	110	44.	18	27	3 P	37	20	1 8 8	22	13	15	26	24 15	16	27	15	4.7 C.	19	16	2	20	23	20	18	34	11	22	13.0	20	27	25	18	31 26
Ce (ppm)	104	113 78	189	178	α	o⊓	209	Q (131	85	75	38	77	-n C	51	(1)	161	,,0	J. 7.	39	41	37	1, 4, V ()	50	4 N r	4.4	62	128	4. 4 0 K	30	119	9.40	37	53 47
La (ppm)	76	51 37	0 8	64	101	ა ა	162	37	4 3 60	40	30	16	30	19.	, 4°C	61	о v	2 6	7,7	21	20	19	32 18	27	17	2.4.5	26	41	21 در	13	42	21 50	20	41 32
thin	0849640 0849440	4879	4811	4779	14894	34/64 34918	34764	34956	34767 34767	35034	34758	34825	35026	34832	34831	3477	34856	7467	34687	35000	34670	35000	35018	34714	35008	85004	84733	8503	84 / 84 84 5 7 2	8470	8451	8447	8465	8437 8460
tin	226	462	387	346	520	536	317	570	:04 <i>2</i>	104	2136	036	2120	2028	2020	3306	2034	770	2040	2952	2210	2952	7562	1804	295	2882	181	285	70/T	164	197	194(161	180(156
Äμ	1	909	900	90	9	96	61	$\overline{9}$	9 5	6	9.5	2.0	6	9	9 6	6	6	òù	9 6	6	9	9	0 0	ف	9	9	ف	9	و بو	ŵ	9	96	è	9 9

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Au (ppb)	7 -	വെ	(. 7 -		C ∙1	4	C 3	ጠ	C1	ထ	10	~
(wdd)	6.0	111	۲,	on 0	14	m	78		4		ന	-	ω
Th (ppm)	11	23.	11	20 0	14	10	12	9	18	σ	ហ	9	18
Bi (ppm)	0.0	000	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0
Pp (mdd)	34	22.2	30	24	21	19	36	10	18	ET.	22	22	18
Ce (ppm)	164	164 82	94	47	100	71	116	45	145	34	64	52	126
La (ppm)	449	98	34	26	51	31	63	22	09	18	35	24	99
Northing	0842880	0842260	0842100	0845640	0842100	0844300	0845570	0848230	0849050	0848210	0848850	0848260	0848460
Easting	216190	216750	217720	220620	220490	218400	220210	216450	222880	216080	223630	215740	224470
Sample Reference	KLC3648	KLC3650	KLC3652	KLC3653	NDC 3655	KLC3656	KLC3657	KLC3658	KLC3659	KLC3660	KI,C3661	KLC3662	KLC3663

Table 2 Scardroy panned concentrate data

Scardroy Panned Concentrate Data

Ní (mgď)	111744 9 8 9 8 9 7 7 8 9 8 9 8 9 8 9 8 9 8 9 8	22 32 12 16
Co (ppm)	22222222222222222222222222222222222222	116 22 14 16
a 5.		- (4 (- W L)
Mn (mga)	20000000000000000000000000000000000000	9080 8560 5800 8510
(wđđ) ^	2001 1001 1001 1001 1001 1001 1001 1001	158 102 164 95
Ti (ppm)	117390 117390 127390 127390 12730 12	0 0 0 0 0 0 0 C C C C C C C C C C C C C
	28400 28	43100 42400 34800 42800 29400
orthi	0854970 0851780 0851770 0851770 0851770 0851870 0851880 0852800 0852880 0852880 0852880 0852830 0853130 0853330 0853330 0853520 0853520 0853520 085360 085360 085360 085360 085360 085360 085360 085360 085360 085360 0852770 085360 085360 0852770	8851
Easting	232030 21932030 21932030 21932030 21932030 21932030 21932000 21932000 2193200 2123320 2123320 2123320 2123320 2123320 2123320 223320 223320 223320 223320 223320 223320 223320 223320 223320 223320 223320 223320 223320 223320 223320	20000
ample eferen	KLP3501 KLP3502 KLP3503 KLP3503 KLP3504 KLP3506 KLP3510 KLP3511 KLP3511 KLP3512 KLP3513 KLP3523 KLP3523 KLP3523 KLP3523 KLP3534 KLP3534 KLP3534 KLP3534 KLP3534 KLP3534 KLP3534 KLP3534 KLP3534	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

Ni (ppm)	10 5 54	10	21	47	58	63	10	7.9	43	4.2	, ∞	16	4.9	23	69	4 8 7 3	19	09	14	52	20	6 ° °	52	86	22	17	09	29	9 9 8	3 ~	94	w (-1 0	50
Co (bpm)	i	14 11	19	16	41	19	ω δ	10	16	15	9	7	28	11	33	18 36	10	23	7 در	15	18	24	28 28	26	1 ር ማ	1 1 2	20	15	12	္ခဲ့ထ	33	10	11	13
Fe (ppm)	17 21 5	188200 177000	161500	141700	195600	60200	211300	185400	44600	74100	205800	36000	72700	68000	73600	91200	42800	00699	39600	101200	88900	93300	97200	62900	99400	145900	54800	116700	176500	189700	58400	173800	184700	165700
E		33	44	90	62 54	53	14	45	43	ν 4 υ π	91	15 5	61	58	21	2 6	28	71	48	75	05	, 5 5	43	46	9 6	69	45	52	24 18	29	33	65	4 A	94
(wdd)	158 158 81 68	σ	128	·œ	Ω	123	oυc	113	93	109	α	9 -	164	9	4	231	ω	146	ഗര	, CJ	ന	~ v	າຕ	~	~ v	4	104	\sim	\circ	104	119	152	7 O	118
Ti (ppm)	9430 3700 2850	74	24	82	11	11	847	36	94	5.0	62	73	63	16	96	って	36	64	8 6 7	54	99	72	68	98	/ a	87	55	82	4 م م	68	43	15	7 0	20
Ca (ppm)	43100 23700 19300	80	20	9	ွင္	9	22	20	20	20	90	200	30	30	20	22	20	2	50	20	01	200	8	20	200	20	9	8	200	20	70	20	2 0	0.4
hin	08514 08556 08511	85530 85255	8541685268	85368	85461	85764	85474 85770	85507	85784	85742	85476	85776 85701	85302	85752	85213	85176 85176	85812	85174	85836 85122	85128	85068	85129	85125	84979	85093	85094	84896	85074	84930 84843	84909	84855	84896	846/4	84936
rin	2245 2245 2273	507	526 773	519	90e	563	802 805	613	620	989	912	7 10 2 5 4	211	293	246	332	382	430	3.96 4.85	164	554	444 673	25.5	693	351 757	378	746	436	523	495	744	480	707	924
Sample Reference N	P3552 P3553	355	355 355	355	356 356	356	356 356	356	356	500	356	357	357	357	357	357	357	357	35.7 25.8	358	358	ກິດ	358	358	ກິດ	358	359	359	359 959	359	359	359	א מ א מ	359

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Co (mdd)	20 10 12	11. v 70 r.	11.	-	ω ς	12	ο,	14 19	15	16	11	ي ر	22	17	y (-	12	6	ω <u>-</u>	1 1 2	13	29	22	11	16	ט י	15 15 15	282	21	76	22	ω,	15	ည္ဆ
Fe (ppm)	148300 199700 177900	$^{\circ}$	- 00 0	വര	സ്ഥ	135600	o u	100600	ᠬ	ാന	7	~ 4	\sim	101700	っト	ഗ	64100	29800	130500	82400	60200	44400 61600	63800	59200	56700	101900	59500	50300	63300	56800	23300	45900	74500
MM QQ)	6330 8350 7180	7 7 7	200	62	97	9	800	76	52	25	33	5 2 2 3	26	396	7 6	86	59	80	32	.	24	4 C	44	70	42	200	12	11	7 (28	57	\sim	4 €
v (mqq)	1002	400	103	4	69	4.3	\sim $<$	117	← (215	90	7 L	123	m L	102	9	69	ഗഠ) ო	106	41	140	·œ	135	വ	ŊΨ	S	116	າ ຕ	142	57	900	06
_	5240 6750 6350	6280 6280 6030	7990	7040	4810	5610	3380	5330	12290	12730	2900	3660	8880	4720	5310	3550	4670	2930	4790	3490	3930	4710	3470	3990	1950	5090	4530	3070	3280	3680	2510	3020	4940 5260
Ca (ppm)	1000	23600	27800	10900	12800	8800	6100	31800	51400	52700	20700	35100	29000	43400	26500	7500	21200	13000	33500	33900	44900	42400	25300	46200	16800	4000 0000 0000	44900	35200	49400	46400	9200	37200	28700
Northing	0000																																
Easting		387	8 4		2 2	7	55	4.4	2 4 4	22	90	200	28	22	240	7	2	3.5	12	12		4	ູນ	82	<u>რ</u> :	2 5	\sim	8	9 Y	27	2	$\frac{1}{2}$	3.6
Sample Reference N	LP360 LP360 LP360	909	909	909	960	61	2 5	61	61	61	198	62	162	62	62	862	62	262	62	963	63	863	363	363	963	863	363	364	900	364	364	364	364

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Scardroy Panned Concentrate Data

Fe Co Ni (ppm) (ppm)
d) (wdd)
(mdd)
Ti (ppm)
Ca (ppm)
Northing
N Easting
Sample Reference

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Sn (mdd)		4 (7	9	O ~) ←	ı 	0	7	. ⊣ (20 0	ט ע) M	0	0 (⊃ -	۳ ۲۰) M	0	Ħ	0	m •	- L	n c	0 ~	ı 	7	, -	3 (1	n m	٣	7	0 1	ኅ ሆ	0 73	4	7	٦ ٥	~ ~	4	4
Ag (ppm)	ا ف	20.0	•	•		٠	•	٠	•	•	•		•	•	٠			•	٠	٠	٠	٠	•				•			•	•	•			•	•	•	0.0		•
qN qw	11.	8 1	11	9 1	- 4	11	9		10	ט ע].		ស	χ	, t	~ o	n 00	12	9	S	σ (ט עכ	~ ư) [7	4,	.0 0	, ,	. v	7	ω (ס ס	° [9	ഗ	20 C	ν _Φ	10	6
Zr (ppm)	ો તેર <		30	<u> </u>	4 4	~~	ഹ	ω,	4.0	VΥ	ے د	S	~	~ c	ע ע	r 9	2	σ	S	0	4	٥,	ન પ	o	3	0	4.4	# C	4	æ	ന	æς	75	· (7	æ	€,	⊣ ດ	ე 4	Ō	7
	273											· ~					4																			\sim	უ (S	2
Cng()	77	79	168	84 113	33	77	47	600	90	, T) o	72	71	4.0	0 5	61	29	64	06	51	67	0. 7.0	- L	73	64	54	99	504	99	71	72	0/	2 C	38	51	61	49	0 C	70	77
Cudď)	9 6 6	20				σ.		12		14			16) ON		15					17				117			23					14		28		11
thin	08549	85100	85177	85187	85250	85148	85292	85288	8514/	85288 85174	85288	85243	85370	85246	85165	85474	85164	85462	85411	85312	85399	87778	85336	85363	85277	85205	85457	85313	85520	85302	85493	85260	85241	85452	85210	85464	85167	85468	85137	85498
stin		2000	1677	1669	1682	1916	1604	1588	1848	1782	1540	1576	1760	13/0	1550	1648	1546	1660	1639	1864	1610	1000	1894	1588	2084	2119	156/	1946	2232	1971	2302	2036	2058	2359	2146	2360	2056	2382	2693	2395
le rence	3501	20		വ	2	മ	ກ	υ.	ດແ	ຸດຕ	2	2	ທິເ	ח מ	າແ	2	35	35	ഗ	ທ	ν u	ດແ	່ດ	3	Š	50	ນັ້	2 (2)	2	Š	ຕຸ	ກິດ	ດແ	ຂ	35	ഗ	υ u	വ	2	2

Scardroy Panned Concentrate Data

Sn (ppm) Zn (ppm) Cu (bpm) 0848436 0848636 0848558 0848960 0848740 0849910 0848960 0850749 0849300 0850939 0848930 0849790 z Sample Reference KLP3552 KLP3553 KLP3553 KLP35554 KLP3556 KLP3556 KLP3566 KLP3566 KLP3567 KLP3567 KLP3567 KLP3567 KLP3568 KLP3567 KLP3568 KLP3568 KLP3568 KLP3568 KLP3568 KLP3568 KLP3568 KLP3568 KLP3588 KLP3588 KLP3588 KLP3588 KLP3588 KLP3588 KLP3594 KLP3595 KLP3596 KLP3597 KLP3598 KLP3598

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Scardroy Panned Concentrate Data

(mdd)	0.0				•		•		•			•					•	•			•			•	•		•	•	•		٠	٠		
Sn (mdd)	0 m D	101	M 62	c	4-	7	7 5	~ 4	т v	0 0	. .	4 C	ν ν	ഹ	7 2	44	7	ed (n	0	M +	-0	П	ഗ ഗ	J C	≀ ⊷	0	00	o (\	ım	⊷,	-1 C	10	
Ag (ppm)							•		•		•	•					•	•		•	•		•	•	•		٠	٠		•	•	•		
qN qN		11 16	18 e	11 20	14	16	10	12		י סי	9	14	10		y (12	11	6	11	80	10	11	9	σ 1	u 6	10	9	94	10	9	ហ	σ α	o 0	
Zr (ppm)	294 313 295	9	യവ	7	0	ာ ထ	8 4	o 4.	0 0	വ	4	∿ 4	ro	(7	3	3	\sim c	o [~	2	ო <	r 9	~	r~ <	> -	10	4	\circ	, ~	4	9	$\supset o$	n ω	
Y (mdd)	209	ササに	~ 4	٦٣	\sim 0	292	S	7 (7)	40	0 ო	9	א עכ	164	ωı	352 230	ı ω	78	0 to	176	69	26	7 2 2 2	58	4. r	1.09	82	21	19	21	26	12	90	8 4	
nZ (mdd)	55 68 77	61 76	77	68 67	23	75	39	99 95	68 7	9 8 9 9	41	0 0 0 0	629	63	7 8	69	30	73	61	51	23	4 4 4 4	36	200	878	63	54	<u>ል</u> ሊ	T (*	57	51	39	25	
Cu (bpm)	138		1 T 8	10		ο Φ		15	ω ₆	16	90	ס ס	29	12	112	30		12	16		19	4 0	ω	۲ (α עב	10	17	17	ი ი	16	18	9 -	→ 80 →	
id i	849	84879 84872	84811 84868	84779 84894	84764	84764 84764	84956	84767	85034	85026	84825	85026 84832	84827	84831	84//3 84856	84672	84890	84682	84670	85000	84640	84714	85008	84716	85004 84733	85035	84784	84528	84512	84678	84476	84655	84 605 84 605	
stin	2269 2192 2268	2462 2678	7387 2668	2346 2520	2317	2317	2570	2174	2104	2120	2036	2120	2408	2020	2306 2034	2277	2842	2245	2210	2952	2177	1804	2955	1818	7887 1818	2850	1702	1960	1976	1627	1940	1612	1567	
er	LP3600 LP3601 LP3602	P360 P360	P360	2360 P360	P360	P361	P361	P361	P361	P361	P361	P361	P362	P362	7362	9362	9362	7362	9362	2363	9363	2007	P363	P363	2000	P363	P363	P364	2000	P364	P364	P364	364	

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sting Northing	Cu (ppm)	2n (mqq)	(wdď)	Zr (ppm)	(mqq)	Ag (ppm)	Sn (mdd)	dS (mqq)
	11	2. 4. 7. 4.	78 78	823 709	10	3.0	40	0.0
	12	09	40	793	14	3.0	1	0.0
	11	32	18	474		2.0		0.0
	7	25	28	445	7	0.0	2	2.0
	വ	24	26	969	10	0.0	ഗ	3.0
	æ	26	49	1173	17	3.0	⊣	0.0
	13	33	31	905	12	2.0	4	0.0
	9	22	16	436	9	0.0	2	0.0
	10	41	23	435	80	3.0	0	0.0
	10	33	63	455	6	4.0	2	0.0
	14	70	116	299	14	4.0	м	1.0
	10	32	107	441	10	3.0	7	1.0
	ထ	49	141	300	δ	7.0	2	2.0
	σ	35	216	574	15	8.0	0	2.0
	6	54	212	443	12	2.0	2	2.0

Sample Reference N	; <u>;</u>	thin 	Ba (ppm)	La (ppm)	Ce (ppm)	(mdd)	Th (ppm)		Au (ppb)
KLP3501 KLP3502	232030	854 851	0.00 0.00	25	45	14	90	3.000	1 5
P350	200	85100	132	10	16		ഹ	38	7 2
7,500	167	85177	90	10	ω -	11	⊷ (88	70
P350	166	85187	67) [0	w 0	C	300	7 -
P350	168	85250	357	ıω	9	ω	10	88	-
P350	191	85148	155	11	18		П	00.	4
7,55	91	85292	257	13	36	10	٦,	8	5
7,000	200	85788 85147	200	97	4. 20 Q	4.	4.	80	2 -
P351	151	85288	453	ν r.	25		٦ ,	36	٦.
P351	178	85174	197	œ	ı ω '	ω	1 W	88	+ m
P351	154	85288	224	ഗ	10	12	0	00.	7
P351	157	85243	198 215	34	78	ω μ	0 -	90.	0.0
2351	7.5	27778	225	7 0 0	7 <	u (-	⊣ ⊔	36	უ -
9352	178	85474	198	1 2 2	r		J (38	→ ←
2352	155	85165	275	7	19	י סי	ı	00.	·
9352	164	85474	186	13	13	· &	ıω	80.	٠.
9352	154	85164	591	10	25	18	٣	00.	2
2352	166	85462	156	13	17	٣	9	00.	г
2352	163	85411	128	10	ም ,	4 ,≀	m	00.	.
300	36	85312	243	n ۱	14	ıΩ (φ,	80.	⊶ .
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2250	7 0	8558	261 195	7 -	y 2, C	ω r	ማ <	36	_ <
27.5	י מ מ	7777	707) t	- 0	- ۳	יינ	3 6	≱ ' −
2353	158	85363	198	-1 -	35	16	v C	36	→ C
2353	208	85277	273	12	18) IC	20	د
2353	211	85205	292	اص	23	ı		00.	1 M
2323	156	85457	204	15	28	13	S	00.	
2353	221	85536	210	17	32	4	1	00.	2
2353	194	85313	129	6	10	∞ ι	0 1	00.	7
2353	223	85520	210	$\frac{17}{2}$	30	ლ -	ഹ	8.	
2353	197	85302	122	7	13	σ,	. .	00.	7
47.00	200	85493	170	14	52 23 23	,	4 , (00.	
200	אר כי היי	82260	202	77	7 0	Λ \	٠,	36	25
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25.54	200	85241	184	16	97	7'	4 , ,	00.	-
45.54	23.	85452	215	52.	9 6	ه د	، و	80.	(
700	7 7	01700	207 204	ρ	0 F	את	n c	38	7.
200	2 6	65464	210	T C	2.4 0.4	o o	ט ע	36	٦ ،
# W	2 6	0210/ 85157	154	17	o c	۷ ر	n -	36	7 -
23.54	2 C	85468	71	7 7	0 0		-	30	→ ←
2355	269	85137	74	19	32	· თ	, co	00.	· m
9355	239	85498	94	34	77	. 0	8	00.	1

Scardroy Panned Concentrate Data

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Th (ppm)	 	
(mdd)	 	
Ce (ppm)	1 1 1 1 0 8 9 0 7 4 8 9 9 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	
La (ppm)		
Ba (ppm)		
:hi		
Easting	22020202020202020202020202020202020202) }
Sample Reference N	20 20 20 20 20 20 20 20 20 20 20 20 20 2	

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A pp]	3	დ (27	4960	20 5) 4	12	7	φ.	4 . c	1 C	4	7	m •	⊣ ⊢	٦.	٠.	2 2	2	4	~ 1	സ	m ,	~4 +	u	0	. ~	S	7	9	m	4	י ע	ብ ‹	Υ) <	r -	٠.	9	1	Α.	⊣
(wdd) N	3.000	96	38	86	36	80	00.	00.	0.0	38	30	00.	00.	80	. c	36	20	00.	00.	00.	0	٥	80	36	35	200	00.	00.	8	8	8	86	30	36	38	36	20	00.	00.	0.0	5
Th (ppm)	12			22		12		12		Ω પ	o ve	4	13	∽ •	4. C		12		15	2	10		7	n c	א ע	19	0	7	0	m ·	7	4 4 ⊓	ഹ ദ	ס נ	77	٠ ٧	13	7	9	01	`
(mdd)	00	σ п) H	11	n C) O	13	4	11	77	- C	.00	10	ω (۰ ۵	nα	o vo	· α	13	7	20	m (10	7 1	12	10	13	7	80	18	10	11	o •	4 , [~ ư	ر ت	4	$1\overline{2}$	7	, n	12
	55	39 72	54	149	152	9	30	74	900	7 P	9.0	49	81	e c	א מ א מ	0.4	70	40	92	65	86	37	17	1 C	7 C	50	$\frac{1}{21}$	46	26	35	23	51	3.0	77	770	2 4	32	17	35	12	46
La (ppm)	37	25	25	900	3/	46	15	43	37	10) (M	23	46	21	9 C K	1.0	34	12	45	36	99	14	7 ,	C	87	20	7	22	σ	15	σ	23		77	ש כ	יי ב	13.0	9	14	σ (77
Ba (ppm)		125 81	\sim	156	n oc	S	-	\leftarrow	250	ソロ	248	6	~	114	VΟ	S) (V	0	┙	4	\sim	4	σ	D 0	ס ע	۰ v	0	9	0	3	φ.		J (~ ($^{\circ}$	7	J [ഹ	0	201	4
ii	00	84958 84879	84872	84811	84779	84894	84764	84918	84764	84700 85076	84767	85034	84758	85026	04070 85076	84832	84827	84831	84773	84856	84672	84890	84682		846/0	84640	85018	84714	82008	84716	85004	84732	85035	84/84	84578	24.70	84678	84476	84655	84377	84605
1	226 219	268 268	267	238	234	252	231	253	231	700	217	210	$\frac{213}{13}$	212	2 5	202	240	202	230	203	227	282	777	ν c υ c	700	217	295	180	295	181	288	181	20,1	7,	175	96	167	194	161	186	ΪŽ
Sample Reference	LP3600 LP3601	9 9	9	999	9	9	9	61	191	5 5	61	191	19	191	19	62	62	162	95	962	62	200	200	2 0	797	63	363	363	93	963	9	9	200	200	7 V	7	364	364	364	364	564

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(qdd) (wdd	.000	0000	.000	.000	.000	.000	0.000	.000	.000	2.000 1	1.000 1	0.000	.000 2	.000
) (wdd)	98	11 8	7 0	5	6	8	0 9	S	3	12 2	4 1	2	5	13 2
(mdd)	12	15	12	13	13	14	11	თ	4	9	4	7	0	10
(ppm)	343	39	23	17	16	19	21	32	14	62	21	37	31	75
(mgd)	24 16	17	7	7	10	11	80	16	10	35	σ	15	15	34
. (mgd)	431 369	684 475	469	489	368	440	493	480	221	353	208	225	179	229
Northing	0842880 0845940	0842260 0845800	0842100	0845640	0842100	0845670	0844300	0845570	0848230	0849050	0848210	0848850	0848260	0848460
Easting	216190 220920	216750 220640	217720	220620	217670	220490	218400	220210	216450	222880	216080	223630	215740	224470
Reference N	KLP3648 KLP3649	KLP3650 KLP3651	KLP3652	KLP3653	KLP3654	KLP3655	KLP3656	KLP3657	KLP3658	KLP3659	KLP3660	KLP3661	KLP3662	KLP3663

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Sample			Major rock	C a	Ti	>	Mn	F) O	ပိ	Z,	C
Reference	Easting	Northing	type	(mdd)	(mdd)	(mdd)	(wdd)	(mdd)	(mdd)	(mdd)	(mdd)
KLR3502	217,080	0851780	22EM	51500	4300	260	8760	86900	30	99	06
KLR3504	216770	0851770	2C00	16400	3690	272	490	41400	13	88	203
KLR3506	16	0851870	2000	28800	3240	131	1030	49400	24	55	99
KLR3507	~	0851140	2230	51300	4160	157	6200	97200	42	34	1022
KLR3511	_		2270	31100	8230	349	930	65500	54	66	559
KLR3533	_		227E	13500	8730	260	1670	119500	22	73	307
KLR3541	N		493C	88200	680	21	1290	26000	7	6	12
KLR3584	216520		2200	36500	1520	28	400	26800	11	35	52
KLR3589	CA		2300	700	2110	46	140	23500	6	17	36
KLR3606	(V		2K00	44000	5190	193	1190	00699	30	62	90
KLR3617	(N		2170	17300	5570	113	910	49500	16	25	25
KLR3664	(V		3800	13000	5330	478	009	101600	16	116	233
KLR3665	(V		3800	15900	2690	128	1240	55500	20	31	32
KLR3666	(\		3800	8600	2440	45	360	27000	4	S	σ
KLR3667	_		2230	63500	3060	87	1200	53800	61	760	7
KLR3668	_		4H00	49900	6500	203	850	00099	26	38	13
KLR3670	_		2270	13200	4060	444	350	41300	29	155	402
KLR3671	_		2230	83200	1110	313	3390	125600	21	15	342
KLR3672	_		2230	47700	480	84	3820	189000	188	176	2976
KLR3673	216925		3800	263800	150	24	7620	57500	30	52	848

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Mo Ag m) (ppm) (ppm)	5 46.0 3.0 6 6.0 3.0 6 6 6.0 3.0 6 6.0 1.0 6 6.0 1.0 6 6.0 1.0 6 6.0 1.0 6 6.0 1.0 6 6.0 1.0 6 6.0 1.0 6 6.0 1.0 6 6.0 1.0 6 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0 6.0	53.0
Zr Nb (ppm)	11 1040 11 1040 11 1040 11 1048 11 1048 11 1048	
(wdd)	23 1119 126 127 137 158 159 159 159	2 9 2 9 5 4 5 8 5 8 5 8 5 8 5 8 5 8 5 8 5 8 5 8
Sr (ppm)	2002 2001 2000 2001 2000 2001 2000 2001 2000 2001 2000 2	149 116 34
Rb (ppm)	112 311 79 79 118 128 28 28 28 50 50 121 121 121 121 121 121 121 121 121 12	
Sn (mqq)	147 319 158 158 295 101 101 101 206 206 207 207	991 172 172 65
Major rock type	222500 2000 2000 2230 2230 2230 2230 2300 2400 33800 33800 33800 2400 2400	2270 2230 2230
Northing	0851780 0851770 0851870 0851840 0851440 0852600 0852600 0849600 0850941 0850260 0850260 0850252 0850252	0851850 0851420 0851420
Easting	217080 216770 216670 219840 218800 220320 220360 221650 221200 221200 221235 221235	
ample eference	LR3502 LR3504 LR3504 LR3511 LR3511 LR3589 LR3606 LR3664 LR3665 LR3665 LR3666	LR3670 LR3671 LR3672

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Scardroy Rock Data

Au (ppb)	 	414		7	1	7	(,)	(1	-	(4	7	(4	w	C	7			w	7
(wdd)	E	o, 4	2	٣	m	1	1	.	ហ	9	12	4	m	7	7	12	10	7	7
Th (ppm)	5	o ~	. —	\vdash	2	2	г	7	٣	11	9	12	9	0	4	6	m	0	2
dq (mdd)	4.	4 9 8	,	ω	4	9	0	7	7	15	6	18	7	4	S	4	9	7	0
Ce (ppm)	14	33 23	14	14	3	34	20	36	20	81	30	80	44	S	31	47	294	11	213
La (ppm)	7	11	ហ	δ	9	16	ω	16	10	39	27	40	21	7	13	25	129	14	96
Ba (ppm)	174	396 391	42	522	573	168	925	598	234	630	635	670	311	100	509	626	53	38	30
(wdd)	0.0	00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0
(mdd)		00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Major rock ing type	780 22EM	770 2C00 370 2C00	140 2230	0	0	500 493C	500 2200	•		350260 2170	313 3800	~	~	700 2230	8698 4H00	350 2270	420 2230	120 2230	480 3800
Northing	0851	08517	0	8	08	O	O	0850941	O	ö	085031	0	80	0848.	084	0851850	0851	0851	0851
ب ت.	217080	216770	219840	218800	216020	220360	216520	223780	226680	221200	221106	221235	221235	217840	217843	216300	216920	216920	216925
mple ference		KLR3504 KLR3506	KLR3507	KLR3511	KLR3533	KLR3541	KLR3584	KLR3589	KLR3606	KLR3617	KLR3664	KLR3665	KLR3666	KLR3667	KLR3668	KLR3670	KLR3671	KLR3672	KLR3673

Table 4 Major rock type code classifications

												'gossan'
cardroy open File Report - Rock Codes	Biotite schist	Gneiss - undifferentiated	Garnet mica gneiss	Hornblende gneiss	Biotite gneiss	Biotite garnet gneiss	Granitic gneiss	Psammitic gneiss	Pelitic gneiss	Breccia	Quartz-carbonate vein	Iron oxide/hydroxide rock -
cardroy o	170	200	2 EM	230	270	27E	300	000	K00	800	93C	Н00