



CEI0037

**FINAL REPORT ON THE
CAPRICORN COPPER MINERALS SYSTEMS PROJECT**

**CAPRICORN COPPER PROJECT, GUNPOWDER,
NORTHWEST QUEENSLAND**

TITLE: EPM 26421, 26422 & 26423, Round 2, CEI0037 – Capricorn Copper Mineral Systems Project, Final Report

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1. Executive Summary

In June 2019 Capricorn Copper Pty Ltd (Capricorn) commenced lithochemical sampling of potential source rocks around the Capricorn Copper Mine (CCM). The program aimed at defining geochemical characteristics of near-mine rocks from the Eastern Creek Volcanics and Surprise Creek Formation units which could then be applied to more regionally located samples of the same rocks. The program has identified a number of elemental and mineralogical signatures which could be used to vector toward potential mineralisation and has highlighted a number of low priority follow up targets within the Capricorn tenement package.

2. Introduction

The Capricorn Copper Mine (CCM) is located 115 kilometres North of the mining township of Mount Isa. CCM has been a sporadic operation from 1927 - 2013 with reported production estimated at 12.9Mt at an average grade of 3.67% Cu for a total of 521,178 tonnes of copper. Mining operations recommenced in 2017 and are currently being undertaken at the Mammoth, Greenstone and Esperanza South deposits.

In late 2018, the State of Queensland acting through the Department of Natural Resources, Mines and Energy (the Department) approved partial funding of a regional rock chip sampling program through its Collaborative Exploration Initiative scheme. The funding approved totalled 50% of the direct activity costs up to a cap of \$54,667 AUD if delivered by 20th December 2019. Sampling commenced in June 2019, with final sample collection in late August 2019. Assay and hyperspectral results were returned in September 2019, with thin section interpretation delivered in late November 2019. This report details the activities and interpretation of the subsequent results of the program.

3. Tenure

The Capricorn tenure package comprises 4 Exploration Permits (EPMs) and 31 Mining Leases (MLs) (Figure 1). The current tenements cover a total area of 678 sub-blocks. On 27 October 2015, Capricorn Copper Holdings Pty Ltd ("CCH") acquired all of the issued shares of Birla Mount Gordon Pty Ltd. On 1 November 2015, Birla Mount Gordon Pty Ltd changed its name to Capricorn Copper Pty Ltd and in 2018 EMR Capital became the sole owners of Capricorn. The EPMs and current MLs are in good standing with no known impediment to the granted mining permit. Activities for this program were restricted to EPM 26421, 26422 and 26423.

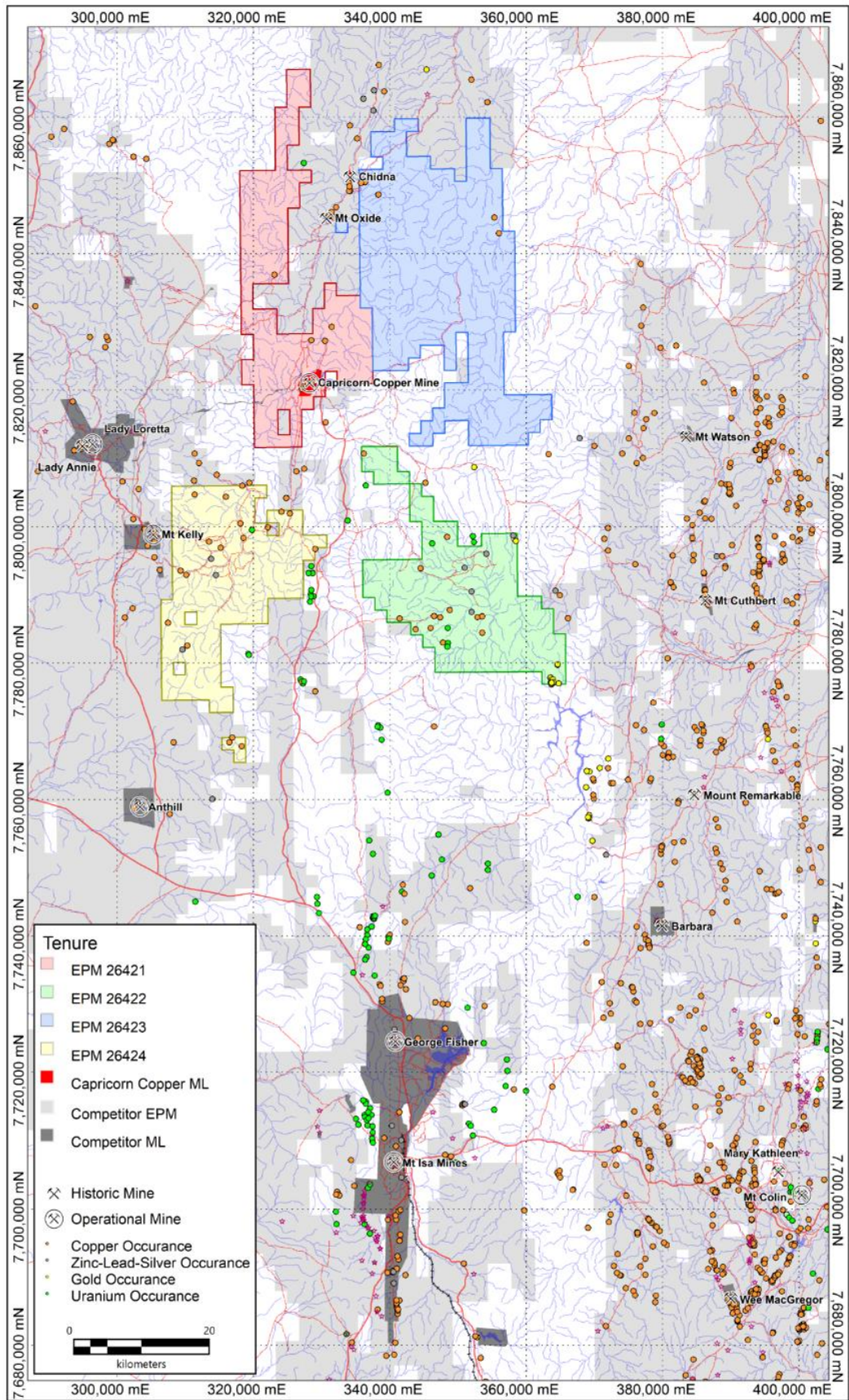


Figure 1. Location of the Capricorn Copper Mine and associated Mining Leases and Exploration Permits. Activities for the Mineral Systems Project took place on EPMs 26421, 26422 and 26423.

4. Geology, Structure and Mineralisation

4.1 Regional Geology, Structure and Mineralisation

The copper deposits of the CCM occur within the Western Fold Belt of the Mount Isa Inlier, specifically within the Leichhardt River Fault Trough (LRFT) tectonic sub-domain. The LRFT is a ~300km x 50km belt of variably deformed and metamorphosed sediments and volcanics deposited in a succession of rift-sag cycles between 1790Ma and 1645Ma. It is bounded to the West by the Mount Gordon (MGFZ) and May Downs Fault Zones, across which lies the Lawn Hill Platform tectonic sub-domain. It is bounded to the East by the Bull Creek High Strain Zone, across which lies the Ewen Block tectonic sub-domain, and by the Gorge Creek Fault Zone, across which lies the Kalkadoon-Leichhardt Belt tectonic sub-domain. The stratigraphy within the LRFT can be sub-divided into three groups representing distinct cycles of basin formation and sedimentation. The oldest is Leichhardt Super Basin (1790-1760Ma) which formed during intra-plate rifting caused by slab roll-back at the continental margin, far to the South West. The Haslingden Group, which includes the Eastern Creek Volcanics and Myally sub-group sediments was deposited during this event. This was followed by the formation of the Calvert Super Basin (1690-1670Ma), another major, rifting-related period of rapid sedimentation and bimodal volcanism. The Surprise Creek Group, Torpedo Creek Quartzite and lower units of the Gunpowder Creek Formation were deposited during this event. The formation of the regionally extensive sag basin, the Isa Super Basin (1670-1645Ma), followed the cessation of rifting, with the deposition of thick packages of carbonaceous and carbonate-rich sediments the Mount Isa group and McNamara Group. All the major Pb-Zn-Ag deposits within the Western Fold Belt are thought to have been formed during deposition of the Isa Super Basin.

The early rifting history of the region created numerous large faults that were subsequently reactivated during successive periods of rifting and orogeny. Major base metal deposits within the Western Fold Belt are always spatially associated with these structures, e.g. the Paroo Fault at Mount Isa, the Carlton and Swan Faults at Lady Annie and Lady Loretta, and the Mammoth Extended Fault at CCM.

The Isan Orogeny (1600Ma-1500Ma) broadly refers to 3 main deformation/metamorphism events (termed D1, D2 and D3) impacting the Mount Isa Inlier. D1 (1600-1570Ma) was characterised by N-S oriented crustal shortening and reactivation and inversion of the early E-W oriented, rift-related faults. D2 (1570-1520) was the peak metamorphic event, with ductile deformation and folding associated with E-W oriented crustal shortening. Major N-S oriented shears and folds were generated during D2, including the MGFZ and the Bull Creek High Strain Zone. D3 (1520-1500Ma) was the final major deformation event in the region, with ENE-WSW oriented compression generating wrench faulting and brittle deformation locally on pre-existing structures. Structurally-hosted copper mineralisation throughout the inlier is generally interpreted to have been emplaced during D3.

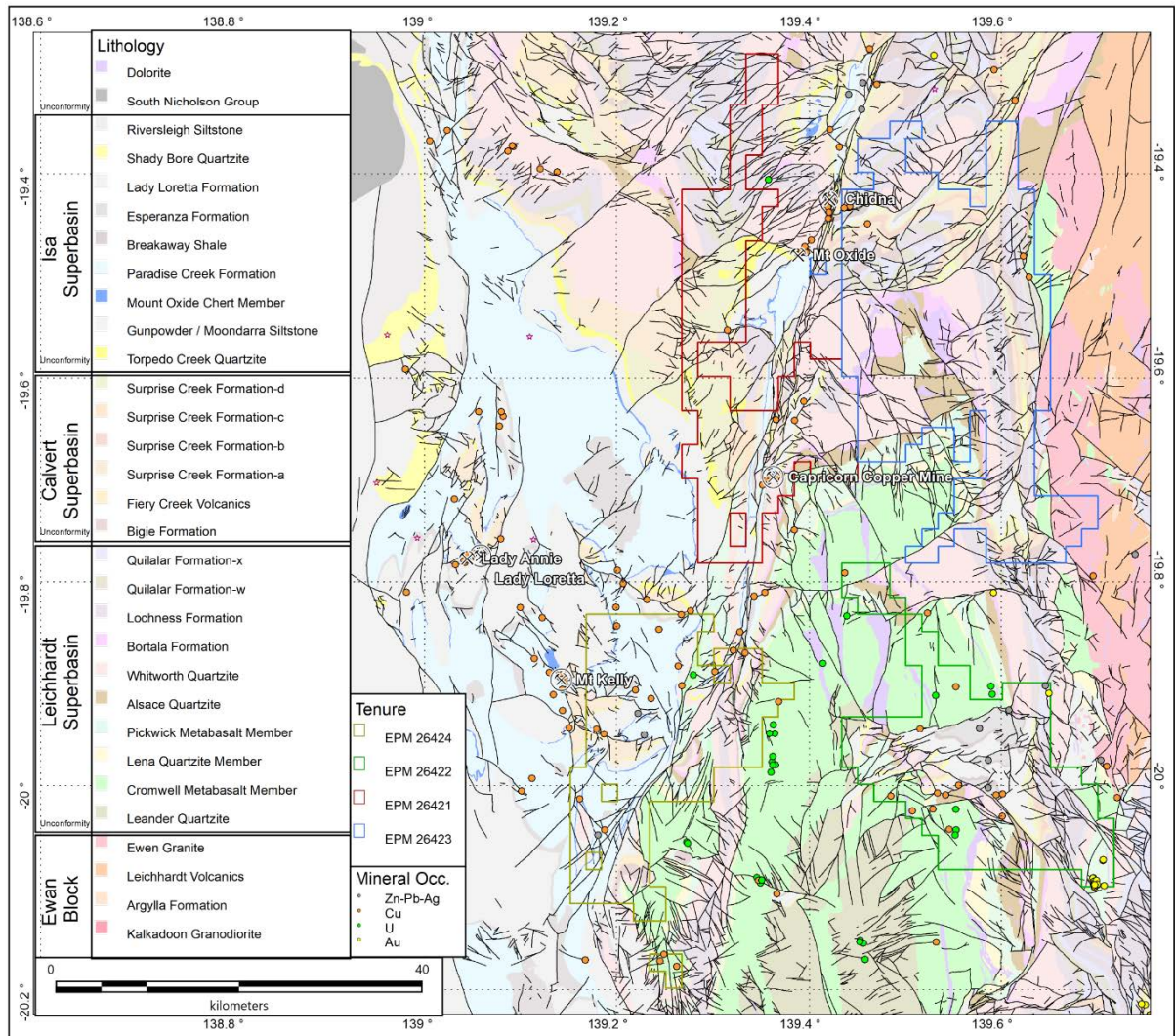


Figure 2. Regional Geology (100k) of the Capricorn Copper Mine area

4.2 Local Geology, Structure and Mineralisation

The CCM area contains rocks from the Leichhardt Superbasin, Calvert Superbasin and Isa Superbasin. The Leichhardt Basin rocks are dominated by the Eastern Creek Volcanics and the Myally Subgroup rift-related clastic metasediments. These are overlain unconformably by the Surprise Creek Group, a package of clastic metasediments, and subsequently by McNamara Group sediments.

The CCM area deposits are all located along significant fault intersections and are tightly grouped within a 3,000m x 700m area (Figure 3). The sizes and key geological features of the deposits are summarised in Table 1. Mammoth and Esperanza South both remain open down plunge and to date have been drilled to a depth of ~1,500m and 800m respectively (Figure 4).

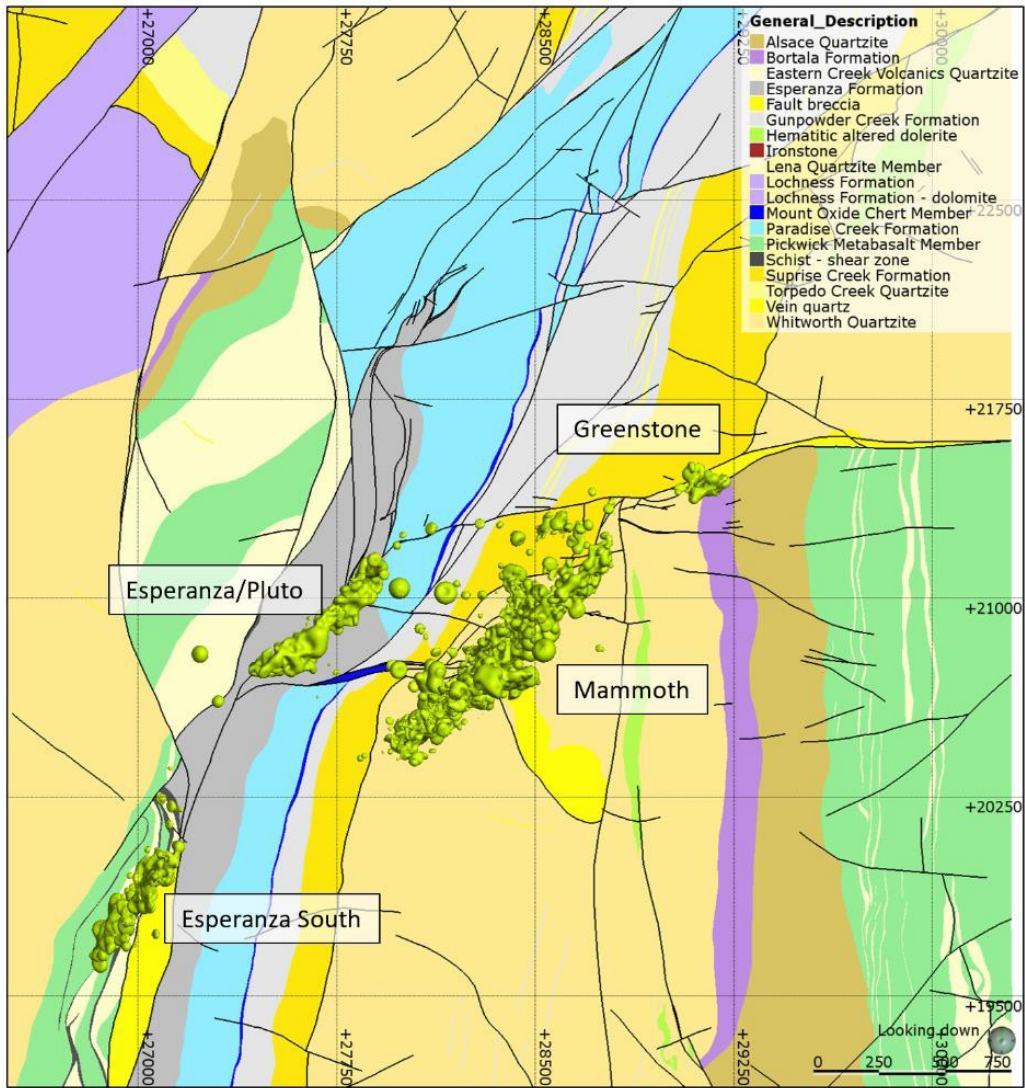


Figure 3. Geology and Mineralisation of CCM area deposits (0.7% Cu Leapfrog grade shell shown)

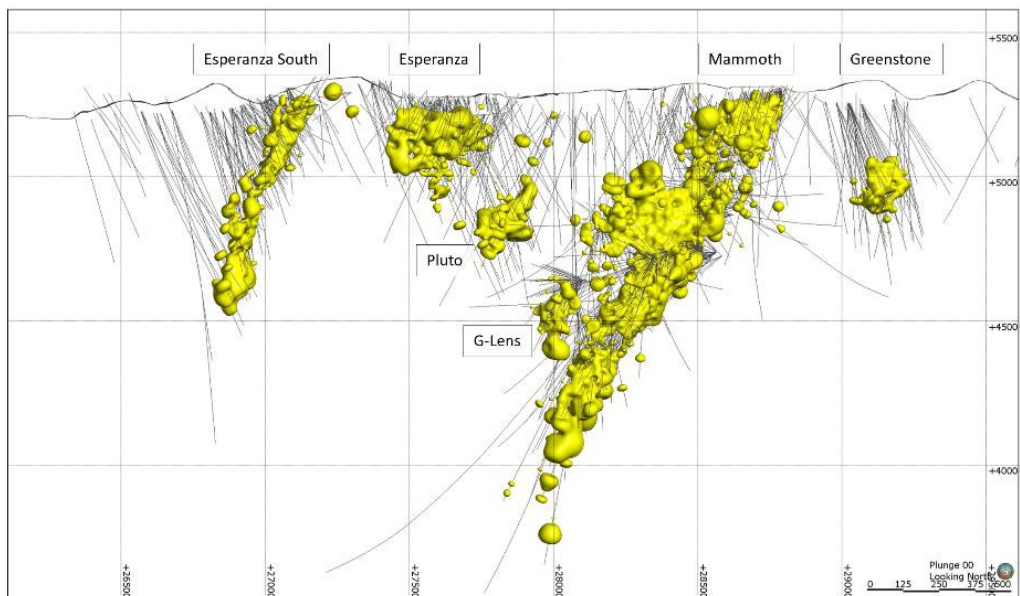


Figure 4. Section looking North showing 0.7% Cu Leapfrog grade shells of all CCM deposits with drill traces

Table 1. Summary of the CCM deposit characteristics

	Tonnes	Copper Grade	Contained Copper (kt)	Host Lithology	Dominant Cu species	Style	Structural Control
Mammoth*	28.64	2.47	707.6	Quartzite	Chalcocite - bornite	Sulphide breccia fill	SW-plunging fault intersection
Esperanza*	4.6	7.72	355	Silicified siltstone	Chalcocite	Massive sulphide pyrite replacement	N-S trending destruction zone between major faults
Esperanza South*	8.38	2.46	206	Silicified siltstone	Chalcocite - chalcopyrite	Massive sulphide pyrite replacement	SW-plunging fault intersection
Pluto - Esperanza North	5.48	3.07	168.3	Dolomitic siltstone and graphitic shale	Native copper - chalcocite	Veining and bedding-parallel pyrite replacement	Intersection between major fault and reactive stratigraphy
Greenstone*	1.73	2.26	39.2	Quartzite	Bornite - chalcocite	Sulphide breccia fill	Vertical to steeply NW-plunging fault intersection

*Pre-mining estimate: includes previously mined material (see www.capricorncopper.com/resources-reserves/ for current public in-ground resource estimate)

All the deposits in the CCM have a distinctive Cu(-Co-Ag-As) metal association that mineralogically bears strong similarities to stratabound Cu deposits such as those from the Central African Copperbelt or the Kupferschiefer. While CCM deposits are manifestly not stratabound, this observation was a key driver of the core ideas behind the original proposal.

Stratigraphically, the Greenstone and Mammoth ore bodies are hosted within the Whitworth Quartzite of the Myally Subgroup. The mineralisation exhibits as chalcocite, bornite and chalcopyrite hosted as fracture fill (low grade) through to matrix supported breccias (high grade). In contrast, the Esperanza, Esperanza South (ESS) and Pluto deposits are siltstone-hosted orebodies within the McNamara Formation sediments. Esperanza and ESS are hosted within silicified, graphitic Esperanza Formation siltstones; whereas Pluto sits within the underlying Paradise Creek formation dolomitic siltstones, which at Pluto are heavily leached and oxidised. At ESS, the Esperanza Formation is in fault contact with the Eastern Creek Volcanics, and mineralisation typically consists of secondary chalcocite adjacent to hematitic fault structures through to chalcocite-pyrite and eventually chalcopyrite-pyrite at depth. Esperanza also grades downwards from chalcocite dominant near surface, where the copper mineralisation sits under a silica cap, through to chalcopyrite dominant at depth. The majority of the chalcocite zone has been mined out. Due to the intense leaching along the Mammoth Extended Fault, the Pluto deposit consists of fracture-hosted to bedding parallel sooty chalcocite and pyrite, grading to cuprite and native copper in the most leached mineralised areas. The most intense leached zones also strip out the native copper and consists predominantly of kaolinite.

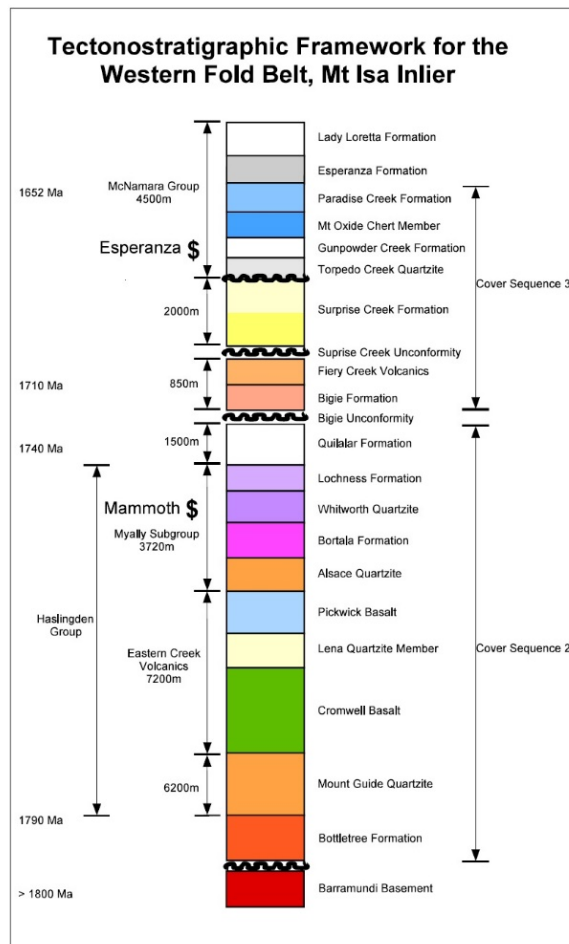


Figure 5. Basic stratigraphy of Western Fold Belt, Mount Isa Inlier, after O’Dea et al 1997, and Clarke 2003

5. Previous Exploration

5.1 Historical Exploration

The immediate area around the CCM deposits has been the subject of extensive exploration since the discovery of copper at Mammoth by the Shah brothers in 1923. However very little rock-chip sampling has been conducted within either the Surprise Creek Formation (51 samples) or the ECVs (76 samples). This sampling has been completed during numerous different campaigns and analysed with different or unknown methods, making correlation of results problematic. Scott and Taylor (1982) collected 28 samples of ECV from within the mine area and up to 20km away, specifically to investigate the ECVs as potential source rock for the deposit. Results from their work suggested weak depletion of base metals proximal to the CCM deposits but was inconclusive.

EPM26423 has had very little detailed exploration work completed on it. The area has been well-covered by stream sediment sampling, but due to the generally low tenor of base metal anomalism in the stream sampling, very little follow-up work has been completed. Minor drilling has been completed at the historic workings at Mount John. Soils sampling has been completed over the Mount John, Fearnot and the Southern Surprise Creek Formation outcrops. No systematic rock chip sampling has occurred within either the ECVs or the Surprise Creek Formation in this EPM.

6. CCM Litho-geochemistry (LGC) Sampling Program

6.1 CEI Proposal and Approval

In application for Round 2 of the Department’s Collaborative Exploration Initiative, CCM proposed a total of 500 rock chip samples across EPMs 26421 and 26423 targeting potential source rocks. The proposed program was designed to generate a better understanding of the potential source-rocks and early-stage fluid pathways responsible for the deposits within the CCM. In this Project we proposed assessing the potential metal source and fluid pathways for the CCM deposits, via a detailed litho-geochemical study around known mineralisation (known as Phase 1). The aim was to then apply exploration vectors generated in that study to identifying regions of potential source rock that have undergone metal scavenging within EPM 26423, a large and relatively underexplored portion of the CCP (Phase 2). The Project was designed to highlight litho-geochemical gradients within potential source rocks for the CCM area deposits, and then to apply that understanding to similar rocks within the regional EPM.

6.2 LGC Program Summary

Sampling for the LGC Program commenced in June 2019 initially around the near mine (Phase 1) and extending out to the Phase 2. The final samples were collected in August 2019. A total of 469 samples were taken across three EPMs – 26421, 26422 and 26423. A number of Phase 2 samples were moved from their original location within EPM 26423 into EPM 26422 due to the proposed sample locations being too remote for reasonable logistics upon visit to the field areas. However, in keeping with the original proposal, EPM 26423 contained the majority of the samples taken. Sample totals are listed below in Table 2.

Table 2. Samples collected vs EPM

Exploration Permit	Number of Samples
EPM 26421	168
EPM 26422	109
EPM 26423	192

6.3 Sample Collection and Logistics

Prior to commencement of the sampling program, the areas were assessed for accessibility via known access tracks and satellite imagery. The sample locations were then campaigned with three separate field teams designated separate sample areas in order for consistency and to ensure samples were collected primarily by workers with the most familiarity with the area due to the remoteness of the sample points. Most samples were collected on day excursions from the CCM site, however a small portion of samples, particularly those in the north of EPM 26423, were collected from a fly-camp base. Sample areas were accessed using existing access tracks and then on foot where the terrain was impassable by vehicle. One location, around the Mt John prospect, required minor refurbishment earthworks of existing access tracks to provide entry to the sample area.

Samples were assigned a pre-allocated ID number and proposed sample coordinates were input into a handheld GPS prior to departure. These coordinates were then navigated to in the field and the

area was then scouted for outcrop of the required stratigraphy and lithology. Outcrop was selected as relatively fresh and exposed, whilst being largely representative of the surrounding stratigraphy. Coordinates were then updated on the handheld GPS unit. Samples were collected using a sledge or rock hammer to remove any surficial weathering in order to ensure a fresh sample was collected. A number of hand samples from the same outcrop were taken to be representative of the outcrop as a whole. Samples were placed into a calico bag, numbered with the assigned Sample ID and typically weighed in the order of 1.8kg per sample. Field data including lithology, stratigraphy and alteration was recorded by the Geologist during the sampling process. At the end of each field visit, samples were placed in sequence into polyweave bags, typically five per bag, and stored on a pallet ready for dispatch. Samples were delivered to the laboratory at ALS Mount Isa in two separate dispatches for geochemical assay and hyperspectral analysis. A total of 33 samples were also flagged for petrological analysis in thin section. A small, rectangular sliver of rock measuring approximately 8cm x 3cm was cut using a manual brick saw prior to dispatch. These slivers were then placed in plastic bags numbered with the associated Sample ID and dispatched separately for thin section preparation and analysis. The remainder of the sample was returned to the original calico bag and placed back in the normal sample stream for assay dispatch.

6.4 Staffing

For the duration of the program, three separate field teams of two individuals – one Geologist and one Field Technician – were utilised. One Geologist was provided by Capricorn Copper, and the remaining five team members were sourced externally as technical contractors from Gnostic Exploration Services Pty Ltd (Gnostic). The Gnostic staff were inducted onto the Capricorn Copper mine site and followed Capricorn field procedures whilst conducting the program.

7. Data Recording and Management

7.1 Sample Data

Once a final sample site had been selected, coordinates were updated directly to the handheld GPS unit using the “waypoint move” function. Geological data for each sample was recorded into a Field Notebook by the sampling Geologist, and included Lithology, Stratigraphy, Alteration, Grain Size, Colour and any additional comments which the Geologist deemed of interest, such as magnetism or mineralisation. Upon return from the field, this data was then entered manually into a master spreadsheet accessible by all Geologists. The updated coordinates were imported direct from the GPS using Garmin Basecamp software and transferred into the master spreadsheet.

7.2 Assay Data Collation

Following review and validation of the master spreadsheet, the samples were also imported into Capricorn’s internal geochemistry database which holds assay data. The samples were put into the required format in Microsoft Excel and imported into the database using Microsoft Access. Upon delivery of the assay results, the values were imported into the Geochem database. A query is then used to interrogate the data to return the sample information with correlating assay values.

8. Analytical Services

8.1 Geochemical Laboratory

Sample preparation and analysis were undertaken at accredited commercial laboratories, Australian Laboratory Services (“ALS”) with preparation carried out at ALS-Mount Isa and analytical determination at ALS Brisbane (MS) and Townsville (FA). A sample preparation and analysis flowchart is attached as **Appendix 1**. Industry standard analysis was undertaken with the entire rock chip sample crushed and pulverised to 90% passing <75µm, to produce 500g pulps. A 1g charge was taken for analysis of 48 elements utilising a four-acid digest with an ICP-MS determination. It was proposed that any over range Cu (>10,000ppm, i.e. 1% Cu) and Ag (>100g/t) would be re-analysed using a standard Ore Grade method utilising a four-acid digest producing a volumetrically precise digest analysed with an ICP-AES finish, however no sample assays reached this overrange threshold. Gold was determined using a 30g charge for fire assay with an AAS determination.

Assay turnaround time was variable between the two batches, with the first batch, named MI19187144, taking 29 days from delivery to completion, and the second batch, MI19206960, taking just 16 days. Below is a table outlining the batch details:

Table 3. Sample Dispatch Batch Details

Batch ID	Date Submitted	Date Completed	Turnaround Time (Days)	Number of Samples
MI19187144	30/7/19	28/8/19	29	180
MI19206960	21/8/19	6/9/19	16	289

8.2 Hyperspectral Analysis

Following preparation of the sample at ALS-Mount Isa, a representative split of the coarse crushed sample was sent to ALS-Perth for hyperspectral analysis. Analysis was completed using an ASD Terraspec 4 Hi-Res mineral analyser. The samples were scanned within a wavelength range of 350 – 2500nm at a resolution of 3 to 6nm. The Terraspec 4 is particularly suited toward identification and characterisation of Fe-oxides, white micas, clays, carbonate, chlorite, epidote and amphiboles. The scans were input into AusSpec aiSIRIS software for automated interpretation. Interpretations are largely based on mineral identification through the presence of VNIR (Very Near Infra-red), NIR (Near IR) and SWIR (Short wavelength IR) wavelengths of known minerals. The specific wavelength value was then assessed within this range to determine speciation of the mineral. The percentage of the mineral within the sample is also estimated. Again, two batches were dispatched, correlating to the two stated in section 8.1.

8.3 Assay Results

Assay results were delivered to Capricorn in CSV format, in two separate files relating to the batch numbers. These were then imported into the Capricorn Geochemistry Database as mentioned in Section 7.2 and exported for data review. Appendix 2 contains the exported Geochemical data. Upon completion of the assays, it was evident that one sample was incorrectly numbered.

Maximum and minimum values for a selection of elements are listed below:

Table 4. Global Maximum and Minimum Assay Values

Element	Unit	Minimum	Maximum	Mean Average
Au	ppm	<0.01	0.05	0.00
Ag	ppm	<0.01	1.79	0.10
As	ppm	0.50	326	19
Co	ppm	0.20	214	21
Cu	ppm	2.4	1530	107
Fe	%	0.29	30.70	5.02
Pb	ppm	1.1	333	9
S	%	<0.01	1.18	0.02
Zn	ppm	<2	536	50

8.4 Quality Assurance/Quality Control

Due to the nature of the sampling program (i.e. broad scale, regional analysis) Capricorn utilised internal laboratory QAQC as the primary QAQC method for the program. The laboratory uses a rigorous program of duplicate check samples, blank samples and standard samples at the analysis stage of the analytical process.

8.4.1 Standard Reference Samples

Analytical standards were inserted routinely using a certified reference material (“CRM”) sourced from internally by ALS, and externally by GeoStats Pty Ltd (“GeoStats”) and OREAS. Four standards were used in total and entered the assay process at the digestion phase. Two of the four standards were internal, named MRGeo08 and OGGeo08, the other two external – Geostats GBM908-10 and OREAS-supplied OREAS-45e, which are discussed here and outlined in the table below.

Table 5. External Standard Reference Samples used

Std ID	Type	Cu_ppm	Ag_ppm	Co_ppm	Comments	Qty Used
GBM 908-10	Low Grade	3601	2.9	23	Low copper oxide	9
OREAS 45e	Low Grade	780	0.31	57	Lateritic oxide	9

Analysis of the external standards has shown that across the 18 assayed samples, all lie within 2 standard deviations of the certified value. This is deemed an accurate result. Assays for GBM 908-10 consistently assayed slightly higher than the certified Cu value (3601ppm), averaging 3646ppm Cu, but well within the limits of acceptability. Furthermore, there was no bias in this over reporting between batches and was consistent throughout. The OREAS 45e standard assayed either side of the certified value, averaging very close to the certified value for Cu (780ppm) at 779ppm.

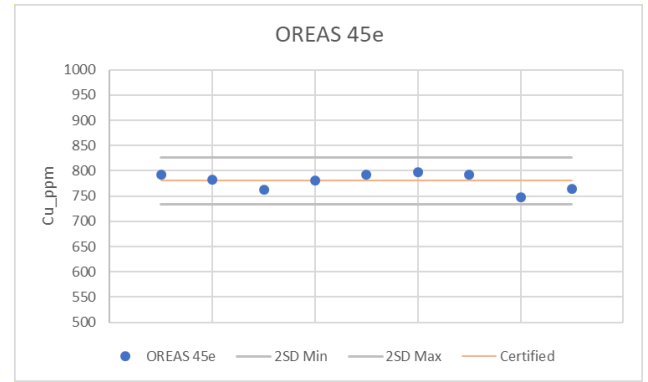
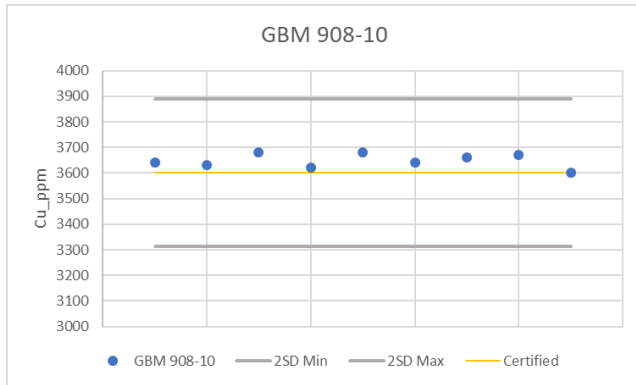


Figure 6. CRM performance for a) GBM 908-10; and b) OREAS 45e.

8.4.2 Duplicates

A total of 29 duplicate check samples were analysed by the laboratory. The duplicates are taken as pulp replicates following pulverisation of the rock chip sample. Therefore, the sample tests the repeatability of the results (i.e. precision). For Cu, results were highly comparable with all duplicate samples assaying within 10% of their original sample value. For typical QC processes an acceptable precision/repeatability discrepancy level for duplicates range between 5% to 15% (preferably below 10%) for 90% of the duplicate samples.

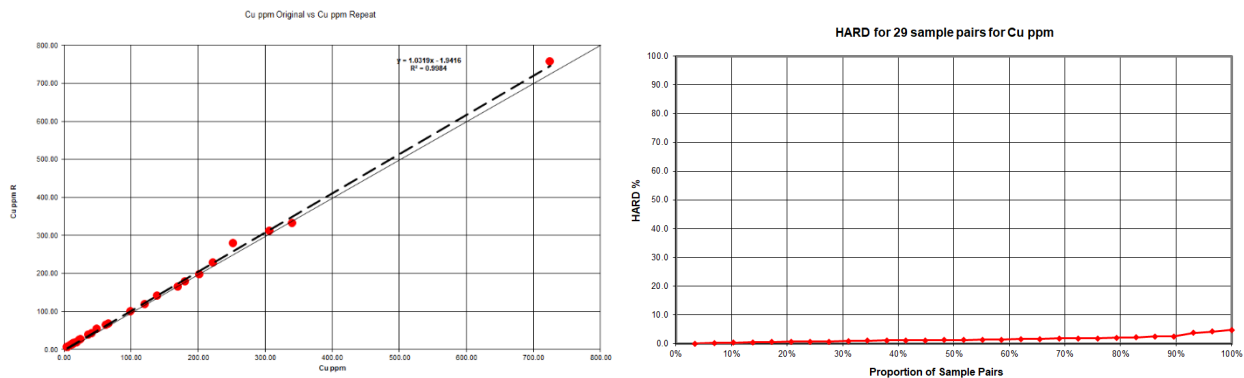


Figure 7. Duplicate Performance shown as a) Cu Assay; and b) HARD percentile

8.4.3 Blanks

A total of 18 laboratory blanks were used, eight within the first batch, and ten within the second. The blanks consist of an empty tube which goes through the analytical process and checks for contamination in the weighing, digest and analytical stages. They are not involved in the preparation stage and so no comments can be made in relation to this. In terms of Cu, all blanks assayed less than 1ppm indicating no expected contamination during analysis for this element. All other elements did not show any elevations and reported largely minimal assays.

9. Data Results

9.1 Data Groupings

For review of the data both geologically and geochemically, the samples have been split into 18 groups based on stratigraphy and location. The originally designated “Phase 1” (or near-mine) samples consist of five groups – four ECV basalts, and one SCF group. The remaining 13 groups make up the more regional phase two, although this does include the ECV metasediments of which are of mixed locations. The groups are shown in Figure 8 below:

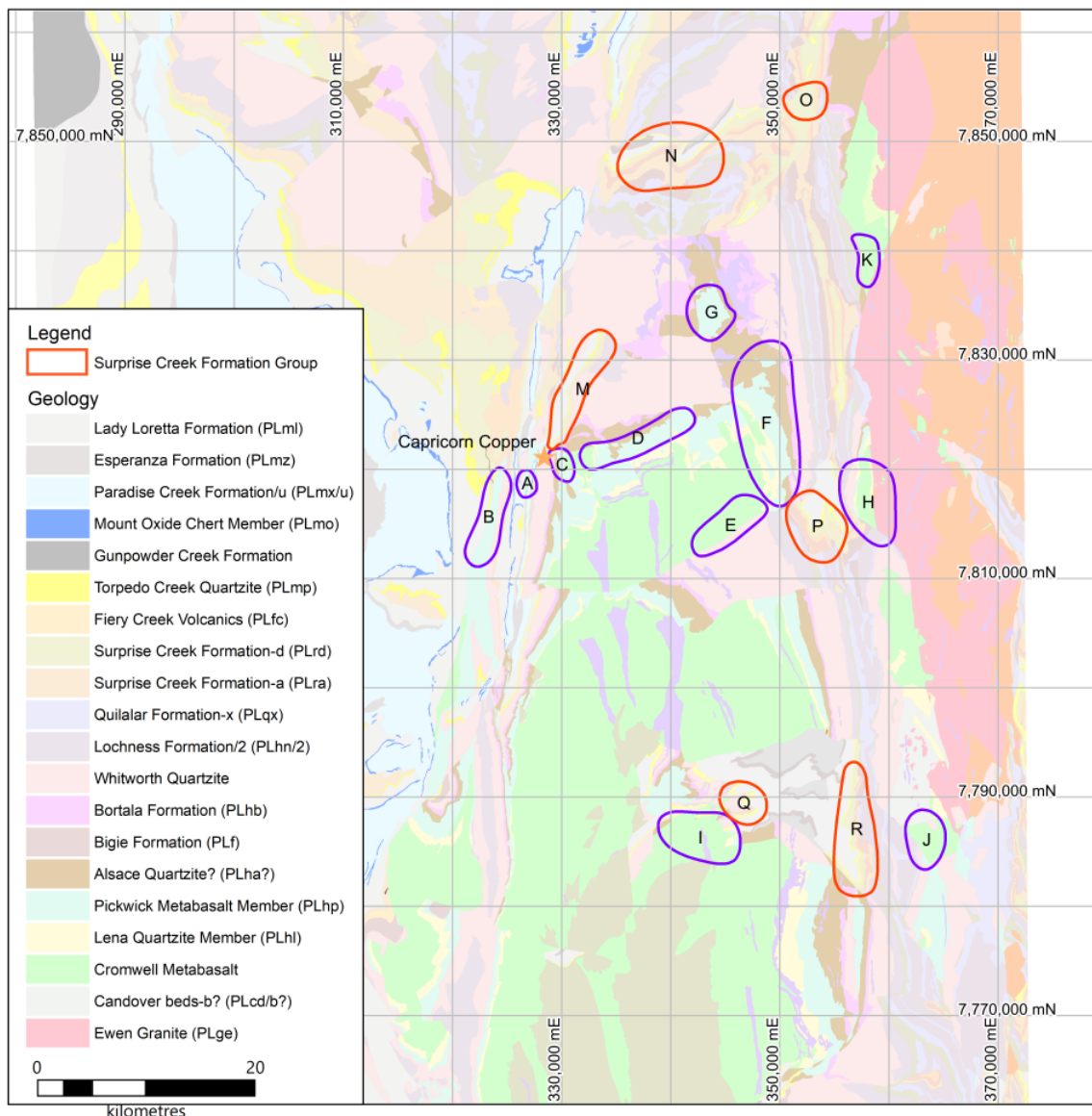


Figure 8. Stratigraphic Groups identified during analysis. Note, Group L is not highlighted due to multiple locations near Group H and near-mine.

9.2 Sample Geology

Samples were selected primarily for stratigraphic purposes, owing to the aforementioned theory that the basalts of the Eastern Creek Volcanics (ECV) are a potential source of the copper mineralisation within the Capricorn region. Another theory postulated by Capricorn in this study is that the upper Surprise Creek Formation (SCF), largely the Surprise Creek "D" beds ("Prd"), are derived from the erosion of the Cu anomalous Eastern Creek Volcanics. This could have an implication that the Cu source has undergone a secondary upgrading phase prior to eventual structural emplacement within the Whitworth Quartzite and McNamara Group rocks.

Therefore, all samples proposed were derived from the Eastern Creek Volcanics and Surprise Creek Formations. Preference in the Surprise Creek was given to the Prd, however due to the locally ambiguous nature of the transition between the beds and their variable thickness, occasional traverses crossed a number of Surprise Creek Formation beds.

Samples which were relocated prior to collection, namely those within EPM 26423 which were moved to EPM 26422, also targeted the same stratigraphic units as the originally proposed sample.

Review of the recorded geological data suggests that 146 samples collected were of basalt of the Eastern Creek Volcanics and designated as Groups A to K. Basalts are regionally chlorite altered with lesser amounts of hematite, carbonate and epidote. Basalt textures range from massive and blocky, through to sheared and foliated. Amydgales are common, typically filled with quartz and carbonate. A further three samples were of quartzite (QT) and six of silty to sandy metasediments within the ECVs. The metasediments noted are largely pink, feldspathic sandstones and lesser silt. Metasediments are not uncommon in the ECVs, however the pink, feldspathic nature could imply they actually belong to a Myally Subgroup in which arkosic sediments are common. QT is common throughout the Eastern Creek Volcanics, not only in the Lena Quartzite unit, but as frequent metamorphosed sandy interbeds between basalt flows, and so is not unusual in this regard. They are generally located on a single line and, along with the ECV quartzites, have been designated Group L as to distinguish from the surrounding basalts.

Samples collected from proposed SCF vary between sandstone (73 samples), siltstone (200 samples) and quartzite (41 samples). Previous detailed geological mapping by Capricorn has been conducted in two of the sample locations – the Magazine and Mt John prospects (Figure 9). Mapping at Magazine suggest that in the west of the traverses, samples may have strayed into Gunpowder Creek Formation (GCF) and Torpedo Creek Quartzite. Although not explicitly mentioned on a regional scale, quartzite is common throughout the SCF typically at the top of the Pra at Magazine (where Prb and Prc is not present) and again at the top of the Pra at Mt John. Samples also suggest there could be quartzite beds within the Prc in the southeast of the program area, should the regional stratigraphy be accurate. The Prd in the traverses has largely been mapped as siltstone, with lesser sandstone.

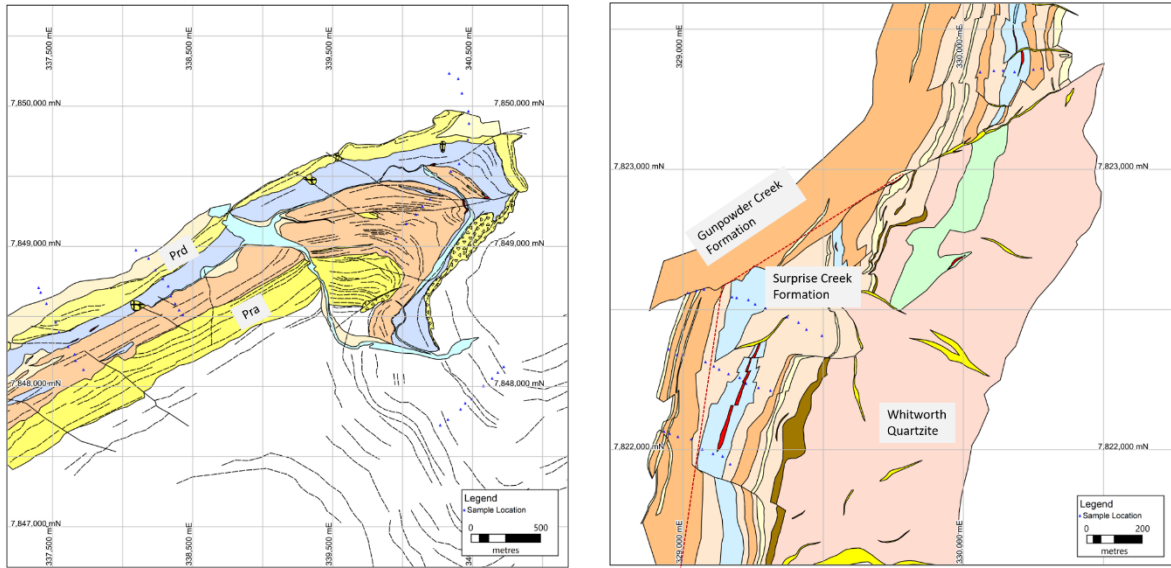


Figure 9. Local Geology of a) the Mt John, and b) the Magazine prospects

9.3 Group Assays

Assays from all groups have been assessed to demonstrate which groups are enriched or depleted in certain elements relative to their comparable groups (i.e. same stratigraphy). The averaged group assays for a selection of elements are summarised in Table 6 below.

Table 6. Averaged Assays for selected elements across the 18 Groups

Group	Strat	Lith	Ag ppm	Al %	As ppm	Ca %	Co ppm	Cu ppm	Fe %	K %	Mg %	Na %	Ni ppm	Pb ppm	V ppm	Zn ppm
A	ECV	BA	0.01	3.21	22.13	0.72	38.22	61.32	8.29	0.93	1.26	0.40	20.20	4.05	87.17	26.83
B	ECV	BA	0.06	7.14	3.51	2.53	44.39	187.22	8.89	2.53	3.60	1.40	63.72	23.98	297.76	157.14
C	ECV	BA	0.03	6.83	2.70	1.92	30.56	106.13	7.01	2.40	2.54	1.38	64.74	4.53	272.86	57.05
D	ECV	BA	0.08	7.18	2.49	4.85	45.99	133.47	8.87	1.32	3.21	1.95	67.63	9.72	293.26	147.33
E	ECV	BA	0.06	7.05	2.97	5.50	42.43	192.86	10.11	1.09	2.92	1.77	76.09	11.00	319.29	153.57
F	ECV	BA	0.08	7.08	2.23	4.75	45.70	155.83	8.65	1.12	3.33	2.11	74.50	8.45	272.35	138.74
G	ECV	BA	0.15	6.90	2.18	5.01	51.04	192.31	10.03	1.47	3.24	2.01	57.75	9.12	347.54	182.23
H	ECV	BA	0.01	5.94	8.33	2.81	34.39	116.93	9.67	3.79	1.91	0.54	40.05	4.37	224.55	64.27
I	ECV	BA	0.04	6.87	5.08	5.58	36.80	186.29	9.66	0.69	2.34	1.71	53.69	15.60	282.75	126.38
J	ECV	BA	0.03	6.54	1.73	3.58	26.18	70.83	7.52	3.12	2.21	0.73	82.45	5.28	198.50	91.50
K	ECV	BA	0.04	7.03	6.85	2.94	42.70	88.47	10.13	2.22	3.14	2.06	54.17	9.07	297.33	290.33
L	ECV	MSED	0.02	4.44	3.51	0.13	8.69	40.90	4.05	3.51	0.18	0.15	19.53	5.20	100.88	27.13
M	SCF	SED	0.22	3.69	55.65	0.33	24.12	202.41	4.21	2.88	0.16	0.05	17.23	9.40	31.30	12.57
N	SCF	SED	0.13	4.16	10.01	0.47	5.79	33.35	2.39	2.15	0.19	0.03	9.60	6.63	39.14	9.40
O	SCF	SED	0.03	6.45	5.40	0.04	4.75	23.45	2.65	2.20	0.25	0.05	10.38	3.81	60.50	19.00
P	SCF	SED	0.09	5.27	16.70	0.15	6.65	35.43	3.39	2.18	0.27	0.04	14.09	9.76	59.00	17.74
Q	SCF	SED	0.07	5.13	14.63	0.14	6.93	77.97	3.40	1.76	0.34	0.04	15.22	6.08	55.86	14.10
R	SCF	SED	0.04	4.90	8.39	0.06	5.64	20.63	2.50	1.96	0.28	0.04	14.04	7.42	53.50	17.42

The groups show the relative depletions and enrichments across all elements as listed below in Table 7.

Table 7. Group Element Depletion and Enrichment

GROUP	STRAT	LITH	RELATIVE DEPLETION	RELATIVE ENRICHMENT
A	ECV	BA	Ag, Al, Ba, Ca, Ce, Cr, Cu, Ga, K, Li, Mg, Mn, Na, Nb, Ni, P, Pb, Sc, Se, Sn, Sr, Ta, Ti, V, Y, Zn, Zr	As, In, Mo, Sb, U
B	ECV	BA	Ca, Mo	Al, Cs, Cu, Ge, Mg, Pb
C	ECV	BA	Ca, Ce, Co, Fe, In, Mo, P, Pb, Sr, Zr	-
D	ECV	BA	Be, Ce, La, Mo, Sb, Sn, Th, U, W, Zr	Al, Ca, Co, Mg, Na
E	ECV	BA	Bi, K,	Al, Ca, Cd, Cr, Cs, Cu, Fe, Ga, Ni, Se, Sr, Ti, V,, Y
F	ECV	BA	As, Be, Bi, Ce, In, La, Mo, Sn, Th, U, W, Zr	Ca, Co, Cr, Na, Ni, Sr
G	ECV	BA	As, Be, Cr, Mo, W, Zr	Ag, Ca, Co, Cu, Fe, Ga, Na, Sc, Sr, V
H	ECV	BA	Ag, Co, Mg, Mn, Na, Pb, Sr,, Zn	Ba, Be, Bi, Ce, Fe, Hf, K, La, Nb, P, Rb, Sn, Ta, Te, Th, Ti, Tl, U, W, Y, Zr
I	ECV	BA	Ba, Cs, Ge, K, Li, Rb,, Tl	Ca, Cd, Ce, Cu, Fe, Ga, Hf, In, La, Mo, Nb, Sn, Sr, Ta,Ti, W, Y, Zr
J	ECV	BA	Ag, As, Bi, Ce, Co, Cu, Fe, Ge, In, La, Mg, Mn, Na, Pb	Cr, Cs, K, Li, Ni, Rb, Tl, U, W
K	ECV	BA	Cr, Cs, Cu, Ge, S, Se	Au, Ba, Bi, Cd, Ce, Fe, Ga, Hf, Li, Mn, Na, Nb, Sb, Sn, Ta, Th, Ti, U, W, Y, Zn, Zr
L	ECV	MSED	N/A	N/A
M	SCF	SED	Be, Ce, Cr, Cs, Ga, Ge, Hf, La, Li, Mg, Nb, Sc, Sn, Ta, Th, Ti, V, Zr	Ag, As, Ba, Ca, Co, Cu, Fe, In, K, Mn, Mo, Na, Ni, Pb, S, Sb,, U
N	SCF	SED	Be, Fe, Mg, Na, Nb, Ni, S, Sc, Ta, Th, Ti, Tl, V, W, Zn	Ca, P, Sr,
O	SCF	SED	Ag, As, Ba, Bi, Ca, Co, Cu, Fe, Mn, Mo, Ni, P, Pb, Sb, Sr, U	Be, Cr, Cs, Ga, Ge, La, Li Na, Nb, Rb, Sc, Se, Sn, Ta, Th, Ti, Tl, V, W, Zn
P	SCF	SED	Bi	Ce, Hf, La, Li, Sr, Th, Tl, V, Y, Zn, Zr
Q	SCF	SED	In, K, Mn, Rb, Sb, Y	Ge, Mg
R	SCF	SED	Ag, As, Bi, Ca, Cu, Fe, Mn, P, Sb, U	Li, Zn, Zr

9.4 Group Hyperspectral

All samples were analysed using Terraspec 4 HR scans on the crushed samples. The scans were assessed using aiSIRIS software to provide some interpretation on mineral speciation.

Estimated percentages of minerals across the groups are averaged in Table 8.

Table 8. Averaged, estimated mineral percentages using Hyperspectral analysis

Group	Strat	Lith	Chlorite %	Epidote %	Kaolinite %	Carbonate %	Amphibole %	Nontronite %	Jarosite %	Tourmaline %	White Mica %	Water silica %	Dickite %
A	ECV	BA	20.00	0.00	20.00	2.50	6.67	0.00	0.00	0.00	50.83	0.00	0.00
B	ECV	BA	44.52	0.95	3.10	12.38	10.71	1.67	0.00	0.00	26.67	0.00	0.00
C	ECV	BA	40.24	0.00	1.19	8.33	3.81	7.38	0.00	0.00	34.29	0.00	0.00
D	ECV	BA	38.70	10.00	0.00	7.41	17.59	0.00	0.00	3.70	22.59	0.00	0.00
E	ECV	BA	36.43	12.14	2.14	10.71	18.57	0.00	0.00	0.00	20.00	0.00	0.00
F	ECV	BA	36.52	14.57	2.61	7.83	16.96	0.00	0.00	0.00	21.52	0.00	0.00
G	ECV	BA	34.23	14.23	4.23	6.54	23.08	0.00	0.00	0.00	17.69	0.00	0.00
H	ECV	BA	55.45	0.00	2.73	1.82	0.00	6.82	0.00	0.00	31.36	0.00	0.00
I	ECV	BA	35.63	28.75	1.25	11.25	8.13	0.00	0.00	0.00	15.00	0.00	0.00
J	ECV	BA	36.25	5.00	3.75	3.75	3.75	0.00	0.00	0.00	47.50	0.00	0.00
K	ECV	BA	53.33	0.00	5.00	5.00	10.83	4.17	0.00	0.00	15.83	0.00	0.00
L	ECV	QT	3.13	0.00	63.13	1.88	0.00	4.38	0.00	0.00	27.50	0.00	0.00
M	SCF	SED	0.00	0.00	35.86	2.05	0.00	0.57	0.95	0.00	51.81	4.67	0.00
N	SCF	SED	0.24	0.00	53.49	1.90	0.00	0.00	0.00	0.00	44.13	0.00	0.24
O	SCF	SED	0.00	0.00	45.00	5.63	0.00	0.00	0.00	0.00	49.38	0.00	0.00
P	SCF	SED	0.12	0.00	40.58	3.49	0.00	0.00	0.00	0.00	55.81	0.00	0.00
Q	SCF	SED	1.90	0.00	61.03	3.10	0.00	0.17	0.00	0.00	31.55	0.00	0.00
R	SCF	SED	0.45	0.00	60.00	3.11	0.00	0.38	0.00	0.00	36.06	0.00	0.00

Average wavelengths, which are used to indicate mineral speciation, are shown in Table 9.

Table 9. Averaged Mineral group wavelengths across the Strat Groups

Zone	Wav WtMica	Wav Chlorite	Wav Main	Wav AIOH	Wav FeOH	Wav MgOHcb	Wav OH1400	Wav Ep1550	Wav H2O	Wav FeOxide
A	2210.77	2253.15	2259.19	2209.59	2248.33	2339.15	1408.63		1921.65	850.93
B	2214.85	2253.56	2316.41	2213.61	2252.84	2337.08	1405.11	1541.09	1940.99	915.43
C	2218.91	2251.77	2281.05	2216.97	2250.96	2338.95	1407.82		1935.77	905.04
D	2210.32	2253.48	2328.51	2210.20	2253.19	2337.12	1403.15	1545.82	1942.06	879.38
E	2207.41	2254.99	2326.25	2207.68	2254.99	2337.57	1405.41	1548.81	1939.50	
F	2209.93	2254.24	2326.55	2209.13	2254.24	2336.46	1404.08	1548.97	1930.19	862.00
G	2210.27	2253.65	2326.52	2209.29	2253.65	2333.68	1402.95	1546.33	1936.72	
H	2214.65	2252.83	2271.27	2213.42	2252.83	2342.48	1409.81		1946.97	900.77
I	2205.76	2254.61	2337.35	2206.64	2254.61	2337.35	1404.07	1542.65	1940.02	
J	2217.60	2249.81	2278.46	2214.36	2249.81	2343.04	1408.09	1552.46	1954.49	
K	2212.53	2253.30	2307.71	2211.11	2253.30	2321.99	1404.01		1932.63	
L	2216.30	2239.42	2209.62	2209.62	2239.42	2344.58	1414.51		1921.70	883.01
M	2210.53		2211.99	2209.19	2247.28	2346.43	1414.11		1921.49	888.19
N	2210.27	2238.93	2208.45	2208.45	2239.09	2348.93	1414.12		1919.98	863.00
O	2208.72		2207.91	2207.91		2351.18	1413.70		1916.94	866.16
P	2210.69		2208.90	2208.90		2352.04	1414.10		1913.47	871.74
Q	2214.09	2244.76	2208.56	2208.56	2239.38	2347.74	1414.17		1918.27	884.86
R		2251.31	2208.44	2208.44	2251.31	2350.41	1414.20		1915.77	872.02

9.5 Petrology

A total of 33 polished thin sections were created from rectangular slivers of rock specimens sent to Ingham Petrographics. Petrographic descriptions were then undertaken by Mintex Petrological Solutions (Mintex) and delivered to Capricorn in November 2019 as a detailed report with accompanying photomicrographs.

In summary, the report showed the following characteristics for the 18 groups of rocks:

- Group A – Two samples, one BA and one QT. Basalt shows pervasive chlorite and clustered secondary epidote. Opaques are abundant, likely to be titanomagnetite with alteration of rutile and ilmenite. Lesser titanite and actinolite. QT shows anhedral quartz with common opaques – earthy hematite.
- Group B – Two volcanics samples, the first of which is described more as an andesite than a basalt. However, both show dominant plagioclase, with a strong chl-cb groundmass and no visible ferromagnesian phases. Magnetite is the dominant opaque, with minor alteration to haematite.
- Group C – One sample of which is reported as a heavily altered basalt. Feldspars altered to amphibole and chlorite, with common opaques (earthy he and rutile).
- Group D – Three samples. Two of which are clinopyroxene dominated basalt to dolerite, with chl+ep alt, and magnetite (altered to haematite) opaques. One sample is feldspar dominated basalt, common chl-act-cb alt with magnetite opaques and cu sulphide bearing carbonate amygdale.
- Group E – nil
- Group F – Two samples. Both are chlorite-epidote-carbonate altered plagioclase-bearing basalts, one which notably contains copper sulphides (chalcopyrite, bornite, covellite) in carbonate-filled vugs.
- Group G – One sample of fine grained amygdaloidal basalt. Fine grained plag altered to ep-chl-cb, common mag with he alt. Amygdales are qz, cb, ep.
- Group H – One sample. Pervasive chl-cb altered basalt
- Groups I & J – nil
- Group K – One sample. Pervasive chl-ep alt basalt, microlitic, common he after mag. No cb.
- Group L – 1 sample. Quartzite, brecciated variably of grains and fragments. Occasional clay. He veinlets.
- Group M – 7 samples. Samples are largely sandstones with minor siltstone. The samples furthest south tend to be more arkosic and show strong, pervasive hematite alteration of feldspars. White mica is present but uncommon. Further north, the rocks are less hematite altered and more quartz dominant, with mica slightly more common. Chlorite is present in all but in trace amounts.
- Group N – 3 samples. Two quartzites, quartz-dominant (non-arkosic) but showing common clay after feldspar, and one siltstone sample with very weak sericite to chlorite alteration. All samples generally homogenous.
- Group O – 1 sample. Quartzite, with minor scattered hematite and clay (after fsp?)
- Group P – 3 samples. Two are reported as quartz-dominant sandstones with lesser feldspar and mica. Haematite alteration of feldspars is noted, as well as occasional sericite and clay alteration. The third sample is heavily sericite altered with disseminated pyrite and chlorite and has not been determined. Weak ductile deformation.

- Group Q – 1 sample. Very fine grained siltstone (grading to mudstone), dominantly quartz, with pervasive sericite-haematite alt of feldspar.
- Group R – 3 samples. Three siltstone samples, two of which show significant haematite and sericite alteration. Haematite is thought to be late in these samples. One sample of fairly unaltered siltstone with way up indicators is also present.

10. Discussion and Interpretation

Despite on a grander scale the samples were designated as Phase 1 and 2, more locally they reflect individual characteristics based on their stratigraphy, lithology and local variations. It is these three factors which have led to the derivation of the 18 sub-sets named A to R.

10.1 Eastern Creek Volcanics

Within the basalts of Phase 1 – groups A to D (Figure 10) there are significant differences mineralogically and geochemically. Group A and C are located most proximal to the CCM ore bodies, with Group A located in hangingwall contact with the Esperanza South deposit, and Group C located to the east of the Greenstone deposit to the south of the Mammoth Extended Fault.

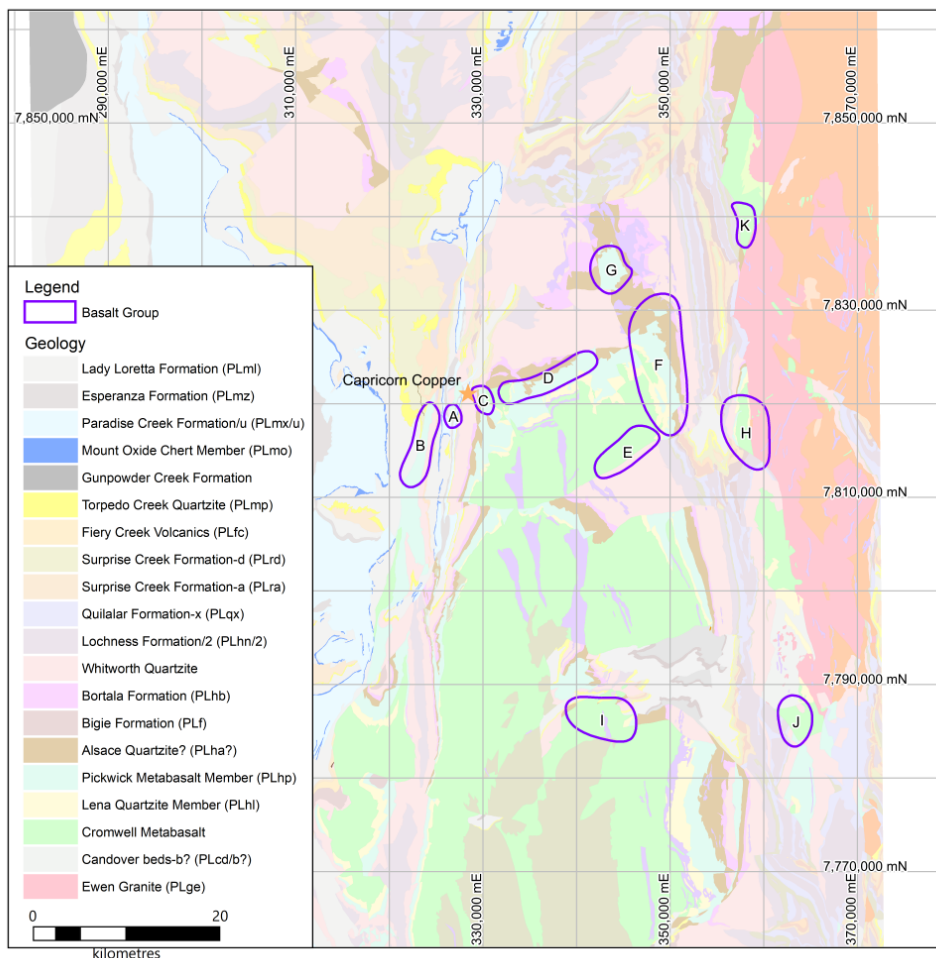


Figure 10. Basalt Groups from the LGC Sampling program

Field notes suggest that Group A is variably sheared and notably more hematitic and less chloritic on surface than basalts elsewhere. This is supported by the average hyperspectral mineral percentages which indicates that Group A has the lowest chlorite quantity of all the basalts – averaging around 20% of the mineral constituents. The dominance of haematite over other iron oxides is prevalent in the Fe-oxide wavelengths of the hyperspectral analysis. Other Phase 1 basalts show an affinity toward a more moderate mix of haematite to goethite, although Fe-oxides aren't typical of the lithology. Group H leans towards the other end of the spectrum where goethite is arguably the more dominant of the two. Kaolinite is highly elevated in the Group A hyperspectral and will likely be a direct correlation to the increased haematite content, likely owing to increased oxidation and leaching. Unfortunately, no haematitic basalt samples of Group A were sent for thin section. Sample 163001, the only basalt sample thin section of Group A, was described as a minor chlorite-bearing basalt with no significant hematite in both field records and thin section, and also includes epidote, actinolite and carbonate alteration. Chlorite is interpreted to be an alteration of a plagioclase groundmass. One difference in the hyperspectral analysis to thin section analysis is that no epidote was identified in the HR scan, however small amounts of secondary epidote have been recorded in the sample thin section. The presence of titanomagnetite in the thin section could imply that haematite could be an alteration product of this opaque. A hematitic basalt sample, 163022, from Group C was however sent for petrography. The rock is heavily altered to earthy hematite and possible amphibole-chlorite. Chlorite here is believed to be paragenetically late as is seen rimming opaque grains and could be a later chlorite phase to that seen regionally altering the less-haematitic basalts.

An overview on elemental concentrations, as seen in previous summary Table 6, highlights that the Group A basalts are depleted fairly consistently across the board, notably in Cu and other metals. Group C also returns values below the average, however these depletions are not as marked. The distal Group J is the only other group which consistently shows a number of elemental depletions. Group A is also notably enriched in As, In and Mo. No other groups show comparable enrichments.

Assessment of the hyperspectral suggests that Group C is similarly not well-endowed with epidote or amphibole, is elevated in white mica, but unlike Group A it does not show elevations in kaolinite. Geological notes on the centrally located basalt groups indicates that the most distal Phase 1 basalt, Group D, consists of typically massive, amygdaloidal basalt with localised epidote brecciation. Although not specifically noted in the field data, chlorite alteration is assumed to be present owing the green colour of the samples. The hyperspectral also suggests chlorite is fairly common here (38%). Review of the Chlorite wavelengths suggest that chlorite of the Phase 1 groups is typically Magnesium-dominant, whereas more distal basalts are slightly more borderline Mg to Fe-dominant. The epidote content of Group D is also verified by the hyperspectral analyses. Notably, no kaolinite was logged within Group D. To the south of D, Group E is recorded as massive, blocky basalt with common chlorite alteration. No thin sections were taken from Group E, however the hyperspectral suggests elevated carbonate and amphiboles. These centrally located basalt groups (D, E, F and G) all appear to show significant elevations in amphiboles compared to other groups on the hyperspectral analyses. This is correlated in one thin section sample from Group D which shows common actinolite, along with chlorite and carbonate alteration. Four other sections however, do not explicitly mention amphiboles. Cu sulphides were noted within vugs in a petrographic section in Group F and are interpreted to be paragenetically associated with the epidote-carbonate assemblage. Copper mineralisation within the basalts will be discussed further later in this section. The most distal basalts – H, I, J, and K – are commonly chlorite altered throughout, which is verified by both the hyperspectral and thin sections. Petrography here of one shows a pervasive chloritised groundmass overprinting relict plagioclase. Group I shows elevated carbonate and epidote, which

are believed to be contemporaneous alteration phases, whilst H, J and K are typically epi-cb poor. Stratigraphically, Group I is believed to have more of a direct relationship with Group E and epidote-carbonate hyperspectral percentages and elemental averages appear to reflect this.

Near mine basalt groups show a tendency to be depleted in immobile elements, such as Fe, Hf, Ti and Zr, compared to those more distal from the CCM, namely Groups H, I and K, as seen below in Table 10.

Table 10. Group averages for immobile elements

Zone	Strat	Lith	Al %	Ce ppm	Fe %	Hf ppm	K %	La ppm	Nb ppm	Ni ppm	Pb ppm	Th ppm	Ti %	V ppm	Y ppm	Zr ppm
A	ECV	BA	3.21	32.03	8.29	2.47	0.93	15.98	3.62	20.20	4.05	4.88	0.23	87.17	13.23	96.57
B	ECV	BA	7.14	38.45	8.89	4.09	2.53	18.37	9.56	63.72	23.98	4.85	0.85	297.76	30.77	166.93
C	ECV	BA	6.83	31.06	7.01	3.30	2.40	15.06	7.85	64.74	4.53	4.42	0.71	272.86	22.33	118.90
D	ECV	BA	7.18	31.35	8.87	3.21	1.32	14.54	7.84	67.63	9.72	3.83	0.78	293.26	24.59	112.53
E	ECV	BA	7.05	50.23	10.11	5.21	1.09	23.11	13.90	76.09	11.00	5.07	1.26	319.29	40.30	187.81
F	ECV	BA	7.08	31.75	8.65	3.25	1.12	14.83	8.63	74.50	8.45	3.76	0.78	272.35	24.11	118.27
G	ECV	BA	6.90	36.64	10.03	3.45	1.47	17.53	8.77	57.75	9.12	4.88	0.87	347.54	27.24	124.92
H	ECV	BA	5.94	70.91	9.67	7.05	3.79	33.97	17.28	40.05	4.37	9.22	1.13	224.55	43.68	256.77
I	ECV	BA	6.87	54.09	9.66	5.13	0.69	25.18	14.31	53.69	15.60	6.36	1.13	282.75	37.83	192.78
J	ECV	BA	6.54	34.71	7.52	4.93	3.12	15.28	9.58	82.45	5.28	6.71	0.72	198.50	24.70	182.55
K	ECV	BA	7.03	53.60	10.13	5.57	2.22	23.95	15.67	54.17	9.07	6.96	1.13	297.33	39.90	215.33
L	ECV	MSED	4.44	78.18	4.05	6.85	3.51	38.54	8.04	19.53	5.20	10.81	0.34	100.88	23.26	201.74
M	SCF	SED	3.69	57.42	4.21	4.03	2.88	26.00	6.87	17.23	9.40	11.79	0.16	31.30	23.54	137.89
N	SCF	SED	4.16	68.56	2.39	4.34	2.15	30.64	7.38	9.60	6.63	13.20	0.18	39.14	25.90	160.01
O	SCF	SED	6.45	79.96	2.65	5.18	2.20	40.34	11.36	10.38	3.81	15.81	0.30	60.50	27.09	185.51
P	SCF	SED	5.27	91.34	3.39	6.10	2.18	41.53	10.11	14.09	9.76	16.07	0.24	59.00	31.24	221.23
Q	SCF	SED	5.13	75.02	3.40	4.43	1.76	35.43	9.29	15.22	6.08	14.76	0.23	55.86	22.07	155.65
R	SCF	SED	4.90	74.03	2.50	5.39	1.96	35.42	9.52	14.04	7.42	14.66	0.24	53.50	23.08	198.05

More mobile elements, such as Ca, Na, P, and K are notably heavily depleted in Group A and to a lesser extent in Group C (Table 11). Group B is the most enriched in Phase 1. More distal groups tend to show broader enrichments in mobile elements, although Groups J and K are similarly depleted in Cu to Group A. This depletion in metals such as Cu, Pb and Zn in Group A (and to a lesser extent Group C) could further the argument of the ECV basalt source for the copper mineralisation, where Cu has been stripped and remobilised elsewhere at the CCM.

Table 11. Group averages of mobile elements

Zone	Strat	Lith	Ba ppm	Ca %	Cu ppm	K %	Mg %	Na %	P ppm	Pb ppm	Rb ppm	Sr ppm	Zn ppm
A	ECV	BA	113.33	0.72	61.32	0.93	1.26	0.40	431.67	4.05	41.70	56.32	26.83
B	ECV	BA	477.14	2.53	187.22	2.53	3.60	1.40	873.81	23.98	70.09	79.36	157.14
C	ECV	BA	351.43	1.92	106.13	2.40	2.54	1.38	534.29	4.53	76.47	50.03	57.05
D	ECV	BA	354.44	4.85	133.47	1.32	3.21	1.95	628.89	9.72	51.10	154.07	147.33
E	ECV	BA	454.29	5.50	192.86	1.09	2.92	1.77	1291.43	11.00	43.01	176.07	153.57
F	ECV	BA	370.43	4.75	155.83	1.12	3.33	2.11	620.87	8.45	43.79	156.32	138.74
G	ECV	BA	463.08	5.01	192.31	1.47	3.24	2.01	677.69	9.12	63.26	161.53	182.23
H	ECV	BA	674.55	2.81	116.93	3.79	1.91	0.54	1980.00	4.37	137.81	46.16	64.27
I	ECV	BA	283.75	5.58	186.29	0.69	2.34	1.71	1262.50	15.60	20.69	227.34	126.38
J	ECV	BA	410.00	3.58	70.83	3.12	2.21	0.73	1275.00	5.28	171.28	90.38	91.50
K	ECV	BA	848.33	2.94	88.47	2.22	3.14	2.06	1265.00	9.07	88.52	101.12	290.33
L	ECV	MSED	475.00	0.13	40.90	3.51	0.18	0.15	480.00	5.20	123.89	38.38	27.13
M	SCF	SED	707.90	0.33	202.41	2.88	0.16	0.05	1594.00	9.40	108.90	52.59	12.57
N	SCF	SED	433.49	0.47	33.35	2.15	0.19	0.03	2200.16	6.63	113.23	110.46	9.40
O	SCF	SED	366.25	0.04	23.45	2.20	0.25	0.05	757.50	3.81	149.08	37.11	19.00
P	SCF	SED	695.81	0.15	35.43	2.18	0.27	0.04	1382.33	9.76	130.19	104.10	17.74
Q	SCF	SED	415.52	0.14	77.97	1.76	0.34	0.04	1121.72	6.08	96.39	45.32	14.10
R	SCF	SED	436.36	0.06	20.63	1.96	0.28	0.04	713.64	7.42	125.28	47.53	17.42

The Group A basalts, when plotted against others for immobile elements, show a characteristic signature. Nb/Y-Zr/Ti plots are typically used to delineate volcanic compositions using immobile elements which are somewhat resistant to the effects of alteration and regional metamorphism. On the chart, shown in Figure 11, the Group A rocks consistently plot within the rhyo-dacitic zone, indicating a higher SiO₂ content than typical basalts or andesite. Caution must be taken in interpreting these results as ideally whole-rock XRF geochemistry would be utilised, as opposed to a 4-acid digestion and ICP-MS method, and trace quartzite laminations in foliations and amygdaloidal quartz fill which could be playing a role here. They will still be referred to as the Group A basalts here but is still of interest how they plot characteristically different to most other basalt groups. Thin section sample 163001, is the one basalt sample which does not plot within the rhyo-dacite zone, and instead sits on the borderline basalt-andesite zone. This agrees somewhat with the thin section interpretation by Mintex which defines it as a chlorite-epidote-actinolite altered fine-grained meta-amygdaloidal basalt. Furthermore, a simple Zr vs Ti plot (Figure 12) indicates that Group A is highly depleted in Zr compared to the other basalt units. As Zr is considered a highly incompatible element, it could be assumed this is a particular characteristic of the source magma for these basalts, but these interpretations are outside the scope of this study. In comparison, Groups D, F, G and I in particular show mid-range Zr values (e.g. 0.8ppm) which in general increase as Ti does. The same applies for Groups E and K, although Zr values are higher (around double, 1.6ppm). Group C shows relatively flat Ti values throughout, around 100ppm, regardless of Zr values. Group H is similar to C in this regard, albeit with higher Ti (around 250ppm) and a wider spread of Zr values. Group B is more variable with two apparent phases – one similar to D, F, G and I, and another at lower Zr values which appears inversely correlated to Ti. Basalt group J has a spread of data with no significant correlations although there is only a small dataset (4 samples). Spatially, the only area with similar Zr/Ti ratios (albeit lower due) is the northern extremity of Group B. The single closest sample to Group A using these ratios belongs to Group D, however the sample is isolated amongst others of a much different composition and as such is an outlier from the Group

D area. In summary, the plots suggest that Group A in particular is geochemically different to other basalts. Group H is fairly variable throughout, whereas the others plot fairly consistently.

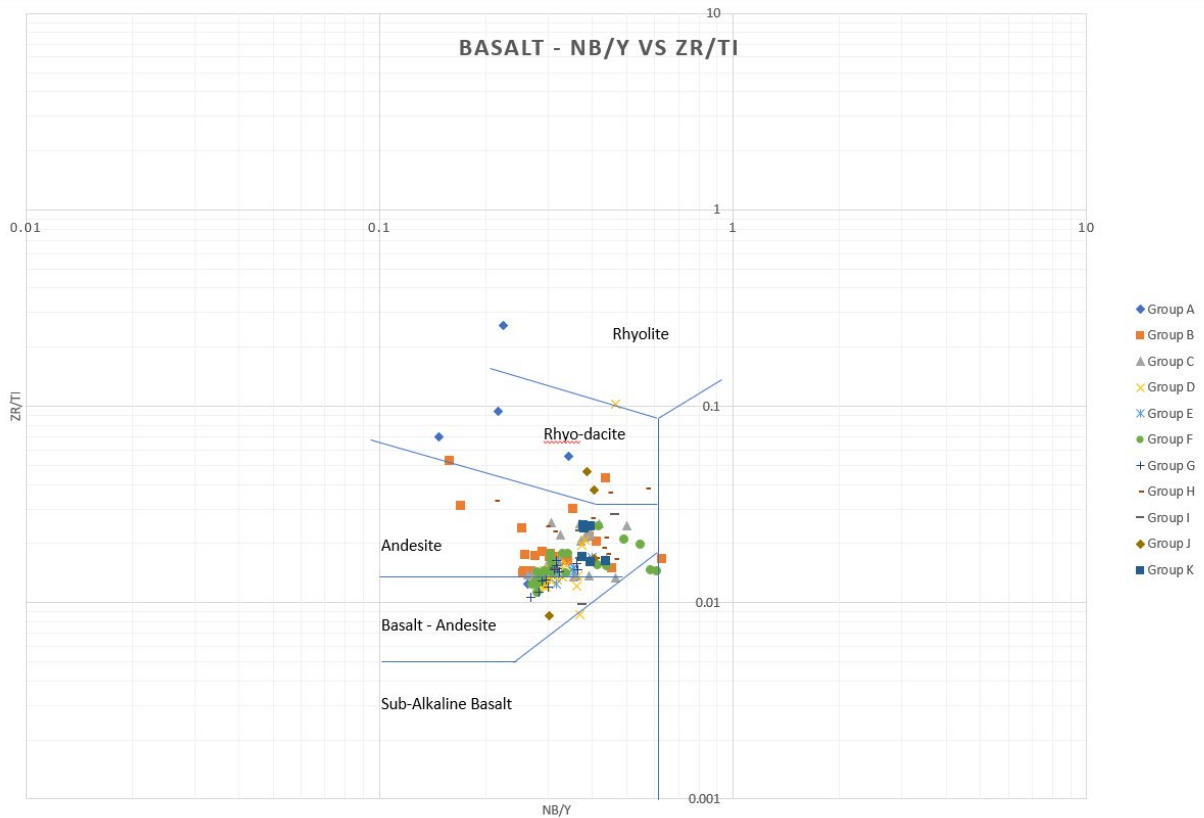


Figure 11. Nb/Y vs Zr/Ti Plot for Basalt LGC

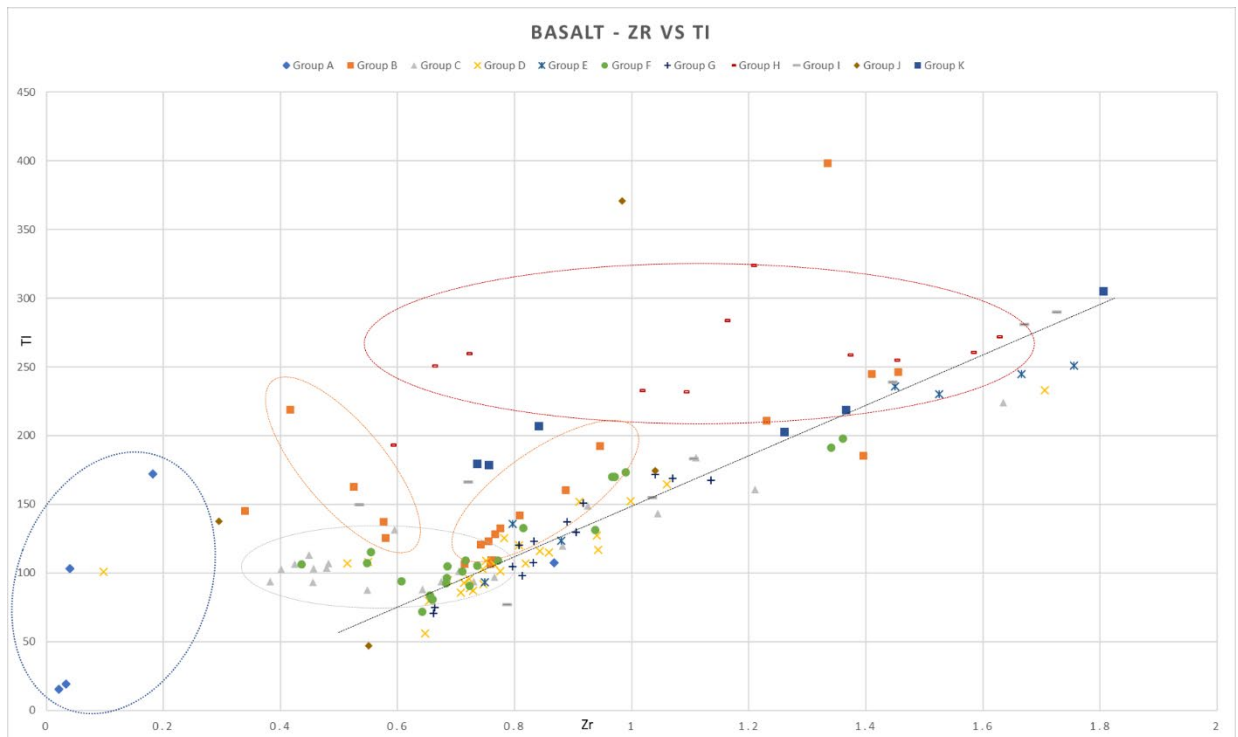


Figure 12. Zr vs Ti plot for Basalt LGC, highlighting trends for different basalt groups

Interestingly, the Cu averages of the basalts most proximal to known mineralisation (i.e. Group A) show significant Cu depletion in comparison to other basalt units (61ppm, compared to an overall regional basalt average of 145ppm). This regional average is lower than that stated for the ECV basalts by Wilson et.al in 1984 which referenced Cu values of 150 – 200ppm. Group C is the Phase 1 area with the second lowest Cu average (106ppm). Distal groups J and K have the second and third lowest Cu averages at 71ppm and 88ppm respectively. Three basalt thin sections are noted to contain copper sulphides – two from Group D and one from group F. Sample 163040 of Group D is typical chlorite-actinolite-carbonate altered feldspar-rich basalt with common magnetite altered to hematite. The copper sulphides are present within chalcedonic quartz-filled vugs which have been overprinted by carbonate. The copper is hosted within chalcopyrite and bornite, which have undergone some alteration to chalcocite and covellite. The second Group D thin section, 163050, is a more clinopyroxene dominated basalt with fine pyrite and chalcopyrite disseminations. Group F thin section, 163193, reflects that of sample 163040 with Cu-sulphides hosted within vugs of a chlorite altered feldspar-rich basalt. It is noted that the copper sulphides are paragenetically associated with the epidote-carbonate phase.

10.2 Surprise Creek Formation

Rocks of the Surprise Creek Formation were sampled under consideration as a second source to the copper mineralisation at CCM. The SCF “D beds” (Prd) is notable for containing anomalous Cu in soils around CCM, hosting weak copper mineralisation at the Mt John prospect, as well as hosting the Mt Watson copper oxide orebody. The SCF samples have been segregated upon completion into 6 groups (Figure 13), with Group M belonging to Phase 1 and located immediately north of the CCM. The southern portion of Group M belongs to an area known as Magazine, where localised copper mineralisation has been recorded in Whitworth Quartzite units to east of the SCF. The SCF at Magazine sits unconformably atop the Whitworth Quartzite and consists of Pra (basal conglomerate, sandstone and quartzite) and Prd (sandstones and siltstones). To the west of the SCF here is Torpedo Creek Quartzite and Gunpowder Creek Formation units. The Magazine area sits immediately north of the c Greenstone deposit, across the E-W trending Mammoth Extended Fault. It therefore is highly proximal to significant mineralisation. The remaining groups form part of Phase 2, including Group N, which includes the Mt John prospect.

Group M is significant as is highly elevated relatively to the other SCF groups in elements associated with the mineralisation style at CCM, including Cu, Co, Ag, As and Pb. Cu averages around 202ppm for Group M, which is over double that of the second most group. Somewhat surprisingly, Group N, around Mt John, is not particularly elevated in these elements, with Group Q the only other slightly elevated group for Cu at 78ppm Cu (compared to around 20 – 30ppm for the others). Hyperspectrally, Group M is relatively depleted in kaolinite and carbonate but shows elevated white micas and can contain minor jarosite, implying weak sulphides. In relation to clays, hyperspectral shows a zonation of AIOH wavelengths from east to west, indicating that mica/clay mineral composition varies from the upper Prd than in the lower.

Thin sections collected from Group M suggest that the samples in the south of the group (and hence nearer the CCM) are arkosic and show strong haematite alteration of the feldspars. Sediments in the north of the group are more quartz dominant and show less haematite alteration. Proportionally, however, the hyperspectral iron oxides grade more towards goethite within Group M. When compared to the local geological mapping at Magazine, the haematite wavelengths appear proximal to a mapped haematitic-dolomitic sandstone, whereas goethite is more dominant on peripheral siltstones. This contrasts to the Mt John area, Group N, where iron oxides are dominantly

haematite, although there are significantly less Fe-oxides here than in M. Significant goethite dominance in the Fe-oxide wavelengths are not common elsewhere in the SCF.

Geological mapping at Magazine also suggests that some samples collected in Group M on the western flank may have been collected at the base of the Gunpowder Creek Formation / Torpedo Creek Quartzite. These consist of quartzite samples collected in the west of the traverses above the units typically defined as Prd. There is not a significant number of these samples, however, and so are not deemed to affect the overall signatures of Group M in any considerable way.

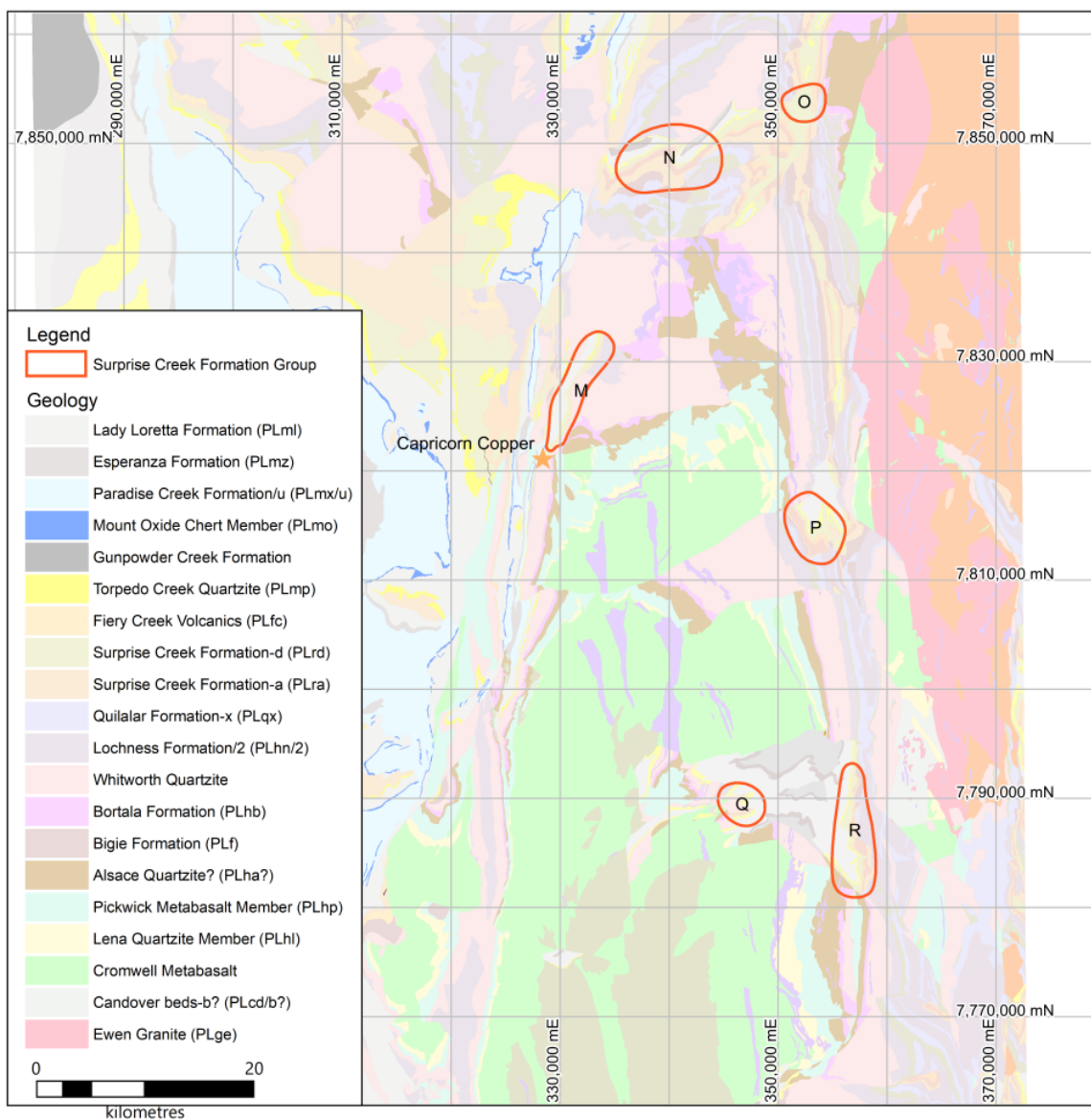


Figure 13. Groups of the SCF

Group P shows fairly average values, weakly elevated in Zn and V along with Group O, however the tenor of the elevations are not significant. Group N, situated around the Mt John prospect is fairly depleted across the board. Previous mapping by Capricorn around the Mt John area did not find anything of significance in the area.

More distally, Groups Q and R, located in EPM 26422 in the southeast of the program area, returned similar hyperspectral quantities of kaolinite, carbonate and white micas to each other which agrees

with their similar stratigraphic and geographical location within the Crystal Creek basin. They are notably enriched in kaolinite relative to the other SCF groups. Thin section review of these groups note significant sericite-haematite alteration of feldspars and as such the kaolinite could be related to weathering of this alteration style.

10.3 Exploration Significance

The results and subsequent discussion have identified a number of parameters in which future exploration programs can assess. The basalts immediately in the vicinity of the known copper mineralisation, namely Group A and C, are relatively depleted in Cu in comparison to the wider regional Cu average (Figure 14). This furthers the argument that Cu could have been stripped from these basalts during mineralising events at the CCM although the question whether these localised depletions could have provided enough Cu to account for all of the CCM remains unexplored here. The fact these depletions are very localised (e.g. Group B does not reflect Group A) points to the suggestion that should the basalts be the source, the fluids have not travelled very far laterally. All basalt groups are unique in their own regards and although Group C is weakly depleted in Cu it is not elevated in As, Mo, or In (in contrast to Group A). More distally, basalt groups H and J correlate best with A and C on a direct elemental average comparison. These are located in interpreted Cromwell Metabasalt as opposed to Pickwick Metabasalt for A and C. Hyperspectrally, Group A has a significantly different average composition to the other basalt groups, consisting of strong white mica (muscovite dominant) and kaolinite and comparatively less chlorite. Fe-oxides are notably hematite dominant (as opposed to goethite) and is reflected in the geological field data. Again, Group J is most similar to A from the regional group in the hyperspectral data, shown by elevated white mica concentrations and low carbonate and amphibole. There is no single basalt regional group which is identical to A or C, which are themselves different from one another, particularly hyperspectrally. However it can be concluded that Group J does appear to reflect certain characteristics of Group A.

The dataset for Group J is small consisting of just four samples and so further sample collection would be recommended. Geologically Group J forms a fault bounded wedge of Cromwell metabasalt, the western boundary of which is marked by a northwest trending fault that brings the unit into contact with Myally Subgroup sediments (namely the Quilalar Formation) (Figure 15). It is further surrounded by Myally Subgroup rocks to the south and southeast, whilst to the north the basalt package is in contact with Candover Metamorphics, which are contemporaneous with the Eastern Creek Volcanics. The Ewen Granite is interpreted to outcrop to the east of the Group J basalts. Soil sampling (Bulk Cyanide Leach) by Ashdon Gold in 1993 targeted gold potential in the area which returned weak anomalism of 10 – 20ppb close to the fault contact. Cu values in the Candover Metamorphics were minimal (all <200ppm). It is clear that the Cu mineralisation at CCM has both a structural and stratigraphic control with Cu hosted within either Whitworth Quartzite or McNamara Group sediments. There are no McNamara Group sediments or Whitworth Quartzite in the immediate vicinity to Group J, which significantly downgrades the area. However, smaller prospects at Lochness (Cu) and Boozer Smith's (Au) are located along a similar structure in Quilalar Formation units just 12km to the north. It is therefore recommended that, following further encouraging LGC sample collection, a future wide-spaced (e.g 200m) soil sampling program be undertaken over the main fault structure, with particular focus on where the fault direction varies. An example is 4km to the northwest where the fault flexes from northwest-trending to north-trending. This program is considered to be of low priority however due to the stratigraphic context.

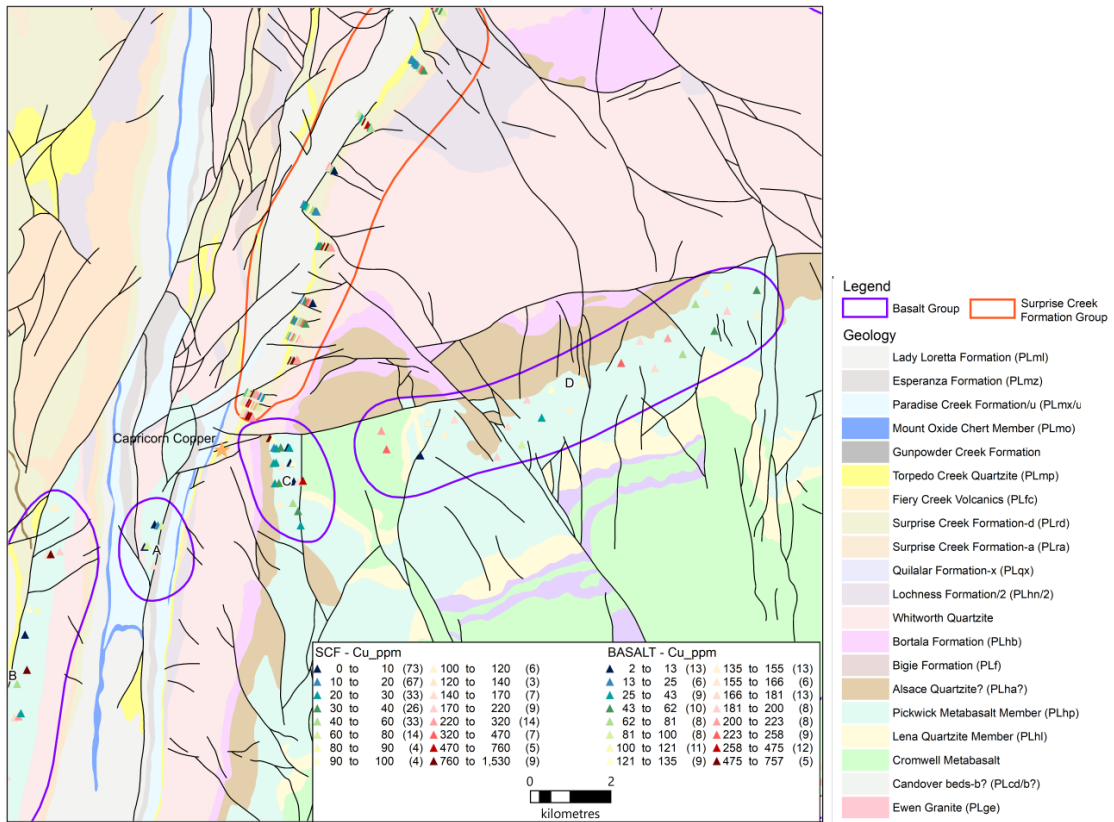


Figure 14. Relative copper values around the CCM. Note the green basalt values (depletion) and red SCF numbers (enrichment).

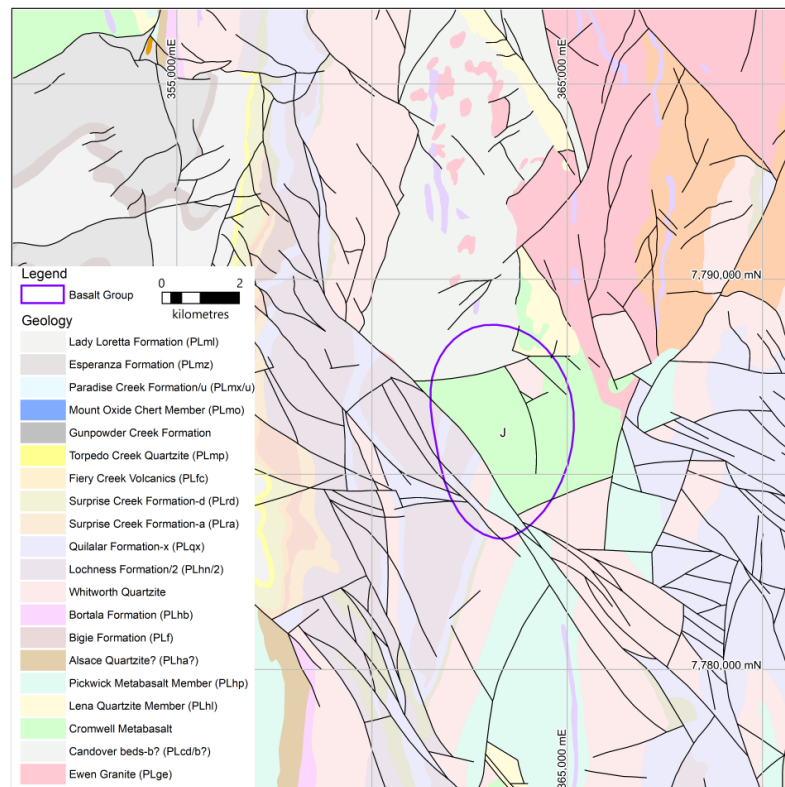


Figure 15. Geology around Basalt Group J

The other aforementioned basalt group, H, is stratigraphically (and arguably structurally) more favourable (Figure 16). Again, here Cromwell Metabasalts are bounded in the south by a northwest trending faults; and on the eastern side by a north-south trending fault which brings Ewen block granite into contact. The Quilalar Formation is again in close proximity, but more distally are Surprise Creek Formation (Group P) and Moondarra Siltstone units (Mt Isa Group equivalents of McNamara Group Gunpowder Creek Formation). The Surprise Creek samples of Group P show some hyperspectral similarities with near-mine Group M, however elemental assays for P were significantly less elevated with the exception of Pb. Nevertheless, the slightly more favourable local Geology, coupled with north-south trending faulting is of interest. Furthermore, approximately 4.5km to the northwest of Group H, the Investigator Fault, a parallel structure to the Mammoth Extended Fault, flexes to the north and as such is an area of structural curiosity. It is recommended that a low priority regional soil sampling program target the fault structure in the south of Group H, as well as this Investigator Fault flexure, particularly where it is contact with Whitworth Quartzite and McNamara Group sediments (or their Mt Isa Group equivalents). More proximal to the mine, spot anomalism in Group D does show significant Cu depletion in could provide a local target along the Mammoth Extended Fault, as seen in Figure 14.

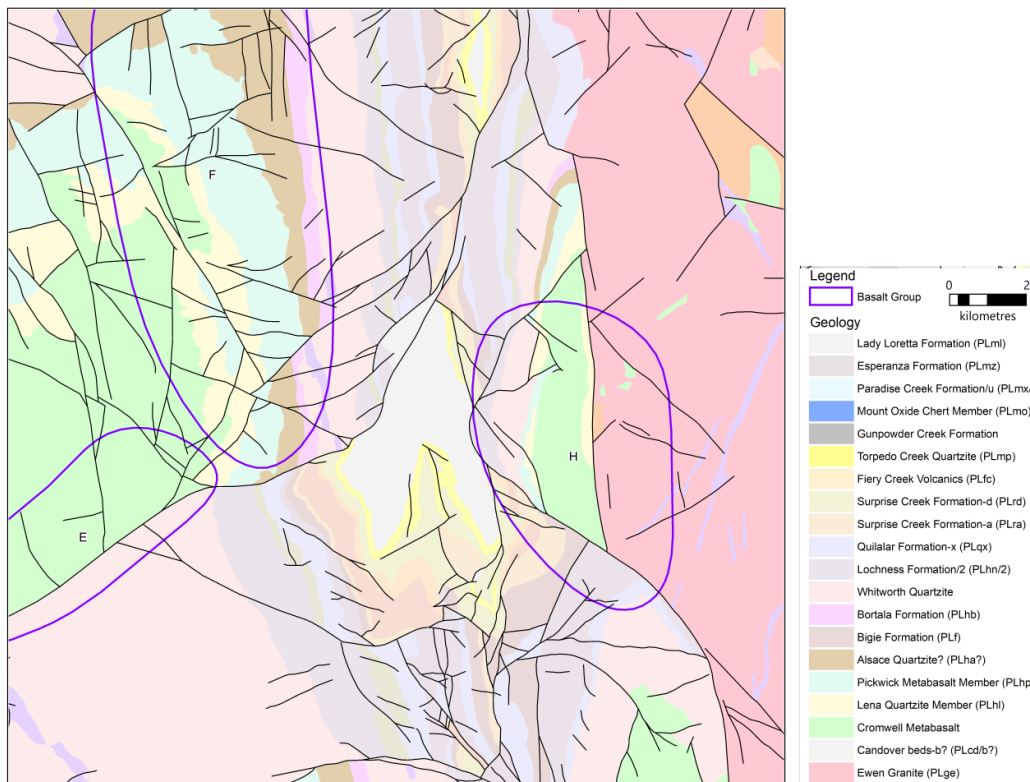


Figure 16. Geology around basalt Group H. Grey units to the west are reportedly Moondarra Siltstone, Mt Isa Group equivalents of Gunpowder Creek Formation.

Sampling of the Surprise Creek Formation has shown a significant difference in near-mine Group M alteration and geochemistry compared to those more distal, even to those with known localised mineralisation such as Mt John. The near mine SCF is highly elevated in Cu and other metals which gradually diminish away from the mine site area. However, the signature here is arguably more widespread than that seen in the basalts. Furthermore, the strong haematite alteration diminishes within the same unit further from the CCM and the known controlling structures. It is therefore interpreted in this report that the anomalism in near-mine Surprise Creek D units are caused by the mineralising events, rather than being a potential source of the mineralisation. Elevated metal anomalism in the Surprise Creek Formation units should be considered as proximal to potential mineralisation, however not necessarily hosting or sourcing the main copper mineralisation. Should the beds have acted as permeable conduits for seepage of mineralising fluids in areas close to favourable structures, Cu (and other metal) anomalism could be used to vector toward mineralised sites in more favourable structural and stratigraphic hosts. No other SCF groups were as anomalous as Group M in similar elements (Ag, As, Co, Cu, Fe, Ni, Pb, Zn) (Figure 17). A small localised area in Group Q shows very weakly elevated Cu in the northern section of a northwest-trending fault known locally as the Lake Julius Fault (LJF) (Figure 18). A number of prospects are noted along secondary structures close to the LJF, including Caroline and Mt West, which form part of the Crystal Creek sub-basin. A second line of Group Q samples approximately 1.2km northwest of the anomalous line, do not show elevated Cu and as such downgrades the potential of this area. In addition, nearby Basalt Group I shows significant Cu elevations rather than depletions as seen in Groups A and C. It would be recommended as a low priority program to carry existing soil sampling further northwest along the fault to the vicinity of the anomalous Group Q rocks to see if any local elevations exist. A second small anomaly is present in Group P however, again the size of the anomaly and surrounding depleted Cu values does not favour this area. Any follow up should involve ground truthing and possible soils over local structures.

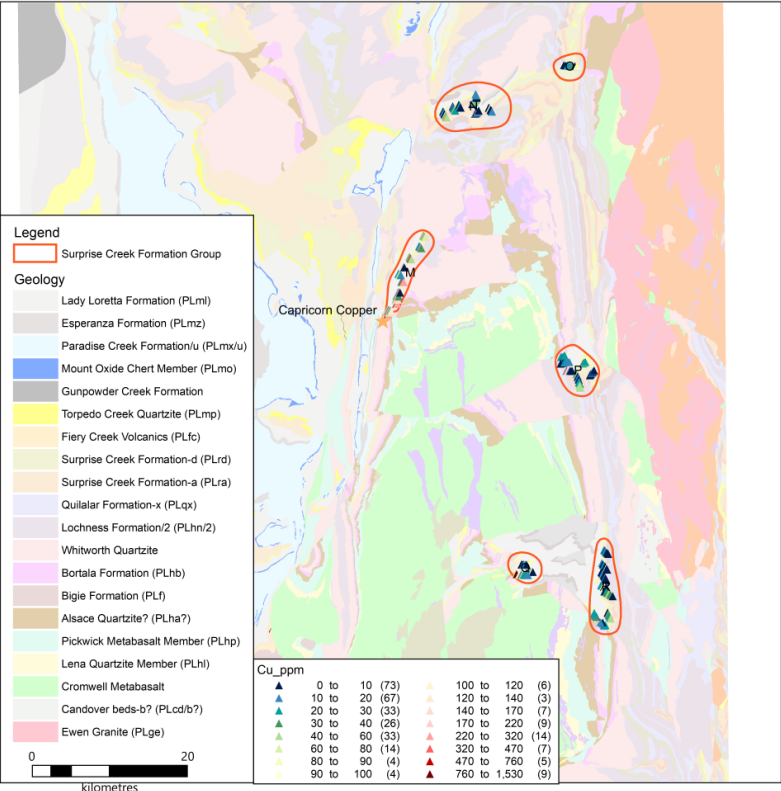


Figure 17. Cu anomalism in SCF groups. Note elevations in the southern portion of near-mine Group M

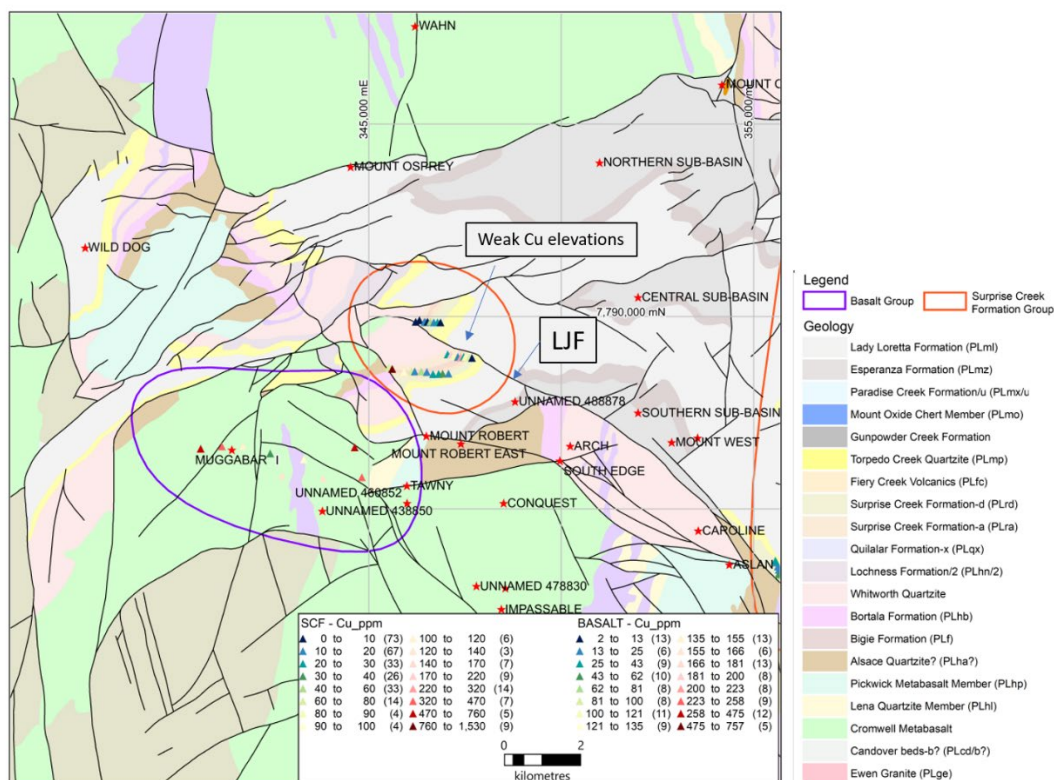


Figure 18. SCF Group Q adjacent to Basalt group I. Very weak elevations are seen adjacent to the L.J.F.

11. Conclusion

The Capricorn Litho-geochemistry study has returned a multitude of geochemical and geological data that have identified a number of low priority areas for follow up. Furthermore, this database can be grown by future LGC programs to create, amend and apply interpretations throughout the entire Western Fold Belt. The basalts closest to the mine site show specific signatures, including depleted Cu, Ag, Ni, Pb, V and Zn, and elevated As, In and Mo and could be used to vector in to any future targets. Mineralogically, the proximal basalts tend to contain lower amounts of chlorite and epidote and higher amounts of white mica and iron oxides, the latter of which are typically haematite-dominated. However, as these signatures are highly variable on a regional scale it implies that this particular systems approach should still be coupled with a structural and stratigraphic assessment when vectoring towards proposed targets. The Surprise Creek Formation units, particularly the Prd, are anomalous in metals, including Cu, As, Co and Pb, the vicinity of the CCM and this anomalism should be considered of interest if found in SCF units elsewhere. Whilst not considered a source of the Cu as originally hypothesised here, the unit is seemingly susceptible to be “smoke” in the vicinity of an orebody, likely due to proximity to fluid channels (structures) and the inherent porosity of the sediment units (namely sandstones). Local anomalisms could be economic in their own right on a small scale, such as at Mt Watson, and should be investigated, but may also be used to vector toward more significant mineralisation in more favourable known host rocks, such as Whitworth Quartzite or McNamara Group sediments.

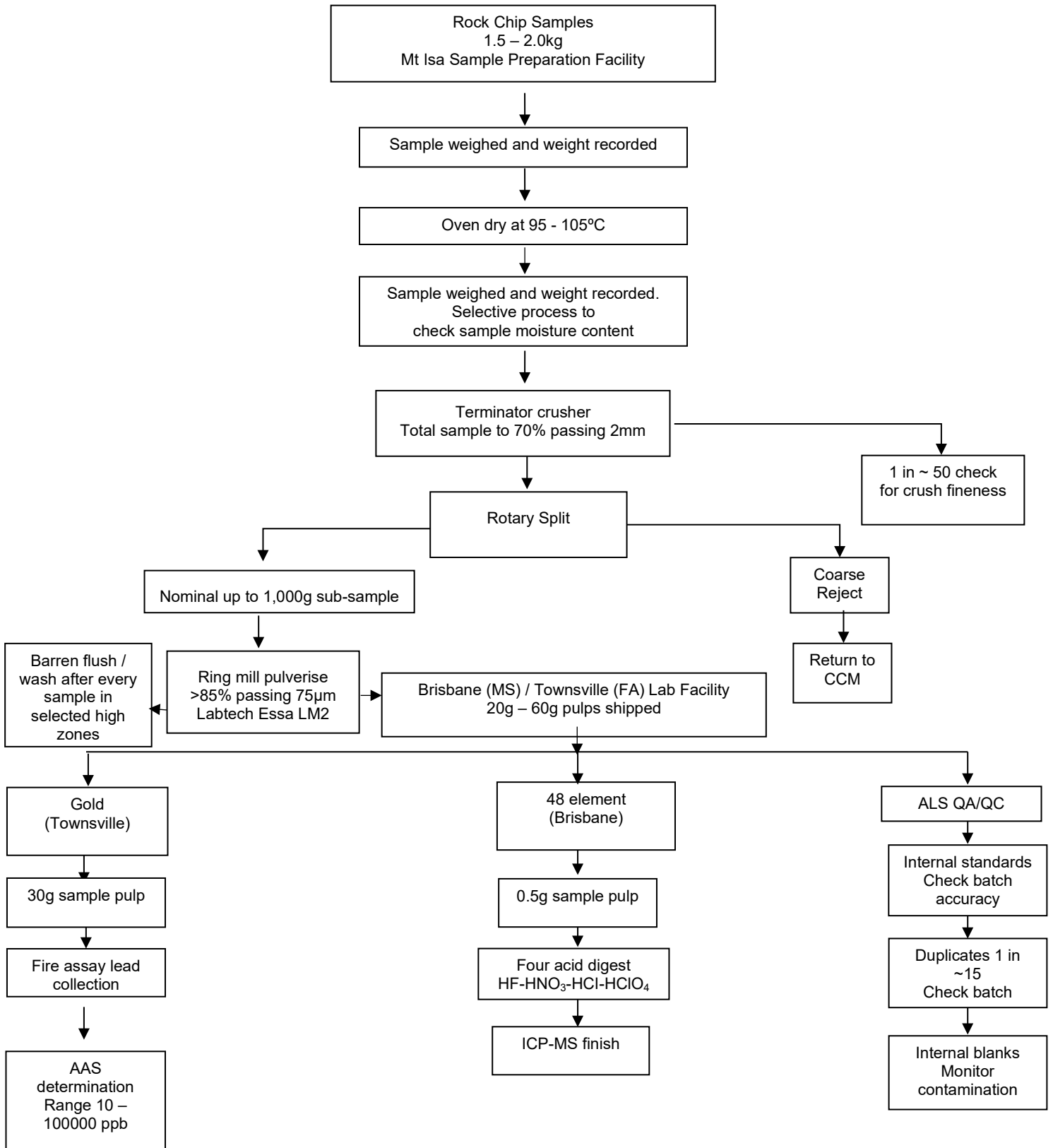
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APPENDIX 1
Sample Preparation and Analytical Flowchart
Capricorn Copper Mine

**Sample Preparation and Analytical Flowchart for the Capricorn Copper Mine
ALS Minerals Services, Mt Isa/Brisbane/Townsville Laboratories, Australia**



Further Appendices (External Datasets):

Appendix 2 – Raw Assay Data

Appendix 3 – Raw Hyperspectral Data

Appendix 4 – Full Geochemical Data Compilation

Appendix 5 – Assay Average Table

Appendix 6 – Hyperspectral Average Table

Appendix 7 – Assay Maps

Appendix 8 – Mintex Petrological Report