An assessment of trace element geochemistry of paleo-surface gravels, lateritic regolith and rock outcrops for Orogenic Gold Formation Processes in Guyana

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4) Elita Marco - Geo Tech GGMC
5) Tonya Boman - Geo Tech GGMC
6) Samella Britton -University of Guyana Undergraduate
7) Saafiya Wickham -University of Guyana Undergraduate
8) Mauresha Sue -Geo Tech GGMC/GMSTCI
9) Miracle Miller -Geo Tech GGMC

Outline of Presentation

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- Location and Access to Project Area
- Regional Structures, Geology and Geophysics
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- Methodology
- Results and Findings
  - Trace element distribution within Paleo surface gravels
  - Trace element distribution within Pan concentrate
  - Gold Grain morphology of selected samples within Campbeltown
- Interpretation and Discussion of results:
  - Correlation of trace elements to potential Orogenic Gold Formation Process sites using datasets including (BLEG, Gold grains, Airborne Magnetics, Structures and Geology)
- Recommendations and Next Steps
- References

Introduction

Background of project

- The search for large scale Orogenic Gold Deposits, over the past century, has seen decreasing rates of discoveries, higher production costs and associated unmitigated metallurgical and environmental issues.
- This creates a demand for the development of new exploration approaches that consider the complexity of mineralization events and their geochemical and geophysical proxies for exploration (Stromberg et al. 2018; McIntyre et al. 2010; Muhkergee and Large 2017).
- The discovery of every Large scale Orogenic Gold Deposit within the South American Continent has been preceded by active long term small and medium scale gold mining operations within the locality of their discoveries(e.g Omai, Troy, Aurora, Toraparu, Eagle Mountain)
- This project presents a novel exploration approach that utilizes **easily accessible sampling mediums** (paleo-surface gravels and pit basement sap rock etc) **within well established small and medium scale gold mining camps in Guyana.**
- The data derived from this and other similar projects within various mining camps/mining districts can give useful exploration insights into potential areas for follow up investigation where there are suspected geophysical and geochemical proxies of deep seated orogenic gold mineralization processes being present.

Introduction

Objectives of project

- To sample small and medium scale mining operations within the project area (gravel, Pit, Sluice, Tailings, Pan Concentrate)
- To conduct XRF analysis on samples to determine the distribution of select trace elements for Orogenic Gold Mineralization
- To scrutinize the spatial relationships of anomalous trace element samples with other data sets including regional geochemistry (INAA, BLEG and Gold Count), gold grain morphological analysis for selected samples,regional geophysics(air borne magnetics), regional geology and structures
- To make recommendations on Next Steps

Introduction

Geographic Description of project area

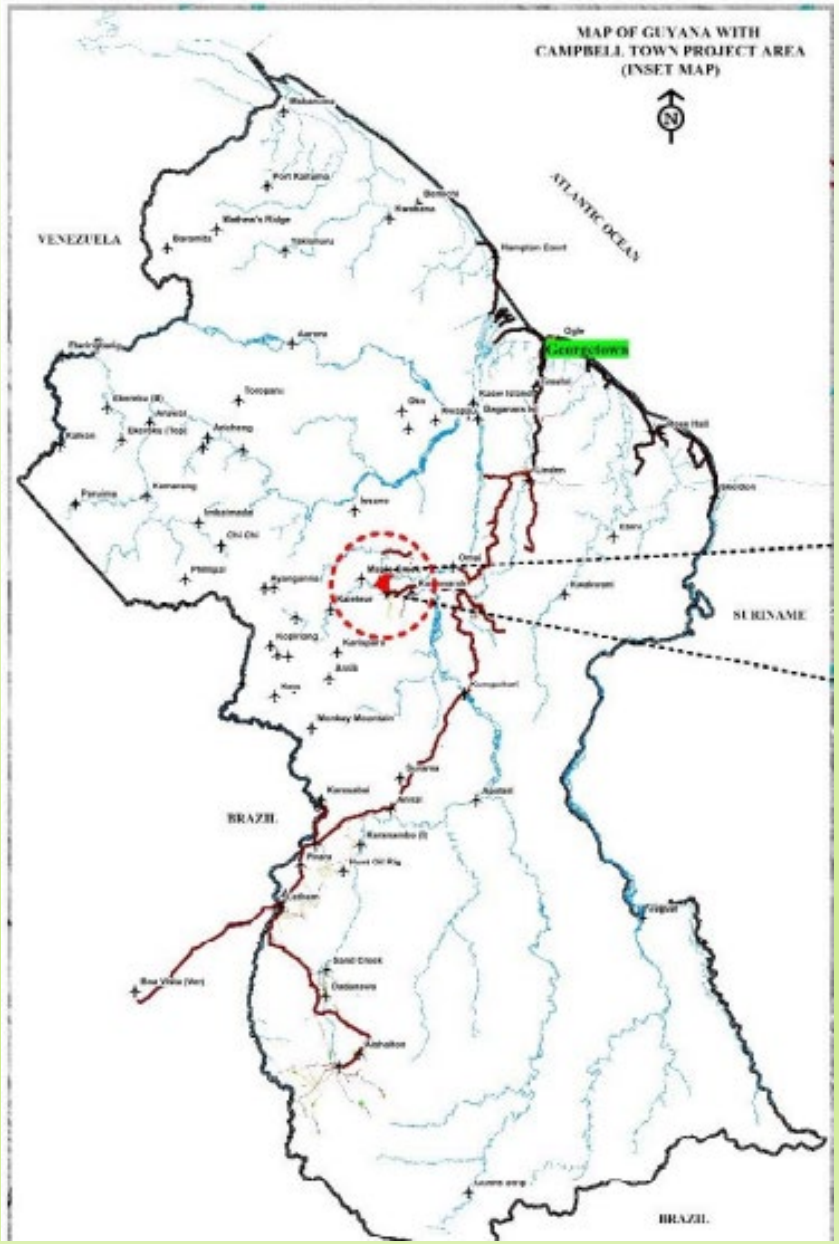
The project area is bounded by geographic coordinates

A (246 815mE, 557 967mN), B(250 822 mE,595 082 mN)

C (286 034 mE,595972mN) and D (282 675 mE,559 626 mN).

The project area encompasses localities that include Blackwater, Konowaruk, Salbora,Pamela, Campbeltown, Red Hole, St Elizabeth, Marabunta and Micobie)

Location and Access to Project Area



- The project area can be accessed via an aircraft departing from Ogle

International Airport en route to the Mahdia airstrip for approximately

55 minutes. From the Mahdia Airstrips the various localities within the

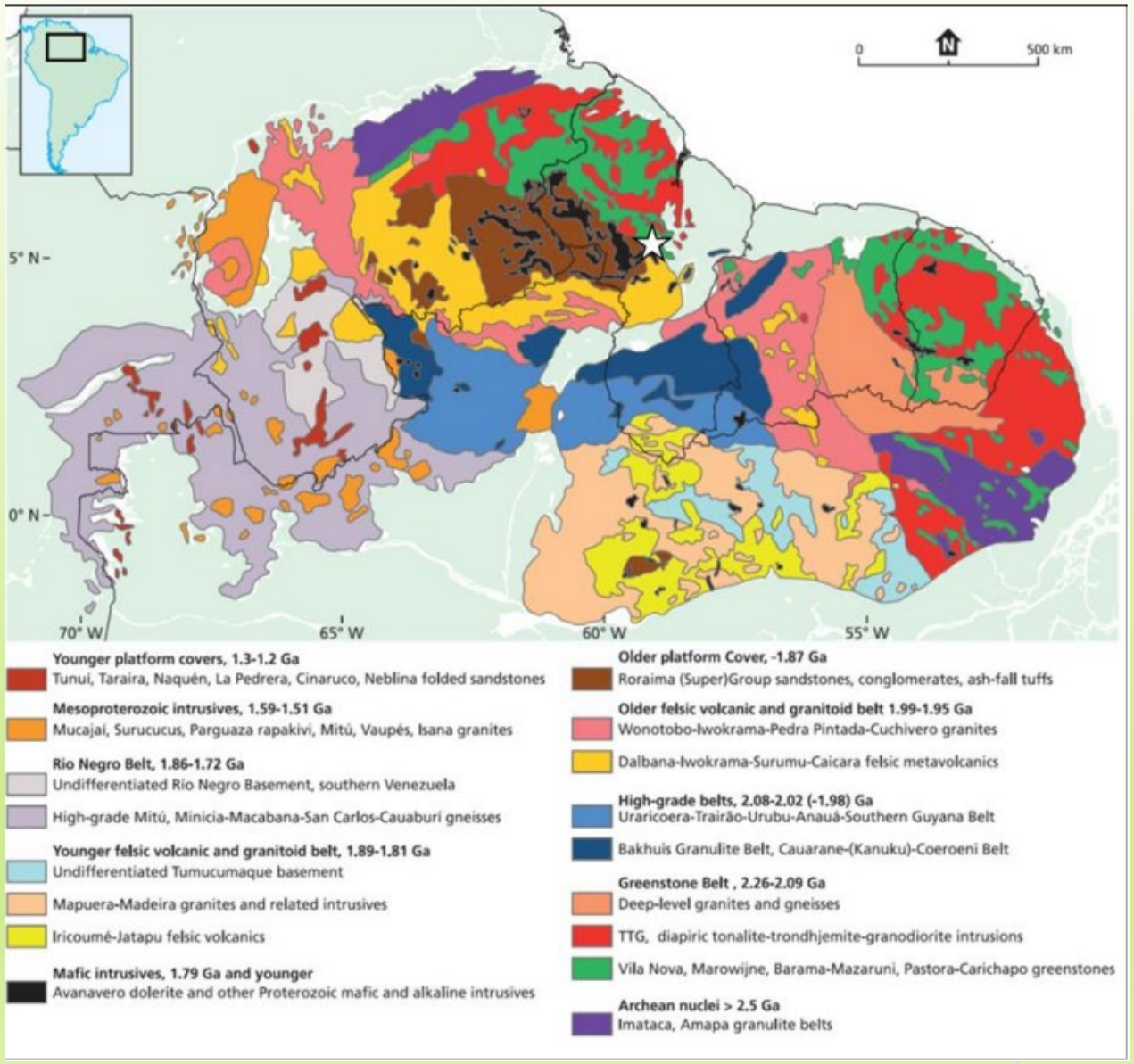
project area can be accessed by overland pickup or ATV ranging between

2 hours (Blackwater/Konowaruk), 1 hour (to Micobie) and 15 to 30 minutes

(Salbora,Pamela/Campbeltown/St Elizabeth, Marabunta,Red Hole).

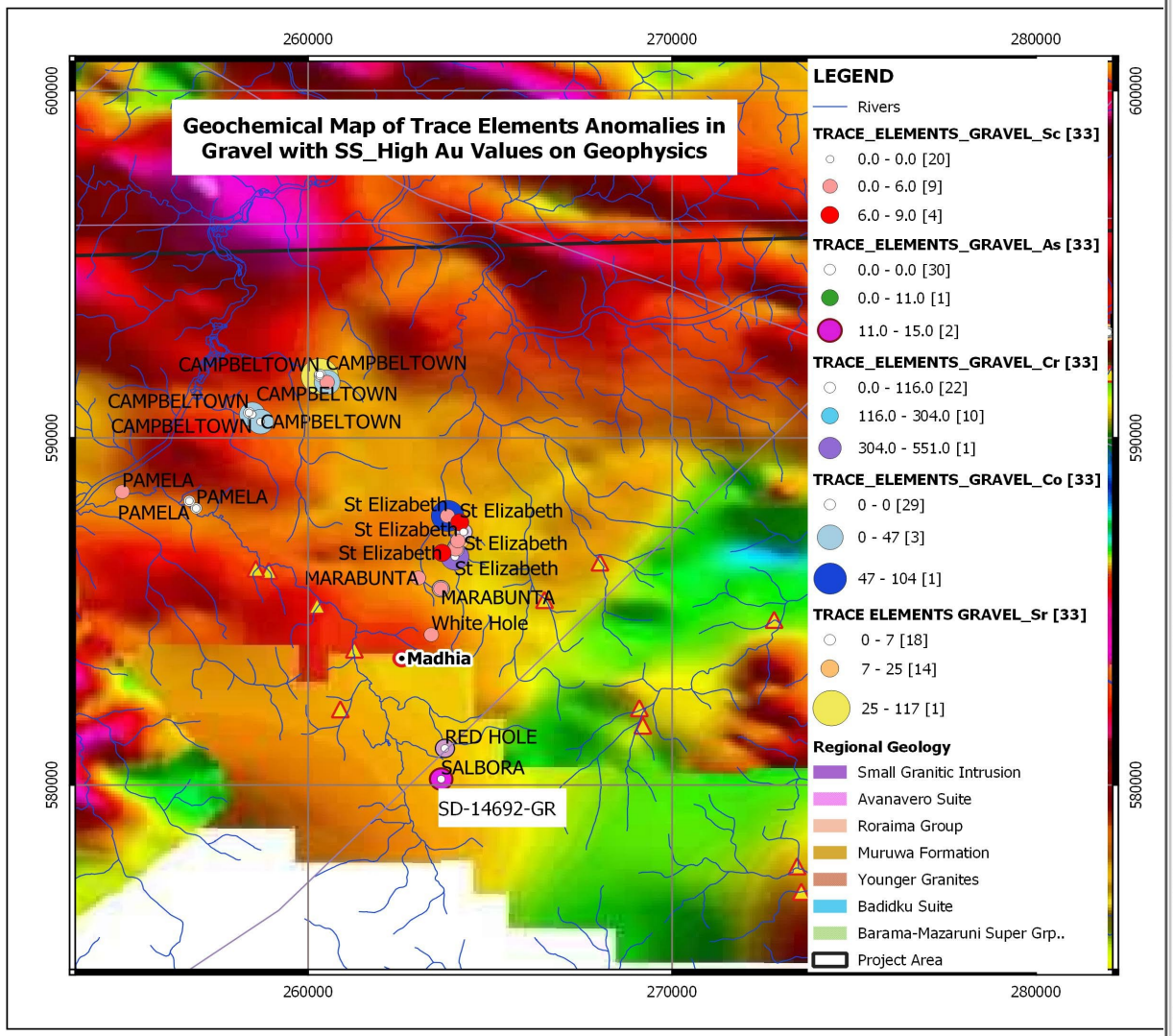
- The project area can also be accessed via an overland transportation (bus or land cruiser) by departing Georgetown for Linden and then unto Mahdia (approximately 200 km south). From Mahdia the various localities within the project area can be accessed.

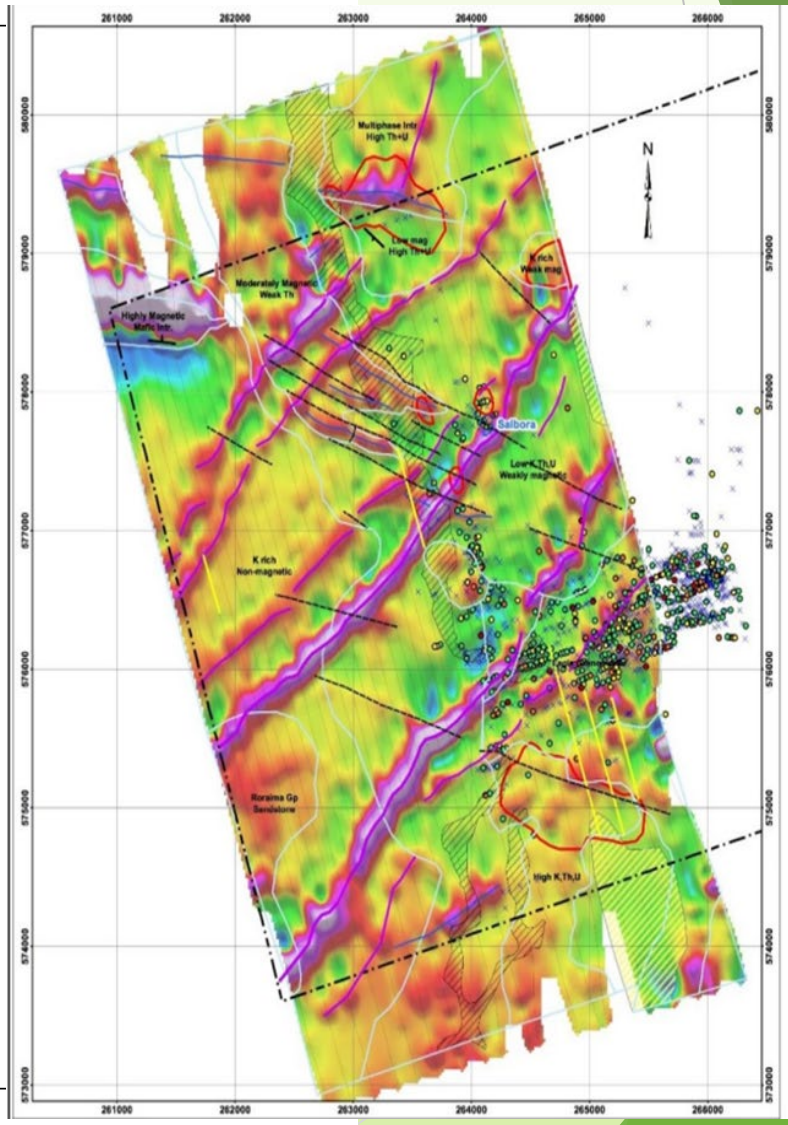
Regional Geological Map of the Guiana Shield

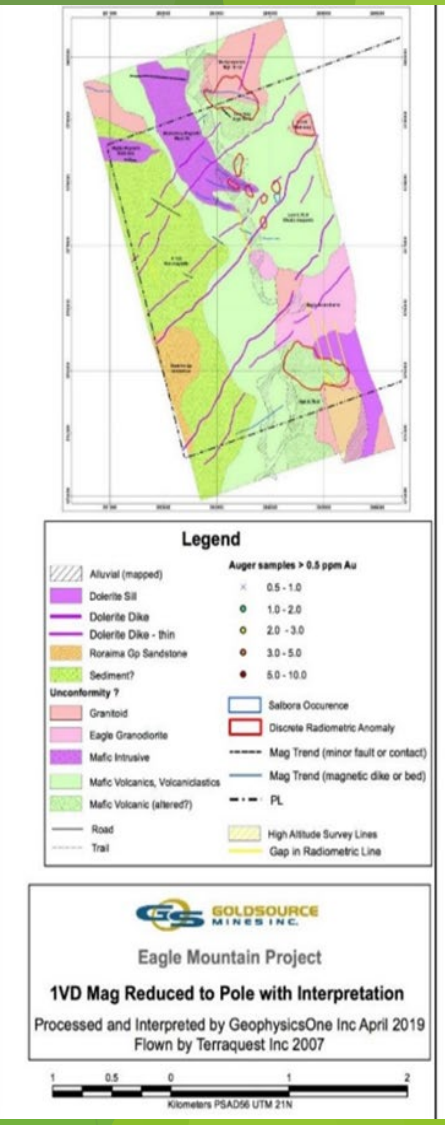


Source: Gold Source NI 43-101 2022

Regional Geophysics Map of the Project Area

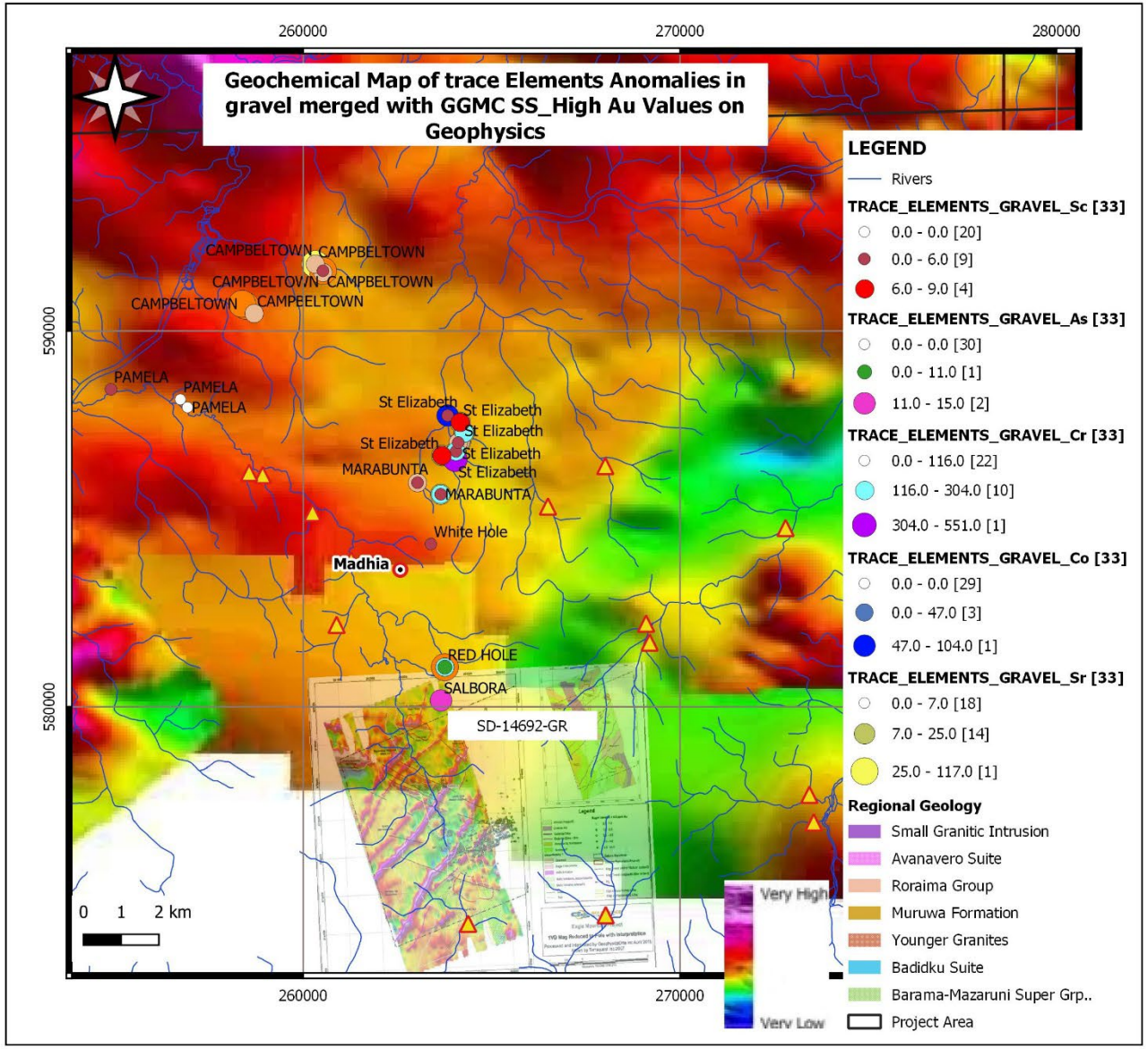




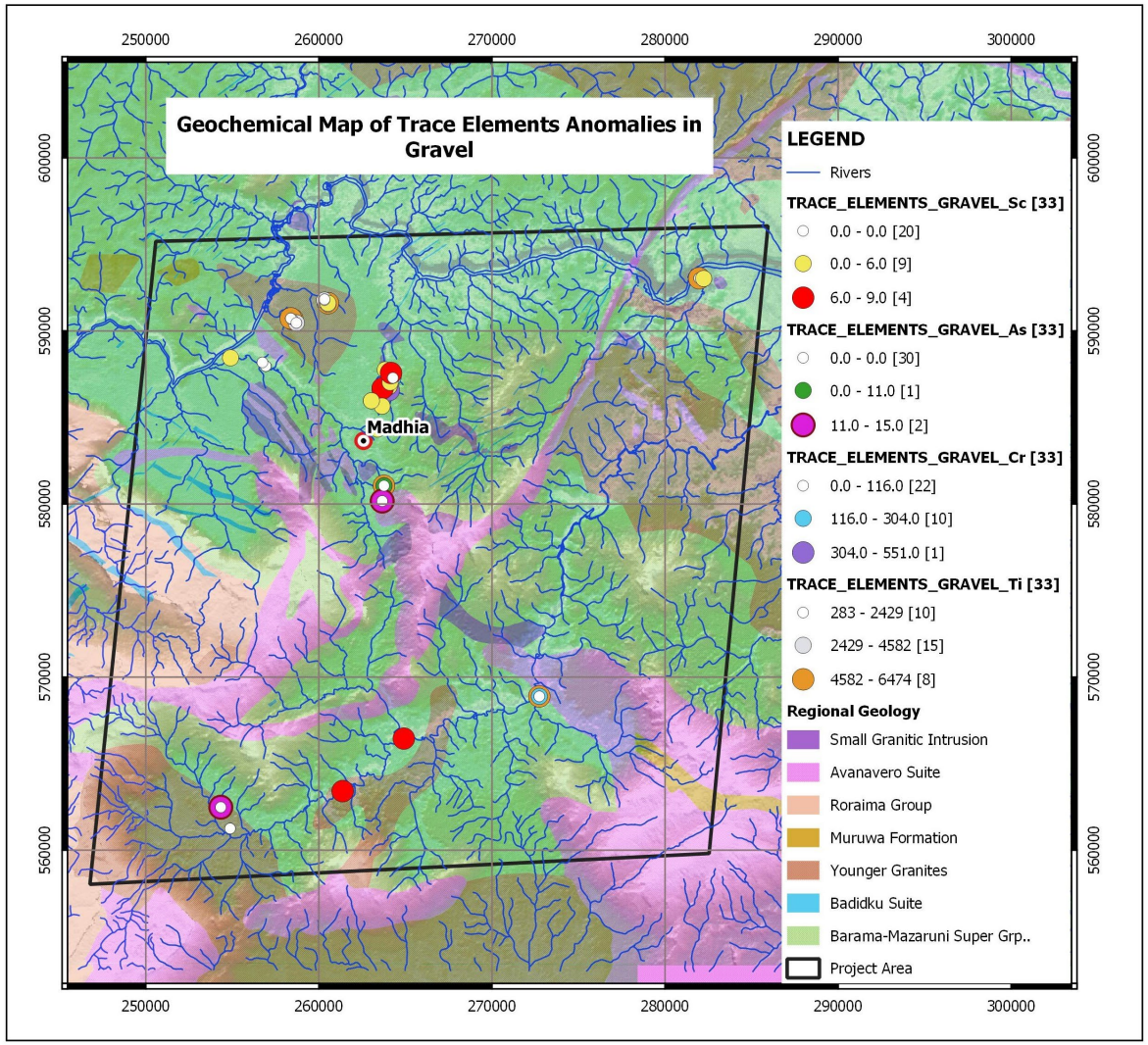


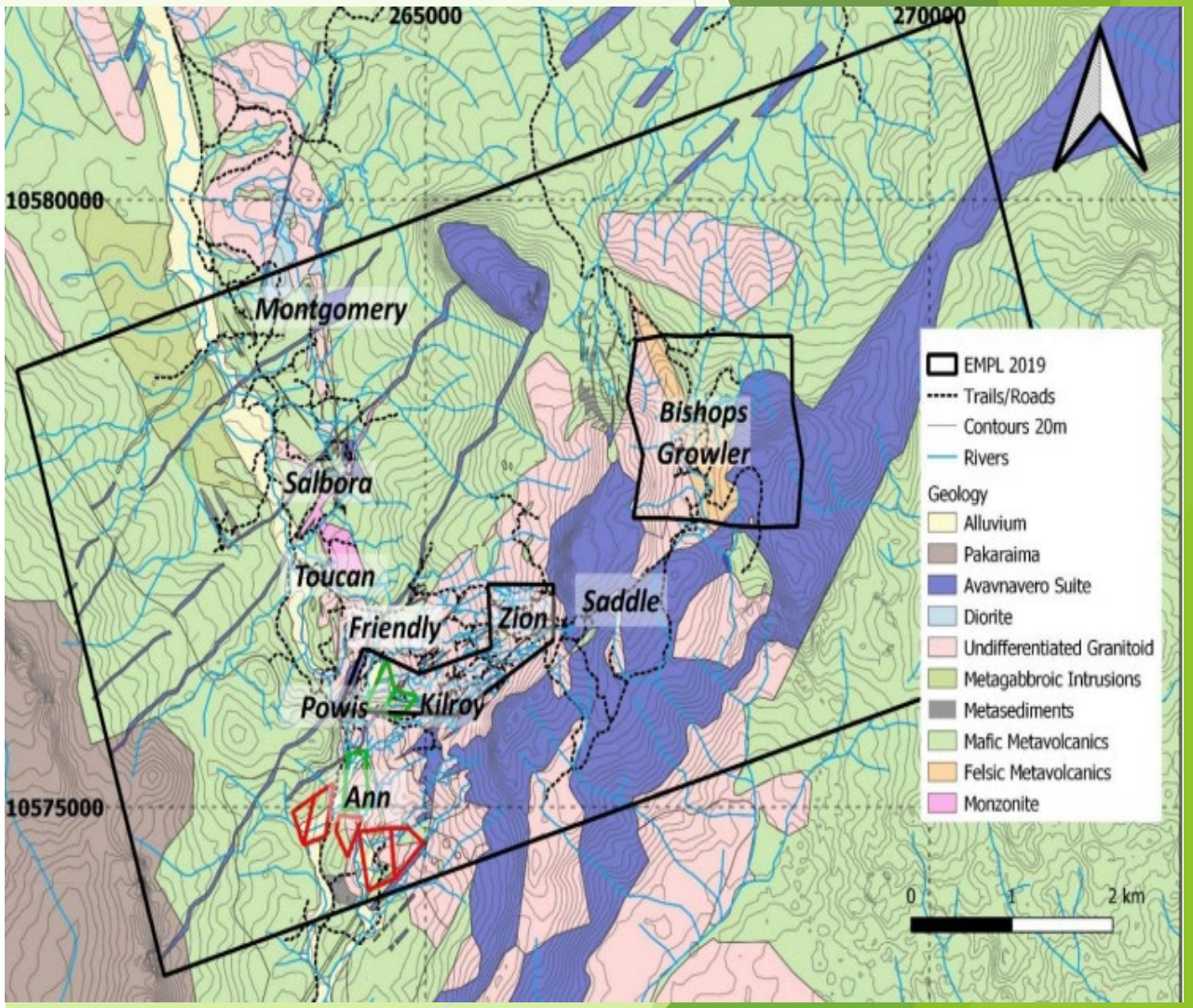
Source: Gold Source NI 43-101 2022

Regional Geophysics Map of the Project Area



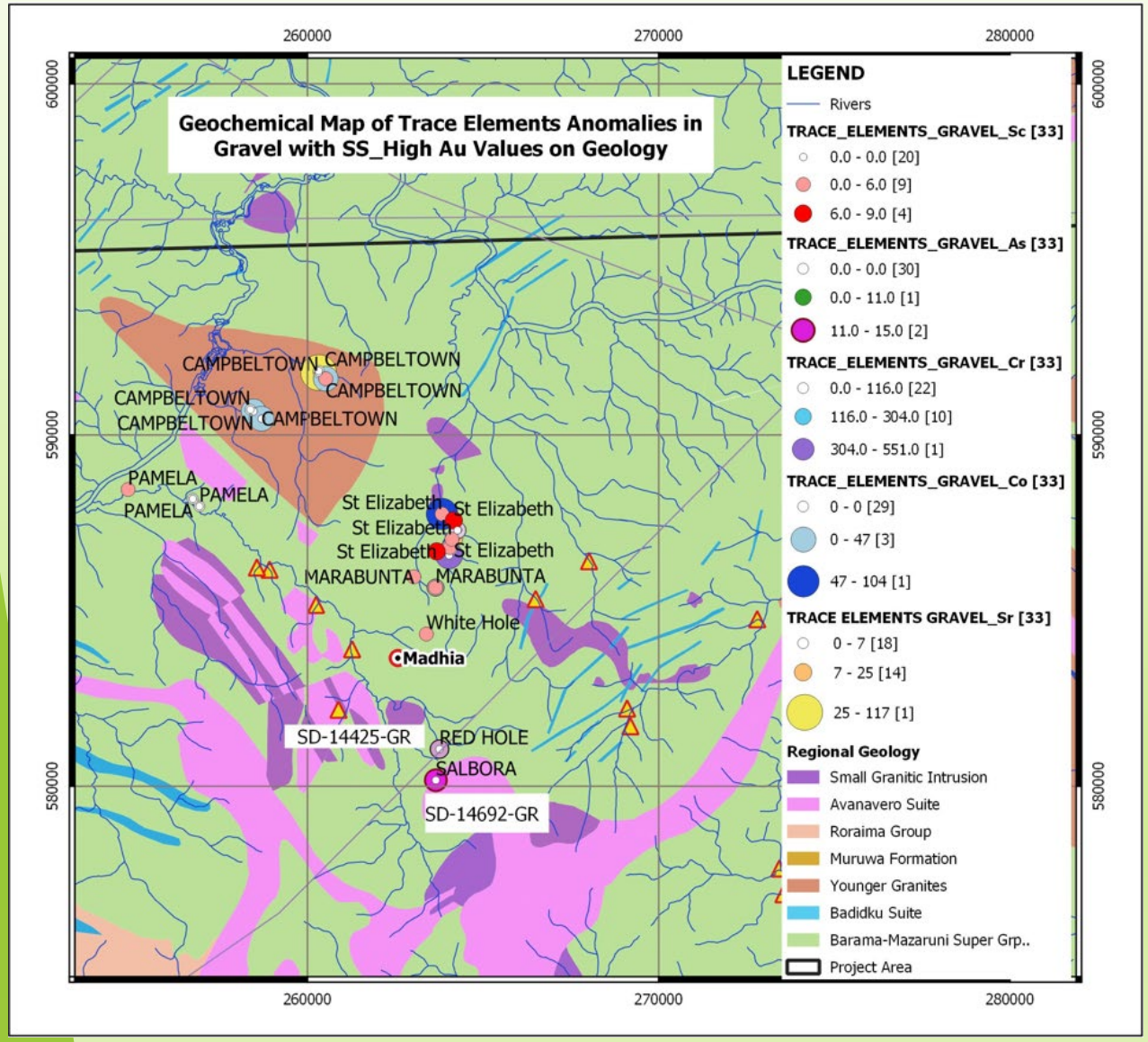
Regional Geological Map of the Project Area





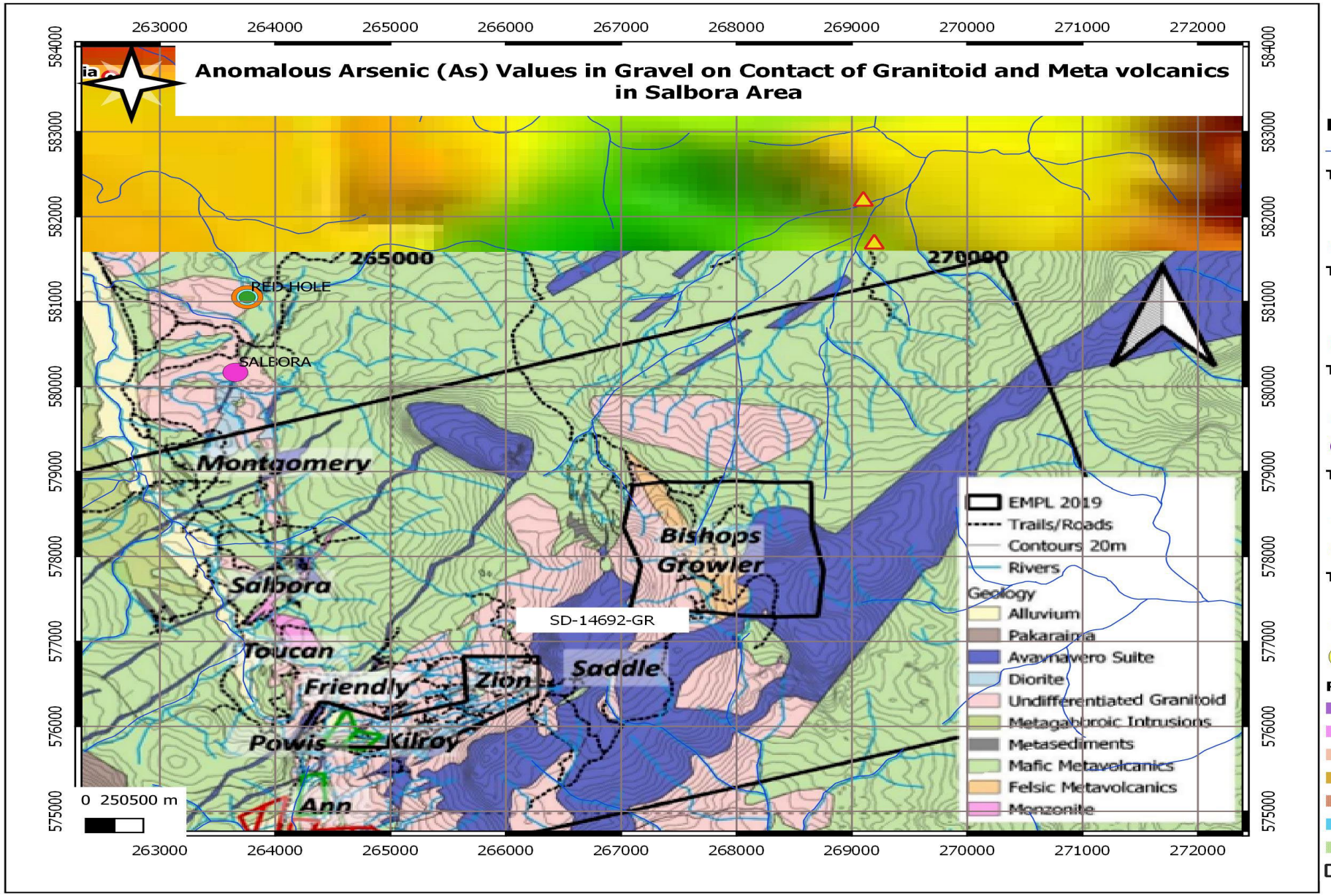
Regional Geology Map of Eagle Mountain
Source: Gold Source NI 43-101 2022

Description of Geology within the North Western Quadrant of the Project Area

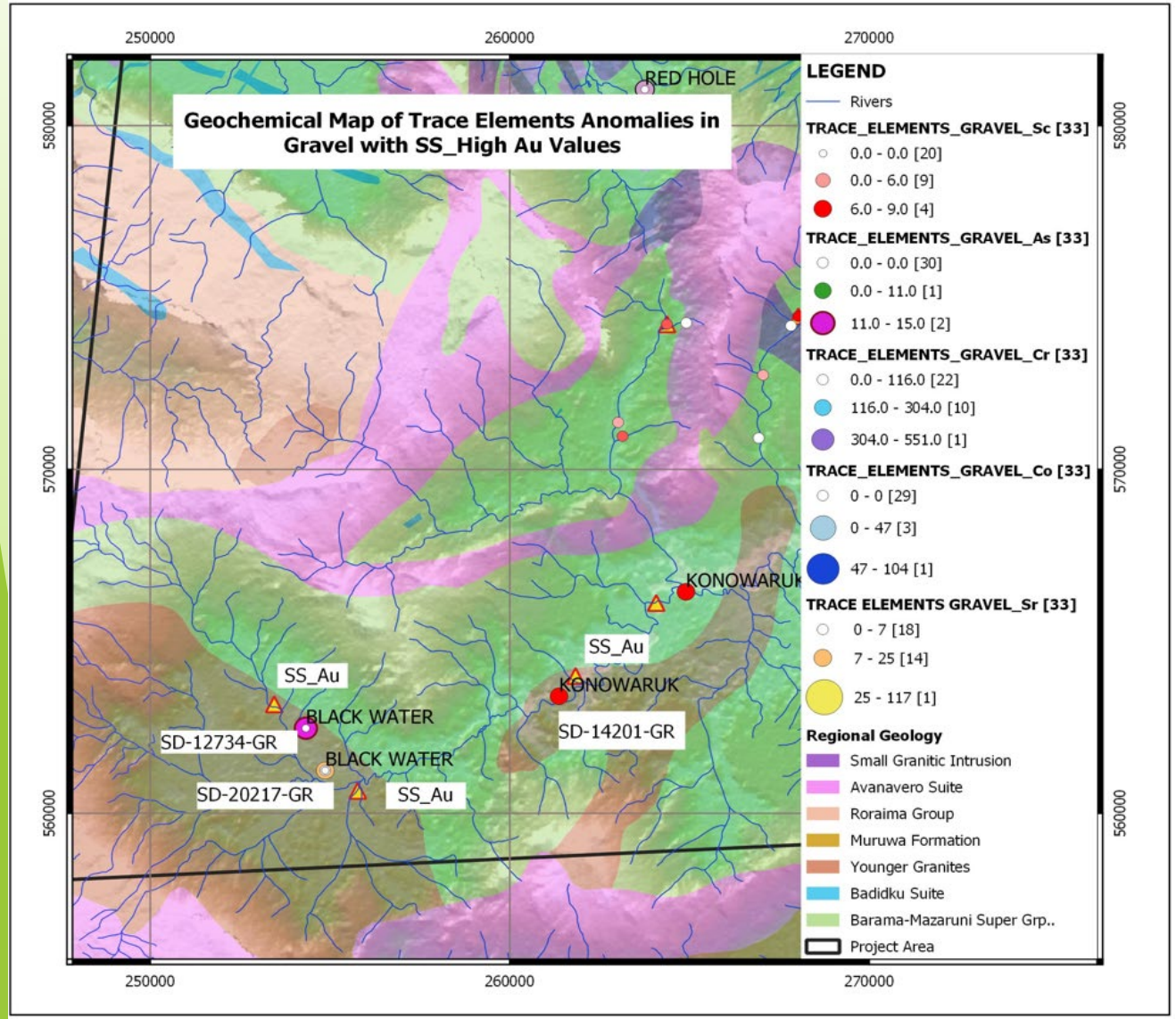


- The areas within the North Western Quadrant of the project area includes Campbeltown, Pamela, St Elizabeth, Marubunta, Red Hole, Salbora and part of the Eagle Mountain Gold Mine Concession:
- **Metavolcanics of the Grenstone Belt (Barama Mazaruni Supergroup:** composed of acid volcanics including Rhyodacites to mafic volcanics (meta Andesites) of the Barama Mazaruni Supergroup
- **Younger Granitic Intrusions: intrudes the BMS**
- **Avanavero Suite (Sills and Dykes)** : younger in age that intrudes the BMS and younger
- **Roraima Formation**

Local Geological Map of the Project Area

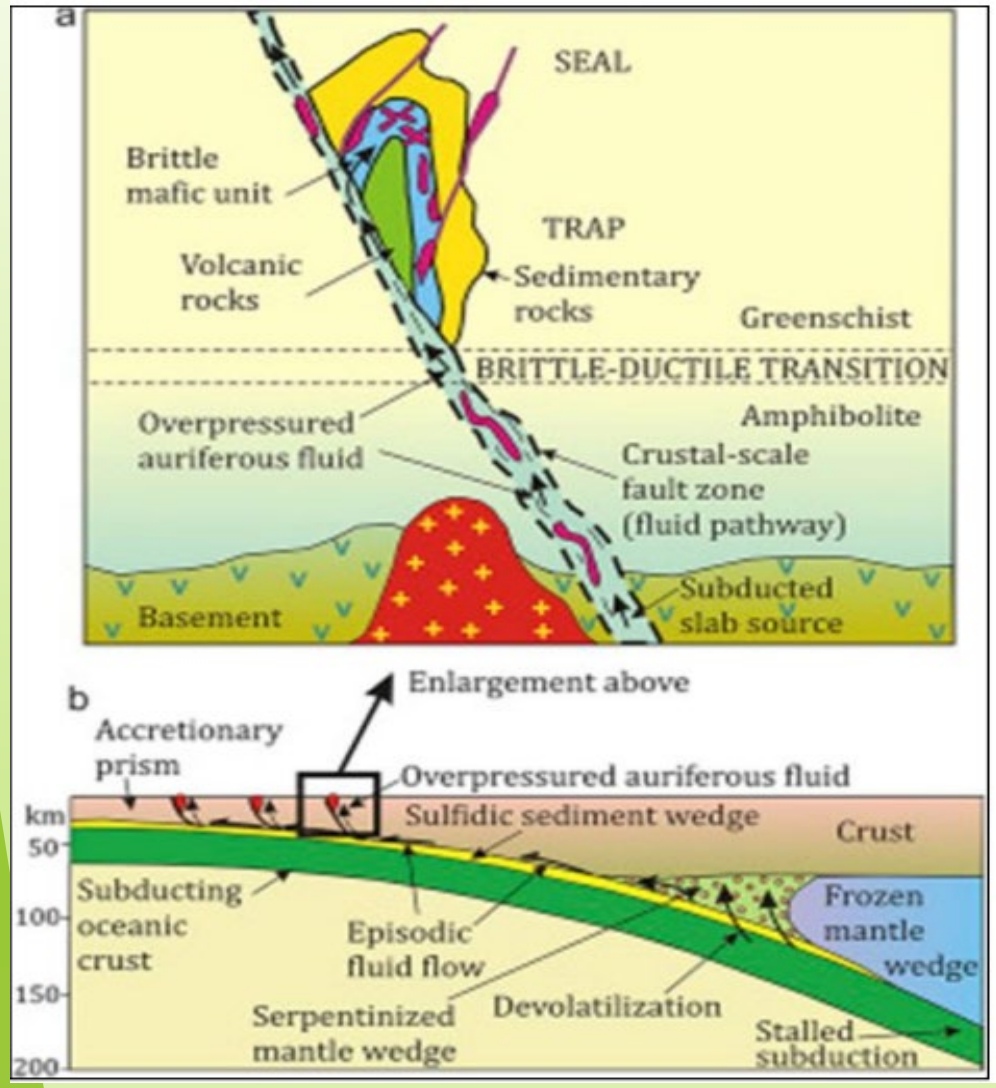


Description of Geology within the South West Quadrant of the Project Area



- The project area includes part of the Eagle Mountain Gold Mine Concession, Blakwater and Konowaruk.
- **Metavolcanics of the Grenstone Belt (Barama Mazaruni Supergroup:** composed of acid volcanics including Rhyodacites to mafic volcanics (meta Andesites) of the Barama Mazaruni Supergroup
- **Younger Granitic Intrusions: intrudes the BMS**
- **Avanero Suite (Sills and Dykes)** : younger in age that intrudes the BMS and younger
- **Roraima Formation**

Metallogeny of the Project Area (Eagle Mountain Orogenic Gold Deposit)



Source: Gold Source NI 43-101 2022

- Metallogeny is the study of the genesis and regional-to-global distribution of mineral deposits, with emphasis on their relationship in space and time to regional petrologic and tectonic features of the Earth's crust.
- Over pressure subducted slab derived fluids advects upwards through second order structures or hydraulically fractured rock bodies to form Orogenic Gold Deposits (Groves and Santosh,2016)
- This Orogenic Gold Formation Model is posited for the Eagle Mountain and surrounding localities
- Trace elements of Orogenic Gold Deposits include Sb,As,Ag,S
- Correlation coefficient for Au and As show strong relationships with approximately 0.59 within the Salbora area (Pickett 2022)

Methodology

- Desktop research was conducted on project area(geophysics, geochemistry, structures etc) and Orogenic Gold Formation processes and trace elements
- Samples were taken of mining pits (Gravel, Pit, Tailings, Sluice and Pan Concentrate)
- XRF analysis was conducted for selected trace elements
- Trace elements analyzed included Mo,Zr,Sr,U,Rb,Th,Pb,Au,Se,As,Hg,Zn,W,Cu,Ni,Co,Fe,Mn,Cr,V,Ti,Sc
- Correlation coefficient for Au and As show good strength with approximately 0.59 within the Salbora area (Pickett 2022)
- Schematic maps prepared for As,Sc,Co,Zr,Sr distribution within paleo-surfcae gravels

Site Description
SD# 9292

Project: Mahdia (Region 8)

Prospect: New Jack

Name: SD#9292

Depth: 10ft

Date: 26th. 02. 2021

GPS Coordinates: 264 166mE, 581 660mN

Pan Concentrate

No. Pans – 3

Au Fine No. of grains – 3

H Minerals –2%

Comments

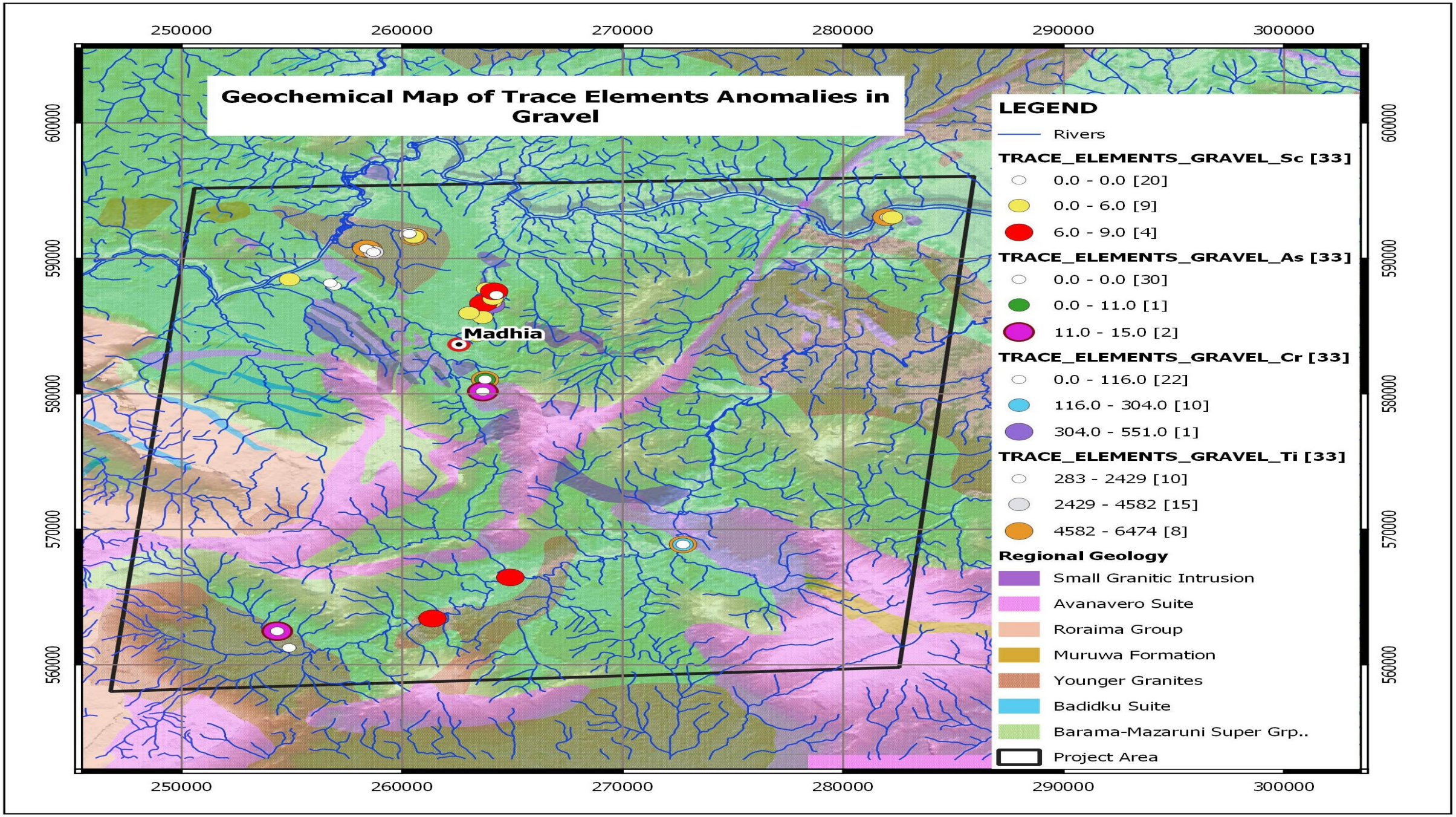
- 6 inch dredge
- Reworking tailings
- 3 ounce on a 7 day wash down
- Pit –clay (white), laminated sheet, fine grains with bolder and cobble (red orange), lateritic material
- Tailings- gravel, lateritic material, sand (red)

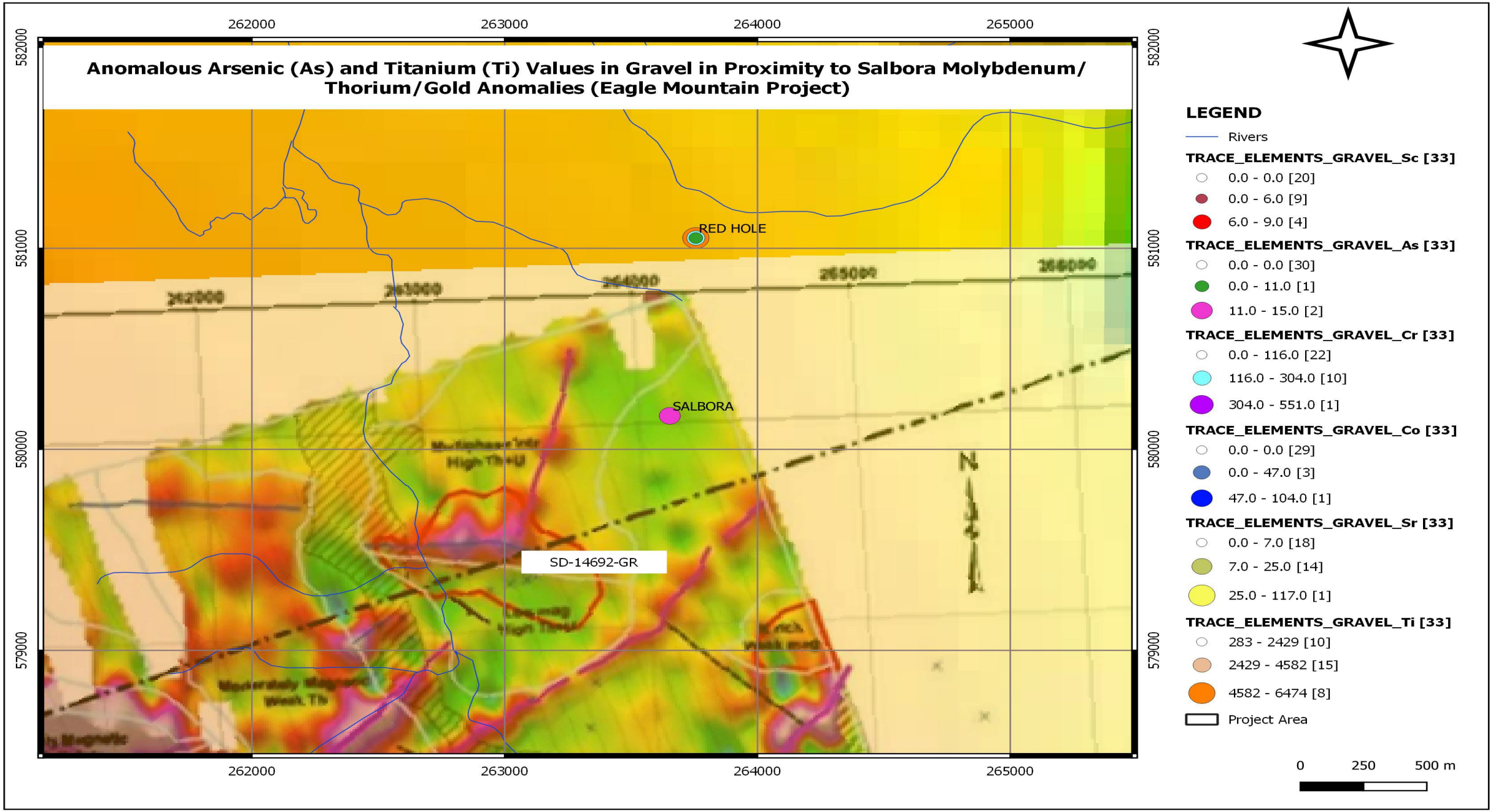
Pit

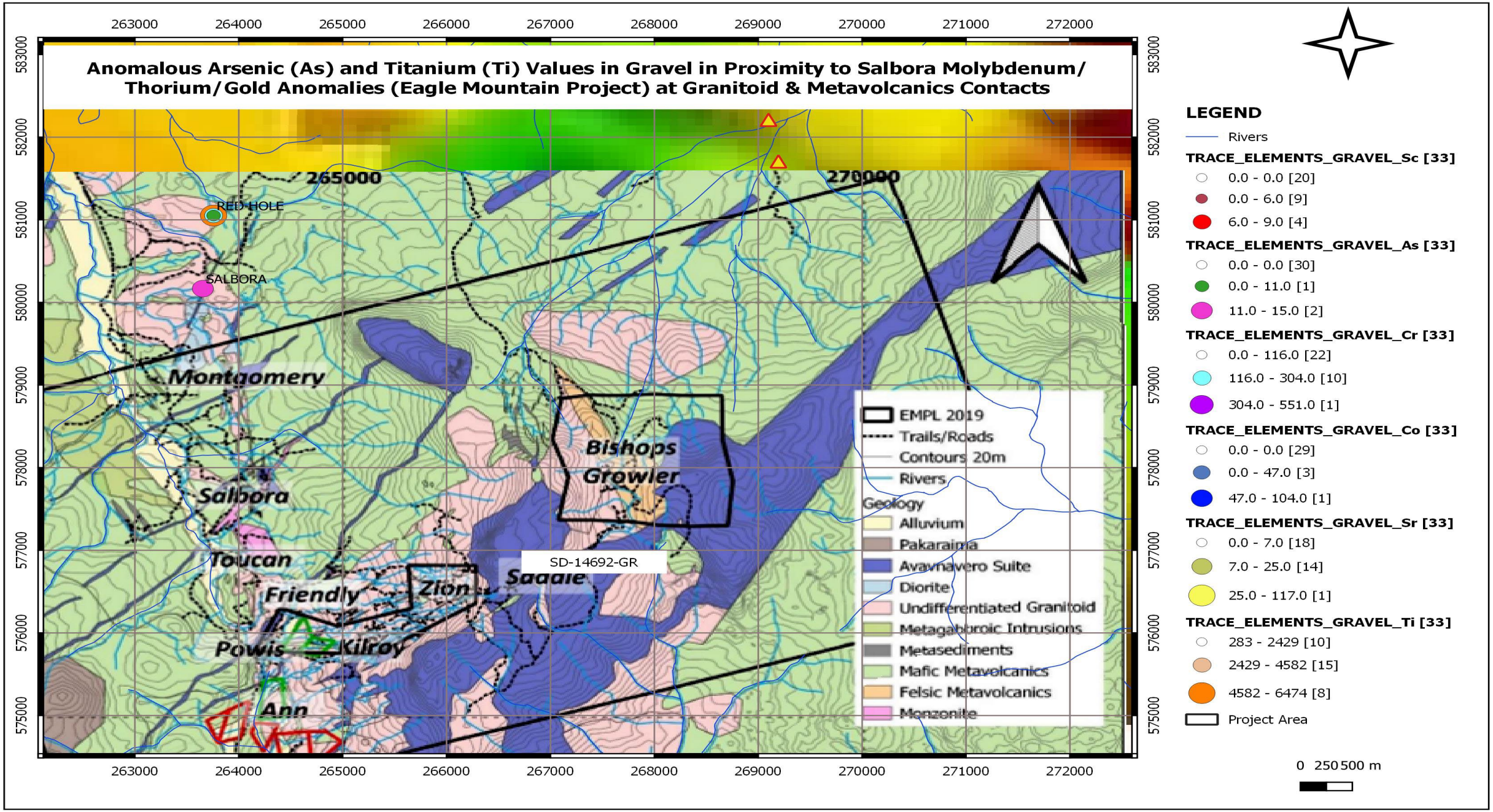
Results

Trace element geochemistry within the paleo-surface gravels

SAMPLE	EAST	NORTH	GEOLOGY	LOCATION	OPR	Mo	Zr	Sr	U	Rb	Th	Pb	Au	Se	As	Hg	Zn	W	Cu	Ni	Co	Fe	Mn	Cr	V	Ti	Sc
SD-12734-GR	254325	562471		BLACK WATER	YES	119	113	2	6	8	0	0	0	0	13	0	0	0	27	0	0	107051	0	212	415	5475	0
SD-9237-GR	264030	586573		St Elizabeth	YES	4	113	9	0	5	4	4	0	0	0	0	9	0	20	29	0	2104	102	551	586	4475	0
SD-14425-GR	263756	581051		RED HOLE	YES	119	85	0	0	6	0	0	0	0	11	0	0	0	32	0	0	105327	0	242	458	4761	0
SD-14201-GR	261370	563401		KONOWARUK	YES	5	248	6	4	8	0	7	0	0	0	0	43	0	51	31	0	42599	308	99	150	6474	8
SD-20897-GR	260519	591600		CAMPBELTOWN	YES	5	225	4	0	0	3	4	0	0	0	0	0	0	0	0	0	950	113	39	31	5246	0
SD-6463-GR	264052	586794		St Elizabeth	YES	8	101	14	0	8	5	8	0	0	0	0	8	0	11	0	0	2142	105	280	251	4304	6
SD-19887-GR	263677	586683		St Elizabeth	YES	4	145	9	0	5	3	6	0	0	0	0	7	0	15	0	0	2497	83	304	299	4172	9
SD-20581-GR	258462	590672		CAMPBELTOWN	YES	0	177	5	4	2	3	0	0	0	0	0	9	0	0	0	47	3824	164	72	61	5865	0
SD-20841-GR	282003	593033		MICOBIE	YES	0	45	6	0	3	0	0	0	0	0	0	23	0	29	95	0	6615	191	115	128	3279	0
SD-20217-GR	254864	561241		BLACK WATER	YES	0	131	14	5	37	3	8	0	0	0	7	49	0	17	0	0	13356	178	18	34	1210	0
SD-15176-GR	272733	568877		KONOWARUK	YES	3	92	25	5	4	0	6	0	0	0	0	22	0	22	43	0	10851	223	199	127	6401	0
SD-20570-GR	260519	591553		CAMPBELTOWN	YES	0	129	0	0	1	0	0	0	0	0	0	0	0	18	75	0	533	148	0	32	4129	0
SD-14692-GR	263653	580166		SALBORA	YES	78	106	10	0	17	0	0	0	0	15	0	19	0	46	0	0	113906	0	147	289	4053	0
SD-15672-GR	263645	585652		MARABUNTA	YES	9	106	13	6	11	4	0	0	0	0	0	60	0	30	0	0	5107	189	215	195	1714	6
SD-20630-GR	258371	590722		CAMPBELTOWN	YES	0	124	7	0	6	0	6	0	0	0	0	8	0	17	0	0	2742	178	70	67	5074	0
SD-16782-GR	263028	585960		MARABUNTA	YES	6	110	5	0	3	4	4	0	0	0	0	8	0	0	0	0	5180	162	97	95	4481	4
SD-13782-GR	264174	587056		St Elizabeth	YES	15	122	9	0	8	4	0	0	0	0	6	23	0	16	0	0	15353	247	106	125	3104	0
SD-15504-GR	281971	593042		MICOBIE	YES	4	68	9	0	4	0	5	0	0	0	0	38	0	20	21	0	12889	185	95	139	5643	0
P, DEFREITAS-GR	258692	590463		CAMPBELTOWN	YES	0	177	0	3	0	0	0	0	0	0	0	0	0	<LOD	23	42	546	89	26	31	3009	0
SD 20846-GR	264111	587028		St Elizabeth	YES	7	75	6	0	4	0	0	0	0	0	0	8	0	0	0	0	1880	172	116	148	3227	5
SD 14580-GR	254890	588445		PAMELA	YES	0	121	3	0	2	0	0	0	0	0	0	0	0	0	0	0	28165	0	40	41	1812	3
SD 16652-GR	264287	587297		St Elizabeth	YES	6	85	4	0	3	3	4	0	0	0	0	9	0	0	0	0	4616	148	80	54	2429	0
SD 19955-GR	282228	593023		MICOBIE	YES	3	167	23	0	5	0	6	0	0	0	0	28	0	24	0	0	12481	310	53	84	3684	6
SD 20086-GR	263829	587749		St Elizabeth	YES	16	162	10	4	3	0	0	0	0	0	0	11	0	24	0	104	12338	170	49	35	1187	4
SD 15532-GR	263383	584328		White Hole	YES	6	77	6	0	4	0	0	0	0	0	0	12	0	0	0	0	1265	142	63	62	2238	5
SD 19433-GR	264164	587566		St Elizabeth	No	8	88	9	0	4	5	0	0	0	0	0	0	0	0	0	0	1886	83	162	123	2817	7
SD 9364-GR	256921	587966		PAMELA	YES	0	79	2	0	0	0	0	0	0	0	0	0	0	0	0	0	12836	0	33	30	1768	0
SD 11927-GR	260519	591600		CAMPBELTOWN	YES	3	113	3	0	0	0	0	0	0	0	0	0	0	0	0	42	679	129	36	20	1220	4
SD 14418-GR	264901	566438		KONOWARUK	YES	4	109	13	0	5	0	6	0	0	0	0	30	0	21	27	0	27374	258	201	158	4582	9
SD 1905-GR	256732	588178		PAMELA	YES	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3751	0	27	12	283	0
SD 2022-GR	264269	587284		St Elizabeth	YES	10	153	14	0	4	4	6	0	0	0	0	8	0	20	0	0	3017	118	176	133	2626	0
SD-12271-GR	260315	591776		CAMPBELTOWN	NO	3	285	117	6	8	8	28	0	0	0	0	15	0	0	0	0	2226	105	35	62	3826	0
SD-20558-GR	260320	591824		CAMPBELTOWN	NO	4	90	3	4	2	0	0	0	0	0	0	0	0	0	0	0	1822	149	31	38	915	0


Geochemical Map of Trace Elements Anomalies in Gravel
250000
260000
270000
280000
290000
300000
600000
590000
580000
570000
560000
Madhia
LEGEND
Rivers
TRACE_ELEMENTS_GRAVEL_Sc [33]
0.0 - 0.0 [20]
0.0 - 6.0 [9]
6.0 - 9.0 [4]
TRACE_ELEMENTS_GRAVEL_As [33]
0.0 - 0.0 [30]
0.0 - 11.0 [1]
11.0 - 15.0 [2]
TRACE_ELEMENTS_GRAVEL_Cr [33]
0.0 - 116.0 [22]
116.0 - 304.0 [10]
304.0 - 551.0 [1]
TRACE_ELEMENTS_GRAVEL_Ti [33]
283 - 2429 [10]
2429 - 4582 [15]
4582 - 6474 [8]
Regional Geology
Small Granitic Intrusion
Avanavero Suite
Roraima Group
Muruwa Formation
Younger Granites
Badidku Suite
Barama-Mazaruni Super Grp..
Project Area


Anomalous Arsenic (As) and Titanium (Ti) Values in Gravel in Proximity to Salbora Molybdenum/ Thorium/Gold Anomalies (Eagle Mountain Project)
262000
263000
264000
265000
582000
581000
580000
579000
RED HOLE
SALBORA
SD-14692-GR
N
LEGEND
Rivers
TRACE_ELEMENTS_GRAVEL_Sc [33]
0.0 - 0.0 [20]
0.0 - 6.0 [9]
6.0 - 9.0 [4]
TRACE_ELEMENTS_GRAVEL_As [33]
0.0 - 0.0 [30]
0.0 - 11.0 [1]
11.0 - 15.0 [2]
TRACE_ELEMENTS_GRAVEL_Cr [33]
0.0 - 116.0 [22]
116.0 - 304.0 [10]
304.0 - 551.0 [1]
TRACE_ELEMENTS_GRAVEL_Co [33]
0.0 - 0.0 [29]
0.0 - 47.0 [3]
47.0 - 104.0 [1]
TRACE_ELEMENTS_GRAVEL_Sr [33]
0.0 - 7.0 [18]
7.0 - 25.0 [14]
25.0 - 117.0 [1]
TRACE_ELEMENTS_GRAVEL_Ti [33]
283 - 2429 [10]
2429 - 4582 [15]
4582 - 6474 [8]
Project Area
0
250
500 m


Anomalous Arsenic (As) and Titanium (Ti) Values in Gravel in Proximity to Salbora Molybdenum/ Thorium/Gold Anomalies (Eagle Mountain Project) at Granitoid & Metavolcanics Contacts
263000
264000
265000
266000
267000
268000
269000
270000
271000
272000
583000
582000
581000
580000
579000
578000
577000
576000
575000
RED HOLE
SALBORA
Montgomery
Salbora
Toucan
Friendly
Zion
Powis
Kilroy
Ann
Bishops
Growler
Saddle
SD-14692-GR
EMPL 2019
Trails/Roads
Contours 20m
Rivers
Geology
Alluvium
Pakaraima
Avanavero Suite
Diorite
Undifferentiated Granitoid
Metagabbroic Intrusions
Metasediments
Mafic Metavolcanics
Felsic Metavolcanics
Monzonite
LEGEND
Rivers
TRACE_ELEMENTS_GRAVEL_Sc [33]
0.0 - 0.0 [20]
0.0 - 6.0 [9]
6.0 - 9.0 [4]
TRACE_ELEMENTS_GRAVEL_As [33]
0.0 - 0.0 [30]
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116.0 - 304.0 [10]
304.0 - 551.0 [1]
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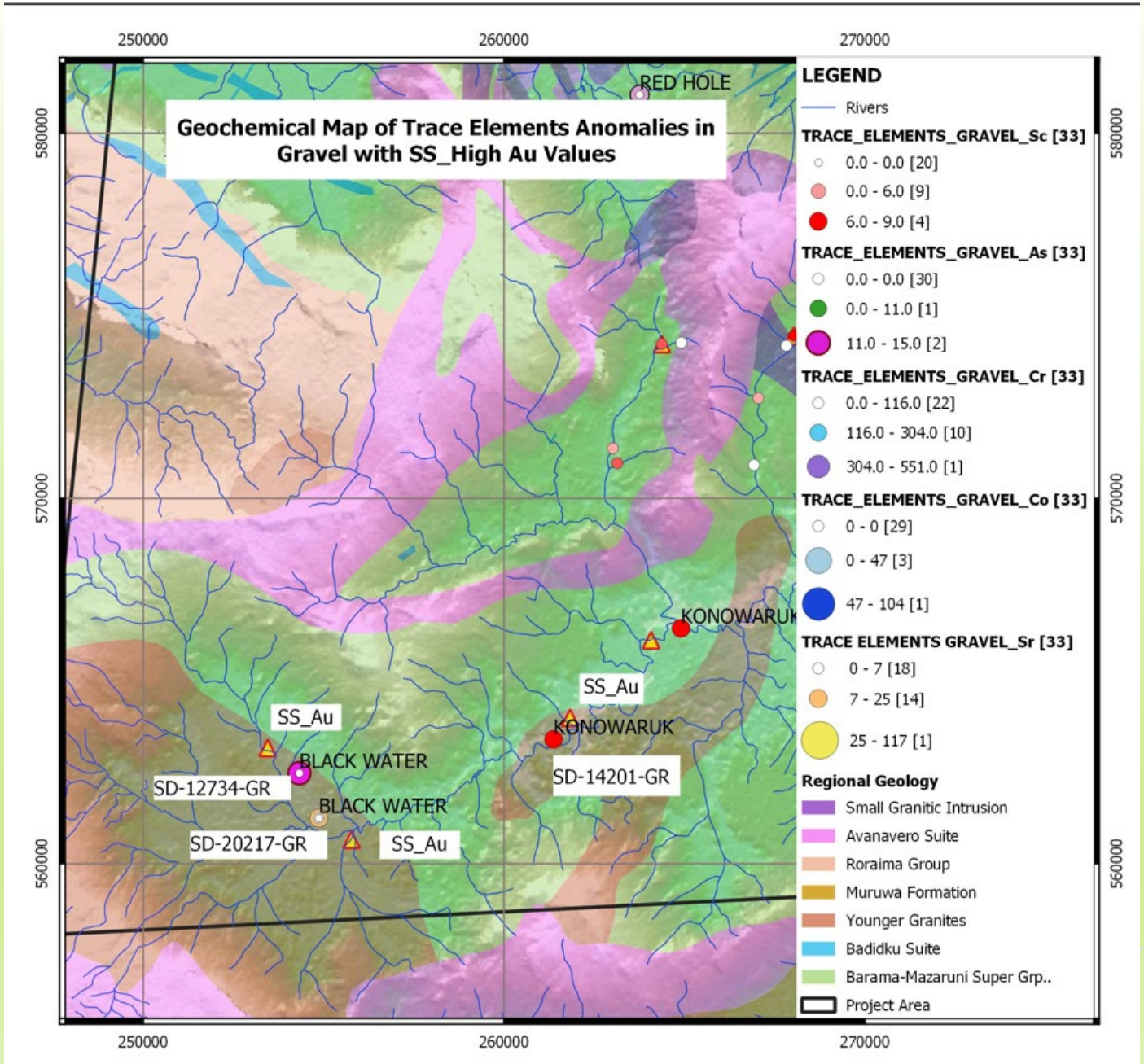
0.0 - 0.0 [29]
0.0 - 47.0 [3]
47.0 - 104.0 [1]
TRACE_ELEMENTS_GRAVEL_Sr [33]
0.0 - 7.0 [18]
7.0 - 25.0 [14]
25.0 - 117.0 [1]
TRACE_ELEMENTS_GRAVEL_Ti [33]
283 - 2429 [10]
2429 - 4582 [15]
4582 - 6474 [8]
Project Area
0 250 500 m

Trace element distribution in paleo surface gravels



Trace element distribution within pan concentrates

SAMPLE	X	Y	LOCATION	OPR	Mo	Zr	Sr	U	Rb	Th	Pb	Au	Se	As	Hg	Zn	W	Cu	Ni	Co	Fe	Mn	Cr	V	Ti	Sc
SD 20581 PC	258462	590672	CAMPBELTOWN	YES	0	8506	9	0	4	0	0	69	0	84	0	563	0	831	127	0	133591	3529	1975	2708	171953	3
SD 20897 PC	260759	591648	CAMPBELTOWN	YES	0	8310	25	0	0	0	0	0	0	0	0	0	0	0	0	0	8588	1689	32	14	17920	3
SD 12197 PC	257031	287901	CAMPBELTOWN	YES	0	14234	0	0	0	0	0	70	0	46	0	249	0	450	0	0	204951	3875	1569	1848	159600	28
SD 1905 PC	256732	588178	CAMPBELTOWN	YES	0	4846	2	0	0	0	41	0	0	0	0	40	0	113	0	345	78797	1541	244	518	115105	0
SD 14580 PC	254890	588445	PAMELA	YES	0	4339	4	0	0	0	14	0	0	58	0	128	0	209	0	0	153990	2949	1036	1661	146895	26
SD 19878 PC	257518	587976	PAMELA	YES	0	1595	3	0	2	0	0	15	0	9	0	142	0	122	0	0	123874	2253	499	937	104436	0
SD 11927 PC	260519	591600	CAMPBELTOWN	YES	0	72600	22	0	0	0	0	780	0	166	0	913	0	1905	0	0	19910	1541	110	34	51443	3
SD 20630 PC	258371	590463	CAMPBELTOWN	YES	0	94563	0	0	0	0	0	0	0	203	0	727	0	2067	0	0	115053	3229	3876	1594	167675	30
SD 12271 PC	260315	591776	CAMPBELTOWN	YES	0	18744	53	0	0	0	0	0	0	0	0	0	0	882	0	0	7989	1766	32	10	12571	3
P. DEFREITAS PC	258692	590463	CAMPBELTOWN	YES	0	147749	21	0	0	0	0	211	0	304	0	1654	303	2600	268	0	7324	1466	6800	267	39837	0

Gold Grain Morphology of Select Samples within Campbeltown : SD 12271

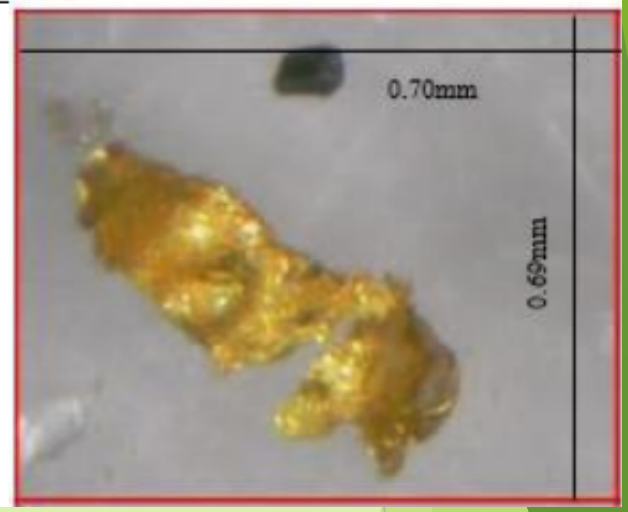
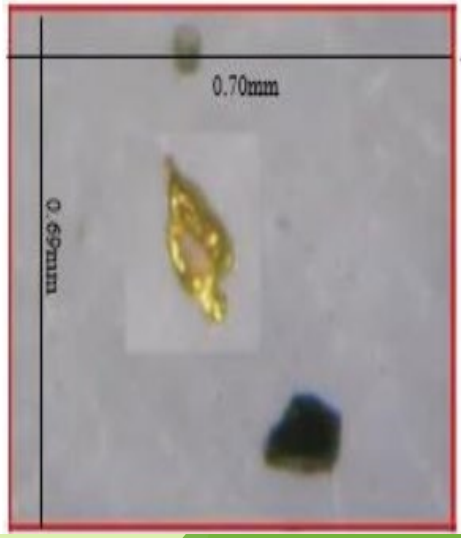
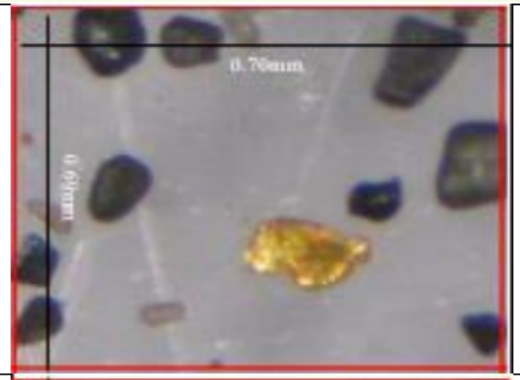
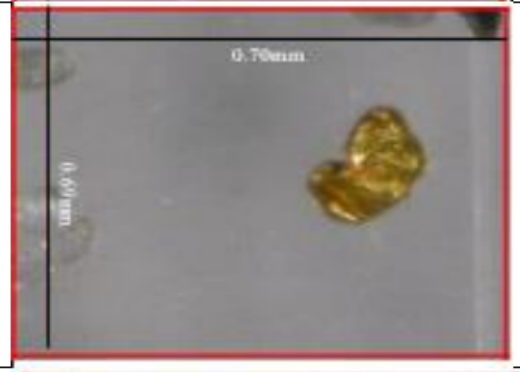
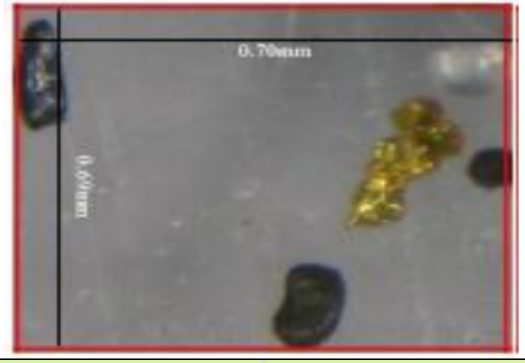
SD 12271	1	520	210	Very angular, irregularly shaped grain, with poorly preserved crystal outline. The grain was fairly smooth in surface texture. ***See fig. 44 to the right.***	
	2	200	100	Sub-angular, elongated grain, with smooth surface texture. ***See fig. 45 to the right.***	

Fig. 45

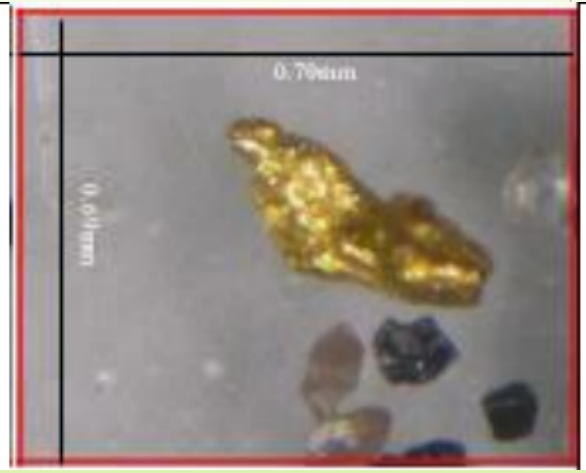
Source: Headley 2021

Gold Grain Morphology of Select Samples within Campbeltown

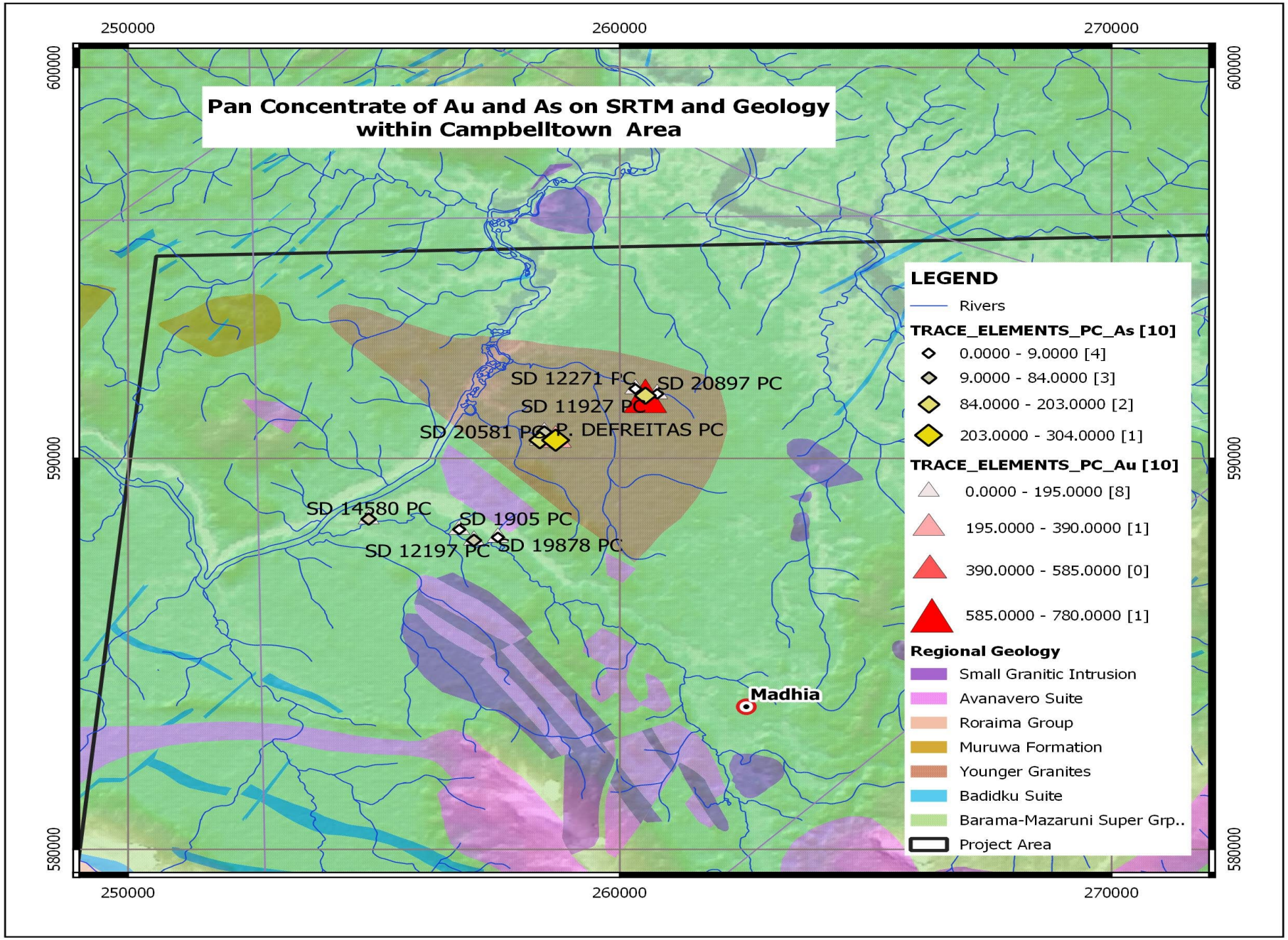
15	180	100	Poorly rounded, irregularly shaped grain, with smooth surface texture. ***See fig. 58 to the right.***		***Fig. 58***
16	200	160	Poorly rounded, irregularly shaped grain, with fairly smooth surface texture. ***See fig. 59 to the right.***		***Fig. 59***
17	280	120	Sub-angular, irregularly shaped grain, with rough surface texture. ***See fig. 60 to the right.***		***Fig. 60***

Source: Headley 2021

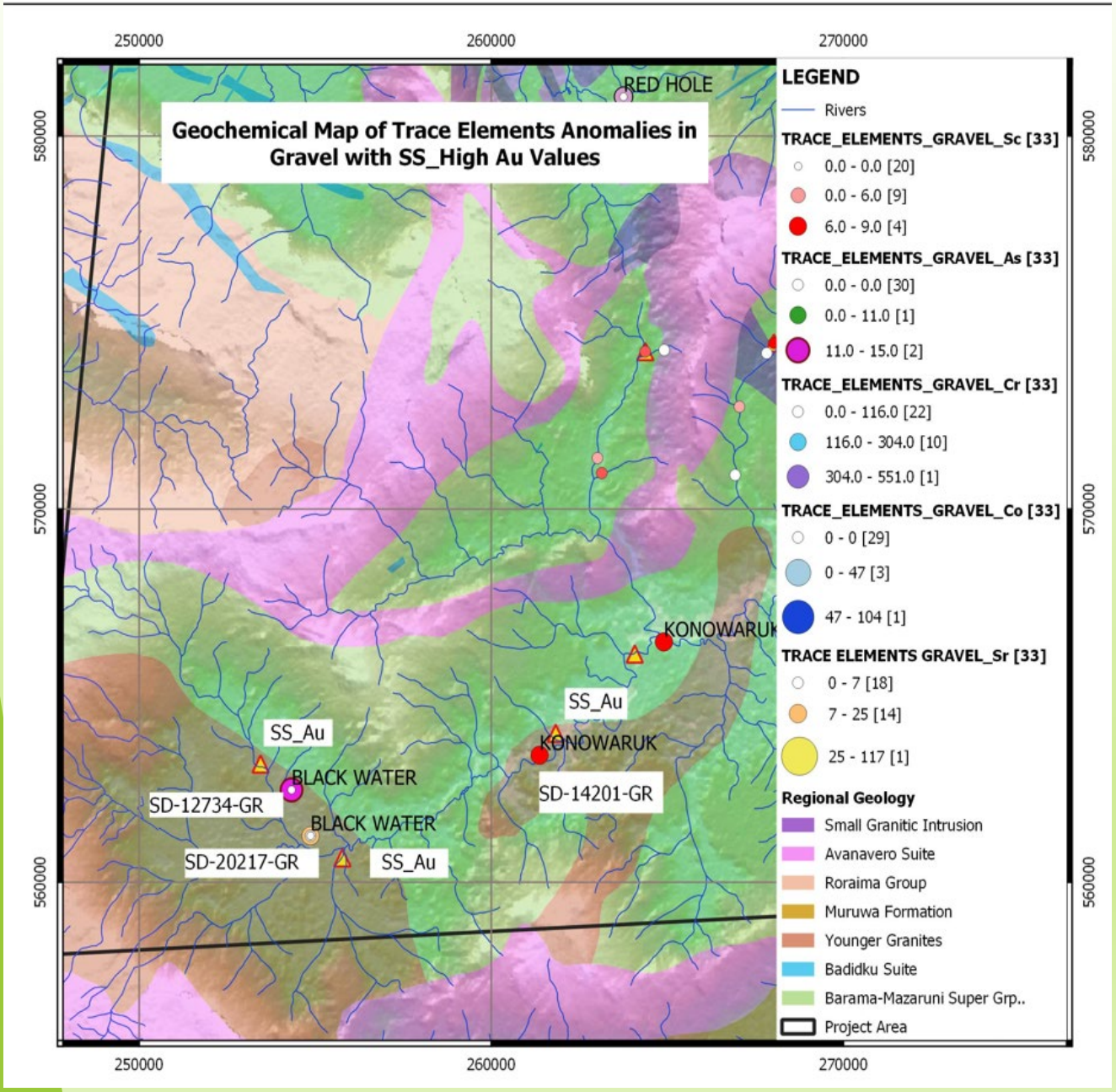
Gold Grain Morphology of Select Samples within Campbeltown

18	400	150	Sub-angular, elongated grain, with rough surface texture. ***See fig. 61 to the right.***		***Fig. 61***

Source: Headley 2021

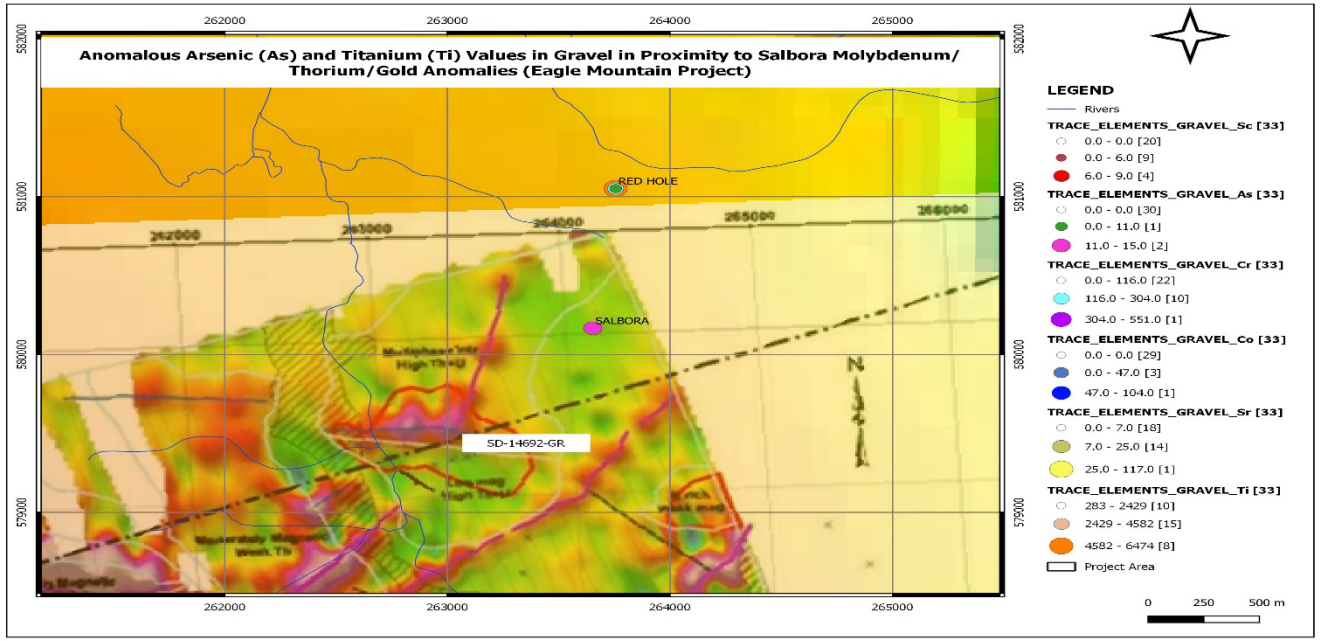

Pan Concentrate of Au and As on SRTM and Geology within Campbelltown Area
250000
260000
270000
600000
590000
580000
SD 12271 PC
SD 20897 PC
SD 11927 PC
SD 20581 PC
P. DEFREITAS PC
SD 14580 PC
SD 1905 PC
SD 12197 PC
SD 19878 PC
Madhia
LEGEND
Rivers
TRACE_ELEMENTS_PC_As [10]
0.0000 - 9.0000 [4]
9.0000 - 84.0000 [3]
84.0000 - 203.0000 [2]
203.0000 - 304.0000 [1]
TRACE_ELEMENTS_PC_Au [10]
0.0000 - 195.0000 [8]
195.0000 - 390.0000 [1]
390.0000 - 585.0000 [0]
585.0000 - 780.0000 [1]
Regional Geology
Small Granitic Intrusion
Avanavero Suite
Roraima Group
Muruwa Formation
Younger Granites
Badidku Suite
Barama-Mazaruni Super Grp..
Project Area

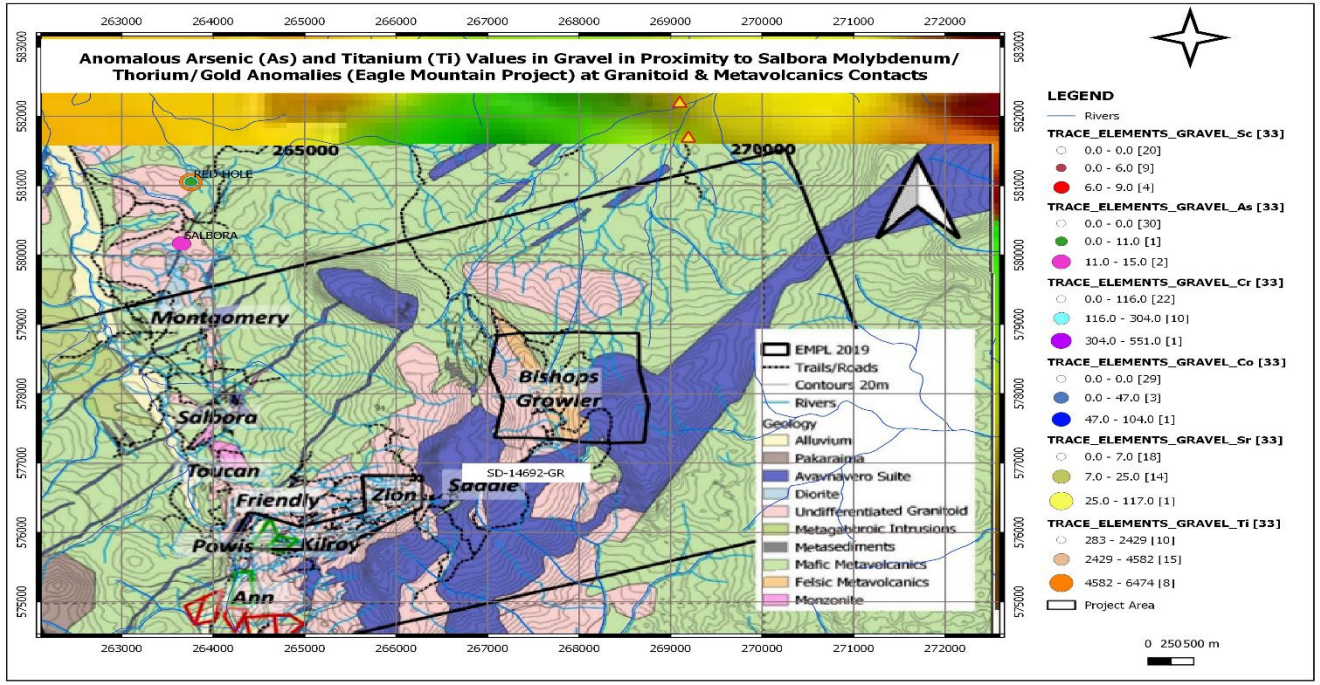
Interpretation and Discussion



SOUTH WEST QUADRANT(BLACK WATER AREA)

1) Apparent anomalous Arsenic(As) located at geological contact of Meta Volcanic and younger Granitic intrusive.
2) Active medium scale mining operations ongoing at sample site.
3) Arsenic (As) correlated with GGMC stream sediment Au BLEG anomaly.
4) Area is a target for follow up ampling and investigations.





CENTRE OF PROJECT AREA (RED HOLE AND SALBORA AREAS)

1) Apparent anomalous Arsenic(As) and Titanium(Ti) values located at geological contacts of Meta Volcanic and younger Granitic intrusive in Salbora and Red Hole (close proximity to Mahdia).
2) Active small scale mining operations ongoing at sample sites.
3) Arsenic (As) anamoly within close proximity to radiometric anamoly (Thorium and Uranium) anamoly.
4) Radiometric anamoly is a Molybdenum/Gold mineralization within the Eagle Mountain Gold Project(Gold Source NI 43-101 2022).
5) Area is a target for follow up sampling and investigations.

Recommendations and Next Steps

1) Gold grain morphological studies for every sample site should be done,
2) A higher efficiency industry accepted XRF machine should be sourced to give better results,
3) Samples should be taken of gravel, pan concentrate and other easily accessible sample sites in other mining camps/ mining districts,
4) Samples to be analyzed with XRF(for trace elements in gravels) and Fire Assay (Au in Pan Concentrate)

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