Integration of the regional gravity and regolith geochemistry datasets in the area of Gascoyne Complex and Bangemall Supergroup

by

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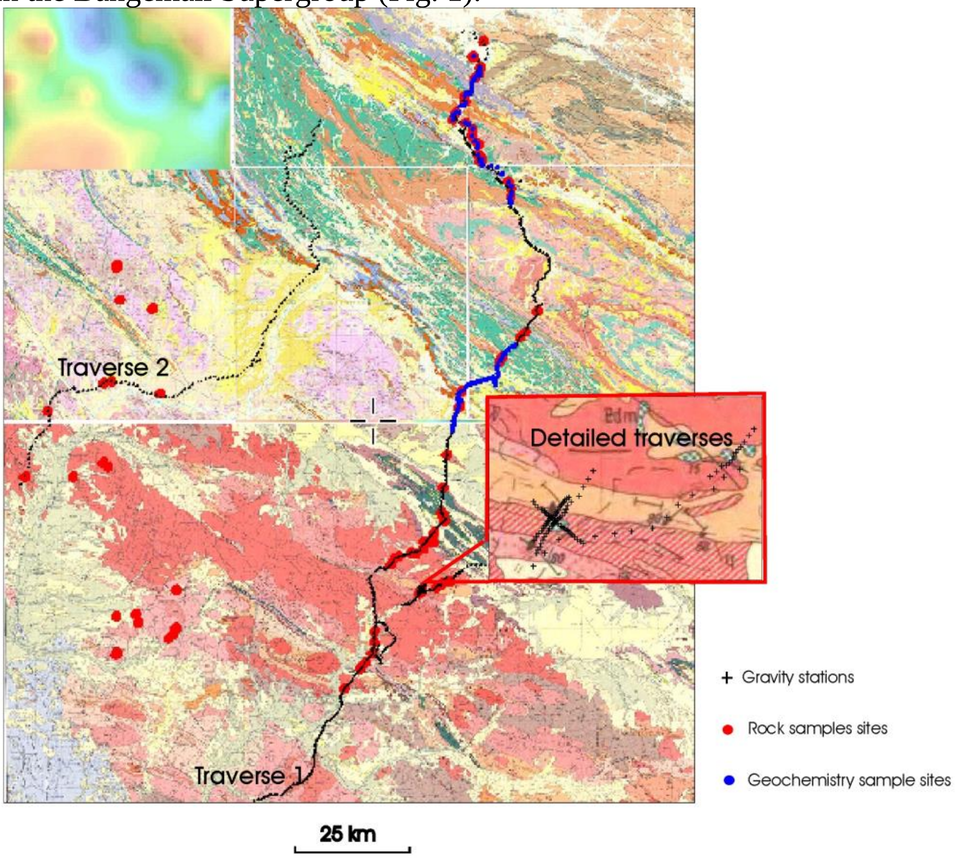
Abstract

Integration of regional datasets; gravity and regolith geochemistry over the Gascoyne Complex and Bangemall Supergroup delineate areas prospective for mineralisation. Gravity traverses across Gascoyne Complex and Bangemall Supergroup were conducted for modelling these units. Petrophisical properties of the rock samples collected in the area were analysed and used for modelling. Detailed regolith sample traverses were conducted across interpreted regional geochemical anomalies confirming that originally interpreted anomalous areas are prospective for mineralisation and further detailed exploration is needed.

Introduction.

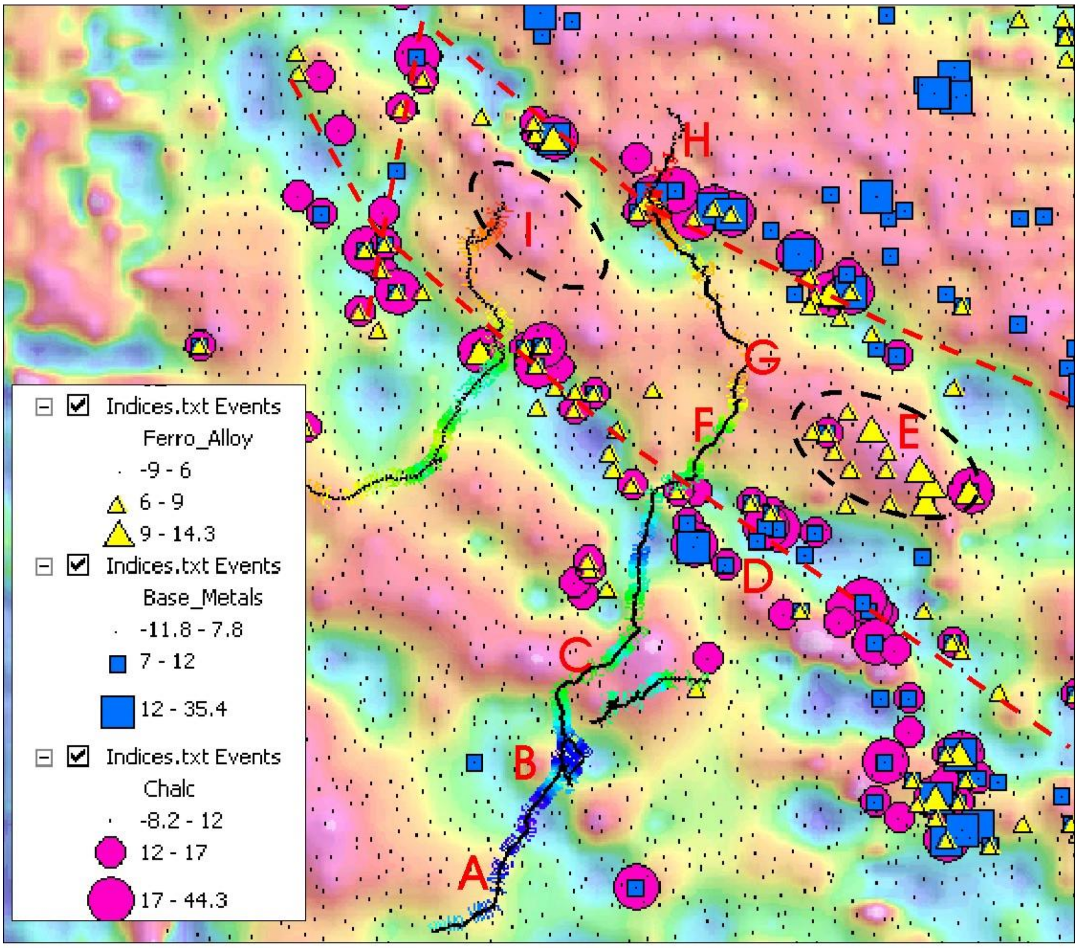
In October-November 2004, the Geological Survey of Western Australia (GSWA) carried out two regional gravity traverses across Gascoyne Complex and Bangemal Supergroup (Fig. 1). The survey was part of a GSWA project of regional interpretation and modeling of geophysical and regolith geochemistry data over the region. Detailed regolith samples were collected along the gravity traverse across the interpreted regional structures and regolith geochemistry anomalies to test prospectively for mineralisation the structures interpreted from regional interpretation in the Bangemall Supergroup (Fig. 1).



Regional and detailed gravity traverses at Gascoyne Complex and Bangemall Supergroup

Fig.1

The regional gravity traverses were conducted using four-wheel drive vehicles along the tracks and parts of cross-country areas over Mount Phillips and Edmund 1:250 000 geological map sheets. Traverse 1 intersected major part of Gascoyne Complex, Bangemall Supergroup and part of the Ashburton Basin. This traverse was used for modelling as it covers all major regional geological units. Traverse 2 intersected only Gascoyne Complex and part of Bangemall Supergroup because of the limited access by vehicle and was not used for modelling in this report.



Regolith Geochemistry standard score indexes above 95 percentile over the image of First Vertical Derivative of Bouguer Gravity

Fig. 2

The type and volume of work has been done in the project are listed in the table below. The gravity survey specifications are listed in Appendices 1-3.

Type of work	Spacing	Stations/Samples
Regional Gravity traverses	1 km	656
Detailed traverses	50-100 m	84
Regolith geochemistry sampling	0.5-1.0 km	95
Rock samples	Variable	258

Regional interpretation

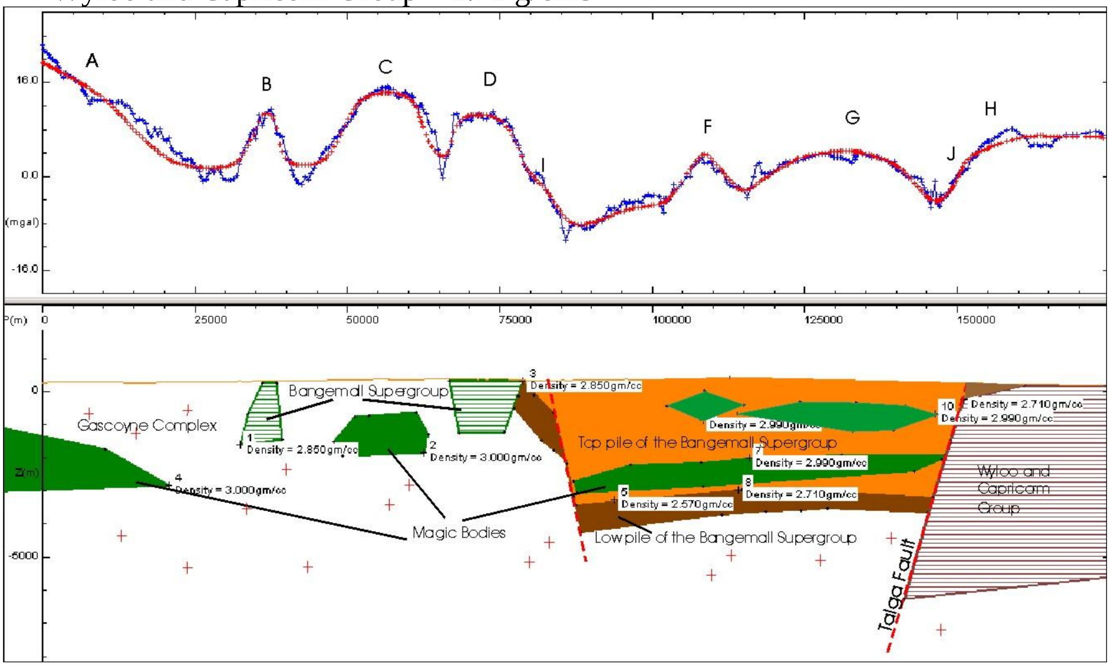
Interpretation of regional gravity and regolith geochemistry data over the Gascoyne Complex and Bangemal Supergroup region indicates two regional geochemistry anomalies likely associated with two NW major regional structures interpreted from regional gravity data. Regional gravity data of 11x11 km collected by Geoscience Australia in 60ss were used this interpretation. The standard scores of Chalcophile Index (As+Ag+Bi+Cd+Sb+Mo+Se+W), Base Metals (Cu+Pb+Zn+Sb+As+Bi+Sn) and Ferro-Alloy Indexes (Ni+Cr+Mo+Co+V) (Fig.2) (gasc_Indices_only.xls) were calculated for regional regolith geochemistry datasets and levelled for the whole area of the Gascoyne Complex and Bangemal Supergoup regions for the data collected by GSWA in 1995-2000.

Interpretation and discussions.

Modelling

Analisys of the rock densities shows that the rocks of the area of investigation can be subdevided in the following subdivisions(piles) that can be related to specific anomalies in the geophysical modelling:

- Mafic bodies (dolerites) 2.99 g/cm3, for dolerite sills in the Bangemall Supergroup and mafic intrusions in the Gascoyne Complex.
- Granitic rocks of the Gascoyne Complex - 2.68 g/cm3
- Bagemall Supergroup is devided in low part with high density sedimentary rocks with Yilgatherra and Irregully Formations of 2.73g/cm3 average density and upper part of the Supergroup of low density sedimentary rocks with average density 2.57 g/cm3. Average density for the Bangemall Supergroup sedimentary rocks is 2.58 g/cm3.
- Wyloo and Capricorn Group – 2.71 g/cm3



Gravity model of the traverse 1 across Gascoyne Complex and Bangemall Sopergroup

Fig. 3

Most of the modelled positive gravity anomalies *A, C, F, G B, D* on Fig. 2 and Fig 3 are related to high density mafic bodies. Bodies *1* and *3* have been mapped from the surface as Bangemall Supergroup rocks within Gacsoyne Complex. It was assumed that 50% of bodies *1* and *3* volume cosist of dolerites with the average density 2.85 g/cm3 for the entire body. Body 2 is interpreted and is not mapped from the surface. The detailed traverses conducted over the small dolerite body modelled as 3D plug of the lens-shape with diamentions of 100 m as a thickness and diameter of 340 m across the body with as a magma chamber below show on the cross-section *D-E*(Fig. 4b). The Bouguer Gravity on Figure 4a, as a plan vew, shows that small anomaly *A* produced by a small plug body (projected on the surface) is likely a part of that regional anomaly *C* (Figs 2 and 3) likely produced by a big mafic body 2 on Fig 3 that could be the source of the magma material for the numerous dolerite and gabbro intrusions mapped in the area of this regional anomaly.

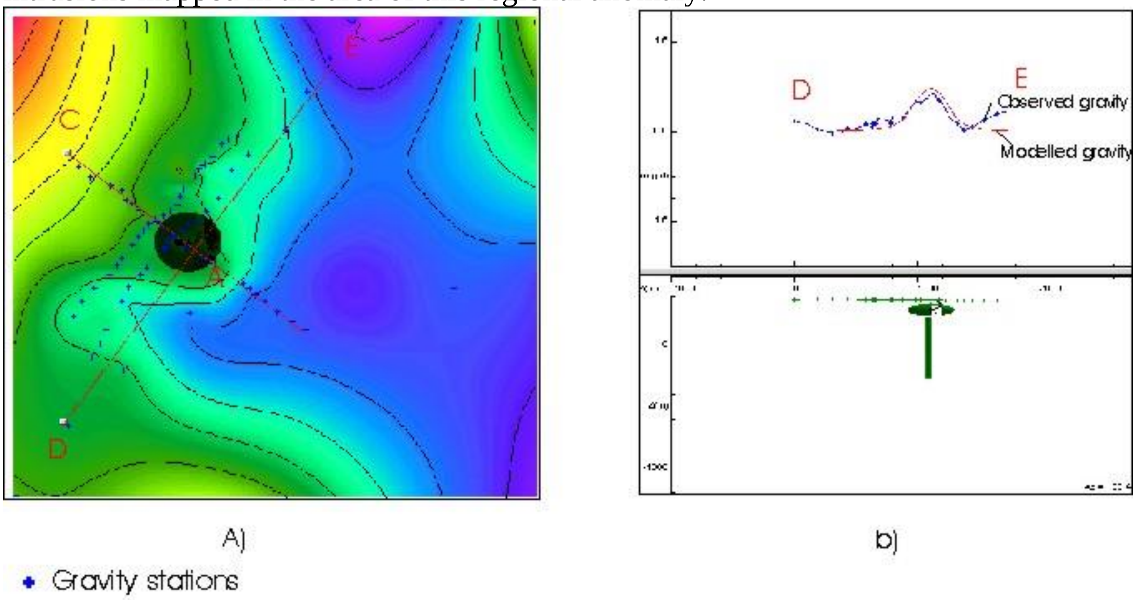


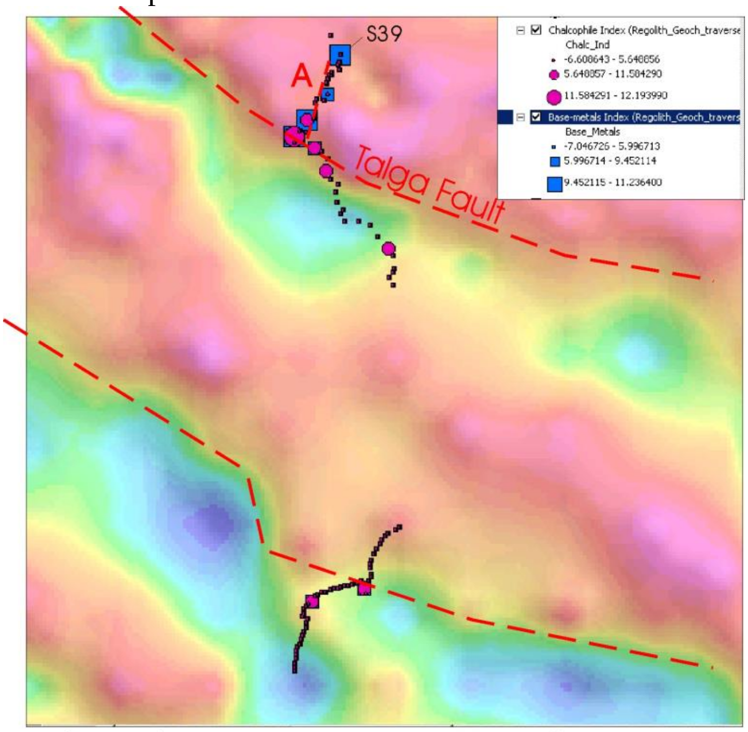
Fig. 4 Modeling of the detailed gravity traverses over mafic body

The positive anomalies *F* and *G* (Fig. 3) are likely relate to the thickest dolerite sills within sediments of across Bangemall Supergroup. Athough it is difficult to define the shape of the dolerite sills, the intensity of gravity anomaly can be related to the thick dolerite intrusions, up to 1000 m and close to the surface.

The highest anomalies *E* and *I* on the regional gravity shown as black dashed lines (Fig. 2) are also likely related to thickest parts of mafic intrusion bodies in the area within Supergroup. The combination of gravity anomaly *E* (Fig. 2) relating to a thickest dolerite intrusion and the highes scores of Ferro-Alloy indexes (Ni+Cr+ Mo+Co+V) in the area of Kenneth Range suggesting this anomalous area can be prospective for PGE mineralisation.

The low density Bangemall Supergroup itself, creates a regional negative anomaly with the modelled depth to basement 4-5 km. Steep gradient *I* (Fig.3) related to the fault structure on the western side of the regional negative anomaly. The eastern side of the low is also limited by steep gradient *J* related to Talga Fault. From, the fault is also contact between high density Ashburthon Basin rocks generating anomaly *H* (Fig. 2 and 3) and cristaline basement granitic? rocks below Bangemall Supergroup indicating the fault as the deep seated structure.

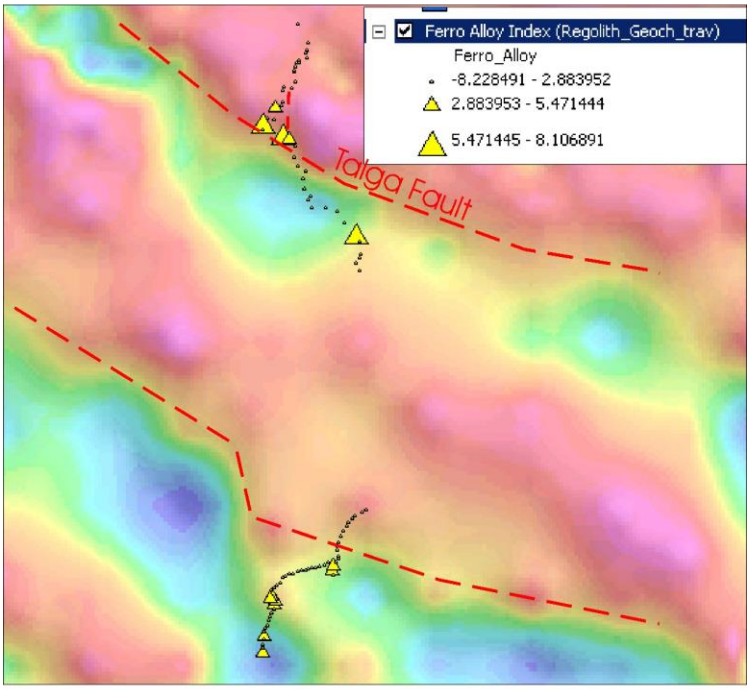
Interptretation of regional regolith geochemistry and regional gravity shows correlation of geochemical anomalies with regional linear gravity gradients interpreted as shear zones. The highest scores of Chalcophile, Base Metals and Ferro-Alloy Indexes are within or close to linear gravity gradients (Fig. 4). The best correlation along these structures for the elements are Zn, Cd and As, Pb. Particularly well the geochemical anomalies coincide with north-western structure mapped as Talga Fault and is likely to be the major deep-seated shear zone. The structure is likely a pathway system for mineral fluids formed regional geochemical anomalies and can be potential for Abra stile base metal mineralisation along that structure.



Chalcophile and Base-metals Indexes of the detailed traverses over 1st vertical derivative of the Bouguer Gravity

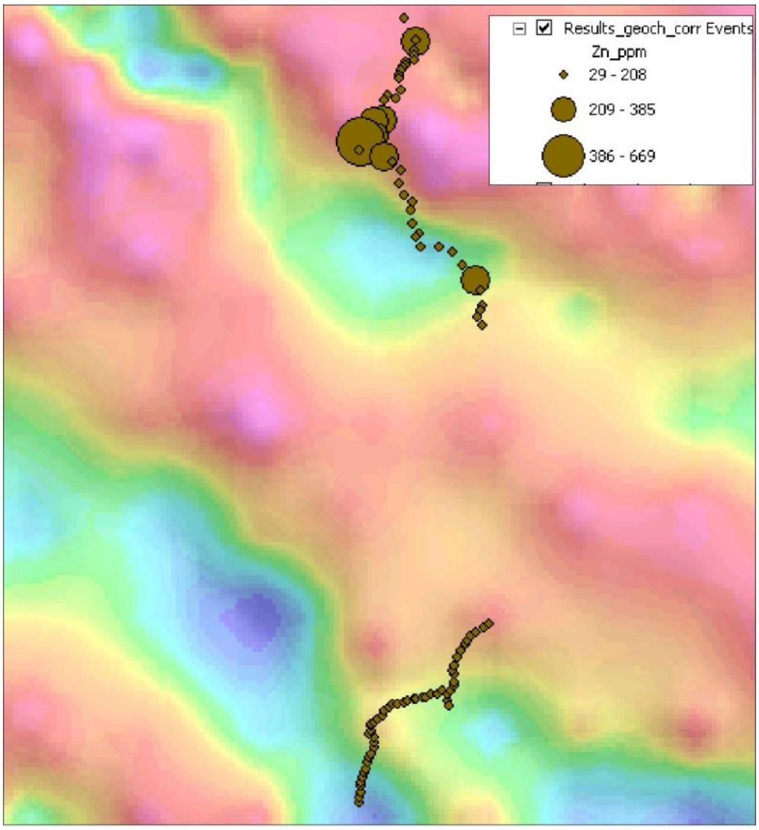
Fig. 5

Collected detailed regolith geochemistry samples over these two fault structures confirm regional geochemistry anomalies as the Chalcophile, Base Metals and Ferro-alloy Indexe Scores, particularly over Talga Fault (Fig. 5), just on the strong gravity gradient(Sample S39, Fig. 4 should be excluded as it was taken close to a probable gossan (to be analysed) within Mooline Formation). The highest values over the Talga Fault are Pt, Mo, W, Mo, As, Zn elements Figs. (7-10). The smaller structure *A* (Fig. 5) in the vicinity of the highest standard scores also interpreted as deep seated fault intersects the magor shear zone. This fault is also partly mapped on the surface. The intersection of two major structures can be important factor for to generate geochemical anomaly and possible mineralisation.



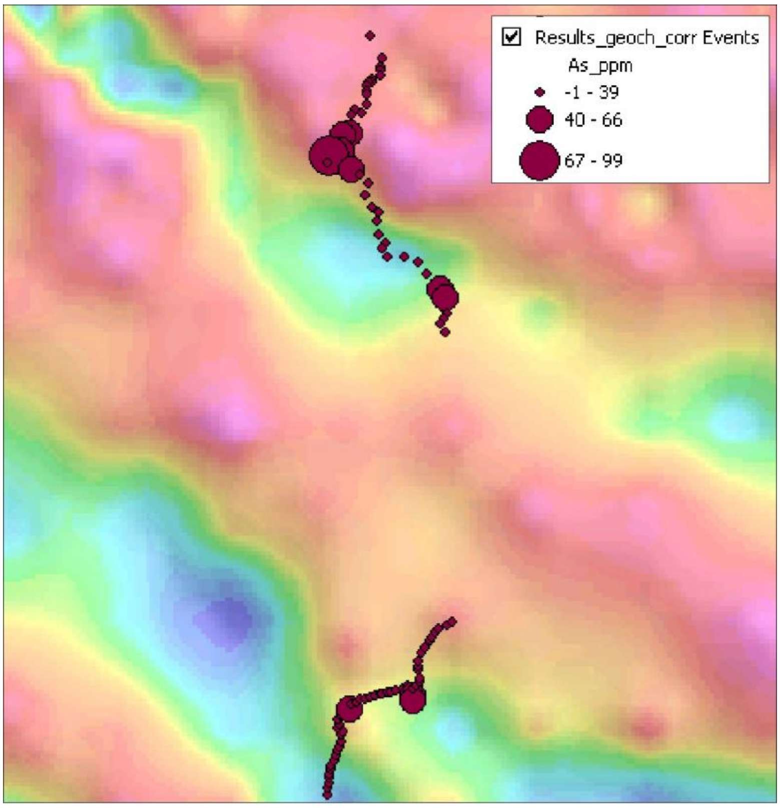
Ferro-alloy Indexes of the detailed traverses over 1st vertical derivative of the Bouguer Gravity

Fig. 6



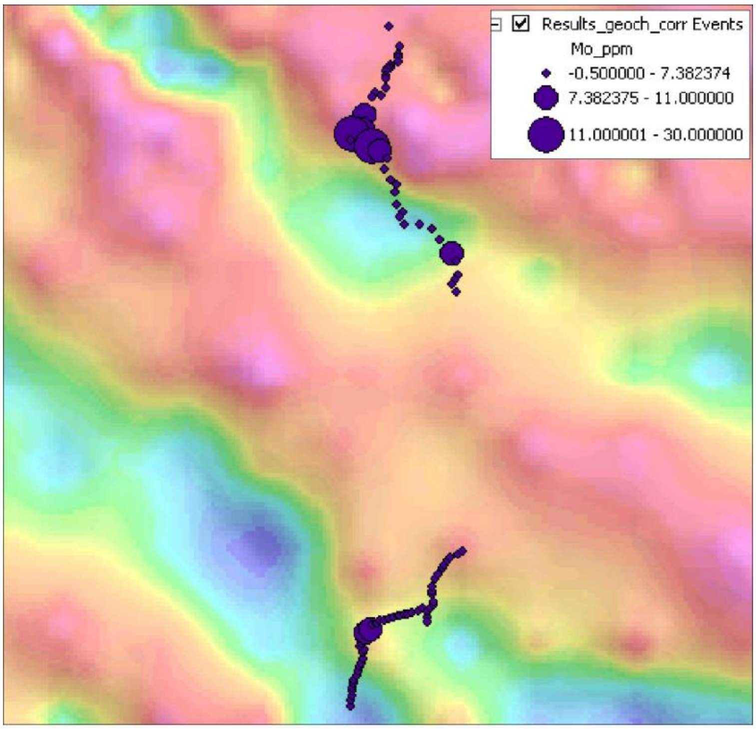
Zn ppm values of the detailed traverses over 1st vertical derivative of the Bouguer Gravity

Fig. 7



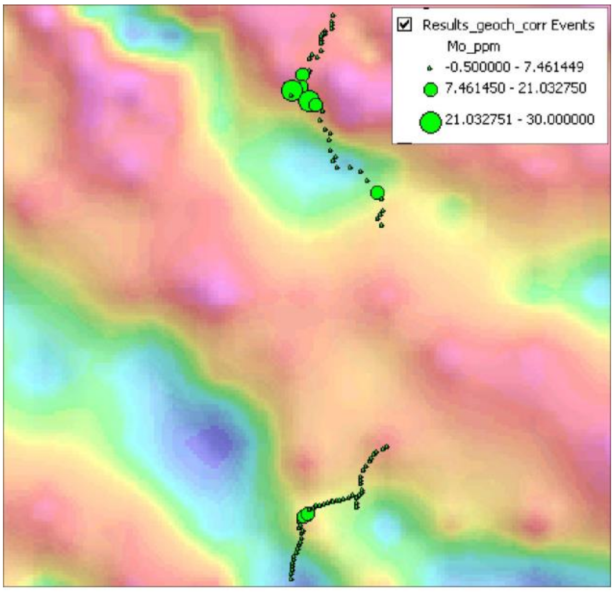
As ppm values of the detailed traverses over 1st vertical derivative of the Bouguer Gravity

Fig. 8



Mo ppm values of the detailed traverses over 1st vertical derivative of the Bouguer Gravity

Fig.9



Mo ppm values of the detailed traverses over 1st vertical derivative of the Bouguer Gravity

Fig 10

Conclusions.

- Large interpreted mafic bodies within the Complex Comples modelled at the depth 1-1.5 km could be the source of the small mafic bodies mapped from the surface.
- Low density sediments of the Bangemall Supergroup are responable for the regional gravity low. Positive gravity anomalies within this gravity low is likely produced by thick dolerite intrusions within Bangemall Supergroup sediments.
- Area along the Talga Fault interpreted as a major deep-seated shear zone and is likely a pathway for mineral fluids produced regional regolith geochemistry anomalies along this structure. The area is interpreted as prospective for Abra base-metal style mineralisation.
- Kenneth Range area where highest values of Ferro-Alloy Indexes coinside with highest gravity values likely relates to thick dolerite intrusions is interpreted as prospective for PGE mineralization.

Table 1.

Petrophisical properties of the rock within Gascoyne Complex and Bangemall Supergroup.

N	Sampl_ name	GSWA N	Sample /Num	Dens_Range	Density	Av_Pile_Dens	Formation	Sus. Range	Aver. Sus.
1	S29	184901	S29/7	2.68-2.77	2.73		**Ashburton F.** PWa-s	10-40	25
2	S24	184902	S24/3	2.56-2.61	2.59		**Baywash F.** PRb-s ??	30-40	35
3	S25	184903	S25/3	2.68-2.76	2.72		**Baywash F.** PRb-s	10-20	15
4	S-26	184904	S26/5	2.74-2.77	2.76		**Mooline F**. PRm-s	18-22	20
5	S27	184905	S27/4	2.70-2.73	2.71	2.71	**Mooline F.** PRm-s	10-45	27
6	S20	184906	S20/6	2.60-2.66	2.63		**Yilgatherra F** PMEy-s	0	0
7	S30	184907	S30/9	2.54-2.85	2.70		**Irregully F.** PMEl-k	0-10	5

8	S32	184908 S32/2	2.83-2.85	2.84	2.73	**Irregully F.** PMEl-k ?	0	0
9	S31	184909 S31/3	2.68-2.78	2.75		**Gooragoora F**. PMIg-st	0-30	15
10	S33	184910 S33/4	2.42-2.53	2.46		**Gooragoora F**. PMIg-st	10-20	15
11	S35	184911 S35/2	2.38-2.39	2.38		**Blue Billy F** PMEb-sl	0-10	5
12	S36	184912 S63/2	2.51-2.63	2.57		**Cheyne Springs F** PMEp-k ?	0-20	10
13	S38	184913 S38/3	2.55-2.67	2.62		**Cheyne Springs F** PMEp-k ?	0-20	10
14	S34	184914 S34/2	2.50-2.53	2.52		**Kiangi Creek F** PMEk-s	0-10	5
15	S37	184915 S37/3	2.54-2.68	2.61		**Kiangi Creek F** PMEk-s	0-20	10
16	S40	184916 S40/2	2.55-2.56	2.56		**Kiangi Creek F** PMEk-s	0-10	5
17	S41	184917 S41/3	2.51-2.60	2.55		**Kiangi Creek F** PMEk-s	0-10	5
18	S42	184918 S42	2-53	2.53		**Kiangi Creek F** PMEk-s	0-10	5
19	S23	184919 S23/4	2.47-2.61	2.52		**Kiangi Creek F** PMEk-sl	0	0
20	S22	184920 S22/6	2.41-2.61	2.57		**Kiangi Creek F** PMEk-sl	0	0
21	S22A	184921 S22A/3	2.38-2.58	2.49		**Kiangi Creek F** PMEk-sl	0	0
22	S21	184922 S21/5	2.48-2.60	2.54		**Kiangi Creek F** PMEk-sl ? 1:250000	20-40	30
23	S15	184923 S15/6	2.42-2.58	2.49		**Kiangi Creek F** PMEk-sl	0	0
24	S15 A	184924 S15A/6	2.45-2.53	2.53		**Kiangi Creek F** PMEk-sl	0	0
25	S43	184925 S43/2	2.62-2.64	2.62		**Discovery F** PMEd-c	0-10	5
26	S17	184926 S17/5	2.54-2.60	2.58		**Discovery F** PMEd-c 1:250k	0	0
27	S16	184927 S16/4	2.52-2.57	2.55		**Discovery F** PMEd-c 1:250k	0	0
28	S61	184928 S61/2	2.68-2.76	2.72		**DevilCreeck F** PMEv-k	30-40	35
29	S44	184929 S44/3	2.47-2.66	2.56		**Ullawarra F** PMEl-s	0-20	10
30	S64	184930 S64	2.69	2.69		**Ullawarra F** PMEl-s	10-20	15
31	S60	184931 S60/5	2.61-2.63	2.63		**Ullawarra F** PMEl-s	20-50	35
32	S45	184932 S45/2	2.63-2.58	2.61		**Coordardoo F** PMEc-s	0	0
33	S-62	184933 S62/8	2.45-2.67	2.56	2.57	**Backdoor F** PMCk-d	0-10	5
34	S-63	184934 S63	2.89	2.89		**Dolerite** Pod1,2	50-55	52
35	S18	184935 S18/4	2.95-2.99	2.97		Dol	50	50
36	S19	184936 S19/1	3.01-3.04	3.02	2.99	Dol	50-60	55
37	S14	184937 S14/6	2.13-2.40	2.29		**Mt Aug SS**	0	0
38	N1	184938 N1/6	2.56-2.59	2.57	2.43	**Mt Aug SS**	0	0
39	N10	184939 N10/7	2.62-3.58	3.25		BIF	0-15	8
40	2020	184940 2020		2.78		Sedim(Pelitic gneiss)	1100	1100
41	2016	184941 2016/3	2.74-2.84	2.77		Sedim(Pelitic gneiss)	2000	2000
42	S101	184942 S101/2	2.69-2.73	2.70		Sandstone, feldsphatic	190-210	200
43	S52	184943 S52/5	2.72-2.79	2.76	2.75	Metasedim shist	30-40	35
44	N11	184944 N11/1	2.64-2.7	2.68		**Mt James F**	120-200	160
45	2003	184945 2003		2.72		Monzogranite	30	30
46	4007	184946 4007		2.76		Granodiorite	30	30
47	2014	184947 2014/2	2.65-2.67	2.66		Monzogranite	700	700
48	4002	184948 4002/1	2.60-2.62	2.61		Leicocratic Granite	0	0
49	Alma Well	184949 Alma/3	2.73-2.75	2.74		Monzogranit	0	0
50	F	184950 F/5	2.66-2.73	2.71		Monzogranite	1500	1500
51	G	184951 G/3	2.68-2.71	2.70		Monzogranite	800	800
52	K	184952 K2	2.64-2.71	2.68		Monzogranite	1000	1000
53	L	184953 L		2.73		Granitic gneiss	1500	1500
54	M22	184954 M22/5	2.69-2.79	2.71		Monzogranite	1000-1500	1250
55	M322	184955 M322/5		2.68		Porphyritic monzogranite	880-920	900
56	N12	184956 N12/3	2.65-2.70	2.67		Granite	0	0
57	N8	184957 N8/5	2.59-2.64	2.62		Monzogranite foliated, coarce grained	0	0
58	N9	184958 N9/7	2.59-2.68	2.62		Monzogranite foliated, leucocratic	0	0

59	S100	184959	S100/7	2.72-2.77	2.75		Granodiorite Foliated, Biotite	5-10	7
60	S102	184960	S102/3	2.74-2.76	2.75		Tonalite, med-c grained	0	0
61	S104	184961	S104/3	2.67	2.67		Monzogranite	590-610	600
62	S2	184962	S2/7	2.64-2.74	2.70		Monzogranite	0	0
63	S3	184963	S3/4	2.62-2.71	2.66		Monzogranite	0	0
64	S4A	184964	S4/1		2.59		Monzogranite	0	0
65	S4	184965	S4/5	2.53-2.77	2.60		Monzogranite	0	0
66	S50	184966	S50/4	2.64-2.73	2.69		Monzogranite	0	0
67	S51	184967	S51/7	2.69-2.83	2.73		Monzogranite, foliated, solicif	0	0
68	S54	184968	S54/3		2.68		Granite	20-45	37
69	S55	184969	S55/2	2.57-2.70	2.63		Granite		
70	S 56	184970	S56/3	2.65-2.69	2.66		Granite	0	
71	S57	184971	S57		2.55		Brecchiatecd granite		
72	S58	184972	S58/2	2.65	2.65		Tonalite, med-c grained	0	0
73	S59	184973	S59/1	2.75-2.76	2.76		Granite, c gr		
74	S6	184974	S6/6	2.74-2.77	2.75		Monzogranite, c gr	0	0
75	S7	184975	S7/6	2.63-2.65	2.64		Monzogranite, med-coarse grained, porph	0	0
76	S7A	184976	S7A/6	2.57-2.63	2.60	2.68	Monzogranite, med-coarse grained, porph	0	0
77	WGS84	184977	WGS84		3.01		?	1600-1900	1750
78	M14	184978	M1		3.05		Dolerite	100	100
79	S56/1	184979	S56/1		2.93		?		2000
80	N12A	184980	N12/2	3.08	3.09		Dolerite		
81	Doler	184981	D/5	2.91-3.00	2.94		Dolerite	30-40	35
82	H	184982	H7	2.78-3.06	2.96		Amphibolites	3000-6000	4500
83	S53	184983	S53/3	2.79-3.26	3.04		?	40-60	50
84	M	184984	M1		2.88		?		
85	S103	184985	S103		2.84		Granodiorite	5	5