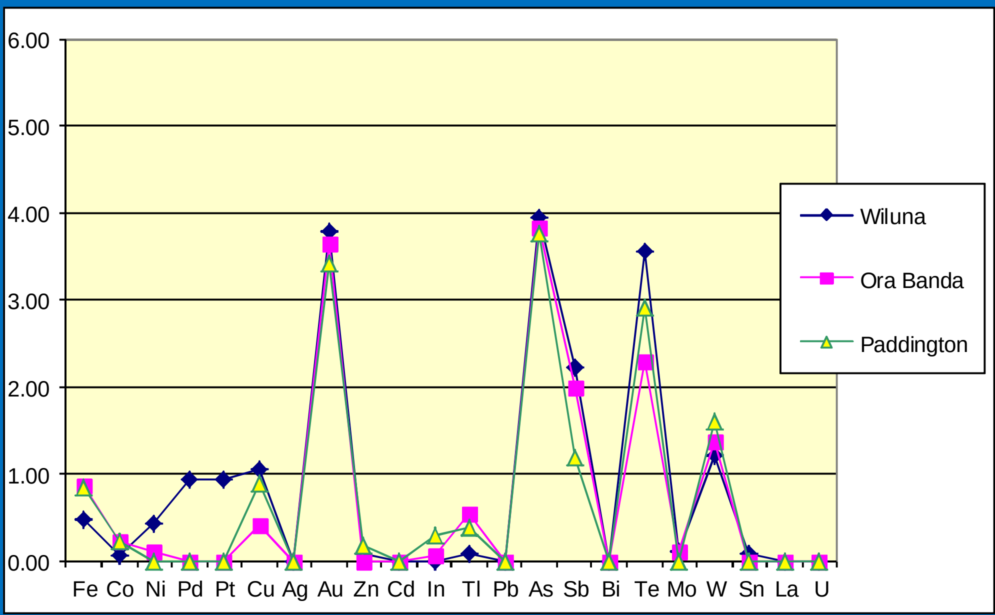
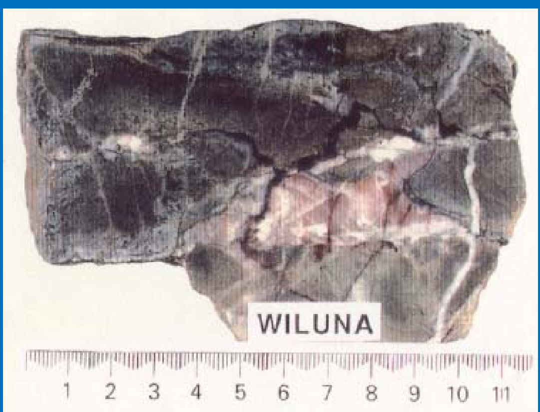
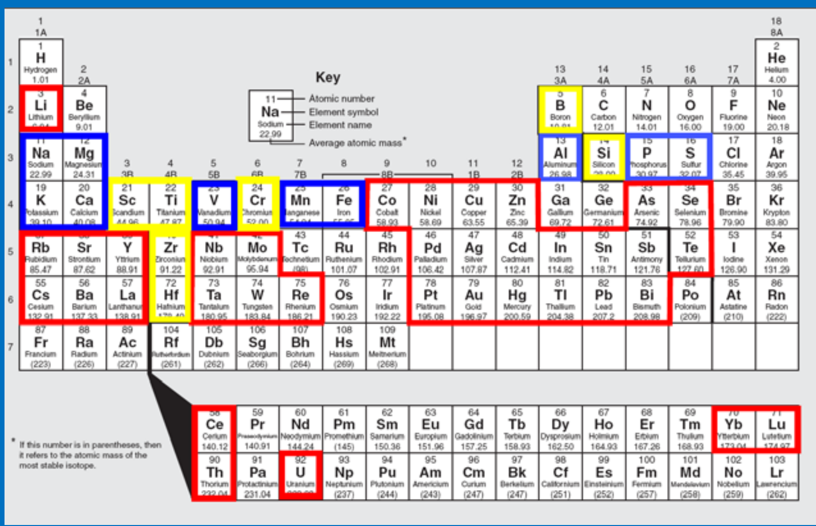
OSNACA FUNDING PROPOSAL

by Carl Brauhart

Geologist – Sipa Resources Limited







Executive Summary

A fund will be established by the Geoscience Foundation on behalf of the Centre for Exploration Targeting (CET) at the University of Western Australia. Its sole purpose is to pay for analytical costs at Bureau Veritas - Ultratrace Laboratories in Perth where ore deposit samples from around the world are being analysed for a comprehensive suite of 53 ore, pathfinder, major and lithogeochemical elements.

The OSNACA Project (Ore Samples Noramlised to Average Crustal Abundance) is an "open source" project where assay data will be made freely publically available through the CET's website as soon as it becomes available. Your organisation is invited to consider contributing to this fund. A recommended amount of $10,000 will pay for 150 analyses at $67/sample.

The fund will reside with the UWA Geoscience Foundation where contributions of this nature are viewed as a donation to UWA, and are fully tax deductible.

Introduction

The idea to create a large database of geochemical analyses was conceived at Sipa after work on a dataset from MERIWA Project M123 ***"The Geochemistry of Archaean Gold Ores from the Yilgarn Block of Western Australia: Implications for Gold Metallogeny"***. A new mathematical technique that quantifies differences in multi-element ore-signatures was developed during that work, but a search for suitable data to test the idea further proved fruitless.

Hence, Steffen Hagemann at the CET was approached to get access to the large collection of ore deposit samples housed at the centre. Simultaneously, Eric Grunsky from the Geological Survey of Canada became involved to assist in the development of the mathematical model.

Thus, the aim of the OSNACA Project is to analyse hydrothermal and magmatic mineralisation from around the world for an extensive (and more importantly consistent) suite of elements, and use these data for research. Sipa Resources have committed $20,000 towards analytical costs and are paying for a student to prepare the samples. Sipa and the CET are underwriting a further $20,000 each towards analytical costs, in anticipation of strong industry support. If funds from industry do not amount to $40,000 or more, Sipa and CET will make up the shortfall between them, so that a minimum analytical budget of $60,000 is assured.

Data will be made freely accessible through CET's website as soon as it becomes available. Research on these data by Brauhart, Grunsky and Hagemann will also be made available as soon as practical.

Deliverables

All deliverables will be publicly available free of charge. However, by supporting this project you will play a part in delivering the following outcomes

1. A database of at least 1,000 (and, if funding allows), several thousand ore deposit analyses for 53 ore, pathfinder, major and lithogeochemical elements. Samples that represent all commodity types and ore deposit styles will be included.

2. A matching catalogue of hand specimens and sample pulps which is publicly available for further study

3. Results of research by Brauhart, Grunsky and Hagemann into measuring differences in multi-element ore deposit signatures

Ore Deposit Samples

Steffen Hagemann has collected and curated samples over the last 15 years from hundreds of ore deposits around the world representing all of the major classes of metallic mineralisation. Collections from David Groves, Brett Davis and others have been incorporated into this collection. More samples are being gathered from Peter Muhling, Leigh Bettenay and other geologists with large sample collections.

Sample preparation by Curtin University student Sofi Redgrave is underway with the first batch of 180 samples submitted to Bureauveritas-Ultratrace on 17 June 2011. All reference samples and assay pulps will be stored at the CET and made available for study.

This first stage of the OSNACA Project will lead to a database of almost 1,000 samples exhausting the initial budget of $60,000. If support from industry takes the OSNACA budget beyond $60,000 then further sample material will be sought. Suggested sources of additional material include:

• CODES (Univesity of Tasmania)	Ross Large
• EGRU (James Cook University)	Tom Blenkinsop
• MDRU (University of British Columbia)	Craig Hart
• Geological Survey of Canada	Benoit Dube
• PIRSA	Tim Baker
• CSIRO	John Walshe
• Various Mining Companies	

Unfortunately Data Metallogenica samples are not available for destructive analyses.

Analyses

Ultratrace Laboratories have provided a generous quote for analysing the samples; **$67** for the 53 elements highlighted in Figure 1. These analyses will be performed by ICP-MS and ICP-AES after preparation by Fire Assay (Au, Pt, Pd), Aqua Regia Digest (Au, Hg, Ag, Te, Bi) Peroxide Fusion (Si, Zr, Ti, Hf, Cr, Sc, B) and Mixed Acid Digest (Remaining Elements, plus Ag, Te, Bi). This analytical package is the best type routinely available for the ore and trace metals of interest, and it also provides acceptable data for sulphur and major elements.

Additional analyses for part, or all of the database samples will be possible using the library of sample pulps. Data could be collected for such things as a full PGE suite, full REE suite, CO2, etc.

Statistical Treatments

A new mathematical technique that ***quantifies*** the difference in metallogenic signature between two samples of hydrothermal mineralisation has been developed. It has long been recognised that different ore deposits are enriched in different groups of metallic elements (e.g. Au-Ag-Sb-As-W for one type of orogenic gold mineralisation, Au-Bi-Te-W for another type of orogenic gold mineralisation, Cu-Mo-Bi-Te-Ag for a porphyry copper sample, and Zn-Pb-Ag-Cd-Tl-In for a carbonate hosted base metal sample). These "fingerprints" are used to

Periodic Table of the Elements

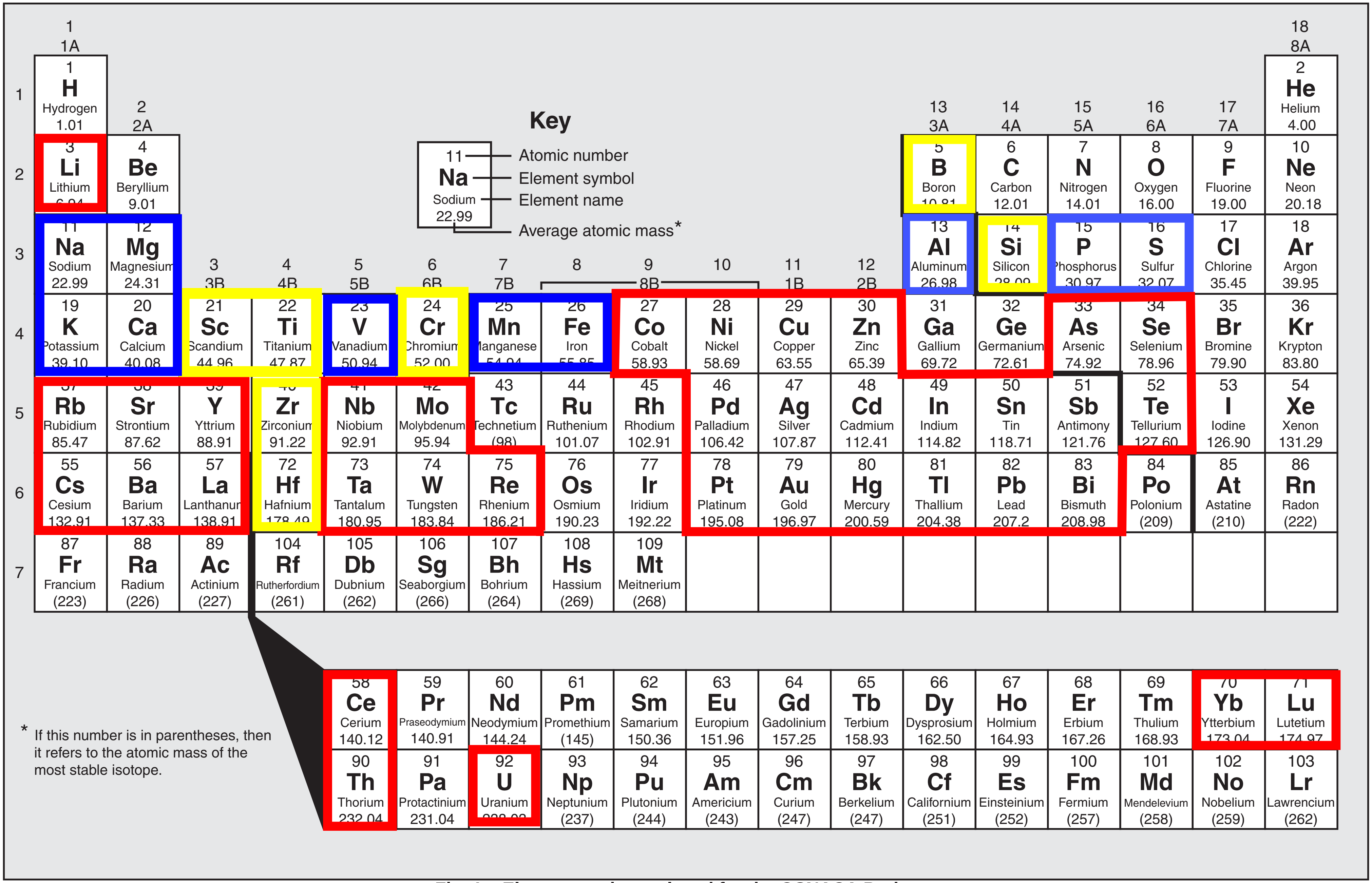


Fig. 1. Elements to be analysed for the OSNACA Project

distinguish different types of hydrothermal mineralisation, but subtle variations between fingerprints within single ore deposit classes have not been studied closely, nor have the many zones of overlap between ore deposit classes. In short, there has not been a statistical tool to tease out the fine detail involved.

Data for 22 metallic elements were selected from the MERIWA Project dataset and represent 22 dimensions in multi-dimensional mathematical space. These data were normalised to average crustal abundance (ACA) after replacing all values below ACA with ACA. The normalised data were then logged and scaled to a fixed distance from the origin (Fig. 2).

With all data a fixed distance from the origin in 22-dimensional space, the Euclidian distance between those two sample points is a proxy for the angle between their "origin to sample point" vectors. Samples with very similar metal signatures lie in very similar directions away from the origin. Therefore, the angle between "origin to sample point" vectors is very small. Consequently the Euclidian distance between scaled sample points is small. Dissimilar samples have large angles and commensurately large distances between them (Fig. 2).

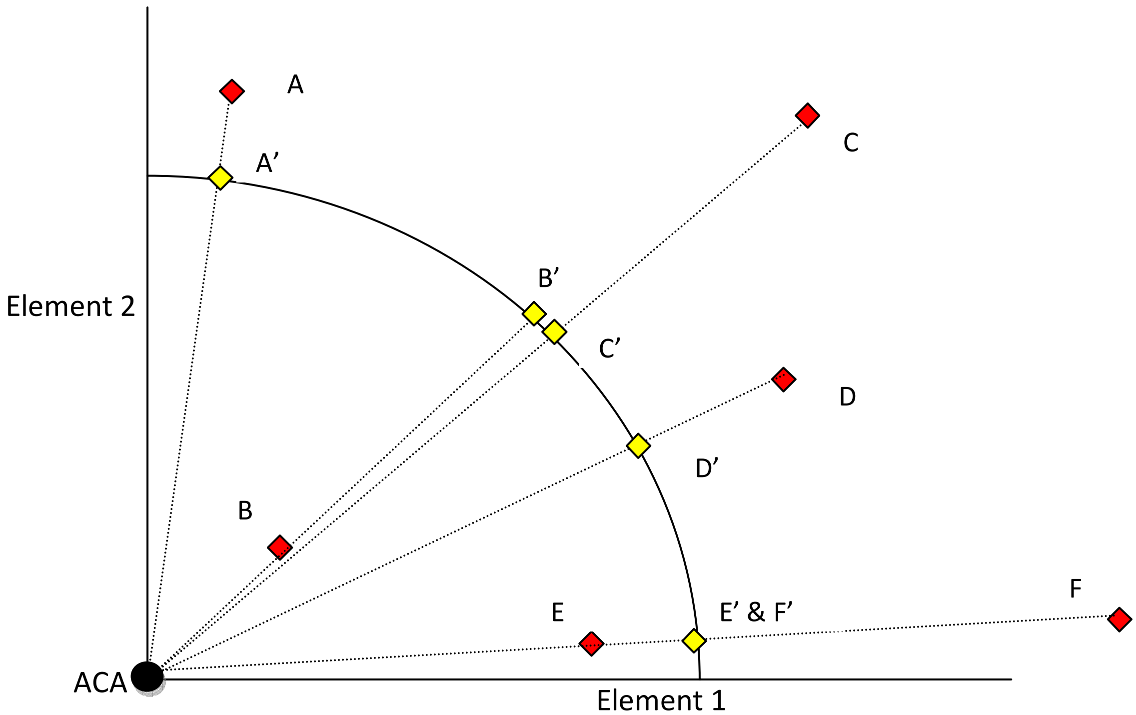


Fig. 2. Two dimensional representation of scaling data to a fixed distance from the origin. Unscaled data are red diamonds; scaled data are yellow diamonds. Distance between yellow dots is equivalent to the angle between "origin – sample point" vectors.

A matrix of Euclidian distance between all the scaled-normalised MERIWA data sample pairs (Fig 3) shows that Yilgarn gold deposit samples break into two major groups. The first groups are marked by Sb-As enrichment and the second group by consistent Te (weak Bi) enrichment. The first group are interpreted to be dominated by metamorphic mineralising fluid and the second group by magmatic mineralising fluid. Within both major groups there

	Griffin's Find 1	Race Track 2	Race Track 3	Race Track 1	Wiluna	Ora Banda	Paddington	Lancefield	Golden Crown	Marvel Loch	Big Bell	Edward's Find	Griffin's Find 2	Meekatharra 1	Meekatharra 2	Sons of Gwalia	Lady Bountiful	Boddington	Rothsay	Reedys 1	Reedys 2	Corinthian	Hopes Hill	Mt Morgans	Nevoria	Bounty	Lawlers	Westonia	Junction	Victory	Mt Pleasant	North Kalgurli	Mt Charlotte
Griffin's Find 1	0	3.94	5.14	5.50	7.12	6.08	6.81	5.92	6.93	4.63	5.73	4.96	5.20	5.43	6.81	6.52	9.37	7.87	10.26	9.30	8.38	8.90	10.14	9.54	7.92	8.15	8.75	9.09	9.13	9.35	6.67	7.15	7.65
Race Track 2	3.94	0.00	1.93	4.71	7.76	6.96	7.72	5.67	6.29	4.97	7.54	7.01	6.35	6.60	6.83	7.19	8.64	7.70	9.97	9.23	8.56	9.52	10.50	10.24	8.61	7.98	9.66	9.79	9.98	10.27	6.78	7.90	8.53
Race Track 3	5.14	1.93	0.00	5.65	8.43	7.88	8.60	5.65	6.77	5.69	7.75	8.01	7.35	7.64	7.33	7.73	8.66	7.57	9.92	9.37	8.71	9.63	10.58	10.20	9.03	8.11	9.99	9.97	10.07	10.33	7.33	8.38	9.12
Race Track 1	5.50	4.71	5.65	0.00	4.23	3.56	4.17	4.74	4.38	4.26	7.56	6.49	5.54	5.50	6.23	6.87	6.59	6.01	7.63	7.02	6.24	7.22	8.20	7.91	5.42	5.68	7.18	7.53	7.78	8.12	4.09	4.71	5.86
Wiluna	7.12	7.76	8.43	4.23	0.00	2.73	2.68	5.66	5.08	5.16	7.41	6.77	5.99	6.14	6.10	6.20	7.52	6.54	6.67	6.17	5.45	5.84	6.43	6.88	4.03	5.82	5.95	6.54	6.69	6.87	4.94	4.43	5.69
Ora Banda	6.08	6.96	7.88	3.56	2.73	0.00	1.92	5.83	5.11	5.24	6.90	5.31	4.59	4.40	5.69	6.14	7.97	6.92	7.44	7.53	6.38	6.63	7.71	7.21	4.27	6.07	6.08	6.82	6.95	7.32	4.82	4.68	5.70
Paddington	6.81	7.72	8.60	4.17	2.68	1.92	0.00	5.80	4.92	5.28	7.92	6.10	5.56	5.56	6.96	6.49	7.48	6.40	6.60	6.81	5.97	5.99	7.07	6.70	3.62	5.54	5.24	6.03	6.26	6.84	4.41	4.30	4.99
Lancefield	5.92	5.67	5.65	4.74	5.66	5.83	5.80	0.00	4.62	4.32	8.26	8.33	7.09	7.64	7.76	8.16	6.71	4.71	6.97	7.03	6.38	6.68	7.71	7.15	5.89	5.50	7.34	7.26	7.26	7.56	5.15	5.38	6.83
Golden Crown	6.93	6.29	6.77	4.38	5.08	5.11	4.92	4.62	0.00	4.02	9.25	8.04	7.05	7.20	7.64	7.68	6.03	6.56	6.69	6.43	5.84	6.97	7.34	6.97	5.23	5.18	6.51	6.45	6.96	7.18	4.25	5.23	6.24
Marvel Loch	4.63	4.97	5.69	4.26	5.16	5.24	5.28	4.32	4.02	0.00	7.25	6.41	7.05	7.13	7.27	6.85	6.48	6.53	8.03	6.32	5.61	6.89	7.61	7.65	6.12	5.99	6.35	6.91	7.43	7.58	4.19	4.97	5.21
Big Bell	5.73	7.54	7.75	7.56	7.41	6.90	7.92	8.26	9.25	7.25	0.00	4.84	6.91	6.81	6.54	6.14	9.99	8.57	10.44	9.22	7.92	8.21	9.43	8.76	8.18	8.83	8.13	8.61	8.40	8.19	7.75	7.50	8.02
Edward's Find	4.96	7.01	8.01	6.49	6.77	5.31	6.10	8.33	8.04	6.41	4.84	0.00	5.41	4.92	6.39	5.27	9.55	8.83	9.85	9.14	7.76	8.20	9.39	8.93	7.27	8.27	7.18	8.01	8.12	8.32	6.54	7.21	6.71
Griffin's Find 2	5.20	6.35	7.35	5.54	5.99	4.59	5.56	7.09	7.05	7.05	6.91	5.41	0.00	1.80	4.62	5.20	10.39	8.51	9.59	9.66	8.59	8.78	9.73	9.12	6.57	7.49	9.13	9.33	8.94	9.36	7.43	7.54	8.56
Meekatharra 1	5.43	6.60	7.64	5.50	6.14	4.40	5.56	7.64	7.20	7.13	6.81	4.92	1.80	0.00	4.82	5.52	10.27	8.90	9.73	9.77	8.58	8.79	9.77	8.94	6.39	7.56	8.92	9.23	8.85	9.29	7.34	7.42	8.22
Meekatharra 2	6.81	6.83	7.33	6.23	6.10	5.69	6.96	7.76	7.64	7.27	6.54	6.39	4.62	4.82	0.00	4.88	10.41	9.27	9.74	9.28	8.19	8.74	9.04	9.83	7.68	8.02	9.63	9.87	9.58	9.65	8.13	8.36	9.33
Sons of Gwalia	6.52	7.19	7.73	6.87	6.20	6.14	6.49	8.16	7.68	6.85	6.14	5.27	5.20	5.52	4.88	0.00	9.80	8.26	8.70	7.81	7.15	7.45	8.09	8.98	6.94	7.29	7.99	8.21	7.94	8.34	7.30	7.89	8.06
Lady Bountiful	9.37	8.64	8.66	6.59	7.52	7.97	7.48	6.71	6.03	6.48	9.99	9.55	10.39	10.27	10.41	9.80	0.00	5.43	5.71	4.12	4.15	5.62	5.85	5.87	6.22	5.00	5.56	5.01	5.69	5.74	3.88	5.18	5.06
Boddington	7.87	7.70	7.57	6.01	6.54	6.92	6.40	4.71	6.56	6.53	8.57	8.83	8.51	8.90	9.27	8.26	5.43	0.00	5.03	5.73	5.78	4.82	6.53	6.26	5.57	5.16	6.29	5.34	5.25	5.87	4.75	5.18	6.33
Rothsay	10.26	9.97	9.92	7.63	6.67	7.44	6.60	6.97	6.69	8.03	10.44	9.85	9.59	9.73	9.74	8.70	5.71	5.03	0.00	5.45	5.67	3.60	4.38	5.63	4.89	5.46	5.75	4.37	4.59	5.47	5.62	6.68	7.18
Reedys 1	9.30	9.23	9.37	7.02	6.17	7.53	6.81	7.03	6.43	6.32	9.22	9.14	9.66	9.77	9.28	7.81	4.12	5.73	5.45	0.00	2.35	4.29	3.70	5.71	5.41	4.42	5.25	4.92	5.07	5.12	4.74	5.10	5.02
Reedys 2	8.38	8.56	8.71	6.24	5.45	6.38	5.97	6.38	5.84	5.61	7.92	7.76	8.59	8.58	8.19	7.15	4.15	5.78	5.67	2.35	0.00	4.04	3.87	4.63	4.46	3.54	4.36	4.42	4.42	4.35	3.80	4.20	4.09
Corinthian	8.90	9.52	9.63	7.22	5.84	6.63	5.99	6.68	6.97	6.89	8.21	8.20	8.78	8.79	8.74	7.45	5.62	4.82	3.60	4.29	4.04	0.00	2.67	4.40	3.94	4.85	4.35	3.21	3.29	4.06	4.69	5.38	5.68
Hopes Hill	10.14	10.50	10.58	8.20	6.43	7.71	7.07	7.71	7.34	7.61	9.43	9.39	9.73	9.77	9.04	8.09	5.85	6.53	4.38	3.70	3.87	2.67	0.00	5.14	4.98	5.32	5.42	4.55	4.77	5.03	5.79	6.49	6.57
Mt Morgans	9.54	10.24	10.20	7.91	6.88	7.21	6.70	7.15	6.97	7.65	8.76	8.93	9.12	8.94	9.83	8.98	5.87	6.26	5.63	5.71	4.63	4.40	5.14	0.00	3.83	4.21	4.55	3.92	3.13	3.48	5.42	4.79	5.38
Nevoria	7.92	8.61	9.03	5.42	4.03	4.27	3.62	5.89	5.23	6.12	8.18	7.27	6.57	6.39	7.68	6.94	6.22	5.57	4.89	5.41	4.46	3.94	4.98	3.83	0.00	3.61	4.64	4.46	4.08	4.87	4.08	3.89	4.83
Bounty	8.15	7.98	8.11	5.68	5.82	6.07	5.54	5.50	5.18	5.99	8.83	8.27	7.49	7.56	8.02	7.29	5.00	5.16	5.46	4.42	3.54	4.85	5.32	4.21	3.61	0.00	5.51	5.21	4.53	5.17	4.21	4.20	4.92
Lawlers	8.75	9.66	9.99	7.18	5.95	6.08	5.24	7.34	6.51	6.35	8.13	7.18	9.13	8.92	9.63	7.99	5.56	6.29	5.75	5.25	4.36	4.35	5.42	4.55	4.64	5.51	0.00	2.58	3.67	4.09	4.08	4.53	3.53
Westonia	9.09	9.79	9.97	7.53	6.54	6.82	6.03	7.26	6.45	6.91	8.61	8.01	9.33	9.23	9.87	8.21	5.01	5.34	4.37	4.92	4.42	3.21	4.55	3.92	4.46	5.21	2.58	0.00	2.21	2.84	4.12	4.95	4.81
Junction	9.13	9.98	10.07	7.78	6.69	6.95	6.26	7.26	6.96	7.43	8.40	8.12	8.94	8.85	9.58	7.94	5.69	5.25	4.59	5.07	4.42	3.29	4.77	3.13	4.08	4.53	3.67	2.21	0.00	1.71	4.96	4.74	5.07
Victory	9.35	10.27	10.33	8.12	6.87	7.32	6.84	7.56	7.18	7.58	8.19	8.32	9.36	9.29	9.65	8.34	5.74	5.87	5.47	5.12	4.35	4.06	5.03	3.48	4.87	5.17	4.09	2.84	1.71	0.00	5.37	4.73	5.30
Mt Pleasant	6.67	6.78	7.33	4.09	4.94	4.82	4.41	5.15	4.25	4.19	7.75	6.54	7.43	7.34	8.13	7.30	3.88	4.75	5.62	4.74	3.80	4.69	5.79	5.42	4.08	4.21	4.08	4.12	4.96	5.37	0.00	3.50	3.57
North Kalgurli	7.15	7.90	8.38	4.71	4.43	4.68	4.30	5.38	5.23	4.97	7.50	7.21	7.54	7.42	8.36	7.89	5.18	5.18	6.68	5.10	4.20	5.38	6.49	4.79	3.89	4.20	4.53	4.95	4.74	4.73	3.50	0.00	3.03
Mt Charlotte	7.65	8.53	9.12	5.86	5.69	5.70	4.99	6.83	6.24	5.21	8.02	6.71	8.56	8.22	9.33	8.06	5.06	6.33	7.18	5.02	4.09	5.68	6.57	5.38	4.83	4.92	3.53	4.81	5.07	5.30	3.57	3.03	0.00

Fig. 3 MERIWA M123 Yilgarn Gold Deposits: Euclidian Distance between sample pairs

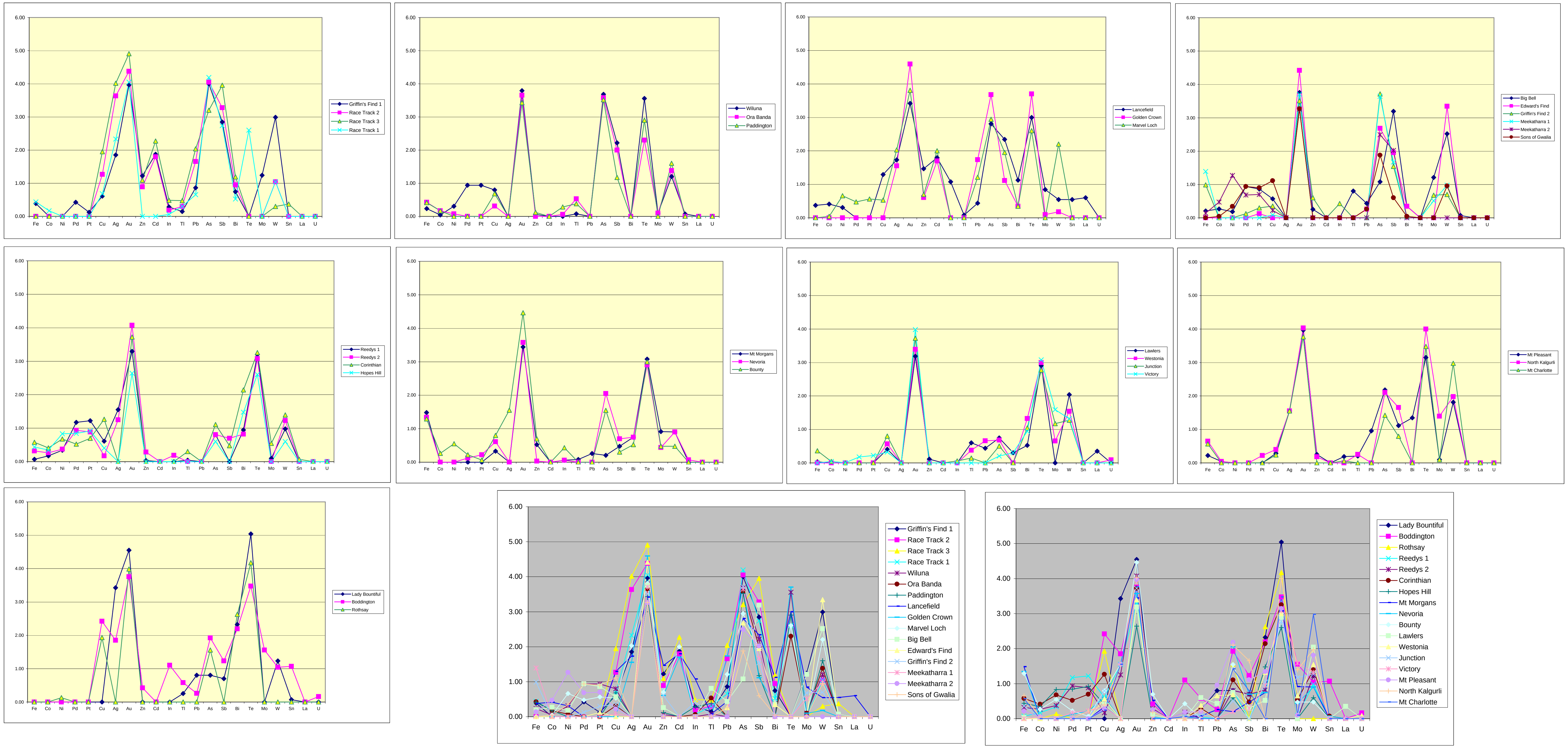


Fig. 4 MERIWA M123 Yilgarn Gold Deposits: Spidergraphs normalised to average crustal abundance

are tighter clusters of more closely related samples (e.g., Wiluna, Ora Banda and Paddington). The cluster North Kalgurli – Mount Pleasant – Mount Charlotte is transitional between the two major groups.

Visualising the ore signature (Fig. 4) is possible by plotting line diagrams normalised to average crustal abundance. These graphs illustrate very similar multi-element signatures for the tight clusters within the major groups.

Refining this mathematical technique is an on-going project between Carl Brauhart (Sipa) and Eric Grunsky (Geological Survey of Canada).

Funding Model

Generous in-kind support from Sipa and the CET has made it possible to direct all funding towards analytical costs. In other words, funds contributed to the OSNACA fund will be used solely to pay for bills from Bureau Veritas – Ultratrace. You can contact Anne Webster at the UWA Offie of Development (anne.webster@uwa.edu.au) to contribute to the fund. The fund will reside with the UWA Geoscience Foundation where contributions of this nature are viewed as a donation to UWA, and are fully tax deductible.

A recommended donation of $10,000 will pay for the analysis of 150 samples. Of course, larger companies are welcome to contribute more than this, and smaller amounts will also be gratefully received.

The public nature of the project means that contributors and non-contributors alike will benefit from the data. However, it is hoped that your organisation will become a contributor because you recognise the value in supporting an initiative that benefits everyone in ore deposit geology. Those who contribute funds will be able to influence which deposits are to be sampled, and their company logo will appear on the OSNACA section of the CET website.

Conclusion

The OSNACA database and associated mineral deposit collection is, potentially, one of the most exciting developments in ore deposit geoscience in recent years. Despite its simplicity, the scope of the OSNACA Project promises to yield many insights into ore deposit genesis and exploration targeting. These insights will have implications, both at the global, and at the deposit scale.

If you can facilitate a contribution from your organisation, you will be playing your part in this exciting advance in ore deposit geoscience.