Melba Siding RL 5/2009

ANNUAL REPORT
FOR THE PERIOD ENDING 28th OCTOBER 2014

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Mineral Resources Tasmania, Hobart
MMG – Melbourne Group office

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1. SUMMARY

During the reporting period several site visits have been conducted, Reid Keays has completed a preliminary report on the Melba Flats mineralisation and a research project has commenced to compare Avebury and Melba Flats mineralisation has commenced.

2. INTRODUCTION

The Melba Siding retention license area RL5/2009 is a ~ 3 km^2 block within the Melba Flats exploration licence EL43/1993 exploration license located to west of the Murchison Highway immediately to the south of the Renison Bell tin mine, between the towns of Rosebery to the north and Zeehan to the south (Figure 1).

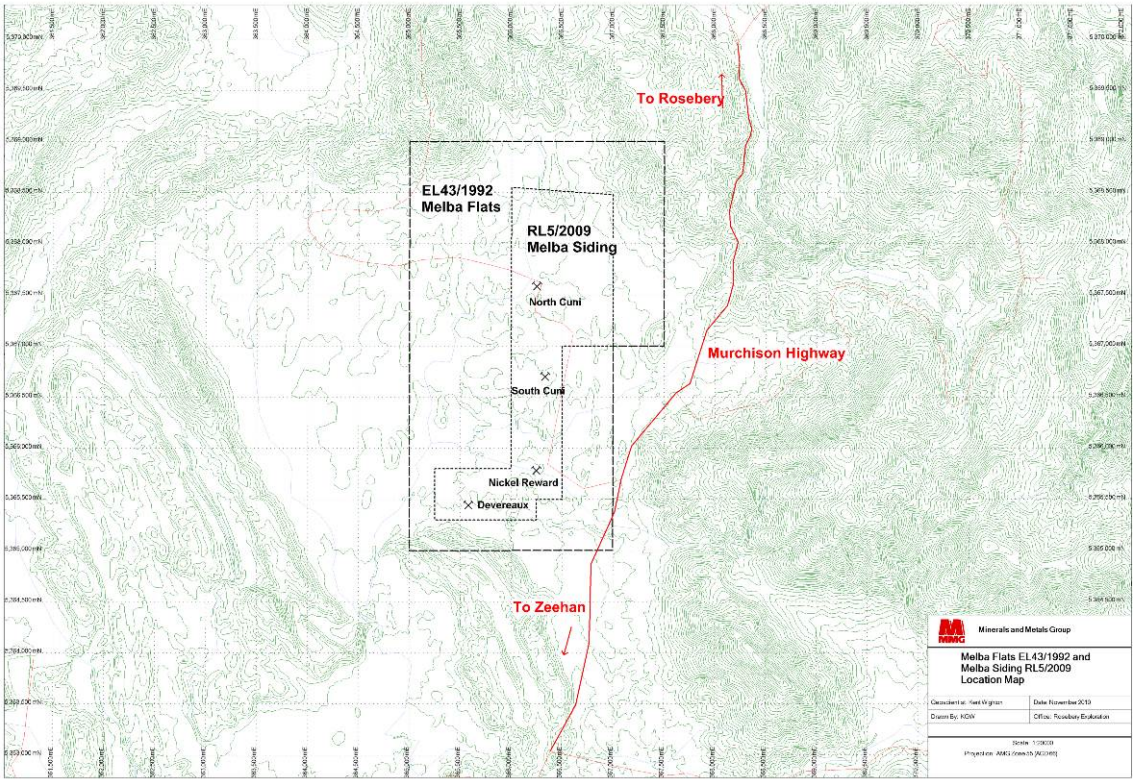

Figure 1: Location RL5/2009 Melba Siding

The Melba Flats area has had a long exploration history as indicated by numerous small scale historical workings and adits. It is thought that copper and nickel mineralization was first discovered in the Melba Creek Area as early as 1893. Recent exploration efforts by Allegiance Mining and later Oz Minerals resulted in the delineation of small scale, high grade nickel resources.

The Melba Flats area is underlain by Cambrian sediments intruded by a number of Cambrian gabbro dikes, genetically associated with the Serpentine Hill and Razorback Ultramafic bodies east of the tenements. The sediments dip to the east and generally strike north-south. Variations in these trends are caused by district folding and common small-scale faulting. The gabbro dikes are intrusive, often with chilled and brecciated margins, and are both concordant and discordant with the enclosing sediments. The dikes, sediments and ultramafics are pervasively altered. Carbonate and carbonate-talc alteration of the gabbro dikes is typically accompanied by late stage carbonate veining. Nickel-copper mineralisation is widespread in the altered gabbros and accumulates in small high grade pods on the footwall of one (?) of these dikes. The mineralisation is accompanied by Au, Pt, Pd, Co mineralisation in broad correlation with the Ni-Cu contents. The late-stage carbonate

alteration and veining is also accompanied by significant coarse galena-sphalerite-chalcopyrite. Exploration to date by Allegiance has shown the Ni-Cu mineralisation to be more widespread and persistent to greater depths than previously thought. Drilling by Allegiance, complemented by surface exposure and former mine workings has identified modest shallow resources at Nickel Reward and North Cuni-Genets. The district is regarded as highly prospective for extensions of these resources and for more substantial bodies at depth associated with larger gabbro and ultramafic intrusives.

The overall strategy of Allegiance and later OZ Minerals at Melba Siding was to commence production from several small pits and to access deeper resources by way of appropriately-sized declines from within these pits. The resources to be extracted from the Melba Flats area were planned to complement and be processed with the ore from Avebury at the Avebury Mine Site.

Exploration activities were disrupted and hindered by economic conditions and subsequent major corporate activities. Prior to its takeover by Zinifex in 2008 (and the subsequent merger etc to create MMG) Allegiance Mining had been exploring and evaluating the Melba area since 1997 with expenditure in excess of $2,500,000. This work culminated in the identification of modest shallow resources within the Melba Flats area at Nickel Reward and North Cuni-Genets.

3. LAND TENURE

In October 2007 a 10 year mining lease 2M/2007 was granted. Subsequently, OZ Minerals applied for and was granted the conversion of Mining Lease 2M/2007 to a Retention Licence RL5/2009 under the provisions of Section 53(2) of the Mineral Resources Development Act, 1995. The application was made on the grounds of economic reasons not to mine the small scale resources. The same economic conditions resulted in the Avebury nickel mine being placed on care and maintenance.

RL5/2009 was granted on 30/11/2009 for a four year period to the 1/12/2013. The tenement was extended in 2013 for a further 12 months to 30/11/2014.

4. ENVIRONMENTAL

No rehabilitation work was completed during the period.

5. WORK COMPLETED 2014

The Avebury and Melba Flats deposits have traditionally been considered unrelated, however recent research suggests this may be incorrect. If the two deposits are related then MMG has a significant tenement holding in a potential new nickel terrain.

The Zeehan area in Tasmania has two known two nickel deposits – Avebury and Melba Flats. Melba Flats is a gabbro hosted Ni-Cu-PGE deposit and there is still significant debate on the mineralisation style of the Avebury deposit, including internally within MMG. The two deposits are hosted within mafic and ultramafic rocks, which intrude sedimentary packages. In the literature the intrusives and sediments at Melba Flats are interpreted to be younger, and the two deposits are thought to be unrelated. However a recent paper by Keays (2011) and field observations suggest the intrusives and enclosing sediments may be of similar age.

If the two deposits are related then MMG holds a significant tenement package in a nickel terrain with potential to discover additional deposits.

There are four key questions that need to be answered to assist with determining the relationship between the two deposits;

1. What are the ages of the host sedimentary rocks at Avebury and Melba Flats and the overall tectonic setting of the two deposits?
2. What are the ages of the Avebury and Melba Flats intrusives?
3. Is Avebury a magmatic or hydrothermal nickel system or a modified magmatic deposit?
4. Does the Melba Flats style mineralisation have depth potential?

These questions are being answered by two Melba specific research programs and another project at Avebury.

A research program is looking specifically at Au_PGE and Se assays to expand of the work completed by Keays and Crawford 2010. The research proposal is attached as appendix 1 and Keays preliminary report is attached as a pdf as appendix 2. Note that the report is preliminary as 7 months after the samples were submitted for assay the selenium results have still not been received.

The key findings of this research are:

- The ore-grade Ni-Cu-PGE sulphides at Melba Flats were formed at depth due to interaction of a PGE-undepleted high MgO magma with S-bearing crustal rocks
- Some of these sulphides were then picked up as liquid sulphide droplets and transported by later batches of the same magma type
- During transport, some of the sulphides were resorbed by the sulphide-undersaturated magma
- As a result some of the Fe and the S in the sulphides were taken back into the magma, leaving residual sulphides that were enriched in Cu, Ni, PGE and Se
- As it is highly probable that only a small proportion of the Ni-Cu-PGE sulphides formed at depth were transported to their current sites, there is considerable potential for significant amounts of additional sulphides at depth
- If present, these sulphides would have somewhat lower tenors than the Melba Flats high grade sulphides
    - However, the tenors of these sulphides are likely to be quite economically attractive as the tenors of the Melba Flats sulphides (~10 % Ni and ~5 % Cu) are significantly higher than many Ni-Cu sulphide deposits

A master's thesis is being completed at Melbourne University by Marcus Phia and supervised by Reid Keays. The research proposal is attached as appendix 3. The research proposal for Avebury is included for completeness.

6. Proposed work 2015:

The Melba Flats tenements are part of the sale to QCG that will be completed shortly, it is expected that QCG will investigate the potential of this mineralisation for mining through the Avebury mill. QCG has given a commitment to continued support of the research currently being completed.

Estimated expenditure for 2015 is $20,000.

7. EXPENDITURE

		Melba Siding RL5/2009
TOTAL COSTS	**AUD**	**12,949.13**
PERSONNEL	AUD	4,680.90
LAND & ENVIRONMENT	AUD	8,268.23

Table 1: Tenement expenditure. Note this does not include any research costs for Melbourne University studies or the recently completed report by Reid Keays –these will be reported in the next period.

8. REFERENCES:

Crawford, A. C. and Keays, 2010. Magmatic Ni-Cu sulphides in mafic sills at Melba Flats, Western Tasmania-a geochemical investigation. Unpubl. Report prepared for Allegiance Minerals, 34 pages.

Keays RR and Jowitt SM (2012). The Avebury Ni deposit, Tasmania; a case study of an unconventional nickel deposit. Ore Geol Rev 52: 4-17.

Vogel, D. C. and Keays, R. R., 1997. The Application of Platinum Group Geochemistry in Constraining the source of Basalt Magmas: Results from the Newer Volcanic Province, Victoria, Australia. Chem. Geol., v. 136., 181-204.

Appendix 1:

Ni-Cu(PGE) sulphides at Melba Flats, Tasmania, revisited

Are these a part of a larger Ni-Cu-PGE sulphide system?

Preamble

In a limited study of 22 samples from 5 different gabbroic sills at Melba Flats, Tasmania, Crawford and Keays (2010) made a number of observations that are encouraging for the formation of significant amounts of Ni-Cu-PGE sulphide mineralization at Melba Flats, viz:

- The sills had formed from high MgO magmas with 12-13% MgO
- All major Ni-Cu-PGE deposits (with the exception of the Sudbury ores, which are the product of meteorite impact) were formed from high MgO magmas
- These magmas had undergone a significant amount of crustal contamination
- The contaminant had been well homogenized with the magma indicating that the magma was dynamic and high energy
- The PGE contents of the sulphides indicate that they are magmatic in origin
- The PGE tenors of the sulphide are reasonably elevated and are similar to those of the Sudbury Ni-Cu-PGE sulphide ores of Canada
- Some of the sulphides have high (=crustal) S/Se ratios; this is also encouraging because external (=crustal) S is a crucial requirement for major Ni-Cu-PGE deposits.

Subsequent to the Crawford and Keays (2010) study, Keays et al. (2012) argued that the Ni in the Avebury Ni deposit was hydrothermal in origin and had been sourced from magmatic Ni-Cu-PGE sulphides at depth. As Avebury and Melba Flats are only ~10 km apart, it is possible that the two Ni systems are linked in some way. Further, if Keays et al. (2012) are correct, it is probable that the Ni in the Avebury deposit was sourced from disseminated sulphides, which would be more reactive in a hydrothermal fluid than massive sulphides.

This suggests that more massive sulphides, if present, would have been left at depth.

Crawford and Keays (2010) tentatively concluded that the Ni-Cu-PGE sulphides at Melba Flats had formed at depth and may represent a very small part of a much larger Ni-Cu-PGE sulphide system. However, they also said it was possible that the sulphides had formed during transport, and therefore would not represent larger volumes of sulphides. Crawford and Keays (2010) cautioned that their conclusions were based on a very small sample population and that additional samples were required to confirm their conclusions.

Based on their geochemistry, Crawford and Keays (2010) concluded that the gabbroic sills were a part of the Crimson Creek suite of magmatic rocks. However, it is possible that they are co-magmatic with the igneous rocks of the Cleveland-Waratah Formation. If they contain suitable accessory minerals such as zircon or baddelyite, it will be possible to establish the age of the gabbroic sills via Laser Ablation-ICP-MS dating methods.

Working Hypothesis

Two types of sulphides appear to be are present at Melba Flats (Fig. 1). Those with high Pd contents were formed by a magma that had formed from a S-undersaturated magma while those with low Pd contents were formed from a magma that had been S-saturated and variably depleted in the PGE. These two types of sulphides also appear to have distinctly different S/Se vs Cu relationships (Fig. 2). In the low Cu group, S/Se ratios decrease with increasing Cu, but with the high Cu (>1000 ppm Cu) group, S/Se ratios appear to be roughly constant with increasing Cu contents.

The hypothesis to be tested in this project is that the sulphides with elevated Cu and PGE contents were formed at depth and were transported from depth by the magmas that formed the gabbroic sills. On the other hand, the sulphides with low Cu and PGE contents were formed during transport.

If this hypothesis is correct, then the high Cu-PGE sulphides in the gabbroic sills at Melba Flats may represent a very small fraction of a much larger body of magmatic Ni-Cu-PGE sulphides at depth.

This hypothesis can be tested by collecting and analysing a very modest number of additional samples. Twelve of the samples in the Crawford and Keays (2010) study reported Se values with below the detection limit of the method employed to analyse them. Selenium will be re-analysed in these samples using a different analytical method that has a much lower detection limit for Se than the method used in the first study.

Aims of the Project

• To confirm the hypothesis that the high Cu-PGE sulphides in the gabbroic sills at Melba Flats were formed at depth and may represent a very small fraction of a much larger body of magmatic Ni-Cu-PGE sulphides.

• To determine the age of the gabbroic sills that host the mineralization at Melba Flats.

Methods and Approach

The aim of this proposal will be accomplished by collecting and analysing an additional 20 samples from Melba Flats as well as by determining the Se contents in the 12 samples for which Se values were reported at levels below the detection limit for Se in the Crawford and Keays (2010) study. The samples will fill in the gaps between the high and the low Cu-PGE sulphide groups as well as add additional samples to each group as illustrated in Figure 3.

The samples will initially be sent to Acme Laboratories in Vancouver for determination of Au, Pd and Pt as well as the major and minor elements including Cu, Ni, S and Se. Acme offers detection limits of 0.1 ppb Pt and 0.5 ppb Pd; these detection limits are absolutely essential to obtain the geologically meaningful Pd and Pt data required for this study. All of the PGE (Pd, Pt, Rh, Ir and Ru) except Os were determined in the Crawford and Keays (2010) study at the Geosciences Labs in Sudbury; however, the Acme cost for Au, Pd and Pt is $21 per sample whereas the academic research rate at the Geosciences Labs for the 5 PGE is $91 per sample.

The rock powders will then be sent to the Geoscience Laboratories for determination of S, Se and Te using their low level analytical techniques.

A search will be made for accessory minerals such as zircon and baddelyite in thin sections of the rocks that can be used to date the gabbros by Laser Ablation ICP-MS using the Scanning Electron Microscope (SEM). Mineral separates will be prepared from the most suitable samples and analysed via Laser Ablation ICP-MS.

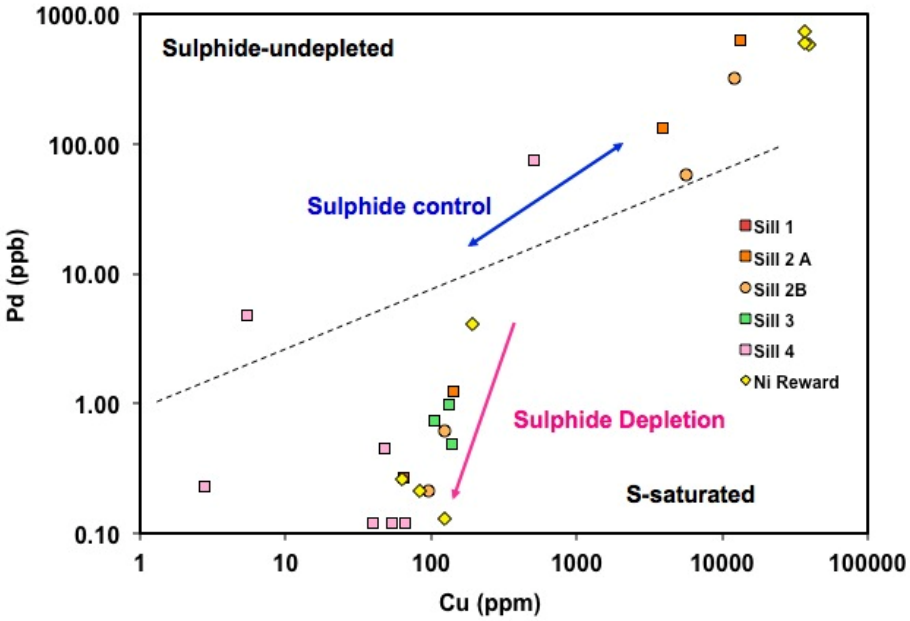

Figure 1. Two types of sulphides are present at Melba Flats. Those with high Pd formed from S-undersaturated magmas while those with low Pd formed from magmas that were S-saturated and had been depleted in the PGE and other chalcophile metals. The dashed line separates the fields of rocks formed from S-undersaturated magmas and those formed from S-saturated magmas and is taken from Vogel and Keays (1997).

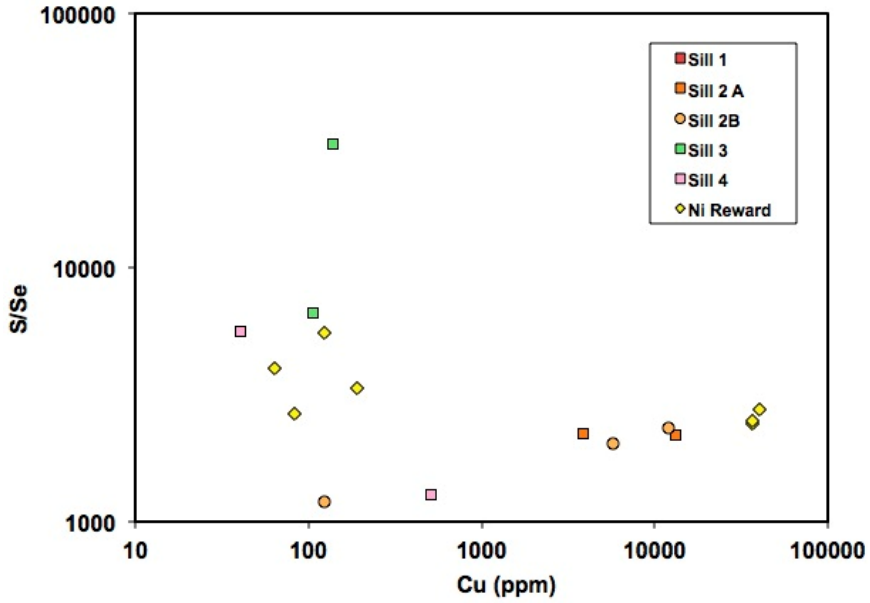

Figure 2. A scattergram of S/Se vs Cu also indicates that there are two different sulphide populations. For samples with Cu >1000 ppm, S/Se values remain constant with increasing Cu contents. However, for samples with Cu < 1000 ppm, S/Se ratios decrease with increasing Cu; the latter pattern is suggestive of resorption of sulphides during transport.

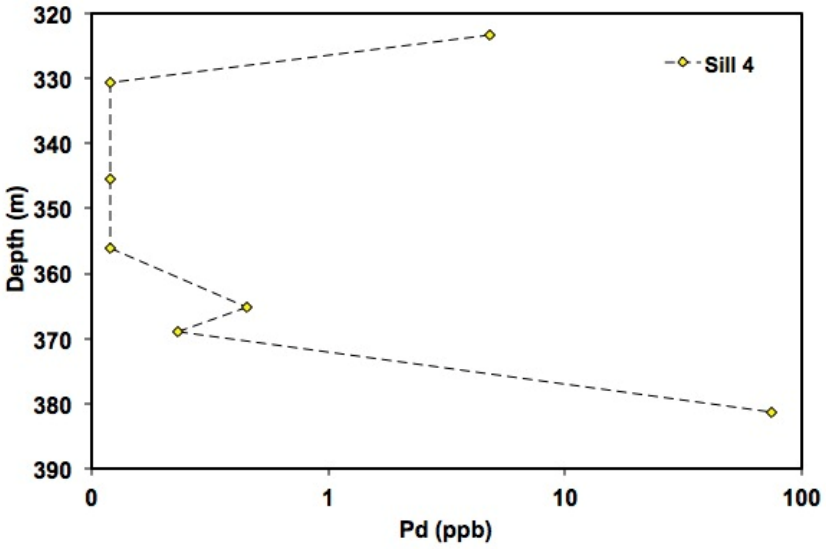

Figure 3. Variation of Pd with depth in DDH MF 93 which was designated "Sill 4" in the Crawford and Keays (2010) study. Additional samples will be taken, for example, between the sample with low Pd at 369m and that with high Pd at 381m.

Budget

Field Expenses	
(Travel, vehicle rental, accommodation)	1000
Analytical Charges	
Shipment of samples to Acme Labs Vancouver	300
Sample preparation	144
Au-Pd-Pt via Method 3B-MS	420
Major and minor elements including Ni, Cu, etc. via Method 4A-4B	1176
S via Leco at Geoscience labs	176
Se-Te via anhydride method at Geoscience Labs	749

Age Dating	
Polished thin sections	400
SEM	500
Laser-Ablation analysis of zircon or baddelyite	2000
Consulting Fees	
Four days @ $1250 per diem	5000
Monash University overhead	1000
Total	12,614

References

Crawford, A. C. and Keays, 2010, Magmatic Ni-Cu sulfides in mafic sills at Melba Flats, Western Tasmania-a geochemical investigation. Unpubl. Report prepared for Allegiance Minerals, 34 pages.

Keays RR and Jowitt SM (2012) The Avebury Ni deposit, Tasmania; a case study of an unconventional nickel deposit. Ore Geol Rev 52: 4-17.

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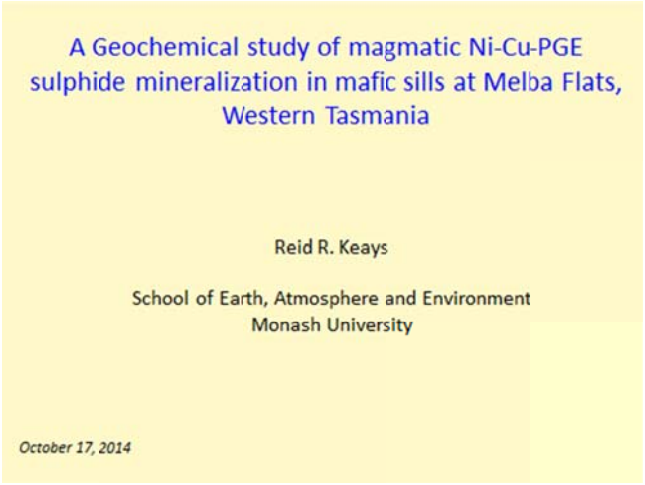
Appendix 2:

A Geochemical study of magmatic Ni-Cu-PGE sulphide mineralization in mafic sills at Melba Flats, Western Tasmania



Attached electronically.

Appendix 3:

Western Tasmania Nickel Project –research

Project 2

Petrogenesis of the gabbroic sills hosting magmatic Ni-Cu-PGE sulphides at Melba Flats, Western Tasmanian

Supervisors: Reid Keays, Dave Phillips (University of Melbourne) and Kim Denwer (MMG)

Field of Study: Economic Geology/ Igneous Petrogenesis

Support offered: Analytical and field costs

Candidate: Marcus Phia

Collaborating Organization: MMG

Commencement date: March 2014

This project focuses on a series of gabbroic sills that host magmatic Ni-Cu-PGE sulphides at Melba Flats where mineralization was discovered in 1893 and worked intermittently until 1948. Although total production was small (~6050 tonnes) the ore was high grade, averaging 9.7 % Ni and 4.7% Cu. The gabbroic sills are narrow and occur in clastic sedimentary rocks. The aims of the project are to establish the tectonic setting, magmatic affiliations and age of the sills. These aims will be accomplished by logging of diamond drill core, petrographic investigations, and whole rock geochemical studies; the ages of the sills will be establishing by U-Pb dating of accessory minerals such as zircon, baddelyite and rutile. These phases will be sought for in thin sections using the scanning electron microscope. For further information, contact reid.keays@monash.edu

The following work will be included in this project:

• A structural study of sill orientations will be carried out

-this will enable the derivation of a 3-D model of the sills

• The whole rock geochemistry of the sills will be assessed to determine if there is a difference in the compositions of the rocks hosting mineralisation and those that do not

-limited geochemical data (Crawford and Keays, 2010) and examination of Melba Flats drill core indicate the mineralised rocks are more primitive than the non-mineralised rocks

• Whole rock geochemical analyses together with PGE, Cu, Ni, S and Se will be carried out on samples from the gabbroic sill intersected in A254 that lies below and appears to intrude the Avebury serpentinite. Sections of the sill carry magmatic Ni-Cu sulphides and a xenolith of some type. These analyses will be undertaken to answer the following questions:

- what, if any, is the relationship between these sills and those at Melba Flats?
- was the magma that formed the sills a “pregnant” magma, transporting magmatic Ni-Cu sulphides?
- is the xenolith a metasomatised serpentinite or is it something else?
- do these gabbroic rocks carry the same granite-related metasomatic overprint as the serpentinites?

• It may be possible to establish an age for this gabbroic sill. Minerals suitable for age dating will be searched for using the SEM in samples of the fractionated gabbro collected on this trip

- if an age can be established, it will provide a minimum age for the Avebury serpentinite
- a search will be made for minerals suitable for age determination in the xenolith observed in the gabbro sill

Project 2

Geological and ore genesis models for the Avebury Nickel deposit, Tasmania

Supervisors: Reid Keays and Kim Denwer (MMG)

Field of Study: Economic Geology/ Igneous Petrogenesis

Support offered: Analytical and field costs

Preferred program: Honours

Candidate: Ben Mackay-Scollay

Collaborating Organization: MMG

Commencement date: March 2014

This project focuses on the ultramafic host rocks and Ni sulphide mineralization of the Avebury Nickel deposit in Tasmania. The aims of the project are to contour the 3-dimensional distribution of the major rock types (serpentinites and skarns) and ore metals (from assay data,) in the deposit and to determine the origin of the mineralization. It has been suggested that the Ni sulphide mineralization is a product of hydrothermal processes, but it may also be possible that Avebury is a metasomatised magmatic Ni sulphide deposit. These aims will be accomplished through logging of diamond drill core, limited mapping of underground exposures and utilization of the drill core photo library. Ore genesis models will be refined using whole rock PGE, Cu, Ni, S and Se data; sample collection for this work will be guided by the results of the mapping and core logging. Rock type identification will be confirmed by petrographic examination of thin sections and the Ni contents of silicates established using the Electron Microprobe.

- An important part of this project on Avebury will involve focussed underground mapping and observation
  - this will be assisted by examination and logging of drill holes that were drilled close to the faces being mapped
- Contour distributions of Ni, S, Co, As, MgO and FeO, as well as lithophile elements such as CaO and Al_2O_3 and overlay these on contours of rock types
  - this will be done to relate assays to rock type
  - if sufficient lithophile element data are available, this may provide information on fluid flow direction

• The composition of magnetite and serpentine will be established using the Electron Microprobe and, if time permits, LA-ICP-MS

-this will be done to determine if iron in the magnetite was derived from the olivine and liberated during serpentinisation or if it was derived from the granite, along with W, Mo, Sn, etc..

-the determination of the Ni contents of serpentine in unmineralised rocks will help to establish whether or not the Ni in the Avebury ores could have been derived from olivine during serpentinisation