Report on Stewart Wallace Funding

Eastern Victoria Goldfields Fieldtrip

17-18 April 2021

Monash Student Chapter of the Society of Economic Geologists

School of Earth, Atmosphere and Environment, Monash University

Melbourne, Australia

1. Introduction

Objective of the activity

The main objective of our activity was to engage with our student members on the topic of metallogenesis in Australia and the processes behind mineral exploration and extraction. Australia is one of the world's top producers of gold, and orogenic deposits are among the main sources of this commodity in the country. Key objectives include:

- Observation of orogenic gold mineral systems and their relation to lithology and structures.
- Discussion of their relationship to the regional context.
- Historical exploration of the area and how the advances in knowledge and technology have helped this goldfield region remain profitable today

Itinerary

Day	Time	Description
Saturday 17th	8:00	Departure from Monash Clayton Campus
	8:00 – 11:30	Travel to Woods Point
	11:30 – 12:30	Lunch in the field
	12:30 – 16:00	Geo-tour
	16:00 - 18:00	Travel to accommodation
Sunday 18th	8:00	Breakfast
	9:30	Departure to the Long Tunnel Mine
	11:00 – 13:00	Visit Long Tunnel Mine
	13:00 – 14:30	Lunch in Walhalla
	14:30	Departure to Melbourne
	17:30	Arrival at Monash Clayton Campus

Participants

Student First Name	Student Last Name	
Sarah	Alkemade	PhD Student - 1st year
Fernanda	Alvarado	PhD Student - 2nd year
Fatemeh	Amirpoorsaeed	PhD Student - 2nd year
Martin	Beilharz	PhD Student - 1st year
Alok	Chaudhari	PhD Student - 3rd year
Gan	Duan	PhD Student - 3rd year
Sam	Inskip	Honours Student
Giorgia	Kendall	Undergraduate Student
Ella	Lausberg	PhD Student - 1st year
Jia-Ping	Liao	PhD Student - 1st year
Owen	Missen	PhD Student - 3rd year
Angus	Rogers	PhD Student - 1st year

2. Geology background

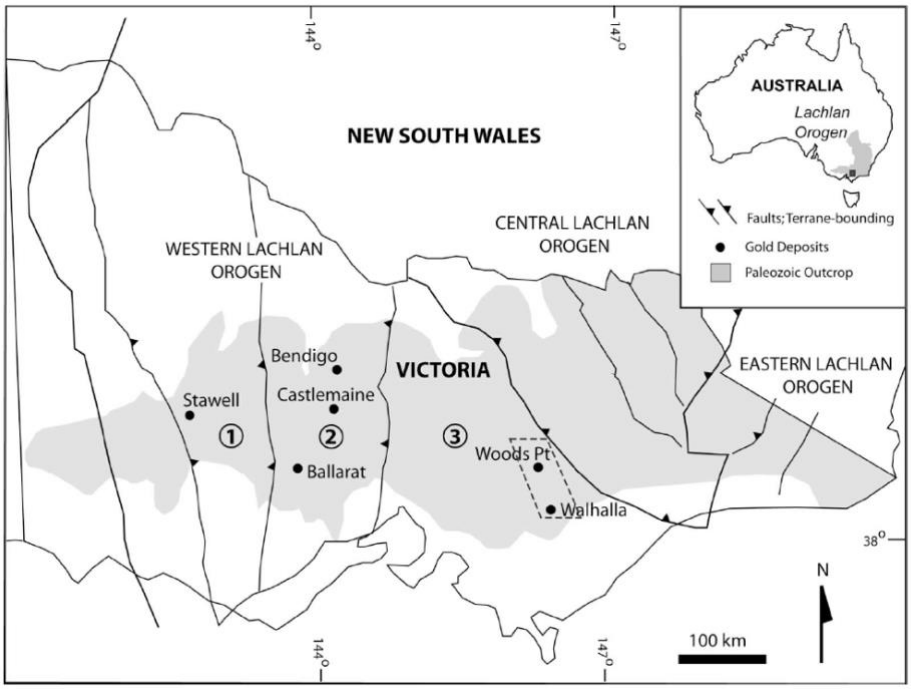


Figure 1. Map of the significant goldfields of Victoria, in context of the Lachlan Orogen: Stawell, Bendigo and Ballarat in western Victoria, and Woods Point and Walhalla in eastern Victoria. (modified from Hough et al., 2010).

The state of Victoria in south-eastern Australia hosts one of the world's major orogenic gold provinces, which has produced ~2500t of gold since 1850. The Eastern Victorian Goldfields is a good place to analyse the phases of orogenic gold mineralisation in the Western Lachlan Orogen, as well as the differences between different orogenic gold deposit types: sediment-hosted, dyke-associated

or dyke-hosted. The field trip takes place in the Eastern Victorian Goldfields (near the town of Woods Point), and the Long Tunnel gold mine (near the town of Walhalla).

The world-renowned gold deposits of the Western Lachlan Orogen (such as Bendigo and Ballarat; Fig. 1) formed at 440 Ma in response to progressive tectonic accretion, and have been the focus of much research (Schaubs & Zhao 2002). The gold mineralisation in the Bendigo-Ballarat Zone occurs within fold-controlled reverse faults within Ordovician turbidites. In contrast, the Walhalla-Woods Point Goldfield (Fig. 1), on the eastern margin of the Melbourne Zone, formed between 380 and 370 Ma (Hough et al., 2010) during the final assembly of Western Lachlan Orogen and Central Lachlan Orogen. The majority of gold deposits in the Walhalla-Woods Point Goldfield are sediment-hosted, although the few high yielding deposits are either associated with or hosted by dyke units. The chosen sites provide a good opportunity to learn more about orogenic gold deposits in the field and to recognize the mineralization stages and their relationship to the regional tectonics.

3. Description of the activities

Pre-fieldtrip activities

On Thursday, the 15th of April, the members of the SEG Student Chapter had a fascinating talk about Victorian Goldfields hosted by Ross Cayley from the Geological Survey of Victoria. He explained the geology of Victoria and how the tectonic framework controls the genesis of Orogenic Gold deposits. The discussion around this topic was crucial for the fieldwork and was significant to understand all the orogenic deposit related research performed in Victoria and how it can positively impact the exploration decisions.

Day 1 – Woods Point

Figure 2. Stopping site at the mining town of Woods Point.

On the first day of our field trip, we visited the mining town of Woods Point (Fig. 2). A boom town in the 1800s, Woods Point's population has dwindled to less than 50 permanent residents today from a peak in excess of 3500 people. Perhaps nothing better illustrates the lack of change in the town than the old petrol station. Two mines still operate in the region, the A1 mine and the Morning Star mine. Unfortunately, both of these mines were shut to any visitors, scientific or not, for operational security and privacy.

Figure 3. Group photo at the mining town of Woods Point.

A walk through the town quickly reveals the rich history of the area. Old mining equipment (Fig. 3) is common in the parks surrounding the Goulburn River, a major waterway in the region which flows into the Eildon Dam. The mines in the region must be careful that runoff from tailings dams does not reach the nearby waterways due to their importance as a catchment area. The hillside around the town is also dotted with numerous old mine shafts, some sealed, some open, remnants of the past when every inch of hillside was taken up by mining claims.

Panning in the Goulburn River revealed specks of gold still present, though most gold in the river has long since been collected, while the chance for new gold to reach the river is limited because of the mining activities collecting most outcropping gold today. Rocks in the river were mostly sedimentary rocks including some highly iron-rich pieces, though a few blocks of granodiorite were also present.

Figure 4. Mining tools and old core samples in the Woods Point Museum.

We also visited the Woods Point Museum, which contained a fascinating collection of mining history, from tools to old core samples (Fig. 4) to personal artefacts. A reminder of times gone by, the Museum was a poignant reminder that while mining can bring great wealth and prosperity to an area, without proper management, gains made can quickly evaporate away. Although mining in the area still occurs today, little of the former grandeur that Woods Point once possessed remains. Instead, the town has the feeling of being stuck somewhere in the 1900s with an eye to the former glory days.

Day 2 – Long Tunnel Extended Mine

On the second day of the field trip, we visited the Long Tunnel Extended Gold Mine, located at the historic gold mining town of Walhalla (Fig. 5). This mine operated between 1865 and 1914, producing 440,312 troy ounces of gold over almost 50 years.

The visit was led by the Mine Manager, Geoff Anderson, who conducted a technical tour of the mine site. The Long Tunnel Extended Gold Mine was an underground operation that developed a stopping method to extract the ore. In its first years of development and production, the miners dug using rudimentary tools and horses to move the ore and waste out of the mine.

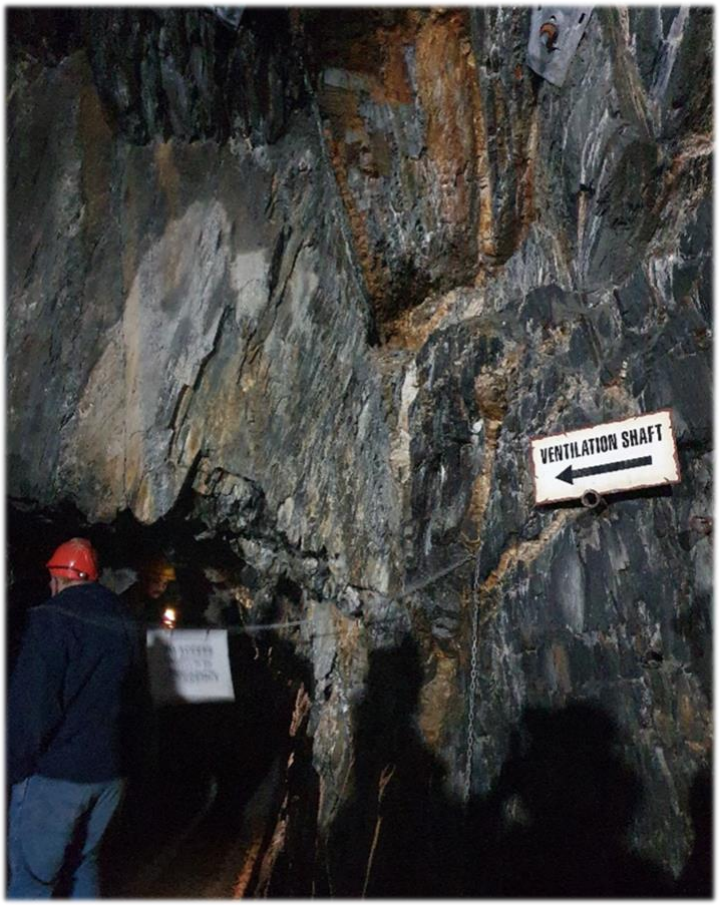
Figure 5. Group photo at the Long Tunnel Extended Gold Mine

By the beginning of the 19th century, the mine was well developed and had implemented cutting-edge technology for that time. The layout of the mine consisted of a deep shaft with crosscuts constructed every 30 m. These crosscuts connected the shaft and the mineralized vein. The ore was mined using shrinkage stope methods at each level, downward to 940 m of depth. Miners accessed the deeper levels of the mine with ladder (Fig. 6).

Figure 6. Example of how the miners accessed the deeper levels of the mine.

In the Long Tunnel Extended Mine, the reef or quartz-rich vein is located in the contact between igneous rocks, particularly trachyte and diorite, and highly deformed metasedimentary rocks (Fig. 7). These dykes applied a strong mechanical control on the development of the gold-bearing veins.

Figure 7. Main quartz -rich vein.



Many structures and foliation were observed in the audit tunnel. We were able to observe a slicken line surface developed by inverse movement of a fault next to the reef (Fig. 8) shows a fault in the ventilation chamber. From a mining engineer' s perspective, this fault was of concern due to the impact on the chamber' s stability. As geologists, we were highly interested in the type of faulting, its temporal relationship with the deposit, and the structural relationship with the folded foliation.

Figure 8. Structures in the ventilation chamber.

4. Budget Breakdown

Budget Summary

Number of people	12
Number of days	2
Number of nights	1

Transport	$655.00
Accommodation	$1,040.00
Activities	$0.00
Others	$800.00
Food	$276.14
Total	**$2,745.00**

Budget breakdown

Transport	**AUD $**	**Quantity**	**Days**	**Total AUD $**
Minivan Hire (12 p)	$ 220.00	2	3	$440.00
Extra kms	$ 0.25	100	-	$25.00
Gas	$ 80.00	2	-	$190.00
			Total Transport	$655.00

Accommodation	**AUD $**	**Number of people**	**Number of nights**	**Total AUD $**
Entire chalet (Baw Baw Village)	$ 600.00	1	1	$600.00
Claening service	$ 300.00	1	**1**	$300.00
Servce Fee	$ 140.00	1	**1**	$140.00
			Total Accom	$1,040.00

Activities	**AUD $**	**Number of people**	**Total AUD $**
Long tunnel mine entry fee	$ -	12	$0.00
		Total Activities	$0.00

Other	**AUD $**	**Number of people**	**Total AUD $**
PGN Banner	$ 100.00	-	$100.00
HiViz	$ 58.40	12	$700.80
		Total Activities	$800.00

Food	**AUD $**	**Number of people**	**Total AUD $**
Groceries (Melbourne)	$164.14	-	$164.14
Groceries (Wurburton)	$112.00	-	$112.00
		Total Activities	$276.14

5. Acknowledgements

We would like to thank the Geological Survey of Victoria and Ross Cayley for the excellent talk on Victorian Orogenic Deposits. We also thank Geoff Anderson and the Walhalla Board of Management for the wonderful tour to the Long Tunnel Extended Mine. And, to our sponsors, the Society of Economic Geologists and PGN Geoscience for their contribution that allows us to perform this field trip.

6. References

1. Hough, M.A., Bierlein, F.P., Ailleres, L., and McKnight, S. (2010) Nature of gold mineralisation in the Walhalla Goldfield, southeast Australia. Australian Journal of Earth Sciences, 57(7), 969-992.

2. Schaubs, P.M., and Zhao, C. (2002) Numerical models of gold‐deposit formation in the Bendigo‐Ballarat Zone, Victoria. Australian Journal of Earth Sciences, 49(6), 1077-1096.