1 Daylesford- EL007330

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EL007330 is located around the town of Daylesford in Central Victoria. A narrow portion of the tenement extends north towards Newstead, adjacent to EL007282 (Yandoit). This narrow section has not been assessed as part of this report, instead the focus has been on the advanced staged projects in the Daylesford area (Figure 1).

Figure 1. EL007330 Location and geology.
2 Regional Geology

EL007330 is located in the Bendigo Structural Zone of the Tasman Fold Belt and covers the north-trending Muckleford Fault. The basement lithology comprises of interbedded slates, siltstones and sandstones turbiditic sequences of the Ordovician Castlemaine Group that have undergone east-west compression during the Benambran Orogeny. Limb thrusts propagating from bedding parallel layer slip planes formed as fold lock up approached. The folds form part of larger scale anticlinoria which form broad, gently plunging dome and basin structures. The Daylesford Goldfield is located at the culmination of such a dome on the Daylesford Anticlinorium. Major west-dipping reverse faults are interpreted as listric faults. The regional north-northwest trending Muckleford Fault passes 3 km west of Daylesford and truncates the Daylesford Anticlinorium west of its hinge (Gough, 2013). Widespread orogenic gold mineralisation associated with faulting occurred during the late stages of deformation (Arden, 1997).

2.1 Local Geology

MacDonald, 2006, undertook a thorough review of the local geology in the Daylesford area. The following information is a summary of this work.

Underground mapping in several mines by the GSV has shown an alternating sequence of shale and sandstone horizons. In practice these may sometimes represent shale horizons up to 2 metres wide, sandstones that may be massive channel deposits up to 10 metres thick, or alternatively they may represent upward fining sand dominated turbidite units mapped individually or as groups of units with similar characteristics. In practice, the distinction between stratigraphic units in the field is extremely difficult.

Folds in the area are upright with axial planes dipping steeply to the east, with wavelengths varying from over 500 metres to less than 50 in some places. The fold pattern appears to be far less regular than that observed in the mineralised corridors of the Bendigo or Castlemaine goldfields. Although faulting may in part explain this irregularity, it appears likely that significant variation in wavelength does exist, as shown on several traverses that have been mapped in detail by the GSV.

Larger amplitude folds appear more likely to host significant mineralisation, with the Ajax and Cornish lines associated with two of the broadest fold limbs in the area. While the general opinion appears to be that folds in the area generally plunge to the north, particularly in the northern end of the field, preliminary examination of the available mine plans, combined with the relationship between the faulting and bedding, strongly suggests that the overall plunge of the Ajax anticline is to the south in the Ajax South (14°S) and Christensen’s Ajax (17°S and 3°S, although here one northerly plunge was also noted) mines. North plunges were noted in the Ajax Consolidated Mine on the south end of the field.

On the Cornish line the only recorded plunge direction was in the North Cornish Mine where an 8°S plunge was noted on the 834’ level. Most plunges measured are less than 10° and would generally be classified as horizontal folds.
It was noted that the workings rarely cut west of the anticline, tending to explore well to the east on most occasions. The relationship between bedding-cleavage lineation did not appear to be recognised, so that the only recorded plunges are where the fold hinge could be observed.

The development of thrust faults during fold development, and particularly after fold ‘lock up’ may be recognised in most Central Victorian goldfields, for example Ballarat and Fosterville. These structures provide conduits for fluid flow and mineralisation, and as such are the key features controlling the development of quartz reef related mineralisation in the region. A summary of the styles of mineralisation developed in this setting is contained in Figure 2, based on examples in the Castlemaine Goldfield, these styles have been recognised in other ‘slate belt’ goldfields in the region with minor variations.

Figure 2. Examples of fold related vein systems in Central Victoria. Daylesford area most like the fault and spur reef example (from Willman, 1995, Castlemaine Goldfield, GSV Rept. No. 106).
Faulting in the Daylesford Goldfield is strongly developed and this goldfield was described by Whitelaw as the most strongly faulted of the Central Victorian Goldfields. Newer volcanic flows have buried paelo-channels on the south-eastern portion of the tenement, with the Glenlyon Lead being the most prominent.

2.2 Mineralisation

The mineralisation of the Daylesford area was described in detail by Arden, 1997. The following information is a summary of this work.

At Daylesford there are some twelve parallel anticlines that host mineralised reefs on their eastern limbs including the Ajax and Comish lines. The gold is partially hosted by quartz, found within shears outside the quartz-bearing zones, and occasionally within slate beds that intercept mineralised features such as faults and shears. Locally at Daylesford, these reefs dip west at 60 to 70 degrees, strike obliquely to the sediments and are usually only payable within the eastern limb of anticlines.

The work by Arden showed that there are four separate primary mineralisation styles, a majority of which are typical of the turbidite hosted gold deposits within the Bendigo-Ballarat zone:

- Vertical to west-dipping reverse faults that strike slightly obliquely to bedding and range from 0.6 to 1.6 metres wide (reported up to 18 m wide at the Comish mine). Where these verticals (which are interpreted as being a form of thrust fault) intercept west dipping strata, they are recorded as continuing as bedded faults with little or no quartz;
- West dipping thrusts that trend 0-005 degrees and act as “feeders” to the verticals;
- Flat to gently westerly-dipping (5-15 degrees) quartz veins known locally as "flatmakes" which have en echelon relationships with steep dipping reverse faults. These flatmakes pinch and swell (up to 1.8 m thick) and often host high grades (>500 g/t). Small displacements have commonly occurred along the flatmakes and have resulted in the development of secondary en echelon - tension gash in-fill veins;
- East-west striking faults locally called "counter" faults, which are poorly understood.

Arden, 1999, summarised the mineralisation style of the Ajax and Cornish lines. His work showed that the principal model of gold mineralisation is related to the formation of dilation zones in and near fold closures whereby at least initially quartz-rich solutions have been deposited. His work showed that the previous understanding and evidence of west-dipping reverse faults being particularly relevant to this deposition process, there appears that there may have been several fault orientations and that it just happens to be that the fold geometry may have meant this is a locally dominant or more important orientation. Arden also noted that the flat to gently easterly-dipping quartz-rich tension features known locally as “flatmakes” in the Ajax and Cornish areas, may also have some form of fault or joint control which has controlled their development into significant and economically important structures in areas.
3 Mining History/Production

3.1 Production History

As with most goldfields in Central Victoria, the Daylesford Goldfield commenced with alluvial mining in the early 1850’s in the Wombat Creek and Jim Crow Creeks. In the following 16 years, over 500,000 ounces (conservative) of mostly alluvial gold was recorded from the goldfield (Arden, 1998). Hard rock mining began in Daylesford in about late 1854 with a total recorded production of at least 796,254 ounces of gold (MacDonald 2006) including several small outlying areas, giving a total yield of nearly 1.3 million ounces. The main period of production was from the late 1870's to 1914 and with further work on the Ajax and Cornish lines from about the early 1900’s to early 1920’s (Arden-Corlett, 1997).

Two Ajax and Cornish lines are the two major lines of workings and dominated historical production for the Daylesford Goldfield. The Ajax line produced 657,343 t. @ 14.8 g/t for 312,789 ounces with the deepest shaft recorded at 370.6m. The Cornish line produced 524,429 t. @ 10.8 g/t for 182,000 ounces, with the New Cornish shaft bottoming out at 304.8m. These lines account for a large percentage of the production from the Daylesford area. Several other significant lines occur in apparent isolation. The Rising Star Mine (233,458 t @10.5 g/t for 78,458 ounces), Maxwell Consolidated (21,988 ounces) and the Specimen Hill Mine (114,875 t @ 9.7 g/t for 35,801 ounces) (MacDonald 2006).

A detailed summary of the recorded reef gold production from the Daylesford area can be found in Continent 1997 Annual Report, GSV Report G27290.

A typical section through the North Nuggety Ajax Mine is shown in Figure 3.
Figure 3. Section of the North Nuggetty Ajax Mine- Gough, 2014
3.2 Nearby Mining Activity
A small private mine ran by BSB Mining currently operates on MIN5503 north of EL007330 at Yandoit, adjacent to the historical Golconda mine. In 2019 a head-frame was erected and a shaft sunk with drives heading towards Goldsmith's reef. No production figures are available.

4 Exploration History
A majority of the exploration on the tenement has been completed by joint venture partners Continent Resources and Range River Gold, with a strong focus on the Ajax and Cornish lines of lode.

This data has been compiled from Technical Reports supplied to the GSV by Continent Resources/Range River Gold.

1/7/03 – 30/6/06
No field activities were undertaken.

4.2 Literature Review
15/5/98 – 14/5/99
A detailed structural interpretation based on historic mining records and Landsat imagery was completed to identify targets for gold mineralisation.

- Previous drilling comprised: Unreported diamond drilling program at the Aurora Mine by Ajax Consolidated NL in 1951.
- RC program (5 holes, aggregating 277 m) at Eganstown by Dome Resources NL in 1988.
- RC program (8 holes, aggregating 497 m) along the Cornish line by Nord Resources (Pacific) Pty Ltd between 1988–89. The only significant intersection from this program was 9 m @ 0.64 g/t Au from 52.0 m including 2 m @ 1.92 g/t from 56.0 m in 125 RC 6.
- A comprehensive review of the past mining and exploration across the Daylesford Goldfield was completed.

15/5/01 – 14/5/02
Further reviews of previous mining activity and literature searches of the records were completed. A significant number of plans and reports were collated, and a number of these were copied for use or reference during interpretation of the area. A list of mine plans was provided in the report.

15/5/02 – 30/6/03
Newspaper reports, historic company reports and other geological data were compiled.
A review of previous exploration was carried out. A geophysical review is in progress.

**Database Compilation and 3D Modelling**

15/5/96 – 15/5/97

Results of historical research were incorporated into 3-dimensional computer models of the Ajax and Cornish lines; and target zones identified based on this modelling. Seven mines have been incorporated into the model for the Ajax line - Ajax North, The Ajax Mine, Ajax Central, North Nuggety Ajax, North Ajax, Nuggety Trafalgar and Christensons Ajax.

Modelling on the Cornish line focussed on the North Cornish, the Victorian Comish (Bonnards) and the New Comish (Mitchalls and Bonnards) mines.

Despite an extensive search by the author in 2020, the modelling data has not been able to be located at the time of reporting.

An image of the modelling on the Ajax line is shown in Figure 4.

**Figure 4. Modelling of the Ajax line, (Arden, 2007)**

15/5/02 – 30/6/03

An extensive database has been compiled of the historical mining and modern exploration of the Daylesford Goldfield in order to generate a 3D model of the key elements of the goldfield.

**Mapping**

16/05/00 – 15/05/01
Structural mapping of the Ajax Anticline and surrounding area by Thom (2000) revealed significant local variations in fold plunge, fold morphology and bedding. It was noted that the workings are associated with areas of intense folding and deformation in stark contrast to unworked areas north of the Ajax North mineshaft.

15/5/01 – 14/5/02
Two reconnaissance visits to the Daylesford area focussed on inspection of the key geological features including major folding, faulting and stratigraphic variation.

4.3 Geochemistry

15/5/98 – 14/5/99
Seven soil samples and one rock sample were collected from the Ajax and Cornish areas respectively. Samples were analysed for an extended suite of elements including gold and platinum but did not return any high values.

4.4 Geophysics

15/5/96 – 14/5/97
An airborne magnetic and radiometric survey was flown across EL 3431 at 100 m line spacings in June 1996. Results from the survey identified NNW trending fold closures that are intersected or displaced by NE trending structures.

4.5 Drilling

Drilling by Continent Resource – Range River Gold was mostly focussed on testing the repetition and extensions at depth of the main gold-bearing structures in the Ajax and Cornish lines. Results have shown that the mineralisation on the Ajax line continues at depth as well as within and along strike of historical workings.

Results and commentary have been summarised from Arden, 1997, 1999.

15/5/94 – 14/5/95
Two RC holes (RC2 & 5 aggregating 170 m) were drilled to test results from the channel sampling at the South Star Extended Prospect. Although the drilling intersected significant zones of quartz veining, no significant gold grades were returned, the peak result being 3m @ 0.07 g/t Au from 12 m in RC5.

Two diamond holes (RD12 & 17 aggregating 467.2 m) were drilled to test for westerly dipping auriferous reefs in the South Cornish and Argus areas south of Daylesford. Hole RD12 intersected several quartz reefs associated with shear zones and carbonaceous shale and slate. Hole RD17 was drilled to follow up anomalous gold results from Nord surface sampling and shallow RC drilling. Designed to intersect surface mineralisation at depth, the hole intersected several auriferous reefs. The South Cornish mine was worked to a maximum depth of about 110 m (360 feet), well above RRG’s high grade intersections in RD12. Significant results are shown in Table 1.

15/5/95 – 14/5/96
A five hole (513 m) RC drilling program (RC7 - 11) was completed to test anomalies identified by further channel sampling at the South Star Extended Prospect. No significant assays were reported.

A six hole (467 m) RC drilling program (KID1 - 6) was completed at the Keep it Dark Prospect to test gold anomalies identified by Nord Resources in 1988. Most holes intersected bleached sandstone and siltstone with abundant quartz veining and sericite–pyrite alteration. Significant results are shown in Table 1 below.

15/5/97 – 14/5/98
Two diamond drill holes (RD18 & 19 aggregating 1035 m) were drilled beneath the North Nuggety, Ajax and Ajax Central Mines. Both holes intersected several weakly mineralised reef structures. The majority of the gold is associated with narrow quartz veins, minor sulphides and structures. However some gold occurs in silty sandstone without any apparent veining, sulphides or structures. Best results were in RD19 with 9.1 m @ 9.18 g/t Au intersected.

15/5/98 – 14/5/99
Four diamond holes (RD20 – 23) with RC precollars (aggregating 963 m) were drilled in the central part of the Ajax line. Arden (1999) reported that this showed “widespread gold mineralisation not solely restricted to a previously mined narrow zone within east-dipping sediments to the east of the Ajax Anticlinal Axis”.

Hole collar locations for drilling along the Ajax line are shown in Figure 5.
Figure 5. Location of drill collars around the Ajax line.
Four shallow RC holes were drilled by the Hepburn Shire Council around the old rubbish dump to monitor the site. Cuttings from one RC hole (BH2) drilled were sampled with a best result of 2 m @ 0.32 g/t Au returned.

Selected intervals were submitted for multi element with one Pt value assayed at 10ppb and the highest Pd assay 14 ppb.

Selected samples from RD 12 and 17 from the Cornish area were re-sampled and re-assayed to correct errors from earlier sampling.

Observation and logging of a wide range of gold intersections in drill core, principally from the Ajax Line but also including samples from the Cornish Line, show that there were at least three generations of quartz veining and at least two generations of gold mineralisation. (Arden, 1999)
Metallurgy

15/5/98 – 14/5/99

Metallurgical tests gave broadly consistent results to gold recoveries reported by the major mines in the area and the tailings retreatment by Bendigo Gold Limited. Screen fire assay (25 samples) of selected mineralised intersections from the Ajax and Cornish lines showed 86.4% (arithmetic average) of gold was less than 106 μm; and three populations of gold grain size on both the plus 106 μm fraction and duplicate minus 106 μm fractions. Metallurgical tests on a 2 kg split of high-grade mineralisation (15.2 ppm, 120.8–126.1 m interval in RD19- Ajax line) indicated that 89.8% of the gold was recoverable by simple gravity methods (grind: 80% passing 112 μm). Further testing showed that 75% of gold was ‘free’ and roughly 10% recoverable by simple cyanide...
4.7 Mineralogy/Petrology

16/05/99 – 15/05/00
Detailed study of selected intervals of core from drill holes RD 19 and RD 21, was undertaken by Thom (2000) to look at sulphide phases in intervals of significant gold mineralisation and to determine the physico–chemical properties of the ore – bearing fluids. Investigation included stable isotope analysis and fluid inclusion studies. The work suggests that the Daylesford quartz vein style of mineralisation is characterised by the presence of pyrite, arsenopyrite and lesser amounts of base metal sulphides. (Bravo, 2001)

16/05/00 – 15/05/01
Thom (2000) and further work by Thom and Bierlein (2001) concluded that elevated gold grades occur in arenaceous intersections containing little or no quartz veining. Petrographic examination of the sediments revealed visible free gold associated with disseminated pyrite aggregates containing an assemblage of arsenopyrite, sphalerite and galena. The gold-bearing pyrite aggregates were found to occur within the host rock matrix away from the quartz veins. (Bravo, 2001)

Hydrothermal wallrock alteration is characterised by the presence of varying degrees of arsenopyrite, pyrite, carbonate, sericite and quartz (Thom and Bierlein, 2001; Maher and Willman, 2001). A notable feature of the alteration is the presence of sulphides and carbonate spotting. Sericite is ubiquitous but much less abundant than in the unaltered rocks. Sericitisation, largely resulting from the breakdown of chlorite and feldspar has produced visibly bleached altered rocks. Scanning electron microscope images of the gold-bearing pyrite aggregates revealed compositional variations in the pyrite suggesting a multistage paragenesis (Thom, 2000). It appears there have been several generations of pyrite formation with gold-sphalerite-galena occurring in the compositionally zoned core of the pyrite. (Bravo, 2001)

4.8 Gough, 2012-2014 EL5420

J. Gough held the lease over the Ajax area for a period of two years. Work was restricted to literature researches and field reconnaissance. Significant effort was put into acquiring the 3D models of the Ajax and Cornish lines of lode without success.

5 Exploration Strategy

Considering the advanced stage of the Ajax project, diamond drilling would be a high priority. Previous drilling on the Ajax line has intersected multiple quartz reef structures with the potential to contain considerable levels of high-grade gold mineralisation. In order to define targeting, the following work is recommended to be completed:

- Obtain or re-create the 3D shapes from modelling of the Ajax and Cornish lines in 1997. Exploration targets were identified by Continent in 1997 based on these
models. These targets will be reviewed once the modelling data has been sourced or re-created. The modelling program should be extended to include structural and lithological data. Contingency for model recreation- $40,000.

- Diamond drilling targets on the Ajax and or Cornish lines- estimate of 8 x 220m holes for a total of 1,800 m- $270,000 (drilling costs only).
- Re-visit drilling conducted by Continent- assess follow up to see core was lodged with the state government in Werribee.
- Interpretation of re-imaged and re-processed data from the low-level geophysical data acquired from Range River Gold with a view to evaluate the potential for further surveys.

6 References


