

EL15/2012  
Avoca  
Year 1 Annual Exploration Report for the  
Period 16/12/2012- 16/12/2013

Authors:

Daryl Nunn

Alex Hepple



Imperial Coal Pty Ltd

15A Tate Street

Albion, Queensland

4010

## Abstract

EL15/2012 Avoca lies in the Fingal-Avoca Coal District in North Eastern Tasmania where coal has been mined since the 1880's from both opencut and underground mines exploiting coal seams hosted in the Triassic Upper Permian Supergroup of the Tasmanian Basin. Within EL15/2012, Imperial is exploring for modest size open-cut and larger underground thermal coal resources that are of sufficient quality to meet export coal specifications.

This report summarises the first year exploration program undertaken by geological consultants Global Ore Discovery (Global Ore) on behalf of Imperial. In this reporting year desktop analysis included literature reviews, remote sensing, land access notifications, geological and drillhole data compilation and cross section interpretation. Field work focussed on mapping of marker horizons, identification of new coal outcrops, relogging of historic drillholes and better positioning of historic drillhole collars and coal seam outcrops

Key aspects of this work include

- Literature review
- ASTER processing and field follow-up program
- Mapping of the outcropping coal including new coal outcrops
- Identification of five historic drillhole holes not with MRTAS database
- New understanding of the potential for shallow coal (potentially open pitable) from water bore intercepts.
- Potential for PCI coal indicated from historic coal quality testing in the south of licence

## Table of Contents

|   |    |
|---|----|
| Abstract.....   | 2  |
| 1. Introduction .....                                     | 5  |
| 2. Review of Previous Work.....                           | 6  |
| 3. Exploration Completed during the reporting period..... | 6  |
| Literature Review .....                                   | 6  |
| Regional Geology .....                                    | 6  |
| Local Geology .....                                       | 9  |
| Historic Coal Exploration.....                            | 10 |
| Regional Exploration Activities .....                     | 20 |
| Remote Sensing .....                                      | 20 |
| Prospect Based Exploration Activities.....                | 24 |
| Field Mapping .....                                       | 24 |
| Drillhole Database Compilation .....                      | 27 |
| 4. Discussion of results.....                             | 33 |
| 5. Conclusions .....                                      | 34 |
| 6. Environment.....                                       | 35 |
| Expenditure.....  | 37 |
| References .....  | 38 |
| Keywords.....   | 40 |
| Appendix – Location of historical drillhole photos .....  | 41 |

## Table of Figures

|  |    |
|--|----|
| Figure 1 - Location overview of South Avoca EL15/2012 .....  | 5  |
| Figure 2 – Subset of Time-space diagram for Tasmania. EL15/2012 is situated closest to the North-East Tasmania Element (From Seymour and Calver, 1998).....  | 8  |
| Figure 3 - Coal quality data from the Mount Christie Coalfield (From Bacon, 1991) .....  | 11 |
| Figure 4 - Coal quality data from Investigator Coal Exploration drillhole 78RG1 (From Bornman, 1981) .....   | 12 |
| Figure 5 - Coal quality data from Shell's AV1 drillhole (Bornman, 1981) .....  | 14 |
| Figure 6 – Location of elements relevant to historic exploration.....  | 19 |
| Figure 7 Remotely sensed ASTER versus Landsat TM bands, and overview of common spectral responses (Hewson, 2003).....  | 20 |
| Figure 8 Aster Processing of Mineral Ratios .....  | 22 |
| Figure 9 Examples of generated ASTER processing products. From left to right: 321RGB; 468RGB; 631RGB.....  | 23 |
| Figure 10 –Coal occurrences located during field investigation (top) Bright angular fragments of subcropping coal in excavated dam spoils; (bottom) Coal outcrop on roadside .....                 | 25 |
| Figure 11 – Overview of data collected during field program .....  | 26 |
| Figure 12 - Showing historic drillholes for which seam data was recovered. Historical cross-section in Figure 13 .....   | 31 |
| Figure 13 – Historical interpreted cross-section showing some geological interpretation conflicting with waterbore data (After The Shell Company, 1979).....                                       | 32 |
| Figure 14 – Location of private- and government-owned (Forestry Tasmania) land parcels within EL15/2012 .....  | 36 |
| <br>   |    |
| Table 1 - Summary of historical coal exploration .....   | 15 |
| Table 2 - Historical reports relevant to EL15/2012 but not available.....  | 17 |
| Table 3 - Summary of ASTER sensor data (Hewson, 2003).....   | 21 |
| Table 4 – Drillhole collars and historical workings searched for during field investigation .....  | 27 |
| Table 5 – Summary of drillholes/waterbores for which coal seam data was recovered. Collar coordinates are in MGA94 zone 55 (GDA94).....  | 29 |
| Table 6 - Drilling details and coal intercepts for Shell historical drilling (not included in the MRT dataset) and coal-bearing waterbores. Collar coordinates are in MGA94 zone 55 (GDA94). ..... | 30 |
| Table 7 Expenditure statement for EL15/2012.....   | 37 |

## 1. Introduction

The Fingal-Avooca District in North Eastern Tasmania was identified by Imperial Coal Pty Ltd (Imperial) through an Australian wide evaluation aimed at identifying high quality, under explored coal provinces. Coal has been mined from the Fingal-Avooca District since the 1880's from both opencut and underground mines, exploiting coal seams hosted in the Triassic Upper Parmeener Supergroup of the Tasmanian Basin. Currently, Cornwall Coal Company (a subsidiary of Cement Australia) is mining coal from the district and in September 2013, Hardrock Coal Mining Pty Ltd was granted a mining licence to extract coal from an underground mine development beneath the Fingal Tier.

Imperial's preliminary analysis of the openfile geological and geophysical datasets identified three core areas within the Fingal-Avooca district to undertake further exploration for coal resources. Applications were submitted to Mineral Resources Tasmania in in the first quarter of 2012 for three licences, including EL15/2012 which is the subject of this report.

EL15/2012 'South Avooca' covers an area of 246 sq.km and is approximately 1km due south of Avooca Township (Figure 1). The Esk Main Road passes through the northwestern extent of EL15/2012, and is accessible from the east via Royal George Road and Old Coach Road. Rail infrastructure parallels Esk Main Rd passing through the northwestern portion of EL15/2012, and provides a valuable link to the export port of Bell Bay near Launceston some 150km to the north.

Within EL15/2012 Imperial is exploring for modest size opencut and larger underground thermal coal resources that are of sufficient quality to meet export coal specifications. This report summarises the first year exploration program undertaken by geological consultants Global Ore Discovery (Global Ore) on behalf of Imperial during the period 16/12/2012 to 16/12/2013.

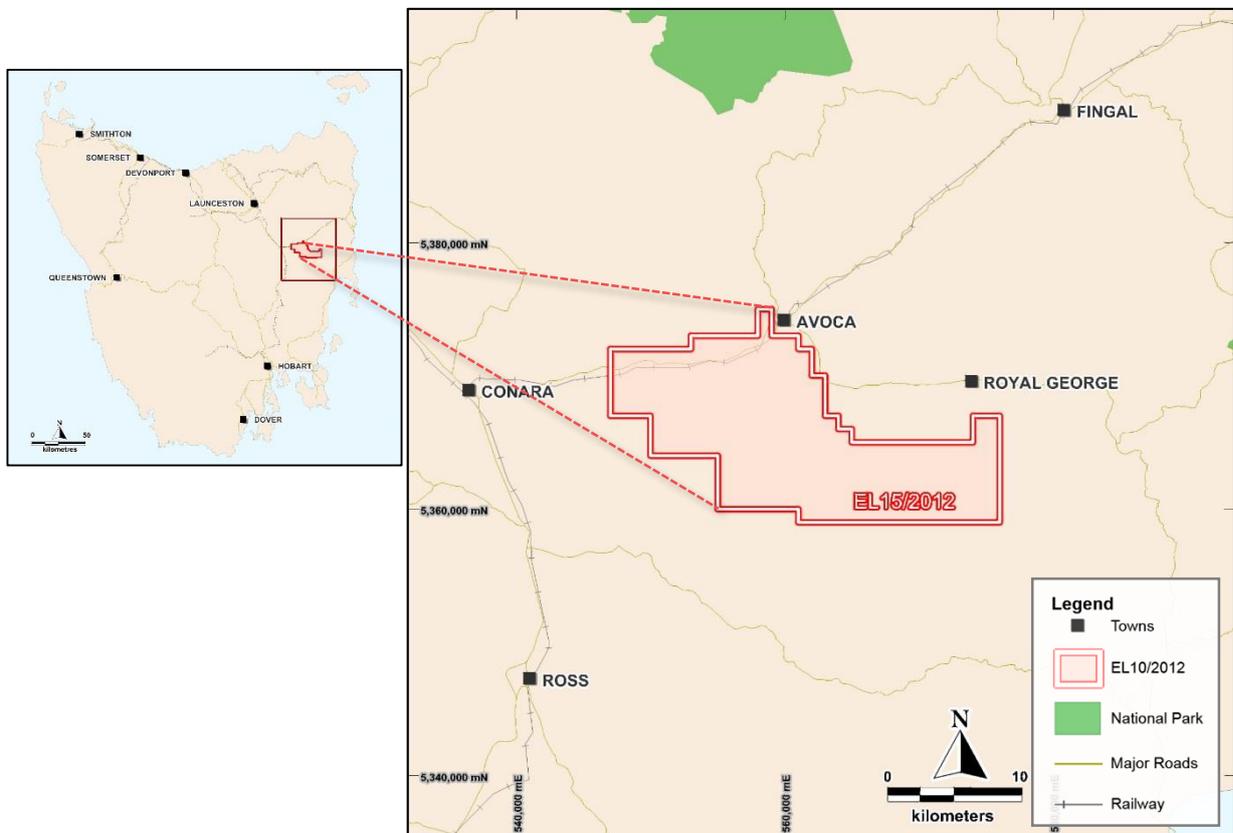


Figure 1 - Location overview of South Avooca EL15/2012

## 2. Review of Previous Work

No previous work has been undertaken by Imperial on the EL15/2012.

## 3. Exploration Completed during the reporting period

### Literature Review

#### Regional Geology

Imperial is exploring for coal hosted within the Late Carboniferous to Late Triassic Tasmania Basin. The Tasmania Basin covers much of eastern and southern Tasmania and the current outcrop edge is dominantly erosional, indicating that the basin originally occupied much larger extents than the current >30,000 sq. km (Seymour and Calver, 1995). EL15/2012 is located within the North East Tasmanian tectonic element. An overview of the stratigraphic-tectonic elements for Tasmania is shown in Figure 2. Sediments within the Tasmania Basin are generally flat lying (Stacey and Berry, 2004) and up to 1.5km thick (Seymour and Calver, 1995) and have been divided into two broad lithological/environmental associations, the Lower and Upper Parmeener Supergroups (Stacey and Berry, 2004). Both supergroups host subordinate coal units (Forsyth et al. 1974).

The Lower Parmeener Supergroup consists of glacial and glaciomarine shallow water sediments. The basal tillite units (which range up to 580m) are absent from the major highs in the Northern Tyennan Element and North East Tasmania Elements (Seymour and Calver, 1995). Subsequent to the deposition of these glaciogenic sediments, carbonaceous pyritic siltstone followed by richly fossiliferous siltstones, sandstone and minor limestone up to 400m thick were laid down (Seymour and Calver, 1995). Deposition due to growth faults seems restricted to the Lower Parmeener Supergroup and is only a minor factor in basin development (Stacey and Berry, 2004). Thicker accumulations of the lower Parmeener Supergroup occupy a NNW orientated elongate depocentre which is spatially coincident with the NNW structural zone separating the Western and Eastern Tasmanian Terranes (Stacey and Berry, 2004).

The Upper Parmeener Supergroup consists of four lithological units of non marine sediments deposited in the Late Permian to Late Jurassic (Forsyth, 1989) and described in detail in Seymour and Calver, 1995. The first unit consists of well sorted, cross bedded sandstone and carbonaceous siltstones and mudstone with thin coal seams in the far southwest and in the northwest (Seymour and Calver, 1995). Thickness of this unit varies from an average of 50m to maximum of 108m with the thickest sediments observed in the west (Seymour and Calver, 1995).

Unit two consists of predominantly well sorted quartz arenite between 200-300m thick, and is generally thinner in the north east of the basin (Seymour and Calver, 1995). Unit three contains quartz granule sandstone with minor conglomerate overlain by interbedded quartz sandstone, lithic sandstone and lutite and concludes with a quartz sandstone interbedded with carbonaceous lutite sandstone and local thin coal seams (Seymour and Calver, 1995).

The fourth unit contains all of Tasmania's economic coal reserves, these being mostly in the northeast (Bacon, 1991) where thickest preserved sections are observed (Seymour and Calver, 1995). This unit consists of lithic sandstone with lesser lutite and coal (Seymour and Calver, 1995). Rare felsic tuff horizons are observed in the upper parts of this unit (Bacon and Everard, 1981), while elsewhere at similar levels rare conglomeratic horizons are observed, which include clasts from a calc-alkaline volcanic source (Seymour and Calver, 1995).

These units of the Upper Permian Supergroup are intruded by a large volume of tholeiitic dolerite, mainly as sheets and sills. Typically these bodies are 400-500m thick (Seymour and Calver, 1995). Only limited areas of correlative extrusive rocks are observed in a graben at Lune River where Jurassic mudstones are also preserved (Seymour and Calver, 1995).

In the Cenozoic basalts were extruded throughout parts of northern and eastern Tasmania. Age dating indicates that volcanism ranged from Paleocene to late Miocene (Seymour and Calver, 1995). In North East Tasmanian Element (as defined by Sutherland and Wellman, 1986) a suite of basaltic flows with variable ages filled valley draining northward to Bass Strait.

Surficial Quaternary-aged deposits throughout Tasmania include glacial, slope, coastal, aeolian, fluvial and cave deposits. Colhoun (1989) provides further details on the regional distribution of the sediments.

# TIME - SPACE DIAGRAM FOR TASMANIA

Compiled by: D.B.Seymour and C.R.Calver  
VERSION 2 (31-03-1998)

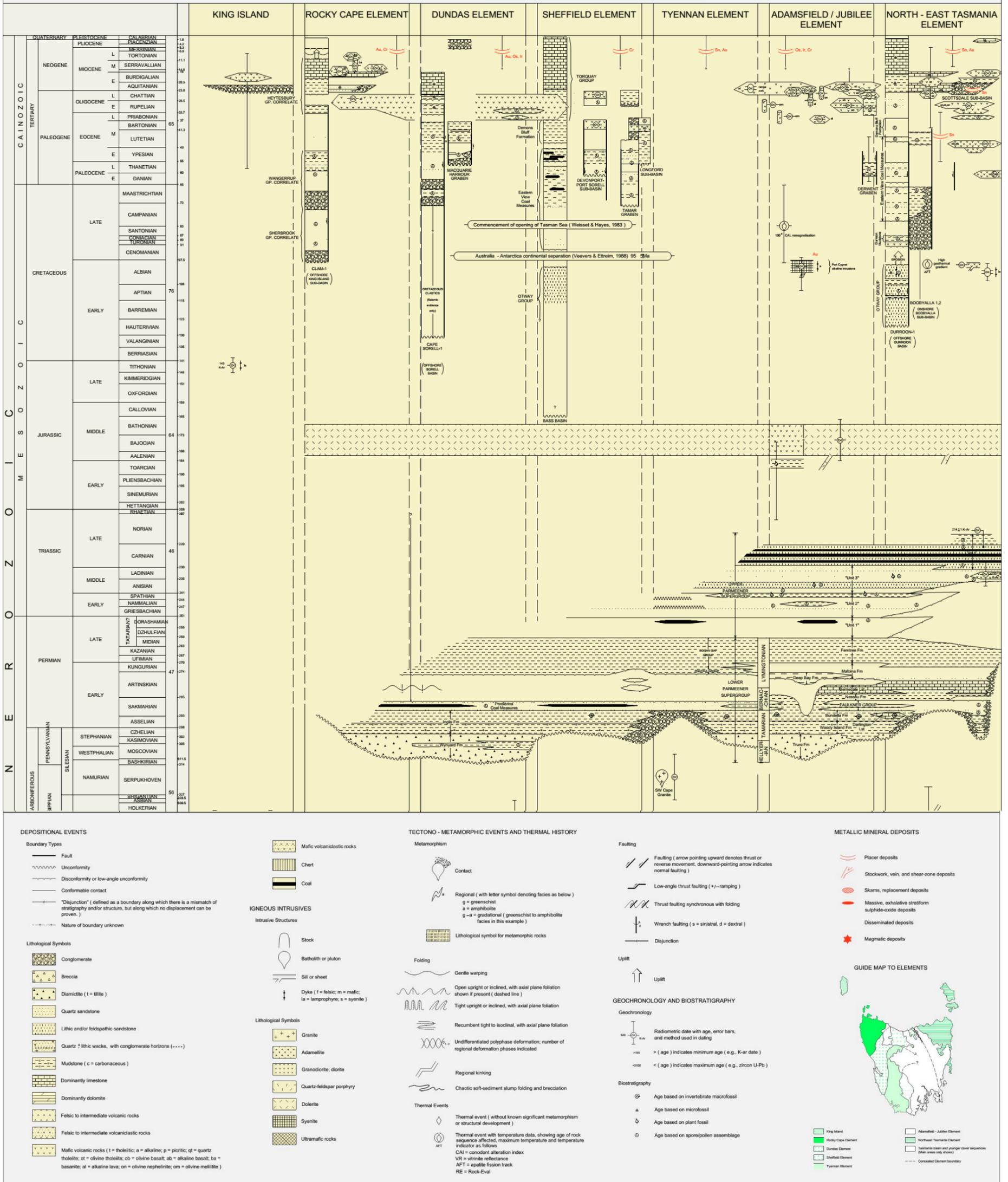


Figure 2 – Subset of Time-space diagram for Tasmania. EL15/2012 is situated closest to the North-East Tasmania Element (From Seymour and Calver, 1998)

## Local Geology

The local geology of EL15/2012 was summarised by Bornman (1981) as part of exploration carried out by Shell Company of Australia Limited in their historical EL18/1977 licence. Published geological mapping data is available at a scale of 1:250,000 (250k) scale over EL15/2012. Imperial conducted a geological mapping program within EL15/2012, which was hampered by the extensive dolerite scree and younger Tertiary units covering potential outcropping geology.

The basement underlying the Tasmanian Basin sediments within EL15/2012 is interpreted to be the Mathinna Beds, consisting of quartzite, phyllite, siltstone and slate deposited during the Ordovician/Silurian to early Devonian (Bornman, 1981). Folding of the Mathinna Bed sediments along a northwesterly axis occurred during the Tabberabberan Orogeny in the Middle Devonian (Bornman, 1981). Granites and granodiorites intruded these sediments during the late Devonian, which are mapped along the northeastern edge of EL15/2012.

Along the northeastern edge of EL15/2012 Permian sedimentary rocks of the Lower Parmeener Supergroup overlie the Siluro-Devonian basement. From the 250k mapping it is interpreted that Permian sediments mostly onlap onto basement, however complex faulting systems have juxtaposed blocks of younger sediments against basement (discussed further below). The base of the sequence comprises freshwater and paralic sandstones, mudstones and coal measures; which transgresses to glaciomarine pebbly mudstones, pebbly sandstone and limestones. The tillite and conglomerate beds observed to overlie the Mathinna Beds in other parts of Tasmania (Seymour and Calver, 1995) are not documented in the EL15/2012 licence area. The Lower Parmeener Supergroup in the Royal George-Fingal area (Royal George is ~2.5km north-northeast of EL15/2012) generally dips 3-4° to the southeast (Bornman, 1981).

The transition into the Upper Parmeener Supergroup is marked locally by a conglomerate marker horizon consisting of quartz, quartzite, mudstone and volcanic material, in a sandy kaolinitic matrix (Bornman, 1981). This conglomerate is not delineated in the 250k mapping, but a conglomerate layer was intercepted at the base of the Upper Parmeener Supergroup in drillhole AV12, located approximately 2.5km north of EL15/2012. Overlying this conglomerate is a package of well sorted, medium grained freshwater quartzose sandstone. The lithic content of the quartzose sandstone is low at the base, and increases slightly towards the top of the unit (Bornman, 1981).

Above the quartzose sandstone is a package of thick interbedded lithic sandstones, siltstones, mudstones, carbonaceous shales and coal seams (Bornman, 1981). This interbedded coal bearing package is shown in the 250k geological mapping to occur within the northern and central areas of EL15/2012. However results from Imperial's field investigation suggests more Upper Parmeener

Supergroup stratigraphy is present within EL15/2012 than is currently mapped. This upper coal bearing package is observed to vary in thickness in EL15/2012 between 240 and 325m (drillholes AV1, AV3 and AV12; Bornman and Murphy, 1980), and is interpreted to represent a floodplain environment (Bornman, 1981). The Upper Parmeener Supergroup generally dips 3-5° to the southwest in the Avoca area, but locally dips can fluctuate greatly and can even be reversed, particularly near dolerite intrusions (Bornman, 1981).

No folding has been previously observed within the Parmeener Supergroup sediments, except for distorting of sediments next to dolerite contacts (Bornman, 1981). No faults or folds were mapped by Imperial during the field investigation due to dolerite scree cover and the isolated nature of sediment outcrops/subcrops. Tensional north-northwest oriented faulting is shown within EL15/2012 in the 250k mapping, which are probably related to the intrusion of dolerite and/or Tertiary block movements (Bornman, 1981).

The northwest trending Castle Carey Fault passes through roughly the centre of EL15/2012, about 2km east of drillhole AV1 and is obscured by dolerite, and has a reported throw of up to 500m towards southwest (Bornman, 1981). The maximum throw on this fault zone is observed 6km to the north of EL15/2012, and the throw decreases towards the south (Bornman, 1981). Faulting along the central-northern edge of EL15/2012 that has the same orientation as the Castle Carey fault system, is delineated in the 250k mapping to juxtapose quartzose sandstone of the Upper Parmeener Supergroup against Siluro-Devonian basement. The offset in geological units could be explained by strike-slip fault movement or oblique dip-slip.

Jurassic dolerite bodies have been intruded as sills and dykes into the Upper Parmeener Super Group, and to a lesser extent the lower Parmeener. The base of dolerite generally dips towards the southwest in the Avoca area (Bornman, 1981).

The Cainzoic sediments within EL15/2012 include Tertiary basalts and Quaternary sediments. Tertiary basalt is mapped along the northeastern boundary of EL15/2012, and is reported to be made up of two flows with a combined thickness of approximately 40m (Bornman, 1981). Lithological logs from waterbores within EL15/2012 records basalt thicknesses between 25 and 30m (waterbore ID 16689 and 16685). The 250k geological mapping suggests quaternary sediments comprise mainly alluvial and lacustrine sand, gravel, silt, clay and regolith

### Historic Coal Exploration

Approximately 5km to the north of EL15/2012 four coal mines make up the Mount Christie (Stanhope) Coalfield, which began operations in 1923: Mount Christie, Stanhope (1932-1957), New Stanhope (1957-1973) and Fenhope mines. An extensive discussion of the Mount Christie Coalfield is given by

Bacon (1991, p.129). The coal seams are hosted in the Upper Parmeener Supergroup, and terminate to the east against the Castle Carey Fault. The Castle Carey Fault extends south roughly through the centre of EL15/2012. The coalfield is structurally complex with significant faulting making correlation of the coal seams problematic. Coal seams have thickness up to 3.8m (Stanhope Mine), 2.1m (New Stanhope Mine), 3.6m (Fenhope Mine), and 2.4m (Mount Christie Mine).

The inferred reserves of the Mount Christie Coalfield is likely to be less than one million tonnes, with production totalling 395 000 tonnes from the Stanhope and New Stanhope mines (the two largest operations) (Bacon, 1991). Coal quality data from different locations in the Mount Christie Coalfield is provided by Bacon (1991) and reproduced in Figure 3. The washed product from the Fenton Seam at Fenhope suggests coal in the area has potential to be export quality.

|  | 1     | 2     | 3     | 4     | 5    |
|--|-------|-------|-------|-------|------|
| Moisture (%)   | 3.1   | 3.8   | 1.94  | 3.03  | 2.1  |
| <i>Analysis basis (AD)</i>   |       |       |       |       |      |
| Ash (%)  | 29.4  | 15.2  | 19.6  | 21.7  | 10.8 |
| Volatile matter (%)  | 24.7  | 28.6  | 31.0  | 31.3  | 31.0 |
| Fixed carbon (%)   | 42.8  | 52.4  | 47.5  | 44.0  | 51.6 |
| Total sulphur (%)  | 0.40  | 0.39  |       |       |      |
| Specific energy (MJ/kg)  | 22.60 | 27.38 | 26.17 | 25.47 |      |
| Carbon (%)   | 54.78 | 67.22 |       |       |      |
| Hydrogen (%)   | 3.56  | 4.17  |       |       |      |
| Nitrogen (%)   | 1.03  | 1.23  |       |       |      |
| Carbon dioxide (%)   | 0.53  | 0.27  |       |       |      |
| <i>Dry, ash-free basis</i>   |       |       |       |       |      |
| Volatile matter (%)  | 36.6  | 35.3  |       |       |      |
| Specific energy (MJ/kg)  | 33.48 | 33.80 |       |       |      |
| Carbon (%)   | 81.16 | 82.99 |       |       |      |
| Hydrogen (%)   | 5.27  | 5.15  |       |       |      |
| Nitrogen (%)   | 1.53  | 1.52  |       |       |      |
| <i>Ash fusion temperatures (reducing atmosphere) °C</i>  |       |       |       |       |      |
| Deformation  | 1200  | 1310  |       |       |      |
| Spherical  | 1490  | 1470  |       |       |      |
| Hemisphere   | 1500+ | 1500  |       |       |      |
| Flow   | 1500+ | 1500+ |       |       |      |
| <i>Trace elements</i>  |       |       |       |       |      |
| Cu   |       |       |       | 20    |      |
| Pb   |       |       | 40    | 100   |      |
| Zn   |       |       | 10    | 10    |      |
| Seam thickness (m)   | 3.54  | 3.54  | 0.48  | 0.61  |      |
| Separation density   |       | F1.70 |       |       |      |
| Yield (%)  |       | 71.1% |       |       |      |
| <ol style="list-style-type: none"> <li>1. Raw coal, channel sample of Fenton seam, 3.54 m thick, Fenhope Colliery (Bacon, 1986).</li> <li>2. Washed coal, channel sample of Fenton seam as above, F1.70 (Bacon, 1986).</li> <li>3. Coal ply 0.48 m thick (between bands 3 and 4) towards base of seam at New Stanhope Colliery, collected near Adit 2 (Bacon, 1986).</li> <li>4. Coal ply 0.61 m thick (between bands 4 and 5) near base of seam at New Stanhope Colliery, collected near Adit 1 (Bacon, 1986).</li> <li>5. Spot sample from dump at New Stanhope Colliery (Western Mining Corporation, 1977a).</li> </ol> |       |       |       |       |      |

Figure 3 - Coal quality data from the Mount Christie Coalfield (From Bacon, 1991)

Stable Creek (Figure 6) and Prospect Tunnel prospects in the east of EL15/2012 both ceasing mining operations in 1922 (Bacon, 1991). Hills et al. (1922) report coal seams of up to 1.83m thick at these prospects. An outcropping seam 0.49m thick was reported (exact location unknown) in a creek bed at approximately the same elevation as the Stable Creek Prospect (Waters, 1978). In 1978 Investigator Coal Exploration Pty Ltd (Sangster, 1979) drilled four percussion drillholes. 78RG1 attempted to intercept the seam reported at Stable Creek and Prospect Tunnel Adits, and intercepted nine seams (seams 1, 2 and 8 were sampled; Figure 4) with a max thickness of 2.01m. In 1992 Merrywood Coal Company targeted on extending the known the seams intercepted by Investigator Coal Exploration, and drilled borehole REM1 which intersected a 1.7m coal seam (Morrison, 1993). They followed this up with three diamond drillholes that intersected coal seams of 1.66m and 2.22m (Morrison, 1994). Merrywood Coal used RGM1, RG1 and RG3 to calculate an indicated resource of 400,000 tonnes (Morrison, 1995). Drillhole and Stable Creek prospect locations are shown in Figure 6.

| DEPTH FROM (m) | DEPTH TO (m) | THICKNESS (m) | AS RECEIVED MOISTURE % | ASH % (d.b) | VOLATILE MATTER % (d.b.) | FIXED CARBON % (d.b.) | % S (d.b.) | S.E. MJ/kg (d.b.) | RELATIVE DENSITY | F.C./VOL. | SEAM |
|----------------|--------------|---------------|------------------------|-------------|--------------------------|-----------------------|------------|-------------------|------------------|-----------|------|
| 22.515         | 23.3         | 0.785         | 4.0                    | 28.5        | I.C.E. 1<br>21.1         | 50.4                  | 0.36       | 24.73             | 1.47             | 2.39      | 1    |
| 29.155         | 30.12        | 0.935         | 8.0                    | 23.2        | 23.5                     | 53.2                  | 0.47       | 26.26             | 1.45             | 2.26      | 2    |
| 30.12          | 30.63        | 0.51          | 6.4                    | 37.4        |                          |                       |            |                   |                  |           | 2    |
| 30.63          | 31.2         | 0.57          | 5.6                    | 33.4        |                          |                       |            |                   |                  |           | 2    |
| 95.78          | 96.485       | 0.705         | 5.4                    | 39.7        |                          |                       |            |                   |                  |           | 8    |

Figure 4 - Coal quality data from Investigator Coal Exploration drillhole 78RG1 (From Bornman, 1981)

Western Mining Corporation drilled nine boreholes (AVT1 to 9; Figure 6) in 1977 which were all collared just north of EL15/2012 (Ashton, 1977). The drilling program totalled 587m of open-hole drilling and 2m of core drilling, and reached a maximum depth of 85m. Four drillholes intersected coal:

- AVT1 – 0.2m net coal
- AVT2 – 1.75m net coal
- AVT3 – 0.8m net coal
- AVT8 – 2.3m net coal and carbonaceous shale

Block faulting and intrusion of dolerite were suggested to have displaced the coal bearing sedimentary package. It was concluded that further work was needed to define the stratigraphy and marker horizons.

The Shell Company of Australia Limited (Shell) exploration of EL 18/77 'Avoca' spanned 1978 to 1980 (Summarised by Bornman, 1981) included the drilling of nine drillholes totalling 3294m (AV1-9; Figure 6). They followed this up with four more drillholes (AV10-13) in 1980. Four of Shell's drillholes (AV1, AV3, AV4 and AV11) are now located within the current EL15/2012 licence. The results from these drillholes were:

- AV1 intersected one seam greater than 1m thick between 250.7 and 251.6m (Figure 5). Wash test on two seams at a density of 1.6 produces potential export quality product with ash values between 15.5% and 21.6%; specific energy between 26.88 and 28.15 MJ/Kg with yields of up to 82% . The analysis of a wash test of combined 1.47m coal returned crucible swelling number of 1 and volatile matter 24.8%.
- AV3 intersected a 1.12m thick seam between 355.72m and 356.84m. Other seams were intersected but they contained thick partings and were thinner.
- AV4 was abandoned due to problems with access and weather issues
- AV11 was terminated in dolerite at 466.5m indicating dolerite is exceptionally thick at that location

In Shell's summary of exploration (Bornman, 1981), they conclude that EL18/77 (a subset of what was EL18/77 is now within the EL15/2012 licence) is prospective for small to medium sized coal deposits, and cite lack of drilling and apparent discontinuity of coal development to be the main barriers to defining an economic resource. Key aspects of historic coal exploration in or adjacent to EL15/2012 are summarised in Table 1.



Table 1 - Summary of historical coal exploration

| Report No | Licences      | Companies -<br>Authors   | Report Title   | Summary of Work   |
|-----------|---------------|--|--|---|
| 77_1201   | EL16/76       | Western Mining Corporation – Ashton, S.M.                            | Exploration Licence No. 16/76, Avoca, Tasmania. Report for Six Months from 2 <sup>nd</sup> August, 1976 to 2 <sup>nd</sup> February, 1977. | Literature review, reconnaissance, detailed mapping, coal sampling. Coal quality data suggest coking potential, Castle Carey Fault has brought coal to west to lower relief area and made more mineable, suggests drilling program. |
| 77_1206   | EL16/76       | Western Mining Corporation – Ashton, S.M.                            | Western Mining Corporation (Tasmania) Pty Ltd; Westminer Investments Pty Ltd (holder)  | 9 boreholes totalling 587.3m (AVT1-9), Downhole geophysics: gamma, resistivity, S.P. Lithological logging. No drilling within EL15/2012.  |
| 78_1282   | EL18/77 Avoca | The Shell Company of Australia Limited. Taylor, D.A. and Ivett, J.K. | Exploration licence 18/77, Avoca. Six monthly progress report for period ending 26 July 1978   | Statistics and borehole lithological logs for drillholes AV1-AV5, and progress report for AV6. Results from field mapping and laboratory testing of coal samples. AV1, AV3 and AV4 occur within EL15/2012.                          |
| 78_1278   | EL16/77       | Investigator Coal Exploration Pty Ltd – Waters D.D.                  | Exploration licence 16/77 Royal George, Report for six months 23 <sup>rd</sup> December 1977 to 23 <sup>rd</sup> June 1978                 | Licence overlaps eastern edge of EL15/2012, Geological mapping, Literature review of surrounding coalfields, coal quality analysis, Calculated coal reserve of 790 000 tonnes near Old Merrywood Mine (not within EL12/2012)        |
| 79_1323   | EL18/77 Avoca | The Shell Company of Australia Limited. Anonymous.                   | Relinquishment report on exploration in the southern part of E.L. 18/77 Avoca  | Photo-geological office studies, field mapping and drilling results. Based on these results relinquishment of area recommended.   |

| Report No      | Licences                  | Companies - Authors  | Report Title   | Summary of Work   |
|----------------|---------------------------|--|--|---|
| 79_1324        | EL16/77                   | Investigator Coal Exploration Pty Ltd – Sangster, J.W.   | Exploration Licence 16/77 Royal George, Report for Six Months 23 <sup>rd</sup> June, 1978 to 23 <sup>rd</sup> December, 1978 | 4 drillholes were drilled totalling 699m, intersecting 29 coal seams ranging from 0.3m to 2.2m. Coal quality analysis suggests potential for geothermal power generation, but is unlikely to have economic quantities of coal. 78RG1 drillhole within EL12/2012 |
| 79_1334        | EL18/77 Avoca             | The Shell Company of Australia Limited. Anonymous.   | Exploration licence 18/77, Avoca. Six monthly progress report for period ending 26 January 1979.                             | Effectively same as report 79_1323. Drilling statistics and lithological logs for AV1-AV9. Coal laboratory testing results, results field mapping program. AV1, AV3 and AV4 occur within EL15/2012.   |
| 83_2301 (1979) | 5/61 Gray and 18/77 Avoca | Industrial and Mining Investigations Pty Ltd, The Shell Company of Australia Ltd. Brunton, J.S., Taylor, D.A. and Senini, P. | A preliminary review of exploration licences 5/61 Gray and 18/77 Avoca   | Location, access, climate etc. details, historical literature review, summary of geology and coal resources in area   |
| 81_1512        | EL18/77 Avoca             | The Shell Company of Australia Limited. Murphy, P., Bornman, J.C.  | Exploration licence 18/77, Avoca, Tasmania, Progress report 1980   | Drilling statistics and lithological logging AV10-AV13, field mapping. AV11 within EL15/2012.   |
| 81_1570        | EL18/77 Avoca             | The Shell Company of Australia Limited. Bornman, J.C.  | Exploration licence 18/77, Avoca, Tasmania. A Review of the Coal Resources and Prospectivity                                 | Summary of work carried out on EL18/77. Conclude that licence is prospective for small to medium sized deposits, suggest two exploration targets. Discuss effectiveness of regional   |

| Report No | Licences   | Companies - Authors                               | Report Title   | Summary of Work   |
|-----------|------------|---|--|---|
|           |            |   |  | gravity to determine where minimal dolerite.  |
| 93_3413   | E.L. 19/91 | Merrywood Coal Company Pty. Ltd. - Morrison, K.C. | EL 19/91 Royal George, Year 1 Annual Report                      | Percussion drilling intersected 1.7m coal seam, coal analysis. Confirmed potential for small open-pit coal resource   |
| 94_3571   | E.L. 19/91 | Merrywood Coal Company Pty. Ltd. - Morrison, K.C. | E.L. 19/91 – Royal George Annual Report Year 2 (10/4/93-10/4/94) | Three NQ drillholes, lithological logging sheets, coal analyses Mt Puzzler. Intersected 'main seam' in RG1 and RG-3. Smaller seam above main intersected RG-3. RG-2 carbonaceous mudstone intersection at correlateable depth to RG1 seam assuming faulting. RG1, 2 and 3 are within EL15/2012. |
| 95_3709   | E.L. 19/91 | Merrywood Coal Company Pty. Ltd. - Morrison, K.C. | E.L. 19/91 – Royal George Annual Report Year 3 (10/4/93-10/4/94) | Drillhole collars reported in 94_3571 surveyed and resource estimate of 400,000 tonnes calculated.  |

Table 2 - Historical reports relevant to EL15/2012 but not available

| Report No | Licences      | Companies - Authors | Report Title  | Summary of Work   |
|-----------|---------------|---------------------|---|---|
| ?         | Many          | Shell May-78        | Photo-geological/structural interpretation of Shell coal leases in north-eastern Tasmania       | Photo-geological mapping, faults and fractures, coal measure sub/outcrops, base elevations of dolerite. Implications for future exploration discussed |
| ??        | EL18/77 Avoca | Shell Dec-78        | Exploration licence 19/77, Avoca. Report on the geology and coal resources of E.L. 18/77, Avoca | Drilling statistics and lithological logs for AV1-AV9. Coal laboratory testing results, results field mapping program. AV1,                           |

| Report No | Licences         | Companies - Authors | Report Title  | Summary of Work                            |
|-----------|------------------|---------------------|---|--|
|           |                  |                     |   | AV3 and AV4 occur within EL15/2012.        |
| ?         | EL18/77<br>Avoca | Shell Jan-80        | Exploration licence 18/77, Avoca. Six monthly progress report for period ending 26 January 1980 | Field mapping, drillhole program proposal. |

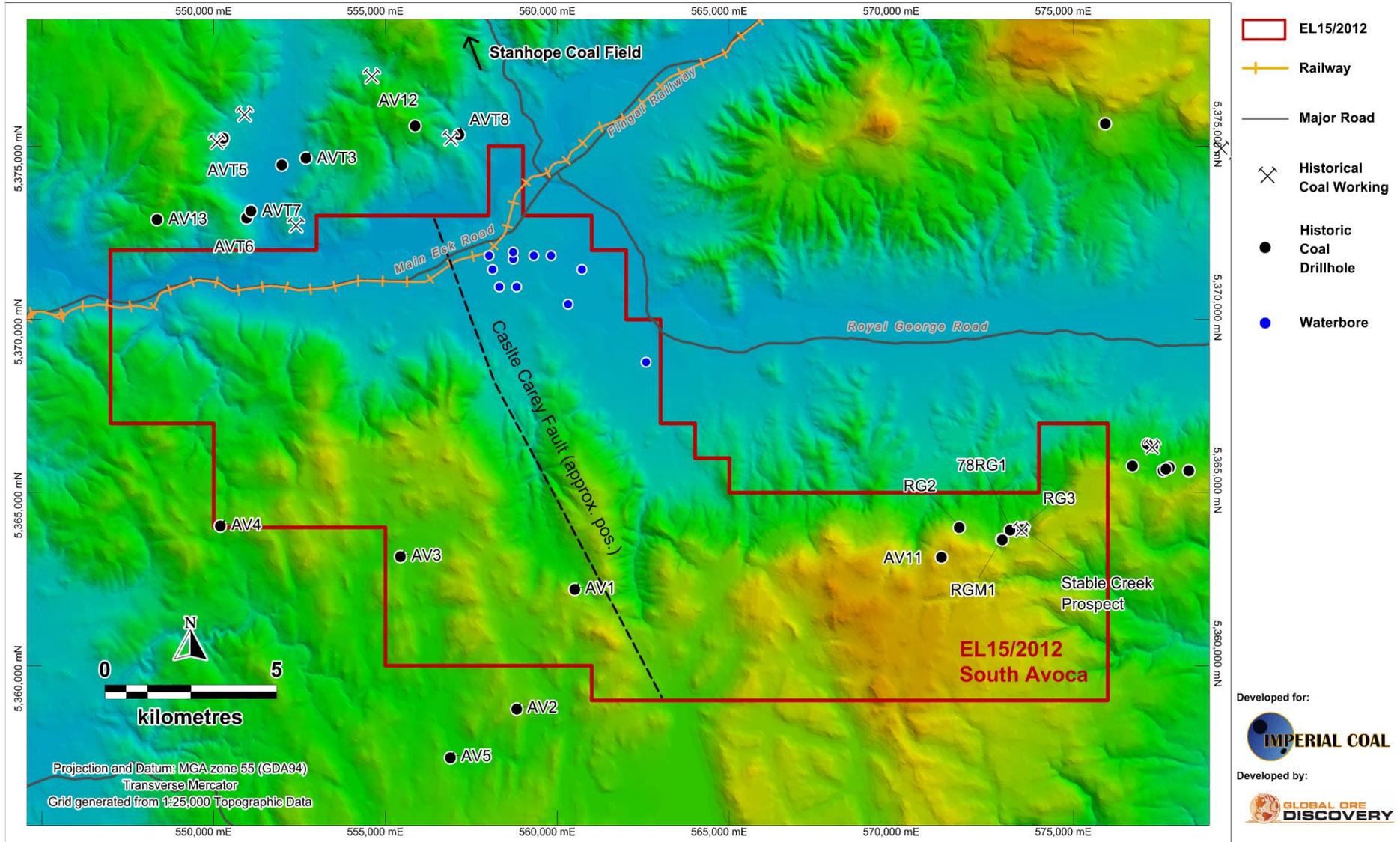


Figure 6 – Location of elements relevant to historic exploration



## Regional Exploration Activities

### Remote Sensing

Multispectral ASTER satellite image data has been acquired, processed and incorporated into the GIS database for use in the integrated interpretation as a key element to drive Imperial's first year reconnaissance exploration program. Processed ASTER imagery can assist in mapping lithological and mineral composition variations over large areas of outcropping stratigraphy.

Key products and applications of the ASTER processing for coal exploration include:

- Clay occurrence and composition for detailed stratigraphic mapping
- Silica occurrence mapping, to assist quartzose stratigraphy interpretation.

The purpose of utilising ASTER data is to assist in discriminating lithological types within EL15/2012, and to further constrain the extent of the coal-bearing Upper Parmeener Supergroup.

The ASTER sensor has a scene area of 60 x 60km and collects information from the following channels (Figure 7, Table 3, Hewson, 2003):

- Three 15m pixel resolution visible-near-infrared (VNIR) channels (bands 1-3)
- Six 30m pixel resolution shortwave infrared (SWIR) channels (bands 4-9)
- Five 90m pixel resolution infrared (TIR) channels (bands 10-14)

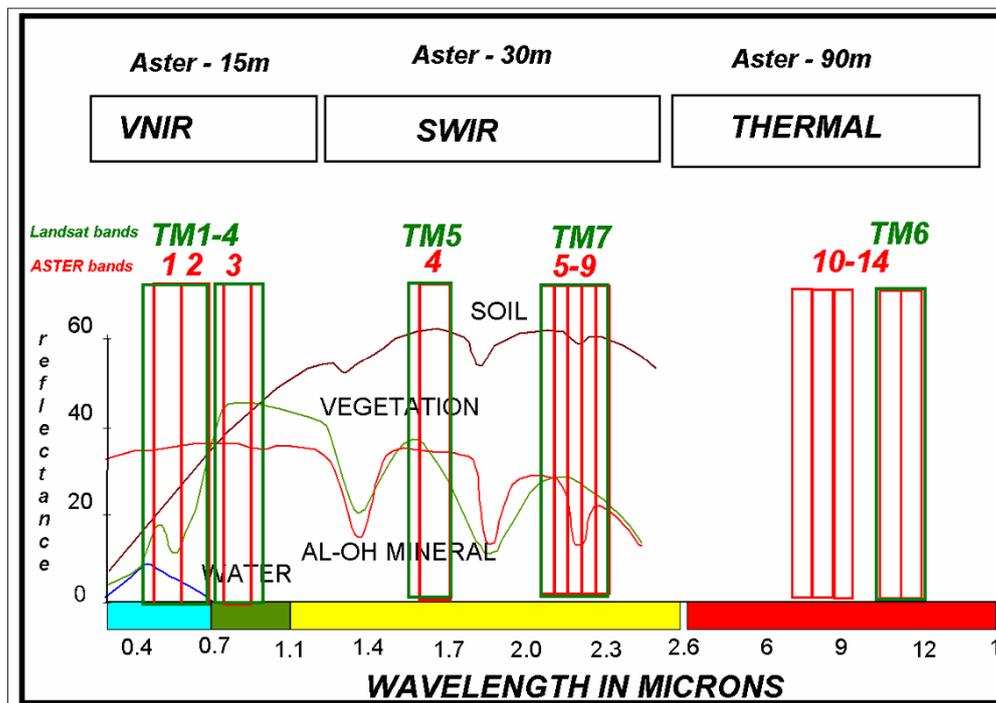


Figure 7 Remotely sensed ASTER versus Landsat TM bands, and overview of common spectral responses (Hewson, 2003)

The VNIR and SWIR modules are arranged as a 5000 element linear array and a 2048 element staggered array respectively, and both have push-broom detectors. The TIR employs a whiskbroom detector with a scan mirror for across track sampling. The VNIR and SWIR are available in 8 bit dynamic range and TIR in 12 bit quantisation (Hewson, 2003). The SWIR bands are accurate to 3m between bands and

50m in overall accuracy. The ASTER sensor has a high signal to noise ratio of minimum 150:1, with most bands around 200:1 (Hewson, 2003).

Table 3 - Summary of ASTER sensor data (Hewson, 2003)

| Spectral Range              | VNIR $\mu\text{m}$                                 | SWIR $\mu\text{m}$              | TIR $\mu\text{m}$                 |
|-----------------------------|--|---------------------------------|-----------------------------------|
| FWHM<br>[Centre $\lambda$ ] | Band 1 0.52 – 0.60<br>[0.556]                      | Band 4 1.600 – 1.700<br>[1.656] | Band 10 8.125 – 8.475<br>[8.291]  |
|                             | Band 2 0.63 – 0.69<br>[0.661]                      | Band 5 2.145 – 2.185<br>[2.167] | Band 11 8.475 – 8.825<br>[8.634]  |
|                             | Band 3N 0.78 – 0.86<br>[0.807]                     | Band 6 2.185 – 2.225<br>[2.209] | Band 12 8.925 – 9.275<br>[9.075]  |
|                             | Band 3B 0.78 – 0.86<br>[0.804]<br>Backward looking | Band 7 2.235 – 2.285<br>[2.262] | Band 13 10.25 – 10.95<br>[10.657] |
|                             |  | Band 8 2.295 – 2.395<br>[2.336] | Band 14 10.95 – 11.65<br>[11.318] |
|                             |  | Band 9 2.360 – 2.430<br>[2.400] |                                   |
| Ground Resolution (m)       | 15   | 30                              | 90                                |
| Dynamic Range               | 8  | 8                               | 12                                |

Raw ASTER imagery was processed to remove atmospheric, radiometric and geometric effects. A series of false colour images were then created from the data and colour balanced using combinations of the 3 VNIR (visible and near infrared) and 6 SWIR (short-wave infrared) ASTER bands.

These products were (Figure 9):

- Natural Colour stretch; the algorithm applied to the VNIR bands 321 in Red (band 2), Green  $((3 \times \text{band1} + \text{band3})/4)$ , Blue  $((3 \times \text{band1} - \text{band3})/4)$ , generates an image that simulates natural colour at 15m pixel size.
- 468 RGB stretch; this image uses ASTER's SWIR sensor, which has a 30m pixel size. These bands are highly sensitive to lithological and alteration variations and are in a region of the electromagnetic spectrum that the eye cannot perceive. The 468 RGB image is therefore the recommended image for geological/and mineralogical interpretation.
- 631 RGB stretch; this image uses a combination of bands 3 and 1 from ASTER's VNIR sensor and band 7 from the SWIR sensor. Band 7 is resized from a 30m pixel size to a 15m pixel to match the 15m pixel size of the VNIR bands. This combination of bands is sensitive to lithological variations and may be useful for geological/alteration interpretation. This image is similar to Landsat TM741 images.

The ASTER investigation comprised processing and mineral mapping as outlined in Figure 8. These mineral maps were generated by combining VNIR, SWIR, and TIR wavelengths in conjunction to specific mineral ratios. This can differentiate mineralogical occurrences in the area of interest. Key mineral ratio products that were processed using ENVI ASTER Mineral Ratio processing tool include:

- Ferric Iron (Band2/Band1) (Rowan and Mars, 2003)
- Ferrous Iron  $((\text{Band5}/\text{Band3}) + (\text{Band1}/\text{Band2}))$  (Rowan and Mars, 2003)
- Epidote/Chlorite/Amphibole (MgOH Bond)  $(\text{Band6} + \text{Band9}) / (\text{Band7} + \text{Band8})$  (CSIRO)
- Sericite/Muscovite/Illite/ Smectite (AlOH Bond)  $((\text{Band5} + \text{Band7}) / \text{Band6})$  (Rowan and Mars, 2003)
- Alunite/Kaolinite/Pyrophyllite  $((\text{Band4} + \text{Band 6}) / \text{Band 5})$  (Rowan and Mars, 2003)

- Quartz rocks (Band14/Band12) (Rowan and Mars, 2003)
- Silica (Band11/Band12) (CSIRO)

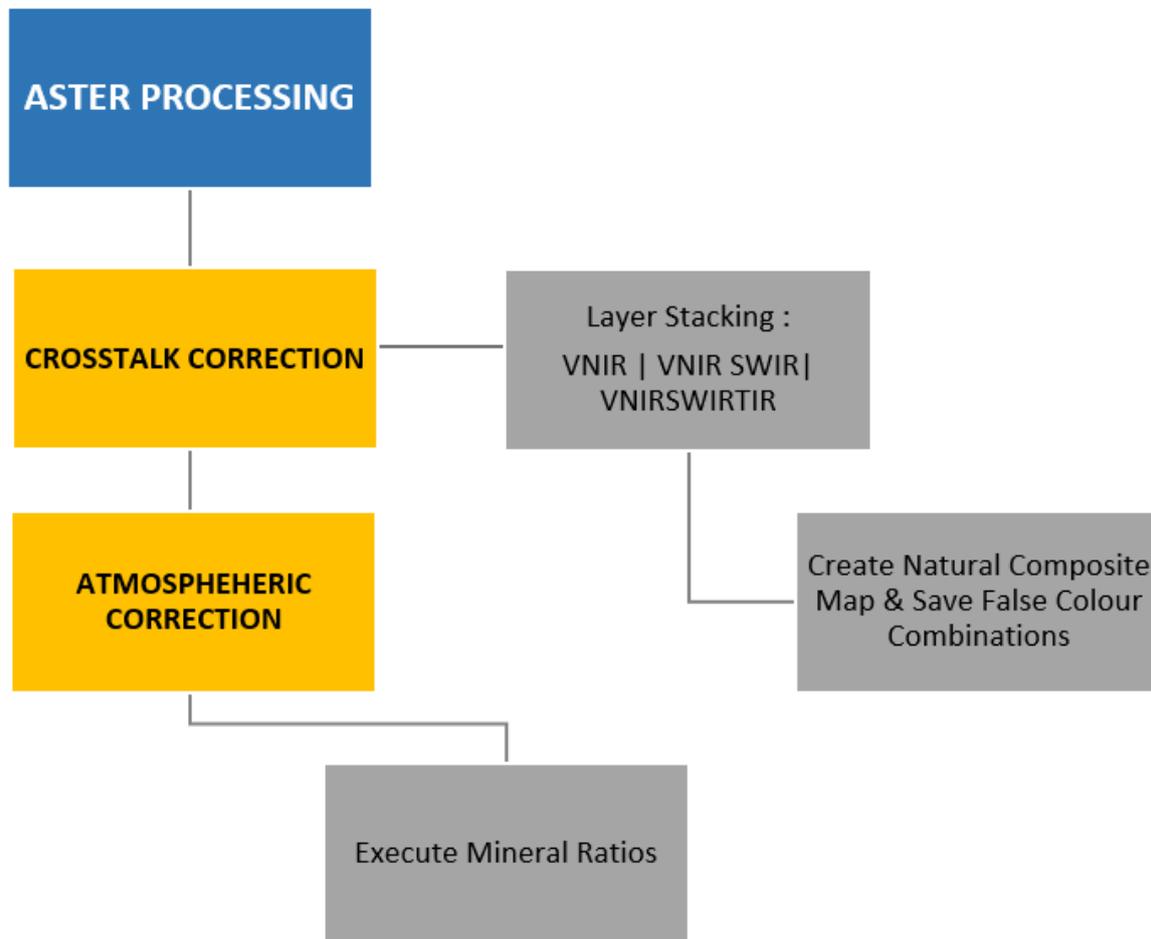


Figure 8 Aster Processing of Mineral Ratios

ASTER mineral ratio images were integrated with open file radiometrics and mapped outcrop geology to identify priority areas of potential outcropping Upper Permian Stratigraphy for field reconnaissance mapping. Due to significant vegetation coverage at the time of imagery acquisition the ASTER imagery was of limited use in mapping the mineralogical variation with the target sedimentary stratigraphy.

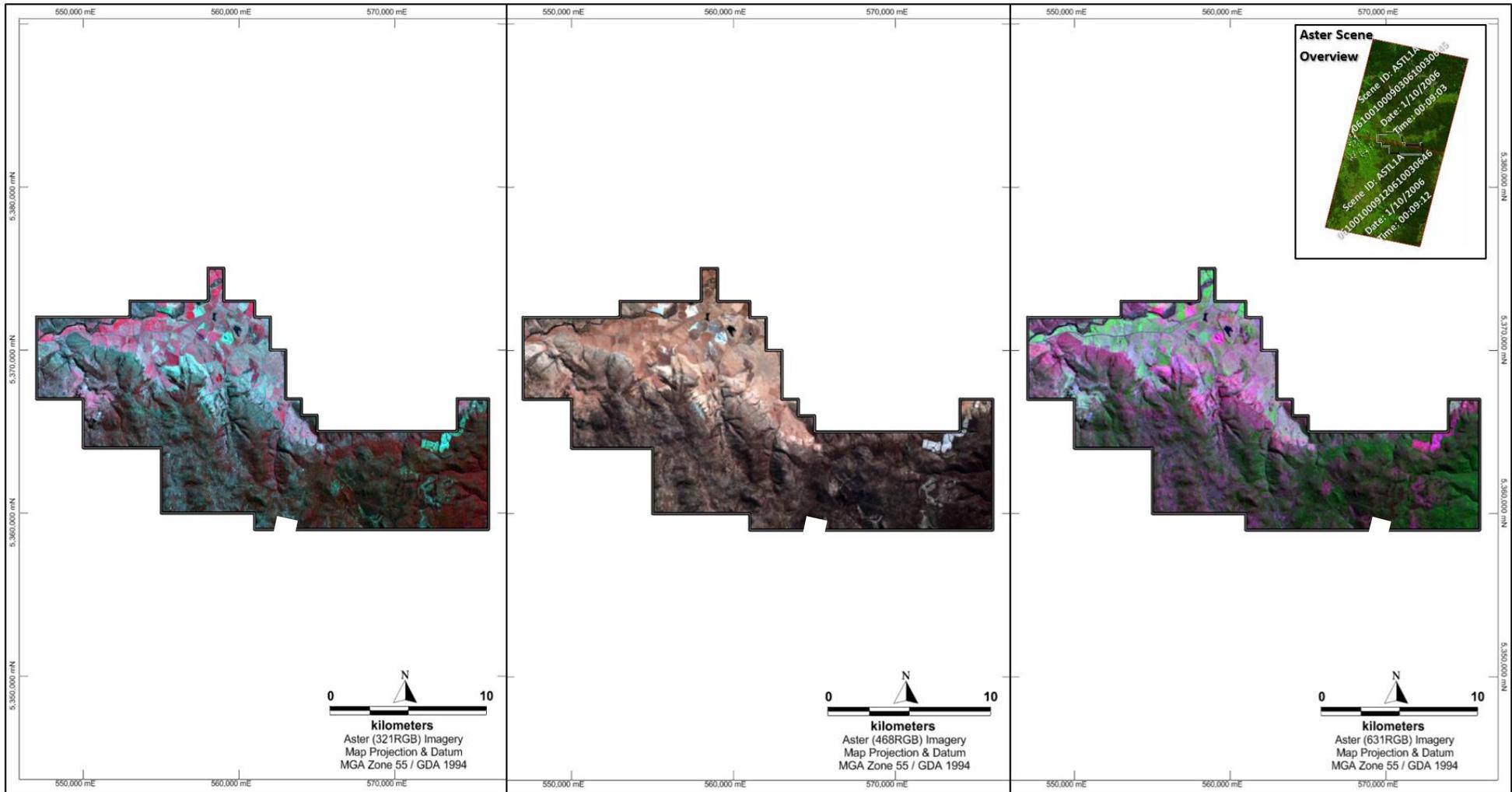


Figure 9 Examples of generated ASTER processing products. From left to right: 321RGB; 468RGB; 631RGB

## Prospect Based Exploration Activities

### Field Mapping

The intention of the field program was to:

- Locate historical drillholes and determine accuracy of collar position using a GPS
- Locate mapped and identify new coal outcrops
- Collect structural measurements to assist cross-section generation
- Follow-up areas of ASTER mineral anomalies that indicated potential outcropping Upper Parmeener Supergroup

The outcomes and highlights of the field investigation were:

- 6 geologist-day reconnaissance covering over 30km of 4WD tracks and hiked traverses (Figure 11)
- Attempted to locate historical drillhole RG3 (Royal George 3) and Stable Creek prospect (Table 4) based on MRT database locations
- Located 2 coal outcrops/subcrops and 1 coal float sample (Photos in Figure 10, and locations shown in Figure 11). This new data will enable more refined modelling of coal seam potential
- Mapping of 4 sediment outcrops and collection of 3 strike and dip measurements
- Ground truthing of ASTER mineral anomalies suggests that remote sensing techniques are appropriate for targeting outcropping Parmeener Supergroup sediments, although due to strong vegetation interference it has limited use in specifically discerning the type of sediment present

During Imperial's field mapping investigation coal within sediments was found in a road cutting (Figure 11) that is an area delineated as dolerite in the 250k geological mapping. Massive (lacking visible bedding) sandstone outcrops were also discovered by Imperial in the east of EL15/2012 (Figure 11). These observations suggest that the Upper Parmeener Supergroup coal bearing stratigraphy is more prevalent within EL15/2012 than is currently mapped in the 250k geological mapsheets.



*Figure 10 – Coal occurrences located during field investigation (top) Bright angular fragments of subcropping coal in excavated dam spoils; (bottom) Coal outcrop on roadside*

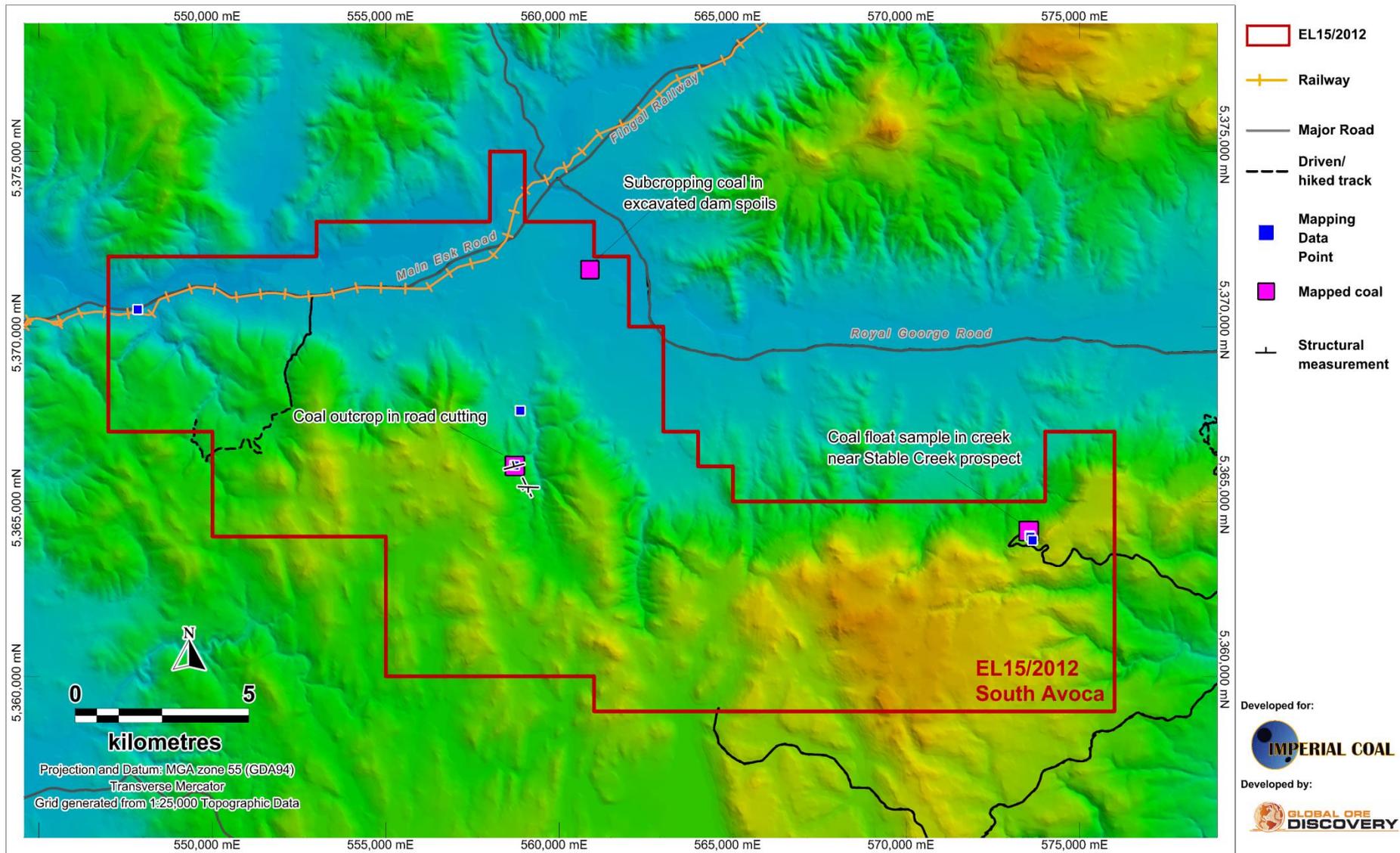


Figure 11 – Overview of data collected during field program

Table 4 – Drillhole collars and historical workings searched for during field investigation

| DH Code <sup>2</sup>  | MRT <sup>1</sup> location |           | Field Location |           | MRT <sup>1</sup> location error (m) | Comment  | Photo ID              |
|-----------------------|---------------------------|-----------|----------------|-----------|-------------------------------------|--|-----------------------|
|                       | Easting                   | Northing  | Easting        | Northing  |                                     |  |                       |
| RG3                   | 593,513                   | 5,375,983 | 573,546        | 5,364,033 | 50                                  | Tree clearing potentially representing drillpad site | N/A                   |
| Stable Creek Prospect | 573,512                   | 5,363,982 | N/A            |           | N/A                                 | No evidence for prospect                             | FGL-33 (See appendix) |

<sup>1</sup> – Mineral Resources Tasmania

<sup>2</sup> – For DH abbreviations see Table 5

## Drillhole Database Compilation

Historic drillhole data was recovered from scanned historical exploration reports to produce a digital GIS drillhole database from which geological cross sections could be generated. Historic drillhole locations were recovered from the published state wide drillhole dataset, and downhole data was compiled from historical company exploration reports, both of which were downloaded from Mineral Resources Tasmania ([www.mrt.tas.gov.au](http://www.mrt.tas.gov.au)). The drillhole data recovered from reports consisted of:

- Survey details
  - Total drillhole length
  - Collar location
- Depth to base of dolerite
- Coal seam depths, thicknesses and descriptions
- Coal quality results

Drillholes were selected primarily for their proximity to EL15/2012, but availability and quality of data were also taken into account. Downhole coal seam intersections were extracted for ten historic coal drillholes and four waterbores. Drillholes and waterbores that have seam data are listed in Table 5 and located in Figure 12. Collar locations and downhole data for historical drillholes AV1, -2, -3, -4 and -5 were found during the literature review, which were not included in the MRT department collar location dataset.

The new historical drillhole locations and seam data are summarised in Table 6. A report by Ivett and Taylor (1978) provides the initial drilling report, and contains schematic lithological logs and preliminary coal analysis of seams in AV1. The Shell Company (1979) provides the detailed downhole logs for these holes, as well as further coal analyses for AV1.

Coal is reported in the downhole logs (DPIPWE, 2013) of four waterbores in the northeast EL15/2012. Coal intersections include a 1.5m seam at 13.7m; a 1.5m seam at 24.4m; and a net coal of 2.5m between 21.3 and 23.2m (Table 6). Data from waterbores can be unreliable as logging is rarely carried out by a geologist. The discovery by Imperial of subcropping coal nearby to waterbores (Figure 11) suggests these intersections may be correctly logged. Given the depth of these intersections and the thickness this area is now considered a high priority target area for shallow potentially open pitable coal.

The waterbores were projected on geological cross sections (Figure 13) interpreted by Shell (The Shell Company, 1979). Coal intersections partly coincide with where Triassic lithic sediments are interpreted; but some sections interpret dolerite and quartzose sandstone where waterbore coal intersections are also reported. This suggests that previous explorers may underestimate the presence and thickness of shallowly covered coal bearing stratigraphy. Therefore its possible that block faulting has potentially preserved a thick package of Triassic coal bearing sediments in the St Pauls River Valley area within EL15/2012.

Table 5 – Summary of drillholes/waterbores for which coal seam data was recovered. Collar coordinates are in MGA94 zone 55 (GDA94).

| Imperial Collar ID | MRT_Name                           | DH_Type              | MRT Drill ID | Length | Easting  | Northing | RL (25kTopo) | Accuracy |
|--------------------|------------------------------------|----------------------|--------------|--------|----------|----------|--------------|----------|
| AVT2               | AVOCA TAR 2                        | Historical Drillhole | 5925         | 85     | 550263   | 5375209  | 278.63       | 50m      |
| RG1                | ROYAL GEORGE RG1                   | Historical Drillhole | 18083        | 22     | 572918   | 5363698  | 594.35       | 5m       |
| RG2                | ROYAL GEORGE RG2                   | Historical Drillhole | 18084        | 18     | 571686   | 5364043  | 608.46       | 5m       |
| 78RG1              | 78RG1 Royal George                 | Historical Drillhole | 5613         | 199.5  | 573163   | 5363964  | 583.14       | 50m      |
| AVT3               | AVOCA TAR 3                        | Historical Drillhole | 5926         | 64     | 552688   | 5374709  | 248.14       | 50m      |
| AVT8               | AVOCA TAR 8                        | Historical Drillhole | 5931         | 80     | 557138   | 5375384  | 250.15       | 50m      |
| RG3                | ROYAL GEORGE RG3                   | Historical Drillhole | 18085        | 30     | 573554   | 5364030  | 570.00       | 5m       |
| RGM1               | RGM1 ROYAL GEORGE/WHITE ROCK BLUFF | Historical Drillhole | 16158        | 40     | 572943   | 5363684  | 597.13       | 50m      |
| AV1                | (Not in Department Database)       | Historical Drillhole | N/A          | 458    | 560510   | 5362258  | 598.57       | N/A      |
| AV3                | (Not in Department Database)       | Historical Drillhole | N/A          | 538.7  | 555438   | 5363201  | 560.00       | N/A      |
| BH16681            | N/A                                | Waterbore            | N/A          | 56.4   | 560312.8 | 5370484  | 211.43       | N/A      |
| BH16683            | N/A                                | Waterbore            | N/A          | 19.8   | 560712.8 | 5371484  | 205.59       | N/A      |
| BH16685            | N/A                                | Waterbore            | N/A          | 29     | 559812.8 | 5371884  | 210.00       | N/A      |
| BH16688            | N/A                                | Waterbore            | N/A          | 41.2   | 558012.8 | 5371884  | 210.00       | N/A      |

Table 6 - Drilling details and coal intercepts for Shell historical drilling (not included in the MRT dataset) and coal-bearing waterbores. Collar coordinates are in MGA94 zone 55 (GDA94).

| Drillhole | Easting  | Northing  | Total Depth (m) | Comments   |
|-----------|----------|-----------|-----------------|--|
| AV1       | 560510   | 5362258   | 458.0           | One seam thicker than 1m between 250.69m and 251.55m. Coal quality info available. |
| AV2       | 558813   | 5358807   | 442.5           | Encountered 97.7m of Triassic sediments and then intersected Dolerite.             |
| AV3       | 555438   | 5363201   | 538.7           | 1.12m coal seam between 355.72m and 356.84m  |
| AV4       | 550196   | 5364087   | 155.6           | Hole abandoned due to access issues  |
| AV5       | 556890   | 5357393   | 350.0           | Terminated in dolerite   |
| BH16681   | 560312.8 | 5370483.9 | 56.4            | 18.3m of 'coal + black mudstone' from 6.1m; 7.6m of 'coal and mudstone' from 42.7  |
| BH16683   | 560712.8 | 5371483.9 | 19.8            | 1.5m of 'coal' from 13.7   |
| BH16685   | 559812.7 | 5371883.9 | 29              | 1.5m of 'coal' from 24.4m  |
| BH16688   | 558012.8 | 5371884   | 41.2            | 1.2m of 'coal' from 23.2m; 1.3m of 'coal' from 21.3m                               |

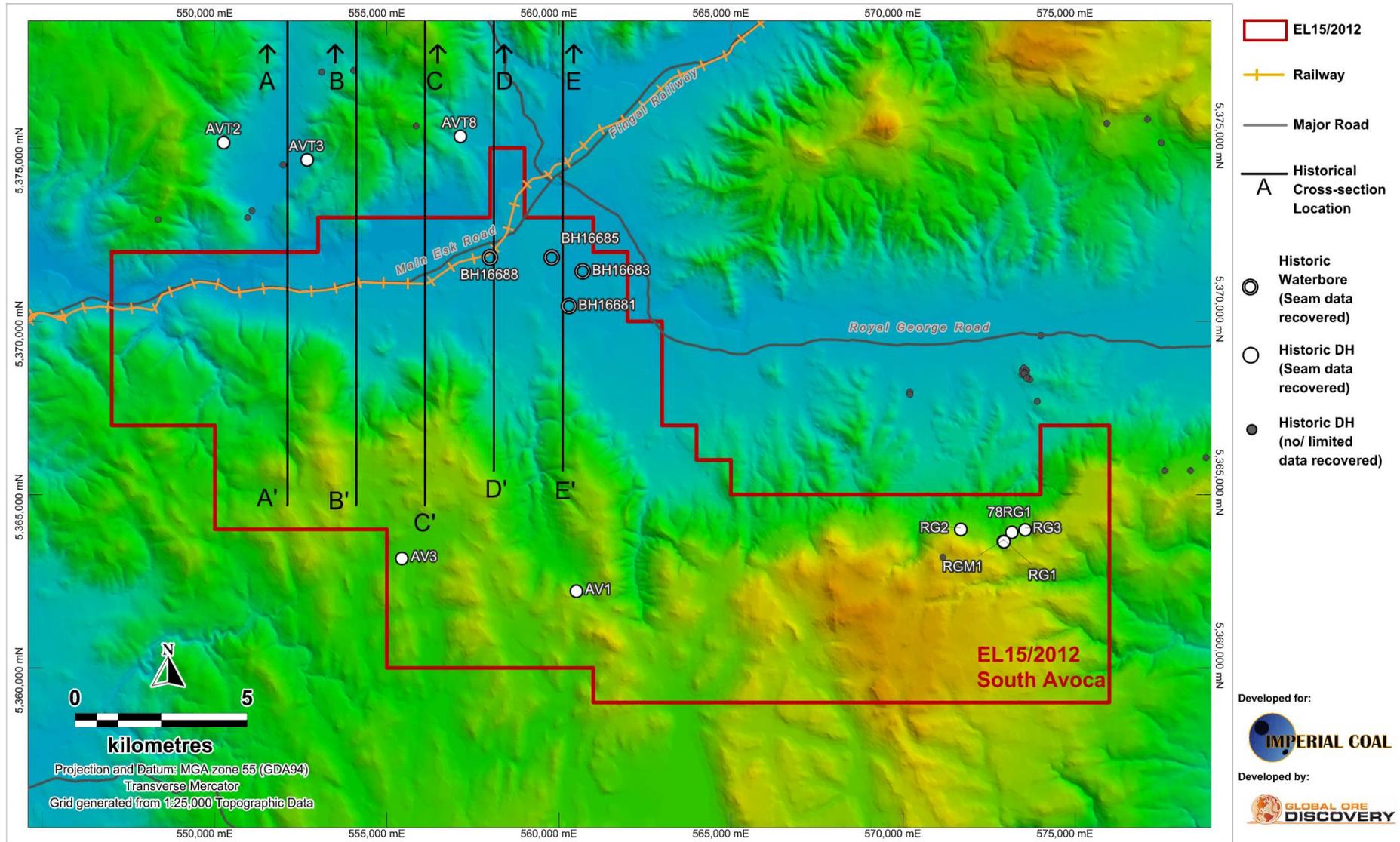


Figure 12 - Showing historic drillholes for which seam data was recovered. Historical cross-section in Figure 13



## 4. Discussion of results

Imperial's first year exploration involving remote sensing, historic drillhole review, field mapping, and sectional interpretation has increased the geological understanding of coal occurrences in EL15/2012. Key aspects of this work include

- ASTER processing and field follow-up program
- Mapping of the outcropping coal including new coal outcrops
- New understanding of the potential for shallow coal (potentially open pitable) from water bore intercepts.

ASTER imagery due to significant vegetation coverage at the time of imagery acquisition was of limited use in remote mapping of the stratigraphy but was useful in determining the potential windows of outcropping sediments in large heavily vegetated expanses.

Mapping by Imperial located 2 new coal outcrops/subcrop including coal within a dam spoil spatially coincident to intercepts in water bores of coaly material up to 1.5m (Figure 11). This discovery provides confirmation of the coal intercepts in water bores and provides evidence of the potential for shallow coal discoveries in this area which has not been tested by historic coal exploration drilling.

The first pass sectional interpretation of the historic drilling through the dolerite in the south of the licence and around the Fenhope mine area to the north, integrated with new field geological and structural mapping, suggests that block faulting may preserve the Upper Parmeener Supergroup in the St Pauls River Valley floor south of Avoca. Additionally, historic coal quality testing of AV1 indicates that there is potential in this area for PCI coal with results from a 1.46m wide seam returning CSN values of 1, energy of 28.15 MJ/Kg and VM of 24.8% (The Shell Company, 1979).

## 5. Conclusions

EL15/2012 is prospective for export thermal coal resources within the Upper Permian of the Tasmania Basin. Little to no exploration has been conducted for coal in the area since the 1990's with the bulk of exploration being a few drillholes through the dolerite in the 1990's. Imperial is exploring EL15/2012 for shallow modest size opencut and larger export thermal coal resources. Imperial's Year 1 exploration program on EL15/2012 consisted of:

Desktop Work including:

- Remote sensing - acquisition and processing of ASTER imagery
- Literature review
- Land access
- Historical cross section analysis

Field Work including:

- Land owner meetings
- Mapping of new coal outcrops
- Attempting to locate drillholes and historic outcrops

Key findings were:

- ASTER mineral mapping did not allow for desktop stratigraphic mapping due to dense vegetation cover, it did however help guide field mapping programs through identification of area more likely to have outcrop.
- Historic Resources adjacent to EL15/2012 are potentially of export quality coal after washing. These resources trend into EL15/2012.
- New coal seam outcrops were identified that will add significantly to modelling of coal throughout the licence.
- New outcropping/subcropping coal excavated from a trial dam confirm the presence of coal logged in shallow water bores in the areas. This coaly sequence in the water bores is up to 2.5m thick (1.3m coal seam from 21.3-22.6m; 1.2m coal seam from 23.2-24.4m).

Recommendations:

Year 2 works will focus on further mapping and exploring for new coal outcrops. Both of these pieces of information will add significantly to the 3D understanding of the distribution of coal within the licence.

Given that Imperial's exploration will focus on outcropping resource potential, small topographic inaccuracies may limit the evaluation of the economic viability of any coal, particularly strip ratio. Therefore Imperial will consider the acquisition of a LIDAR DEM.

A preliminary 3D model using digitally recovered historic seam and detailed lithological data should be built prior to any further drilling. This will assist in choosing locations for drillholes planned in year 2 to maximise the definition of any potential open-pit resource and test areas of high geological uncertainty.

## 6. Environment

Prior to conducting field work in EL15/2012 Imperial submitted a work program to the environmental division of MRT. This program outlined the low impact nature of the investigation, which involved driving on established tracks and roads, hiking to points of interest, and collecting small rock samples. The work program was communicated to Imperial to be accepted on August 9<sup>th</sup> 2013. No environmental concerns were raised, except to be aware of possible eagles nesting.

In accordance with Tasmanian legislation, Imperial sent out letters to advise landholders within EL15/2012 at least 14 days in advance of entry. These letters, sent to both private landowners and Forestry Tasmania (Figure 14), outlined the nature of the exploration activities and provided contact details should the landowners have any queries.

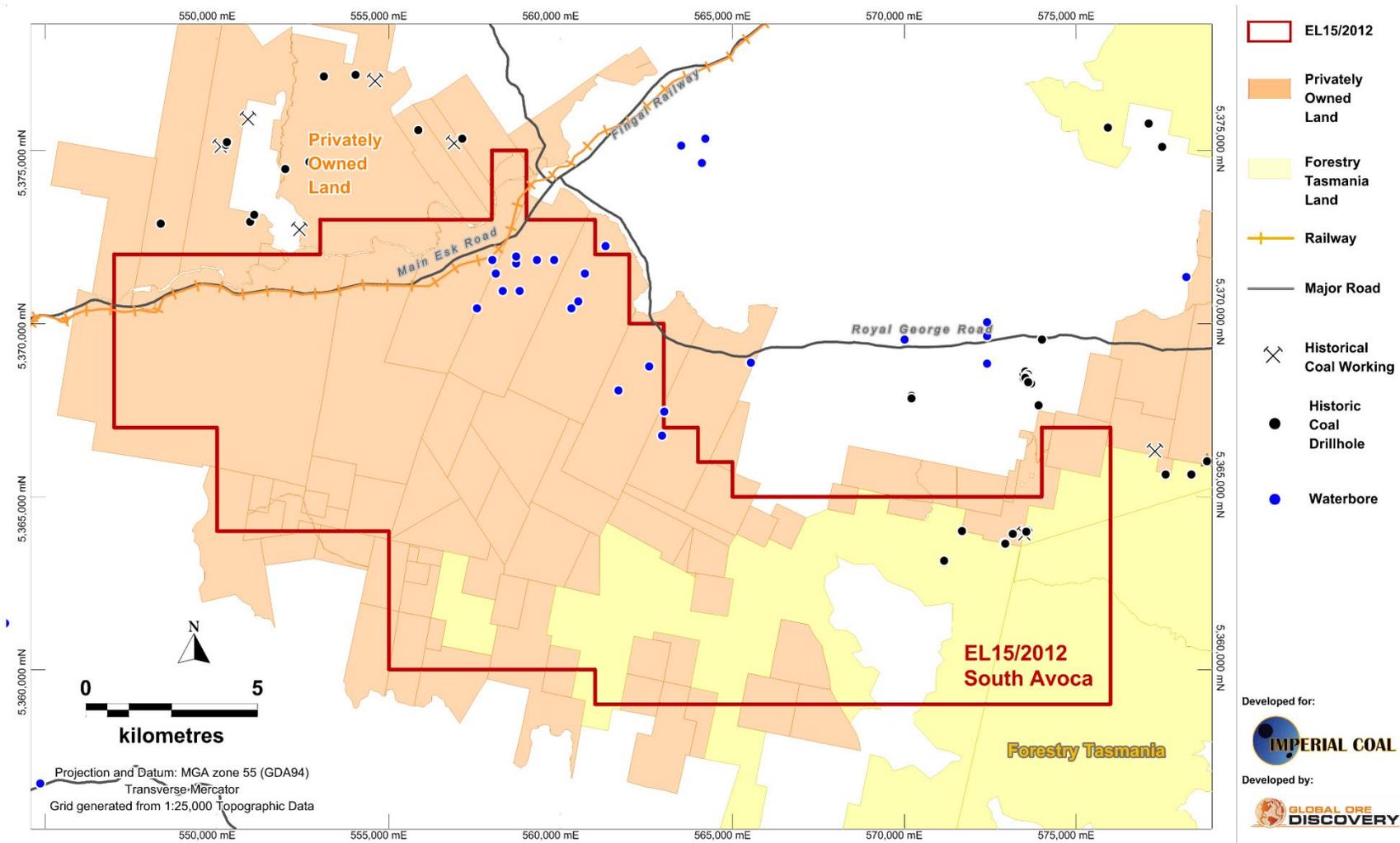


Figure 14 – Location of private- and government-owned (Forestry Tasmania) land parcels within EL15/2012

## Expenditure

Table 7 Expenditure statement for EL15/2012

|                              | Annual Expenditure |
|------------------------------|--------------------|
| 1A. Geology                  | \$ 37,920.71       |
| 1B. Geochemistry             | \$ -               |
| 1C. Geophysics               | \$ -               |
| 1D. Remote Sensing           | \$ 919.00          |
| 2A. Gridding                 | \$ -               |
| 2B. Drilling                 | \$ -               |
| 3. Land Access Costs         | \$ 5,884.72        |
| 4. Rehabilitation            | \$ -               |
| 5. Feasibility Study         | \$ 3,574.96        |
| 6. Other (fees, surveys etc) | \$ -               |
| 7. Administration Costs      | \$ 2,893.16        |
| TOTAL                        | \$ 51,055.05       |

## References

- Ashton, S.M. 1977. Exploration licence no. 16/76, Avoca, Tasmania, Terminal Report. MRT openfile report 77\_1206.
- Bacon, C.A. 1991. The Coal Resources of Tasmania. Division of Mines and Mineral Resources, Geological Survey Bulletin, 64.
- Bacon, C.A., Everard, J.L., 1981. Pyroclastics in the Upper Parmeener Super-Group, near Bicheno, eastern Tasmania. Papers and Proceedings Royal Society of Tasmania 115: 29-36.
- Bornman, J.C. and Murphy, P. 1980. Exploration Licence 18/77, Avoca, Progress Report 1980. MRT Openfile report – 81\_1512.
- Bornman, J.C., 1981. Exploration Licence 18/77, Avoca: A Review of the Coal Resources and Prospectivity. The Shell Company of Australia. MRT Openfile report: 81\_1570.
- Calver, C.R., Corbett, K.D., Everard, J.L., Forsyth, S.M., Clark, M.J., McClenaghan, M.P., Vicary, M. 2012. Geology of Southeast Tasmania, Digital Geological Atlas 1:250,000 Scale Series. Mineral Resources Tasmania (Available at:
- Colhoun, E.A. 1989. Cainozoic geomorphology, in: Burrett, C.F. and Martin E.L. (ed.) Geology and mineral resources of Tasmania. Special Publication Geological Society of Australia 15: 403-409.
- Department of Primary Industries, Parks, Water and Environment (DPIPWE), 2013. Accessed 15<sup>th</sup> January 2013, (Available online at:  
[http://www.mrt.tas.gov.au/portal/page?\\_pageid=35,832332&\\_dad=portal&\\_schema=PORTAL](http://www.mrt.tas.gov.au/portal/page?_pageid=35,832332&_dad=portal&_schema=PORTAL))
- Forsyth, S.M., Farmer, N., Gulline, A.B., Banks, M.R., Williams, E., Clarke, M.J. 1974. Status and subdivision of the Parmeener Super-Group. Pap. Proc. R. Soc. Tasm. 108: 107-109.
- Forsyth, S.M., 1989. The Tamar Graben, in: C.F., Burrett, E.L., Martin (ed.). Geology and mineral resources of Tasmania. Special Publication Geological Society of Australia, 15: 358-361.
- Hewson, R., Cudahy Shoji, T., 2003. Evaluation and Processing of Satellite ASTER Image Data to Generate Accurate, Seamless Geological Maps for Regional Surveys. Exploration and Mining Report, (1084). (Accessed online 22<sup>nd</sup> October 2013, available at:  
[ftp://ftp.csiro.au/arcc/Broken\\_Hill\\_Exploration\\_Initiative/Documents/ASTER\\_Curnamona\\_tech\\_study\\_1084F.pdf](ftp://ftp.csiro.au/arcc/Broken_Hill_Exploration_Initiative/Documents/ASTER_Curnamona_tech_study_1084F.pdf)).
- Hills, C.L., Reid, A.M., Nye, P.B., Keid, H.G.W., Reid, W.D. 1922. The Coal resources of Tasmania. Mineral Resources Geological Survey Tasmania 7.
- Ivett, J.K. and Taylor, D.A. 1978. Exploration licence 18/77, Avoca, six monthly progress report for period ending 26<sup>th</sup> July 1978. MRT openfile report – 78\_1282.
- Morrison, K.C., 1994. E.L. 19/91 – Royal George Annual Report Year 2 (10/4/93-10/4/94). MRT Openfile report – 94\_3571.
- Morrison, K.C., 1993. E.L. 19/91 – Royal George Annual Report Year 1. MRT Openfile report – 93\_3413.
- Morrison, K.C., 1995. E.L. 19/91 – Royal George Annual Report Year 3 (15/4/94-15/4/95). MRT Openfile report – 95\_3709.

Rowan, L.C., and Mars, J.C. 2003. Lithologic mapping in the Mountain Pass, California area using advanced spaceborne thermal emission and reflection radiometer (ASTER) data. *Remote Sensing of Environment*, 84 (3): 350-366.

Sangster, J.W. 1979. Exploration Licence 17/77 Royal George Report For Six Months 24rd June, 1978 to 23<sup>rd</sup> December, 1978. MRT Openfile report – 79\_1324.

Seymour, D.B., Calver. C.R., 1995. Explanatory notes for the Time-Space Diagram and Stratotectonic Elements Map of Tasmania. *Tasmanian Geological Survey Record* 1995/01.

Seymour, D.B., Calver. C.R., 1998. Time-Space Diagram for Tasmania, version 2. *Mineral Resources Tasmania*.

Stacey, A.R., Berry, R.F., 2004. The structural history of Tasmania: a review for petroleum explorers. *PESA Eastern Australasian Basins Symposium II*, Adelaide.

Sutherland, F.L., Wellman, P., 1986. Potassium-argon ages of Tertiary volcanic rocks, Tasmania. *Papers and Proceedings Royal Society of Tasmania* 120: 77-86.

The Shell Company (Anonymous). 1979. Exploration licence 18/77, Avoca (north of 5350000 mN), Six monthly progress report for period ending 26<sup>th</sup> January 1979. MRT openfile report: 79\_1334.

Waters, D.D. 1978. Report for six months 23<sup>rd</sup> December, 1977, to 23<sup>rd</sup> June, 1978. MRT openfile report 78\_1278.

## Keywords

Coal Black

Coal General

Fingal Coal Field

Avoca

Water Bores

Upper Parmeener

Lower Parmeener

Tasmanian Basin

ASTER

EL15/2012

## Appendix – Location of historical drillhole photos



*PHOTO: FGL-33 MRT GPS location of Stable Creek Prospect*