Operator and tenure holder: Teck Australia Pty Ltd, Level 2/35 Ventnor Avenue, West Perth WA 6005, Australia

Compiled by: A.Reed - Teck Australia Pty Ltd
Date: 20th March 2019

Target Commodities: Zinc, Lead, Silver

Distribution: Department of Primary Industries and Resources (NT)
Teck Australia
Acknowledgement and Warranty

1. Subject to 2, the tenure holder acknowledges that this Report, including the material, information and data incorporated in it, has been made under the direction or control of the Northern Territory (the State) within the meaning of section 176 of the Copyright Act 1968 (Cwth).

2. To the extent that copyright in any material included in this Report is not owned by the State, the tenure holder warrants that it has the full legal right and authority to grant, and does hereby grant, to the Territory, subject to any confidentiality obligation undertaken by the Territory, the right to do (including to authorise any other person to do) any act in the copyright, including to:
   - use;
   - reproduce;
   - publish; and
   - communicate in electronic form to the public, such material, including any data and information included in the material.

3. Without limiting the scope of 1 and 2 above, the tenure holder warrants that all relevant authorisations and consents have been obtained for all acts referred to in 1 and 2 above, to ensure that the doing of any of the acts is not unauthorised within the meaning of section 29(6) of the Copyright Act (Cwth).

Declaration

To the best of our knowledge, this document conforms to the format outline for an annual report, as shown by the Northern Territory Geological Survey- Minerals and Energy Division website.
BIBLIOGRAPHIC DATA

Project Name: Carrara Project
Tenement Package: EL29557
Tenement Operator: Teck Australia Pty Ltd
Tenement Holder: Teck Australia Pty Ltd
Report Type: Annual Report
Report Title: Partial Relinquishment Report
Report Period: 21st January 2013 to 20th January 2019
Author: A. Reed
Date of Report: 20th March 2019
1:250,000 Map Sheet: Mt Drummond SE 53-12
1:100,000 Map Sheet: Mitchiebo 6360
Target Commodities: Zinc, Lead, Silver
FIGURES

Figure 1: Location Plan showing relinquished and retained EL29557 sub-blocks  
Figure 2: Map of EL29557 sub-blocks.  
Figure 3: Regional tectonic framework for the North Australian Paleoproterozoic Basins.  
Figure 4: Diagram shows correlated lithostratigraphy across the Northern McArthur Basin, Southern McArthur Basin, Lawn Hill Platform (including McNamara and Fickling Groups), Leichhardt River Fault Trough and the Eastern Fold Belt  
Figure 5: Regional geological setting, showing the Carrara Range, and Little Range Fault in the south. Note the location of Century and the Termite Range Fault to the east.  
Figure 6: Stratigraphic columns for MT DRUMMOND.  
Figure 7: Gamma ray log summary from Carrara Range measured section by McConachie and Krassay (1997), with interpreted correlations with type area for the McNamara Group in Lawn Hill, QLD. On the right columns show Mt Drummond stratigraphy used by Rawlings (2004).  
Figure 8: Stratigraphy and lithological descriptions of interest. Source: Rawlings et al. (2004).  
Figure 9: Thickness summary for McNamara Group displayed in fence diagram showing seven sections. Carrara central section based on McConachie and Krassay (1997), other sections calculated from outcrop widths, aerial photographs and measured dips by Rawlings (2004).  
Figure 10: MT survey location points on a topographical map. MT image is a modelled level plan at 600m below surface. Station locations are presented as dots.  
Figure 11: Gravity stations (dots) and Gaussian Residual (25km) on topographical map
1. SUMMARY

This document is submitted as a Partial Relinquishment Report for EL29557, which is part of the Carrara Project. The Carrara project is deemed prospective for shale-hosted massive sulphide deposits (SHMS) containing zinc (Zn), lead (Pb) and silver (Ag). The Project area hosts lateral equivalents to the Lawn Hill Platform’s Upper McNamara Group members, which hosts the world class Century deposit. Ground was applied for in 2012 following a preliminary desktop study by Teck’s Zn Generative team.

Historically exploration on the project has been focused on exploring for SHMS mineralisation around the Carrara Ranges, but excluded EL29557.

Teck Australia completed limited exploration on the relinquished tenure, comprising 10 magnetotellurics readings and 272 gravity readings. No anomalies of interest were identified.

The 37 sub-blocks were relinquished as part of a compulsory reduction requirement.
2. LOCATION AND ACCESS

EL29557 located 300km northwest of Mt Isa, Queensland, in the Mt Drummond 250K mapsheet. The best way to access the EL from Camooweal is to drive west on the Barkly highway, turn right on the Ranken road due north west, take the turn off to Alexandria station and use station tracks to head north east towards Mittiebah station (Figure 1). Alternatively dirt tracks due north from Camooweal can be used to access the tenements from the east via Gallipoli.

The nearest sizeable township is Camooweal, which is located approximately 150km to the south-southeast of the project. Camooweal has a permanent population of about 200 people.

Land use in the region is predominantly cattle grazing on large pastoral holdings. EL29557 is located on Mittiebah station and Alexandria station, both are owned by North Australian Pastoral Company Pty Ltd

![Figure 1: Location Plan showing relinquished and retained EL29557 sub-blocks](image)

3. TENEMENT INFORMATION

EL29557 comprised 149 sub-blocks when granted on 21st January 2013. On 28th February 2017, 75 sub-blocks were relinquished as part of the fourth year compulsory reduction. Then on 20th January 2019, a further 37 sub-blocks were relinquished for the sixth year compulsory reduction. The remaining tenement was renewed and now consists of 37 sub-blocks which are shown in Figure 2.
4. GEOLOGY

REGIONAL GEOLOGY

The Carrara Project lies within the MOUNT DRUMMOND 250K map sheet, at the northwestern limit of exposure of Palaeoproterozoic to Mesoproterozoic Mount Isa Inlier (Figure 3). The Murphy Inlier separates the Mount Isa Inlier from the southeastern part of the coeval (Figure 4) McArthur Basin (Rawlings 1999). Both the Mount Isa Inlier and McArthur Basin belong to the extensive 1660 – 1590 Ma Isa Superbasin (Southgate et al., 2000). Rocks of the Isa Superbasin are host to giant sediment-hosted massive sulfide (SHMS) zinc-lead-silver deposits: Mount Isa Lead-Zinc, George Fisher, Hilton, Century Lady Loretta and McArthur River Mine. Figure 4 shows the litho-stratigraphy of the North Australian Proterozoic basins and ages of the key SHMS deposits.

The Carrara Project area is situated on the western limit of the Lawn Hill Platform which is part of the Western Fold Belt of the Mount Isa Inlier. Three distinct cover sequences are recognised within the Mount Isa Inlier. The Eastern and Western Fold Belts are separated by the Kalkadoon-Leichhardt Belt which is regarded as Cover Sequence 1 and mainly consists of granite and coeval felsic volcanic rocks. In the Western Fold Belt, rocks of Cover Sequence 2 are typical of those formed within a rift basin, with mafic volcanic rocks being extruded early in the rifting history and coarse to medium-grained clastic sediments filling the grabens.

Cover Sequence 3 is generally represented by the Mount Isa, McNamara and McArthur Groups which are regarded as coeval. Underlying these sequences are the sediment-dominated Surprise Creek Formation and the more restricted volcanic facies of the Fiery Creek Volcanics and Carters...
Bore Rhyolite. These sequences were laid down in local grabens and half grabens, unlike the sediments of the McNamara Group which are more widespread and more representative of a sag phase within the rift cycle. Structurally this accumulation of sediments is known as the Lawn Hill Platform.

![Figure 3: Regional tectonic framework for the North Australian Paleoproterozoic Basins.](image)

The Lawn Hill Platform comprises a moderately deformed sub-green schist metamorphosed terrain of Palaeoproterozoic to Mesoproterozoic-aged sedimentary and lesser volcanic rocks formed within an intracontinental rift setting. The structural history of the wider Western Fold Belt is dominated by inversion tectonics which essentially defined the start and finish of various rift cycles. The effects of the Isa Orogeny are not as obvious in the Western Fold Belt as they are in the Eastern Fold Belt with both deformation intensity and metamorphic grade decreasing to the northeast, away from the Leichhardt River Fault Zone. Structure in the Lawn Hill Platform is generally manifested by northeast growth faults, northwest transfer zones and moderately steep F1 and F2 related to north-south and east-west compression respectively (Andrews, 1998). The northeast growth faults are well documented through surface mapping and constitute the dominant structural fabric on regional
magnetic maps of the Lawn Hill Platform. Subsequent inversion events have generally resulted in north side up reverse faulting and dextral strike slip movements.

![Diagram showing correlated lithostratigraphy across the Northern McArthur Basin, Southern McArthur Basin, Lawn Hill Platform (including McNamara and Fickling Groups), Leichhardt River Fault Trough and the Eastern Fold Belt.](image)

Figure 4: Diagram shows correlated lithostratigraphy across the Northern McArthur Basin, Southern McArthur Basin, Lawn Hill Platform (including McNamara and Fickling Groups), Leichhardt River Fault Trough and the Eastern Fold Belt

In contrast, northwest striking faults are rarely discerned on magnetic maps with the exception of the Termite Range - Riversleigh Fault Corridor (Figure 5). Although first considered a transform fault zone, based on mapped strike slip movements, it also controlled basin development as attested by significant documented stratigraphic thickness changes of Isa Super Basin sequences across the fault zone (Andrews 1996). Consequently the Termite Range – Riversleigh Fault Corridor is considered the eastern bounding fault of the Mount Drummond Basin, which is a poorly understood sub-basin of the Lawn Hill Platform.

**MT DRUMMOND LITHO-STRATIGRAPHY**

The lithostratigraphy of the MOUNT DRUMMOND 250K is described by Rawlings et al. (2004) in terms of five principal tectonostratigraphic units – the Murphy Inlier, Lawn Hill Platform, and South Nicholson, Georgina and Dunmarra basins. Stratigraphic columns for seven areas of the map sheet are presented in Figure 6.
Sweet et al. (1984) were the first to recognise the Lawn Hill Formation (LHF) in the southeast area, known as the Carrara Ranges, based on the occurrence of the Widdallion sandstone member. Sweet could not identify other stratigraphic subdivisions, such as prospective Pmh1 and Pmh4 of the Lawn Hill Formation hence making it difficult to compare and contrast this formation on either side of the TRF. The lithostratigraphy of the Carrara Ranges (Figure 6) shows that two common members – namely the Lawn Hill Formation and the Shady Bore Quartzite- with the McNamara Group stratigraphic column in Figure 4.
However, work by Krassay and McConachie (1997), suggests the Plain Creek Formation (PCF) is a lateral equivalent of both the Termite Range Formation and the Riversleigh siltstone (Figure 7). Further, the Upper Brumby Formation is interpreted as the equivalent to Lady Loretta Formation, which hosts the the high grade deposit of the same name. Consequently, the Plain Creek and Lady Loretta Formations are considered prospective for McArthur River age and Lady Loretta age mineralisation respectively. Lithological descriptions of these units (Figure 8) shows that dolomitic siltstones and shales were mapped by Rawlings et al. (2004) within these units.

Based on chrono stratigraphic correlations across the Lawn Hill Platform, six units are considered prospective for SHMS deposits within the MT DRUMMOND map sheet:

- Doomadgee Formation
- Walford Dolomite
- Mt Les Siltstone
- Lawn Hill Formation
- Plain Creek Formation
- Upper Brumby Formation

Measured sections of the PCF produced by Rawlings et al. (2004) indicate that it varies in thickness from 400-1000 m. Its interpreted stratigraphic equivalents, the Termite Range Formation and the Riversleigh Siltstone are 200-1300m and 800-2900 m respectively according to Andrews (1998). The difference in thickness confirms sedimentation west of the Termite Range –Riversleigh Fault zone.
differs significantly from the rest of the Lawn Hill Platform at this time. From an exploration perspective this does suggest the Mt Drummond Basin offered less accommodation than the LHP which potentially could limit the extent of deep water facies lithologies to discrete sub-basins.

MT DRUMMOND STRUCTURAL FRAMEWORK

A number of easterly to east-northeasterly faults are mapped in the eastern half of MT DRUMMOND, and this dominant structural fabric is most abundant in the Carrara Ranges where inversion thrusting is mapped extensively. The main easterly faults, including Little Range and Mitchiebo (Figure 5), all show north-side-up movements, but some stratal growth is also documented. The structural geometry is interpreted as compressional inversion of earlier compressional and extensional faults (Rawlings et al. 2004). Fault density and thrusting increase southward towards the Little Range fault and elliptical structural horse blocks are mapped in the south ranges. Additionally, a fence diagram (Figure 9) of measured sections of Carrara Ranges stratigraphy indicates that the Drummond Basin was deepening to the south, towards the Little Range fault, at Lawn Hill and Plain Creek formation times. This suggests the Little Range was a growth fault and based on surface geology and regional magnetic maps it is proposed that it was a
basin bounding fault during Lawn hill Platform deposition. Based on this interpretation, the Little Range fault is considered a highly prospective corridor for SHMS Zn-Pb-Ag exploration. The Carrara Project Tenure was secured accordingly.

<table>
<thead>
<tr>
<th>Unit (map symbol), Lithology</th>
<th>Depositional environment</th>
<th>Stratigraphic relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dondenong Formation (Fl.) 280–200 m</strong></td>
<td>Rhyolite, coarse-grained, reddish-brown to gray, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase. To the west, rhyolite to andesite, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>Rhyolite, coarse-grained, reddish-brown to gray, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase. To the west, rhyolite to andesite, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>McNamarra Group</strong></td>
<td>Grey to dark grey, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>Grey to dark grey, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>Waldholt Sandstone Member (Fl.) 350–300 m</strong></td>
<td>Grey to dark grey, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>Grey to dark grey, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>Lowe Hill Formation (Fl.) 250–200 m</strong></td>
<td>Light grey to white, fine to medium-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>Light grey to white, fine to medium-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>Plain Creek Formation (Fl.) 400–300 m</strong></td>
<td>White to grey, fine to medium-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>White to grey, fine to medium-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>Bullwark Conglomerate (Fl.) 50–500 m</strong></td>
<td>Red to brown, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>Red to brown, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>Shark Bay Quartzite (Fl.) 60–100 m</strong></td>
<td>White to grey, fine to medium-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>White to grey, fine to medium-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>Broa Ridge Formation (Fl.) 350–500 m</strong></td>
<td>Red to brown, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>Red to brown, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>Dundee Formation (Fl.) 350–400 m</strong></td>
<td>Red to brown, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>Red to brown, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
<tr>
<td><strong>Surprise Creek Formation (Fl.) 300–400 m</strong></td>
<td>Red to brown, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
<td>Red to brown, medium to coarse-grained, with scattered phenocrysts of olivine, clinopyroxene, and plagioclase.</td>
</tr>
</tbody>
</table>

Figure 8: Stratigraphy and lithological descriptions of interest. Source: Rawlings et al. (2004).
Figure 9: Thickness summary for McNamara Group displayed in fence diagram showing seven sections. Carrara central section based on McConachie and Krassay (1997), other sections calculated from outcrop widths, aerial photographs and measured dips by Rawlings (2004).

5. EXPLORATION RATIONALE

The Carrara Basin was originally identified, following an open file review, as prospective for massive sulphide hosted zinc-lead-silver (SEDEX) deposits similar in style to other deposits in the McArthur River-Mount Isa minerals province such as Century, McArthur River, George Fisher, Mount Isa lead-zinc and Lady Loretta.

The basin lies west of the Termite Range Fault and hosts lateral equivalents to the Lawn Hill Platform’s Upper McNamara Group members. Six prospective lithologies of the McNamara Group are present in the Carrara basin including the Lawn Hill formation which hosts the Century Zn-Pb-Ag deposit.

Prospective host lithologies:

- Doomadgee Formation
- Walford Dolomite
- Mt Les Siltstone
- Lawn Hill Formation
- Plain Creek Formation
- Brumby Formation

The Little Range Fault in the south of the Carrara Basin is considered to be a key structural feature and as such constitutes a high priority target corridor. Areas covered by Georgina Basin sediments where the depth of cover is poorly constrained were the focus of early stage data research and exploration.
The strategy is to explore for SEDEX mineralisation under cover, and through hanging wall stratigraphies by applying modern geophysical techniques such as detailed gravity, IP, airborne EM and seismic surveys, combined with innovative and best practice surficial geochemical surveys to provide targets that warrant drilling.

6. PREVIOUS EXPLORATION

No previous exploration has been carried out over the relinquished area.

7. EXPLORATION ACTIVITIES

Exploration activities over the four years prior to relinquishment comprised a magnetotellurics survey of 10 stations and a gravity survey of 272 stations. The activities are summarised below.

Broadband Magnetotellurics (MT)

Teck acquired two lines of MT data in the relinquished area as part of a broader survey. The lines were orientated N-S and E-W. The program was part of a program designed to aid in the definition of the basin architecture within the Carrara Project.

Location points and a level plan modelled at 600m below the surface are shown in Figure 10.

![Figure 10: MT survey location points on a topographical map. MT image is a modelled level plan at 600m below surface. Station locations are presented as dots.](image)

Survey parameters are listed below, and the raw data in listed in Appendix 1.

**Survey Parameters**
Gravity Survey

Teck acquired 272 gravity stations in the relinquished area as part of a broader survey. The program was part of a program designed to aid in the definition of the basin architecture and stratigraphy within the broader Carrara Project.

Location points and a modelled Gaussian Residual (25km) image are shown in Figure 11.

![Figure 11: Gravity stations (dots) and Gaussian Residual (25km) on topographical map](image)

Survey parameters are listed below, and the raw data in listed in Appendix 2.

**Survey Parameters**

<table>
<thead>
<tr>
<th>Contractor:</th>
<th>Atlas Geophysics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates:</td>
<td>9th July – 7th September 2015</td>
</tr>
<tr>
<td>Proj #:</td>
<td>P2015071</td>
</tr>
<tr>
<td>Total stations:</td>
<td>2246</td>
</tr>
<tr>
<td></td>
<td>(606 in original proposal)</td>
</tr>
</tbody>
</table>
Station spacing: 500 metres
Instrumentation: Scintrex CG-5
Navigation: Leica GS14 Glonass
Repeats: 122 (5.4%)
Base Station: 731,224.9mE, 7917186.4mN (GDA94, MGA Zone 53)
AFGN: Barkly Roadhouse

8. CONCLUSIONS

37 sub-blocks of EL29557 where relinquished on 20th January 2019 as part of the compulsory reduction requirements. Surface geology and interpretations from regional seismic released by Geoscience Australia highlighted favourable stratigraphy to be beyond explorable depths within the area surrendered. This reduced the chances of there being an significant, economical Sediment Hosted Massive Sulphide (SHMS) deposit within explorable depths.

Ten magnetotellurics recordings and 272 gravity readings were taken over the surrendered tenure, with no anomalism of interest returned.

The remaining sub-blocks of EL29557 remain prospective for SHMS mineralisation.
REFERENCES


