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CARRARA PROJECT (GR329)

COMBINED ANNUAL REPORT

For the period 21st January 2014 to 20th January 2015

EL29557, EL29559, EL29560, EL29561, EL29793 and EL29794.

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

Compiled by: G. Amalric - Teck Australia Pty Ltd Date: 18th of March

Target Commodities: Zinc, Lead, Silver

Distribution:

Department of Resources- Minerals and Energy (Northern Territory) Teck Australia

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BIBLIOGRAPHIC DATA

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SUMMARY

This document is submitted as a group report (GR329) for EL's 29557, 29559, 29560, 29561, 29793 and 29794, which comprise 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 lies 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 Teck Australia has opted to explore under cover along the key structural corridor.

Teck Australia has focused on reviewing historical data, desktop interpretations and geophysical modeling as land access has not been possible due to difficulties in identifying Traditional Owners.

LOCATION AND ACCESS

The Carrara project is located 300km northwest of Mt Isa, Queensland, in the Mt Drummond 250K mapsheet. The best way to access the ELs 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 & Figure 2). Alternatively dirt tracks due north from Camooweal can be used to access the tenements from the east via Gallipoli.



Figure 1 Location of the Carrara Project with bing imagery in the background.

The nearest sizeable township is Camooweal, which is located approximately 150km to the southsoutheast 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. The Carrara Project straddles the Mittiebah and Alexandria stations which are both owned by North Australian pastoral Company Pty Ltd.



Figure 2 Topographic map of the tenement area.

TENURE INFORMATION

The Carrara Project comprises 6 granted tenements and 1 application. The tenure, including the application, comes to a total area of 1,277 km squared or 127,700 hectares. Sub-block maps of the tenements are presented below.

EL29557 – 149 sub-blocks



Figure 3: Map of EL29557 sub-blocks.

EL29559 – 26 sub-blocks



Figure 4: Map of EL29559 sub-blocks.

EL29760 – 17 sub-blocks



Figure 5: Map of EL29560 sub-blocks.

EL29761 – 7 sub-blocks



Figure 6: Map of EL29561 sub-blocks. The tenement is bound to the north by an Aboriginal Land Trust zone which cuts through the sub-blocks.



EL29793 – 78 sub-blocks

Figure 7: Map of EL29793 sub-blocks.

EL29794 – 56 sub-blocks



Figure 8: Map of EL29794 sub-blocks.

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 9). The Murphy Inlier separates the Mount Isa Inlier from the southeastern part of the coeval (Figure 10) 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 10 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 9: Regional tectonic framework for the North Australian Paleoproterozoic Basins. Source: Rawlings et al. 2004, page 7.

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 Leichardt

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.



Figure 10: Diagram shows correlated lithostratigraphy across the Northern McArthur Basin, Southern McArthur Basin, Lawn Hill Platform (including McNamara and Fickling Groups), Leichardt River Fault Trough and the Eastern Fold Belt. Source: Fig. 2 Betts, Giles & Lister 2003 p.562.

In contrast, northwest striking faults are rarely discerned on magnetic maps with the exception of the Termite Range - Riversleigh Fault Corridor (Figure 11). 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 12.



Figure 11: 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. Source: Rawlings et al. 2004, page 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 12) shows that two common members – namely the Lawn Hill Formation and the Shady Bore Quartzite- with the McNamara Group stratigraphic column in Figure 10.



Figure 12: Stratigraphic columns for MTDRUMMOND. Source: Rawlings et al. page 9.

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 13). 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 14) 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 (see figure 4). 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.

Super-	Thickness	LAWN HILL				MOUNT DRUMMON		
sequence	(m)	McConachie and Krassay (1997)		This report	Symbol	Formation	Group	
	2400	South Nicholson Group		Constance Sandstone	Psc	Constance Sandstone	South Nicholson	
		V	< 'Murrabu	urra Sandstone'	None known	Psa	Playford Sandstone	Group
Wide			-			Pmh _w	Widdallion Sandstone Member	
	2000 —	_H	Mm					
Lawn	 1600 —		ANNA NAMANA	Lawn Hill Formation	Lawn Hill Formation	Pmh	Lawn Hill Formation	
Term	1200 —		A M	Termite Range Formation	Termite Range Formation	Pma	Plain Creek	Namara Group
River	_		NMA	Riversleigh Siltstone	Riversleigh Siltstone		Formation	MG
	800	E	Shady	Bore Quartzite	Shady Bore Quartzite	Pms Pmu	Shady Bore Bullrush Quartzite Conglomerate]
Loretta	000		2	Lady Loretta Formation	Lady Loretta Formation		Brumby Formation (upper)	
			Esperanz	a Formation Creek Formation	Esperanza Formation	₽mb	Brumby Formation (lower)	
Gun	400 —	—v — ≶ _₽_	G	unpowder Creek Formation	Paradise Creek Formation	Emd ₄ Emd ₃		
		_ <u>Ă</u> _ Z	Torpedo	Creek Quartzite		Emd ₂	Drummond Formation	
	⁴				Gunpowder Creek Formation	Emd,		
Prize		V	s	Formation	Surprise Creek Formation	Pr	Surprise Creek Formation	Not grouped

Figure 13: 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).

MT DRUMMOND STRUCTURAL FRAMEWORK

A number of easterly to east-northeasterly faults are mapped in the eastern half of MT DRUMMOND, and this domiant structural fabric is most abundant in the Carrara Ranges where inversion thusting is mapped extensively. The main easterly faults, including Little Range and Mitchiebo (Figure 11), 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. Additionnally, a fence diagram (Figure 15) of

Unit, (map symbol), thickness	Lithology	Depositional environment	Stratigraphic relationships		
Fickling Group					
Doomadgee Formation (Ed) 200–250 m	Efd.; Coarsening-up cycles from grey and green carbon accous? shale, through flaggy red brown to maroon, dolomitic, micaceous, fine-grained sandstone and siltstone, to white to grey sublithic fine-grained sublithic andstone and medium to coarse sandstone with scattered granules and pebbles; minor lithic sandstone. Thin and medium beds of dololutite, dolarenite and sandy dolarenite, minor dolornitic sandstone and intraclast breccia. Efd; Poorly exposed carbonaceous shale and siltstone.	Marine shelf, ranging from basinal, through storm-dominated shoreface to shallow peritidal environments.	Base not seen, but conformable on Mount Les Siltstone to the north in SEGAL. Overlain disconformably and with low-angle unconformity by South Nicholson Group.		
McNamara Group	1		1		
Widdallion Sandstone Member (Emh _w) 50–370 m	Greyish red to brown, purple-weathering, highly lithic and micaceous fine to coarse sandstone; minor glauconite; siltstone and claystone.	Inner shelf – high energy shoreface environment.	Conformable on lower Lawn Hill Formation; overlain disconformably, or locally with angular unconformity, by South Nicholson Group.		
Lawn Hill Formation (excluding Pmh) (Pmh) 125–2600 m	Interlaminated and thinly interbedded red, grey and brown sitstone and fine- grained sandstone; green to grey shale and siltstone, dolomitic siltstone, laminated and intraclastic dolostone.	Storm-dominated shelf.	Conformable on Plain Creek Formation; overlain conformably by Widdalion Sandstone Member; overlain disconformably or locally with angular unconformity by South Nicholson Group.		
Plain Creek Formation (Ema) 400–1000 m	Micaceous siltstone and shale, fine- to coarse- grained lithic and sublithic sandstone; minor pebble conglomerate, graded sandstone beds, and pebble- to boulder-bearing mudstone- turbidite and mass flow sediments.	Shallow to deep marine basin, including fan deltas.	Both lower and upper contacts concordant and conformable.		
Bullrush Conglomerate (P.mu) 50–500 m	Polymict granule, pebble and cobble conglomerate, cross-bedded sandstone; clasts of quartzlie, quartz sandstone, quartz, chert, brown porphyritic rhyolite and claystone set in lithic sand-granule matrix; stromatolitic chert and chert-clast conglomerate, fine-grained lithic sandstone and sillstone.	Alluvial fan to fan delta.	Unconformable on Top Rocky Rhyolite and Drummond Formation; overlain conformably by Plain Creek Formation.		
Shady Bore Quartzite (Ems) up to 50 m	White, very fine- to medium-grained lithic and sublithic sandstone; prominently wave- rippled bedding surfaces.	Shallow marine.	Conformable on Brumby Formation; overlain conformably by Plain Creek Formation.		
Brumby Formation (Emb) 350–800 m	Interbedded fine- to medium-grained, rarer coarse to granule sandstone; laminated, breeciated and stromatolitic chert; chert-clast breecia and conglomerate with sandstone matrix; siltstone and shale dominate upper part.	Intertidal to supratidal, including sabhka environments; deeper shelf in upper part.	Both lower and upper contacts concordant and conformable.		
Drummond Formation (Emd) 350-600 m	Pmd,: Thin polymict conglomerate overlain by thin- to medium-bedded, fine-grained lithic sandstone, laminated siltstone, red beds of brown lithic dolomitic sandstone and chertified dolostone; caulifower chert; dark grey medium-bedded pyritic coarse sandstone. Pmd, and Pmd,? White to brown, medium- to thick-bedded, fine to medium sublithic to quartzose sandstone; scattered coarse and granule laminae; minor grey chert. Pmd; Laminated kaolinised and chertified claystone (altered carbonate rocks?), fine ferrug inous sandstone, siltstone, and stromatolic chert; fine, sublithic siltstone and sandstone.	Shallow marine, from shore face to intertidal; peritidal mud- and carbonate-flats, and fluvial.	Unconformable on Surprise Creek Formation, overfain conformably by Brumby Formation, and unconformably by Bullrush Conglomerate in Maloney Creek Inlier.		
Unassigned to group					
Surprise Creek Formation (Pr) 300 to 450 m	Local pebble to boulder conglomerate at base; clasts of quark, quartizie and rhyolite in matrix of pink, medium- to coarse-grained sublithic sandstone; remainder is white to pink, thick-to very thick-bedded, medium-to coarse-grained, sublithic to quartz sandstone.	Mainly braided fluvial, with local alluvial fan deposits at base.	Unconformable on Top Rocky Rhyolite, and locally on older formations of Carrara Range Group; unconformably overlain by Drummond Sandstone (McNamara Group).		

Figure 14: Stratigraphy and lithological descriptions of interest. Source: Rawlings et al. (2004).

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.



Figure 15: 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).

PREVIOUS EXPLORATION

Historical mineral exploration in the MT DRUMMOND has focused on diamonds, phosphate and base metals with only marginal gold and iron ore exploration activities (see Figure 11 and Figure 16). Historical base metal exploration focused on the southern part of MT DRUMMOND in the Carrara Ranges.

CRA explored in the area from 1991 to 1995 and tested two targets defined from GEOTEM surveys with eight reverse circulation drill holes with poor results.

Rio Tinto explored the area from 2000 to 2002 conducting an extensive RAB drilling program of subcropping Lawn Hill Formation. Another target area bound by a significant fault intersection was tested with an IP survey but it was deemed that the moderate response did not warrant drill testing.

Anglo American explored the area south east of the Carrara Ranges from 2003 to 2004, and drill tested a discrete combined EM and magnetic anomaly with one diamond and one RC drill hole. Basement lithologies were intersected and tenure was subsequently relinquished.

Overall, the southern portion of the MT DRUMMOND has been under explored considering the lithostratigraphic and structural prospectivity of the area for base metals.

Year	Comments	References
1950–1960	Exploration and evaluation of iron deposits in South Nicholson Group in CLEANSKIN and Constance Range in Queensland	Carter and Zimmerman (1960), Harms (1965)
1959–1963	MOUNT DRUMMOND mapped as part of Bureau of Mineral Resources (BMR) 1958–1963 McArthur Basin mapping project; publication of First Edition MOUNT DRUMMOND 1:250 000 geological map and explanatory notes	Smith and Roberts (1963)
1965–1970	Data collected from 11 km regional grid of gravity stations in McArthur Basin and environs	Whitworth (1970)
1966–1967	Base metals exploration in Carrara Range by Australian Geophysical	Dechow (1967)
1967–1976	Phosphate exploration south of Carrara Range by ICI and Australian Geophysical	McMahon (1969), Perrino (1970), Hackett (1977)
1977–1982	Geological mapping by BMR in Lawn Hill Platform, including publication of 1:100 000 scale geological map Carrara Range Region	Sweet (1982, 1983, 1984, 1985), Sweet et al (1984)
1980	Base metals and uranium exploration in Carrara Range by Afmeco	Orridge (1981)
1983–present	Diamond exploration throughout MOUNT DRUMMOND and at adjacent Coanjula prospect by Ashton Mining, Australian Diamond Exploration (ADX), Redfire Resources, Aberfoyle Exploration, Stockdale Prospecting, CRA Exploration and BHP Minerals	Ashton Mining (1984, 1989), Mitchell (1988), Ong (1995), Rogers (1996b), Kammermann (1997), Reddicliffe (1998), Pang (1998) and others
1990	Stream sediment sampling for gold in Canyon Range	Hitchman (1991)
1990–1992	Assessment of petroleum potential of South Nicholson Group in MOUNT DRUMMOND and drilling of stratigraphic hole DD92SN1	Lanigan (1993)
1991–1994	Aerial photo survey flown by NT Government	This report
1990–2000	Base metals and diamonds exploration in Carrara Range area by CRA Exploration and Rio Tinto, including drilling of numerous RAB holes	Stegman (1992), Moody and Stegman (1993), MacKay (1996), Walker (2000), Walker and Johnson (2001) and others
1995–1997	Measurement of geological sections in Carrara Range by NABRE project and publication of various articles relating to Lawn Hill Platform	Bradshaw et al (1996, 2000), Juodvalkis and Barnett (1997), Page and Sweet (1998), Domagala et al (2000), Krassay et al (2000), Page et al (2000), Southgate et al (2000)
2001	Barkly airborne magnetic and radiometric survey by Tesla Airborne Geoscience for NTGS	Tesla (2001), this report
2001-2003	Geological mapping of MOUNT DRUMMOND by NTGS	Rawlings and Sweet (2004), this report

Figure 16: Summary of geoscientific investigations and exploration activities in MOUNT DRUMMOND. Source: Rawlings et al. 2004, page 4.

EXPLORATION ACTIVITIES

In the past two years of tenure, desktop studies of the exploration licence area were conducted. In the first year a detailed structural interpretation of the area was carried out based on regional geophysical datasets.

In the second year modelling of magnetic data was carried out to assess depth to basement and interpret basin development under cover. Historical drilling and borehole data was reviewed to evaluate the depth of Cambrian cover. As a result of the review the prospectivity of five tenements (EL's 29558, 29760, 29761, 29791 and 29792) was down graded, consequently they were relinquished.

FUTURE EXPLORATION ACTIVITIES

Teck Australia has developed a methodology based on past sediment hosted massive sulphide (SHMS) Zn-Pb-Ag exploration carried out in the Carpentaria region since 2009 and will implement it on the Carrara Project tenure once access is secured. Field validation of the Mt Drummond 250K map will be carried out along with preliminary regolith mapping. Rock chip sampling might be required. A coarse first pass audio-magneto-tellurics (AMT) survey will then be carried out to test our exploration model along the key structural corridor and the geometry of target conductors under cover. Follow up ground gravity will be utilized to test for density anomalies north of the Little Range Fault under cover.

STAKEHOLDER CONSULTATION

AAPA certification was requested upon granting of tenure but due to conflict between Traditional Owners the process could not be completed. Two of the three parties involved have been regularly consulted by Teck Australia's Community relations leader. Considering the difficulty in identifying the legitimate Traditional Owner of the areas of proposed work, field activities have been postponed until the matter is resolved.

Alexandria and Mittiebah station managers have been contacted and informed of Teck Australia's intention to conduct field work once heritage matters have been resolved.

CONCLUSIONS AND RECOMMENDATIONS

The Carrara Project area is prospective for sediment hosted massive sulfide (SHMS) Zn-Pb-Ag deposits. No field work was conducted on tenements of this Group Report due to heritage related access issues.

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