KRUCIBLE METALS LTD
*Mineral Discovery Company*
ABN 12 118 788 846

# TOBERMOREY EL28170

Partial Relinquishment Report

**KRUCIBLE METALS LIMITED**

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**Date:** 30th October 2013

**DISTRIBUTION**

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**Company Report Number: KRB-TSV-2013-171**

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**Summary**

EL28170 'Tobermorey' lies on the Northern Territory and Queensland Border within the Tobermorey pastoral station on the edge of the Simpson Desert. Satellite imagery indicates a number of possible Proterozoic outcrops in an area which has had little previous exploration.

The two concept target models are an Olympic Dam style IOCG (Iron Oxide Copper Gold) deposit in a granitic breccia host, associated with continental faulting and high fluid flow on terrane boundaries; or alternatively Tennant Creek Style orogenic shear related gold/copper/bismuth mineralisation deposited within an iron oxide host, associated with major fault related deformation and granite intrusive sources. Other Targets also include Century and Broken Hill Style lead/zinc/silver mineralisation in Proterozoic rocks as well as Mississippi Valley Style basemetal mineralisation in neo Proterozoic – Palaeozoic sediments.

Magnetic maps provided by Government show numerous destruction zones and obvious large scale folding and faulting. There are a number of sub-parallel structures indicative of stacked or listric fault systems. Gravity images have poor resolution to give much detail over the prospective area.

The tectonic model for the Diamantina region is poorly understood due to paucity of information. However, research suggests the region is characterised by large scale tectonic plate movement and that the Tobermorey application lies within the eastern extent of the Arunta Province close to the junction of 3 other major plates i.e. the Mt Isa Block, the Tennant Creek Block, and the Gawler Craton. Subsequent rifting and thrusting would have created zones of high heat flow and brecciation conducive to development of large scale mineral deposits.

The Toomba Fault to the north and east of the tenement is interpreted by Krucible as a high angle listric fault system with multiple movements and fracturing along this zone resulting in large scale fluid flow and hydrothermal alteration – ideal conditions for the formation of gold and basemetals.
It is along this zone directly east (in QLD) of the EL where Krucible has found copper/gold mineralisation in rock chips and shallow (<100m) RC Drilling (up to 3m @ 2.4% Cu).

Previous mapping completed by both the Northern Territory and Queensland governments has indicated a thick sequence of cover however mapping and field investigations by Krucible has located a number of granitic bodies and metamorphic units which suggest basement is shallow (<100m). Much of the strongly weathered granite bodies have been mapped (photo interpretation) as upper Proterozoic sandstone.

Desktop research of previous exploration in the area by Krucible showed very little exploration has been carried out in this area presumably due to the lack of knowledge and infrastructure, as well as assumptions of deep cover over the mid-Proterozoic basement.

Within the relinquished area Krucible has collect 4 rock chips from reconnaissance trips to the area. All samples recorded low results and interpretations of the area suggest large areas of thick sand and areas of thick overburden to any potential mineralisation. Hence the area has been relinquished.

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*THIS REPORT HAS BEEN WRITTEN AND SUBMITTED IN ACCORDANCE WITH THE NORTHERN TERRITORY GOVERNMENT DEPARTMENT OF MINES AND ENERGY REGULATIONS AS AT DECEMBER 2011.*

## 1. Introduction

EL28170 'Tobermorey is composed of 490 sub-blocks( approximately 1533km$^2$) and is located on the Queensland/Northern Territory border about 400km east of Alice Springs and 300km south southwest of Mt Isa (Figure 1) in an area where the Arunta Complex is believed to be at a shallow depth (<100m) and subjected to several phases of deformation. Geophysical images also indicate a number of parallel structures associated with deformation and remobilisation of fluids prospective for IOCG and Orogenic/Tennant Creek Style mineralisation. Secondary targets include Century and Broken Hill Style lead/zinc/silver mineralisation in Proterozoic rocks as well as Mississippi Valley Style basemetal mineralisation in neo Proterozoic – Palaeozoic sediments.

The area lies in the Hay River (SF53-16) 1:250,000 map sheet on the Northern Territory and Queensland border. The dominant feature of the EL topography is northwest trending sand dunes of the Simpson Desert. These dues are approximately 9-12m high with varying distances between dunes. There are no obvious tracks through the dunes but the pastoral station may have private tracks through parts of the EL. Geological units outcrop between the dunes and these may consist of Proterozoic units.

Krucible believes this area is prospective due to the geological units present, the complex structural framework, the location close to crustal terrane boundaries and the remote location where no previous companies have completed systematic exploration. The company is focused on this area due to the discovery of anomalous copper from drilling by Krucible approximately 60km across the border in Queensland.

### 1.1 Land Tenure

The EL28070 'Tobermorey' consisted of 490 sub-blocks (Figure 2) and was granted to Krucible Metals 100% on the 5th of March 2011 for a period of six years and is not known to contain any restricted lands under the Mining Management Act. The EL is not subject to Native Title but is to heritage protection conditions. On the 7th of August 2013 Krucible applied to relinquish 112 sub-blocks from the EL, this was granted by the Department of Mines and Energy on the 4th of September 2013. The relinquished sub-blocks are listed below:

| BIM | Block | Sub-Block |
|---|---|---|
| SF53 | 3021 | W X |
| SF53 | 3093 | B C G H J M N O R S T W X Y |
| SF53 | 3095 | V W |
| SF53 | 3167 | A B F G L M N O P Q R S T U V W X Y Z |
| SF53 | 3168 | L M N O P Q R S T U V W X Y Z |
| SF53 | 3239 | A B C D E F G H J K L M N O P Q R S T U V W X Y Z |
| SF53 | 3240 | A B C D E F G H J K L M N O P Q R S T U V W X Y Z |
| SF53 | 3312 | D E J K O P T U Y Z |

Total = 112 Sub-Blocks

## 2. Geology and Mineralisation

Most of the EL is covered by recent sediments and sand dunes. Below this, the geology is interpreted to consist of:

- Cambrian

The Georgina Basin is a widespread neo-Proterozoic-Palaeozoic intracratonic basin that was initiated as part of the centralian super-basin and extends east into Queensland (NTGS 2011). The basin is comprised of clastic and calcareous units consisting of shales, limestones, dolostones, and siltstones sitting unconformably on paleo-Proterozoic rocks of the Aileron (east Arunta) Province (GA 2012). These Cambrian aged sediments are prospective for phosphate and rare earth elements (REE) enrichment, as there are a number of these style deposits located in Northern Territory and Queensland.

- Proterozoic

The Arunta Complex is comprised of granite, metamorphic rocks, and pegmatite's intruded by alkali granitoids, outcrops occur as sporadic granitic and schist outcrops. The northern section of the block is considered to be continuous with the gold bearing Tanami and Tennant Creek Regions (Carroll 2008). In the southern area of the EL the Strangways Metamorphic Complex (part of the eastern Arunta Province) is interpreted to be at shallow depths (Figure 3). This complex contains a number of metamorphic assemblages derived from mafic and felsic granitic units (GA 2012).

The Arunta Complex historically has not been considered a highly prospective province but this may be due to the limited exploration. Copper, gold, lead and zinc deposits have all been found and mined in this province and there is increasing interest in this under explored terrane. The Strangeways Metamorphic complex is prospective for carbonatites associated with REE mineralization and marble lenses in the lower stratigraphic units of the complex are prospective for basemetal mineralization.

## 2.1 Structure

The structural framework of the Arunta complex is convoluted, with a long history of reactivation and multiple stages of deformation affecting the geological units of the area (significant tectonic movement ceased in the early meso-Proterozoic). There is a general north western trend to the Proterozoic geology caused by strong east-west thrust zones, these now form geological contacts (Figures 1 and 3).

To the east and north of the Tobermorey tenement the Toomba Fault extends for over 150km trending north-north-west and dipping west-south-west, close to the interpreted Proterozoic Craton boundary of the Mount Isa Inlier and the Arunta Complex. The movement juxtaposes Proterozoic crystalline basement of the Arunta Complex with Palaeozoic sedimentary units of the Toko Syncline. Movement began in the Proterozoic and continued intermittently until the Cretaceous. 5 seismic and gravity profiles by BMR (Bureau of Mineral Resources) across the Toomba fault have established it is a high angle reverse thrust fault with a fault plane dipping south-westerly, with a vertical displacement of up to 6.5km and a strike-slip component estimated at 4km of dextral movement (Shergold 1985). The size of this fault would have provided the channel way for large scale fluid movement.

The Toko syncline is a south-easterly plunging asymmetrical feature caused by tectonic unrest and a major dilation zone forming a half graben (Figure 1a). The syncline has relatively steep dips along its western side, near the Toomba Fault (indicating compression) and shallow dips on the eastern limb (Shergold 1985). The axis runs parallel to the Toomba Fault and the younger (Neoproterozoic to Palaeozoic) sediments are interpreted to have formed in a half graben approximately 5km thick. It is possible early normal faulting associated closely with the Toomba Fault created this extension depositional environment. Magmatic activity might be expected within a deep seated extensional fault system.

The Fault has a long and complicated geological history and because of complexity and poor surface exposure, the structural history of the Fault is difficult to determine. Initial movement of the fault may have been closely associated with the formation of the Toko Syncline in an extensional environment controlled by normal faulting. At some stage a major fault zone like this could have produced a situation where a relatively permeable zone in between a cool block and a hotter one, creates an opportunity for hot fluids to deposit metals with cooling.

Recent modelling by geological and geophysical consultants to Krucible have indicated the Toomba Fault may be part of a listric fault system where parallel structures emanate from an underlying, deep seeded crustal suture.

## 2.2 Exploration Concepts

There are two possible targets within this EL; IOCG Olympic Dam Style which is breccia hosted and IOCG/IRG (Intrusion Related gold) Tennant Creek Style. Both these styles are very plausible within the tenement area.

- IOCG OLYMIC DAM STYLE - Breccia Hosted

Krucible's main target in this EL is Olympic Dam IOCG+REE style intrusive granite breccia systems within a shallow-level magmatic-hydrothermal breccia complex.

The reasons for selection of this are as follows:

- The Toomba Fault is a major thrust separating the Toko Syncline (east) from platform basement (west) - this is considered to be analogous to the Stuart Shelf setting in the Gawler Craton that hosts the Olympic Dam mineralisation.
- There are a number of co-incident & near co-incident magnetic/gravity anomalies as well as magnetic anomalies on gravity gradients which are considered to be ideal conduits for IOCG mineralisation.
- The magnetics at Tobermorey indicate strongly magnetic units which may equate to steely hematites and iron rich metasediments. These are considered to be analogous to the footwall units to mineralisation at Olympic and Prominent Hill.
- Granites outcrop within the tenement indicating basement is shallow within the EL (<100m).

On a continental scale it appears that a major rift and/or thrust has separated the Willyama and Gawler Craton from the Mt Isa Block (at 1500ma?) so that the original position of Olympic Dam would have been quite close to the Diamantina Hinge Zone (Betts & Lister –cited Alston 2001).

The Diamantina Hinge Zone is considered to be similar to the regional setting for Olympic Dam i.e. the north-west trending Toomba Fault and Toko Syncline are analogous to the Stuart Shelf and Adelaide Geosyncline, with the Toomba Fault acting as a hinge zone and possible conduit for hydrothermal fluids.

The geological setting is similar; Olympic Dam lies beneath 350m of flat lying sediments and is contained in an intrusive breccia complex of middle Proterozoic age. Likewise in Toomba area, thick flat lying sediments of the Eromanga Basin cover Palaeozoic and Proterozoic rock.

- IOCG/IRG TENNANT CREEK STYLE - Orogenic-shear hosted

The Tennant Creek region is known for shear related gold, copper, and bismuth deposits hosted within a magnetite +/- hematite ironstone unit, the genesis involves deposition of turbiditic sediments which were then hydrothermally altered to discordant magnetite-hematite-chlorite-quartz ironstone bodies and deformed by faulting during the Barramundi Orogen (1860-1840Ma). A period of granitic intrusions within close vicinity were the source for the economic fluids which precipitated within dilation, fold hinges and shear zones to form many thin pipe-like, ellipsoidal or lensoidal mineralised bodies. (Skirrow, Walshe 2002)
The reasons for selection of this are as follows:

- The Toomba Fault is a major reverse thrust fault similar to those responsible for the deformation and alteration in the Tennant Creek Province.
- The magnetics show indications of folding which maybe reflecting BIF (Banded Iron Formations) or Ironstone units similar to the host type in the Tennant Creek Region.
- The Arunta Complex which outcrops within the area has been said to be geologically continuous with the gold bearing Tanami and Tennant Creek provinces (Carroll 2008). Possible metamorphosed sediments with hydrothermal oxidation close to Toomba fault zone within the Arunta Complex would be a favourable host setting.
- Granite's outcropping at the surface indicate possible sources for the economic fluids required within close vicinity.
- Both areas have similar evolution settings: there is the initial deformation event (Barramundi Orogen) creating the hydrothermal ironstones as well as dilation and shear zones and possible folding, and then later granitoid intrusions which provide the economic fluids.

## 3. Previous work

Very little exploration has been carried out in this area presumably due to the lack of knowledge and infrastructure, as well as assumptions of deep cover over the mid-Proterozoic basement. Companies which have completed work on this area are:

- Le Nickel (Australia) Exploration

EL336
Helicopter supported reconnaissance work failed to locate any areas prospective for sedimentary style uranium Mineralisation.

- Broken Hill

EL 3164
Geophysical interpretation and percussion drilling returned negative results for diamonds.

- Jones Mining / BHP Minerals

EL4320
Looking for Roxby Downs targets completed geophysical interpretations but no field work. They outlined two anomalies which were never followed up.

- CRA Exploration

EL7311
Looking for basemetals and gold completed 111 stream sediment samples and 6 rock chips stream sediment follow up sampling was not anomalous, rock chips collected returned weakly anomalous lead (120ppm) and zinc (550ppm).

## 4. Krucible's Work Program

Krucible has completed desktop interpretations on the relinquished portions of this EL. This work indicated depth to prospective units is beyond economic parameters.

Geophysical interpretations were completed and the regional magnetics show a number of thin magnetically high bands parallel to each other. These appear to be strongly folded and may consist of BIF's or less likely a series of off-set parallel structures in a listric fault setting. Both hypotheses would create ideal situations for mineralisation either IOCG or Orogenic/Tennant Creek style mineralisation.

The gravity image in this area shows a circular low feature on the edge of these parallel features. This low is considered to be a felsic intrusive feature and has disrupted the magnetic signature. The intrusion may also have instigated brecciation and fracturing of the country rock necessary for formation of large mineral deposits.

Google Earth and land satellite images show potential outcropping units with geological interpretations suggesting this area is a contact zone between the Strangways Metamorphic Complex and sediments from the Neo-Proterozoic Amadeus Basin. The interpretations of structure to date show almost all trending northwest-southeast, geological reconnaissance may indicate some north-south trending structures which are possible from satellite images.

Field investigations of this area indicate the area is covered by a thick formation of sedimentary sequences which are considered un-prospective for mineralisation.

### 4.1 Surface Sampling

Krucible has completed a regional helicopter supported field trip to collect rock chip samples for analysis and to identify areas of potential basement outcrop or shallow cover in the Diamantina area. During this trip 2 samples were collected from the relinquished area from outcrops or areas of shallow cover where the rocks indicate mineralisation potential (Figures 2 and 3).

These samples were then sent to ALS Laboratories in Townsville (Queensland) for analysis. No anomalous results were received from these samples (See Appendix 1 for full results).

A recent reconnaissance sampling program completed on the EL collected 2 rock chip samples from within the relinquished areas. Again these were collected from outcrops or areas of shallow cover where the rocks indicate mineralisation potential (Figures 2 and 3).

These samples were then sent to ALS Laboratories in Townsville (Queensland) for analysis. No anomalous results were received from these samples (See Appendix 1 for full results).

## 5. Conclusions

Krucible has completed desktop interpretations including geophysical interpretations of the regional datasets. 4 rock chip samples completed in these relinquished areas failed to return any anomalous values. Exploration in these areas also noted thick sequences of sedimentary units not considered prospective and concluded any prospective units under this sequence would be beyond economic parameters and hence the 112 sub-blocks have been relinquished.

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