Vertebrate Survey of Credo Station

Credo Station, Goldfields Region, Western Australia

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Reptiles and Mammals

Ctenotus xenopleura Photo M. Cowan

Contents

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List of contributors to this report.			
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Abstract

We undertook standardised sampling for reptiles and mammals using pits, funnels and elliot traps at eight locations towards the southern end of Credo Station northwest of Kalgoorlie in the Western Australian Goldfields. Hand searching and opportunistic sightings were made at these survey locations as well as more broadly across the full extent of the station. While conditions remained cool throughout the survey period, we identified 55 terrestrial vertebrate species, with 32 of these being new records for Credo Station and 5 also being new records for the broader region.

Hand foraging provided the greatest number of species and individual captures but this was primarily due to the cool prevailing conditions that reduce trap success. All methods employed contributed to the overall inventory for the station.

1. Introduction

Credo Station is a former pastoral station purchased for the purpose of nature conservation by the Western Australian Department of Environment and Conservation

and is situated approximately 80 km northwest of Kalgoorlie. Towards the southeast the pre-existing Conservation Park of Rowles Lagoon is incorporated. Credo Station has an area of some 200,00 ha, mostly within the Coolgardie Bioregion, although the more northerly and the northeastern areas are within the Murchison Bioregion (Thackway, 1995). There are two subregions of the Coolgardie bioregion represented and these are the Eastern Goldfields subregion (COO3) and the Southern Cross subregion (COO2), with the former just intersecting the western margins and the latter making up the majority of the property. Each of these biogeographic areas incorporate divergent physical attributes of landform, geology and climate thus directly influencing overall diversity of flora and fauna. A broad description of the physical attributes for the Coolgardie and Murchison Bioregions and their component subregions is available in McKenzie *et al*. (2003), Cowan (2003a and 2003b) and Cowan *et al.* (2003), and detailed geology in Wyche (1998). In general the property is comprised of sandplain and occasional exposed granites along the western and northern margins and a central north-south band is comprised of broad plains and paleodrainage channels interspersed with a complex geology of laterites and greenstones. The heavier soils associated with the greenstone belts are dominated by diverse eucalypt woodlands with occasional chenopod shrublands in paleodrainage channels and on plains. The sandplains are usually complex heaths with mallees and acacia thickets, particularly mulga in the north, and hummock grass. The climate varies from semi-arid in the south to arid in the north with average annual rainfall decreasing from 300mm to 200mm from south to north, and mostly falling in the winter months.

There has been no detailed vertebrate survey work undertaken on Credo Station although the fauna of the general area is reasonably well known through surveys undertaken as part of the Eastern Goldfields Survey, at Rowles Lagoon and at Goongarrie Station to the east (McKenzie *et al*. 1992; Chapman 2000; Cowan and How 2004). The existing historic fauna records reported in Appendix 1 are almost exclusively from survey work at Rowles Lagoon and Clear and Muddy Lakes Nature Reserve in the southeast with only a handful of opportunistic records spread from across Credo Station.

2. Methods

2.1 Site selection

A total of eight trapping grids were established and for ethical reasons these were confined to within a 25km radius of the homestead ensuring that they could be checked within a reasonable time frame each morning. Coordinates for Sites 1-8 are given in Table 1. As the homestead is situated towards the southern end of the property this restricted the habitats available for sampling through trapping although hand searching and opportunistic sampling was undertaken over a much broader area (Figure 1a). Sight selection for trapping was determined by the major habitat variation available along established tracks with comparatively easy and quick access. Vegetation descriptions for each of these trapping sites are as follows and their position in relation to the broad scale vegetation mapping and geology is presented in Figure 2 and Appendix 4 respectively.

- Site 1-*Eucalyptus horistes* woodland (6-8m) over *Acacia burkittii* shrubland (3m) over shrubland of *Prostanthera grylloana, Eremophila granitica, Dianella revoluta* to 1m, over sparse *Triodia tomentosa* hummock grassland.

- Site 2-*Maireana sedifolia* open shrubland (1m) over sparse shrubland of *Ptilotus obovatus* to 0.5m over annual herbs.

- Site 3- *Eucalyptus celastroides subsp. celastroides* woodland (10m) over *Eremophila scoparia, Ptilotus obovatus* shrubland (1m) over very open shrubland *Maireana trichoptera* to 0.1m.

- Site 4- *Eucalyptus celastroides subsp. celastroides* woodland (6-8m) over *Eremophila oppositifolia subsp. angustifolia, E. interstans subsp. interstans* shrubland (to 2m) over *Eremophila scoparia* shrubland to 1m.

- Site 5- Mulga woodland (5m) over *Acacia ramulosa var. ramulosa, A. ramulosa var. linophylla* open shrubland (2.5m) over shrubland of *Prostanthera grylloana* and *Eremophila clarkei* to 1m.

- Site 6- *Acacia hemiteles, A. leptopetala, A. steedmanii* shrubland (2.5m) over *Beyeria sp*. shrubland to 1m.

- Site 7- *Eucalyptus ravida* woodland (8m) over *Acacia burkittii* shrubland (6m) over *Acacia sp., Eremophila scoparia, Acacia erinacea, Eremophila sp., Exocarpus aphyllus* shrubland to 1m over scattered herbs.

- Site 8- *Acacia yorkrakinensis subsp. acrita* shrubland to 1m over *Triodia* hummock grassland.

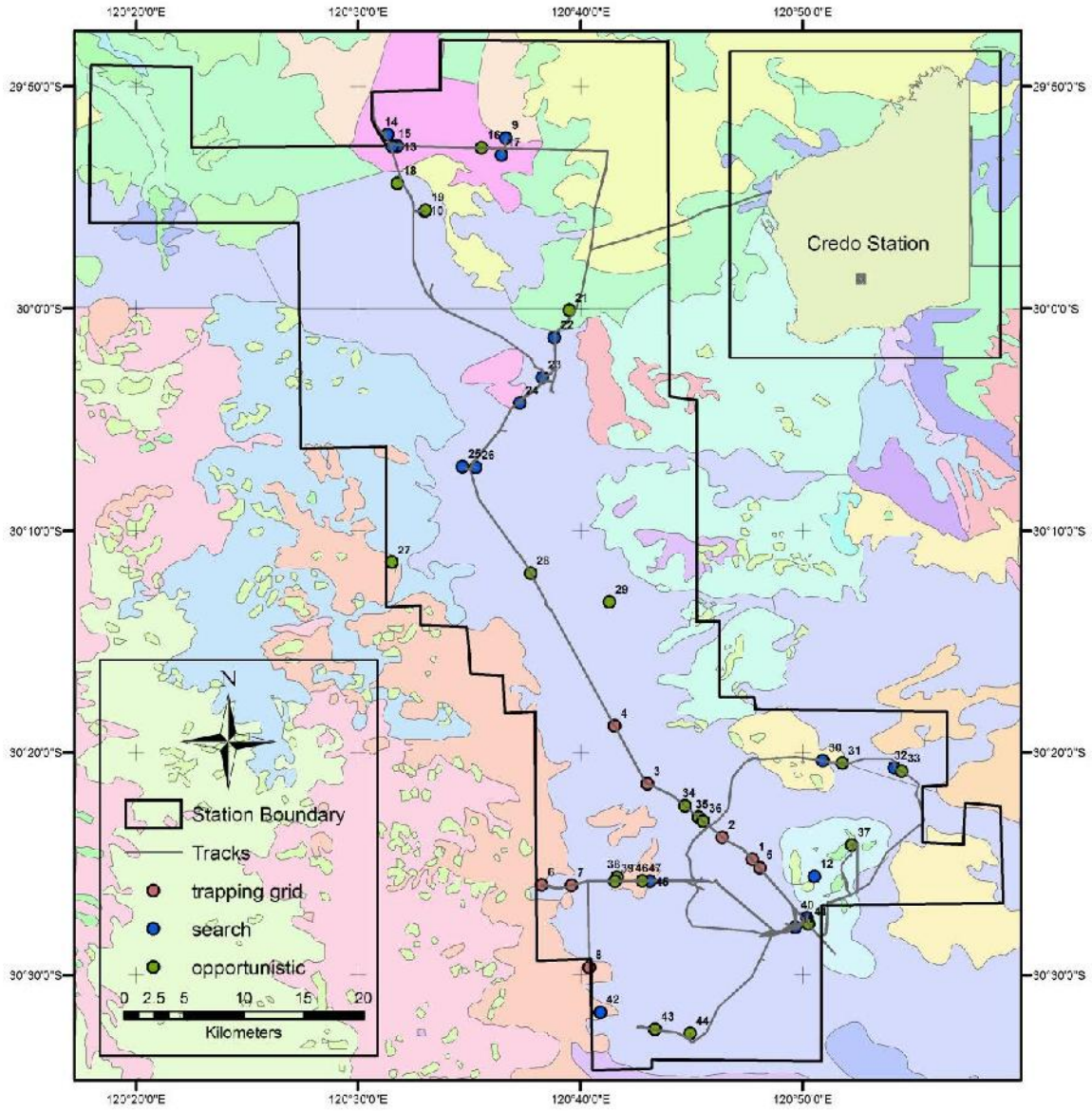
A habitat photo for each of the trapping sites is presented in Appendix 2. The vegetation mapping in Figure 1 is at a broad scale and does not accurately represent the diversity often present within the mapped associations. The geology map provides contextual information on the potential diversity of vegetation associations highlighting the complexity of the geology associated with the greenstone belt running through the centre of the property (Appendix 4).

Opportunistic sightings were recorded from across the station and active hand searching was undertaken at an additional 18 locations to the trapping grids. Night time temperatures remained too cold for reptile activity throughout the survey period and on the two occasions we spotlighted and head torched there was nothing recorded. Graphs of temperature and relative humidity for the duration of the survey are presented in Appendix 3. The windy night time conditions hampered attempts to mist net for bats so data for this group was limited.

Table 1 Geographic coordinates for all locations sampled, along with the number of captures or sightings recorded at each location.

Site #	Latitude	Longitude	Datum	Method	Captures
1	-30.41342	120.79578	GDA94	trapping grid	12
2	-30.39710	120.77332	GDA94	trapping grid	8
3	-30.35695	120.71711	GDA94	trapping grid	13
4	-30.31352	120.69228	GDA94	trapping grid	4
5	-30.41988	120.80138	GDA94	trapping grid	16
6	-30.43262	120.63775	GDA94	trapping grid	22
7	-30.43293	120.65990	GDA94	trapping grid	7
8	-30.49436	120.67332	GDA94	trapping grid	11
9	-29.87205	120.61089	GDA94	search	10
10	-29.92694	120.55006	GDA94	search	8
11	-30.46437	120.82791	GDA94	search	3
12	-30.42631	120.84228	GDA94	search	3
13	-29.87828	120.52961	GDA94	search	2
14	-29.86953	120.52208	GDA94	search	20
15	-29.87831	120.52572	GDA94	search	13
16	-29.87939	120.59269	GDA94	opportunistic	1
17	-29.88492	120.60778	GDA94	search	29
18	-29.90611	120.52963	GDA94	opportunistic	1
19	-29.92614	120.55072	GDA94	opportunistic	1
21	-30.00150	120.65842	GDA94	opportunistic	1
22	-30.02186	120.64739	GDA94	search	41
23	-30.05183	120.63836	GDA94	search	3
24	-30.07097	120.62153	GDA94	search	7
25	-30.11864	120.57842	GDA94	search	33
26	-30.11922	120.58836	GDA94	search	3
27	-30.19086	120.52539	GDA94	opportunistic	1
28	-30.19931	120.62967	GDA94	opportunistic	1
29	-30.22072	120.68842	GDA94	opportunistic	1
30	-30.33956	120.84861	GDA94	search	2
31	-30.34147	120.86318	GDA94	opportunistic	1
32	-30.34503	120.90244	GDA94	search	2
33	-30.34736	120.90783	GDA94	opportunistic	1
34	-30.37344	120.74525	GDA94	opportunistic	1
35	-30.38178	120.75517	GDA94	opportunistic	1
36	-30.38472	120.75889	GDA94	opportunistic	1
37	-30.40286	120.87031	GDA94	opportunistic	1
38	-30.42694	120.69419	GDA94	opportunistic	1
39	-30.42986	120.69253	GDA94	opportunistic	1
40	-30.45728	120.83669	GDA94	search	32
41	-30.46197	120.83783	GDA94	opportunistic	1
42	-30.52808	120.68175	GDA94	search	2
43	-30.54092	120.72281	GDA94	opportunistic	1
44	-30.54400	120.74906	GDA94	opportunistic	1
45	-30.42990	120.71900	GDA94	search	5
46	-30.42960	120.71310	GDA94	opportunistic	1
47	-30.42964	120.71336	GDA94	opportunistic	1

Figure 1 Broad vegetation associations and numbered survey locations



Vegetation Associations

- Bare areas; rock outcrops
- Bare areas; salt lakes
- Hummock grasslands, mallee steppe; red mallee over scin tex, Triodia scariosa
- Hummock grasslands, mixed sandplain; open mallee over sparse dwarf shrubs with spinifex; red mallee mallee & mixed sparse dwarf shrubs over Triodia basedowii
- Low woodland; mulga & red mallee
- Low woodland; mulga mixed with Allocasuarina cristata & Eucalyptus sp.
- Low woodland; Allocasuarina cristata
- Low woodland; mulga (Acacia aneura)
- Medium woodland; York gum & salmon gum
- Medium woodland; goldfields blackbutt & red mallee
- Medium woodland; red mallee group
- Medium woodland; salmon gum
- Medium woodland; salmon gum & gimlet
- Medium woodland; salmon gum & goldfields blackbutt
- Mosaic: Medium woodland; Allocasuarina cristata & goldfields blackbutt Shrublands Acacia quadrimarginea thicket
- Shrublands; Mixed Acacia thicket on sandplain
- Shrublands; Acacia brachystachya scrub
- Shrublands; Acacia neurophylla, A. beauverdiana & A. resinomarginea thicket
- Shrublands, Acacia quadrimarginea thicket
- Shrublands; acacia scrub various species
- Shrublands; acacia, casuarina & melaleuca thicket
- Shrublands; jam thicket
- Succulent steppe with open low woodland mulga & sheoak over bluebush
- Succulent steppe with open low woodland mulga over saltbush
- Succulent steppe with woodland; salmon gum & bluebush
- Succulent steppe; bluebush with saltbush in depressions
- Succulent steppe; saltbush
- Succulent steppe; samphire

2.2 Collection methods

Each of the eight primary survey sites were sampled with a single 50 to 60 metre drift fence of 30 cm high aluminium fly wire and six 20 litre buckets located at even intervals along, and buried centrally under, the drift fence (Image 1). Up to eight funnel traps were used to supplement the pits and these were placed along the same fence as the pits. At Sites 3, 5, 6 and 7, 20 medium sized elliot traps (type A) were placed at 10 to 20 metre intervals and baited with universal bait, including the addition of chopped bacon. An additional 10 large elliots (type B) were used at Site 6 as small mammal tracks were prevalent at this location. All sites were trapped continuously for seven or eight nights except for Site 8 which was only established late in the trip and run for two nights.

Reconyx HC600 camera traps were deployed at Sites 1, 3, 5, 6 and 7 for at least six consecutive nights. Four cameras were used at Ullaring rock (Site 10) for four consecutive nights. An area within the field of view of each camera was baited with universal bait.

Active hand searching was undertaken at a number of locations across the station and this involved raking spoil piles, leaf litter and loose soil as well as turning over timber, rocks and sheets of tin in search of animals. Due to the coolness of the evenings only a limited amount of night searching or road driving was undertaken.

Information was also collated from all researchers for opportunistic sightings providing identifications could be confirmed through photos or descriptions. Species recorded included a *Moloch horridus* (Thorny Devil) and *Varanus giganteus* (Perentie).

We attempted to sample bats on three evenings using a single 30 foot mist set across a dam that was situated seven kilometres northwest of the homestead. Despite bats initially be active at the beginning of each of these occasions conditions were too windy for effective mist netting.

Image 1

2.3 Identifying the collections

Where possible animals were identified in the field and released at point of capture, although initially for some of the more difficult species such as members of the genus *Ctenotus*, individuals were taken back to camp to be keyed out prior to release the following day. Details of sex was recorded along with weights and lengths - pes and cranium for mammals, snout to vent and tail for reptiles.

Representative voucher specimens of most species were taken for lodgement in the WA Museum. These specimens were labelled with a unique identification tag and a tissue sample taken for preservation in 100% ethanol for future molecular analysis.

Voucher specimens were fixed in 10% formalin in the field.

The primary sources of information for identification were the Western Australian Museum's reptile field guides (Storr et al. 1983; Storr et al. 1990; Storr et al. 1999; Storr et al. 2002) although reference was also sought from The Mammals of Australia (Van Dyck et al. 2008), A Field Guide to the Mammals of Australia (Menkhorst and Knight 2004) and A Complete guide to Reptiles of Australia (Wilson and Swan 2008)

3. Results and Discussion

3.1 Overview of collecting

Most historical survey work undertaken in the immediate vicinity of Credo station has been at Rowles Lagoon Conservation Park where there are records of 1 species of frog, 18 lizards, 3 snakes and 5 mammals (including three large macropods). Adjacent to the northeastern end of Credo station and separated by a relatively short distance of sandplain is Goongarrie Station. This property is also managed for conservation by DEC and, has been the focus of the most comprehensive survey in the vicinity with 32 trapping grids sampled on at least 5 occasions spanning multiple season in different years (Cowan and How 2004 and Cowan unpublished). A total of 88 species were recorded at Goongarrie Station including 2 frogs, 46 lizards, 4 pygopods, 13 snakes, 16 terrestrial mammals and more than 6 bats. One of the Eastern Goldfields survey locations was at Black Flag, just to the east of Credo Station (McKenzie et al 1992) with records for 41 vertebrate species while Jaurdi Station, also managed for conservation, to the southwest of Credo was the focus of a survey in 1999 (J. Angus pers. comm.)[1] and documented 43 species. Collectively these surveys have catalogued more than 100 native vertebrate species excluding birds.
As a result of the historic work it was expected that sampling would reveal new records for Credo Station but unlikely to reveal many new species for the general area.

During the BushBlitz survey the mean maximum temperature was 21.0° C (± 4.1) and the mean minimum temperature 7.0 ° C (± 1.9). Despite the cool to mild day time temperatures and the cool nights the survey amounted to the capture or observation of 329 individuals and 55 species of native fauna. This included 2 frogs, 32 lizards, 10 terrestrial mammals, 1 pygopod, 6 snakes and 4 bats. A total of 33 species were new records for Credo station or Rowles Lagoon Conservation Park while five species were new records for the general area and had not been recorded in any of the mentioned surveys.

Trapping accounted for 64 individuals of 19 species with seven of these species only detected through trapping. Supplementary methods of foraging, opportunistic observations and remote cameras etc accounted for 265 observations of 42 species with 31 of these species not detected by trapping. The cool conditions are likely to be responsible for the low trapping success as reptile activity in particular is highly positively correlated with increasing temperature.

Species richness from traps at each of the trapping locations ranged from a low of three at Site 4 and Site 6 to a maximum of 8 at Site 3. All other sites ranged between 4 and 7 species except Site 8 with only 2 species, however as this site was only trapped for two nights under very cool conditions this cannot be compared. Supplementary sampling (active searching and observations) at each of the trapping sites contributed an average of 2 (±2) additional species with the richest location Site 6 with 12 species and Site 4 remaining the poorest with only 3 species. Site 6 incorporated pit and elliot traps around the periphery of a large granite outcrop as well as an elliot trap line running through the middle. This diversity in sampling locations and the ease of searching in such areas contributed to the richness at this location.

The sandplain at Site 8 along the western boundary of the station and the granites at Site 6 contained the most habitat specific species. Despite the low number of species recorded at Site 8 two species, *Ctenotus xenopleura* and *Ctenophorus isolepis*, were not recorded at any other locations. In addition four of the five captures of *Ningaui yvonneae* were from Site 8. The skink *Ctenotus xenopleura* is a species confined to the Coolgardie and very southern Murchison Bioregions and while it has been recorded from Goongarrie station (Cowan unpublished) the extent of its range is not well understood so these records are useful additions. The dragon *Ctenophorus ornatus* is confined to exfoliating granite areas and was only recorded at Site 6 and Ullaring rock (Site 10). The snake *Furina ornata* and the frog *Pseudophryne occidentalis* were also only recorded at Site 6 with the former commonly using sheets of exfoliating rock for cover while breeding of the latter is often associated with ephemeral granite rock pools.

The species most readily encountered during the survey were three species of gecko, *Heteronotia binoei, Nephrurus milii and Gehyra variegata* with observations of 78, 34 and 30 respectively. Foraging was responsible for all of these records. The next three most common species were two skinks and a frog, *Morethia butleri, Lerista timida* and *Pseudophryne occidentalis* with 11, 10 and 11 records respectively and these were also mostly recorded through foraging and observation. The most abundant species recorded though the use of trapping techniques were *Mus musculus* (7) in elliot traps, the Skinks *Ctenotus uber* (8) and *Menetia greyi*(6). Species such as *Ningaui yvonneae* (5), *Tympanocryptis cephalus* (3), *Diplodactylus pulcher* (8) and *Neobatrachus kunapalari* (4) were also recorded more abundantly in traps than through observation. Most other species were only recorded from one or two records including all the mammals except the rodents, all of the snakes and, all of the varanids.

Vouchers of 41 specimens including tissue samples were lodged with the WA Museum.

3.2 Named taxa newly recorded for the reserve

Table 3 lists the 32 species from this survey not previously recorded. The large proportion of unrecorded species reflects the lack of any history of survey work undertaken on the station. A number of the larger mobile species listed as new records are relatively common in the area but are often not recorded during surveys, for example *Macropus fuliginosus* and *M. robustus*, whereas others such as *Tachyglossus aculeatus* are often not seen but may be detected by tracks, scats and diggings.

Significant new records for the station and the region included *Pseudantechinus woolleyae* which was caught on a camera trap (Image 2) at Ullaring rock (Site 10) and probably constitutes an extension to the south of this species known distribution. It is confined to rocky habitats including ranges, breakaways and extensive exposed granites thus its distribution within the station is likely to be limited by the availability of this type of habitat. From the same location *Varanus giganteus* (the Perentie) was observed on two separate occasions as well as recorded by a remote camera. This record is also at the southern limit of its known distribution and it is unlikely to be widespread in other habitats. There was a single capture of what is thought to be *Sminthopsis ooldea* although this may require molecular analysis for conformation. This record is much further south than previously recorded and there have been difficulties distinguishing *S. dolichura* from *S. ooldea* with the former species having a confirmed presence at Credo. The two records of the elapid *Furina ornata* are also towards the southern limit of its known distribution and although it has not been detected in previous surveys in the general area its occurrence is not unusual.

Image 2 (*Pseudantechinus woolleyae*- note: this image is derived from video footage however the determination of the species is clear in the original footage.)

Table 2. Named taxa newly recorded from Credo Station

Taxon	Comment
Ctenophorus cristatus	Common throughout the woodlands
Ctenophorus isolepis	Subspecies *gularis* confined to heaths and spinifex on yellow sands
Ctenophorus scutulatus	Towards the southern limit of distribution at Credo
Diporiphora amphiboluroides	Towards the southern limit of distribution
Moloch horridus	Towards the southern limit of distribution
Tympanocryptis cephalus	Towards the southwestern limit of distribution
Diplodactylus granariensis	Close to northern extent for subspecies granariensis
Furina ornata	Towards the southwestern limit of distribution
Parasuta monachus	Widely distributed in surrounding areas
Pseudonaja nuchalis	Widely distributed in surrounding areas
Simoselaps bertholdi	Widely distributed in surrounding areas
Ctenotus schomburgkii	Widely distributed in surrounding areas
Ctenotus uber	Towards the southern limit of distribution
Ctenotus xenopleura	Small distribution within the general vicinity of Credo. Sandplain specialist
Egernia depressa	Common; Towards the southern limit of distribution
Lerista macropisthopus	Towards the southern limit of distribution
Tiliqua occipitalis	Widely distributed in surrounding areas
Ramphotyphlops australis	Towards northeastern limit of distribution
Varanus giganteus	Sighted and recorded on camera at Ullaring rock. Probably southern range limit.
Cercartetus concinnus	Widely distributed in surrounding areas
Ningaui yvonneae	Towards northern extent in WA
Sminthopsis crassicaudata	Widely distributed in surrounding areas
Sminthopsis dolichura	Widely distributed in surrounding areas
Sminthopsis ooldea	Large range extension to the south of known distribution
Macropus fuliginosus	Widely distributed in surrounding areas
Macropus robustus	Widely distributed in surrounding areas
Mormopterus planiceps	Towards the southern limit of distribution at

Taxon	Comment
	Credo
Tadarida australis	Widely distributed in surrounding areas
Notomys mitchellii	Towards northern extent in WA
Tachyglossus aculeatus	Widely distributed in surrounding areas
Chalinolobus gouldii	Caught in mist net
Nyctophilus geoffroyi	Caught in mist net

3.3 Un-named taxa

There were no un-named or non-formalised vertebrate taxa recorded.

3.4 New species to be described

No new species awaiting description have resulted from this survey however specimens and associated tissue samples collected may contribute towards resolution of cryptic taxa in future taxonomic examinations.

3.5 Weed or pest species

Predators such as cats, dogs and foxes are generally in reasonable numbers throughout most semi-arid areas and general observations suggest this is likely to be the case at Credo station with signs of all three species present.
Goats are also widespread in many parts of the Goldfields and while small groups were seen on two occasions and scats were observed at several locations, they do not appear to be present in large numbers. Scats of camels were found at Site 6 however this was apparently a group of camels released form captivity and these have subsequently been removed. There is evidence of rabbit activity at a number of sites.

Table 4. State or National weed or pest species recorded in Credo Station

Pest/weed species	Location sighted/observed	Indication of abundance
Felis catus	Cat tracks and/or scats were present adjacent to Sites 6 and 8	Likely to be relatively common

Pest/weed species	Location sighted/observed	Indication of abundance
Oryctolagus cuniculus	Sign at Site 6, Ullaring rock and at Rowles lagoon Conservation Park.	Common
Capra hircus	Small groups seen on two occasions in rocky shrubland north of homestead. Scats at seen at numerous locations but not recent	Present in low numbers
Camelus dromedarius	Old scats seen at Site 6	Unlikely to still be present
Vulpes vulpes	Sighting of individual in Rowles Lagoon Conservation park	Present
Canis lupus	Tracks and scats seen at Ullaring rock and at Site 8. Recorded near homestead.	Present

3.6 Vulnerable, threatened or endangered species

While birds were not the focus of this survey the observation of a single Mallee Fowl towards the northern end of the property was the only state or federal listed species recorded during this survey. All other species recorded are generally widespread and comparatively common.

4. General comment on species lists

Previous records provided for the area contain 30 species, most of these from the Rowles Lagoon Conservation Park. While *Lerista muelleri* is identified in the database this is known to be a complex of at least nine species (Smith and Adams, 2007) and the records of the WA Museum do not include *L. muelleri* but rather identify through vouchered specimens only *L. timida* for this area. Similarly the species identified as *Cryptoblepharus plagiocephalus* is now recorded as *C. buchannani* since redescription of this group by Horner (2007). There was a single aberrant record in the data provided and that was of the legless lizard *Delma inornata*, this species does not occur in Western Australia and is confined to the southeast.

5. Conclusions

What is evident for many of the species identified in this survey is that they exist towards either their northern distributional extent for the more mesic adapted species or their southern extent for more arid adapted species. This is not so surprising considering Credo station is positioned across a transitional climatic and associated vegetative gradient

ranging from semi- arid woodlands over much of the area towards the more arid acacia dominated shrublands in the north. This transition provides for an interesting and comparatively unique assemblage of species as documented in this report.

While this survey contributed significantly to the total of 55 species now recorded for the station, judging from the total of over 100 species recorded in the general area additional survey is likely to reveal many more species. This will particularly be the case in the sandplains on the western margin and the northern shrublands as neither of these habitats were a significant focus due to logistical and timing constraints. Additional survey undertaken over warmer times of the year is also likely also assist in the documentation of more species, especially where trapping is involved.

Despite the level of survey undertaken in the general vicinity of Credo Station over a number of years the number of species documented here but previously unrecorded for the area was quite high. Areas of exposed granite with exfoliating sheets were particularly important as there are a number of species confined to this type of habitat which has limited occurrence across the station.

The methods employed for this survey, trapping with pits, elliots and funnels along with active foraging and remote cameras, all made contributions to the collective species richness recorded and demonstrates the need for a diverse sampling approach to this type of inventory survey.

Acknowledgements

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Appendices

Appendix 1. List of Frogs, Reptiles and Mammals occurring on Credo Station.

Number of taxa: 55 native species

FAMILY	Species	Previously recorded	BushBlitz Survey 2011	New record	Pest	EPBC Listed	State Listed
Amphibians							
Limnodynastidae	*Neobatrachus kunapalari*	+	+				
Myobatrachidae	*Pseudophryne occidentalis*	+	+				
Reptiles							
Agamidae	*Ctenophorus cristatus*		+	✓			
Agamidae	*Ctenophorus isolepis*		+	✓			
Agamidae	*Ctenophorus ornatus*	+	+				
Agamidae	*Ctenophorus reticulatus*	+	+				
Agamidae	*Ctenophorus salinarum*	+					
Agamidae	*Ctenophorus scutulatus*		+	✓			
Agamidae	*Diporiphora amphiboluroides*		+	✓			
Agamidae	*Moloch horridus*		+	✓			
Agamidae	*Pogona minor*	+	+				
Agamidae	*Tympanocryptis cephalus*		+	✓			
Carphodactylidae	*Nephrurus milii*	+	+				
Diplodactylidae	*Diplodactylus granariensis*		+	✓			
Diplodactylidae	*Diplodactylus pulcher*	+	+				
Elapidae	*Furina ornata*		+	✓			
Elapidae	*Parasuta monachus*		+	✓			
Elapidae	*Pseudechis australis*	+	+				
Elapidae	*Pseudonaja nuchalis*		+	✓			
Elapidae	*Simoselaps bertholdi*		+	✓			
Gekkonidae	*Gehyra purpurascens*	+	+				

FAMILY	Species	Previously recorded	BushBlitz Survey 2011	New record	Pest	EPBC Listed	State Listed
Gekkonidae	*Gehyra variegata*	+	+				
Gekkonidae	*Heteronotia binoei*	+	+				
Gekkonidae	*Oedura reticulata*	+					
Gekkonidae	*Rhyncoedura ornata*	+					
Gekkonidae	*Strophurus wellingtonae*	+					
Pygopodidae	*Delma australis*	+	+				
Pygopodidae	*Lialis burtonis*	+					
Scincidae	*Cryptoblepharus buchananii*	+	+				
Scincidae	*Ctenotus leonhardii*	+	+				
Scincidae	*Ctenotus schomburgkii*		+	✓			
Scincidae	*Ctenotus uber*		+	✓			
Scincidae	*Ctenotus xenopleura*		+	✓			
Scincidae	*Egernia depressa*		+	✓			
Scincidae	*Egernia formosa*	+	+				
Scincidae	*Eremiascincus richardsonii*	+	+				
Scincidae	*Lerista macropisthopus*		+	✓			
Scincidae	*Lerista picturata*	+	+				
Scincidae	*Lerista timida*	+	+				
Scincidae	*Liopholis inornata*	+	+				
Scincidae	*Menetia greyii*	+	+				
Scincidae	*Morethia adelaidensis*	+					
Scincidae	*Morethia butleri*	+	+				
Scincidae	*Tiliqua occipitalis*		+	✓			
Scincidae	*Tiliqua rugosa*	+	+				
Typhlopidae	*Ramphotyphlops australis*		+	✓			
Typhlopidae	*Ramphotyphlops bituberculatus*	+					
Varanidae	*Varanus caudolineatus*	+					
Varanidae	*Varanus giganteus*		+	✓			
Varanidae	*Varanus gouldii*	+	+				
Mammals							
Bovidae	*Capra hircus*		+		+		
Burramyidae	*Cercartetus concinnus*		+	✓			
Camelidae	*Camelus dromedarius*		+		+		

FAMILY	Species	Previously recorded	BushBlitz Survey 2011	New record	Pest	EPBC Listed	State Listed
Canidae	*Canis lupus*		+		+		
Canidae	*Vulpes vulpes*		+		+		
Dasyuridae	*Ningaui yvonneae*		+	✓			
Dasyuridae	*Pseudantechinus woolleyae*		+	✓			
Dasyuridae	*Sminthopsis crassicaudata*		+	✓			
Dasyuridae	*Sminthopsis dolichura*		+	✓			
Dasyuridae	*Sminthopsis ooldea*		+	✓			
Felidae	*Felis catus*		+		+		
Leporidae	*Oryctolagus cuniculus*		+		+		
Macropdidae	*Macropus fuliginosus*		+	✓			
Macropdidae	*Macropus robustus*		+	✓			
Molossidae	*Mormopterus planiceps*		+	✓			
Molossidae	*Tadarida australis*		+	✓			
Muridae	*Mus musculus*		+		+		
Muridae	*Notomys mitchellii*		+	✓			
Muridae	*Pseudomys bolami*	+					
Tachyglossidae	*Tachyglossus aculeatus*		+	✓			
Vespertilionidae	*Chalinolobus gouldii*		+	✓			
Vespertilionidae	*Nyctophilus geoffroyi*		+	✓			

Appendix 2.

Survey Sites where traps were installed

Site 1

Site 2

Site 3

Site 4

Site 5

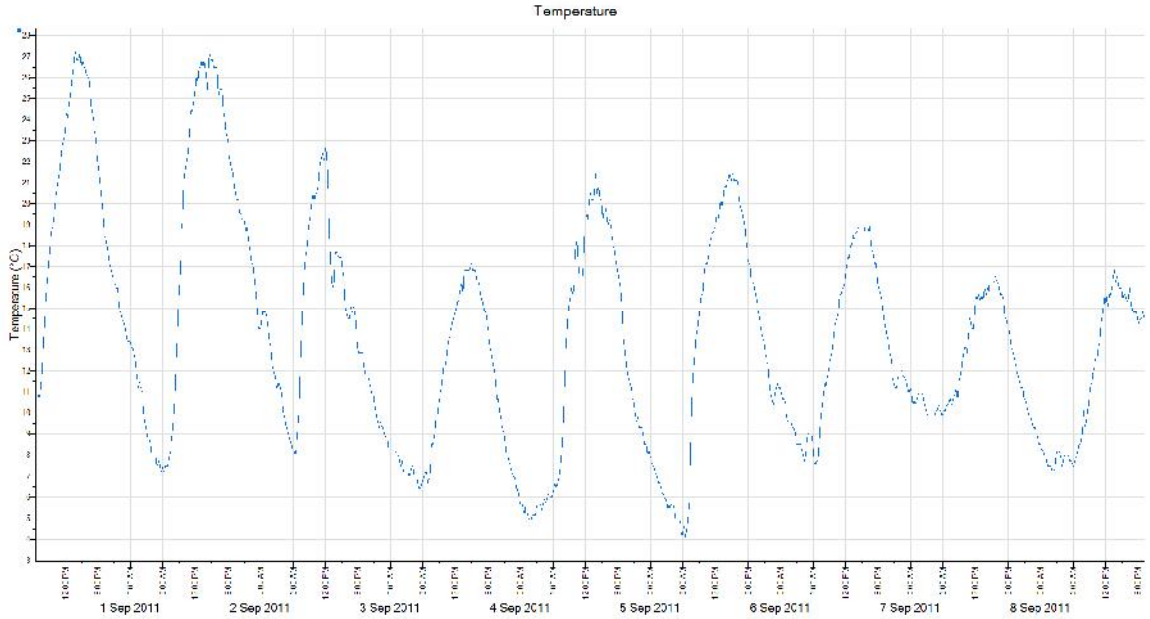
Site 6

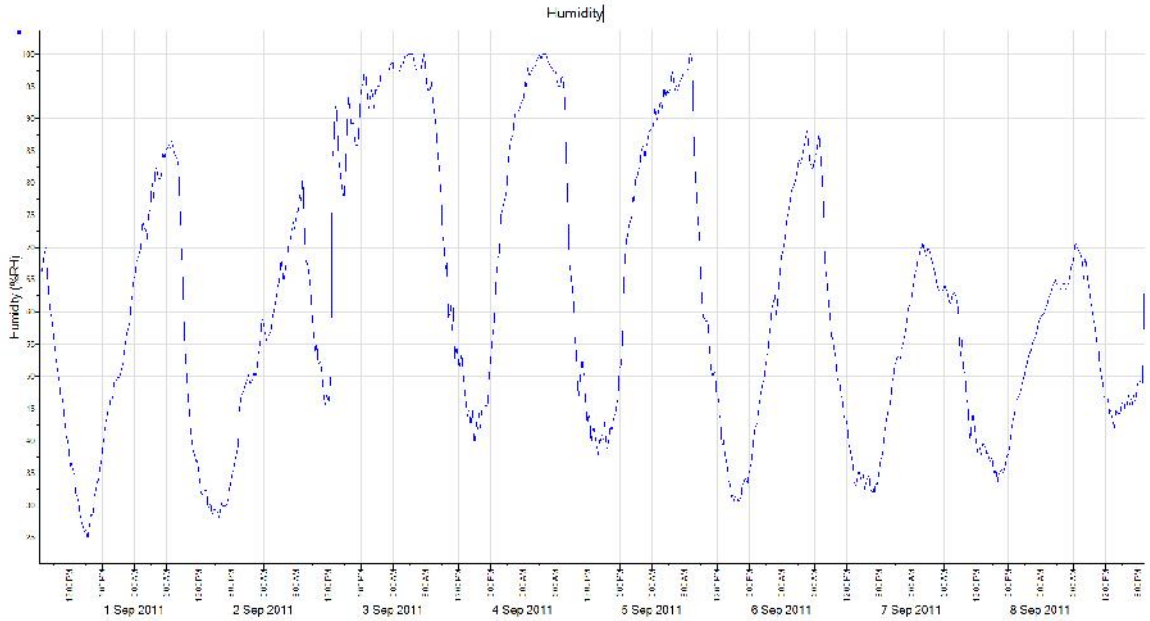
Site 7

Site 8

Appendix 3

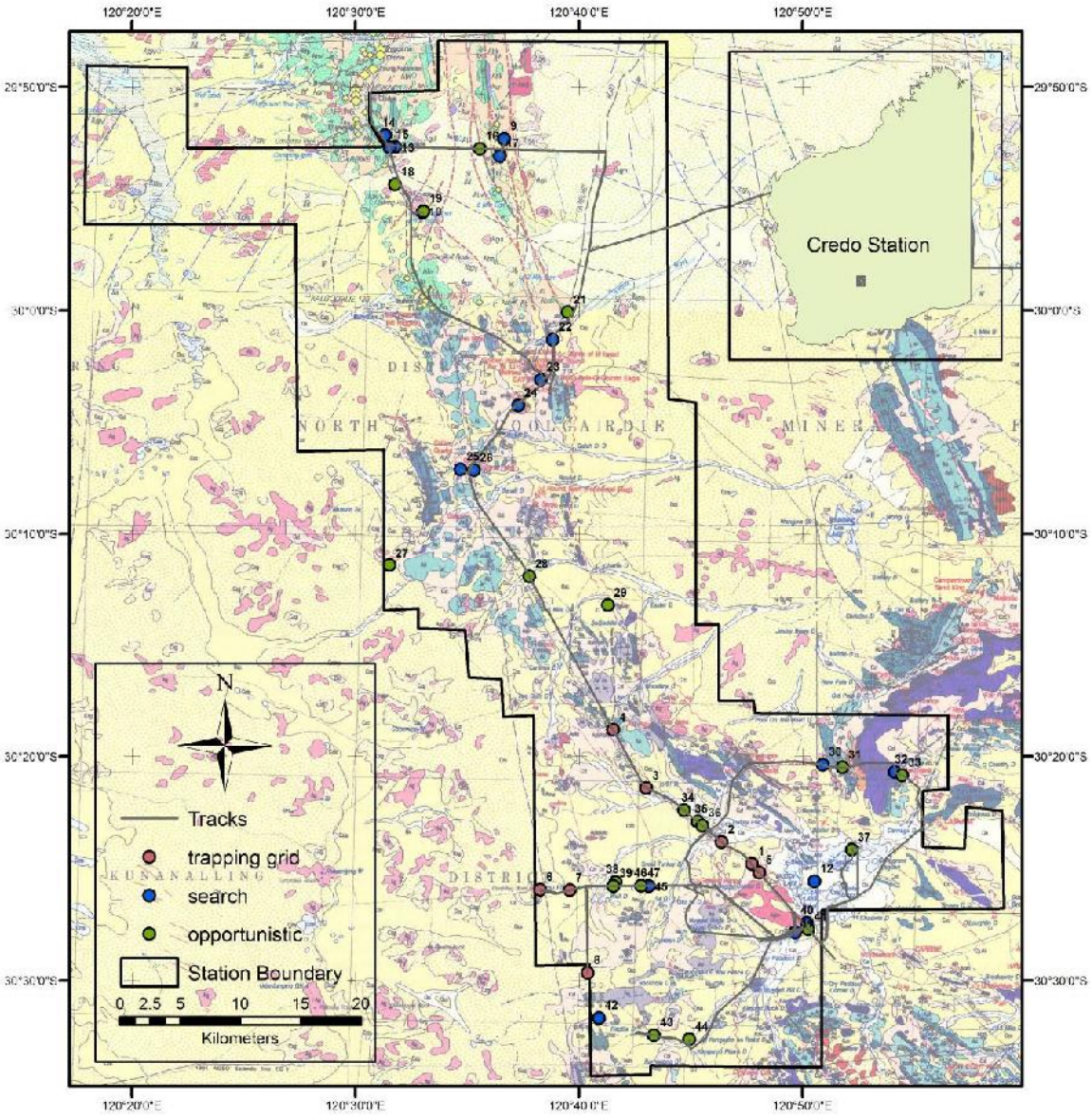
Temperature (top) and humidity (bottom) for survey period at Credo Homestead

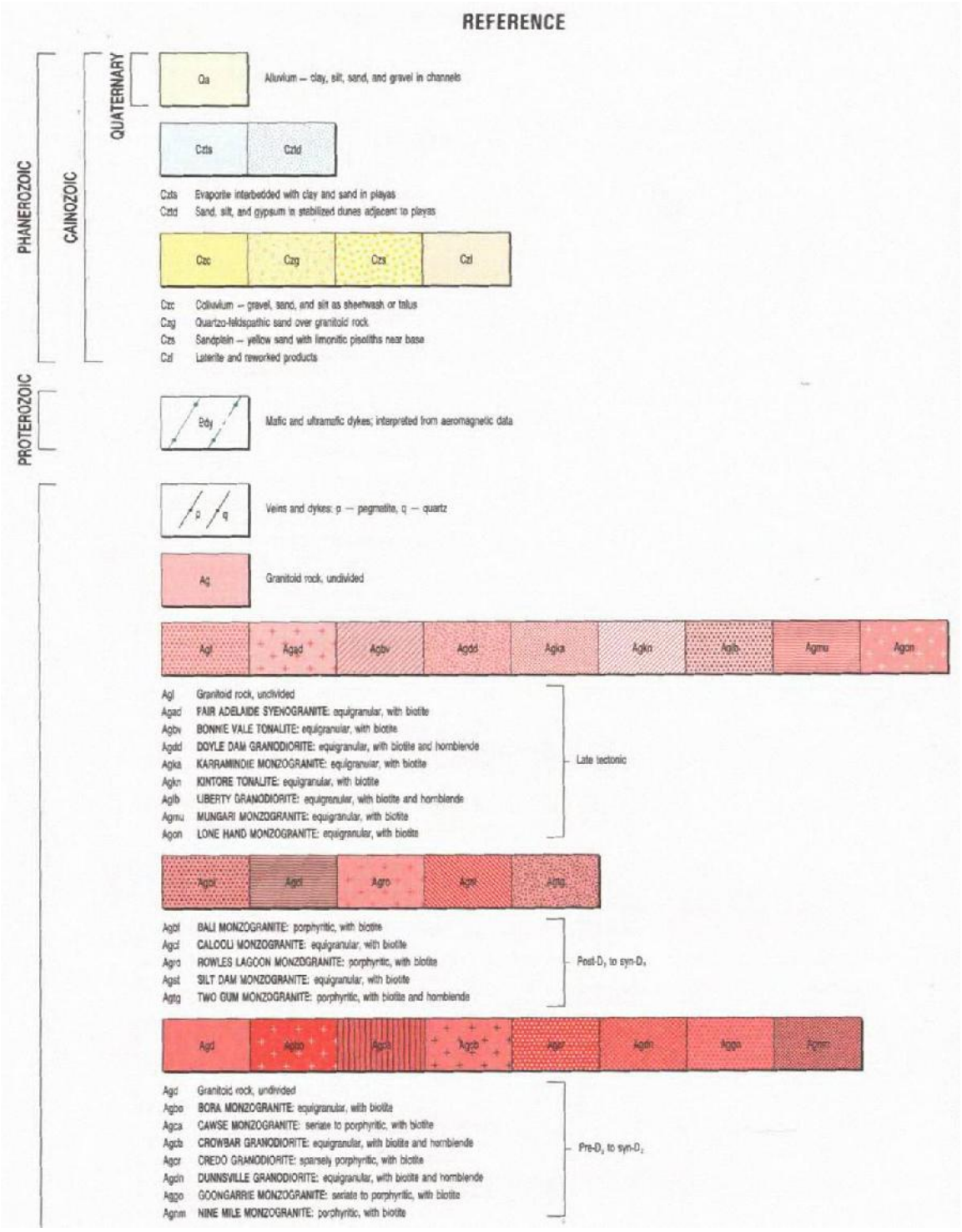


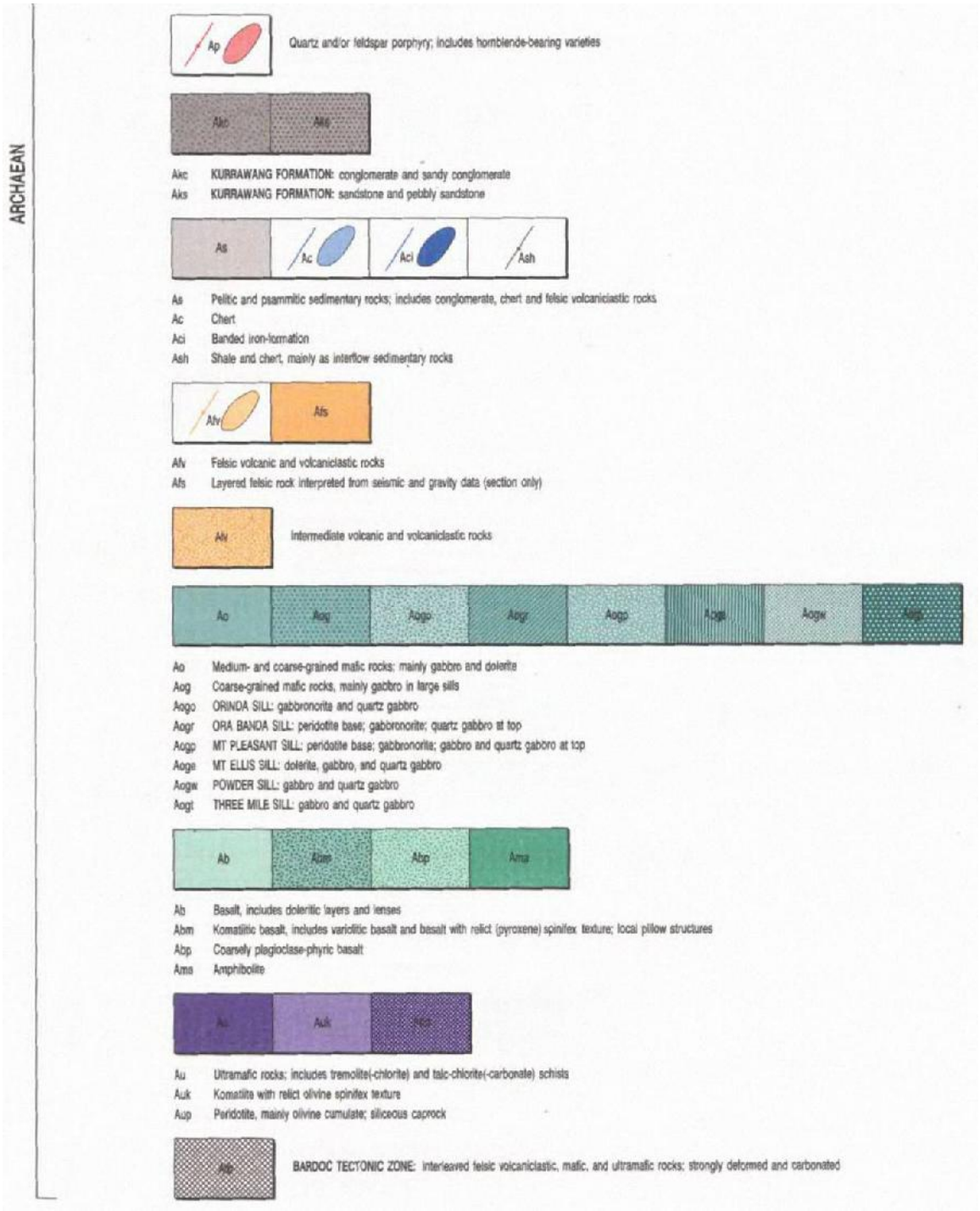


Appendix 4

Geology and numbered survey locations




REFERENCE
PHANEROZOIC
CAINOZOIC
QUATERNARY
Qa
Alluvium – clay, silt, sand, and gravel in channels
Czts
Czld
Czts Evaporite interbedded with clay and sand in playas
Czld Sand, silt, and gypsum in stebilized dunes adjacent to playas
Czc
Czg
Czs
Czl
Czc Colluvium – gravel, sand, and silt as sheetwash or talus
Czg Quartzo-feldspathic sand over granitoid rock
Czs Sandplain – yellow sand with limonitic pisoliths near base
Czl Laterite and reworked products
PROTEROZOIC
Pdy
Mafic and ultramafic dykes; interpreted from aeromagnetic data
p
q
Veins and dykes: p – pegmatite, q – quartz
Ag
Granitoid rock, undivided
Agl
Agad
Agbv
Agdd
Agka
Agkn
Agtb
Agmu
Agon
Agl Granitoid rock, undivided
Agad FAIR ADELAIDE SYENOGRANITE: equigranular, with biotite
Agbv BONNIE VALE TONALITE: equigranular, with biotite
Agdd DOYLE DAM GRANODIORITE: equigranular, with biotite and hornblende
Agka KARRAMINDIE MONZOGRANITE: equigranular, with biotite
Agkn KINTORE TONALITE: equigranular, with biotite
Agtb LIBERTY GRANODIORITE: equigranular, with biotite and hornblende
Agmu MUNGARI MONZOGRANITE: equigranular, with biotite
Agon LONE HAND MONZOGRANITE: equigranular, with biotite
Late tectonic
Agbl
Agcl
Agro
Agst
Agtg
Agbl BALI MONZOGRANITE: porphyritic, with biotite
Agcl CALCOLI MONZOGRANITE: equigranular, with biotite
Agro ROWLES LAGOON MONZOGRANITE: porphyritic, with biotite
Agst SILT DAM MONZOGRANITE: equigranular, with biotite
Agtg TWO GUM MONZOGRANITE: porphyritic, with biotite and hornblende
Post-D1 to syn-D2
Agd
Agbo
Agca
Agcb
Agcr
Agdn
Agpo
Agnm
Agd Granitoid rock, undivided
Agbo BORA MONZOGRANITE: equigranular, with biotite
Agca CAWSE MONZOGRANITE: seriate to porphyritic, with biotite
Agcb CROWBAR GRANODIORITE: equigranular, with biotite and hornblende
Agcr CREDO GRANODIORITE: sparsely porphyritic, with biotite
Agdn DUNNSVILLE GRANODIORITE: equigranular, with biotite and hornblende
Agpo GOONGARRIE MONZOGRANITE: seriate to porphyritic, with biotite
Agnm NINE MILE MONZOGRANITE: porphyritic, with biotite
Pre-D2 to syn-D2


ARCHAEAN
Ap
Quartz and/or feldspar porphyry; includes hornblende-bearing varieties
Akc
Aks
Akc KURRAWANG FORMATION: conglomerate and sandy conglomerate
Aks KURRAWANG FORMATION: sandstone and pebbly sandstone
As
Ac
Aci
Ash
As Pelitic and psammitic sedimentary rocks; includes conglomerate, chert and felsic volcaniclastic rocks
Ac Chert
Aci Banded iron-formation
Ash Shale and chert, mainly as interflow sedimentary rocks
Afv
Afs
Afv Felsic volcanic and volcaniclastic rocks
Afs Layered felsic rock interpreted from seismic and gravity data (section only)
Av
Intermediate volcanic and volcaniclastic rocks
Ao
Aog
Aogo
Aogr
Aogp
Aoge
Aogw
Aogt
Ao Medium- and coarse-grained mafic rocks; mainly gabbro and dolerite
Aog Coarse-grained mafic rocks, mainly gabbro in large sills
Aogo ORINDA SILL: gabbronorite and quartz gabbro
Aogr ORA BANDA SILL: peridotite base; gabbronorite; quartz gabbro at top
Aogp MT PLEASANT SILL: peridotite base; gabbronorite; gabbro and quartz gabbro at top
Aoge MT ELLIS SILL: dolerite, gabbro, and quartz gabbro
Aogw POWDER SILL: gabbro and quartz gabbro
Aogt THREE MILE SILL: gabbro and quartz gabbro
Ab
Abm
Abp
Amp
Ab Basalt, includes doleritic layers and lenses
Abm Komatiitic basalt, includes variolitic basalt and basalt with relict (pyroxene) spinifex texture; local pillow structures
Abp Coarsely plagioclase-phyric basalt
Amp Amphibolite
Au
Auk
Aup
Au Ultramafic rocks; includes tremolite(-chlorite) and talc-chlorite(-carbonate) schists
Auk Komatiite with relict olivine spinifex texture
Aup Peridotite, mainly olivine cumulate; siliceous caprock
Abb
BARDOC TECTONIC ZONE: interleaved felsic volcaniclastic, mafic, and ultramafic rocks; strongly deformed and carbonated

Appendix 5. Financial Statement

I hereby certify that all funds for this project have been spent in the manner and for the purposes specified by the contract.

Name: Mark Cowan

Signed: M L Cowan

Date: 13 February 2012