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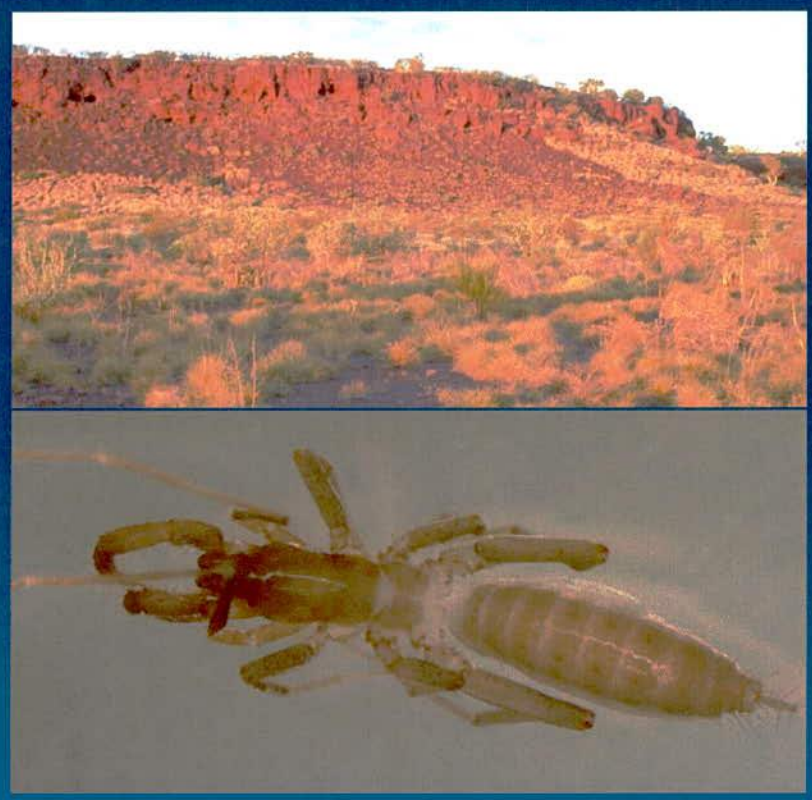
Supplementary Report (Further Troglofauna Sampling at Mesa A) – Mesa A / Warramboo Iron Ore Project, Public Environmental Review



Prepared for

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1.0 Scope and Objectives

The proposal to develop an iron ore mine (and associated infrastructure) at Mesa A was referred to the Environmental Protection Authority (EPA) during early 2005 for a level of assessment to be set under the *Environmental Protection Act 1986*. The EPA determined that the proposal would be formally assessed at the level of Public Environmental Review (PER). An Environmental Scoping Document was subsequently prepared for the PER, including identification of troglobitic fauna as a relevant environmental assessment factor for the proposal.

The Draft PER submitted to the EPA Service Unit (EPASU) by Robe River Mining Company Pty. Ltd. has proposed 'mining exclusions zone and potential troglofauna habitats' as refuges for Mesa A troglofauna. The exclusion zone comprises an area of habitat predominantly running around the outer margins of Mesa A. Sampling effort during the current phase (Phase IV) has focussed on this 'exclusion' area, particularly the portion bounding the outer margin of the mesa.

We provide a summary of interim results of Phase IV of the Mesa A troglofauna sampling programme conducted in 2006. Please note that this is based on the outcomes of litter sample sorting and taxonomic resolution is limited to broad groups only. Further work will be undertaken to achieve species level results.

2.0 Survey methodology and Sampling Effort

Sampling for troglofauna was carried out in accordance with the approach followed during the original Mesa A and Robe Valley troglofauna survey (Biota 2006). Sampling methodology consisted of the use of customised troglofauna traps filled with locally sourced leaf litter (an attractant for the target fauna). These traps were suspended in boreholes with trap depths tailored to match fracture zones and cavities based on drill logs. Traps were left in place for approximately eight weeks and recovered during early August 2006. Thirty-one bores were sampled comprising a total of 91 traps (Figure 3.1).

Leaf litter from recovered traps was hand sorted by zoologists in Perth using dissecting microscopes (Olympus SZ and SZ40). Fauna specimens collected were assigned a unique specimen number based on borehole location and tracked on customised data sheets. All invertebrates, both epigean (surface fauna) and subterranean, were recovered from the samples. Specimens were curated in 100% ethanol to allow for potential DNA analyses. Sub-samples of adults from certain taxa of interest (Schizomida and Pseudoscorpionida) were curated in 70% ethanol to allow for morphological assessment.

Hand sampled leaf litter was submitted to the Western Australian Museum to be placed in tullgren funnels in order to extract fauna that may have been overlooked (primarily Collembola and Acarina). Data from the tullgren funnels is currently pending.

3.0 Phase IV Results

Sorting yielded a total of 262 invertebrate specimens, representing 10 taxonomic groups. Subsequent to the Phase IV sampling, a review of the collected fauna was carried out to distinguish groups that may be troglobitic (and therefore potentially restricted), from deep-soil and surface fauna. Based on this review, in combination with initial examination of the fauna, it appears that only 25 of the specimens collected during Phase IV were troglobitic, representing five taxonomic groups (Table 3.1 and Figure 3.1). Bore hole collection locations and sample identifications for these specimens are outlined in Table 3.2.

Table 3.1 Summary of total troglobitic taxa collected from the mining exclusion zone at Mesa A during Phase IV.

Class	Order	Common name	Number individuals
Arachnida	Schizomida	Schizomids	14
Arachnida	Pseudoscorpionida	Pseudoscorpions	1
Insecta	Thysanura	Silverfish	5
Insecta	Coleoptera	Beetles	1
Chilopoda	Scolopendrida	Centipedes	4

Table 3.2 Details of troglobitic fauna recorded from the mining exclusion zone at Mesa A during Phase IV

Site	Date	Borehole	Taxa (Field Identifications)	n	Sample ID
Mesa A	4/8/06	MEARC4018	Arachnida: Schizomida	1	MEARC4018 T2-42
Mesa A	4/8/06	MEARC4018	Arachnida: Schizomida	1	MEARC4018 T3-45
Mesa A	4/8/06	MEARC4018	Arachnida: Schizomida	1	MEARC4018 T4-51
Mesa A	4/8/06	MEARC4026	Arachnida: Schizomida	1	MEARC4026 T3-43
Mesa A	4/8/06	MEARC4038	Insecta: Coleoptera	1	MEARC4038 T1-40
Mesa A	4/8/06	MEARC4307	Chilopoda: Scolopedrida	1	MEARC4037 T2-40
Mesa A	4/8/06	MEARC4284	Chilopoda: Scolopedrida	1	MEARC4284 T1-41
Mesa A	4/8/06	MEARC4284	Arachnida: Schizomida	1	MEARC4284 T2-43
Mesa A	4/8/06	MEARC4284	Arachnida: Schizomida	1	MEARC4284 T2-45
Mesa A	4/8/06	MEARC4285	Chilopoda: Scolopedrida	1	MEARC4285 T1-41
Mesa A	4/8/06	MEARC4290	Arachnida: Schizomida	1	MEARC4290 T1-40
Mesa A	4/8/06	MEARC4290	Arachnida: Schizomida	1	MEARC4290 T2-42
Mesa A	4/8/06	MEARC4293	Arachnida: Schizomida	1	MEARC4293 T3-40
Mesa A	4/8/06	MEARC4294	Arachnida: Schizomida	1	MEARC4294 T3-41
Mesa A	4/8/06	MEARC4296	Insecta: Thysanura	3	MEARC4296 T1-40
Mesa A	4/8/06	MEARC4296	Chilopoda: Scolopedrida	1	MEARC4296 T2-43
Mesa A	4/8/06	MEARC4296	Insecta: Thysanura	1	MEARC4296 T2-45
Mesa A	4/8/06	MEARC4296	Arachnida: Pseudoscorpionida	1	MEARC4296 T3-46
Mesa A	4/8/06	MEARC4304	Arachnida: Schizomida	1	MEARC4304 T2-41
Mesa A	4/8/06	MEARC4304	Arachnida: Schizomida	1	MEARC4304 T3-43
Mesa A	4/8/06	MEARC4305	Arachnida: Schizomida	1	Not collected
Mesa A	4/8/06	MEARC4305	Insecta: Thysanura	1	MEARC4305 T2-41
Mesa A	4/8/06	MEARC4306	Arachnida: Schizomida	1	MEARC4306 T1-40

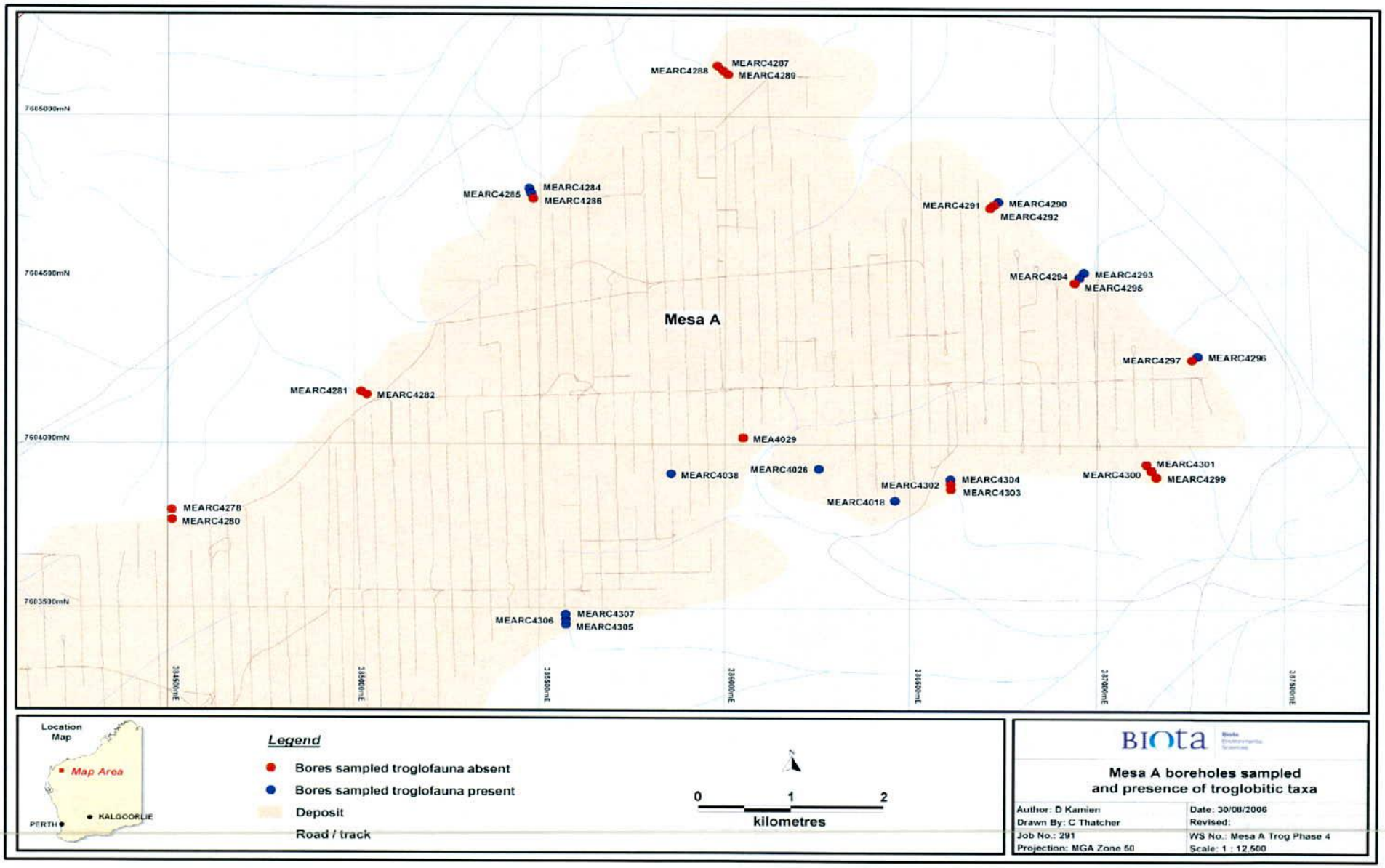

Figure 3.1 **Mesa A bore sampling locations and distribution of troglofauna recorded during Phase IV**

4.0 Discussion

Preliminary examination of all fauna collected during Phase IV did not result in the detection of new taxa (at the order level). However, a single Coleoptera of the family Caribidae (carib beetle) was subsequently confirmed as troglobitic by Mr Brian Hanich and Ms Julianne Waldock of the WA Museum. This comprises a new troglobitic record for Mesa A, illustrating the value of ongoing survey effort at this site. A comparison of the results of troglobitic fauna sampling from Phases I to III with those from Phase IV is shown in Table 4.1

Table 4.1 Overview comparison of troglobitic orders recorded during Phases I-III and Phase IV.

		No. of bores sampled		No. of bores with troglofauna		Total individuals	
Class	**Order**	**Phase I - III**	**Phase IV**	**Phase I - III**	**Phase IV**	**Phase I - III**	**Phase IV**
Arachnida	Schizomida	74	31	18	9	39	14
	Pseudoscorpionida	74	31	2	1	2	1
Insecta	Thysanura	74	31	6	2	7	5
	Coleoptera	74	31	0	1	0	1
Chilopoda	Scolopendrida	74	31	5	3	2	4
Diplopoda	Polydesmida	74	31	1	0	1	0
Diplura	Diplura	74	31	6	0	6	0

Relative to sampling effort, the Phase IV survey recorded a similar diversity and abundance of troglofauna from the mining exclusion zone to that previously recorded from the balance of Mesa A (Table 4.1). The orders represented amongst the Phase IV troglobitic faunal assemblage are largely consistent with those collected during the previous three phases. Four of the six troglobitic orders previously collected from the interior of Mesa A were also recorded from the mining exclusion zone. One of the orders, the Polydesmida, was only represented by two individuals from the entire sampling programme in the Robe Valley in 2005 (Biota 2006). It therefore seems likely that this group might not have been recorded due to its apparent low density and the influence of ecological sampling effects (e.g. polydesmids may be less attracted to the traps than other species as a function of their behaviour, life history or dietary requirements). The remaining group, the diplurans, were relatively well collected during 2005 and additional sampling effort will probably add these to the fauna known from the mining exclusion zone.

It should be recognised that while the same troglobitic orders occur in the exclusion zone, more detailed examination of specimens will be needed to complete a fuller comparison at the species level. An overview of the spatial distribution of troglofauna collected during Phase IV compared to Phase I, II and III is shown in Figure 4.1.

The Phase IV sampling of the mining exclusion zone has confirmed that troglofauna occur in this portion of the mesa. Based on these preliminary data, fauna density in the mesa outer margins appears to be comparable to that in the mesa interior. However, it should be noted that sample size is low for each taxon and different weather conditions during the various sampling phases could have affected the collections. As a result it is difficult to make definitive abundance comparisons based on data collected to date.

Given the current status of knowledge of the distribution and abundance of troglofauna in Mesa A, it is not possible to make any authoritative statements regarding the impact of the proposed mining project on the long-term viability of Mesa A troglofauna populations in the proposed exclusion zones. Sampling at Mesa A has significantly increased knowledge of the troglofauna assemblage, however, the data obtained remain limited, with few individuals represented within each taxon (i.e. the sample size is low).

Even if the current data set were sufficient to allow valid monitoring and statistical analysis of troglofauna populations, additional biological and physical information would be required to predict the impact of the proposed mining operation on the long-term viability of troglofauna

within Mesa A. For example, predicted changes to subterranean microclimate, surface hydrology, vibration and a reduction in organic inputs, in addition to genetic data and species' life histories (e.g. survivorship, recruitment, longevity, sex ratio and fecundity).

In short, knowledge of life histories and physical impacts combined with a high level of statistical power are fundamental in determining long-term viability of a species' population within what appears to be a restricted habitat.

Troglofauna sampling typically requires "high effort for low sample return". A sustained sampling program is required throughout the region to develop a sufficient information base to more adequately interpret ecological aspects such as seasonal fluctuation, diversity and population variability. The company is currently developing a regional troglofauna sampling program to gather that information.

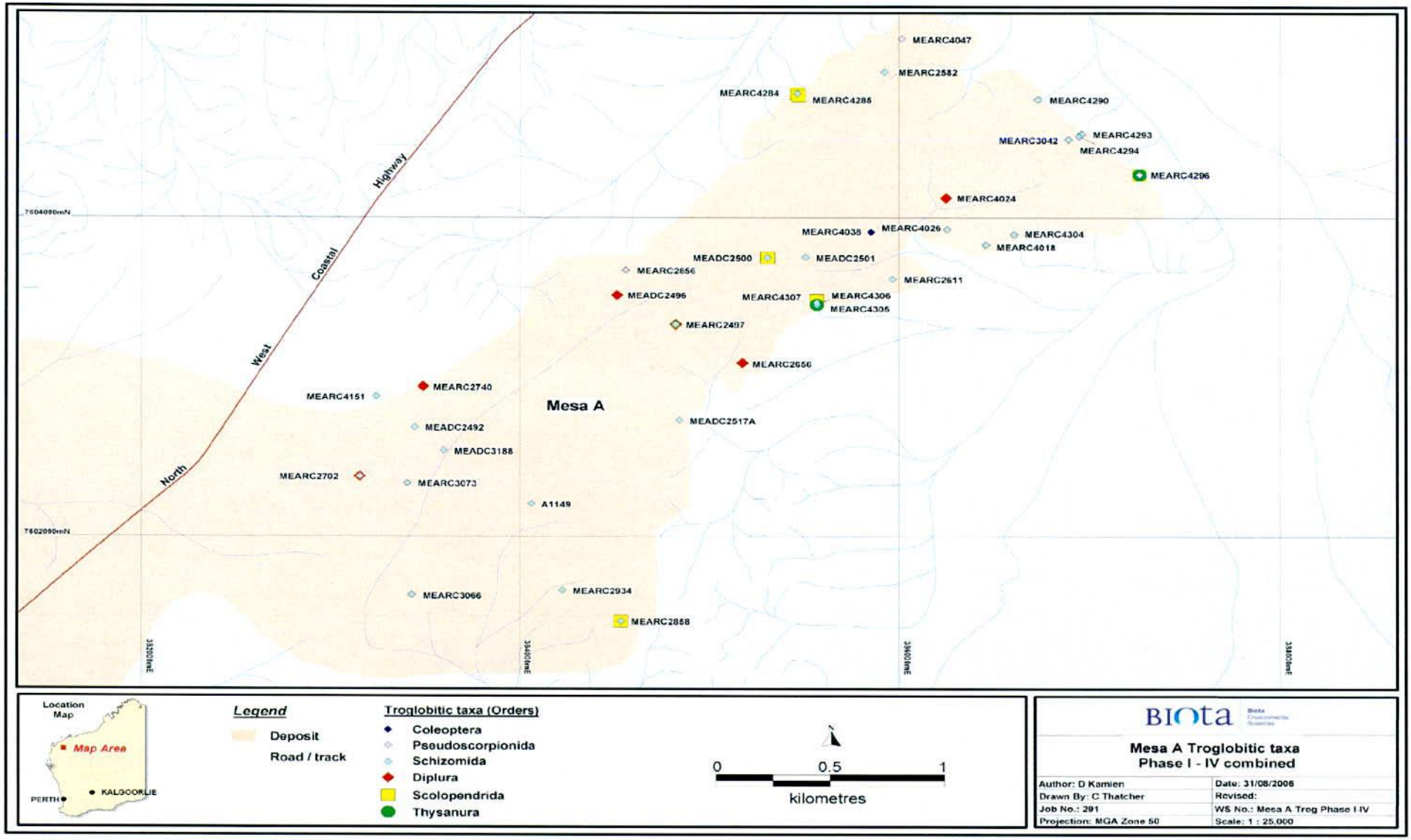

Figure 4.1 **Mesa A distribution of troglofauna recorded during Phases I, II, III and IV combined.**

5.0 Current Status and Direction

The current status and direction on this project is as follows:

- all sorting of recovered traps has now been completed, preliminary specimen identifications are complete and all data have been entered. Preliminary maps showing the spatial distribution of the troglobitic specimens have also been prepared as supplied in this interim report;
- collected specimens have been lodged with the WA Museum for detailed taxonomic resolution;
- Hand sorted leaf litter from the traps has been submitted to the WA Museum to be placed in tullgren funnels in order to extract any fauna missed during hand sorting;
- Dr Mark Harvey and Ms Karen Edward of the WA Museum are currently determining detailed identification of the specimens collected to date; and
- A draft report for this study will commence in September 2006. This will also draw in findings from previous work completed by Biota and others on this fauna at other localities.

6.0 References

Biota Environmental Sciences (2006). Mesa A and Robe Valley Mesas Troglobitic Fauna Survey, Subterranean Fauna Assessment. Unpublished Report prepared for Robe River Iron Associates.