

10 APPENDIX 1: Plant list for survey sites and points of interest

(Nomenclature follows Albrecht et al. (1997) or Australian Plant Name Index (www.anbg.gov.au); * indicates introduced to southern region of Northern Territory (Albrecht et al. 1997))

SPECIES	LOCATION								
	1	2	3	4	5A	5B	6	Plenty River	Spinifex Bore
<i>Abutilon leptocarpum</i>	*	*	*	*	*	*	*		*
<i>Acacia aneura</i>	*	*	*				*		
<i>Acacia coriacea</i>			*	*					
<i>Acacia estrophiolata</i>	*	*	*	*	*	*	*		*
<i>Acacia farnesiana</i>							*	*	
<i>Acacia kempeana</i>	*	*	*			*	*		
<i>Acacia melleodora</i>			*	*					
<i>Acacia victoriae</i>	*	*		*			*	*	*
<i>Acetosa vesicaria</i> *	*								
<i>Acyranthus aspera</i>								*	
<i>Alectryon oleifolius subsp. elongatus</i>									
<i>Amyema maidenii</i>	*								
<i>Aristida holathera</i>	*	*	*	*	*		*		*
<i>Aristida strigosa</i>	*	*	*				*	*	
<i>Atalaya hemiglauca</i>	*			*	*		*	*	
<i>Atriplex elachophylla</i>	*	*			*	*	*	*	
<i>Boerhavia coccinea</i>	*	*		*	*		*		
<i>Brachycome ciliaris</i>				*	*	*			
<i>Brachycome tesquorum</i>	*	*							
<i>Bracteantha bracteata</i>	*	*	*	*	*	*	*		
<i>Calocephalus knappii</i>	*	*	*	*	*	*	*		
<i>Calocephalus platycephalus</i>	*	*			*		*		
<i>Calotis hispidula</i>	*	*	*	*	*	*	*	*	*
<i>Calotis plumifera</i>			*			*			
<i>Capparis spinosa</i>								*	*
<i>Cenchrus ciliaris</i> *	*	*	*	*	*	*	*	*	*
<i>Chamaesyce drummondii</i>	*	*	*	*	*	*	*		*
<i>Chenopodium cristatum</i>							*		
<i>Chenopodium melanocarpum</i> *		*				*			
<i>Chenopodium murale</i> *									*
<i>Chloris virgata</i> *	*	*			*			*	
<i>Chrysocephalum apiculatum</i>		*							
<i>Chrysocephalum pterochaetum</i>			*						
<i>Chrysopogon fallax</i>			*				*		*
<i>Citrullus colocynthis</i> *	*	*			*				
<i>Cleome viscosa</i>	*	*	*	*	*		*		
<i>Convolvulus erubescens</i>									*
<i>Crotalaria cunninghamii</i>								*	
<i>Crotalaria eremaea</i>				*	*				
<i>Crotalaria novae-hollandiae</i>	*	*				*			*
<i>Cullen australasicum</i>		*							
<i>Dactyloctenium radulans</i>		*					*		
<i>Datura species</i> *									*

<i>Daucus glochidiatus</i>								*	
<i>Digitaria brownii</i>						*	*		
<i>Digitaria coericala</i>	*					*			
<i>Einadia nutans</i>							*	*	*
<i>Enchylaena tomentosa</i>	*	*	*			*	*	*	*
<i>Enneapogon avenacea</i>	*								
<i>Enneapogon eriopoda</i>							*		*
<i>Enneapogon oblongus</i>						*			
<i>Enneapogon polyphyllus</i>	*	*	*	*		*	*		
<i>Eragrostis eriopoda</i>	*		*	*	*				
<i>Eragrostis longifolia</i>									
<i>Eragrostis setifolia</i>	*								
<i>Eremophila christophori</i>								*	
<i>Eremophila latrobeii</i>	*	*	*						
<i>Eremophila longifolia</i>		*	*						*
<i>Eremophila sturtii</i>	*								
<i>Eriachne aristidea</i>		*	*	*	*				
<i>Eriachne helmsii</i>			*	*					
<i>Erodium cygnorum subsp. glandulosum</i>							*		
<i>Eucalyptus camuldensis</i>					*		*	*	*
<i>Eucalyptus coolabah subsp. arida</i>	*								
<i>Eulalia aurea</i>	*							*	
<i>Euphorbia tannensis subsp. eremophila</i>			*						
<i>Evolvulus alsinoides</i>			*				*		
<i>Glycine canescens</i>		*	*	*				*	
<i>Goodenia heterochila</i>		*	*		*		*		
<i>Goodenia lunata</i>	*								
<i>Grevillia striata</i>							*	*	
<i>Hakea divericata</i>		*		*			*		*
<i>Hakea lorea</i>	*	*							
<i>Indigofera linnaei</i>									*
<i>Indigofera psammophila</i>			*						
<i>Ixiochlamys filicifolia</i>	*								
<i>Lechenaultia divaricata</i>		*		*	*		*	*	*
<i>Leichhardtia australis</i>		*			*		*		
<i>Lepidium muelleriferdinandi</i>								*	
<i>Lepidium phlebopetalum</i>	*	*	*		*	*			
<i>Leptochloa digitaria</i>								*	
<i>Maireana villosa</i>						*	*		
<i>Malvastrum americanum*</i>								*	
<i>Melaleuca glomerata</i>	*								
<i>Melhania oblongifolia</i>	*		*	*		*	*		*
<i>Muehlenbeckia cunninghamii</i>	*				*		*		
<i>Nicotiana velutina</i>	*	*						*	
<i>Phyllanthus fuernrohrii</i>		*					*		*
<i>Portulaca oleracea</i>	*								*
<i>Ptilotus obovatus</i>	*		*		*	*	*		
<i>Ptilotus polystachyus</i>	*	*	*			*			
<i>Ptilotus sessilifolius</i>	*								
<i>Rhagodia spinescens</i>	*	*	*	*	*	*	*	*	*
<i>Rhodanthe charsleyae</i>	*					*			

SPECIES	LOCATION								
	1	2	3	4	5A	5B	6	Plenty River	Spinifex Bore
<i>Rhodanthe floribunda</i>	*	*			*	*			*
<i>Rhodanthe tietkensis</i>	*	*	*	*	*	*	*		*
<i>Rostellularia pogonantha</i>	*					*			
<i>Rutidosia helichrysoides</i>			*						
<i>Salsola tragus</i>	*	*		*	*			*	
<i>Santalum acuminatum</i>	*								
<i>Santalum lanceolatum</i>		*	*		*				
<i>Scaevola depauperata</i>				*					
<i>Sclerolaena cornishiana</i>	*								
<i>Sclerolaena costata</i>	*	*					*		
<i>Senecio gregorii</i>	*	*	*	*			*		*
<i>Senecio magnificus</i>								*	
<i>Senna artemisioides subsp. filifolia</i>	*	*	*	*	*	*	*	*	*
<i>Senna artemisioides subsp. helmsii</i>			*						
<i>Senna artemisioides subsp. oligophylla</i>			*						
<i>Senna pleurocarpa var. pleurocarpa</i>			*	*					
<i>Setaria surgens</i>			*						
<i>Sida fibulifera</i>	*	*		*			*		
<i>Sida filiformis</i>			*						
<i>Solanum chenopodium</i>								*	
<i>Solanum ellipticum</i>	*	*	*						
<i>Solanum quadriloculatum</i>						*	*		*
<i>Sonchus oleraceus*</i>								*	
<i>Swainsona flavicarinata</i>		*							
<i>Swainsona microphylla</i>				*			*		
<i>Swainsona phacoooides</i>	*	*		*		*	*		*
<i>Tephrosia sphaerospora</i>		*		*					
<i>Themeda triandra</i>								*	
<i>Trachymene glauca</i>			*	*		*			
<i>Tribulus angustifolia</i>	*		*						
<i>Triodia schinzii</i>				*					
<i>Triraphis mollis</i>	*	*							
<i>Urochloa piligera</i>	*					*		*	
<i>Ventilago viminalis</i>									*
<i>Wahlenbergia species</i>				*		*	*		
<i>Zygochola paradoxa</i>					*				
<i>Zygophyllum simile</i>	*	*	*	*	*			*	*
TOTAL	62	53	47	38	33	34	49	31	32

11 APPENDIX 2 – SITE PHOTOGRAPHS



Plate 1 Riparian zone along the Arturga Creek illustrating need for buffer zone to prevent erosion of riparian creek banks and loss of vegetation.

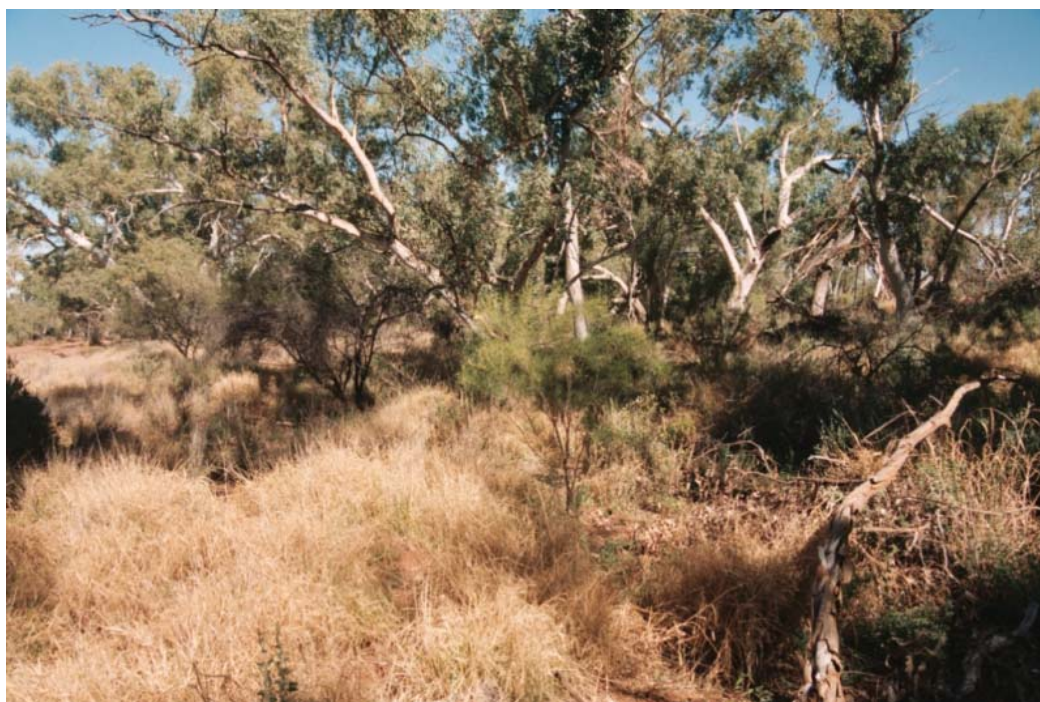


Plate 2 Riparian vegetation of Red Gums (*Eucalyptus camaldulensis*) overstorey with dense understorey of Buffel Grass (*Cenchrus ciliaris*).



Plate 3 Potential habitat for Possum (*Trichosurus vulpecula vulpecula*) in Red Gum (*Eucalyptus camaldulensis*) along Artunga Creek.



Plate 4 Coolibah (*Eucalyptus coolabah subsp. arida*) with dense understorey of of Buffel Grass (*Cenchrus ciliaris*) along Artunga Creek near the Plenty Hwy.



Plate 5 Scar on branch of Coolibah (*Eucalyptus coolabah* subsp. *arida*), possibly a Coolamon removal site along Artunga Creek.



Plate 6 Saltbush (*Rhagodia spinescens*) flat in Kanandra Land System with Woollybutt Grass (*Eragrostis eriopoda*) the dominant grass species growing in between saltbush. Harts Range in background. This area is part of the flood plains which will initially be mined.



Plate 7 View from tall sand dunes of Simpson Land System across to Harts Range.



Plate 8 Interdune habitat of Kanandra Land System showing dominant Witchetty Bush (*Acacia kempeana*) and Cassia (*Senna artemisioides* subsp. *filifolia*).



Plate 9 A stand of Gidgee (*Acacia georginae*) on Kanandra Land System in Aturga Creek floodplain. These trees are very common further east, but sparsely scattered in western Mt. Riddock Station.



Plate 10 Erosion potential of soils of Kanandra Land System demonstrated in a channel extending from an earth dam. Exposed roots of Witchetty Bush (*Acacia kempeana*) clearly visible.

APPENDIX 6

Mineral Compositions



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Harts Range 30/60# Garnetblende

Typical Specification

November 2004

Mineral Composition (typical)

Garnet	20%
Hornblende	78%
Ilmenite	<2%
Quartz (free silica)	<0.5%
Others	<1%

Physical Characteristics (typical)

Specific Gravity	3.3
Hardness	6

Chemical Analysis (typical)

SiO ₂	44%
Al ₂ O ₃	12%
Fe ₂ O ₃	19%
TiO ₂	<2%
MgO	11%
CaO	10%
U	<10ppm
Th	<10ppm

	% Retained (typical)
Microns	30/60 Mesh
+1000	-
+850	-
+710	-
+600	2%
+500	16%
+425	15%
+300	50%
+250	16%
+180	1%
-180	-

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Harts Range +30# Garnetblende

Typical Specification

November 2004

Mineral Composition (typical)

Garnet	8%
Hornblende	90%
Ilmenite	<2%
Quartz (free silica)	<0.5%
Others	<1%

Physical Characteristics (typical)

Specific Gravity	3.3
Hardness	6

Chemical Analysis (typical)

SiO ₂	45%
Al ₂ O ₃	12%
Fe ₂ O ₃	18%
TiO ₂	<2%
MgO	11%
CaO	11%
U	<10ppm
Th	<10ppm

	% Retained (typical)
Microns	+30# Mesh
+1000	14%
+850	18%
+710	34%
+600	31%
+500	3%
+425	-
+300	-
+250	-
+180	-
-180	-



OLYMPIA
RESOURCES LIMITED

Harts Range 30/60# Garnet

Typical Specification

November 2004

Mineral Composition (typical)

Garnet	85%
Hornblende	13%
Ilmenite	<2%
Quartz (free silica)	<0.5%
Others	<1%

Physical Characteristics (typical)

Specific Gravity	4
Hardness	7.5

	% Retained (typical)
Microns	30/60 Mesh
+1000	-
+850	-
+710	-
+600	1%
+500	10%
+425	13%
+300	48%
+250	24%
+180	4%
-180	-



OLYMPIA
RESOURCES LIMITED

Harts Range +30# Garnet

Typical Specification

November 2004

Mineral Composition (typical)

Garnet	94%
Hornblende	6%
Ilmenite	<1%
Quartz (free silica)	<0.5%
Others	<1%

Physical Characteristics (typical)

Specific Gravity	4
Hardness	7.5

Chemical Analysis (typical)

SiO ₂	38%
Al ₂ O ₃	21%
Fe ₂ O ₃	32%
TiO ₂	<1%
MgO	6%
CaO	3%
U	<10ppm
Th	<10ppm

	% Retained (typical)
Microns	+30 Mesh
+1000	23%
+850	18%
+710	27%
+600	28%
+500	3%
+425	1%
+300	-
+250	-
+180	-
-180	-

APPENDIX 7

Aturga Creek Archaeological Survey - September 2004

**ATURGA CREEK
SAND-MINING SITE,
Harts Range, Central Australia:**

STAGE 1

ARCHAEOLOGICAL SURVEY

Report prepared for
Olympia Resources Ltd,
Herdsmen, Western Australia

by
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September 2004

ABSTRACT

The survey located two light concentrations of stone artefacts (AC-1 & 2), a scarred tree (AC-3) and a potential occupation site (PHS) within the survey area, and a sizable scatter at *Anthere* claypan. A background scatter of stone artefacts in most exposed areas along Aturga creek margins but these were not seen as representing any repeated focus of Aboriginal occupation or activity.

The scarred tree should be preserved and avoided by the development. Archaeological salvage is recommended if sites AC-1 & 2 are to be disturbed. It is also recommended that the PHS site be assessed by test excavation.

Acknowledgments

The survey was organised by Dr Wolf Martinick (MBSE: Exec. Chairman) and supervised by Kristy Sell (MBSE: Director - Environmental Science) and John Baxter (Technical Director, Olympia Resources Ltd). Thanks go to Harts Range community members Lindsay Cavanaugh and Riley Williams, for assisting in the field, and Tony Petrick for discussions regarding traditional aspects of the area. Donna Cole, administrator at Harts Range, assisted in organising the fieldwork.

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1 INTRODUCTION

1.1 Prelude

Olympia Resources Ltd, of Perth, WA, required an archaeological survey to be undertaken of for a proposed course-sands mining site, on the Mt Riddock Pastoral Lease, near Harts Range, Central Australia (Figure 1). The overall aim was to locate, assess, and make management recommendations for, any Aboriginal archaeological sites that would be impacted by the proposed development. This report presents the results of that survey.

1.2 The protection and preservation of Aboriginal Cultural sites

Aboriginal archaeological sites provide tangible evidence of the Aboriginal occupancy of Australia and reflect their traditional use of the landscape prior to the European invasion. Through the analysis of site location and content, a partial picture of the lifestyle of the people who left these relics can be developed.

In very few regions of Australia has the pattern and chronology of traditional Aboriginal land and landscape use been firmly established. Archaeological sites then have much to offer to the present Aboriginal Communities, academic research, and the broader notion of the history of Australia. Agricultural, mining, industrial and tourist developments over the past 200 years have destroyed or damaged the integrity of Aboriginal sites throughout Australia. It is imperative therefore that remaining archaeological sites be managed primarily for their preservation. If disturbance or destruction is unavoidable then appropriate research should be undertaken to salvage the content and context of the site.

Prescribed archaeological places in the Northern Territory are protected under the **Heritage Conservation Act 1991** (Northern Territory of Australia). These are defined in the Heritage Conservation Regulations:

- (1) For the purposes of Part 6 of the Act, the following archaeological places are prescribed archaeological places:
 - (a) places containing rock paintings or rock carvings;
 - (b) prehistoric or protohistoric occupation places;
 - (c) places (not being cemeteries within the meaning of the *Cemeteries Act*) containing human remains or burial artefacts;
- (2) For the purposes of Part 6 of the Act, archaeological objects which are Aboriginal portable cultural objects (including but not limited to secret and ceremonial objects, log or bark coffins, human remains, portable rock or wood carvings or engravings or stone tools) are prescribed archaeological objects.
- (3) Without limiting the generality of sub-regulations (1) and (2), the Minister may, by instrument in writing, prescribe for the purposes of Part 6 of the Act a particular archaeological place or archaeological object.

It is a condition of the regulations that any person who discovers an archaeological place or archaeological object shall, as soon as practicable after discovering it, advise the Director of the discovery and its location.

Archaeological objects within a Sacred Site are also protected under the **Northern Territory Aboriginal Sacred Sites Act 1989 (Sacred Sites Act)**.

Both Acts apply whether or not particular sites have been Registered, Declared or otherwise brought to official attention.

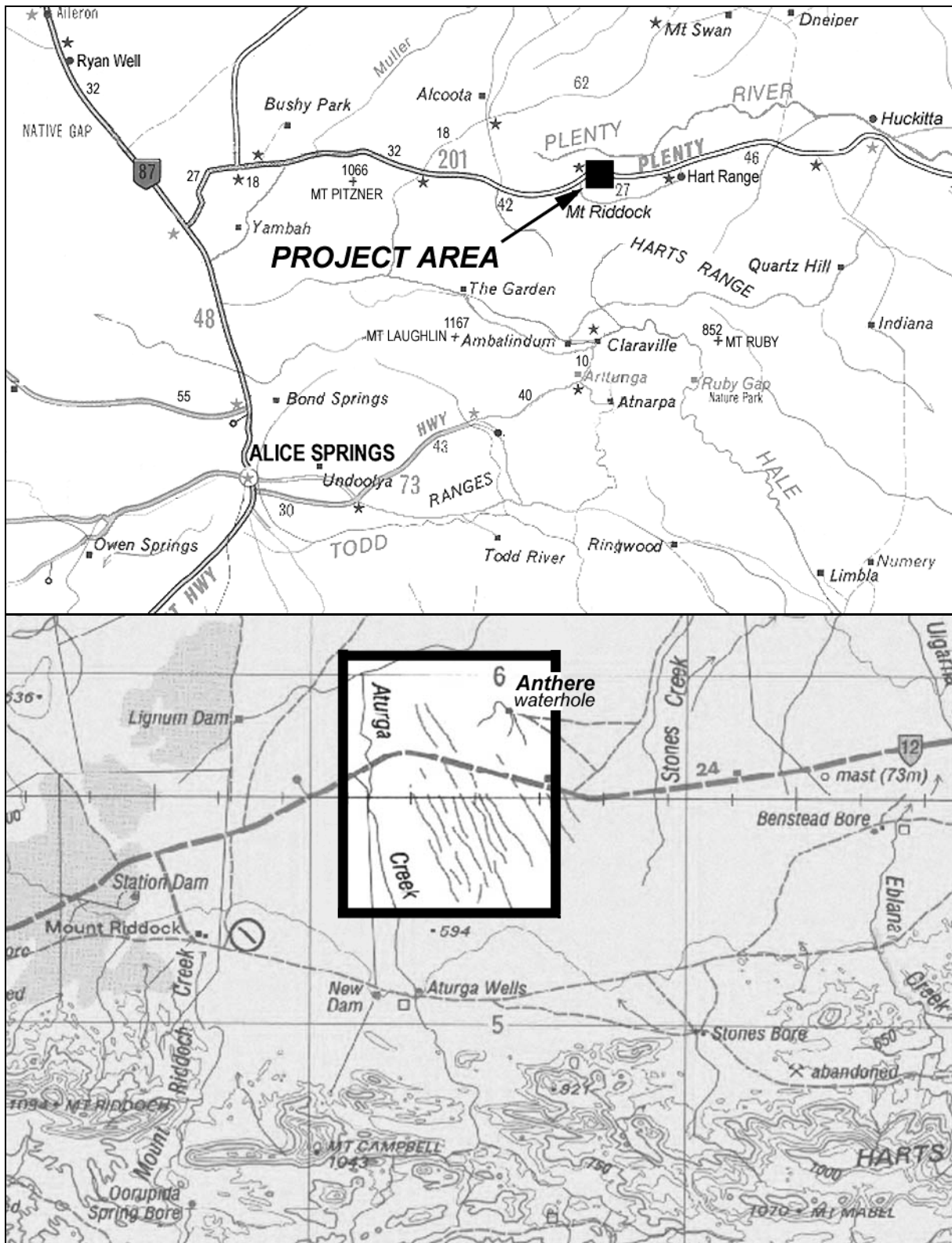


FIGURE 1: Location of the survey area

2 AIMS

The project had four aims:

- *consult with local Aboriginal Communities,*
- *undertake a desktop study of the survey area,*
- *undertake an archaeological survey of the proposed development area and record all sites located,*
- *prepare a report documenting:*
 methods used,
 results of the survey and assessment,
 recommendations regarding the development.

3 THE STUDY AREA

3.1 Survey area and access

The survey area (Figures 1 & 2) was some 4.5 km x 2.5 km (or c.11 km²). It lies fully within the Mt Riddock Pastoral Lease and has been grazed by cattle for over 100 years. Access to the area was via the Plenty Highway, which bisects the project area. Within the project area access was via lightly graded 4WD survey tracks.

The survey area was defined as that area between Aturga Creek to the west and north, dune No. 2 to the east, and northing 58000N in the south (Figure 2). It was subdivided into four landform units for analysis: sand dune & swale, floodplain (and channels), sand plain, and creek margin.

In addition, at the request of the developers, a claypan, *Anthere*, was investigated to determine its archaeological significance and provide comparative data for the project area artefacts.

3.2 Natural environment

The survey area contains three major landform types: creek-line, floodplains and sanddunes. The red sands across the whole area contain a high proportion of hornblende and garnet, which are the target of the proposed mining project.

The regions major stream is the Plenty River, to the immediate north of the project area. Aturga Creek is a minor, northerly flowing tributary that floods out from the Harts Range. It has cut a shallow channel through the superficial sandy plain and has large bordering areas of periodic floodplain. The creek is floored with coarse sands and is bordered by River Red Gums or Coolibahs within a dense but narrow belt of grasses. Any stone artefacts located within the creekbed would doubtless have been born by floodwaters from higher up in the catchment.

The sandy plains bordering the creek consist of creek margin, floodplain, and sandplain (Figure 2). The creek margin is up to 50 m wide and generally abuts the sandplain. It is that area where the slope increases and drops from the sandplain to the creek. It is therefore more prone to erosion than the other landforms here. In places the sandy surface has eroded down to a more resistant, crusted, surface. It is unknown whether this is an earlier soil horizon or a product of the erosion process. Vegetation on the creek margin is sparse and consists of scattered 1-3 m shrubs with very little ground cover. There tends to be a narrow corridor of floodplain between the creek margin and the creek proper.

The floodplain is scarred by a number of shallow overflow and palaeo channels that largely parallel the northerly direction of the creek. This typically consists of shallow sands over clays

that are exposed along the paths of the channels. Vegetation here consists of 5 m high woody shrubs (eg. Honey-myrtle), with a saltbush or perennial grass understorey, particularly the introduced *cenchrus ciliaris* (buffel-grass). Gravels on the floodplain contain nodules of schist, quartz, crystal quartz, amphibole, garnet and hornblende. These have been heavily rounded by water action, and lie in irregular, thin, lag deposits in areas of gentle slope change.

The sandplain is that remaining area of the plain not affected by floodwaters. It appears to be relatively stable and supports both 1-3 m high acacia shrubs and patchy stands of larger trees (mainly ironwood). Extensive areas of open native grassland also occur on this landform, particularly to the north end of the project area.

To the west of the sandy plains lies an extensive area of sand dunes. The north-east/south-west trending dunes rise to around 5 m above the plain and consist of loose red sands with a well-established and varied vegetation cover of light 1-3 m high shrubs. The shrubs were dominated by *acacia*, *hakea* and *eremophila* (Low 1985), while the grasses are dominated by *eragrostis eriopoda* (woolybutt) or *triodia sp* (spinifex). Scattered *grevillea striata* (beefwood), *eucalyptus terminalis* (bloodwood) and *atalaya hemiglauca* (whitewood) are the predominant tree species. This landform also has a wide range of potential Aboriginal plant foods and is the richest of the three landforms encountered.

The area contains a limited range of reptiles and small mammals (Low 1985), although small birds were common throughout the area and red kangaroos were conspicuous within the sanddune landform.

The area has a semi-arid climate, with low humidity and widely varying annual rainfall (Shaw & Wells 1983). The regional average annual rainfall is around 250 mm, but with annual totals ranging from 82 mm (1965) to 783 mm (1974) (ibid). The evaporation rate is around 3000 mm per annum (Thompson 1991). Rainfall tends to fall mostly in late summer. The mean daily temperature ranges from a 4° – 21° C in July, to 23° - 38°C in January. Winters are cool to cold and summers very hot. Surface water is therefore generally scarce and dependent on rainfall events. Consequently, all water reserves were highly prized in traditional Aboriginal society, and are generally found to be the foci of archaeological sites (Gunn 1997).

Overall, the project area can be seen to have been particularly rich in plant and animal foods and timber reserves, but poor in stone. In conjunction with the fresh-water springs and other water reserves within the Harts Ranges to the immediate south, the project area is most likely to have been heavily exploited.

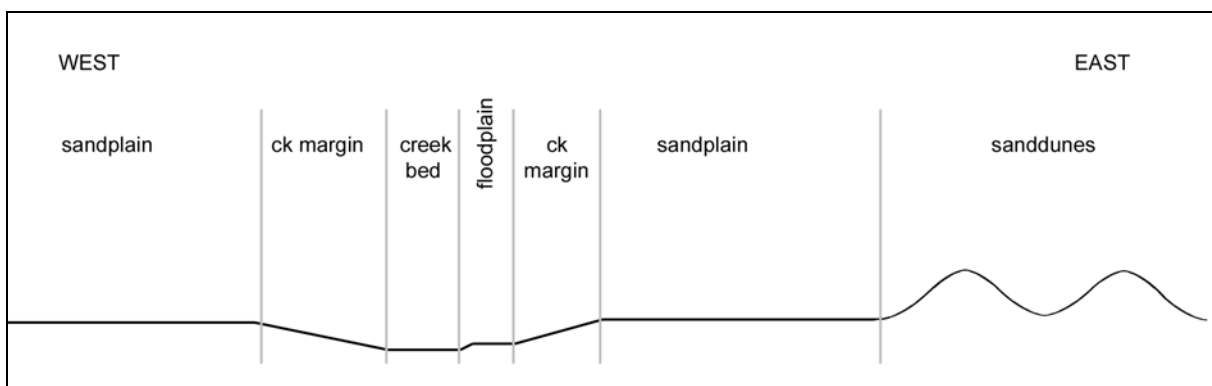


FIGURE 2: Generalised profile of the survey area

3.3 Aboriginal affiliations

3.3.1 Archaeology

The Central Australian ranges appear to have been first occupied around 30,000 years ago (Smith 1996; Smith *et al.* 1997; Thorley 1998a & b). It is most likely that they were occupied continuously through the late Pleistocene and Holocene period to the present, however occupation during the glacial maximum (18,000 – 12,000 BP) is still being assessed (Smith 1996; Veth 1989).

These studies also reveal an increase in site usage around 1000 BP that continued up until the contact period (Smith 1988; Smith & Clarke 1993; Thorley 1998a & b; Veth *et al.* 2001). This is characterised by a greatly increased density of “chipped stone artefacts, grindstones, charcoal, bone and other types of occupational debris” (Smith 1996: 68). On this basis and as a result of geomorphic factors, it is expected that any surface artefacts located within the project area will be from this later period.

Grindstones were introduced into the region around 3,500 years ago but, as mentioned, they become far more numerous after c. 1000 BP (Smith 1986, 1996).

3.3.2 Ethnography

Strehlow’s map of “Aboriginal Central Australia” (1971), has no Aboriginal sites within the project area. He does however locate two sites just outside the area: the place name of *Areja* (sic) to the north-west, and the totemic site of *Erala Banberaka* (sic) to the south-east. Neither of these sites was visited or discussed with present custodians.

3.3.3 Mythology

A Sacred Site Clearance had been previously undertaken for the exploration permit and a single site, *Anthere*, was recorded. Consequently, no further ethnographic work was undertaken.

3.3.4 Contemporary custodianship

Today, the project area is within the traditional estate of either the Bloomfield and/or Jenkins families (Tony Petrick, pers. com.; 2004).

3.4 Historical notes

The history of the area is detailed by Low (1985), and is only préciséd here.

The first non-Aboriginal person to pass through the Mt Riddock area was John Ross in 1870. He was followed by Charles Winnecke (c.1877) who named Mt Riddock for John Riddoch, member for Victoria River. The following year, H. V. Barclay passed through and named the Plenty River due to its plentiful supply of water. Gem stone prospectors converged on the Harts Range with the 1880’s “Ruby Rush”. A mica mine was being worked on Mt Palmer in the late 1880’s and, after 1926, intensive mica mining occurred throughout the ranges.

The initial pastoral lease, which was to become part of Mt Riddock station, was issued in 1910. The land has been continually used and developed for cattle production since that time.

4 PREVIOUS INVESTIGATIONS

4.1 *Aboriginal prehistory*

No previous archaeological studies are known to have been undertaken within the study area.

Site recording projects have been undertaken within the Harts Ranges to the east (Gunn 2001; pers. field notes), the Dulcie Ranges to the north-east (Gunn 1989, 1992, 1993, 1997; Cleary et al. 1994; Thorley 1994) and on the sand plains to the east of Harts Range (Gunn 2002). These have shown that archaeological and other Aboriginal site types tend to concentrate around existing water sources, with a general decrease in frequency with distance from the water reserve (Gunn 1997). It is also likely that bedrock outcrops near water reserves will contain rock art.

Barton (2003) has argued that open surface scatters (lithic assemblages) in the Simpson Desert “are the result of long-term processes of accumulation, occurring at the scale of human generations and millennia...(and that these result) from ecological-scale processes” (p.32). Consequently, different types of assemblages will occur in different environments. For example, on sandplains, which carry a wide range of plant and animal foods, full waterholes would have been a central location for foraging. Such locations are expected to show a wide range of stone-tool use, such as extended core reduction, high rate of tool discard and little evidence of tool production and repair, and extensive use of grindstones. This thesis should provide an interpretative framework for any stone scatter sites recorded within the present study area.

Thorley (199b & 2001) found that major campsites during the Holocene period would not occur at the most permanent water reserves (such as permanent waterholes along major rivers), but rather at the larger semi-permanent supplies (such as large rockholes along escarpments). He proposed that this was in response not only to a risk-minimising strategy (Gould 1977) whereby the permanent waters were preserved for use only in times of stress, but also to optimising the exploitation of ephemeral events. This appears to be a change from the Pleistocene pattern but the timing of the change has yet to be clarified.

4.3 *Predictive model*

From the regional profile, it is expected that Aboriginal exploitation of the project area would have been in the vicinity of any water reserve (waterhole, creekline, soak or swamp) and that this will be primarily reflected by the presence of one or more radially distributed scatters of stone artefacts. Away from such reserves and wherever visibility permits, a very sparse (background) scatter of stone artefacts could be expected throughout the landscape.

Within the project area then, archaeological material could be expected throughout but with particular concentrations along Aturga Creek. Another, possibly denser, scatter is likely to exist around Anthere swamp.

5 METHODS

5.1 *Methodology*

5.1.1 *Cultural property and Custodians rights*

Aboriginal archaeological sites are acknowledged to be the cultural property of the respective Aboriginal Custodians or Communities in whose lands they occur. It is therefore essential to

obtain their permission to survey for such sites. Also, many areas of Crown Land are currently subject to native title claim and hence it may also be necessary to consult with the representative applicant group or groups.

5.1.2 Archaeological sites

Aboriginal archaeological sites reflect Aboriginal use of the landscape. Through the analysis of the location and content of these sites and comparison with other known sites within the region, a partial picture of the lifestyle of the people who left these surviving objects or features can be developed (c/f Thomas 1975, Dunnell & Dancey 1983). This picture however, will always be a small glimpse of the total picture and, while additional studies may further elaborate the picture, it will never be totally understood as fact. Our comprehension can only benefit by an increase in such studies.

The definition of what constitutes a surface artefact scatter site is problematic, for little work has been done on small scale sites in Central Australia. On the basis of his own fieldwork, Thorley (1998: 135) selected two criteria as being required for a scatter to constitute a site:

- A density of (at least) 1/20m² (or 0.05 artefacts/m²), and
- A total of more than 5 artefacts.

This is similar to the definition used in Victoria where a site requires 5 per 100m² (Witter 1977). Other numerical definitions varied from 2 a/100 m² to two artefacts less than 50 m apart (Witter 1996). Subsequently, when defining a site for the NSW NPWS, Witter (1996) abandoned the concept of a numerical definition as he considered an archaeological site an arbitrary unit of observation where cultural material exists. He stressed however that a site was also a unit of management. The arbitrariness of a site “depends upon its analytical potential or other context” (Witter 1996: 12). It is this approach that is utilised for this report.

5.2 Consultation

The consultant was engaged by Dr Wolf Martinick (MBS Environmental) on the 31 July 2004. The project was discussed briefly with him and also John Baxter (Technical Director, Olympia Resources Ltd) and Kristy Sell (MBSE) by email prior to arriving in Alice Springs.

On the 11th August, John Baxter took the consultant and Bill Low, an environmental consultant, on a vehicle tour of the project area, defining the survey boundaries, describing the proposed mining methods, and discussing the site avoidance strategies. He also introduced us to Donna Cole, administrator at Harts Range, who was to organize the field assistants from the Community.

5.3 Survey Methods

5.3.1 Survey strategy

The survey undertook a grid pattern survey of all landforms within the project area. From these results prospective landforms were targeted for further survey and then any areas of artefacts were studied in greater depth.

5.3.2 Survey methods and fieldwork

The cleared survey lines within the project area were walked, with two people examining the ground and a third following in the vehicle. Visibility was generally good (>70%) and a strip eight metres wide was covered.

The fieldwork was undertaken on the 12-15 August 2004. The weather was fine and no problems were encountered. The work was undertaken with the assistance of Lindsay Cavanaugh and Riley Williams from the Atitjere Community.

5.3.3 Site Recording

The Department of Environment and Heritage do not require site cards as they remove site data from the submitted survey reports. In this instance all artefacts located were recorded with GPS and their measurements and characteristics noted. Site boundaries and site buffer areas for mining purposes were then developed from the distribution of artefacts.

5.3.4 Effective Coverage

The location of surface scatters, the most common type of site in Western Victoria, is dependent on surface visibility. This is in turn affected by erosional processes and vegetation cover. "Effective coverage" is therefore one method whereby the efficiency of the survey can be quantified. Following Witter (1990) the following formula was used:

$$EC = (a) \times (e) \times (v) \times (b)$$

where EC = effective coverage
a = area surveyed in sq meters
e = erosion rating
v = visibility
b = background effect

Erosion rating (e) is the index of sedimentation with

- 0.1 = aggrading surface
- 0.5 = stable surface
- 1.0 = degrading surface

Visibility rating (v) is an estimation of the proportion of bare ground within the survey unit.

- 0.1 = negligible visibility
- 0.2 = 1 - 25% (< quarter)
- 0.3 = 26 - 50% (quarter to half)
- 0.5 = 51 - 75% (half to 3/4)
- 0.7 = 76 - 99% (> 3/4)
- 1.0 = 100%

Background Effect rating (b) is a measure of the occurrence of naturally occurring material (such as stone or shell) that impedes the detection of archaeological material.

- 0.1 = high
- 0.5 = medium
- 1.0 = low

5.3.3 Significance Assessment

Significance is an academic construct that reflects the values and ideologies of the archaeological and Aboriginal Communities that can and will change over time (see Smith 1996). Significance assessment is however, essential in justifying the implementation of practices in management, conservation and interpretation.

Three aspects have been recognised which must be considered in the assessment of the significance of archaeological artefacts, sites or site complexes:

- Aboriginal significance
- Academic (Archaeological) significance
- Heritage significance

These need not be mutually exclusive nor need they agree in their statements. [see Bowdler 1983:39-40; Sullivan & Bowdler (eds) 1984; Smith, Lj.1996].

Aboriginal significance reflects the importance of the site or area to the traditional owners, other local Aboriginal people and/or the relevant Community representatives. The statement should incorporate its relevance to both traditional and/or contemporary culture.

Academic (principally Archaeological) significance assess the site's research potential and representativeness (Bowdler 1983: 39-40, Craib 1999: 50-51). The first describes its probable capacity to answer present or future research questions. As, obviously, the questions of the future are unknown today, there is a strong case for the allocation of equally high significance to all sites. In practice however, this is usually taken to mean the foreseeable, or at least imaginable, future. The second criterion, representativeness, requires that a "representative" sample of all archaeological site types be preserved in perpetuity. As a corollary, the more unique a site is the higher its significance (ibid.). The basis for recognising uniqueness lies in comparing each site with others within an archaeologically (or culturally) meaningful region (Witter 1984). Hence, before the representativeness of any one site can be established, a representative sample of the sites and site types from the region needs to have been recorded and an overview produced. The previous surveys in the region provide such an overview (see 4.1 & 4.2 above). Bowdler (1983:40) notes that in some areas, especially with short-term consultancies such as this one, it may not be possible "to quickly and decisively establish the significance of a given site" (ibid.). She therefore concluded that it was unrealistic for management bodies to ask for a definitive assessment of archaeological significance in those areas where no such regional framework exists.

Craib (1999) questions the usefulness of representativeness as a significance criterion, as true probabilistic sampling methodologies are rarely used in contract surveys due to the problems of definition and sampling in such a restricted sampling universe. He therefore argues that scientific significance should be discussed in terms of landscape rather than individual sites. Throughout Australia, archaeological sites tend to occur in geographic clusters that are often composed of a range of different site types. As a consequence, several authors (Vinnicombe 1984, Ross 1996, Gunn 1997) have also argued for the use of site clusters as the basic unit for assessment, rather than the individual site. This aspect will also be addressed in this report.

Heritage Significance takes into account its present use and appreciation by the general public (recreational, aesthetic, economic, etc), its potential for public education and or appreciation, any historical associations and its capacity for management to achieve these potentials (development, conservation, preservation, presentation and interpretation). As with Academic Significance, the concept of representativeness is also important, especially if sites are to be nominated for registration to the National Estate.

6 RESULTS

6.1 *The survey area*

6.1 *Survey coverage*

The survey covered a total of 41,460 m over five days (Table 1; Figure 3). Visibility ranged from good to excellent (70-100%; most 85%) except within the buffel grass areas of the floodplain where it was reduced to around 40-50% (most 50%). The Effective Coverage of the unit was therefore around 33,910 m² or 82%. With transect widths being around 8 m, the effective coverage for the survey was therefore around 271,280 m² (or c.0.3 sq. km, or 2.7% of the project area). In addition, many parts of the project area were traversed by vehicle on numerous occasions, allowing for further but unquantified coverage.

Most of the survey was undertaken within the sand dune landform (53%), which comprised the greater part of the project area. The other landform areas were smaller and were reflected in the lengths of their respective transect lengths: the Sandplain (26%), creek margin (12%) and floodplain (9%). While the survey effective coverage was less than the recommended 5%, as the project area is mostly sand dunes, it is seen as adequate as all areas with high potential were covered and it is highly unlikely that any sites will have been overlooked by the survey.

6.2 *Artefacts recorded*

One hundred and eleven stone artefacts were located within the project area. All but two artefact concentrations occur along the margins of Aturga Creek and on the sandplains immediately adjacent to the creek (Figure 3).

The exceptions were a single artefact on the crest of the highest sand dune, two kilometres east of the creek, and a light but concentrated scatter in and around a stand of Gidgee trees within the sand dunes, 200 m east of the creek. The former was an unusual little-used core (or unifacial chopper) in quartz. It was located on the crest of the highest sand dune in the project area. The scatter represents a potential habitation site and is discussed further below.

Chalcedony is the dominant stone type (70%) and debitage (flakes, chips and pieces) are the most common artefact type (79%; Table 2). Most debitage and retouched flakes (here represented mostly by scrapers) are made from chalcedony. However, while only 18% of flakes are made from quartz, quartz accounted for over half of the cores recorded.

The formal tools were primarily scrapers, including an adze and an adze slug, and a small number of grinding implements (Table 3). The grinding tools consisted of two upper grinders and a broken grindstone. The scrapers were dominated by steep-edged, convex unifaces, with a small number of less abruptly retouched flakes. The repertoire is consistent with maintenance stone working and woodworking, with a limited amount of seed grinding. These are elements consistent with light and transitory occupation.

A light scatter of stone artefacts occurred along the creek margins south of the highway and particularly in areas of sheet erosion. They were however, more densely concentrated at one location that was consequently designated site AC-1. Another smaller concentration at the northern end of the project area was designated site AC-2. Nine stone artefacts were outside the site boundaries and are seen as reflecting a general background scatter that probably extends along most of the creek line. A scarred tree was also recorded in this area (site AC-3). A brief description of the sites now follows.

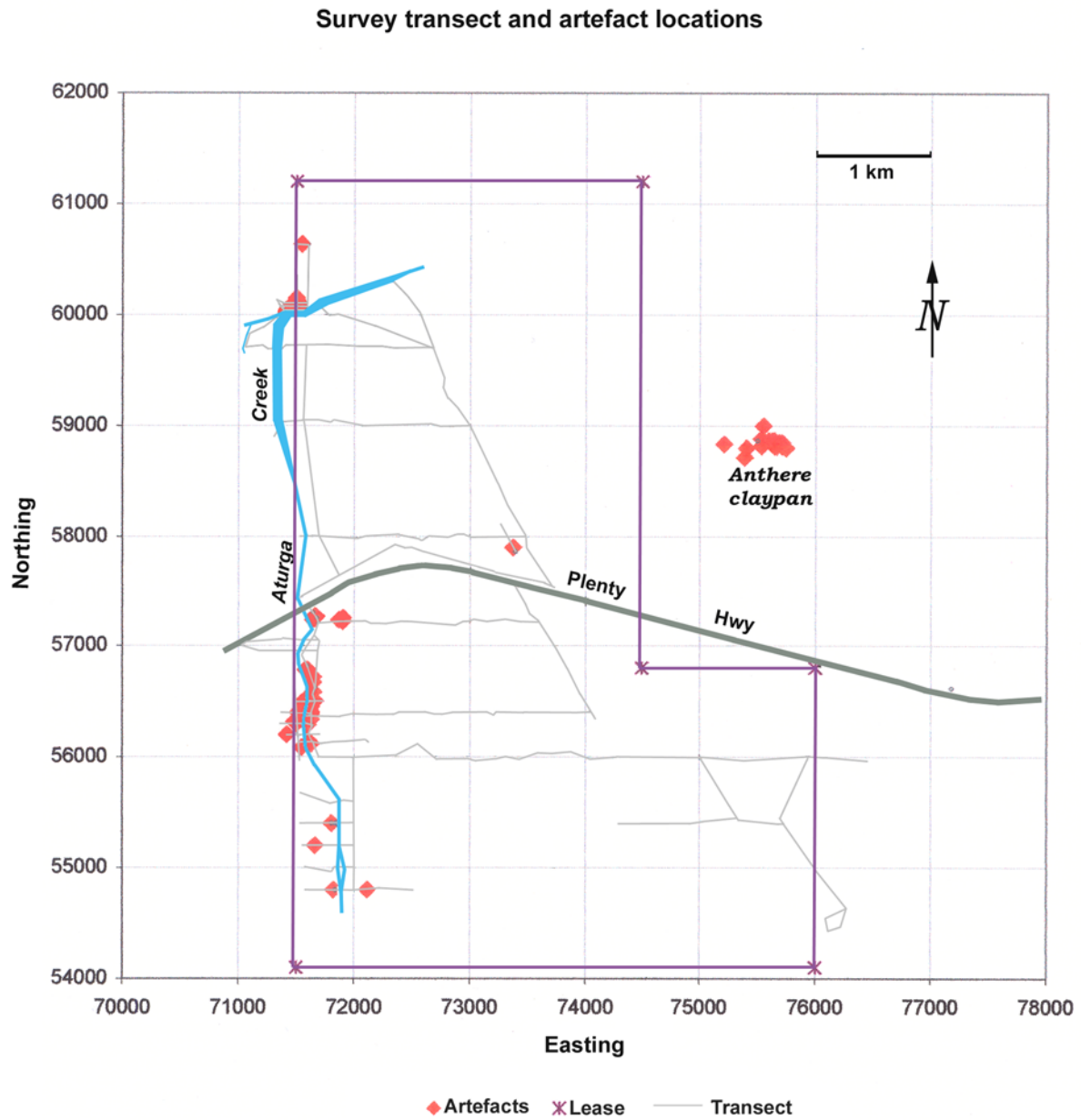


FIGURE 3: Transect and artefact locations

TABLE 1: Transect lengths by landform (m).

	Transect	Landform				TOTAL
		sand dune	sandplain	ck margin	floodplain	
Thursday	1	2600			200	2800
	2	1270			730	2000
	3	1100			800	1900
	4	300				300
	5	1370			1000	2370
						9370
Friday	1	1450				1450
	2	1910	570			2480
	3			280		280
	4	540	500			1040
	5			340		340
	6			1070		1070
	7	1780	150			1930
						8590
Saturday	1			140		140
	2	3980	520	140		4640
	3	1820				1820
	4	1500				1500
	5	680				680
	6		1230			1230
	7		920	100		1020
	8		350	100		450
	9		350	100		450
	10		350	100		450
	11		350	100		450
	12		500			500
						13330
Tuesday	1	880		50	720	1650
	2		510	380		890
	3			1100		1100
	4		770			770
	5		1230			1230
	6	710			350	1060
						6700
2 nd Wednesday	1		675	50		725
	2		575	50		625
	3			500		500
	4		170	50		220
	5		160	50		210
	6		150	50		200
	7		290	50		340
	8		650			650
						3470
Total length		21890	10970	4800	3800	41460
<i>Effective coverage</i>		<i>18605</i>	<i>9325</i>	<i>4080</i>	<i>1900</i>	<i>33910</i>

TABLE 2: Artefacts by stone type

ARTEFACT TYPE	STONE TYPE				Total
	Chalcedony	Quartz	Silcrete	Other	
Debitage	86	26	2		114
Core	9	11			20
Scraper	13	4			17
Grinding				12	12
TOTAL	108	41	2	12	163

TABLE 3: Artefact types by site

SITE	AC-1	AC-2	PHS	Isolated artefacts	Anthere	TOTAL
Flakes	43	15	5	4	21	88
Chips	6	3			5	14
Pieces	5	1			5	11
Cores	9	2	1	2	5	19
Scrapers	8			1	4	13
Adzes	2					2
Points					1	1
Geometrics					1	1
Other flaked				1	1	2
Grinders	2	1			4	7
Grindstones					5	5
TOTAL	75	22	6	8	52	163
Mean density (a/100m ²)	0.4	0.2	0.5		0.6	

TABLE 4: Stone types by site

SITE	Chalcedony	Quartz	Quartz crystal	Silcrete	Other	TOTAL
Nos						
AC-1	54	12	5	2	2	75
AC-2	18	3			1	22
AC-PHS	3	2				5
Isolates	5	4				9
Anthere	28	11	4		9	52
%						
AC-1	72	16	7	3	3	101
AC-2	82	14			5	101
AC-PHS	na					na
Isolates	na					na
Anthere	54	21	8		17	100

6.3 Sites recorded

Three archaeological sites and a potential habitation site were located within the project area (Figure 4). Two were distinguished on the basis of artefact concentrations, Aturga Creek 1 and 2 (AC-1 & 2 respectively) (Figures 5 & 6). The third was a scarred tree (Aturga Creek 3 or AC-3), located just south of the highway and one kilometre downstream (north) from AC-1. A potential habitation site (PHS) was located within a stand of gidgee trees to the east of the scarred tree. A scatter was also located at *Anthere* claypan, to the east of the project area.

6.3.1 Aturga Creek 1 (AC-1)

A concentration of stone artefacts, designated Aturga Creek 1, was focused around a large coolibah tree in the centre of the creek at 471582E / 7456394N. The creek here is around 10 m wide and has a well-defined course without any marginal floodplain. All of the artefacts were located on the eroding creek margin or adjacent flat sandplain (Figures 7 & 8; Appendix 1). The area was traversed in detail and the concentration of artefacts was found to run from 7456000N to 7456800N, with a width of around 100 m each side of the creekbed. Altogether the site has an area of around 160,000 m² (including the creekbed). Although no surface water was apparent, Riley Williams from Harts Range Community suggested that the tree was on the site of an old creekbed soak.

A total of 74 artefacts were located along 2240 m of transect, giving a mean density of 0.4 a/100 m² (74/22.40 x 8 m). A sample area 40 x 20 m located near the centre of the site, found 19 artefacts giving a maximum density of 24 artefacts /100 m². This is a low mean density compared with major occupation sites where 1000 a/100m² are not uncommon. It is expected however, that this figure will be reflective of the general artefact density on such transient campsites.

Three stone types were utilized for stone tool production: chalcedony (72%), quartz (23%) and silcrete (3%) (Table 4).

Of note here is a large chalcedony core and two adjacent large flakes:

Core	1350 x 1300 x 1200 mm
Flake	1104 x 81 x 24 mm
Flake	96 x 78 x 48 mm

The flakes can be co-joined with the core (Plate 13). It appears that they were struck to remove the outer cortex and show the inner quality of the rock. Being very patchy the core and flakes were discarded here and not re-used. The close association of the core and flakes indicates that there has been very little disturbance of the site by cattle or water wash.

Two red silcrete artefacts were also located: a flake and a piece. These were the only examples of flaked stone other than quartz or chalcedony located within the project area.

Two grindstone uppers (grinders) were located here: one in schist was flat and discoidal in shape (commonly called a "nardoo" stone), while the other was in gneiss and had two bevelled facets on the one face. Both are likely to have been used for seed grinding although no grindstone bases, the other essential requirement for seed grinding, were located.

6.3.2 Aturga Creek 2 (AC-2)

At the northern end of the project area, Aturga Creek is met by another creek channel coming from the west. At this point the creek is some 20 m wide and supports River Red Gums. The northern bank is the steeper, due to water cutting. A very light scatter of stone artefacts occurs on the lightly eroded surface of the creek margin (Figures 4 & 9; Appendix 2). All but one of the

22 artefacts recorded occur along the creek margin, in an area 200 x 50 m. These are all flaked stone pieces (cores, flakes, etc). The exceptional artefact is an isolated bifacial, saddle-grindstone fragment, which lies at the northern end of a stand of mulga, 500 m north of the creek. The lack of any other artefacts in the vicinity suggests that this is no longer at the place where it was used.

While not greater than that of a general background scatter in many areas, two artefacts makes this site noteworthy. The first is the grindstone fragment mentioned above. This is the only piece of grindstone located during the survey, and supports the contention that station workers or mineral prospectors may have previously collected complete grindstones from this site.

The second is a small core surrounded by a suite of flakes and is interpreted as a “workshop” or “knapping area” (Plate 14). This records the activities of a single individual removing flakes from a core. Being still within close proximity to the discarded core, the assemblage indicates that there has been little disturbance to the artefacts by animals or erosion. It is possible that the artefacts were produced a considerable time ago (possible 100 years or more) and that they were gradually covered by sands, but which have subsequently become visible again through gentle erosion due to grazing.

6.3.3 *Aturga Creek 3 (AC-3)*

An old coolibah tree within the creekbed bears a scar consistent with the removal of a bark or wood slab (Plate 16). Such slabs were commonly used for either shield or coolamon production (eg. Mulvaney 1975: 250).

The scar was oval in shape and 550 x140 mm in size, with 100 mm of bark overgrowth. At the site of the scar the tree has a circumference of 1330 mm and the scar is orientated across the creek at 225°. Few scarred trees have been recorded in Central Australia and consequently, this site has a high academic significance.

6.3.4 *Aturga Creek PHS*

Five stone artefacts were located within and around a small stand of mature gidgee trees (Plate 15; Appendix 3). The stand occurs on the crest of a low sand dune, 200 m east of the creek. The stand is wholly within an area 60 x 40 m and centred on 471893E / 7457220N. The artefacts were mostly on the northern side of the trees, however as the trees are still used by cattle for shade, the ground is thickly covered with manure and ground visibility was very much reduced. Although these few artefacts are not themselves significant, they are seen as being indicators of a possible larger scatter. The concentration of artefacts around natural features, such as shady tree stands, water reserves or stone sources, is common throughout Australia. Little more can be said of the site until it is further explored by excavation. It is possible that no further artefacts will be located in which case the scatter would not constitute an archaeological site.

6.3.5 *Isolated artefacts*

Eight isolated artefacts were located along the margins of Aturga Creek (Appendix 3). These consisted of two quartz cores, a chalcedony retouched flake, four chalcedony flakes and a crystal quartz flake. None of these artefacts were dissimilar to types found on the more concentrated sites here.

A further quartz core or chopper was located on the highest point along the crest of the tallest sand dune within the survey area, two kilometres east of the creek. This unique implement is a split pebble that has been flaked back at about 45° from the fractured edge. It is unclear whether this was used as a core or as a handheld “chopper”.

6.3.6 *Anthere claypan*

The name *Anthere* is the local Arrernte name for the locality and it is a registered sacred site. It consists of a low-lying depression with sandy slopes that lies within an otherwise scrubby sandplain (Figure 10; Plates 17 & 18). The depression is about 300 m in diameter. Central to this depression is a large claypan about 150 m diameter. It is fed by five inlet gullies that have eroded to a maximum depth of about one metre. The largest of these, entering from the east, revealed a dense scatter of stone artefacts some 200 m long and beginning about 50 m out from the claypan (Figures 11 & 12, Plates 19 & 20; Appendix 4).

The perimeter of the claypan was first walked around the waterline and then roughly along the crest of the sand rise 100 m out from the pan. Each of the inflowing gullies was also walked. All artefacts located were plotted and described.

Artefact density was calculated from a transect along the major gully line, 200 m long and 30 m wide, which was the most exposed area of the site. Within this strip 38 artefacts were located giving a maximum density of 0.63 artefacts per 100 m². The percentage of quartz here was considerably higher than at AC-1 (28% *cf.* 16%), while the proportion of chalcedony was correspondingly lower (54% - 72%) (Table 4). *Anthere* also had significantly higher numbers of other stone types (9 *cf.* 2), all of which were metamorphic rocks used for grinding.

Artefacts of particular interest were a unifacial point in chalcedony (25 x 14 x 8 mm; Figure 13, Plate 20), and a geometric microlith (backed-flake; 15 x 11 x 4 mm) (Figure 13). A chalcedony tula flake (24 mm) and a burren flake in quartz (30 mm) were also of interest as formal tool types were uncommon in the project area.

The higher number of grindstones fragments (5) and grinders (4) here stood out in contrast to three located along Aturga Creek (Plate 19).

6.4 *The stone assemblages*

6.4.1 *Stone types and sources*

Chalcedony accounts for around three quarters of all the flaked assemblages, with quartz making up most of the remainder (Table 4). Other stone types are rare. A source for the chalcedony is reported to occur near Alcoota Stn, 30 km to the north-west (R. Williams, pers. comm. 2004) but pebbles also occur in the bed of the Plenty River immediately north of the project area (W. Low, pers. comm., 2004). No local source of quartz is known but quartz is common in the Harts Range to the south. No potential source for the silcrete is known. Of the other stone types amongst the grinding implements, schist, gneiss and granite are common in the Harts Range, whereas the quartzose-sandstone most likely comes from the Dulcie Ranges, 100 km to the north-east.

The stone was therefore primarily derived from locally available sources. The lack of exotic stone suggests that none of these sites were aggregation sites (Conkey 1980), such as for large-scale, intertribal gatherings.

6.4.2 *AC-1*

The assemblage at AC-1 consisted primarily of chalcedony (72%) and quartz (23%), with two flaked silcrete artefacts and a gneiss grinder. The flaked artefacts were primarily represented by unmodified flakes (57%; Table 3). These ranged up to 45 mm in length (along the striking axis), with quartz flakes tending to be longer and thinner than chalcedony flakes, that tend to be wider than long (Figure 14). When thickness is included in the analysis, the resultant reduction chart (Figure 15) is well clustered, with thickness increasing with surface area, and no differentiation between the quartz and chalcedony. This suggests that the stone working

was not the same for both material types. Chalcedony was primarily used for broad lamellar flakes, while quartz was used for more elongated flakes. In general, lamellar flakes tend to be produced to provide scraping or cutting implements, while elongated flakes tend to be used for piercing implements.

Nine cores were located on the site. The largest of these was very exceptional in that it was extremely large (1350 x 1300 x 1200 mm) when compared to the others (all less than 55 x 45 x 40 mm). This large core had only two flakes removed (Plate 13). It appears that when the surface cortex of the nodule was removed the quality of interior rock was found to be unsuitable and the rock was then discarded. Consequently, this core is not included in the analysis. The remaining cores ranged in maximum dimension from 20 mm to 54 mm (Figure 16). The quartz cores tend to be smaller than the chalcedony cores and the crystal quartz cores the smallest of all. A reduction chart of these cores shows two size groups, but of these it is the small crystal quartz cores that again stand out as being the most heavily reduced (Figure 17). This doubtless relates to the finer working quality of the material and the fact that smaller flakes could be removed from these more predictable cores.

The nine scrapers located were all unifacially worked and, all but one, were steep-edged. Steep-edged scrapers are generally thought to be the product of heavy woodworking. Six of the eight unifacial “scrapers” measured, form a tight cluster on a reduction chart (Figure 18). Despite differences in type (notched, nosed, convex and straight edged) then, these were all produced from flakes of similar size, and consequently using the same technology. The two exceptions were both considerably larger. These two consisted of a tula adze flake and a tula slug. The difference shown on the reduction chart can then be directly related to production technology, as the making of tula flakes is a very specialised task

Eleven of the 43 chalcedony flakes had substantial areas of cortex. Five were clearly decortification flakes (primary flakes struck to remove the cortex and provide a better striking platform). This number represents an unusually high proportion and suggests that this site was not too far distant from the stone source. Two chalcedony flakes had pebble cortex, as did one of the two silcrete artefacts, suggesting that these, and probably all the chalcedony, may have derived from pebbles carried up from the Plenty River. Similarly, the size of the largest core (which was abandoned after testing) was around two kilograms in weight (guestimate) and is unlikely to have been carried for any long distance before being tested and discarded.

6.4.2 *Anthere*

As at AC-1, the assemblage at *Anthere* consisted primarily of chalcedony (66%) and quartz (33%), although the proportion of quartz is notably higher and no other flaked stone was present. Other stone types, restricted to grinders and grindstones, consisted of quartzose-sandstone (4); an unknown, black and brown banded, metamorphic stone (2); and one each of gneiss, schist, granite.

The flaked artefacts were again primarily represented by unmodified flakes (40%; Table 3), however the proportion was considerably less than at AC-1. These were similar in size to those from AC-1 but here there was no size differentiation between the chalcedony and quartz (Figures 19 & 20). Unlike AC-1 therefore, the stone working here consisted of a single technology that was applied regardless of material. (A singular exception may be the large quartz flake 47 x 43 x 12 mm). The majority of the flakes were again broad lamellates, and no elongated flakes were located. This suggests that scraping implements were again the major end product.

The five cores located on the site accounted for 10% of the assemblage, a figure similar to the 12% at AC-1. These ranged in maximum dimension from 19 mm to 60 mm; a similar range to that at AC-1. As with the flakes however, there was no real difference between size of the chalcedony and quartz cores. All bar one were unidirectional, and the three chalcedony cores

all bore traces of cortex. These, and other cores recorded as isolated finds across the project area (Figure 21), reinforce the bipartisan grouping found at AC-1, and particularly the separation of small crystal quartz cores and larger chalcedony cores.

Other flaked artefact types included four scrapers, a bi-marginal point, a geometric microlith, and a pebble “chopper” or core tool (Table 3). The scrapers included a tula adze flake, a quartz burren slug, one acutely retouched flake and a steeply retouched flake. Unlike AC-1, only two of the chalcedony flakes here bore traces of cortex. This suggests that these were not primary flakes but rather more specialised products. If the Plenty River were the source of the chalcedony nodules, as *Anthere* is closer than AC-1, it would be expected that a similar number of cortex bearing flakes would be found. The lack of flakes from the initial stages of production suggests that perhaps this was site of secondary working.

7 DISCUSSION

7.1 *The survey findings*

The sites recorded and their contents are consistent with models of archaeological site location for Central Australia (Smith 1988; a & b 1998; Barton 2003). The preference for chalcedony as a stone working material suggests a local source for this rock type. The presence of grinding implements, geometric microliths, bi-marginal points and small cores, indicates as expected, that the sites are all from the late Holocene period (<3000 years old).

At the finer level, the differences between the creek scatter (AC-1; with a high proportion of chalcedony scrapers and broad lamellar flakes) and the claypan scatter (Anthere; with few broad flakes and scrapers and a higher proportion of grinding, quartz and microblade implements) is seen as representing the different functions of the two sites. Anthere is interpreted as the more major campsite, and probably a local seasonal base-camp, from which hunting and foraging (including seed harvesting) occurred. The Aturga Creek site is seen as a transient stopover camp at which basic maintenance (woodworking and preliminary core reduction) was carried out.

Together these sites present a unique snapshot of the prehistoric use of this area. It is assumed that this pattern is represented throughout the region and, while unique at this level, is unlikely to be outstanding from a regional perspective.

7.2 *Archaeological significance*

While *Anthere* is of primary importance to the local Aboriginal people, they tend to see archaeological sites as being of little significance in themselves. While this contrasts to the attitude of many other groups elsewhere in Australia, this largely reflects the lack of importance given to archaeological sites in practice, by Government Agencies, private companies, and individuals throughout the Territory. It is likely that, with further education of all parties in the value of archaeological sites, that the true value of these sites will be developed.

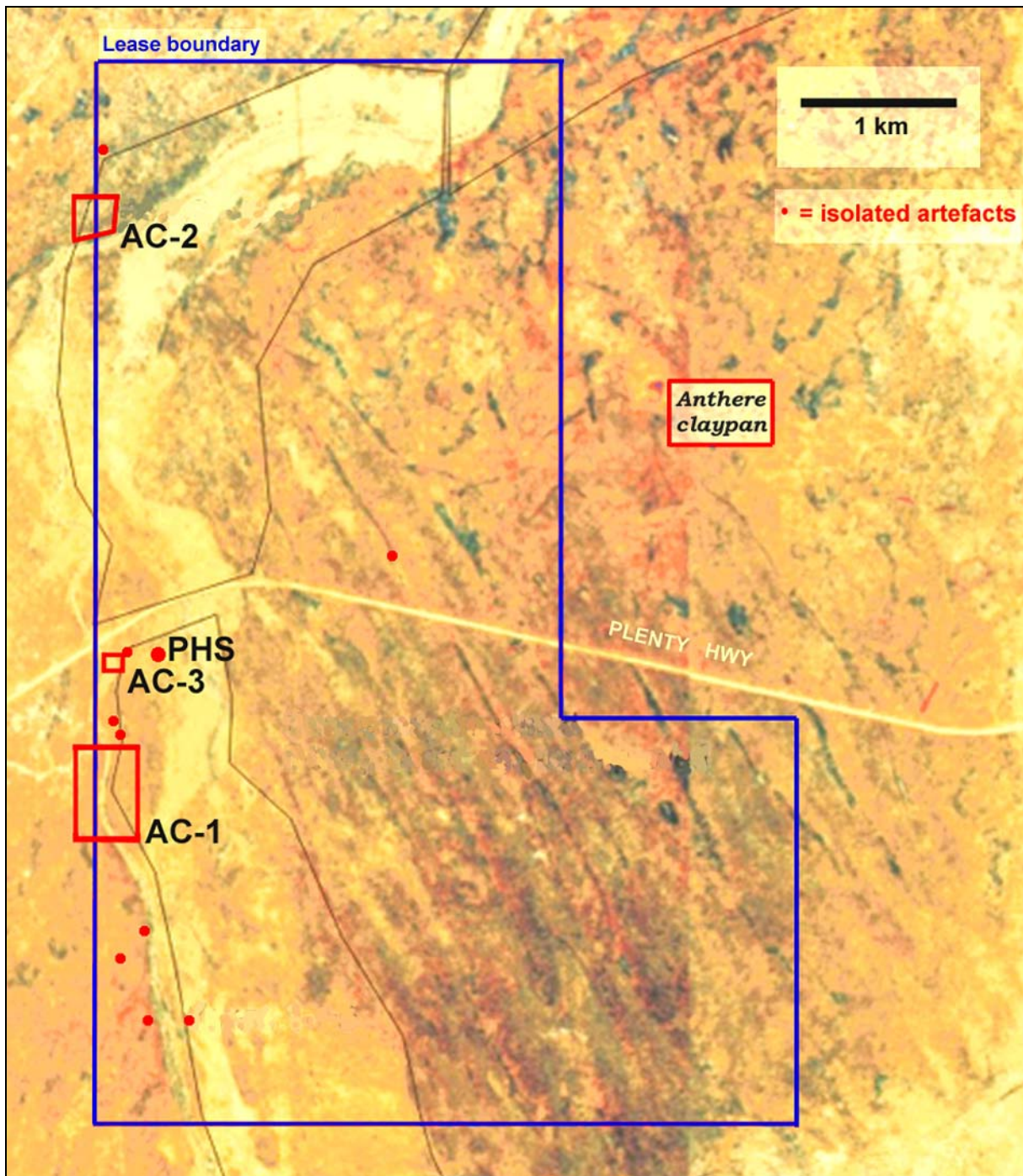


FIGURE 4: Archaeological site locations

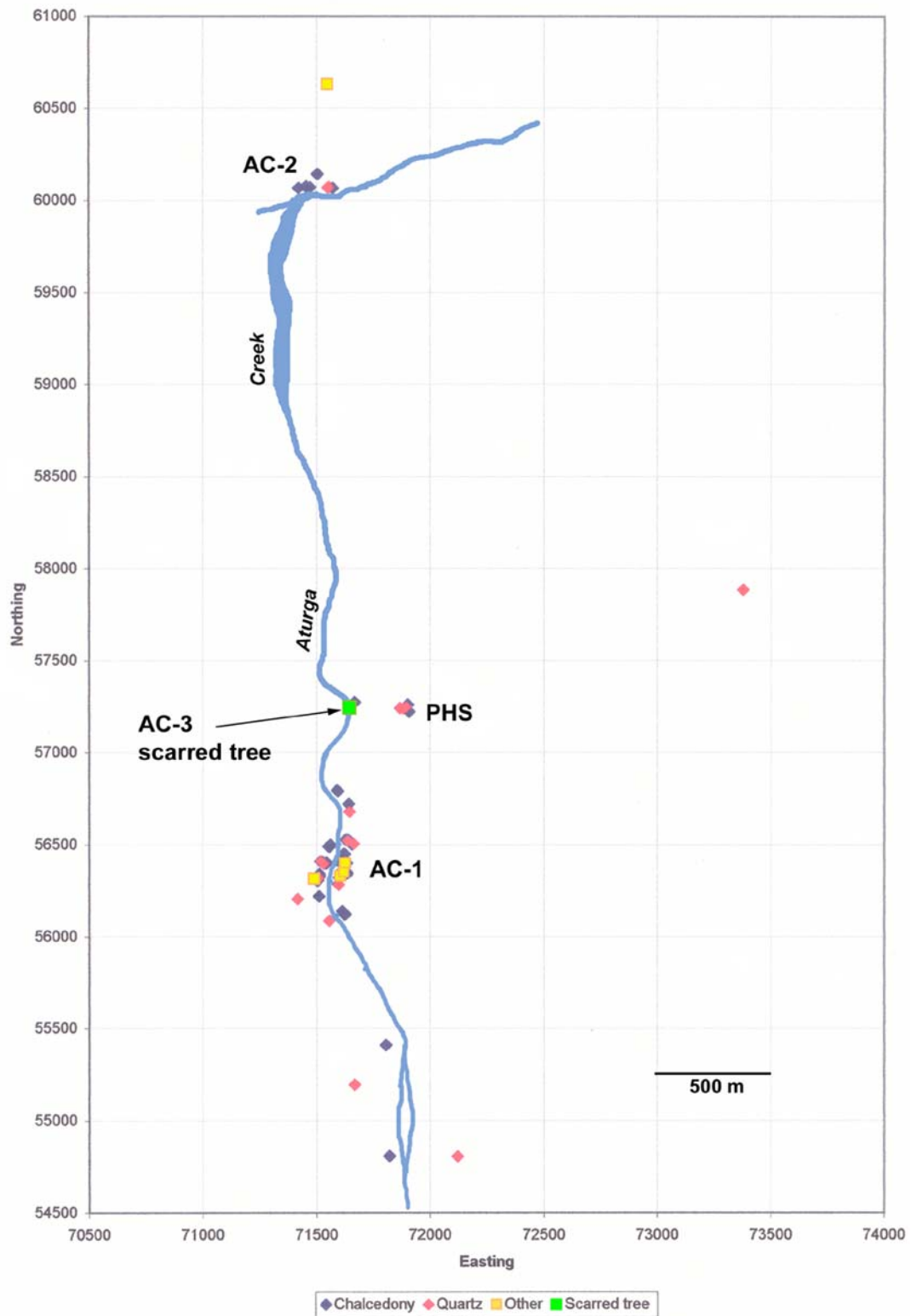


FIGURE 5: Aturga Creek: distribution of artefacts by material

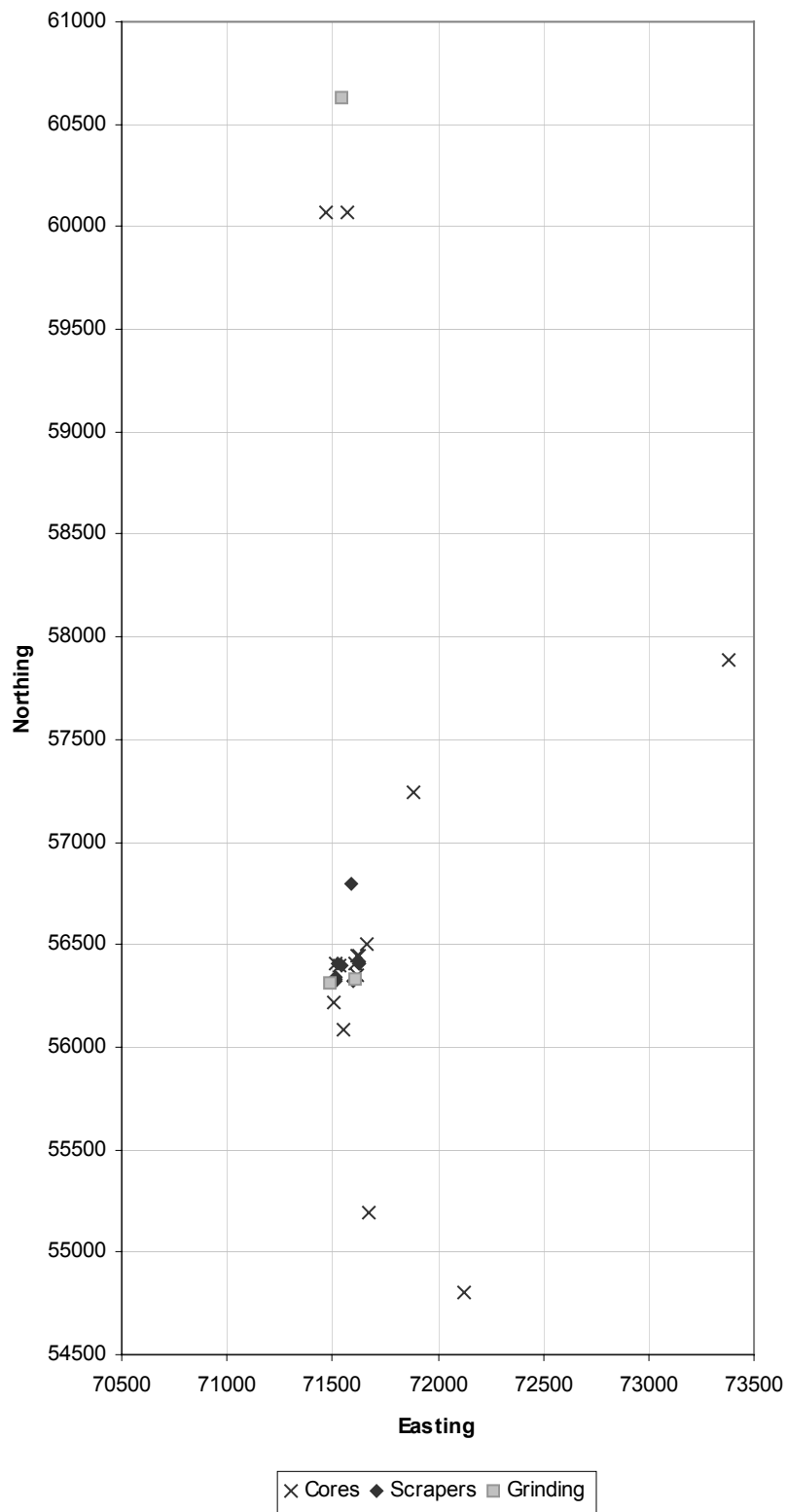


FIGURE 6: Aturga Creek: distribution of stone tool types

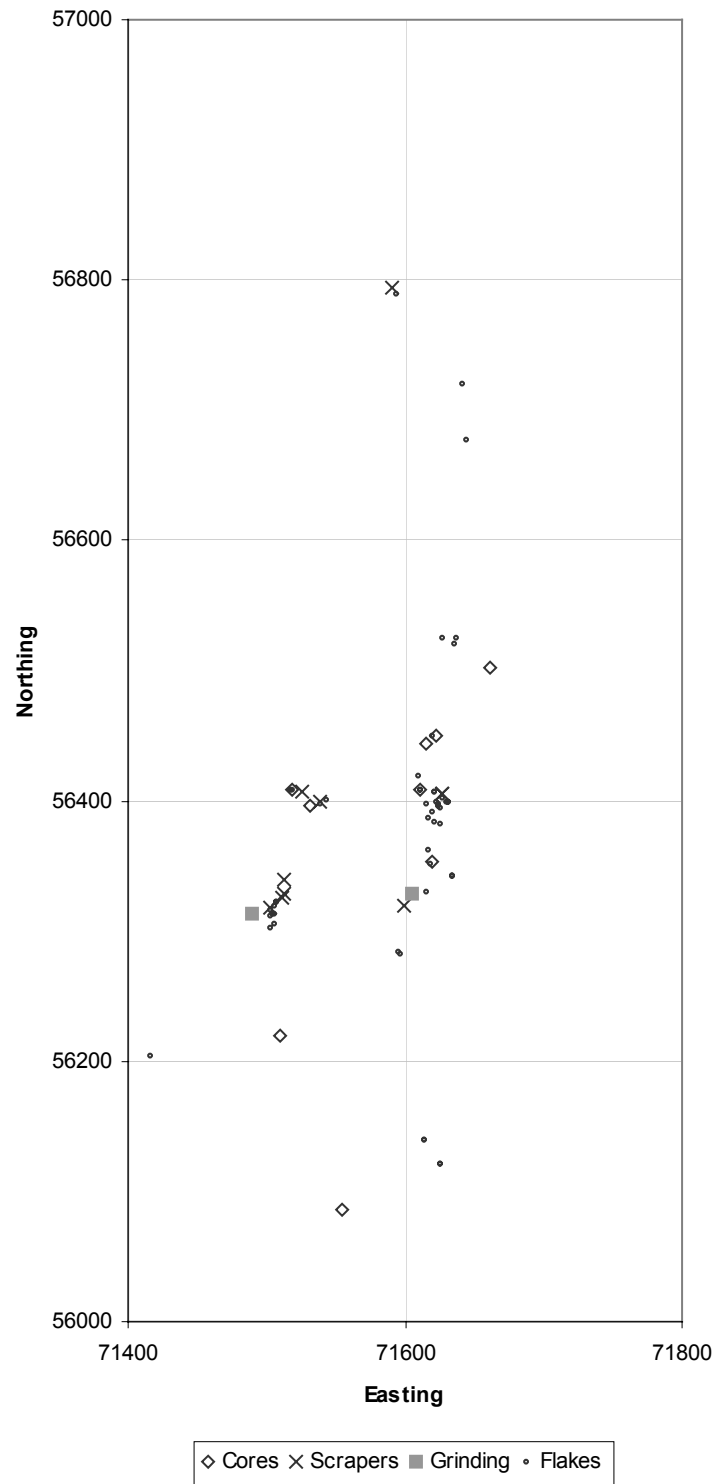


FIGURE 7: AC-1: distribution of artefacts by type

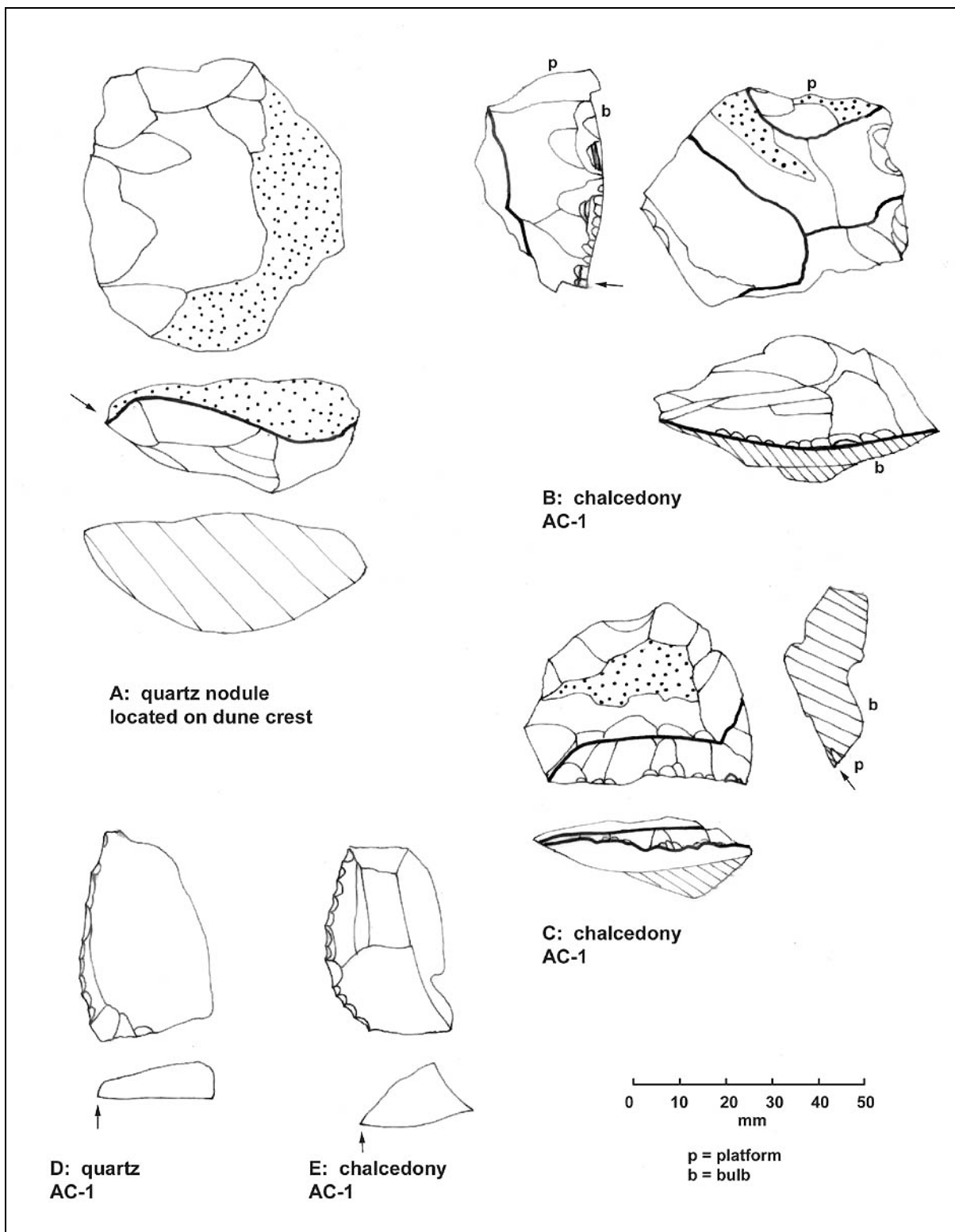


FIGURE 8: AC-1: select stone artefacts

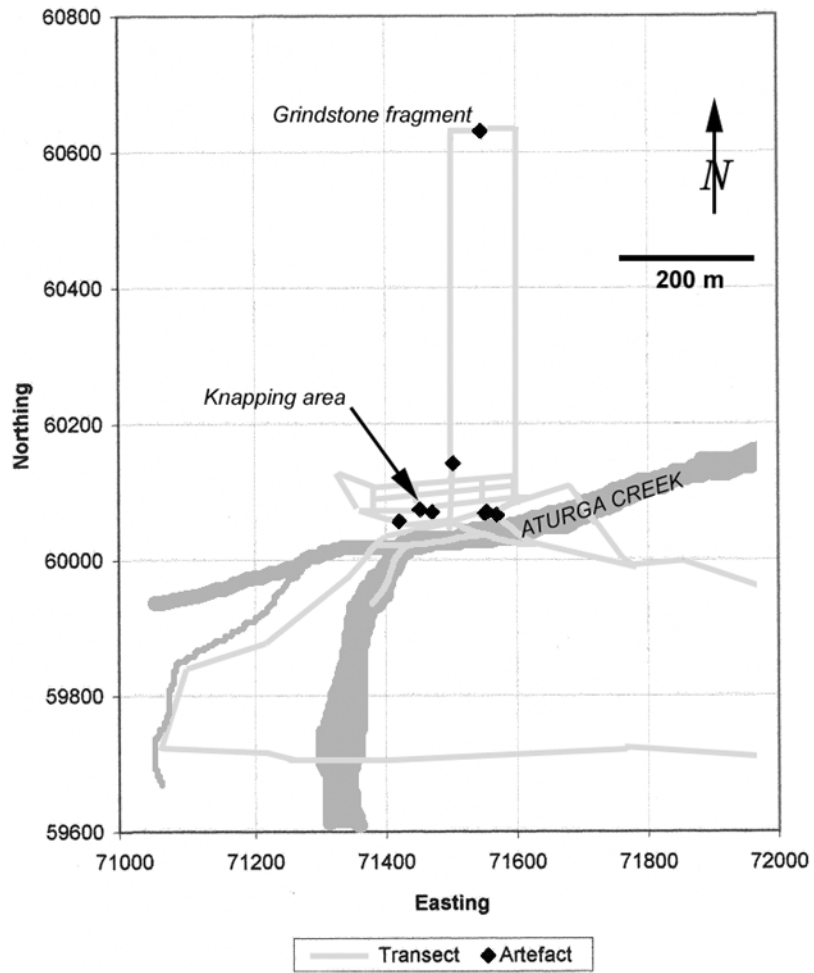


FIGURE 9: AC-2 artefact distribution

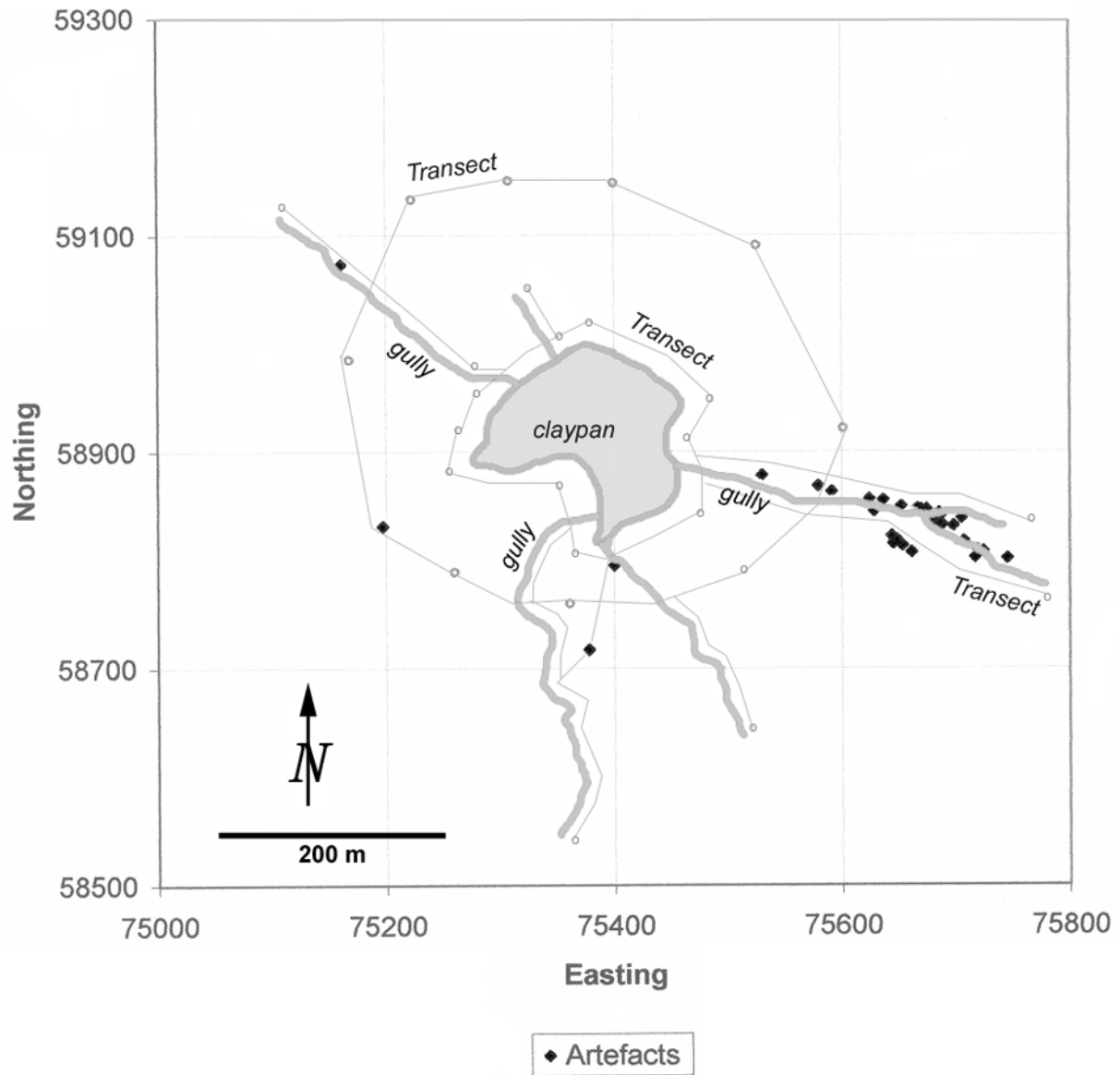


FIGURE 10: Anthere transects and located artefacts

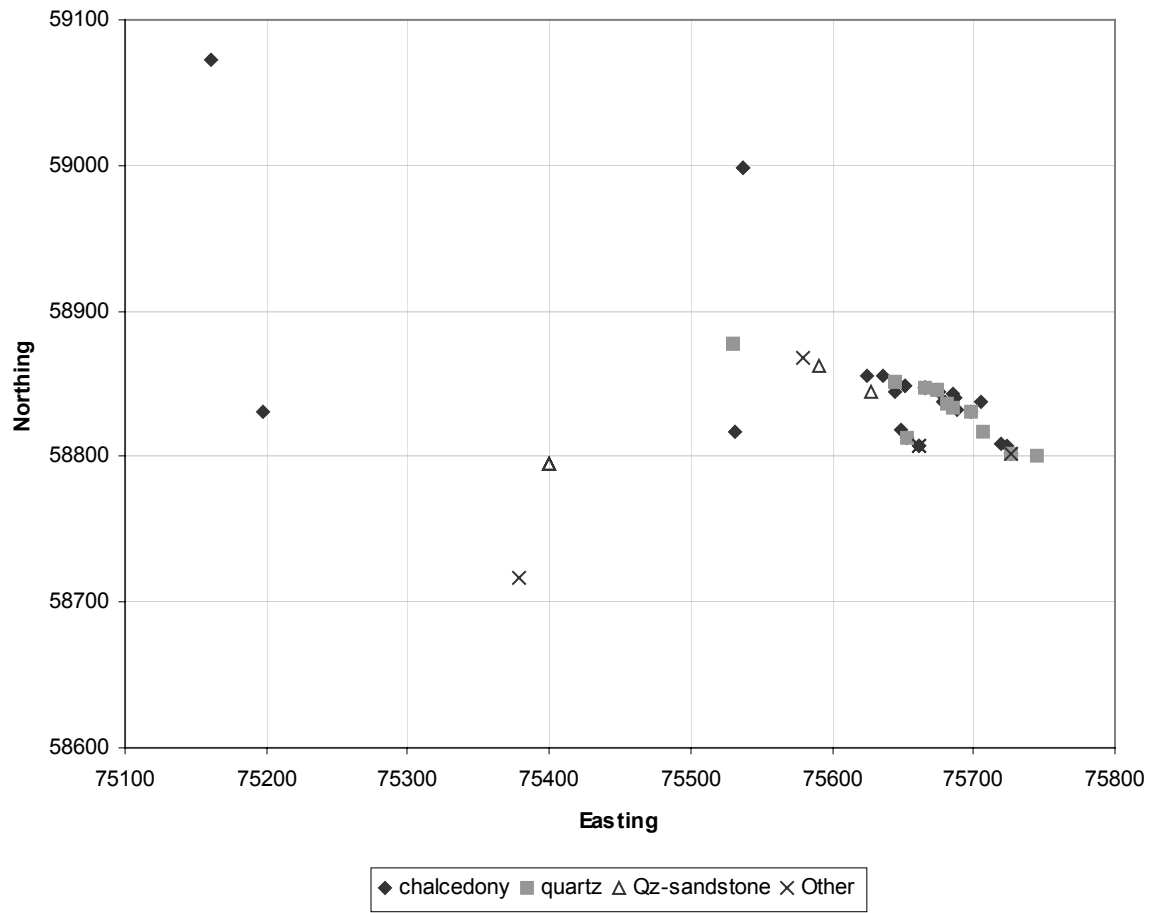


FIGURE 11: *Anthere* distribution of artefacts by stone type

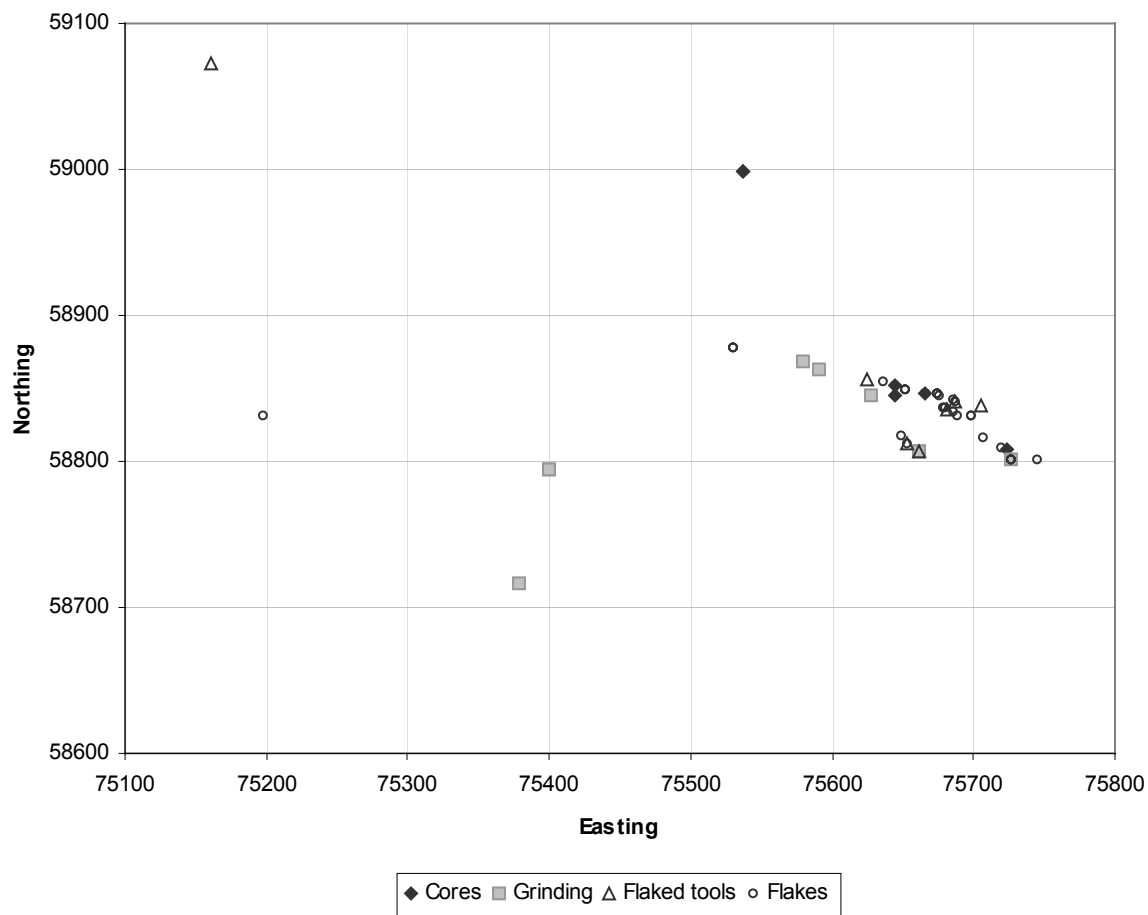


FIGURE 12: *Anthere* distribution of artefact by type