Toolkits and Utility in Australian Lithics

A comparison of a comprehensive woodworking kit and discard assemblages

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Abstract

The concept of a toolkit has been used to describe functional aspects of lithic assemblages since the 1960s, but has proved difficult to define. The history of the concept, which emerged from the analysis of European Mousterian assemblages by the Binford and Bordes, is traced from its roots to the present day. In Australia it has become a generalised term which has been used to explain the complete range of technologies available to a culture, as well as defining strategies for risk management and mobility. This research investigates the concept and its applicability to Australian lithic assemblages.

In 1970 a cache of 105 stone artefacts was discovered at the top of a sand dune in the arid landscape around Lake Hanson on South Australia’s Arcoona Plateau. Its finder interpreted the cache as ‘a comprehensive woodworking kit’. This ‘tool-kit’ is compare with assemblages from four sites collected from nearby Mungappie Creek by the same person. The analysis compared the number of artefact types, their sizes, and the materials used at each of the Mungappie sites, including the Lake Hanson cache. Using the notion that a functional toolkit would need to have more potential utility than a discarded one, an assessment of the potential use life of an artefact in the form of ‘utility units’ was employed to indicate the possible presence of toolkits at each of the Mungappie sites. The results indicated that the toolkit cache was a unique collection of artefact and material types that were scarce at any of the four Mungappie assemblages. The conclusion being that there are profound differences between discard assemblages and discrete entities such as caches and toolkits, suggesting the need for a revision of the toolkit concept from a generalised to a specific terminology.
‘I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by any other person except where due reference is made in the text.’

John Hayward
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1. Introduction

1.1 Introduction

This thesis is a critical analysis of the concept of the ‘toolkit’ as used in contemporary archaeology to describe stone artefacts. The aim of the thesis is to investigate if ‘toolkit’ is an appropriate term to apply to Australian Indigenous lithics, and if so, how toolkits can be identified in lithic assemblages. The theoretical analysis traces the inception of the concept from European archaeology in the mid 1960s to its current usage. To investigate the applicability of the concept, a lithic assemblage from the Arcoona Plateau region of South Australia, collected in the late 1960s and early 1970s by amateur archaeologist Ron Hewitt, has been analysed. A subsection of Hewitt’s private collection was a cache of stone artefacts, described by him as a “comprehensive woodworking kit” (Hewitt 1977:29).

Whilst there are numerous ethnographic accounts of stone implements being used for woodworking in Australia, the notion of these tools forming a discrete toolkit entity is not explicit, and has not been described ethnographically. This raises the question of whether a stone toolkit actually existed as a physical entity, and if so, why was it unnoticed by ethnographers? Either way, the existence of such a grouping could have significant implications for the study of the adaptation and resource management of prehistoric cultures (Torrence 1983; Hiscock 1994; Kuhn 1994; Moore 2003), as the changing composition of the woodworking toolkit through time and space could have a direct relationship to the environment and cultural behaviour. In contemporary life toolkits do reflect social behaviour and technological trends, so why should this not be the case with prehistoric toolkits – if they existed?
1.2 Aims and significance

The impetus behind this research is to gain an understanding of the concept of toolkits in lithic archaeology. The aims of this research are to:

- Examine the historical origins of the term ‘toolkit’ in archaeology.
- Interrogate the changing concept of the toolkit in contemporary Australian archaeology.
- Understand how changing notions of the toolkit are related to theories of mobility and flexibility in Australian archaeology.
- Examine the composition of toolkit structure in comparison to the composition of lithic assemblages.

The concept of toolkits has been used in many parts of the world to describe a range of aspects related to lithic assemblages, and in so doing has become quite elastic and flexible. Most researchers (e.g. Binford 1966, 1968, 1977, 1983; Bordes 1977; Cahen et al 1979; Hayden 1977, 1979; Hewitt 1976; Hiscock 1994; Kuhn 1994; McCarthy 1976; Moore 2003; Banks 2009) do not critically analyse their use of the term and its implications. This thesis seeks to redress this by focusing on the concept of the toolkit in global archaeology by tracing its use over the past fifty years, and analysing its contribution to Australian archaeology. This is the first time that lithic toolkit structure has been analysed in the Australian context. In doing so, the research will help to redefine the meaning of the toolkit within Australian archaeology.

1.3 Toolkits and function

The etymology of the term ‘toolkit’ is obscure, and it may not have been common until the early twentieth century. When the term ‘kit’ was used in the mid-nineteenth century it was generally understood as the part of the workshop where cobbler’s worked and kept their tools, and later in 1881 extended to ‘the kit of tools for a nipple maker’ (Oxford English Dictionary (v) viii:465). Both definitions suggest a grouping of tools associated with a trade. Contemporary usage is similar but applied more broadly.
The traditional view in archaeological literature is that toolkits are also function-specific (Binford and Binford 1966; Freeman 1966:232; Binford 1968). The question of what defines a function-specific stone toolkit is critical in contemporary lithic studies, with the added consideration of how to identify such toolkits within an assemblage. What are the distinguishing traits connecting one artefact to another, that, when combined, make a kit? One stone tool by itself cannot be a kit, but are two stones of similar type or function a kit? Are three stone of similar types, or two similar stones and one different stone a kit? How many stone tools constitute a kit?... and so on.

Contemporary tradespeople carry with them kits of tools that are quite specific to their trade, and can vary considerably depending upon their area of specialisation. Toolkits and function are therefore closely aligned; a toolkit that is comprised of multifunctional tools may cover a range of basic tasks, but may not fulfill the needs of a specific task; a toolkit that has tools which are flexible, and can be adapted to specific tasks or tailored for unseen events could be a good model for some situations but may need to be larger to accommodate the unexpected; and a toolkit that is designed to complete a specific task may not be adaptable or comprehensive enough for general needs. It is possible that at any archaeological site there may be multiple toolkits present, each with their own function, to facilitate the range of activities (Binford 1983:147).

Recent research has shown that morphologically diverse assemblages are not, as previously thought, discontinuous – with each morphological type having a function-specific design – but in a state of continuous variation which reflects artefacts in different stages of reduction (Hiscock and Attenbrow 2003, 2005). The notion that a stone implement can change both its morphology and function during its use life is no longer contentious, indicating that a lithic assemblage is not merely a snapshot image of an archaeological moment where everything is clearly categorised, but rather is just one frame of an ever-changing, and never-ending epic where the characters are continually changing roles. This idea not only challenges the traditional approach to lithic typology but also brings into question the notion that specific types constitute a toolkit. If toolkits are function-specific (Binford
and Binford 1966; Freeman 1966:232; Binford 1968), as traditional understanding suggests, then either multi-functional tools cannot be accommodated in ‘function-specific toolkits’, or the notion of ‘function-specific toolkits’ need to be re-thought as being multi-functional or trans-functional toolkits. These issues will be explored through artefact collections from the Arcoona Plateau of South Australia collected by Ron Hewitt.

1.4 Approach

During the ten years that Ron Hewitt worked in the outback South Australian town of Woomera, as a technical engineer for the defence establishment, he collected several thousand Aboriginal stone artefacts from a number of sites on the Arcoona Plateau that surrounds the town (Figure 1.1). In 1970, the Woomera Natural History Society, a group of locals interested in anthropology and natural history, organised a field excursion to the Lake Hanson area, about 50 kms west of Woomera. During that trip Ron Hewitt found what he regarded in his 1976 paper as a cache of Aboriginal stone artefacts (Fig 2). He described the cache as a hoard of “semi discoidal adzes, discoidal adzes, micro adzes, gouges, engravers, and burins which together make up a comprehensive woodworking kit” (Hewitt 1976:29; Hiscock 1988:68). Hewitt’s cache had a similar number of tulas to one excavated by Hiscock in the Boulia District of Queensland during the 1980s, which consisted of fifty stone artefacts. These are two of a small number of assemblages found in Australia that can be classified as caches for later use (Hiscock 1988:68).
Figure 1.1 The Arcoona Plateau and location of the Mungappie sites and the Lake Hanson toolkit cache.

Hewitt’s personal stone artefact collection, including the Lake Hanson cache, has not yet been located, and so direct analysis of the artefacts has not been possible. Hewitt did, however, document the raw materials and typologies of the 105 artefacts that constituted the Lake Hanson cache, and these have been used as a model for the woodworking toolkit as conceived in the 1970s. This model toolkit was compared with other assemblages collected by Hewitt at four sites around Mungappie Creek on the Arcoona Plateau in the late 1960s and early 1970s. A total of 1364 artefacts from Mungappie Creek, Mungappie Creek North, Mungappie Hut, and Mungappie Swamp were recorded onto an Excel spreadsheet where statistical analysis was done to test the hypothesis of Hewitt’s toolkit as a recurring discrete item at these sites.
1.5 Limitations

The assemblages are from surface scatters found in wind-eroded sites of the Arcoona Plateau which Hewitt described as being “so dense that it is impossible to not walk on them” (Hewitt 1978:11). These collections may be more representative of the collector’s bias towards archetypal tool types, than of the true nature of the scatters. It was expected that Hewitt’s collection would under-represent unretouched flakes, which at the time would not have been considered as tools, but debitage (Campbell and Edwards 1966:172).

Much of Hewitt’s Arcoona collection is held at the archaeology store of the South Australian Museum. However, searches of the museum’s database, and physical searches through relevant boxes revealed that Hewitt’s Lake Hanson cache was absent. Hewitt, who lives in Adelaide, was contacted by collections manager Dr. Keryn Walshe, in the hope that his personal collection would be intact along with documentation of the artefacts. Hewitt had contacted the museum some five years ago (before Dr. Walshe worked there) to donate his personal collection, but the museum declined the offer. The museum then referred the offer to a local heritage firm who, along with a representative of the Woomera Indigenous Traditional Owners – Kokatha Mula, reclaimed the artefacts. Not having the cache for comparative research has enforced limitations on the type of comparisons that could be made.

1.6 Outline of the thesis

The literature review discusses the inception of the term “toolkit” in the archaeological literature, and follows the unfolding definitions of the concept from the 1960s to the 1980s. This chapter also traces some of the experimental analysis used to determine the composition of curated toolkits, and how this research relates to Australian archaeology.

An account of Hewitt’s cache and collections, including typologies, material types, and descriptions of the Mungappie sites, is detailed in chapter 3. Because Hewitt’s focus on raw materials is significant to the results, geological, geographical and environmental information is described
including raw material, quarry sources, how they relate geographically to the sites, and how they affect the significance of the woodworking toolkit. This chapter also gives an account of woodworking stone tools that have been ethnographically described in Australia, and how these tool types relate to the Mungappie sites and the Lake Hanson cache.

Chapter 4 describes the methods used to record the Mungappie Creek assemblages, including background information about typologies employed, criteria for definitions, and codes. The spreadsheet analysis including statistical information about the assemblages; the comparisons made between the sites, the materials, and the types; metric analysis of each artefact attribute; and how this relates to the search for toolkits in the assemblages, will also be discussed.

A complete analysis of the results of all the attributes recorded is given in Chapter 5. This includes comparisons of the artefact composition for the four Mungappie sites, relationships between artefact types and attributes, and the differences between the Mungappie sites and the Lake Hanson woodworking kit.

Chapter 6 discusses the results of the Mungappie Creek sites analysis and relates them to current theories of mobility, and flexibility in Australian archaeology. The results are also used to compare Hewitt’s analysis of the Lake Hanson cache on material and typological terms. The comparison of the cache with the Mungappie site assemblages on a range of criteria, generated a number of measurable differences between them, which is discussed in detail.

The significance of the outcome of the research, and its implications for the understanding of toolkit structure is summed up in the conclusion chapter. Some points that can be used to define toolkits are outlined, as well as indicators of future research ideas.
1.7 Conclusion

This thesis responds to Hiscock’s call for a “more sophisticated conceptualisation of tool use and toolkits” (Hiscock 2005:53). Archaeologists have tended to use the term toolkit as a heuristic device that has even been used to refer to the entire range of technologies available to a culture. This thesis attempts to take a more reflective and individualised view of the toolkit by considering its role in prehistoric culture. The aim of the research is to increase understanding of the meaning of toolkits within Australian lithics, and to offer definitions for toolkit structure that have not yet been examined.
2. The evolution of the toolkit concept

2.1 Introduction

Toolkits, having been defined by their functional attributes by Lewis and Sally Binford (1966, 1968) in the mid 1960s, have continued to be the subject of both theoretical and experimental research in archaeology, including contemporary ethnoarchaeology (Hayden 1977, 1979; Cane 1984, 1992), use-wear analysis (Kamminga 1985; Grace 1989; Fullagar et al 1996; Banks 2009), reduction sequences (Kuhn 1990; Hiscock 2005) and risk management theories (Hiscock 1994; Kuhn 1994; Moore 2003). These studies, which have not only raised issues related to the technological and functional aspects of stone artefact production, but also their cultural associations, will be described in relation to current debates in Australian archaeology.

2.2 Early approaches to Australian lithics

Stone tool typology was introduced to Australia from Britain by settlers such as Robert Brough Smyth, anthropologist Baldwin Spencer and geologist Walter Howchin in the late nineteenth century. The cartographer and ethnographer Brough Smyth, who arrived in Melbourne in 1852 initially as a miner, on his retirement from the Board of Protection of Aborigines in 1878 produced a classification of Australian stone implements which used European terms such as hatchets, knives, and adzes, to describe the way tools were used by Aboriginal people (Hoare 1976:161 Mulvaney 1977:263; Roddom 1997:16).

This publication influenced Kenyon and Stirling’s stone artefact classification, including nearly 70 variations of particular types determined by the tools’ shape, which was used as the basis of the display of Aboriginal stone artefacts at the new National Museum of Victoria established by Baldwin Spencer in 1899 (Kenyon and Stirling 1900; Howchin 1934:22; Mulvaney 1977:264). Spencer had been trained at Oxford and was closely associated
with Edward Tylor, first Professor of Anthropology at Oxford (Mulvaney 1977:264).

Howchin had also published on British stone tools before he arrived in Adelaide in 1881, and his typology of the stone implements of the Adelaide area is probably the earliest South Australian typology of its kind (Mulvaney 1977:264). This typology, based upon his work in Britain, is described in his 1934 publication ‘The Stone Implements of the Adelaide Tribe of Aborigines’. He found marked differences between European and Australian stone chisels, chipped-back knives, and hollow scrapers, but drew favourable comparisons between the general scrapers, and some drill type points (Howchin 1934:31-68). These early researchers had a significant influence on Australian archaeologists who were mostly concerned with typologies and cultural sequences until the 1960s when the advent of processual archaeology allowed other disciplines such as anthropology to shape its ideology.

### 2.3 The toolkit in archaeology

The idea that prehistoric sites may contain toolkits had been discussed by the anthropologists Howell and Freeman, both from Chicago University, in 1964 and 1966 (Howell 1964, Freeman 1966). Howell’s concentration on the differences manifest at Acheulian sites from the UK raised questions about the nature of artefact variation within assemblages (Howell 1966:181), and Freeman’s analysis of Mousterian sites from Spain and France advanced the possibility of assemblage variation being more than just industrial evolution or cultural influence, but rather toolkits which reflected different activities (Freeman 1966:232). Lewis and Sally Binford’s reassessment of François Bordes’ Mousterian facies of the 1950s utilised the same concept and determined that the assemblages did not represent cultural variations, as argued by Bordes, but were toolkits aimed at performing different tasks at different times and places, depending upon seasonal variations (Binford and Binford 1966:292; Holdaway and Stern 2004:50). The Binfords’ toolkit categorisations, later defined in 1968 by the artefacts’ presumed functional attributes, went on to become a mainstream archaeological term used to
describe stone tool assemblages, whether their functional attributes are being defined or not.

Bordes (1953) introduced standards of description and comparison into archeological analysis that were previously unknown. Dibble and McPherron (2006:783) describe this standardization of the typology for lithic artefacts as one of the most important contributions to palaeolithic archaeology during the middle of the last century. Bordes' methodology made objective comparison between basic types of Mousterian assemblages possible for the first time. Bordes initially classified these assemblages, in 1953, into six groups (Dibble 1991:239), which he later condensed into four typological units in 1961 (cited in Binford and Binford 1966:238). They are:

- **The Mousterian of Acheulian Tradition (M.T.A.):** characterised by the presence of handaxes, numerous side-scrapers, denticulates, and backed knives.
- **Typical Mousterian:** like M.T.A., but with reduced frequencies of handaxes and knives.
- **Denticulate Mousterian:** 80% denticulates and notched tools; no handaxes or backed knives.
- **Charentian Mousterian:** subdivided into two types - Quina and Ferrassie; characterised by few or no handaxes or backed knives, as well as very high frequencies of side-scrapers.

These typological units, the Mousterian facies, are still used to this day (Dibble and McPherron 2006:783). Bordes use of cumulative frequencies (Figure 2.1) allowed him to trace the relatively minor fluctuations of artefact types in the different Mousterian assemblages based upon the presence, absence, and frequency of particular artefacts – typical backed knives, Quina scrapers, and handaxes (Bordes 1970:61).
The Binfords took a different approach. The Binfords’ use of statistics to determine toolkit structures was derived from a theory of ‘multivariate causation’ which states that the ‘determinants of any given situation are multiple and may be linked’ (Binford and Binford 1966:241). Initially each artefact was given a functional interpretation based on implement types, which they called ‘variables’ (Binford and Binford 1966:243). The factors used in this statistical method were groups of ‘variables’ linked together through frequencies of occurrence, that when isolated through the aid of a factor analysis programme, showed consistent patterns of mutual covariation (Binford and Binford 1966:245; Mellor 1970:82). This method measured the variability present in the Mousterian assemblages, which was interpreted by the Binfords as ‘functional variability’ (Binford and Binford 1966:292). The analysis produced five factor groups, each with their own list of tool types, suggested activity, and relation to Bordes’ types (Binford and Binford…

Figure 2.1. Cumulative graph of Denticulate, Typical, and Quina Mousterian as used by Bordes.
1966:259), which the Binfords stated were ‘sub-units of artefacts which we can infer were used in a related set of activities’ (Binford and Binford 1966:292). Binford and Binford (1966:292) made two main points about their analysis of the Mousterian complex:

The use of multivariate statistics allowed the partitioning of Mousterian assemblages into subunits of artifacts which could reasonably be interpreted as representing tool-kits for the performance of different sets of tasks.

These subunits of artifacts vary independently of one another and may be combined in numerous ways.

These five factors were later refined into functionally distinct toolkits by Binford (1968:52). They are (abbreviated here):

- Activities carried out around the home-based manufacturing of secondary tools and hide finishing. Borers, becs, end scrapers, burins, and naturally backed knives.
- Hunting and butchering tools. Points and side scrapers of all types.
- Food preparation. Backed knives, naturally backed knives, end notched pieces, typical and atypical Levallois flakes, and unretouched blades.
- Processing of plant material. Denticulates and notched tools, scrapers with abrupt retouch, raclettes, truncated flakes.
- Specialised hunting and butchering. Elongated Mousterian points, discs, scrapers on the ventral surface, typical burins, and unretouched blades.

The obvious differences in approach between Bordes’ cultural assemblages and the Binfords’ multivariate factors can be summarised as typological frequencies versus functional groupings. Bordes’ assemblages were purely determined by the frequency of particular tool types (mainly handaxes), whereas the Binfords had grouped tool types and given them a functional interpretation (Binford and Binford 1966:244).

Another disputed difference in approach emerged later, when Bordes used an analysis of reindeer teeth and antlers from Mousterian sites to conclude
that they were permanently occupied all year round (Bordes 1961:806; Bordes and Bordes 1970:66). Binford's toolkit variability rationale was based upon his view of the character of Mousterian life, which relied on mobility as a major survival strategy (Binford 1973). Mobility assumes seasonal activities at different places, ensuring the need for a more complex set of tools related to the spatial and temporal variations (Binford 1973:238). Despite Binford's resolute denial that Mousterian culture could affect assemblage variability, Bordes never denied the existence of toolkits as a component of lithic assemblages (Bordes 1961:804). It seems that their differences lay in their theories about Mousterian life, with Bordes advocating assemblage variation due to changing cultures, living sedentary lifestyles, but responding to seasonal and environmental changes, whereas Binford saw a culturally continuous group, perpetually on the move, and responding to environmental changes which reflected their varying toolkits (Binford 1973:227).

Lewis Binford went on to study contemporary Nunamiut people in Alaska during 47 hunting trips (Binford 1977). The data collected from these trips demonstrated the important principle that archaeological remains refer directly to the organisation of behaviour, with Binford drawing correlations between which tools were taken on hunting trips, the distance travelled, and the amount of time spent away from home.

The distribution, association between, and relative frequencies of tools are greatly affected by the character of the technological organisation. No simple equation between tool and task, or frequency and population is possible. Before one can make meaningful statements as to the significance of patterns of observed variability in the archaeological record, one must consider the causal determinants of the patterning (Binford 1977:36).

Binford was referring to temporal patterning as a result of technological organisation and the importance of the activity for which a tool is used. This relates to theories he developed around expedient and curated technologies, in which toolkits are generally composed of curated tools. This concept, which was developed during Binford's ethnographic research with the Nunamiut suggested that expedient tools (non toolkit types) were discarded at a higher rate than curated tools, consequently forming the majority of
debris at lithic assemblage sites (Binford 1977; 1979). Bordes (1977:36), on the other hand, described a generalised Mousterian level of evolution as being defined by a basic flake toolkit to which more specialised tools could be added to make more specialised toolkits which, in his opinion, reflected cultural differences over time. In this sense ‘toolkits” are not used to define functions or tasks, but as cultural markers; although he concluded that if each cultural group had different toolkits then they must have had different technologies and economies (Bordes 1977:39). In some cases it is “the proliferation of only one tool which highlights the individuality of the assemblage” (Bordes 1977:39).

Five years later Binford (1983:147) defined his meanings of ‘toolkit’, ‘activity’, and ‘activity areas’:

A toolkit is a set of tools used in the execution of a task.

An activity is an integrated set of tasks, generally performed in a temporal sequence and in an uninterrupted fashion.

Activity areas are places, facilities, or surfaces where technological, social, or ritual activities occur.

We can readily imagine activities which make use of a number of toolkits and, conversely, different activities, which make use of one or more identical toolkits.

Binford refers once again to the task-specific nature of toolkits, but then introduces some flexibility into the concept in saying that identical toolkits can be used for multiple tasks. Function in this sense seems to be dependent upon the interactive nature of the tool and its user, and not necessarily specific to one task (Binford 1989:185).

Binford used anthropological observation to determine the layout of activity areas and associated toolkits (Binford 1983:149), but it has been argued that these concepts were not useful for archaeologists because toolkits were not abandoned at their place of use (Simek 1984:3; Binford 1989:234) which
could be the reason why others have suggested that he never offered any empirical evidence for their existence (Dibble 1991:240). Some have argued that his analysis was misguided, because not only had he misinterpreted the statistics, but more importantly because he had used data (Bordes’ types) which were never intended to be analysed as functional types (Grace 1989:155). Independent use-wear analyses on Middle Palaeolithic assemblages by Beyries (1988) and Dibble and Rolland (1992) revealed that the tool types described by Binford and Binford had no direct relationship to their use (Holdaway and Stern 2004:51). A high number of tested artefacts showed no use at all, and most of the used tools, regardless of type, had been used to work wood, although a few had been used for butchery and hunting (Beyries 1988:214). Further analysis of stone tool edge resharpening by Dibble and Rolland (1992) revealed that many of Bordes’ types were actually the same tool in different stages of the resharpening, and therefore not different cultural types at all.

However, whilst evidence against the existence of archaeological toolkits was building in some areas, other experimental analysis on toolkit composition was adding legitimacy to the concept. In the late 1970s Cahen, Keeley and Noten (1979) re-fitted a late Upper Palaeolithic stone assemblage at Meer, Belgium, in order to analyse toolkits within lithic assemblages. This consisted of reassembling various artefacts, including tools, flakes, and fragments that had been knapped from the same block at the same time, with the outcome of being able to calculate more accurately the ratio between ‘expedient’ artefacts (opportunistic implements made for immediate tasks) and ‘curated’ ones (tools kept for many tasks) (Cahen et al. 1979:662). Their argument that curated artefacts are tools commonly used together, thus representing a toolkit (Cahen et al. 1979:662) was dependent upon Binford’s (1973) ‘functional’ argument which was developed during his research with Nunamiut communities (Binford 1977; 1979). Cahen et al’s (1979) refitting demonstrated several stages of utilisation, transformation (reduction) and series preparation for specialised activities in particular locations. It also showed that the predominant artefacts at the site were expedient tools, suggesting that assemblages in the Upper Palaeolithic contained toolkits that were not necessarily comprised of only curated tools (Cahen et al 1979:671).
Banks (2009) used cast resin models of assemblages from Solutré in France to determine if use-wear on experimental models could be matched to the originals. Solutré is a complex site that covers a range of eras including Aurignacian (around 35,000 bp), Gravettian (28,000 bp), Solutrean (17,000 bp), and Magdalanian (12000 bp), and each layer had a different tool assemblage structure. He conducted analysis of use-wear signatures to determine how artefacts were used, and how the composition of curated toolkits are structured over time. Banks concluded that:

Curated toolkits are dominated by tools that can perform a variety of tasks, are easily and efficiently maintained, are made in advance of their anticipated use, are transported from place to place over the course of their life, and may well be recycled into functionally different tools prior to their eventual discard. One must keep in mind that a toolkit may have started out as one that was composed of small functionally specific tools. However the actual realised needs and uses of the toolkit may not have mirrored those that were originally anticipated, and functionally specific tools had to be used in an improvised manner in some scenarios over a long period of time (Banks 2009:31).

In this sense the toolkit is a flexible entity, which started life as a planned grouping of functionally specific tools, but was superseded by tools that were capable of being multi-functional or improvisational. Banks (2009:31) hypothesised that ‘If a curated toolkit was to be abandoned or lost shortly after its creation, and recovered archaeologically, then one might be able to demonstrate that Kuhn's predictions are accurate’.

Kuhn (1994) used ideas about efficient tool design to predict how mobility affects the kind of toolkit a person took with them. He argued that mobile populations needed tools that were not only light and efficient to transport but were also multifunctional, having a ratio of size to effectiveness (mass/utility) suggesting they should be small and versatile (Kuhn 1994). He proposed that a common behavior of mobile populations is the need for expediently manufactured and curated tools, including cores, that can be cached at frequently visited places (Kuhn 1994:427). Hewitt’s cache from Arcoona Plateau, and Hiscock’s from the Boulia District of Queensland, are two of a
few caches that have been reported by ethnologists and archaeologists in Australia (Hewitt 1976; Hiscock 1988:67). Both caches fulfill Banks' (2009) scenario of being cached hoards that contain unused artefacts, and therefore reveal stages of manufacture which Hiscock claims are often lost to archaeologists who find mainly used artefacts (Hiscock 1988:60).

2.4 Australian toolkits

The function-specific toolkit hypothesis put forward by the Binfords in 1966 coincided with a new approach to the problem of archaeological interpretation in the 1960s which became known as processual archaeology, where quantitative techniques, scientific method and anthropology were applied to archaeological data (Willey and Phillips 1958; Binford 1962). Processual archaeology and the toolkit had found their way into Australian archaeology by the 1970s (Gould 1977:163).

Nowhere in Australian ethnographic literature is there a description of an Aboriginal toolkit; one reason possibly being that the term ‘toolkit’ did not appear to be in the vocabulary of archaeologists and ethnographers until the 1970s. Norman Tindale (1965:161) used ‘stock-in-trade’ as a collective noun for an assemblage, and Howchin oscillated between ‘stock in trade’ and ‘outfit’ (Howchin 1934:v). Aiston (1928:130) regarded tools such as the knife, the pirrie, the scraper, and the *tuhla* as part of ‘a series’ that showed an evolution from the simple flake. We only see the term toolkit as a reference to stone tool assemblages being used in archaeological texts after Bordes/Binford debate in the 1960s. One prime example of this is McCarthy’s book on Australian Aboriginal stone implements. The 1967 edition does not mention the toolkit concept, as it was probably written before the critical 1966 Binford paper, but by 1976 a paragraph describing a toolkit used by the Aborigines in Western Australia had been included (McCarthy 1976:19).

McCarthy’s (1976:19) description of the toolkit used by Western Desert Aborigines included “a crude handaxe for detaching slabs from trees and for rough shaping of them into weapons and other objects; a hafted stone chisel
for general woodworking; large hafted knives for domestic use; wooden wedges and stone hammers; and two sacred tools used by men – a hafted flake for engraving spearthrowers and ritual boards, and a knife for body scars and circumcision”. This ‘kit’, which covers both everyday domestic, and occasional specific tasks, would not fit into any of Binford’s function specific toolkit categories, begging the question – is it a toolkit, or just the range of technologies available to Aboriginal desert people as perceived by a European?

Balfour (1951) describes a much more specialised mobile kit that is carried by the men of the Worora tribe from the Kimberley district of Western Australia when they go hunting. A wallet made of paper bark and lined with bird down contained a hardwood stick, a small piece of sandstone, four pointed kangaroo bones, a partially made biface point, a number of completed spear points, a sinew, gum from the bloodwood tree, and string made from the inner bark of a boabab tree (Balfour 1951:273). This is a maintenance kit for repairing spears and sharpening the stone tips damaged during a hunting trip. Mulvaney (1969:69, 1975:74) briefly described Aboriginal hunting spears, spear throwers and boomerangs as “a small but remarkably adaptable tool-kit which consisted chiefly of wooden implements”, and by defining weapons as tools severely stretches the definition of what is a tool.

This kind of personal kit, which an Aboriginal person would carry on a hunting trip, has been of interest in countries such as America and Australia where ethnographic accounts of lithic artefact use and manufacture have been recorded. Despite this, ethnographic accounts of Indigenous toolkits as discrete entities are not common. Balfour’s (1951) short but succinct description of a hunter’s spear maintenance kit is one of the clearest examples of personal gear in Australia. Another study that may help us understand the paucity of personal toolkit recordings is Hiscock’s (2004) compelling observations of Slippery and Billy’s stone knapping process in Amaroo, Central Australia. Hiscock concluded that an explanation for assemblage variation in Australia is still an archaeological challenge (Hiscock 2004:76), because knappers like Slippery and Billy initially make flakes, not
predefined tools, and therefore not toolkits. Toolkits must, in this case, be made later.

The other challenge for later researchers has been how to fit European toolkit theory into their work on Aboriginal Australians. The ‘new toolkit’ (Johnson 1979:144 cited in Hiscock 1994:271) of the mid-Holocene was defined by the introduction of a range of small tools such as points, backed blades, and tulas commonly known as the ‘small tool tradition’. This toolkit included elements that have been contentiously interpreted as non-functional or stylistic, as well as being more efficient in food procurement (Mulvaney 1977; Hiscock 1994:272). Jones (1977:202) described the Tasmanian toolkit as the simplest in the world, being the ‘irreducible minimum for the long term survival of a human society in Australian conditions’. This toolkit also included non-tools such as spears, throwing sticks and trapping devices, as well as grinding and pounding stones. Cane’s (1984:276) interviews with Aboriginal people of the Western Desert about their stone artefacts proved to him that unretouched flakes, of which 98.9% were considered rubbish, were an unimportant component of the Aboriginal toolkit. Law (2005:92) used Kuhn’s (1990) geometric index of unifacial (stone tool) reduction (GIUR) and perimeter-reduction index (PRI) to characterise provisioning strategies of late Holocene populations as risk reducing: mobile foraging groups utilised a mobile toolkit consisting of backed artefacts, tulas, points, and high quality retouched flakes. Hiscock and Attenbrow (2005b:139) have suggested specific stone engineering strategies that prolong the usefulness of the material at hand as ways of enhancing the readiness of the toolkit.

The above examples demonstrate that the toolkit in Australian archaeology is a flexible concept. Despite the term ‘toolkit’ being traditionally used to describe an organised, linked, and specialised set of tools that have been produced for specific tasks, each of these applications of the toolkit concept are quite different, suggesting a range of ideas and functions which reflect both specific and general use.
Toolkits have been used to describe stone artefact assemblages in Europe (Binford and Binford 1966; Freeman 1966; Bordes 1977; Banks 2009) that have been found in stratified layers, correlated to clear temporal and cultural phases, and can therefore arguably be used as representative models for these phases. In Australia the issues are not so clear. Many Australian assemblages are surface scatters that may have built up over long periods of time (Mulvaney and Kamminga 1999:19), and therefore do not represent clear temporal and cultural phases. The toolkits that Binford saw in the Mousterian assemblages in the 1960s are not the same toolkits that archaeologists have identified in the Australian desert (Binford 1973:244). Gould’s (1971:167) comparison of Australian stone artefact types against similar Mousterian types showed some similar use-wear patterns on some scrapers, and some marked differences on other types, and so given the difference in environments the outcome was inconclusive.

The difference in Australia, and one of the reasons that researchers from overseas such as Gould and Hayden came to Australia, was that stone tools were being used by Australian Indigenous populations for a number of years after colonisation, and consequently the opportunity to study stone tool use first-hand through ethnography was available; but herein lies a problem. Ethnographic insights only relate to the state of stone tool technology since the arrival of Europeans, whereas most of the collected archaeological assemblages date back much earlier. Ethnographic descriptions, as well as having a Eurocentric bias (Sheridan 1979:12) also tend to describe a highly flexible and unstructured approach to tool use and function (eg. Gould et al 1971:163. Hayden 1977:178), whereas archaeologists who study reduction sequences in stone tool assemblages see knapping events as being highly structured (Moore 2003:24). Another factor is that many Australian Aboriginal people were seasonally mobile (Hiscock 2008;200, Gould 1980), and so the notion of an Australian “toolkit” has to include both sedentary and non-sedentary behavior, and become something that is portable, flexible, and therefore multifunctional (Hiscock 1994, 2006), whereas Mousterian assemblages came from sedentary sites that were occupied almost all year round (Lev et al 2005:475; Bordes 1970:65).
2.5 Conclusion

The concept of archaeological toolkits that define function within stone artefact assemblages emerged from Europe in the mid 1960s from a Mousterian site occupied by Neanderthals for several thousand years. Binford and Binford’s (1966, 1968) thesis was that variability within those assemblages could be described as ‘functional variability’, which they formulated by measuring the frequency of tool types within each factor (toolkit). The term ‘toolkit’ was subsequently adopted in many parts of the archaeological world, and arrived in Australia in the mid 1970s, where it has been used to describe a range of attributes relating to Aboriginal stone artefact studies ever since. In the ten years it took to arrive here the original concept had evolved into a term that encapsulated all tool types regardless of function, material, or gender. Ethnographic accounts of stone tool manufacture and use in Australia have emphasised a flexible approach by Aboriginal people which allowed for artefacts to have multiple functions. The flexible nature of lithic use in Australia, and the increased understanding of stone reduction methods that document both form and function variation during the life of an artefact, means that Australian lithics do not fit comfortably into the functionally-specific toolkits as described by the Binfords.

The Binfords’ initial analysis of toolkit structure was achieved through the use of multivariate statistics, not through looking at individual artefacts. Their characterisation of toolkits as ‘subunits of artefacts which vary independently of one another and may be combined in numerous ways’ (Binford and Binford 1966:292) indicates that there are no set parameters that can be applied to toolkit recognition, and that sophisticated computations may be needed to find them. This is possibly the reason that toolkits have been seen as large-scale elements that can be used broadly to paint big picture theories.

Use-wear and residue analysis has been widely used to reduce the functional ambiguity of artefacts, in so doing demonstrating the misuse of functional
typologies, and in one case discrediting toolkit theories (Beyries 1988). The idea that functional, personal toolkits are comprised mainly of curated artefacts, suggests that they will not normally occur in discard or expedient assemblages (Binford 1979:269), or be found at activity sites because their residual usability was valued for future use (Simek 1984:3; Odess and Rasic 2007:691). It is therefore not surprising that everyday toolkits which are elusive in the archaeological record have had little critical attention given to them. One such assemblage that could come under the category of a personal toolkit is the Lake Hanson cache.
3. The Lake Hanson cache

3.1 Introduction
The stone artefact material collected by Hewitt was within a limited radius of Woomera where he worked as a technical officer. Woomera is almost centrally located on the quartzite gibber plain known as the Arcoona Plateau, and the isolation of the Woomera region made the area ideal for the development of a defence institution. Both the Lake Hanson cache site and the Mungappie sites are located within the geological region of the Arcoona Plateau, and therefore had comparable characteristics. This chapter describes the study area from where the artefacts were collected, both geographically, geologically and socially.

3.2 The Woomera Natural History Society
Woomera was established as a rocket range in 1947 to accommodate Britain’s defence plans. Various missiles and rockets were launched towards the north west, where numbers of Aboriginal people were known to live in reserves, particularly in the Western Desert (Morton 1989:80).

In 1947 the Minister for Defence established the Native Patrol Officer (NPO) scheme, to protect Aboriginal people during the proposed rocket tests at the range (Morton 1989:81). Walter MacDougall, who was recruited as the first Native Patrol Officer, was also one of the founding members of the Woomera Natural History Society (Morton 1989:81; Edwards 2000:201). During the British nuclear tests at Emu Field and Maralinga after 1953 it was McDougall’s job to discourage Aboriginal people from traveling across the desert (Morton 1989:81; Gara 2010).

One of Ron Hewitt’s (Figure 3.1) earliest memories of arriving in Woomera in the mid 1960s was seeing two Aboriginal men walking across the desert in the direction of Port Augusta, and never seeing them again (Hewitt 2010 pers comm). In fact after that he never saw another Aboriginal person around Woomera, and like many Europeans in Australia during the mid-twentieth
century, witnessed the inevitable expansion of settlers at the expense of traditional Aboriginal culture (Griffiths 1996:188; McGrath 1991:121). The fascination with the relics of the ‘primitive’ stone age, which were plentiful in the area, became the focus of interest for those who established the Woomera Natural History Society (Gorman 2009:137). They conducted monthly excursions to various locations to learn more about the local environment, including wild flowers, sand dune age, ochre pits etc (Gibber Gabber 1968:52) and to collect geological and cultural objects (Gorman 2009:137). They also invited visiting speakers such as palaeobotanist Heinz Amstberg, S.A. Museum curator Bob Edwards, and archaeologist/anthropologist Norman Tindale to give lectures and slide shows to the local community and members (Gibber Gabber 1969:43, 1968:52; Gorman 2009:137). Hewitt was an active member of the society while he lived in Woomera, adding to the collection of stone artefacts that became the centre of the annual exhibitions that were initially held at the United Church until a more permanent space was made available at the rear of the new clubrooms in August 1969 (Gibber Gabber 1969:44).

In 1965 the South Australia Aborigines and Historic Relics Preservation Act was enacted, and the role of Protector of Relics was established. This role was given to the Director of the South Australian Museum to whom local wardens under the scheme reported (Allen 1975:70). The Woomera Natural History Society had members who were wardens who sought to protect Aboriginal sites and relics from vandalism and tourist damage, such as the Eucolo Creek engravings (Gibber Gabber 8.5.1969:11). Hewitt was appointed a warden by the Governor in 1971 and remained active in this role until he left Woomera a couple of year later to live in Adelaide (Hewitt 2010 pers. comm).
3.3 The Mungappie sites

The sites around Mungappie Creek fall into four areas identified by Hewitt (as written on the artifacts). They are Mungappie Creek, Mungappie Creek North, Mungappie Hut, and Mungappie Swamp.

Mungappie Creek runs into Lake Koolymilka, which is approximately 35km north west of Woomera, and Mungappie Hut is about 10km south of the lake. The Mungappie Creek sites are north of the Hut heading towards Lake Koolymilka. Mungappie Swamp is near a perennial lake that lies approximately 7kms east of Lake Koolymilka. Lake Hanson is situated about 23 km west of Lake Koolymilka (Figure 3.2).
The sites, on the traditional land of the Kokatha people, are in an area of South Australia known as the Arcoona Plateau. The Plateau is roughly triangular in shape and extends from Lake Torrens in the east to the northern tip of Lake Hanson in the west, and from the northern shores of Island Lagoon in the south to Andamooka at the northern tip of Lake Torrens in the north, with Woomera roughly in the center. Geologically, the Arcoona Plateau is an undisturbed platform of Upper Proterozoic sediments, capped by a resistant quartzite called the Arcoona Quartzite Member, which is an even-grained sandstone quartzite of fine to medium quartz grains (Johns 1968:21,31). The plateau is composed of strata of sandstones, quartzites, shales, clays and grits, with a cap rock stratum of hard rock called Arcoona quartzite, and a surface of deep red clay soil (Johns 1968:21; Hewitt 1978:6). This surface soil has been protected by a cover of lag gravels, pebbles and boulders called gibbers, and a strong growth of saltbush and other arid land species (Hewitt 1978:6; Bourman and Milnes 1985:229). The gibber areas in the region are from mixed origins, with the most common being quartzite and silcrete clasts (Bourman and Milnes 1985:229).
Hewitt described the sites as seasonal hunting bases, some 12 to 15 kilometers apart, that could easily be reached in an unhurried day's walk (Hewitt 1978:12). The Mungappie Creek campsites were located at the base of sheltered sandhills near the watercourse, which were densely covered with implements exposed by the action of wind (Hewitt pers comm 2010).

In a letter to the senior curator of anthropology at the South Australian Museum on 16.8.1977, Hewitt described his comparative classification of the archaeological site sizes, ranging from large, medium to small. Large sites covered an area up to 100 metres or more across with heavy concentrations of implements so dense as that ‘it is impossible not to walk on them’, with water availability offering nearly permanent occupation (Hewitt 1978:11). Medium to smaller sites have a location with a poorer water supply suggesting a more seasonal use. Small sites are often isolated and generally devoid of all but very short-term water, suggesting only casual short term occupational possibilities. Mungappie Hut is a medium size site and the Mungappie Creek sites are small but dense.

3.4 The Lake Hanson cache and Hewitt’s collecting

Lake Hanson is a salt lake situated on the western edge of the Arcoona Plateau approximately 55 kms north-west of Woomera and 220 km north-west of Port Augusta (Figure 3.2). In October of 1970 the Woomera Natural History Society held a field excursion to the Lake Hanson area, and it was during the trip that Ron Hewitt, a fastidious collector and researcher of stone artefacts for some years, discovered the cache of stone artefacts on the upper part of a sand dune which was set apart from the main sites in the area (Hewitt 1976:16; Figure 3.3). Hewitt's (1976:29) assessment of the cache was:

The implement types represented in this hoard are semi-discoidal adzes, discoidal adzes, microadzes, gouges, engravers and burins, which together make up a comprehensive woodworking kit. These implements are all effective woodworking tools when used in a hafted state, with the possible
exceptions of the burin and engraver types, some of which may have been used unhafted. A distinction is made between these implements and those commonly referred to as distal scrapers, end scrapers, women’s knives and other forms of implements used for light woodworking and other general purpose functions, but having differences in the method of use, the nature of the working edge and the shape of the lower surface.

The reasoning behind Hewitt’s decision to classify the cache as a woodworking kit seems to lie in the unambiguous woodworking function attributed to these implements by writers like McCarthy, who Hewitt referenced. The current thinking on other tools at the time such as scrapers and knives that he mentions, was that they were thought to have been used for other purposes as well as woodworking. All 105 items of the cache were found within a one square metre area, some still neatly piled up and partially covered by sand (Hewitt 1976:20).

Hiscock (1988:67) has defined an archaeological cache as ‘the underground and concealed storage of objects’, with the qualification that the objects may not necessarily have re-use potential. The excavation of a cache of fifty tulas at Mucklandama Creek in western Queensland’s Boulia District, was however, interpreted by Hiscock as a cache ‘destined for barter’ (Hiscock 1988:60). The ochre trade route from Cape York and Queensland to the South Australian Lake Eyre region (Jones 2007:353) passed through the
Boulia District, making it a ceremonial and trading centre (Hiscock 1988:66). Hewitt also considered the possibility of the Lake Hanson cache being a ‘trade parcel’ but suggested that they could also be a ‘tribal stockpile’ (Hewitt 1976:48). The homogeneity of the material (not common in other assemblages in the area, and of unknown provenance) and the minimal reduction of most of the implements implied to Hewitt that the cache was the work of one person (Hewitt 1976:31).

The Lake Hanson cache became a part of Hewitt’s private collection, which he kept until 2004, when it was handed back to Aboriginal Liaison Officer with the Defence at Woomera, Andrew Starkey from Kokotha Mula.

3.5 Hewitt’s classifications

Hewitt did not publish a recording sheet for the cache, but has listed the artefact and material types in his 1976 paper (summarized in Table 3.1). Hewitt classified the cache into twelve morphological types. Hewitt used the term adze to refer to tula, which has been put in brackets here.

<table>
<thead>
<tr>
<th>Artefact Types</th>
<th>Qty</th>
<th>% of total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Tula: Slug</td>
<td>3</td>
<td>2.9</td>
</tr>
<tr>
<td>B. Tula: Part Reduced</td>
<td>6</td>
<td>5.7</td>
</tr>
<tr>
<td>C. Tula: Semi-discoidal</td>
<td>43</td>
<td>41.1</td>
</tr>
<tr>
<td>D. Tula: Asymmetric</td>
<td>6</td>
<td>5.7</td>
</tr>
<tr>
<td>E. Tula: Discoidal</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>F. Tula: Side Trimmed</td>
<td>5</td>
<td>4.7</td>
</tr>
<tr>
<td>G. Tula: Blanks</td>
<td>9</td>
<td>8.6</td>
</tr>
<tr>
<td>H. Micro Tula</td>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>I. Micro Tula Blank</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>J. Burin/Engraver</td>
<td>14</td>
<td>13.3</td>
</tr>
<tr>
<td>K. Nondescript Flake</td>
<td>5</td>
<td>4.7</td>
</tr>
<tr>
<td>L. Nondescript Lump</td>
<td>6</td>
<td>5.7</td>
</tr>
<tr>
<td>Total</td>
<td>105</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 3.1 Cache artefact types and quantities. Codes, types and quantities are from Hewitt (1976:19).
Hewitt's descriptions and coding of the cache tool types have been abbreviated here (in italics) from his 1976 paper:

**A. Adze (tula) Slugs**
Reduced to the point that no percussion point is evident. Two of the three have been trimmed to make a graving point (Hewitt 1976:20).

**B. Adze (tula): Partially reduced**
The cutting edge has been trimmed for re-use in five. Two have one end trimmed as an end scraper. One has been broken across the middle, and then trimmed on the broken edge for re-use. One has had the platform trimmed for reverse re-use (Hewitt 1976:20).

**C. Adze (tula): Semi discoidal**
The platform and/or point of percussion is diametrically opposed to the worked edge, and the worked edge is curved and extends to points that agree roughly with the extremities across the width of the flake. More than two thirds have cortex material on some part of the flake, and on several the cortex extends to within a millimetre of the trimmed edge. Three or four are in need of sharpening, the rest are considered to be “ready for use”. Two in the group have the shape of small cores (Hewitt 1976:20-23).

**D. Adze (tula): Asymmetric**
Similar characteristics to type C except that the working edge is about 45° to the platform. One has two working edges, the third has cortex. One has cortex over most of the dorsal and the platform, and has a fossil leaf imprint (Hewitt 1976:23).

**E. Adze (tula) Tula: Discoidal**
Nearly circular with a delicately prepared working edge that extends for three quarters of the perimeter. 5.8 cm is the largest in the group. High standard of workmanship (Hewitt 1976:23; Figure 3.4).
F. Adze (tula): Side Trimmed
Four have both margins trimmed but not the front (distal). Two of the four have a hinge fracture at the front edge produced by the initial flake removal. One of the other two is triangular in section and has been trimmed at both sides. One specimen is the shape of a large convex/concave implement but with cortex on the entire dorsal face and platform with both sides trimmed to “conventional adzing edges”. The last in this group has cortex on two faces either of which could have been the platform. (Hewitt 1976:25; Figure 3.4).

G. Adze (tula): Untrimmed Blanks
All have cortex on the dorsal face and seven of these have cortex on the platform too. Several have a few small experimental flakes removed, and some seem to be discoidal (Hewitt 1976:25).

H. Micro adze (tula)
A variety of forms, but all have micro scraper or chisel-like edges. One is a stout double-edged micro-adze with the worked edges terminating in a point at one end and a flat butt at the other. No point of percussion is evident. One is a conventional micro adze shape except that one third of the working face is untrimmed and appears unfinished. The platform is not opposite the working face. Two have a micro chisel edge on the thick edge of a small flake (Hewitt 1976:25).

I. Micro adze (tula) blank
One has a convex ventral surface and a concave dorsal face with secondary retouching on both lateral edges. The other is of a similar shape to the first but quite thick and has no secondary work, but has a curved sharp edge with a convex lower face that would already be suitable for use (Hewitt 1976:28).
Figure 3.4 Hewitt’s drawings. Fig 12 and 13 are type f ‘side trimmed’ and Fig 14 and 15 are type e ‘discoidal’.

J. Burin/engraver
All have at least one sharp projection or point with evidence of spalling and appear suitable for engraving work. Retouched concave edges on several. Four pairs fit together. The fracture surfaces fitted together exactly leaving no doubt that each pair was originally a single piece (Hewitt 1976:28).
K. Nondescript Flake
Two show no secondary work and no potential as working tool. The other two have sharp edges and have some attrition indicating that they may have been used for cutting (Hewitt 1976:29).

I. Nondescript Lump
Some have sharp edges and points, but no methodical trimming. Use is possible in some cases (Hewitt 1976:29).

It is possible that the last two categories were not actually associated with the cache as Hewitt has alluded to some other artefacts in the immediate area as nondescript flakes and lumps.

Hewitt noted the high frequency of oolitic chert in the cache (47%) compared to other local assemblages, and considered the nature of the stone as a prime factor in its selection for the tulas in particular.

3.6 Cache artefact woodworking types
Stone tools used for working wood have been described ethnographically since the nineteenth century (i.e. Roth 1897; Spencer and Gillen 1899) and during the twentieth century (Roth 1904; Spencer and Gillen 1904; Horne and Aiston 1924; Basedow 1925; Howchin 1934; Tindale 1932; McCarthy 1946; Mitchell 1949; Campbell and Barrett 1958; Hayden 1977, 1979; Cane 1984; Bates 1985). These observations indicate a range of products being made, such as spears, spearthrowers, clubs, throwing sticks including boomerangs, bowls, digging sticks, hafted tools, shields, and ritual objects.

The Lake Hanson woodworking types identified by Hewitt, and recorded ethnographically, include tulas, micro tulas, burin/engravers and flakes, which are described here. Other types not present in the Lake Hanson cache but known to be at other sites in the Arcoona Plateau region are also discussed in a similar manner (type codes in brackets).
**Tulas (A - G)**

Tulas were the archetypal Aboriginal Australian woodworking tool, developed during the mid-Holocene in arid zones for working hardwood (McCarthy 1977:260). This tool survived as one of the main woodworking implements until the arrival of steel with Europeans (O’Connell 1977:277). The tula is one part of a composite tool made up of three components: the stone cutting implement, the shaped wooden handle, and the resin to cement the stone to the handle, which when combined has been called *Koondi Tuhla*, (Figure 3.5) from the Central Australian Wonkonguru name *Tuhla* (Horne and Aiston 1924:29; Sheridan 1979:10; Hiscock 1997). The cutting end of the tool, the chipped stone flake, has particular characteristics that make it distinct and therefore easily recognisable in the archaeological record. When found archaeologically, it has often been sharpened many times and has taken on a different form to the original tula flake that would have been initially inserted into the resin (Figure 3.6). This heavily reduced form is called a tula slug (Gould 1977:165; Holdaway 2004:255).

![Figure 3.5 Koondi Tuhla from Yuendumu in Central Australia, hafted by Minjena on 22.8.1951. Collected by N. Tindale. J. Hayward.](image)

Hiscock and Attenbrow (2005:110) have described the tula slug as a wide flake with a pronounced bulbar curve on the ventral surface, that is characterised by its short length created by low angle retouch onto the dorsal across the entire width of the flake at the distal end. It is not uncommon for
tula slugs to be inverted in the haft and the dorsal margin of the striking platform used as a scraping edge, or sometimes rehafted with the point exposed and used as graving tools (Cane 1984:277).

Many early ethnographers have described the tula as an adze (Roth 1897:101; Spencer and Gillen 1899:594; Horne and Aiston 1924:80; Campbell and Edwards 1966:193) and even more recently (Gould 1977; O’Connell 1977:277; Cane 1984:277). This is unusual because tulas do not resemble the traditional European or New Guinea adze, which has a blade that is fixed at almost right angles to the handle and is used standing up (Sheridan 1979:16). Hiscock (1997) states that most prehistoric specimens are thought to have been used primarily for wood scraping, but advises that the functional description of this class as "tula adze" is to be avoided, since adzing (rough primary shaping) was almost certainly a minor function. The fact that the tula has also been described as functioning as a chisel, a gouge, and scraper indicates that it was principally a woodworking tool, but has also been recorded as having other functions (Roth 1897:101; Horne and Aiston 1924:90). For example, when hafted to the woomera or spear thrower (O’Connell 1977:277) the tula flake then became a butchering tool (Spencer and Gillen 1899:584; Campbell and Barrett 1958b).

Figure 3.6 Tula reduction sequence (Campbell and Edwards 1966). Top, blanks – bottom, slugs.
**Micro Tulas (H - I)**

Micro adzes or micro tulas are morphologically similar to tulas but smaller. The examples from Lake Hanson illustrated by Hewitt are no more than 25 mm long. Some archaeologists categorise them as scrapers as they conform more closely to thumbnail scrapers than tulas (Holdaway and Stern 2007:255) but they could have been used for either purpose (Gould 1977). Hewitt’s division of these two types is confusing, and his drawings do not aid clarification.

**Burin/Engravers (J)**

Burin type artefacts have been recorded in European, Middle Eastern and Indian sites dating back to Middle Palaeolithic periods. Debénath and Dibble (1993:36) have described them as artefacts “where a lateral (or occasionally, a transverse) edge is removed with one or more blows that follow the ridge formed by the sharp margin of the flake resulting in a surface that is more or less perpendicular to the original flat surface of the flake”. The removal of one or two the burin spalls leaves a very sharp edge on the burin margin where the flake scars meet (Holdaway and Stern 2007:241). The primary function of these types in the western Australian desert was for engraving of sacred hardwood ceremonial boards, which were engraved at sacred locations and hidden at special places in the landscape (Hayden 1979:168; Cane 1984:236).

**Flakes (K)**

Flakes are generally considered as the product of knapping events. Flakes have been variously described by ethnologists as instant tools that can be opportunistically picked up from debitage to be used for a task at hand as expedient tools (Binford 1973; Hayden 1977:179; Cahen et al 1979:161; Gould 1980:72) in order to distinguish them from curated tools (Kuhn 1994; Shott 2009:94).

Ethnologists have reported that the process of flake selection for further retouch can be both socially complex, and surprising (Hiscock 2004:72; Hayden 1977:179). Cane’s (1992) research with Indigenous people in the
Western Desert produced some interesting results. Of 4478 unretouched flakes shown to Indigenous people that Cane had collected from a site 1.15% (51) were considered usable, but only 0.4% were actually sharp enough for butchering or scarring, and 0.35% were good enough to be hafted (Cane 1992:19). Hayden (1977:179), on the other hand, was surprised how often these flakes were utilised. Others have considered the flake as an important part of stone assemblages, being deliberately manufactured items for use (Hiscock 1998:261; Dibble and McPherron 2006:777).

### 3.7 Other woodworking artefact types

The tool types described above relate directly to the cache; the types described below were not components in the Lake Hanson woodworking kit, and have not therefore been described by Hewitt, but have been recorded as woodworking tools by ethnologists and researchers. Others, such as pirrie points were not still in use when Europeans arrived in Australia so have not been ethnographically described, but have since been associated with woodwork through use-wear and residue analysis.

**Points**

This research project distinguishes points from pirrie points, as they appear to be morphologically, and functionally different. Pirries have a specific morphology (described in next section), and have not been recorded ethnographically, whereas points came in a variety of forms and were still in use when Europeans arrived.

Howchin (1934:62) noticed that points vary in size from a fine needle-like form to the thickness of a heavy nail. He described analogous ‘awls or ‘borers’ from Europe which are “usually thick and clumsy implements” but thought that these fine points were unique to Australia. Campbell and Edwards (1966:197) also describe similar types they called asymmetric points, which are usually long and thin, triangular in section, and with a sharp point at their distal end (Figure 3.7).
There are ethnographic descriptions of skins being made flexible, after they have been scraped and cleaned, by scoring across the fleshy side with sharp stones classified as points (Howchin 1934:63), but what type of points were used for that purpose is unclear. Ethnographic films made by the Board for Anthropological Research (BAR 1935) in the Western Australian Warburton Ranges shows a split spearthrower being repaired using a stone point opportunistically fashioned with a couple of skillful chips to form a point on the distal end of a flat flake. Holes were made with the point through the side of the broken spearthrower, which was then ‘sewn’ together with kangaroo sinew through the holes.

**Pirrie Points**

These stones are tear or leaf-shaped, triangular in section, longer than broad with a sharp point at the distal end, and are unifacially trimmed. The dorsal face can be finely chipped or pressure flaked to produce a curved surface that has the dorsal ridges removed (Figure 3.8). In some examples the proximal end is worked to produce a thin rounded margin where the flaking can extend onto the ventral face. They were first reported, named and illustrated by Horne and Aiston in 1924, although they had probably first been collected from the Arcoona Plateau region in the late nineteenth century where they have been found in large numbers (Campbell and Edwards
1966:199). Those from the northern parts of South Australia were termed ‘Eyrean’, being distinct from the southern smaller versions termed ‘Fulham’ by Campbell and Noone in 1943 (Campbell and Edwards 1966:199).

Mulvaney (1975:221) speculates that these items could have been spear heads. Horne and Aiston (1924; Aiston 1928:125) had already asserted that pirries were never used as spear tips, but when hafted in slim handles were used for fine engraving on timber artefacts like women’s carrying vessels or boomerangs, and making holes by drilling. Howchin agreed, stating that in the Adelaide region at least all the spears had wooden tips (Howchin 1934:64), and Spencer and Gillen (1899:575) had already recorded that spears with stone tips were not encountered south of Powell Creek near Tenant creek in the Northern Territory (Lourandos 1997:291).

Plate 3.8 Pirrie Point with broken tip. (Holdaway and Stern 2004:268)

**Scrapers**

Tools described as scrapers or end scrapers are found commonly in prehistoric sites worldwide (Andresfky 1998:193). Bordes included a number of different types of scrapers or *racloirs* in his Lower and Middle Palaeolithic typology, which were classified by the amount or positioning of retouch on the
flake edge (Dibble 1987:109). In Australia, scrapers, along with axes, choppers, and pounder/grinders, have maintained a continuity of tradition from the Pleistocene through to the arrival of Europeans (Pretty 1977:10).

Howchin’s (1934:52) Australian typologies have differentiated between a number of scraper types including: straight, horseshoe, circular, side, duck-bill, kite shaped, oblique, flat, hollow, pointed or scalloped, and thumb scrapers. This differentiation, which is based solely on the morphology of the flake, does not reflect Bordes’ Palaeolithic scraper classes according to retouch, but might have similarities in that both Bordes’ and Howchin’s types could be trans-functional tools in differing stages of reduction (Dibble 1987:110). The reduction process which changed both the size, angle and form of the working edge could have affected their functional capabilities, but according to Hayden (1977:182) they would still have been associated with woodworking.

Campbell and Edwards (1966:188) reduced central and southern Australian scraper classifications to two basic types, asymmetric and symmetric, without referring them as scrapers. The asymmetric types refer to side trimmed and irregular flakes which include concave faces and points on nosed forms, whereas the symmetric types are broad or long distal trimmed flakes (Campbell and Edwards 1966:189-191. (Figure 3.9). They also acknowledge a miscellaneous group of trimmed flakes.

Figure 3.9 Long distal scrapers. Photograph R. Hewitt.
**Geometric Microliths/ Backed Artefacts**

Geometric microliths have been associated with cultural industries in South Africa from 70,000 years ago (Wymer 1982:223; McBrearty and Stringer 2007:793). Excavations in European Magdalenian sites have produced a relative abundance of these microliths which were to become common and typical in the Mesolithic (Bordes 1973:223). Backed artefact assemblages similar to Australian types have been found in India and Ceylon (Sri Lanka) from 7000 BP (McCarthy 1977:255). They are known to have appeared in north east Australia in the late Pleistocene and become abundant in the south east from 3500 – 1500 BP (Lourandos 1997:289; Robertson *et al* 2009:296).

Geometric microliths are backed at either one or both ends, and sometimes on one lateral edge. They include crescent, segment, triangle and trapezoid shapes and are classified as being less than 3 cm or less on their maximum dimension (Campbell and Edwards 1966:204; Holdaway and Stern 2007:262 Figure 3.10).

The ‘backing’ which describes the artefact is a form of steep retouch that is formed on one or two margins of the stone, usually on the opposing side to the working edge or chord, which acts as either a strengthening element to the blade, or a preparation of the stone to receive hafting resin (McCarthy 1976:45; Holdaway and Stern 2004:159). Because manufacture of these items had ceased before European settlement in Australia, no ethnographic record of their use exists, and so their function has been speculative (Robertson *et al* 2009:296). McCarthy (1967, 1976) thought that they must have been points for throwing spears, and many archaeologists have adopted that view (Mulvaney 1975:108; Kamminga 1982).
Robertson et al's (2009) use-wear analysis research of these artefacts refutes this idea, arguing that the microscopic indications are that they were used predominantly for working wood or other craftwork, whereas Boot's (1993) residue analysis suggest that a small percentage were hafted and used for cutting plant material (Boot 1993:11; Robertson et al 2009). This outcome is contrary to previous speculation that these implements, which were produced in great abundance, were primarily used in ritual and ceremonial activities and on human flesh (Robertson et al 2009:297).

**Burren**

Burrens were sometimes categorised as adzes in that they were hafted, and reduced to a slug form (Kamminga 1978:28; Cane 1992:22; Holdaway and Stern 2007:257). They differ from tulas, whose retouch is mainly on the distal end, by having steep retouch on one or both of the laterals (Holdaway and Stern 2007:257). The lateral margins were continually used and sharpened,
resulting in a slug which was then sharpened at each end, hafted and used for wood boring or graving (McCarthy 1976:31).

**Hand Choppers**
Campbell and Edward (1966:184) have described these implements in Australia as *large trimmed flakes* which have the size and weight suggestive of a hand held chopping tool. Whilst these types of implements have been described as heavy duty butchering tools (Holdaway and Stern 2004:53) they have also been ethnographically recorded in primary woodworking activities such as the initial shaping of artefacts like spears, gigging sticks, bowls, and spearthrowers (Hayden 1977: 183; 1979:30-37).

### 3.8 Conclusion
Hewitt’s definition of the Lake Hanson cache as a woodworking kit was based on artefact types that when hafted would be effective woodworking tools. The range of different tula types, being archetypal Aboriginal woodworking tools (McCarthy 1977:260), from unworked blanks to slugs found in the cache does suggest that the assemblage was a kit with a specific function, not solely for trade, but made for a special purpose from materials that were not commonly found in lithic scatters around the camps.

The tool types from A – J, including all tulas, micro tulas and engravers, are classic examples of Binford’s curated tools types with a high degree of production investment, and relatively long use life (Binford 1973:215; 1979:269). The storage and re-use of tools in anticipation of future needs is also a characteristic of curation that can be directly applied to the Lake Hanson cache (Shott and Nelson 2008:24). The high quantity of tula blanks and partially reduced tulas in the cache fulfills Bank’s (2009:31) requirements for a curated toolkit by having tools that are efficiently maintained, are made in advance of their anticipated use, and may well be recycled into functionally different tools prior to their eventual discard. The tula slugs had signs of reworking and could still have been functional as fine engraving tools. The variants in this woodworking toolkit appear to be the nondescript flakes and
lumps. The flakes could have been opportunistic or expedient tools, as Hewitt recorded some use wear on a few of them, and the lumps did also show signs of attrition. The other possibility is that both the lumps were a source of good quality raw material for further shaping, or not a part of the actual cache at all, but rather unassociated lithic scatter exposed by the wind. The fact that they were similar materials to the cache, such as oolitic chert, jasper and translucent chalcedony, favours the former.
4. Methodology

4.1 Introduction
Hewitt’s collections from various sites near Woomera are numerous, and occupy many museum boxes at the South Australian Museum’s archaeology collection. After an initial search through some of the boxes it was decided to concentrate on one site for analysis; a site with quantities that were manageable within the time frame of the research, and a site that had a good range of artefact types. Another criteria was to work with a site that was in close proximity to the Lake Hanson cache, but there were no collections on the museum database attributed to Hewitt from the Lake Hanson area. Mungappie Creek and associated sites were chosen because they were only 35kms from Lake Hanson at the closest point and seemed to have a variety of type concentrations which provided the opportunity for comparisons with each other as well as with the Lake Hanson cache. The artifacts were collected by Hewitt from August 1966 to June 1971.

All of the Mungappie site collection boxes were sorted through to list the accession numbers that were represented in each box. These were recorded on an Excel database sheet that had been copied from the museum’s database.

Volunteers who helped with recording the artefacts at the museum were briefed on attribute standards such as colour, type and material in order to maintain recording consistency.

4.2 Recording systems
The recording form for the Mungappie sites was designed to facilitate not only a basic comparison with Hewitt’s Lake Hanson cache, but also to accommodate a more complex level of analysis (Figure 4.1). The four main attributes that Hewitt had used for the cache were used as the basic criteria; they included artefact type, material, colour, and retouch location. Other
attributes were added to allow for a more detailed analysis of the collections, and to make projected analyses about the Lake Hanson cache based upon the main four criteria.

<table>
<thead>
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<td>box no:</td>
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<td>South Australian Museum archaeology collection</td>
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<th>edge</th>
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<th>color</th>
<th>matL</th>
<th>matR</th>
<th>untype</th>
<th>comments</th>
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</table>

Figure 4.1  *Recording sheet for Mungappie site assemblages.*
The fields on the recording form included: site name, box number (the museum collection box number that appears on the exterior of the box for ease of storage and identification, and relates to the database), collector (in this case Hewitt), date (date of recording), and recorder (the name of the person recording). The recording form itself has eighteen attributes for each artefact as well as a comments column:

1. **Accession number.**
These numbers were given to the artefact collections by the South Australian Museum when they were formally accessioned. They were originally recorded into a ledger and then onto microfilm; some were then transferred onto a database.

2. **Site name.**
The site names had been identified by Hewitt on each stone, and were recorded on the sheets as he had written them on the artefacts.

3. **Artefact number.**
A unique artefact number was given to each artefact as it was recorded. These numbers are used for identification purposes in analysis, drawings and photographs.

4. **Raw material.**
Hewitt gave a list of raw material types that he had found in the region (Hewitt 1976:17). This list was used and added to with other materials that were found amongst the collection. These materials are:

- Oolitic chert
- Translucent chalcedony
- Silcrete
- Banded jasper
- Chert
- Jasper
- Quartzite
- Quartz
- Indurated Mudstone
- Porcellanite
- Rock crystal
Hewitt's definitions of the stone types found in the Lake Hanson cache may be idiosyncratic, but they correspond well to textbook definitions, and were descriptive of the types found within the Mungappie assemblages. They have therefore been used for the purpose of classifying the assemblage artefacts, and for direct comparison with the cache.

A jeweler’s 30x magnifying glass with a light was used to help identify some of the material types, which could only be confirmed by close examination. The following is a list of material types encountered and identification methods used.

Oolitic chert is distinguished by its “regular sized rounded concretions that loosely float in a chalcedonic matrix” (Hewitt 1976:17) that can easily be seen under magnification. Ooliths are spherical rock particles which have grown by accretion around an inorganic or organic nucleus (Whitten and Brooks 1972:321). Translucent chalcedony (as classified by Hewitt), a mix of fine grained quartz and the silica moganite (Heaney and Post 1992:441) differs from most other crypto-crystalline material in the assemblages in that it has at least some translucent properties as well as, in some cases, faint oolitic markings (Hewitt 1976:18). Because of this it was sometimes difficult to distinguish this material from oolitic chert and banded jasper, which can also have oolitic markings.

The banded jasper in the assemblages were recognised by the rich brown bands of colour that laced through it. Jaspers tended to be recognised by a single pure colour throughout the artefact and have a very soapy feel, and are a fibrous form of micro-crystalline quartz and silica, as is chalcedony (Howchin 1934:15; Heaney and Post 1992:441; Luedtke 1992:6). The chert, being a non-fibrous form of micro-crystalline quartz (Heaney and Post 1992:441; Luedtke 1992:6) was predominately dark grey and sometimes had a chalky cortex.

Silcrete forms much of the duricrust that covers the Arcoona plateau in the form of gibbers (Stephens 1964:1407; Bourman and Milnes 1985:229). The silcrete clasts that make up the duricrust contain loosely packed water-
rounded quartz grains which were deposited in the silica when it was laid down (Stephens 1966:497), making it difficult to sometimes differentiate it from quartzite, which is also prominent in the region (Johns 1968:31, Stephens 1966:497; Smale 1973:1084; Hewitt 1976:16). Some coarse grained varieties of quartzite also occur, with rounded grains that can look much like silcrete, and the very fined grained varieties had a waxy chalcedonic feel with no visible quartz grains. Hewitt had omitted quartzite, quartz, and rock crystal from his list, because they were not represented in the cache. However, in the other assemblages, quartzite came in a range of colours from light grey to light brown/green with some pink and reds. Quartz is not common in the region and was not expected in the assemblages, whereas rock crystal, a glass like transparent form of pure quartz (Whitten and Brooks 1972:412) that occurs as a sparse natural material amongst the gibbers, has been recorded at other campsites (Hewitt 1978:17).

The indurated mudstones described by Hewitt were from a limonite or haematite base (Hewitt 1976:18), which includes various amorphous iron oxides providing the red colour in ochres (Whitten and Brooks 1972:269). Porcellanite, which Hewitt has described as a very fine quartzite (Hewitt 1976:18) was not recognised in the assemblage, but could have been some of the very fine quartzites that were occasionally recorded, or could also have fallen into the jasper-chalcedony classification; all being forms of micro-crystalline silica (Heaney and Post 1992:441).

5. Colour.

Colour was estimated within a range that seemed to cover most materials in the assemblages (Table 4.1). Artefacts that had more than one colour, or seemed to be a mix of two colours, were given a dominant colour, and a secondary colour ie. a buff stone that had a light grey tendency would be coded bu/lg, or a principally dark grey chert with white bands would be dg/w.
Table 4.1. Colour range codes for stone types at Mungappie sites.

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<td>buff</td>
<td>bu</td>
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<td>w</td>
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<td>green</td>
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It was intended to use this information for artefact identification purposes, and for analysis of materials that might have come from specific sources. For example, there was a red-brown quartzite quarry located near Pernatty Lagoon 20 km SE of Woomera (Johns 1968:27). Colour could also relate to heat treatment, which can result in a systematic colour alteration although it is not a reliable method for detecting heat treatment (Rowney and White 1997:653).

6. Artefact type.

As Hewitt's toolkit types are the model for this research, the occurrence or non-occurrence of these types in each Mungappie site will determine the presence of toolkit members there. Hewitt's classifications and typologies, which are based on McCarthy (1967), have been used as the comparative types. Hewitt had described the toolkit artefacts from A - L in enough detail to be able to use the descriptions to code types from Mungappie Creek sites and do a direct comparison with the cache.
Some artefacts fall between types, or are not easily reconciled using the classification system. For example, Hewitt has a *burin/engraver* type – a classification which describes both the technology used to make the item and its supposed function. This can be confusing; even though it is documented that *burins* were used for specialised engraving purposes (Cane 1984:236), many classifications have *engravers* which are also described as *pirries* or *points* (Aiston 1928:125). Hewitt’s drawings of this type are ambiguous and do not seem to illustrate classic burin technology, where spalls are taken off to make a sharp point, or *pirries*, which have a quite distinctive morphology. This raised the issue of whether Hewitt’s *burins* are really *burins* even though he describes them as having burin spalls (Hewitt 1976:28). It was decided to include only artefacts with burin spalls in this category and to make a separate category for other engraving type tools such as *pirries* and *points*. *Points* were classified as flakes with point-type terminations or manufactured point protrusions on the lateral edges, but were clearly different to the more clearly defined *pirries* that demonstrated a classic uniform tear/leaf shape morphology.

Hewitt’s nondescript flakes from Lake Hanson have been discussed in the previous chapter. The flakes recorded in the Mungappie assemblages were
identified by their lack of obvious retouch. Some had signs of use-wear, or use damage, and these were recorded accordingly. Some were broken or had no obvious proximal or distal ends, and were recorded as medial flake pieces (Kp).

7 - 9. Artefact dimensions.
The length, width, and thickness measurements were based upon the method of measuring the length on the ventral surface from the PFA (Point of Force Application - see item 12) to the mid point of the termination. The width of the flake was measured at right angles to its axis at the mid point, and the thickness being measured at the same axis as the width (Andrefsky 1998:97; Smith and Burke 2004:214). Where there is no distinct termination or platform (which is quite common due to retouch) the length is measured along the flake path. Many flakes have varying widths due to their irregular shape, and therefore the width of a flake at the mid point, or the medial axis (Holdaway and Stern 2004:139) is considered to be a medium width that is less than the widest point, but more than the narrowest; likewise with thickness. The equipment used for measuring the artefacts was a 150mm vernier caliper capable of 0.02mm calibrations. All measurements were in millimeters with 0.5 of a millimeter being the smallest calibration.

10 - 11. Platform size
Much information about manufacture and reduction history can be determined from the platform (Holdaway and Stern 2004:120), but because this project is not principally concerned with stone tool reduction sequences, the basic information about its size only was recorded as it can relate to some retouched tool types such as tulas. Platform width was measured at the widest point between the lateral edges, and thickness was measured at right angles to the width at the widest point between the ventral and dorsal faces, which is commonly at the impact point (Andrefsky 1998:93 Holdaway and Stern 2004:124).
12. **The Point of Force Application (PFA)**

The PFA is the point where the hammer was struck on the core platform to detach a conchoidal flake. The PFA, which is characteristic of a Hertzian-type initiation, is defined by a semicircular protrusion that is visible on the platform, and which radiates down the ventral face as ring cracks to form a *bulb of percussion* (Holdaway and Stern 2004:109 Cotterell and Kamminga 1983:685). The width of the PFA can be measured across its diameter on the platform. The size of the PFA can have characteristic relationships to material, hammer type, and initiation processes (Cotterell and Kamminga 1983:687). The PFA is often very small and in some cases not visible. In these instances it was recorded as indeterminate.

13. **Cortex.**

The cortex is the outside skin of the stone or pebble that the artefact was struck from, and accordingly cortex will be found mainly on the dorsal face and proximal end of a flake, but can occur on the distal if the termination was plunging towards the rock’s interior. The amount of cortex on the artefact gives an indication where in the reduction sequence the artefact was. A dorsal surface consisting entirely of cortex indicates the flake being struck at the early stages of a knapping sequence, and consequently no cortex indicates that the artefact was struck at a later stage nearer the centre of the core. One way of measuring cortex is to divide the dorsal face into quadrants and record its presence in the number of quadrants (Holdaway and Stern 2004:144). The diverse range of shapes and sizes of the artefacts in the collections necessitated the need for the cortex on the dorsal face to be estimated in 5% ordinals.

14. **Termination**

The termination of a flake is at the end opposite to the platform where the flake last separates from the core. The four basic termination types were recorded: feather, hinge, step, and plunging (Grace 1989:14; Andrefsky 1998:88; Cotterell and Kamminga 1987:685). If the termination had been chipped off the artefact during the process of shaping and sharpening, it was therefore not recordable.
15. Breakage
Flakes can be either intentionally or unintentionally broken by the maker, accidentally broken during use, trampled by animals or people after discard, damaged through agricultural processes, or naturally broken by heat or fire (Hiscock 1985; Holdaway and Stern 2004:111). Artefacts that have either no distal end or proximal end, or both, could have been broken transversally. These fragments are called proximal, medial or distal flakes depending upon which portion of the flake they represent. Flakes can also be broken longitudinally and may therefore have both proximal and distal ends (Holdaway and Stern 2004:169). Breakage is an important factor in large assemblages which have high percentages of debitage if accurate statistical representations are required. In this project where the assemblage has already been collected and debitage is not recorded, breakage only affects artefact identification.

16. Edge angles
Edge angles on stone tools have been used to describe many aspects of tool use and manufacture including use life, where the retouch angle relates to the amount of reduction (Kuhn 1990; Hiscock 1994; Collins 2007); and function (Wilmsen 1968; Cantwell 1979; Collins 2008). A common theory is that the working edge angle of a tool may be representative of the type of work that the tool is used for, with a lower edge angle being better for cutting, slicing or shaving, and a higher edge angle being more suited for scraping (Wilmsen 1968:156; Grace 1989:93). Modern woodworking tools represent these differences quite well. A general hand plane has a working bevel of around 30° but is set in the plane body at between 45°-50° (Hayward 1973:38; Sheridan 1979:13; Kingshott 1992:66). Chisels come in a variety of edge angles but the harder working mortise chisels would generally have a higher angle of around 50° than finer finishing and carving tools which would be around 30°-40° (Goodman 1964:197). Scrapers used for fine grain finishing are used at an angle of around 80°-85° to the timber (Hayward 1973:119).
Dibble and Bernard (1980) have identified four methods for measuring stone tool edge angles. Methods a) and b) use a polar coordinate graph (Burgess and Kvamme 1978:482). In method a) the artefact edge, when seen in cross section, is set against a polar coordinate graph which has angle increments as it’s index to measure the angle. In method b) a clay impression of the working edge is measured against the graph index. These two methods were deemed less flexible, and accurate than the c) goniometer, and d) caliper methods. The d) caliper method requires a specially modified set of calipers with a calibrated depth gauge which measures two triangulated lengths of the working edge which are then entered into a formula: \( \theta = 2\tan^{-1}(\frac{.5T}{D}) \) to calculate the angle of the edge \( \theta \) (Dibble and Bernard 1980:861). Given the inaccuracy of methods a) and b) and the complexity of method d), it was decide to use method c), the goniometer, for this project. A goniometer is an engineering tool for measuring fine angles. It is similar to a protractor, but has an additional moveable arm which moves against the protractor angle gauge when the artefact is placed between it and the instrument base (Burgess and Kvamme 1978:482). When used for stone tools it gives a reasonably good indication of the angle even though there needs to be some user interpretation due to the inconsistency of the stone surface. The middle of the working edge, the apex, can generally be a sufficient indication of the overall angle (Grace 1989:75) but in this instance (depending upon retouch extent) two, three or four measurements were taken on the retouched section of a working edge, or edges, to give an average measurement for the whole working edge. When there was more than one working edge, all the working edges of the principal retouch type were measured. The average of these measurements was calculated to give a single composite angle for recording purposes (Figure 4.2).
Figure 4.2 Edge angles were taken from three points of the retouched working edge of the flake. J. Hayward

17. Retouch location

The retouch location was calculated by dividing the dorsal face of the flake into four segments by drawing diagonal lines from top left corner to the bottom right corner and visa versa for the other side (Figure 4.3). The margins are named proximal, distal, left lateral, and right lateral. There are 15 possible combinations of the margins, which are coded from A – O (Table 4.2). Proximal retouch is only recorded on the ventral face. Retouch on the dorsal face at the proximal is not recorded as this may be core overhang preparation prior to flake removal, and has no influence on artefact functionality or type (Dibble and Bernard 1980:92).

Figure 4.3 Ventral and Dorsal faces of flake showing retouch margin divisions. J. Hayward.
18. Retouch type and use wear

The retouch type column recorded the method used for retouching the working edge. These were serrating, crushing, pressure, chipping, and backing. Serrating is a notching that forms a series of small or fine projections like a saw edge. Crushing is a shattering of the tool edge, either by damage or attrition, as result of use wear rather than deliberate shaping (McCarthy 1976:102; Hayden 1979:19; Holdaway and Stern 2007:167), and so is not retouch as such, but does give an indication of intense use wear. Pressure flaking is a method of retouch where pressure is applied to the artefact by a tool often made of wood or bone, which results in a fine control over the removal of flakes (Holdaway and Stern 2004:12). Chipping, in this instance, is a generic term for a range of retouch which can either be steep or flat, stepped or scalar, but is usually done with a hammer stone. Backing is defined as steep, short retouch of more than 80°, which can be either uni- or bi-directional shaping of the flake, usually found on the opposite edge to the working edge, or chord, and is initiated from the ventral platform of the flake (Hiscock 2004:97 Holdaway and Stern 2007:111,159). Flakes with more than one type of retouch had all the retouch types recorded.
4.3 Data analysis

The data was taken from the handwritten recording sheets and entered into an Apple spreadsheet programme called ‘Numbers 08’ which can be exported to a Microsoft Excel format. The handwritten sheets were the primary data which did not change, and have been referred to a number of times when checking the Excel sheets for discrepancies. ‘Sorts’ were used to arrange the data according to attributes into separate worksheets, so that refined ‘sorts’ could be achieved. For example, type A artefacts were put into a separate sheet which could be sorted for colour, size, retouch type, retouch location etc. For most of the size attributes, mean (average) calculations were used as this was used by Hewitt, and was therefore comparable. Percentage calculations were used for artefact quantities because the ranges were too high for accurate charting.

The data from each of these attributes were recorded in ordinals of 5 from 0 - 100, other than termination type, breakage, retouch location, and retouch type, which were recorded by codes. Each ordinal range states the number of artefacts that appear in that ordinal range. The average volume was calculated using the length, width, and thickness data, which indicated comparative volumes between artefacts. This information will be used to calculate a reduction index for tula blanks and other tula types. Knowing how much an artefact has been reduced indicates the amount of use it has had, and how much potential use an artefact has (Shott and Nelson 2008; Shott 2009). These reduction calculations feed into theories related to ‘curation’ and ‘mobility’ (Cahen et al 1979; Kuhn 1994; Banks 2009).

4.4 Volumes of artefacts

The average volume of each artefact type from the Mungappie sites was calculated using the length, width, and thickness data (Table #4 in Appendix metrics). Even though this can never be an accurate calculation of the volume of the artefact due to the amorphous nature of a flake, it does represent a comparative measurement as all the flake’s volumes were calculated using the same method. The artefacts were measured in
millimetres, but the volumes have been converted into cubic centimetres as a standard volumetric measure throughout this project.

The volumes of all tulas from blanks (G. tula blanks) to fully utilised tulas (a. tula slugs) from the all of the Mungappie sites were used to calculate a reduction index for each tula, using Kuhn’s (1994) theory of the potential utility of a core being based on its volume. The utility of a core is assessed on its potential to produce fresh usable edges, with the larger core expressing more potential than a smaller one (Kuhn 1994:429). The potential utility of a tula is its ability to be resharpened a number of times, until it becomes unusable. Tula slugs were used as the minimal usable, or irreducible, artefact size to calculate utility, instead of an arbitrary figure of 3 as employed by Kuhn (Kuhn 1994:430).

### 4.5 Conclusion

The principle reason for some of the recording methodologies used was to allow for a direct comparison with the Lake Hanson toolkit cache by reproducing the methods used by Hewitt in the 1970s, which were concerned with artefact type, material, colour, and retouch location. Further attributes were used to facilitate a more sophisticated analysis of the Mungappie assemblages, which may not have necessarily related to the Lake Hanson cache. Bivariate attribute comparisons were possible with ‘sort’ options that could generate new tables; percentage calculations were generated with formulas; averages, means, and ranges were automatic calculations; and complex graphs could be generated directly from tables.
5. Results

5.1 Introduction

In this chapter, the Mungappie Creek sites are compared to the Lake Hanson cache in order to determine the frequency that cache artefact and material types appear. The total number of artefacts recorded from the Mungappie sites was 1364. The number of artefacts types from each site was:

<table>
<thead>
<tr>
<th>Site</th>
<th>Artefacts</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mungappie Creek</td>
<td>866</td>
<td>63.5%</td>
</tr>
<tr>
<td>Mungappie Creek North</td>
<td>226</td>
<td>16.6%</td>
</tr>
<tr>
<td>Mungappie Hut</td>
<td>213</td>
<td>15.6%</td>
</tr>
<tr>
<td>Mungappie Swamp</td>
<td>59</td>
<td>4.3%</td>
</tr>
</tbody>
</table>

Attributes of the artefacts recorded including material type, colour, artefact size/volume, cortex, termination, breakage, edge angles, retouch type, and retouch location are compared and analysed. The artefact sequence of toolkit types from A - L is used to match Hewitt’s sequence.

One of the aims of this thesis is to examine the composition of toolkit structures compared to lithic assemblage structures. Hewitt’s Lake Hanson cache is the model toolkit which can be tested against the four Mungappie lithic assemblages. The four Mungappie sites as one entity increase the sample size for toolkit type comparison. In cases where there are significant differences with one or more of the Mungappie sites, this will be indicated. This comparison focuses on toolkit types represented in the Lake Hanson cache, and therefore non-toolkit types and non-woodworking types such as hammerstones, and grinding stones are not included in the analysis. Whilst they are important components of the Mungappie assemblages and other toolkit types, they are not immediately relevant to the cache comparison.
5.2 Artefact types at Mungappie sites

The percentages of all artefact types from A – X recorded at the Mungappie sites was calculated for each site and compared on schematic graphs (Figure 5.1). These graphs illustrate the distribution frequency of artefact types at each site, and allow for an immediate comparison between sites. Lake Hanson woodworking kit types are represented between A – L as recorded by Hewitt; the sequence from M – X is arbitrary.

All sites had similar rates of scrapers, being P. scrapers 20 – 28%, and PL. long scrapers around 10%. All sites also had medium percentages of W. geometric backed artefacts with Mungappie Hut and Mungappie Creek North having approximately 20%, and Mungappie Swamp and Mungappie Creek having between 10 – 15%. In most other respects, the rates of artefact frequencies differ from site to site.

Mungappie Swamp had the smallest sample size of the four sites (58 artefacts), and was only visited once by Hewitt – on 26/07/1970. It had no G. tula blanks, B. part-reduced tulas, J. burin/engravers, and no K. unretouched flakes but did have the highest percentage of A. tula slugs of all the sites, as well as a high proportion of all scraper types and cores, and the highest percentage of R. thumbnail discoidals. Unusually, it was the only site to have no T. pirries and N. points.
Figure 5.1. Percentage distribution of artefact types for each of the Mungappie sites. Woodworking kit types range from A - L.
Cores at each site
Core samples at each site were similar in percentage terms (Table 5.1). Mungappie Creek had the largest range of material types including a rare banded jasper and oolitic chert sample (Figure D.1). Unsurprisingly, quartzite was the most common material at all sites. Mungappie Hut had the largest cores (Figure D.9) with an average volume of 115cc with a range from 53 – 231cc, but had the lowest cortex count, except Mungappie Swamp which had none. The cortex range was similar at all three sites.

![Table 5.1 Cores at all Mungappie sites.](image)

5.3 Toolkit types
The quantity of toolkit types A – L found at all the Mungappie sites was 319. The numbers from each of the Mungappie sites are:

<table>
<thead>
<tr>
<th>Mungappie Creek</th>
<th>Mungappie Creek North</th>
<th>Mungappie Hut</th>
<th>Mungappie Swamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>204</td>
<td>47</td>
<td>46</td>
<td>22</td>
</tr>
<tr>
<td>63.9%</td>
<td>14.7%</td>
<td>14.4%</td>
<td>6.9%</td>
</tr>
</tbody>
</table>

The only Mungappie site to have a full contingent of all toolkit types was Mungappie Creek, which also had the highest sample size of artefacts (866)
collected from the four sites. The other three sites all had at least two components of the kit not represented. All sites had samples of types *A. tula slugs, C. semi discoidal, D. asymmetric* and *E. discoidal*. Mungappie Creek had a small number of *G. tula blanks* and Mungappie Swamp had none. All sites had more than 1% of *H. micro adzes* and *I. micro adze blanks* except for Mungappie Hut, which had 0.5% of *H.* and no *I.* All sites had between 3-6% of *K. unretouched flakes*, except for Mungappie Swamp which had none.

**Comparison of Mungappie sites and Lake Hanson cache**

A frequency graph of toolkit artefact types A – L from each Mungappie site was overlaid on the Lake Hanson cache (Figure 5.2). The pattern of woodworking types from each site show areas of difference against the cache. No site matches the cache, but the overlaying areas indicate the degree of difference that each site has. Each site also has artefact frequency variations; the lower the sample number the less the artefact range, with Mungappie Swamp showing distinct peaks and troughs. Mungappie Creek, with the largest sample, has a similar make-up to the combined Mungappie sites.
Comparison of ‘Woodworking Kit’ Artefacts at Lake Hanson Cache and Mungappie Sites

A - Tula: slugs
B - Tula: part reduced
C - Tula: semi discoidal
D - Tula: asymmetric
E - Tula: discoidal
F - Tula: side trimmed
G - Tula: blank
H - Micro adze/chisel
I - Micro adze blank
J - Burin/engraver
K - Nondescript flake
L - Nondescript lump

- Lake Hanson Cache
- Mungappie Sites

Figure 5.2 Comparison of ‘woodworking kit’ artefact distribution between the Lake Hanson Cache and each Mungappie site.

Units are a percentage of ‘woodworking kit’ type artefacts from each site (quantities in brackets).
Artefact quantities in the toolkit range A – L at the four Mungappie sites were compared to the Lake Hanson cache (Figure 5.3). The cache has high quantities of \( C. \) semi discoidal tulas, (41.1%) and \( G. \) tula blanks (8.6%), which is not matched in the Mungappie sites, which have 10.6% and 1.6% respectively. The other irregularity is the J. burin/engraver category where the cache has 13.3% compared to 4.5% at all Mungappie sites.

![Figure 5.3. Percentage comparison of 'woodworking kit' artefact types at Lake Hanson and all Mungappie sites](image)

**Tula Types at all sites**
The range of tulas in the cache, from blanks to slugs, represents all stages of the reduction sequence; therefore the quantities of all tula types were compared with the Munagappie sites (Table 5.2). The cache has a total of 9 type \( G. \) tula blanks, whereas the combined assemblages of 1364 artefacts produced only 5 of the same type. Likewise with type \( C. \) semi-discoidal tulas: the cache had 43, the assemblages had 33. The Mungappie sites had 50 type A. tula slugs (Figure D.1) compared to 3 in the cache. The lack of tula
types in two of the Mungappie site are apparent, with Mungappie Creek North having no type F, and and Mungappie Swamp having no type G and both with no type B. Both Mungappie Creek and Mungappie Hut had the full range of tulas.

<table>
<thead>
<tr>
<th>Tula types</th>
<th>Cache</th>
<th>Mungappie Creek</th>
<th>Mungappie Creek North</th>
<th>Mungappie Hut</th>
<th>Mungappie Swamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Tula slugs</td>
<td>3</td>
<td>50</td>
<td>35</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>B. Part reduced</td>
<td>6</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>C. Semi discoidal</td>
<td>43</td>
<td>33</td>
<td>16</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>D. Asymmetric</td>
<td>6</td>
<td>39</td>
<td>19</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>E. Discoidal</td>
<td>2</td>
<td>26</td>
<td>14</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>F. Side trimmed</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>G. Blanks</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Totals</td>
<td>74</td>
<td>165</td>
<td>93</td>
<td>23</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 5.2 Comparison of tula type quantities between Lake Hanson Cache and the Mungappie sites.

Mungappie Creek and the Cache

A direct comparison between Lake Hanson cache and Mungappie Creek (the site that has all cache types) highlights one main criteria that differentiate these two assemblages: artefact types. Mungappie Creek had nearly twice the number of cache types as the cache (204/105); it did not, however, have quantities of types such as G. blanks and C. semi discoidal tulas and J. burin/engravers to match the cache, but had much higher amounts of flakes (35.2%) and tulas slugs (17.2%) than the cache (4.8% and 2.8%) (Table 5.3).

The other criteria which gives the cache its distinctive composition is its raw materials.
Table 5.3 Mungappie Creek and Lake Hanson cache - a comparison between materials and types.

<table>
<thead>
<tr>
<th>MC</th>
<th>Total</th>
<th>%</th>
<th>OC</th>
<th>TC</th>
<th>S</th>
<th>BJ</th>
<th>C</th>
<th>J</th>
<th>M</th>
<th>QU</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>35</td>
<td>17.2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>17</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>B.</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>C.</td>
<td>23</td>
<td>11.3</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>11</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D.</td>
<td>19</td>
<td>9.3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>11</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E.</td>
<td>14</td>
<td>6.9</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F.</td>
<td>10</td>
<td>5.1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G.</td>
<td>2</td>
<td>1.1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.</td>
<td>4</td>
<td>2.9</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.</td>
<td>11</td>
<td>5.4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J.</td>
<td>9</td>
<td>4.4</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K.</td>
<td>72</td>
<td>35.2</td>
<td>3</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>37</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L.</td>
<td>6</td>
<td>2.9</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>204</td>
<td>100</td>
<td>8</td>
<td>33</td>
<td>3</td>
<td>50</td>
<td>27</td>
<td>1</td>
<td>74</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>%</td>
<td>100</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>1</td>
<td>25</td>
<td>13</td>
<td>0</td>
<td>37</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5.3 Mungappie Creek and Lake Hanson cache - a comparison between materials and types.

5.4 Raw materials

The range of raw materials recorded at all the sites was:

- Oolitic chert
- Translucent chalcedony
- Silcrete
- Banded Jasper
- Chert
- Jasper
- Quartzite
- Mudstone
- Porcellanite

There was no porcellanite recorded at the Mungappie site, but there were some items in the cache from this material. The cache had no quartzite artefacts.

The Mungappie sites had high percentages of the common quartzite and silcrete materials found in the environment (58% and 15% respectively). The less easily obtained mudstone and jasper are present, but in lesser amounts
(0.15% and 6.1%, Figure 5.4). The antithesis of this is found in the Lake Hanson cache, which has no quartzite and very few silcrete artefacts, but has a very high percentage of oolitic chert (47%), and moderate amounts of translucent chalcedony (12.4%), banded chert (10.5%), and mudstone (7.6%). The only area of commonality is shared by chert (13%) and jasper (5.5%; Figure 5.4).

![Figure 5.4 Percentage comparison of material types at Lake Hanson cache and all Mungappie sites.](image)

Material distribution for each of the Mungappie sites shows similar patterning (Figure 5.5), except for higher quantities of silcrete and chert at Mungappie Creek North and Mungappie Swamp. The high percentage of quartzite at each site is apparent, with Mungappie Hut having the highest (76.3%) and Mungappie Swamp the lowest (29%). Quartzite at Mungappie Hut was used principally for *P. scrapers*, *W. microliths*, and *T. pirrie points* (32%, 17% and 5.6%). The only types not made from quartzite at any of the sites were *G. tula blanks* and *H. micro tulas* which were made from mainly cherts and
jaspers. All the Mungappie sites had a low incidence of oolitic chert and high incidence of quartzite.

Figure 5.5 Materials for each Mungappie site and Lake Hanson cache.

Raw Material colour
The colour of each artefact was recorded (appendix database sheets 8 and 3), but did not appear to have any significant correlations with raw material or artefact types. Further research into quarry sites in the area would be useful in determining the provenance of particular materials and colours. In brief, the most common material was a light grey quartzite (21.7%) which was used for 10.5% of all scrapers and 3.5% of pirrie points, followed by buff quartzite (7%) which was also used for 3.5% of scrapers and 2.7% of geometric microliths, and buff silcrete (3.8%) which made up 2.1% of scrapers, predominantly at Mungappie Creek. The cache had no quartzite and only 3 silcrete artefacts (Appendix database sheet 6).
Raw material composition of each toolkit type

Comparing the material make up of each toolkit type from A – L for each site with the cache shows that some material types which are used for a wide range of tool types in the cache are hardly used in any of the Mungappie sites (Figure 5.6). Banded Jasper, translucent chalcedony and oolitic chert combined are used for 11 out the 12 types at the cache, but these material are found in only small pockets at any of the other sites. The J. burin/engravers, composed of either banded jasper and translucent chalcedony, are not repeated at any of the sites including Mungappie Creek which has a reasonable number of the types. The large amounts of types C. G. and J. cannot be found at any of the other sites.
Figure 5.6 Raw material composition of each toolkit type from A - L at Lake Hanson Cache and all the Mungappie sites. Actual artefact numbers are compared.
5.5 Utility Units of tulas

The Utility Units of tulas is a measurement of the amount of potential utility that each tula type has. This is calculated by using the volume (length x width x thickness) of each artefact.

Hewitt’s cache of 105 artefacts was composed of 70% tulas, with seven different types being recorded. These types ranged from tula blanks, a flake that had been shaped to a classic tula format, but not trimmed or retouched for use (Andrefsky 1998:161), to tula slugs which were at the end of their usable life (Gould 1977:165; Holdaway 2004:255). This range of artefacts, from G. tula blanks to A. tula slug, also recorded in the Mungappie sites assemblages, represents the only full reduction sequence that can be compared between the sites and the cache. The tulas were given the same typology as the Hewitt types so that the two could be compared.

The volume of the tula blanks averaged at 22.34cc, with a range of 14.2cc to 35.42cc (Table 5.4). The tula slugs had a volumetric average of 5.34cc, with a range of 1.56cc to 13.57cc. By subtracting the average volume of the A. tula slug 5.34cc from the G. tula blank 22.34cc, 17cc becomes the average Utility Unit (UUs) for the overall life of a tula. Subtracting the average volumes of the other tula types from the slug volume gives a utility unit for each tula type. Utility Units in this context represent the amount of resharpening potential that a tool possesses, with larger volumed tools having more potential than smaller ones (Kuhn 1994:429).
Table 5.4 Volumetric averages of tula types from all Mungappie sites in cubic centimetres (cc).

<table>
<thead>
<tr>
<th>Tula Type</th>
<th>Average</th>
<th>Min</th>
<th>Max</th>
<th>Utility Units Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Slug</td>
<td>5.34</td>
<td>1.56</td>
<td>13.57</td>
<td>0</td>
</tr>
<tr>
<td>B. Part Reduced</td>
<td>21.55</td>
<td>8.4</td>
<td>32.48</td>
<td>16.21</td>
</tr>
<tr>
<td>C. Semi Discoidal</td>
<td>17.48</td>
<td>5.83</td>
<td>39.17</td>
<td>12.14</td>
</tr>
<tr>
<td>D. Asymmetric</td>
<td>20.97</td>
<td>4.22</td>
<td>126.63</td>
<td>15.63</td>
</tr>
<tr>
<td>E. Discoidal</td>
<td>15.31</td>
<td>5.25</td>
<td>81.9</td>
<td>9.97</td>
</tr>
<tr>
<td>F. Side Trimmed</td>
<td>11.06</td>
<td>6.55</td>
<td>17.96</td>
<td>5.72</td>
</tr>
<tr>
<td>G. Blank</td>
<td>22.34</td>
<td>14.2</td>
<td>35.42</td>
<td>17</td>
</tr>
</tbody>
</table>

Other tula types have a range of Utility Units (UUs) depending upon the amount of reduction they have already received, with type B. part reduced still having 16.21 UUs remaining whereas type F. side trimmed have only 5.72 units of utility left.

The comparative volumes of each of the tula types generated a reduction sequence that was calculated based on reducing volumes from G. tula blanks to A. tula slugs. The reduction sequence was: G. tula blanks, B. part reduced, D. asymmetric, C. semi discoidal, E. discoidal, F. side trimmed, to A. slugs (Figure 5.7). The expected sequence would have E. discoidal changing places with D. asymmetric. The inclusion of an uncharacteristically high volumed D at 126.63cc has skewed this expectation.

The amount of usable life, or Utility Units (UUs) in each artefact was calculated on volume and followed the volume reduction sequence. Tula slugs are assumed to have been discarded with zero UUs, therefore all other
tula types will have a UU of 5.34 less than their volume. These figures demonstrate that the tula blanks that were identified in the assemblages did have the largest volumes that could have been reduced into the various other tula types.

Figure 5.7 Volume and Utility Units of tulas at Mungappie sites.

The volume of each tula type is used to calculate its remaining Utility Units that follow the reduction sequence from G. blanks to A. slugs.
Figure 5.8. *Utility Units for All Mungappie site compared to individual Mungappie sites.*

*Total UU index for each site is displayed next to name.*
Utility Units of each Mungappie site.

The Utility Units of each site, other than Mungappie Swamp which did not have a complete A – G sequence, were calculated using the same formula for the combined sites of subtracting the average volume of *A. tula slugs* from the average volume of each tula type (Figure 5.8). The reduction sequences for these three sites varied significantly from the combined sites due, in part, to two sites each lacking a type.

Mungappie Swamp had no *G. tula blanks* or *B. part reduced*, making a complete reduction sequence impossible. Mungappie Hut had no *F. side trimmed*, but had the highest volume tulas with *E. discoidal* the highest. Mungappie Creek North had no *B. part reduced*. The variations in these graphs are representative of the average volume of all tula types at each site. Mungappie Hut has some large G. D. and E. tulas.

![Table 5.5 Numbers of tulas at each Mungappie site.](image)

The Utility Unit graphs in Figure 5.8 were generated from these numbers of tulas for each site (Table 5.5). Large numbers of all tulas do not necessarily represent high UUs; it is the number of high value UU artefacts that that generates the high UUs at a site. ie. slugs have zero UUs, therefore a high quantity of slugs at Mungappie Creek does not raise the overall UUs.
Mungappie Hut, which had the highest UUs of all the sites, also had the highest number of quartzite tulas (58.1%). All the high UU rating tulas from this site, without exception, were made from quartzite, which was not the case for the other sites. Quartzite frequency for the other sites are: Mungappie Creek had 32.6%, Munappie Creek north 50%, and Mungappie Swamp 29%.

**Utility Units of the cache.**

Calculations for the Lake Hanson cache UUs are a theoretical projection based solely upon tula type quantities which are known, and not upon the actual volumes of the tulas, which are unknown. The Lake Hanson cache tula percentages from A – G were compared to the Mungappie site tulas (Figure 5.9). The cache has peaks of *C. semi discoidal* and type *G. tula blanks*, which have medium to high UUs. The Mungappie sites have a peak of type *A. slugs*, which have zero UUs.

![Figure 5.9](image-url)  
*Figure 5.9 Percentage comparison of tula types at all Mungappie Sites and Lake Hanson cache.*
The percentages of tula types A – G, from both the combined Mungappie site assemblages and the cache assemblage, were used to calculate the overall UUs of each tula type, and then both tula assemblages. The percentage of each tula type from each assemblage was multiplied by the UUs index for each tula type to give the overall UU value for each type at each site. The formula is: (UU index) x (% of tulas) = overall UU for each type. The total UUs of all the types for the Mungappie sites was 910.1 whereas the total UUs for the Lake Hanson Cache was 1221.4, a difference of 311.3 indicating that the tula component of the Lake Hanson woodworking kit had 25.5% more use value than the tulas in the four Mungappie sites (Table 5.6).

<table>
<thead>
<tr>
<th>Type</th>
<th>Utility Units Index</th>
<th>Cache % of tulas</th>
<th>Mungappie % of tulas</th>
<th>Cache UU</th>
<th>Mungappie UU</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>15.79</td>
<td>12.2</td>
<td>3.1</td>
<td>192.6</td>
<td>48.9</td>
</tr>
<tr>
<td>B</td>
<td>16.21</td>
<td>8.1</td>
<td>4.27</td>
<td>131.301</td>
<td>69.2167</td>
</tr>
<tr>
<td>D</td>
<td>15.63</td>
<td>8.1</td>
<td>23.8</td>
<td>126.603</td>
<td>371.994</td>
</tr>
<tr>
<td>C</td>
<td>12.14</td>
<td>58.1</td>
<td>20.13</td>
<td>705.334</td>
<td>244.3782</td>
</tr>
<tr>
<td>E</td>
<td>9.97</td>
<td>2.7</td>
<td>15.86</td>
<td>26.919</td>
<td>158.1242</td>
</tr>
<tr>
<td>F</td>
<td>5.72</td>
<td>6.75</td>
<td>3.05</td>
<td>38.61</td>
<td>17.446</td>
</tr>
<tr>
<td>A</td>
<td>0</td>
<td>4.1</td>
<td>30.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>1221.405</td>
<td>910.1081</td>
</tr>
</tbody>
</table>

Table 5.6. Calculation of Utility Units by volume (cc) of tulas at Lake Hanson cache and Mungappie Sites.
Utility units for all sites
Looking at the UUs of each Mungappie site indicates distinct locational variations (Figure 5.11). Once again Mungappie Swamp is not included due to its lack of tula blanks, meaning that it would have an incomplete reduction range, and would therefore not have been comparable to the other sites. The total UUs are calculated for each site using the range and quantity of tulas at each site. The remaining three sites are compared with the Lake Hanson’s UUs as calculated in the previous section. In all of the sites the highest UUs are found in the D – E range. The expectation would be to find the highest rate in the G. blanks, but only Mungappie Creek North and the cache show high levels. The UU rates are an indication of the utility of each item, as well as the quantity of each types at each site. The high numbers of types D – E and low numbers of G at the Mungappie sites account for these anomalies.
Figure 5.11 The total Utility Units for each site type. Mungappie Swamp is not included due to an incomplete tula range.
5.6 Edge angles

The average edge angle for each artefact type was generated for all retouched artefacts.

Figure 5.12 indicates the average edge angle of each type at the time of discard. Average angles vary from a low 28° (chord) for geometric microliths to high 79° for handchoppers. Most artefacts had angles in the mid 60° range, which could be interpreted as either being an efficient working angle for most scraping and planing tasks (Wilmsen 1968:157), or that the working edge had been exhausted and was no longer useful. Others such as W. geometric microliths, V. knife blades, and T. pirrie points, had much lower angles of between 28° – 50°. Some anomalies, such as F. side trimmed tulas, suggest some other reason for a consistently lower angle.

Tulas have angle ranges from 35° to as high as 90° with the mode concentrating in the 60°-75° range. The micro tulas had a lower range from 45° - 85° but peaked a little higher at between 70 – 74°. All the scrapers had similar ranges but there were much higher concentrations of numbers in the middle range from 50° – 80°, maybe indicating a wider range of uses. The geometric microliths had mid range concentrations between 20° – 35°, but varied from as low as 10° to 65°.
Figure 5.12 Average edge angles for all artefacts at all Mungappie sites.

The range for type A. *tula slugs* was between $45^\circ$ – $90^\circ$, with the majority clustering between $60^\circ$ – $75^\circ$ (Figure 5.13). The lower angle would account for 49% of these types having retouched laterals. *C. semi discoidal tulas* had a lower range from 30 – 89°, but *E. asymmetric*'s range was reduced to 50 – 80°. The five *tula G.* blanks in the assemblages had three between 55 – 59°, with the highest at 90 – 95°.
Figure 5.13 Number of tulas types for each edge angle range from all Mungappie sites.

Figure 5.14 shows the edge angle of each tula type. These graphs support the expectation that more reduced types such as *A. slugs* would have higher edge angles than less reduced types such as *E. discoidal*. Variations to this expectation occurs at Mungappie Creek North having type *A.* with low edge angles, and *D. asymmetric* with relatively high readings.
Figure 5.14 Average edge angles of tulas from each Mungappie site. Only tula types represented at each site are graphed.
5.7 Cortex

The flakes that are the first struck from the outside of a core with cortex will have more cortex on the dorsal face than those struck later in the knapping sequence. Hewitt indicated the number of tula types with cortex in the Lake Hanson cache but did not record the amount of cortex on each artefact. Therefore the tula types with cortex at Lake Hanson and the Mungappie sites can only be quantitively compared.

Individual tula types at each Mungappie site and Lake Hanson cache were compared (Figure 5.15). The order of tula types from G – A was set using the UU reduction sequence G. B. D. C. E. F. A. so that cortex could be compared with tula UUs. All types in the cache, except for types A. slugs, and B. part reduced, were described by Hewitt as having cortex (Hewitt 1976:20). The Mungappie sites, despite having far fewer types with cortex, had some types with mid to high percentage rates such as D. asymmetric at Mungappie Swamp (24%) and Mungappie Hut (16%), resulting in Ds having the highest cortex rate for all sites (11%). The two blanks from Mungappie Hut both had cortex and 66.6% of types C. semi discoidal and D. asymmetric from Mungappie Swamp also recorded cortex. Type C. semi discoidal was the cache type with the highest cortex rate of 42%.

It was expected that there would be some correlation between reduction amounts and remaining cortex on tulas, with more reduced types like A. tula slugs having little or no remaining cortex and less reduced types such as G. blanks having more cortex. However, all of the Mungappie sites, except for Mungappie Creek North, recorded G. blanks with no cortex, and A. slugs with cortex. In this sense Mungappie Creek North follows the expectations to some degree, whereas the others did not. The larger percentage of artefacts with cortex from Lake Hanson cache supports the result that the cache also has tulas with higher UUs than the Mungappie site tulas.
Figure 5.15 Percentage of tula types from each Mungappie site with cortex. Sequence G - A is the same as UUs.
Table 5.7 shows all tula types from the Mungappie sites with percentage of cortex in 5% ordinals. The majority of tulas had cortex on between 5 – 20% of their surface, and most of those were C. D. and E., supporting the individual site graphs (Figure 5.17). Of the five type G. blanks, two had no cortex and one had 90%. Types C. and D. had the most artefacts with cortex.

5.8 Terminations

Most flakes in the Mungappie assemblages with retouch on the distal end had the termination chipped away. Those with no retouch on the distal end, such as K. flakes, N. points, P. scrapers and T. pirrie points, had terminations remaining which could be recorded. Feathered terminations represented 83% of all terminations, but were only 6.9% of all artefacts recorded from the Mungappie sites (Table 5.8). Of 150 T. pirrie points from all Mungappie sites 131 (87%) had feathered terminations. Hewitt did not record terminations of the Lake Hanson cache so no comparison can be made.
<table>
<thead>
<tr>
<th>Termination</th>
<th>Feather</th>
<th>Stepped</th>
<th>Hinged</th>
<th>Plunging</th>
<th>Totals</th>
<th>% of total</th>
<th>% of all sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Tula: slugs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Tula: part reduced</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Tula: semi discoidal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Tula: asymmetric</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td></td>
<td>1.5</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>E. Tula: discoidal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Tula: side trimmed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Tula: blank</td>
<td>1</td>
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<td>1</td>
<td></td>
<td>0.4</td>
<td>0.1</td>
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<tr>
<td>H. Micro adze/chisel</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td>0.7</td>
<td>0.2</td>
<td></td>
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<tr>
<td>I. Micro adze blank</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Burn/engraver</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td></td>
<td>1.5</td>
<td>0.3</td>
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<td>K. Nondescript flake</td>
<td>36</td>
<td>2</td>
<td>10</td>
<td>2</td>
<td>50</td>
<td>18.5</td>
<td>3.7</td>
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<tr>
<td>KP. Flake Piece</td>
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<td></td>
<td></td>
<td>1</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>L. Nondescript lump</td>
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</tr>
<tr>
<td>M. Burren</td>
<td>1</td>
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<td>1</td>
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<td></td>
</tr>
<tr>
<td>N. Points</td>
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<td>28</td>
<td></td>
<td>10.3</td>
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<td></td>
</tr>
<tr>
<td>O. Hammerstone/pounder</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>P. Scraper</td>
<td>15</td>
<td>4</td>
<td>7</td>
<td>14</td>
<td>40</td>
<td>14.8</td>
<td>2.9</td>
</tr>
<tr>
<td>PB. Bulbous Scraper</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>PD. Discoidal Scraper</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>PL. Long Scraper</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td></td>
<td>7</td>
<td>2.6</td>
<td>5</td>
</tr>
<tr>
<td>Q. Core</td>
<td></td>
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<td>R. Thumbnail discoidal</td>
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<td>1</td>
<td></td>
<td>2</td>
<td>0.7</td>
<td>0.2</td>
<td></td>
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<tr>
<td>S. Stone block</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>T. Pirrie points</td>
<td>131</td>
<td></td>
<td></td>
<td></td>
<td>131</td>
<td>48.3</td>
<td>87</td>
</tr>
<tr>
<td>U. Flake core</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. Cutting blade/knife</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W. Geometric/backed microliths</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>X. Hand chopper</td>
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<td></td>
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<td></td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>225</td>
<td>7</td>
<td>23</td>
<td>16</td>
<td>271</td>
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<td>19.868</td>
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<tr>
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<td>2.6</td>
<td>8.5</td>
<td>5.9</td>
<td>100</td>
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<td></td>
</tr>
</tbody>
</table>

Table 5.8 Terminations of all artefacts types from all Mungappie sites.

5.9 Breakages

Breakages from the Mungappie sites totaled 6% of all artefacts, of which 70.7% (58 artefacts) were scrapers. Fifty seven of the broken scrapers were distal ends which still displayed retouch. The majority of proximal breaks (7 out of 8) were recorded as flakes as they displayed no retouch. Many scraper breaks displayed similarities in length (4.5 cm average) and break angle (45 - 60%) that could have been deliberate; in some cases the breaks were retouched into fine points (Figure 5.16). Hewitt’s collecting strategy, to look for recognisable artefact types (letter to SA museum 1969), suggests that his intention was not to collect broken artefacts, resulting in the low incidence of
breakages in the assemblages. Those he did collect would have looked like complete artefacts.

Figure 5.16 Artefact #1060. Distal end break with point. J. Hayward.

5.10 Retouch location

Nearly 76% (1033) of all artefacts from all Mungappie sites had retouch that could be allocated a code. The 206 type W. geometric microliths were not given retouch location codes due to the proximal and distal being chipped off. Of those 1033, C. distal retouch accounted for 43% and L. left + right laterals + distal retouch for 14% (Table 5.9).
Table 5.9 Retouch locations for all artefacts with retouch at all Mungappie sites

A complete chart of all retouch locations for all artefacts is in appendix metrics sheet 10. Because of the morphological similarities, and occasional confusion between tulas and scrapers, and points and pirrie points, a comparison was made correlating edge angles and retouch location between these types from the Mungappie sites. The pattern of retouch location in relation to the average edge angles was similar for both tulas and scrapers (Figure 5.17). The same comparison for pirrie points and points indicated a marked pattern difference in retouch location (Figure 5.219).

The percentages of each artefact type for each retouch location were calculated (Figure 5.18 and 5.20). Scrapers had a larger number of type C retouch whereas tulas had a larger percentage of type L retouch. Pirrie points had over 30% of type I and M – which were also some of the lowest edge angle measurements – whereas points had a larger range of type B, D, and I retouch locations.
Figure 5.17 Comparison between scrapers and tulas - edge angles to retouch location.

Figure 5.18 Percentage amounts of scrapers and tulas for each retouch location.
Figure 5.19 Comparison between pirrie points and points - edge angles to retouch location.

Figure 5.20. Percentage amounts of pirrie points and points for each retouch location.
5.11 Retouch types

Of all the artefacts collected by Hewitt from the Mungappie Creek sites, 90% had some kind of retouch (Table 5.10) The remaining 10% was accounted for with types such as hammerstones, grindstones and some nondescript flakes. Just over 41% of these flakes had had some sort of minimal retouch and 69% of these was type C. distal retouch. Chipping was the most common type (53.8%) of retouch recorded for the whole site. W. geometric backed microliths accounted for 99% of all backing, and T. pirrie points had received 90% of all pressure flaking. A combination of crushing and chipping, indicating both use-wear and resharpening was found on 43% of tula slugs, and 15% of scrapers.

<table>
<thead>
<tr>
<th>RETOUCH TYPE</th>
<th>CH</th>
<th>CR</th>
<th>SR</th>
<th>PR</th>
<th>BA</th>
<th>CR/CH</th>
<th>CH/PR</th>
<th>BA/CH</th>
<th>PR/CR</th>
<th>SR/CH</th>
<th>totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Tula: slugs</td>
<td>21</td>
<td>7</td>
<td></td>
<td>21</td>
<td>21</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td>49</td>
</tr>
<tr>
<td>B. Tula: part reduced</td>
<td>2</td>
<td>5</td>
<td></td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>C. Tula: semi discoidal</td>
<td>20</td>
<td>1</td>
<td>12</td>
<td>33</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Tula: asymmetric</td>
<td>30</td>
<td>7</td>
<td>1</td>
<td>38</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Tula: discoidal.</td>
<td>25</td>
<td>1</td>
<td></td>
<td>26</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>F. Tula: side trimmed</td>
<td>5</td>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. Tula: blank</td>
<td>2</td>
<td></td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>H. Micro adze/chisel</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I. Micro adze blank</td>
<td>11</td>
<td>1</td>
<td>4</td>
<td>19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J. Burin/engraver</td>
<td>9</td>
<td></td>
<td>2</td>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K. Nondescript flake</td>
<td>27</td>
<td>1</td>
<td>4</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>KP. Flake Piece</td>
<td>5</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>L. Nondescript lump</td>
<td>4</td>
<td></td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M. Burren</td>
<td>7</td>
<td></td>
<td>2</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N. Points</td>
<td>25</td>
<td>2</td>
<td>2</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. Scraper</td>
<td>286</td>
<td>3</td>
<td>2</td>
<td>361</td>
<td>54</td>
<td>9</td>
<td>1</td>
<td>4</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>PB. Bulbous Scraper</td>
<td>40</td>
<td>1</td>
<td></td>
<td>48</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD. Discoidal Scraper</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PL. Long Scraper</td>
<td>108</td>
<td>6</td>
<td>1</td>
<td>129</td>
<td>13</td>
<td>1</td>
<td></td>
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<tr>
<td>R. Thumbnai discoidal</td>
<td>15</td>
<td></td>
<td>3</td>
<td>21</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>T. Pirrie points</td>
<td>70</td>
<td>1</td>
<td>27</td>
<td>147</td>
<td>4</td>
<td>41</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>U. Flake core</td>
<td>3</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V. Cutting blade/knife</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>W. Geometric/backed microliths</td>
<td>206</td>
<td></td>
<td>206</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X. Hand chopper</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td>734</td>
<td>24</td>
<td>7</td>
<td>1231</td>
<td>30</td>
<td>207</td>
<td>150</td>
<td>64</td>
<td>2</td>
<td>11</td>
<td>100.0</td>
</tr>
<tr>
<td>Percentage of recorded</td>
<td>59.6</td>
<td>1.9</td>
<td>0.6</td>
<td>16.8</td>
<td>12.2</td>
<td>5.2</td>
<td>0.2</td>
<td>0.2</td>
<td>0.9</td>
<td>0.9</td>
<td>100.0</td>
</tr>
<tr>
<td>Percentage of total (1364)</td>
<td>53.8</td>
<td>1.8</td>
<td>0.5</td>
<td>15.2</td>
<td>11.0</td>
<td>4.7</td>
<td>0.1</td>
<td>0.1</td>
<td>0.8</td>
<td>0.2</td>
<td>90.2</td>
</tr>
</tbody>
</table>


Table 5.10 Retouch types for all retouched artefacts from all Mungappie sites.
5.12 Conclusion

Comparisons between the four Mungappie sites of all the artefact types indicated similar patterns of assemblage composition, with some variation due to either sample numbers, collector’s bias, or an actual difference of site use. Inter-site comparisons, such as cortex distribution and Utility Unit dispersal, revealed some data that could be significant to determining site use. Mungappie Hut in particular has a number of features such as highest UUs for tulas of all sites including the Lake Hanson cache, highest volume for cores, and the highest percentage of quartzite artefacts.

The use of Utility Unit calculations to identify potential utility in tulas can be used as an indication of toolkit signatures in assemblages. The high UUs at Mungappie Hut, for example, correlates with the average artefact and core size, suggesting that this site could be a source of high utility quartzite tools.

Comparing the Lake Hanson cache with the Mungappie sites highlights significant differences between the assemblage structures (Table 5.11). The typological and material makeup of the cache is distinctive in its use of less common materials such as oolitic chert and banded jaspers, and in its range of tula types that show little retouch and the high percentage of engraver type tools. The UUs of the cache are higher than the average UUs for all the Mungappie sites, but not higher than Mungappie Hut as an individual site.

Comparisons of other artefact attributes such as breakage and retouch location has produced results that can be used for technological analysis within the Mungappie sites, but are not comparable with the Lake Hanson cache as Hewitt did not include these types of analyses in his reports. The number of artefacts with breakages at the sites are low suggesting that Hewitt did not generally collect incomplete items. Comparisons of retouch location and edge angles of types with similar morphologies demonstrated that tulas and scrapers share similar edge angle ranges but differing retouch locations, whereas pirrie points and points had a less compatibility between the two.
<table>
<thead>
<tr>
<th>Item</th>
<th>Lake Hanson cache</th>
<th>Mungappie sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw Materials</td>
<td>Principally oolitic chert, banded jasper, and translucent chalcedony.</td>
<td>Mainly quartzite and silcrete</td>
</tr>
<tr>
<td>Artefact Types</td>
<td>105 artefacts in all. Types range from A - L. 74% tulas. 13% engravers.</td>
<td>1364 artefact at 4 sites. Types range from A - X. 14.5% tulas 1% engravers.</td>
</tr>
<tr>
<td></td>
<td>Woodworking typologies.</td>
<td>Mainly woodworking types but other types too.</td>
</tr>
<tr>
<td>Toolkit types</td>
<td>More blanks and curated types. Larger quantity of high UU types.</td>
<td>More discard and expedient types. Lower UUs for all sites. High UUs for Mungappie Hut</td>
</tr>
<tr>
<td>Cortex</td>
<td>Higher percentage of tulas with cortex - particularly G. and C. Oolitic chert, banded jasper, and translucent chalcedony all have low cortex rates.</td>
<td>Lower cortex rates caused by either more retouch and more use, or different material. Quartzite and silcrete have highest cortex rates. Types C - E have highest cortex rating.</td>
</tr>
<tr>
<td>Edge angles</td>
<td>Not recorded</td>
<td>Type A slugs have generally higher edge angles than Type E. discoidal. Mungapple Creek north has low angles for slugs but high angles for D. asymmetric. Mungappie Hut has the lowest edge angles for type E.</td>
</tr>
</tbody>
</table>

Table 5.11 Summary of differences between Lake Hanson cache and the Mungappie sites.
6. Discussion

6.1 Introduction

The results in the previous chapter provide detailed information about the physical characteristics of the artefacts at the four Mungappie sites. Comparisons between these sites demonstrate compositional differences which may relate to their past function. The differences between the Mungappie sites and the Lake Hanson cache are highlighted in the combination of artefact types and materials that constitute the cache; and the amount of usability (Utility Units) that differentiates the cache tulas from the Mungappie tulas.

6.2 Site comparisons

The Mungappie sites lithics

An abundance of microliths in the lithic assemblages, which were prevalent from about 3500 BP to 1500 BP, indicates the possible antiquity of the sites (Boot 1993: 11; Robertson et al 2009:296). Hewitt attributes the abundance of lithic material found in such places to higher populations that flourished during a moister climate (Hossfeld 1966:87), and the possibility of artefacts being hidden due to sand dune movement during periods of vacation and then being exposed again in later times (Hewitt 1978:19). The full extent of the density of lithic material has only become apparent in more recent historical times by the action of strong winds that have blown the sand that once covered the sites several kilometers away onto the surrounding areas of drifting dunes (Hewitt pers. comm. 2010).

Raw material

Quartzite was dominant in the Mungappie assemblages (57.2%), while oolitic chert was rare (3.2%). The cache had 47% oolitic chert and no quartzite: the complete antithesis of the sites. The provenance of oolitic chert was not precisely known to Hewitt. It is not a common material in other assemblages.
in the area, as Hewitt had recorded other campsites around Lake Hart which had only 2 oolitic chert out of 117 artefacts (1.7%) (Hewitt 1976:31). Hewitt asked the South Australian Museum to identify the material, and they reported a source in the Flinders Ranges, some 250 kms directly to the east. Another possible source could be near Mt Harvey or Mt Toondina, north of Coober Pedy, about 330 kms north of Lake Hanson, where small quantities of this unusual form of silica has been observed (Smale 1973:1084). A more local source would not account for the rarity of the material in other assemblages, unless it was reserved for culturally specific use (Taçon 1991).

If the raw material had been brought in from a distance to be made into implements for a special purpose, possibly by one person, there would have been a time and effort cost that added value to the cache as a trading stockpile, or toolkit for specialisation.

The more common material of the Mungappie sites, quartzite, is found in gibber form across most of the Arcoona Plateau, but also occurs as boulder outcrops in a number of locations, including Mungappie Hut (Hewitt 1978:15).

Each Mungappie site
The difference in the artefactual composition of each site assemblage could be the result of differing site specialisations, similar to Binford's Mousterian factors. It could also be a result of Hewitt’s collecting methods, other taphonomic interventions, or the different sample sizes which range from 866 at Mungappie Creek to 59 at Mungappie Swamp.

Mungappie Creek
The Mungappie Creek assemblage was the only one of the four Mungappie sites that contained the complete range of toolkit types from A – L, replicating the cache. It was also the only site to have banded jasper and oolitic chert cores. For these two reasons Mungappie Creek would appear to be the most obvious place to look for replica cache toolkits, other than the fact that it also has the lowest UU rate of all the sites. This tends to suggest that this site, despite having a full complement of toolkit types, has the highest rate of discarded toolkit types. Despite having the rare core types it did not have as
many other implements of the same rare materials, suggesting that they were either not collected by Hewitt or removed from the site some time before.

**Mungappie Creek North**

Mungappie Creek North had one characteristic to directly compare to the cache. Its cortex distribution (quite different to the other Mungappie sites) was the one most like the cache, with blanks having a high cortex rate, and slugs with none. It also had a UU index that most closely followed the combined Mungappie sites index, other than not having any type \textit{B. part reduced tulas}. Having a similar, but slightly higher, site UU rating as Mungappie Creek would put it in the same category as being a site that may have more depleted implements than usable ones.

**Mungappie Hut**

This site had the largest cores made from quartzite and silcrete; the largest tulas in the types C, D and E; the largest tula blank (chert); and was the site with the highest UUs, albeit the most erratic. The combination of these features, along with the site being close to a quartzite outcrop, suggests that it could have been the place closest to the quarry where raw material was procured and knapped into blanks. It is for these reasons that this site is the one of all the Mungappie sites to have the highest potential of providing artefacts that could be formed into a functional toolkit.

**Mungappie Swamp**

The lack of tula blanks at Mungappie Swamp meant this it was impossible to do a complete UU index for its artefacts that could be compared with the other sites. The absence of a number of other types from Mungappie Swamp, which were abundant at other sites, needs explanation. These types are \textit{B. part-reduced tulas}, \textit{T. pirrie points}, \textit{N. points}, \textit{J. burin/engravers} and \textit{K. unretouched flakes}. It did, however, have the highest percentage of \textit{A. tula slugs} and \textit{R. thumbnail discoidals} of all the sites, and a high proportion of all scraper types and cores. Types such as pirrie points and tulas would have been high on Hewitt’s list of collectable items, suggesting that they were quite possibly not there. Even nondescript flakes would have been collectable at this small site, as their abundance at other assemblages testifies. Their
absence from the site suggests that this was not a knapping site (Cane 1984:198), but a place where finished artefacts were brought in, or taken away, for a particular reason.

Each site has its own unique characteristics, suggesting that different activities were occurring at each place. Sites like Mungappie Hut with high UUs will be more likely to have useable toolkit types than Mungappie Swamp. The total UU rate for all tulas at Mungappie Hut, being much higher than Lake Hanson cache, suggests that not having a full sequence of tula types does not necessarily equate to not having a toolkit. These types, though, would make a quite different toolkit to the one in the cache. Mungappie Creek, whilst having all toolkit types available, has a lowest UU index of all the sites indicating the usability of the toolkit types may not be satisfactory.

Lake Hanson cache seems to be a particular type of toolkit designed to fulfill a specific task. The Mungappie sites may not have had all the requirements to replicate the cache but could have supplied some high UU tools from some sites, in particular Mungappie Hut.

6.3 Lake Hanson cache

The distinctive structure of the cache such as the different use of raw materials for particular tool types and the high percentage of blanks and other high utility tools, becomes clear in comparison with the Mungappie sites. Hewitt thought the cache was the work of one crafts-person, due to the homogeneity of the material, and the same amount of minimal reduction on most of the implements (Hewitt 1976:33). It is an assemblage with personal attributes, as opposed to the main Mungappie assemblages which are a result of communal activities. Tools made by one person from rare materials and cached in a remote location are all attributes of a personal toolkit not found in general sites.
The high percentage of type *J. burin/engravers* are of interest in the cache. They have been ethnographically recorded as being specifically used for engraving sacred ceremonial hardwood boards in the Western Desert (Hayden 1979:168; Cane 1984:236). The fact that the cache has a large component of these types made from particular raw materials could indicate that its use was for cultural and ceremonial purposes. The symbolic use of particular stone types has been noted by some researchers (Hayden 1977183; Taçon 1991). Engraving of cultural motifs on wooden artefacts is an important aspect of cultural transmission (Shennan 2003), and the craftsperson needs appropriate tools made from culturally appropriate materials to achieve this.

The Utility Unit calculations from the Mungappie sites support the idea that the cache contains tula types of high utility. The high percentages of tula types and engraver type tools also supports Hewitt’s claim for it being a function specific woodworking kit. This combination of high utility, function specificity, and caching suggest this assemblage was systemic rather than discarded; it was still in use, or had potential use.

**Caching**

Caching in archaeology can represent a range of behaviours, from ritual, dedicatory or votive deposits, to banking or insurance caching (Schiffer 1987:79). The former type of caching has symbolic meaning, and the latter a more functional purpose. Banking refers to the hiding of objects with some value (monetary or functional) for safekeeping, and future use (Schiffer 1987:79). The reason they become part of the archaeological record could be due to the hoarder forgetting the location, or being prevented from return to the cache. Binford’s (1976) description of Nunamiut Eskimos leaving multiple insurance caches in strategic locations around the territory for emergency use might also account for some caches being forgotten or lost.

Hiscock’s (1988:67; 1989:38) definition of caching as ‘the underground and concealed storage of objects’, ruling out grave burials and most artefacts
found in stratigraphic excavations unless they show signs of concealment, differentiates caches from discard. Discard assumes that the item will no longer be needed, whereas the association with caching is that the items will be recovered and presumably re-used (Hurst 2006:102). Although Hiscock’s definition limits the number of caches claimed to be found in Australia to quite a low number, Hewitt’s claim for the Lake Hanson cache does appear to be legitimate (Hiscock 1998:68).

Cache finds in the Southern Plains of North America, on the other hand, have been documented at over 100 in 2006 (Hurst 2004:101). Most of these were uncovered in isolated contexts, with the minority being discovered within campsites (Hurst 2004:101). If caching is a concealing behaviour, then it would be logical to conceal a cache in a place where other people are not expected to go. Hewitt’s cache was found approximately 50 metres away from the main Lake Hanson campsites (Hewitt 1976:16), whereas Hiscock’s Mucklandama Creek 6 cache seemed to be found within a surface artefact scatter (Hiscock 1988:61). Hiscock had the benefit of being able to directly compare measurements of cache and surface tulas, with the result being that the cache items have larger dimensions than those from surface scatters (Hiscock 1988:65), indicating higher volume and utility values (Kuhn 1994). The loss, or abandonment, of cached artefacts that represent toolkits is not commonly reported, but the notion that specialised tools can be cached for safekeeping at frequently visited workshop sites is not unheard of (Baker 1975; Schiffer 1987:93; Barkai et al 2002:673; Odess and Radic 2007:691).

### 6.4 Artefact attribute analyses

**Cortex**

Hewitt (1976:31) thought that the reason for the high percentage of cortex on the cached tulas was due to the raw material occurring in small nodules. It is also a characteristic of blanks, or less reduced artefacts, to have more cortex than highly reduced or discarded artefacts (Andrefsky 1998:181). The cortex analysis (Fig 26), which indicates the quantity of tulas with cortex at all assemblages, confirms that significantly more cached stones had cortex on
some part of their surface than their counterparts at the Mungappie sites. The fact that the dominating cache materials are different from the Mungappie sites suggests that the difference in cortex could also be related to the difference in material types and their sources. Quartzite artefacts at Mungappie Creek with cortex accounts for 57.4% of all material with cortex, whereas oolitic chert is 4.2%. Cortex signatures for each material indicate that quartzite had a much higher occurrence rate than oolitic chert, translucent chalcedony, and banded jasper on all Mungappie artefacts. This being the case, one would expect there to be a higher cortex rate at the Mungappie sites, not less, suggesting that the artefacts at the Mungappie sites were, in general, more reduced than the cache.

### Edge angles

The average edge angles of the tula types measured at the Mungappie sites were generally in a narrow range of 65° – 71° except F. side trimmed tulas, at 58°. The mean edge angle for all scrapers from all Mungappie sites is 65° (range 23 – 90°) and for tulas is similar at 66° (range 29° – 90°). These results imply that these two types might have had similar applications, as edge angle variants can suggest particular use, but may also be indicative of the most efficient angle for prolonged use life (Collins 2008:2168). *Side trimmed* tulas at Mungappie could have been developed for different woodworking techniques that required a sharper, lower angle.

The site with the highest toolkit supply potential, Mungappie Hut, had larger tulas such as type *E. discoidal* with higher edge angles suggesting that they were less reduced (Figure 5.14). Consequently, this site also had tula type *A. slugs* with higher angles, which correlates with higher reduction. This was the model site; others like Mungappie Creek North had opposing trends with type *A* having lower angles than any of its larger less reduced counterparts. One explanation for this could be that the high angled types *D* and *C* were more reduced at discard, and the lesser angled *A. slugs* had been recycled into finer graving tools prior to discard.
Retouch Location

One result that can be extrapolated from the tula/scaper edge angle to retouch analysis graph (Figure 5.18) is that there was a strong correlation between the two types over most retouch locations other than A. proximal and K. Proximal and Left Lateral and Distal. These retouch locations, including M. Right Lateral and Proximal and Left Lateral, and N. Proximal and Right Lateral and Distal which did not rate, were either sole proximal retouch or combination proximal retouch locations, indicating that not many tulas had proximal retouch, whereas scrapers did. This could be an important distinction between the two types which are sometimes difficult to distinguish.

6.5 Conclusion

The attributes of the Lake Hanson cache and the Mungappie sites, either as a group or as individual sites, are quite divergent. The choice of raw materials that the maker of the Lake Hanson cache used indicates a special toolkit that possibly had a significant use. It is a systemic assemblage and therefore will not be found in surface scatters like the Mungappie sites. This is confirmed by the difference in artefact types, numbers and materials at all Mungappie sites compared to the cache.

Mungappie Creek, the one site that had the artefact range to provide all the toolkit types, also had the lowest utility units of all the sites, indicating a more used or depleted range of tool types. Mungappie Hut, on the other hand, had Utility Units higher than any other site, including the cache, and therefore is the one Mungappie site with the potential to provide a range of tulas with high UUs that could become a working toolkit. This is supported by a range of edge angles in some tula types, which suggest less reduction, and therefore more potential utility.
Bordes’ insight into the way that variation within Mousterian facies in France could be visualised through distribution analyses stimulated debate about assemblage variation amongst archaeologists in North America. Howell (1966) speculated on the variation amongst Acheulian assemblages in Northern Europe and Freeman discarded the possibility that variation represented differences in industrial and cultural evolution, and speculated that they therefore signified different activities (Freeman 1966:232). It was Binford’s (1966) re-evaluation of Bordes’ Mousterian lithic assemblages, using computer technology and multivariate statistics, that launched a controversial theory that has since become standard archaeological thinking. Now, both typological and technological approaches to lithic analysis use toolkits to categorise and explain assemblages. Prehistoric peoples from all over the world, from northern Alaska (Binford 1977) to northern Belgium (Cahen et al. 1979) and from the Oldawan tradition of Africa (Clark 1992:201) to the central deserts of Australia (McCarty 1976:19), have been postulated to use toolkits. Extensive analysis of prehistoric lithic toolkits (Cahen et al 1979; Grace 1989; Kuhn 1994; Odess and Rasic 2007; Banks 2009) supports use of the concept as a global approach for describing aspects of risk management (Torrence 1983; Myer 1989; Hiscock 1994), mobility (Kuhn 1994), curation (Shott 2009), and even functionality in prehistoric stone tool assemblages (Banks 2009).

Archaeologists have predominantly used toolkit as a generalised term that can quite often refer to an entire range of technologies available to a culture, ie. the Tasmanian toolkit, a Mousteroid toolkits, or the Aboriginal toolkit (Jones 1977:202; Bordes 1977:37 Cane 1984:276). This generalisation of the term has overridden the original idea of a toolkit being a personal collection of ‘tools of the trade’ and as a result there has been very little specific analysis of prehistoric toolkits at the personal or functional level. There are three reasons why this might be the case: the difficulty of finding toolkits that fit the definition of personal in lithic assemblages, mainly as a result of there
being few personal traits that can be attributed to stone tools when they are analysed statistically; another is that stone tools can be multifunctional; and lastly, personal toolkits fit into a systemic rather than an archaeological context, meaning that toolkits were useable entities that had not yet been discarded. Sites that display Pompeiian-type assemblages will have systemic toolkits (Schiffer 1985). The few lithic assemblages that have been identified as personal toolkits have tended to be discrete entities that have been cached or stored away for future use (Baker 1975; Schiffer 1987:93; Hurst 2004; Odess and Radic 2007:691).

The Lake Hanson cache was buried and stacked at the top of a wind-swept sand dune, away from the campsites, for a particular purpose. The predominance of two rare material types, and uniform retouch, indicates that it was possibly made at the same time, by the same person (Hewitt 1976:48). It represents a systemic assemblage, and was a function-specific collection of tools which could have been stored for future use or for trading. It was distinctly different from the general lithic assemblages in a number of ways, as the results of the assemblage analyses have shown.

The generalised approach would be to describe each Mungappie site assemblage as a different toolkit. In this sense each assemblage is the toolkit, and the variations they display can reflect different activities or behaviours over time. The “assemblage as toolkit” approach can account for big picture theories, but does not necessarily address individual behaviour. Interpreting the Lake Hanson cache as a personal toolkit can offer insights into both the individual and the culture. It can also be used a measure of toolkit structures in other assemblages.

The analysis undertaken in this project has looked at four lithic scatter assemblages within ten kilometres of each other, each with different attributes, and characteristics. Comparing these sites with the cache has raised issues about the nature of toolkit structures in lithic assemblages. The combination of specific tool types with a high utility rating made from special materials represents a unique entity. When looking for this entity in the
Mungappie assemblages it was found that none of the sites could replicate the entity as a whole, on both typological and raw material criteria. Mungappie Creek could provide all the types but in limited numbers, and could not match the material types. Mungappie Hut, whilst not having a full range to match the cache, did have high Utility Units that suggest a high probability of toolkit type components being there. They will not be cache like in their material composition but they will have potential usability.

The use of Utility Units to measure the potential utility of an artefact is a method that can identify toolkit signatures in an assemblage. Signs of high utility in a range of tools could suggest a functional toolkit, and low utility signatures will indicate a higher rate of depletion. Depleted tools are the remains of toolkits. Evidence of artefacts at the early stages in the reduction sequence will be a sign of tools being renewed, and therefore of toolkit replacement. Tool replacement indicates a toolkit maintenance programme that is the signature of preparedness, and the ability to ameliorate risk. In this respect the Lake Hanson cache is the model of a highly maintained toolkit as it has a full range of tula types, from blanks to slugs. The antithesis is a site like Mungappie Swamp, with a stockpile of tula slugs and few other tula types, which does not indicate toolkit renewal.

Lewis and Sally Binford’s initial observation, when they began their investigation of lithic toolkits, was that there are no set ‘types’ of toolkits. “These subunits of artefacts vary independently of one another and may be combined in numerous ways” (Binford and Binford 1966:292). This suggests that a toolkit cannot be recognised by the individual artefacts of which it is composed. There has to be something about the combination of the individuals that, when grouped into subunits, forms this elusive entity. The applicability of this to Australian lithic archaeology lies in the ability to analyse assemblages with a conceptual framework that allows for the type of flexibility that has been attributed to Indigenous tool use.

The scarcity of caches which can be interpreted as toolkits in Australian archaeology compared to other continents such as North America can be explained by the nature of the landscape and its current usage. Many of the
places where cached entities of tools have been discovered in America have been in developed or agricultural landscapes where the sites have been unearthed by heavy digging or ploughing (Mallouf 1982:79; Rogers 1985:116; Wyckoff 1996:289; Hucknell et al 2011:965). These cache sites have usually been away from known archaeological occupation sites (Hurst 2004:101), reinforcing the notion that caching is an activity that is carried out in places where the cache will not be found easily. The arid nature of much of the Australian landscape has not been conducive to such development. Australian archaeology tends to focus on occupation and workshop sites; places where toolkits will not be found (Simek 1984:3). The paucity of toolkit type entities in Australian archaeology could be that they have either not been found, or have not been recognised. Other reasons could be that they are very rare cultural items, or do not exist. The latter is supported by the lack of ethnographic recordings of toolkits in Australian Aboriginal culture, other than the mobile type hunting maintenance toolkits as demonstrated by Balfour; and references to these are scarce too. The added problem of surface scatters, which are common archaeological sites in Australia, is that they were deposited over long periods of time and the possibility of being able to identify discrete entities such as toolkits belonging to one individual at one time, is all but impossible. The conclusions are that; complete entities which can be classified under traditional and common definitions of a toolkit will not be found in discard lithic assemblages; cached items are more likely to include artefact types with high utility, and therefore possibly be a toolkit, or items for toolkit replacement; and the use of the term toolkit to describe a complete range of artefact types in an assemblage is inaccurate and misleading.

There are also broader conceptual implications of this research project, which was initially inspired by the desire to enquire into what seemed a rather inadequate and inaccurate use of the toolkit concept by archaeologists. Having found that there are advantages in conceptualising the toolkit as a specific set of tools for personal or trade use, I suggest that archaeologists should strive to tighten the use of this term. Some of the benefits of such a tighter concept for Australian archaeology include: a more sophisticated
understanding of the ways in which Indigenous cultures used technologies and resources in their everyday life; understanding that sites with differing functions such as quarries, workshops, storage places etc. have different assemblages which reflect these variations, but do not necessarily contain toolkits; and, how we as archaeologist can identify these variations without deferring to heuristic devices and generic terms such as ‘toolkit’ without more in depth analysis.
References


