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Assemblage variability in the Willandra Lakes

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Abstract

An examination of existing typological descriptions of the stone artefact assemblages from the Willandra Lakes facilitates the development of basic models about assemblage variability in the region. After defining some of the limitations of the data set we illustrate well-defined spatial patterns in assemblage composition and hypothesise that they reflect a strategy of provisioning the lunette landscape with stone artefacts that were robust and with a comparatively high potential for further use/reduction. These conclusions undermine the notion of the 'Core tool and scraper tradition' as an appropriate depiction of assemblage composition and variability in the Willandra Lakes region.

Archaeological investigations in the Willandra Lakes region have inspired many interpretations of Australian prehistory. In particular, studies of the artefact assemblages in this region underpin a number of key models about Pleistocene lifeways that were proposed in the 1960's and 1970's. The assemblages from Lake Mungo seemed to offer proof that large, robust artefacts were old, something that had eluded similar claims by Tindale for the Kartan. It was the descriptions of artefacts at the Willandra Lakes that promoted notions of the Pleistocene tool-kit as large and robust, and it was in that context that the Rhys Jones and Harry Allen constructed the model of the 'Australian core tool and scraper tradition' (Bowler et al 1970). Furthermore the perceived lack of major variation in these assemblages reinforced an idea of homogeneity in Pleistocene assemblages, and of regional continuity throughout the late Pleistocene-Holocene in the Willandra district (see Allen 1998:207). These ideas have been extremely influential in the construction of ideas about Australian prehistory, but have recently been the subject of critical re-evaluation by the original researchers (Allen 1998; Shawcross 1998). These reconsiderations have not merely offered images based on more sophisticated theoretical and methodological understandings, but have highlighted the limitations of the data collected in those pioneering days of Australian 'desert' archaeology, and have challenged many of the conclusions thought to be well established. In terms of an understanding of the spatial distribution of stone artefacts Shawcross (1998) has highlighted the importance of studying taphonomic processes and Allen (1998) has signalled the imperative of more detailed spatial records, perhaps in the ways demonstrated by Holdaway et al (1998). In terms of assemblage composition both authors have stressed the need to explore and understand variability within Pleistocene assemblages, with Allen (1998:210–211, 216–217) emphasising the relevance of sampling and distance to source as factors in need of consideration in the Willandra region (Allen 1998:209–211; Shawcross 1998:198).

Of course such approaches to assemblage variability are probably best pursued with observations collected through dedicated fieldwork and recorded using a technological rather than typological perspective. This does not, however, mean that we cannot usefully reflect upon assemblage variability in the Willandra Lakes using existing typological information. Indeed, it is our purpose here to produce a discussion of artefact assemblages in the Willandra region using available information, in such a way that might raise the awareness of the need for dedicated technological studies of the subject. The analysis presented below explores data collected by Harry Allen (1972) in his 1969–1972 survey (Figure 1). These data he collected and with which we deal in this article consists primarily of counts of various typological categories of stone artefacts and is reproduced here in Table 1. Definitions of all artefact classes, including the division of some retouched flakes and cores into a number of implement types, remain as originally defined by Allen (1972). While the interpretation of traditional Australian typologies is greatly complicated by the ambiguity of categories and their inconsistent relationship to manufacturing processes, our approach in this paper is to focus on the structure of assemblage variation rather than to interpret individual types. This approach has allowed us to develop general statements about assemblage variation, while avoiding at least some of the complications of the implement typology. Hence, while we acknowledge the difficulty of developing broad models of landscape use and technology on the basis of typological information from a small number of assemblages, we take a positive view of this endeavour because it results not only in basic models of prehistoric behaviour but also helps define the limits of the existing database.

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	Gn1(AandB)	Backshore Gn1C (Area 1)	MBs1	WC1	Lunette M1	MLA	MLB
Total stone artefacts	**2383**	**818**	**1495**	**872**	**270**	**100**	**32**
Implements	269	85	147	116	115	32	13
Broken Implements	45	6	30	17	6	3	0
Unmodified cores	172	44	45	78	16	6	8
Unmodified flakes	1800	676	1211	637	106	56	9
Rejuvenation flakes	44	5	45	17	26	2	0
Hammerstones	29	1	7	0	3	0	2
Grindstones	26	1	7	9	0	1	0
Number of Implements:							
Horse-hoof cores	19	1	7	12	25	1	0
Steep scrapers	72	17	25	32	54	7	1
Notched scrapers	25	9	15	12	2	4	2
Flat scrapers	31	15	17	21	8	1	0
Straight scrapers	51	15	12	13	7	3	3
Serrated scrapers	3	0	0	1	0	0	0
Miscellaneous scrapers	13	8	12	6	7	0	0
Retouched flakes	25	6	53	15	12	16	7
Flake adzes	6	4	4	4	0	0	0
Backed flakes	20	8	2	0	0	0	0
Fabricators	4	2	0	0	0	0	0

TABLE 1. Artefact counts by category and site (data from Allen 1972 and 1998:210).

Assemblage age and contemporaneity

The nature and magnitude of assemblage variation in the Willandra lakes was a key archaeological trait influencing early interpretations of Pleistocene occupation, both at a local and continental levels. In his critical reinterpretation of earlier models Allen (1998:209) summarised some of these arguments as follows:

> The artefact collections at WC1, MBs1, Gn1 A and B and Gn 1C, which include backed flakes, adzes, horse-hoof cores and steep edged scrapers, were interpreted as being of Recent age (Allen 1972:344). These were compared with the Pleistocene collections from M1, and MLIII A and B to support a conclusion of technological continuity. This was bolstered by the supposed presence of horsehoof cores and steep edged scrapers dating to less than 2000 BP at the stratified Burke's Cave site, west of the Darling River (Allen 1972:201). The thesis of technological similarity was extended to cultural continuity through the incorporation of ethnographic information.

Such an approach is now rejected, partly because of the inadequacies of imposing ethnographic relationships on the archaeological record (Allen 1998:207), and partly because of the recognition of typological differences between Burke's Cave and Willandra assemblages that were not initially appreciated (Allen 1998:209). That earlier approach is also rendered problematic by two recent findings about backed artefacts. Firstly, it now appears that at least in some regions backed artefacts are present by the early Holocene (Hiscock and Attenbrow 1998), and hence the presence of backed specimens need not indicate a long lapse of time from late Pleistocene assemblages. Secondly, it has been shown that the presence or absence of rare typological elements such as backed artefacts is strongly conditioned by assemblage size (Hiscock in press).

This final point provides a useful starting place for this reappraisal of the Willandra Lakes assemblages. Taking the assemblage information provided by Allen (1998:210) as provided here in Table 1 it is clear that some typological elements display a strong positive relationship with sample size. For instance, the number of implements is strongly correlated with the total number of artefacts ($r = 0.94$, $r^2 = 0.88$, $p = 0.002$). Figure 2 shows the consistency of this pattern, revealing that implements make up a reasonably consistent proportion of each assemblage. However the Mungo 1 (M1) assemblage has an unexpectedly higher proportion of implements than would be predicted from the composition-size relationship displayed by the other assemblages,

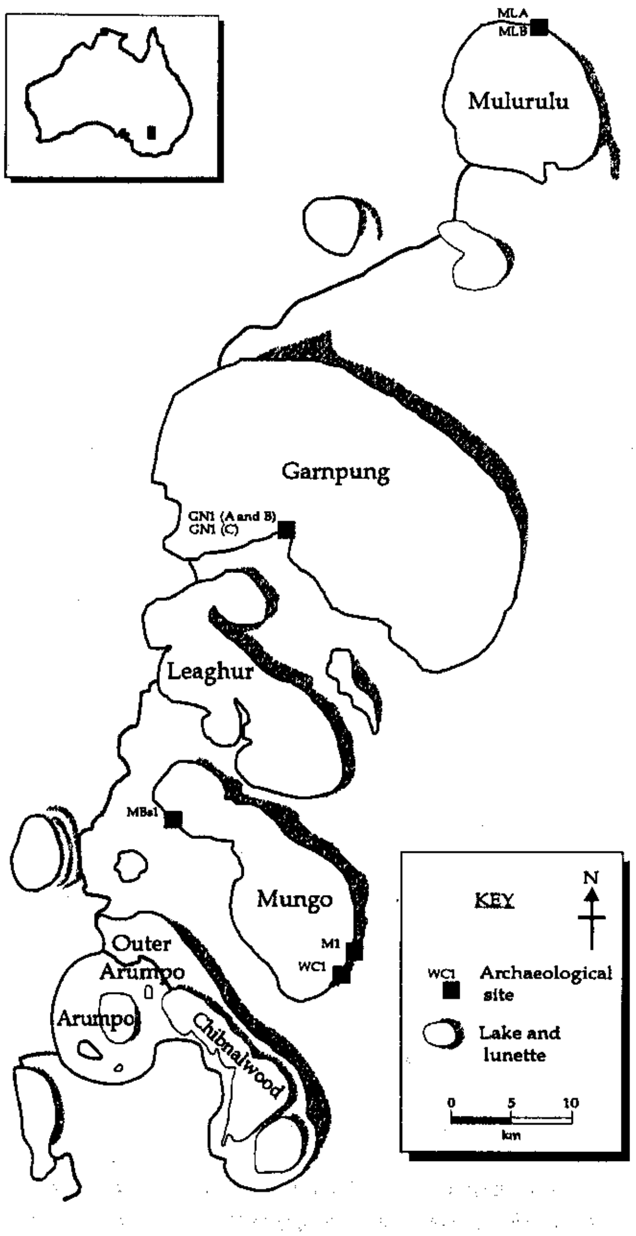

Figure 1. Archaeological sites in the Willandra Lakes mentioned here.

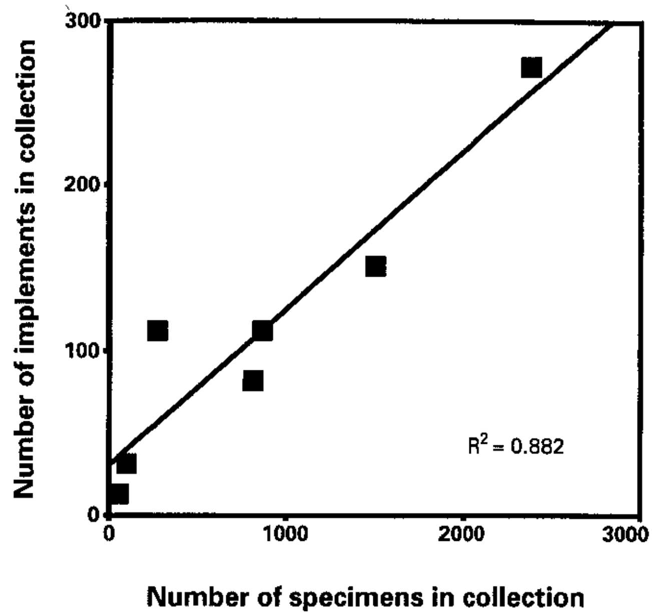

Figure 2: Relationship between the number of implements and the size of the collection

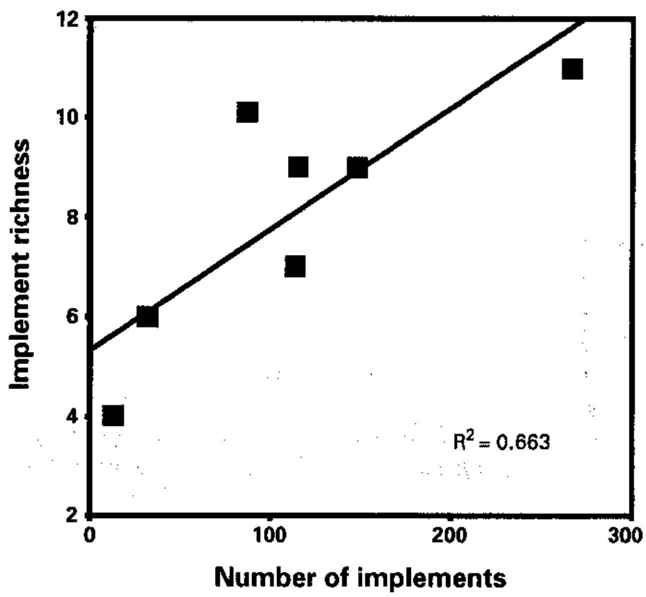

Figure 3: Relationship between the variety of implements and the number of implements recovered.

which may indicate that a factor additional to assemblage size is present at that locality. It is likely that recovery method is a contributing factor at Mungo 1, where a collection procedure favouring the recovery of larger artefacts was employed, unlike the approach at sites such as WC1 where the site was gridded and everything within selected squares was collected to produce a representative collection.

More importantly, the number of different implement classes (implement richness) also displays a strong correlation with the number of implements ($r = 0.82$, $r^2 = 0.66$, $p = 0.026$). This is a typical signal of assemblage sizes so small that variations in sample size affect assemblage composition (see Hiscock in press). One implication is that some types will be present in large assemblages, and not in small ones, solely as a consequence of the difference in sample size. Figure 3, which plots this relationship between typological richness and number of implements, reveals that in Willandra assemblages with more than about 130–150 implements there is likely to be about 2 or 3 types not present in smaller assemblages. The types that will be present only in larger assemblages will probably be those that are most infrequent, and Allen's categories of 'backed flakes' and 'flake adzes' are both rare even in the assemblages in which they occur. It is therefore not unexpected that both of these types display strong correlations with sample size ($r = 0.79$, $r^2 = 0.62$, $p = 0.036$ for backed artefact numbers and number of implements; $r = 0.80$, $r^2 = 0.64$, $p = 0.033$ for the number of adzes and number of implements).

Observations of these positive relationships between assemblage composition and size are not unexpected but create complexity for interpretations of open surface sites such as these. One possibility is that much of the variation discussed above, including the presence or absence of types such as backed artefacts, is simply a consequence of archaeological sampling, and that all of the collections retrieved by Allen are so small that they suffer these effects. This interpretation would reinforce Allen's (1998:211) dissatisfaction with the original hypothesis of technological continuity through time.

However there are other possible interpretations of this composition-size relationship. For instance, it could be hypothesised that some sites have larger assemblages because they represent palimpsests, with multiple occupation producing not only larger but more diverse assemblages. One variant of this is Allen's (1998:211) extremely plausible suggestion that subsequent occupation of some sites might have involved scavenging and recycling of artefacts from earlier times. But the notion that this 'time averaging' fully explains the pattern introduces further complexity. For one thing, the assemblages with backed artefacts, bipolar cores (fabricators) and 'flake adzes' are found on the non-lunette portions of the lake (in the backshore zone – see Table 1 and below), and this suggestion would imply those localities were the focus of later occupation. Another implication might be that with the exception of those added elements the large and small assemblages show marked typological similarities, which might perhaps imply a level of similarity in the assemblages deposited by initial and later occupants, and hence be at least consistent with the notion of technological continuity. However even this assertion is complicated by the reality that the typological systems used in Australia often suggest similarity and uniformity because they are insensitive to many aspects of technological change (see Hiscock 1986, 1993), and that if Allen is correct in suggesting frequent recycling of items by later visitors it could be expected that the patterns of reduction and artefact form would largely be set by the first artisan thereby enforcing similar manufacturing practices through time.

As a consequence of these possibilities the explanation for observable composition-size relationships in the Willandra assemblages is not resolved here. Quite likely there are multiple factors working in conjunction, with sampling, scavenging, taphonomy and technological change all contributing to the pattern of variation visible today. Clearly the disentangling of these factors will be a difficult task and will require specific research designs centred on detailed technological and geomorphic field studies of sites such as these. Furthermore, an evaluation of the chronological variation in assemblages will need to be based on an understanding of the spatial variability displayed prominently in these assemblages, and to which we now turn.

A zonal analysis of assemblage variation

If discerning antiquity and chronological change on these open sites has proved difficult, the identification of broad scale spatial variation in assemblage composition is far easier. Our examination of available data suggests that the Willandra pattern fits with many other regions in reflecting distance to source variability. Even though detailed studies of source characterisation have yet to be undertaken in this region, it remains possible to examine assemblage variability at a landscape level by contrasting zones containing flakeable material to those without.

Much of the archaeological activity in the Willandra region was initially concentrated on the margins of the lakes. Certainly all of the assemblages presented in Table 1 derive from the lake margins, and therefore it is environmental differences around the lake edges that will help to interpret assemblage variation. While the geomorphic history of the lake system is complex (see Bowler 1998), it seems useful to distinguish two environmental zones encompassing the lakes, based on differences in the access to stone suitable for artefact manufacture. Consequently, we have constructed the following analysis on the distinction between two zones:

Lunette zone: well-defined lunettes found on the east and northeast of the lakes.

Backshore zone: shore and surrounding land on the western and southwestern margin of the lakes.

The Lunette zone is dominated by the well-developed lunettes consisting of quartz sands, clayey sands and clays (see Bowler 1998). Siliceous rocks of knappable size are not naturally occurring in this landscape, and stone artefacts found on these sediments have been transported from elsewhere. Hence one economic role of the lunette zone can be understood in terms of it being a receiver of stone and stone artefacts. The transportation of rock to this zone by humans would have facilitated their exploitation of it.

As Allen (1998:209) has discussed, the majority of artefacts are made from silcrete and silcrete ridges can be found on the backshore (western and southwestern) margins of a number of the lakes within the Willandra system. For example, silcrete deposits are known on the western shore of Lake Mungo, on higher ground west of Lake Garnpung, and on the small peninsular emerging from the backshore of Lake Leaghur (Bowler 1998:151). This silcrete is of variable quality and is exposed in various forms including cobbles and small and large blocks. Silcrete pieces of flakeable size are in some instances spread widely around exposed sources, reinforcing the usefulness of regarding the backshore as a source and near source zone.

Exploitation of these silcrete outcrops appears to be varied. For example, artefact densities were low at

Allen's (1972) Chibnalwood excavations, and somewhat higher on the Leaghur Peninsula and Lake Garnpung. These differences may be correlated to the size of silcrete pieces, with gravels being abundant at Chibnalwood[1] and far larger fragments available at the other localities. A number of quarry localities have been identified, including in the backshore zone Lake Mungo at Mungo Backshore 1 and MA 103 (Mullen-Schulte 1985), at Leaghur and Chibnalwood. Williams (1991) has argued that these localities vary in the degree to which initial stoneworking is carried out on the quarry or at nearby sites off the quarry.

Using the typological data provided in Table 1 it is possible to characterise the assemblages in the backshore and lunette zones. Three sites are positioned in the backshore zone: Mungo Backshore 1 (MBs1), Garnpung 1A and 1B (Gn1 A and B), and Garnpung 1C (Gn 1C). Four sites are located in the lunette zone: Walls of China 1 (WC1), Mungo 1 (M1), Mulurulu III A (ML IIIA), and Mulurulu III B (ML IIIB).

The most apparent pattern amongst these sites relates to the production and distribution of flakes and cores across the landscape. Table 2 expresses this in the simplest manner, by calculating the number of unretouched flakes (unmodified flakes plus rejuvenation flakes) divided by the number of 'unmodified' cores. This is effectively the flake:core ratio, and indicates the debris discarded at each locality as a consequence of a) the length of the reduction process, and b) the balance between transporting items to and from each locality. In the backshore zone there are on average three times as many flakes per core as in the lunette zone. Perhaps the most likely explanation of a pattern such as this is that many specimens are extensively reduced in the raw material supply zone prior to their transportation away to the lunette zone.

	N.of sites	$\bar{X} \pm$ s.d.	Min.	Max.
Backshore	3	18.04 ± 8.76	10.7	27.9
Lunette	4	6.86 ± 3.87	1.13	9.67

TABLE 2. Flakes/cores between zones

One model that could be based on this pattern is that core reduction and initial retouching of flakes (including production of implements) was concentrated close to raw material sources, in the backshore zone. A test of this model would be to describe the distribution of broken and incomplete 'implements': if initial production of implements was focused in the material supply zone then proportionately more broken specimens would be found there. An examination of the ratio of complete:broken implements shows that breakage of implements is indeed more frequent on average in the backshore zone (= 8.4:1) than in the lunette zone (= 12.2:1). While recycling of implements would complicate this calculation, and even anticipating that recycling would be more common away from the raw material supply zone, the pattern is explicable in terms of implement production in the backshore zone and maintenance in the lunette zone.

This model implies that the assemblages away from the material source zones would be more extensively reduced than those near the material sources. One measure of this available in the 1969–1972 Willandra database is the relative abundance of 'rejuvenation' flakes. These are flakes with remnants of platform edges on their dorsal faces, and during the 1970's were commonly said to assist in rejuvenating the edges of tools - hence the name. Today it is clear that these flakes would not have 're-sharpened' an edge, and they merely represent the rotation of the rock being flaked and the initiation of new platforms. Hence the ratio of flakes: 'rejuvenation' flakes is a rough measure of the number of blows per platform. As shown in Table 3 sites in the lunette zone typically have fewer flakes per 'rejuvenation' flake, which indicates a reduced periodicity of platform initiation, consistent with the working of more reduced items in the lunette zone.

	N.of sites	$\bar{X} \pm$ s.d.	Min.	Max.
Backshore	3	67.67 ± 58.90	26.9	135.2
Lunette	3	23.18 ± 17.21	4.08	37.5

TABLE 3. Flake/rejuvenation flake between zones

Difference in the extent of reduction between the two zones is revealed in the size data presented by Muhlen-Schulte (1985) for Lake Mungo. Here a backshore locality (MNG109) had much larger unretouched flakes than three lunette zone sites. The length of complete flakes at MNG109 was substantially greater on average, and flakes larger than 6–7cm are found only in the backshore zone.

The observation of higher rates of core rotation in the lunette zone might be accompanied by an expectation of smaller cores and retouched flakes in that landscape compared to the supply zone of the lake backshores. However, the available information does not demonstrate a distinct size difference. For example, Allen (1972:277a) recorded weights of horsehoof cores in the Mungo backshore 1 site as 140±146 g (N=7), and in the Walls of China 1 site as 165±174 g (N=12). While caution should be exercised in view of the small sample sizes and the fact that these measurements are of only one class of core, these data do not conform to the more reduced lunette zone artefacts being smaller. This pattern

1 Although gravel sized fragments dominate the backshore bed of Lake Chibnalwood, larger fragments of silcrete would have been available from the bed of Chibnalwood, but only when the lake was dry.

could be explained by a selection of larger material for transportation out of the backshore zone, such that after more extended reduction they are discarded at about the same size as the specimens left in the supply zone. By preferentially transporting larger cores, or retouched flakes, away from the raw material supply zone knappers might be enhancing the functionality of these items.

Such a process of differential transportation of large items, from backshore to lunette zones, appears to be even more strongly evidenced in the typological data on 'scrapers'. Traditional typological distinctions between different kinds of retouched flakes, such as straight scrapers or flat scrapers or notched scrapers, are difficult to interpret; and it is now clear that subtly different forms need not reflect different uses. Nevertheless the conventional typological categories may perhaps provide information about the size and reduction 'life-span' of specimens. In particular Allen's (1972) analysis revealed patterns in scraper sizes that we can use here, namely that some types are by definition thicker than others. Several scraper types (notched, straight, flat, round) are relatively thin, dorsal to ventral, with mean thickness measurements between 12mm and 17mm. In contrast large steep, steep and multi-concave scrapers are typically thicker (steep scrapers with a mean thickness of 27mm at WC1). Other types, such as miscellaneous scrapers, display different thicknesses at different Willandra sites and are excluded from the following discussion. Taking the available typological categories we constructed a 'scraper index' as follows:

$$\frac{\text{Number of steep scrapers}}{\text{Number of straight scrapers + number of flat/round scrapers + number of notched scrapers}}$$

This index is effectively the number of thick retouched flakes per thin retouched flake, for the scraper types being discussed. Values less than one reflect fewer thick than thin, and values larger than one reflects a dominance of the thick forms. While we acknowledge that this is a rather rough measure of size differences in retouched flakes, it may be sufficient to identify assemblage contrasts. In particular, the thickness of marginally-retouched flakes will be little or unaffected by the extent of reduction and therefore is a useful indicator of the size of flake selected for transportation. Table 4 provides mean and maximum values for the two landscape zones. In the backshore zone thick scraper types are numerically infrequent, whereas in the lunette zone the thicker steep scrapers are proportionately more frequent and in some assemblages overwhelmingly dominant. Since all of the specimens are transported to the lunette zone, presumably from outcrops in the backshore zone, and since thin scrapers cannot be made thicker, this pattern reveals the preferential transportation of thick specimens to the lunette zone sites. This process might be revealing activity differences between backshore and lunette landscapes, but it might simply reflect the need to transport specimens with greater reduction potential to a landscape devoid of natural rock.

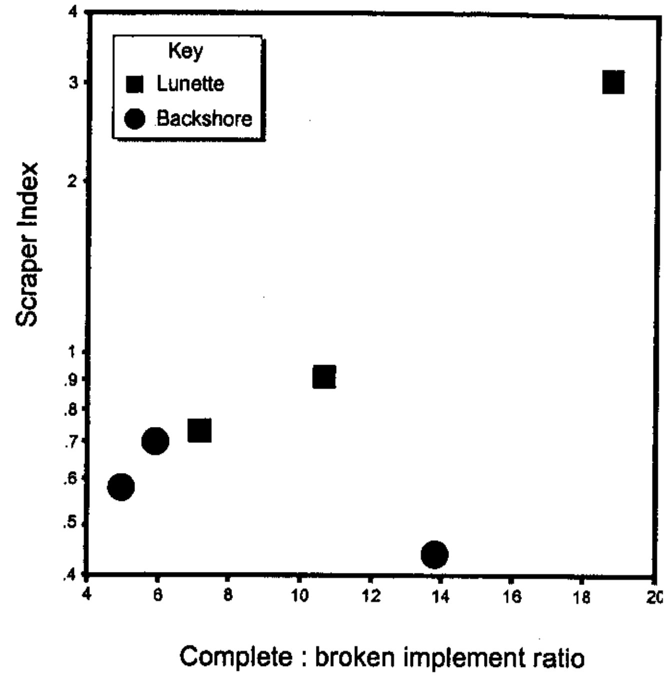

Figure 4. Scraper index plotted against complete implements / broken implements.

	Max.	Mean
Backshore (N = 3)	0.67	0.62
Lunette (N = 4)	3.18	1.24

TABLE 4. Scraper index between zones

This discussion can be summarised with the help of Figure 4 which plots the scraper index against complete: broken implement ratio. The first point to be made about this scattergram is that the backshore and lunette zone assemblages form coherent groupings, revealing that there is a correlation between the assemblage form and the landscape categories we have employed. Furthermore, this figure graphically displays the two dimensions of assemblage variation we have discussed. On the x-axis the complete: broken implement ratio shows a *tendency* for higher rates of breakage in the backshore zone, which we have hypothesised to reflect the concentration of initial flake production and retouching in that zone. On the y-axis the scraper index shows a *tendency* for the preferential transportation of larger, in this case thicker, retouched flakes to the lunette zone. We hypothesise that both of these trends are archaeological indicators of a strategy of provisioning the lunette landscape with stone artefacts that were robust and with a comparatively high potential for further use/reduction.

There are, of course, other models that could account for these observations. For instance in Figure 4 the Mungo 1 assemblage in the upper right corner, is somewhat atypical of these sites and this might suggest that there is a chronological factor that has not been fully discussed here (on this matter see the discussion by Shawcross 1998). For example, variations in the system of rock transportation and reduction may reflect changes to landscape movement between lake full and lake dry conditions. Another example of an alternative model is the possibility that some of the trends discussed here were created by more complex transportation of artefacts around the landscape, in which specimens were not only moved from the backshore zone to the lunette zone but also carried back again. Such multi-directional movement would mean the simple interpretation of assemblages from the two zones as distinct stages in a unilinear trajectory is in error. While such alternatives are extremely plausible it will require specific field investigations of assemblage variation in the Willandra region to evaluate the model sketched here or obvious alternatives to it.

Conclusion

Some readers might consider this as a curious paper, in which we have employed a thirty-year-old typological data set to propose very simple models of resource use in a landscape context. However, there is currently no other published information on artefact assemblage variability for the Willandra Lakes, and even such hypotheses as we have provided here are novel in this region. Hence we consider this a first-order model, constructed as a means of stimulating further theory development and testing in the Willandra region. No doubt technological information obtained from fieldwork specifically designed to investigate these models will identify a more complex pattern of variation, and modify or perhaps even refute the statements made here. We welcome and encourage those investigations.

However, our interpretations reinforce a growing view that the supposed uniformity of Pleistocene assemblages is largely mythical. The landscape patterning of assemblage variation in the Willandra Lakes is displayed over short distances, measured over only tens of kilometres. Small-scale geographic variation in Pleistocene artefact assemblages related to resource distribution has now been reported from a number of other Australian regions (see Hiscock 1988; McNiven 1993, 2000; Webb 1993). Perceiving a similar pattern in the Willandra assemblages has especial irony since it was here that the depiction of the 'Core tool and scraper tradition' was first framed. Consequently the observations of assemblage variation presented here reinforce the view that that the notion of this 'tradition' has hidden significant variation and encouraged a simple binary view of the Australian archaeological sequence (see Allen 1998:207; Shawcross 1998:198). As Shawcross has argued, the generalising power of this idea has been shown to be wanting and its application at a pan-continental level inappropriate. We are therefore inclined to follow the lead of Hiscock and Attenbrow's (1998) rejection of the Small Tool Tradition concept, and argue that the idea of the Core Tool and Scraper Tradition should be set aside in favour of a study of intra- and inter-regional assemblage similarities without the presumption of continental scale uniformities.

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