The Interpretation of Surface Stone Artefact Assemblage Composition from Eroded Contexts in Arid Western New South Wales, Australia

Western New South Wales is internationally renowned for the Pleistocene archaeological record of the Willandra Lakes World Heritage Area. Other significant features include the lunettes and shell middens of the Menindee Lakes, the stratified open deposit of Burkes Cave and the rock art and engravings of Mutawingee National Park and Sturts Meadows. The cultural and scientific significance of these places has been established through numerous archaeological and cultural heritage studies. Less well known are the many thousands of open deflated stone artefact scatters and heat retainer hearths that are found throughout western NSW. These are easily the most common archaeological feature and are the major focus of cultural heritage management assessment. Despite this they are somewhat maligned because they are perceived to be ubiquitous, mixed, disturbed and of low research potential. These attitudes have relegated open surface stone artefact scatters to the role of bit part players in the archaeological discourse of western NSW.

This situation is gradually changing with an increasing amount of research into the formation of open surface deposits. A significant amount of this has emerged from the decade old Western New South Wales Archaeological Programme combining archaeology and geomorphology to understand the spatial and temporal characteristics of open surface deposits. At the same time researchers such as Harry Allen and Wilfred Shawcross began to re-evaluate their data from research undertaken in the Willandra Lakes during the 1960's. Both Allen and Shawcross acknowledge that theoretical developments in the field of non-site archaeology provide solutions to many of the methodological challenges they encountered dealing with the expansive surface deposits of the Willandra Lakes.

Research conducted on Pine Point and Langwell Stations south of Broken Hill aimed to link an investigation of the formational history of deflated surface assemblages to an understanding of assemblage composition. A priority of this was to relate the accumulated pattern in lithic assemblages to the types of behavioural processes resulting in artefact discard. This approach also highlights the research potential and some aspects of the heritage value of lithic assemblages. This is important not only for understanding the scientific value of these features but also for providing information towards identifying broader community or social values and allowing people to make informed decisions about the future management of places that may have significance for them.

Characteristics of Surface Assemblages

Unlike buried deposits, the surface archaeological assemblages of western NSW largely lack stratigraphic profiles. Accelerated erosion during the last 150 years of pastoral land use has resulted in the deflation of artefacts onto a single surface. Therefore, the vertical relationships between different discard events have been lost. Additionally, once exposed artefacts may be subject to other potential sources of disturbance such as sheet wash, tredage, collecting, differential visibility and re-deposition. These factors combined have contributed to perceptions that surface assemblages are at best tainted sources of information on patterns of past human activity.

Studies of the geomorphological context of western NSW surface assemblages by Trish Fanning and Simon Holdaway have demonstrated that while horizontal movement and differential visibility are issues, these effects of these can be understood through the investigation of the micro-geomorphic context of individual artefacts.

Pine Point/Langwell

Pine Point and Langwell Stations are adjoining sheep grazing properties totalling a combined area of 180,000 acres 60 kilometres south of Broken Hill. The area is on the semi to arid margin and experiences a uniform, but low average rainfall and high evaporation. Grazing and timber clearing have significantly altered the present landscape.

The area can be divided into four main land systems. In north are the foothills of the Barrier Range and to the south sand and alluvial plains. These are covered by salt bush and blue bush with occasional mulga trees. Two main creeks dissect the area. Pine Creek is the largest Creek with its head waters in the Barrier Range west of Broken Hill. Rantyga Creek is a smaller tributary channel of Pine Creek. The focus of my work in the area was around the confluence of these two creeks. This area was selected because it contained extensive surface distributions of artefacts and numerous charcoal bearing ground ovens on bare scalded surfaces. Four separate areas were selected for detailed artefact recording and ground oven excavation. Additionally, an area of flaked silcrete outcrop in the foothills north of the confluence was also selected for recording. Being a silcrete quarry this location provided information on raw material utilisation. Unfortunately this area did not contain any ground ovens.

There were three main aims of the artefact and oven excavation programme:

1. To record sufficiently large samples of the assemblages so that a range of artefact analyses could be undertaken.
2. To obtain sufficient charcoal from the ground ovens for radiometric analysis so that an occupational chronology could be established for the area.
3. To study the geomorphic context of the surface distribution to understand the role of post depositional processes in the formation of the material record that can be seen in the present.

Cultural Heritage Studies in the Pine Point/Langwell Area

Michael McIntyre’s survey of the Mildura to Broken Hill electricity line corridor during the mid 1970’s is the first comment on the heritage value of archaeological deposits in the Pine Point/Langwell area. This was effectively a north-south transect of lower western New South Wales extending from the Murray River across the Darling River and the Great Anabranch to the Barrier Range of Broken Hill. The survey covered a range of landforms, many of which are typical of the wider region. The section of the transect covering the southern part of Pine Point and Langwell included treeless plains with internal drainage basins forming small swamps and low ridges with scalds. The northern section crossed the major drainage channel of Pine Creek near its junction with Rantyga Creek where Palaeo-channels, flood plains and gibber pavements are common. Occasional source bordering dunes also occur along Pine Creek.

McIntyre recorded several large surface stone artefact scatters near the confluence of Pine and Rantyga Creeks containing numerous flakes and cores made of both quartz and silcrete. He noted that a surprisingly greater density of material was discovered on the treeless plain south of Pine Creek. McIntyre's survey was undertaken at a time prior to the practice of considering community or contemporary social values of archaeological remains. The sites recorded were only regarded in terms of their research potential.

Building an Occupational Chronology

The remains of 122 heat retainer hearths were recorded during intensive pedestrian survey of the Pine Creek – Rantyga Creek confluence. Information on the excavation and recording of the hearths has been published elsewhere, and is briefly summarised here. Hearths were classified into three groups according to their relative degree of preservation. Of those with partially exposed and clustered heat retainers, 30 were selected for excavation based on their spatial proximity to the stone artefact recording areas. The excavated hearths consisted of a sandy matrix with a cluster of heat retainers and varied amounts of mostly fragmented charcoal. No structural evidence of hearth reuse or multiple lenses of charcoal were found.

Sufficient charcoal for radiocarbon determinations was recovered from 16 hearths. The hearths are distributed along the alluvial gullies of Rantyga and Pine Creeks.

Hearths KZ1H2, H3, and H7 are associated with the KZ1 location. KZ2 H25 is associated with KZ2 location. CN H7, H23, H24, H25, H42 and H55 are associated with the CN1 location. Hearths CN H32, H33, H34, H35, H36 and H56 are associated with the CN3 location.

A Bayesian analysis of temporal patterning within the total pool of 16 determinations indicated that rather than forming a continuous sequence, the determinations cluster into five main phases of hearth construction. The oldest is a single determination from KZ1 H3 at approximately 2000 calBP. The second group consists of two hearths with determinations between 1500 and 1700 calBP. The third group is one hearth with a determination between 1050 and 1300 calBP. Seven determinations make up the fourth group, with determinations spanning 750 to 950 calBP. The fifth and final group consists of five determinations spanning 550 to 350 calBP. Together the radiocarbon determinations from the 16 hearths indicate a chronology of late Holocene occupation across the four study localities and a temporal framework for the investigation of stone artefact assemblage formation.

The SQ1 location is situated on a residual surface and may have a very different temporal context to the surfaces from the alluvial valley. Unfortunately the absence any hearths in the area meant that it was not possible to establish an occupational chronology in the same way as was achieved for the other locations.

The Assemblages

Two of the assemblages, CN1 and CN3 are in the Conservation/Fowlers land system and are situated on an alluvial terrace adjacent to Pine Creek. The other two, KZ1 and KZ2, are in the Kars land system and are adjacent to Rantyga Creek. KZ1 covers an alluvial terrace and distal flood plain on both sides of Rantyga Creek. KZ2 is situated on a scalded sandy rise on the northern side of Rantyga Creek. The locations are all situated within the immediate vicinity of the confluence of Rantyga Creek with the larger Pine Creek. The distance from the furthest two locations KZ1 and CN3 is four kilometres.

The fifth location, SQ1 is situated five kilometres north of the confluence.

Assemblage Composition

The assemblages are summarised in terms of raw material representation, artefact composition and several measures of reduction intensity. These factors permit a simple summary of the assemblages that can be related to a model of assemblage formation.

Raw Material

In common with surface stone artefact assemblages from other areas of western NSW, the Pine Point-Langwell assemblages are dominated by quartz and silcrete. There are clear differences in the proportion of raw materials between the two CN and the two KZ assemblages (Table 3). All four assemblages are dominated by quartz, but the proportion of quartz in the CN assemblages is considerably greater than that for the KZ assemblages. Approximately 80% of artefacts in the CN1 and CN3 assemblages are made from quartz. There are two types of silcrete – clast (quartz grains present in the matrix) and non-clast (quartz grains rare or absent in the matrix). The two types of silcrete combined account for 16.3% of raw materials at CN1 and 14.1% at CN3.

The KZ1 and KZ2 assemblages demonstrate a different pattern of raw material abundance to the CN1 and CN3 assemblages. Quartz accounts for 62.4% of raw materials at KZ1 and 61.6% at KZ2. The two types of silcrete combined account for 34.7% at KZ1 and 36.6% at KZ2. Therefore, the proportion of silcrete in the KZ assemblages is considerably greater than that for the CN assemblages. As with the CN assemblages, silcrete is dominated by clast material. The proportion of non-clast silcrete is slightly greater at KZ1 (7.3%) compared to KZ2 (5.1%). The other materials category includes crystal quartz, chert, hornfels, ironstone, quartzite, sandstone and schist and these make up only a small percentage of raw material.

Differences in raw material access are likely to account for some of the variability in the relative proportions of raw materials between the assemblages. Quartz is available as fist sized cobbles in creek beds and as gibber pavements within immediate vicinity of all the assemblages and is classified as a local raw material. Clast silcrete outcrops with evidence of human use occur in the low hills approximately six kilometres north of Pine Creek. The characteristics of one of these assemblages is analysed in Shiner (2006).No sources of non-clast silcrete were identified in the study area. Both types of silcrete are regarded as a non-local raw material because sources of each are not available within the immediate vicinity of any of the assemblages. The two KZ assemblages contain the highest proportions of silcrete, and are located two to three kilometres in a straight line from the silcrete outcrops. The CN assemblages are located five to six kilometres in a straight line from the silcrete outcrops.

Access to raw materials is clearly an important factor in assemblage variability. Exposure of raw material sources is unlikely to have been a limiting factor because the landscapes of Pine Point and Langwell are primarily erosion dominated and outcrops and gibber pavements are widely distributed. Alternatively, access to raw material sources is likely to have varied with factors associated with the length of occupation duration and mobility reduction as occupation duration increases.

Flake to Core Ratio

The MNF to core ratio is the most basic measure of core reduction intensity and is calculated by summing the total number of flakes with a platform (complete and proximal flakes), together with half the longitudinal splits. As core reduction proceeds, the number of flakes produced increases relative to the number of cores. Longer duration occupation by less mobile groups will limit opportunities to replenish raw material stocks and result in more complete reduction of cores and the increased production of flakes.

Plotting the ratio for each raw material type indicates both similarities and differences between the assemblages. In all of the assemblages the ratio for quartz is lowest indicating that this local material was the least intensively reduced. The quartz ratio also shows the least variability between assemblages. KZ2 has the highest ratio with eight and CN1 the lowest with 7.1, while the ratio is 7.3 for both CN3 and KZ1.

The ratio for clast silcrete is lower than that for non-clast silcrete in each of the assemblages except KZ1. The CN1 assemblage has the highest ratio for clast silcrete, followed by KZ2, CN3 and KZ1. The higher ratio at CN1 and the lower ratio at KZ1 are consistent with a distance decay relationship, but this is not the case for either the KZ2 or CN3 assemblages. The ratios for non-clast silcrete demonstrate a greater amount of variability between the assemblages than those for clast silcrete and quartz. KZ2 has the highest ratio for non-clast silcrete, followed by CN1 and CN3.

None of the assemblages demonstrate a clear pattern of intensive core reduction in all of the raw material categories. KZ1 has the lowest value for clast and non-clast silcrete and the second lowest for quartz, suggesting that reduction was less intensive relative to the other assemblages. This may reflect the closer proximity of KZ1 to major clast silcrete sources than is true for the other assemblages. Both CN1 and KZ2 have the highest ratios for clast and non-clast silcrete, indicating that silcrete core reduction was most intensive in these assemblages. In addition, KZ2 has the highest ratio for quartz. CN3 exhibits more intensive core reduction than KZ1, but this is not as intensive as either CN1 or KZ2. The implication of the overall patterning in MNF to core ratios is that KZ2 saw the longest occupation of the four assemblages.

Cortical to Non-cortical Flake Ratio

Increased core reduction also leads to a decrease in the proportion of cortical surfaces on flakes and cores. The MNF to core ratios suggested that non-clast silcrete was generally the most intensively worked material, thus it is expected that the non-cortical to cortical complete flake ratio will be highest for this material. Results for this ratio indicate that this is not the case, but rather the ratio is highest for clast silcrete across all the assemblages. Non-clast silcrete has the second highest ratio, followed by quartz. The ratio is consistent for quartz in the four assemblages and points to the reduction of local cortical nodules. The same cannot be said for clast silcrete. Clearly clast silcrete, although available within the wider area, was not utilised in the same way as local quartz and was less likely to be available as fist sized gibber nodules. Clast silcrete nodules were transported to the locations as partially decertified cores. This is further supported by the relative proportion of cortical complete flakes to non-cortical complete flakes. Quartz exhibits a different pattern to both the silcretes. Cortical complete flakes are common and a large proportion of the flakes have greater than 50 percent cortex. This indicates on site reduction of cortical nodules.

The KZ1 and KZ2 ratios for quartz are higher than the ratios for CN1 and CN3, suggesting more intensive reduction of quartz cores in the KZ assemblages, a result supported by the MNF to core ratio for KZ2, but not KZ1. The patterns emerging at KZ2 and to a lesser extent KZ1 cannot be attributed to differential raw material access because both locations are of equal distance from the nearest silcrete sources. CN1 and CN3 show similar values for both types of silcrete. This result supports the relatively high values of the MNF to core ratio and suggests that silcrete reduction was intensive in these two assemblages. KZ1 and KZ2 have similar results for both types of silcrete. This result is surprising because the MNF to core ratio suggested that core reduction was more intensive at KZ2 than KZ1.

Non-cortical Core to Cortical Core Ratio

The non-cortical to cortical core ratio provides another measure of core reduction intensity. Values for this ratio by assemblage and raw material are presented in Table 12. Clast silcrete has the highest ratio for each of the assemblages, followed by non-clast silcrete, except for CN3, where no cores with cortex were recorded. Quartz has the lowest ratio in all the assemblages, with the ratio not exceeding one, indicating that there are more cortical than non-cortical cores.

The highest ratios for the three raw material types all occur in the KZ1 assemblage. This is unexpected because the MNF to core and the non-cortical flake to cortical flake analyses suggested that KZ1 cores are the least intensively worked, but it does fit with the high proportion of rotated core forms at KZ1, which suggest a greater likelihood of cortex removal resulting from the flaking of multiple surfaces. The results for the CN1 and KZ2 assemblages are also ambiguous. The MNF to core and the non-cortical to cortical complete flake ratios suggested that core reduction was intensive at CN1. This is not supported by the non-cortical to cortical core ratio, which indicates a low proportion of decortified cores at CN1. There is a similar result for KZ2, but the pattern is less clear. The MNF to core ratio was high at KZ2, but the non-cortical to cortical complete flake ratio low. The low proportion of decortified cores at KZ2 supports the non-cortical to cortical complete flake ratio, but is in disagreement with the MNF to core ratio. CN3 follows a pattern consistent with the non-cortical to cortical complete flake ratio.

Unmodified Flake to Tool Ratio

The unmodified flake to tool ratio is the simplest measure of tool production. Low values for this ratio indicate that proportionally more flakes in an assemblage are modified into tools. Proportionally fewer quartz flakes are modified into tools in the CN1, CN3 and KZ2 assemblages compared to both types of silcrete. The KZ1 assemblage is an exception. Here the ratio for quartz is less than that for most clast silcrete components. The ratio in all assemblages is lowest for non-clast silcrete indicating that there are fewer unretouched flakes relative to retouched flakes on this material than in any other material. Non-clast silcrete appears to have been favoured for tool production.

In general, tool production is least intensive at KZ2. The ratio for clast silcrete and quartz at KZ2 is the highest of the assemblages; the value for non-clast silcrete is the second highest behind KZ1. The CN1 and CN3 assemblages have the lowest values for both types of silcrete, but there is only a marginal difference between the non-clast value at CN1 and KZ2. Additionally, there is no clear pattern between the silcretes in the CN1 and CN3 assemblages, with the value for clast lowest at CN1 and the value for non-clast lowest at CN3. For quartz, the value at CN1 and CN3 is much higher than that at KZ1.

Summary

As with much of the archaeological record of western NSW, the surface archaeological distributions across Pine Point and Langwell Stations cannot be interpreted as ethnographic slices of time, but is rather a time accumulative record. The radiocarbon chronology indicated multiple episodes of occupation during the last 2000 years and the artefacts point to the variable nature of assemblage formation. Some of these inconsistencies may reflect the variable forms in which the raw materials are available as well as the variable nature of the behavioural processes responsible for assemblage accumulation. These behaviours may include artefact recycling, and artefact removal as well as variable occupation spans.

Consistent patterns of reduction intensity for both types of silcrete are difficult to identify. In the alluvial valley assemblages the non-cortical to cortical complete flake and the non-cortical to cortical core ratios are highest for clast silcrete rather than non-clast silcrete. These results do not follow the MNF to core ratio that generally suggested non-clast cores were the most intensively worked. The MNF to core and the non-cortical to cortical complete flake ratios suggest that core reduction is most intensive in the CN1 and KZ2 assemblages, but this is not supported by the non-cortical to cortical core ratio. From this it is difficult to draw straightforward conclusions about the intensity of clast and non-clast silcrete core reduction. Instead, the variability hints at the complex nature of assemblage formation, and suggests that the Pine Point-Langwell assemblages do not represent a single process of silcrete acquisition and reduction through time. Rather, the assemblages represent multiple raw material management processes. The re-occupation of the locations through time also raises the possibility that at least some of the artefacts were reused. The implication of this is that not only were many of the artefacts, and especially those made of either type of silcrete, manufactured elsewhere, but also they may have experienced multiple episodes of reduction and use.

The reduction of quartz across the assemblages shows far greater consistency. The MNF to core ratio suggest that quartz is the least intensively worked material, and the non-cortical to cortical complete flake and the non-cortical to cortical core ratio support this. Quartz is also generally the least intensively utilised material for the production of tools. This consistency suggests a more limited set of behaviours are represented in the acquisition and reduction of quartz compared to the silcretes. Quartz is a local raw material to all of the assemblages and occurs fist sized rounded cobbles on valley slopes and creek beds. The size and form of the nodules may also constrain the reduction of quartz thus producing a more uniform pattern than the two types of silcrete.

At least some aspects of variability between the assemblages reflect differential access to raw materials. For example, the non-intensive reduction of quartz reflects to some degree the abundant sources of this material within the immediate vicinity of the assemblages. Measures of silcrete reduction are inconsistent. Some aspects of a distance decay relationship are evident, but the assemblages located furthest from possible silcrete sources do not exhibit a clear pattern of more intensive reduction. This may be interpreted in a number of ways; silcrete was not always transported to the locations from the closest sources, each location has variable occupation histories, and a single place was rarely used the same way through time.

Community Values

Consideration of the community value of archaeological remains is a standard feature of most contemporary cultural heritage studies, particularly those where a conflict between heritage and development may exist. These values are derived from the participation of indigenous people in the heritage management process. Community values are often associated with people's perception of history, their sense of identity and connection to land and their concern that their cultural heritage be preserved or at least managed in an appropriate way. These values also apply to the surface stone artefact assemblages of western NSW.

Representatives of the Broken Hill Local Aboriginal Land Council were supportive of the low impact methods of data collection that I outlined in my consultation. The research methodology was designed so that all stone artefacts were analysed in the field. Additionally, criteria were established to ensure that only hearths likely to contain charcoal were excavated and that these were carefully reconstructed.

Detailed research focused on understanding the formational history and patterns of assemblage composition provides additional information for heritage professionals, developers and traditional owners. There is a risk that cursory recording and limited sampling may not capture the potential information available from such sites. This information can be important to management decisions. It is true that some traditional owners regard the scientific aspects as of secondary importance or in some cases not important at all, but equally there are other traditional owners who are interested in the information that these approaches can provide. The research at Pine Point and Langwell demonstrates that deflated surface artefact assemblages are indeed profitable sources of information on past patterns of human behaviour. This information is important for guiding future management decisions in the face of continued landscape change.

Conclusion

The surface archaeological record of Pine Point-Langwell was investigated as a series of places with individual use histories. These were revealed through the investigation of assemblage formation over a 2000 year long period of occupation which was indicated by the radiocarbon ages from 16 heat retainer hearths. While this is not a definitive chronological record, it provides a good chronological framework consistent with other hearth dating programmes across western NSW (e.g. Holdaway et al. 2002, 2005). The results of this analysis reveal both variability and consistency in assemblage composition across a relatively small area of the landscape. While some aspects represent responses to the distribution and form of lithic raw material sources, others are indicative of variability in the intensity of occupation over the long-term. Different locations exhibited varied occupational signatures, for instance, measures of raw material utilisation suggest that occupation intensity at KZ1 and CN3 was less intensive than that at KZ2 and CN1.