Copyright Statement

The digital copy of this thesis is protected by the Copyright Act 1994 (New Zealand). This thesis may be consulted by you, provided you comply with the provisions of the Act and the following conditions of use:

- Any use you make of these documents or images must be for research or private study purposes only, and you may not make them available to any other person.

- Authors control the copyright of their thesis. You will recognise the author's right to be identified as the author of this thesis, and due acknowledgement will be made to the author where appropriate.

- You will obtain the author's permission before publishing any material from their thesis.

To request permissions please use the Feedback form on our webpage. [http://researchspace.auckland.ac.nz/feedback](http://researchspace.auckland.ac.nz/feedback)

General copyright and disclaimer

In addition to the above conditions, authors give their consent for the digital copy of their work to be used subject to the conditions specified on the Library Thesis Consent Form
Place as Occupational Histories: Towards an Understanding of Deflated Surface Artefact Distributions in the West Darling, New South Wales, Australia

BY

Justin Ian Shiner

A thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Anthropology, The University of Auckland, 2004
Abstract

This thesis develops theoretical and methodological approaches to the investigation of deflated surface stone artefact scatters beyond those that emphasise synchronic behavioural interpretations. The study is undertaken on Pine Point and Langwell Stations, two adjoining pastoral leases south of Broken Hill in arid Western New South Wales, Australia. The main objective of the study is to investigate long-term accumulated patterns in stone artefact assemblage composition within archaeological deposits with known occupational chronologies. These are derived from the dating of charcoal from heat retainer hearths. It is argued that the Pine Point-Langwell assemblages represent multiple episodes of accumulation over the last 2,000 years. Therefore, the formation of the Pine Point-Langwell assemblages means they are ideal for the investigation of long-term accumulated patterns.

To analyse the composition of the Pine Point-Langwell assemblages, the concepts of artefact use life, curation, the intensity of raw material utilisation and occupation intensity are used. These permit the investigation of assemblage accumulation as a temporal process. Assemblages are not thought of as synchronic functional sets but rather as the consequence of repeated and discontinuous discard episodes over time. As occupation intensity increases, so does the intensity of raw material utilisation. Cores and tools will be worked more intensively and assemblages will be dominated by local raw material, as access to distant sources becomes restricted.

Analysis of the composition of the Pine Point-Langwell assemblages indicates both consistencies and inconsistencies in the reduction and utilisation of lithic raw materials. Some of the consistencies are argued to reflect the character and distribution of the wider lithic landscape. In general, there is a distance decay relationship in the reduction of silcrete. This relationship is not evident in all measures of reduction intensity. Variation in measures of core reduction is interpreted to reflect the variable nature of occupation through time at each of the locations in both duration and frequency. Over the time span represented in the Pine Point-Langwell occupational chronology, multiple behavioural patterns result in internal assemblage variability.

Environmental variability may also contribute to the formation of variable assemblage patterns. There is evidence from south western NSW for environmental oscillation over the period represented by the occupational chronologies in the Pine Point-Langwell study area.
This is interpreted as a possible impulse for the punctuated record of human occupation in the area during the last 2000 years. Hiatuses in the occupational chronology provide further evidence of the variability associated with the formation of the assemblages. Finally, notions of continuity and discontinuity in assemblage formation are explored across the wider region of Western NSW. Late Holocene assemblages from Fowlers Gap and Burkes Cave are compared to the Pine Point-Langwell assemblages.

It is concluded that the approaches to reconstructing past settlement systems in the Australian arid zone are based on a fundamental misunderstanding of the formation of deflated archaeological deposits. This in turn leads to the use of inappropriate interpretive frameworks for the archaeological record. These frameworks often ignore chronology and assume both contemporaneity and consistency in behaviour through time. This denies the opportunity to investigate the diachronic aspects of deflated deposits, both in terms of occupational chronologies and discontinuities in raw material management and reduction.

Keywords: Assemblage Composition, Intensity of Raw Material Utilisation, Long-Term Place Use History, Occupational Chronologies, and Occupation Duration
Acknowledgements

A great many people have assisted in the researching and writing of this thesis. First and foremost, I would like to acknowledge the assistance of my supervisors Dr. Simon Holdaway and Dr. Peter Sheppard of the Department of Anthropology, The University of Auckland. Special thanks are extended to Simon whose encouragement and assistance over many years is not only inspiring but also greatly appreciated. Dr. Patricia Fanning of the Graduate School of the Environment, Macquarie University has also been a constant source of encouragement and assistance over many years. I also wish to acknowledge Simon Holdaway and Trish Fanning for allowing me to access the WNSWAP database including the radiocarbon determinations from the ND and SC locations. Thanks in general to the Western New South Wales Archaeology Program (WNSWAP) for providing me with the opportunity to study the surface record of the Western Division.

Thanks to the Broken Hill Local Aboriginal Land Council, which has supported my research throughout, and especially Ray O'Donnell. A special thanks also to Ron and Marilyn Harvy and family of Pine Point Station and Doug and Joy Harrison and family of Langwell Station for allowing the project to be undertaken on their pastoral leases and also to Robert Pearce of Sunnydale Station. Further thanks to the Harvy’s for allowing me to make my home in the shearers’ quarters and old homestead. Badger Bates of the New South Wales National Parks and Wildlife Service, Broken Hill District Office suggested several possible locations for the project to be undertaken and I thank him for his help.

Many of the staff in the Department of Anthropology at Auckland provided assistance including Hamish McDonald and Tim Mackrell who helped with photography equipment and photo production, and Joan Lawrence and Seline McNamee for drawing the figures. Thank you to Jill Scott from Weipa who kindly proofread the final draft. Thanks, also to local media organisations in Broken Hill, ABC radio and the Barrier Daily Truth.

The assistance of the following people (in no particular order) is acknowledged. Harry Allen, Melinda Allen, Peter White, Robin Torrence, Richard Robins, Leanne Brass and staff of the Australian Museum, Sydney, David Frankel, LuAnn Wandsnider, Jeffrey Parsons, the Edwards Family formerly of Broughton Vale Station, John Pickard, Thegn Ladefoged, Rod Wallace, Sarah Martin, Harvey Johnston, Peter Hiscock, Nikki Stern, staff at the Department of Mineral Resources, Broken Hill, staff at the Department of Land and Water Conservation,
Broken Hill. Thanks to Silvie Hrdlicka for support and the long hours in the lab and to Bridget Mosley for the very long hours spent in the field during the 2001 field season. Thanks also to the Anthro students at Auckland, and in particular those in the Friday morning PhD reading group.

Thanks to my parents, Ian and Beverley for constant support and encouragement over many years. And to Lisa, thanks for imposing eight hour days on me and making my time in Broken Hill so much better. Your support has been fantastic.

A University of Auckland Doctoral Scholarship funded the majority of this research. The University of Waikato Graduate Radiocarbon Dating Fund, the Australian Institute of Aboriginal and Torres Strait Islander Studies and Dr. Simon Holdaway and Dr. Patrica Fanning provided additional funding for radiocarbon determinations.
# Table of Contents

Abstract ............................................................................................................. I
Acknowledgements ............................................................................................ III

## Chapter One

**Introduction to the Study** ............................................................................. 1

1.1 Introduction .................................................................................................. 2

1.2 Research Aim ............................................................................................... 6

1.3 The Study Area ............................................................................................ 7

1.4 Thesis Organisation ..................................................................................... 9

1.5 Geomorphic History of Western New South Wales and the Formation of Deflated Surface Archaeological Deposits ................................................................. 11

1.5.1 The Surface Record – What is it? ............................................................. 11

1.5.2 Geomorphic Processes and the Formation of the Western New South Wales Surface Archaeological Record ................................................................. 12

1.5.3 Implications for the Study of Deflated Surface Distributions ............... 14

1.6 Settlement Pattern Models and the Surface Archaeological Record of the Arid Zone ............................................................................................................. 15

1.6.1 Settlement Pattern Models ....... ............................................................. 15

1.6.2 The Synchronic Functional Paradigm and Site Types ............................. 17

1.6.3 Site Types in Australian Archaeology .................................................... 19

1.6.4 Arid Zone Settlement-Subsistence Models ........................................... 20

1.6.5 Predictive Models .................................................................................. 26

1.7 An Alternative to Current Settlement Pattern Models – The Pine Point-Langwell Approach ............................................................................................ 27

1.7.1 Geomorphic Processes and the Surface Archaeology of the Pine Point-Langwell Study Area ................................................................. 28

1.7.2 Theoretical Approach – Place Use History ........................................ 28

1.7.3 Methodological Approach .................................................................... 30

1.8 Summary .................................................................................................... 32

## Chapter Two

**Time and the Temporality of Artefact Accumulation** .................................... 34

2.1 Introduction .................................................................................................. 35

2.2 Chronological Contexts and Surface Archaeological Deposits: A Case Study of Stud Creek ................................................................................................. 37

2.2.1 Dating Arid Zone Surface Archaeological Deposits ............................... 38

2.2.2 Establishing an Occupational Chronology for Deflated Surface Deposits at Stud Creek ................................................................. 40

2.3 Archaeological Time and the Accumulation of the Surface Archaeological Record ............................................................................................................. 42

2.3.1 Perceptions of Archaeological Time ......................................................... 42

2.3.2 Time Resolution and the Palimpsest Problem ....................................... 46

2.3.3 Discard and the Accumulation of Archaeological Deposits .................... 48

2.3.4 Change, Variation and the Temporal Character of the Record ............. 49

2.4 Approaches to the Spatial Analysis of Surface Artefact Distributions .......... 53

2.4.1 Occupation Intensity, Occupation Duration and Spatial Structure .......... 54
Chapter Nine
Discussion: The Temporal Character of Assemblage Formation

Chapter Ten
Conclusion to the Study
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.5.1 Continuity/Discontinuity</td>
<td>304</td>
</tr>
<tr>
<td>10.5.2 Long-term Place Use Histories – A Dynamic Behavioural Interpretation?</td>
<td>306</td>
</tr>
<tr>
<td>10.5.3 Future Applications for the Investigation of Place Use History in Deflated Deposits</td>
<td>308</td>
</tr>
<tr>
<td>10.6 Conclusions</td>
<td>309</td>
</tr>
<tr>
<td>Bibliography</td>
<td>313</td>
</tr>
<tr>
<td>Appendix One: Article from the Barrier Daily Truth, Tuesday August 20, 2002</td>
<td>345</td>
</tr>
<tr>
<td>Appendix Two: Artefact Definitions</td>
<td>347</td>
</tr>
<tr>
<td>Appendix Three: Artefact Attribute Definitions</td>
<td>349</td>
</tr>
<tr>
<td>Appendix Four: Micro Geomorphic Surface Definitions</td>
<td>353</td>
</tr>
<tr>
<td>Appendix Five: Hearth Attribute Definitions</td>
<td>354</td>
</tr>
<tr>
<td>Appendix Six: Assemblage Composition Tables</td>
<td>355</td>
</tr>
</tbody>
</table>
List of Figures

Figure 1.1. Location of the Pine Point-Langwell study area and other features of Western New South Wales mentioned in the text, including the location of assemblages from Fowlers Gap (ND and SC) and Burkes Cave................................. 8
Figure 4.1. Land systems of the Pine Point-Langwell study area.................................................. 104
Figure 4.2. Pine Creek channel on Pine Point Station................................................................. 109
Figure 4.3. A section of the Rantyga Creek channel on Pine Point Station............................... 110
Figure 4.4. Section of a box swamp on Pine Point Station.......................................................... 113
Figure 4.5. A source bordering dune along Pine Creek on Langwell Station............................ 114
Figure 5.1. Location of the sampling areas and the SQ1 silcrete quarry...................................... 129
Figure 5.2. Landscape context of the KZ1 sample area............................................................... 142
Figure 5.3. Landscape context looking south of the KZ2 sample area......................................... 143
Figure 5.4. Landscape context of the CN1 sample area............................................................... 144
Figure 5.5. Landscape context of the CN3 sample area............................................................... 145
Figure 5.6. Artefacts marked with nails and coloured tape in the KZ2 sampling area.................. 148
Figure 6.1. Condition of hearths in the Pine Creek and Rantyga Creek alluvial systems............ 160
Figure 6.2. Excavation potential of hearths recorded in the Pine Creek and Rantyga Creek alluvial systems................................................................. 161
Figure 6.3. Calibrated radiocarbon determination plot for the Pine Point-Langwell hearths........ 170
Figure 6.4. Distribution of dated hearths from the Pine Creek and Rantyga Creek alluvial systems................................................................. 173
Figure 6.5. Calibrated radiocarbon determinations from hearths on Fowlers Gap Station........... 178
Figure 7.1. Distribution of potential raw material sources relative to the four sampling areas.......... 183
Figure 7.2. Quartz gibber in the Emmore Hills west of Pine Creek on Pine Point Station.......... 186
Figure 7.3. SQI silcrete quarry on a residual surface in the Sampson’s Paddock Hills on Pine Point Station................................................................. 190
Figure 7.4. Raw material proportion calculated for the SQI assemblage by MNF, number and volume................................................................. 191
Figure 7.5. Raw material proportion calculated for the CN1 assemblage.................................... 195
Figure 7.6. Raw material proportion calculated for the CN3 assemblage.................................... 196
Figure 7.7. Raw material proportion calculated for the KZ1 assemblage.................................... 197
Figure 7.8. Raw material proportion calculated for the KZ2 assemblage.................................... 198
Figure 8.1. Shape plot of clast complete flakes by assemblage.................................................... 242
Figure 8.2. Shape plot of non-clast complete flakes by assemblage............................................. 243
Figure 8.3. Shape plot of quartz complete flakes by assemblage................................................. 244
Figure 9.1. Raw material proportions by number for the Pine Point-Langwell, Fowlers Gap (ND and SC) and Burkes Cave (BC) assemblages................................................................. 278
Figure 10.1. Hypothetical landuse/settlement model for the Pine Point-Langwell study area........ 298
List of Tables

Table 1.1 Radiocarbon determinations from the four rockshelters in Veth's Rudall River study (Adapted from Veth 1993:Chapter Five). ................................................................. 23
Table 3.1. Water permanency class per individual site and the proportion, and distribution of local raw materials reported by Veth (1993:29-38). .................................................. 78
Table 4.1. Description of the geological history of the Broken Hill Block (Adapted from Stevens 1986:75-78). ............................................................... 97
Table 4.2. Monthly rainfall total (mm) for Pine Creek station from 1991 to 2002. ............... 107
Table 4.3. Potential chronological contexts of landforms in the Pine Point-Langwell study area. ................................................................................. 118
Table 5.1. Archaeological assessment of individual landforms within each land system for the Pine Point-Langwell study area. .............................................. 127
Table 5.2. Transect CN1A description. ............................................................................. 130
Table 5.3. Transect CN1B description. ............................................................................. 132
Table 5.4. Transect KZ1 description. ............................................................................... 133
Table 5.5. KZ2 Transect description. ............................................................................... 135
Table 5.6. Description of artefact categories used for the initial quantification of the composition of the Pine Point-Langwell assemblages. ........................................... 153
Table 6.1. Radiocarbon determinations on charcoal from heat retainer hearths on Pine Point and Langwell Stations. .............................................................. 167
Table 6.2. Calibrated determinations at the 95% probability level for the Pine Point-Langwell study area. ............................................................... 168
Table 6.3. Interpretation of Bayes factor Model 2 v. Model 1, from Rafierty (1996). .............. 171
Table 6.4. Single versus multiple phases of hearth construction tested for the Pine Point-Langwell determinations. ............................................................... 172
Table 6.5. Mean likelihood ratio for Single versus multiple phases of hearth construction tested for the Pine Point-Langwell determinations. ......................... 172
Table 7.1. Frequency and percentage (in brackets) of clast silcrete non-cortical and cortical complete flakes and cores at SQ1. ................................................. 189
Table 7.2. Raw material by minimum number of flakes (MNF) for the four assemblages. ....... 199
Table 7.3. Raw material by number of individual pieces for the four assemblages. ............... 199
Table 7.4. Raw material by volume (mm$^3$) for the four assemblages. ............................ 199
Table 7.5. Non-gibber to gibber cortex ratio for complete flakes, complete tools and cores combined. ................................................................................. 201
Table 7.6. Frequency and percentage (in brackets) of clast silcrete complete flakes with different amounts of cortex. ......................................................... 202
Table 7.7. Frequency and percentage (in brackets) of non-clast silcrete complete flakes with different amounts of cortex. ......................................................... 202
Table 7.8. Frequency and percentage (in brackets) of clast silcrete complete flakes from the SQ1 silcrete quarry with different amounts of cortex. ....................... 203
Table 7.9. Frequency and percentage (in brackets) of quartz complete flakes with different amounts of cortex. ................................................................. 204
Table 7.10. Length of complete non-cortical and cortical complete flakes from the CN1 assemblage. ............................................................................... 205
Table 7.11. Length of complete non-cortical and cortical complete flakes from the CN3 assemblage. .................................................. 205
Table 7.12. Length of complete non-cortical and cortical complete flakes from the KZ1 assemblage. .................................................. 206
Table 7.13. Length of complete non-cortical and cortical complete flakes from the KZ2 assemblage. .................................................. 206
Table 7.14. Results of least significance difference test (LSD) for complete cortical flake length between the three major raw material categories within the four assemblages. 207
Table 7.15. Results of least significance difference test (LSD) for cortical complete flake length with raw material class between assemblages. .................................................. 207
Table 8.1. Frequency and proportion of clast silcrete core types per assemblage. ................. 215
Table 8.2. Frequency and proportion of non-clast silcrete core types per assemblage. ........ 216
Table 8.3. Frequency and proportion of quartz core types per assemblage. ......................... 217
Table 8.4. MNF (minimum number of flakes) to core ratio per raw material and assemblage. ... 219
Table 8.5. Non-cortical to cortical complete flake ratio per raw material and assemblage. .... 220
Table 8.6. Non-cortical to cortical core ratio per raw material and assemblage. .................. 221
Table 8.7. Mean maximum length, width and thickness of clast silcrete cores in the four assemblages. .................................................. 223
Table 8.8. Mean maximum length, width and thickness of non-clast silcrete cores in the four assemblages. .................................................. 224
Table 8.9. Mean maximum length, width and thickness of quartz cores in the four assemblages. .................................................. 225
Table 8.10. Results of least significance difference test (LSD) for cores on different raw materials in the CN1 assemblage. ......................... 225
Table 8.11. Results of least significance difference test (LSD) for cores on different raw materials in the KZ1 assemblage. ......................... 226
Table 8.12. Results of least significance difference test (LSD) for cores on different raw materials in the KZ2 assemblage. ......................... 226
Table 8.13. Results of least significance difference test (LSD) for clast silcrete cores between assemblages. .................................................. 227
Table 8.14. Results of least significance difference test (LSD) for non-clast silcrete cores between assemblages. .................................................. 228
Table 8.15. Results of least significance difference test (LSD) for quartz cores between assemblages. .................................................. 228
Table 8.16. Frequency and percentage (in brackets) of exterior platform surface of complete flakes per raw material for the CN1 assemblage. .................................................. 230
Table 8.17. Frequency and percentage (in brackets) of exterior platform surface of complete flakes per raw material for the CN3 assemblage. .................................................. 230
Table 8.18. Frequency and percentage (in brackets) of exterior platform surface of complete flakes per raw material for the KZ1 assemblage. .................................................. 231
Table 8.19. Frequency and percentage (in brackets) of exterior platform surface of complete flakes per raw material for the KZ2 assemblage. .................................................. 231
Table 8.20. Mean length, width, thickness, platform width and platform thickness of clast silcrete complete flakes in the four assemblages. .................................................. 234
Table 8.21. Mean length, width, thickness, platform width and platform thickness of non-clast silcrete complete flakes in the four assemblages. .................................................. 235
Table 8.22. Mean length, width, thickness, platform width and platform thickness of quartz complete flakes in the four assemblages (complete bipolar flakes not included)........236
Table 8.23. Results of least significance difference test (LSD) for complete flakes on different raw materials in the CN1 assemblage. ........................................................................................................237
Table 8.24. Results of least significance difference test (LSD) for complete flakes on different raw materials in the CN3 assemblage ........................................................................237
Table 8.25. Results of least significance difference test (LSD) for complete flakes on different raw materials in the KZ1 assemblage. ..............................................................................238
Table 8.26. Results of least significance difference test (LSD) for complete flakes on different raw materials in the KZ2 assemblage. ..............................................................................238
Table 8.27. Results of least significance difference test (LSD) for clast silcrete complete flakes between assemblages. ...........................................................................................................240
Table 8.28. Results of least significance difference test (LSD) for non-clast silcrete complete flakes between assemblages. ........................................................................................................240
Table 8.29. Results of least significance difference test (LSD) for quartz complete flakes between assemblages. .............................................................................................................241
Table 8.30. Clast silcrete platform type frequency and percentage (in brackets) for each assemblage. ........................................................................................................................................246
Table 8.31. Non-clast silcrete platform type frequency and percentage (in brackets) for each assemblage. ......................................................................................................................................246
Table 8.32. Quartz platform type frequency and percentage (in brackets) for each assemblage. ............................................................................................................................................247
Table 8.33. Flake to MNT (minimum number of tools) ratio per raw material and assemblage. Proportionally more non-clast silcrete flakes are retouched into tools, followed by clast silcrete in three assemblages (except KZ1 where the quartz ratio is lower)....................250
Table 8.34. Complete tool form frequency and percentage (in brackets) per raw material type in the CN1 assemblage. ........................................................................................................251
Table 8.35. Complete tool form frequency and percentage (in brackets) per raw material type in the CN3 assemblage. ........................................................................................................252
Table 8.36. Complete tool form frequency and percentage (in brackets) per raw material type in the KZ1 assemblage. ........................................................................................................253
Table 8.37. Complete tool form frequency and percentage (in brackets) per raw material type in the KZ2 assemblage. ........................................................................................................254
Table 8.38. Ranking of the proportion of scrapers per raw material and assemblage..................255
Table 8.39. Complete flake to complete tool scraper surface area ratio. ......................................256
Table 8.40. Summary statistics for complete flake and complete scraper surface area..............257
Table 8.41. Mean number of retouched quadrants on complete scrapers per raw material type in the four assemblages. ........................................................................................................258
Table 9.1. Artefact frequency and percentage (in brackets) per raw material type in the SQ1 assemblage. ......................................................................................................................................264
Table 9.2. Complete tool frequency and percentage (in brackets) per raw material type in the SQ1 assemblage. .............................................................................................................264
Table 9.3. Number of seed grinding artefacts recorded per assemblage for the Pine Point-Langwell study area. .........................................................................................................................268
Table 9.4. Radiocarbon determinations on charcoal from heat retainer hearths at the ND location..................................................................................................................................................276