USE OF THESSES

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SUMMARY

WHERE THE CROW FLIES BACKWARDS:
MAN AND LAND IN THE DARLING BASIN

Harry Allen
The Australian National University
Canberra
1972

The Darling River, the second largest river in eastern Australia, flows through an area of semi-arid grassland. The presence of the river in this dry region created a highly favourable environment for the Aboriginal inhabitants.

Historical descriptions of these Aborigines, mostly written in the late nineteenth century, show the Darling River as the single most important human resource in the Darling Basin. These records provide some evidence that the Bagundji Aborigines of the Darling Basin moved from the narrow river margin into the drier hinterland and back again. These movements coincided with discernible seasonal climatic fluctuations.

The majority of archaeological sites so far discovered in the Darling Basin are clustered around the shores of lakes. Some of these lakes have not been filled with water for the past 15,000 years. Analysis of these lakeside sites, dated back as far as 26,000 B.P., reveal that the prehistoric Aborigines exploited the Darling Basin in a similar manner to that described for the historic Aborigines.

Stone implements recovered from the older sites are similar to those recovered from younger sites, such as Burke's Cave, in the same region. This is taken as indicating that the inhabitants of the Basin have shared a single cultural tradition from the late Pleistocene to the ethnographic present.
ERRATA

p.12  lines 18 and 24: for "reversal" read "excursion"

p.21  lines 23 and 24: for "Cumpston (1925)" read
      "Cumpston J.H.L. (1925)"

p.38  lines 23 and 24: for "Meggitt 1966:67-8" read
      "Meggitt (1964b) 1966:67-8"

p.55  footnote 1: for "from Bickford (1966)" read
      "after Bickford (1966)"

p.96  line 25: for "Harris" read "Harriss"

p.104 line 5: for "howitt" read "Howitt"

p.127 paragraph 2, sentence 2: delete "These are reproduced
      from Etheridge (1918: Plate VI) are shown on Plate 4.2b."
      and insert "Sketches by Mathews of the carved trees from
      one Bora ground were reproduced in Etheridge (1918:
      Plate VI). A copy of Etheridge's plate appears on
      Plate 4.2b in the present volume."

p.128 line 11: for "superceded" read "superseded"

p.159 line 3: for "pieces ecailles" read "pièces écailles"

p.210 line 20: for "McCarthur" read "McArthur"

p.258 paragraph 4, sentence 2: delete "A copy of this paper is
      included at the back of this thesis."

p.285 line 24: for "[W.C.L.]" read "[L.I.]"

p.336 lines 13, 17 and 23: for "families" read "genera"

p.346 line 7: for "(Meggitt 1946:30)" read "(Meggitt 1964a:30)"

p.363 entry 17: "_________ 1951. Charles Sturt. His Life and
      Journeys of Exploration.  Georgian House, Melbourne."
      should read
      "Cumpston J.L. 1951. Charles Sturt. His Life and
      Journeys of Exploration.  Georgian House, Melbourne."

      among the Australian Aborigines.  Bijdragen 120:
      163-78."
      should read
      "_________ [1964b] 1966. Indigenous forms of
      Government among the Australian Aborigines.  In
      Ian Hogbin and L.R. Hiatt (eds.) Readings in
      Australian and Pacific Anthropology.  M.U.P.
      Melbourne, pp.57-74.
WHERE THE CROW FLIES BACKWARDS:

MAN AND LAND IN THE DARLING BASIN

by

HARRY ALLEN

This work is a thesis submitted for the degree of Doctor of Philosophy in The Australian National University.

September 1972
Except for work done jointly with Rhys Jones on the Mungo I site published in Bowler et al., (1970:47-56) and the acknowledged assistance of specialists in various fields, this thesis is the product of original field and library research of the author.

Harry Allen
Canberra
September 1972
Yes I'm tall dark and lean
everyplace I've been
the whiteman calls me Jack
it's no crime I'm not ashamed
I was born with my skin so black
when it comes to riding rough horses
or working cattle I've mixed with the best
in the land where the crow flies backwards*
and the pelican builds his nest.

Dougie Young Sings Songs From the Aborigines Camp.
Wattle Recordings, Melbourne 1965

* To keep the dust out of his eyes.
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PREFACE

I would like to thank the many people who assisted me in the field and back in Canberra.

My fieldwork was helped by Joy Allen, Mike Barbetti, Jacques Bierling, Tom Brown, Raelie Cheyney, Peter Corris, Mirabelle Fitzgerald, Les and Rosemary Groube, Ron Lampert, Peter Lauer, Betsy Lieberman, Margaret Lord, Harry Lourandos, Tony Minson, Biatta Ruthenberg, Graham and Dianne Sampson, Desney Shoemark, Ruth Streuver, Ron Vanderwal, Mark Ward and Percy Wooley.

The Director and staff of the National Parks and Wildlife Service of New South Wales gave me every assistance and also permission to do the fieldwork.

I received much help and hospitality from many landowners in western New South Wales. Albert and Venda Barnes, Mungo Station, Alex and Mrs Barnes, Joulmi Station, Clarrie and Mrs Barnes of Leaghur Station, Mr and Mrs Barnes of Chibinalwood Station, Mr and Mrs Johnston of Zanci Station, Pat and Mrs Roberts of Meadow Glen Station, Henry and Mrs Creswell of Broughton Vale Station, Mr and Mrs Caskey of Byrnedale Station, Mr and Mrs Hand and Ron Lukosheck ( overseer) of Boolaboolka Station, and from the owners of Garnpung, Gol Gol, Mulrulu, Spring Hills, Red Hill, Mount Manara, Tandou, Bindara, and Milton Grove Stations.

The mammalian remains were identified by Dr Jeanette Hope, the rats by Jack Mahony, the birds by Pat Rich, the egg shell by Alan McEvey and the reptiles by David Horton, I received assistance with the fish from L.C. Llewellyn, John Paxton and Alan Weatherley.

I would like to thank Henry Polach and John Head and the staff of the C14 laboratory for running the carbon dates and Brenda Stephenson and Rina Chao for the fluorine analyses. I received assistance with technical matters from Wal Ambrose, Jim Bowler, Mike Barbetti, Duncan Merillees, Larry Marshall, Girdup Singh, Dick Barwick, Edmund Gill, Con Key, Geoff Hope, Dick Tedford and Phillip Grimshaw.

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I would like to thank Lois White, Beverley Fox, Anne Bayles and Jean Adams for the typing, Win Mumford for the illustrations and Dragi Markovic for the photographs.

Joy Allen assisted with the many drafts and corrections and Jane and Meredith Allen added to the pandemonium.

The Mitchell Library, Sydney gave permission for the reproduction of plates 2.1a, 2.1b and 3.1a and the State Library of Victoria permission to reproduce plates 3.1b and 6.2b.

The head of my Department, Professor J. Golson gave me every assistance. I was ably supervised by Rhys Jones and during his absence, by Alan Thorne and they helped with many problems though they bear no responsibility for any errors.

I apologise to anyone whose name has been omitted from the acknowledgements above due to an oversight on my part.
CHAPTER 1

THE DARLING BASIN

1.1 Location

The Darling Basin, with an area of 90,000 square miles, is situated in western New South Wales (figure 1.1). It is a subdivision of the Murray-Darling Basin, the main rivers in the Murray Darling system being the Murray, the Darling and the Murrumbidgee.

The headwaters of the Darling River rise in south-eastern Queensland, and the river flows for 1000 miles before it joins the Murray. The main sources of water for the Darling are the Bogan, Macquarie, Castlereagh and Gwydir Rivers rising in the Great Dividing Range of north-eastern New South Wales. No major tributaries join the Darling River south of Bourke. Below Wilcannia the river has two anabranch systems known as the Great Anabranch and the Talyawalka.

1.2 Relief

Most of the basin is less than 500 feet above sea level and is generally flat. The relief map (figure 1.2) shows the low hilly areas found on the eastern and western margins.

The Barrier Ranges together with small features such as the Scropes, Bynguano and Noonthorangep Ranges, make up the 'Northwestern fold belt' (Packham 1969:2-5) and this forms the western boundary of the Darling Basin. The fold belt consists of old sedimentary and metamorphic rocks (Archaean to Devonian, Vernon et al. 1969:21) which were folded about 400 million years ago (Packham 1969:5). There has been deep weathering of these rocks and they form only low hills surrounded by soil rather than by rock rubble (Vernon et al. 1969:20-21).

The foothills of the Great Dividing Range form the eastern boundary of the Darling Basin. These are low wooded ranges, the erosional remnants of folded upper Devonian sandstones and shales. Outliers occur as isolated outcrops rising from the floor of the Basin separated by deep alluvium as at Mount Manara and the Manfred Range (Packham et al. 1969:164-8).

The main surface features of the Darling Basin were not formed by the present river: rather they are relic landforms (Pels 1969:499). The southern and south-western portions of the
Fig. 1.1: Location of the Darling Basin

Fig. 1.2: Relief map
basin, below Menindee, lie on top of deep tertiary marine sediments and strandline features of this period are still preserved as low ranges (Pels 1969:figure 8.1, Bowler 1971:figure 5.3). East and north of the strandlines, the basin is composed of lacustrine and fluviatile sediments, silts and sandstones. The top 300 feet of these sediments was laid down during the Pleistocene, burying an older tertiary lacustrine landscape (Pels 1969:503-4).

During the Pleistocene, large quantities of mobile sand formed long, linear, east-west ridges. These dunes stretch across Australia from the west coast, the Darling Basin being their easternmost occurrence (Bowler 1971:figure 5.1, 55; Mabbit 1971: figure 6.2). The deposition of these longitudinal dunes interfered with the Darling and Willandra Rivers and probably contributed to the formation of the lake basins in the area. These include the Menindee, Anabranch, Talyawalka, and Willandra Lakes (Bowler 1971:55, figure 5.3, and figure 1.2). The dunes are now inactive and stabilized by vegetation. Bowler (1970a:254) estimated that they are 'older than 40,000 B.P. with perhaps an age of 60 to 100,000 B.P. being.....more realistic'.

The only lake system to have been studied in detail is that of the Willandra by Bowler (1970a, 1970b, 1971). His examination has provided information about late Quaternary environments in the Darling Basin. It was Bowler's discovery of artefacts and other human remains within dated sediments which provided the original stimulus for my own research programme.

1.3 Geomorphological succession of the Willandra Lakes

The Willandra Lakes are what Bowler calls 'lunette lakes' 'dry shallow deflation basins with regular transverse crescentic dunes (lunettes) on their eastern margins' (Bowler 1970a:6). The lunette dunes, which are up to 30 metres in height, are not forming on contemporary lakes and hence relate to earlier Quaternary environments and point to major climatic changes. The location of the lunette lakes is shown on figure 1.4. These dunes have remained inactive for about the last 15,000 years.

Within the lunettes, Bowler has isolated three soil sedimentary units consisting of separate mappable elements recognised on the basis of related morphology and soil and sedimentary characteristics (Bowler 1970a:15). Each was laid down by a complex cycle of changing environmental conditions. Separating them were phases of soil development.
Bowler has set out the following sequence.

The oldest lacustrine phase, before 40,000 B.P., is associated with the Golgol sedimentary unit which forms the core of the lunettes and is an old lunette ridge. Soil formation has destroyed depositional structures and there is little environmental evidence preserved within it (Bowler 1970a:110).

The Golgol unit is overlain disconformably by the Mungo unit, which contains two members. The lower, a quartz rich sandy zone with freshwater mollusc shells, was formed during a high freshwater phase and the upper, a clay rich zone associated with Coxiella shells came from a saline low water phase with periods of lake floor drying (Bowler 1970a:110-12).

The uppermost sedimentary layer, called the Zanci unit, lies on top of the Mungo unit. It is also made up of a lower sandy zone and an upper clayey zone (Bowler 1970a:112-190).

The Mungo unit was laid down between 40,000 and about 24,000 B.P. The Zanci unit dates from 23,000 B.P. to about 17,000 B.P. The deposition of the Zanci and Mungo units were separated by a period of soil formation.

Bowler's sequence is summarized on table 1.1 below and a stylized section through the Mungo lunette appears on Figure 8.4.

Other lunette lakes in the Darling Basin were inspected by Bowler who concluded that apart from Lake Menindee where the sequence was condensed, the other lakes, Caundilla, Tandou and Nitchie, had sequences that 'strongly suggest a correlation with the Willandra stratigraphy' (1970a:149-50). He also has demonstrated that the same lunette building phases took place at the same time at Lake Albacynia 200 miles south of the Willandra Lakes (Bowler 1970a:152061, Polach, Lovering and Bowler 1970:1-18). This establishes the regional nature of the conditions described above for the Willandra Lakes.

Lakes in western New South Wales that were not within the lunette-building zones may also have had high water phases at about the same time as the Willandra Lakes. Dury and Langford-Smith (1970:73) have dated a hearth close to high strandlines at Pleistocene Lake Yantara in northwestern New South Wales at 26,000 ± 1100 (GAK-2121). Carbonate from a high strandline on nearby Lake Bancannia gave a C\(^{14}\) determination of 14,500 ± 400 B.P. (GAK-2488).
Table 1.1  Summary of stratigraphic sequence, radiocarbon chronology and fluctuations in the Willandra Lakes

<table>
<thead>
<tr>
<th>Lunette units</th>
<th>Soil - sedimentary environments</th>
<th>Radiocarbon chronology</th>
<th>Lake levels</th>
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<tbody>
<tr>
<td><strong>ZANCI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil formation</td>
<td>No deposition</td>
<td>Lakes dry</td>
<td></td>
</tr>
<tr>
<td>Clay dune formation</td>
<td>16,530 ± 400 ANU-312</td>
<td>Low fluctuating levels, clay deflation from exposed lake floor. High salinities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17,670 ± 550 ANU-330</td>
<td>Fluctuations began.</td>
<td></td>
</tr>
<tr>
<td>Quartz sands deflated from high level beach</td>
<td>23,350 ± 550 ANU-310</td>
<td>High levels, low salinities. System overflowed through southern outlet channel.</td>
<td></td>
</tr>
<tr>
<td><strong>MUNGO</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clay dune formation</td>
<td>26,000 (approx.) ANU-375</td>
<td>Fluctuating water-levels, moderate to high salinity</td>
<td></td>
</tr>
<tr>
<td>Quartz sands deflated from high level beach</td>
<td>30,250 ± 950 ANU-303</td>
<td>High water-levels, low salinities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>32,750 ± 1250 ANU-331</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>38,500 ± 2950 ANU-306</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2150 ANU-306</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>GOLGOL</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong soil formation</td>
<td>38,500</td>
<td>Long period, dry lakes</td>
<td></td>
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<tr>
<td>Sedimentary features destroyed by pedogenesis</td>
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<td>Golgol lunette formation. Early high lake levels.</td>
<td></td>
</tr>
<tr>
<td>Quartz sands</td>
<td></td>
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</table>

From Bowler (1970a:144)
Prior to the final drying up of the Willandra Lakes there was a short period of dune instability. This resulted in some areas, mainly near the Darling River, having irregular sub-parabolic dunes as well as the long linear dunes (Bowler 1970a:51). There has been little soil development in the Zanci sediments in the last 15,000 years. The well preserved condition of the dunes, the lunettes and the lake floors, argues forcefully that there has been little geomorphological activity in the region since the final lacustral phase 15,000 years ago (Bowler 1970a:275). Bowler concluded that

'One of the remarkable features of the Murray Basin [including the Darling] is the apparent stability in lakes, streams and dunes throughout the past 15,000 years. [Almost]...all major depositional units are older than 15,000 years.' (1970a:278).

1.4 Present Climate

The South Darling Basin is one of the most arid portions of New South Wales. McCabe, one of the earliest surveyors in the region described it as

'a vast level, and, with the exception of a small portion of available land along the rivers,...a desert. A sandy desert covered with Eucalyptus dumosa or Mallee scrub or Callitris pyramidalis on them, and patches covered with tufts of prickly grass; with other small patches covered with salsolaceous shrubs and acacia. The soil is so loose as not to retain water after heavy rains.' (1848-52 Ms: Aug. 3 1848).

There is an average of between 6 inches and 12 inches of rain (150-300 mm) annually. Rainfall increases from the north-west to the South-east, figure 1.3 shows the rainfall isohyets. Although the southern part of the basin receives a slight winter maximum, falls of rain over the region are well distributed throughout the year (Beadle 1949:27).

Evaporation is higher than rainfall in every month, reaching its peak during summer when surface waters dry rapidly. Evaporation is lower in winter when rainfall may lie in pools for some months.

Wilcannia on the Central Darling gets an average rainfall
Fig. 1.4: Geomorphic map

Fig. 1.3: Rainfall map
of 9.5 inches and is subject to a theoretical evaporation of 69 inches per year (figure 4.7). Combining the evaporation and precipitation together, it is possible to calculate the number of months of effective rainfall per year. Leeper (1970:18) who has done this for the whole of Australia estimates that five months of effective rainfall is the minimum requirement for growing crops. All of western New South Wales gets less than four months effective rainfall and the westernmost portion only one month.

More important in inland Australia is the yearly variability of rainfall. There have been seasons along the Darling when crops were grown but there have also been other seasons when even the desert hardened trees withered and died. Wilcannia, with an average rainfall of 9.5 inches, received 20 inches in 1936, but in 1940 less than 3 inches. Variations in rainfall at Bourke are shown on figure 3.8. There is a 30 to 35 percent variability in rainfall in the Darling region, with variability being highest in areas with the lowest rainfalls. There is a correlation between rainfall variability and percentage loss of stock in western New South Wales where losses have been as high as 70 percent (Beadle 1948:90-1). Variability of rainfall was the factor that exerted the greatest stress on Aboriginal populations (see Chapter 3 section 3.6).

Temperatures are much more regular. Average values do not vary by more than a few degrees from one year to another. January is the hottest month with an average maximum at Wilcannia of 95°F (35°C) and record highs up to 122°F (50°C). July is the coolest month with an average minimum of 40°F (5°C) with record lows down to 22°F (-6°C) (Comm. of Aust. 1956:71, 101). Weatherly (1967:8) has shown that the mean air temperature and the temperatures in the Darling River itself are roughly similar.

1.5 Past Climates

It can be seen that there is a marked contrast between the present climatic conditions and the ones responsible for the lakes and fossil dune systems described in section 1.3. In this region over the past 100,000 years there have been climatic changes of large magnitude which affected all the lakes and streams in the Darling Basin and upset the vegetation - landscape equilibrium.
There is little evidence of conditions or events for the period more than 40,000 B.P. This is the time of the older (prior) streams, of the origin of the lake basins, and the initiation of the dunefields (Bowler 1970a:288).

There is more evidence for conditions post 40,000 B.P. Bowler (1970a:290) describes the period 40,000 - 17,500 B.P. as a Major Lucastral period. The conditions of this period correspond closely to that of a 'pluvial' which was synchronous with or overlapped the full-glacial period of the Northern Hemisphere. Bowler interprets the high lake levels and stream discharges that mark this period as coming as a result of lower temperatures in conjunction with a rainfall of similar magnitude to that of today. Thus he sees no confirmation of a 'glacial arid period' postulated by Galloway for Australia in 1965 (Galloway 1965:616). More recently Galloway (1970:251-9) reviewed evidence from Lakes in the United States and concluded that full glacial precipitation 'was somewhat [10-15%] less than it is today'. Galloway's modified view is probably not in conflict with Bowler's evidence.

However, Bowler's use of the term 'pluvial' to describe a period in which rainfall is thought to be similar to today seems to be inappropriate in view of Dury's (1966-8:239) argument that a full glacial pluvial would have twice the rainfall of the present. The Mungo oscillation between 25,000 and 23,000 B.P. may have been an oscillation of short magnitude and duration which did not affect areas away from the Willandra Lakes (Bowler 1970a:276).

During this lacustral phase the Willandra Lakes were filled with water to a depth of 20 metres or so and covered an area of 1000 km² (Bowler 1970a:106). Water in the Willandra billabong at present does not reach Mulurulu, the northernmost lake. Bowler, in order to get some idea of the water required to maintain this lake system at a high water phase tried a number of different computations (1970a:291-7). He concluded that the Lachlan would have had to carry at least twice its present discharge in order that the Willandra could channel off sufficient water to maintain the lakes. He also concluded that the Lachlan discharge could be doubled as a result of lower evaporation following a lowering of temperatures during the Pleistocene of about 5°C. He states (1970a:295)

'The evidence therefore indicates that there was a substantial increase in discharge during full-glacial time equivalent to at least twice present-day values. This can be adequately
explained by increased runoff due to low temperatures assuming that precipitation remained close to present-day values."

While there is no evidence for a full glacial arid period there is good evidence for a late glacial arid period. Bowler describes that as a Major Drying or Arid Period which occurred between 17,500 - 15,000 B.P. During this period the Willandra Lakes changed to low or oscillating water levels with high salinity when the thick Zanci clay dune lunette deposits were laid down. In other parts of the world most clay dunes are associated with very hot regions but it seems likely that mean temperatures at this period were similar to those of the full glacial. Bowler (1970a:302-3) interprets it as a period of warm to hot summers with temperatures like the present summer temperatures and cold dry winters possibly considerably colder than now. The changes that took place in this period also require that there was a drastic reduction in precipitation.

The final period occurred between 15,000 and 10,000 B.P. when there was a major interlacustral. There is little record of this phase in the sedimentary sequence but its effects are observable in the dry lake basins. Although dry, the period must have been moist enough to stabilize the dunes which were mobile during the preceding phase.

Evidence for minor climatic events in the period 10,000 years to the present comes mainly from the enclosed Lake Keilambete in Victoria but pollen sequences in southwestern Western Australia support the postulated fluctuations (Churchill 1968: 125-51). These were only slight shifts in temperatures and precipitation insufficient to cause significant landscape changes. The events did not affect less sensitive situations and should possibly be regarded as minor oscillations within a major interlacustral period that has continued until the present, although Bowler assigns them greater significance (1970a:320-7). The evidence does not support any of the suggestions of drastic changes previously suggested for this period of mid-Holocene aridity and the use of the term 'Great Arid Period' (Gill in Barendsen et al. 1957:916) is inappropriate (Bowler 1970a:317-19).

Comparison of the above sequence, summarized in table 1.2, with local sequences from elsewhere in the world (Bowler 1970a: 321-7) gave good agreement at some points but differed markedly
<table>
<thead>
<tr>
<th>Time</th>
<th>Phase</th>
<th>Geomorphic events</th>
<th>Climatic interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present -</td>
<td>Several minor oscillations within a major interlacustral.</td>
<td>Lake Keilambete rises and falls several times.</td>
<td>Higher temperatures c. 4000 B.P. corresponding to world-wide post glacial climatic optimum.</td>
</tr>
<tr>
<td>10,000 B.P.</td>
<td>Major interlacustral.</td>
<td>Stable period, little erosion or sedimentation.</td>
<td>Climate stable, lower temperatures? and precipitation?</td>
</tr>
<tr>
<td>10,000 - 15,000 B.P.</td>
<td>Major drying or arid period</td>
<td>Transitional stage between high freshwater environments to low or oscillating water levels and increased salinity. Dunes mobile, clay dune deposition.</td>
<td>Late glacial climate, summer temperatures hot, winters very cold. Increased evaporation and a drastic reduction in precipitation.</td>
</tr>
<tr>
<td>17,500 B.P.</td>
<td>Major lacustral or pluvial period</td>
<td>High lake levels, high water tables and high stream discharge. Period was interrupted by the Mungo oscillation at c. 23,000 - 25,000 B.P.</td>
<td>Temperatures c. 5° C lower, precipitation at approximately the present level but stream discharge twice that of the present day.</td>
</tr>
<tr>
<td>40,000 B.P.</td>
<td>Dune instability, prior stream system and some lunette lakes.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
at others. In the United States, the major drying phases seem to be out of agreement with those postulated for Australia. There may be differences between Australia and the Northern Hemisphere due to regional differences or to different air circulation patterns.

Human remains have been found associated with the Mungo high water phase dating back to 32,000 B.P. (Barbetti and Allen 1972: in press). The Mungo site is the major one as cremated human remains in association with stone implements and scattered and burnt food remains were found (Jones and Allen in Bowler et al. 1970:48).

1.6 Archaeomagnetism

The magnetism of Aboriginal fireplaces in Australia is currently being studied by Michael Barbetti. Because of the length of occupation in the Willandra Lakes the research has centred on this area. Barbetti (Barbetti and McElhinny 1972: in press) has found evidence in hearths from the Lake Mungo lunette for a brief reversal of the geomagnetic field between 28,000 and 31,000 B.P. The dates from these hearths, in particular ANU-680 30,750 ± 520, provide the oldest positive evidence of Man in Australia found. (Details of these dates are in Barbetti and Allen 1972: in press).

There are no indications as yet of the possible environmental effects of such a reversal. Crain (1971:2603-6) has recently postulated a direct causal relation between geomagnetic events and biological extinctions but the evidence seems slim.

1.7 Vegetation

Almost nothing is known of the vegetation history of western New South Wales. From the pre-Pleistocene period the remains of Nothofagus and some Myrtaceae and Casuarinaceae have been recovered in tertiary brown coal deposits 300 feet below the surface near Griffith (Pels 1969:504). From the Pleistocene, the only evidence consists of the remains of shrubby plants found in the gut or faeces of a Diprotodon from Lake Callabonna [S. Australia] dated to 40,000 B.P., which contained "fragments

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1 Department of Geophysics and Geochemistry, A.N.U.
of Chenopodiaceae and Amaranthaceae or Nyctagenaceae, and it may be inferred that...the vegetation may have been similar to that of today's saltbush-bluebush communities" (Gentilli 1961:491).

The present vegetation of the Darling Basin consisting mainly of mallee and semi-arid open scrub is typical of all of the semi-arid areas of southern and central Australia. The formations and plant associations compiled by myself from Beadle (1948:figure 21) and Comm. of Australia (1963:vegetation map) are shown on figure 1.5.

Three formations are dominated by *Eucalyptus* species. These are the mallee scrub, the tree savannah along the river and the *Eucalyptus-Acacia* shrub woodland.

1. **The Mallee:** The mallee is the most dense formation in western New South Wales. It forms thick belts of almost impenetrable scrub. The main species are *Eucalyptus dumosa* and *Eucalyptus oleosa*. The mallee is a unique plant formation as it is the only one dominated by *Eucalyptus* species able successfully to colonise arid and semi-arid regions. The trees are stunted (up to 30 feet in height) and many-stemmed. They grow thickly in some areas and this combined with a heavy under-storey of sclerophyllous shrubs forms a dense thicket (Beadle 1948:172). The mallee has always been a barrier to settlement and movement. In the Darling Basin, the mallee occurs chiefly on the sandy dunes and is the major vegetation type stabilising this environment.

The sandy nature of the soil precludes the formation of waterholes in the mallee. The absence of permanent water and the thickness of the vegetation make the mallee an unattractive environment for human exploitation. Beadle (1948:175-6) lists eighty plant species found in mallee areas. Of this total, only 13 (16%) of the plants were known to be eaten by Aborigines. This is the lowest proportion of edible plants to total plants found in any formation in western New South Wales. For the other formations, an average of twenty seven percent of all plants are edible in some form or another.

2. **Tree Savannah:** The tree savannah is dominated by *Eucalyptus collabah* (the collabah of Waltzing Matilda fame) or *Eucalyptus bicolor* (black box). Both species are dominant on heavy alluvial soils subject to occasional flooding.
Fig. 1.5: Vegetation map

Fig. 1.6: Fossil deposits of extinct marsupials
E. bicolor occurs in the southern part of the Darling Basin, E. coolabah in the north. The tree savannah is an open woodland with trees spaced so that only the canopy edges touch. Along the channel of the Darling River and its associated billabongs the formation can be restricted to a timber belt only one tree deep. The ground cover consists of grasses and succulent herbs (Beadle 1948:117-37). One third of the plant species (33%) listed as occurring in this formation are edible.

3. Shrub Woodland: The northern and eastern portions of the Darling Basin covered by shrub woodland are dominated by E. populifolia (bimble box) and Acacia aneura (mulga). West of Cobar, an area of shrub woodland is dominated by Acacia and Eremophila species. The formation occurs in areas that receive more than ten inches of rainfall, often on stony ground.

The higher rainfall areas are more like true woodland with an even open tree cover. Lower rainfall areas are more scrubby with patches of trees growing thickly together separated by patches of open grassland (Beadle 1948:165-71 and 185-97).

There are two formations in which Eucalyptus plays little or no part. These are savannah and shrub steppe and shrub steppe and grassland.

4. Savannah and shrub steppe: This is the predominant vegetation formation in the Darling River Basin (figure 1.5). The various plant communities are highly variable and trees may occur as dense stands separated by wide areas of grassland or thinly spaced, in which case large numbers of grasses, dwarf shrubs and herbs are found between the trees or in open patches. East of the Darling River, and in a small area south of Menindee, this formation is dominated by Casuarina lepidophila (belah) and Heterodendron oleafolium (rosewood). West of the Darling River north of Broken Hill, the formation is dominated by Acacia aneura (mulga). Mulga occurs in areas receiving less than twelve inches of rain. The grazing of sheep has severely reduced the density of mulga which occasionally was found in thick scrubby belts.

5. Shrub steppe and grassland: Species of saltbush (Atriplex sp.) and bluebush (Kochia sp.) dominate this formation. These are both small succulent bushes forming a low
scrub (two feet to four feet high) with the bushes separated by a few feet. This is the most open of any formation in the Darling basin, often covering many square miles without a single tree. It is common on areas of alluvial and strongly alkaline soils (Beadle 1948:223-42).

All the above formations have been changed structurally and floristically by activities carried out by pastoralists in the last one hundred years. Overgrazing, particularly in drought years, has had a deleterious effect on the whole countryside. Erosion is a serious problem in semi-arid Australia.

Large areas of Darling Basin scrub were cleared in the last century and clearing continues. However, this clearing has only reversed a situation created by European settlement. Loughan (1887:170-1) described the 'Great Central Scrub' which lay between the Darling, Bogan and Murrumbidgee rivers; he stated

'A few years ago the centre of the colony now described as scrubby was good clear open country, excellently well grassed, but very slightly watered ... the effect on a large number of these blocks of stocking ... has been the growth of an enormous amount of scrub which had previously been kept in check by sweeping bushfires. About 20,000 acres of land are affected. More than half of this great area is [now] thickly covered with pine [Callitris sp.]'.

It has been known since the first days of settlement that Aboriginal firing of the country side was an essential factor maintaining the open park-like woodlands. Mitchell (1848:412) stated

'Fire, grass, kangaroos and human inhabitants seem all dependent on each other for existence in Australia... fire is necessary to burn the grass, and form those open forests in which we find the large forest kangaroo ... but for this simple process, the Australian woods had probably contained as thick a jungle as those of New Zealand or America instead of open forests'.

Possible effects of Aboriginal burning on the Australian environment have been summarised by Jones (1969:224-8). In western New South Wales the absence of regular burning has meant that large areas have become thickly covered with young pine trees (Callitris sp.) (Dixon 1892:200).
1.8 Fauna

A number of fossil faunal collections have been made in the Darling Basin. Many of the collections made from older deposits contain species or families of marsupials known to have become extinct by the late Pleistocene. The large size of many of these extinct animals has caused them to become known as the giant marsupials. The location of fossil deposits that include extinct marsupials\(^1\) is shown on figure 1.6.

'The fauna from four of these sites, Lake Menindee, Lake Tandou, Lake Victoria and Hamilton Park are presently being studied. (Tedford 1967, Ritchie in Anon 1969:14, Marshall 1972: in press\(^2\), Merrilees 1972:in press\(^2\)).

The oldest fossil deposits are found near Lake Victoria. They date to an upper Pliocene age being found in the Moorna Sand. The vertebrate fauna is designated as the "Fisherman's Cliff Fauna" (Marshall 1972:in press). The fauna contains a number of species of the extinct genera Diprotodon, Protemnodon, and Sthenurus but surviving genera such as Bettongia, Lagostrophus, Lagorcheates, and Macropus are also present (Marshall 1972:in press).

Most of the other fossiliferous deposits in the Lake Victoria region are Late Pleistocene in age. The faunal collection from the Lake Victoria lunette is the most representative. The species obtained by Marshall from the Lake Victoria lunette are almost exactly the same as those collected from the Tandou lunette by Merrilees and Tedford and from the Lake Menindee lunette collected by Tedford. There are some slight differences. No species of Sthenurus were collected at Tandou (Merrilees 1972: in press) whereas three species were recovered at Lake Victoria (Marshall 1972:in press). On the other hand more species of Macropus were obtained at Lake Tandou than at Lake Victoria. The Sthenurids consisted of members of the subgenus Sthenurus which were browser-grazers, indicating a savannah-plains environment.

If the three sites are combined the list of species from them totals approximately sixty in number\(^3\). Fifteen of these

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\(^1\)Except for deposits containing the Tasmanian Tiger and Tasmanian Devil, which, although extinct on the mainland, survived in Tasmania.

\(^2\)Referred to with the kind permission of the authors.

\(^3\)These 60 species include the rodents as well as the marsupials.
species (25%) are known to have become extinct before the end of the Pleistocene (See a review of Pleistocene extinctions in Western Australia in Merrilees 1968). After reviewing the evidence available on when the extinctions occurred Jones (1968:203-4) suggested that the major extinctions took place in the period 20,000 - 30,000 years ago. The extinct forms are absent from deposits 15,000 years old and while the process is unlikely to have been a sudden event it was probably complete by that date.

The animals which were found in the lunette sites in western New South Wales and which are now extinct include Diprotodon, a number of Macropus species, Protemnodon, Procoptodon, Sthenurus, Propleopus, Phascolonus, and Thylacoleo. All of these species, except possible Propleopus, are larger in size than any marsupial still extant. The extinctions mainly affected the 'giant' species of marsupials.

From the Willandra Lakes region the only extinct remains found so far is a single jaw of Macropus ferragus (L. Marshall pers.comm.). This fragment was not associated with the Aboriginal remains and is probably much older.

The late Pleistocene fauna known from three lunette sites west of the Darling River are, as yet, not known from the lunettes of the Willandra lakes only thirty to fifty miles east of the Darling. I have made collections from a number of areas on the Willandra lunettes and can state that there are apparently no deposits with fauna similar to those found at Lake Victoria, Tandou and Menindee. This apparent absence is discussed by Jones and Allen (in Bowler et al 1970:54-5).

Of the forty five species, from the west Darling lunettes, which did not become extinct thirty five or 78% still existed in the same lower Darling region in the nineteenth century (Wakefield 1966a and 1966b). The other ten surviving species in the lunette fauna which are not today found in the Darling area are Dasyuroides byrnei, Byrne's pouched mouse; Thylacinus cynocephalus, the Tasmanian tiger; Sarcophilus harrisii, the Tasmanian devil; Perameles gunnii, the striped bandicoot; Isoodon auratus, the golden bandicoot; Phascolarctus cinereus, the Koala; Caloprymnus campestris, the desert rat-kangaroo; Lagorchestes conspicillatus, the spectacled hare-wallaby; Wallabia bicolor, the swamp wallaby and Rattus lutreolus, the eastern swamp rat (Marshall 1972:in press).
The Tasmanian Tiger and Devil probably became extinct on the mainland after the Dingo was introduced. The Koala, although apparently absent from the area today, could live in the forests along the Murray River without difficulty. The same is true of the other species requiring forest or swamp conditions, the swamp rat, swamp wallaby, and striped bandicoot.

The rest of the species today dwell in areas more arid than the Darling River. However, it is likely that areas away from the rivers would have provided suitable habitats.

Merrilees (1968) examined the marsupial species recovered from fossil bone deposits in Western Australia. In Western Australia thirty three percent of the species found in late Pleistocene deposits became extinct. Most of the animals which survived were still present in historical times. He came to three main conclusions: that there was

1. Extinction without replacement by related species.
2. Gradual species by species impoverishments not a sudden mass extinction.
3. Migration into the area was very limited (Merrilees 1968: 17-20).

The same conclusion would seem to be true for the Darling River also. There certainly was no replacement for the animals that became extinct. The fact that so many of the animals found in the lunette fauna were still present in the area 20,000 years or more later argues that there has been little major environmental change since that time. This conclusion is in conflict with the geomorphological evidence discussed above. The differences between these two sorts of evidence will be discussed further in chapter 9.

Both Jones (1968:202-5) and Merrilees (1968:19-20) concluded that environmental changes had not been responsible for the extinction of the giant marsupials. Further, both concluded that the activities of Aboriginal man, particularly hunting and the alteration of habitats by firing, had been the major cause (Jones 1968:204-5; Merrilees 1968:70).

Except for a species of *Macropus* found at Menindee (Tedford 1964:24), the remains of the giant extinct marsupials have not yet been found in direct association with Aboriginal man.
(Jones 1968:202-5, Mulvaney 1969:155-6). The Willandra Lakes area, with Aboriginal camping sites dating back to 30,000 B.P. appeared to be the perfect situation in which to find evidence of the association. This was one of my reasons for research in the area.
CHAPTER 2

ALIENS IN THEIR OWN LAND: ABORIGINES OF WESTERN NEW SOUTH WALES AND THEIR CHRONICLERS

2.1 Introduction

As a background for my assessment of the ethnographic literature I will now give a history of the Aboriginal peoples of the Darling Basin and of the destruction of their society by the Europeans.

It is an unfortunate fact that by 1890 when Fraser was publishing the "Golden Bough" and anthropological theory was still in its infancy, the Aboriginal inhabitants of the Darling River Valley were already living a miserable existence in shanty settlements outside the major towns. By this time they could truthfully be described as aliens in their own land. Of these people, Eyre said

'All that they have is in succession taken away from them - their amusements, their enjoyments, their possessions, and their freedom, - and all that they receive in return is obloquy, and contempt, and degradation, and oppression'. (1845a Vol.2:161).

2.2 Early exploration and settlement

The effects of the European colonisation of Eastern Australia were felt by the Aborigines before their first contact with the whites. Shortly after explorers had crossed the Blue Mountains a disease similar to smallpox infected the Aboriginal population. Descriptions of the disease are given by Cumpston (1925). When Sturt reached the Darling River in 1829 he recorded that "a violent cutaneous disease raged through the tribe,... sweeping them off in great numbers" (1833 Vol.1:93). Mitchell described similar effects on the Liverpool Plains in 1831 (1839 V Vol.1:218). Mitchell concluded "the population of the Darling seemed to have been much reduced by smallpox" (1839 Vol.1:307). Another epidemic in 1850 was estimated by Bonney (1883:124) to have killed one third of the Darling River Bagundji. We have no way of estimating what effect the death of probably one third to one half of the population over a period of twenty years may
have had on the survivors. In addition, there is no way of knowing how these epidemics have affected the information collected from the survivors.

When John Oxley crossed the Blue Mountains in 1817 he possessed a comprehensive list of instructions detailing the observations he was to record. The instructions covered the full range of natural science as it was then known. The age of European colonial expansion was one of curiosity and interest in the lands and people that were brought under domination. For the Aboriginal inhabitants that he met, Oxley was instructed to give "the extent of their population, their occupation, and means of subsistence; whether chiefly or to what extent by fishing, hunting, or agriculture, and the principal objects of their pursuits...A vocabulary of the language spoken...their condition and rules of society; their genius and disposition; the nature of their amusements; their diseases and remedies; etc., their objects of worship, religious ceremonies; and the influence of those ceremonies on their moral character and conduct" (Oxley 1820:361). Needless to say Oxley was able to describe only a small part of Aboriginal culture, as he passed quickly through the country; but from the beginning there were pressures for a full description of Aboriginal culture.

The explorations of Oxley, Hume and Hovell, and Cunningham had by 1827 set the scene for further exploration in New South Wales. These explorers had discovered eight major rivers flowing westward and the only clue to what happened to these rivers came from an unfortunate guess made by Oxley. When Oxley arrived at the flooded Macquarie marshes he "felt confident that (they)...were in the immediate vicinity of an inland sea, most probably a shoal one,...filled up by the immense depositions from the higher lands..." (Oxley 1820: quoted in Cumpston 1964:72). Oxley's theories stimulated further research, but later workers, in order to avoid the hypothetical sea set out during periods of drought (See Sturt 1833 Vol.1:2). Thus the observations they made were of Aboriginal peoples distressed by drought conditions. This factor also tied the explorers to the rivers to such an extent that our knowledge of native peoples living away from the rivers has always been limited.

The journals of the early expeditions remain the major source available for descriptions of Aborigines on the land and
for descriptions of economic activities. The explorers were sent out to solve geographical problems and had economic concerns, such as looking for good pasture, as a secondary aim. The material they provide is limited as the expeditions proceeded rapidly and only a small part of what was seen was recorded. However, a sufficient number of parties went through the Darling River area to provide some cross checks and a comprehensive picture of certain Aboriginal activities (See Appendix I). Lawrence discussed evidence contained in exploration accounts (Lawrence 1968: 23-8).

In this account, I will not give a detailed history of the exploration of the Darling River. Such histories are readily available (Cumpston 1951, 1952, 1964; Hardy 1969; Lee 1925). I have listed the expeditions under the names of the leaders, and have included a description of the country through which they passed and the manuscript and published material available for each expedition in Table 2.1.

The understanding of Aboriginal society at this time was not great. Most small groups are described as 'tribes'. Mitchell was amazed at the fact that his guide from Bathurst could converse freely with men on the Lower Lachlan and that these men were familiar with country almost to the Darling, but he had no idea that they made up a part of the one tribe (Mitchell 1839 Vol.3:36). Although in general the early accounts are purely descriptive, occasionally the recorder saw their information as being valuable for theoretical purposes. Mitchell made the comment that "the savage tribes of mankind, as they approach nearer the conditions of animals, seem to preserve a stronger resemblance to themselves and to each other. The uniform stability of their manners seems a natural consequence of the uncultivated state of their faculties; and it is satisfactory to discover such direct illustrations of ancient history, among these rude and primitive specimens of our race" (1839 Vol.2:347-8).

Settlement had begun along the Darling River by 1850 and stations were taken up around Lake Menindee in 1848. Accounts of the settlement of the Darling River can be found in the following works: Bean 1945, 1956; Bourke Historical Society 1966; Hardy 1969; Heathcote 1965; Jarvis 1949, 1952, 1956; Larcombe 1935; Roberts 1924, 1935; Ronald 1960.
Table 2.1  Early explorers

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<tr>
<th>Observer and period of observation</th>
<th>Location</th>
<th>References</th>
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<td>Macquarie and Bogan Rivers to the Darling</td>
<td>Sturt 1833</td>
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<tr>
<td>Sturt 1829-31</td>
<td>Murrumbidgee and Murray Rivers</td>
<td>Sturt 1833</td>
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<td>Mitchell 1831-32</td>
<td>Namoi and Barwon Rivers</td>
<td>Mitchell 1839; White 1832</td>
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<td>Mitchell 1835</td>
<td>Bogan and Darling Rivers to Menindee</td>
<td>Mitchell 1839</td>
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<td>Mitchell 1836</td>
<td>Lachlan, Murrumbidgee, Murray Rivers</td>
<td>Mitchell 1839; Stapylton 1837</td>
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<td>Hawdon 1838</td>
<td>Murray River to Adelaide</td>
<td>Hawdon 1952</td>
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<td>Eyre 1844</td>
<td>Morunde to Lake Menindee</td>
<td>Eyre 1845b</td>
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<tr>
<td>Sturt 1844-6</td>
<td>Darling River, Barrier Ranges to Cooper's Creek</td>
<td>Sturt 1849; Brock 1846; Browne 1845</td>
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<tr>
<td>Mitchell 1845-6</td>
<td>Bogan River to Cape York</td>
<td>Mitchell 1848</td>
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<td>Roderick Mitchell 1846</td>
<td>Darling and Warrego Rivers</td>
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<td>Kennedy 1847</td>
<td>Warrego, Barcoo, Cooper and Darling Rivers</td>
<td>Kennedy 1852</td>
</tr>
<tr>
<td>McCabe 1848-52</td>
<td>Between Lachlan and Darling Rivers</td>
<td>McCabe 1852</td>
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There are few descriptions of Aboriginal life from this early period of settlement. Although the settlers tried to maintain peaceful relations with the Aboriginal inhabitants, their activities brought them into collision on numerous occasions. The Aborigines had already had skirmishes with Europeans before 1850. Mitchell had had clashes with Aborigines on the Gwydir, in 1831, on the Darling in 1835, and on the Murray River in 1836 (1839 Vol.2:92-4). The Aboriginal inhabitants of the area near the junction of the Darling and Murray Rivers had a series of battles with Europeans driving sheep and cattle to Adelaide between 1839 and 1841. These clashes ended after a bloody punitive expedition from Adelaide inflicted severe casualties (Hassel 1962: 52-72). Raye drove cattle down the Darling in 1846 and had a series of similar skirmishes (Hardy 1969:61).

Conflict increased as more Europeans moved into the area and had reached a stage in the early 1850's such that a large number of stations had to be abandoned. McKinlay, the explorer, an early station-owner on the Darling gave a graphic if one sided description of the times: "...the Aborigines...came down upon the half-protected stations and livestock of the settlers, committing frightful murders and destroying their flocks and herds to an alarming extent. The blacks in fact took possession of the country, and threatened to utterly exterminate the white man, and establish a perfect reign of terror" (quoted in Hardy 1969:68). Eyre, writing from nearby Morunde, gave another point of view: "...without laying claim to this country by right of conquest, without pleading even the mockery of cession, or the cheatery of sale, we have unhesitatingly entered upon, occupied, and disposed of its lands, spreading forth a new population over its surface, and driving before us the original inhabitants. To sanction this aggression, we have not...the slightest shadow of either right or justice" (1845 Vol.2:159).

During 1845, Europeans were forced off the northern Darling (R. Mitchell 1845:157) and by the end of 1852 "...there was virtually no white settlement remaining on the Darling north of Polia" (Hardy 1969:69). One reason the Aborigines were able to regain the Darling country was that the pastoralists had serious difficulties getting labour in the period following the discovery of gold in New South Wales and Victoria in 1851.
In this respect the gold strike was to the advantage of the Aborigines. However, the increases in the price of meat, from less than two pence per pound in 1851 to one shilling per pound in 1854 and the doubling of the price of wool between 1851 and 1861 stimulated greater efforts on the part of the pastoralists (Taylor 1940:246). The country was retaken by 1859 and there is no record at what cost to human life. Few pastoralists took the view of Eyre. An interesting note appeared in a Sydney paper "...many of the blacks have of late years gone mad, and in that state become possessed with the idea that the devil is making strenuous efforts to carry them off and under the influence of this delusion often become very violent" (Anon. 1856).

Almost all frontage blocks had been taken up again by 1860. An important factor in the retaking and further occupation of the country by the Europeans was the increasing sophistication of firearm technology. McKinley's expedition in search of Burke and Wills in 1861 carried Colt revolvers\(^1\) and cartridge-loading rifles (Davis 1863:86). A pastoral-explorer, Gow, described the arsenal that he carried while on the Paroo river, it consisted of one double-barrelled gun, one revolving rifle, one revolving pistol, one duelling pistol and a horse-pistol (Gow Ms.1861). It is little wonder that some natives that he met "were very anxious to know if we were going to shoot them,...and were delighted when he replied in the negative" (Gow Ms.1861).

Spears may have been effective against muzzle-loading rifles and pistols but they were hopeless against cartridge-loading and revolving rifles and pistols.

The Aboriginal inhabitants had no legal rights whatsoever over land taken up and were from this time trespassers. The British Attorney General in 1847 stated that "the local government could not legally introduce into leases...a provision securing to the Aborigines the privilege of free access to lands remaining in an unimproved state, so as to enable them to procure the animals, birds and fish, on which they subsist" (Historical Records of Australia series 1:Vol.26:635). From 1847, leases were granted...

\(^1\)Samuel Colt patented his first revolving pistol in 1836, and Colt pistols were used extensively in the Mexican war 1846-8. Anon. Encyclopaedia Britannica (1969 Vol.6:107).
without any provision for Aborigines. The Aborigines had little choice but to leave their own lands and to attempt to find security and subsistence around the homesteads of the settlers. Europeans at this time rationalised this displacement in terms of what was later to become known as Social Darwinism. Eyre stated that it "was a popular, but an unfair and unwarranted assumption, that these consequences are the result of the natural course of events, that they are ordained by providence, unavowed and not to be impeded" (1845a Vol.2:157-8).

Because of a continued manpower shortage during the 1860's, the Aboriginal population became an important part of the pastoral industry. They were employed extensively as shepherds. Stations at this stage were huge runs covering up to 1,000 sq.miles, only partially fenced with brush fences, and stocked with flocks minded by shepherds, who lived at out-stations situated near permanent or regular water supplies.

2.3 Closer settlement

In 1857 a scientific expedition, led by William Blandowski, spent five months at the junction of the Murray and Darling Rivers. Blandowski made a personal trip up the Darling to Mt.Murchison (Wilcannia) but left few records (Blandowski 1857:129). More useful were two papers later published by Gerard Krefft, his assistant (Krefft 1866a, 1866b). In these two papers Krefft described the mammals and reptiles of the area and provided a detailed account of the Aboriginal economy. Along with the information about the Aboriginal exploitation of this riverine and semi-arid area, Krefft gave scientific descriptions of the animals caught. This was one of the very few occasions where unambiguous accounts of Aborigines hunting specific animals were given. (See Wakefield 1966a and Appendix I). A black and white reproduction of a watercolour by Krefft showing an Aboriginal woman cleaning a fish is shown on Plate 3.1a.

The years 1860 and 1861 were important years in the history of Australian exploration. In 1860, the Victorian Exploring Contingent, set up under the auspices of the Philosophical Institute of Victoria and led by Robert O'Hara Burke, left Melbourne to cross the continent. The party included Dr. Herman Beckler as botanist and Ludwig Becker as naturalist. The party
<table>
<thead>
<tr>
<th>Observer and period of observation</th>
<th>Location</th>
<th>References</th>
</tr>
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| Beckler 1860-61                    | Murrumbidgee River to Menindee  
                                    | Menindee to North-West N.S.W.    | Beckler 1861 |
| Becker 1860-61                     | Murrumbidgee River to Menindee   | Becker 1861 |
| Wright 1861                        | Menindee to Cooper's Creek       | Wright 1862 |
| Brahe 1861                         | Menindee to Cooper's Creek       | Brahe 1862 |
| Wills 1861                         | Menindee to Gulf and Cooper's Creek | Wills 1863  
                                    |                       | Wills 1861 in Burke and Wills 1861 |
| King 1861                          | Cooper's Creek                    | In Burke and Wills 1861 |
| Howitt 1861                        | Menindee to Cooper's Creek        | Howitt 1861 in Burke and Wills 1861  
                                    |                       | Welch 1861 |
| Howitt 1862                        | Wilcannia to Cooper's Creek       | Howitt 1862 |
| McKinlay 1861                      | Adelaide to Cooper's Creek        | McKinlay 1862; Hodkinson 1861;  
                                    |                       | Davis 1863 |
| Landsborough 1861                  | Gulf of Carpentaria to Barcoo and Darling Rivers | Landsborough 1867 |
camped at Arumpo House near the 'Walls of China' on 27th September. Unfortunately Burke was uninterested in the problems of science and left the scientific contingent at Menindee. His later fate has been the subject of many books (Burke and Wills 1861, Clune 1944, Moorehead 1963, McLaren 1959, Royal Commission 1862, Wills 1863).

Becker and Beckler left journals of short expeditions around Menindee and Becker made some fine drawings (See Plates 3.1b and 6.2b). Apart from the journals and notes kept by King and Wills when they were living with the Aborigines, the scientific achievements of the expedition were almost nil. Far more useful in terms of geographical and scientific knowledge of Central Australia are the reports made by members of the many relief expeditions which were sent out to try to find the lost party. I have set out a list of these expeditions and the country through which they passed, together with a list of the records available in Table 2.2. Together they form a good collection of observations of Aboriginal life in north-western New South Wales and Central Australia.

While the fate of the Burke and Wills expedition was holding the attention of the eastern capitals, exploration in the Darling country for pastoral lands and for transport routes continued. Accounts left by pastoralist explorers generally provide little information about the Aboriginal inhabitants. Their journals reflect their lack of interest in the Aborigines and include little apart from reports of the frequent and bloody clashes they had with the Aborigines. A typical example came from the reminiscences of W.H. Tietkins "...a few evenings after our arrival a large body of blacks...camped upon the north and north-west shore of the lake (Cobham)...all night long they made the night hideous with their war chants and corroborees...we fired upon them when they rushed...they got such a very rough handling that they soon retreated" (Tietkins, n.d.b:3). Table 2.3 lists these later expeditions into the back-country away from the rivers. Descriptions of pasture, the location of waterholes, and descriptions of their relations with the 'blacks' was all that most accounts of these expeditions contain, although there were some exceptions.

The consolidation of stations proceeded during this period, particularly after 1859 when the first two riverboats
<table>
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<tr>
<th>Observer and period of observation</th>
<th>Location</th>
<th>References</th>
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<tr>
<td>Maher 1850</td>
<td>Bogan and Lachlan Rivers</td>
<td>Maher et al. 1850</td>
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<tr>
<td>Suttor 1858</td>
<td>Lachlan to the Darling River</td>
<td>Suttor 1887</td>
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<td>Anon 1859</td>
<td>Lachlan to the Darling River</td>
<td>Anon 1860b</td>
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<tr>
<td>Dowling 1859</td>
<td>Paroo and Bulloo Rivers</td>
<td>Dowling 1859</td>
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<tr>
<td>Gow 1860-61</td>
<td>Menindee to Barrier Range</td>
<td>Gow 1861</td>
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<tr>
<td>Woore 1863</td>
<td>Northwest of Wilcannia</td>
<td>Woore 1928</td>
</tr>
<tr>
<td>Gormly 1864</td>
<td>Lachlan to the Willandra Billabong</td>
<td>Gormly 1918</td>
</tr>
<tr>
<td>Tietkins and Giles 1865</td>
<td>Wilcannia to the Bulloo</td>
<td>Tietkins n.d.</td>
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steamed up the Darling and opened up new lines of supply and communication (Randell 1861, Hardy 1969:85). Occasional incidents of conflict between the Aborigines and whites continued at least until 1867 (Hardy 1969:141), but by this time there were native police troopers in the area and clashes became rare.

At the same time, Aborigines on the central and northern Darling had become shepherds, as had the Aborigines in the south a few years earlier. Initially the Aborigines were able to work for the Europeans while continuing some traditional economic pursuits. Technological changes during the early 1870's were to make both pursuits less possible if not impossible. From about 1873 galvanized wire for fences became available. This enabled the pastoralists to subdivide their huge holdings into paddocks and "as the paddocks became smaller the shepherds became fewer" (Hardy 1969:99). Wells and bores were being sunk in the back country to tap subterranean water supplies thus enabling close pastoral activities to spread out from the river frontages and permanent springs. A contemporary observer recollected in 1905 that she had seen "some of the blacks methods of catching game" but that "some had long since died out of use" (Parker 1905:105). Descriptions of subsistence activities written after the end of the 1870's are probably relying on the author's memory or the memories of others. It is unlikely that they could have seen much of the traditional economy after this time.

2.4 Homestead accounts

Some of the many European settlers living along the Darling River and elsewhere made notes on Aboriginal activities and began to question the Aborigines about other aspects of their society and life. Many of these accounts were written in the early period of settlement but were only published later in the 19th century as a response to the growing interest in Aborigines both in Australia and overseas. One was published as recently as 1943 (Dunbar 1943) and some unpublished notes made by Frederick Bonney were not cited until 1971 (Sullivan 1971). Table 2.4 lists these homestead accounts.

The information in these works varied widely. Most provided vocabularies and most were by this time familiar with the larger Aboriginal groupings such as tribes but gave little detail about smaller social groups. There was some confusion about the boundaries and location of tribes and names.
<table>
<thead>
<tr>
<th>Observer and period of observation</th>
<th>Location</th>
<th>References</th>
</tr>
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<tbody>
<tr>
<td>Eyre 1841-1844</td>
<td>Moorunde, Murray River</td>
<td>Eyre 1845a</td>
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<tr>
<td>Beveridge 1845-1868</td>
<td>Murray and Lower Darling Rivers</td>
<td>Beveridge 1883</td>
</tr>
<tr>
<td>Tuelon 1863-1884</td>
<td>Bourke</td>
<td>In Curr, Vol. 2 1886</td>
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<tr>
<td>Bonney 1865-1880</td>
<td>Wilcannia and Mt Murchison</td>
<td>Bonney 1883; Bonney n.d.</td>
</tr>
<tr>
<td>Newland 1861-1876</td>
<td>Paroo and Darling Rivers</td>
<td>Newland 1888; Newland 1913; Newland 1921; Newland 1926</td>
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<tr>
<td>Cameron 1868-?</td>
<td>Willandra Billabong (Mulurulu)</td>
<td>Cameron 1884; Cameron 1899; Cameron 1900</td>
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<tr>
<td>Parker 1870-c.1890</td>
<td>Narran and Darling Rivers</td>
<td>Parker 1896; Parker 1898; Parker 1905; Parker 1918 Parker 1930</td>
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<tr>
<td>Bennett ? -1893</td>
<td>Willandra Billabong (Mossgie1)</td>
<td>Bennett 1893; Bennett 1897</td>
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<tr>
<td>Dunbar ? -1943</td>
<td>Darling River (Louth)</td>
<td>Dunbar 1943</td>
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Table 2.5 lists groups mentioned in the homestead accounts. Tuelon mentions that Aborigines from the back country had already moved on to the River by 1884 (Tuelon in Curr 1886 Vol.2:189). So there had certainly been some dislocation by this time. Table 2.5 also gives some idea about which tribes each author described or knew. There is ample ground for confusion as 'Bagundji' means 'river people' and 'Maljangaba' means 'Lake water' (Beckett 1958b: 91 and 1967:456) and presumably there are other similar names which could be used. A Nualko group may have been called 'bagundji' if they lived by the river even though they did not belong to the 'Bagundji' tribe. All these writers describe the rapid decline in the Aboriginal population over the period 1860 to 1880 and all express fears that the Aborigines would soon become extinct. This decline was probably caused by a combination of attrition, disease, demoralisation and starvation.

Howitt (1889-90:40) described part of the process of settlement and depopulation

'I know an instance when the blacks were not permitted by the white occupiers of their country to roam over it, but were compelled to live in certain places, and these were not the most favourable on the run. The result was semi-starvation, followed naturally by cattle killing and this led to the tribe being, in the euphemistic phrase of the frontier, 'dispersed'.'

In the New South Parliament in 1901, mention was made of the fact that the game had died out in the electorates of Wilcannia and Wentworth and that the blacks 'were in a state of half starvation'. Newspaper cutting October 18th 1901 (Bonney Ms.).

While the disruption of traditional Aboriginal life was taking place Europeans were able to obtain some information about the traditional social and economic organisation of the Darling River Aborigines.

Many of the accounts included descriptions of ceremonies concerned with birth, with the coming of adult status and with the death of an individual. However, none of the authors was able to place these ceremonies in the context either of the social organisation or of the sacred life of the groups described. Tuelon noted "the blacks of the present day are singularly reticent touching all their ceremonies" (in Curr 1886 Vol.2:202). Surprisingly enough, the woman contributor, Parker, was the only
<table>
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<tr>
<th>Table 2.5</th>
<th>Tribal groups</th>
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<tr>
<td></td>
<td>Tindale&lt;sup&gt;1&lt;/sup&gt; 1939</td>
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<tr>
<td><strong>Darling River</strong></td>
<td></td>
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<tr>
<td>Barenbinja Ng.emb</td>
<td>Burrembinya</td>
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<tr>
<td>Naualko</td>
<td></td>
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<tr>
<td>Ku.1a Ba.kendji</td>
<td>Kahtegully</td>
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<tr>
<td><strong>West Darling</strong></td>
<td></td>
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<tr>
<td>Paru.ndji</td>
<td>Bahrunjy</td>
</tr>
<tr>
<td>Wanjiwalku</td>
<td></td>
</tr>
<tr>
<td>Wiljakali</td>
<td></td>
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<tr>
<td>Dangga.li</td>
<td>Tung-arlee</td>
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<tr>
<td>Malyangappa Karenggapa</td>
<td></td>
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<tr>
<td><strong>East Darling</strong></td>
<td></td>
</tr>
<tr>
<td>Wiradjuri Wongaibon Barindji</td>
<td>Wiradjeri Wonghi Ber-aite</td>
</tr>
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<sup>1</sup> A variation on Tindale’s map for the West Darling can be found in Beckett 1958:96
<sup>2</sup> Bonney (1883:122) describes Weynebulckoo as the language spoken by all of the Bagundji tribes not as a tribal group.
<sup>3</sup> Beckett's Bandjigali.
ethnographer to supply many details of the sacred life at all, which she says she was told "by a very old man...in whispers" (Parker 1905:5). Information about economic life is sketchy, only Bonney giving any detailed information (Bonney Ms.c.1881). The writers of the homestead accounts, by the time they published, were familiar with the theoretical interests of writers such as Howitt. Parker was a correspondent of Andrew Lang and knew the works of Herbert Spencer, Spencer and Gillen, and Fraser.

Towards the end of the 19th century there were further disruptions which hastened the destruction of any remaining traditional aspects of Aboriginal life. The ecological basis of traditional life slowly disintegrated as many species of animals and plants became locally extinct from the pressure of sheep and over grazing, rabbits, foxes and drought. Parker referred to totemic clans which continued to exist after the totem animals had themselves become extinct (Parker 1905:17-20). Rabbits were common around White Cliffs as early as 1884 (Ronald 1960:148). The discovery of valuable minerals in Western New South Wales brought gold rushes to some centres and large town populations to others. Copper was discovered at Cobar in 1869, and at other centres in the central West; gold was discovered at Mt. Brown in 1880, and silver and lead at Silverton in 1882 and Broken Hill in 1885. By 1891, Broken Hill was a town of 20,000 people (Hardy 1969:151-77). The value of the Aborigines as an economic asset for the pastoral industry was also diminishing at this time. In 1891 there were 15 million sheep in the Western Division but serious destruction of pastures from overgrazing and drought years from 1891 to 1902 reduced this number drastically. After World War I some increase in sheep numbers took place but the Western Division still held only 3.5 million sheep in 1921 (Baker in Cobar Copper Centenary 1969:30).

Along with the general destruction of Aboriginal life in the Darling River valley traditional life did survive in a few isolated places. Beckett stated that certain groups of the Wongaibon inhabiting the dry country between the Lachlan and Darling Rivers "had only limited contacts with the whites until the 1920's when the Condobolin-Broken Hill Railway was laid" (Beckett 1969:200). On the lower Darling an Aboriginal man named Nanya fled from Cuthero with two women in 1864 and lived in the
dry mallee country close to the South Australian border. When the group returned to the settled areas in 1894 they numbered 30 persons (Cudmore 1893:525; Birdsell 1957). All thirty were dead from sickness or other causes by 1906 (Tullock 1965:53). (see also Hardy 1969:20-21; Russel 1953:61).

2.5 Postal anthropologists
In his biography of Darwin, de Beer lists six works concerned with the evolution of human society published between 1860 and 1871 (de Beer 1968:217). These were the Origin of Species and the Descent of Man by Darwin; Maine's Ancient Law; Maclean's Primitive Marriage; Lubbock's Origins of Civilization and the Primitive Condition of Man and finally Tylor's Researches into the Primitive History of Mankind. These books and others published later had a great effect on the few people in Australia writing on the Aborigines from a theoretical point of view. One of the things that did concern these Australianists was the lack of comparative information available about different groups of Aborigines. To fill this gap in knowledge a number of writers sent out questionnaires to missionaries, policemen, magistrates and landholders. These were the first attempts to obtain systematic comparative information about the Aborigines and, for some Aboriginal groups, the correspondents' replies remain the only sources of information. Four major compilations were published (Brough-Smyth 1878; Curr 1886; Howitt 1904; Taplin 1897). Curr, Howitt and Taplin had all had first-hand experience gathering ethnographic material from Aborigines and were aware of some of the dangers of their approach to the subject. (See Lawrence 1968:29-30; Corris 1968:10-21). Copies of Taplin's questionnaire were published in the original volume (Taplin 1879:5-6) as was Curr's (Curr 1886 Vol.2:189-207). Howitt's questionnaire was reproduced in Lawrence (1968:242). The questionnaires concentrated on language, social organisation, legal systems, ceremonies and beliefs to the neglect of economic life and material culture, with the emphasis on the comparative study of culture traits rather than on an integrative study of the culture of any one group.

Elkin, Mulvaney and Thomas provided studies of the early history of Australian Anthropological thought (Elkin 1963; Mulvaney 1957-9, 1971; Thomas 1906). All emphasise the impact of the
theories on overseas writers on early Australian Anthropologists. Of the authors reviewed in these historical studies, A.W. Howitt is the most important for Darling River studies. Howitt was strongly influenced by Morgan and the evolutionary schemes that he proposed (Mulvaney 1957:8:306-8, 1971:285-374 and Harris 1968:180-8 for a summary of Morgan's work). Howitt was also influenced by Tylor (Mulvaney 1957:9:311). In a series of papers, Howitt proposed a number of different evolutionary sequences (see Mulvaney 1971:372-4 for a comprehensive bibliography of Howitt's works). He arranged the social institutions of Aboriginal tribes into sequences going from ancient to modern. On the basis of these sequences Howitt was also able to arrange the tribes into an order going from most primitive to least primitive. The 'Barkinji type of system' from the Darling Basin took its place at the bottom of the scale (1888:9:32).

Unfortunately for our knowledge of the social organisation of the Bagundji, the type society for the 'Barkinji type of system' remained the Dieri. The Dieri, Kurnai and Kamilaroi tribes formed the focus of Howitt's work.

In 1899 Spencer and Gillen published The Native Tribes of Central Australia marking the beginning of active research in central and northern Australia. Yet by 1904 when Howitt published his Native Tribes of South Eastern Australia the opportunity for research into traditional Aboriginal culture in the south-east was already almost lost. The early interest in the tribes of the south-east occurred because it was thought they "represented the Type of Prehistoric Man, in the initial stages of human social development through Savagery" (Howitt quoted in Mulvaney 1971:287). However, after Spencer and Gillen's work, interest shifted to the Centre, as the Arunta were thought to represent an even earlier stage. Fraser, introducing The Native Tribes of Central Australia, described Central Australia as "shut off...from the outer world...isolated from the rest of Australia...the ideal field for the anthropologist who desires to study man in the lowest stage of culture now accessible to us on the globe" (Fraser 1898:281). Some of the evolutionary sequences postulated by writers overseas were to find their validation in Central Australia. Fraser described the Intichiuma ceremony as "the long-looked-for rite" (Fraser Preface to Golden Bough 2nd ed. quoted in Mulvaney 1957-9:312).
2.6 R.H. Mathews

R.H. Mathews, a government surveyor, spent considerable periods of time in western New South Wales. His anthropological interests were language, social organisation, and ritual. His first paper was published in 1892. Elkin commented on Mathews that while he "did not recognise the value of formal representation of the full kinship system...he did observe that kinship was inherent in the section system" (Elkin 1963:15). Similarly he recognised the connection between Aboriginal beliefs and ritual although unable to get much information from informants (Mathews 1895-6:318). He was able to see performances of some of the last Wiradjuri and Kamilaroi ceremonies of initiation. In a paper on the Bagundji published in 1898, Mathews attempted to group together a number of tribes situated about the Darling River because they shared similar rituals and were all internally divided into two matri-moieties named 'Muckwarra' and 'Keelpara'. He described this grouping as the 'Barkunjee Nation' (Mathews 1898:241-55). Howitt attempted to combine the same tribal groups into three nations, 'the Itchmundi', 'the Karamundi' and 'the Barkinji' (Howitt 1904:49-51). Both attempts relied on too few criteria to be successful. Their 'nations' masked real differences in language, ritual and belief systems between some of the tribes which they combined. (See Meggitt 1966:67-8 for a criticism of the 'nation' concept).

2.7 Later anthropologists

During this century four social anthropologists have worked in western New South Wales, all gathering their material from interviews with one or a few old men (Beckett 1958a, 1959, 1967; Berndt 1947; Elkin 1938; Radcliffe-Brown 1929). Radcliffe-Brown worked with people from Cobar as part of an Australia wide survey of kinship systems; Elkin was mainly working in South Australia but interviewed some men from north-western New South Wales; Berndt worked at Menindee securing information about Wiradjuri magicians; Beckett, working at Lake Cargelligo and Wilcannia, collected information on traditional life of the Wongaiben and Maljangaba and also on present day conditions.

Between Radcliffe-Brown and Howitt there are considerable theoretical differences. Howitt's evolutionary sequences are seen
by Radcliffe-Brown as "conjectural history"; and although he described himself as an evolutionist in the "Spencerian sense" (1952:8) and despite his statements about the importance of history and the physical environment in anthropological studies, Radcliffe-Brown and others of the British school of social anthropology have in fact largely ignored these aspects. In western New South Wales it was clearly impossible to observe the kinship and totemic systems operating within the wider cultural and ecological context, as the latter had been destroyed in the middle of the 19th century. But this was not true elsewhere, and the absence of any study in which social, environmental and historical aspects have been analysed in an integrated fashion, means that we have not a single model with which to compare the fragmented data available for the south-east. These social anthropologists in the main were using what Radcliffe-Brown called the "synchronic approach": "the description of a form of social life as it exists at a certain time, abstracting as far as possible from changes that may be taking place in its features" (Radcliffe-Brown 1952:4). The effect of this approach was that historical information inherent in the information collected was ignored or remained undeveloped. The additional information gathered for western New South Wales fills in gaps in the knowledge of the kinship systems of some tribes and also provides occasional hints about the history of these systems.

2.8 Field archaeology

After the First World War, some field archaeology was carried out in western New South Wales, generally without reference to the few surviving members of Aboriginal groups still living in the area.

When Sir Thomas Mitchell passed along the Darling River in 1835, at one spot he noticed some objects made of gypsum, one of which had the appearance of a skull cap (Mitchell 1839 Vol.2:253). These were funerary items now known as 'grave markers' and 'widow caps' (Plate 4.1). They were uncovered in the first excavation carried out in the Darling River area (Officer 1901) and because of their limited distribution, which is restricted to the Darling River and northwest to Lake Eyre, they have caused considerable interest (Black 1949; Bulmer in Curr 1886 Vol.2; Goddard 1936; Mathews 1909, 1911; Officer 1901; Waite 1921-2). Other unique items of the Darling River material culture such as cylindro-conical
stones (Plate 4.2) also caused interest. A voluminous literature on these stone phalli has appeared (Black 1942; Etheridge 1916; Harper 1898; Mathews 1909; Pulleine 1922). The discoveries of these items of material culture stimulated further work in the area. A number of studies of art sites and ceremonial grounds were carried out (Cameron 1900; Dow 1938a, 1938b; Pulleine 1925a, 1925b; Richards 1908; Towle 1939, 1943). Gresser (1962, 1963) made large collections of stone implements from surface sites. During the period 1941–1950, R. Lindsay Black published twelve papers and travelled extensively in western New South Wales (Black 1941, 1942, 1943a, 1943b, 1943c, 1944, 1949, 1950).

Black was motivated by a deep personal interest in the Aborigines of the Darling River. Many of the articles and pamphlets listed above he published at his own expense.

Elkin in the foreword to one of Black's books stated "It is almost possible to speak of a Darling River culture, although in some of its features eg., bora rings and carved trees it was linked with the east coast, while the matrilineal moieties and cylcons of the tribes on its western bank link the latter with the Cooper's Creek cultural region" (Elkin in Black 1944:1). Black, unfortunately despite his studies on the distribution of cultural elements such as carved trees, rock carvings and paintings, cylcons, stone mounds and arrangements (Bora grounds) did not arrive at any conclusions about whether or not the Darling River represented a distinct cultural region. Black was not familiar with the boundaries of tribal territories in any real sense and he failed to notice that the spatial distribution of some of the cultural traits which he mapped was not always continuous across these boundaries (see Figure 4.2).

The Lake Menindee site, discovered in 1939, was explored in 1953 by Tindale and Tedford (Tedford 1954, 1967; Tindale 1954). Mootwingee, an important art site, was surveyed and some excavations were carried out by McCarthy and Macintosh (1962) from 1959-1961. These later archaeological activities will be fully discussed in chapter 7. Their introduction in the present chapter brings this historical summary to an end.
CHAPTER 3

THE BAGUNDJI RIVERINE ECONOMY

3.1 Introduction

I shall now reconstruct the economy and subsistence activities of the Darling River Bagundji using the detailed ethnographic observations made by the settlers, explorers and anthropologists discussed in Chapter 2.

The ethnographic descriptions discussed below provide information about the people who left the archaeological remains in recent sites such as Burke's Cave, Mootwingee and Meadow Glen which are described in later chapters. A detailed understanding of the ethnographic information is necessary in order to interpret the final phase of Aboriginal prehistory. It is also necessary so as to be able to understand those changes that took place in the prehistoric period and which produced the societies that were observed when the Europeans arrived.

This understanding is based not on the use of ethnographic analogies but on the documented link between the archaeological materials and the Aboriginal people who formerly inhabited the area. This is a direct historical connection. It is one that provides a powerful tool that can be used to analyse the differences between the distant past and the ethnographic present.

The more detailed aims of this chapter are listed below. These are:

1. To document the various foods known to have been eaten by the Aborigines in the research area. (These are listed in Appendix 1).
2. To illustrate the methods that the Aborigines used to obtain these foods and the seasonal variation in their availability.
3. To analyse the ethnographic literature in order to see what effect fluctuations in the environment, such as droughts or seasonal changes, have on group movements and group sizes.

One of the broader questions to be asked of the economic data is whether or not the Bagundji-speaking tribes of the area,
who inhabited territories up to 100 miles from the river, can be regarded as having a riverine economy.

The ethnographic information about the diet and subsistence activities of the Murray-Darling Aborigines has been reviewed by a number of authors in recent years (Bickford 1966; Lawrence 1968; Allen 1968; Sullivan 1970). I review this literature again in order to assist the archaeological interpretations that follow.

In chapter 2, the concept of a 'nation' of Aboriginal tribes was mentioned. This concept was used extensively by ethnographers in the last century, such as Howitt and Mathews, to designate a number of separate Aboriginal tribes which could be combined into a unit or a nation on the basis of one or more shared traits. Once the term 'nation' was applied to combine a number of different tribes, however, the connotation of some political or administrative connection soon sprang up in the minds of people discussing them. As doubt has been raised as to whether there is any administrative or political connection between the local groups making up a single tribe (Meggitt 1966:68-9) it is inappropriate to use a term that implies such connection between tribes.

On the other hand, there is a need for a term to describe a number of tribes living in a single area who share a number of cultural traits. Elkin (1931:53; 1938:40-41) uses the term 'group' of tribes to express this concept (Elkin [1938] 1961:42-4). A number of tribes inhabiting the area to the east of Lake Eyre, the Dieri, Wonkanguru etc., have been called the 'Eastern Lakes Group' by Elkin.

The tribes that formerly inhabited the Darling River Valley and adjacent areas have divided into three groups by Beckett (1958a:32-5, 1958b:91-2). He called these the Wiradjuri, Bagundji and Maljangaba groups. The division is based on linguistic, kinship and ritual similarities. The approximate tribal areas for each of the tribes mentioned is shown on figure 3.1.

(i) The Wiradjuri Group

This group included the Wiradjuri, Wongaibon, Weilwan, Ngeumba and Yalarai tribes (Beckett 1958a:32, 1959:200). These

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1Beckett's original formulation did not include the Yalarai but this tribe is in fact fairly closely related to the Ngeumba and Wongaibon in social and ritual organisation (see Parker 1905:6-15, Mathews 1908:24-6, Beckett 1959:205).
tribes made up a linguistic subgroup (Capell 1956:31).

(ii) **The Maljangaba Group**

The Wonggumara, Gungadidji, Maljangaba, and Wadidgali were originally included with the Dieri, Yantruwanta, Wonganguru and Arabana to form Elkin's "Lakes Group" of tribes. Beckett (1958a:35) discussed them as a different group though they share some linguistic and ritual practices with the Lakes Group (Beckett 1967:461 and Wurm quoted in Beckett 1958a:35). It seems to be more profitable to regard them, as Beckett did, as two different but related groups.

(iii) **The Bagundji Group**

The Bagundji, Danggali\(^1\), Wainjubalu\(^2\), Bandjigali, Barundji, and Wilyali\(^3\) tribes made up the Bagundji group (Beckett 1958a:32, 1967:475). These tribes had essentially the same language (Wurm quoted in Beckett 1958a:32). The Birindji and Maraura tribes can be included in the Bagundji group because of linguistic and kinship system similarities (Cameron 1884:346; Radcliffe-Brown 1918:248-9).

The various tribes making up the Bagundji group occupied different geographical areas and possessed different ecological resources. Because of this there were variations in diet and seasonal movements from area to area within the Darling River Valley. To look at these variations, ones that particularly affect the subsistence ecology, I have divided the Bagundji group into three different divisions on the basis of the nature of the inhabited territory.

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\(^1\)These names vary from author to author, see a list on table 2.5 in Chapter 2, above.

\(^2\)Elkin considers the Wanyabalgu as either part of the Wadikali tribe or another name for it (Elkin 1938:4); Bonney (1883:122) describes the Bagundji language as Weynebulckoo but does not mention a tribe of this name. Tindale (1939) and Beckett (1958:96) both have a tribe of this name marked on their maps.

\(^3\)Elkin thought that there were few differences between the Wilyakali and Maljangaba (1938:43), a comparison of the kinship systems of these tribes (Beckett 1967:457-8) reveals significant differences.
Fig. 3.1: Approximate tribal boundaries

Tribal name: KULA
Approximate boundary

No. of people observed

0-10
10-25
25-50
50-75
75-100
100 +

Small group
Large group

Perennial stream
Ephemeral stream

Lands subject to inundation

Summer observations

Miles
(a) The West Darling Division
This geographical division covers the area occupied by tribes inhabiting the hilly country and plains away from the river flats, to the north and west of the river. These tribes were the Wilyali, Bulali, Danggali, Bandjigali\(^1\), Wainjubalgu, and Barundji.

(b) The River Division
The tribes inhabiting the river frontages, Maraura, Bagundji and possibly the Burrumbinja. These tribes occupied both banks of the Darling River east and west to a width of about 40 miles from Wentworth to Bourke.

(c) The East Darling Division
The East Darling area, like the West Darling, is 'back country', land away from the river. Unlike the West Darling there are few rocky areas. The East Darling division, occupied mainly by the Birindji tribe\(^2\), is a very dry area of scrub and grass-covered plains or sandy dune and mallee country.

3.2 The subsistence ecology of the river division
There is no doubt that the river is the single most important resource in the Darling River Valley. Its fluctuations probably affected the lives of all of its former Aboriginal inhabitants whether they lived directly on its banks or not. As a source of food it appears to have been invaluable.

In 1968 (Allen 1968:37-8), after carrying out a content analysis of the ethnographic literature I came to the conclusion that about 30-50% of the food eaten by the Darling River Aborigine, came from, or was directly associated with, the river. These foods were fish, freshwater mussels, crayfish, turtles, aquatic birds and aquatic plants.

These foods are listed in Appendix 1. Rather than describe each type of food in detail I will use extracts from the ethnography to illustrate the methods that the River Bagundji used

\(^1\)Bungyarlee of Bonney (1883:122). I use Beckett's (1958b:96) terms.

\(^2\)The name means 'people of the trees' [scrub] (Tindale 1939:245) The Brindji are the Berri-aits of Cameron (1884:346) and Howitt (1904:}
to harvest the food from the river. The methods varied with the condition of the river and the local situation. What I hope will emerge from these descriptions is a picture of the Bagundji as a group of hunter-gatherers who were able to bring a sophisticated range of material items into operation in order to secure their livelihood.

The hallmark of their economic activities seem to have been the net, trap and snare operated by a group of people rather than the traditional picture of the lone Aboriginal hunter armed only with a spear and his own resourcefulness.

(a) Fish

A common method of fishing consisted of placing a brush dam across a creek and catching fish in a net attached to the middle of the weir; Mitchell saw such traps on the Gwydir River

'No fish could be caught this day, and we supposed that the natives were busy taking them, above and below our camp, for in their mode of fishing, few can escape. We had previously seen the osier [basketwork] nettings, erected by them across the various currents,...The frame of each trellis was well squared...and the twigs were inserted, at regular intervals, so as to form, by crossing each other, a strong and efficient kind of net or snare...a small opening was left towards the middle of the current, probably, that some bag or netting might be applied there to receive the fish, while the natives in the river above should drive them towards it' (1839 Vol.1:100-1).

Fixed nets were used in the same way. An early settler on the Darling described how

'for catching fish a smaller net than that used for birds was stretched across a small creek emptying a lake or billabong...'

He also discussed some of the other methods used

'when the water back from the river became low, large quantities of fish were obtained by driving them into shallow pens made of mud. There were also permanent stone pens formed on reefs across the Darling' (Newland 1887-8:23).

The most detailed descriptions of Aboriginal fishing methods came from the Murray River. The same methods and equipment were
probably in use on the adjacent Darling River. Beveridge, a resident on the Murray whose brother was speared to death by Aborigines, described fishing nets as having been

'About as long as duck nets [100 yds] but not so deep, only four foot wide, the mesh is also different being 3 inches wide...the first and most common method of fishing ...termed hauling...A lagoon known to abound in fish, and perhaps not more than waist deep, is chosen...They tie pieces of calcined clay weighing about a pound and a half each, at intervals of 4 feet, all along the bottom line of the net...on the upper line of the net they fix small bundles of reeds at every 6 foot throughout its length; these reed bundles...act as floats.'

Two men can set the net but

'should the haul be a successful one, all the available muscle in the shape of women and even children help...at last, with one final tug...the glittering denizens of the lagoon are triumphantly landed on the grass margin.' (1883:45-6).

Sturt (1833 Vol.I:90) found a similar net in a hut on the banks of the Darling. He estimated that it was over 90 yards in length. Shortly afterwards he saw a group of men setting such a net.

'They had placed it in a semicircle, with either end to the shore, and rude pieces of wood were attached to it to keep the upper part perpendicular. It was in effect a sein [- a fishing net for encircling, with floats at top and weights at bottom edge], only that the materials, with the exception of the network, were simpler and rougher than cork or lead - for which last, we afterwards discovered stones had been substituted.' (Sturt 1833 Vol.I:92).

Fixed nets were also used

'When a small assemblage, such as two or three families happen to be encamped in near proximity to a lake...[then] they fix a net in zig-zag lines about 20 yds from the shore ...from this daily supplies of fish are drawn, consisting principally of perch and catfish; occasionally a monster
cod-fish is enmeshed. Nets so staked are visited morning
and evening, and on each occasion from eight to a dozen
fish are taken, varying in size from a minimum of 2 up to
10 lbs in weight' (Beveridge 1883:47).

There is no way of estimating how productive these methods of
fishing were, but Eyre saw at Lake Victoria

'six hundred natives encamped together, all of whom were
living at that time upon fish procured from the lake,
with the addition perhaps of the leaves of the
Mesembryanthemum [pig face]' (1845a Vol.II:252).

Beveridge said that he had seen 'on many occasions' 3 to 4 cwt
(300-500 lbs) drawn from lagoons at a single haul consisting of

'...codfish from 50 lbs downwards, and perch both
gold and silver, from 10 lbs down to 2 lbs, catfish
...and turtle; the large mesh of the net prevents
the landing of small fish' (1883:47).

While most of the fish probably came from the nets and traps, some
was obtained by men, either in canoes or swimming, and using fishing
spears. Mitchell saw a group of 36 men who worked in teams and
systematically swam up and down different pools in the river (see
Appendix I:5, Mitchell 1839 Vol.I:268-9). Sightings of one or
two men fishing from a canoe were quite common.

Less is known about any fish poisons that might have
been used. At one spot on the Lachlan River, Mitchell found that

'the holes had recently been poisoned, a process adopted
by the natives in dry seasons, when the river no longer
flows, for bringing the fish to the surface of deep ponds,
and thus killing the whole...All these holes were full of
recently cut boughs of the eucalyptus, so that the water
was tinged black' (1839 Vol.I:24).

(b) aquatic birds

A number of ethnographers have provided accounts of the
method of obtaining aquatic birds in the Murray and Darling River
valleys (Eyre 1845 Vol.II:286-9; Krefft 1866b:368-9; Newland
Birds such as ducks, swans, pelicans and herons were caught in large nets strung across waterways. (Detailed descriptions are included in Appendix I:9; see also Plate 3.2a). These nets were between 50 and 100 feet long and about 20 feet deep and were capable of taking 50-100 birds at a haul (Krefft 1886b:368-9). In the Darling River Valley, trees were not always to hand but the early explorers saw long poles set up along the Darling to take one end of these nets (Mitchell 1839 Vol.I:305; Sturt 1848 Vol.II:140).

Duck hunting was a communal activity. The men set the net, raised, lowered it and threw the sticks and boomerangs into the air to get the ducks to swoop into the net. The women went up stream and flushed the birds and drove them towards the nets (Eyre 1845a Vol.II:283-6).

(c) aquatic plants

On the Lachlan and Murray Rivers a considerable quantity of food was obtained from the bulrush (Typha sp., probably T. muelleri¹). Detailed descriptions of the gathering of large amounts of this root can be found in Beveridge (1883:36, 42), Krefft (Ms.1856-7, 1866b:361) and Mitchell (1839 Vol.II:53). These authors described how the root was dug out and baked. After it was cooked flour-like carbohydrate was removed and baked into cakes. The fibre was subsequently used to manufacture fishing and duck-catching nets.

Every observation of the collection of this plant food was made in the period spring to late summer. During the winter months, when the river level is lowest and the lagoons and billabongs have dried up, the above-ground portion of this plant withers. When the area is again inundated, during the spring flooding, the tuber sends out shoots and grows. It does best in about 3 feet of water.

There are no direct references to the collection of this plant on the Darling. However, there are a number of references to undescribed plants that probably refer to Typha. The Menindee Aborigines

¹G.Hope pers.comm.
'at this period...[Oct] subsisted on the barilla root, a species of rush which they pound and make into cakes' (Sturt 1844 Vol.I:135).

After the farinaceous material had been removed from the roots of the Typha, the Lachlan Aborigines left it in balls of dry fibre. Mitchell on observing these recalled that he had seen similar heaps of fibre on the Darling being made into twine for nets (Mitchell 1839 Vol.II:52). He also saw large beds of reeds in lagoons behind the river (1839 Vol.I:300).

(d) division of labour

In general there were few tasks restricted to men. One of these was the spearing of fish. On the other hand there were a large number of tasks generally performed by women but occasionally performed by the men as well.

The collection of freshwater mussels was regarded as women's work. Eyre noted that

'mussels of a very large kind are got by diving. The women whose duty it is to collect these, go into the water with small nets hung around their necks' (Eyre 1845a Vol.II:267).

Occasionally, however, men collected this food (Sturt 1833 Vol.I:17) and Mitchell found about 100 people at Lake Cargelligo, living mainly on mussels that were apparently collected by both the men and the women.

The same is true for the collection of crayfish. Women seemed to be the main collectors of freshwater crayfish (Eyre 1845a Vol.II:252, 265-7) but men also occasionally collected them (Eyre 1845a Vol.II:286; Krefft 1866b:369). Men and women were commonly recorded setting nets but the effort needed to land a successful haul appears to have required everyone that was to hand. Fixed nets and weirs were mainly tended by the women as part of a daily routine. On the Bogan River, Mitchell concluded that fishing was left entirely to the women who used

'...a moveable dam of long, twisted dry grass through which only water can pass,...pushed from one end of the pond to the other, ...all the fishes are necessarily taken' (Mitchell 1839a Vol.I: 336).
The collection of roots from the lagoons was not a job that fell only to the women. Like other foods that were abundantly available over a short period of time, the bulrush root was collected by everyone in a community. Mitchell (1839 Vol.II:61) described an old man carrying a heavy load of *Typha* roots in a net bag on top of his head.

There was no strict division of labour in the Darling and Murray River valleys. Men, at least occasionally, performed all of the tasks that had to be done. Males and females cooperated in the collection of aquatic foods. This may have been a reflection of the abundance of food that could be collected in a short time from the river if a large number of people combined their energies.

(e) **seasonal variation in economy**

The river was not a constant source of food, even if it were it would be unlikely that any Australian Aboriginal group could have stomached an unvarying diet of even the most satisfying delicacy for a whole year. The ethnographic evidence suggests that the river was only a source of food at certain times.

The 'Brewarrina Fishery', a series of stone fish traps on the upper Darling in Ngeumba territory, was used

'During the early spring months of the year, or at any time when there was a fresh in the river, the fish travelled up stream in immense numbers...[the Ngeumba tribe] mustered there in considerable numbers in the fishing season, or at other times when fish were expected to be plentiful. The same people did not remain there all the time, but when certain families moved away into the back country to hunt for kangaroos and other game other families came into the river and participated in the piscatorial harvest' (Mathews 1903:152).

The condition necessary for there to be large quantities of food available from the river was that there should be a fresh (an increase in discharge) down the river during the spring or summer period.

On the Darling River, Browne stated that

'Just then [Oct] was the season of flood in the Darling when the
natives from both sides collect on its banks and numerous lagoons - to fish and catch ducks &c.,... in fact this was their harvest and general yearly meeting' (Browne Ms 1844-6 Oct.).

Eyre noted a similar happening on the Murray River

'An unlimited supply of fish is procurable at the Murray about the beginning of December, when the floods, having attained their greatest height, begin again to recede' (Eyre 1845a Vol.II:253).

Although Gerard Krefft was on the Murray River for a much shorter time than either Eyre or Beveridge, the freshness of the surroundings together with the scientist's eye meant that he noticed some of the details that other observers missed. His description of the activities of the Murray River Aborigines after the fall of the spring flood is typical.

'From the beginning of February to the end of March they erect their mia mias or rough huts on the borders of these swamps, which are covered with the Typha. Towards the end of March the creeks and lagoons are at their lowest and then they gather in large numbers at rich waterholes to procure fish, crawfish and turtle. Here they abide until the rain sets in, when other sources supply them with food, again in different localities either on the river or on the plains' (Krefft Ms. 1856-7).

While the spring and summer period was usually described in terms of large gatherings of people on the river and of ample food, the winter period was everywhere described in terms of cold, hardship, and starvation. Beveridge, who provided an Aboriginal classification of the seasons, described how

'Miange (Winter) begins with the first tenangin (frost), and continues until the mild lengthening days of spring puts it to flight. There is but small chance of this season passing unnoticed, as the cold, wet dreary days and nights thereof are frequently borne by the poor aborigines whilst in a state of semi-starvation as
regards both food and warmth, therefore the first indication of spring makes them jubilant to a degree, as then the near approach of food in abundance and of all kinds seems tolerably tangible, and no longer mere visions of the brain induced by partaking of infrequent as well as insufficient meals of very indigestible food' (1883:62).

He had already mentioned that

'a whole weeks starvation is not by any means an uncommon occurrence with them, especially during stormy winter weather' (1883:27).

Other authors noted the same thing.

'During the heavy and constant rain periods the blackfellow lies up in his gunyah, suffering the worst pangs of hunger. His food at this time is unprocurable or at least, the chance of its capture so remote as to render the attempt mere folly' (Merral 1875).

The Aborigines on the river were reluctant to enter the cold river water to get any food that was available there. Krefft noted that

'During the winter or rainy season the natives are very dirty. I do not think they wash themselves once without compulsion though they might be provided with a good ducking during a fishing excursion.' On the other hand while the warm weather lasts they are different beings and very clean, in and out of the water 20 times a day' (Krefft Ms. 1856-7).

After the Europeans arrived in this area the Aborigines made use of their handouts to tide them over the hard winter period. In the Lachlan District, the Commissioner for lands, Edgar Beckham, sent a report to the Governor of New South Wales which stated

'The Aborigines have no fixed residence, but each Tribe has its own particular portion of country, which they seldom leave for any long period...They wander from place to place, generally forming their camps in the vicinity of the Settler's
stations during the Winter; and in summer they proceed to their favourite hunting and fishing grounds'
Correspondence of Fitz Roy to Grey, 1847, in Historical Records of Australia (Vol.26:401).

During winter, the foods from the river were not so important and were replaced by foods from other sources. Sturt described that the natives

'appeared to...live chiefly on vegetables during the season of the year that I passed up the Murray [Aug-Sept], herbs and roots certainly constituted their chief food' (Sturt 1849 Vol.I:100).

While there are important differences between the Murray and Darling Rivers, it is useful to use as a model of seasonal variations for the Darling, the much fuller information available from the Murray River area. Such a model can be made from information summarised from Bickford (1966) and appears on table 3.1. This shows seasonal variations in the climatic conditions and Aboriginal subsistence activities in the Murray River area. The Murray River has a regular water regime. It is fed by rain and snow fall on the Snowy Mountains and consequently floods regularly during spring¹. Because the river flow changes with each season, the subsistence activities of its Aboriginal inhabitants also changed. The activities and the variations can be predicted on the basis of one's knowledge of stream conditions at the time. Lawrence reviewed the same literature and came to the conclusion that

'the seasonal pattern in the economic life of the Aborigines was directly related to the seasonal fluctuations in river flow (1968:96).

The Murray is also in a fairly regular winter rainfall area thus ensuring the growth of winter annuals every year.

¹Before European dams were built.
Table 3.1  Murray River: variation in climatic conditions and Aboriginal subsistence activities

<table>
<thead>
<tr>
<th>Season</th>
<th>Climatic conditions</th>
<th>Subsistence activities</th>
</tr>
</thead>
</table>
| Early spring    | Cool weather. 
River rising, fills billabongs. | Aborigines and land mammals retreated to high ground. Kangaroos, emus, rats, and wombats formed a large part of the diet. |
| Late spring     | River at its highest level.              | Aborigines moved back onto the floodplain. Fish plentiful. Mussels, yabbies, lakeside vegetables gathered in quantities. |
| Summer          | Hot dry weather. 
Floods recede. | Fish traps catch fish as water receded. Crayfish, mussels, waterbirds important. Typha roots in late summer. |
| Early autumn    | River at its lowest.                    | Land animals returned from dry areas, in the back country, to the river banks. Vegetables abundant. |
| Late autumn     | Local rains. 
Snowfalls on catchment. 
River low. 
Cold weather. | Food more difficult to obtain. Less fish, mussels, and crayfish, more kangaroo, emu, scrub birds, possums, eggs in diet. Land animals hibernated and were easy to dig out. |
| and winter      | River flow increases.                   |                                                                                        |

1 From Bickford (1966).
The fluctuations in the river flow in the Darling and the periods of local rainfall are much less predictable. The river

'is almost wholly dependent for its rises on the rains and these do not always come when expected. The usual rises are three in number: the main one, due to tropical rains, generally occurring in the latter part of January or the beginning of February, and continuing through March and April; the second about August or Sept. and a third sometimes occurring about Christmas. The rises in the Murray and Murrumbidgee, occasioned by heavy rains and subsequent melting of the snow on the mountains in which both rivers take their rise, are of a much more certain character. They commence about April and continue to November'. (Proud 1883:5).

Because the Darling River is not regular, it is impossible to draw up tables predicting seasonal variations in the subsistence activities. Given that winter is everywhere a 'bad' season in this area\(^1\), (for reasons that will be analysed in section 3.3 of this chapter), the activities of the Aborigines during the other seasons will depend on the river conditions and on the rainfall. Statistically the behaviour of the Darling River Aborigines conformed closely to the mode shown for the Murray River but the pattern was prone to be broken at any time by a year long drought or by a failure of the river to flow at all. Such events appeared to be far from rare on the Darling.

A percentage frequency graph of the months in which floods\(^2\) have been recorded at Bourke, on the Darling River, is shown on figure 3.2. In the 107 years of record (1852-1959), there have been fifty floods or an average of one every two years. Floods have been recorded in almost every month of the year, the exceptions being May and June. The highest proportion of floods

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\(^1\)Favourable river conditions during winter can mollify the effects of this 'bad' period.

\(^2\)A flood occurs at Bourke when the river height exceeds the critical height of 35 feet.
have occurred in the later summer and late winter and spring periods. These floods are major events and they may fill areas in the back country with water that lasts for some years. Every five to eight years, on average (Comm.of Aust.1948:Appendix 18), there is an exceptionally high flood which covers the flood plain for about 50 miles, as it did in 1956 and 1971.

The effects of the floods of great magnitude were described by Becker (Ms.1860-61)

'The river has its periodical floods, every seven or eight years all the country around is inundated, it is then that all the depressions of the country are filled with water; lakes are formed generally 4-6 feet deep, backwaters or billabongs are running and fish and waterfowls are everywhere. That is the time when all the natives appear round and sound, but it lasts them only as long as there is super abundance of food'.

The information derived from tables of floods is slightly misleading as sometime during most years there are one or two increases in flow down the river. Many of the billabongs and lakes fill when the water is at about half to three quarters bank full and this may happen after a rise of only a few feet. Figure 3.3 shows a series of graphs recording variations in the height of the Darling River at Wilcannia for the six year period 1909-1914. These graphs give some impression of the variability in river discharge from month to month and from year to year. Again the late summer and late winter-spring periods show the highest water levels and increases in discharge and May to June period is the time of low water.

Floods take about six weeks to travel the 380 miles of river from Bourke to Pooncairie and this should be taken into consideration when the month of a flood is considered.

Statistically the late winter-spring and the late summer periods are the ones in which an increase in discharge in the Darling is most likely and the autumn and early winter periods are ones in which low discharge is most likely.

(f) **seasonal variation in group size**

There is evidence that Aboriginal group size was related
to the ease or difficulty of obtaining food or water. This is not to argue that there was not a minimum group size that was determined socially, the Australian evidence is that the basic social and foraging unit was the band, whose usual composition ranged between 25 and 50 people and only in exceptional circumstances and for short periods was it ever as small as a single family unit (Birdsell 1970:131; Jones 1972:3; Meggitt 1966 [1964]:65-9; Peterson 1972:26). The question concerns whether or not a number of these minimum groups will come together to form a larger community or spread out as individual units through the tribal territory.

Groups of people who come together during periods of local abundance have been called 'seasonal ceremonial groups' by Hiatt ([1962] 1966:10) and Berndt ([1959] 1966:48-9). Eyre leaves no doubt that such seasonal ceremonial groups formed in the Murray Valley.

'At certain seasons of the year, usually in the spring or summer, when food is most abundant, several tribes meet together in each other's territory for the purpose of festivity or war, or to barter and exchange such food, clothing, weapons, implements, or other commodities as they respectively possess' (Eyre 1845a Vol.II:218).

Eyre made a trip from Moorunde to Menindee in December 1843 and noted

'We continually met with large bodies of natives along our whole course, especially on the Darling' (Eyre 1845b:331).

Sturt, who travelled the same section of the river in the following spring when the river was rising, also saw large numbers of Aborigines in groups (See Sturt 1849 Vol.I:115-24). He was on the northern Darling in summer in 1829 [near Fort Bourke] and he stated that

'A large body of natives about 70 in number, visited the camp' (Sturt 1833 Vol.I:105).
Mitchell travelled down the Darling River during winter when the river was clear, cold, and low (Mitchell 1835 Vol.I:215, 222). Near the spot where Sturt saw 70 people Mitchell remarked 'the tribe frequenting that neighbourhood [Fort Bourke] consists of a very few inoffensive individuals' (Mitchell 1839 Vol.I:298). Almost all groups seen by Mitchell were small (1839 Vol.I:233) and for a distance of about 100 miles along the river he found the area quite uninhabited (1839 Vol.I:304). Thus, on the Darling, large groups of Aborigines were seen during the spring and summer period and small groups were seen in winter.

To quantify this data and to subject the material to statistical tests I collected references to observations of Aboriginal groups made in three areas, the Darling River Valley, the West Darling, and the Murray River Valley (from Bickford 1966). Only observations where reliable estimates of the sizes of groups had been made are used in the analysis. The information was often inadequate as on many occasions the explorers simply mentioned for example 'a large tribe' and did not estimate the numbers. Such observations could not be used. The location of observations and the sizes of the groups seen in the Darling River area is shown on figure 3.1, the tribal distribution map.

Because there were some months in which few observations were made, or else they were periods when no explorer passed through the area I combined the observations into two six month periods.

The Darling River and West Darling observations were divided into two groups, those seen in the period September to March (spring and summer) and those seen from March to August (autumn and winter). The Murray River material was divided into observations made in the period December to May (summer and autumn) and those made in the period June to November (winter and spring).

For these groups of observations I obtained the means and standard deviations of size of group seen and I carried out 't' tests between these means. The results of these statistical procedures and tests are shown on table 3.2. The information on the West Darling is scanty, and will be discussed in another part of this chapter (see section 3.5b).

The groups seen on the Darling and Murray Rivers at certain (and slightly different) times of the year, mainly summer, are on average three times as large as the groups seen at other
Table 3.2 Means and standard deviations of sizes of Aboriginal groups seen in the Darling and Murray River areas, and the results of 't' tests testing seasonal variation in group size.

Darling River

<table>
<thead>
<tr>
<th></th>
<th>Spring-summer</th>
<th>Autumn-winter</th>
<th>'t' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>10</td>
<td>17</td>
<td>4.64</td>
</tr>
<tr>
<td>x ± s</td>
<td>45 ± 23</td>
<td>13 ± 13</td>
<td>significant difference at</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the 1% level</td>
</tr>
</tbody>
</table>

West Darling

<table>
<thead>
<tr>
<th></th>
<th>Summer¹</th>
<th>Autumn-winter</th>
<th>'t' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>12</td>
<td>6</td>
<td>0.63</td>
</tr>
<tr>
<td>x ± s</td>
<td>25 ± 33</td>
<td>14 ± 14</td>
<td>no significant difference</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>at the 5% level</td>
</tr>
</tbody>
</table>

Murray River

<table>
<thead>
<tr>
<th></th>
<th>Summer-autumn</th>
<th>Winter-spring²</th>
<th>'t' value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>37</td>
<td>35</td>
<td>2.36</td>
</tr>
<tr>
<td>x ± s</td>
<td>60 ± 102</td>
<td>20 ± 14</td>
<td>significant difference at</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>the 2% level</td>
</tr>
</tbody>
</table>

¹ There were almost no observations in the West Darling area in spring and these were not included in the analysis.

² This calculation does not include an observation of 200 men on the Murray River who attacked Mitchell as these men came from the Darling River to settle an old score with Mitchell (1839 Vol.II:92). They were described by local Murray Aborigines as strangers who had come to fight (Mitchell 1839 Vol.II:99).
Fig. 3.4: Observations of Aboriginal groups
times, mainly during winter. Tests on these observations showed significant differences between sightings made at different times.

The conclusion that I draw is that both the Darling and Murray Rivers were considerably less productive habitats during the winter period and relatively more productive in the summer period.

Figure 3.4 shows a series of histograms drawn using the same observations as were used to get the means and standard deviations shown on table 3.4. These graphs show the percentage distribution of groups of various sizes seen at different seasons in the three areas.

The percentage distribution patterns at these different seasons varies markedly. The Darling River graphs (B, C, and F) show that during autumn and winter there are a large number of small groups. The size range of groups seen at this time is not great. On the other hand, during spring and summer (graphs A, C, and E), the size of the groups ranged from small to very large. Fewer groups were seen but the groups were bigger. The pattern seen on the graphs for the Darling River is repeated exactly on the Murray though the seasons differ slightly.

It is not possible to tell from the figures in table 3.2 or the graphs in figure 3.4 whether or not the effect of seasonal change was to split up the large summer groups into smaller units which all stayed along the river, or whether the effect was to split into small groups, some of which stayed on the river and some of which went into the back country away from the river. Put another way, did the river support fewer people during the winter, as well as forcing the people to split up into small groups spaced along its banks?

In order to answer this question I attempted to find out how many people there were on the Darling per mile of river during the spring-summer and autumn-winter seasons.

The spring-summer information is restricted to the Lower Darling, from Wentworth to Menindee (Sturt 1849 Vols.I & II; Browne Ms.1844-5; Brock Ms.1844-6) and to a small section of the northern Darling, near Bourke (Sturt 1833 Vol.I). To make allowance for the extreme sinuosity of the Darling River I doubled the straight line distance between any two points. Sturt's party on the way up to Menindee saw thirteen groups. They gave estimates of the size of eight of them and these estimates totalled 256 people. Probably
there were between 300-400 people on the river. The equivalent river frontage totalled about 260 miles, so a reasonable estimate of the density of population on the Lower Darling at this time would be between one and two people per mile of river. On the northern Darling, Sturt covered about 90 miles of river frontage and saw 114 people or just over one person per mile of river. This density was of the same order as that observed on the lower Darling.

During winter, Mitchell (1839 Vol.I) travelled down the Darling from Bourke to Menindee. He covered an estimated 600 miles of river frontage. On his journey down he saw seventeen groups of Aborigines and provided numerical estimates of eleven of them. His estimates total 128 people. Even if we allow this number of people again to make up for the six groups where no estimate was made we still get only 256. This is an average of less than one person for every two miles of river frontage.

Each mile of river was apparently capable of supporting at least twice as many people in the summer period than during winter. In other words, half the river population, at least, was forced during winter to seek their livelihood in areas away from the river banks.

The estimate of from one half to two people per mile of river on the Darling can be compared with Eyre's estimate that on the Murray River there were about three to four natives to every mile of river (1845a Vol.II:372).

These figures provide a good basis on which to judge the comparative productivity of the two rivers. The major ecological difference between them is that the Murray was a regular and predictable source whereas any population on the Darling had to be small enough to cope with the unpredictability and irregularity of the river and the climate.

The population density of Aborigines along the Darling and Murray rivers [one to five per mile of river] was of the same order as that recorded for Aboriginal populations on the coasts of Arnhem Land and the Sydney region [two to six per mile of coast] (Meggitt 1966 [1964]:60-1) and also on the Tasmanian coast [three to five per mile] (Jones 1971:281). Population density in this riverine region was many times greater than densities recorded for other non-riverine inland areas (Meggitt 1966 [1964]:62).
Another estimate of the productivity of the river at different seasons can be got by looking at the average distance between the groups observed in spring and summer and autumn and winter. The locations of these observations are shown on figure 3.1. In spring and summer, the large groups of the order of 45 to 50 people are separated by an average distance of about 30 miles in autumn-winter the smaller groups of about 20 people are separated by only slightly shorter distances, an average of 25 miles. While the winter groups were significantly smaller there is no evidence that they had moved closer together or further apart as a response to the poor conditions.

3.3 The ecological effects of winter

(a) River flow

Every winter in the Darling River Valley is cool. There is little variation in temperature at any time of the year from one year to another (Beadle 1948:27). Every summer is hot. The water temperature in the river follows the air temperature fairly closely. Consequently during summer the water temperature is warm to hot and may get up to 80°F (30°C). In winter, the water is cold and may drop to less than 50°F (10°C) (Weatherley 1967:8).

At the same time as the water is at its coldest it is least likely to have a flood or a fresh pass down it. The period April to July is the period that shows the lowest proportion of increases in flow down the Darling. During this time period the river is likely to be almost still. It is the combination of low water temperatures and low river discharge that makes the winter period unproductive. Temperatures are always cold at this time, but if there were a flood it would change this pattern and produce a substantial increase in the resources available to an Aboriginal population. A winter flood would probably affect the movement patterns discussed in the previous section but statistically winter floods are unusual.

Some of the riverine resources are affected by low temperatures, some others are affected by low water conditions. The abundance of fish in the Murray-Darling River system appears to depend on whether or not there are floods and freshes. Discussing the returns from a professional fishery on the Murray River one writer stated
'The native species on which the fishery depends have adapted their spawning cycle to make use of the extremely productive conditions which occur in the river during and following flood flow. Good fishing years have always been associated with the extensive floods, and fishing has been poor during cycles of low river...Fishing seasons are not well defined but are determined by the state of the river. Best catches are generally taken during flow conditions. Time and extent of the flow varies annually, and often it may be negligible. In recent years flows have been particularly poor, and catches have fallen accordingly' (Anon.1968:30-1).

The floods are thought to cause 'runs' of the fish upstream (Anon 1968:30). Little is known of these movements but their economic effects are felt by the fishermen. One report, published in 1962 noted that

'the fish did not move in the low level streams last season [the Murray] and many professional fishermen moved to the Murrumbidgee and other streams carrying large volumes of water' (Anon 1962:31).

Figure 3.5 shows the percentage distribution of the weight of fish taken from New South Wales inland streams. Increases in flow down the Murray, Murrumbidgee, and Lachlan rivers in the period August to October are correlated with a sharp increase in the quantity of fish taken during this time. The fact that data from a number of rivers with markedly different flow regimes are included in this graph means that no season with really low catches appears on the graph.

Amateur fishermen regard the spring to late summer period as the best time for fishing native freshwater species (Pratt 1970: 27; 1971:46). Lake (1964:25) provides information on some of the factors involved in the connection between floods and the abundance of fish in the Murray-Darling system.

'Water temperature is only part of the answer. Rises in water level induce plankton blooms and these blooms are most prolific following inundation of backwaters, anabranches, and flood plains generally. The larger the areas inundated then
WATERFOWL

Idealized diagram to show the relationship of the breeding seasons of some common ducks to changes in water-level in inland billabongs (Frith 1967).

Fig. 3.6

FRESHWATER FISH

Monthly variation in fish catch, N.S.W. rivers average 25 years to 1938 (data from Dakin and Kesteven 1938).

Fig. 3.5
the more plankton and suitable environments are created for the young fish'.

The water temperature is important as it must exceed a critical level before fish will breed. Murray Cod, Golden Perch and Silver Perch, the three most common species in the Darling, only begin breeding after a fresh if the water temperature exceeds certain temperatures. For Murray Cod the water must be about 69°F (20.6°C), for Golden Perch and Silver Perch it must exceed 74.3°F (23.5°C) (Lake n.d. 32-37).

Different river conditions favour different species of fish. At the present time Golden and Silver Perch are the most common species in the Darling although there are a few Murray Cod (D. Francois, N.S.W. Fisheries Branch, pers.comm.). However, when Mitchell passed down the Darling in July 1835, when the water was clear, cold and still (Mitchell 1839 Vol.I:215,222) he found that the Aborigines were mainly taking Murray Cod (1839 Vol.I:310). There is evidence from elsewhere that these water conditions favour cod.

'Over the last six months the Lachlan River in the Condobolin area has been low and clear, giving rise to the capture of some large Murray Cod...This on top of the large number taken before last easter from a river that is not strictly a cod stream is remarkable' (Anon [Winter] 1963:29).

Fast flowing warm waters appear to favour perch. When discussing the Brewarrina fisheries, Mathews quoted the opinion of an Aboriginal informant.

'The black bream [probably Silver Perch] and the Callop [Golden Perch] were the main fish caught during these freshes...The codfish [Murray Cod] ramble down as well as up stream, and were caught in the pens at any time' (Mathews 1903:150-3).

The presence of warm water and the absence of a fresh down the stream makes the river unproductive as well. Sturt (1849 Vol.II:117-8) returned to the Darling from the interior during summer. He found that there had been no flood, that all of the deep pools in the river had been fished out and the Aboriginal inhabitants were living on herbs and roots.
In many ways aquatic waterbirds such as ducks, swans, pelicans and herons react to increases in water levels in the rivers in the same way as do the fishes. Figure 3.6 shows the relationship between the condition of the river and the initiation of breeding by several duck species. Frith (1967:11) concluded that

'In inland NSW there is a clear connection between the water level and the waterfowl breeding season...When a suitable rise in water-level occurs breeding follows, and it is more meaningful to refer to a particular species' place in a set sequence of breeding seasons than to allot it a separate month'.

In particular nomadic species such as the Black Duck, the Pink-eared Duck, and the Grey Teal (Frith 1967:169-237) fly into riverine areas of New South Wales after a flood or fresh and leave when the billabongs and lagoons lose their water. The Black Duck, while requiring a rise in water level only breeds in the spring and summer (Frith 1967:169). The advent of a flood can mean that hundreds of thousands of birds fly into the riverine area. The birds themselves and the eggs they lay would provide a valuable resource for Aborigines at these times, particularly in view of the large scale netting techniques that the Aborigine used to catch them (see above section 3.2a).

(b) **low temperatures**

The effects of low temperatures on Australian animals were summarised by Cogger

'It is doubtful whether many animals in Australia really hibernate...[though] a form of semi-hibernation is quite common in frogs in many parts of the state [N.S.W.]. At the approach of the colder months they crawl under rocks or logs, and there excavate a small, body-fitting chamber where they spend most of the winter. However, during milder breaks in the normally cold weather (particularly during rainy spells, which are usually accompanied by a rise in temperature) they may make excursions into the open to feed or breed' (Cogger 1960:12).
While this movement is not true 'hibernation' this tendency does make these animals much harder to obtain in winter. Animals such as tortoises and other reptiles are good sources of food during summer but they are unobtainable in winter. In particular the long necked tortoise *Chelodina longicollis* was described as providing quantities of food during summer, especially from eggs which were laid in January (Krefft 1866a:23). The tortoise and other reptiles were described as 'retreating into the ground in the cold season' (Krefft 1866a:23) and hence were not available in winter.

Beveridge and Eyre both documented the fact that freshwater crayfish were easiest to obtain in summer. In the references quoted below Beveridge described how, with much difficulty, they could be obtained during winter and Eyre described how abundant they were when they emerged from their winter holes.

'An hours scraping [with a net across the muddy bottom of a lagoon] frequently results in as many of these delectable crustaceae as will fill a 6-gallon measure. It is only during the warm weather that these little crawfish can be taken by scraping the lagoons; in the cold weather they are all in their holes, so that when a noble savage has a longing for a meal of these favourite shellfish whilst they are hibernating, his poor drudge of a wife has to turn out in the cold to procure the delicacy for him by groping with her hands down the holes of the little creatures; and as the entrances to the holes are all under water, it is a cold and tedious undertaking to capture a dish of them sufficient for a meal worthy to be set before her lord' (Beveridge 1883:49-50).

'At Moorunde, when the Murray annually inundates the flats [during spring], freshwater cray-fish make their way to the surface of the ground from holes where they have been buried during the year, in such vast numbers that I have seen four hundred natives live upon them for weeks together' (Eyre 1845a Vol.II:252).

Yabbies, small freshwater crayfish (*Cherax sp.*), in Victoria and Tasmania breed in spring (Williams 1968:148-9). The large Murray River crayfish (*Eustacus armatus*) is more tolerant
to cold water than the yabbie. Murray River crayfish are restricted to the Murray and Murrumbidgee Rivers because the summer water temperatures in the other N.S.W. inland rivers are too hot. They are not found in the Darling.

The molluscs, in general, cease feeding and growing once temperatures fall below given tolerances (Wilbur and Owen 1964:234 in Wilbur and Yonge 1964 Vol.I). There is, however, no evidence that the water temperatures in the inland rivers are low enough for the freshwater mussels to suspend activities. During drought conditions and other adverse climatic conditions freshwater mussels bury themselves in the mud (Allan 1959:398) but it is not known if the colder waters and low velocity of current [and hence less food] of the winter season constitute such adverse conditions. There are few references to Aborigines collecting freshwater mussels from the rivers during winter but this is probably a reflection on the unpleasantness of fishing around in the mud to procure them when the water is quite cold.

Water plants such as *Typha* sp. die off during winter and they constitute a major food only after they send out shoots again in the springtime, following the floods. Many of these aquatic species require warm days in order to grow.

Given that cold and still water conditions tend to coincide with the period April to July from the above discussion, it will readily be seen why this period is likely to be one of hardship on the rivers compared to other periods. For one reason or another, fish, aquatic birds, crayfish, molluscs and aquatic plants were not readily available to Aboriginal gatherers. As a response to the lower winter productivity of the rivers about half the population left the river margins and went to the country away from the river.

3.4 **The country away from the river**

(a) **the effects of rainfall**

The river was probably the single most important ecological zone utilised by the Darling River Aborigines. The fact that it has received all of the discussion up to now is not intended to suggest that people were not utilising the country away from the river at the same time to get other foods. At certain times of the year, notably the spring and summer period, more food probably
came from the river than from elsewhere. But a number of ethno-
graphers observed that a variety of foods were eaten at all times.
Krefft stated that

'A good supply of animal food is always at hand, the country
abounds with wallaby and opossums, ducks and other water-
fowl are numerous on the lagoons and their diet is relieved
by the capture of an emu or a kangaroo' (Ms 1856-7).

The fact that a large number of people moved away from the
river in winter probably meant that land foods, animals and plants,
were relatively more important at that time. This seems to be the
meaning of Sturt's statement that

'their chief food [of the Darling River Aborigines] is fish,
of which they have great supplies in the river; still
they have their seasons for hunting their emus and kangaroos.
The nets they use for this purpose, as well as for fishing,
are of great length and are made upon large frames'

Foods recorded as eaten by Aborigines of the Darling River
Valley and adjacent areas are listed in appendix 1. Material
summarised from Bickford (1966) suggests that land foods were the
most important foods during the winter and early spring.

The most important ecological factor affecting the
availability of land foods is rainfall. Beadle (1948:27) discussed
the nature of the rainfall in Western New South Wales and concluded

'Double maxima occur over the whole of the west, the actual
frequency being greater than either summer or winter
maximum frequencies'.

The vegetation reflects this bimodal climate as there are
perennial plants that can fruit or seed twice or more times in a
year, perennials that will flower after rain during winter and
others during summer and also annuals that have a winter or a
summer growing period. Thus as long as a minimum amount of
precipitation occurs there will be some plant foods available all
over the area during most of the year. Season of availability
is included in the list of plant foods in appendix 1.
The plant foods that are available all year round, or become available at irregular periods following necessary conditions (usually minimum amounts of rain) include the fruit of *Capparis sp.*, (native oranges); the seeds of *Marsilea sp.* (Nardo); *Acacia sp.*, (Wattle); and *Amaranthus sp.*; and the leaves of *Carpobrotis sp.*, (pigface); *Trigonella sp.*, (Warrigal cabbage); and *Nasturtium sp.*

Plant foods available during the period autumn to spring included seeds of the grasses *Aristida sp.*, *Stipa sp.*; seeds of the saltbushes and goosefoot *Chenopodium sp.*, and *Atriplex sp.*; seeds of the flax plant, *Linum marginale*; and of *Pittosporum phillyrecoides*. The roots of *Triglochin procera*, *Geranium sp.*, *Picris sp.*, *Cucumis sp.*, roots and fruits, leaves of *Sonchus sp.*

Important foods available in summer are grass seeds *Panicum* (native millet), *Eragrostis* (love grass) and *Setaria sp.*; the seeds, leaves, fruits of *Portulaca sp.*; fruits of *Nitraria schoberi* and *Santalum acuminatum* (quondong); and the roots of *Boehavia sp.*, and *Typha sp.* The first group of plants require rain and low temperatures to stimulate fruiting and seeding, the second rain and high temperatures.

The temperature differences between the seasons also affect the length of time that water will stand in clay pans and soak. There are no permanent streams flowing into the Darling for the lower 500 miles of its course. There were no permanent sources of water in the research area, except for some rock holes, apart from the river. Consequently falls of rain that filled the claypans formed the only water resources on the back country, and access to this area was limited to periods following good rain. During summer, the high evaporation dries these pools quickly; in winter they may last from autumn to early summer. Some idea of the excess of evaporation over rainfall in this area can be got from the rainfall and evaporation graph shown on figure 3.7. Thus during winter the back country was open continuously for exploitation by Aborigines; in summer it was only available spasmodically and for relatively short periods. This was another factor limiting the population to the river bank in summer. The richness of the river and some of the plant foods available in summer, particularly the grass seeds, made this time the 'good' season on the river.
The rainfall and river conditions affect the distribution of animals other than man in this area. A survey done near Wilcannia in 1965 found that 90% of the red kangaroos, (M. rufus) were grazing on the river frontage following a flush. However, after light rains in September and October

'the kangaroos left the river frontage and headed inland. The river frontage was soon completely deserted and 78% of the kangaroos were now in the scrub lands'
(Frith and Calaby 1969:92).

The red kangaroo will travel quite long distances if the conditions are favourable. Frith and Calaby (1969:92-3) document that they could travel up to fifty miles to reach the hilly country beyond the river.

'The stony hillsides which...are already occupied by Europs (M. robustus) are usually barren and bare and support very few kangaroos, but following very heavy rain, preferably in cool weather when evaporation is low, there is some pasture growth and numbers of red kangaroos move to them from the plains...following heavy rains in September 1963...nearly half the kangaroos in the scrublands had left to graze the hillsides and hilltop'.

During periods of drought in western New South Wales, the red kangaroo will travel even greater distances to get to better pasture. In one study (Bailey quoted in Newsome 1971:36) red kangaroos made long movements of between 60 and 136 miles for this reason.

A similar pattern of usage was followed by the early pastoralists who had their main holdings on river frontage blocks but would move cattle or sheep into the back country after rain. One result of putting in dams and bores was that

'The country away from the rivers and creeks, which had been useful only after heavy rains had left some natural water upon it, could now be brought into year-round use'
(quoted in Heathcote 1965:24).

Without rain, the river people could only have moved into the back country as far as they could carry a kangaroo skin waterbag.
Tindale noted a similar thing among the occupants of the Murray River margins (Tindale 1959:41). Bennett (1883:213) stated that Aborigines who lived up to forty or fifty miles from the rivers were compelled to go into the rivers during the hot, dry, summer months.

(b) cereals

An analysis of the diet of Darling River Aborigines which I carried out in 1968 (Allen 1968:37-41 ff) left me with little doubt that plant foods were an item of major importance making up at least one third of all the foods eaten. The category most often mentioned was seeds either of trees such as *Acacia* or of the grasses.

Meggitt (1964:30-34) compared the economies of northern Australia and the arid hinterland. He came to the conclusion that

'In both regions...the most important contributions to the daily diet were the vegetable foods collected and prepared by the women...in the inland the staple...was seed from trees and grasses...dispersed over wide areas'.

Golson (1971:205) also noted the importance of seeds in inland Australia as did Tindale (1959:50).

'Among the present day Murundian peoples of the 5-25 inch rainfall areas in Australia where grasslands are most prevalent today, the grass seed milling practices have come to play almost a primary role in Aboriginal food economy'.

There were many references to the gathering of seeds in western New South Wales (see appendix I:33-4), some gathering techniques being of spectacular dimensions.

The method of gathering appears to have differed from area to area. In most cases, grass seeds had to be collected before the seed was fully opened. Sturt mentioned

'The seeds were ripening fast along the banks of the creek, and we collected as many varieties as we could; but they matured so rapidly, and the seed-vessels burst so suddenly that we had to watch them' (1849 Vol.I:215).
Parker described one method of gathering grass before it had ripened. The Aborigines near Lake Narran gathered barley grass (Panicum sp.) in large quantities.

'they made a brush-yard and the grass was put into this yard...fire was set to the grass which was full in the ear yet green. While the fire was burning the blacks kept turning the grass with sticks all the time to knock the seeds out. When this was done, and the fire burnt out, they gathered up the seed into a big opossum rug, and carried it to the camp' (1905:118).

When Mitchell was travelling down the Darling River in 1835, as he was near Tilpa he found that the grass had been pulled up and piled into hay-ricks

'the ricks, or haycocks, extended for miles...and not a spike of it was left in the soil, over the whole of the ground...The grass was beautifully green beneath the heaps, and full of seeds' (1839 Vol.I:238-9, 290-1).

The grass was identified as Panicum decompositum (native millet) (Mitchell 1839 Vol.I:237). On the Darling this species is an annual that grows in summer and seeds in the period December to April (Cameron 1961:234-5; Leigh and Mulham 1965). Mitchell's observation of the grass as being green and full of seeds was made in July. This almost certainly was a method of 'in field' storage, one that had kept the seeds for at least two months. Mitchell saw similar heaps of Panicum decompositum on the Narran River in 1846 (1848:90) and also heaps of Portulaca (1848:98). Putting the green grass into heaps also had the function of concentrating the seed into one spot before it fell. The method employed was as follows

'the natives obtain large quantities [of Portulaca seed in this case] by pulling up the plants, throwing them in heaps, which after a few days they turn over and an abundant supply of seed is found to have fallen out and can easily be gathered up' (Maiden 1899:121).

Dried heaps of grass with the seed threshed out were reported from wide areas in western New South Wales. Sturt found a quantity of Panicum decompositum 'spread out on the sloping bank
of the creek to dry, or ripen in the sun (Sturt Vol.I 1849:285), he also saw heaps in other places.

Gregory was the only observer to mention that the grass was cut with a stone knife. All of the other references referred to the pulling the grass out by hand. He stated that

'On Cooper's Creek [S.W. Qld.], the natives reap a Panicum grass. Fields of 1,000 acres are there met with growing this cereal. The natives cut it down by means of stone knives, cutting down the stalk half way, beat out the seed, leaving the straw, which is often met with in large heaps' (in Ling Roth 1887:132).

Sturt described how the Aborigines collected Acacia pods.

'the boughs of the trees were all broken down...there were numerous places where they had thrashed out the seed and heaped up the pods' (1849 Vol.I:226-7).

There is some evidence that large groups of people might subsist almost entirely on seeds.

'Mr. Poole and his party met with a tribe of about 60 in number engaged in collecting grass seeds. They behaved very civilly...were all living on the seeds of a kind of rice (Panicum effusum) which grew abundantly on the flooded lands near the creek...At this season of the year [summer] the natives live principally on seeds both of Acacia and grass...' [N.W. NSW] (Browne Ms [Dec] 1844-6).

Occasionally authors described the collection of grass seeds as women's work (Newland 1887-8:22) but there were also references to both men and women collecting grass and other seeds. Eyre stated

'the gathering [of] vegetable food, and in fact the cooking and preparing of food generally devolves upon the women... except in the case of...the larger and more valuable animals' (1845 Vol.2:291).

On the other hand Howitt (Ms.1862:April 17-21) found, near Cooper's Creek a large number of people living almost exclusively on portu- lac seeds and some of his references were to men collecting the seeds.
The sporocarps of Nardoo (Marsilea drummondii) appear to have been used less often on the Darling than elsewhere in Central Australia. Newland (1920-21:12) and Dunbar (1943-4:175) both state that it was only used during a drought. Nardoo certainly was an important part of the diet on Cooper's Creek at the time Burke, Wills and King were stranded there (Burke and Wills 1861:3-6).

The contribution of seed foods from plants other than the grasses and nardoo to the diet of this area could easily be underestimated. In particular, seeds from the saltbush, goosefoot, the acacias and even from the Kurrajong were eaten in quantities when grass seeds were not available. References to these other seed foods are also listed in appendix 1.

There is little doubt that the Aborigines of Western New South Wales and Central Australia stored seeds. There are quite a few references to this in the literature. Near Cooper's Creek, Howitt found such a store, he stated

'These, like the natives at Dampurnoo, seemed to be laying in a stock of bower [Portulac seed]. Harry...found one 'plant' near our last nights camp. The seed is wrapped up in grass and coated with mud and the parcel would probably hold a bushel and a half' [12 gallons capacity] (Howitt Ms. 1862:April 27).

Bonney described skin bags used to hold seed

'Bags to hold water or grass seeds are made of the whole skin of a wallaby, or possum, or small kangaroo...bags are very useful...to hold a store of grass seed after a good harvest of it. These seeds are very small, some resembling fine gun powder (Bonney Ms. c. 1881).

The use of skin bags to hold seed was confirmed by Parker (1905:119).

'the seed (Panicum sp.) was put into skin bags to be used as required'.

Horne and Aiston (1924L7) described storage methods used by the Wonkonguru living east of Lake Eyre

'A store of nardoo, munyeroo [Portulac], wadroc, (vegetable foods) is buried in the sand or kept in a pirrha (wooden bowl) placed on top of a hut'.
Simpson Newland, a long term settler on the Darling, stated quite clearly that the Darling River Aborigines stored grain

'The grain was carefully cleaned...a portion ground up for early use and quite large quantities stored for future consumption in various articles in Aboriginal domestic use' (Newland 1920:1:13).

King, the sole survivor of the Burke and Wills' expedition found a bag of nardoo (Marsilea drummondii) which was enough to last him a fortnight at a time when he was living almost entirely on nardoo. (King's diary, in Burke and Wills 1861:5).

There are some references to grain storage from further afield. At Newcastle Waters, in the Northern Territory, an overlander droving sheep to Darwin, in 1870, visited an encampment of a number of huts. In the largest hut he estimated that there was a ton of seed stored in 17 wooden dishes, a foot deep and five foot long. The dishes were covered with paperbark (Ashwin 1832:64). In northwestern Western Australia, Withnell (1901:23) noted 'had the Aborigines been resourceful they could store enough grass seeds to last them through a drought, but they make very little provision this way. They do, however, gather small quantities in heaps, which they cover with bark, and they find even this a great stand-by'.

The archaeological manifestation of the large scale of cereal collection in this region consists of hundreds of grinding stones that have been recovered from the area. Many of these grindstones presently grace the garden paths of homesteads and a few are in the State Museums.

Aborigines were seen by Sturt's party carrying these stones from place to place (Sturt 1849 Vol.I:261). Bennett (1897:3) described the stones used in the dry country between the Lachlan and Darling Rivers as a

'a large heavy flat stone, used either for grinding or pounding purposes. These stones, though of great weight, were often carried about for considerable distances by the women in their net bags. When the seed season was over they were left at one or other of their favourite camping grounds to be in readiness for, the ensuing seed season'.
Great numbers of these stones are concentrated on the Darling River. The South Australian Museum has over 170 from the Menindee area alone. In 1968 (Allen 1968:maps 9 and 10) I plotted the distributions of 269 upper and low millstones from N.S.W. in the collections of the Australian Museum, Sydney. Ninety six (35%) came from locations on the Darling River and almost all the others came from the Macquarie, Bogan and Barwon Rivers near the Darling. Few were found in eastern New South Wales.

(c) **animal foods**

Animal foods can be roughly divided into two categories, those gathered and those hunted. This is no hard and fast division but it is a useful one as it divides the animals into two size groups, large and small. In general, the larger animals were hunted by the men and the smaller animals were collected by the women.

In the eastern woodlands and on the western slopes and the strip forests along the Murray the main animals collected by the Aborigines were possums. In the drier Darling country, there seem to have been few possums; Sturt noted that they were rare (1833 Vol.I:105-6; 1849 Vol.II appendix:6) and Mitchell described the Aborigines of the Darling as not wandering so much 'as those who hunt kangaroo and opossum, in the higher country, near our colony' (1839 Vol.I:307). Rather than the possum, animals such as reptiles, rodents and other small Macropods were the main animals collected.

Betty Hiatt (1971:4-8) has reviewed a number of sources concerning the division of labour and the importance of various foods in the subsistence economies of the Aboriginal inhabitants of Australia. The economy of the region and the division of labour into male and female activities is similar to that described for central Australia.

The methods used to collect the land animals varied with the species. Some mammals, such as wombats (probably *Lasiorhinus sp.*) rat kangaroos (*Bettongia lesueurii*), bilbies, rabbit-eared bandicoots, (*Macrotis lagotis*), hopping mice (*Notomys sp.*) and some reptiles like the goanna (*Varanus sp.*) dig burrows and were dug out of them by the Aborigines. Holes were sunk often after lighting fires at the entrances to the burrows to suffocate the inmates with the smoke.
Krefft saw Aborigines near the junction of the Murray and Darling Rivers sinking shafts up to 12 feet deep to get Bettongs (Krefft 1866b:371) and Sturt saw a pit big enough to hide a man, in the Scrope's Ranges, dug to get Bilbies (M. lagotis) (Sturt 1849 Vol.I:161). Fire was used to drive stick-nest rats (Leporillus sp.) out of their nests which were three to four feet tall and many feet in circumference (Eyre 1845a Vol.II:268). Browne (Ms.1844-5) noted that Sturt's party saw hundreds of these nests on their way up the Lower Darling. He estimated that there were 6-10 rats in each nest.

Mitchell describes a more general use of fire

'In summer, the burning of the long grass also discloses vermin, birds nests etc. on which the females and children, who chiefly burn the grass, feed' (1848:412).

This method of grass burning would also kill large numbers of snakes and lizards. Organised hunts were made to collect these classes of smaller animals.

'Hunting was the men's pastime, but the main food supply was secured by the women leaving camp in the early morning for the place selected for the days' hunt, the women spread out and advanced...in a straight line...Bird's eggs, iguana lizard or anything that was edible was gathered and stowed into the ghooli or net bag hanging across each woman's back. On the return journey back to camp, seeds were gathered for bread' (Dunbar 1943-4:175).

Even when travelling, if any article of food was seen someone stopped and collected it and then returned to the party (Dunbar 1943-4:176). Krefft (Ms.1856-7) related that

'nothing could escape their eye whether a bird flew up or a small bettongia hopped across our path they were sure to be attacked with half a dozen waddys'[throwing sticks].

Thanks mainly to Gerard Krefft (1866a, 1866b) there is a good deal of information regarding the identification of the species of small animals collected by the aborigines. These are listed in appendix 1:12-21, and in Wakefield (1966b). The other ethnographic sources did not describe methods of getting small animals and emphasised the hunting of the larger ones.
Consequently there is a tendency to overlook the role of the small animals in discussions of diet. The larger animals, hunted by the men, may not have been very plentiful. Oxley (1820), Sturt (1849 Vol.II:140) and Mitchell (1839 Vol.II:308) all remarked that they saw very few kangaroos and emus in inland western New South Wales. There is some evidence that some species of kangaroos have increased in numbers in New South Wales as a consequence of European settlement (Frith and Calaby 1969:156). They may at the time of first European settlement have been fairly rare.

Krefft (Ms.1856-7) stated that

'the common kangaroo (M. gigas), though much more common than the red kangaroo is also scarce'.

Because of this the largest species of kangaroos probably did not contribute very much to the subsistence economy of the Aborigines inhabiting the River plains. Far more abundant and probably more important, were the smaller kangaroos and wallabies. The two species described as common were the bridle nail-tailed wallaby (Onchogalea fraenata) and the eastern hare-wallaby (Lagorchestes leporides). In particular, the latter was described as being common in the level country between the Murray and the Darling (Krefft 1866a:19), these animals are medium to large in size, being from 18 to 22 inches tall (Marlow 1962:106-7, 110-11).

Berndt (1947:76) and Eyre (1845a Vol.II:282-3) provided descriptions of netting wallabies. (Berndt's description is included in appendix I.13). In Eyre's description the hunt was a communal affair with the men manning the nets and the women beating the ground and driving the wallabies before them into the net. A similar description was given of the hunting of rock wallabies in the hills near White Cliffs by Bonney (Ms.c.1881). There, nets were strung across ridges and the rock wallabies (probably wallaroos, M. robusta) were driven down and caught between the net and the cliffs. The use of the net as an aid to hunting clearly gave the Darling River Aborigines an extraordinarily useful tool. Eyre described that they were used for hunting kangaroo, emus, wallabies and birds (Eyre 1845a Vol.II:276-88) as well as for fish, tortoises and crayfish. They were not the only techniques used, however, and Eyre described the use of snares, pitfalls, and spearing and clubbing as methods of getting larger
game. Similar methods were described by Parker for the Ualarai (1905:105-119).

The fact that few Aborigines were seen with spears west of the Darling may be an indication of the importance of nets. Wills, on his way up to Cooper's Creek, found that the Aborigines 'seldom carry any weapon, except a shield and a large kind of boomerang, which I believe they use for killing rats' (Wills 1863: 180). 'Sometimes but very seldom they have a large spear...'. A similar observation was made in the same area by Welch, a member of Howitt's expedition to Cooper's Creek. He noted

'their only weapon, at least as far as we have seen is the boomerang' (Ms.1861 Sep.24).

McKinlay further to the west met some Aborigines near the Cooper, he commented

'They were the first tribe that we fell in with so fully armed, every man with a shield and a lot of boomerangs, and some with spears' (1862:37).

Two land foods available only at special times of the year are emus eggs and mallee fowls eggs. The emu is a winter layer, the mallee hen lays in spring. Eastman discussed the laying season of the emu

'the nesting season may begin at any time from May to August, depending on the part of the country in which the emu lives. The controlling factor is climate. The emu normally nests during the coldest months of the year, hatching eggs just a week or two after spring begins, when the grass and vegetation are an inch or so tall' (Eastman 1969:23).

The emu can be found all over the Darling country, depending on local conditions. It requires large quantities of water and so in the Darling River Valley probably has similar movement patterns to the red kangaroo discussed above. The emu was probably widely dispersed after rain. It lays from 5-20 eggs with an average clutch of 7 eggs. An egg can weigh up to 2 lbs (Eastman 1969:24). The malleehen is restricted to the southern Darling country where the Eucalyptus dominant mallee scrub is found. The eggs are laid
in the period September to October and are laid in a nest made of leaves and sand (Kenyon 1914:63). Up to 20 mallee hen's eggs are laid in each mound (Leach 1968:13). The mallee-hen like the emu, was eaten as well as having its nests raided. The eggs and the birds were probably an important food in the late winter and early spring period when other foods were difficult to get.

(d) huts and movement

In 1968, I summarised the methods Aborigines used in western New South Wales to construct their huts (Allen 1968:51-6). The Bonney Ms. provides some further information (Bonney Ms.c.1881). Near Wilcannia, huts were made of boughs and thatched with grass, the design used depending on the number of people to be accommodated. A trench was dug around each hut to drain rain water away and skin rugs were put over the top of the huts to stop any leaks. Such huts were occupied in winter. During summer, a few boughs only were used to form a wind break. In hot weather, no shelter was used in case it interrupted any small breeze.

The above description is similar to that given of Dieri huts by Howitt (in Brough Smyth 1878:302) except that the latter put a thick coating of clay over the grass. The people on the Murray River cut turf to put on top of their huts (Pyre 1845a Vol.II:301).

Large numbers of huts were seen by the early explorers but these descriptions were too few to analyse. The largest number of huts seen in a single encampment on the Darling River was 70 (Sturt 1833 Vol.I:89). Observations of groups of ten or more huts were not uncommon. Different numbers of huts were seen at different places, in most cases there are sufficient numbers to regard them as small hamlets or villages. The huts seen consisted of 6-8 huts on the Barrier Range (Gow Ms.1860-61), 6-8 on the ranges north of the Barrier (Sturt 1849 Vol.I:254), 12 huts at Lake Victoria (Sturt 1849 Vol.I:92), 16 huts (Brock Ms.1845-6) and 23 huts in northwestern New South Wales (Browne Ms.1844-6), and finally 32 huts on the Paroo River (Gow Ms.1860-61).

There appears to have been two main reasons why encampments were vacated, the death of a resident, or whenever the smell of refuse around the camp became too offensive. The move might only be to a spot 200 or 300 yards away (Bonney Ms.c.1881).
In the case of mounds surrounded by floodwaters, on the Murray, the move was only to the next mound (Beveridge 1883:39). There is little information about how long a group would stay in one place. Mitchell saw one group of Aborigines, on the Darling River, in June and again at the same spot in August [3 full months] and concluded from this 'and other circumstances...that some of the tribes, on the Darling, are not migratory' (1839 Vol.I:294). Beveridge stated that Murray River Aborigines might stay on one mound for as long as a month (1883:39) but Eyre was more conservative in his estimate:

'In habit they are truly nomadic, seldom remaining many weeks in one locality, and frequently not many days' (Eyre 1845a Vol.II:278).

Eyre's long experience on the Murray River provides the information with which we can interpret the seasonal movements discussed in the earlier section of this chapter. Eyre stated that

'The number travelling together depends, upon the period of the year, and the description of the food that may be in season. If there is particular variety more abundant than another, or procurable only in certain localities, the whole tribe generally congregate to partake of it. Should this not be the case, then they are probably scattered over their district in detached groups or separate families' (1845a Vol.II:218).

3.5 The back country

(a) the east Darling

This area consists of the country occupied by the Barindji tribe and it is a particularly inhospitable area. Apart from an incident at Mount Manara concerning an exploring party related by Sutton, there are virtually no direct descriptions of Aborigines in this area (Sutton 1887:110). Early explorers regarded it as the driest part of New South Wales (Gormlyn n.d.: 586). There are some semi-permanent waterholes in this area, rock holes at Mount Manara and spots where water could be got by digging holes in the sand. At irregular periods water from a big Darling flood fills the Talywalka Lakes, in the eastern part
of the area. Once full, the lakes may retain water for as long as four years. Station records (Boolaboolka and Albermerle stations) suggest that flooding has decreased since the turn of the century because of sand filling the channel, due to the over-grazing of sheep. These records suggest that lakes flooded every four years or so and they may have supplied a permanent water source in the area. In winter time, there is plenty of surface water and all of this area would have been open for exploitation by Aborigines.

A large portion of the southern part of this area was covered with Mallee scrub, a thick Eucalypt scrub with low intertwined branches. Mallee is poorly regarded by Europeans but it seems to have been a reasonable seasonal source of food to the Aboriginal inhabitants. There is some information describing the Aboriginal exploitation of the closely adjacent Victorian Mallee country.

The Victorian Mallee apparently had no permanent population but was visited during periods when water was available by people from adjacent areas (Kenyon 1913-14:198; Massola 1966: 268). Beilby, a pastoralist-explorer, came across a substantial well dug in the sand in the mallee and remarked that

"the blacks evidently resort here in considerable numbers during the seasons when they chiefly exist upon emus and lowans [Mallee fowls] eggs. There were many old mia mias [huts] around the well, and incredible quantities of bones of small animals or birds and egg shells" (quoted in Kenyon 1913-14:47).

Morris (1943:167-170) listed a number of the plant foods available in the Mallee.

Bennett documented a source of water not previously discussed. Eucalypt, Hakea, and Kurrajong trees store water in their roots. If these are dug up and broken into pieces and stood in a receptacle, the water drains out. The roots may contain several pints, depending on the length dug. He goes on "on these roots, the natives in former times...used to depend for

1Late winter - spring
their supply of water for four or five months of every year (and in times of drought for the whole year)' (1883:214). A.L.P. Cameron, who lived on a nearby station, also documented this method of obtaining water (1884:347). He also stated that the inhabitants of this area would occasionally go into the river (1884:346).

(b) the west Darling

The ethnographic information for this area is limited. Insufficient observations of people were made in this region to get any idea of seasonal variation in group size. There is some increase in group size in summer (see table 3.1) but tests suggested that the differences between the summer and winter observations were not significant. While some large groups, in the order of 60-100 people, were seen in this region, most of the reports are similar to that of Sturt who said

'the natives are but thinly scattered over the interior...
the families wandering over those gloomy regions may
scarcely exceed one hundred persons' (Sturt 1849 Vol.II:135).

He found it surprising because the country was fairly well stocked with animals, bird's nests and vegetable foods (1849 Vol.I:208). Sturt concluded that the population in the Barrier Ranges, up to 100 miles away from the river, increased and decreased with fluctuations in water levels in the Darling. When Sturt met with large numbers of people at one spot in the Barrier Range (over 100), he and Brown concluded that the Darling River had not flooded (Sturt 1849 Vol.II:108-9). When the party reached Menindee, they found that the Darling had ceased to flow, that there were no fish in the ponds and the inhabitants were living on roots (Sturt 1849 Vol.II:117).

Two years earlier, on their way from the river into the interior, the river was in flood and parties of people were seen leaving the hills and heading down to the river (Browne Ms.1844-5).

A similar situation was noted for the Murray River. Eyre describes that 'there are other tribes also frequenting the river occasionally, from the back scrubs on either side,...these range through a great extent of country beyond the valley, and only sometimes come down there on a visit' (Eyre 1845a Vol.II:372).

Water was also a problem in the west Darling region, but as it is a rocky country, water collects in crevices and rock holes
and is therefore more plentiful than in the east. The Bonney manuscripts (c.1881) provided a detailed account of the economy of the inhabitants of the Mt Murchison - White Cliffs area. Most of the animal and plant foods are the same as those described for the country away from the river, discussed earlier (section 3.4c) except that montane animals such as the Wallaroo (M. robustus) were also important.

In order to share in the food obtained from the river the people inhabiting the Barrier Ranges went down to the Darling. The people to the north and west probably went to the Bulloo overflow country, which is connected to the channel country of south-western Queensland. Large encampments of Aborigines were observed on the Bulloo at different times by Beckler (1861 Ms.), Sturt (1849 Vo.I:260), Tietjens (Ms.n.d.), Wills (1863:156) and Wright (1862:511). These observations are marked on the map (figure 3.1) showing tribal boundaries. With people going to the Darling River in the south and the Bulloo overflow in the north, the inhabitants of all of this region must have had a typical riverine diet at least for some part of each year unless it was a drought year.

This was not a one way process as there is some evidence that river people would, during the winter, go into the hilly country to net wallabies. Menindee Aborigines knew the location of waterholes in the Barrier and Bynguano Ranges and Aborigines could guide Europeans through the area. When Eyre was at Menindee in 1843 he was told that a creek 'came from the hills I had seen [the Barrier Ranges] and...that water was to be found all the way from the Darling to Mount Bryan [in the Northern Lofty Ranges a distance of >200 miles to the west] by which route the natives frequently crossed backwards and forwards, though chiefly, I apprehend, in the winter season' (1844b:331).

Sturt provided an excellent summary of the diet of people living in the interior

'their food...varies with the season. That which they appeared to me to use in the greatest abundance were seeds of various kinds, of grasses...,of the mesembryanthemum [probably Portulaca], of the Acacias, and of the box-tree; of roots and herbs, of caterpillars and moths, of lizards and snakes, but of these there are very few. Besides
'these they sometimes take the emu and kangaroo, but they are never so plentiful as to constitute a principal article of food. They take ducks when the rains favour their frequenting the creeks and lagoons,...with nets stuck up to long poles' (Sturt 1849 Vol.II:140).

3.6 **Drought**

Erratic rainfall patterns are a feature of the Australian climate. The research area has an average yearly rainfall of about 10 inches but in any one year as much as 20 inches of rain may fall or as little as 3 inches. Disastrous droughts have occurred on a number of occasions since Europeans settled the area.

The definition of a drought has been a recurrent problem as the measure of rainfall over any period does not provide a satisfactory indication of whether or not a drought was occurring. A drought occurs in an area when the amount of rain that falls is insufficient to stimulate normal biological processes. In western New South Wales this means when insufficient rainfall is received to stimulate the spring/summer and the autumn/winter plant growing periods, and, prior to the advent of dams and bores, when insufficient water lay on the ground or filled the rock holes to make access to country away from the river possible.

It is difficult to gauge the effect of a drought on the Aboriginal population in western New South Wales. The two main, and interconnected effects, appear to have been a reduction in mobility and in the amount of food available. The ordinary subsistence activities described in the preceding sections appear to have been interrupted for the duration of a drought period and then resumed once the drought was over.

In order to get some idea of rainfall variability and the frequency of drought occurrence, I plotted the rainfall figures from Bourke for the 85 years from 1885-1970. This graph is shown on figure 3.8. While about one year in every three years in that period received a below average rainfall often the preceding year received an above average rainfall. To some extent, resources carry over from good years and the effect of many of the droughts would thus have been ameliorated. We know from contemporary records that bad drought periods have occurred when below average rainfall has fallen in a period following a series of years which
Fig. 3.7

Fig. 3.8
received average or slightly below average rainfall. These periods were 1896-1904, 1913-1916, 1926-1928, 1942-1946 and 1964-1969. Between these years droughts of shorter duration occurred. In order to look at the frequency of occurrence of droughts I used the rainfall figures from Wilcannia for the period 1880-1930 (Comm. of Aust. 1948:479). This information was broken up into seasons, summer, winter, autumn and spring and allowance was made so that above average rainfall in one season could compensate for below average rainfall in the next. At Wilcannia over the 50 year period the mode of occurrence is shown on table 3.3.

Table 3.3 Length of drought and frequency of occurrence during the period 1880 - 1930 at Wilcannia, western New South Wales.

<table>
<thead>
<tr>
<th>Period</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>6 months</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
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<tr>
<td>12</td>
<td>2</td>
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<td>3</td>
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<tr>
<td>18</td>
<td>-</td>
</tr>
<tr>
<td>21</td>
<td>2</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
</tr>
</tbody>
</table>

About once in every six years, on average, there was a drought lasting twelve months or more. There is a slightly greater chance of a drought occurring in the summer - autumn period than in winter and spring.

Table 3.3 does point up the fact that hunter-gatherers utilising western New South Wales would have had to survive long periods of stress.

There is little information about the effect of a drought on an Aboriginal population. Meggitt states that some of the Walbiri were driven out of the desert during the 1924-1929 drought and that of those that stayed in the desert 'a number died' (Meggitt 1962:24).

There is no evidence of people dying in western New South Wales during a drought. There is however evidence that new born
children were killed during bad seasons (Bonney 1883:125) and uterine and post-natal mortalities would have increased during these times also. Possibly old people would have died from the added exertions such as travelling long distances between waterholes. What evidence there is suggests that there was sufficient food even during the harshest drought to support the main part of the young adult and adult population. Mortalities seem to have occurred more from exhaustion, exposure and stress rather than from malnutrition or dehydration and these affect more the young, the old and the weak. Frederick Bonney (Ms.c.1881) gave a good description of what happened during a drought

'Occasionally two years would pass without there being a sufficient rainfall to increase the water supply by replenishing the natural reservoirs in the back country, or to soak the ground to promote the growth of grass and herbiage - in such times the aborigines were driven to the river frontage or to the few permanent supplies of water in the back country such as Springs, lakes and the largest creek waterholes. There they lived chiefly upon fish and upon game such as kangaroos and emus caught with nets at the waterholes when they came to drink and possums caught in the holes in the hollow gums and box-trees. When rain fell to replenish the back creeks they moved back and were glad to get to their hunting grounds near the ranges after being perhaps for some months confined to a tract of country bare and parched, such as the country about the river Darling'. (cf.Bonney 1883:123 for a slightly amplified description of drought conditions).

Sturt documented the trips made by Aborigines following a shower of rain, in northwestern New South Wales, to hunt the jerboa (Notomys mitchelli) and Tolpero (Macrotis sp.) (Sturt 1849 Vol.II:140). Prior to the fall of rain he had stated that the natives 'were dispersed at different waterholes, there being no one locality capable of supporting any number' (Sturt 1849 Vol.I: 298). Thus we can summarise the effect of a long drought: they were to slowly reduce the maneuverability of the people as one temporary water resource after another dried up or became too salty to drink or support aquatic life. At the same time vegetable
food resources became more scarce. Eventually each group would be restricted to a permanent water supply. The Bagundji possessed water bags of up to 8 gallons capacity but this would only allow a couple of day's travel. Large mammals also would be forced to use the same waterholes and would be caught. Reptiles and small mammals were probably not affected, at least by short duration droughts. The evidence available suggests that broader and broader tracts of land became totally depopulated and Aboriginal diet changed to include things such as *Acacia* gums which were not normally part of the diet. The picture we get is one of dwindling food resources, particularly of plant foods, over the entire area at the same time that conditions restricted the mobility of the people to smaller and smaller areas. The river has rarely flooded during drought periods and though it would remain a good source of water it would be at its lowest ebb and at its saltiest and probably would not be a great source of food. Short falls of rain enabled the people to travel quickly and gather over a larger area but unless the rains were sufficient to break the drought the people would be once again forced back onto permanent supplies. Once the drought was broken by a substantial fall of rain or an inch or two, then life would have returned to normal.

Australian animals had two responses to these stress situations. These were:

i) The maintenance of high numbers during good seasons followed by massive mortalities during bad ones. This response is shown by many animals, fish and by pastoralist-controlled sheep populations. The red kangaroo breeds continually in good seasons but suffers a very high infant mortality rate during long droughts (Newsome 1971:34-9).

ii) The maintenance of low numbers during good seasons followed by few mortalities during bad ones.

For the Bagundji Aborigines permanent waterholes seem to have been sufficient to provide water for long periods and there is no evidence of drastic reductions in population during droughts. More than likely the Bagundji had adapted themselves and their own population density to a situation where strenuous efforts could support most people during bad seasons and very little effort would support everyone during normal and good seasons.
3.7 Conclusion

The Darling River, a major geographic feature in western New South Wales, dominated the lives of its Aboriginal residents. The entire pattern of their existence seemed to have been determined by its fluctuations and the greater part of their food was supplied by it. Whenever good conditions prevailed, the people living in areas up to 100 miles from the Darling came in to the river and were made welcome by its nearer residents. A flood in the river coincided with a fall in population on the immediate river margins.

The Bagundji, whether they lived on the river margins or in the hilly country far to the northwest, were river people, the river was their source of livelihood in a harsh environment. If the river had not existed then the movement pattern of the Darling Aborigines would probably have been entirely reversed and may have been similar to the patterns of movement of the desert people. For the Walbiri the 'good season' was in autumn and winter when the 'billabongs were full and vegetable foods abundant, [and] the people congregated in one or two large groups' (Meggitt 1962:48-9).

The spring and summer, when evaporation dried the waterholes, was the time that foraging groups were reduced to the level of a single family (Meggitt 1962:50). The Walbiri country in fact gets more rain than most of the Darling River Valley (see Australian Rainfall Map in Leeper 1970:14). It was the river that made the Bagundji country a far better habitat than Walbiri country and changed the entire Aboriginal response to the climate. For this reason, I conclude that the Bagundji had a predominantly riverine economy.

While the riverine aspect of the Bagundji economy is outstanding, other aspects should not be overlooked. Particularly important was seed collection. The Darling River flows through flat country covered with semi-arid open grassland. It was the ability the Bagundji demonstrated in tapping these resources of the river and the grassland which gave them a distinctive economy, one which indicated that they had made a sophisticated adaptation to a difficult semi-arid environment. Both the Darling River and Murray Valley economies were essentially riverine and they shared a number of basic characteristics. The combination of river foods and cereals distinguished the Darling from the Murray Valley economy, where cereals were unimportant and where few grinding stones have been found.
In Australia, Aboriginal coastal peoples whether living in tropical northern Australia or in the temperate south-east and Tasmania, also shared certain important characteristics (Bowdler 1970; Hiatt. B., 1967-8; Jones 1971; Lampert 1971; Lawrence 1968; Meggitt 1966 [1964]:59-60; Thompson 1939 discuss Australian maritime societies). There were similarities also between the Murray-Darling Aborigines and those in other riverine areas like the Alligator river in Arnhem Land (White and Peterson 1969, see also Meggitt 1966 [1964]:60-1 for a discussion of riverine tribes). The Bagundji were similar to hunter-gatherers and semi-agriculturists inhabiting areas like the lower Illinois Valley, a tributary of the Mississippi (Stuever 1968:285-312); they could also be compared with the prehistoric Natufians of the Jordan Valley (Binford 1968:335-6; Clark 1969:87-9; Kenyon 1969:37-43; Mellaart 1965:22-32). In all these cases the river was the economic focus of the people inhabiting the area.

In a recent paper on the origins of domestication in the near east, Flannery listed three 'pre-adaptations' that set the cultural stage for domestication. These were (1) 'a trend... from exploiting a more "narrow spectrum"...a considerable broadening of the subsistence base to include progressively greater amounts of fish, crabs, water turtles, molluscs, land snails, partridges, migratory water fowl (and possibly wild cereal grains in some areas?) (1969:77). (2) 'The development of ground stone technology'...and (3) 'the development of storage facilities' (1969:78). These three conditions are probably necessary for domestication but are not sufficient by themselves as the next developmental stage of domestication of plants and animals may or may not follow.

All three of these changes had taken place in the Darling River Valley at some prehistoric time yet the Bagundji remained hunter-gatherers. It cannot be argued that plants suitable for domestication were absent from western New South Wales as the two main cereals collected were Panicum sp., and Setaria sp., closely related members of the same families that produced the domesticated Italian millet (Setaria italica) and common panicum (Panicum miliaceum) (Brothwell and Brothwell 1969:97). The detailed evidence about the genetics of these plants and about Aboriginal methods of exploiting them necessary to decide whether or not the Bagundji were approaching an early dry farming stage or not is lacking. However, I do not discount the possibility that they were.
While it may be difficult to justify the description of the Darling River Bagundji as 'early farmers', their status as an advanced group of hunter-gatherers seems assured. Their use of nets, snares and traps for hunting, the gathering and storage of grain, the use of woven baskets, bags and mats and of skins sewn together for rugs (see Plate 3.2.b) and the fact that they came together in large semi-sedentary groups living in village-like encampments of substantial grass huts marks them off as a people whose material culture had flourished in an environment that was the equal of the semi-arid Near East (Braidwood and Howe 1960; Hole, Flannery and Neely 1965) and the dry Tehuacan Valley (Byers 1967:48-65) areas where domestications took place. Unlike the contemporary opinion of many hunting and gathering groups, the Bagundji were not a culturally impoverished group of nomads who had fled into an inhospitable and inaccessible region as a result of cultural pressures from agriculturalists.

The conservativeness of Australian Aboriginal society has been suggested as one reason why the Aborigines did not become agriculturalists (Meggitt 1964 [1966]:64, White J.P. 1971:183-95 discusses some of the other reasons). It is possible, however, that the Bagundji hunting and gathering economy rather than an agricultural one may have been the most efficient subsistence strategy for the Darling River Basin, one that enabled them to withstand considerable environmental pressures without any population loss. (See Harris 1971:46-8 for a discussion of possible subsistence strategies).

The relationship between the Aborigines and their environment has often been described as parasitical (Elkin [1938] 1961:15; Meggitt 1964:32; Meggitt [1964]1966:63; Peterson 1971:24). Most of these authors considered that the mode of life of Aboriginal hunters, gatherers and fishers was a form of economic parasitism. This was because the means of subsistence were gained by 'directly exploitative techniques; nowhere did the aborigines engage in horticulture, even of the most rudimentary kind, nor was there any efficient domestication of indigenous animals' (Meggitt [1964] 1966:63). However,'the essential criterion of parasitism is dependency, the loss of freedom to live an independent existence' (McGraw-Hill 1960 Vol.6:555). Aborigines were independent, free-living beings and possessed few of the qualities that define parasites. To describe the relationship between hunter-gatherers and
the environment they inhabit as being a form of economic parasitism is to make a moral judgement not an ecological one.

In western New South Wales Aboriginal man was the major predator and a competitor for the resources of the environment and his activities almost certainly limited the populations of many of the land mammals discussed above.

The whole population structure of the native fauna was probably determined by Aboriginal hunting and gathering activities and by Aboriginal competition for food resources. At certain times and places the use of beating and netting techniques would have virtually eliminated local populations of some of these animals and forced survivors to temporarily migrate into other areas. There is evidence that local fish populations were eliminated in river pools and that a heavy toll was taken elsewhere. Where the outlets of draining lakes and billabongs were netted, there was a total mortality in all the fish too large to fit through the nets. Beveridge (1883:48) states that he has seen thousands of dead fish behind these weirs. Mollusc and crayfish populations were also harvested in great quantities. Acres of grass vegetation were disturbed by the collection of seed and large areas of swamp disturbed in the collection of aquatic plants.

I briefly discussed the use of fire by Darling River Aborigines in Chapter 1, section 1.7. There is evidence of large scale regrowth of scrub, in the area, in open areas where fire was kept out (Loughan quoted in Sydney Mail July 23, 1887:170-1) and it seems significant that the Bagundji word for 'flame' - 'Pullara' was also the word for 'open country' (Tuelon in Curr 1886 Vol.2: 211). Tuelon adds 'flame, whereby open country is made'. Jones (1969:224-8) has summarised the effects of Aboriginal burning in Australia. Because it seemed to him that the Aborigines deliberately used fire to facilitate economic activities, he called it 'fire-stick farming' (1969:224).

Aboriginal man had to adapt himself to the Australian environment but also the environment was changed by his arrival and had to adapt to the presence of an efficient predator and competitor. The major fluctuations in the western New South Wales environment had a controlling effect on the lives of the Aborigines and later of the pastoralist Europeans. It was only when the European's industrial base provided the technology to tap water
resources beneath the plains that they became less subject to these variations. It is fashionable to regard the Aborigines as being totally helpless in the face of the environment and to think of the Europeans as being able to control the environment. But even with the material equipment presently available, the Europeans have only been able to replace the Aborigine's hunting and gathering use of the land with a particularly inefficient and costly form of pastoralism. At the present time in the Darling River area, the grazing of domesticated animals provides only a bare subsistence for a population that is not much larger than the Aboriginal one. Bonney (1884:123) estimated that the Bagundji had an average population density of one person to every 20 square miles. This is probably an underestimate of the densities prior to the setting up of the sheep stations. The present day density of people in the area per square mile is about 1 person to 6 square miles (Comm. of Aust. 1963 population map).
CHAPTER 4

THE BAGUNDJI CULTURE AREA

4.1 Introduction

We have seen how the economies of the peoples within the Darling Basin belonged to a single unified system dominated by the river. Can we also see these people as having possessed a unique set of cultural and material traits different from those possessed by neighbouring peoples? In other words was there a Bagundji culture area? Kroeber (1939:1-15) has discussed the concept of a culture area as a cultural climax related to a geographical area and its environment. Past historical influences were also taken into account. The classification is the cultural analogue of a vegetation classification.

In order to see whether or not there was a Bagundji culture area it is necessary to make a general review of Bagundji culture. This will also provide necessary background information about Bagundji society, particularly those aspects that governed the distribution of people through the area. Further, it will provide information about the external historical and cultural influences that affected the Bagundji culture.

4.2 Bagundji kinship

A number of workers have collected sets of Bagundji kinship terms. The earliest were obtained at Wentworth by Holden (in Taplin 1879:170198). Similar terms were collected at Bourke (Tuelon in Curr 1886 Vol.2:215) in the last century and at Wentworth (Radcliffe-Brown 1918:248-9), Tibooburra (Elkin 1938:41-7) and Pooncairie (Beckett 1958b:91) in this century.

Elkin came to the conclusion that the Bagundji kinship system represented a system in transition from a Kariera (Wailpi) system [marriage with a real or classificatory cross cousin, MBD or PZD] to an Aranda (Dieri) type of system [marriage to a second cousin usually MMBDD] (Elkin [1938] 1961:68, 1938:42).
Most of the tribes of south-eastern Australia possessed a Kariera type of kinship system; those in central Australia an Aranda type. From the evidence of Elkin and others (Holden in Taplin 1879:168; Bonney Ms c.1881) it would seem that the Bagundji had, at the time of settlement, been influenced from the north-west as far as the kinship system was concerned.

Beckett came to a similar conclusion about the northern and southern portions of the adjacent Wongaibon. The northern Wongaibon possessed an Aranda type of kinship system, the southern Wongaibon a transitional type between a Kariera and Aranda system. He concluded 'that the more northerly group of Wongaibon had made the changes towards which the southerly group were proceeding' (Beckett 1959:202).

4.3 Social organization

The Bagundji group of tribes were all internally divided into two named groups (moieties). A man belonged to his mother's moiety and married a woman from the other. The Bagundji moieties were called Muckwara (Eaglehawk) and Kilpara (crow) (Mathews 1893:242).

Subdividing these moieties were a number of matri- totemic clans. Howitt (1888-9:41) lists some of the clans that made up the two Bagundji moieties. A few more clan names were provided by Mathews (1898:43). Clans listed for the Kilpara moiety were kulthi-emu, turu-carpet snake, namba- bone fish, birnal-goanna, bauanya-pademelon, verilpari-opossum, plain turkey, mallee hen, swan, wallaby, shingleback lizard, Murray cod, diver, crow, shipsnake, curlew, native companion and brown duck. Those listed for Muckwara were bilyara- eaglehawk, turlta-kangaroo, burkunia-bandicoot, ulebri-duck Karni-lizard, common magpie, honey, galah, dingo, teal duck, pelican, bilby, echidna, native bee, bronze-wing pigeon, carpet snake, wood duck, ibis, and black duck (Howitt 1888-9:41; Mathews 1898:43).

Howitt (1904:194) stated that for the Darling River tribes
'There was a limitation as to totem marriage: for instant...Muckwara-eagle-hawk married Kilpara-bone-fish; Muckwara-kangaroo married Kilpara-emu; Muckwara-dog married Kilpara-padi-melon, and so on'.

Parker said that among the nearby Ualarai, each clan, as well as having a major totem of the sort named above, such as goanna, bandicoot, had as many as 23 subtotems. She listed 13 totemic clans and 152 subtotems adding that some of the major clans had become extinct for want of any surviving members (Parker 1905:15-20). The situation amongst the Bagundji was almost certainly similar. A man's fellow clansmen were his matrikin. Beckett (1967:459) described their roles.

'A man's close matrikin were near him in all the crises of his life. They supported him in disputes, conducted his burial rites, avenged his death, arranged his marriage and gave the order for him to be initiated'.

A man's matri-totemic clan was known as his meat, symbolising the sharing of a common life based on the inheritance of one flesh and blood through the mother (Elkin [1933] 1967:164).

Each of these totemic clans conducted the ceremonies that took place when young men were initiated. There has been a tendency to underestimate these ceremonies, which sometimes lasted for months. Part of their performance consisted of the men going through various 'pantomimic performances imitating the animals which are the totems of those present...different burlesques taking place every evening' (Mathews 1898:248). Howitt gave more information

'...it must be mentioned that, whenever possible, the men who represented animals were of those totems, and indeed all the animals which were represented in these performances were the totem animals of the tribe' (1904:545).

Radcliffe-Brown who gathered some information from Weilwan and Wiradjiri informants described a similar situation concerning
the performance of these dances and added

'I was told that when the animal with which the dance was connected was a totem of one of the clans only the men of that particular clan would take part in it. If any man who did not belong to the opossum clan, for instance, should try to dance the opossum dance, the men of that clan would be very angry with him and there would probably be a fight' (1923:439).

Despite the fact that these clans 'owned' dances, symbols and myths, they were still interpreted as social rather than as ceremonial groups. Part of the reason for this seems to have been that the clans, because of their matrilineal recruitment principal, were non-localised. The members were spread all over the tribal territory. Mathews described this feature

'In the Wirraidyuri tribe, where the totem descends from the mothers to the offspring, the totems are scattered indiscriminately throughout the tribal territory... [because of viri-local\(^1\) residence patterns] a totemic group would not be coincident with a "local division"' (Mathews 1906:942).

Thus the clans could not be tied to sites of totemic interest in the way that the localised patri-totemic clans of Central Australia were. Tindale (1939:244-5) described an eaglehawk and crow myth which belonged to four Maraura men. While the men owned the myth almost all of the locations where specific incidents took place were outside their tribal territory as well as being outside the territory of their own local group.

The elements of Bagundji social organization described above, were also found amongst the neighbouring Wiradjeri group of tribes. The social organization of the Wiradjeri differed only from the Bagundji in the possession of sections. There

\(^1\)Viri-local residence is a residence pattern in which the married couple set up their household in the husband's country.
is good evidence that the Wiradjieri had only recently acquired sections from areas to the north (Beckett 1959:202-3; Elkin 1945:208). The system also appeared to have been a late development in other areas such as Central Australia, Meggitt concluding that

'It is probable that the Walbiri received the section system no more than a century ago and subsections 20 or 30 years later' (1962:168-70).

Howitt (1888-9:31-2) thought that the 'Barkinji type of system' based on dual social organisation could be interpreted as evidence of a stage through which all of the other southeastern Australian tribes had passed. However, his concentration on the section system blinded him to the fact that most of the southeastern tribes shared many features with the Bagundji. The Bagundji lacked the section system because they had not been affected by the same cultural and historical influences as had the Wiradjieri.

4.4 Local organisation

Malinowski ([1913] 1963:134-43) reviewed many of the ethnographic sources on the Aborigines of southeastern Australia and came to the conclusion 'there is always a certain territory allotted to the exclusive possession of a certain group...a Local Group...a division of the tribe [that] possesses the exclusive right to use a given territory and to dwell within its limits'([1913] 1963:134-5). Such statements fit the facts as they are known except that all local groups probably left their territories for some time each year as part of a regular seasonal change.

Howitt (1904:50-1) was able to provide a few more details

'the unit of local organisation is a small group or family which hunts over a restricted area of country. A number of these form a horde and a number of hordes together form a tribe'.
Howitt defined the horde as a

certain geographical section of an Australian community which occupies certain definite hunting grounds [in southeast Australia]...its members are from different totems' (Howitt and Fison 1884-5:143).

One of the few areas in southeast Australia for which there is some information about the size of a hordal territory is the country around White Cliffs, 70 miles northwest of Wilcannia. Howitt (1904:50-1) states that five hordes made up the Tongaranka tribe (probably the Wainjubalgu). These horders were situated at Momba, Tarella, Wonaminta, Yandarle and the Daubeny Ranges. These localities are between 13 and 22 miles apart and if each locality formed the centre of each hordial area then the average area would be about 800 sq.miles ranging from 500 to 1500 sq. miles. On the river these areas should be considerably less. Henderson (1851:108) described hordal territories of about 300 square miles for coastal New South Wales.

'Each [local group] has a certain beat, or hunting ground, frequently of not more than 20 miles in diameter, from which they never move, unless on certain occasions, when they visit the territory of a neighbouring tribe for the purpose of a fight, or a ceremony. Sometimes the [local group] will wander about in parties of five or ten; at other times all the members will encamp together' (quoted in Malinowski [1913] 1963:141-2).

Rights in the locality of birth appeared to be the normal system of recruitment to local groups in the southeast. For the Wiradjeri, Mathews stated that the tribe

'comprised a number of sub-tribes, or independent groups, each of which has its recognised hunting grounds in some part of the tribal territory and is known by a name derived from some local feature of its district, or other distinguishing nomenclature.

Every tribe is still further divided into smaller groups, consisting, for example, of an old man with
'his wives, his sons and their wives, and the families of the latter. Perhaps there were also residing with them a few other near relatives. They usually have their abodes near each other, but they do not necessarily live at the same camping place. Most of these people, at any rate all the men and children, were born in that particular locality, and occupy its forests and streams as a common hunting ground by virtue of their birthright' (1906:941-2).

A man had other rights, though not necessarily equal rights, to tracts of land with which his mother or father were associated. The factors that determined where a couple would be living at any one time probably varied according to the nature of the season and the nature of their relationship with various relatives. The fact that a person had a kinship obligation towards one did not mean that that person could not fulfil his obligations in an ungenerous and cranky manner.

Sentiment was expressed by individuals about the place they were born. This was expressed in a wish to be buried near the place of birth. It was noticed by some of the early ethnographers that a

'strong desire [was] manifested by members of certain tribes [in N.S.W.] to bury their deceased relatives as near the place of birth as possible, or, at any rate, among their kindred' (Fraser 1893:80 quoted in Etheridge 1918:14).

Elkin (1953:417-8) questioned whether or not patrilineal local groups existed all over the country, and particularly in the southeast, where there was almost no emphasis on patrilineality at all. Radcliffe-Brown replied that he was satisfied that the local groups of the Ualarai, Wiradjeri, Kamilaroi, and Wongaibon were patrilineal (1954:166). The evidence presented above supports Elkin's contention (1953:418) that there was no ideological bias towards patrilineal groups, local or otherwise, in southeastern Australia.

During the last twenty years there has been continuing debate about Aboriginal local organization centred on the
question of whether or not it was based on a system of patrilineal local groups occupying a defined territory (Elkin 1953: 417-8; Hiatt [1962] 1966:1-25; Hiatt 1966-7:81-92; Meggitt [1964] 1966:57-74; Stanner 1965-6:1-26). Clearly the evidence from western New South Wales supports the view that local organisation varied from place to place.

4.5 Bagundji totemism

The absence of patrilineal local groups meant that the totemic system of the Bagundji differed in important respects from that described for tribes in central and northern Australia. In the latter areas, patrilineal local groups were intimately associated with 'sacred sites' within their territory. Consequently these groups were also localized patri-totemic clans. Radcliffe-Brown concluded for tribes such as the Wongaibon, Wiradjeri, Weilwan and Ngeumba, that

'There is no evidence in this area for the existence of local totem centres with increase ceremonies' (1930-31a:232)

and that while

'the Wongaibon horde may be a local clan with male descent it was not totemic' (1923:444).

Because of the differences between the totemic systems of the eastern and central Australian tribes Radcliffe-Brown thought that Australian totemism could be divided into two major types, an 'eastern type' without localised totem centres and a 'western type' with

'special totemic centres at which ceremonies for a particular totem are regularly carried out. At such centres there is sometimes a natural feature...which plays some part in the ceremony. An essential feature,...is the belief in totemic ancestors who have established the totem centres and first performed the ceremonies' (Radcliffe-Brown 1926a:204-5).

When Spencer and Gillen published 'The Native Tribes of Central Australia' in 1899 they realised that the description of the
Arunta totemic system was something new in Aboriginal anthropology. They commented

'What has gone before will serve to show what we mean by speaking of the totems as being local in their distribution...It will be evident from the general account already given that the totemic system of the Arunta and other Central Australian tribes differs in important aspects from those of other tribes which have hitherto been described' (Spencer and Gillen 1899:126-7).

While the Bagundji clans may not have been attached to certain localities, the myths were. The Darling River Valley and the adjacent areas were the scene of many totemic dramas and, like all other areas in Australia, some happening appears to have taken place at almost every spot. The Darling River, in one myth, was formed when the ancestral hero Ngurunderi pursued a giant Murray cod. As the fish swept its tail from side to side it widened the river to its present size (Berndt and Berndt 1968:204). This same Ngurunderi eventually met two sisters who had fled from the Manara Range (see Fig.3.1) across the sandy plains to Pooncairie and then down the Darling in order to escape from Crow, of the Eaglehawk and Crow myth (Tindale 1939:256-9). The events passed out of the Darling Valley and eventually the sisters ended up on Kangaroo Island. In both of these connected myths the heroes followed tracks from place to place pausing here and there for adventures.

Another totemic hero, possibly Ngurunderi under a different name, pursued a giant Murray cod which formed the Murray as it swam along. This being was called That-tyu-kul and he left the Murray and made another track through the Mallee country and down past the Grampians in Victoria (Mathews 1907:282-6). That-tyu-kul is of interest because he was regarded as being responsible for changing the Bookoomurri (primitive beings) into animals (Howitt 1904:494).

Two of these Bookoomurri were described as being responsible for the formation of the Willandra Creek. They pursued a giant kangaroo from Hilston on the Lachlan River for hundreds of miles until they eventually killed him near the
junction of the Murray and Darling Rivers. The Willandra Creek was supposed to be the track of the fleeing kangaroo. The few hills which occur in the district (such as the Manfred Range) were the camping spots of the Bookoomurri (Cameron 1884:369). Sometimes the incidents concerned malevolent beings and ancestors. Newland (1921-2:1-6) was told that Mount Macpherson, on the west side of the Darling, was the scene of a battle between the Bagundji and the Mulas, an ugly people with short legs and long arms and a sharp bony blade growing out of each elbow with which they fought striking backwards. The spirits of the Mulas still haunted the mountain and were described as being responsible for mischiefs and deaths. On recent maps the name Mt. Macpherson has been changed back to Mulyah Mountain.

Other myths relate to totemic beings such as one about Giwa the moon. The events took place between the Culgoa and Warrego Rivers, west and north east of Bourke. Giwa was saved from a flood by two women who carried him on a pole. However, either he was thrown in or fell in and drowned. Near Wiltagoonah station he managed to get his revenge by suffocating some humans under a ring of leopard-wood bark that now forms the ring around the moon (Mathews 1904-5:358).

These myths are not different in nature from myths in Central Australia and Northern Australia particularly those associated with various tracks. Yet, in Central Australia, the spots where events took place are today sacred sites whereas in Eastern Australia the spots are known but apparently have little importance in the totemic ceremonies.

There are two main reasons why the Bagundji totemic system was not localised. The first is that there was no belief in spirit conception or conception totemism. Totemic beings such as Wahn, the crow, and Bu-maya-mul, the wood lizard, made the spirits of children and these spirits could 'catch' their mothers in any spot. They were not restricted to sacred sites.

The second reason, related to the first, is that these child-spirits were not reincarnated ancestors. In Central Australia the various totemic ancestors went into the ground at certain localities and remained there (Howitt 1904:475-82).
A woman became pregnant when she passed one of these spots and an ancestral spirit entered her body. This was a true belief in reincarnation. In south-eastern Australia the ancestral beings went up to a sky camp and remained there. Elkin ([1938] 1961:212-4) calls these latter beings 'sky heroes'. Thus there are no sacred sites in the east because there were no spots where ancestral beings were still in residence.

4.6 **Bagundji mythology**

Some of the Aboriginal tribes in southeastern Australia possessed a belief in a supreme being, an 'All Father'. He had a number of names in different places representing different beings who had kin relationships with each other. Thus the Wiradjiri group of tribes, the Kurnali and some Victoria tribes all had myths, rites, and ceremonies, that together formed a cult to the culture hero, Baiame. Baiame had a one-legged son called Daramalan. In other areas, such as southeast New South Wales, the cult hero was Daramalan alone and little mention was made of Baiame. Some tribes had beliefs in similar beings but called them different names.

Howitt (1904:488-508) reviewed the literature on this topic and concluded that...'It seems quite clear that Nurrundere, Nurelli, Bunjie, Mungan-ngaua, Daramalan and Baiame all represent the same being under different names...Thus extending the range of this belief certainly over the whole of Victoria and New South Wales, up to the eastern boundaries of the tribes of the Darling River. This would define the part of Australia in which a belief exists in an anthropomorphic supernatural being, who lives in the sky, and who is supposed to have some kind of influence on the morals of the natives'. Baiame, together with most of the mythical personalities described in the southeastern myths, lived in a sky-camp. He and they could return to earth to work magic or to punish transgressors of marriage rules. Baiame and Daramalan were thought to return to earth during certain initiation rituals, particularly the ceremony by which a clever man was made (Berndt 1947-8:334-6).

The location of the living place of these beings in the sky, marked them off from ancestral or creative beings in other areas who went into the ground and inhabited certain surface features. Elkin concluded 'in the central and northern
parts of Australia, the belief in the sky-hero of initiation has either ceased to exist or else has been pushed into the background by totemic heroes whose spirits are tied to the earth' ([1938] 1961:213).

One of the differences that has been thought to exist between the Wiradjeri and Bagundji tribes was that the former had ceremonies connected with Baiame whereas the Bagundji did not. In describing the Bagundji tribes Beckett wrote,

'Tooth avulsion and the plucking of bodily hair were practised but the ceremony had no connection with the Baiami and Daramulan cult, or, so far as I can discover with any other deity' (1958a:32).

The Maraura, the southernmost Bagundji tribe did have a belief in a spiritual being called Nurelli. Holden provided some information about Nurelli who lived in the sky (quoted in Taplin 1879:18). He had a cruel wife and lived forever. Holden commented

'they consider the course of the Murray was pursued by the winding of a very large serpent, and that this serpent was killed by this great man "Norallie"' (Taplin 1879, note I:27).

There is some evidence that the Nurelli myth was a fairly recent innovation in Maraura cosmology. Van Gennep recorded an attempt to fit the myth in with an eagle hawk and crow myth, 'in the beginning...there were many Nuralies. Some figured as eaglehawks, others as crows. They fought against each other, the crow was wounded in the foot, but they were finally reconciled and founded the Wiimbaio [Maraura] tribe with the two phratries, eagle hawk and crow (Mukwara and Kilpara)' (Van Gennep in Ehrlich 1922:66). In this myth Nurelli has lost all similarity to Baiame and has become identified with the probably more ancient eaglehawk and crow myth.

The rest of the Bagundji tribes did not have myths concerned with Baiame. However, Bonney (Ms 1881) provided evidence that they believed in Baiame's wife kurikuta, a belief
they shared with the Wongaibon tribe to the east (Berndt 1947-8: 77-8). Other unpublished myths from the Bonney manuscript (Ms. c.1881) allow us to see to what extent the Bagundji shared a common mythology with their eastern neighbours.

One of the most widely distributed Aboriginal myths concerned two totemic beings, Eaglehawk and Crow. Tindale recorded a very detailed account of this myth from Maraura informants living at Wentworth on the Lower Darling. A fragment of this myth also was collected by Bonney (Ms. c.1881). It compares word for word with the version obtained by Tindale. The activities took place on a trek from Mount Manara to the Darling River near Pooncarie and continued down the Darling and along the Murray as far as Swan Reach. I will paraphrase the myth to illustrate some of its features.

The Eaglehawk [Kanau] and the Crow [Waku] were brothers-in-law, they quarrelled over the fact that Eaglehawk had no sister to give to Crow in exchange for Eaglehawk's wife. Crow went away dissatisfied. He later made his penis grow and travel through the ground in order to commit incest with two sisters who were squatting down collecting vegetables. The sisters were classificatory mothers-in-law to Crow. They each became pregnant and later left the Manara Range with their children in order to avoid Crow. They cohabited with Kingfisher [Tula] who was a Kilpara man and hence a legitimate spouse. Waku the Crow killed Kingfisher and pursued the women as far as Swan Reach on the Murray. These two women later became the wives of Nurrunderi and took part in events as far south as Kangaroo Island (Tindale 1939:259). Waku returned to his own country [Barindji Territory] and revenged himself on Eaglehawk by killing Eaglehawk's son, Crow's sister's son. Crow pretended that his nephew was killed in a raid but Eaglehawk did not believe him. They fought and were eventually both turned into birds (Tindale 1939:243-61). An interesting version, only a fragment, was collected by Hercus in 1970 from a Madimadi man living at Balranald (Hercus 1971). Tindale (1939:260) has published a distribution map marking the spots where this myth has been recorded. It has been recorded from all over southern Australia and at spots on the coast in northern Australia. Its distribution is peripheral to the Centralian-
Northern Territory area and this supports Tindale's conclusion (1939:259) that the myths 'are of rather remote origin in time'.

4.7 Encroachment from the north-west

(a) mythology and totemism

Up to this point, all the social aspects described for the Bagundji have marked them off as a rather typical south-eastern Australian tribe. In section 4.2 above, I described the Bagundji kinship system as being influenced from the north-west. This was not the only aspect of Bagundji culture that was influenced in this way.

In a myth collected by Bonney (Ms. c.1881) a Nychee [Rainbow Serpent] was pursued and killed, near Lake Peri, by an ancestral hero called Coolooberro. Bonney described him as being on one half side Kilpara and Mukwara on the other and stated 'some Aborigines say that Coolooberro made blackfellows as they are now'. The association of Coolooberro with the Rainbow Serpent in a Bandjigali myth collected prior to the 1890's is interesting. George Dutton, a Bandjigali man was able to give fragments of the same myth to McCarthy and Macintosh in 1959. When discussing Aboriginal mythology connected with the art site of Mootwingee, Dutton stated that

'it was up Giles Creek that the mura Kulabiru (syn: Kwilabiru, Gulubira) walked on his journey from the south, and each of the waterholes was made by his footsteps; as each was made he cried Kokaru, i.e. the hole, and in each subsequently there grew a ngaitchi - water snake'. McCarthy added 'This is according to our informant, Mr. George Dutton, who as a lad was taken by his father up this creek in the pathway of Kulabiru' (McCarthy and Macintosh 1962:253).

The possession of myths concerned with the tracks of mura-mura ancestor heroes was important as it linked some of the Bagundji beliefs with those held by the Dieri and other tribes to the northwest. The mura-mura myths are what I term 'western myths'. Howitt discussed these and said that
'Baldwin Spencer has told me that the equivalents of the Mura-muras occur with the Urabunna, and the places are pointed out where they died and where their spirits still are...this evidently connects the Mura-mura beliefs of the Dieri with the Alcheringa beliefs of the Arunta' (Howitt 1904:482).

Beckett (1958a:36) described the mura beliefs of the Maljangaba

'they...trace descent, patrilineally, from a number of legendary heroes called mura, who once travelled the country naming hills and waterholes. This is a feature of the South Australian cultures, but it seems that the northwestern Bagundji peoples may also have shared it, for the muras passed through their country'.

The Bagundji, west of the River, possessed this mura-mura belief and possibly the tribes further to the east also as Reay (1949:108) was able to obtain some information about the mura-muras from Bagundji men, probably from Bourke.

The mura-muras did not go up into the sky but went into the ground and continued to dwell there. There are localized totemic clans associated with these spots.

In areas in the Darling basin where the mura-mura myths had been adopted there was a relationship between a man's place of birth and the sacred sites at that place. Thus part of the Bagundji group possessed both eastern and western forms of totemism. The Maljangaba, Bandjigali, Wiljali, Wainjubalgu tribes of northwestern New South Wales, and possible some of the river Bagundji people had probably accepted these mura-mura beliefs from the west and north quite recently.

Such a situation seems not to be unusual. Meggitt (1965-7:31-3) discusses the spread of the Kunapipi and other cults into the Walbiri area from northern and southern neighbours in historical times and came to the conclusion that they were

'no more than historically determined specialisations of a more basic and archaic initiatory complex that was once widespread through Aboriginal Australia.'
'With the older complex I associate the operations of tooth-avulsion and depilation, with the later developments the act of blood letting, whether through circumcision, subincision, or the piercing of the arm veins... such a division... is... compatible with Howitt's distinction (1904:501ff) between western and eastern types of initiation ceremonies' (Meggitt 1965:7:34).

(b) initiation ceremonies

Bonney (Ms. c.1881) described a rain-making ceremony which involved the tying of ligatures, the cutting of veins and the pouring of the blood into a dish of feathers. Howitt (1904:396) described a similar ceremony carried out by the tribes all along the western bank of the Darling from Menindee to Bourke and up the Warrego River. Blood-letting ceremonies connected with rain have not been described for other tribes in southeastern Australia (Howitt 1904:394-9). Blood-letting as part of such ceremonies was restricted to the area west of the Darling River. Meggitt (1965-7:34) interpreted such blood letting as part of the later development in Australia of a ritual complex that included circumcision and subincision also.

Elkin (1961 [1938]:38-9) and Berndt and Berndt (1964:139) have published maps of the distribution of circumcision and subincision. Both were restricted to Northern and Central Australia and were absent from the southwestern and southeastern Australia. The rite was still spreading at the time of European settlement in some areas.

The Danggali, Wainjubalgu and Bandjigali of the Bagundji group shared with the Maljangaba, a variant form of the South Australian Wiljaru \(^1\) ceremony (Beckett 1967:457). The possession of this rite, together with circumcision, strongly links these western Bagundji tribes with tribes to the north and west.

The other tribes in the Bagundji group had different initiation ceremonies. Tooth avulsion was practised from

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\(^1\) The Wiljaru rite consisted of making a particular pattern of cicatrices in rows on the back. They differ from the cicatrices put on at various times by tribes in the south-east.
Wilcannia north to Bourke and depilation of the hair from the body and pubes was carried out south and east of Wilcannia (Mathews 1898:243-50). These differences were noticed by Mitchell as he passed down the Darling. He saw Aborigines near Menindee who had not had their front teeth removed and remarked that it was

'an uncommon circumstance; for these were the first natives, whom I had seen in Australia possessing both' (Mitchell 1839 Vol.I:258).

Mathews summarised the information about Bagundji ceremonies of initiation

'Modified forms of ceremonies are practised in different parts of the country occupied in the northern end...for example, the rites are dispersed in a somewhat similar manner to those of the Kamilaroi and Wiradjeri people; in the southern portion the ceremonies resemble those in force among the Lower Murray tribes; whilst in a wide tract of country along the western boundary we find the rite of circumcision is incorporated with the other forms, or is to some extent in substitution of them' (1898:242).

The rule was not altogether hard and fast as Beckett (1958b:97) described how in areas that had adopted circumcision the Dalara, the Bagundji initiation involving tooth avulsion, was still considered valid.

Howitt thought the rites of hair depilation and tooth avulsion belonged to an eastern type of initiation (1904:512ff). Circumcision he thought of as being a western trait. This divided the Bagundji tribes into those to the west of the Darling River practising the western rite, and those in the south and east, practising the eastern type. The beliefs in the mura-muras possessed by the western Bagundji were obviously associated with the spread of circumcision as they were of a type widely known from the area west of the Darling River but not from the east.
4.8 Disposal of the dead, mourning caps, grave markers and cylindro-conical stones

There were a number of forms of burial practised in the Darling River Valley. In the north, the deceased was bound in the sitting position and buried. There was no outer grave structure other than a small mound of earth. The women wore mourning caps made of gypsum that were placed on the head over a net (see plate 4.1a). They have often been called 'widows caps' but many other mourners also wore them (Meehan 1971:74). Grave markers, cylindrical lumps of gypsum, were placed on top of the grave (Dunbar 1943-4:145) (Plate 4.1b). Similar funerary items were used in the area northwest of Wilcannia except that some graves had a brush fence around the mound and Bonney described one that had a bough hut erected over it. In addition, a piece of flesh or hair was removed from the corpse, cut up and distributed amongst the relatives (Bonney 1883:134-6). The Ngeumba and the Ualarai, tribes belonging to the Wiradjuri group, also had mourning caps as part of their funerary rites, but they may have borrowed these from the adjacent Bagundji (Dunbar 1943-4:145; Parker 1905:9203). Graves on the lower Darling were more substantial than those on the Northern Darling. Browne (Ms. 184405, Oct.2nd) described a grave he saw near Pooncairie,

'I found some native graves on a sandhill. They were each covered with sticks with one end fixed in the ground and meeting in a point. On these were thrown pieces of bark and a large quantity of grass and overall a net is fastened which keeps everything in its place. Round the grave there was a path about 2 feet wide terminating in a point east and west [of the grave]. At each point there was the remains of a fire. The inside of the structure was hollow and partly filled with grass which had evidently served someone for a bed, probably the nearest relative of the deceased'.

Krefft (1866b:374) saw similar graves on the lower Darling and on the Murray.
The Wonkanguru, occupying the country east of Lake Eyre and north of the Dieri, also used mourning caps and grave markers and buried their dead in shallow graves with low mounds over the top of branches on the mound, like the Bagundjji (Horne and Aiston 1924:153-5). In most cases the body was bent up, or flexed, and tied with the knees near the face. This facilitated burial in a small hole though I do not think ease of burial was a major consideration in this. In other areas kinsmen went to immense trouble and spared no effort in their attempts to bury their relatives 'right'. The Maraura would rebury a corpse if tracks around the grave suggested that it was uncomfortable enough to get up at night and walk around (Howitt 1904:452).

The methods of disposing of the dead practised by the Bagundjji were similar to those carried out in many areas of Australia (Howitt 1904:426ff; Berndt and Berndt 1964:386ff and Meehan 1971). However, the mourning cap does appear to have been a specialised badge of mourning restricted in its distribution to the Darling River Valley and the country from the Darling up to the eastern shore of Lake Eyre. Meehan, after reviewing the evidence, came to the conclusion that mourning caps were not used outside the Darling River - Lake Eyre region (Meehan 1971:7508). The use of white pipe clay on the body and hair is a traditional Aboriginal badge of mourning found all over Australia (Meehan 1971:74). The development out of this practice of the wearing of a heavy mound of gypsum on the head seems to have been a local development confined to the Darling River and adjacent areas.

Another cultural trait that appears to have been confined to the Darling River Valley and the area to the east of Lake Eyre was cylindro conical stones or cylicons (Plate 4.2a). Cylindro-conical stones are cylindrical stones pointed at one end and often are covered with markings and scratches. They have often been referred to as 'mystery stones' (see Black 1942). The vast majority of these stones have been recovered from places along the Darling.

No full description of their exact function has come to hand, but the cylindro-conical stones probably had similar uses to objects like the sacred boards or the Tjurunga of
Central Australia. Some of the evidence about the cylindro-conical stones, collected from Aboriginal informants, has been regarded as contradictory but in most cases this may not be so.

The best statement about their use in Bagundji territory was given by an old man interviewed by Mathews. He stated that 'the stones were used in incantations for causing a supply of game and other food to increase, for the making of rain and other secret ceremonies...They were not to be seen by the uninitiated or by women...' (Mathews 1909:497). A Tirari man from near Lake Eyre gave Gregory a similar explanation about cylindro-conical stone, he said it was a 'Wommagnar-agnara, which, being interpreted is "The Heart of the snake". It was used at a ceremony to make the dark olive-brown carpet snake, known to the natives as "Womma", i.e., to increase the supply' (quoted in Etheridge 1916:14-15).

Most authors have recognised the phallic shape of the stones but were unwilling to accept that they were associated with fertility or increase ceremonies on the grounds that the Aborigines had no idea of male parentage and hence would not use a phallic object as part of such a rite (Etheridge 1916:16). However, other phallic symbols such as the Rainbow Serpent are commonly associated with rain and fertility cults (Berndt and Berndt 1964:234ff).

The association of these stones with increase ceremonies is not inconsistent with the Wonkonguru's view that the stones were the petrified penises of initiates who had died as a result of having been circumcised with firesticks (Horne and Aiston 1924:168-9). Circumcision with a firestick is a common theme of myths in the Great Victoria and Western Deserts (Berndt and Berndt 1968:215). Nor is it inconsistent that some informants suggested that the stones were 'used' during circumcision and tooth-avulsion ceremonies (Bonney quoted in Etheridge 1916:14; Horne and Aiston 1924:169). They were probably shown to initiates and later used in ceremonies in the same way that bull roarers were shown to Kamilaroi initiates (Mathews 1897:169-70).

The markings on some of the stones consisted of emu and bird tracks, circles, crosses, stars, line patterns and
herring bones. (see Black 1942:15). They are as Black states 'typical of the motifs used by the aborigines in their art designs in nearly all parts of the continent'.

4.9 Rock engravings

In Chapter 5 a series of rock engravings from the Burke's Cave site are discussed (see also plate 6.1a and b). Similar rock engravings have been reported from a number of sites in western New South Wales and in South Australia. A distribution map of some of these sites is shown on figure 4.1. Western N.S.W. engravings have been described by Black (1943) Dow (1938, 1939) and McCarthy and Macintosh (1962). Engraved sites in South Australia have been recorded by Edwards (1971), Mountford (1929, Mountford and Edwards (1963). Similar rock engravings have been found in the Alice Springs - Cleland Hills region in the Northern Territory (Edwards 1971) and on Depuch Island off the coast of northwest Western Australia (McCarthy 1961).

The engravings are generally associated with water supplies and rock holes. At most of the sites, circles and animal tracks are the most common designs (Edwards 1971:362). Further inspection of the carvings has revealed that they are badly worn and heavily patinated in all galleries with the exception of the Depuch Island engravings (Edwards 1971:363-6). Edwards cites the development of patination on these engravings as evidence of great age (1971:360) and on present understanding of the process of patination this seems a reasonable assumption. On the other hand, in desert conditions, a thousand years may be enough time to wear the engravings to their present state.

More forceful are arguments based on the distribution pattern of the art sites. From figure 4.1 it can be seen that all of the rock engraving sites are situated in the west Darling area. In particular they are restricted to a confined area of the Barrier Range, the Scrope's Range, the Mootwingee and Koonenberry Ranges.

No engraving sites have yet been reported from the rocky areas northwest of Wilcannia, near White Cliffs, or from the east Darling area at the Manara, Manfred and Darnick Ranges.
All these areas possess rock surfaces suitable for the engravings. The distribution of these sites in western New South Wales follows a pattern that is not reflected in any of the cultural traits hitherto discussed. There is no correlation with the spread of the rite of circumcision, as engraving sites have been found in the territory of the Bulali and Danggali tribes who did not practise circumcision and no engraving sites have been found in the territory of the Wainjubalgu who did. It bisects the area in a manner that suggests that the sites are associated with an older tribal distribution and not with the present day distribution.

After looking at the Australia wide distribution of sites with this form of engraving, Edwards concluded that

'It seems significant that this pattern cuts across the multiple divisions of customs, language, artefacts, and decorative and cave art recorded in these same areas. It might be inferred that these motifs pre-date the time when tribal boundaries became rigid and separate cultural entities developed' (Edwards 1971:363).

4.10 Cave paintings

Unlike rock engravings, the distribution of sites with rock paintings reflects exactly the present distribution of Bagundji speaking tribes.

The distribution of painted sites in the area is also shown on figure 4.1. At some places, such as Burke's Cave, Mootwingee and Koonawarra, the painted caves are associated with the rock engravings mentioned above. At other places, Mount Manara, Wonnaminta and Mena Murtee painted surfaces but no engravings have been reported (see Black 1941). At all of these sites hand stencils, animal foot stencils and stencils of material objects such as boomerangs, and bark dishes predominate (Figure 4.3). Apart from these stencils there are only a few simple designs such as long yellow lines. The simplicity of these paintings at these sites strongly differentiates them from art styles of surrounding areas.

To the east of the Darling River Valley, in the Cobar pediplain area, was country belonging to the Wiradjuri group of tribes, the Ngeumba, Wongaibon and Wiradjuri. Art
Fig. 4.1: Distribution of art sites

- Sites with Cobar style naturalistic art
- Sites with Darling style stencilled art
- Engraving sites

Fig. 4.2: Distribution of cyloncs and carved trees
sites found within this area, Gunderbooka, Winbar, Mount Grenfell, Wiltagoona¹, Meadow Glen and Coombie, have paintings in a totally different style with different subjects from those seen in the Darling River paintings (Figure 4.3). At these sites

'groups of little men are shown fighting with spears, dancing corroborees, and associated with totems. Three or four tiers of these figures are linked together to form a set...drawings of lizards, echidna, dingo, kangaroo, wallaby, tortoise, emu and fish and linear designs of line mazes, grid, concentric circle and barred concentric circle, and concentric diamonds are scattered through the sites' (McCarthy 1962:44-5).

The richness of the art from these Cobar sites marks them off in strong contrast to the simple hand stencils of the Darling sites (see Black 1941:51-61).

Paintings similar to the ones at the Cobar sites have been reported from widely separated areas such as Gudgenby (A.C.T.) (Hossfeld 1966:Fig.8, Flood, pers.comm.), Conic Range in north-eastern Victoria (Tugby 1953:446-50), Glenisla in western Victoria (Davidson 1936:79), the Marne Valley in southern South Australia (Hossfeld 1926, Teusner 1963) and Blackall in Western Queensland (McCarthy 1962:37, fig.17). The style varies from area to area but it has sufficient similarities to be thought of as part of an art province covering most of eastern Australia excluding the Darling River.

To the west of the Darling River, in the Flinders' Ranges art sites with paintings of a style different from either the Darling River or the Cobar sites can be found. At Galleries at the south Para River, Bimba, and Malkaia (Davidson 1936:81-8), the rock paintings are highly symbolic and figurative and are quite unlike the naturalistic art styles of eastern Australia (Figure 4.3). The art style found in shelters in the northeast

¹Mr. F.D. McCarthy is at present preparing a major report on the cave paintings at Mt. Grenfell and Wiltagoona.
Fig. 4.3: Art styles
of South Australia seems to have strong connections with the
totemistic art of Central Australia (see Davidson 1936:83-103). Elkin describes the designs as 'geometrical and symbolical'
but adds 'nothing definite is known about their meaning' (Elkin [1938] 1961:225).

In terms of cave paintings the rock art of the Darling River Valley is different from the symbolic art found
at sites on the adjacent Flinders Ranges and from the naturalistic art found at sites to the east, on the adjacent Cobar Pedeplain. The Darling River art is notable for its absence of character rather than for any particular style. In the
main, it is an art of stencilling and it lacks the freedrawn art of surrounding areas.

The art would suggest that the Darling River is a provincial region situated at the boundaries of two major art areas without, at the time of European contact, being incorporated into either. It is significant that southwestern Western Australia is another area where all of the observed paintings are stencils or simple linear designs (Elkin [1938] 1961:229). The southwest is certainly an area that had remained unaffected, because of its isolation, by major art influences to the north and northeast.

4.11 Carved trees

In the area to the east of the Darling River, another cultural trait can be found which again is absent from the Darling country. These are carved trees. There are two sorts, those associated with burials or graves 'Tapoglyphs' (Etheridge 1918:1ff), and carved trees associated with ceremonial or bora grounds 'Teleglyphs' (Etheridge 1918:59ff). These names have fallen into disuse in favour of more mundane terms such as 'carved trees' or 'burial trees' (Black 1941).

Their distribution was limited as

'none have ever been found west of a line drawn from Bourke, Cobar, Hillston and Balranald', it appears to have been 'a custom peculiar to the Kamilaroi Wiradjuri nations' (Black 1941:13-14).
While there is little doubt that the carving of trees was a trait restricted to a few Aboriginal tribes such as the Kamilaroi and the Wiradjuri there is some difficulty in explaining why no trees have been found in the western part of the Wongaibon territory but are present in the east (see Black 1941:17).

It is possible that there may have been an ecological reason for their distribution as all of the carved trees, for which distributional information is known, have come from areas dominated by open Eucalypt forest and woodland (see Black 1941 and Etheridge 1918 and figure 4.2 for a map of the distribution of the carved trees and Leeper 1970:Fig.32 and Fig. 1.5 for a map of the vegetation).

The eastern part of the Wongaibon territory is covered with open Eucalypt forest and it is here that the carved trees were found. They were absent from the Acacia and Casuarina scrubs found in the western part of the Wongaibon country, where suitable trees were present but not abundant.

Designs were painted onto trees too small to be carved. Dunbar stated that amongst the Ngeumba

'Ceremonial marked trees were shown to the initiate on his journeys to and from the ceremonial ground...The tree designs were not cut into the trunks, but painted on them. Because the ceremonies were carried out in the red country, there were no trees large enough growing in the scrub. The biggest of the trees would be not more than eight inches in diameter' (1943-4:144).

At a bora ground at Conoble, near Ivanhoe, Mathews stated that 'Only a few trees were marked, because most of the timber growing near the pathway was too small for the purpose' (1901:340).

The paintings on the trees would soon be washed off so there is no way of knowing whether or not trees were painted in Bagundji areas.

Some of the designs discussed as forming part of the Cobar rock paintings, e.g. line mazes, grids, circles and diamonds, are common subjects carved into the trees. Also, naturalistic figures of men, lizards, and snakes were occasionally carved. Plate 4.2b shows a series of drawings of carved
trees mainly after Mathews. The carvings on trees around a grave were mnemonic devices from which the identity of the occupant could be worked out. It appears that each individual had a particular design and this design was carved into the trees.

'On the bare part of the tree certain marks are cut to correspond with the marks on the dead man's possum rug or cloak, for I might say that each man's rug is particularly marked in order to signify its respective ownership' (Greenway in Etheridge 1918:29).

The Bagundji lacked carved trees but they made similar designs on their skin rugs. Bonney stated that

'on some [skin rugs] devices are scraped and afterwards coloured with red ochre...some make devices illustrating animals, reptiles and emu...on other [rugs] a plain diagonal pattern is made' (Ms. c.1881).

Krefft, (1866b:374) noted that the Aborigines near the junction of the Murray and Darling Rivers marked their weapons and skin coverings with 'a series of straight lines at various angles, red and white being the usual colour to set off the pattern'. He also noted that they did some 'tracings, on sheets of blackened bark'. A Victorian bark painting illustrated by Mulvaney (1969:plate 58) from this area shows the same sort of narrative art (though with naturalistic figures) as do the bark paintings from Arnhem Land. Mathews (1896:48) described similar bark paintings from the northern Darling River

'When surveying pastoral runs on the Barwon River, New South Wales, in 1871, I saw at native camps pieces of bark on which were drawn rude figures of men, fish and other objects. They were outlined in pipe-clay, red ochre, or charcoal, and in some instances there was a combination of two or more of these colours in the same drawing'.

The Bagundji also made sand carvings. Sturt's party saw sand carvings on the lower Darling as they passed up towards
the Menindee. Browne (Ms.1844-6:Sept.23rd) noted 'on some of these paths I observed a great number of figures most of them resembling tortoises or snakes drawn in the sand'.

The carvings associated with the Bora or ceremonial grounds probably refer to a series of totemic happenings, to a 'track', or a number of consecutive incidents marking spots on the route that any ancestral hero took. The Ualarai had carved trees. Parker (1905:79) stated 'at his second Boorah ...a man is allowed to see the carvings on the trees and to hear the legend of them'. A native informant described the carved trees at one spot on the Macquarie as representing 'the transmigrations of the numerous offspring of Piaume,"the father of their race", who with two exceptions, were destroyed by an evil spirit named Madjegong'. (Henderson in Etheridge 1918:75).

Mathews sketched the tree carvings from a number of Bora grounds in New South Wales. These are reproduced from Etheridge (1918:Plate VI) are shown on Plate 4.2b. Each carved tree in a series from any one ground looks very much like a single panel in a composite picture that related a number of incidents in a totemic narrative. The designs and figures in a series were not repetitive but formed single entities that taken together looked like plausible totemic maps or stories. The more conventionalized the carvings, the more they looked like the incisions on churungas and the geometrical designs painted on totemic sites in Central Australia (see the discussion of Arunta decorative art in Spencer and Gillen 1927:551-78).

The evidence from the painted rock shelters in the Cobar area must be seen in the context of an artistic tradition that includes large numbers of symbolic tree carvings and also naturalistic rock art. The absence of the naturalistic style of painting in the Darling River Valley can be argued to be a real absence as there are many suitable surfaces in Bagundji territory on which paintings could have been applied but were not.

Though the carved trees appear to be a peculiar local development of Central New South Wales the trees may simply represent a totemic style of art found all over
Australia and wrought in different materials, cave paintings in one area, weapons and bullroarers in another. While carved trees may or may not be absent from the Darling River Valley the similarities of markings on the trees to the designs made on rugs and weapons (see Sullivan 1970 for photographs of Darling River weapons) reveal exactly the same sort of art.

4.12 Conclusion

In the last century, a number of authors thought that the social institutions of the Darling River Bagundji were survivals of very ancient systems, ones that had been superseded by more advanced customs elsewhere in Australia (Howitt 1888:9:32, Spencer 1904:390).

In the review of the Bagundji culture above there is nothing to indicate that the Bagundji were anything more or less than a typical south-eastern Australian tribe.

It is more difficult to decide whether or not there was a Bagundji culture area. All members of the Bagundji group of tribes, Wilya, Bagundji, Bandjigali etc., spoke the same language and hence formed a linguistic group. The individual tribes making up the Bagundji group are probably not tribes in the usual sense of the word1 but named divisions of a single tribe covering the whole area. This was not the case on the Murray River. Holden (in Taplin 1879:26) noted

'The same language is spoken all up the Darling, for 500 miles by land, but on the Murray, above and below the junction, the language changes every, say fifty miles'.

The degree of interaction between these tribes, particularly the people coming down to the river from the back country, (discussed above in chapter 3) suggests that these groups are more closely related than at the tribal level.

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1See Elkin [1938] 1961:25-7 for his definition of a tribe, on page 27 he noted 'the linguistic test of tribal grouping is a sound one; in most cases, a tribe is a territorial and linguistic group with some other characteristics peculiar to itself'.
The possession of a common kinship system supports this conclusion also.

The Bagundji possessed few unique elements of culture. This is because recent historical influences had caused marked cultural differences within what I regard as the same tribal grouping. The fact that the northwestern Bagundji possessed the mura-mura myths, practised circumcision and the South Australian Wiljaru ceremonies of cicitirization, marks them off from the southern and eastern Bagundji. The variation in methods of initiation within the Darling River Valley is quite remarkable. I think it is best to interpret these changes as being recent influences. To answer whether or not there was a Bagundji culture area it is probably necessary to look at older cultural elements, such as the totemic or social system. The adoption of circumcision and of the mura cults may have only taken place in the hundred years or so prior to white settlement in the area.¹

The use of mourning caps and the distribution of cylindro-conical stones from the Dieri country east of Lake Eyre across to the Darling River Valley suggests some connections between the Bagundji, Maljangaba and the Eastern Lakes groups. If we ignore for a time the patrilineal local groups associated with the mura cult then the basic similarities in the social organisations of these three groups based on a system of moieties and non-localised matri-totemic clans becomes apparent. These three groups share with the other tribes in southeastern Australia a basic mythology consisting of such things as the Eaglehawk and crow myths, and beliefs in the same malevolent beings. There were similarities between the Eastern Lakes group, the Bagundji and the Wiradjeri groups in myth and social organisation. Associated with these myths were probably what Meggitt (1965:7:34) calls the more archaic forms of initiation, tooth avulsion, hair depilation cicitirization. The Lakes, Bagundji and Wiradjeri groups were possibly

¹Berndt and Berndt (1968:139, fig.10) document areas in Western Australia and Arnhem Land where circumcision has been adopted during this century.
at one time three adjacent groups which shared more cultural features than they do now. Changes from different directions may have differently affected these three areas. The elevation of ancestral heroes into 'All father' figures probably took place in southern Australia and spread all over the Wiradjeri area as far as the eastern boundary of the Bagundji area, affecting the Maraura, the southern Bagundji. The Wiradjeri group also adopted the section system, which the Bagundji did not or had not when the whites arrived. The impressive naturalistic rock paintings found in the Wiradjeri group area could have been associated with either of these cultural changes as they too did not become part of the culture of the Bagundji group even though they can be found right on the boundary line dividing the territory of the two groups. Tree carvings can be interpreted as a local Wiradjeri and Kamilaroi development, one that came out of a totemic tradition common to all the southeastern areas, including the Bagundji area.

Probably related to the changes affecting the Wiradjeri group were those affecting the Lakes group. The Dieri and other tribes adopted a variant of the Aranda kinship system myths associated with ancestral heroes who went into the ground and formed sacred sites (the mura-muras), and blood-letting ceremonies of initiation and magic, bleeding from arteries, circumcision and subincision. Localised patri-clans apparently developed from this complex. The newer cultural elements were combined with the older elements ending up with a complex form of two different systems of totemism and social and local organisation. When the Europeans arrived the changes that had affected the eastern Lakes group and the Maljangaba group had only affected the northwestern members of the Bagundji group.

If the Bagundji area can be regarded as being unique then it is so because of the unusual cultural configuration it possessed as a result of all of these influences. The Bagundji group certainly appeared to have been a recipient culture in the ethnographic present rather than a donor culture. The Darling River may best be interpreted as an area that was
remote from cultural changes taking place in the north and
west and in the south and east. These changes had influenced
all of the groups around the Darling River Valley and were in
the process of influencing the Bagundji during the nineteenth
century. Had the changes been permitted to continue, then
the Bagundji culture may have shared sufficient features of
what we could call 'the Great Eastern' and 'the Great Western'
cultural complexes to have taken an intermediary position
between the two.
CHAPTER 5

FIELDWORK 1969-1971

In this chapter I will describe my fieldwork programme and how it was affected both by theoretical considerations and by problems raised by the research.

A Ph.D. programme is a restrictive way of carrying out research. Occasionally fieldwork decisions were determined by my own research interests and at other times by the requirement of putting together a cohesive thesis.

Surveys of the historical literature on the Aborigines have been carried out regularly in the past few years at the Department of Anthropology, University of Sydney. Betty Hiatt's thesis on 'The Diet and Economy of the Tasmanian Aborigines' was the first in recent years (B. Hiatt 1967-8). Such studies have now become a regular part of research towards a B.A. (hons) degree at that University. In 1968, I carried out library research comparing Aboriginal material culture, population and diet in three adjacent regions across eastern Australia. These were the western slopes of N.S.W., the Northern part of the Darling Basin and the Bulloo overflow and Cooper's Creek areas (Allen 1968). This thesis stimulated my interest in the Aborigines of the Darling River Valley, particularly in aspects of their material culture, seasonal variations, collection and use of cereals, and the effects of a fluctuating climate. This interest continued when I came to Canberra early in 1969.

Soon after arrival in Canberra, in March 1969, I visited western New South Wales with a party of geologists, soil scientists and archaeologists, in a trip organized by Dr. Jim Bowler of the Department of Biogeography and Geomorphology at the A.N.U. During the inspection of a site on the southern end of the Lake Mungo lunette, Bowler pointed out some burnt bones. These were heavily encrusted with carbonate and were associated with the Mungo soil unit thought to be about 30,000 years old. On close inspection some of the bones were recognised as being human. Because they were eroded and in an exposed position they were removed in a block and brought
back to Canberra (Jones and Allen in Bowler et al., 1970:47).

A week later, Bowler and a small archaeological party which included Rhys Jones and myself, returned to the Mungo site to survey it in detail and tie in the stratigraphic position of the human remains. Hearth areas with burnt bones, fish bones, and some in situ stone implements were found during the survey of the site (Jones and Allen in Bowler et al., 1970:47-56).

This site and the other Willandra Lakes sites were of great interest because not only were they the oldest reliably dated Aboriginal sites on the Australian continent but also because they contained stone tools, campsite features and the bones of food animals. It was felt that these sites could be used to examine the relationship of the Aborigines to a particular environment over a long period of time, one that had begun before the maximum phase of the Wisconsin glaciation and only ended in the 1860's. In addition, the Lake Menindee site (Tedford 1967; Tindale 1955) had provided information that Aboriginal man and a number of giant extinct marsupials had been contemporaries in the Darling River area. Some of the Willandra sites were as old as, if not older than, the Lake Menindee site and they could possibly throw some light on whether or not the Aborigines had caused the extinction of the giant marsupials.

Despite these existing possibilities I was left on the horns of a dilemma as one of the things I had wanted to do was to interview the few old Aborigines of the area who had lived in the bush. I was hoping to test problems raised by this salvage anthropology by a limited archaeological programme. Such a project could easily have failed, but at least it might have preserved information not elsewhere available. The few people in western New South Wales who have any knowledge of the traditional life are all of advanced age and some have died in recent years. As the extent of traditional knowledge was unknown, I had to choose whether I wanted to do a difficult ethnographical project or a more strictly archaeological one working obviously important sites. With some regrets, I decided to do the latter project but I have tried to integrate this strictly archaeological one with a detailed assessment of the ethnographic literature.
The first field trips, April to August 1969, were mainly exploratory. The places visited are shown on figure 1.2 and figures 6.1 and 8.1. I made surface collections of implements and excavated a burial at a site near Mungo I, but much younger [W.C.1]. There I was able to use a relative chronology based on the identification of Bowler's three sedimentary units, the Golgol, the Mungo, and the Zanci. The W.C.1 site was on top of the Zanci Sedimentary unit and was therefore <15,000 years. Where possible I collected materials for $^{14}$C dating. I surveyed a number of midden sites at Lake Leaghur and Garnpung [LI, LBSI, and GNI].

A number of problems about the Willandra area soon became apparent.

1. The area provides exceptional sites for the period between 30,000 years and 15,000 years ago. After that the lakes became permanently empty and the pattern of economic exploitation of the area by the Aborigines changed.

2. On all sites that I thought were less than 15,000 years old there was no economic material preserved.

3. Collections of stone implements from many of the surface sites thought to be of Pleistocene age included implements such as backed flakes, flake adzes and pirri points implements not known, so far, from deposits older than about 5,000 years B.P. This suggested that some of the collections were mixed.

4. I could find no stratified sites for the more recent period of occupation of the Willandra Lakes. This meant that I was unable to date the introduction of stone implements into the area, such as backed flakes, nor could I examine the relationships between the older and younger stone industries.

To attempt to solve these problems I decided on two courses of action

(i) In order to get comparative material on the utilization of lakes I went across to the western side of the Darling to Lake Tandou, south of Lake Menindee and surveyed the lunette there. Like Lake Menindee, Tandou is still operative, the last fill was in 1951. On the southern end of the lunette I found the remains of a human cremation associated with some in situ implements [TL1].
A couple of small midden sites were found near the middle of the lunette [TL II and III] and others on Tandou Creek to the east [T.C.1].

(ii) I felt I needed a site with a deep deposit containing superimposed layers containing a sequence of implement assemblages. I decided to search the rocky upland areas for rock shelters and caves containing suitable deposits. I looked initially at the Manfred Range, a rocky range of hills 30 miles east of Lake Mulurulu, but failed to find any promising sites. I then looked at the Mount Manara Range\(^1\), a hundred miles to the north, again with no result.

These problems were discussed in a seminar which I gave to my department in October 1969. It was decided that one of two alternative course of action could be followed

1. Accept that a sequence of implements and faunal remains from the Willandra area was impossible to obtain and concentrate on an intensive analysis of the variety and distribution of the sites and their faunal and implement contents.

2. Continue to look for sites that might provide a stratigraphically controlled sequence for the Darling Basin and concentrate less on the settlement aspects of the Willandra area.

As mine was the first major archaeological survey of the Darling Basin, it seemed better to try and fit the Willandra material into a wider regional sequence, rather than to do a detailed settlement study that would be in an archaeological limbo as far as the rest of Australia was concerned.

Two areas suggested themselves as likely spots for sites. The ranges east of the Darling River towards Cobar, in particular a shelter on Meadow Glen station\(^2\), where I spent a week excavating, and a series of ranges west of the Darling where art sites had been reported. In the west, I inspected Burke's Cave site in the Scrope's Ranges and spent two weeks

---

\(^1\)A report on the survey of the Mt. Manara Range is on file at the Institute of Aboriginal Studies, Canberra.

\(^2\)I am grateful to Mr. F.D. McCarthy, Principal A.I.A.S. for giving me the location of the Meadow Glen shelter.
excavating there. Burke's Cave was by far the more important of the two sites. The deposit was rich in artefacts and faunal remains and it extended down beyond a depth of six feet. So productive was this short excavation that almost all of my time since May 1970 has been spent analysing the material from it. The Burke's Cave excavation helped to solve some of the problems that had arisen from the Willandra survey but brought with this solution many other problems which are discussed in the next chapter.

The final fieldwork in Dec-Jan 1970-1 was again in two parts. The first consisted of surveying and making surface collections of implements and faunal remains at the Talywalka Lakes, north of the Willandra Lakes [Ratcatchers Lake and North Lake sites], at the Lake Mulurulu sites, and at recent sites on the backshore of Lake Mungo [MBs 1]. The second part consisted of excavations at the Leaghur midden site mentioned previously [LI] and at a gravel beach site at Lake Chibnalwood. Apart from shells almost nothing was recovered from the Leaghur excavations and only a few flakes from the Chibnalwood beach.

One of the fieldwork problems concerned the midden sites. They usually consisted of an in situ layer of bone fragments and shells less than an inch thick. Each represents a record of a short period of occupation sealed in by the deposition of the lunette sediments and exposed subsequently by erosion. My training in archaeology had poorly prepared me for such sites and it was not until about halfway through my fieldwork that I began to feel comfortable dealing with them.

There were a number of logistical problems caused partly by the isolation of the area and partly by the climate. Also it was difficult to get student assistance at A.N.U. as there was no undergraduate department there at the time I did my fieldwork. The availability of labour affected the order in which some of the fieldwork was done. Some of this I was forced to do alone.

---

1A Department of Prehistory in the School of General Studies has since been set up.
The ethnographic work summarized in the preceding chapters formed an integral part of the research. The remains from sites such as Burke's Cave and Meadow Glen were left by the people described in the ethnographic literature. Almost all of the archaeological work was done in areas known to have been inhabited by Bagundji-speaking Aborigines at the time of white settlement. I have tried to use the archaeology to see how far back I could trace any of the patterns of subsistence activities and also to see if I could isolate an archaeological complex that could be associated with the Bagundji linguistic unit. The former task was the easier of the two, but I doubt if my work has been detailed or systematic enough to throw much light on whether or not one can directly trace Bagundji history back into the Pleistocene.
CHAPTER 6

BURKE'S CAVE

6.1 Burke's Cave: an open site in the rocky uplands

The location of the Scrope's Range and the Burke's Cave site can be seen on figure 6.1. Thomas Mitchell saw the range from the Darling River and named it after George Scrope, an English Volcanologist. The name first appeared on Mitchell's map of 1839 but has been modified to Scope's Range on later maps.

In the dry country to the west of the Darling River, rocky uplands provided basins in which water could collect, facilitating movement in the area. Poole, Charles Sturt's assistant, visited waterholes in the Scrope's Range in 1844 and Sturt visited them later in the same year. After the establishment of a small settlement and hotel at Menindee in 1854 (Hardy 1969:82-3), a native well, known as Kokrieiga, on the eastern side of the range became an important camping site for pastoralist-explorers moving north from Menindee. A small cavern near this well has become known as Burke's Cave, named after the unfortunate leader of the Victorian Exploring Contingent. William Wright, an experienced bushman employed on Kinchega Station, guided the party to the well in 1860. He visited the site again in 1861 and left us the following description:

'Cookmerega, or Kokrieiga...we arrived at the base of a rocky range, 25 miles north-west of the Darling and camped in a glen close to the main track. A large cave, adorned with native drawings, and covered with marks of various visitors, furnished an acceptable shelter from the scorching heat...Hodgkinson and Smith set to work clearing out a well about 100 yards from the mouth of the cave. There is no permanent water at Cookmerega, and in fact none nearer than the Darling, except at rare intervals...the worn-out cavities of the rocks furnish shelter to numerous marsupial animals, more particularly to a species of rock wallaby, termed wanguroo by the natives' (1862:508).
Fig. 6.1: West Darling Sites: Location map
Between Wright's first and second visit to Kokriega, Herman Beckler and Ludwig Becker, both attached to the V.E.C. party at Menindee, visited the glen and collected native plants. Beckler provided a further description of the site and Becker made a drawing of Burke's Cave (see plate 6.2b).

'we discovered...some splendid rocky waterholes in the gully. Entering the gully we saw on our right a cave or rather a grotto...Mr. Burke's party had also been here as we found their mark with the number of the camp (36) painted on one side of the cave. The cave contains also numerous marks from the natives which look rather strange. These marks are the out-lines of hands, large and small ones, with out-stretched fingers.

Standing at the entrance the open view is to the south with far stretching plains, bordered on the distant horizon by forest...and right before us the glen with its profusion of yellow acacia blossoms amid the vivid green bushes and herbs...The cave must be one of the [Aborigines] favorite spots when they are in the mountains' (Beckler, 1860:letter Nov.13).

Other explorers visited Kokriega during the period prior to the setting up of large sheep and cattle stations. Earnest Giles explored for good pastoral land in the period 1860-63 and visited Mootwingee and Kokriega and left his mark at both places (see Plate 6.1c and Dow 1938:109). McKinlay probably visited the site and John Crawford searched the Scrope's Range for minerals (Hardy 1969:121). In June 1861, Robert Gow spent a night at the waterhole and noted that the native well was 'about 8 feet deep and had about 2 feet of good water in it' (Gow 1861:Mts). After 1885, the main coach road from Broken Hill to Wilcannia passed by the cave and a house and animal pens were built on the site. The hut served both as a change station and grog shanty. Broken beer bottles from Resch's first New South Wales brewery at Wilcannia litter the site (Dow 1937:3). A mine shaft was sunk to a depth of 100 foot or so early in this century by unsuccessful prospectors. Since that time the local spring has been deepened and
now forms a watering spot for sheep on Broughton Vale Station. A 'Bell and Co' matchbox was recovered at the top level of the site (see plate 6.1c) and has been identified by Mr. F. Carter of the Australian Match Cover Collectors Society. It was manufactured at 'Cheapside', London some time after 1835 and before 1860 (see Mulvaney 1965: plate XXII for a photograph of a matchbox manufactured by this same company after 1860).

The waterholes in the ranges formed loci for Aboriginal movement in the country away from the rivers. During the summer there were few other sources of water. Beckler recorded that the Menindee Aborigines knew of five waterholes, apart from Kokriega, between Menindee and the Mootwingee area. The water sources that he recorded were at 'Langawirra, Mootwingee, Bynguano and Nootumbulla' (Beckler 1861) (these spots are shown on figure 6.1).

The Aboriginal occupation of Burke's Cave site has left many tangible reminders. In front of the small cave is a large open terraced area sloping down towards the bed of an ephemeral stream that winds out of a rocky gorge (Plate 6.2a). The surface of the soil is stained dark grey by the charcoal from fires, while stone implements and bone fragments cover the area.

A few hundred yards further to the west, up the small gorge are two large rockholes which are presently silted up (Plate 6.1c and Figure 6.2). The Aborigines probably maintained them by cleaning out the sand. Close by are two large cairns of stones on either side of the gully which may be the remains of a rockfill dam (see plate 6.2d and figure 6.2). Similar cairns have been recorded by Dow (1939:213-6) in the Noonthorungee Ranges and an earth dam has been reported further to the north on the Bulloo River (Rowlands and Rowlands 1969: 132-6). Higher up on the hill slopes are more small caverns with rock paintings, mainly hand stencils. Beckler's watercolour of Burke's Cave shows the rock paintings before they were partly obliterated by camp fire smoke and stage coach visitors' initials (plate 6.2b). Since 1861 a major part of the roof of Burke's Cave has fallen. Opposite the cave on a smooth rock face are many rock engravings (plate 6.1a and b) similar to the ones described for Mootwingee (McCarthy and
Fig. 6.2: Burke's Cave or Kokriega
Macintosh 1962) and for other places as far away as Depuch Island on the north-western coast of Western Australia (McCarthy 1961) and Tasmania (Jones pers.comm.) (Meston 1931). The rock engravings at Burke's Cave are the most easterly of their type yet reported for the Australian mainland (see Edwards 1971:357, Figure 24.1). The engravings and paintings have been described by Dow (1938:117-8) and by Black (1943:14). In the open valley to the east of Burke's Cave is a large flat area on which there are many surface implements. In a few places there are stone circles about three feet in diameter which may either be fireplaces or ceremonial stone rings. Similar circles have been recorded in many parts of Australia (Radcliffe-Brown 1926). They are common in the Darling Valley (Black 1949; Dow 1938b:30-36).

The Scrope's Range is now only sparsely timbered but when Gow visited the Kokriega well in 1861 he noticed that the hills were 'thickly covered with Mulga [Acacia] scrub' (Gow 1861). There has been general deforestation in far western New South Wales due to the need for timber for fuel and building in the mining towns and due also to serious overgrazing of native pastures (Beadle 1948:219). Browne, one of Sturt's party, visited the Barrier Plains in 1844-5 and saw large patches of Acacia homolophylla [Brigalow] which he said 'were of great value to the natives', for seeds and for wood. In 1898, he noted 'All the Acacia-trees seem to have died out, for when ten years ago I looked down upon the great plain from the top of Mount Robe, the only trees on it were a few pines and some mallee in scattered clumps' (J. Harris Browne 1898:234).

6.2 The excavations

The archaeological deposit at Burke's Cave occupies a small terrace on the gully floor at the southern end of a long rocky spur. The open site is directly in front of the small cave where Burke camped (figure 6.3). The site covers an area of about half an acre (2000 sq.metres) and contains an estimated 2000 cubic yards (1520 cubic metres) of stratified deposit. Limitations in the time available and in the number of voluntary workers available forced me to sample only a tiny
area of this site. About one percent of the total volume (105 cubic feet or 3 cubic metres) was excavated and about 20,000 artefacts were recovered.

The Burke's Cave cavern has a rocky floor so I decided to excavate in the open area about ten feet in front of its entrance (see figure 6.3). An area 4 feet by 4 feet was marked out and excavated to a depth of 5 1/2 feet (BC1/1). This trench was extended another 4 feet to the south-west and this second trench was called BC1/2. A small test pit was excavated to a depth of two feet near the eastern margin of the visible deposit. The material from this pit (BC1/3), apart from the faunal remains, was not included in the analysis.

Before the first trench was dug I had no idea of what the deposit was like. Therefore, I started excavating in arbitrary depth units [spits] of about six inches. If, while any of these arbitrary units was being removed, a stratigraphic change was perceived then the unit was terminated at that spot. A new excavation unit was then dug into the new stratigraphic horizon. The excavation of square BC1/1 combined arbitrary and stratigraphic units.

As the second trench dug, BC1/2, was an extension of the first I was able to divide the stratigraphic units into excavation units on the basis of their thickness. As the lowest unit appeared to stratigraphically undifferentiated it was removed using arbitrary depth units. Material recovered was put through a 1/4 inch (6mm) sieve and stone and bone material was brought back to Canberra for washing and inspection. Column samples for soil analysis were taken at the end of the excavation before the trenches were refilled. The results of the analysis of these column samples are set out in table 6.1.

The major material making up the deposit was coarse sand and small round pebbles which could have been deposited by the small stream immediately to the south of the site. Quantities of sandstone, including substantial boulders, had fallen onto the site from the rocky ridges above it and had been incorporated into the deposit. The deposit was generally uniform from the top to the bottom of the excavations but some
Fig. 6.3: Burke's Cave archaeological site
Table 6.1  Burke's Cave soil analysis

<table>
<thead>
<tr>
<th>Depth inches</th>
<th>Ph</th>
<th>Activity with HCl</th>
<th>% weight of flaked stone</th>
<th>% weight of coarse sand¹</th>
<th>Colour</th>
<th>Colour after ignition</th>
<th>% weight of organic material</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-7</td>
<td>5</td>
<td>None</td>
<td>4%</td>
<td>53%</td>
<td>Dark greyish brown (10YR3/2)</td>
<td>Reddish yellow (5YR6/6)</td>
<td>10%</td>
</tr>
<tr>
<td>8-12</td>
<td>6</td>
<td>Little</td>
<td>10%</td>
<td>62%</td>
<td>Very dark grey (10YR3/1)</td>
<td>Light brown (7.5YR6/4)</td>
<td>5%</td>
</tr>
<tr>
<td>13-20</td>
<td>7</td>
<td>Slight bubbling</td>
<td>5%</td>
<td>62%</td>
<td>Dark brown (7.5YR4/2)</td>
<td>Reddish yellow (5YR6/6)</td>
<td>5%</td>
</tr>
<tr>
<td>21-25</td>
<td>7</td>
<td>Vigorous bubbling</td>
<td>1%</td>
<td>61%</td>
<td>Greyish brown (10YR5/2)</td>
<td>Reddish yellow (5YR6/6)</td>
<td>5%</td>
</tr>
<tr>
<td>26-66</td>
<td>7</td>
<td>Vigorous bubbling</td>
<td>1%</td>
<td>59%</td>
<td>Light brown (7.5YR6/4)</td>
<td>Reddish yellow (5YR6/6)</td>
<td>-</td>
</tr>
</tbody>
</table>

¹ Soil particles >0.250 mm in diameter - <2 mm.
minor stratigraphic horizons could be distinguished on the basis of carbon and carbonate content and of minor colour differences. These horizons are listed below

<table>
<thead>
<tr>
<th>Horizon</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0-9 inches very dark greyish brown sand with a high proportion of organic matter.</td>
</tr>
<tr>
<td>B</td>
<td>9-20 inches very dark grey sand with artefacts and sandstone lumps forming up to 20 percent of the deposit by weight. This horizon was roughly horizontal.</td>
</tr>
<tr>
<td>C</td>
<td>21-25 inches dark grey to brownish sand, water rolled pebbles, strata dips slightly towards the creek.</td>
</tr>
<tr>
<td>D</td>
<td>26-66 inches. A high proportion of CaCO₃, light brown sand, water rolled pebbles and some massive sandstone boulders.</td>
</tr>
</tbody>
</table>

Horizon D continues on below the bottom of the excavation for at least another sixty feet. I terminated the excavation at a depth of 66 inches as the yield of artefacts recovered had decreased to less than one per cubic foot of deposit. With the limited resources available it seemed better at the time to increase the sample of material from the richer upper layers. No definite artefact was recovered from the lowest foot of deposit.

The horizons, A-D, described above are hereafter referred to as 'stratigraphic units'. They are simply depositional features. Sections of the trenches showing the stratigraphic units are on figure 6.4A. This figure may give the impression that considerable pedogenesis had taken place in the deposit but in reality soil formation was particularly weak. The dark grey, organically rich, upper horizons result from the human activities on the site as they are not part of a humic soil zone. Soil samples, after ignition are remarkably similar, the only difference being a slight increase in carbonate content with greater depth (Table 6.1).

The presence of water-rolled pebbles and the constant high proportion of coarse sand suggests that the material was deposited by the creek. As there are no marked disconformities I have concluded that it was laid down fairly constantly.
The levels in the excavation are called 'excavation units' irrespective of whether they were determined stratigraphically or arbitrarily. The fifteen excavation units in BCl/1 and the eight excavation units making up BCl/2 are shown on figure 6.4b.

After a preliminary examination of the artefactual material recovered from the excavations I organized the material into four 'Industrial units'. These industrial units were defined in terms of the various implements found in the different excavation units as shown below.

<table>
<thead>
<tr>
<th>Industrial Unit</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>European and Aboriginal artefacts present.</td>
</tr>
<tr>
<td>2</td>
<td>No European artefacts present; Aboriginal implements included core tools and scrapers, flake adze slugs, backed flakes (microliths), and pirri points.</td>
</tr>
<tr>
<td>3</td>
<td>No flake adze slugs, no pirri points, but core tools and scrapers and backed flakes were present, a much greater density of artefacts per unit of volume compared to unit 4.</td>
</tr>
<tr>
<td>4</td>
<td>No backed flakes, no flake adze slugs and no pirri points. Core tools and scrapers present.</td>
</tr>
</tbody>
</table>

This preliminary analysis was based only on the stone material. In this context an 'artefact' is any stone that has been modified in some way by human action. Artefacts included cores, unmodified flakes, core and flake tools, hammer and anvil stones, and grinding stones. Whereas an 'implement' is an artefact that has been used as a tool or has had definite secondary retouch (retouch B) applied to a margin. Implements included backed flakes, flake adze slugs, retouched flakes, utilized flakes, core tools and scrapers, pirri points and glass scrapers. I grouped the implements recovered into four stone industries each making up an 'industrial unit' on the basis of the presence or absence of particular artefact types.
A. STRATIGRAPHIC UNITS
   Northern face
   RC1/2
   RC1/1
   Dark greyish brown sand
   Dark grey sand
   Light brown sand

   Southern face
   RC1/1
   RC1/2
   1850 ± 240 B.P. (ANU-704)
   Water-rolled pebbles
   Sandstone boulders

B. EXCAVATION UNITS.

C. INDUSTRIAL UNITS AND ARTIFACT DENSITY

Artifact density per cubic foot
more than 300 per ft³ □
more than 200 per ft³ □
less than 100 per ft³ □

Fig. 6.4: Burke's Cave: sections
If any of the excavation units contained no pirri points, flake adze slugs, backed flakes or glass scrapers then those levels were grouped to form the industrial unit 4 which was defined by those absences. Excavation units without those items all occurred at the bottom of the trench. If however, backed flakes were present but no flake adze slugs, or pirri points, the material from those excavation units was placed in industrial unit 3.

Industrial unit 1 consisted of all the artefacts recovered from excavation units 1-3 in square BCl/1 and excavation units 1-2 in square BCl/2; industrial unit 2 consisted of excavation units 4 (BCl/1) and 3 (BCl/2); industrial unit 3 of excavation units 5 (BCl/1) and 4 (BCl/2) and the lowest industrial unit, 4, of material recovered from excavation units 6-15 (BCl/1) and 5-8 (BCl/2). The division of the two trenches into the industrial units is shown on figure 6.4c and the relationship between the industrial units and excavation units and the stratigraphic units can be seen by comparing this figure with 6.4b and 6.4a.

The industrial units correspond in general to the stratigraphic units. Industrial unit 1 is restricted to stratigraphic unit A, industrial unit 2 formed the top part and industrial unit 3 the bottom part of stratigraphic unit B. Industrial unit 4 combines the lowest two stratigraphic units, C and D.

A radiocarbon date was obtained from a charcoal sample collected from stratigraphic unit C (the upper part of industrial unit 4). The location of the sample, two feet below the surface, is marked on figure 6.4a. It gave a radiocarbon age of 1850 ± 240 B.P. (ANU-704). No material suitable for a $^{14}C$ determination was recovered from the lower four feet of the site.

In the remainder of this chapter, industrial units are referred to as unit 1, unit 2, unit 3 or unit 4. Whenever the term unit appears it is an industrial unit that is being referred to.
### Table 6.2 Burke's Cave: distribution and % age distribution of artifacts

<table>
<thead>
<tr>
<th>ARTIFACT TYPE</th>
<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Unit 4</th>
<th>Total</th>
<th>Density per cubic foot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Implements (a)</td>
<td>524</td>
<td>9%</td>
<td>449</td>
<td>9%</td>
<td>857</td>
<td>13%</td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>72</td>
<td>1%</td>
<td>61</td>
<td>1%</td>
<td>134</td>
<td>2%</td>
</tr>
<tr>
<td>Unmodified cores</td>
<td>104</td>
<td>2%</td>
<td>132</td>
<td>2%</td>
<td>145</td>
<td>2%</td>
</tr>
<tr>
<td>Grindstone fragments</td>
<td>8</td>
<td>&lt;1%</td>
<td>4</td>
<td>&lt;1%</td>
<td>5</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Hammerstone</td>
<td>9</td>
<td>&lt;1%</td>
<td>6</td>
<td>&lt;1%</td>
<td>5</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Unmodified flakes (b)</td>
<td>5098</td>
<td>88%</td>
<td>4658</td>
<td>88%</td>
<td>5160</td>
<td>82%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(a) Includes broken and unbroken implements
(b) Unmodified flakes computed from sample of 3/8 of all waste flakes

### Table 6.5 Burke's Cave: raw materials, % age distribution

<table>
<thead>
<tr>
<th>UNIT</th>
<th>QUARTZ</th>
<th>QUARTZITE</th>
<th>SILCRETE</th>
<th>CHERT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unmodified a flake</td>
<td>Unmodified a flake</td>
<td>Unmodified a flake</td>
<td>Unmodified a flake</td>
</tr>
<tr>
<td></td>
<td>Cores b</td>
<td>Implements c</td>
<td>Cores</td>
<td>Implements</td>
</tr>
<tr>
<td>Unit 1</td>
<td>47%</td>
<td>63%</td>
<td>23%</td>
<td>9%</td>
</tr>
<tr>
<td>Unit 2</td>
<td>26%</td>
<td>88%</td>
<td>17%</td>
<td>8%</td>
</tr>
<tr>
<td>Unit 3</td>
<td>31%</td>
<td>72%</td>
<td>9%</td>
<td>2%</td>
</tr>
<tr>
<td>Unit 4</td>
<td>39%</td>
<td>70%</td>
<td>28%</td>
<td>7%</td>
</tr>
</tbody>
</table>

a) sample no = 2298
b) sample no = 70
c) sample no = 491
6.3 The excavated materials

(a) artefact density

The distribution of artefacts within the excavated deposit is shown on table 6.2. Material from both squares, BC1/1 and BC1/2, has been combined for this and subsequent analyses. On the table, column 8 shows the average number of artefacts obtained from each cubic foot of deposit. The density of artefacts increases from 80 per cubic foot in unit 4 to over 400 per cubic foot in unit 3 and then drops off slightly in units 2 and 1 to more than 200 per cubic foot. This suggests that there might have been an increased intensity of site use after the period during which unit 4 was deposited. The density of unmodified flakes also shows this trend.

Table 6.3 Burke's Cave: density of unmodified flakes

<table>
<thead>
<tr>
<th>Unit</th>
<th>BC1/1 Unmodified flakes per cubic foot</th>
<th>BC1/2 Unmodified flakes per cubic foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>304</td>
<td>167</td>
</tr>
<tr>
<td>2</td>
<td>261</td>
<td>373</td>
</tr>
<tr>
<td>3</td>
<td>230</td>
<td>264</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>76</td>
</tr>
</tbody>
</table>

At least four times as many unmodified flakes were recovered from unit 3 as from unit 4. Trench 1/1 was excavated at a deeper level than was 1/2 and hence Unit 4 in trench 1/1 has a much lower flake density. In the area of the site excavated there was a marked increase of occupation from unit 3 time onward but sampling over a much larger area would be necessary before one could generalize to the entire site.

When considering the possibility of an increased density of artefacts as an indication of increased intensity of site use, any alternate explanation must be dealt with. One other possibility is that the increased density of artefacts resulted from a decreased rate of deposition. This seems unlikely at Burke's Cave. The soil features at the
site are only weakly developed. They are masked by large quantities of organic materials introduced by human activities on the site. Apart from these organic materials the deposit is remarkably homogeneous, particularly as regards the proportion of coarse sand. Had there been a decrease in the rate of deposition during unit 3 times then I would have expected for instance a greater proportion of clay in stratigraphic unit B or else some evidence of an indurated layer, common on eroded surfaces in the area.

With an average density of more than 200 artefacts per cubic foot and an estimated volume of 54,000 cubic feet, in terms of stone artefacts, Burke's Cave must be one of the largest and richest open sites in Australia. This is the more striking in that Burke's Cave is situated in a semi-arid region receiving less than 10 inches (255 mm) of rain per year.

(b) bone debris

Associated with the stone artefacts recovered from the Burke's Cave excavations was a large quantity of broken pieces of bone. These bones are analysed, in terms of species represented and number of animals killed, later in this chapter. Bone made up between 1% and 3% of the total weight of soil and stone fragments excavated but formed about 25% by weight of the total artefactual debris recovered. The total weight of bone recovered was approximately 91b (4kg).

Figure 6.5 shows the percentage distribution of unidentifiable bone recovered from trenches BC1/1 and 1/2. Comparing this figure with table 6.3, the table showing the density of unmodified flakes recovered per cubic foot, it can be seen that bone and stone vary in much the same way on the site. The only difference is that there was a more gradual decrease in the amount of bone with increasing depth. This probably has to do with soil chemistry, the displacement of carbonate, and the increasing age of the lower deposits. Virtually no bone was recovered from unit 4.

In terms of weight, 61% of the total bone recovered came from trench 1/2. It is possible that the area closest to the creek bank is richest in bone.
Fig. 6.5: Burke's Cave: distribution of bone
(c) **ratios of flakes, cores and implements**

Comparing the number of implements, unmodified cores, unmodified flakes, and rejuvenation flakes (see section 6.5j) recovered in the excavations (table 6.2) and adding the number of broken implements (table 6.6) it becomes possible to look at the relationships between these artefact categories. These relationships in ratio form are set out below in table 6.4. The number of flakes per implement (10:1) for all units suggests that the portion of the site excavated was not one where implements were being manufactured. Jones (1966:2-4) interpreted one part of the Rocky Cape South site to be an area where the residue from stone tool manufacture was deposited on the basis of a flake to implement ratio of 40:1. On the other hand, the presence of fairly large numbers of cores in the site (from table 6.2) requires that some flakes were being manufactured there. These two conclusions are not contradictory as simple flakes may be made and used for cutting tasks on a site where specialized implements had been imported. Raw materials have some bearing on these conclusions and will be discussed below. The high number of broken implements and rejuvenation flakes (retrimming flakes) per implement attests to the fact that there was high intensity use of stone implements. The implications of this will be discussed in a later section.

6.4 **Geology of the Scrope's Range and raw materials used in implement manufacture.**

Western New South Wales has been recently explored for minerals and petroleum and detailed information for some areas is now available. Scrope's Range formed part of exploration lease No.52 and was prospected by the Alliance Oil Development Co. Part of a map prepared by this company is reproduced on figure 6.6 (Alliance n.d:map). Four of the deposits may have provided raw materials for the manufacture of stone artefacts. These deposits, shown on figure 6.6, and the potential artefacts are listed below:

(i) Fine sandstones (grinding stones, cooking stones and hammerstones);
Table 6.4  Burke's Cave: ratios of implements, broken implements, cores, flakes and rejuvenation flakes

<table>
<thead>
<tr>
<th></th>
<th>No. of flakes and implements per core</th>
<th>No. of flakes per implement</th>
<th>No. of implements per rejuvenation flake</th>
<th>No. of implements per broken implement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>55:1</td>
<td>10:1</td>
<td>7:1</td>
<td>3:1</td>
</tr>
<tr>
<td>Unit 2</td>
<td>40:1</td>
<td>11:1</td>
<td>7:1</td>
<td>3:1</td>
</tr>
<tr>
<td>Unit 3</td>
<td>40:1</td>
<td>6:1</td>
<td>6:1</td>
<td>3:1</td>
</tr>
<tr>
<td>Unit 4</td>
<td>90:1</td>
<td>20:1</td>
<td>5:1</td>
<td>2:1</td>
</tr>
<tr>
<td>All units</td>
<td>40:1</td>
<td>10:1</td>
<td>7:1</td>
<td>3:1</td>
</tr>
</tbody>
</table>
Fig. 6.6
(ii) pebble conglomerates of quartzite pebbles (quartzite cores);
(iii) cobble conglomerates of granite pebbles (quartz, quartzite cores and hammerstones);
(iv) shales and interbedded limestones (chert artefacts).

A deposit of interest, not shown on figure 6.6 but present in nearby sections of the Scrope's Ranges, consists of crystalline limestones, another likely source of chert.

An important raw material used at the site but apparently not present in the Scrope's Ranges is a silicified sandstone known as 'silcrete'. Silcrete is a hardpan material that develops in soil horizons enriched by silica. Although it is a relic of tertiary soils in Western New South Wales it is readily available in most areas (Corbett 1969:297).

The four main raw materials used for producing flake artefacts were quartz, quartzite, silcrete and chert. Sandstone was important for grindstones and quartzite for hammer and anvil stones but these latter artefact categories have not been included in the analysis. Table 6.5 shows the percentage distribution of these four raw materials for implements, cores, and unmodified flakes and also the percentage distribution of raw materials in the four industrial units. The first thing that can be seen is that there was no consistent change in raw materials over time. The majority of cores were made of quartz and the majority of implements were made from silcrete. About half of the unmodified flakes were made of silcrete, a third made of quartz and the rest fairly equally divided between quartzite and chert.

The low ratio of flakes to implements generally suggested that not all implements were actually manufactured on the site. If they had been, one would expect a higher number of flakes. The low ratio of silcrete flakes to silcrete cores suggests that silcrete implements were the ones being imported. Quartz was generally not being used to manufacture implements, but it was the material from which a high proportion of the unmodified flakes were made. This is evidenced by the high number of quartz cores and unmodified flakes. Quartz was probably filling the need for sharp small flakes on the site.
White has noted that a feature of stone industries with a high proportion of quartz as a raw material is often a large number of fabricators, scalar cores or pieces écailles, i.e. those with bruising and battering on opposing ends (White 1968:662-5). The Burke's Cave cores are mainly irregular in shape; many are bifacially worked but none possess the utilisation scars reported for fabricators on the east coast. The technique of shattering cores to produce flakes by using a hammerstone and an anvil stone resulting in bi-polar flake scarring was not used to produce the large number of small flakes on this site.

There were few cores of either chert or quartzite, these materials being of minor significance on the site.

6.5 **Implement typology and analysis**

My analysis was geared to test the preliminary conclusions arrived at after the initial sorting of the material. These may be briefly summarized as follows:

(i) That the core tool and scraper component of the various industries did not change from the top to the bottom of the site.

(ii) That flake adze slugs, pirri points and backed flakes were not present in the lowest levels.

(iii) That the core tools such as horsehoe cores and steep-edged scrapers, and flake adze slugs, pirri points and backed flakes were still being used at the site after Europeans had arrived in the area.

The division of the implements into categories was initially intuitive and was based on my knowledge of the literature and experience with other Australian stone industries. The initial division used worked edges on the implements as the deciding criteria rather than the overall morphology.

This is a modified version of studies of stone implements carried out previously at this department by White J.P. (1967, 1969), White C. (1967) and Jones (1971) and at the Department of Anthropology, University of Sydney, by Glover (1969).
Mellars (1964:231) when discussing Mousterian racloirs stated that one recurrent feature of these was that 'the edge alone is the important part of the tool; the overall shape is of little importance'. White J.P. (1969:23) makes the point that this is a latent idea behind Mulvaney's discussion of Kenniff Cave artefacts (Mulvaney and Joyce 1965:174-9). Jones, in dealing with Tasmanian implements, followed this procedure because it seemed

'more meaningful to base one's typology on an analysis of the various traits such as concave edges or steep step-flaked edges rather than to try and study the shape of the whole tool' (1971:318).

Jones' typology was based on the characteristics of the worked edge (1971:318) but as a large proportion of the western New South Wales stone material was altered by use rather than by systematic and deliberate retouch I decided to also include 'altered edges' (White J.P. 1969:23) which allows 'retouched and unretouched but used edges' to be included in the definition. White (1969:24) defined an 'altered edge' as 'a length along the intersection of two surfaces (planes) of stone, one or both of which surfaces bear retouch or use-wear'.

This seemed to be the best approach as the western New South Wales stone assemblages have highly variable morphologies in which the characteristics of the altered edges appear to be more constant than any other feature.

I list below the various implement categories isolated within the Burke's Cave stone industries. These categories represent populations not types (Jones 1971:316; White 1969:45). Where a category was defined because of visible secondary retouch I refer to this as the 'worked edge', where use has determined the nature of the edge I refer to 'use wear', these are two subdivisions of 'altered edges'.

(a) Round edged scrapers (adzes) (Figure 6.8 nos 1-10)

Round edged scrapers are flat scrapers possessing a convex worked edge. The secondary retouch is generally invasive but becomes more similar to step flaking on worn examples and may extend around a small part or the entire
margin of the implement. They correspond in general form to unworn or slightly worn 'Tula' adze flakes (see Cooper 1954:91-4; McCarthy et al., 1946:26; Mulvaney 1969:114 and figure 23). Initially I divided this group of scrapers into a large component and a small component. However, when I measured the implements it became obvious that there was little real difference, so I combined the samples to form a single category. At the larger end of their range, round edged scrapers are similar to Arapias (See McCarthy et al., 1946:20 and fig.39, p.25, and figs. 71-81; Tindale and Maegraith 1931, figs. 10 & 11; Tindale 1937:48). The smaller round edged scrapers are indistinguishable from discoidal scrapers and thumbnail scrapers (McCarthy 1967:21, fig. 6:45, fig. 25). Some round edged scrapers are long and thin corresponding to end scrapers. These are similar to the ethnographic kalara endscrapers used by the Wonkonguru of Lake Eyre (Gould 1966:5). They were used both in the hand or mounted in gum at the end of a handle. A discussion based on the similarities and differences between round edged scrapers and flake adze slugs appears in section 6.7.

(b) flake adze slugs (figure 6.8 Nos 11-15)

Flake adze slugs are defined on the basis of steep, step-flaked edges. The characteristic use wear present on these adzes results from the severeimpact to which they were subject when hafted as a chisel. Flake adzes before they were worn back to a short step-flaked slug were not distinguishable from other categories of scraper. They generally divided into two groups, the tula adze and the barren adze depending on the position of the altered edge in relation to the bulb of percussion (see McCarthy et al., 1946:29-30).

Gould (1971:161) has noted that Western Desert Aborigines produce both forms and that the relationship between the altered edge and the bulb of percussion came as a result of a fortuitous choice on their part. However, Glover and Lampert (1969:223-4) and Mulvaney (1969:74) have drawn attention to the fact that the division is valuable for archaeologists because barren and tula adze slugs were not distributed randomly either in time or space in Australia. Mulvaney
(1969:74) makes the point that tula adze-flakes were absent from eastern and north-eastern Australia. Tindale, who excavated at Tartanga and Devon Downs, first used the term 'tula' to describe archaeological material (Hale and Tindale 1930:173). Previously the term 'tuhla' has been used to describe a broad flake used by Aborigines living to the east of Lake Eyre. The tuhla was described as a flake with 'the edge chipped by striking with coolkee [hammerstone] until it is semi-circular, with a keen edge all round the semi-circle. It is always chipped from one side, so that viewed from the one side it presents a clean edge, but on the other it shows the crenulations caused by the chipping. This is mounted on a curved piece of boomerang-shaped wood with mindrie pitch and is used as a chopping tool. When the edge is blunted it is sharpened up again by chipping. This sharpening is continued until the stone from having a convex edge becomes concave. It is then thrown away and another stone is selected' (Horne & Aiston 1924:89).

Other descriptions of the development of flake adze slugs from either random flakes or round edged scrapers are given by Cooper (1954:91-4), Gould (1966:1-4) and Tindale (1965:153, fig. 19). This developmental sequence has often been illustrated, the latest being in Mulvaney's Prehistory of Australia (1969:114, fig. 23). The implement used by the Aborigines of the Western Desert described by Tindale (1965:153) would in this study be classified as an unmodified flake, a round edged scraper, and a flake adze slug at different stages in its life. Mulvaney discussed this problem and concluded 'a prehistorian can term a flake, 'adze' (i.e. hafted), only when the stepped flaking or use fracture is present' (Mulvaney and Joyce 1965:189).

---

1 Ones with the altered edge opposite the bulb of percussion.
(c) **straight edged scrapers** (fig. 6.9 nos.1-6)

These are flat scrapers, made on flakes possessing a relatively straight working edge. The retouch is generally invasive and can be restricted to a single side or an end or else extend right around the implement.

(d) **notched scrapers** (fig. 6.9 nos.7-10)

Notched scrapers have a steep, abruptly retouched, shallow notch. The notches are narrow distinguishing notched scrapers from concave scrapers, the latter having a greater retouch length along a concave edge. Concave scrapers are rare or non-existent in the Burke's Cave stone assemblage.

(e) **horsehoof cores** (fig. 6.7 nos.5-8)

These are high domed cores with flat round bases from which flakes were struck to give them their circular domed shapes.

'A second pattern of flaking was superimposed on the first, causing the angle of the worked edge to become steep, with extensive step flaking. Typically this angle is 90° or more, forming an obtuse overhanging edge. Most tools have this steep worked edge around much of their perimeter and few show it all the way round (Jones and Allen in Bowler et al., 1970:49).

The horsehoof cores from Burke's Cave are smaller than those recovered from Kangaroo Island (Tindale and Maegraith 1931:281) but very similar in their overall appearance.

(f) **steep edged scrapers** (fig.6.7 nos.1-4)

Steep edged scrapers are manufactured on thick flakes or cores. The worked edge varies from being slightly concave to being slightly convex and is steep, step-flaked and often undercut.

'There does not seem to be any formal relationship between the position of the worked edges and the total implement; rather, any suitable part of the flake was chosen and
'retouched until a robust steep edge was formed'
(Jones and Allen in Bowler et al., 1970:51).

(g) **miscellaneous scrapers**

Miscellaneous scrapers are scrapers which possess sufficient length of secondary retouch to separate themselves from retouched flakes but insufficient to characterise them as belonging to any of the other scraper groups.

(h) **retouched flakes**

These are flakes with a few, generally less than three, secondary flakes detached from a continuous working edge.

(i) **utilized flakes**

Utilized flakes are flakes that possess some use-wear. This is usually in the form of chattering - very small flakes crushed from one side of an edge with the appearance of minute step flakes (White 1969:26-7). This use-wear has the appearance of having been produced by cutting or scraping tasks rather than by deliberate secondary retouch. Utilized flakes are similar in appearance to the *Yutchawunta* knives used by the Wonkonguru (Gould 1966:4) or the *tjimari* knives used by the Aborigines of the Western Desert (Gould et al., 1971:149-51; Tindale 1965:133-9). Gum, to form a handle, was fixed to the back of these particular 'knives' and in most cases 'the extremely sharp edge of the freshly-struck flake is regarded as sufficient' (Gould et al., 1971:149). There is no evidence that the Burke's Cave utilized flakes were 'hafted' with gum.

(j) **rejuvenation flakes**

These are flakes which have been struck off an implement in order to resharpenn the working edge. They retain the traces of the implement's worn working edge on the dorsal surface of their striking platforms. In most cases the retouch present on these dorsal surfaces is step-flaked.
(k) **backed flakes (microliths)** (fig.6.10 nos.1-6 and 9)

These are small flakes with abrupt secondary working. This secondary work, termed backing, must be done from more than one direction. The size and apparent shape of the artefact was not taken into consideration. Most of the backed flakes in the Burke's Cave collection resemble geometric microliths in McCarthy's typology (McCarthy *et al.*, 1946:41-4) or Glover's (1967:424-5) group A. I have termed this category of implement backed flakes rather than the more usual 'backed blades' in order to draw attention to the fact that they are manufactured on small flakes. No evidence for a blade technology has yet been found in Australia. Glover and Lampert (1969:224-5) argue for the term 'backed blade' although Glover (1967:415) states 'they are...usually made from complete flakes unlike the Old World microliths which are often made from sections of long blades'.

(1) **pirri points** (fig. 6.10 nos.7-8)

A pirri point is a leaf shaped flake with invasive unifacial secondary work. This secondary work may be present all over one surface (Mulvaney 1961:75-9). Campbell (1959:509-24) has discussed their features at length.

(m) **glass scrapers** (fig.6.9 nos.11-16)

These have been defined on the basis of the material of manufacture.

6.6 **Distribution of implements within the Burke's Cave site**

The distribution of broken and unbroken implements recovered from the excavations is shown on tables 6.6 and 6.7. I have restricted my study to unbroken implements (table 6.7) because of some biases towards certain implement types which became apparent when the broken implements were also counted. Indeterminate broken scrapers formed about 10% of the collection. In general it was found to be impossible to distinguish broken retouched and utilised flakes from unmodified flakes.

From table 6.7 it can be seen that many of the implement categories present in unit 4, horsehoof cores, steep
Fig. 6.7

1-4 steep edged scrapers

5-8 horsehoof cores
Fig. 6.8

1-10 round edged scrapers

11-15 flake adze slugs
Fig. 6.9

1-6 straight edged scrapers

7-10 notched scrapers

11-16 glass scrapers
Fig. 6.10

1-6 group A backed flakes

7-8 pirri points

9 group B backed flake

10 mussel shell artifact
edged scrapers, round edged scrapers, were also present in all of the other units. Despite this continuity there were a few consistent changes taking place from bottom to top. These involve four groups of implements; flake adze slugs, backed flakes, pirri points, and glass scrapers. All these implements were absent from the lowest levels of the site. Backed flakes were present in small numbers in unit 3; they were present, with flake adze slugs, in somewhat greater numbers in unit 2, and were common in unit 1. The numbers in which they occurred and the proportion they form of total implements consistently increased from unit 3 up to the top of the site. Pirri points only appear in units 2 and 1, and glass scrapers were present only in the very top levels. Probably much of unit 1 postdates the arrival of Europeans in the area (c.1850). The $^{14}C$ date previously mentioned was obtained at the top of unit 4 (ANU-704: 1850 ± 240 B.P.) and it predates the presence of backed flakes, flake adze slugs and pirri points on the site. Thus it appears that backed flakes, flake adzes, and pirri points were first used or manufactured at the site more recently than 2000 years ago, and continued to be used right down into the historic period. The other implement categories, such as horsehoof cores, round edged scrapers, and steep edged scrapers were present in all units of the site. The proportion that these formed of total implements varied from unit to unit but not consistently. In addition, the increasing importance of implements such as backed flakes and flake adze slugs was not accompanied by a significant diminishing of importance of the other scrapers. It seems that implements like backed flakes and pirri points were added to an existing Aboriginal tool kit without replacing any of the older items.

The $\chi^2$ test seemed to be the most appropriate to test the validity of my impressions based on the percentage distribution of the implements. In these cases the tests consisted of setting up a series of null hypotheses - that there were no differences between the numbers of implements in each category making up the various populations [units] within the site. Each cultural unit was taken to represent a separate population and each implement category a component of that population.
Table 6.6  Burke's Cave: distribution and % age distribution of broken and unbroken implements

<table>
<thead>
<tr>
<th>IMPLEMENT TYPE</th>
<th>Round edge scrapers (adzes)</th>
<th>Flake adzes (slugs)</th>
<th>Straight edged scrapers</th>
<th>Notched scrapers</th>
<th>Horsehoe cores</th>
<th>Steep edged scrapers</th>
<th>Miscellaneous scrapers</th>
<th>Retouched flake (a)</th>
<th>Utilised flake (a)</th>
<th>Backed flakes</th>
<th>Pirri points</th>
<th>Glass scrapers</th>
<th>Indeterminate broken scrapers</th>
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<td>%</td>
<td>No</td>
<td>%</td>
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<td>%</td>
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<td>%</td>
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<tr>
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<td>6</td>
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<td>17</td>
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<td>42</td>
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<td>73</td>
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</table>

(a) broken retouched or utilised flakes are difficult to distinguish from broken unmodified flakes

Table 6.7  Burke's Cave: distribution and % distribution of unbroken implements

<table>
<thead>
<tr>
<th>IMPLEMENT TYPE</th>
<th>Round edge scrapers (adzes)</th>
<th>Flake adzes (slugs)</th>
<th>Straight edged scrapers</th>
<th>Notched scrapers</th>
<th>Horsehoe cores</th>
<th>Steep edged scrapers</th>
<th>Miscellaneous scrapers</th>
<th>Retouched flakes</th>
<th>Utilised flakes</th>
<th>Backed flakes (microliths)</th>
<th>Pirri points</th>
<th>Glass scrapers</th>
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<td>%</td>
<td>No</td>
<td>%</td>
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<td>8</td>
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<td>6</td>
<td>2%</td>
<td>9</td>
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<td>18</td>
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</table>

(a) Pirri points are included here although some are broken
I then tested one unit against another in terms of various combinations of implement categories using 2 X 2 contingency tables. Given 1 degree of freedom and accepting a 5 percent probability level, the null hypothesis was rejected whenever $\chi^2$ had a value greater than 3.84 (Simpson et al., 1960:188, 190-1).

I used the following procedure. Consider two units 1 and 2 each with implement categories A-F as shown below

<table>
<thead>
<tr>
<th>Unit</th>
<th>Implement Categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A¹ B¹ C¹ D¹ E¹ F¹</td>
</tr>
<tr>
<td>2</td>
<td>A² B² C² D² E² F²</td>
</tr>
</tbody>
</table>

My first procedure was to test the two units in terms of A¹ and A² against all other implement categories. If the frequency of A was shown to be significantly different in the two units then it was excluded from further tests in this set because the differences would mask internal differences between the two units within categories B-F. My next test compared the units in terms of B against all other categories and so on. The first test actually run took the form:

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>Unit 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round edged scrapers</td>
<td>All other implements</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 2</td>
<td>Unit 2</td>
</tr>
<tr>
<td>Round edged scrapers</td>
<td>All other implements</td>
</tr>
</tbody>
</table>

In some instances, the small number of implements shown in more than one window of the table made the test inconclusive. The $\chi^2$ test 'requires that the expected frequencies in each cell should not be too small [usually not less than 5]. When this requirement is violated, the results of the test are meaningless' (Siegel 1956:109-10). Further, Simpson et al., suggest that Yates' correction for continuity may be worse than no adjustment at all (1960:189). Both authors suggest regrouping the data in order to make the expected frequencies larger. Therefore the relevant tests were carried out combining the numbers of one category of implement from more
than one unit. One of these tests is shown below

<table>
<thead>
<tr>
<th>Units 1-3</th>
<th>Units 1-3</th>
</tr>
</thead>
<tbody>
<tr>
<td>backed flakes</td>
<td>All other implements</td>
</tr>
<tr>
<td>Unit 4</td>
<td>Unit 4</td>
</tr>
<tr>
<td>backed flakes</td>
<td>All other implements</td>
</tr>
</tbody>
</table>

The results of the 52 $\chi^2$ tests carried out are shown on table 6.8. Where the value of $\chi^2$ was greater than 3.84 the value has been recorded in the table. I have added my interpretation of the significance of the results. Where $\chi^2$ had a value less than 3.84 I have marked it by the initials NSD (No Significant Difference).

(a) tests between units 4 and 3
Tests between units 4 and 3 showed a number of significant differences:

(1) There were no backed flakes in unit 4. The small numbers of backed flakes in other units were still sufficient to make their absence from unit 4 a highly significant difference.

(2) The numbers of flake adze slugs were smaller even than that of backed flakes, there being only a single questionable flake adze in unit 3 and none in Unit 4. Even so, there was a significant difference between unit 4 and all others in terms of flake adze slugs. For both (1) and (2) the tests consisted of comparing the unit 4 number against the numbers of the implements in units 1-3 combined. This was necessitated by the fact that the numbers of backed flakes and flake adze slugs in units 4 and 3 were too small alone to give valid results in a $\chi^2$ test.

(3) Other significant differences between units 4 and 3 were the increased numbers of round edged scrapers and the decreased numbers of horsehoeof cores and straight edged scrapers in unit 3.
Table 6.8  Burke's Cave: results of $\chi^2$ tests comparing implement numbers in each unit

<table>
<thead>
<tr>
<th>Units compared</th>
<th>Round edge scrapers (adzes)</th>
<th>Flake adzes (slates)</th>
<th>Straight edged scrapers</th>
<th>Notched scrapers</th>
<th>Horsehoe cores</th>
<th>Steep edged scrapers</th>
<th>Miscellaneous scrapers</th>
<th>Retouched flakes</th>
<th>Utilised flakes</th>
<th>Backed flakes (microliths)</th>
<th>Pirri points</th>
<th>Glass scrapers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>Significant increase 10.03</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>significant increase 5.03</td>
<td>NSC</td>
<td>NSC</td>
</tr>
<tr>
<td></td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>significant increase 12.45</td>
<td>NSC</td>
<td>NSC</td>
</tr>
<tr>
<td>Unit 2</td>
<td>Significant increase 10.59</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>Significant increase 9.40</td>
<td>NSC</td>
<td>NSC</td>
</tr>
<tr>
<td></td>
<td>Significant increase 6.85</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>Significant increase 7.08</td>
<td>NSC</td>
<td>NSC</td>
</tr>
<tr>
<td>Unit 3</td>
<td>Significant increase 42.45</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>Significant increase 12.45</td>
<td>NSC</td>
<td>NSC</td>
</tr>
<tr>
<td></td>
<td>Significant increase 6.92 b</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>NSC</td>
<td>Significant increase 7.08</td>
<td>NSC</td>
<td>NSC</td>
</tr>
<tr>
<td>Unit 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a) No significant change
b) See text for details of these tests

Table 6.9  Burke's Cave: artifact number, sample number and sample % age

<table>
<thead>
<tr>
<th>Unit</th>
<th>Round edge scraper</th>
<th>Notched scraper</th>
<th>Retouched flakes</th>
<th>Utilised flakes</th>
<th>Unmodified cores</th>
<th>Unmodified flakes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total no</td>
<td>Sample no</td>
<td>Sample % age</td>
<td>Total no</td>
<td>Sample no</td>
<td>Sample % age</td>
</tr>
<tr>
<td>Unit 1</td>
<td>100</td>
<td>45</td>
<td>45%</td>
<td>33</td>
<td>20</td>
<td>61%</td>
</tr>
<tr>
<td>Unit 2</td>
<td>111</td>
<td>50</td>
<td>45%</td>
<td>18</td>
<td>18</td>
<td>-</td>
</tr>
<tr>
<td>Unit 3</td>
<td>286</td>
<td>73</td>
<td>26%</td>
<td>41</td>
<td>20</td>
<td>49%</td>
</tr>
<tr>
<td>Unit 4</td>
<td>31</td>
<td>31</td>
<td>-</td>
<td>17</td>
<td>17</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>528</td>
<td>199</td>
<td>38%</td>
<td>109</td>
<td>75</td>
<td>69%</td>
</tr>
</tbody>
</table>

174.
(b) **tests between units 3 and 2**

Differences between units 4 and 3 in terms of particular implement categories also affected units 3 and 2.

1. There was a significant increase in the numbers of backed flakes and flake adze slugs in unit 2.
2. Pirri points were absent from units 4 and 3 but present in unit 2 in small numbers. Their presence in unit 2 made that unit significantly different from the two lower ones.
3. There was a significant decrease in the number of round edged scrapers in unit 2.

As unit 2 was marked by a decrease in the numbers of round edged scrapers and an increase in the numbers of flake adze slugs I decided to test whether or not flake adze slugs were being used as a replacement for round edged scrapers. To do this I ran the test shown below:

<table>
<thead>
<tr>
<th>Unit 2</th>
<th>Unit 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round edged scrapers plus flake adzes</td>
<td>All other implements</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Unit 3</td>
<td>Unit 3</td>
</tr>
<tr>
<td>Round edged scrapers plus flake adzes</td>
<td>All other implements</td>
</tr>
</tbody>
</table>

This test gave a $\chi^2$ result of 4.6 showing that units 2 and 3 were significantly different in terms of these two categories combined. The combined class of round edged scrapers/flake adze slugs was, in unit 2, decreasing relative to other implements compared to unit 3. If flake adze slugs were replacing round edged scrapers then they must have been efficient enough for each flake adze slug to replace a number of round edged scrapers. Apart from this conclusion, the test was inconclusive.

(c) **tests between units 2 and 1**

The tests revealed four significant differences between units 2 and 1. The increases already noted from unit 4 through to unit 2, in the numbers of backed flakes and flake
adze slugs, continue.

(1) There was a further significant increase in the number of backed flakes in unit 1.

(2) There was also a further significant increase in the number of flake adze slugs.

(3) Glass scrapers were absent from unit 2 but present in substantial numbers in unit 1. Testing revealed that this represented a significant increase in the number of glass scrapers.

(4) There was a decrease in the number of retouched flakes in unit 1.

To test whether or not there was some functional interaction between retouched flakes and glass scrapers I combined them in the form of the test set out below.

<table>
<thead>
<tr>
<th>Unit 1</th>
<th>Unit 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>glass scrapers plus</td>
<td>total implements less glass</td>
</tr>
<tr>
<td>retouched flakes.</td>
<td>scrapers, and retouched</td>
</tr>
<tr>
<td></td>
<td>flakes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit 2</th>
<th>Unit 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>glass scrapers plus</td>
<td>total implements less glass</td>
</tr>
<tr>
<td>retouched flakes.</td>
<td>scrapers, and retouched</td>
</tr>
<tr>
<td></td>
<td>flakes.</td>
</tr>
</tbody>
</table>

This test gave a $\chi^2$ value of 0.789. Tested separately glass scrapers had increased, retouched flakes had decreased. However, when these two categories were combined the differences disappeared. Apparently some glass scrapers were replacing some retouched flakes.

Glass as a raw material has some advantages over other materials in hardness and sharpness. At Burke's Cave glass was not used to manufacture specialized implement types but rather was used for fairly nondescript scrapers. If they had not been made of glass, many of these implements would have been classified as retouched flakes. The demand for glass as a raw material was recorded at Cooper's Creek by Dr. E. Jung, who was driving cattle from Longreach to Adelaide in the early 1870's. He noted
'glass and glass-splinters were much sought-after articles, used to smooth and point weapons. They were superior instruments to the rare pieces of quartz which were previously used'  
(Jung 1878:75) (translated by P. Lauer).

The $\chi^2$ tests, in general, have supported conclusions based on the percentage distribution pattern. This was particularly so in regard to the increase in numbers of backed flakes and flake adze slugs from the lower levels to the top of the site. The $\chi^2$ tests did not reveal any consistent changes in the numbers of implements in categories such as, horsehoof cores, steep edged scrapers, straight edged scrapers and notched scrapers from unit to unit. In particular, there is no decline in the numbers of horsehoof cores or steep edged scrapers from the lower to the higher levels of the site, both of these categories remaining roughly constant in all units.

6.7 Scraper characteristics

In this section I will provide detailed information on the characteristics of the various implement categories described above and then to do some tests on their validity as separate populations. The number of implements excavated at the site and the limited time available for the analysis has meant that this study is only partially complete. The calculation of correlation coefficients and the use of cluster analysis would be necessary to complete what is the first step of an R-type analysis (Sokal and Sneath 1963:207-9).

The analysis carried out follows work done previously by Lampert (1971:16-22), Mulvaney (Mulvaney and Joyce 1965:176-8) and Jones (1971). I have attempted to measure both whole implement traits and some of the features of the altered edges.

The scrapers characteristics length, breadth, thickness, breadth-length ratio, thickness-breadth ratio, weight, angle of retouch$^1$ and disposition of retouch were measured in

$^1$I have followed Lampert (1971:20) here and have taken the average of several measurements along a retouched edge. Jones (1971:331-4) however measured the maximum angle.
the manner described by Lampert (1971:19-20), except that whenever an implement had more than one type of edge the measured characteristics of that implement appear more than once in the calculations. Thus if an implement primarily classified as a round edged scraper also possessed a notch on its side, then the measurements of the whole implement characteristics would appear both in the calculations for round edged scrapers and again in the calculations for notched scrapers. However, measurements of its edge characteristics would appear only once for each sort of edge. This affected the calculation of some variables. Thus length of retouch refers to length of continuous retouch along an edge. If there are gaps between retouched edges I have regarded these as different edges and measured length of retouch for both. Percentage of retouch on the whole implement was then calculated for each edge separately. The following variables were also measured:

**thickness-length ratio** - thickness as a percentage of length to provide some idea of the long profile of the implement.

**height of retouch A** - retouch A consists of the broad high flakes detached from the face of an implement in order to prepare it for the removal of ordinary secondary flakes.

**height of retouch B** - retouch B consists of the small flakes removed from an implement to give it a working edge. They are the ordinary secondary flakes that sharpen and harden an edge. Jones (1971:331 and fig.30) discussed height of retouch A and B, which he called height A and height B of edge respectively.

**bulbar length** - the length of an implement from the top of the bulb of percussion (striking platform) to the tip of the implement taken at right angles to the striking platform.

**bulbar breadth** - the maximum breadth of the implement taken at right angles to the line along which the bulbar length was measured.
striking platform angle - is the angle between the striking platform and the inner or ventral face of the flake.

Bulbs of percussion survived on only a small proportion of the implements and flakes discussed here. 45% of the flake adzes and 42% of the round edged scrapers retained their bulbs but only about 30% of the straight edged scrapers, retouched flakes and utilized flakes still had bulbs. Of the other implement categories fewer than 20% still possessed bulbs of percussion. Measurements such as striking platform angle, bulbar length, were only taken for implement categories with a high percentage of the implements with bulbs of percussion.

(a) sampling

Approximately 1400 implements or utilized flakes were recovered from the excavations and I found it impossible to analyse them all in the time available. In some cases where the numbers were low all implements were chosen. Thus flake adzes, straight edged scrapers, horsehoof cores, steep edged scrapers, and miscellaneous scrapers were not sampled. Other categories, such as round edged scrapers, had high numbers and were sampled, but this was carried out in such a way as to ensure that there was a minimum number of 20 objects in any implement category. Table 6.9 shows the total number of artefacts, the number sampled for this analysis and the percentage that this forms of the total.

Using a Hewlett-Packard 9100 B desk calculator\(^1\) with a histogram generating programme, I calculated the mean and standard deviation for implement and edge characteristics for all implement categories. This information for all units combined is shown on table 6.10 and for each unit, for categories where \(N\) was greater than 20, shown on table 6.11. The programme enabled me to inspect the plotted histogrammes of

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\(^1\)I would like to thank Professor R.G. Ward of the Dept. of Human Geography and Professor D. Walker of the Dept. of Biogeography and Geomorphology for permission to use this calculator.
### Table 610: Burke's Cave: means and standard deviations for implement and edge characteristics

<table>
<thead>
<tr>
<th>Implement types</th>
<th>All units</th>
<th>Maximum length mm (a)</th>
<th>Maximum breadth mm (b)</th>
<th>Thickness mm</th>
<th>Weight gms</th>
<th>Breadth/ length index</th>
<th>Thickness/ breadth index</th>
<th>Length of retouch mm</th>
<th>% of retouch</th>
<th>Retouch angle degrees</th>
<th>Height retouch A mm</th>
<th>Height retouch B mm</th>
<th>Bulbar length mm (c)</th>
<th>Bulbar breadth mm</th>
<th>Striking platform angle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round edge scraper</td>
<td>N</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
<td>211</td>
</tr>
<tr>
<td>(adzes)</td>
<td>N</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Flake adze (slugs)</td>
<td>N</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
<td>31</td>
</tr>
<tr>
<td>Straight edged scraper</td>
<td>N</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Notched scraper</td>
<td>N</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
<td>82</td>
</tr>
<tr>
<td>Horsehoe core</td>
<td>N</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Scaphe scraper</td>
<td>N</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>Miscellaneous scraper</td>
<td>N</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Retouched flake</td>
<td>N</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>110</td>
</tr>
<tr>
<td>Unmodified core</td>
<td>N</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
<td>129</td>
</tr>
</tbody>
</table>

(a) Length of implement irrespective of position of striking platform
(b) Breadth of implement taken at right angles to the length axis
(c) Length of implement taken at right angles to the striking platform
(d) Sample only
Table 6.11  Burke's Cave: means and standard deviations for implement and edge characteristics

<table>
<thead>
<tr>
<th>Implement type</th>
<th>Unit</th>
<th>Minimum length (mm)</th>
<th>Maximum breadth (mm)</th>
<th>Thickness (mm)</th>
<th>Weight (gms)</th>
<th>Breadth/length index</th>
<th>Thickness/length index</th>
<th>Length of retouch (mm)</th>
<th>Angle of retouch (degrees)</th>
<th>Retouch angle (degrees)</th>
<th>Height retouch A (mm)</th>
<th>Height retouch B (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round edge scraper (adze)</td>
<td>Unit 1</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>46</td>
<td>64</td>
<td>32</td>
<td>31</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26 ± 7</td>
<td>19 ± 7</td>
<td>10 ± 4</td>
<td>6 ± 4</td>
<td>76 ± 12</td>
<td>39 ± 11</td>
<td>50 ± 16</td>
<td>45 ± 19</td>
<td>85 ± 12</td>
<td>18.5 ± 6.3</td>
<td>6.3 ± 1.6</td>
</tr>
<tr>
<td></td>
<td>Unit 2</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>55</td>
<td>67</td>
<td>67</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>27 ± 7</td>
<td>22 ± 6</td>
<td>11 ± 5</td>
<td>8 ± 7</td>
<td>82 ± 10</td>
<td>41 ± 14</td>
<td>50 ± 18</td>
<td>41 ± 20</td>
<td>75 ± 10</td>
<td>11.6 ± 2.5</td>
<td>5.3 ± 2.2</td>
</tr>
<tr>
<td></td>
<td>Unit 3</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
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<td>Maximum breadth mm</td>
<td>Thickness mm</td>
<td>Weight gms</td>
<td>Breadth/length index</td>
<td>Thickness/breadth index</td>
<td>Thickness/length index</td>
<td>Length of retouch mm</td>
<td>% retouch</td>
<td>Retouch angle degrees</td>
<td>Weight retouch A mm</td>
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<td>9.1 ± 3.7</td>
<td>4.0 ± 1.3</td>
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<td>20 ± 13</td>
<td>19 ± 8</td>
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<td>41 ± 9</td>
<td>27 ± 6</td>
<td>108 ± 9</td>
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<td>3.3 ± 1.7</td>
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<td>3.3 ± 1.1</td>
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<td>4.3 ± 1.6</td>
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<td>73 ± 18</td>
<td>58 ± 14</td>
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<td>4.0 ± 1.4</td>
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<td>Unit 3</td>
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<td>36 ± 6</td>
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<td>3.2 ± 1.8</td>
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<td>53 ± 14</td>
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<td>15 ± 3.9</td>
<td>5.2 ± 1.5</td>
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</table>
each implement characteristic to observe the type of population it formed. In particular, I was interested in whether the distribution had a single peak suggesting a single normally distributed population, or whether they tended to show two peaks characteristic of two significantly different populations. The majority of these histograms had curves that, on inspection approximated to the normal curve. The distribution of the continuous variables, such as length and breadth was in most cases close to normal. Weight, being a variable that is determined by the functions of volume and raw material, generally had a positively skewed distribution. It is possible to transform the skewed distribution of weight into a more normal population by plotting the log-normal distribution. However, Jones (1971:338) suggested that the results did not warrant the extra work.

(b) differences within implement categories

From table 6.11 it can be seen that few variations occurred over time within any of the implement categories. I tested any differences using the Student's 't' test. Round edged scrapers were the only implements which showed significant and consistent differences between units, these were in terms of height of retouch A, height of retouch B and angle of retouch. From unit 4 continuing up to unit 1 there was a consistent increase in the height of retouches A and B and a consistent decrease in the angle of retouch (i.e. it became more acute). With the information available, I am not able to explain these changes.

Although there are apparent differences evident in the table between steep edged scrapers in units 3 and 4, 't' tests failed to show any significant differences.

(c) differences between implement categories

I again used 't' tests to determine differences between implement categories, testing each against all others. Table 6.12 sets out the results of those tests where 't' had a value high enough\(^1\) to warrant the conclusion that there were

\(^1\)I accepted that there were significant differences in these tests whenever 't' had a value high enough for there only to be a 1% chance that the two samples were drawn from the same population. Only three of the tests had less than 60 degrees of freedom.
### Table 6.13 Burke's Cave: Matrix of results of Student's 't' tests comparing means of scraper characteristics for each implement type

<table>
<thead>
<tr>
<th>Implement type</th>
<th>Flakes per scraping (slug)</th>
<th>Number of scraper characteristics showing significant differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horsehoe core</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steep edged scraper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ummolthead core</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notched scraper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilised flake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retouched flake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flakes per adze (slug)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight edged scraper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miscellaneous scraper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round edged scraper</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Implement type</th>
<th>Number of scraper characteristics significantly different x 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horsehoe core</td>
<td></td>
</tr>
<tr>
<td>Steep edged scraper</td>
<td></td>
</tr>
<tr>
<td>Ummolthead core</td>
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<tr>
<td>Notched scraper</td>
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<tr>
<td>Utilised flake</td>
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<tr>
<td>Retouched flake</td>
<td></td>
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<tr>
<td>Flakes per adze (slug)</td>
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<tr>
<td>Straight edged scraper</td>
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<tr>
<td>Miscellaneous scraper</td>
<td></td>
</tr>
<tr>
<td>Round edged scraper</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Total number of characteristics compared</th>
<th>Number of scraper characteristics significantly different x 100</th>
</tr>
</thead>
</table>
significant differences between characteristics. In the
discussion that follows I have assumed that implement categor-
ies with many significantly different characteristics are
quite dissimilar.

From the results of each series of tests I counted
the number of significantly different characteristics between
each implement category from table 6.12. This number was
converted into a percentage of the total number of character-
istics which had been compared in that series of tests. Thus,
for example, if I tested between implement A and implement B
for sixteen characteristics and found that eight showed
significant differences then A shared only $\frac{8}{16} \times 100$ or 50%
of its characteristics with B. This information was arranged
in a matrix on table 6.13. I have assumed that categories
with 75% or more of their characteristics significantly
different will be dissimilar.

The five implement categories, horsehoof cores,
steep edged scrapers, unmodified cores, notched scrapers and
utilized flakes were sufficiently different from each other
or any other implement to form five distinct categories. The
nature of these differences can only been seen from the raw
data represented in tables 6.10 and 6.11.

(i) Utilized flakes were smaller than any other
implement in all characteristics except breadth-
length index.

(ii) Unmodified cores were significantly smaller than any
core implement (horsehoof cores, steep edged scrapers)
but significantly larger than any of the flake implements.

(iii) Horsehoof cores were larger than any other scraper
category in all dimensions other than length. Their
greater thickness probably accounts for the high retouch A and
retouch B that they possess. In addition, thickness may
correlate positively with angle of retouch as horsehoof cores
are the only category possessing an obtuse angle of retouch.

(iv) If a horsehoof core could be distorted topologically
by being squashed the resulting implement would look
like a steep edged scraper. Most of the differences between
horsehoof cores and steep edged scrapers consisted of character-
istics dependent on thickness (thickness-breadth, thickness-
length, height of retouch A and retouch B, and angle of retouch). The only other difference was maximum length, steep edged scrapers being longer.

(v) Thickness and its associated characteristics distinguished notched scrapers from other categories. They were thicker than all of the other scraper categories except horsehoe cores and steep edged scrapers. The notches were small. This meant that notched scrapers had a short length of retouch and a low percentage of retouch. The notches had a small range with a mean width of $14 \pm 5$ mm and a depth of only $2.2 \pm 1$ mm.

Five implement categories - retouched flakes, straight edged scrapers, miscellaneous scrapers, flake adze slugs, and round edged scrapers had many resemblances raising the question of whether it may be more profitable to regard them all as variations within a single category. As round edged scrapers formed the most numerous category, each of the other categories was compared with it.

(i) Retouched flakes can be differentiated from round edged scrapers only on the basis of two characteristics. They were thinner than round edged scrapers and they had a shorter length of retouch. Clearly length of retouch, the criterion used to differentiate this category, is not particularly useful as a defining characteristic, and retouched flakes may be regarded as a variation of round edged scrapers.

(ii) Straight edged scrapers were longer than round edged scrapers and a higher proportion of them had retouch on one side only (see tables 6.14 below showing the percentage distribution of disposition of retouch). Their retouch was shorter than that of round edged scrapers, and while both of these implements were of the same thickness, straight edged scrapers possessed a retouch angle that was significantly more acute. The mean retouch angle of round edged scrapers, $77^\circ$, and of straight edged scrapers, $66^\circ$, falls within the range of retouch angles recorded for ethnographic adzes from the Western Desert and Lake Eyre (Gould et al., 1971:151). Since they had four characteristics distinguishing them from round edged scrapers (apart from their defining characteristic, a straight edge) implements in this category could not be so definitely
Table 6.14  Burke's Cave: percentage distribution of disposition of retouch

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<tr>
<th>Implement</th>
<th>N</th>
<th>S</th>
<th>SS</th>
<th>E</th>
<th>EE</th>
<th>SE</th>
<th>SEE</th>
<th>SSE</th>
<th>SSEE</th>
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<tbody>
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<td>(a) disposition relative to the striking platform</td>
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<tr>
<td>Flake adzes</td>
<td>17</td>
<td>18%</td>
<td>-</td>
<td>24%</td>
<td>47%</td>
<td>6%</td>
<td>6%</td>
<td>-</td>
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<td>19%</td>
<td>6%</td>
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<td>(b) disposition relative to maximum length</td>
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<td>37%</td>
<td>43%</td>
<td>-</td>
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<td>23%</td>
<td>3%</td>
<td>20%</td>
<td>3%</td>
<td>18%</td>
<td>10%</td>
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<tr>
<td>Straight edged scrapers</td>
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<td>56%</td>
<td>19%</td>
<td>10%</td>
<td>-</td>
<td>6%</td>
<td>2%</td>
<td>8%</td>
<td>-</td>
</tr>
<tr>
<td>Notched scrapers</td>
<td>79</td>
<td>34%</td>
<td>24%</td>
<td>27%</td>
<td>5%</td>
<td>6%</td>
<td>-</td>
<td>4%</td>
<td>-</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>49</td>
<td>45%</td>
<td>22%</td>
<td>6%</td>
<td>4%</td>
<td>14%</td>
<td>4%</td>
<td>4%</td>
<td>-</td>
</tr>
</tbody>
</table>

1 This divides scrapers into categories derived from various combinations of 'side' (S) and 'end' (E). 'S' refers to scrapers retouched along one margin and 'SSE' refers to retouch along both margins and an end.
regarded as just a variation of round edged scrapers. Yet
they did not possess as many distinguishing features as I
would require to justify placing them in an entirely inde-
pendent category (cf. discussion of implement types which do
justify this, such as horsehoof cores above). Straight edged
scrapers were similar in all dimensions to round edged scrapers
and they may have performed closely related functions.
(iii) Miscellaneous scrapers were defined as scrapers
possessing insufficient criteria to enable them to
be put into any of the more specialized scraper categories.
Therefore, as might be expected, they possess characteristics
similar to all of the other scraper categories.
(iv) The difficulties entailed in separating round edged
scrapers from flake adze slugs have already been
touched upon (in section 6.5b). The information contained
in tables 6.10 and 6.14 provides no additional means of
separating these two groups, once it has been accepted that
flake adze slugs may be badly worn round edged scrapers. No
significant difference was registered for any characteristics
that may be independent of wear - maximum length, thickness,
percentage of retouch, angle of retouch, height of retouch A
and B, bulbar breadth and striking platform angle. Whenever
significant differences occurred (see table 6.12) they were
for characteristics which were affected by wear. Figure 6.11
shows histograms plotting the percentage distribution of six
characteristics of flake adzes and round edged scrapers. Two
of the lower set of histograms plot characteristics that were
independent of wear (bulbar breadth and thickness). For these
two characteristics round-edged scrapers and flake adzes showed
almost exactly the same population distribution. Rather unex-
pectedly the population plot for angle of retouch showed a
similar distribution for the two scrapers. One would generally
expect that angle of retouch would be dependent on wear and
would therefore expect the retouch angle of flake adze slugs
to have a much more restricted distribution. A possible
explanation was that the use of the implement chips off flakes
continually so that the edge was self-rejuvenating.
The other three characteristics plotted (bulbar
length, breadth-length index and weight) were three variables
that do reflect the amount of wear on an implement. In the histograms plotting wear dependent characteristics, the plot for flake adzes fitted in at the smallest end of the range of round edged scrapers. The inclusion of the flake adze slug data normalises the otherwise slightly skewed distribution. Although, as discussed above, the distribution of the weights of round edged scrapers is strongly positively skewed, the weights of flake adze slugs still fit in at the smallest end of the range.

Table 6.14 showing the disposition of retouch again fails to differentiate between the two implements. The disposition relative to the striking platform was mainly on one (E) or both ends (EE). The high proportion of round edged scrapers with retouch on the side and end (SE) and on two sides and an end (SSE) and the smaller proportion of flake adze slugs with this disposition of retouch may again represent a function of wear. As the end wears back the sides shorten and traces of retouch on these sides may disappear.

There are few round edged scrapers with retouch along one side only (relative to the striking platform) but a number of flake adzes possess this trait. This trait was also a feature of straight edged scrapers so it may be that these flake adze slugs are worn straight edged scrapers.

The evidence presented here therefore supports the point made by Cooper (1954:96) when he warned collectors against thinking that worn slugs represented 'a totally different type of implement to the semi-discoidal adze-stone...a careful examination...appears to indicate without doubt that all represent successively worn stages of original forms such as shown in figure 1'. His figure 1 shows a round edged scraper.

There still remains, however, the problem that flake adze slugs have a different distribution within the site from round edged scrapers.

Tindale (1955:282) and Cooper (1954:94) have both suggested that proximity to raw materials is an important factor determining the proportion of adze slugs to partly worn round edged scrapers. Describing the adze stones from Lake Menindee, Tindale noted that 'with sources of stone probably
only a few miles removed, partly used adze stones are much more
abundant and few show the great reduction which comes with
long use and continued resharpeming' (Tindale 1955:282). Raw
materials are readily available at Burke's Cave and therefore
cannot be the determining factor in this case. Also an argu-
ment based on the availability of raw materials cannot explain
variations within a single stratified deposit. The proportion
of flake adze slugs to round edged scrapers varies from 0:30
in unit 4, 1:290 in unit 3, 1:20 in unit 2 and 1:4 in unit 1.
χ² testing showed that there was a real increase in the number
of flake adze slugs and furthermore this was not accompanied
by a compensating decrease in round edged scrapers.

(d) **functional interpretations of round edged scrapers
and flake adze slugs**

The oldest known flake adze slugs come from Puntut-
jarpa in Western Australia (Gould 1971:162) dated to 10,170 ±
230 B.P. [no laboratory number], another from Tartanga in South
Australia is estimated to be older than 6000 years B.P.
(Mulvaney 1969:113). Round edged scrapers have been recov-
ered from situations older than this. Scrapers similar to
round edged scrapers make up a part of the stone industry at
Mungo (see Chapter 8 below) and have, therefore, an antiquity
of 25,000 years. Round edged scrapers indistinguishable from
those at Burke's Cave were recovered from contexts dated to
about 12,000 years at sites near Lake Tandou (see Chapter 7
below). They have been recovered at Keilor, in Victoria, from
sediments dated as being older than 8000 years (Wright 1970:85-6
and 92; Mulvaney 1970:74). They have also been recovered from
Tasmania (Jones 1971:340-3).

Although no flake adze slugs have been recovered from
Victoria despite a hundred years of collecting (Mulvaney 1969:
74) round edged scrapers are common scraper forms on Victorian
camp sites (Mitchell 1949:36-7 and 112-169). Clearly flake
adze slugs and round edged scrapers can be taken as two inde-
pendent implements unless they are found in association on any
site.

Mulvaney (1965:189) has suggested that the presence
of a flake adze on a site with its distinctive step-flaking or
Fig. 6.11: Comparison of round edged scrapers and flake adze slugs
use fracture would mark the time that the Aborigines at the site first hafted a round edged scraper into a handle and used it.

This explanation would fit the evidence from Burke's Cave. The increasing importance of flake adze slugs on the site in the recent period could be taken to indicate an increase in the use of hafted tools. However, while one might accept the assumption that flake adze slugs, being badly worn, were hafted round edged scrapers, this does not warrant extension to the assumption that unworn, slightly worn or medium worn round edged scrapers were not hafted. There is nothing in the nature of a round edged scraper to prevent its being hafted. I have shown above that the two implement categories should properly be regarded as belonging to the same population. From this evidence one can reasonably conclude that at least some round edged scrapers were unworn to medium worn hafted implements.

Mulvaney's division of the Kenniff Cave stone material into two components, one 'hafted', the other 'nonhafted' (Mulvaney & Joyce 1965:186-93) has stimulated much discussion (Jones 1966:5; White 1967a:151-2; Gould 1969: 233-4). Since White's discovery of, presumably hafted, Pleistocene axes (White 1967a:151) in Arnhem Land the discussion has centred on the type of hafting. Gould (1969:233) stated that 'it seems probable that the Oenpelli axes were hafted with simple plant or sinew lashings, while the small, chipped stone tools required an adhesive like spinifex or black boy resin'. Hafting with fibre or sinew lashing does not only refer to axes as Strathern (1969:316-20) has documented the hafting of unmodified flakes in the New Guinea Highlands in this manner. The Yutchawanta and Tjimari knives discussed in section 6.5(i) above, although simple unmodified flakes, often had gum handles. It is usually not possible to prove from archaeological material whether or not any of the unmodified flakes or implements were hafted or not.

The positive evidence for hafting in archaeological sites is the presence of flake adze slugs with their characteristic use wear. This use wear was produced on the adzes when they were gripped in both hands and used as a chopper 'for a
variety of rough shaping and hollowing tasks' (Mulvaney 1961: 84; see also Horne and Aiston 1924:101-3; Thomson 1964:418). But hafted adzes were not always used in this manner; Horne and Aiston (1924:103) documented their use as gouges and Thomson (1964:418) described them being used as a graving tool, a spoke shave, and a hafted cutting implement used amongst other things for quartering large game. He commented

'It is primarily a maintenance implement, used for repairing rather than for making implements'.

In their use as gouges the adzes resemble the Wonkonguru kalara described by Horne and Aiston (1924:90) as being

'used as a scraper...its appearance varies a lot. Some are very like small tuhlas, having a chipped edge, others are only square-ended flakes; they are not bedded so deeply in the mindrie [gum], as they are used more as a gouge, often they are not embedded at all, but are used in the hand. The edge is kept to the work and forced along, so that a groove is made, along the weapon which is being fashioned, from end to end...they were also used in shaping up any wooden implement after it had been roughed out with the tuhla'.

It is unlikely that hafted adzes used as chopping tools would exhibit the same wear patterns as hafted adzes used as gouges or scrapers. The flake adze slugs may represent hafted implements used as choppers and the round edged scrapers, the same hafted implements used as scrapers or gouges. In these terms, the increasing number of flake adze slugs in the Burke's Cave site could be interpreted as the increasing importance of a specialised hafted chopping tool. This would explain why the significant increases in flake adze slugs were not accompanied by a decrease in round edged scrapers, for the two forms possibly were complementary as in the description of the kalara and tuhla given by Horne and Aiston above.

In areas where hafted flake adzes were not used or were used predominantly as scrapers or gouges the rough shaping
and chopping tasks were done with large hand-held core tools or flake scrapers. Thomson noted that

'When the Bindibu hunter is in camp with his family, it is the rugged bi-faced handaxe which serves as a chopper and scraper...In addition he uses cleavers or choppers and side scrapers to make...wooden tools and implements' (1964:419).

The use of similar implements for these tasks has been documented by Horne and Aiston (1924:92-4) for the Arunta and by Tindale (1941:37-41) and Gould et al., (1971:156) for the Western Desert Aborigines. The equivalent tools in western New South Wales were horsehoof cores and steep edged scrapers.

There is at the Burke's Cave site, however, no evidence that flake adze slugs were replacing horsehoof cores and steep-edged scrapers. At the time that flake adze slugs became dramatically more abundant on the site (units 2 and 1) horsehoof cores and steep edged scrapers remained constant.

The proportion of horsehoof cores and steep edged scrapers at Burke's Cave was small (<10%) whereas at Lake Mungo these same categories made up 70 percent of all stone implements. South Australian surface sites such as Hallett's Cove and sites on Kangaroo Island reveal industries in which large core tools and scrapers are the most numerous categories present (Cooper 1959, 1966, 1968; Tindale and Maegraith 1931). At younger sites on the Murray Valley, Devon Downs and Fromm's Landing where adze flakes were present, core tools and scrapers were present in small numbers only or absent altogether (Hale and Tindale 1930:177-203; Mulvaney 1960:72-80; Mulvaney et al., 1964:487-92). It would appear that there was a decrease in the number of these large tools but without a long sequence it is impossible to decide if it was a constant decrease or whether or not this decrease was associated with an increase in flake adzes. This will be discussed in a later section.
6.8 Other artefacts

(a) backed flakes

I have followed procedures described by Glover (1967:419-20) in order to divide the 54 backed flakes obtained at Burke’s Cave into groups. Glover divided a collection of backed flakes from Western Australia into two groups according to their length/breadth ratios. Backed flakes in Group A had L:B ratios of <2:1; backed flakes in Group B had L:B ratios of >2:1 (Glover op.cit.:419). I have followed this procedure in order to avoid the difficulties entailed in objectively dividing the backed flakes into the essentially subjective groups that have been used in the past, such as symmetrical and asymmetrical, geometric and other. There is a plethora of names describing backed flakes from western New South Wales, all somewhat inadequately defined. These have included Woakwine, Paroo and Adelaide points, geometrical microliths, rounded microliths, angular microliths and untrimmed microliths (see McCarthy et al., 1946:34-43).

Table 6.15 shows the dimensions of the Burke’s Cave backed flakes and their L:B ratios.

Table 6.15  Burke’s Cave: backed flake dimensions and L:B ratios

<table>
<thead>
<tr>
<th>Unit</th>
<th>Group</th>
<th>N</th>
<th>Length  mm</th>
<th>Breadth mm</th>
<th>L:B ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>x ± s</td>
<td>x ± s</td>
<td>x ± s</td>
</tr>
<tr>
<td>1</td>
<td>A</td>
<td>28</td>
<td>17 ± 3.5</td>
<td>12.1 ± 2.8</td>
<td>1.4 ± 0.4:1</td>
</tr>
<tr>
<td>1</td>
<td>B</td>
<td>6</td>
<td>18.5 ± 2.6</td>
<td>8.7 ± 1.1</td>
<td>2.2 ± 0.4:1</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>13</td>
<td>16.9 ± 3.1</td>
<td>12.1 ± 2.3</td>
<td>1.4 ± 0.1:1</td>
</tr>
<tr>
<td>2</td>
<td>B</td>
<td>1</td>
<td>19.0</td>
<td>9</td>
<td>2.1:1</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>6</td>
<td>18.3 ± 3.9</td>
<td>10.5 ± 2.0</td>
<td>1.7 ± 0.2:1</td>
</tr>
</tbody>
</table>

47 of the Burke’s Cave backed flakes had L:B ratios of <2:1 (Group A). This amounts to 87% of the total number of backed flakes from the site. The Burke’s Cave backed flakes are shorter and broader than those reported for other sites (cf.Glover 1967:424). The proportion of backed flakes in Group B seems to have greatly increased in unit 1 at the site. However, χ² testing of this failed to show any significant differences between units 1 and 2. Figure 6.10 nos.1-6 shows
illustrations of the backed flakes obtained from Burke's Cave. Some of the Group B backed flakes are similar to 'Bondi points' (see McCarthy et al., 1946:35-6 Plate 6.10 no.9) and one of the Group A backed flakes is similar to an eloura (see McCarthy et al.1946:28 Plate 6.10 no.1). This latter implement is bifacially chattered along the chord and may have been used in the fashion of a flake adze. Despite the location of the site in the middle of a region where cereals formed a major part of the diet, no implements bearing traces of use polish or silica gloss were recovered (see Lampert 1971:47 for a description of use polish on implements from the southern N.S.W. coast).

Glover, after comparing a collection of backed flakes from Western Australia with material from three archaeological sites in Eastern Australia, noted 'the similarity in most respects between the four groups is remarkable. Only in the treatment of the butt is there the hint of a difference between the Millstream implements and those from New South Wales...It is difficult to believe that such a uniformity could be the result of anything but a single cultural tradition' (Glover 1967:424). The evidence that Glover presents does support this conclusion. However, the Burke's Cave backed flakes are different from the backed flakes described by Glover from Eastern and Western Australia. They are only half the length, are much thinner and most of them have L:B ratios of <2:1. The backed flakes from Western Australia and the east coast of New South Wales may be the product of a single cultural style, but it is one that is not continuous across Central Australia.

(b) pirri points

There were nine pirri points, all from the upper levels of the site (Plate 6.10 nos.7-8). These included three entire points, five broken butts and two broken tips. One tip was subsequently found to join onto one of the broken butts. Both halves were found in adjacent quadrants separated by a depth of only a few inches suggesting that the site had not been physically disturbed to any great extent. The broken points exhibited hinge fracturing along the break as if pressure had been applied to the tip of the point upwards from the bulbar surface. This may mean that the points recovered from the site
were used as engraving tools rather than as spear points.

(c) **shell artefacts**

Three pieces of fresh water mussel shell (Unionidae) with ground edges were found (see figure 6.10 no.10). All came from the top unit. Shell fragments were recovered from lower levels but none possessed visible traces of grinding. Artefacts made of mussel shell have frequently been recorded in the ethnographic literature for eastern Australia. They have been described as being used as scrapers (Oxley 1820:77) on the Lachlan River, and on the Darling River for cutting open, skinning and dividing animals (Tuelon in Curr 1886:193) and also for making hooks on twigs used to spear small subterranean grubs (Brock, Ms. 1845).

Portion of the mouth of a small cone shell (Conus sp.) was excavated in the top level. It may have been a shell ornament or an artefact. This shell is a marine shell and as the nearest saltwater is 300 miles to the south-west in Spencer's Gulf it must have been imported or traded in over this distance.

(d) **grinding and pounding stones**

These stones are often called mill stones in the literature but I prefer to call those with smooth ground surfaces grindstones as ochre was often ground on them as well as vegetable foods. Eighteen pieces, mostly broken, came from units 1-3 of the site (table 6.2). No grinding or pounding stones were recovered from unit 4.

Grindstones can be divided into upper and lower grindstones. The upper grindstones, handstones or mullers, were better preserved than the lower grindstones as five of the eight upper grindstones were unbroken whereas nine of the ten lower grindstones were broken or very worn fragments. All were made of sandstone except for one upper grindstone that was made of quartzite. Six anvil stones and 17 hammerstones made up the 23 pounding stones. These were manufactured mainly from quartz or quartzite pebbles.
(e) **unmodified flakes**

The size analysis of the unmodified flakes from Burke's Cave is shown on table 6.16 below.

Table 6.16  Burke's Cave: size analysis of unmodified flakes

<table>
<thead>
<tr>
<th>Unit</th>
<th>Sample No. of flakes</th>
<th>size &lt;1</th>
<th>1-1.5</th>
<th>1.5-2</th>
<th>2-2.5</th>
<th>2.5-3</th>
<th>&gt;3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>286</td>
<td>58%</td>
<td>37%</td>
<td>3%</td>
<td>1%</td>
<td>&lt;1%</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>329</td>
<td>54%</td>
<td>39%</td>
<td>4%</td>
<td>3%</td>
<td>1%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>3</td>
<td>259</td>
<td>50%</td>
<td>39%</td>
<td>6%</td>
<td>4%</td>
<td>1%</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>373</td>
<td>32%</td>
<td>54%</td>
<td>8%</td>
<td>5%</td>
<td>1%</td>
<td>&lt;1%</td>
</tr>
</tbody>
</table>

There is a marked decrease in the size of the unmodified flakes from the bottom levels to the top. This seems to be a consistent and continuous change. The decrease in size of the unmodified flakes coincides exactly with the increasing number of backed flakes and flake adzes on the site and adds further credibility to the notion that the absence of these implement types from the lower levels of the site is a real one.

(f) **ground edged axes**

Tuelon (in Curr 1886 Vol.II:191-2) recorded that implements at Bourke were made only with ground edged tomahawks, chisels and knives. Bonney (Ms.c.1881) observed the use of ground edged axes and chisels as well as stone chips near Wilcannia. It may be that raw materials from which ground edged artefacts were manufactured were rare in the Darling River Valley. Binns and McBryde (1969:232) have recorded axes from the Central Darling area and have noted that they were made of materials imported from as far away as the New England Ranges, 400 miles away. Ground edged axes were commonly used for manufacturing bark canoes (Sturt 1849 Vol.I:127; Dunbar 1943-4: 174), for cutting bees nests out of trees for honey (Tindale 1968:621) and for cutting possums out of their nests (Krefft 1866b:370). Large trees are rare in the scrub covered ranges west of the river so presumably are bees nests and possums. Sturt recorded seeing only one possum in the interior after a
stay of over a year (Sturt 1849 Vol.II Appendix:4). Canoes
would be useless away from the river. However, even at
sites near the river, such as Menindee (Tindale 1955:293)
where canoe building ought to have been an important site
function, ground edged axes are rare.

6.9 Conclusions about the stone industry

The excavations revealed a three part industrial
sequence. The oldest and lowest portion of this sequence con-
sisted only of implements belonging to the 'Australian core
tool and scraper tradition' similar to those recovered at
Mungo (Jones and Allen in Bowler et al., 1970:47-52), from the
lower levels of Kenniff Cave (Mulvaney and Joyce 1965), from
Burrill Lake (Lampert 1971:13-28) and Rocky Cape in Tasmania
(Jones 1971). The second part of the sequence consisted of
these same core tools and scrapers plus a number of new ele-
ments in small numbers. These new elements are backed flakes,
flake adze slugs and pirri points. The third and final part
of this sequence, a part that was probably not more than 200
years old, consisted of the core tools and scrapers, with
backed flakes, flake adze slugs and pirri points in greater
numbers, together with Aboriginal implements made from glass
obtained from early white settlers.

The stone sequence from Burke's Cave, as far as
backed flakes, flake adze slugs and pirri points were con-
cerned, differs from sequences described by Tindale (Hale and
Tindale 1930) and Mulvaney (Mulvaney 1960; Mulvaney et al.,
1964) for sites in the lower Murray River Valley. At the
Murray Valley sites, Devon Downs and Fromm's Landing, backed
flakes and pirri points were first used 4,000 - 5,000 years
ago. Flake adze slugs were recovered from only slightly
younger contexts, 3750 ± 85, p 308 (Dury 1964:105). Flake
adzes continued to be used at these sites up to the top levels.
However, no backed flake or pirri point was found in levels
younger than about 3000 years.

At Burke's Cave, the oldest backed flakes, flake
adzes and pirri points were all younger than 2000 years B.P.
There was no decrease in the numbers of backed flakes and pirri
points in the upper levels of the site; in fact these implements increase in numbers in the very top levels. The marked degeneration in stone craftsmanship of the later occupants of both Fromm's Landing and Devon Downs' rock shelters observed by Mulvaney (1960:74) did not take place at Burke's Cave. The different distributions of backed flakes and flake adze slugs at the Murray Valley sites was also discussed by Mulvaney (1960:75). He noted that the

'earliest occurrence [of flake adze slugs] at both sites [Fromm's Landing and Devon Downs] coincided with the latest examples of well made pirris and microliths [backed flakes] and they were most numerous after production of these types declined. The inference therefore is that the increasing emphasis on wood-working was accompanied by a deterioration in stone working skills'.

At Burke's Cave, as at the New England sites of Bendemeer and Sealands and at Mt.Burr, South Australia (Mulvaney 1969:126) the production of backed flakes probably continued until the nineteenth century. There was no deterioration in stone working skills.

On the other hand, the constant proportion of round edged scrapers, horsehoof cores, steep edged scrapers, and notched scrapers throughout the site and the increasing number of flake adze slugs may indicate that woodworking was becoming an increasingly important activity.

On comparison of the site with other sites such as Devon Downs (Hale and Tindale 1930), Fromm's Landing (Mulvaney 1960), Kenniff Cave (Mulvaney and Joyce 1965), Currarong (Lampert 1971), Millstream, Curracurrang, Lapstone and Sassafras (the last four sites discussed in Glover 1967) the number of backed flakes at Burke's Cave is about average. Flake adze slugs and pirri points do not occur on the coastal N.S.W. sites. There are relatively fewer flake adze slugs at Burke's Cave than at the Murray Valley sites but this may represent an ecological or functional difference. No site yet excavated in southern Australia has revealed many pirri points so here Burke's Cave again is exceptional.
The only positive evidence for hafting on the site consists of the presence of flake adze slugs and backed flakes. The lowest flake adze slug probably marks the first time hafted choppers were used but this does not rule out the possibility that the lower round edged scrapers were hafted gouging or scraping tools used in conjunction with large hand-held core or flake choppers.

The presence of these chopping tools, the horsehoof cores and steep edged scrapers, links the site historically and culturally with the Lake Mungo site which is more than 20,000 years older. These links were particularly strong with the industry associated with unit 4 but the basic nature of this lowest Burke's Cave industry continued up through the deposit unchanged even though new elements were added to it. It seems that backed flakes, pirri points and flake adze slugs were added to an existing Aboriginal tool kit without replacing any of the older items.

The continuous aspect of Australian stone industries has been reported from a number of sites. Lampert, when discussing the Burrill Lake site, stated that 'the Bondaian added a number of specialised tools to, rather than replaced, a basic industry' (1971:66). The discovery of steep edged scrapers and horsehoof cores through all levels of a sequence covering 10,000 years at the Puntutjarpa site in the Western Desert led Gould (1971:174) to state

'There are no sharp breaks in the Puntutjarpa sequence. There were no interruptions, and no changes occurred which transformed the culture...it is impressive to note the long term continuities in culture that have existed there from at least 10,000 years ago to the present day Aborigines. Thus it becomes possible to suggest the hypothesis that during all or most of the post-Pleistocene period in this region there has existed a stable hunting and foraging way of life which can be regarded as the Australian desert culture'.

In the following chapters, I will examine the proposition that a definable riverine culture existed in the Darling River region for an even longer period.
6.10 Economic remains

(a) fauna

A considerable number of bones were recovered from the three topmost units of trenches BC1/1 and 2 (see fig.6) and from trench 1/3. There was little bone present in unit 4 the bottom most unit.

The bones of the smaller animals were quite well preserved. The bones of the larger mammals, especially of the kangaroos, however, were badly smashed suggesting that they had been subjected to some special process. Of the bones of the larger kangaroos, not a single entire jaw or tooth was recovered. The evidence for the kangaroos consists of fragments of smashed molar teeth. The numbers of these are recorded on table 6.17 below.

Most of the fragments probably came from separate teeth. A kangaroo has a total of sixteen molar teeth and using this as a basis for calculation one arrives at the figure of a minimum number of twelve large kangaroos. Only 20 percent of these fragments are tentatively attributable to species. Three of the large kangaroos were present, the wallaroo, the red kangaroo and the grey kangaroo, and all three species were almost equally represented (table 6.17).

To arrive at the estimated number of each species of kangaroo as shown on figure 6.18, I took three things into consideration.

i) There was evidence for approximately twelve or more kangaroos from the excavation;

ii) there was some spatial variation of the identifiable teeth within the site;

iii) equal numbers of tooth fragments had been identifiable to species suggesting that the three species of kangaroo present were equally represented.

Whatever method is used to calculate the number of kangaroos it is clear that they formed the single most important mammal category on the site. The numbers of the other animals were calculated from counts of left or right mandibles.

In considering table 6.18 it should be realised that the remains are only from the small volume of the total site
Table 6.17  Burke’s Cave: numbers of Macropod tooth fragments

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Unit (BCI/1-2)</th>
<th>BCI/3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>M. giganteus</em></td>
<td>grey kangaroo</td>
<td>- 1 3 4 4</td>
<td>-</td>
<td>12</td>
</tr>
<tr>
<td><em>M. robustus</em></td>
<td>euro (wallaroo)</td>
<td>- 4 1 5 -</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td><em>M. rufus</em></td>
<td>red kangaroo</td>
<td>2 4 5 - 2</td>
<td>9 63 45 22</td>
<td>183</td>
</tr>
<tr>
<td>Indeterminate</td>
<td></td>
<td>9 63 45 22</td>
<td>9 148</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>11 72 54 31</td>
<td>15 183</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.19  Burke’s Cave: estimated number of lizards for trenches I/1-3

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Unit (BCI/1-2)</th>
<th>BCI/3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIZARDS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Tiliqua cf. rugosa</em></td>
<td>stump-tailed skink</td>
<td>1 1 - 6 9</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td><em>Tiliqua sp.</em></td>
<td></td>
<td>- - - - - 1</td>
<td>- 1</td>
<td></td>
</tr>
<tr>
<td>Agamidae</td>
<td>dragon lizards</td>
<td>1 1 - 1 - 2</td>
<td>1 3</td>
<td></td>
</tr>
<tr>
<td>?</td>
<td></td>
<td>- - - 1 2 1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2 2 1 10 10</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.20  Burke’s Cave: number of fragments of egg shell, bird bones and freshwater mussel

<table>
<thead>
<tr>
<th>Category</th>
<th>Unit (BCI/1-2)</th>
<th>BCI/3</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGG SHELL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emu shell</td>
<td>2 - - - 35</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>- - - 4 -</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>UNIDENTIFIED BIRD BONES</td>
<td>1 - - - 1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>FRESHWATER MUSSEL</td>
<td>- 6 1 12 2</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Species</td>
<td>Common name</td>
<td>Unit (1/1,2)</td>
<td>Min. no.</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>--------------------------</td>
<td>--------------</td>
<td>----------</td>
</tr>
<tr>
<td><em>Macropus giganteus</em></td>
<td>grey kangaroo</td>
<td>1 1 1 1</td>
<td>4</td>
</tr>
<tr>
<td><em>Macropus robustus</em></td>
<td>wallaroo</td>
<td>1 1 2 -</td>
<td>4</td>
</tr>
<tr>
<td><em>Macropus rufus</em></td>
<td>red kangaroo</td>
<td>1 1 2 1</td>
<td>5</td>
</tr>
<tr>
<td><em>Onychogalea fraenata</em></td>
<td>nail-tailed wallaby</td>
<td>- - - 2</td>
<td>2</td>
</tr>
<tr>
<td><em>Lagorchestes sp.</em></td>
<td>hare-wallaby</td>
<td>- 1 - -</td>
<td>1</td>
</tr>
<tr>
<td><em>Bettongia sp.</em></td>
<td>rat-kangaroo</td>
<td>- 1 - -</td>
<td>1</td>
</tr>
<tr>
<td>Undetermined macropodidae</td>
<td></td>
<td>- - 2 -</td>
<td>2</td>
</tr>
<tr>
<td><em>Isoodon obesulus</em></td>
<td>short-nosed bandicoot</td>
<td>- - 1 1 -</td>
<td>2</td>
</tr>
<tr>
<td><em>Chaeropus ecaudatus</em></td>
<td>pig-footed bandicoot</td>
<td>- - 1(?) -</td>
<td>1(?)</td>
</tr>
<tr>
<td><em>Dasyurus geoffroii or viverrinus</em></td>
<td>native-cat</td>
<td>- - - 1</td>
<td>1</td>
</tr>
<tr>
<td><em>Dasyurus cristicauda</em></td>
<td>crest-tailed marsupial mouse</td>
<td>- - - 1</td>
<td>1</td>
</tr>
<tr>
<td>Rattus sp.</td>
<td>bush-rat</td>
<td>- 1 2 2 2</td>
<td>7</td>
</tr>
<tr>
<td><em>Leporillus conditor</em></td>
<td>stick-nest rat</td>
<td>1 1 1 1 1</td>
<td>5</td>
</tr>
<tr>
<td>Notomys sp.</td>
<td>hopping-mouse</td>
<td>- 1 - - -</td>
<td>1</td>
</tr>
<tr>
<td>Notomys or Pseudomys sp.</td>
<td></td>
<td>- - 1 1 -</td>
<td>2</td>
</tr>
<tr>
<td><em>Canis familiaris</em></td>
<td>dingo</td>
<td>- - 1 - -</td>
<td>1</td>
</tr>
<tr>
<td>Ovis</td>
<td>sheep</td>
<td>- - - 1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>2 7 11 9 12</td>
<td>41</td>
</tr>
</tbody>
</table>
which was excavated and that the total number of animals in
the site would be about 100 times greater than this.

Bush and stick-nest rats form the other main
mammalian category, all other animals being present in very
small numbers. Bone was well preserved, especially of the
smaller animals, and there was no evidence at the site that
the large numbers of kangaroos was only an apparent predomi-
nance caused by the differential preservation of bone.

Tables 6.19 and 6.20 show the other faunal remains
recovered. Of these, the lizard, particularly the stump-
tailed skink is the most numerous\(^1\). The agamid species is
probably *Amphibolurus barbatus*, the common bearded dragon
(D. Horton pers.comm.). Both the stump-tail and the bearded
dragon are common in western New South Wales (Worrell 1963:64-7).

Most of the emu egg came from trench 1/3 and this
suggests that there is some spatial variability of food remains
on the site. However, emu egg is the only food remains varying
in this way. In terms of volume of deposit excavated the
number of lizards and mammals from trench 1/3 is of approxi-
mately the same magnitude as that recovered from trench 1/1-2.
The presence of sheep bones and glass at the base of trench 1/3
means that these remains were laid down at the same times as
those from unit 1 of the main trench.

From tables 6.17 - 6.19 it can be seen that little
bone was preserved in unit 4. As, however, individuals of
the commonest animals on the site, the red kangaroo, the stick-
nest rat and both species of lizard were recovered from unit 4
it is reasonable to conclude that there was little faunal
change from the bottom to the top. There is certainly no
change from unit 3 time onwards suggesting that the same type
of diet was eaten by the Aborigines at Burke's Cave for at
least two thousand years.

All of the bone at the site was examined in Canberra
and no bone implements were found. At the Menindee site, 40
miles away, over 20 bone points were recovered (Tindale 1955:
285) and this fact may indicate some functional differences

\(^1\)The lizard remains were identified by David Horton, Department
of Zoology, University of New England.
between the Menindee and Burke's Cave sites. The bone points at Menindee are possibly much older than any of the Burke's Cave material. They may have been parts of fishing spears.

(b) plant remains

No plant remains, other than charcoal, were found. Had it been possible to process the soil matrix using a water flotation technique I am sure that some could have been recovered. Some or all of the grinding and pounding stones could have been used to prepare cereals and other vegetable foods for eating and cooking. When Herman Beckler and Ludwig Becker visited Burke's Cave in November 1860 they found many of the plants in flower, in particular the wattles (Beckler, letter Nov.13 1860). Beckler made a collection of about fifty plants from the immediate vicinity of the glen near Burke's Cave (Willis 1962:446-68). The list is shown below.

While there is no specific evidence that any of these plants were eaten by the Aboriginal inhabitants of Burke's Cave, their presence in close proximity to the site makes it likely that they were.

(c) discussion of the faunal remains

The Burke's Cave fauna consists almost entirely of species observed in western New South Wales at the time of early European settlement (Krefft 1866a, Marlow 1958, Wakefield 1966b). With the exception of *Dasy cercus cristicauda*, the crest-tailed marsupial mouse\(^1\), all were also recorded as having been eaten by the Aborigines in the Darling Basin (see Appendix I:12-21).

All of the Burke's Cave fauna could have been obtained by the Aborigines from within a radius of a mile or so from the

\(^1\) *D.cristicauda* has not previously been recorded in recent deposits in New South Wales (J.Calaby pers.comm.). However, as the skeletal remains of an apparently recently dead crest-tailed mouse were also recovered near the Mungo I site, it probably was widespread at the time of white settlement. It was possibly a chance omission from the inadequate faunal records from the western half of the state (Marlow 1958).
Table 6.21  Burke's Cave: food plants collected by Beckler at Burke's Cave and in its environs

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Part eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>PITTOSPORACEAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Pittosporum phillyreoides</em></td>
<td>-</td>
<td>seeds, gum</td>
</tr>
<tr>
<td>PORTULACACEAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Calandrinia volubilis</em></td>
<td>-</td>
<td>leaves, stems, flowers</td>
</tr>
<tr>
<td>MALVACEAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Hibiscus brachysiphonius</em></td>
<td>-</td>
<td>roots</td>
</tr>
<tr>
<td>LEGUMINOSAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Acacia tetragonophylla</em></td>
<td>-</td>
<td>seeds</td>
</tr>
<tr>
<td>SOLANACEAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Solanum esuriale</em></td>
<td>tomato plant</td>
<td>fruit</td>
</tr>
<tr>
<td><em>Solanum ellipticum</em></td>
<td>wild gooseberry</td>
<td>fruit</td>
</tr>
<tr>
<td>MYOPORACEAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Myoporum montanum</em></td>
<td>native myrtle</td>
<td>fruit</td>
</tr>
<tr>
<td><em>Myoporum platycarpum</em></td>
<td>sugar-wood</td>
<td>exudations</td>
</tr>
<tr>
<td><em>Emersophila longifolia</em></td>
<td>emu bush</td>
<td>fruit</td>
</tr>
<tr>
<td>CHENOPODIACEAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Enchylaena tomentosa</em></td>
<td>ruby saltbush</td>
<td>fruit, seeds</td>
</tr>
<tr>
<td>LORANTHACEAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Amyema quandang</em></td>
<td>grey mistletoe</td>
<td>fruit</td>
</tr>
<tr>
<td>SANTALACEAE</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Santalum lanceolatum</em></td>
<td>plum bush</td>
<td>fruit</td>
</tr>
</tbody>
</table>

1 Collected at Bilpa in the northern Scrope's Ranges
waterhole and most from an even smaller area. The wallaroo, the dingo and the rats (probably R. villoisissimus or R. tunneyi, see Appendix 2), are the only species known to generally inhabit the rocky ridges west of the Darling. Most of the other species inhabit open plains rather than rocky areas. They could have been caught at the waterhole (see plate 6.1c), in the small Burke's Cave fault valley near the site (see figure 6.2) or on the adjacent plains. Grey kangaroos can today often be seen eating salt-bush in the valley and the remains of bettong burrows have been identified on sandhills within a mile of the site (J. Caskey pers. comm.). Frith and Calaby (1969:92-3) described red kangaroos moving up to fifty miles from the Darling River to reach pastures on the hilltops and slopes after rain. Burke's Cave is only 20 miles from the Darling and their presence at the site in relatively high numbers may be prehistoric evidence of this movement. On the other hand, both the grey and red kangaroos and the smaller wallabies may have been semi-permanent residents of the nearby open plains making regular use of the waterhole. It was the permanent spring and deep waterhole at Burke's Cave which formed the focus of utilization of the site by both animals and Aborigines and later by the European stage-coach company.

The potential contribution of the red and grey kangaroos and wallaroos to the diet of the Aborigines was even greater than the bone remains suggest. As well as being the most numerous of all mammals on the site, the kangaroos weigh much more than any of the other animals as can be seen from table 6.22.

Using the information in table 6.22, which is all that is available, I have attempted to calculate the total live weight of the animals recovered from the excavation for three categories, large kangaroos, small mammals and lizards. This is shown on table 6.23.
Table 6.22: Mean weights and heights of some Australian mammals.

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Height(^1)</th>
<th>Weight(^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Macropus giganteus</em></td>
<td>grey kangaroo</td>
<td>150 cm</td>
<td>36 ± 13 kg (N=10)</td>
</tr>
<tr>
<td><em>Macropus robustus</em></td>
<td>wallaroo</td>
<td>150 cm</td>
<td>38 ± 10 kg (N=4)</td>
</tr>
<tr>
<td><em>Macropus rufus</em></td>
<td>red kangaroo</td>
<td>170 cm</td>
<td>55 ± 22 kg (N=2)</td>
</tr>
<tr>
<td><em>Orychogalea fraenata</em></td>
<td>nail-tailed wallaby</td>
<td>55 cms</td>
<td>-</td>
</tr>
<tr>
<td><em>Lagorchestes conspicillatus</em></td>
<td>hare-wallaby</td>
<td>-</td>
<td>3 ± 0 kg (N=2)</td>
</tr>
<tr>
<td><em>L. leporides</em></td>
<td>hare-wallaby</td>
<td>50 cms</td>
<td>-</td>
</tr>
<tr>
<td><em>Caloprymnus campestris</em></td>
<td>plains rat-kangaroo</td>
<td>45 cms</td>
<td>-</td>
</tr>
<tr>
<td><em>Bettongia penicillata</em></td>
<td>brush-tailed rat kangaroo</td>
<td>35 cms</td>
<td>-</td>
</tr>
<tr>
<td><em>B. lesueur</em></td>
<td>burrowing rat-kangaroo</td>
<td>-</td>
<td>840 ± 70 gms (N=2)</td>
</tr>
<tr>
<td><em>Trichosurus vulpecula</em></td>
<td>brush-tailed possum</td>
<td>45 cms</td>
<td>2.4 ± 1.2 kg (N=10)</td>
</tr>
<tr>
<td><em>Lasiorhinus latifrons</em></td>
<td>hairy-nosed wombat</td>
<td>100 cms</td>
<td>26 ± 1 kg (N=2)</td>
</tr>
<tr>
<td><em>Isoodon obesulus</em></td>
<td>short-nosed bandicoot</td>
<td>35 cms</td>
<td>1.3 ± 1 kg (N=3)</td>
</tr>
<tr>
<td><em>Perameles bougainville</em></td>
<td>barred bandicoot</td>
<td>40 cms</td>
<td>-</td>
</tr>
<tr>
<td><em>Chaeropus adustus</em></td>
<td>pig-footed bandicoot</td>
<td>30 cms</td>
<td>-</td>
</tr>
<tr>
<td><em>Macrotis lagotis</em></td>
<td>rabbit-eared bandicoot</td>
<td>45 cms</td>
<td>1.3 ± 0.4 kg (N=4)</td>
</tr>
<tr>
<td><em>Dasyurus maculatus</em></td>
<td>tiger cat</td>
<td>60 cms</td>
<td>2.2 ± 0.6 kg (N=3)</td>
</tr>
<tr>
<td><em>D. viverrinus</em></td>
<td>eastern native-cat</td>
<td>40 cms</td>
<td>1.1 ± 0.3 kg (N=3)</td>
</tr>
<tr>
<td><em>D. geoffroii</em></td>
<td>western native-cat</td>
<td>40 cms</td>
<td>550 gms (N=1)</td>
</tr>
<tr>
<td><em>Sarcophilus harrisii</em></td>
<td>Tasmanian devil</td>
<td>70 cms</td>
<td>6 ± 2 kg (N=2)</td>
</tr>
<tr>
<td><em>Dasyurus cristicauda</em></td>
<td>crest-tailed mouse</td>
<td>15 cms</td>
<td>106 ± 46 gms (N=4)</td>
</tr>
<tr>
<td><em>Thylacinus cynocephalus</em></td>
<td>Tasmanian tiger</td>
<td>110 cms</td>
<td>-</td>
</tr>
<tr>
<td><em>Rattus lutreolus</em></td>
<td>eastern swamp-rat</td>
<td>-</td>
<td>165 ± 26 gms (N=4)</td>
</tr>
<tr>
<td><em>R. villosissimus</em></td>
<td>long-haired rat</td>
<td>-</td>
<td>180 ± 5 gms (N=2)</td>
</tr>
<tr>
<td><em>Caniis familiaris</em></td>
<td>dingo</td>
<td>-</td>
<td>15 ± 1 kg (N=2)</td>
</tr>
</tbody>
</table>

\(^1\) From Marlow 1962 (height = length of head and body)
\(^2\) From Finlayson 1947 (only data for adults and subadults has been included)
Table 6.23  Burke's Cave: Estimated total live weights of large kangaroos, small mammals and lizards

<table>
<thead>
<tr>
<th>Category</th>
<th>No.</th>
<th>Estimated total weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large kangaroos</td>
<td>13</td>
<td>300 - 700</td>
</tr>
<tr>
<td>Small mammals(^1)</td>
<td>27</td>
<td>70 - 80</td>
</tr>
<tr>
<td>Lizards(^2)</td>
<td>25</td>
<td>c.22</td>
</tr>
</tbody>
</table>

Table 6.23 shows that the contribution of the large kangaroos is three to five times that of the other two combined. While the table is possibly inaccurate it does adequately show the relative contributions of the food categories.

I have not attempted to calculate the proportion of edible meat available from these animals as there is no information for the smaller mammals or the lizards. Gould (1967:59) states that 50 percent of the total body weight of a large kangaroo consists of edible meat. This, however, assumes complete butchering and no loss of meat through spoilage, a questionable assumption given the descriptions of Aboriginal butchering techniques and lack of storage facilities in places like Arnhem Land (see McCarthy and McCarthur 1960).

It is interesting that kangaroos should have been the most numerous mammals at Burke's Cave as they are thought to have been less common in the period preceding European settlement than at present (Frith and Calaby 1969:156, Calaby 1971:24). Mitchell (1839 Vol.II:308), Sturt (1849 Vol.II:140) and Krefert (Ms. 1856-7) noted that large kangaroos were uncommon in western New South Wales. Although Wright (1862:508) found that wanguroos (probably wallaroos, *M. robustus*) were fairly numerous in the small caverns at Burke's Cave, the red and the grey kangaroo were scarce. Frith and Calaby (1969:92-3)

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\(^1\)The dingo was included in the small mammals category. The sheep recovered in trench 1/3 was not included in these calculations.

\(^2\)Both the lizards, *Tiliguana* and *Amphibolurus*, have an average length of 45-60 cms (Bustard 1970:94 and 116). The stump-tail can weigh as much as 1kg. but the Dragon lizard weighs much less (A. Thorne pers.comm.).
concluded that 'the stony hillsides which...are already occupied by euros (M. robustus) are usually barren and bare and support very few kangaroos'.

The best way to explain the abundance of all three species of large kangaroo at the site is to assume that the Aborigines made concentrated efforts to capture them and that the smaller species were caught incidentally to the main task of catching kangaroos. Aborigines using specialized techniques to capture wallabies were observed in the hilly country near Momba station about 100 miles to the north of Burke's Cave by Bonney (Ms. c.1881)

'Rock wallaby (wongooroo) are caught on the rocky ridges in nets placed across the ridge. The hunters beginning at one end of the ridge drive the wallaby by shouts and noises to where the net is placed, often those that go under boulders and rocks can be hurled out as the holes are generally not deep. The wallaby run at the net formed as a snare and are there killed by the blacks chasing them. After beating one length the net is moved further down the ridge and another length is beaten and so on till the end is reached. The meat is considered very good meat and the fur is valued for making rugs'.

The grey and the red kangaroos may have been taken on the adjacent plains with either spears or nets but given the presence at Burke's Cave of a narrow valley leading to a waterhole it would seem most likely that they were ambushed there as they went for water. Gould (1967:42 and 1968a:108, 112) has documented similar activities in the western desert. He stated (1967:42)

'Waterholes situated in natural defiles were (and still are) popular places to wait for game, for they offered concealment for the hunter and restricted the movement of the quarry. If no natural concealment were available, the hunters constructed circular blinds of brush or piled stones'.

The use of waterholes in hunting red kangaroos by the Aborigines of the Darling Basin was described by Bonney (Ms. c.1881). He stated

'When in time of drought there are few watering places for them, they are caught at the waterholes nets of a large mesh being placed at a small angle to the water and at some distance from it so that when the kangaroo comes to drink and gets inside the net it is driven to the water by missiles sent at them by the natives. They take to the water where they are easily killed. Another mode of catching them at waterholes is this. A waterhole is fenced round with brush but a race leads down to the water from an opening in the fence and at the end of the race a noose is fixed and hidden, the boughs arranged round it. The animal coming to drink goes over the race and when moving forward towards the water with its head through the noose draws it together round its neck or body and is thus held securely'.

The Burke's Cave site thus appears to have been a specialized site for the hunting of large kangaroos, probably with nets. In a real sense it was a 'big game' site.

Such archaeological sites have proved to be uncommon in Australia. In the great majority of sites excavated thus far, the principal mammalian remains have consisted of medium to small mammals. Few large mammals, particularly large kangaroos have been found in them. This is true of the Devil's Lair site in Western Australia (Dortch and Merrilees 1971:107), of Devon Downs (Hale and Tindale 1930:177-214) and Fromm's Landing (Wakefield in Mulvaney et al., 1964:494-8) on the Murray River in South Australia, of the Tasmanian coastal sites, Little Swanport (Lourandos 1970:41-2) and Rocky Cape (Jones 1971:536-44), of Burrill Lake, Currarong (Lampert 1971: 11-12 and 56-8), Bass Point (Bowdler 1970:91-6) and Seelands (Wakefield in McBryde n.d.:372-3) in New South Wales as well as of the Arnhem Land sites, Padypadiy, Melangangerr, Nawamoyn, and Tyimede (White C. 1967b:69-72, 155, 214, 261-2 and 389).
Only two sites had large kangaroos as their principal species. These were Puntutjarpa in the Western Desert (Tedford in Gould 1968b:185) and Crown Lagoon in eastern Tasmania (Lourandos 1970:66).

'The Puntutjarpa site 'served until recently as a hunting-trap. From time to time, groups of men would burn the brush along the south side of the range, chasing kangaroos and wallabies over the 26-foot high escarpment, where other men would be waiting below with spears and club to finish them off. Game killed at the site was cooked in earth-ovens on the sandy slope below' (Gould 1968b:163).

At Crown Lagoon, the only faunal material recovered consisted of molar fragments of teeth of the grey kangaroo, M.giganteus (Lourandos 1970:66, table 5.1). Lourandos (1968:42) interpreted the site as a specialized 'inland camp' one that was complementary to 'coastal shell midden' sites where terrestrial animals were poorly represented. He concluded (1970:23-4) that the Aboriginal population of Eastern Tasmania was mobile and utilized coastal and hinterland sites at different times. However, though there are suggestions in the literature that the inland sites were occupied during summer and the coastal sites in the winter, Hiatt (1966-7:123) found that there was no positive evidence that coastal foods were exploited for only part of the year. Consequently, we must assume that the occupation of coastal or inland sites in Tasmania was not strictly seasonal.

I will discuss the possibility of seasonal utilization of the Burke's Cave site in the next section.

The other smaller animals could have been caught by Aborigines moving around the general Burke's Cave locality. The dingo, hare-wallaby and nail-tailed wallaby are likely to have been startled from their daytime resting places by noise or movement. Alternatively all could have been taken at the waterhole (Appendix I:13, 21). The bettongs, the crest-tailed marsupial mouse and the hopping mice probably were dug out of their burrows in the ground (Appendix I:14, 19-20) and the rats, stick-nest rats, the pig-footed bandicoot and the native cat found in their nests (Appendix I:16-17, 19-21). Both species
of lizards can be seen today in the warmer months basking in the sun or on the rocks near the site.

6.11 **Human activities at the site**

From information in Chapter 3 section 3.2(f), I concluded that there were significant variations in the size of the Aboriginal population along the Darling River. The ethnography available for the west Darling area, summarised in Chapter 3 section 3.5(b), supported Sturt's (1849 Vol.II: 108-9) conclusion that the Aboriginal population in these ranges, for up to 100 miles away from the river, increased and decreased with fluctuations in water levels in the Darling. This conclusion was based on observations of Aboriginal movements made near the Scrope's Ranges.

Browne, Sturt's surgeon, saw residents from the hills going down to visit the river. As the party first headed up towards the foothills of the Barrier Ranges, Browne noted (Ms.1845-6)

'just then [Oct] was the season of flood in the Darling when the natives from both sides collect on its banks and numerous lagoons to fish and catch ducks etc., in fact this was their harvest and general yearly meeting. We met several small parties all going down to the river from their own barren hills' (Browne Ms.1845).

Prior to this incident, Sturt had observed another Aboriginal in the Scrope's Ranges digging for tolperos [*Macrotis lagotis*] and this man was very pleased to hear that the river was in flood. Sturt left little doubt that this man was about to leave the Scrope's Ranges and go down to the river.

The Aborigines at Menindee were familiar with much of the area west and northwest of the river. Beckler was guided to Burke's Cave and Mootwingee and to the Bulloo overflow, 150 miles north of Menindee, by an Aborigine from Menindee (Beckler Ms.1861). Topar, another Menindee Aborigine, guided Sturt in 1844 almost to the South Australian border and was quite familiar with tracks and water holes in the Barrier Ranges, up to 90 miles west of the Darling River.
(Sturt 1849 Vol.I:136-163). When Eyre was at Menindee, the Aborigines described a 200 mile long track from waterhole to waterhole from Menindee to the Mount Lofty Ranges in South Australia by which, he stated, they frequently passed backwards and forwards 'though chiefly, I apprehend, in the winter season' (1845b:331). There was clearly a great deal of movement between the rocky upland areas and the river. This movement varied seasonally, being generally towards the river in summer and away from the river during winter.

While there was considerable social interaction between these areas there is ethnographic evidence to support the conclusion that there were groups of people who regarded the hills specifically as their 'homeland'. Sturt refers to 'hill people' inhabiting these ranges. On his return after spending over a year in the interior he was met by a group of 100 men and women and children in the hills 70 miles northwest of Menindee (Sturt 1849 Vol.II:111). When Sturt's party surprised three men who were strangers to his Menindee guides at a waterhole called Parnari in the Barrier Ranges, he noted that

'they were hill natives and shorter in stature than the river tribes' (Sturt 1849 Vol.I:166).

The map of Aboriginal tribal boundaries (figure 3.1) shows three different tribal groups in the west Darling area: the Bagundji along both sides of the Darling River; the Danggali inhabiting the country away from the river up to the foothills of the Barrier Range including the Scrope's Range; and the Bullali occupying the Barrier Range. These names designate the type of area inhabited by each group. Bagundji comes from barkka meaning river (Tuelon in Curr 1886 Vol.II:217); dangga means a hillside or slope (Howitt 1904:49); and Bullali comes from bola meaning a hill (Howitt 1904:49). The names of these groups were collected from Aboriginal informants by a number of independent ethnographers in the last century (see table 2.5), suggesting that there were three different Aboriginal groups inhabiting this part of the Darling Basin. However, the observed movements and interaction of the three groups argues against their being three different tribes.
The Burke's Cave site, therefore, was probably used both by the Aborigines in whose country it was located, who went down to the river for some part of most years, and also by river Aborigines visiting or travelling through the hill country.

There is positive archaeological evidence for seasonal utilisation of the site. The presence of emu egg shell indicates that the site was occupied during the winter to early spring period (Eastman 1969:23). This is also the time that the red kangaroos would have been most likely to leave the river flats and go onto the stony hillsides to graze the winter pasture (Frith and Calaby 1969:92). While both species of lizards hibernate during winter they are particularly common in the spring time and they could have been taken as they fed on the spring herbage (Bustard 1970:92-3, 117). Thus there is some positive evidence that the site was used in the winter and springtime. This would fit in with the ethnographically observed pattern of winter in the hills and summer on the river. The site was probably used all year round as a watering spot and in summer whenever the river failed to rise or when there was a serious drought.

It is only twenty-five miles over flat open plains from Burke's Cave to the Darling River. This distance is comparable to the distance observed travelled by Aboriginal groups making seasonal movements elsewhere in Australia. These were apparently short in Arnhem Land (White and Peterson 1969:54) but longer in Cape York (up to 50 miles) (Thomson 1939:209-21) and Central Australia (Meggitt 1962: Chapter 5). Jones (1972:12) estimated that Tasmanian Aborigines made seasonal movements of up to 100 miles.

Some functional information about the site can be obtained by dividing the stone tool assemblage into two groups, using a division suggested by Binford and Binford (1966:247-59). The first group of implements includes those used to manufacture artefacts from materials not made of stone for example, spears, digging sticks, nets, bark dishes, skin rugs etc., and also implements used to prepare food (plant or animal) for consumption at the site. These tasks are called 'maintenance tasks' (Binford and Binford 1966:259). The second group of
implements incorporates those used to directly kill and butcher animals away from the site and also those used to collect plant and other foods in preparation for bringing them back to the site. These are called 'extractive tasks' (Binford and Binford 1966:259). I have not tried to quantify these groupings as they are non-exclusive. Implements that would be listed under the heading of 'maintenance tasks' would include round edged scrapers, flake adzes, straight edged scrapers, notched scrapers, steep edged scrapers, horsehoeof cores, retouched flakes, utilised flakes, glass scrapers, grindstones and pounding stones. Implements involved in 'extractive tasks' comprise pirri points, backed flakes and utilised flakes.

Round and straight edged scrapers, flake adzes, notched scrapers, horsehoeof cores and steep edged scrapers are the most abundant implements on the site. These tools were observed in use as woodworking tools in some areas of Australia (see above sections 6.5 and 6.7b). Given the large number of these tools obtained from a small excavation, it is apparent that the intensive manufacture of wooden implements was a major activity at the site. The abundance of mulga trees on the ridges in the last century (see section 6.1) was a likely reason for the location of this industry at Burke's Cave. Mulga, Acacia aneura, has fine, close-grained wood and was used to make spears and boomerangs (Bonney Ms.c.1881).

The hunting of large game, the manufacture of wooden implements and the use of stone tools are all usually regarded as men's activities in Australia. One of Tindale's informants, Milerum, a man from the River Murray entrance in South Australia stated that

'the women of his tribe were forbidden to handle stone for cutting purposes. For such work they depended chiefly on the sharp edges of mussels and on knives made from solid Eucrassatella valves' (Tindale 1968:625).

Horne and Aiston (1924:105) report that 'practically all of the stone tools and weapons were made by the old men' and that 'the young men and the women looked after finding the food'. In
the Western Desert, Bindibu women use no stone implements apart from grinding and crushing stones (Thomson 1964:407).

The Burke's Cave site revealed little evidence of women's activities. It is true that some of these, such as the manufacture of baskets and hunting nets, would leave few recoverable remains. But there were very few grinding and crushing stones, implements used by women to prepare vegetable and animal foods (Peterson 1968:567-70). There were also comparatively few small animals - rats, bettongs, lizards, bandicoots and small wallabies. These are the kinds of foods that women collected on their beats. While men would collect any small animals they came across they rarely set out to systematically gather food of this nature (Hiatt B. 1967-8:217; 1971:2-8).

In summary, the Burke's Cave site appears to have been a base camp for a fairly permanent group which moved to the Darling River during periods of flood and may also have been occasionally visited by other groups. The presence of the ravine and waterhole, the rocky ridges and the mulga trees seem to have been the most important factors in locating the two major industries, kangaroo hunting and wooden implement making, at the site.
CHAPTER 7

OTHER WEST DARLING SITES

7.1 Rocky upland sites II: Mootwingee

Mootwingee is forty miles due north of Burke's Cave (see figure 6.1). Like Burke's Cave, it is in an area of rocky glens and its caverns have rock paintings, rock engravings and other traces of the former Aboriginal population. Mootwingee was visited by Giles and by the Burke and Wills expedition (Dow 1938:109). There was a waterhole there which was known to Bagundji speaking Aborigines resident at Menindee (Beckler 1861).

F.D. McCarthy and N.W.G. Macintosh visited the site in 1960 and 1961 to record the rock engravings and paintings. They also excavated four shallow rock shelters. A report was published the following year (McCarthy and Macintosh 1962).

One of the shelters excavated had a depth of deposit of 18 inches and 70 implements were found. Charcoal collected from a depth of 9 to 18 inches gave a C14 result of 1665 ± 80 B.P. or 1918 ± 250 B.P. (=Modern) (NSW-1, AIAS 1966: 24). Thus the material excavated is probably no older than a few hundred years. This would make it about as old as material in units 1 and 2 at Burke's Cave.

In the published report, McCarthy organised the stone material into three units depending on depth (1962:294-5). \( \chi^2 \) tests suggested that there was little statistical difference between the upper and lower layers on the site. The Mootwingee artefacts can probably be combined and treated as a single archaeological unit.

The artefactual material from Mootwingee is similar to that from Burke's Cave. McCarthy's 'oval crown and concave blocks' would be classified as steep edged scrapers in this study. Mootwingee provides independent evidence that steep edged scrapers, backed flakes, pirri points and flake adzes all continued to be used by Aboriginals in the Darling River Valley up until the time that the Europeans arrived. Pirri points were not reported in the 1962 publication but were later
mentioned by McCarthy as present on the site (McCarthy in Berndt and Berndt 1965:76).

Backed flakes made up 9 percent of all implements at Mootwingee and also 9 percent at Burke's Cave. However, a different picture emerged when flake adze slugs were examined. In the top level at Burke's Cave flake adze slugs made up 7 percent of all implements; at Mootwingee they made up 30 percent and $\chi^2$ testing revealed that the numbers in which they were represented at each site were significantly different. The ratio of flake adze slugs to all other scrapers$^1$ (excluding broken ones) was 2:3 at Mootwingee; in unit 2 Burke's Cave the ratio was 1:26 and in unit 1 it was 1:8.

As there were abundant raw materials available at Mootwingee (McCarthy and Macintosh 1962:294), the proportionately greater number of flake adze slugs at Mootwingee compared to Burke's Cave cannot be explained in terms of scarcity of raw materials.

Further, it seems unlikely that there could have been many cultural differences between the people who occupied Mootwingee and those who occupied Burke's Cave as they probably came from the same local group or a closely related one.

The most likely explanation is that certain purposes for which flake adzes were used intensively were carried out relatively more frequently at Mootwingee than at Burke's Cave.

7.2 Billabong and lacustrine sites 1: Lake Menindee

Although some work was done at the Lake Menindee site in 1939, it was not until 1953 that an intensive examination of the site was made. Reports on the archaeology of the site and on the extinct mammalian remains recovered were published in 1955 (Tindale 1955; Tedford 1955). A further detailed report on the fossil Macropodidae from the site was published in 1967 (Tedford 1967).

The Lake Menindee archaeological site consisted of a series of blowouts at the northern most end of Lake Menindee on the far northwestern end of the lunette fringing the lake

$^1$All other scrapers includes glass scrapers but not retouched and utilised flakes.
(see figure 6.1). Until 1948, when considerable work was done to divert water into these lakes to use them as storage basins, any high flood in the Darling River would fill all the lakes near Menindee and they would hold water for a number of years.

The material from the site, faunal or otherwise, came from the surface, most of it 'float'. Some pieces were found eroding out of one surface or another and these have been regarded as 'in situ' finds. The archaeological material was collected from four of the blow-outs and the implements were sorted into groups on the basis of the sediment on which each was found. Tindale identified 3 stratigraphic horizons at the site and he called the beds or layers O, A and B. Bed O was thought to represent the last of three episodes that had laid down each of the beds. Tedford carried out an analysis of these three beds and came to the conclusion that they represented 'the A and B zones of a single mallee soil profile upon which a thin younger profile bed developed' (Tedford 1967:17). Tedford only included 'material found in situ or float bearing concretionary encrustation of calcareous sand' (Tedford 1967:22) in his analysis of the fauna.

344 stone implements and twenty bone points were collected on the three beds, Tindale (1955:278) provided a table showing the percentage distribution of implement categories collected in the three groups. On the basis of these observed percentage distributions, Tindale divided the three implement collections from Menindee into the same named industries that he had isolated from the Murray Valley site of Devon Downs (Hale and Tindale 1930).

Implements from layer O, crescentic and triangular microliths, some discoidal microliths, and bondi points (Tindale 1955:279) were equated with the Mudukian industry. Those from layer A, pirri-form points, high core-like discoidal scrapers and a large number of the discoidal and other adze stones with prepared platforms were associated with the Pirrian industry. The oldest implements, those from layer B including large hand choppers, horsehoof implements, small cores in great numbers and adze flakes made on random flakes were said to have 'affinities with those called Tartangan on
the Murray River, although there are a few examples of karta-like implements' (Tindale 1955:285-91).

To test the differences between the implements in each of these groups I converted Tindale's percentage distribution table into a table showing the raw numbers for each implement category. To do this I made use of information that Tindale had included in the text of the report (Tindale 1955:277-9). Table 7.1 shows the estimates of these raw numbers. I then tested the differences between each of these groups of implements by doing $\chi^2$ tests on the numbers in each implement category. For these tests I combined some categories. The numbers of blades, microlithic crescents, microlithic discoidals, and bondi points were combined into a general backed flake (microlithic) category; irregular adzes, adzes on random flakes and adzes with prepared platforms were combined into an adze category; and finally, karta-like implements, horsehoof cores and large hand choppers were combined into a large core tool category.

$\chi^2$ testing between the numbers of each implement category or combined categories of implements found on or in bed B and those found on or in bed A revealed no significant differences. $\chi^2$ testing of the numbers of implements in bed A compared to number in bed 0 revealed significant differences in only one case. Of the total number of implements found on each of these beds, a greater proportion of microliths or backed flakes were found on bed 0 than on either of the other two. The bed 0 implements were collected from a more restricted area than were those from bed A or bed B (Tindale 1955:279) and this may mean that one area of the site was used for some specialised function of which the backed flakes are the tangible remains. This single statistical difference between beds 0, A and B is not sufficient to justify the description of the implements collected on these beds as the remains of three different industrial traditions.

Had Tindale used the same criteria as Tedford for dividing the implements into two collections: one a simple surface collection, the other a collection consisting of implements collected in situ or else possessing a coating of soil carbonate, there would have been fewer problems.
Table 7.1  Lake Menindee Site: artifact numbers

<table>
<thead>
<tr>
<th>Implement type</th>
<th>No. on or in Bed 0</th>
<th>No. on or in Bed A</th>
<th>No. on or in Bed B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blades</td>
<td>2</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>Microlith crescents</td>
<td>10</td>
<td>3</td>
<td>14</td>
</tr>
<tr>
<td>Microlith discoidals</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Bondi points</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Throwing balls</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cores (microlithic)</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Mill stones</td>
<td>6</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>Irregular adzes</td>
<td>3</td>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>Adzes on random flakes</td>
<td>6</td>
<td>15</td>
<td>53</td>
</tr>
<tr>
<td>Adzes, prepared platform</td>
<td>-</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>Scrapers, core like</td>
<td>1</td>
<td>17</td>
<td>39</td>
</tr>
<tr>
<td>Eloura implements</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>End scrapers</td>
<td>-</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Points, pirri-form</td>
<td>-</td>
<td>14</td>
<td>28</td>
</tr>
<tr>
<td>Kartza-like implements</td>
<td>-</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Horsehoof cores</td>
<td>-</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Large hand choppers</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Totals</td>
<td>33</td>
<td>80</td>
<td>231</td>
</tr>
</tbody>
</table>

1 Numbers estimated from figures provided by Tindale 1955, pp. 277-9
Unfortunately, more than 90 percent of the implements shown on Table 7.1 would have to be regarded as surface implements and only a possible pirri point, two unmodified flakes and about 12 of the 20 bone points could be placed into an 'in situ' collection.

Three C\textsuperscript{14} determinations have been published for material collected from bed B of the site. The oldest: LJ-204, 26,300 \pm 1500 B.P. dated 'charcoal from an apparent hearth associated with charred bone fragments and teeth of the giant kangaroo, Macropus ferragus' (Dury 1964:106). A second date from a different hearth at the top of bed B gave a result of 18,800 \pm 800 B.P., GAK-335 (Tindale 1964:24). The third determination, done on a shell sample from a food hearth from the top part of horizon B, gave a date of 6570 \pm 100, NZ-66 (Tindale 1957:36-7). This third date may be from intrusive material. The well defined concentration of calcium carbonate in bed B makes it likely that this bed may be as old as 18,000 years (a discussion of the age of soil carbonate accumulates appears in the next section of this chapter).

On the basis of the radiocarbon dates, it is possible to link the Menindee stratigraphy with dated stratigraphic sequences from lunettes in the Willandra lakes system described and discussed by Bowler (1970a; 1971). However, Bowler (1970a:149-52) has discussed these lunettes and those on the Menindee and Anabranch Lakes and has concluded that

'The sequence [on the Menindee Lakes], therefore, while bearing some resemblances cannot be directly correlated with the Willandra. The differences are probably due to local hydrologic factors, especially proximity to and frequent flooding by the Darling River'.

He goes on to discuss two sites, Nitchie and Menindee, and states

'The Menindee site is located in an identical situation with respect to the lake and lunette in a shallow deflation zone on the northwestern segment where the dune sequence is thin and difficult to interpret' (Bowler 1970a:152).
Aboriginal man has been present in areas adjacent to the Darling River for at least 30,000 years (see Barbetti and Allen 1972:in press) so there is little problem in accepting the proposition that he was at Menindee 26,000 years ago. Tindale discussed the provenience of the second $^{14}C$ date obtained from bed B at Menindee, GAK-335 $18,800 \pm 800$ B.P. in 1964. He stated then

'the date, 18,800 B.P., is based on charcoal from a fire hearth in Area II at the top of layer B...The hearth from which it came lies stratigraphically above a stone implement found in situ in layer B. This implement [was a] generalised flake type...[the charcoal sample] was sent as a check on a date $26,000 \pm 1400$ B.P. (LJ-104) [LJ-204?] for a Lake Menindee charcoal horizon in layer B, associated with some rather nondescript implement flakes' (Tindale 1964:24).

Tedford later added that the 26,300 B.P., date came from

'concentrations [that] presumably represent Aboriginal hearths, as one sample (LJ-204) contained the charred remains of the extinct kangaroo, Macropus ferragus' (1967:18).

The association, at Lake Menindee 26,000 years ago, of Aboriginal man and the extinct marsupial Macropus ferragus can be accepted on the basis of the evidence presented above. This evidence consisting of burnt bones of the animal, charcoal and flakes seems to be sufficient to justify this.

The fact that Aboriginal man was associated with one extinct species at Menindee, however, cannot be given as evidence that he was associated with all of the animals found on the site. The bulk of the animal remains were found in situ in bed B (Tedford 1955:302) but few stone artefacts were found in situ in this bed (Tindale 1955:284). 'Frequently [bone] materials in place consisted of whole or partial skeletons, more or less articulated' (Tedford 1955:302). The presence
of articulated bones argues against the animals having been
eaten by Aborigines. Bones on known Aboriginal camping sites
in the area are usually smashed into quite small pieces.
Apart from the *Macropus ferragus* remains, the other burnt bones
recovered were not found in association with any possible
hearthis. In addition, 'the bones, particularly of the larger
herbivores, often showed the effects of prolonged exposure
to the sun and air before burial in their broken and cracked
condition' (Tedford 1967:20) (my italics). Thus even the
'in situ' bones may have been present on the site for an
unknown time before bed B was laid down. Finally as yet no
full suite of extinct marsupials is known from contexts dated
to less than 30,000 years ago (Jones 1968:203; Merriees 1968:
7-18). For all of these reasons, it seems likely that most
of the animals found at Menindee were not in association with
Aboriginal man. This does not mean, however, that some of
the animals, in particular *Macropus ferragus* did not survive
long enough to be exploited by Aborigines. There is 'no
justification at present for assuming a sudden disappearance
of the extinct...species' (Merrilees 1968:19). Some of the
extinct species are known to have survived until more recently
than 30,000 years ago.

Merrilees discussed the survival of *Sthenurus brownei*
in Western Australia until late Quaternary time, (Merrilees
1968:18) and also evidence that *Protemnodon anak* survived until
about 8,000 years B.P. (Merrilees 1968:13, 17). A faunal
assemblage that contained quite large numbers of *Sthenurus
gilli* has been dated to 15,200 ± 320 B.P. (GAK-509) by Wake-
field (1967:376-81).

It is possible that *Macropus ferragus* also survived
after a number of other species of marsupials became extinct.
Later, it too became extinct. *Macropus ferragus* is a likely
candidate for survival. It is a fossil relative of the now
living *Macropus major* and shared many of its features (Tedford
1967:147). The limb bones of *Macropus ferragus* are about the
same size as those of the living red kangaroo, *Megaleia rufa*
(Tedford 1967:136) so its giantness is only relative.

Apart from some of the carbonate encrusted bone points,
the overwhelming bulk of the artefacts collected at Menindee
cannot reasonably be associated with either the 26,300 B.P. date or the 18,800 B.P. date of the extinct fauna. The Menindee stone assemblage is not like that reported from the 25,000 year old Mungo sites (see Jones and Allen in Bowler et al., 1970:47-52 for a discussion of the Mungo stone assemblage).

Rather the stone assemblage from Menindee looks like that excavated at Burke's Cave, only 25 miles northwest of Lake Menindee, most of which was less than 2000 years old.

Comparing the Burke's Cave and Menindee artefacts in detail it can be seen that the two collections are quite similar. Most of the Menindee adzes would be classified as round edged scrapers at Burke's Cave (see Tindale 1955:figs. 5-8). At both sites few adze slugs were recovered.

Tindale noted

'At Lake Menindee, with sources of stone probably only a few miles removed, partly used adze stones are much more abundant and few show the great reduction which comes with long use and continued resharpening' (Tindale 1955:282).

Both collections have horsehoof cores and steep edged scrapers (karta-like implements) in small numbers. $\chi^2$ testing showed significant differences in the numbers of backed flakes at Burke's Cave and Menindee. They form a greater proportion of the total stone at Menindee than at the other site. This may represent a functional difference between Menindee and Burke's Cave. Extractive tasks involving the use of spear points or barbs may have been more important at Menindee.

There is one other difference between the Menindee and Burke's Cave stone assemblages. Pirri points are common at Menindee but relatively rare at Burke's Cave. This may reflect the fact that Tindale's definition of a pirri point is very wide. Tindale has described pirris as 'ranging from forms entirely free of secondary working, to the most perfectly bilaterally trimmed examples' (1957:22). This definition would allow some pointed primary flakes to be classified as pirri points and some of the points illustrated in the Menindee report appear to be only primary flakes (see Tindale 1955:fig.7).
I have classified pirri points in the way outlined by Campbell (1960:510) and include only those with secondary work, so the differences in the numbers of pirri points may be more apparent than real. In conclusion, the fauna at Menindee appears to be as old as 25,000 years but there seems to be little reason to associate most of the stone implements with either the age or the fauna. The stone assemblage from Menindee is very similar to that recovered at Burke's Cave. The artefacts from Menindee are probably younger that 5000 years and may be much younger than that age. The division of the stone into three different collections seems to be unwarranted on the grounds that there is little statistical difference between the collections.

7.3 Billabong and lacustrine sites II: Lake Tandou

Lake Tandou is about 25 miles south of Lake Menindee. It is connected to the Darling River and received floodwaters from the river until 1952. A levee now prevents the lake basin from filling and Darling River floodwaters pass down Tandou Creek into the Darling Anabranche. There is a high sandy lunette along the eastern margin of the lake.

Three archaeological sites were found during an extensive survey of the southern end of the lunette (Tandou Lunette I-III and another site was found on Tandou Creek (Tandou Creek I), the creek that formerly supplied water to the lake.

(a) Tandou Lunette III

Site T.L.III was near the centre of the lunette and consisted of a small midden eroding out of the uppermost sedimentary layer on the site. The midden of Unionid shells (V. ambiguus) was surrounded by scattered bones, some burnt, and stone implements. In one part of the lunette blowout some fragments of human bones were found. This site (T.L.III) covered an area of about 4 acres (1.6 hectares).

The few implements collected from this site are listed in table 7.5. There is a possibility that the material is mixed as some implements and bones may have eroded down from
from the top of the lunette. Because of this possibility, no C\textsuperscript{14} date was obtained for the site. Unlike the Willandra Lakes, the Menindee and Anabranch Lakes still operate and a site with fish bones and mussel shells is not necessarily old. I have not measured the stone artefacts from the site.

The stratigraphy of the lunette at the site is similar to that discussed for the Mungo and Nitchie lunettes by Bowler (Bowler et al., 1970a:42-4); 1970b:105; Macintosh 1970:99-100). It consists of an upper zone of loose sands and of grey-yellow stratified sands showing little soil development, overlying sediments where marked pedogenesis has taken place. These lower sediments can be divided on the basis of colour into two facies, one brown and the lowest one visible, reddish brown.

A large suite of bones of fossil marsupials has been recovered from the Tandou lunette (Tedford 1964:3; Merrilees 1968:9, 1972 in press). Merrilees has collected some material, including human bones from the T.L.III site (D. Merrilees pers. comm.). The human bone which I collected from this site was examined by Mr. Alan Thorne\textsuperscript{1}. His report is included in Appendix 3.

The fauna from the site is shown on table 7.2. The wide variation in the sorts of animals on the site (table 7.2) makes it likely that most of them were brought there by the Aborigines. Wombats (Lasiorhinus sp.), and bettongs (B. lesueur) may have lived and died in burrows on the site.

A Tasmanian Devil, (Sarcophilus harrisii) was the only extinct marsupial found at T.L.III. These animals survived in the Murray Valley at least until about 3,500 years ago and possibly longer (Tindale 1930:187; 1957:36). They still exist in Tasmania. A necklace of pierced canine teeth of Sarcophilus was found associated with a human burial at nearby Lake Nitchie (Macintosh 1970:95-99). Macintosh, the excavator, estimated that between 46 and 70 animals would have had to have been killed to supply the 159 teeth in the necklace. Early observers saw Darling River Aborigines eating all of the species of

\textsuperscript{1}Research Fellow, Department of Prehistory, R.S.Pac.S., A.N.U.
animals listed in table 7.2 except the Tasmanian Devil (appendix I:1, 5, 7-8, 13-16, 19).

All of the species collected from T.L.III were also collected from Lake Tandou fossiliferous deposits by Merrilees (1972: in press). However, unlike Merrilees' collection, the giant extinct marsupials (see section 1.8) were completely absent from the T.L.III site. Merrilees, in a general description of the provenience of the bone material that he had collected, stated 'most of the fossils were on surfaces in the bottom lithified part of the earliest unit [of the dune], and nearly all the extinct forms were on or in such surfaces' (D. Merrilees pers. comm.). The material that I collected at T.L.III was between 10 and 30 feet above any lithified sands and I have assumed that it is substantially younger.

The small number of animals shown on table 7.2 and the presence of a tiny midden means that the site represents the remains of only a very short stay by the Aborigines.

The fauna was obtained from two main environments. From the lake came the swans, fish and fresh-water mussels; from the adjacent plains the emu, small wallabies, rat-kangaroos, bandicoots and rats. It is difficult to assess which of these two environments contributed the most resources to the diet of the Aborigines. From table 7.2 it seems likely that they were contributing equally. There is no information on plant foods but the presence of grinding and pounding stones (table 7.5) indicates that they were eaten at the site.

The presence of emu egg means that some Aborigines were there in the winter to spring period. The fish and the mussels were most likely collected during the spring to summer period (see chapter 3 section 3.2(e). Krefft (1866b:359 found that black swan Cygnus atratus was a principal food of the Aborigines at Kow Swamp during February and March. The other animals could have been collected at any time of the year.

(b) Tandou Lunette II

T.L.II consisted of no more than a heap of about 30 freshwater mussel shells (Vambiplus). It was recorded because it had the appearance of being a single meal eaten by
Table 7.2  Tandou Lunette III: estimated minimum numbers of animals

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Onychogalea fraenata</em></td>
<td>nail tailed wallaby</td>
<td>1</td>
</tr>
<tr>
<td><em>Lagorchestes</em> sp.</td>
<td>hare-wallaby</td>
<td>2</td>
</tr>
<tr>
<td><em>Bettongia lesueur</em></td>
<td>burrowing rat-kangaroo</td>
<td>4</td>
</tr>
<tr>
<td><em>Bettongia</em> sp.</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><em>Lasiorhinus</em> sp.</td>
<td>wombat</td>
<td>2</td>
</tr>
<tr>
<td><em>Isoodon obsesus</em></td>
<td>short-nosed bandicoot</td>
<td>1(?)</td>
</tr>
<tr>
<td><em>Perameles</em> of. <em>bougainville</em></td>
<td>barred bandicoot</td>
<td>1</td>
</tr>
<tr>
<td><em>Sarcophilus harristii</em></td>
<td>Tasmanian devil</td>
<td>1</td>
</tr>
<tr>
<td><em>Leporillus conditor</em></td>
<td>stick-nest rat</td>
<td>2</td>
</tr>
</tbody>
</table>

**BIRDS**

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Dromaius</em> novae-hollandiae</td>
<td>emu</td>
<td>1</td>
</tr>
<tr>
<td><em>Anatidae</em> of. <em>Cygnus</em> atratus</td>
<td>black swan</td>
<td>3</td>
</tr>
</tbody>
</table>

**EGG SHELL**

| Emu egg                      | (fragments)     | 1        |

**FISH**

| Plectroplites ambiguus (?)   | golden perch    | 1        |

**FRESH-WATER MUSSEL**

| Velesunio ambiguus           | (shell volume c. 6 cubic feet) | 1        |
one person who had gathered a few mussels from the lake and had then sat down by the lake shore and eaten them.

(c) **Tandou Lunette I.**

T.L.I is situated at the far southwestern end of the Lake Tandou lunette (figure 6.1). Numerous scattered human bones on the site are evidence of a large number of burials which have eroded out of place along the ridge of the lunette. Ten skeletons are still in situ. Some of the scattered bone was burnt. On the lakeside margin of the lunette were the remains of a cremation only just eroding out of some brown sands.

The Tandou lunette has been breached by Tandou Creek to the east and west of the site and some erosion has taken place on the southern edge. These events have complicated any interpretation of the lunette stratigraphy. A plan of T.L.I is shown on figure 7.1 and a plan of the cremation is shown on the same page (figure 7.2). Information obtained from 11 auger holes put down near the cremation allow some discussion of its stratigraphic position. The cremation lay in a brown, non-calcareous sand which was the uppermost sediment on the lunette. Beneath this was a light olive-grey horizon with some carbonate accumulation. These two sediments probably form two horizons of the same soil with the sand in which the cremation lay being a weakly eluviated horizon.

A number of flexed burials have been dug into the olive-grey carbonated sediment near the crest of the lunette. These burials may be younger than the cremation as they appear to have been dug into this carbonated layer after the site had been extensively eroded. The eroded remnants of these carbonate-rich sediments form two small ridges running east-west across the site. Only a small amount of the cremated bone was visible on the surface but there was sufficient to see that the bones are in rough anatomical position, the vertebra and ribs on the eastern side and long bones, legs and pelvis, on the western side. Scattered on the surface and directly associated with the bone shown in figure 7.2 were burnt cranial fragments and some burnt teeth indicating that some of the skull had eroded out and had been scattered. I excavated around the
Fig. 7.1: Tandou lunette I: site plan

Fig. 7.2: T.L.I: plan of cremation
in situ bone to the depth of a foot and then removed the cremated bone in blocks and brought them back to A.N.U. for examination. Bone extended 6-7 inches down into these blocks. Alan Thorne's report on this cremation appears in Appendix 3.

A $^{14}C$ determination made on some 'charred collagen' from some bone fragments from the southern part of the cremation gave a result of $12,530 \pm 1630 \pm 1350$ B.P., ANU-705. This date provides an age for the cremation and a minimum age for the final phase of lunette deposition on the southern end of Lake Tandou.

I excavated this cremation because of its similarity to the Mungo cremation, and because its stratigraphic position made it likely that it would be much younger than the Mungo remains. Thus it would extend knowledge of the geographical and chronological range of cremation as a method of disposing of the dead. Hiatt (1969:104-111) has summarised the evidence from archaeological and ethnographic sources for cremation as a method of disposing the dead in Tasmania and on mainland Australia. Burnt human remains have been reported from Chowilla and Lake Victoria in the Darling River Valley (Hiatt 1969:110) and from Lake Mungo in the Willandra Lakes system (Bowler et al., 1970:43-58). The Mungo remains are 26,000 years old (Bowler, Thorne and Polach 1972, in press). The date of the Tandou cremation provides evidence that cremation in the Darling River Valley was practised at least from 26,000 years ago to 12,000 years ago and probably much more recently than that.

15 stone implements including 6 broken pieces of grindstone were recovered from the same sediment in which the cremation was found. These implements were directly associated with the cremation and are, therefore, about 12,000 years old. A small heap of freshwater mussel shells was also found about 20 feet north of the cremation in the same sediment.

The grindstone fragments found 'in situ' all appear to have belonged to a single lower grindstone. Some of the pieces fit together. Their age, the same as that of the cremation, makes them the oldest grindstone fragments yet recovered in Australia. They are slightly older than a millstone from Kenniff Cave, reported by Mulvaney as being associated
with a $^{14}\text{C}$ date of 10,280 ± 180, GAK-646 (Mulvaney and Joyce 1965:table 3).

The number of artefacts in each category collected from the same sediment as the cremation is shown on table 7.5. Table 7.6 shows the measurements for the round edged scrapers, horsehoof cores and steep edged scrapers from this site combined with the measurements for the same implements from Tandou Creek I. Table 7.7 shows the results of 't' tests between the measurements of the implements from these two sites and those from Burke's Cave. The significance of these tests is discussed at the end of this chapter.

(d) **Tandou Creek I**

Tandou Creek supplies Lake Tandou with water. The creek is now artificially maintained as part of the Menindee Lakes Storage Scheme. Previously it would have been a quiet backwater or it may have dried up altogether whenever the Darling River was low.

T.C.I is an open midden site covering about a quarter of an acre of a terrace on the eastern bank of the creek. A line of drowned trees marked the water course prior to the damming of the creek. The creek would have been about 80 yards to the west of the site. It consists of scattered surface implements and mussel shells with some in situ hearths. The shell on the site was discovered on excavation to extend down to about six to seven inches beneath the surface. The features of the site are shown on figure 7.3.

From field observations at the site, I concluded that there had been more than one phase of occupation. The shells, some of the artefacts, and some burnt fragments of hearth or cooking stones were thickly coated with carbonate. Such a coating usually implies some antiquity. On the other hand,

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1A coating of soil carbonate can form on an implement quite quickly in some cases. However, in the Darling River Valley there is so little precipitation that movement of soil constituents, such as carbonate, takes a very long time. The Zanci unit, described by Bowler (1970:109), laid down between 15 and 17,000 years ago has had mild soil formation producing only 'weak colour differentiation and some carbonate segregation into soft nodules'. Implements in this Zanci unit only have a very thin coating of carbonate.
hearth at the southern end of the midden looked fresh and had been dug through the buried shell lens. Further, some bones recovered from near the centre of the site were identified by Mr. John Calaby\(^1\) as the remains of a horse.

The stone artefacts scattered on top of the midden appeared to be concentrated at opposite ends of the site. I divided the site into five areas (figure 7.3) and made separate surface collections from each area in order to test if there were concentrations on different parts of the site. A table showing the density of artefacts\(^2\) in each of these areas is shown below.

<table>
<thead>
<tr>
<th>Area</th>
<th>Density of artefacts per square foot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 artefact per 13 square feet</td>
</tr>
<tr>
<td>2</td>
<td>1 artefact per 20 square feet</td>
</tr>
<tr>
<td>3</td>
<td>1 artefact per 80 square feet</td>
</tr>
<tr>
<td>4</td>
<td>1 artefact per 40 square feet</td>
</tr>
<tr>
<td>5</td>
<td>1 artefact per 10 square feet</td>
</tr>
</tbody>
</table>

There are not many artefacts on the site. Area 5, the richest area is associated with a concentration of shells at the northern end of the site, areas 1 and 2, the next richest, are near the hearths at the southern end. These two concentrations of artefacts probably represent the different phases of occupation of the site.

\(^{14}\)C\(^{14}\) dating was used to determine the different times at which the site had been used. I excavated next to hearth IV and a diagrammatic section of this is shown on figure 7.4. From this figure it can be seen that the hearth was dug down through the shell midden and the shells form lenses around it. Two samples were taken for \(^{14}\)C\(^{14}\) dating and their location is shown on the section. Charcoal from the hearth (ANU-449) gave

\(^1\)Wildlife Research, CSIRO, Canberra, A.C.T.

\(^2\)The density of artefacts was obtained by dividing the number of artefacts by the number of square feet in the area collected over.
Fig. 7.3: Tandou Creek I: site plan

Fig. 7.4: Section through hearth 5
a $^{14}C$ determination of $105 \pm 65 = \text{Modern}$ whereas a $^{14}C$ determination of the shell sample taken only a few inches away (ANU-702) gave a result of $12,350 \pm 170$.

Because these two samples gave such different results I decided that I could not associate most of the artefacts collected from the site with the date of the midden so I decided to deal only with those artefacts that had some carbonate coating. With this carbonated collection were included a number of flakes recovered from four $4 \times 4$ feet trenches that were excavated down to the base of the midden. These artefacts are shown on table 7.5. The round edged scrapers, horsehoof cores and steep edged scrapers were measured and the measurements were combined with those obtained from the T.L.I.

The scattered fragments of an eroded human burial were also collected from the surface of the midden. These bone fragments were examined by Mr. Alan Thorne. They are coated with carbonate and the bones are probably 12,000 years old.

A striking feature of the surface collection from Tandou Creek I was the very high number of grindstones and percussion stones collected. There were 105 pieces of grindstone, mostly unbroken, and 8 hammer or anvil stones in the non-carbonated collection. This represented 25 percent of all artefacts collected including unmodified flakes. Grindstones and hammer stones made up more than 50 percent of the carbonated collection. The presence of carbonate encrusted grindstones, some bearing the characteristic fine and smooth surface associated with the wet grinding of grass and other seeds, is further evidence that the activity of collection and grinding seeds is at least 12,000 years old in western N.S.W.

Clearly, the collection and utilisation of plant foods was a very important activity at the site. No plant remains were recovered, but a list can be obtained from Beckler's collections made along the Darling from Pooncairie to Menindee and from around Lake Pammamaroo and Lake Cawndilla. These are the kinds of plants which could have been eaten on the site. Table 7.4 was extracted from a list of all of the plants collected by the Victorian Exploring Contingent from

The major shell species making up the midden was the freshwater mussel *Alathyria jacksoni*. This is a large species of mussel, growing to a length of 150 mm (McMichael and Hiscock 1958:412). The shells in the midden are up to 100 mm long. Some shells have a shell thickness of 15 mm. *A. jacksoni* is found all over the Murray-Darling River system (McMichael and Hiscock 1958:412). The shells of the river snail, *Notopala* sp., are also common in the midden. These shells are up to 25 mm high. A gastrolith\(^1\) of a freshwater crayfish was recovered from one of the excavated trenches. It probably came from a large yabbie, *Cherax destructor*.

Some of the features of the site invite a functional interpretation. Flaked stone implements are generally regarded as men’s implements (Tindale 1968:625) and there are few of these on the site. On the other hand, there are large numbers of women’s implements (Peterson 1968:567) such as grinding and pounding stones. Further the collection of shellfish and plant foods in the Darling River Valley (see Appendix I:1 and Chapter 3, section 3.2(d) have generally been recorded as activities performed by women.

Eyre, while living at Moorunde on the Murray River, downstream from its junction with the Darling noted that

> 'muscles of a very large kind are...got by diving. The women, whose duty it is to collect these, go into the water with small nets hung around their necks' (1845a Vol.II:267).

Eyre goes on to describe the collection of freshwater crayfish by either men or women but adds that the women would do it if the weather was cold (Eyre 1845a Vol.II:265-7).

There is no evidence on the site of activities usually performed solely by men such as fishing with spears or the hunting of large mammals. Apart from the presence of

\(^1\)Gastroliths are lens shaped concretions of calcium carbonate, [which] develop between the old and new stomadael linings as calcium is reabsorbed from the cuticle during the moultng (Lockwood 1968:72).
Table 7.4 Edible plants collected by Beckler from the Menindee region in 1861

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Part eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CRUCIFERAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blennodia eremigena</td>
<td>-</td>
<td>leaves, flowers, stems</td>
</tr>
<tr>
<td><strong>PORTULACACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calandrinia volubilis</td>
<td>-</td>
<td>leaves, flowers, stems</td>
</tr>
<tr>
<td><strong>LEGUMINOSAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acacia victoriae</td>
<td>elegant acacia</td>
<td>seeds</td>
</tr>
<tr>
<td>Trigonella sauvissima</td>
<td>trefoil</td>
<td>leaves</td>
</tr>
<tr>
<td><strong>MYRTACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eucalyptus caerululensis</td>
<td>red gum</td>
<td>nectar, flowers</td>
</tr>
<tr>
<td><strong>COMPOSITAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picris hieracioides</td>
<td>-</td>
<td>roots</td>
</tr>
<tr>
<td><strong>CONVOLVULACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convolvulus erubescens</td>
<td>-</td>
<td>leaves, stems, shoots</td>
</tr>
<tr>
<td><strong>SOLANACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solanum esuriale</td>
<td>tomato plant</td>
<td>fruit</td>
</tr>
<tr>
<td><strong>MYOPORACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eremophila longifolia</td>
<td>emu bush</td>
<td>fruit</td>
</tr>
<tr>
<td><strong>AMARANTHACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alternanthera nodiflora</td>
<td>-</td>
<td>seeds</td>
</tr>
<tr>
<td><strong>CHENOPODIACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chenopodium nitriariaceum</td>
<td>-</td>
<td>seeds</td>
</tr>
<tr>
<td>Chenopodium atriplicinum</td>
<td>-</td>
<td>seeds</td>
</tr>
<tr>
<td>Salsola kali</td>
<td>rolly poly</td>
<td>seeds</td>
</tr>
<tr>
<td>Echynchaena tomentosa</td>
<td>ruby saltbush</td>
<td>seeds</td>
</tr>
<tr>
<td><strong>POLYGONACAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meuhlenbeckia cunninghamii</td>
<td>lignum</td>
<td>seeds</td>
</tr>
<tr>
<td><strong>PROTEACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grevillea striata</td>
<td>beefwood tree</td>
<td>seeds</td>
</tr>
<tr>
<td><strong>THYMELAEACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pimelea microcephala</td>
<td>-</td>
<td>fruit</td>
</tr>
<tr>
<td><strong>SANTALACEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Santalum acuminatum</td>
<td>quandong</td>
<td>fruit</td>
</tr>
<tr>
<td><strong>GRAMINEAE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tragia australiana</td>
<td>bur grass</td>
<td>seeds</td>
</tr>
<tr>
<td>Panicum effusum</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Eragrostie dieleii</td>
<td>mulka grass</td>
<td></td>
</tr>
</tbody>
</table>
crayfish, there is no other evidence of activities performed by both men and women, the collection of small mammals and reptiles or the obtaining of small mammals or fish with nets.

The carbonated hearth stones came from earth ovens. These ovens are at least as likely to have been used to cook vegetable foods such as leaves or rootstocks\(^1\) as to cook large mammals, especially as there are no large mammal bones associated with the shell midden. The site lacks much evidence that men performed many activities there at all. This is in contrast to the Burke's Cave site where men's activities apparently predominated.

Compared to the Tandou Lunette III site, only 8 miles north of this site and possibly about the same age, the Tandou Creek I site is extraordinarily specialised. The evidence is limited to shellfish, yabbies and plant foods. This could be explained in a number of ways. It may be the remains of a women's camp; it may have been a site used to collect seasonally available foods; or it may have been used when other food resources were unavailable.

There is very scanty evidence in the literature for the existence of women's camps. Tindale described one of Mulvaney's sites, Fromm's Landing No.6, as a 'women's camp' on the testimony of an aboriginal informant (Tindale 1968:625). But among the records of early contact Mitchell alone provides any evidence for their existence and this is by no means unequivocal.

'At this same encampment, we perceived smoke arising from the same native bivouac,...which I had visited before the party left Fort Bourke.[two months previously] From this smoke and other circumstances, it would appear that some of the tribes on the Darling River are not migratory, but remain in part at least, the gins and children possibly, at some particular portion of the river' (Mitchell 1839 Vol.I:293).

\(^1\)Krefft (1866b:361) provides a good description of the cooking of bulrush, *Typha muellerii*, in an earth oven.
This is only a speculation of Mitchell's. All his references to actual meetings with Aborigines mention parties of men and women. In one description of such a party he does say that 'the females and children were in huts at some distance from those of the men', but this is in the course of explaining that they were all sheltering from the rain: '...a great number sat huddled together and covered down under each gunya'. It is not clear how far away the women and children were from the men, nor whether they lived thus separately or simply happened to be in separate groups when they took shelter.

Although foraging groups composed entirely of either men or women were frequently seen by the early explorers in the Darling River Valley, the residential groups observed were always composed of both men and women. Encampments would probably have consisted of a number of separate camps\(^1\): one consisting of a number of separate family groups, a young men's camp, a visitors' camp, and a widows' camp\(^2\). All of these camps, however, would have been closely adjacent. Also, in this type of encampment the residents of the widows' camp would not live only on the food they themselves could gather but would also be given foods obtained by their male relatives. Taking account of the limited ethnographic evidence, therefore, I do not think that the site can be interpreted as a women's camp. Two other explanations are possible: the site may have been camped on in a time of drought, or it may have been a temporary seasonal camp.

All the food resources in this area are ephemeral. Droughts are common and have a disastrous effect on the animal and plant life. The river has been known to stop flowing and the lakes have dried up a number of times in this century.

---

\(^1\) See Howitt (1904:773-6) for a description of a *kurnai* [Victoria] encampment.

\(^2\) Meggitt (1962:278, 323) describes the residents of a widows' camp. It included recent widows, menstruating women and women in the latter stages of pregnancy.
Sturt, after experiencing a drought of 12 months duration in the interior returned to Menindee to find that

'the Darling at this time had ceased to flow, and formed a chain of ponds...The natives having cleared the river of the fish that had been brought down by the floods, now subsisted for the most part on herbs and roots of various kinds, and on the caterpillar of the gum-tree moth, which they procured out of the ground with their switches, having a hook at the end. I do not think they could procure animal food in the then state of the country, there being no ducks or kangaroos in the neighbourhood, in any great quantity at all events' (1849 Vol.II:117-8).

Mitchell noted a similar restriction of diet during a drought on the Lachlan River

'Dry and parched as the bed of the lake then was, the natives found nevertheless live freshwater mussels, by digging to a substratum of sand' (1839 Vol.II:66).

The shells and yabbies at T.C.I could represent the remains of meals gathered when no other foods were available. However, one would not expect to find so many grinding and pounding stones on a drought camp by a waterhole. Almost all the perennial seed plants, such as Acacia aneura, do not flower or fruit during a drought and the ephemerals would not come up at all. In a drought, the plant food content of the diet, except for things such as saltbush leaves, pigface leaves or Mallee roots, would fall off drastically. The presence of such a very large number of plant processing tools argues strongly against explaining the site as a drought camp.

On the other hand, it is likely that a diet of shellfish, crayfish and vegetable foods would, at certain seasons, provide a welcome break from animal foods. It has been reported that Aborigines in northern Australia become jaded with too monotonous a diet. They complained if they spent periods on either a largely meat or a largely vegetable diet (N. Peterson pers.comm.). The inhabitants of the Tandou
Creek may have simply come to the site for a few days, especially for the foods available there and then passed on to another site. Mitchell described an encampment of people on Lake Cargellico consisting of about a hundred men, women and children living mainly on the large freshwater mussel (Unio) at the time his party visited [April] (Mitchell 1839 Vol.II:33-5). The evidence for the seasonal variation in subsistence activities was presented in Chapter 3. Freshwater crayfish are a seasonal food since they hibernate in their burrows during the cooler months and are difficult to catch in winter. Although Mitchell describes women gathering shellfish in the Darling in August (Mitchell 1839 Vol.I:311), other authors (Beveridge 1883:49-50; Krefft Ms.1856-7:March) noted that the coldness of the water during winter discouraged this activity. The majority of references describe the collection of shellfish during the summer months. The grasses, portulac and nardoo (Marsilea drummondii), seed during the summer months so that the presence of grindstones supports the view that the site was probably a summer camp. However, the lack of much evidence of stone or wooden implement manufacture marks it as a camp that was not occupied for extended periods. I think it can be concluded that T.C.I was a temporary summer camp.

7.4 Comparison of stone implements from Tandou Creek I, Tandou Lunette I, and Burke's Cave

Two collections of stone implements from the Lake Tandou sites can be assumed to be approximately 12,000 years old. They are the 'in situ' collection recovered from within the same sediment as that in which the cremation from Tandou lunette I was found, and the carbonate encrusted collection from Tandou Creek I. These collections are shown on table 7.5. Both collections are small and probably unrepresentative of the entire stone industries at either site. Apart from broken scrapers, one retouched flake and two utilised flakes, the implement assemblages consisted only of round edged scrapers, horsehoof cores and steep edged scrapers. These were all in small numbers. Because these assemblages were almost the same age and came from sites close to one another, I combined
them to form a single collection for comparisons with Burke's Cave. The results of the measurements of the characteristics of round edged scrapers, horsehoof cores, and steep edged scrapers are shown on table 7.6.

Beneath this table are shown the results of 't' tests comparing the characteristics of the scraper categories from the Lake Tandou sites with the characteristics of the same categories from Burke's Cave (table 7.7).

Round edged scrapers from the Lake Tandou sites and Burke's Cave were about the same size in every characteristic.

A different picture emerged when the Tandou lunette horsehoof cores and steep edged scrapers were compared with those from Burke's Cave. The horsehoof cores and steep edged scrapers from Lake Tandou are significantly larger than those from Burke's Cave. The differences occur in every primary characteristic: length, breadth, thickness, weight and length of retouch. In all these characteristics the Tandou implements are very much bigger.

On the other hand, there were no significant differences between Burke's Cave horsehoof cores and the Lake Tandou horsehoof cores or between Burke's Cave steep edged scrapers and the Lake Tandou steep edged scrapers in those characteristics which defined

i) the shape of the implements such as breadth/length index thickness/breadth index or thickness/length index or

ii) the nature of the working edge, percentage of retouch and retouch angle.

It is noteworthy that there were no differences between the retouch angles of the horsehoof cores from the two sites or between the retouch angles of the steep edged scrapers despite the fact that there were significant differences in the thickness of the implements. The positive correlation between thickness and retouch angle noted previously (see Chapter 6 section 6.7(c)iii)) may only occur when different implement categories are compared. There does not seem to be any correlation when comparisons of the same category between sites are made. However, the significant differences
Table 7.5  Lake Tandou Sites: artifact now.

<table>
<thead>
<tr>
<th>Site</th>
<th>Round edged scrapers</th>
<th>Flake adzes</th>
<th>Straight edged scrapers</th>
<th>Notched scrapers</th>
<th>Horsehoe cores</th>
<th>Steepe edged scrapers</th>
<th>Broken scrapers</th>
<th>Retouched flakes</th>
<th>Utilised flakes</th>
<th>Rejuvenation flakes</th>
<th>Unmodified flakes</th>
<th>Unmodified cores</th>
<th>Grindstone pieces</th>
<th>Hammer or anvil stones</th>
<th>Ochre</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tandou Lunette II</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td>44</td>
<td>7</td>
<td>2</td>
<td>3</td>
<td></td>
<td>91</td>
</tr>
<tr>
<td>Tandou Lunette I ('in situ')</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Tandou Creek.1 ('carbonated')</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>11</td>
<td>2</td>
<td>12</td>
<td>8</td>
<td>2</td>
<td>44</td>
</tr>
</tbody>
</table>

Table 7.6  Tandou Lunette I and Tandou Creek I: mean and standard deviations for scraper characteristics

<table>
<thead>
<tr>
<th>Implement type</th>
<th>Maximum length</th>
<th>Maximum breadth</th>
<th>Thickness</th>
<th>Weight gms</th>
<th>Breadth/length index</th>
<th>Thickness/length index</th>
<th>Thickness/length index</th>
<th>Length of retouch</th>
<th>% of retouch</th>
<th>Retouch angle</th>
<th>Retouch retreat A</th>
<th>Retouch retreat B</th>
<th>Retouch retreat C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round edged scraper</td>
<td>N</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Horseshoe cores</td>
<td>N</td>
<td>15 ± 2</td>
<td>11 ± 3</td>
<td>76 ± 3</td>
<td>67 ± 7</td>
<td>51 ± 7</td>
<td>29 ± 5</td>
<td>33 ± 7</td>
<td>87 ± 6</td>
<td>11.5 ± 1.6</td>
<td>4.1 ± 0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steepe edged scrapers</td>
<td>N</td>
<td>91 ± 33</td>
<td>86 ± 30</td>
<td>44 ± 19</td>
<td>563 ± 472</td>
<td>95 ± 2</td>
<td>50 ± 5</td>
<td>47 ± 4</td>
<td>120 ± 80</td>
<td>37 ± 17</td>
<td>85 ± 4</td>
<td>25.8 ± 12.2</td>
<td>9.5 ± 4.5</td>
</tr>
</tbody>
</table>

Table 7.7  Results of 't' tests comparing implements from the Lake Tandou sites and Burke's Cave

<table>
<thead>
<tr>
<th>CHARACTERISTICS COMPARED</th>
<th>DF</th>
<th>Maximum length</th>
<th>Maximum breadth</th>
<th>Thickness</th>
<th>Weight gms</th>
<th>Breadth/length index</th>
<th>Thickness/length index</th>
<th>Length of retouch</th>
<th>% of retouch</th>
<th>Retouch angle A</th>
<th>Retouch retreat A</th>
<th>Retouch retreat B</th>
<th>Retouch retreat C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burke's Cave and Lake Tandou round edged scrapers</td>
<td>212</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
</tr>
<tr>
<td>Burke's Cave and Lake Tandou horseshoe cores</td>
<td>19</td>
<td>5.35</td>
<td>4.91</td>
<td>7.05</td>
<td>9.29</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>3.22</td>
<td>nsc</td>
<td>2.9410</td>
<td>4.13</td>
<td></td>
</tr>
<tr>
<td>Burke's Cave and Lake Tandou steep edged scrapers</td>
<td>49</td>
<td>4.35</td>
<td>5.38</td>
<td>3.91</td>
<td>6.53</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>4.70</td>
<td>nsc</td>
<td>nsc</td>
<td>nsc</td>
<td>2.84</td>
</tr>
</tbody>
</table>

N.S.: no significant difference between characteristics tested.
in the heights of retouch A and retouch B seem to be related to thickness differences.

There are two possible explanations why the Tandou horsehoof cores and steep edged scrapers should have been very much larger than the same implement categories at Burke's Cave.

i) The differences may reflect the different ecological zones, Burke's Cave in rocky uplands and Lake Tandou on the river plain.

ii) The use of the flake adzes as chopping tools at Burke's Cave may have made the large horsehoof cores and steep edged scrapers unnecessary.

7.5 **West Darling sites: conclusions**

The West Darling sites provide sufficient information to enable an industrial sequence of stone implement assemblages to be set up. The Lake Menindee site provided the oldest evidence for the occupation of the area by Aboriginal man. Unfortunately no stone implements can be associated with the oldest dates from this site (LJ-204 26,300 ± 1500; GAK-335 18,800 ± 800 B.P.). The evidence for occupation at this time is restricted to the remains of a fire, a few flakes and the charred teeth of an extinct kangaroo, *Macropus ferragus*. The stone implements being used in the area at that time and the other animals being eaten remain unknown.

The oldest stone implements, dated to 12,000 years B.P., came from the Tandou Lunette I and the Tandou Creek I sites. At Tandou Lunette I horsehoof cores, steep edged scrapers, round edged scrapers and other scrapers were in association with a human cremation, some broken pieces of grindstone and a few fragments of shell (*Velesunio ambiguus*). At Tandou Creek, a similar implement assemblage was associated with an extensive shell midden (*Alyathyria jacksoni*) and large numbers of grinding and pounding stones. The grindstones from the Lake Tandou sites are the oldest yet discovered in Australia. The implement assemblage is the same as that recovered from the lowest levels of the Burke's Cave site (Unit 4).
The Burke's Cave site gives the information that backed flakes, flake adze slugs and pirri points were introduced into this area only 2,000 years ago. The core tool and scraper part of the assemblage continued unchanged after these new elements were added. This stage of the sequence is typified by the middle units at Burke's Cave and the stone assemblages from Menindee and Mootwingee.

The final stage in the industrial sequence is the introduction of materials such as glass, indicating the penetration of Europeans into the area. All the elements of the preceding stages continued into this later stage.

Three of the West Darling sites have insufficient associated economic remains for any interpretation of their function to be made. These are Mootwingee, Menindee, and Tandou Lunette I.

The remains at Burke's Cave showed the people there living on a fairly specialised diet of kangaroos caught in the local rocky environment and supplemented by the collection of smaller game. The people probably also moved onto the adjacent plains and the ethnography provides evidence that they travelled to the river in times of abundance. To get a complete picture of the life of the Aboriginal inhabitants of Burke's Cave it would be necessary to find the sites which they occupied on the open plains and by the river.

When the inhabitants of the ranges came down to the river or the lakes they may have had a mixed diet, consisting of shellfish, fish, waterbirds and small mammals, such as the diet suggested by the variety of remains at Tandou Lunette III. On the other hand, they may have had a relatively specialised riverine diet consisting of shellfish, yabbies and plant foods similar to the one that fed the people on Tandou Creek I. Apparently specialised sites with only shellfish remains and stone implements, including grindstones, have been reported from the Lake Victoria area, to the south, dating from 7,000 years B.P. to the present. Thus one aspect of the above pattern of exploitation, that of specialised riverine or lacustrine sites utilising a few foods only, can be shown to have existed in the Darling River Valley for the past twelve thousand years.
CHAPTER 8

THE WILLANDRA LAKES

8.1 Introduction

The Willandra Lakes occupy an area of 400 square miles (1000 sq. km) between the lower Lachlan and Darling Rivers. The lake system consists of a series of large shallow basins subelliptical in plan with their long axes orientated in a northwest - southeasterly direction (Bowler 1970a:106) (figures 1.2 and 8.1). They are the largest dry lakes in New South Wales.

The Willandra Lakes are lunette lakes 'dry shallow deflation basins with regular transverse crescentic dunes (lunettes) on their eastern margins' (Bowler 1970a:6). The lunettes were formed when the lake system was operative.

The Lakes were last active between 40,000 and 15,000 years ago when they were fed by the Willandra Creek (Bowler et al., 1970:42). They have been dry lake basins for the last 10,000 years.

When the lakes were full they acted as a focus for the Aboriginal inhabitants of the area. Shell middens and other sites are clustered around the old shorelines both on the western shores and on the lunettes.

The area today is extremely dry and barren. The unpredictable rainfall supports only a sparse vegetation of acacia trees, grasses and xerophytic shrubs, such as saltbush.

The initial aim of my research in this area was to document the utilisation of these Pleistocene lakes by the Aborigines and to see whether the various fluctuations and eventual drying of the lakes was accompanied by any evidence of parallel changes in Aboriginal economy.

8.2 The Chibnalwood Lakes

(a) Introduction:

The Chibnalwood Lakes (see figure 8.1) consist of three small dry lake basins which formed inside the basin of the older Outer Arumpo Lake during the period 20,000 to 15,000 years B.P. (Bowler 1970a:106, 142). Outer Arumpo is the
Fig. 8.1: Willandra Lakes: location map
southernmost of the Willandra Lakes.

On the southwestern margin of Outer Arumpo there are two areas of exposed beach gravels, consisting of rounded silcrete pebbles, associated with the Zanci high water phase. Rolled artefacts occur within these gravels.

During initial inspection of this site in early 1969, a rolled core implement similar to a horsehoof core was found. This discovery, together with the dating conjectured from geomorphological evidence suggested that an in situ stone industry of considerable antiquity might be recovered from the gravels and it was with this aim that I began work there.

Excavations were carried out at both localities where the gravels were exposed. At the first locality, approximately 4 miles (7 km) north of the Chibnalwood homestead, two trenches were dug (CH1 and CH2). Although approximately 40 cubic feet (1.1 cubic metres) of sand and gravels was removed from each of these trenches no artefacts were recovered.

(b) Chibnalwood locality 2:

The second site was approximately half a mile (.8 km) to the southeast of locality 1. Here three trenches were excavated (CH3, CH4 and CH5, see figure 8.1 and 8.2). The silcrete gravels at this second locality were coarser and bedded in thicker layers than at the first.

A plan of Chibnalwood locality 2 giving details of the gravel exposures and the location of trenches CH3 to 5 is shown on figure 8.2. Plate 8.1 shows a general view of the site.

The first trench, CH3, was placed on the southern bank of a long gully in the gravels. Here a five foot section was exposed, allowing me to excavate using the various gravel layers as a guide to the stratigraphy. This trench covered an area of 8 by 4 feet and the base of the gravels, where they rested on a clayey horizon, was reached at a depth of 7 feet. Figure 8.3 shows the southern face of the two squares (1 and 2) making up trench CH3 and plate 8.1b the northern face.

CH4 was placed 50 feet to the southwest of CH3 on brown sands to test the extent of the gravels. The excavation went to a depth of four feet through sands in which a poorly
Fig. 8.2: Chibnalwood 3-5: site plan
developed red calcareous soil had formed (Stace et al., 1968: 53-5). No gravel and few artefacts were found. The absence of gravel meant I could not correlate the stratigraphy in this trench with either of the other two and consequently I have not included the artefacts with the analysis below.

CH5 was placed between CH3 and CH4 (see figure 8.2). Gravels were reached, at a depth of one foot, beneath a horizon of sterile reddish-brown sand. The gravel band was 4 \( \frac{1}{2} \) feet thick here compared to 7 feet in CH3. This suggested that the gravels would lens out within a few feet to the southwest of CH5 and explains why gravels were not found in trench CH4. The southern face of square 1 of CH5 and the excavation units are shown on the lower part of figure 8.3.

The gravels in CH3 and 5 were basically similar. The top layers were mixed with reddish-brown sands; the middle layers consisted of fine to coarse, well-rounded gravels mixed with grey and yellow sands; the lower levels consisted mainly of grey and yellow sandy horizons with sparser bands of coarse angular gravels (figure 8.3). Interrupting the middle horizons were thin bands of pea-sized gravels and pellets of carbonate (pisolites).

In both trenches the gravels were coated with a layer of carbonate which was thickest on the medium sized pebbles near the top. This coating made the identification of artefacts in the field a difficult task. The coarse gravels near the bottom were only very thinly coated. At the top of the trench CH5 carbonate deposition had produced a conglomerate.

An attempt was made to make the excavation units (figure 8.3) conform strictly to the visible stratigraphic horizons. The deposit was sieved and artefacts were picked out and bagged. Samples of each excavation were taken and a size analysis was carried out. The results of this analysis from one trench (CH3) together with the distribution of artefacts is shown on table 8.1.

From this table it can be seen that the gravels consistently increase in size from the top to the bottom of the site. The largest pieces of rock recovered were silcrete fragments found in the basal clay material (figure 8.3). These showed no evidence of water-rolling and had the appearance of
Fig. 8.3: Chibnalwood 3-5: sections
naturally shattered boulders of silcrete. Silcrete fragments probably formed the raw-material for the gravels. They may have been eroded out and subsequently rolled back and forwards on the lake shore by small waves until they were eventually incorporated into the beach deposits.

I returned to Canberra with 14 cubic feet (.4 cubic metres) of possible artefacts. After washing and treating with acid to remove the carbonate coating I found I was left with 45 pieces of stone which possessed bulbs of percussion or negative flake scars. This means that in the 150 cubic feet (4.5 cubic metres) of gravels excavated in trenches CH3 and CH5 only 45 artefacts were found representing an average of one artefact per 3.3 cubic feet. Between 1500 and 2000 pebbles occur in each cubic foot of this deposit: there were only about two artefacts in every thousand pebbles, forming only between 0.0015-0.02 percent of the deposit. Such a low proportion of artefacts to natural pebbles suggests that the artefacts could have been produced by the knocking together of the pebbles rather than by any human agency. However, although Clark (1958:76-7) after examining gravels from Batoka Gorge in Northern Rhodesia concluded that apparent pebble and flake tools could be produced by nature, he pointed out that 'this is very unlikely to have been produced under water'. He decided that in river situations where pebbles were not falling onto each other from heights man was the probable agency producing flake and pebble tools.

In the Chibnalwood gravel terrace most of the movement of the gravels would have been caused by waves created by storms and wind. These waves would have been quite small as the lake only had a reach of 1 km or so. These forces are not sufficient to explain the presence of large flakes (up to 110 mm long and 60 mm wide) in the collection. The size and character of the gravels - that they are smallest in diameter and most rounded at the top and largest and most angular at the bottom - is consistent with the interpretation that they were produced by persistent low energy movements. The size of fractured silcrete boulders at the base of the site is not very much larger than the fine to medium-sized gravels which comprised most of the gravel layers. The artefacts, however,
Table 8.1  Chibnalwood 3 and 5: size analysis of gravels and distribution of artifacts

<table>
<thead>
<tr>
<th>TRENCH CH3 SQUARE 1</th>
<th>TRENCH CH3 SQUARE 2</th>
<th>TRENCH CH5</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCAVATION UNITS</td>
<td>GRAVEL ANALYSIS¹</td>
<td>NO. OF ARTIFACTS</td>
</tr>
<tr>
<td></td>
<td>% age coarse</td>
<td>% age fine to medium</td>
</tr>
<tr>
<td></td>
<td>gravel²</td>
<td>gravel³</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>96</td>
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<td>37</td>
</tr>
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<td>16</td>
<td>42</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>18</td>
</tr>
</tbody>
</table>

¹ By weight.
² Coarse gravels are those with a diameter greater than 4 mm.
³ Fine to medium gravels have a diameter of less than 4 mm.
are markedly larger than the gravels in which they were found. Table 8.2 below shows the percentage distribution by weight, of coarse and medium to fine gravels for units 1 to 11 and the same analysis for the artefacts from these units.

Table 8.2  Chibnalwood 3-5: size analysis of gravels and artefacts

<table>
<thead>
<tr>
<th>Units 1-11</th>
<th>&gt;4 mm diameter</th>
<th>4 mm or less</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pebbles</td>
<td>15%</td>
<td>85%</td>
</tr>
<tr>
<td>Artefacts</td>
<td>81%</td>
<td>19%</td>
</tr>
</tbody>
</table>

The artefacts also appear to have been less rolled; further, a high proportion of them (66% n=30) possessed more than one flake scar (if cores) or negative flake scars on their dorsal surfaces (if flakes).

Mason (1965:3-16) analysed naturally fractured stones from the Makapansgat site in South Africa concluding that natural fracture series generally have 'a low proportion of "flakes" to "cores"' (1965:5) and also that they have a high proportion of sidestruck to endstruck flakes (1965:8).

Artefacts were divided into flakes, on the presence of positive bulbs of percussion, and cores on the presence of negative bulbs of percussion and negative flake scars. No definite implements (artefacts with secondary retouch) were found, although a number of flakes had crushing along one or more margins.

The artefacts from the Chibnalwood gravels show a high proportion of flakes to cores (3:1) and also a high proportion of endstruck to sidestruck flakes (82% of the flakes were endstruck).

The striking platform angle of 109 ± 7° (N=22) is sufficiently obtuse for us to question whether the artefacts were naturally produced, as natural processes tend to produce near vertical striking platform angles (Mulvaney 1970:71).

Because of the size differences between the artefacts and the gravels, the high frequency of more than one flake scar on artefacts, the high number of flakes to cores, the high
number of endstruck flakes to sidestruck flakes, and the obtuse striking platform angle I concluded that the flakes and cores were probably human artefacts.

A radiocarbon date of $14,630 \pm 110$ B.P. (ANU-881) was obtained from charcoal associated with a layer of sand occurring about a foot beneath the top of CH3 square 2. Some shell fragments were recovered from beneath the dated horizon.

Most artefacts came from above the stratigraphic position of this date. The sample was very small (only one-fifth of the laboratory requirements H.Polach pers. comm.) and consequently may have been contaminated by small quantities of younger carbon or by humic acids. The $^{14}$C date should not therefore be taken as contradicting Bowlers's estimate (Bowler 1970a:302-3) that the final drying phase in the Chibnalwood Lakes took place approximately 17,000 years ago based on ANU-329, $17,380 \pm 280$ from sediments in the Outer Arumpo lunette (Bowler 1970a:141-2).

In areas of the backshore of Lake Chibnalwood where gullying had exposed silcrete boulders quarry debris is abundant. These sites, consisting of scattered large flakes and cores look relatively recent. I think that the artefactual material in the gravels is quarry debris from surface sites, incorporated into the beach deposits when the water rose during the Zanci phase.

8.3 Mungo l.

(a) Introduction

A preliminary report detailing the discovery of this site, its stratigraphy and features, with comments on the Mungo l cremation, has been published (Bowler et al., 1970). A copy of this paper is included at the back of this thesis. The following report is therefore limited to a short description of the site and of the work that has been done on the implements and human and faunal remains since the above paper was published.

The Mungo l site is located on an eroded area at the southeastern end of the Mungo lunette, which fringes Pleistocene Lake Mungo (figure 8.1). The stratigraphic features of
the site were discussed by Bowler (et al., 1970:39-47). Archaeologically, the most important feature is the Mungo sedimentary unit within which marked pedogenesis has taken place. Carbonate accumulation in the form of a calcrete band has occurred in the B horizon of this soil. These carbonates are responsible for the preservation of the bones on the site. The Mungo 1 cremation was found embedded in a disintegrating block of calcrete.

On the basis of $^{14}$C dates from the Mungo unit, determined from samples taken further along the lunette, Bowler argued that 'an estimate between 25,000 and 32,00 B.P. seems consistent with the data presently available' (Bowler et al., 1970:46). Dates from the Mungo 1 site and from the human remains have now been published (Bowler et al., 1972) confirming Bowler's original estimate and reliably replacing the age of the Mungo 1 remains as being between 25,000 and 26,000 years old (see stratigraphic section on figure 8.4).

The most important find at Mungo 1, from the south-western end of the site, was the burnt and broken skeletal remains of a young woman. This is the oldest dated skeleton yet found in Australia and is also one of the oldest reliably dated evidences of Homo sapiens yet found in the world (Bowler et al., 1972: in press; Thorne 1971:85-9).

Further description of the cranium has been published by Thorne (1971:86-7). He concluded that the Mungo cranium gave an overall impression of extreme gracility and that not only did it lie within the range of recent Australian skeletal form but that it was 'at the morphologically modern end of that range'. His interpretation of the mode of disposal, that of the cremation of a fully-fleshed cadaver, the resulting bones of which were subsequently smashed and then gathered into a heap, remains unchanged (in Bowler et al., 1970:57).

(b) the archaeology of the Mungo 1 site

A plan of the Mungo 1 site and a stratigraphic section from Bowler et al., (1972) is shown on figure 8.4. From this figure it can be seen that all of the archaeological features of the site are associated with the northernmost exposure of calcrete.
The major archaeological feature consists of zones of burnt calcareous sediment exposed along the deflated surface of the lunette. These lie above the calcrete zone and Bowler et al., (1972: in press) have fixed their stratigraphic position as being about 15 cm higher than the calcreted Mungo 1 skeleton. The concentrations of carboniferous sediments occur in two main areas, one between 30 and 50 metres and the other between 100 and 300 metres, to the east of the spot where the cremation was found. A sample of organic carbon from the burnt patch near the cremation gave a C¹⁴ result of 26,250 ± 1120, ANU-375B (Bowler et al., 1972: in press).

Further along the lunette the deposits take the form of roughly circular patches some 2 to 3 feet in diameter. Jones and Allen (in Bowler et al., 1970:48) interpret these patches as fireplaces.

Archaeological activity at the site has so far been restricted to mapping and dating the surface features, to limited excavations near the cremation site, to the collection of surface artefacts, the collection of 'in situ' artefacts from the Mungo sedimentary unit, and finally the intensive collection of artefacts and faunal remains from selected areas of the burnt deposit discussed above. Where surface collections have been made efforts have been taken to ensure the collection of every bone and stone fragment from within a restricted area of the site rather than taking a simple 'grab sample'.

(c) stone artefacts

Two collections of stone artefacts have been made. The first consists of 27 artefacts found eroding out of the Mungo unit after heavy rains had swept the lunette. Jones and Allen (in Bowler et al., 1970:56) regard this as an 'in situ' collection. The second was a general collection of all stone implements found on the surface of the site. This consists of 440 artefacts of which 295 (67%) possessed some evidence of a thick coating of carbonate, suggesting that they had derived from the Mungo unit close to the zone of carbonate (calcrete) accumulation and hence associated with the 26,000 B.P. date.
### Table 8.3  Mungo I: 'in situ' and 'calcrete encrusted' artifacts

<table>
<thead>
<tr>
<th>Artifact category</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implements</td>
<td>114</td>
<td>35%</td>
</tr>
<tr>
<td>Broken implements</td>
<td>8</td>
<td>2%</td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>27</td>
<td>8%</td>
</tr>
<tr>
<td>Unmodified cores</td>
<td>16</td>
<td>5%</td>
</tr>
<tr>
<td>Unmodified flakes</td>
<td>106</td>
<td>33%</td>
</tr>
<tr>
<td>Hammer and anvil stones</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td>Cooking stones (?)</td>
<td>28</td>
<td>9%</td>
</tr>
<tr>
<td>Ochre fragments</td>
<td>21</td>
<td>7%</td>
</tr>
<tr>
<td>Total</td>
<td>322</td>
<td></td>
</tr>
</tbody>
</table>

### Table 8.4  Mungo I: 'in situ' and 'calcrete encrusted' implements

<table>
<thead>
<tr>
<th>Implement category</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat scrapers</td>
<td>15</td>
<td>13%</td>
</tr>
<tr>
<td>Horsehoof cores</td>
<td>25</td>
<td>22%</td>
</tr>
<tr>
<td>Large steep edged scrapers</td>
<td>5</td>
<td>4%</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>49</td>
<td>43%</td>
</tr>
<tr>
<td>Multi concave scraper</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Miscellaneous scrapers</td>
<td>7</td>
<td>6%</td>
</tr>
<tr>
<td>Utilised flakes</td>
<td>11</td>
<td>10%</td>
</tr>
<tr>
<td>Total</td>
<td>114</td>
<td></td>
</tr>
</tbody>
</table>
The presence of a calcrete coating on an artefact at the Mungo site can be taken to indicate that the artefact has eroded from the Mungo unit, because insufficient segregation of carbonates has taken place in the overlying Zanci unit to produce the encrustations of up to 3 mm in thickness found on some of the artefacts.

Artefacts without any evidence of calcrete were excluded from the analysis that follows. As no typological differences were detected between the 'in situ' and 'calcrete encrusted' collections (Jones and Allen in Bowler et al., 1970:48) they have been combined. The number and proportion of the different types of artefacts found is shown on table 8.3.

The low number of unmodified flakes compared to implements (a ratio of 1:1) suggests that the collection may have been biased towards the larger stones. However, it is also possible that the above table shows the true proportion of artefacts on the site and that the site had relatively few cores and unmodified flakes and large numbers of implements. If this was the case then the site was one on which implement usage was more important than implement manufacture. The relatively high number of rejuvenation (retrimming) flakes and of broken implements to unbroken implements support this conclusion.

The cores were irregular and small. Two of them had been alternatively flaked on all their margins, giving them the appearance of disc cores. The two largest cores had been worked on a number of sides and now look like nuggety blocks.

The cooking stones (?) were calcreted pebbles of silcrete (indurated sandstone) and sandstone, some of which had apparently been fire blackened and shattered by heat. The hammer and anvil stones consisted of one large calcrete encrusted block of sandstone and a large battered pebble of silcrete.

The absence of grinding stones was noted in the 1970 paper (Jones and Allen in Bowler et al., 1970:55-6). None was found during three subsequent visits to the site, when special efforts were made to find calcrete encrusted grindstone pieces. However, grindstone fragments can make up as
small a proportion of total artefacts as less than 1 percent (as at the Mungo backshore I and Walls of China I sites) (see tables 8.11 and 8.13) or as great a proportion as 25 percent as at the Tandou Creek I site (see table 7.5). It is not possible to prove whether the absence of grinding stones from the Mungo I site is due to chance or not.

One of the 21 fragments of ochre, although heavily encrusted with calcrete, shows evidence of grinding on one surface and on an edge which had been ground to a smooth curve. The presence of ground ochre does not necessarily mean that other forms of grinding took place at the Mungo site. The other ochre pieces range from small fragments weighing only a few grammes to quite large lumps of up to 300 gms.

(d) **raw materials**

Apart from a single quartzite pebble core and two waste flakes made of a rough sandstone, all other flaked stone is silcrete. Silcrete is a silicified sandstone derived from an indurated zone in tertiary soils. It is sufficiently crystalline to have good flaking qualities but is definitely inferior to chert or flint. 95 percent of the flaked artefacts were manufactured from a light olive coarse-grained silcrete and the rest from a grey fine-grained silcrete. Both of these varieties of silcrete may have been obtained locally from exposures near the Mungo homestead, about 13 km (8 miles) away (J. Bowler pers.comm.).

The ochre could have been obtained from locally available exposures at the Manfred Range or on the Murray and Darling Rivers.

(e) **implements**

The Mungo I implements are listed on table 8.4. The characteristics of most of the categories have been discussed in relation to the Burke's Cave implements and also by Jones and Allen (in Bowler et al., 1970:49-52). Some of the Mungo artefacts are illustrated in Bowler et al., (1970:figure 13). There are some differences between table 8.4 below and table 4 in Jones and Allen (in Bowler et al., 1970:51). Some of them arise from the fact that the 8 broken scrapers (five steep
edged scrapers and 3 flat scrapers) were included in the counts for the earlier paper but not in table 8.4. The other differences came about because I included utilised flakes in table 8.4 and took five large scrapers from the 'miscellaneous scraper' section of the published paper and created a new category of 'large steep edged scrapers'.

Initially the 'large steep edged scrapers' were thought to be too flat, in relation to their breadths and lengths, to be included in the steep edged scraper category. However, when the characteristics of these implements were measured it was found that, although their primary dimensions were greater, they did not differ from steep edged scrapers in respect of retouch angle, percentage of retouch, breadth/length index, thickness/breadth index and thickness/length index (see table 8.5). This was later confirmed by 't' tests. From the tests I concluded that the large flat scrapers were in reality a larger variety of steep edged scrapers. I have kept them as separate groups because the differences in their overall dimensions justified this.

The flat scrapers comprised 8 straight edged scrapers, 5 round edged scrapers and 2 concave scrapers. The characteristics of the Mungo I scrapers are listed on table 8.5.

The most striking feature of the Mungo I implement collection is the large number of horsehoof cores, large steep edged scrapers and steep edged scrapers. These formed nearly 70 percent of all implements.

Relative to the other implement categories there are twice as many horsehoof cores and steep edged scrapers on Mungo I as there are on any other site that I have worked on in the Darling Basin. At the conclusion of this chapter, I will examine whether this relative abundance can best be explained as a functional difference or whether there is some other explanation.

Comparing the Mungo scrapers (table 8.5) with those from Burke's Cave (table 6.10) it can be seen that those from Mungo are very much larger. However, the Mungo implements are only small to medium in size by comparison with similar implement categories from places such as Kangaroo Island. The Mungo implements are neither massive nor crude. Some of the
<table>
<thead>
<tr>
<th>Implement category</th>
<th>Maximum length mm</th>
<th>Maximum breadth mm</th>
<th>Thickness mm</th>
<th>Weight gms</th>
<th>Breadth/length index</th>
<th>Thickness/breadth index</th>
<th>Thickness/length index</th>
<th>Length of retouch mm</th>
<th>% of retouch</th>
<th>Retouch angle degrees</th>
<th>Height retouch A mm</th>
<th>Height retouch B mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flat scrapers</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>48 ± 12</td>
<td>34 ± 7</td>
<td>12 ± 3</td>
<td>20 ± 10</td>
<td>72 ± 13</td>
<td>37 ± 11</td>
<td>26 ± 6</td>
<td>34 ± 11</td>
<td>39 ± 20</td>
<td>63 ± 10</td>
<td>6 ± 3</td>
<td>4 ± 2</td>
</tr>
<tr>
<td></td>
<td>68 ± 17</td>
<td>55 ± 15</td>
<td>50 ± 14</td>
<td>284 ± 273</td>
<td>81 ± 12</td>
<td>92 ± 19</td>
<td>73 ± 13</td>
<td>103 ± 53</td>
<td>61 ± 23</td>
<td>93 ± 7</td>
<td>40 ± 16</td>
<td>15 ± 6</td>
</tr>
<tr>
<td>Large steep edged scrapers</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>109 ± 17</td>
<td>81 ± 11</td>
<td>39 ± 5</td>
<td>336 ± 61</td>
<td>75 ± 10</td>
<td>50 ± 11</td>
<td>37 ± 9</td>
<td>102 ± 50</td>
<td>34 ± 20</td>
<td>79 ± 11</td>
<td>29 ± 8</td>
<td>10 ± 4</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>55 ± 11</td>
<td>40 ± 8</td>
<td>22 ± 6</td>
<td>54 ± 28</td>
<td>73 ± 14</td>
<td>56 ± 15</td>
<td>41 ± 11</td>
<td>51 ± 25</td>
<td>38 ± 15</td>
<td>81 ± 8</td>
<td>16 ± 5</td>
<td>7 ± 2</td>
</tr>
<tr>
<td>Multi concave scrapers</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>54 ± 2</td>
<td>43 ± 2</td>
<td>22 ± 2</td>
<td>50 ± 2</td>
<td>80 ± 5</td>
<td>51 ± 2</td>
<td>40 ± 4</td>
<td>37 ± 20</td>
<td>24 ± 14</td>
<td>67 ± 0</td>
<td>22 ± 12</td>
<td>9</td>
</tr>
<tr>
<td>Miscellaneous scrapers</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>50 ± 12</td>
<td>40 ± 9</td>
<td>21 ± 7</td>
<td>45 ± 29</td>
<td>81 ± 10</td>
<td>52 ± 17</td>
<td>42 ± 16</td>
<td>31 ± 7</td>
<td>24 ± 11</td>
<td>66 ± 21</td>
<td>17 ± 7</td>
<td>5 ± 3</td>
</tr>
</tbody>
</table>

1 This table was compiled from information contained in a computer programme devised by Rhys Jones and is reproduced with his permission.
smaller flat scrapers exhibit fine retouch and most show evidence of high quality craftsmanship that does not suffer by comparison with the same implement types made by the inhabitants of the recent Burke's Cave site.

(f) faunal remains

Most of the faunal remains came from the areas of burnt calcareous sediment discussed in section 8.2(b). The bone included in the analysis was either encrusted with calcite or was recovered 'in situ' from one of the hearth areas. Much of the bone consisted of unidentifiable fragments of burnt, smashed bone. The length and breadth of one quarter of the unidentifiable bone (by weight) was measured and more than 70 percent of it was found to be less than 15 mm long and 10 mm wide. This suggests either that the Aborigines may have purposely smashed the bone for marrow or that the waste bone on the site has been chewed by carnivores such as the Tasmanian tiger or devil.

The commonest remains consisted of the heel and jaw bones of mammals and the vertebrae, spines and otoliths of fishes. Otoliths (earstones) are calcareous growths secreted within the auditory canals of Teleost fishes (Frizzell and Dante 1965:688). They show distinct determinative features which enable exact generic [and in some cases, specific] identification to be made by comparison of the fossil with analogous living forms (Stinton 1953:66).

The estimated minimum numbers of animals found on the site are set out on table 8.6. The 18 mammals and 130 fish recovered probably represent less than one quarter of the total number of animals on the site. There is, however, no way of accurately estimating how much of the occupation horizon is still buried by younger lunette sediments.

Evidence for three birds was found; the bones of two of these are consistent with birds as large as a swan or pelican, but not as large as an emu. The third individual was dove-sized. The published information (Allen and Jones in Bowler et al., 1970:table 3) overestimates the number of bird bones. This was due to my misidentification of a number of small mammal bones.
The figures on table 8.6 would seem to be representative for all groups except freshwater mussels. Fragments of unionid mussels were scattered along the entire length of the site but nowhere was there any visible concentration. Possibly the thin mussel shells deteriorated more rapidly than the other remains and consequently are poorly represented.

The Mungo I fauna provides the oldest evidence of Aboriginal diet yet found in Australia. Its age, 26,000 years, places it well into the Pleistocene when conditions, as shown by the presence of the lakes, must have been very different from the present environment. Yet most of the animals recovered (table 8.6) are known to have inhabited the same area during the last century. The stump-tailed skink T. rugosa, the native cat D. geoffroii, the barred bandicoot P. bougainville, the hairy-nosed wombat L. kreffti, the burrowing rat-kangaroo B. lesueur, the brush-tailed rat-kangaroo B. penicillata and emu eggs D. novaehollandiae were all recorded as being eaten by Aborigines in the Darling Basin (Appendix I:5, 11-18; Kref5 1866a, 1866b).

The only animal present on the Mungo site but not collected during the nineteenth century was the hare-wallaby Lagorchestes. There are probably two species present at Mungo, both larger than L. hirsutus and L. leporides, the two extant species likely to have been in the area. These two undescribed species may have been ancestral to some or all of the modern species (see Appendix 2:4).

The most numerous animals on the site were fish. The minimum number estimated from otolith counts was 130 individuals. The otoliths were identified as being probably those of the golden perch, P. ambiguus. (The specimens were compared with the otoliths of Murray River freshwater fish, in my own collection, at the Australian Museum, Sydney, and at the N.S.W. Inland Fisheries Research Station, Narranderra). Otoliths of the golden perch can be distinguished from the otoliths of the two other common species, Maccullochella macquariensis the Murray cod and Bidyanus bidyanus the silver perch, in terms of their morphology (plate 9) and by their length to breadth ratios, as shown in table 8.7 below.
### Table 8.6 Mungo I faunal remains

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lagorchestes sp.</td>
<td>hare wallaby</td>
<td>4</td>
</tr>
<tr>
<td>Bettongia penicillata</td>
<td>brush-tailed rat kangaroo</td>
<td>1</td>
</tr>
<tr>
<td>Bettongia lesueur</td>
<td>burrowing rat-kangaroo</td>
<td>4</td>
</tr>
<tr>
<td>Bettongia sp.</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Undetermined macropodinae</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Lasiorhinus kreffii</td>
<td>hairy-nosed wombat</td>
<td>1</td>
</tr>
<tr>
<td>Perameles cf. bougainville</td>
<td>barred bandicoot</td>
<td>1</td>
</tr>
<tr>
<td>Dasyurus geoffroii or viverrinus</td>
<td>native cat</td>
<td>2</td>
</tr>
<tr>
<td>Rattus sp.</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

#### LIZARDS

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tiliqua cf. rugosa</td>
<td>stump-tailed skink</td>
<td>1</td>
</tr>
</tbody>
</table>

#### BIRD

| Undetermined                                |                           | 3        |

#### EGG SHELL

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emu egg</td>
<td>(fragments)</td>
<td>29</td>
</tr>
</tbody>
</table>

#### FISH

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eucrotoplites ambiguus (?)</td>
<td>golden perch</td>
<td>130</td>
</tr>
</tbody>
</table>

#### FRESHWATER MUSSELS

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Velesunio ambiguus</td>
<td>scattered fragments only</td>
<td></td>
</tr>
</tbody>
</table>

---

Mammals from the Lake Mungo Lunette, not associated with the Mungo I site.

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macropus ferragus</td>
<td></td>
<td>1 (probably older than 26,000 B.P.)</td>
</tr>
<tr>
<td>Macropus giganteus</td>
<td>grey kangaroo</td>
<td>1 (recent)</td>
</tr>
<tr>
<td>Sarcophilus harriisi</td>
<td>Tasmanian devil</td>
<td>1 (unknown)</td>
</tr>
<tr>
<td>Dasyurus cristicauda (?)</td>
<td>crest-tailed marsupial mouse</td>
<td>1 (recent)</td>
</tr>
<tr>
<td>Thylacinus cynocephalus</td>
<td>Tasmanian tiger</td>
<td>1 (unknown)</td>
</tr>
</tbody>
</table>
Table 8.7 Length:breadth ratios of otoliths of Murray-Darling fish

<table>
<thead>
<tr>
<th></th>
<th>L:B</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray cod (Murray and Murrumbidgee rivers)</td>
<td>2.4 ± 0.1</td>
<td>5</td>
</tr>
<tr>
<td>silver perch (Murray and Murrumbidgee rivers)</td>
<td>2.2 ± 0.1</td>
<td>4</td>
</tr>
<tr>
<td>golden perch (Murray river)</td>
<td>1.7 ± 0.1</td>
<td>33</td>
</tr>
<tr>
<td>golden perch (Mungo I)</td>
<td>1.7 ± 0.2</td>
<td>113</td>
</tr>
</tbody>
</table>

No differences between the length:breadth ratios of the Mungo and Murray River golden perch were revealed by 't' tests. The tests did, however, show significant differences at the .01 level of significance between the ratios for the Mungo otoliths and the ratios for Murray cod and silver perch otoliths.

It is more difficult to distinguish between golden perch otoliths and those from the closely related Macquarie perch *M. australasica*. Because the otoliths were large and came from young fish, I concluded that most of the otoliths belonged to golden perch rather than Macquarie perch though I do not discount the possibility that both species are present. As both of these species have similar ratios of otolith length to standard length of fish, it does not matter, for the discussion that follows, which of the two was present.

Appendix 4 includes a series of graphs of the regression curves calculated from the statistical relationships between:

(i) fish length and fish weight;
(ii) otolith length and fish length;
(iii) otolith length and fish weight;
(iv) mean diameter of vertebrae and fish length;
(v) mean diameter of vertebrae and fish weight.

Tests on these variables (all significant at the .01 level of significance) revealed stronger correlations for vertebrae diameter/fish length and otolith length/fish length than between the other three pairs. This information permits estimates of fish length or weight to be calculated from the
lengths of archaeological otoliths or the diameters of archaeological fish vertebrae. The sample was inadequate for small sized fish, so extrapolations from very small otoliths or vertebrae to estimated fish length or weight are almost certainly inaccurate.

Figure 8.6 gives the percentage distribution of otolith lengths and vertebrae diameters from Mungo I. The otolith curve approximates to a normal curve, suggesting that the otoliths came from a single population of fish (golden perch).

The vertebrae curve on the other hand is strongly positively skewed and shows some bimodality, suggesting there was more than one population of fish present on the site. This second population was not represented by otoliths.

The different interpretations arrived at, after considering the evidence from the otoliths and the vertebrae, can be illustrated further when estimates of fish sizes on the site are made.

Table 8.8 Mungo I: estimated lengths and weights of fish from (i) otoliths and (ii) vertebrae

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Smallest  Largest</td>
</tr>
<tr>
<td>(i) Otoliths</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of fish</td>
<td>340 ± 60 mm</td>
<td>150 - 400 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>450 ± 500 gms</td>
<td>100 - 1000 gms</td>
</tr>
<tr>
<td>(ii) Vertebrae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of fish</td>
<td>500 ± 200 mm</td>
<td>100 - &gt;700 mm</td>
</tr>
<tr>
<td>Vertebrae</td>
<td>1800 ± 2000 gms</td>
<td>75(?) - 8000 gms</td>
</tr>
</tbody>
</table>

The range of estimated lengths and weights of fish on the site, based on vertebrae diameters, is very much greater than that from the otoliths.

Beveridge (1883:47-8) stated that Murray River Aborigines, using nets, took golden perch ranging from 1 kg (2 lb) to 4.5 kg (10 lbs). These figures accord well with modern populations, where fish up to 4.5 kg (10 lbs) are
commonly taken (Lake n.d.:27). However, the largest vertebrae on the site suggest fish that are larger than this size range. The only larger fish present in the Murray-Darling Rivers is the Murray cod, *M. macquariensis*, which commonly weighs between 2 kg (4.5 lbs) and 14 kg (30 lbs).

The differences between the otolith and vertebrae graphs suggest that while the great majority of fish being caught were small to medium-sized golden perch, some large fish, for which there was no otolith evidence, were also being caught. These large fish may have been medium sized Murray cod, or large golden perch.

The fish populations on the Mungo I site, consisting of large numbers of golden perch and possibly a few Murray cod, is exactly the situation described for the Menindee Lakes at the present time (D.D. Francois pers.comm.). The absence of otoliths of the large fish can possibly be explained by reference to the Aboriginal practice of cutting up large fish and distributing pieces so that the remains of a single large fish may be spread over an entire camping site.

Eyre described how this was done on the Murray River.

'The larger fish are divided into three pieces...comprising the head, backbone and tail, another the fleshy part that covered the back, and the third the belly and sides. This last is the most prized of the three. This method... is well adapted for ensuring rapid preparation in the process of cooking; it is also well suited for satisfying the respective owners and claimants' (1845 Vol.2:292-3).

Also, the skulls of large fish were probably broken up while they were being eaten. On the other hand, small fish are likely to have been distributed whole, so the remains of each fish would be clustered around a particular hearth.

(g) *diet*

Table 8.9 below showing the estimated total live weights of terrestrial animals and fish gives some indication of the contributions of lake and adjacent plains to the diet of the prehistoric inhabitants of the site.
Table 8.9  Mungo I: estimated total live weight of terrestrial animals and fish

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Estimated weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrestrial animals</td>
<td>20</td>
<td>65 kg</td>
</tr>
<tr>
<td>Fish</td>
<td>134</td>
<td>75 kg</td>
</tr>
</tbody>
</table>

From this table it would appear that fish contributed slightly more to the diet than the other animals. The above table, however, possibly gives a wrong impression, by over estimating the contribution of terrestrial animals; other factors must be taken into consideration. The contribution of the lakes to the diet is probably under estimated as there was no way of calculating how much shell fish was consumed on the site. The number of fish shown in table 8.9 consists of 130 golden perch plus an estimated 4 unidentified larger fish.

The terrestrial category, consisting of mammals and lizards, includes one hairy-nosed wombat which represents almost half of the total live weight of the terrestrial animals. Even with the wombat present the site can be interpreted as one primarily used for the exploitation of the lake with the diet of the inhabitants supplemented by small mammals captured on the adjacent plains.

Some interpretations of the methods used to catch the fish can be drawn from the information on fish sizes shown in figure 8.6 and table 8.8 but this will be discussed in a later section when information on the fish populations from other Willandra Lake sites can be included. Of the terrestrial animals, the wombat and the burrowing rat-kangaroos are likely to have been dug out of their burrows and the other animals caught as the people moved about the plains near the site.

(h) seasonality

The evidence for seasonal usage of the site, during the late winter to summer period, presented in the preliminary report (Jones and Allen in Bowler et al., 1970:55) remains unchanged. This conclusion was based on the presence of emu
eggs which are laid in the late winter to early spring period (Eastman 1969:23), and of immature golden perch, presumably spawned during the preceding spring. The evidence from the fish is further discussed in a later section of this chapter where conclusions about the Pleistocene environment of the Willandra Lakes are drawn. The presence of the stump-tailed skink, commonest in the spring following winter hibernation (Bustard 1970:92-3) also indicates use of the site at this time.

The Lachlan River is likely to have had its flow regime governed by the amount of snow melt in its upper catchment during the late Pleistocene. It is likely to have resembled snowfed rivers in the Snowy Mountains today, such as the upper Murrumbidgee which discharges 63 percent of its total yearly discharge in the period July to October, the late winter and spring (S.M.H.E.A. 1971:33) and which has low discharges in the period summer to early winter. The Willandra Creek, a tributary of the Lachlan, and the Willandra Lakes are likely to have had similar fluctuations.

On the Murray River, which has a similar flow regime to that postulated for the Pleistocene Willandra Lake system, with high water levels and floods in late winter and spring, and low water in autumn, the nineteenth century Aborigines made seasonal movements in concert with these fluctuations in discharge (see table 3.1). Their diet also changed from being concentrated on land animals and plants during the low water and early flooding phase to being concentrated on riverine and lacustrine foods when the water levels had stabilised after flood and until the flood had totally receded.

With this Murray River model in mind, the Mungo site can be interpreted as one that was occupied during the late winter to summer period, with occupation beginning shortly after the spring floods had reached their highest level.

(i) summary

The small number of animals found on the site so far and their small size, coupled with the fact that only 400 or so artefacts have been recovered from the 300 metre long site, indicates that the Mungo site was occupied by a small group of
people for a short time, possibly at intervals over a period of years, before it was subsequently covered up or abandoned. The portion of the site exposed reveals just above the Pleistocene water level, a series of fireplaces, in which the cooking was done and around which the men probably sat using the core tools and scrapers presumably for manufacturing wooden implements (see chapter 6 section 6.7(d) for a discussion of the use of similar stone implements). No areas of specialised activity have yet been isolated and faunal remains, stone implements, cooking stones, ochre pieces and fireplaces have been found in every portion of the site.

8.4 Other Lake Mungo sites

(a) Walls of China I

The Walls of China I site is located on the Lake Mungo lunette about 1/2 km to the west of the Mungo I site (figure 8.1). It consists of an area of about 1100 sq. metres (1300 sq. yards) on which artefacts are thinly scattered. At the western end of the site were the eroded remains of a burial dug into the Zanci sediments.

The stratigraphic position of the W.C.I site on top of Zanci sediment dates it to being less than 15,000 B.P. (see Bowler 1970a:141-3 for the dating of the final phase of Zanci clay dune deposition). By comparison with other sites in the Willandra Lakes area, it is probably much younger than 15,000 and possibly younger than 10,000 years.

A collection of all the artefacts on this site was made. This collection totalled 872 individual pieces, slightly less than 1 per sq. metre. The artefacts are shown on table 8.10. The ratio of flakes to implements (1:4) while a much higher ratio than at the adjacent Mungo I site (see table 8.3), is still too low to suggest that implements were being manufactured on the site. The ratio of cores to flakes (1:8), however, is the same as on the Mungo I site (also 1:8) and this may indicate that the Mungo I collection is biased towards the collection of large artefacts.

Apart from one core made from a fine milk chocolate coloured chert and one implement made from grey chert all other
Table 8.10  Walls of China I: artifacts

<table>
<thead>
<tr>
<th>Artifact type</th>
<th>No.</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implements</td>
<td>116</td>
<td>13%</td>
</tr>
<tr>
<td>Broken implements</td>
<td>21</td>
<td>2%</td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>13</td>
<td>2%</td>
</tr>
<tr>
<td>Unmodified cores</td>
<td>78</td>
<td>9%</td>
</tr>
<tr>
<td>Unmodified flake</td>
<td>639</td>
<td>73%</td>
</tr>
<tr>
<td>Grindstone fragments</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>872</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.11  Walls of China I: Implements

<table>
<thead>
<tr>
<th>Implement category</th>
<th>No.</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round edged scrapers</td>
<td>21</td>
<td>18%</td>
</tr>
<tr>
<td>Flake adze slugs</td>
<td>4</td>
<td>3%</td>
</tr>
<tr>
<td>Straight edged scrapers</td>
<td>13</td>
<td>11%</td>
</tr>
<tr>
<td>Horse hoof cores</td>
<td>12</td>
<td>10%</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>32</td>
<td>28%</td>
</tr>
<tr>
<td>Notched scrapers</td>
<td>12</td>
<td>10%</td>
</tr>
<tr>
<td>Miscellaneous scrapers</td>
<td>6</td>
<td>5%</td>
</tr>
<tr>
<td>Utilised flakes</td>
<td>15</td>
<td>13%</td>
</tr>
<tr>
<td>Serrated edged scraper</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>116</td>
<td></td>
</tr>
</tbody>
</table>
implements and cores were manufactured from locally available silcrete.

Table 8.11 lists the implements from the Walls of China I site. The implement categories, except for the single serrated edged scraper, are the same as those obtained from the Burke's Cave, Mungo I and the Tandou sites and consequently need no further explanation.

The serrated edged scraper is a small endstruck flake with a series of regular retouching flakes struck off in one direction along one margin. These form a serrated working edge of the type called a 'toothed saw edge' by McCarthy (1967: 34).

One feature of the implement assemblage from the W.C.I site (table 8.11) compared to the Mungo I site (table 8.4) is the small number of horsehoof cores and steep edged scrapers recovered from W.C.I. At Mungo I these implement categories accounted for nearly 70 percent of all implements whereas at W.C.I they made up less than 40 percent.

The characteristics of the implements from W.C.I are shown on table 8.14.

No faunal remains or other evidence of economic activities, apart from the 5 grindstone fragments shown on table 8.10, were recovered from this site. However, as the site was used after the lakes had dried up only land foods could have been consumed there.

The burial is discussed in appendix 3.

(b) Mungo backshore I

The M.bsh.I site is situated on top of the cliffed shoreline on the northwestern end of Lake Mungo (figure 8.1). It covers an area of 4200 sq.metres (5000 sq.yards = 1 acre) and consists of the remains of seven ovens around which are scattered implements. One of the hearths has been dated by Barbetti (Barbetti and Polach 1972:in press) to 940 ± 50 B.P. ANU-660.

Artefacts were collected from within a gridded area of 440 sq.metres (520 sq.yards). This represented approximately 10 percent of the area of the site. Some 1495 artefacts were collected, about 3 artefacts per sq. metre.
The artefacts are listed in table 8.12. The ratio of implements to flakes is 1:7 which is the same as at W.C.I; the ratio of cores to flakes (1:26) is much lower than at the other site. Because of the small number of flakes to implements, the M.bsh.I site cannot be regarded as an implement manufacturing site.

Silcrete was the main raw material used; only three implements (less than 3 percent) were made of chert. The implements from M.bsh.I are shown on table 8.13. Horsehoof cores and steep edged scrapers made up only 25 percent of all implements. Steep edged scrapers form a smaller proportion of total implements than was the case at W.C.I and are considerably fewer than at Mungo I. This will be discussed further in the next section.

Ovens and grindstone fragments were the only evidence of economic activities. Like W.C.I, this site was used after the lakes had dried. Large land animals or vegetables were possibly cooked in the ovens. There is no economic evidence preserved on any of the Willandra Lakes sites known to have been used after the final drying of the system.

(c) comparison of the stone implements from Mungo I, Walls of China I and Mungo backshore I

The number of implements in each category and the percentage that this forms of the total number of implements from the three sites are listed in tables 8.4, 8.11 and 8.13.

In terms of the implement categories present at the three sites, apart from the presence of small numbers of flake adze slugs at W.C.I and M.bsh.I and of small numbers of backed flakes (microliths) at M.bsh.I, there are few discernible differences. Horsehoof cores, steep edged scrapers make up the most important categories at Mungo I, Walls of China I and Mungo backshore I. Notched scrapers are absent from the Mungo I collection although concave edges were present on three of the steep edged scrapers and two of the flat scrapers. Retouched flakes are absent from the Mungo I site and the Walls of China I site.
### Table 8.12  Mungo backshore I: artifacts

<table>
<thead>
<tr>
<th>Artifact type</th>
<th>No.</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implements</td>
<td>148</td>
<td>10%</td>
</tr>
<tr>
<td>Broken implements</td>
<td>37</td>
<td>2%</td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>38</td>
<td>3%</td>
</tr>
<tr>
<td>Unmodified cores</td>
<td>48</td>
<td>3%</td>
</tr>
<tr>
<td>Unmodified flakes</td>
<td>1215</td>
<td>81%</td>
</tr>
<tr>
<td>Grindstone fragments</td>
<td>3</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Anvil stones and pebbles</td>
<td>6</td>
<td>&lt;1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1495</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Table 8.13  Mungo backshore I: implements

<table>
<thead>
<tr>
<th>Implement category</th>
<th>No.</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round edged scrapers</td>
<td>17</td>
<td>11%</td>
</tr>
<tr>
<td>Flake adze slugs</td>
<td>5</td>
<td>3%</td>
</tr>
<tr>
<td>Straight edged scrapers</td>
<td>12</td>
<td>8%</td>
</tr>
<tr>
<td>Horsehoof cores</td>
<td>7</td>
<td>5%</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>25</td>
<td>19%</td>
</tr>
<tr>
<td>Notched scrapers</td>
<td>14</td>
<td>5%</td>
</tr>
<tr>
<td>Miscellaneous scrapers</td>
<td>12</td>
<td>8%</td>
</tr>
<tr>
<td>Retouched flakes</td>
<td>15</td>
<td>10%</td>
</tr>
<tr>
<td>Utilised flakes</td>
<td>39</td>
<td>26%</td>
</tr>
<tr>
<td>Backed flakes (microliths)</td>
<td>2</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>148</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Maximum length mm</td>
<td>Maximum breadth mm</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td><strong>(a) Walls of China I</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Round edged scrapers</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>41 ± 9</td>
<td>33 ± 9</td>
</tr>
<tr>
<td>Flake adze slugs</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Straight edged scrapers</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Notched scrapers</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Horsehoe cores</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Miscellaneous scrapers</td>
<td>37 ± 5</td>
<td>23 ± 4</td>
</tr>
<tr>
<td>Utilised flakes</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Serrated edged scraper</td>
<td>40</td>
<td>19</td>
</tr>
<tr>
<td><strong>(b) Mungo backshore I</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Horsehoe cores</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>54 ± 13</td>
<td>37 ± 11</td>
</tr>
</tbody>
</table>

Note: The table compares the means and standard deviations for scraper characteristics between Walls of China I and Mungo backshore I.
I tested the number of each category of implements present at the three sites using $\chi^2$ tests. The tests revealed

(i) There were significantly fewer horsehoof cores and steep edged scrapers at the W.C.I and M.bsh.I sites than at Mungo I, with M.bsh.I also having significantly fewer steep edged scrapers than W.C.I.

(ii) There was a significantly higher number of round edged, straight edged and miscellaneous scrapers at W.C.I and M.bsh.I than of flat and miscellaneous scrapers at Mungo I.

(iii) There were no significant differences between the numbers of utilised flakes from Mungo I and Walls of China I but M.bsh.I had a significantly greater number than the other two sites. M.bsh.I also had a significantly higher number of retouched flakes.

The differences between the three sites can be summarised as follows: the Mungo I site had large numbers of steep edged scrapers and horsehoof cores and only small numbers of any other type of scraper; the Walls of China I site had fewer horsehoof cores and steep edged scrapers than Mungo I and more round and straight edged scrapers; and the Mungo backshore I site had fewer steep edged scrapers and more utilised and retouched flakes than Mungo I and Walls of China I and fewer horsehoof cores and more round and straight edged scrapers than Mungo I.

Comparison of the various metric attributes of scrapers between the three sites, from tables 8.5 and 8.14, using 't' tests gave the following results.

(i) The Mungo I horsehoof cores were significantly thicker, had higher retouch A and B and a greater percentage of their perimeters had secondary retouch than did the horsehoof cores from the other two sites. The other eight characteristics showed no significant differences.

(ii) Steep edged scrapers from Walls of China I were significantly thicker than those from Mungo I but there were no other significant differences.
There were no significant differences between Mungo I flat scrapers and W.C.I round edged scrapers. The 't' tests revealed that there were few significant differences between the Mungo I horsehoof cores and steep edged scrapers and those from the other two sites and that there was little difference between the Mungo I flat scrapers and the Walls of China I round edged scrapers. The differences between the three sites involve changes in the frequency of implement types, not changes in the nature of the implements.

The Mungo I site is 26,000 years old; the Mungo backshore site is probably only 1,000 years old. The Walls of China I site is younger than 15,000 years. Despite the great age differences between the Mungo I site and the other two, the implements from all three sites clearly belong to the same industrial tradition. I interpret this as strong evidence for cultural continuity in the Lake Mungo region. Whether the differences between the implement assemblages can be taken as indicating cultural change or functional variations between the sites will be discussed in the conclusion to this chapter. The few flake adze slugs at W.C.I and M.bsh.I and the few backed flakes at M.bsh.I can be interpreted as new implements added into the tool assemblages at these sites without changing the basic nature of the industry.

(d) Barbetti's site 3

This site is fully described in Barbetti and Allen (1972:in press). It consists of five Aboriginal fireplaces located on the southern portion of the Lake Mungo lunette (see figure 8.1).

The site was discovered by Barbetti during a survey of the lunette for possible archaeomagnetic sites. Archaeomagnetic analysis on three of the fireplaces has provided a record of a brief excursion of the earth's geomagnetic field (Barbetti and McElhinney 1972:in press).

$^{14}C$ determination on charcoal from the fireplaces provided dates for this geomagnetic event and dated the oldest Aboriginal activities so far found in Australia. The $^{14}C$ dates from this site are listed in table 8.15. They come from Barbetti and Polach (1972:in press).
Table 8.15 $^{14}C$ dates from Barbetti's site 3

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>$^{14}C$ age</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANU-667</td>
<td>26,270 ± 470 B.P.</td>
</tr>
<tr>
<td>ANU-680</td>
<td>30,780 ± 520 B.P.</td>
</tr>
<tr>
<td>ANU-681</td>
<td>28,310 ± 410 B.P.</td>
</tr>
<tr>
<td>ANU-682</td>
<td>27,530 ± 340 B.P.</td>
</tr>
<tr>
<td>ANU-683</td>
<td>28,000 ± 410 B.P.</td>
</tr>
</tbody>
</table>

ANU samples 667, 680 and 682 were taken from typical Aboriginal ovens consisting of layers of lumps of baked clay on top of shallow elliptical pits filled with ash and pieces of charcoal (Barbetti and Allen 1972:in press). This type of oven has been dated by Barbetti and Polach (1972:in press) from being as old as 30,000 years, as above, to as recent as 200 years. A section through a recent oven of this type is shown on figure 7.4. The other two samples came from circular areas of burnt and blackened earth similar in appearance to the hearth areas at the Mungo I site.

Unfortunately no stone implements or economic remains can be directly associated with the ovens and hearths at this site 3. In the ethnographic literature the ovens were described as being used for cooking vegetables such as watercress (Bonney Ms.c.1881) or bulrush roots (Krefft 1866b:361-2) or else large animals such as the red kangaroo (Bonney Ms.c.1881) or the emu (Parker 1905:116). Eyre (1845a Vol.II:289) provides a good description of the use of an oven:

'The native oven is made by digging a circular hole in the ground, of a size corresponding to the quantity of food to be cooked. It is then lined with stones in the bottom [or clay balls where stones are unavailable], and a strong fire made over them so as to heat them thoroughly, and dry the hole. As soon as the stones are judged to be sufficiently hot, the fire is removed, and a few of the stones taken, and put inside the animal to be roasted if it be a large one. A few leaves or a handful of grass, are then sprinkled over the stones in the bottom of the oven, on which the animal is deposited,
'generally whole, with hot stones...laid on top of it. It is covered with grass, or leaves, and then thickly coated over with earth, which effectually prevents the heat from escaping'.

Smaller animals were generally broiled on the coals of an open fire.

Although site 3 is only about 5 km from the Mungo I site and is about the same age it differs from Mungo I in the presence of ovens and the absence of the preserved remains of Aboriginal foods and of stone implements. These differences suggest that different activities were carried on at the two sites. The ovens probably indicate the cooking of either vegetables or large animals, or both, at site 3. If so, it gives an indication of other activities carried out by Aborigines in the Lake Mungo area and is possibly the sort of site occupied by them when they were not exploiting the animal resources of the lake.

(e) Leaghur I midden

The Leaghur I midden is situated near the southwestern backshore of Lake Leaghur (figure 8.1). It is, however, eroding out of Lake Mungo lunette sediments and probably represents remains of shellfish gathered from Lake Mungo.

The site consists of an eroded shell midden visible on both banks of a shallow gully in the Mungo lunette. The midden originally covered an area of at least 925 sq.metres (1100 sq.yards) but has been eroded back so that it covers less than half of this area.

From the surface, the midden consists of a thin lens of freshwater mussel shells, *Velesunio ambiguous* visible around the gully. Augering showed that the midden extended back beneath the reddish-brown dune sands which cover lunette sediments. A plan of the LI site is shown on figure 8.5. The shell in some places has been burnt and is generally mixed with finely divided charcoal and ash. A coating of carbonate covers the shell layer.

A sample of shell and charcoal was submitted for radio-carbon analysis. The shell fraction gave a result of
Fig. 8.5: Leaghur I: site plan

Fig. 8.6: Leaghur I: sections

Area excavated
Modern dune sand
Grey sand
Exposures or layers of shell
Charcoal
Contour intervals in feet above datum
27,160 ± 900 B.P., ANU-372B, and the charcoal fraction a result of $24,020 \pm 1480$ B.P., ANU-372A. These two determinations are in statistical agreement and indicate that the I.I site is close to being the same age as the Mungo I site. The different C$^{14}$ results from shell samples and charcoal samples are discussed in section 8.9(a) of this chapter.

(f) Leaghur I excavations

I excavated a 8 x 4 foot (2.4 x 1.2 metres) test trench into the southeastern part of the midden to determine whether or not stone artefacts or faunal remains other than shell could be recovered. This trench was dug to a depth of between 3 and 4 feet (1.2 metres). The trench was excavated in depth units determined by stratigraphic differences within the deposit.

The location of the excavated trench and sections showing the stratigraphy and excavated units appear on figures 8.5 and 8.6.

The shell lens which outcrops on the surface to the northwest of the trench can be seen continuing as a thin band of shell (figure 8.6) and it dips quite steeply to the southwest. This trend was also shown by shell and charcoal rich horizons stratigraphically lower than the dated lens.

Although shells were abundant down to the base of excavation unit 5 (figure 8.7) those at the bottom were badly eroded and in a fragmented state.

Charcoal, in thin bands and in one spot (figure 8.6) as a discrete fireplace, was also found down to the base of the trench. Concentrations of charcoal were found associated with the shells.

Only 7 unmodified flakes and one water-rolled pebble were recovered from the excavation. All had a thin coating of carbonate. One flake came from just above the main shell lens, (excavation unit 2) two were directly associated with this lens (excavation unit 3), and the other four came from as much as one foot beneath it (excavation unit 4). No stone was recovered from excavation units 5 and 6. There was a density of artefacts in the deposit near the shell lens of about 1 artefact to every 4 cubic feet but from the excavation
as a whole there was a density of only 1 artefact to every 16 cubic feet.

A single mandible of an unidentifiable marsupial about the size of a rat-kangaroo or a small wallaby and a few fragments of other bones, one identified as having come from a small bird, were recovered from excavation unit 4.

The excavation revealed little information about human activities at the site other than the collection of shell-fish. Extensive surface collecting in eroded areas of the midden revealed few stone artefacts and no animal bones. I have interpreted the Leaghur I site as a specialized shell midden site of the same type as Tandou Creek I discussed in Chapter 7.

(g) **Comparison of the Mungo I, Barbetti's site 3 and the Leaghur I site.**

Three of the Lake Mungo sites, the Mungo I site, Barbetti's site 3 and the Leaghur I midden, are older than 24,000 years B.P. These sites show considerable variation.

The largest, the Mungo I site, showed evidence of a wide range of activities, fishing, shellfish collection, the hunting of land mammals and the collection of birds eggs and lizards. The occupants exploited both the adjacent lacustrine and terrestrial environments. Although relatively few artefacts were recovered from the site there were sufficient to indicate that activities involving the use of large core and flake scrapers, such as the manufacture of wooden implements, took place there also.

The Leaghur I midden, possibly as large as the Mungo I site in terms of the amount of food remains, consisted mainly of freshwater mussel shell. There were few indications of activities other than shell fishing at the site. The small number of flakes and animal bones recovered from the excavation suggests that only limited tasks involving stone implements or the collection of land foods were carried out.

The Leaghur I and Mungo I sites are possibly two kinds of summer seasonal camp of the type discussed above in relation to the younger Tandou Lunette III and Tandou Creek I sites. At Mungo I a wide range of activities were practised
and a wide range of foods were eaten; the site was relatively unspecialized. The occupants of the Leaghur I site concentrated almost entirely on the collection of shellfish.

The only economic remains that can be traced from the oldest occupational phase at 30,000 years to the ethnographic present in the Willandra Lakes area are the Aboriginal ovens. As the final drying phase of the lakes took place more than 10,000 years ago, the ovens since that time could only have been used for cooking land foods. No bones have been recovered, even from the youngest of these oven mounds.

Because the ovens have a continuous history in the area I think the use to which they were put 30,000 years ago was probably similar to their described use one hundred years ago as ovens for cooking vegetables and land animals. If this was their use, then Barbetti's Site 3 can possibly be interpreted as a winter seasonal camp used for the cooking of land foods when the resources of the lakes were either unavailable or too difficult and unpleasant to exploit owing to the coldness of the water.

Irrespective of the conclusion drawn about Barbetti's site 3, it can be shown that the inhabitants of the Lake Mungo area 24,000 years ago used a variety of sites. They ranged from (i) simple oven sites [Barbetti's site 3] and (ii) specialized shell midden sites [W.C.I] to (iii) more generalised sites showing the exploitation of a variety of environments and the performance of a wide range of tasks [Mungo I]. A similar range of sites existed in the Willandra Lakes area until the lakes dried up; Lake Tandou at 12,000 years B.P.; and on the Darling River and at Lake Victoria until the ethnographic present.

The drying of the Willandra Lakes disrupted this pattern, but I think the differences between the three roughly contemporaneous Lake Mungo sites demonstrates that their inhabitants utilised Lake Mungo 25,000 years ago in roughly the same way as the Aborigines of the Darling Basin utilised similar resources only one hundred years ago.
8.5 Lake Leaghur Sites

(a) Leaghur Peninsula I

L.P.I is located near the centre of a long peninsula jutting into the southwestern part of the Lake Leaghur basin (figure 8.1). This peninsula forms a north-south line with silcrete exposures on a remnant headland in Lake Mungo and with the headland in Lake Chibnalwood where the Chibnalwood gravels are found (figure 8.1). This suggests that these three features are structurally controlled by a ridge of silcrete (J. Bowler pers. comm.).

As large pebbles and rough flakes of silcrete are common on L.P.I it can be interpreted as a quarry site even though no exposures of silcrete presently occur near it.

After mapping and gridding, stone artefacts were collected from a number of squares. Most of the stone material consisted of large silcrete flakes and cobbles but some small scrapers and backed flakes were also present.

The stone artefacts did not allow division into two or more collections on the basis of carbonate accumulations as at Mungo I and Tandou Creek I. Further the stratigraphy did not suggest possible ways of unmixing what I thought was a mixed artefact assemblage as it did at Garnpung I, discussed below. For these reasons I did not attempt any analysis of the stone artefacts.

The faunal remains, however, can be roughly sorted into two groups.

(i) Animals associated with lake full conditions such as fish and shellfish together with bones with a heavy carbonate encrustation.

(ii) Bones neither associated with the lake nor possessing any traces of carbonate.

The first group is probably older than 10,000 years; the second younger. They are distinguished below on table 8.16, which lists the animals in each group.

There was no charcoal on the site from which a radiocarbon date could be obtained. The stratigraphy was confused. It appeared that a number of phases of erosion had dumped the
Table 8.16  Leaghur peninsula I: fauna

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) probably older than 10,000 B.P.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagorchestes sp.</td>
<td>hare-wallaby</td>
<td>2</td>
</tr>
<tr>
<td>Caloprymnus campestris</td>
<td>desert rat-kangaroo</td>
<td>1</td>
</tr>
<tr>
<td>Bettongia lesueur</td>
<td>burrowing rat-kangaroo</td>
<td>1</td>
</tr>
<tr>
<td>Bettongia sp.</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Plectroplites ambiguus (?)</td>
<td>golden perch</td>
<td>1</td>
</tr>
<tr>
<td>Veleusnico ambiguus</td>
<td>freshwater mussel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(scattered fragments)</td>
<td></td>
</tr>
<tr>
<td>(ii) probably younger than 10,000 B.P.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macropus giganteus</td>
<td>grey kangaroo</td>
<td>2</td>
</tr>
<tr>
<td>Macropus rufus</td>
<td>red kangaroo</td>
<td>1</td>
</tr>
<tr>
<td>Bettongia lesueur</td>
<td>burrowing rat-kangaroo</td>
<td>2</td>
</tr>
<tr>
<td>Bettongia sp.</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Leporilus conditor</td>
<td>stick-nest rat</td>
<td>1</td>
</tr>
<tr>
<td>Notomys or Pseudomys sp.</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Unidentified egg shell [not emu] fragments</td>
<td></td>
<td>17</td>
</tr>
</tbody>
</table>
stone material from a number of periods of occupation together onto a single erosional surface.

Bones, otoliths, eggshell, and freshwater mussel shells were found on the same surface as the backed flakes. The presence of fish bones and mussel shells suggests that the site was used while the lake held water [more than 10,000 years ago]; the presence of backed flakes suggests that it was also used in the last few thousand years [as, on present evidence, the oldest backed flakes from a number of sites in southeastern Australia are all younger than 6000 B.P.].

(b) **Leaghur backshore I-III**

Along the western shore of the Lake Leaghur basin are three extensive shell midden sites, Leaghur backshore I-III (figure 8.1).

There are no economic remains at the three sites apart from freshwater mussel shell, *V. ambiguus*. A plan of the Leaghur backshore I site is shown on figure 8.7. At the Leaghur backshore II and III sites, by contrast to L.bsh.I., the middens are more extensive, taking the form of a continuous thin layer of shell as was the case at the Leaghur I midden.

All three sites are in similar stratigraphic situations to that shown on figure 8.7 with the middens resting on reddish-brown dune sands in which weakly developed grey-brown calcareous soils (*Stace et al.*, 1968:55) have formed. These sands were mobilised before the final drying of the lakes forming sub-parabolic dunes which migrated across the lake strandlines and in Lakes Leaghur and Garnpung were trimmed by the lake waters (*Bowler 1970a:249*). *Bowler (1970a:247)* concluded that this dune activity was synchronous with or followed by the last phase of lacustrine activity. The presence of the Leaghur backshore I-III middens in these dunes supports Bowler's conclusion. Overgrazing of sheep has remobilised some of the dunes in recent years and the Leaghur backshore I site is now surrounded by mobile dunes formerly stabilised by vegetation (figure 8.7).

A sample of *V. ambiguus* shells from the Leaghur backshore II site was submitted for dating and gave a result of $15,690 \pm 235$ B.P., ANU-461. This age agrees well with Bowler's
Fig. 8.7: Leaghur backshore I: site plan

Shell midden
Modern dune sand
Contour interval in feet below datum
estimates of the age of dune mobility and I expect all three sites to be about this age.

Apart from a few very eroded grinding stones, there were very few stone artefacts at either L.bsh.I or L.bsh.III. At L.bsh.II, where the 15,000 B.P. date was obtained, stone artefacts including backed flakes were found indicating that this site had been used by Aborigines more than once. There may have been 12,000 years between subsequent visits.

Some of the features of Leaghur backshore I were well preserved (figure 8.7). From this figure it can be seen that the freshwater mussel shells on the site occur as discrete circular heaps (Plate 8.3A). There are 8 of these, each with a radius of about one metre (3.3 ft) and a thickness of 15 cm (6 inches) indicating a volume of shell and sand in each of half of a cubic metre (17 cubic feet). Plate 8.3a shows a photograph of one of the small circular middens at L.bsh.I.

I interpret the eight small middens at the Leaghur backshore I site as the remains of meals of eight small groups of Aborigines [families?] who on one or a few short visits gathered shellfish in the nearby lake and sat up in the dunes to eat them.

8.6 Garnpung I

(a) stratigraphy and stone artefacts

Garnpung I is located on the backshore of Lake Garnpung (figure 8.1) in a similar situation to the Leaghur backshore sites. It is associated with an area of dune sands which migrated over the backshore and into the lake. Figure 8.8 is a plan of the Gn.I site on which are marked areas of exposed stratigraphy. There are three main sediments.

(i) A coarse grey sand on which there are middens of freshwater mussel shell and stone artefacts.

(ii) A reddish-brown consolidated dune sand on which there are the remains of Aboriginal fireplaces and stone artefacts.

(iii) Yellow modern dune sands on which no bones, shells or stone artefacts occur.
Fig. 8.8: Garnpung I: site plan

Fig. 8.9: Garnpung I: grey sand area
A sample from the shell midden on Gn.IA and B (figure 8.9) an area of grey sands gave a result of 13,920 ± 480 B.P., ANU-373A for the charcoal fraction and 15,480 ± 210 B.P., ANU-373B for the mussel shell fraction. This indicated that the site was occupied at almost the same time as Leaghur backshore II. A sample from a hearth dug into some reddish-brown sands adjacent to the Gn.IA and B grey sand exposure gave a radiocarbon age of 3560 ± 85 B.P., ANU-701. These different radiocarbon dates indicated at least two phases of occupation.

A collection of stone artifacts from the Gn.IA and B grey sand area contained flake adze slugs and backed flakes indicating that some of the stone artefacts on the site may not be associated with the 14,000 year old shell midden. As mixed stone artefact assemblages seems to be a perennial problem with these open sites, I decided to try to unmix the assemblage using the site stratigraphy.

From figure 8.9 it can be seen that the eastern end of the grey sands are covered by reddish-brown dune sands. Similar exposures occur in the dunes to the north and west of the site. On all of these areas artefacts and fireplaces but no bones or shells occur. The reddish-brown sands lie on top of the grey sands in a number of places and therefore were probably deposited after them. A comparison of artefacts collected from on top of the reddish-brown sands with those from the grey sands midden area could give some idea of the nature of either a young or an old unmixed stone industry.

I called the areas of reddish-brown dune sands Gn.IC areas I-III. Their location is shown on figure 8.8. The artefacts collected from the grey sand midden site [Gn.IA & B] are listed in table 8.17 and those from an adjacent area of reddish-brown sands [Gn.IC area I] are on table 8.18.

In terms of the percentages of the various artefacts types (tables 8.17 and 8.18) and of the ratios of unmodified flakes to implements or cores, there is little difference between the two collections. This conclusion is supported by the fact that the density of artefacts over each area is roughly the same, being 20 artefacts per square metre (17 per sq.yard) on the grey sand and 15 per square metre (13 per sq.yard) on the reddish-brown dune sands.
Table 8.17 Garnpung IA and B: artifacts collected from on top of the grey sands

<table>
<thead>
<tr>
<th>Artifact type</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implements</td>
<td>267</td>
<td>11%</td>
</tr>
<tr>
<td>Broken implements</td>
<td>45</td>
<td>2%</td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>44</td>
<td>2%</td>
</tr>
<tr>
<td>Unmodified cores</td>
<td>172</td>
<td>7%</td>
</tr>
<tr>
<td>Unmodified flakes</td>
<td>1800</td>
<td>73%</td>
</tr>
<tr>
<td>Grindstone fragments</td>
<td>26</td>
<td>1%</td>
</tr>
<tr>
<td>Hammer and anvil stones</td>
<td>29</td>
<td>1%</td>
</tr>
<tr>
<td>Gypsum lumps</td>
<td>2</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Pebbles and ochre fragments</td>
<td>88</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>2473</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.18 Garnpung IC area I: artifacts collected from on top of the reddish brown dune sands

<table>
<thead>
<tr>
<th>Artifact type</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implements</td>
<td>85</td>
<td>10%</td>
</tr>
<tr>
<td>Broken implements</td>
<td>6</td>
<td>1%</td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td>Unmodified cores</td>
<td>44</td>
<td>5%</td>
</tr>
<tr>
<td>Unmodified flakes</td>
<td>676</td>
<td>83%</td>
</tr>
<tr>
<td>Grindstone fragments</td>
<td>1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Hammer and anvil stones</td>
<td>1</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Total</td>
<td>818</td>
<td></td>
</tr>
</tbody>
</table>
Table 8.19 Garnpung I: Implements collected from Gn.1 A and B (grey sand) and Gn.1 C areas I-III (brown dune sand)

<table>
<thead>
<tr>
<th>Implement category</th>
<th>Gn.1 A and B</th>
<th>Gn.1 C area 1</th>
<th>Gn.1 C area 2</th>
<th>Gn.1 C area 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Round edged scrapers</td>
<td>31</td>
<td>12%</td>
<td>15</td>
<td>18%</td>
</tr>
<tr>
<td>Flake adze slugs</td>
<td>6</td>
<td>2%</td>
<td>4</td>
<td>5%</td>
</tr>
<tr>
<td>Straight edged scrapers</td>
<td>51</td>
<td>19%</td>
<td>15</td>
<td>18%</td>
</tr>
<tr>
<td>Notched scrapers</td>
<td>25</td>
<td>9%</td>
<td>9</td>
<td>11%</td>
</tr>
<tr>
<td>Horsehoof cores</td>
<td>19</td>
<td>7%</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>72</td>
<td>27%</td>
<td>17</td>
<td>20%</td>
</tr>
<tr>
<td>Miscellaneous scrapers</td>
<td>13</td>
<td>5%</td>
<td>8</td>
<td>9%</td>
</tr>
<tr>
<td>Utilised flakes</td>
<td>25</td>
<td>9%</td>
<td>6</td>
<td>7%</td>
</tr>
<tr>
<td>Serrated edged scrapers</td>
<td>1</td>
<td>1%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Fabricators</td>
<td>4</td>
<td>2%</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Backed flakes</td>
<td>20</td>
<td>7%</td>
<td>8</td>
<td>9%</td>
</tr>
<tr>
<td>Total</td>
<td>267</td>
<td></td>
<td>85</td>
<td></td>
</tr>
</tbody>
</table>
Table 8.19 lists the implements collected from the grey sand area (Gn.IA & B) and from three separate areas of reddish-brown sand (Gn.IC areas I-III). Again there is no real difference between the collections from the four areas. The percentages of the various implement types show little variation from area to area.

Two conclusions can be drawn: either all four artefact collections from different parts of the Gn.I site are mixed in exactly the same, or none of the collections are mixed.

Because of the similarities of the Garnpung implement assemblages to other recent industries from the Willandra Lakes area such as those from the Walls of China I (table 8.11) and Mungo backshore I (table 8.13) sites, I concluded that all the collections both from the grey sands and the reddish-brown dune sands were unmixed and represented an implement industry used on the Garnpung site during the recent period. Such a conclusion entails acceptance of the unprovable hypothesis that very few stone artefacts from the Gn.IA and B site were actually associated with the 14,000 year old midden. Given the paucity of stone artefacts at similar shell midden sites such as Leaghur backshore I and III and the Leaghur I midden this seems to be a justifiable hypothesis.

(b) Garnpung I fauna

The main faunal remains consisted of freshwater mussel shells V. ambiguus and the eroded remnants of an extensive midden are shown on figure 8.10. Prior to erosion, the midden would possibly have covered an area of 1300 square metres (1600 sq.yards = 1/3 acre). Though extensive the midden was quite thin (8 cm average thickness) and augering failed to disclose any shell bands in the underlying sediments. In its original state, the shell midden would have contained an estimated 104 cubic metres (136 cubic yards) or 26 times as much shell as the Leaghur backshore I site.

The fish, crayfish and mammalian remains were collected from the southeastern quarter of the Gn.IA and B site. The remains were poorly preserved. The evidence for mammals on the site consisted of a few fragments of burnt and unburnt
bones. Otoliths constituted the main fish remains, gastro-
liths the main crayfish remains.

The minimum number of animals found in this quarter
of the site is listed in table 8.20 below.

The tentative identification of the red kangaroo was
based on the presence of a small lower molar fragment.

The mean length of the fish from Garnpung (extra-
polated from otolith lengths) was 390 ± 40 mm (12-18 inches)
and the mean weight was 1100 ± 600 gms (1/2 to 3 lbs).
Thus the fish caught at Garnpung were considerably larger
than the fish for which there was otolithic evidence at Mungo.
They were, however, of comparable size to the fish at Mungo
for which there was evidence in the form of vertebrae.
Preliminary counts of otolith growth rings indicate that most
of the Garnpung fish were from two to three years old.

There are two species of freshwater crayfish in the
Murray-Darling river system. The Murray River crayfish,
Eustacus armatus, the larger of the two (length = 300 mm [12
inches]) is confined to the cooler running streams such as
the Murray River (Bishop 1967:113-4; Hale 1927:72-6).
Cherax destructor, the yabbie, (length = 180 mm [7 inches])
frequents streams, isolated pools and billabongs (Hale 1927:
72-3). The gastroliths of the Murray River crayfish are
large (up to 25 mm in diameter).

Analysis of the gastroliths from the Garnpung I site
indicated that they came from a single population of small
crayfish with a gastrolith diameter of 10 ± 2 mm and thickness
of 5 ± 1 mm. I concluded that the gastroliths probably came
from yabbies, Cherax destructor.

Beveridge (1883:49-50) and Eyre (1845a Vol.2:252)
recorded that Murray River Aborigines found yabbies easiest
to obtain during spring and summer. The gastroliths are only
formed at certain times 'In freshwater crayfish...[gastroliths]
...are formed a little time before molting; these are stored
in the stomach, and are dissolved after molting, apparently
to supply some of the calcareous material necessary for
strengthening the new integument' (Hale 1927:72). As the
crayfish go into a phase of semi-hibernation during winter,
the spring and summer is the most likely period of molting and
hence of gastrolith formation.
Table 8.20 Garnpung I midden fauna

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Min. nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAMMALS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>? <em>Macropus rufus</em></td>
<td>red kangaroo</td>
<td>1</td>
</tr>
<tr>
<td><strong>EGG SHELL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified [not emu] fragments</td>
<td></td>
<td>585</td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Euchromis argenteus</em></td>
<td>golden perch</td>
<td>244</td>
</tr>
<tr>
<td><strong>FRESHWATER CRAYFISH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Cherax destructor</em></td>
<td>yabbie</td>
<td>27</td>
</tr>
<tr>
<td><strong>FRESHWATER MUSSEL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>V. variegatus</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


There were quite large quantities of an unidentified bird egg shell on the site; some of the fragments were burnt.

The large quantity of mussel shell and the high numbers of fish and crayfish on the Garnpung I site indicate that the occupants of the site were primarily interested in exploiting the resources of the adjacent lake. These foods could all have been obtained from the shallow lakewaters and muddy sands of the western shore of Lake Garnpung.

There is a sufficient quantity of shell and fish remains at the site to suggest that it was occupied by a relatively large group of people possibly on a number of occasions or else by a smaller group for an extended period of time.

(c) Garnpung I flake adze slugs and backed flakes

The Garnpung I artefacts, although probably much younger than the shell midden, contain sufficient number of backed flakes and flake adze slugs to compare them with these implements from other sites. The disposition of retouch, relative to the striking platform, on the Garnpung I flake adze slugs compared to those from elsewhere is shown on table 8.21 below.

From this table, it can be seen that the great majority of flake adze slugs from the Willandra Lake sites (Garnpung I and Walls of China and Mungo backshore I) have their retouched edges along the flake margins, the edge is at right angles to the striking platform. The great majority of Willandra Lakes flake adze slugs conform to the burren adze slugs of McCarthy's typology (McCarthy et al., 1946:29-30). By contrast, the great majority of flake adze slugs from Burke's Cave and Meadow Glen have their retouch on the ends of the flake, parallel to the striking platforms, and hence conform to tula adze slugs (McCarthy 1946:29-30). While I accept Gould's (1969:232) warning that the formal differences between burrens and tulas may not imply separate cultural traditions, the differences between the Willandra Lakes flake adze slugs and those from Burke's Cave and Meadow Glen in regard to disposition of retouch are sufficiently marked for
Table 8.21: Disposition of retouch relative to the striking platform on flake adze slugs from Garnpung I, Walls of China and Mungo backshore I, Burke's Cave and Meadow Glen

<table>
<thead>
<tr>
<th>Site</th>
<th>Disposition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S^1</td>
</tr>
<tr>
<td></td>
<td>No.</td>
</tr>
<tr>
<td>Garnpung I</td>
<td>5</td>
</tr>
<tr>
<td>Walls of China and Mungo backshore I</td>
<td>2</td>
</tr>
<tr>
<td>Burke's Cave</td>
<td>3</td>
</tr>
<tr>
<td>Meadow Glen</td>
<td>4</td>
</tr>
</tbody>
</table>

^1 S = side, working edge at right angles to the striking platform.

^2 E = end, working edge parallel to the striking platform.
Table 8.22  Backed flakes from Burke's Cave and Garnpung I

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Length mm $\bar{x} \pm s$</th>
<th>Breadth mm $\bar{x} \pm s$</th>
<th>Length:breadth $\bar{x} \pm s:1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garnpung I</td>
<td>A</td>
<td>23 ± 5</td>
<td>15 ± 3</td>
<td>1.5 ± 0.2:1</td>
</tr>
<tr>
<td>Burke's Cave unit I</td>
<td>A</td>
<td>17 ± 4</td>
<td>12 ± 3</td>
<td>1.4 ± 0.4:1</td>
</tr>
<tr>
<td>Garnpung I</td>
<td>B</td>
<td>28 ± 7</td>
<td>14 ± 4</td>
<td>2.0 ± 0.1:1</td>
</tr>
<tr>
<td>Burke's Cave unit I</td>
<td>B</td>
<td>19 ± 3</td>
<td>9 ± 1</td>
<td>2.2 ± 0.4:1</td>
</tr>
</tbody>
</table>
me to reject the hypothesis that these differences are due to fortuitous circumstances (Gould 1968b:168). Any conclusion must await further archaeological exploration in the surrounding regions.

Comparison of the backed flakes (microliths) from Garnpung I and Burke's Cave (table 8.22) revealed that the Garnpung group A backed flakes (L:B ratio >2:1) were significantly larger than those from Burke's Cave. However, there was no significant difference between the length:breadth ratios of the group A backed flakes from either site, nor any difference between the group B microliths.

There was no statistical difference in the proportion of group A to group B backed flakes from Garnpung or Burke's Cave. The great majority of backed flakes from both sites were in group A. The backed flakes from Garnpung and Burke's Cave are more similar to each other than they are to backed flakes from the east coast of New South Wales and from Western Australia discussed by Glover (1967:415-25).

8.7 Mulurulu I

Lake Mulurulu is the northernmost of the Willandra Lakes (figure 8.1) and is the lake closest to the Lachlan River, the previous water source for the Willandra system. The Willandra Creek, which connected the Willandra Lakes to the Lachlan, now ceases to flow about 80 km (50 miles) to the east of Lake Mulurulu. In times of flood, the Willandra Creek has filled Gunnaramby Swamp only 32 km (20 miles) to the east (N.S.W. Royal Commission 1885:41). Record floods have probably filled part of the Mulurulu basin at different times during the past 15,000 years and the lake may also have held water after the southern Willandra Lakes had dried.

The Mulurulu I site (M.L.I) is on the southern end of the lunette (figure 8.1). It consists of a series of small shell middens running parallel to the lake shoreline. There are nine middens (plate 8.3b), similar to those at Leaghur backshore I (figure 8.10, see figure 8.7 for a plan of L.bsh.I and plate 8.3a and b) but they are approximately twice the size.

Fish and mammal bones, some burnt, are scattered around some of the middens and there are the remains of a large
Aboriginal oven at the northern end of the site.

Two shell samples gave consistent $^{14}\text{C}$ results, one being $15,120 \pm 235$ B.P., ANU-880A, and the other $15,450 \pm 240$ B.P., ANU-880B. The ages suggest that the MLI site was occupied at about the same time as the Leaghur backshore I and Garnpung I middens.

There were few stone artefacts associated with the middens except for a few eroded and broken pieces of grinding stone.

There is some variation in the foods eaten on different parts of the site. Most of the fish and animal bones were associated with the five southernmost middens. Three of the other middens had no bone scatter around them and the northernmost midden was only associated with a small scatter of fish bone.

Apart from shells, the faunal sample from MLI was collected from an area of 60 square metres (70 square yards) pegged out in the centre of the bone scatter at the southern end of the site. The sample represents between 33 and 50 percent of all animals present (figure 8.23).

The nine middens of *V. ambiguus* shell contain a total of about 9 cubic metres of shell and sand (303 cubic feet, an average of 1 cubic metre [34 cubic feet] in each). This is twice as much shell as was estimated for the Leaghur backshore I site.

While this volume of shell is equivalent to only 8 percent of the volume at Garnpung I there are, relative to shell fish, many more fish and mammals at MLI than at Garnpung I. This indicates that the occupants of the Mulurulu I site spent more time fishing and hunting than did those who occupied the Garnpung site.

Golden perch are probably the most numerous fish present. The Murray Cod was identified from a single large otolith fragment (see Appendix 4).

The otoliths give an accurate idea of the sizes of the great majority of fish on the site. The lengths suggest a length of $350 \pm 50$ mm (12-16 inches) and a weight of $640 \pm 400$ gms (.5-2.5 lbs). As at Mungo I, estimated lengths and weights of fish based on extrapolations from vertebrae
### Table 8.23 Mulurulu I fauna

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAMMALS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Macropus (Oesphranter) robustus</em></td>
<td>wallaroo</td>
<td>1</td>
</tr>
<tr>
<td><em>Lagorchestes sp.</em></td>
<td>hare wallaby</td>
<td>9</td>
</tr>
<tr>
<td><em>Bettongia penicillata</em></td>
<td>brush-tailed rat-kangaroo</td>
<td>4</td>
</tr>
<tr>
<td><em>Bettongia sp. (lesueur or pencillata)</em></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><em>Perameles cf. bougainville</em></td>
<td>barred bandicoot</td>
<td>1</td>
</tr>
<tr>
<td><em>Perameles sp. (?)</em></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td><em>Rattus sp. (?)</em></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><em>Leporillus conditor</em></td>
<td>stick-nest rat</td>
<td>2</td>
</tr>
<tr>
<td><em>Notomys or Pseudomys sp.</em></td>
<td>hopping mouse</td>
<td>2</td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Plectroplites ambiguous (?)</em></td>
<td>golden perch</td>
<td>172</td>
</tr>
<tr>
<td><em>Macullochella macquariensis (?)</em></td>
<td>Murray cod</td>
<td>1</td>
</tr>
<tr>
<td><strong>EGGSHELL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emu egg</td>
<td>(fragments)</td>
<td>7</td>
</tr>
<tr>
<td><strong>SHELLFISH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Velesunio ambiguous</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fig. 8.10: MuluruI I: site plan

Fig. 8.11: MuluruI IIIA middens 6-12: site plan
diameters (table 8.35, figure 8.15) are considerably larger than those obtained from otolith length. In this case, however, the presence of a large Murray cod otolith supports the conclusion that there were some large fish on the site.

Mammals (table 8.23) ranged from the large kangaroo *M. robustus* to the tiny hopping mouse, with the hare-wallaby and the rat-kangaroo being the most numerous. The fauna is very similar to that at Mungo I, despite the fact that the Mungo site is 10,000 years older. The wombat at Mungo I and the wallaroo at Mulurulu I may both represent chance captures of large mammals made during the short period of occupation at either site.

Food obtained from the lakes may have been the most important item of diet at MLI. Fish (table 8.24) contributed about 1.5 times the estimated total live weight of mammals. If the large quantity of shellfish is also taken into consideration, it can be seen that the Aborigines at MLI exerted much more energy exploiting the lake. The hunting and collecting of land foods was clearly less important than at Mungo I but more important than at shell midden sites such as Leaghur, Leaghur backshore and Garnpung I.

Table 8.24 Mulurulu I: estimated total live weight of mammals and of fish.

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Estimated weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammals</td>
<td>25</td>
<td>77 kg</td>
</tr>
<tr>
<td>Fish</td>
<td>172</td>
<td>114 kg</td>
</tr>
</tbody>
</table>

8.8 Mulurulu III

(a) stratigraphy

The Mulurulu III site is located on the far northern end of the lunette (figure 8.1). Deflation in this section of the lunette has revealed the stratigraphy (figure 8.12).

In the centre of the lunette core sediments of quartz sands, in which pedogenesis and carbonate accumulation has taken place are exposed. Bowler tentatively equates this soil with the Mungo unit (J. Bowler pers.comm.). A C\textsubscript{14} date
from the next sedimentary unit, above the core deposits, indicates that they are older than 15,000 years. Artefacts, fireplaces, burnt bones and the remains of other human activities were associated with the older sediment.

Stratigraphically above the core sediments are other quartz sands, in some places consisting of layered beach sands rich in organic remains, in which a weak brown-coloured soil has formed. A sample of carbon from these sands gave an age of 15,490 ± 740 B.P., ANU-882. The absence of aeolian clayey sands from the northern end of Mulurulu means that this second sedimentary unit cannot be equated with the Zanci unit and also suggests that the terminal stages of Lake Mulurulu may have been slightly different to those at Lakes Garnpung and Mungo.

A thin deposit of silt was deposited over the beach sands on the lake-side edge of the lunette (figure 8.13). A midden on this silt gave a $^{14}$C age of 15,560 ± 240 B.P., ANU-948B, from a sample of mussel shells, and 12,800 ± 990 B.P. ANU-948A, from a small sample of charcoal and sand. The carbon dates from the uppermost lunette deposits at Mulurulu indicate that the final phase of lunette building and of permanent lake full conditions may have occurred as much as 1000 years later at Mulurulu than on the southern Willandra Lakes.

Recent mobile white sand has formed a foredune on the lakeside margin of the Mulurulu lunette and also covers the offshore margin.

(b) Mulurulu IIIA

Dotted along 1 km (1100 yards) of the northern end of the Mulurulu lunette are twelve small shell middens. They are all on the fine silts or sandy beach deposits of the uppermost lunette deposit. There is a semi-continuous scatter of bones around middens 1-5 (figure 8.12) and around middens 6-12. On the 220 metres (700 feet) between these two groups of middens no artefactual or faunal material was found. Because of this I initially dealt with middens 1-5 and 6-12 as two different sites. On examination, however, it was found that all 12 small middens, as well as being in identical stratigraphic
Fig. 8.12: Mulurulu IIIA-C: Location map and stratigraphy

Lake floor

Fig. 8.13: Mulurulu IIIA middens 6-12: section
situations, had the same species of animals and the same numbers of each species relative to shell volumes. I therefore decided to deal with all 12 middens and their associated fauna as a single archaeological unit, MLIIIA.

The animals collected from MLIIIA are listed on table 8.25. The mammals on this table represent an estimated 40 percent of all of the mammals associated with the twelve middens. The shell middens are all small, having an estimated total volume of 6 cubic metres (212 cubic feet) and an average volume of .5 cubic metres (17 cubic feet). There are many more animals, relative to the volume of shell, at MLIIIA than at MLI and many fewer fish.

The fish were larger than those from any other Willandra site excepting Garpung I. They had an estimated length of $370 \pm 40$ mm (12-17 inches) and weight of $800 \pm 300$ gms (.6-3 lbs). The presence of fragments of jaws from fish of a very large size suggests that fish, possibly Murray cod or large golden perch, for which there was no otolithic evidence, were also caught.

The large number of mammals (table 8.25) relative to other food categories suggests that the hunting and collecting of land mammals was the main occupation of the users of the site. With mammals ranging from large kangaroos to mice, birds, reptiles, fish and shellfish, the MLIIIA site shows the wide variety of foods available near the lakes during the Pleistocene. Hare-wallabies and rat-kangaroos are numerically the largest group on the site, as at Mungo and Mulurulu I. Either these were particularly common in the area or the Aborigines made special efforts to capture them.

Macropus (O). cooperi, identified by Mr. L. Marshall¹, was a larger, now extinct, ancestor of the extant M. robustus, the wallaroo. This animal and the wallaroo from M.L.I could have been caught on the plains between Lake Mulurulu and the Manfred Range 24 km (15 miles) to the east. Wallaroos are generally found near stony uplands or rocky country (Calaby 1971:24). The other mammals could have been caught on the

¹Department of Zoology, Monash University.
### Table 8.25 Mulurulu IIIA: fauna

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mammals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macropus giganteus</td>
<td>grey kangaroo</td>
<td>1</td>
</tr>
<tr>
<td>M. rufus</td>
<td>red kangaroo</td>
<td>1</td>
</tr>
<tr>
<td>M. (O) cooperi</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Onychogalea fraenata</td>
<td>nail-tailed wallaby</td>
<td>1</td>
</tr>
<tr>
<td>Lagorchestes sp.</td>
<td>hare-wallaby</td>
<td>37</td>
</tr>
<tr>
<td>Bettongia penicillata</td>
<td>brush-tailed rat-kangaroo</td>
<td>6</td>
</tr>
<tr>
<td>B. leuereur</td>
<td>burrowing rat-kangaroo</td>
<td></td>
</tr>
<tr>
<td><strong>Bettongia sp.</strong> (leuereur or penicillata)</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>Undetermined macropodidae</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Trichosurus vulpecula</td>
<td>brush-tailed possum</td>
<td>2</td>
</tr>
<tr>
<td>Isodon obesulus</td>
<td>short-nosed bandicoot</td>
<td>2(?)</td>
</tr>
<tr>
<td>Perameles cf. bougainville</td>
<td>barred bandicoot</td>
<td>1</td>
</tr>
<tr>
<td>Perameles sp.</td>
<td></td>
<td>2(?)</td>
</tr>
<tr>
<td>Dasyurus viverrinus or geoffroii</td>
<td>native cat</td>
<td>1</td>
</tr>
<tr>
<td>?Sarcoophilus harrisii</td>
<td>Tasmanian devil</td>
<td>1</td>
</tr>
<tr>
<td>Rattus lutreolus</td>
<td>eastern swamp-rat</td>
<td>1</td>
</tr>
<tr>
<td>Leporillus conditor</td>
<td>stick-nest rat</td>
<td>3</td>
</tr>
<tr>
<td>Pseudomyx sp.</td>
<td>hopping mouse</td>
<td>1</td>
</tr>
<tr>
<td><strong>Birds</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>? Columbidae</td>
<td>dove</td>
<td>1</td>
</tr>
<tr>
<td>Podiceps sp. (?)</td>
<td>grebe</td>
<td>1</td>
</tr>
<tr>
<td>? Ciconiiformes</td>
<td>heron</td>
<td>1</td>
</tr>
<tr>
<td><strong>Reptiles</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agamidae</td>
<td>dragon lizards</td>
<td>2</td>
</tr>
<tr>
<td><strong>Bird Egg Shell</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emu egg</td>
<td>(fragments)</td>
<td>117</td>
</tr>
<tr>
<td><strong>Fish</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plectroplites ambiguus (?)</td>
<td>golden perch</td>
<td>12</td>
</tr>
<tr>
<td><strong>Freshwater Mussel</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Velesunio ambiguus</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
plains surrounding the lake. The swamp-rat can be found in most wet grassy areas (Ride 1970:136).

During collection of a sample of the faunal remains near MLIllA midden I a finely shaped bone point (plate 8.3d) was found. The bone point has a thin coating of carbonate attached to the end opposite the point suggesting that it eroded from the lunette sediments. Similar bone points, also with carbonate coating, were found at the Lake Menindee site (Tindale 1955:285-7).

No backed flakes (microliths) or flake adze slugs were associated with any of the Mulurulu middens. The stone from MLIllA middens 1-5 consisted mainly of grinding stones with only the odd scraper here and there along the lunette. A piece of grinding stone from midden 5 is shown on plate 8.3c.

I did more work on the six middens at the northern end of the site. Figure 8.11 is a plan of this portion of MLIllA. Also Bowler carried out stratigraphical examination of the lunette sediments near this spot and a section showing the sequence of sediments, drawn by Bowler, is reproduced on figure 8.13.

Sample ANU-948, mentioned previously, was taken from midden 6 (figure 8.11) and it gave a result of 15,560 ± 240 B.P. ANU-948B from shell and 12,800 ± 990 B.P. ANU-948A, from carbon. All 12 middens on site MLIllA are almost certainly between 13,000 and 15,000 years old, the exact age depending on how accurate the ANU-948B determination was. A bone sample, ANU-464, gave an age 7210 ± 100 B.P. from its 'calcite' fraction and 4020 ± 320 B.P. from 'collagen'. As the dated bone had a slightly higher fluorine content (0.25%) than fish bone from within the dated midden (6) (0.20%), I have assumed that the bone date was inaccurate. As yet, bone dates have not yielded consistently correct or acceptable ages (Polach 1971:in press).

The MLIllA middens 6-12 area consists of a number of shell middens around a small deflation basin in which there is a surface scatter of stone implements and bones. Excavation within the fine grey sand and silt on which the site was situated (see figure 8.13) revealed 'in situ' bones and stone artefacts in small numbers associated with patches of blackened silt which I interpret as fireplaces. The 100 artefacts in
Table 8.26  Mulurulu IIIA middens 6-12: artifacts

<table>
<thead>
<tr>
<th>Artifact type</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implements</td>
<td>32</td>
<td>32%</td>
</tr>
<tr>
<td>Broken implements</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td>Rejuvenation flakes</td>
<td>2</td>
<td>2%</td>
</tr>
<tr>
<td>Unmodified flakes</td>
<td>56</td>
<td>56%</td>
</tr>
<tr>
<td>Unmodified cores</td>
<td>6</td>
<td>6%</td>
</tr>
<tr>
<td>Grinding stones</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Pebbles</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.27  Mulurulu IIIA middens 6-12: implements

<table>
<thead>
<tr>
<th>Implement type</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round edged scrapers</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Straight edged scrapers</td>
<td>3</td>
<td>9%</td>
</tr>
<tr>
<td>Notched scrapers</td>
<td>4</td>
<td>13%</td>
</tr>
<tr>
<td>Horsehoof cores</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>7</td>
<td>22%</td>
</tr>
<tr>
<td>Retouched flakes</td>
<td>7</td>
<td>22%</td>
</tr>
<tr>
<td>Utilised flakes</td>
<td>9</td>
<td>28%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>
table 8.26 were collected from an area of 263 square metres (315 square yards) giving a density for the site of 1 artefact for every 2.6 square metres (3.2 square yards). This is a much lower density of artefacts per unit area than was the case at the Walls of China, Mungo backshore and Garnpung I sites.

A large number of small rounded pebbles were found. These were too small to have been used for cooking and I am at a loss to explain their presence.

The small number of unmodified flakes to implements (table 8.27) indicates that little implement manufacture took place on the site. The implement assemblage, with utilised and retouched flakes making up 50 percent of total implements, is possibly one that was used to prepare the animals for cooking as well as possibly to make wooden implements.

The surface collections from within the gridded area revealed some site features not otherwise apparent. Most of the bone was recovered from near the centre of the area where excavation had revealed the presence of fireplaces. Most stone artefacts occurred on the fringes of the collected area towards the small middens which encircled the entire site. The spatial arrangement of the site features, with bones near the centre surrounded by artefacts, which were in turn surrounded by small middens, is sufficiently marked to justify the conclusion that there was considerable segregation of tasks on the site.

(c) MLIIIIB

Directly to the north of middens 3 and 4 on the MLIIIA site, eroding out of lunette core deposits, were four small fireplaces surrounded by burnt animal bones. This small site is probably about the same age as the Mungo I site, older than 20,000 years. A carbon sample is presently being dated.

Thirty seven artefacts and implements were collected from around fireplaces and these are listed in table 8.28 below. Of the 13 implements collected, 7 (54 percent) consisted of utilised flakes, possibly indicating that most of the implements around the fireplaces were used to prepare the food.
<table>
<thead>
<tr>
<th>Artifacts and Implements</th>
<th>No.</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight edged scrapers$^1$</td>
<td>3</td>
<td>8%</td>
</tr>
<tr>
<td>Steep edged scrapers</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Notched scrapers</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td>Utilised flakes</td>
<td>7</td>
<td>19%</td>
</tr>
<tr>
<td>Unmodified flakes</td>
<td>9</td>
<td>24%</td>
</tr>
<tr>
<td>Unmodified cores$^2$</td>
<td>8</td>
<td>22%</td>
</tr>
<tr>
<td>Pebbles</td>
<td>5</td>
<td>14%</td>
</tr>
<tr>
<td>Large pounding stones</td>
<td>2</td>
<td>5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37</strong></td>
<td></td>
</tr>
</tbody>
</table>

$^1$ One straight edged scraper also possessed two notched edges.

$^2$ Included two fabricators or bipolar cores.
The animals found around each fireplace and the total number of animals is given on table 8.29. Variation in foods eaten at different places on the same site, which was previously noted at the Mulurulu I and Mungo I sites (section 8.6 and Jones and Allen in Bowler et al., 1970: table 3), is again apparent at this site. I think the site could represent the remains of a single meal eaten by a small group of people, some of whom had been fishing and some hunting. If this were true then those who sat around hearth I may have eaten only a rat-kangaroo and a large tiger cat whereas those at hearth 2, possibly a larger group, had a small wallaby, two rat-kangaroos, two native cats, eleven fish and an emu egg. The people sitting at hearth 2 may have donated some fish to their relatives at hearth 3 to supplement the six wallabies and the single mouse. Around hearth 4 were the remains of 7 small wallabies, two rat-kangaroos and a lizard.

There was no evidence of any shellfish and the few fish bones came from quite small fish with an estimated length of 300 ± 25 mm (11-13 inches) and weight of 140 ± 200 gms (.3-.75 lbs). The otoliths were significantly smaller than those recovered from the adjacent, but much younger, MLIIIA site. Thin sections of some of the MLIIIB otoliths revealed that most of the fish were about 18 months old. Two of the smaller otoliths were from slightly older fish indicating that they came either from golden perch reared in an unfavorable environment or else from the smaller related species Macquarie perch, Macquaria australasica.

The numbers of small wallabies, rat-kangaroos and native cats (table 8.29) reveal that more food was obtained from the surrounding plains than from the lake. The estimated live weight of land animals is 16 times that of the fish. The fact that the site shows little evidence of the exploitation of the lake, less than 100 metres away, suggests that the lunette and lakeshore provided a pleasant camping and watering spot for Aborigines who spent most of their time systematically collecting mammals from adjacent terrestrial environments.
Table 8.29: Mülürulu IIIB: faunal remains

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>Minimum numbers</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hearth 1</td>
<td>Hearth 2</td>
<td>Hearth 3</td>
<td>Hearth 4</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MAMMALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lagorchestes sp.</td>
<td>hare-wallaby</td>
<td>1</td>
<td>6</td>
<td>7</td>
<td></td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bettongia lesueur</td>
<td>burrowing rat-kangaroo</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bettongia sp. (penicillata or lesueur)</td>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undetermined Macropodidae</td>
<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dasyurus maculatus</td>
<td>tiger cat</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dasyurus geoffroii or viverrinus</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dasyurus cristicauda (?)</td>
<td>crest-tailed marsupial mouse</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrophorus ambiguus (?)</td>
<td>golden perch</td>
<td>11</td>
<td>3</td>
<td></td>
<td></td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>REPTILES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agamidae</td>
<td>dragon lizard</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BIRD EGG SHELL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emu egg</td>
<td>(fragments)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
MLIIIC is also associated with the Mulurulu lunette core sediments, in this case, directly behind the MLIIIA middens 6-12 area (figure 8.12).

The site was badly eroded, no site features other than a scatter of bones, mussel-shell fragments and crayfish gastroliths being present. The few animals recovered are listed in table 8.30. Some of the mammals, in particular the wombat, Lasiorhinus sp., could have lived on the site and have been incorporated into the deposit without any human intervention. The mussel shells and the crayfish remains, some burnt, require human transport.

Gastroliths and fragments of chitinous exoskeleton, particularly pincers, were the commonest remains. The absence of spines or tubercules from these pincers confirm the identification of the crayfish as yabbies, Cherax destructor. The gastroliths, with a mean diameter of $11 \pm 2.3$ mm, were not significantly different in size from those at Garnpung I.

Table 8.31 sets out the results of fluorine analysis of bone samples from MLIIIC and from other sites. The results of this analysis independently confirm Bowler's conclusion that the lunette core at Mulurulu was approximately the same age as the Mungo unit. Fluorine analysis of mammal bone from MLIIIC showed the bone to contain about twice as much fluorine as bones and fish vertebrae associated with the adjacent midden 6 dated to between 13,000 and 15,000 years. On the other hand the bone from MLIIIC contained almost equal amounts of fluorine as did mammal bone samples from the Mungo I site dated to 26,000 B.P. Fish bone appears to absorb less fluorine than does mammal bone.

8.9 Willandra Lakes carbon dates

(a) the validity of ages derived from freshwater mussel shells

Three of the shell middens from the Willandra Lakes sites consisted of shell and finely divided carbon. Samples from these middens were dated in order to test whether freshwater mussel shells, from this area, would give consistent and
Table 8.30  Mulurulu IIIC: fauna

<table>
<thead>
<tr>
<th>Species</th>
<th>Common name</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mammals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unidentified kangaroo</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Lagorchestes sp.</td>
<td>hare-wallaby</td>
<td>3</td>
</tr>
<tr>
<td>Bettongia penicillata</td>
<td>brush-tailed rat-kangaroo</td>
<td>1</td>
</tr>
<tr>
<td>Lasiorhinus sp.</td>
<td>wombat</td>
<td>1</td>
</tr>
<tr>
<td>Rattus lutreolus</td>
<td>eastern swamp-rat</td>
<td>1</td>
</tr>
<tr>
<td>Reptiles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agamidae</td>
<td>dragon lizard</td>
<td>1</td>
</tr>
<tr>
<td>Crayfish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cherax destructor</td>
<td>yabbie</td>
<td>18</td>
</tr>
<tr>
<td>Eggshell</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emu egg</td>
<td>(fragments)</td>
<td>11</td>
</tr>
<tr>
<td>Freshwater Mussel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veleunio ambiguus</td>
<td>scattered fragments</td>
<td></td>
</tr>
</tbody>
</table>
Table 8.3: Fluorine analysis\(^1\) of Willandra Lakes bone samples

<table>
<thead>
<tr>
<th>Site</th>
<th>Nature of sample</th>
<th>Known age?</th>
<th>% age fluorine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mungo I</td>
<td>burnt mammal bone</td>
<td>26,000 B.P.</td>
<td>0.49 ± 0.01</td>
</tr>
<tr>
<td>Mungo I</td>
<td>fish vertebrae</td>
<td>26,000 B.P.</td>
<td>0.31</td>
</tr>
<tr>
<td>Mulurulu IIIC</td>
<td>mammal bone</td>
<td>?</td>
<td>0.51 ± 0.05</td>
</tr>
<tr>
<td>Mulurulu IIIA midden 6</td>
<td>mammal bone</td>
<td>12-15,000 B.P.</td>
<td>0.25 ± 0.01</td>
</tr>
<tr>
<td>Mulurulu IIIA midden 6</td>
<td>fish vertebrae</td>
<td>12-15,000 B.P.</td>
<td>0.20</td>
</tr>
<tr>
<td>Mulurulu IIIA midden 6</td>
<td>fish vertebrae</td>
<td>12,15,000 B.P.</td>
<td>0.15 ± 0.04</td>
</tr>
<tr>
<td>Walls of China</td>
<td>mammal bone</td>
<td>modern control</td>
<td>0.01</td>
</tr>
</tbody>
</table>

\(^{1}\) Carried out by Miss B. Stephenson and Mrs R. Chao both Research School of Chemistry, Australian National University.
accurate ages. The $^{14}C$ determinations from the shell and carbon fractions are listed in table 8.33 below. Two determinations from shells from the same midden, (MLI) which gave identical results, are also shown.

From table 8.33 it can be seen that the ages from the mussel shells give consistent and accurate indications of the age of the middens. The differences between the means of ages derived from the shell and associated charcoal fractions may have been as much due to the inadequate sizes of the charcoal samples (less than 50% of the normal minimum laboratory requirement in all three cases, H. Polach pers.comm.) as to consistent differences in the proportion of $^{14}C$ in either fraction. Bowler (1970a:228-9) reviewed the literature on the dating of shell carbonates and concluded that 'since geologically old limestone does not occur in the Willandra Lakes region, shells which grew in the lake waters would closely reflect the atmospheric levels of $^{14}C$ at that time'. Bowler (1970a:229) also found that ages derived from shell carbonates were consistent with independent stratigraphic and chronological evidence.

(b) dates associated with archaeological sites

There are 39 $^{14}C$ determinations available from archaeological sites in the Willandra Lakes area. These come from three sources: Bowler's work on the geomorphology of the area and his attempts to date various sedimentary units (in Polach et al.,1970:1-18), my own work on the archaeological sites, and Barbetti's work on the archaeomagnetism of Aboriginal fireplaces.

The oldest dates for human skeletal remains (26,000 B.P. Bowler et al., 1972:in press) and for human activity in Australia (31,000 B.P., Barbetti and Allen 1972:in press) both come from this area.

The dates from the Willandra Lakes are shown on figure 8.14 graphs A-C. Graph A shows the distribution of dates mainly from shell midden sites obtained by Bowler (in Polach et al.,1970:11-18) and by myself. The dates span two periods 13-16,000 B.P. and 25-30,000 B.P. and generally coincide with Bowler's Zanci and Mungo high-water phases
Table 8.32  Willandra Lakes: shell dates

<table>
<thead>
<tr>
<th>Site</th>
<th>Sample no.</th>
<th>$^{14}$C age (years B.P.)</th>
<th>Difference between means</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Charcoal fraction</td>
<td>Shell fraction</td>
</tr>
<tr>
<td>Leaghur I</td>
<td>ANU-372</td>
<td>24,020 ± 1480 1250</td>
<td>27,160 ± 900</td>
</tr>
<tr>
<td>Garnpung I</td>
<td>ANU-373</td>
<td>13,920 ± 480</td>
<td>15,480 ± 210</td>
</tr>
<tr>
<td>Mulurulu IIIA midden 6</td>
<td>ANU-948</td>
<td>12,800 ± 990</td>
<td>15,560 ± 240</td>
</tr>
<tr>
<td>Mulurulu I</td>
<td>ANU-880</td>
<td>-</td>
<td>15,120 ± 235</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-</td>
<td>15,450 ± 240</td>
</tr>
</tbody>
</table>
(Bowler et al., 1970:47). There is no evidence for shell middens younger than this. Graph B shows dates obtained by Barbetti (Barbetti and Polach 1972:in press). Most of Barbetti's dates fall within the periods 0-5000 years and 25-35,000 years. No economic remains were associated with any of these fireplace sites (M. Barbetti pers. comm.).

All the Willandra Lakes dates are shown on graph C. There is evidence for midden and oven sites during the periods 12-20,000 B.P. and 25-35,000 B.P. Only oven sites have been dated for the period 0-5000 years B.P. and there is an absence of evidence for occupation of the area between 5 and 12,000 B.P. and between 20 and 25,000 B.P. The earlier gap, 20-25,000, coincides with the Mungo oscillation, a minor drying phase, when conditions may have forced abandonment of the area. The second period, 5-12,000, spans periods where conditions may have been slightly wetter than today and when conditions near the Willandra Lakes should have been quite favourable. The absence of dates from both periods, on the other hand, may simply represent an absence of preserved sites.

Radiocarbon dates from elsewhere in the Darling Basin are listed in table 8.33 and their distribution is shown on graph D.

From table 8.33 and figure 8.14D it can be seen that, while the youngest dated midden site on the Willandra Lakes is 13,000 years old, C\textsuperscript{14} dates from lake and river sites from other areas in the Darling Basin reveal that the collection of freshwater mussel shells continued down until the nineteenth century. Most of these middens consisting of \textit{V. ambiguus} shells only were similar to those at Leaghur I and Leaghur backshore I.

On graph E (figure 8.14) all carbon dates from the Willandra area and the rest of the Darling Basin are plotted. This last graph supports the conclusion that human occupation has been more or less continuous in the Darling Basin for the last 30,000 years.
A. Willandra Lakes C¹⁴ Dates
(From shell middens)
N=10

B. Willandra Lakes C¹⁴ Dates
(From hearths and ovens)
N=29

C. Willandra Lakes C¹⁴ Dates
(A and B combined)
N=39

D. Other Darling Basin C¹⁴ Dates
(Excepting the Willandra Lakes)
N=62

E. All Darling Basin C¹⁴ Dates
(C and D combined)
N=61

Fig. 8.14: Darling Basin C¹⁴ Dates
Table 8.33  C$^{14}$ dates from the Darling River Basin

<table>
<thead>
<tr>
<th>Locality</th>
<th>Number</th>
<th>Date years B.P.</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Middens</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake Victoria</td>
<td>Gak-2515</td>
<td>15,300 ± 500</td>
<td>E. Gill pers. comm.</td>
</tr>
<tr>
<td>Lake Victoria</td>
<td>Gak-1726</td>
<td>7210 ± 160</td>
<td>E. Gill pers. comm.</td>
</tr>
<tr>
<td>Lake Victoria</td>
<td>Gak-2512</td>
<td>1660 ± 110</td>
<td>E. Gill pers. comm.</td>
</tr>
<tr>
<td>Lake Victoria</td>
<td>Gak-2008</td>
<td>1320 ± 80</td>
<td>E. Gill pers. comm.</td>
</tr>
<tr>
<td>Lake Victoria</td>
<td>Gak-2511</td>
<td>180 ± 80</td>
<td>E. Gill pers. comm.</td>
</tr>
<tr>
<td>Lake Tandou</td>
<td>ANU-705</td>
<td>12,530 ± 1630</td>
<td>1350 Chapter 7</td>
</tr>
<tr>
<td>Lake Tandou</td>
<td>ANU-703</td>
<td>12,350 ± 170</td>
<td>Chapter 7</td>
</tr>
<tr>
<td>Redcliffs</td>
<td>Gak-1062</td>
<td>11,250 ± 240</td>
<td>Gill 1971:75</td>
</tr>
<tr>
<td>Lake Menindee</td>
<td>NZ-66</td>
<td>6570 ± 100</td>
<td>Dury 1964:106</td>
</tr>
<tr>
<td>Lake Menindee</td>
<td>NZ-67</td>
<td>Modern</td>
<td>Dury 1964:106</td>
</tr>
<tr>
<td>Lake Menindee</td>
<td>NZ-68</td>
<td>Modern</td>
<td>Dury 1964:106</td>
</tr>
<tr>
<td>Ratcatcher's Lake</td>
<td>ANU-949</td>
<td>7170 ± 110</td>
<td></td>
</tr>
<tr>
<td>(ii) Ovens and fireplaces</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lake Yantra</td>
<td>Gak-2121</td>
<td>26,200 ± 1100</td>
<td>Dury and Longford-Smith 1970:73</td>
</tr>
<tr>
<td>Lake Victoria</td>
<td>Gak-2514</td>
<td>18,200 ± 800</td>
<td>E. Gill pers. comm. (1972:in press)</td>
</tr>
<tr>
<td>Lake Menindee</td>
<td>LJ-204</td>
<td>26,300 ± 1500</td>
<td>Dury 1964:106</td>
</tr>
<tr>
<td>Lake Menindee</td>
<td>Gak-335</td>
<td>18,800 ± 800</td>
<td>Tindale 1964:24</td>
</tr>
<tr>
<td>(iii) Upland sites</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burke's Cave</td>
<td>ANU-704</td>
<td>1850 ± 230</td>
<td>Chapter 6</td>
</tr>
<tr>
<td>Mootwingee</td>
<td>NSW-1</td>
<td>Modern</td>
<td>Dury 1966:161</td>
</tr>
<tr>
<td>Mt Grenfell</td>
<td>V-49</td>
<td>200 ± 65</td>
<td>Birmingham 1966:514</td>
</tr>
<tr>
<td>Wuttagoona</td>
<td>V-50</td>
<td>310 ± 75</td>
<td>Birmingham 1966:514</td>
</tr>
</tbody>
</table>
8.10 The Willandra Lakes Environment: Past and Present

(a) The present environment

The climate of the area is now very dry (200-250 mm, 8-10 inches precipitation) and only a sparse vegetation of mallee, saltbush and open casuarine scrub is present. Surface water is generally available only during winter when evaporation rates are low. Today low density sheep grazing in the area is made possible only by the sinking of deep bores.

Tietkens and Giles crossed this area in 1859 and reported

'We camped that night in the little village of Balranald...it was midsummer and our route now took us across the waterless waste of over 100 miles between the Murrumbidgee and Darling Rivers and at this time not a drop of water existed for the whole distance. The few settlements that had been affected were abandoned owing to the waters having all dried up. After travelling one night we arrived at one of the abandoned homesteads...[we were without water until] we rode two days later into Tarcoola [Pooncairie] a station on the banks of the River Darling' (Tietkens Ms.1859-87).

There are no streams or permanent water sources and the earliest settlers (Gormly n.d.:286) regarded it as one of the driest areas in New South Wales, drier even than areas further to the west with lower rainfalls and permanent rock waterholes.

Conditions during the late Pleistocene (13000-30000 B.P.) were very different. The Lachlan River supplied the Willandra Creek with water from the snow fields on the Snowy Mountains. This creek carried sufficient water to maintain a system of six permanent deep lakes covering an area of 1000 square km.

At the same time, other presently intermittent lake systems in the Darling Basin (Menindee, Anabranch, Talywalka, Bulloo and Paroo) were permanently full.

The effects of the present-day lakes in the semi-arid Darling Basin, such as Lake Menindee which is regularly filled
by the Darling River, are purely local in character. Apart from a thin corridor of eucalypt trees along the river and around the lakes, the open semi-arid wood and grassland is not changed by the presence of lake waters. Saltbush and xerophytic shrubs grow right up to the lake's edge.

The situation near the Willandra Lakes may have been similar. Bowler (1970a:297) concluded that

'since all large lakes were maintained by streams draining the southeastern highlands, the lacustral conditions recorded in them may reflect increased runoff in the catchments rather than high precipitation on the plain... precipitation probably remained close to that of today'.

The areas away from the lakes may not have been very different from the area today except that lower Pleistocene temperatures and lower evaporation would mean that the present low rainfall would have been more effective. While this may have meant more standing pools of water in summer and winter, it may not have been enough to stimulate the growth of a vegetation lusher than the shrub steppe and open woodland found there today (figure 1.5).

Mallee vegetation may not have been present in the area during the lower temperatures of the Pleistocene as the mallee eucalypts are very sensitive to frost (Bowler 1970a:309). Mallee has colonised and stabilised the sand dunes. The mobilisation of these dunes at around 15000 B.P. may be another indication that the mallee was not present at the time.

(b) the Pleistocene lacustrine environment

The Aborigines gathered shellfish and freshwater crayfish and fished from the lake waters. The fauna they obtained allows some reconstruction of the lacustrine environment. The reconstruction is hindered, however, by the fact that the species involved are all widespread at the moment.

The main fish species present, golden perch P. ambiguus, was found, prior to the construction of dams, in warm and sluggish waters throughout the Murray-Darling River system, except at higher altitudes (Lake n.d.:27). It lived
and bred above the present day Wyangala, Burrinjuck and Yarrawonga dams on the upper Lachlan, Murrumbidgee and Murray Rivers respectively. The annual mean air temperatures of these areas ranges from 14 to 16°C (57-61°F). This is 4°-6°C lower than the mean air temperatures experienced presently in the Willandra area (18-21°C, 64-69°F); golden perch would have found quite favourable conditions in the Willandra Lakes if Pleistocene temperatures fell by only this much.

The small size of the golden perch at Mungo I (table 8.35) and their young ages, estimated from otolith growth rings (1 to 3 years old), were taken to indicate that the fish had bred in the system and that the site had been occupied at some time between late winter and autumn. The immature fish of about one year had probably been spawned during the previous summer as even under the present climatic regime most fish growth is restricted to the summer months (Lake 1964:27) and golden perch show gonad development only between August and October. It requires particularly warm water to allow spawning as late as March (Lake n.d.:28-9).

Golden perch spawn during floods and freshets when water temperatures exceed 23.5°C (74.3°F) (Lake n.d.:2708). For them to have bred in the Willandra Lakes would require that a flow of warmish water was fed into the system. This condition does not mean that air temperatures could not have been lower in the Pleistocene in the Willandra area since water temperatures as high as 23.5°C have been recorded from places as cool as Tumut (Lake 1967:195) in the Snowy Mountains 700 km (300 miles) to the east. The presence of young golden perch in the lakes does require that water temperatures were above 4°C (39°F).

Murray cod, like golden perch, are widespread in the Murray-Darling system and are at home in both the fast flowing cooler mountain streams and the warm slow rivers of the interior.

The crayfish (yabbie) and the freshwater mussel species present on the archaeological sites also have a wide water temperature tolerance, being present in streams and ponds from the plains right up into the Snowy Mountains.
The lacustrine fauna from the archaeological sites supports Bowler's conclusion that there was a series of large freshwater lakes in the Willandra area from 33,000 B.P. until at least 13,000 B.P. Bowler, on the basis of evidence from areas outside Australia, estimated (1970a:291) that air temperatures during the major lacustral period would have been 5°-8°C lower than the mean annual temperature today. The lake fauna, as revealed on the sites, could have tolerated a drop in water-temperatures of this order. While all of the species could have tolerated such a change, their presence in the Willandra Lakes during the Pleistocene neither supports nor counters an argument that such a fall in mean annual temperatures took place. It is unfortunate that I was not able to demonstrate the presence of Macquarie perch in the lakes as this is a cold water fish requiring water temperatures below 20°C (68°F) for survival (Lake n.d.:26). I intend to continue to work on this problem after the conclusion of the present project. If it could be demonstrated that Macquarie perch was present in the Willandra Lakes this would be strong evidence for low water temperatures in the lakes during the Pleistocene. Macquarie perch is presently only found more than 200 miles further up the Lachlan.

(c) the terrestrial environment

The mammalian fauna from the Darling River area in the last century is listed in table 8.34. It is a faunal assemblage that could be found anywhere in arid or semi-arid Australia as the majority of species are widespread in inland grassy plains or open woodland environments. Table 8.35 also shows that a high proportion of the mammals recorded in the area in the 19th century were present on the Willandra Lakes sites 13,000 - 30,000 years ago. The few species present at the Willandra Lakes sites, but absent from the zoological records for the area, such as the desert rat kangaroo or the tiger cat, were probably present in small numbers (see Calaby 1971a:86-8).

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1It is important to note that in shallow rivers and lakes air temperatures and water temperatures are similar (Weatherley 1967: 8).
The mammals on the Willandra sites (Mungo I, Mulurulu I, Mulurulu IIIA, B and C) are the same mammals that were there 100 years ago. The fauna from the Willandra sites is characteristic of the semi-arid inland. These formations are widespread in the Darling area today. This suggests that there has been little change in vegetation or climate in the last 30,000 B.P., certainly not great enough to produce significant alteration of species' limits, either in or out of the area.

The continuity of the mammalian fauna in this area (table 8.34) is remarkable considering that these animals have been hunted and collected by Aborigines for the past 30,000 years without causing any apparent faunal changes. Even the populations may not have changed very much. The grey and red kangaroos, present in small numbers on the archaeological sites, were both scarce in the area in the 19th century (Krefft Ms. 1856-7), whereas the hare wallabies, the commonest mammals on the Willandra Lakes archaeological sites, were described as being 'common on the level country between the Murray and the Darling' (Krefft 1866a:20).

The other land animals present on the sites, dragon lizards, stump-tailed skinks and [the eggs of] emus are of little value for ecological reconstructions for they are found in a variety of environments ranging from arid grasslands to tall Eucalypt forests.

The evidence that the lakes and lake fauna were present until 13,000 B.P. but absent since that time is not necessarily in conflict with the evidence that the land fauna showed little change from 30,000 B.P. to the nineteenth century\(^1\) despite the drying of the lakes. The presence of a characteristic semi-arid fauna on the Willandra sites only requires the situation postulated by Bowler (1970a:295) - of lower temperatures and lower evaporation rates and the maintenance of precipitation values no higher than today's values. To this must be added the proviso that these conditions must have maintained a vegetation pattern broadly

\(^1\)Most of the species are now locally extinct.
<table>
<thead>
<tr>
<th>Darling Basin Present in the 19th Century (incomplete)</th>
<th>Willandra Sites 13-20,000 B.P.</th>
<th>25-32,000 B.P.</th>
<th>Menindee, Tandou and Lake Victoria sites &gt;32,000 B.P.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macropus giganteus (M. titan)</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. robustus (M.O. cooperi)</em></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>M. rufus</em></td>
<td>X</td>
<td></td>
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<tr>
<td>Orychogalea lunata</td>
<td>X</td>
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<tr>
<td>O. fraenata</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Lagorchestes leporides</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Lagorchestes sp. (?)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bettongia penicillata</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>B. lesueur</td>
<td></td>
<td>X</td>
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</tr>
<tr>
<td>Trichosurus vulpecula</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Pseudocheirus sp.</td>
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<td></td>
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<tr>
<td>Lasiorhinus sp.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Isoodon obsesus</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perameles bougainville</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chaeropus ecaudatus</td>
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<td></td>
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<tr>
<td>Macrotris lagotis</td>
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<td></td>
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<tr>
<td>Dasyurus geoffroii or viverrinus</td>
<td>X</td>
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<td></td>
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<tr>
<td>Phocoagale calura</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Dasyuromys or Dasyuroidea sp.</td>
<td></td>
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<tr>
<td>Antechinus sp.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Smynthropsis sp.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Antechinomys sp.</td>
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<td></td>
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<tr>
<td>Myrmecobius fasciatus</td>
<td></td>
<td></td>
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<tr>
<td>Rattus sp.</td>
<td>X</td>
<td></td>
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<tr>
<td>Cont fibratus albipes</td>
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<td></td>
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<tr>
<td>Leporillus conditor</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>Leporillus apicalis</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Notomy sp.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Pseudomys sp.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canis familiaris</td>
<td>X</td>
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</table>
similar to that of today. The Willandra country must still have been open and semi-arid despite the presence of 1000 sq.km of lake water right in the middle of it.

8.11 The Aboriginal Economy: 13,000 - 33,000 B.P.

(a) Introduction

While there was considerable variation in the economic remains found on the Willandra Lakes sites, the same types of sites with similar faunas are found from different times within this period. I have decided therefore to regard all the evidence as part of a single type of subsistence economy.

Some discussion of the variation of sites took place in section 8.3(d) above. This discussion can be widened to include all four types of sites found in the Willandra area. These are:

(i) Hearth and oven sites without preserved economic remains [three sites on the Lake Mungo lunette, Barbetti's site 3, an oven site dated to 19,420 ± 360 B.P. ANU-668 and a hearth site dated to 12,490 ± 550 B.P. ANU-684 (Barbetti and Polach: in press)].

(ii) Midden sites where freshwater mussel shell made up the major part of the economic remains (Leaghur I, Leaghur backshore I-III).

(iii) Midden sites where large amounts of freshwater mussel shell were present together with fish, mammals, crayfish and birds' eggs (Garnpung I, Mulurulu I).

(iv) Sites where land foods, mammals etc., were as important as or more important than lake foods such as shell-fish and fish [Mungo I, Mulurulu IIIA and B].

The variation between sites, excluding oven sites, is no greater than the variation within single sites such as Mungo I (Jones and Allen in Bowler et al., 1970:table 3) or Mulurulu I or Mulurulu IIIB, discussed above, where the remains varied markedly from one part of the site to another. The variation between and within sites is interpreted as a
reflection of different preferences and group compositions of the occupants, varying ecological conditions or different periods of occupation.

The Mungo I site, because of the presence of emu egg shell, of lizards and of immature fish aged about one year, was interpreted as having been occupied during the late winter to summer period. Most of the other sites with faunal remains also had emu egg shell and reptiles, suggesting that they had also been occupied from the late winter to summer period.

If temperatures during the Pleistocene were lower in the Willandra area then I would expect that the Lakes and creek would have had a marked low-water phase during autumn and winter as do streams fed by melting snow waters today such as the Murray and Murrumbidgee. In chapter 3 section 3.3 it was concluded that the combined effects of cool weather and low discharge on the Murray and Darling Rivers renders them unproductive. Such conditions were accompanied by Aboriginal movement away from the river and into the hinterland.

All of the Willandra Lakes sites can be interpreted as seasonal camps occupied for a short while during warm weather high discharge phases, probably between September and March, when the Aboriginal inhabitants of the area clustered around the margins of the lakes. The oven and fireplace sites may have been the winter camps of people who remained camped near the lakes while a large part of the population had dispersed through the plains country.

Unfortunately no sites, with or without preserved economic remains, dated to this period have been found in the area away from the lakes so it is not yet possible to test the hypothesis that winter seasonal movements away from the lakes took place in the Willandra area during the Pleistocene.

From the discussions about each site above, it will be obvious that lake foods, fish, shellfish and crayfish provided most of the food at most of them. The shellfish, which formed the greater part of the dietary remains, could have been collected by the women from sand and mud areas near each site as could the crayfish.

The fish fall into a different category as it is likely that they would have come from a wide area of each lake
rather than from a limited area adjacent to each site. It is worthwhile looking at the population of fish from each site in order to see if some information about fishing methods can be obtained.

(b) Fish

The sizes of the otoliths and vertebrae from the Willandra Lakes sites, from the North Lake\(^1\) and Ratcatcher's Lake I sites on the Talyawalka Lake system (figure 1.2) and from a sample of golden perch from the Murray River, purchased from a Mildura fish shop are shown on table 8.35 and figure 8.15.

It can be seen from table 8.35 that the mean length and weight of fish estimated from the otoliths and vertebrae of the modern fish sample corresponds closely to the real length and weight of these fish and that the sizes estimated from otoliths for these fish correspond closely to the sizes estimated from the vertebrae.

It can also be seen that there is a marked difference between the lengths and weights of fish estimated from the otolith lengths and the lengths and weights estimated from vertebrae diameter. This is true for every archaeological sample, but not for the fish from the Murray River where the otoliths and vertebrae came from the same specimens. It is especially true for the Ratcatcher's Lake I sample where two species of fish are definitely present, probably golden perch and Murray cod. Apart from Ratcatcher's I, only Mulurulu I had otolithic evidence for Murray cod but the presence of large vertebrae at all sites where vertebrae were preserved indicates that they may have been present in small numbers at all sites. The species found on the archaeological sites have two sagittal otoliths but about 25 vertebrae so that the presence of a few large fish is more likely to be registered in a collection of vertebrae than of otoliths.

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1 The sites from the Talyawalka Lakes will be described later. Insufficient analysis has been carried out to include the site descriptions in this work.
Figure 8.15 graphs F and J show the size distributions of otoliths and vertebrae from present day Murray River golden perch, the remainder show the same information for otoliths and vertebrae from the archaeological sites.

Of the otolith graphs, those from the MLIIIB, MLIIIA, North Lake and Ratcatcher's Lake I sites show J shaped distributions skewed to the left (graphs B, E, K and L). Only small numbers of otoliths were available from these sites, the left-skewed distribution curves being probably caused by inadequate samples. (See Simpson et al., 1960:59 for a discussion of J shaped distribution curves which in most cases result from small samples).

The other graphs (A,C,D,F-J,M) of otolith lengths from Mungo I, Garnpung I and the Murray River and of vertebrae diameters from Mungo I, Mulurulu I and IIIA, and North Lake I show variations of an approximate poisson distribution or right skewed distribution of a type that often results from faunal population samples (Simpson et al., 1960:132-3) in this case from Aboriginal fishing. The curves of vertebrae diameters could have resulted from fish catches that consisted of large numbers of small to medium fish [golden perch] together with a few large fish [either golden perch or Murray cod].

The distributions of the otolith lengths from the Willandra sites are very similar to those plotted for the otolith lengths from modern Murray River golden perch which were caught by professional fishermen probably using a regulation 5 inch (127 mm) mesh gill net. The fish at the Willandra Lakes sites are large enough (300-400 mm, 12-16 inches) to have been caught in the 3 inch (76 mm) mesh gill nets used by the Aborigines of the Murray River to catch golden and silver perch and Murray cod in the nineteenth century (Beveridge 1883:47-8 see appendix I:5-6). On the other hand, similar fish populations could have been obtained by Aborigines either swimming underwater and spearing fish (Sturt 1833 Vol.2:113-4, appendix I:4) or spearing them from canoes (Mitchell 1839 Vol.I:268, appendix I:5).

While there is no evidence of the exact method or methods used to catch the fish on these sites, if information
Fig. 8.15: Otolith lengths and vertebral diameters: fish populations on archaeological sites
were available from a number of younger sites it might be possible to work out whether there had been changes in fishing techniques, by pinpointing changes in the fish populations being caught. This would require also the ability to eliminate possible ecological explanations.

The graph of the diameters of vertebrae from the youngest dated site, Ratcatcher's Lake I (7170 ± 110 B.P., ANU-949) (figure 8.14 graph N) shows a different distribution pattern from the other graphs. Where the graphs from the Willandra sites show a single right-skewed distribution the Ratcatcher's Lake I graph of the vertebrae not only approximates to a normal curve but is also markedly bimodal. As both golden perch and Murray cod are present on the site part of this pattern may have resulted from the Aborigines catching almost equal numbers of large Murray cod and of small to medium golden perch. However, the possibility that the bimodal pattern has resulted from the Aborigines using two different fishing methods, such as netting and spearing to exploit the lake, cannot be ignored.

(c) Land foods

The lists of animals from each Willandra site (tables 8.6, 8.20, 8.23, 8.25 and 8.29) reveal that some land foods, in particular mammals, were eaten on most sites. Almost equal amounts of land and lake foods may have been eaten at Mungo I and land foods apparently provided the bulk of the food at Mulurulu IIIA and B.

On every site, hare-wallabies and rat-kangaroos were the most numerous mammals present and in most cases there were twice as many of these animals as all others combined. While some large kangaroos were present it is clear that small animals contributed the major part of the land foods eaten. All those animals smaller than the hare-wallabies were probably collected by the women. The hare-wallabies could have been collected by the men and the nail-tailed wallabies and kangaroos almost certainly were. All could have been obtained in the plains around the lakeside sites.

Apart from the foods from the lakes, the major land foods consisted of hare-wallabies and rat-kangaroos supplemen-
ted by small numbers of bandicoots, native cats, large
kangaroos, rats, birds, bird's eggs and reptiles.

The burrowing rat-kangaroos Bettongia lesueur would
probably have been dug out of their burrows while Bettongia
penicillata and the hare-wallaby, Lagorchestes sp., could
have been disturbed from their daytime resting camps. The
slightly greater number of rat-kangaroos relative to hare-
wallabies at Mungo I compared to those at the Mulurulu sites
may reflect some slight environmental differences between the
two lakes, which are nearly 70 km (43 miles) apart.

One interesting feature of faunal remains from the
Willandra Lakes sites is the absence of the giant extinct
marsupials (see chapter I section 1.8). Seven families of
extinct marsupials were present in the lunette faunas from the
Lakes Menindee, Tandou and Victoria sites. These were
Protemnodon, Procoptodon, Diprotodon, Sthenurus, Propleopus,
Phascolonus, and Thylacoleo. No member of these families was
found on any Willandra Lakes archaeological site nor were they
present in the Zanci or Mungo sedimentary units dated from
13,000-33,000 B.P. I cannot explain why these extinct animals
should be common in the lunettes of lakes west of the Darling
but absent from the Willandra lunettes. The evidence from the
Willandra suggests that the above families were locally extinct
by 33,000 B.P. and suggests the possibility that the Menindee,
Tandou and Lake Victoria lunette faunas are older than this.

If Aboriginal man caused or partially caused the
families listed above to become extinct the process had termi-
nated before 33,000 B.P. for since that time there has been
little faunal change in the area.

The mammals from the Willandra sites and the diet
they reveal is one that appears to have been more typical of
Aborigines living in arid or semi-arid areas than in temperate
regions. The list from the Pleistocene Willandra lakes is
similar to that recorded by Meggitt (1962:table 5) of mammalian
foods eaten by Walbiri Aborigines of desert areas (rainfall
less than 250 mm or 10 inches) of the Northern Territory.

The animals caught by the Willandra Aborigines
13,000-30,000 years ago were also similar to those eaten by
Aboriginal occupants of the Fromm's Landing site on the Murray
River in South Australia from 3,000 B.P. to the ethnographic present (Wakefield in Mulvaney et al., 1964:494-8). The situation at Fromm's Landing may have been analogous to that on the Willandra as the Murray River in South Australia flows through a semi-arid area (200-330 mm) and the Aborigines there were able to exploit the resources both of a very narrow fertile river plain and of the semi-arid plains.

The diets of Aborigines living in better watered areas of New South Wales differed from that of the Pleistocene Willandra Lakes Aborigines mainly in the number of arboreal mammals eaten. In particular, in the woodland and forest areas of New South Wales to the east of the Willandra Lakes in the nineteenth century kangaroos and possums were the main animals eaten. About the Darling River Aborigines, Mitchell stated

'Depending chiefly on the river for subsistence, they do not wander so much as those who hunt the kangaroo and opossum, in the higher country, near our colony' (1839 Vol.2:307).

The economy of the Aborigines of the wooded areas west of the Great Dividing Range was described by Gardner (1854 Vol.1:257)

'The principal food of the various tribes of natives in the interior is the opossum, other mammals such as wallaroo, kangaroo, bandycoot and emu may be had in the bush, as also fish in the rivers, these, however, are not always to be depended upon, by these wandering tribes'.

Krefft (1866a:17) described the brush-tailed possum as 'the staff of life' of the Aborigines of the Murray River to the south of the Willandra area.

Archaeological sites in open Eucalypt woodland areas to the northeast of the Willandra Lakes reveal large numbers of brush-tailed possums. These animals made up 40 percent
of all animals recovered from the Meadow Glen site\(^1\) and 70 percent at the Mt. Grenfell site\(^2\).

The virtual absence of brush-tailed possums from the Willandra lakes sites indicates that there was little woodland near the lakes, as these animals would generally be flesh food staple of Aborigines living in the temperate woodland areas of eastern Australia. The animal diet of the Willandra Lakes Aborigines, apart from foods from the lakes, was typical of that obtained today by Aborigines living in semi-arid plains country.

(d) **Vegetable foods**

There is little information about vegetable foods on the sites except that grinding stones with the characteristic smooth surfaces obtained from the wet grinding of grass and other seeds are present on sites associated with the Zanci high-water phase.

Grinding stones, reliably dated to 12,000 B.P. on the Lake Tandou sites, are also commonly associated with midden sites around the Willandra Lakes dated between 13,000-20,000 B.P. on sites where there is no evidence of intrusive stone artefacts (Leaghur backshore I, Mulurulu I and Mulurulu IIIA). Bowler has recovered from the lunettes grinding stones which were heavily coated with carbonate indicating a minimum age of 15,000 B.P. (J. Bowler pers. comm.).

The conclusion can therefore be drawn that cereal foods formed a part of the diet of Aborigines in the area 15-20,000 years ago.

The collection of grass seeds in the period 15-20,000 B.P. may represent a new subsistence activity, a major adaptation to the inland Australian environment. In other parts of the world grinding stones do not appear in the archaeological record until much later. In the Near East, the earliest dated grinding stones were at Zawi Chemi Shanidar to about 10,000 B.P. (Clark 1969:85, 93) and in North America

\(^1\)To be described.

\(^2\)Excavated by F.D. McCarthy (pers. comm.).
they appear at about the same time (Willey 1966:56). The presence of grinding stones in inland Australia at an early date is surprising. However, ground edged axes also have a long history in Australia (White 1967:149-51) and grinding stones and ground edged axes could possibly be considered as two parts of a similarly advanced industrial complex.

The presence of grinding stones on the Willandra sites is further evidence that the plains around the lakes were covered with semi-arid open grass and scrub-lands rather than by temperate woodlands for the large scale collection of cereals was an activity that was generally confined to the arid and semi-arid inland areas (Allen 1968:48; Golson 1971: 205; Meggitt 1964a:30-34; Tindale 1959:50). Comparatively few grinding stones have been found in wooded areas.

Grinding stones were not present on any site older than 20,000 years. Seed grinding had apparently not yet become part of the subsistence activities of Australian Aborigines. Grasses which could have been used for cereals were probably present in the Willandra area at that time, as no major environmental changes appear to have occurred from 30,000 to 13,000 B.P. However, it may be that more suitable growth forms appeared towards the end of this period. Suitable grasses are available in a variety of habitats in eastern Australia. Most of the species listed in Appendix I (33-4) can be either perennials or ephemerals depending on the local situation (Allen 1968:62). Ephemeral growth forms set much more seed than do perennials. It is possible that the rises in temperature and evaporation at the end of the Pleistocene favoured the growth of ephemeral grasses. This would make seed collection a more profitable activity.

8.12 The Aboriginal subsistence economy in the nineteenth century

At the time of European settlement the semi-waterless area in which the Willandra Lake basins occur was inhabited by members of the Barindji tribe (figure 3.1) related linguistically to the Darling River Bagundji, who occupied the river frontages (Cameron 1884:346).
There is evidence that movement in the area was restricted during summer, owing to the scarcity of water, and that some of the inhabitants moved in to the Darling River, 50 miles to the west. Bennett, a resident at Mossgiel station, stated that

'the country situated between the Lachlan and the Darling Rivers was...even in ordinary seasons entirely destitute of water for several months in each year, and the natives who formerly claimed and roamed over the country for a distance of forty to fifty miles from the...rivers, were compelled during the hot dry months, to resort to their banks' (1883:213).

A.L.P. Cameron owned Mulurulu station on which some of the archaeological sites discussed above were located. He described a different situation, one in which the Barindji and Bagundji were openly hostile. He said (1884:346-7) that there was

'a great resemblance between the languages of the [Bagundji] and [Barindji]. I suggested to my informants that they were parts of the same tribe, but they would not hear of it. I suggested that before the whites came the [Barindji] blacks must have been forced to go into the rivers in summer time. They said that now and then they did so, but went in a sufficiently strong party to fight any section of the river tribes they might meet, and that when they had no water they lived on what they obtained from the roots of the Mallee and of a species of Hakea. I was told that a proof of their being totally distinct was that any old [Bagundji] black could swim, but that no [Barindji] could. To some it may seem strange that any tribe could live in the almost waterless region between the Lachlan and the Darling Rivers, where the territory of the [Barindji] is located.

Considerable quantities of water may, however, be obtained from the roots of trees, notably from those of the Mallee and of a species of Hakie, locally known as the "needlebush".
In 1896, Bennett presented a collection of material objects used by the people in the Willandra Creek area to the Australian Museum. Much of the collection has since been lost but fortunately a detailed catalogue was published. From this catalogue (Bennett 1897) it is possible to get a good idea of the material culture and economy of the people inhabiting the dry country between the Lachlan and Darling Rivers. Weapons consisted of wooden barbed spears, boomerangs, clubs, and shields, manufacturing implements of small ground-edged chisels in wooden handles, fragments of glass, ground-edged axes, and pieces of steel shearing blades. A flint knife was used to skin animals. Implements used to capture or prepare food included wooden 'yam sticks' and scoops used for digging up roots and also rat-kangaroos [bettongs], bandicoots, and stick-nest rats; wooden shovels for digging out goannas and other reptiles; wooden horns whose sound imitated the challenge of a male emu, and which were used as a decoy; large flat grinding stones for portulaca and other kinds of seeds; and small round pounding stones for crushing hard seeds and the bones of reptiles and mammals. Water bags, made from the entire skins of wallabies, enabled movement through the area, one or more water bags being carried by the women, along with many of the other material items described above, all in large net bags.

Berndt (1947-8:76) described the capture of small wallabies in the Willandra area. They were driven by fire from grassy ridges into fixed nets (see also Appendix 1:13).

The Aboriginal subsistence economy in the Willandra Lakes area, in the 19th century, was based on the collection of cereals and small animals, wallabies, bettongs, bandicoots, rats and lizards.

Water supplies in the Willandra area seem to have been insufficient to allow the entire population to remain in the area throughout the summer months. Some people, if not all, moved into the Darling River during summer. They were only able to return after winter rains made most of the country accessible.

The foods eaten and the movement patterns are similar to those described for Aborigines inhabiting other semi-arid
areas of Australia such as the southwestern area of the Northern Territory (Meggitt 1962:tables 2-3 and 49-50), here the environment supported about one person for every 34 square km (13 sq.miles) (Meggitt 1964b:6).

8.13 **The effects of the drying of the Lakes**

The economy of the Aborigines when the Willandra Lakes were full was based in summer on the collection of fish, crayfish, and freshwater mussels supplemented by small animals, mainly hare-wallabies and rat-kangaroos and, during the final lake-full stages, the collection of grass seeds. In winter, the same mammals with a slightly greater emphasis on large kangaroos and other vegetable foods would have been important. The lower mean temperatures would mean that there was lower evaporation. Consequently more water at all seasons would have been available to facilitate movement. Seasonal movements would have focussed, as in the Darling and Murray Basins in the ethnographic present, on the Willandra Lakes and Creek with the population clustering around them during the particularly productive warm summer high-discharge periods. During autumn and winter when the lake waters may have been low, cold and unproductive, the Aboriginal inhabitants would have been compelled to seek food over wider areas of the country away from the lakes.

The Willandra Lakes in the Pleistocene appear to have existed in an environment that was characterised by a semi-arid plains vegetation and fauna. Permanent water resources coupled with a semi-arid terrestrial environment provide, by analogy with areas like Cooper's Creek in southwestern Queensland or the Darling River (Allen 1968:64), a particularly favourable combination of resources for Aboriginal hunter-gatherers. Such areas were able to support a higher population than were the better watered temperate forest or woodland areas (Allen 1968:20-1, 33-7) but lower densities than the Murray River or areas around the coasts (Meggitt 1964b:3-4).

On the basis of the faunal evidence and the features of the Willandra sites it would be reasonable to hypothesise that the above subsistence pattern, very much like that practised on the adjacent Darling River, has been characteristic
of some areas of the Darling Basin for the past 30,000 years.

However, in the Willandra area, the events which took place at the end of the Pleistocene changed this pattern. The drying of the lakes and rise in temperatures and evaporation rates changed the area from one with a water surplus rich in lacustrine and riverine resources to an area of open semi-arid plains with a chronic water deficiency.

There is little doubt that these environmental changes created a less favourable environment for the Aborigines than the one that had preceded it. In the Darling Basin, the Menindee, Anabranch, Talyawalka, Paroo and Bulloo Lake systems were converted from permanent into intermittent lakes, in some cases filling rarely. The Willandra Lake system dried up completely. The effect of this could have meant that there were fewer people in the Willandra-Darling Basin area 100 years ago compared to 15,000 years ago.

The drying of the Willandra Lakes removed the source of the fish, shellfish and crayfish and a major source of water. The diet of the Aborigines within the area changed from a mixed one of lake and land foods to one consisting only of land foods. They could maintain their old subsistence patterns only by making long seasonal movements into the Darling River, 50 to 100 km to the west.

The pattern of seasonal movements possibly changed from one in which the Aborigines clustered around the lakes in summer and dispersed across the plains in winter to a pattern where scarcity of water may have forced a large proportion of the population to leave the area in summer and where free movement through the area was only possible during winter.

While the drying of the lakes caused spectacular changes in some subsistence activities it should not be forgotten that the terrestrial resources, mammals and plant foods, apparently remained constant while the lakes were drying. The part of the diet of the Pleistocene Willandra Aborigines that was based on the collection of small wallabies, rat-kangaroos, other small animals and cereals was still part of the diet of the inhabitants of the area 100 years ago. The only discernible change in this part of the diet is that there is no evidence for the collection of cereals earlier than 15,000 years ago.
The conclusion to be drawn from the land food sector of the Aboriginal diet is that the drying of the lakes did not greatly affect the plains. This part of the Willandra area must have been basically similar to the area today. The evidence that the effects of lower Pleistocene temperatures, lower evaporation rates and consequently more effective, if not higher, rainfall were insufficient to promote the growth of a woodland vegetation in the area, seems to be quite strong.

8.14 The Willandra Lakes stone artefacts

(a) variations between sites

The difficulty of finding demonstrably unmixed stone artefact assemblages on the Willandra sites has limited the conclusions that could be drawn from the artefact collections.

The Mungo I collection (tables 8.3 and 8.4), with its identifying carbonate coating, is the only one to which an age [25,000 B.P.] can confidently be given. The artefacts from Mulurulu IIIB (table 8.28) are probably about the same age while those from MLIIIA (tables 8.26 and 8.27) are probably 13,000 years old.

The artefacts from Walls of China I (tables 8.10 and 8.11) Mungo backshore I (tables 8.12 and 8.13) and Garnpung I (tables 8.17, 8.18 and 8.19) are possibly unmixed collections deposited within the last 5000 years.

All these artefact collections are basically similar. They include steep, round and straight edged and notched scrapers, horsehoof cores, and retouched and utilised flakes. Grinding stones are present in assemblages younger than 20,000 B.P. (Mulurulu IIIA, Mulurulu I, Garnpung I, Leaghur backshore I and 3], and flake adze slugs and backed flakes (microliths) are present on sites younger than 5000 B.P. [Walls of China I, Mungo backshore I and Garnpung I].

I have already discussed the variation in the relative numbers of implement categories from site to site at the end of section 8.3 above. This discussion mainly concerned the proportion of large scrapers, horsehoof cores and steep edged scrapers compared to small scrapers, round and straight edged, and to retouched and utilised flakes.
At the Mulurulu IIIB site (table 8.28), about the same age as the Mungo I site, there was a high proportion of utilised flakes to other scrapers. These flakes may have been used to prepare animal carcasses for cooking. At the Mungo I site there were few utilised flakes (table 8.4) and a large number of large scrapers. The differences between these two possibly contemporary sites probably relate to the performance or frequency of different tasks, rather than to cultural changes.

One cultural change can be isolated. The Walls of China I, Mungo backshore I and Garnpung I sites (probably all recent) had a high proportion of small scrapers, round and straight edged, and a relatively low number of large scrapers, horsehoof cores and steep edged scrapers. The 25,000-year-old Mungo I site and the 13,000 Mulurulu IIIA site both have high proportions of horsehoof cores and steep edged scrapers compared to small scrapers. This suggests that there may have been a trend towards the use of fewer horsehoof cores and steep edged scrapers in the Willandra area.

While it is possible that during the 30,000 years of occupation of the Willandra Lakes there was a decrease in the proportion of horsehoof cores and steep edged scrapers there was apparently little change in the characteristics of the implements and of the round and straight edged scrapers during this time. Tests of significance between the characteristics of the implements from Mungo I, Walls of China I and Mungo backshore I indicate few significant differences.

The discernible differences within the scraper components on the Willandra sites are those of frequency of implement types rather than differences in the nature of the implements. Irrespective of the age of the site, the scraper implements belong to the same basic industry. I conclude that there has been little change in the scraper component of these industries over the last 30,000 years.

Two other changes occurred in this industry. Grinding stones appear on sites younger than 20,000 B.P. and flake adze slugs and backed flakes are present on sites younger than 5000 B.P.
I have already discussed the presence of grinding stones on sites associated with the Zanci high-water phase and their absence from sites associated with the Mungo high-water phase. Ethnographic accounts indicate that the collection and milling of tree and grass seeds was a major Aboriginal activity in inland Australia and that these cereals made up the most important contribution to the diet (Meggitt 1946:30). The presence of the grinding stones indicates that Aborigines had made a great advance in their adaptation to the inland environment. This probably represents the most important cultural change discernible in the archaeological record.

The other change concerns backed flakes (microliths) and flake adze slugs. These are present in small numbers at Garnpung I and Mungo backshore I and flake adze slugs are present in small numbers at Walls of China I.

At Garnpung I these implements were loosely associated with a C14 date from a small oven of 3560 ± 85 B.P., ANU-701 and at Mungo backshore I with a date of 940 ± 50 B.P. ANU-660 (Barbetti and Polach 1972: in press). Barbetti (Barbetti and Polach 1972:in press) has dated a number of other oven sites in the Willandra Lakes area with which backed flakes (microliths) were associated. These dates were: at Lake Mungo 760 ± 150 B.P., ANU-659, and at Lake Garnpung 2010 ± 100 B.P., ANU-655 and 2440 ± 80 B.P., ANU-678. The last three sites were on the dry floors of the lake basins.

These dates suggest that backed flakes and flake adze slugs may be present earlier in the Willandra area than they were at Burke's Cave (section 6.8) where they were less than 2000 years old. However, the Willandra dates are from surface hearths only and are not necessarily associated with stone implements scattered near them. Consequently no conclusions can be reached.

(b) The Stone Implement Sequence

Various types of scrapers, horsehoof cores, steep, round, straight edged and notched scrapers and flakes with limited retouch or marks left by utilisation, make up the most characteristic part of the stone implement assemblage. This scraper component, apparently present in the area from 30,000
B.P. to the ethnographic present, shows little change over time. The single discernible change is that the numbers of smaller scrapers (straight and round edged) increase at the expense of larger scraper categories (horseshoe cores and steep edged scrapers).

Grinding stones became part of the industry at about 15,000 B.P. and backed flakes (microliths) and flake adze slugs were later added in small numbers. No discernible changes in the basic scraper industry accompanied these later additions.

The continuous history of a single scraper industry in the area over a great length of time suggests a high level of cultural continuity. This does not necessarily imply that changes in other areas of the culture did not take place.

The scrapers recovered are similar to ones described as being used by Aborigines (chapter 6 section 6.7(d)) as wood-working implements. These were used to manufacture wooden items such as spears, throwing sticks, digging sticks, boomerangs, shields, and dishes and containers. These are the sort of unspecialised items that are likely to have been necessary throughout the entire period of human occupation of the Willandra area. There seems little reason, in the absence of evidence of the movement of people with a different industrial tradition, to expect that there would be great changes in the stone industry used to manufacture them.

Wooden items such as those listed above may have been used to exploit both the lacustrine and terrestrial environments of the Pleistocene Willandra area. As the terrestrial animals and plants appear to have changed little in this area over the past 30,000 years there is little reason to postulate changes in the wooden implements and the stone implements used to manufacture them.

This does not imply cultural stability or stagnation. The presence of grinding stones implies that during this period a major adaptative change took place. Other changes, such as the introduction of hunting or fishing nets, might not leave any archaeological evidence.

It is difficult, on the basis of a generalised scraper industry without preserved organic items of the material culture, or specialised stone artefacts such as projectile points, to come to more detailed conclusions that would be valid for the total culture.
CHAPTER 9

MAN IN THE DARLING BASIN: CONCLUSIONS

9.1 Antiquity

Aboriginal man first arrived in the Darling Basin and in Australia more than 32,000 years ago (Barbetti and Allen 1972; in press). The earliest evidence of his presence consists of oven and midden sites around the shores of the Pleistocene Willandra Lakes. The artefactual and faunal remains on the sites and their variety suggest that by 30,000 B.P. Aboriginal man had made the basic adaptations necessary to permit efficient exploitation of the lakes and plains of inland Australia. The basic stone tool assemblages and subsistence patterns shown on these sites were to be maintained until the arrival of the Europeans in the 19th century. Depending on the degree of adaptation necessary, the existence of a mature economy and stone industry in the inland Willandra area by 32,000 B.P. argues for a much earlier presence of man in Australia.

This conclusion is further supported by the fact that land fauna associated with Aboriginal man in the Willandra area consisted almost entirely of species that survived in the area until the 19th century. The animals and, by extrapolation, the vegetation, must have already developed a stable relationship with man and his hunting and firing activities.

The extinction of the giant marsupials (discussed in Chapter 1 section 1.8) in the Darling Basin may have taken place earlier than 33,000 B.P. This faunal rearrangement could have been stimulated or been partly the result of man's activities. It is difficult to isolate any environmental change that could have been responsible for the extinctions took place in this area during the major lacustral period. At Menindee, Tandou and Lake Victoria, the extinct faunas were recovered from within lunette sediments.

It has been ten years since there was a major statement outlining the possible environmental reasons for the extinctions (Gentilli 1961). Since that time Jones (1968) and Merrilees (1968) have suggested that man, either directly
through hunting or indirectly through habitat alteration by burning, was the decisive factor. It is clearly time for those who deny man a role in the catastrophic faunal changes that took place to restate the alternative environmental reasons for the event. At present there appears to be good evidence that the extinctions began shortly after man's arrival in Australia. The process was concluded by 30,000 B.P. in the Willandra area and since that time an essentially modern fauna has inhabited the region.

9.2 Subsistence economy

Knowledge of the economy in the Darling Basin is restricted to the Willandra Lakes and Lake Tandou region. Preliminary information suggests that similar sites are also present at Lake Victoria (Gill 1972:in press).

All the sites found were located on rivers or lakes. Our knowledge is likely to be limited, therefore, to that sector of the economy that was concerned with the exploitation of resources in rivers, lakes and immediately adjacent land areas. The Pleistocene rivers and lakes are likely to have been relatively unproductive during the colder winter months. Numbers of the Aborigines at this time probably left the lake shores and hunted and collected in the hinterland. If so the hunting of kangaroos and wallabies may have been more important during winter.

The economy during the period 13,000-30,000 is known only from the Willandra area. The sites reveal a lacustrine diet of fish, shellfish and crayfish, supplemented by land foods such as hare-wallabies, rat-kangaroos and some few kangaroos, wombats, native cats, bandicoots, rats, [eggs of] emus and other birds and reptiles. These sites are clustered around the strandlines of the, then full, lakes. There is, unfortunately, no clue as to the plant foods eaten by the Aborigines at this time. There is no evidence that they gathered seeds. Bowler (1970a:229-30) found thin calcareous tubes in shallow water deposits on some of the lakes. He suggested that these were the remains of the stems and roots of aquatic plants. The inhabitants of the Willandra Lakes may
harvested such aquatic plants. A variety of aquatic plants, such as lignum, bulrushes and reeds, provided substantial quantities of food for the Aborigines of the Murray and Lachlan Rivers in the historic period (Appendix I:30-4).

In most areas of Australia, no economic evidence is preserved on sites older than 7000 B.P. In the Willandra area, no economic evidence was found on sites younger than 13,000 B.P.

There is good information about the land animals eaten on the sites for the period 13,000-30,000 B.P. The species involved are the same as were described as being eaten by the hunter-gatherers of the Darling Basin in the nineteenth century. The continuous Aboriginal exploitation of these species from 30,000 B.P. to the ethnographic present is remarkable. It suggests the existence of a stable system of interrelationships between these species and Aboriginal man. This longstanding relationship was destroyed with the introduction of sheep, cattle, foxes and rabbits in the area by the Europeans. Shortly after that time the Aborigine's way of life and 16 of the 30 species listed in table 8.34 became extinct (Calaby 1971b:17-24; Ride 1970:197-208). The hare-wallabies and bettongs, vigorously exploited by Aboriginal man for at least 30,000 years, seem to have been particularly sensitive to competition with exotic animals (Calaby 1971b:25). It is possible that bettongs and hare-wallabies were to some extent dependent on Aboriginal activities, such as the maintenance of open grassland, by burning, for survival.

Information about the economy of the Willandra area ends at the same time as the lakes dried up. Fortunately not all of the lakes in the Darling Basin dried up. The Darling River continued to flow and sites on this river and its associated lakes provide glimpses of the same riverine and lacustrine economy as was seen to operate around the Willandra

1I have not discussed the extinction of the Tasmanian Devil and Tiger in the area. Clearly the introduction of the carnivorous dingo [at about 7000 B.P. (?)] would have upset this ecological system, resulting in the elimination [through competition] of the two largest marsupial carnivores.
Lakes. Sites such as Tandou Lunette III, Tandou Creek I, Lake Victoria (Gill 1972:in press), Ratcatcher's Lake I, and Burke's Cave allow us to trace the continuous exploitation of the shellfish, crayfish and fish and terrestrial animals, birds and reptiles in the Darling Basin from 13,000 B.P. to the ethnographic present.

At about 15,000 B.P., towards the end of the high water phases of the Willandra Lakes, [grass and tree?] seeds were gathered by the Aborigines. It can hardly be coincidental that this activity began as the first effects of the terminal phase of the Pleistocene were felt. Bowler estimates that the onset of the final drying phase in Lake Chibnalwood, the southernmost Willandra Lake (figure 8.1) took place at about 17,000 B.P. (Bowler 1970a:133). The final drying did not affect Lake Garnpung until 14,000 B.P. (see section 8.5 above) and was even later (13,000 B.P.) on Lake Mulurulu (section 8.8(b)), the northernmost lake.

No major change occurred in the terrestrial environment. The drying of lakes, or their less frequent filling, all over the Darling Basin produced a major reduction in productivity as it removed lacustrine and riverine resources which had formed a major part of the Aboriginal diet. Changes in temperature and evaporation rates may have created new resources in the form of ephemeral grasses producing large quantities of seed. A decreasing food supply would stimulate Aborigines to utilise hitherto untapped resources of this sort. Thus the terminal phase of the Pleistocene appears to have caused a major shift in the Darling River economy.

The addition of cereals to the diet at about 15,000 B.P. created an economy almost indistinguishable from that practised by the Darling River Bagundji in the last century (see section 3.2). The collection of fish, small mammals and cereals has been practised in this area for the past 15,000 years.

This is not to suggest that changes within this economic system did not take place. Very probably, slow and steady improvements raised the efficiency with which the fairly harsh Darling River environment could be exploited. In particular, it is to be expected that the highly sophisticated
material equipment and methods used by the Bagundji was
developed during this period. The development of nets to
catch animals, birds and fish, of snares, poisons, lures,
traps and also of methods of seed storage are all improvements
that were made over a long period.

Apart from the ethnographic literature, the Burke's
Cave site is the only proof that the Bagundji made seasonal
movements into the hinterland and to the rocky ranges. The
lower levels of Burke's Cave could not be dated, and one of
the tasks of future research in the Darling Basin should be
to see if dated sites away from the rivers and lakes can be
found.

At the moment we can only conclude that an economy
similar to that of the Darling River Bagundji existed in the
area for 15,000 years and that some aspects of this economy
have existed for the past 30,000 years.

9.3 Stone implement sequence

The scraper assemblages from the Darling Basin sites
form a recognisable industry. This industry belongs to the
'Australian core tool and scraper tradition' described by
Jones and Allen (in Bowler et al., 1970:52). Industries
which formed part of this tradition have been excavated from
widely separated areas in Australia.

The most important components of this tradition are:

(i) Large thick or domed scrapers made from cores, pebbles
or flakes on which abrupt, unifacial retouch has produced steep
step-flaked or notched working edges.

(ii) Small scrapers made on flat flakes with acute,
invasively retouched working edges. In general, the edges
range from convex to straight, rather than concave. Convex
edges seem to be characteristic of the tradition as a whole.
Only at Green Gully, in Victoria (Mulvaney 1970:73) is there a
scraper industry with a high proportion of concave edges.

The tradition can be classified as a generalised
woodworking tool kit. There is, however, sufficient varia-
tion from site to site to suggest that the tradition is composed
of a number of regional industries.
The definable features of the Darling River industry lie not only in the presence of horsehoof cores, and steep, round, straight edged and notched scrapers, but also the differing proportions that they make up of the various site assemblages. The absence of unifacial pebble tools differentiates the Darling River industry from those found in eastern and southeastern Australia. Horsehoof cores are present only in small numbers in eastern Australia.

The Darling River scraper industry is similar to that excavated at Puntutjarpa in Western Australia (Gould 1971:152). It is possible that both of these industries are part of an inland component of a tradition demonstrating adaptations to the arid and semi-arid environment. Also, it is significant that the Burke's Cave and Puntutjarpa faunas were similar.

The Darling River scraper industry has a recognisable continuity in the Darling Basin for 30,000 years. This represents remarkable stability, yet it is not unique in Australia. At Puntutjarpa, the scraper industry changed little in 10,000 years (Gould 1971: 174 ) and Mulvaney found little change in the scrapers at Kenniff Cave in 20,000 years of occupation (Mulvaney and Joyce 1965:144-8; D.J. Mulvaney pers.comm.1971). Lampert found a similar situation in the 20,000 year occupation of the New South Wales coastal site of Burrill Lake (1971:66). Further afield, 16,000 years passed without any recognisable variation in stone technology in sites in western Arnhem Lane (C. White 1967). The core tool and scraper tradition and its component regional industries appear to have persisted for very long periods.

In all areas, except for Tasmania isolated by the Pleistocene sea rise (Jones 1971), excavations reveal that certain new stone implements appear in levels dated to less than 10,000 B.P. - Gould's 'small tool tradition' (1971:153). The implements within this tradition consist of stone projectile points (pirri or Kimberley points, see Mulvaney 1969:116-22) backed flakes (microliths) and flake adzes.

All of these implements have been reported from South-East Asia (Mulvaney 1969:127). I agree with Mulvaney (1969: 127) that they were probably introduced to Australia.
In most cases, the additions to the tool kit produced no discernible changes in the pre-existing and continuous scraper industries. Mulvaney, summarising the period during which these changes occurred, stated

'It must be stressed that one of the striking features of this phase was the continuance of older tool traditions within the new complex' (1969:107).

There are striking regional variations connected with the introduction of the elements of this new tradition, and each element can be seen as an independent item. Some areas apparently received all elements, while others received only some. Further, there are wide variations in dates connected with their first use in a number of areas.

In the Darling River Valley, the oldest dated backed flake was only 2000 years old [at Burke's Cave]. At Fromm's Landing, in the lower Murray Valley they were only present from 3700-5000 B.P. (Mulvaney 1964:181). Apparently, they were not used after 3700 B.P. on the lower Murray Valley sites. Backed flakes [and Pirri points] are not present in the recent levels of many Australian archaeological sites. They appear to have dropped out of the archaeological record by 1000 B.P. (Lampert 1971:68).

Backed flakes, however, were present in the New England district of northern New South Wales until the 16th century [A.D.] (McBryde 1966). In the Darling Basin they were recovered in association with flake adze slugs, and at some sites with pirri points, in levels dated at, or estimated to be 100 years old. At Burke's Cave, Mootwingee, Meadow Glen and Mt. Grenfell backed flakes appeared to still be in use when the Europeans arrived.

At Burke's Cave, backed flakes, flake adze slugs and pirri points were increasing in use at the very time that European artefacts such as glass first became present.

Elements of the small tool tradition were received by the Bagungundji¹ at Burke's Cave after other people had

¹There seems little reason to doubt that the Bagundji were using Burke's Cave for the last 2000 years.
already given up using them. The Bagundji continued to use them until after they had gone out of fashion at almost every other site in Australia for which we have information.

The evidence is that there was a time lag in the Bagundji's adoption of new stone implements, compared to tribes inhabiting surrounding areas. This agrees well with general conclusions about Bagundji culture (chapter 4) where changes in their social, totemic and ritual organisation, and art forms, appeared to be continuing in the Darling River Valley after they had concluded in other areas. The Europeans seem to have cut short a very dynamic period of Bagundji development.

Apart from the introduction of new elements discussed above, the main change discernible in the Darling Basin stone sequence is the reduction in the proportion of large scrapers (horsehoeof cores and steep edged scrapers).

In the earlier period of the sequence this reduction appears to have been accompanied by an increase in small scrapers (round and straight edged scrapers). In the later phases, the large scrapers may have been replaced by flake adzes [an implement that is morphologically, and probably functionally very similar to round or straight edged scrapers].

On some recent sites in the Darling Basin, Burke's Cave, Mootwingee, Meadow Glen and Mt. Grenfell, there is a high proportion of round edged scrapers or of flake adze slugs and a low proportion of horsehoeof cores and steep edged scrapers. There is some variation in this observed trend for on the recent Willandra sites, Walls of China I, Garnpung I and Mungo backshore I, horsehoeof cores and steep edged scrapers continue to be numerically important until the historic period. However, the large scrapers on these sites were accompanied by round and straight edged scrapers in much greater percentages than was the case on the older Mungo I site. Flake adze slugs are present only in low numbers on the Willandra sites.

This trend, the replacement of large scrapers by smaller ones, can be interpreted as being continuous throughout the Darling Basin archaeological record. Lampert (1971:66) noted a similar trend at Burrill Lake in the period 5000-20,000 B.P. In some Australian situations it would appear that there
was a general and continuous trend towards greater use of smaller varieties of scraper. The trend in these cases does not begin abruptly with the appearance of the first [hafted] flake adze slug.

This trend [possibly beginning more than 20,000 years ago and ending only in the ethnographic present in some areas] can be interpreted as the product of a steady increase in the use of hafted flake implements. Unlike Mulvaney (Mulvaney and Joyce 1965:188-9) I would not restrict the concept of 'hafted' flake implements to backed flakes (microliths), stone projectile points, and flake adze slugs. On the basis of the discussion of round edged scrapers and flake adze slugs (in section 6.7(b)) I conclude that some round and straight edged scrapers were probably hafted. The distinctive wear patterns on hafted flake adze slugs possibly come from distinctive modes of use rather than from being hafted alone.

I would thus conclude that the apparent replacement of horsehoof cores and steep edged scrapers in the Darling Basin came as a result of the steady increase in the use of hafted small scrapers.

9.4 General conclusion

The main impression gained from an archaeological study of the economy and stone implements on sites in the Darling Basin, together with an ethnographic study of the Darling River Bagundji, is one of a single continuous cultural tradition. Changes took place in this tradition during man's 32,000 year history in the area, but these were not so great as to destroy the impression of continuity.

This is most apparent in the Darling River stone industry which, despite quite drastic environmental changes at the end of the Pleistocene, continued as a recognisable regional component of the Australian core tool and scraper tradition from 30,000 B.P. to 2,000 B.P. After 2000 B.P. new stone implements were added to the industry which still continued as a recognisable unit.

More change is apparent in the prehistoric economy. At the end of the Pleistocene, the collection of cereals was added to the basic riverine and lacustrine economy that had
been practised from 30,000 B.P. The addition of cereals to the diet, at about 15,000 B.P., produced the type of economy that continued in the Darling Basin until the ethnographic present. By the 19th century, the Bagundji had developed a remarkably efficient and sophisticated riverine economy.

It seems the Bagundji were the inheritors of an old and complex cultural tradition in the Darling Basin. This cannot be much consolation to their dispossessed descendants living in the shanty towns outside Bourke, Wilcannia and Wentworth.


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APPENDIX I

FOODS EATEN BY THE ABORIGINES
OF THE DARLING BASIN

Errata

In the references in this appendix, numbers in brackets after a date of publication (I), (II) and (III) refer to the order in which the reference appears in the bibliography above i.e., a, b or c. Numerals without brackets refer to the volume number e.g., II is vol. 2.
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>COMMON NAME</th>
<th>LOCALITY</th>
<th>NOTES</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHELLFISH</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNIONIDAE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>? sp.</td>
<td>Freshwater mussel</td>
<td>Central Darling River</td>
<td>Creek surrounded with the remains of numerous fires of the natives, besides which lay heaps of mussel shells (Unio) mixed with the bones of pelican and kangaroo. JANUARY.</td>
<td>Mitchell 1839 I:284</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Darling River</td>
<td>Women gather freshwater muscles (Unio) from the muddy bottoms of rivers or lagoons with their toes.</td>
<td>Mitchell 1839 I:306</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lake Cargelligo</td>
<td>On first approaching the lake, we saw the natives in the midst of the water gathering muscles (Unio). The lake abounds with the large freshwater muscle, which was the chief food of the natives at the time we visited it. APRIL.</td>
<td>Mitchell 1839 II:34-5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lachlan River</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Lower Lachlan River</td>
<td>Dry and parched as the bed of the lake then was, the natives found nevertheless live freshwater muscles, by digging to a substratum of sand. APRIL.</td>
<td>Mitchell 1839 II:66</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moorundie</td>
<td>Muscles of a very large kind are also got by diving. The women whose duty it is to collect these, go into the water with small nets hung around their necks.</td>
<td>Eyre 1845(1) II:267</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray and Darling Rivers</td>
<td>Lagoons and rivers supply muscle shells (Unio) large mounds of which may be traced upon the river banks at intervals for hundreds of miles.</td>
<td>Krefft 1866(11):369</td>
</tr>
<tr>
<td>FRESHWATER CRAYFISH</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Eubastacus armatus</td>
<td>Murray River Crayfish</td>
<td>Murray River</td>
<td>The large freshwater lobster is sometimes procured by diving in which case the females are generally employed, as the weather is cold - weigh 2-4 lbs each.</td>
<td>Eyre 1845(1) II:265-7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moorundie</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Murray and Darling Rivers</td>
<td>The large crayfish (Potamobius serratus) distinguished by its spiny back and white pincers is caught by two or three natives in a canoe paddling their fingers in the water, the great crustacean makes a dart at their fingers with its pincers - the pincers are immediately broken off and he is landed into the canoe.</td>
<td>Krefft 1866(11):369</td>
</tr>
</tbody>
</table>
FRESHWATER CRAYFISH (Cont'd)

Cherax destructor

Murray River, Echuca to Wentworth

Moorunde

Moorunde

Wilcannia district

Murray River, Echuca to Wentworth

Smooth freshwater crayfish or yabbie

Murray lobster

U-kod-to the crayfish of the small kind is obtained by the women wading into the water ... or by men, wading and using a large low net, called a wharro which is dragged along by 2 or 3 of them.

Women wade into the water in a long close line, stooping down and walking backwards whilst they grope with their hands for the crayfish.

Plenty of crayfish in the back creeks, harbour themselves in dry clay bed when the waterholes dry up. The largest I ever saw ... appeared in a waterhole that had been dry for about two years.

Yabbie.

Beveridge 1883:41

Eyre 1845(1) II:267-8

Eyre 1845(1) II:252

Bonney Ms. c.1881

REPTILES AND AMPHIBIANS.

FROGS

Moorunde

Moorunde

Wilcannia district

Lower Murray, Murrumbidgee, Lachlan and Darling Rivers

Murray and Darling Rivers

Frogs are dug out of the ground by the women, or caught in the marshes.

Frogs are a last resort in summer, they may also be secured, summer or winter, beneath the bark of the flooded gum-trees.

Rarooka - cooked on coals.

During the cold bleak winter frogs are deemed good.

Frogs are thought good by camp epicures.

Beveridge 1883:41

Eyre 1845(1) II:268

Krefft 1866(1):370

Bonney Ms. c.1881

Beveridge 1883:37

Parker 1905:110

FRESHWATER TORTOISES

Chelodina longicollis

Murray and Darling Rivers

Long-necked tortoise

It affords food to the natives especially during summer, when the lagoons are dry, their eggs, which are deposited in the beginning of January, amount to 15 or 20 perhaps even more, as the natives who eat them in great quantities informed me.

Krefft 1866(1):24-5
Chelodina sp.  
Junction of Murray and Darling Rivers  Small freshwater turtle, they seldom failed to take the poor little animal.  Sturt 1833 II:114
Murray and Darling Rivers  Chelodina ... taken in the lagoons and rivers, generally during the hot summer days when the water is low.  Krefft 1866(11):369
Lower Murray, Murrumbidgee, Lachlan and Darling Rivers  Turtles are caught in nets 100 yds long, 4' deep and 3'' mesh.  Beveridge 1883:47

LIZARDS AND SNAKES

Tiliqua scincoides  Common bluetongue  Murray and Darling Rivers  Cyclopus gigas - captured by the natives.  This species is prized by the natives as an article of food.  Krefft 1866(1):28

Trachydosaurus rugosus  Shingleback  Murray and Darling Rivers  Stump tail, large, lazy and is very common, frequents open sandy plains,  Krefft 1866(1):25

Varanus varius  Lace Monitor Goanna  Murray and Darling Rivers  Is one of the most common forms on the plains of the Murray.  They grow to a large size as much as 7 or 8'.  Krefft 1866(1):25

Wicannia district  Iguana - they eat the fat of most reptiles which tastes like the fat of fish.  Bonney Ms. c.1881

Country between the Lachlan and Darling Rivers  Hydrosaurus, lace lizard is unearthed with a wooden shovel.  Bennett 1897:1

Central Darling River  Iguana - much esteemed as a food.  Dunbar 1943-4:176

NW N.S.W.  A native had caught a talpero [Macrota lagotis] and a lizard.  Sturt 1849 I:296

Wilcannia district  0

Morelia sp.  Carpet python  Lower Murray, Murrumbidgee, Lachlan and Darling Rivers  During the cold bleak winter the then hibernating carpet or true snake is deemed most toothsome.  Beveridge 1883:37
Central Darling River  The carpet snake yuiffi was much esteemed as a food.  Dunbar 1943-4:176
<table>
<thead>
<tr>
<th><strong>Morolia sp.</strong></th>
<th>Carpet python</th>
<th>Murray and Darling Rivers</th>
<th>Does not appear to be so common on the plains.</th>
<th>Krefft 1866(1):26</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Snakes</strong></td>
<td></td>
<td>Wilcannia district</td>
<td><a href="#">Bonney Ms. c.1881</a></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray and Darling Rivers</td>
<td>Snakes etc., are roasted upon the coals.</td>
<td>Krefft 1866(11):369</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NW N.S.W.</td>
<td>The natives killed a snake which they represented as being highly poisonous but did not scruple to devour it with great relish. MARCH.</td>
<td>Wright 1862:514</td>
</tr>
<tr>
<td><strong>Reptiles</strong></td>
<td></td>
<td>Murray and Darling Rivers</td>
<td>In the cold season reptiles can only be obtained with the most difficulty.</td>
<td>Krefft 1866(1):23</td>
</tr>
<tr>
<td><strong>FISH</strong></td>
<td></td>
<td></td>
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<tr>
<td><em>Fluvialosa richardsoni</em></td>
<td>Bony bream</td>
<td>Darling River, Menindee</td>
<td>'This fish was caught today (Oct.7, 1860) by natives at a backwater of the Darling'</td>
<td>Becker Ms. 1860-2 (Drawing)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray and Darling Rivers</td>
<td>'The women were cooking fish, of which a large supply had been obtained during the day, - carefully reserving the taboo'd fish called Manor (Chatoennisome) for the use of the aged, no youth or lass being permitted to partake of it'.</td>
<td>Krefft 1866(11):368</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray and Darling Rivers</td>
<td>One of the principal fishes used as food by the natives.</td>
<td>Krefft 1866(11):368</td>
</tr>
<tr>
<td><em>Tandanus tandanus</em></td>
<td>Freshwater catfish</td>
<td>Murray and Darling Rivers</td>
<td>'We exchanged pieces of iron-hoop for two other kinds of fish, one a bream, the other a barbel, with the natives. They would slip, feet foremost into the water ... to avoid the splash ... they would reappear with a fish writing upon the point of their short spears'.</td>
<td>Sturt 1833 II:113-4</td>
</tr>
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<td></td>
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<td>Upper Lachlan River</td>
<td>'In these ponds the natives speared several fishes ... among them was one, apparently the sal-fish (<em>Flotopus tandanus</em>), caught during my first expedition'. MARCH.</td>
<td>Mitchell 1839 II:10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lake Buchanan, Northeast S.A.</td>
<td>'The natives ran up with strings of fishes, three kinds including the Murray catfish'; OCTOBER.</td>
<td>Hodkinson Ms. 1861-2 McKinlay 1862:9</td>
</tr>
<tr>
<td>Fish</td>
<td>Habitat</td>
<td>Description</td>
<td>Reference</td>
<td></td>
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<tr>
<td><em>Tandanus tandanus</em></td>
<td>Freshwater catfish</td>
<td>Caught either in nets 100 yds long, 4' deep with a 3&quot; mesh or else in fixed zig-zag nets set about 20 yds from the lake shore (21lbs - 10lbs).</td>
<td>Beveridge 1883:47-8</td>
<td></td>
</tr>
<tr>
<td><em>Electrophorus ambigus</em></td>
<td>Golden perch</td>
<td>'Natives ran up with strings of fishes ... 3 kinds ... golden perch ...'</td>
<td>Rodkinson Ms. 1861-2 McKinlay 1862:9</td>
<td></td>
</tr>
<tr>
<td><em>Macullochella maquariensis</em></td>
<td>Murray cod</td>
<td>'The species of fish most abundant in the Darling, is the <em>Graeter peelia</em>, or cod perch, and they are caught of a very large size by the natives'.</td>
<td>Mitchell 1839 1:310</td>
<td></td>
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<tr>
<td>**</td>
<td>*</td>
<td>*There was a deep and broad reach of the river opposite to our camp, and it appeared that [the natives] fished daily in different portions of it ... The King stood erect in his bark canoe, while nine young men, with short spears, went up the river and as many down ... all dived into [the river] and returned towards him, alternately swimming and diving; transfixing the fish under the water and throwing them on the bank. Others on the river bank speared the fish when thus enclosed, as they appeared among the weeds, in which small openings were purposely made that they might see them. In this manner, they killed with astonishing dispatch some enormous cod-perch; but the largest were struck by the chief from his canoe, with a long barbed spear. After a short time the young men in the water were relieved by an equal number; and these came out, shivering, the weather being very cold, warmed themselves in the centre of a circular fire kept by the gins on the bank'. JULY.</td>
<td>Mitchell 1839 1:268</td>
<td></td>
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<tr>
<td><strong>FISH (Cont'd)</strong></td>
<td><strong>Moluccella maquariensis</strong></td>
<td><strong>Murray Cod</strong></td>
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<tr>
<td>Murray River</td>
<td>'The natives at this place appeared to subsist principally upon fish, of which three or four kinds including the Murray Cod (<em>Oligopus maquariensis</em>) were roasting on their camp fires.'</td>
<td>Krefft 1866(11):360</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray and Darling Rivers</td>
<td>One of the principal fishes used as food by the natives.</td>
<td></td>
<td>Krefft 1866(11):368</td>
<td></td>
</tr>
<tr>
<td>Namoi and Barwon Rivers</td>
<td>Forbidden to the young men.</td>
<td></td>
<td>Ridley 1872:271</td>
<td></td>
</tr>
<tr>
<td>Wilcannia district</td>
<td>'Pumador - Murray Cod are often caught weighing as much as 20lbs. Speared or caught in nets, not with hooks'.</td>
<td></td>
<td>Bonney Ms. c.1881</td>
<td></td>
</tr>
<tr>
<td>Murray River, Echuca to Wentworth</td>
<td>Murray cod from 50lb downwards are caught in hauls of 3-4 cwt in nets 100 yds long, 4' wide with 3' meshes.</td>
<td></td>
<td>Beveridge 1883:41 and 47</td>
<td></td>
</tr>
<tr>
<td>Murray River, Echuca to Wentworth</td>
<td>Murray Cod, of a giant size, are occasionally caught in zig-zag nets set about 20 yds off the lake shores.</td>
<td></td>
<td>Beveridge 1883:48</td>
<td></td>
</tr>
<tr>
<td>Western Rivers (Murray tributaries)</td>
<td>'Mundre or Correll - Murray Cod, a hand net is most in use, another variety is a net about 2-3 yds long, oblong in shape and is frequently used as a drag net.'</td>
<td></td>
<td>Wyndham 1891:113,117</td>
<td></td>
</tr>
<tr>
<td>Brewarrinna fisheries</td>
<td>The codfish ramble down as well as upstream, and were caught in the pens at any time. The larger fish were killed by spear or club, the smaller ones were caught by hand.</td>
<td></td>
<td>Mathews 1903:153</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Bidyanus bidyanus</strong></th>
<th><strong>Silver perch</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray and Darling Rivers</td>
<td><em>Lates coloconum</em> is one of the principal fishes used by the natives as food.</td>
</tr>
<tr>
<td>Murray River, Echuca to Wentworth</td>
<td>Silver perch from 2-10lbs caught in nets 100 yds long, 4' deep with a 3' mesh or else in zig-zag nets set about 20 yds offshore.</td>
</tr>
</tbody>
</table>

| **Bream** | **Junction of the Murray and Darling River** | Exchanged pieces of iron-hoop for two other kinds of fish, the one a bream, the other a barbel. | Sturt 1833 II:113-4 |
FISH (Cont’d)

_______?
Bream
Lake Buchanan, Northeast S.A.
The natives had a species of bream, the *Nobre* of the Darling. Probably Bony Bream. OCTOBER. Hodkinson Ms. 1861-2 McKinlay 1862:9

_______?
Bream
Wilcannia district
The bream is a much smaller fish [than a Murray Cod] though it is generally considered the nicer fish to eat. Bonney Ms. c.1881

_______?
Bream
Western Rivers (Murray tributaries)
'Coopre' a bream. Wyndham 1891:113,117

_______?
Black bream
Brewarrinna fisheries
The principal fish which formed the operations of the traps were Murray Cod, black bream and yellow bellies. The black bream was the favourite fish among the Aborigines as an article of food. Almost certainly Silver perch (*Bidyanus bidyanus*). Mathews 1903:153

_______?
Perch
Western Rivers (Murray tributaries)
'Pubbe, a small speckled perch' probably the spangled perch (*Megalania intocotu*). Wyndham 1891:113,117

Fish
Murray River
'It is certain, from their indifference to them, that the natives seldom eat fish when they can get anything else'. Sturt 1833 II:114

Darling River
'We saw a tribe of natives who were collected for the purpose of fishing ... there were 42 men on this side of the river and about 50 women and children on the other side'. SEPTEMBER 30th. Browne Ms. 1845–6

Murray River, Buchuca to Wentworth
Fish are caught from August to January as the flooded back country drains and nets and wiers are placed across the creeks. Beveridge 1883:48

BIRDS

*Dromaius novaehollandiae* Emu
Central Darling River
We saw no emus further down than Dunlop’s Range. Mitchell 1839(1):308

Lower Darling River
Emus also are caught in nets made from a thorny twine. OCTOBER. Brock Ms. 1844–6

Barrier Ranges
Observed the remains of an emu trap ... a long rude fence open at one side to admit the bird, on this fence a large net is hung and when the game is firmly in, the natives and his companions close up the gap with the net. DECEMBER. Brock Ms. 1844–6
<table>
<thead>
<tr>
<th>BIRDS (Cont'd)</th>
<th>Emu</th>
<th>Kow Swamp, Gunbower Creek</th>
<th>Emus, malle hen, the black swan, fishes, crayfish etc. appeared to be their principal food at the time. FEBRUARY-MARCH.</th>
<th>Krefft 1866(11):359</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Wilcannia district</td>
<td>Emu - malle. Emus are netted or speared like the kangaroo. In the winter season they are caught at night in nets ... the natives fix strong nets, of a 12&quot; mesh, in a square leaving an opening at the 4 corners or else in the form of an angle. With the horn goombiutooloo he is able to imitate the noise of the female bird which brings all the emus, once they are within the net the natives rush in upon their prey and slaughter them with spears and throwing sticks.</td>
<td>Bonney Ms. c.1881</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Narran and Darling Rivers</td>
<td>Emus noosed with a ground noose or else trapped in nets using a cornet lure.</td>
<td>Parker 1905:106-7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Darling River</td>
<td>A large cord net was set up like a triangular palissade to catch emus, which were driven into it and dispatched with clubs, a decoy horn was also used.</td>
<td>Dunbar 1943-4:175</td>
</tr>
<tr>
<td><em>Pelecanus conspicillatus</em></td>
<td>Australian Pelican</td>
<td>Central Darling River</td>
<td>We noticed the fires of the natives besides which lay heaps of muscle shells (Unio) mixed with the bones of pelican and kangaroo.</td>
<td>Mitchell 1839(1):84</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moorunde</td>
<td>Pelicans are caught in nets or while they are asleep in the water, by natives wading in and seizing them by the legs.</td>
<td>Eyre 1845 II:284, 286-7</td>
</tr>
<tr>
<td><em>Phalacrocorax</em> sp.</td>
<td>Cormorants</td>
<td>Moorunde</td>
<td>Netted the shag or created cormorant.</td>
<td>Eyre 1845 II:286-7</td>
</tr>
<tr>
<td>Geese</td>
<td></td>
<td>Moorunde</td>
<td>Netted in nets 30-60' long and 20-30' deep hung between trees.</td>
<td>Eyre 1845 II:286-7</td>
</tr>
<tr>
<td><em>Cygnus atratus</em></td>
<td>Black Swan</td>
<td>Moorunde</td>
<td>... speared or killed with birris (throwing stick)</td>
<td>Eyre 1845 II:283</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kow Swamp, Gunbower Creek</td>
<td>Black swan was one of the natives principal foods at the time. FEBRUARY-MARCH.</td>
<td>Krefft 1866(11):359</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wilcannia district</td>
<td>'Zungoole'.</td>
<td>Bonney Ms. c.1881</td>
</tr>
</tbody>
</table>
**BIRDS (Cont'd)**

*Anas superciliosa*  
**Black Duck**  
Murray River (near Mildura)  
A large net, sometimes 20' deep by 100' long, is spanned across a creek or river, to the two ends to which a string is fastened, resting upon some branch of a tree, being kept in readiness by two natives, who are posted beneath this tree, and the net completely immersed in the water. Some 2 or 3 miles higher up the creek, a party of natives start the birds, which invariably follow the bend of the creek, ... as soon as they are nearing the net another native who is posted in the scrub gives a peculiar whistle - similar to a species of hawk - throwing a flat piece of wood or boomerang among the startled birds, which immediately swoop ... the net is raised, the ducks get entangled in its meshes. I have seen from 50-100 ducks taken in this manner at a haul.  
Krefft 1866(11):368-9

*Anas gibberifrons*  
**Grey Teal**  
Murray River  
Teal, *Anas punctata*, caught in the same way as the black duck.  
Moorunde  
Teal are caught in a large square or oblong net (*Kue-rad-kor*), from 30-60; broad and from 20-40' deep formed by lacing together pieces of old fishing net, or any others made of light twine, that they might have. This net is strung between trees and can be lowered and raised by two men on either side of a river or lagoon. The women are sent to put the birds up, as they fly past a whistle like a hawk is sounded, the ducks lower their flight and strike against the net. The net is lowered on top of them. As many as 50 birds are taken in a single haul.  
Eyre 1845 II:286-9

*Anas rhynchos*  
**Blue-winged Shoveller**  
Murray River (near Mildura)  
The shoveller, *Spatula rhynchos*. Caught in the same way as the black duck.  
Krefft 1866(11):368-9

*Malacorhynchus membranaceus*  
**Pink-eared duck**  
Murray River (near Mildura)  
The pink-eyed or whistling duck *M. membranaceus* taken in the same way as the black ducks.  
Krefft 1866(11):368-9

*Aythya australis*  
**White-eyed duck**  
Murray River (near Mildura)  
White-eyed duck, *Aythya australis* caught in the same way as the black duck.  
Krefft 1866(11):368-9

*Chenonetta jubata*  
**Wood duck**  
Murray River (near Mildura)  
The wood duck, *Bermola jubata* caught in the same way as the black duck.  
Krefft 1866(11):368-9
<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Description</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ducks</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Widgeon (wild ducks)</td>
<td>Central Darling River</td>
<td>The largest of their nets are those set across the Darling for the purpose of catching the ducks which fly along the river in considerable flocks. The nets are strong, with wide meshes; and when the occasion requires, they are stretched across the river from a lofty pole erected for the purpose on one side, to some large opposite tree on the other. Such poles are permanently fixed, supported by substantial props. The nets are well worked and very much resemble our own in structure.</td>
<td>Mitchell 1839 I:305</td>
</tr>
<tr>
<td></td>
<td>Murray River</td>
<td></td>
<td>Eyre 1845 II:286-7</td>
</tr>
<tr>
<td></td>
<td>Moorunde</td>
<td>Netted in the same way as described for teal, both birds are also snared in slip nooses set amongst the reeds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower Darling River</td>
<td>Ducks are trapped in large nets.</td>
<td>Brock Ms. 1844-5</td>
</tr>
<tr>
<td>WIlcannia district</td>
<td></td>
<td>Ducks in great variety are caught.</td>
<td>Bonney Ms. c.1881</td>
</tr>
<tr>
<td>Narran and Darling Rivers</td>
<td></td>
<td>Ducks are caught in nets stretched between trees across creeks also killed with boomerangs.</td>
<td>Parker 1905:106,109</td>
</tr>
<tr>
<td>Central Darling River</td>
<td></td>
<td>Wild ducks meshed by a net stretched across a narrow portion of the waterway, at dusk. Also caught in reedy swamps or in billabongs by swimming beneath the surface, reaching up and catching the ducks by the legs.</td>
<td>Dunbar 1944-5:175</td>
</tr>
<tr>
<td>Leipoa ocellata</td>
<td>Kow swamp, Gunbower Creek</td>
<td>One of the principal foods at the time. FEBRUARY-MARCH.</td>
<td>Krefft 1866(11):359</td>
</tr>
<tr>
<td></td>
<td>Murray River</td>
<td>Leips or native pheasant, eggs are found in singular-looking mounds of sand, thrown up by the birds in the midst of the scrubs. Young men and women are forbidden to eat Mallee fowl. The bird weighs about 4½ lbs.</td>
<td>Eyre 1845 II:274-5</td>
</tr>
<tr>
<td></td>
<td>Moorunde</td>
<td></td>
<td>293-4</td>
</tr>
<tr>
<td>Grus rubicunda</td>
<td>Brolga or Native Companion</td>
<td>Either speared or killed with Bartris (a short heavy stick with a knob at one end).</td>
<td>Eyre 1845 II:283</td>
</tr>
<tr>
<td></td>
<td>Murray River</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moorunde</td>
<td>Koor-loo-roo-koo.</td>
<td>Bonney Ms. c.1881</td>
</tr>
<tr>
<td>Rallus pectoralis</td>
<td>Lewin water rail</td>
<td>There are numbers of this rail on the Murray, but not many on the Darling; the natives can easily run it down.</td>
<td>Sturt 1849 II:</td>
</tr>
<tr>
<td></td>
<td>Darling River</td>
<td></td>
<td>Appendix page 54</td>
</tr>
<tr>
<td>BIRDS (Cont'd)</td>
<td>Australian Bustard</td>
<td>Namoi and Barwon Rivers</td>
<td>Forbidden to young men.</td>
</tr>
<tr>
<td>---------------</td>
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<td>------------------------</td>
</tr>
<tr>
<td>Eupodotis australis</td>
<td>Australian Bustard</td>
<td>Wilcannia district</td>
<td>Smaller variety 'Dickbird' larger 'Toolkika' [male and female]? the young men believed that they would go grey headed if they ate these.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Darling River</td>
<td>A delicacy reserved for the old men.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Narran and Darling Rivers</td>
<td>Plains turkey was killed with boomerangs.</td>
</tr>
<tr>
<td>Phaps chalcoptera</td>
<td>Common Bronzewing Pigeon</td>
<td>Murray River</td>
<td>The natives of the Murray set nets across any gully down which they fly to water on the banks of the Murray and so catch them in great numbers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Darling River</td>
<td>Bronze winged pigeons are caught in nets across narrow glades in thick timber.</td>
</tr>
<tr>
<td>Pigeons</td>
<td></td>
<td>Narran and Darling Rivers</td>
<td>Caught in nets stretched in front of waterholes by men in hides, the net is overturned and the birds are trapped. Also killed with boomerangs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray River Moorunde</td>
<td>Caught in nets, in the same way as Grey Teal.</td>
</tr>
<tr>
<td>Cockatoos</td>
<td></td>
<td>Warrego River</td>
<td>'A single native was seen this evening, he came to his gunyah with two or three cockatoos'. OCTOBER.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wilcannia district</td>
<td>Natives eat cockatoos and parrots.</td>
</tr>
<tr>
<td>Eolophus roseicapillus</td>
<td>Galah</td>
<td>Narran and Darling Rivers</td>
<td>Nets are stretched in front of waterholes, men hide and then upturn the net and trap the birds. Also killed with boomerangs.</td>
</tr>
<tr>
<td>Crow</td>
<td></td>
<td>Narran and Darling Rivers</td>
<td>Caught in the same way as Galahs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moorunde</td>
<td>The eggs of birds are extensively eaten by the natives, being chiefly confined to those kinds that leave the nest at birth, as the mallee hen, the emu, the swan, the goose and the duck etc., ... the others where the young remain some time in the nest are left and the young are taken before they can fly.</td>
</tr>
</tbody>
</table>
**BIRDS (Cont'd)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wilcannia district</td>
<td>The eggs of emus and ducks are eaten in any stage of incubation, fresh eggs not being preferred.</td>
<td>Bonney Ms. c.1881</td>
</tr>
</tbody>
</table>

**MAMMALS**

**MACROPODIDAE**

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macropus fuliginosus</td>
<td>Murray and Darling Rivers</td>
<td>The common kangaroo, though much more common than the red kangaroo, is also scarce, all the specimens procured were small.</td>
<td>Krefft 1866(1):19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Megaleia rufa</td>
<td>Murray and Darling Rivers</td>
<td>The red kangaroo like the great kangaroo (grey) feeds in flocks ... in wet weather when the chalky top soil of the mallee scrub is softened, these kangaroos are easily captured. Any blackfellow's cur will stick to the tail of the kangaroo until his master is able to come up and crack its skull, or run a spear through it.</td>
<td>Krefft 1866(11):370</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macropus sp.</td>
<td>Rock Wallaby</td>
<td>'Kokriega ... the worn out cavities of the rocks furnish shelter to numerous marsupial animals, more particularly to a species of rock wallaby, termed <em>Wangaroo</em> by the natives'. JANUARY.</td>
<td>Wright 1862:508</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Wilcannia district</td>
<td>'Wongooaroo - Rock wallaby are caught on the rocky ridges in nets placed across the ridge. The hunters beginning at one end of the ridge drive the wallabies by shouts and noises to where the net is placed, often those that go under the boulders and rocks can be lured out as the holes are generally not deep. The wallabies run at the net formed as a snare and are there killed by the blacks chasing them. After beating one length the net is moved further down the ridge and another length is beaten.</td>
<td>Bonney Ms. c.1881</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wallaby</td>
<td>West Darling River</td>
<td>Jerboas, wallaby, dipus and other game are now found in abundance and the natives, during this part of the year, live principally on flesh. OCTOBER.</td>
<td>Brock Ms. 1844-6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Notes</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kangaroos</td>
<td>Lower Darling River</td>
<td>The natives could only just have killed a kangaroo that was lying on the ground partly prepared for cooking.</td>
<td>Sturt 1849 I:115</td>
</tr>
<tr>
<td><strong>Mammals (Cont'd)</strong></td>
<td><strong>Naaropus sp.</strong></td>
<td><strong>Wallaby</strong></td>
<td><strong>West Darling district</strong></td>
</tr>
<tr>
<td>----------------------</td>
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<td>-------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td><strong>Rock wallaby</strong></td>
<td></td>
<td><strong>West Darling district</strong></td>
<td>Very few kangaroos were seen, none indeed beyond the parallel of 28°. All that were seen were of the common kind, none of the minor description apparently inhabiting the interior, if I except some rock wallabies, noticed on the Barrier Range.</td>
</tr>
<tr>
<td><strong>--- sp.</strong></td>
<td></td>
<td><strong>Darling River</strong></td>
<td>We saw no kangaroos lower than Dunlop's Range [Louth].</td>
</tr>
<tr>
<td><strong>Oxychogalea lunata</strong></td>
<td><strong>Crescent nail-tailed wallaby</strong></td>
<td><strong>Murray and Darling Rivers, west of the Darling</strong></td>
<td>'Harrin, often seen out during the day time, gregarious, the most common of all the smaller species. May be met within any part of the Murray scrub.'</td>
</tr>
<tr>
<td><strong>Oxychogalea frasenata</strong></td>
<td><strong>Bridle nail-tailed wallaby</strong></td>
<td><strong>Murray and Darling Rivers</strong></td>
<td>'Thurit, common upon the level country between the Murray and the Darling; strictly nocturnal and solitary ... generally found asleep under some salt bush or in any other sheltered locality'.</td>
</tr>
<tr>
<td><strong>Lagorhoestes leporides</strong></td>
<td><strong>Eastern Hare-wallaby</strong></td>
<td><strong>Murray and Darling Rivers</strong></td>
<td>'Ruma: F a little hairy wallaby which lived in great numbers in the porcupine grass ridges. The old people netted these animals with a mukar wallaby net (made of grass fibre and kangaroo sinew). The nets would be arranged, while some hunters would go around setting light to dry mukar grass; others would stand near the nets, with clubs in their hands, and as the paddy-melons came out of the grass &quot;as thick as rabbits&quot;, they would be knocked over and put in heaps ready to be collected. When the grass burnt out, only bare ground was left'.</td>
</tr>
<tr>
<td><strong>--- sp.</strong></td>
<td><strong>Pademelons</strong></td>
<td><strong>Willandra billabong, Lachlan River</strong></td>
<td>'A species of kangaroo-rat (Betongia campestris) and a sort of bandicoot [Macrotis lagotis] are dug out occasionally by the natives.</td>
</tr>
<tr>
<td><strong>Caloprymnus campesi</strong></td>
<td><strong>Plains rat-kangaroo</strong></td>
<td><strong>Murray and Darling Rivers</strong></td>
<td>Not seen west of the Murrumbidgee.</td>
</tr>
<tr>
<td><strong>Aepyprymnus rufescens</strong></td>
<td><strong>Rufous rat-kangaroo</strong></td>
<td><strong>Murray River, Gumbower Creek</strong></td>
<td>Not seen west of the Murrumbidgee.</td>
</tr>
</tbody>
</table>
MAMMALS (Cont'd)

Bettongia penicillata

Brush-tailed rat kangaroo
Murray and Darling Rivers

'Pattcock, very partial to the thick clusters of polygonum scrub so frequent on the Murray. Female specimens were frequently brought to me by the natives'.

Krefft 1866(1):20-21

Bettongia lesueur

Lesueur's rat kangaroo
Murray and Darling Rivers

'Booming, the kangaroo-rat, called Booming, is common in the scrub, and its burrows often cover a couple of acres of ground ... the natives trace the direction of the holes by inserting long slender twigs, and then sink a shaft ... sometimes from 10-12' deep. More than once I have noticed a couple of natives to sink 3 such shafts in a day. A pointed stick to loosen the earth, a sort of scoop to throw it up, or if too deep, to fill a kangaroo skin with it, are all the digging utensils they require. It is nocturnal, always leaves its burrow after the sun is down. The Murrumbidgee junction is apparently the eastern boundary of this species'.

Krefft 1866(1):21-2
Krefft 1866(11):371

Bettongia sp.

Country between the Lachlan and Darling Rivers

' Implements resembling yam sticks are used in digging up bettongs, perameles, rabbit-rats etc., the earth is loosened and then removed with a wooden shovel.

Bennett 1897:2

Bettongia sp.

Lower north of S.A.

The Bohra afforded their chief supply of animal food at all times, but more especially during the summer months, their skins made into rugs formed the only clothing they possessed. The bohras lived in families, as many as 20 individuals in one burrow. Each burrow had several inlets, all of them converging to a central chamber ... A burrow having been found ... the natives ... stop up all the holes, except one on the windward side in which they make a fire. Smoking took from 15-20 minutes. The natives then sank a hole into the centre of the burrow to get at those that had died in the central chamber. The native loosened the earth between his legs with a yam stick, and threw it over his shoulders with a shovel. I once saw 11 bohra taken out of one burrow. A full grown bohra weighs as much as an average sized rabbit.

J. Harris Browne 1897:72-3
### MAMMALS (Cont'd)

#### PHALANGERIDAE

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Trichosurus vulpecula</em></td>
<td>Brush-tailed possum</td>
<td>Northwestern N.S.W.</td>
<td>'Saw only one in the interior'.</td>
</tr>
<tr>
<td>Murray and Darling Rivers</td>
<td>This species is the staff of life to the natives ... after a hard day's unsuccessful hunting, how carefully they would examine the large flooded gum-trees fringing the river banks, how nimbly they would get a footing upon some hollow limb, and with what perseverance &quot;possum&quot; was dislodge. Occur in the mallee scrub sometimes 20 miles from water.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### PETAURIIDAE

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Pseudocheirus peregrinus</em></td>
<td>Common ring-tail</td>
<td>Murray and Darling Rivers</td>
<td>A rare animal on the Murray and Darling, I secured no more than 2 specimens.</td>
</tr>
<tr>
<td>Upper Lachlan River</td>
<td>Ring-tail possum cut from a tree, by a native, with a stone hatchet.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moorunde</td>
<td>Flying squirrels are taken in the same way as opossums.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____?</td>
<td>Opossum</td>
<td>Bogan River</td>
<td>Cut out of a tree by the natives.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Species</th>
<th>Common Name</th>
<th>Location</th>
<th>Notes</th>
</tr>
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<tbody>
<tr>
<td>_____?</td>
<td>Opossum</td>
<td>Moorunde</td>
<td>They are hunted during the day and by moonlight; natives climb trees with possum scratches on the bark and listen for noises inside holes, then pulls the opossum out or else a fire is lit at the base of the tree near an opening and the smoke soon drives the animal out. Dogs are used to scent them at night.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Species</th>
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<th>Location</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opossum</td>
<td></td>
<td>Namoi and Barwon Rivers</td>
<td>Forbidden to the young men.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Species</th>
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<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opossum</td>
<td></td>
<td>Wilcannia district</td>
<td>'Tarongoe is caught in his hiding place in a hollow tree ... a hole is cut and the opossum is pulled through the hole, dragged out by his hind legs and swung around. They are cooked whole on the ashes of a camp fire, the fur being either frayed off or taken off with the skin.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th></th>
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<th></th>
<th>Sturt 1849 II Appendix page 9</th>
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</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td>Sturt 1849 II Appendix page 9</td>
</tr>
</tbody>
</table>

| | | | Krefft 1866(1):17; (11):370 |
| | | | Oxley 1820:171 |
| | | | Eyre 1845 II:282 |
| | | | Mitchell 1839 I:203 |
| | | | Eyre 1845 II:279-82 |
| | | | Ridley 1872:271 |
| | | | Bonney Ms. c.1881 |
MAMMALS (Cont'd)

Opossum
Narran and Darling Rivers
A prized food, the skins made rugs, the hair was woven into cords and they carved their weapons with an opossum's tooth.
Parker 1905:115

Opossum
Central Darling River
Dogs were used to locate opossums by scent.
Dunbar 1943-4:176

Opossum
Darling River
'We saw but few cloaks among them, since the opossum does not inhabit the interior. Those that were noticed, were made of the red kangaroo skin'.
Sturt 1833 VI:105-6

PHASCOLARCTIDAE

Phascolarctos cinereus
Koala
Moorunde
The sloth, which is an animal as large as a good sized monkey, is also caught among the branches of the larger scrub-trees, among which it hides itself; but it is never found in holes.
Eyre 1845 II:282

VOMBATIDAE

_______ sp.
Wombat
Moorunde
The wombat is driven to his hole, with dogs at night, and a fire being lighted inside, the mouth is closed with stones and earth. The animal by this means suffocated, is dug out at leisure.
Eyre 1845 II:284

_______ sp.
Wombat
Darling River
In the red sand hills were many burrows of wombats, but these also became scarce as we proceeded downwards.
Mitchell 1839 II:308

PERAMELIDAE

Isoodon obscurus
Short-nosed bandicoot
Murray and Darling Rivers
Pirrikim - the flesh is delicious especially when done in the native style, that is, the hair removed, and the game roasted upon the coals.
Krefft 1866(1):16-17

Perameles bougainville
Barred bandicoot
Murray and Darling Rivers
Northern district of Victoria and the interior of N.S.W. It seldom burrows except ... for food ... nocturnal, social ... seeks shelter during daytime in hollow logs and under stones, although sometimes it constructs a nest like chaeropus.
Krefft 1866(1):15-16

Perameles sp.
Country between the Darling and Lachlan Rivers
Implements resembling yam sticks are used in digging up bettongs, perameles, rabbit-rats etc., the earth is loosened and then removed with a wooden shovel.
Bennett 1897:2

Chaeropus ecaudatus
Pig-footed bandicoot
Lower Darling River
Seen on the banks of the Darling in the possession of the natives.
Sturt 1849 II Appendix page 4
<table>
<thead>
<tr>
<th>Mammals (Cont'd)</th>
<th>Species</th>
<th>Location</th>
<th>Description</th>
<th>Author/Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chæropus sœzidatus</strong></td>
<td>Pig-footed bandicoot</td>
<td>Lower Darling River</td>
<td>Among the game [the native] had caught during the day was a beautiful animal, in some respects like the Jerboa but several times larger - and having a long snout. Mitchell acquired one and represents it in his work with a stump tail whereas it has a very long tail finished at its tip with fire bristles as feathers grow on the quill. SEPTEMBER.</td>
<td><strong>Brock Ms. 1844-6</strong></td>
</tr>
<tr>
<td><strong>Macrotis lagotis</strong></td>
<td>Pig-footed bandicoot</td>
<td>Murray and Darling Rivers</td>
<td>I fell in with a party of natives who had succeeded, at last, in securing a pair of the Chæropus. OCTOBER.</td>
<td><strong>Krefft Ms. 1856-7</strong></td>
</tr>
<tr>
<td><strong>Macrotis sp.</strong></td>
<td>Rabbit bandicoot</td>
<td>Lake Cawndilla</td>
<td>The natives got us two pinkoes, its colour was blue for on the back and white belled it ran like a rabbit, the buck was as large as a hare, the doe somewhat smaller, it had a snout similar to the pig, its feet marsupial. OCTOBER.</td>
<td><strong>Brock Ms. 1844-6</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray and Darling Rivers</td>
<td>'Würjeew' (Murray River), Jacko (Darling) social, not gregarious ... only found in pairs scattered over the wide plains ... It digs into the ground, forming a burrow like a rabbit, but with only one entrance and differs herein from Bettongia leucaur the burrows of which are provided with several outlets. Occasionally dug out by the natives but the holes are very deep and are often found to be uninhabited.</td>
<td><strong>Krefft 1866(1):14-15; 1866(11):371</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Darling River</td>
<td>The bilby, a small kangaroo rat like a burrowing marsupial was very plentiful and was an important article of food obtained by the women, because it was possible to dig it out of its burrow.</td>
<td><strong>Dunbar 1943-4:176</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scrope's Ranges</td>
<td>Tolperos, a native animal about the size of a rabbit, but longer in shape. The poor fellow had just dug a pit, for a Tolperos, big enough to hide himself in.</td>
<td><strong>Sturt 1849 I:161</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northwestern N.S.W.</td>
<td>The native skinned it the moment he arrived ... moistened them and then stuffed the skin with the leaves of a plant of very astringent properties. MARCH. [To cure the skin].</td>
<td><strong>Sturt 1849 I:296</strong></td>
</tr>
</tbody>
</table>
**MAMMALS (Cont'd)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Region</th>
<th>Description</th>
<th>Source/Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Macarotis sp.</em></td>
<td>Western N.S.W.</td>
<td>The natives subsist almost exclusively on the <em>Hapalotris mitchelli</em> and on an animal they call the Tolpero, a species of Perameles, which is spread over a great extent of country, being common in the sand hills on the banks of the Darling to the south-east of the Barrier Ranges, as well as to the sandy ridges in the northwest interior. They hunt these little animals as long as there is any surface water.</td>
<td>Sturt 1849 II Appendix pp. 1 and 7</td>
</tr>
<tr>
<td><em>Dasyurus geoffroii</em></td>
<td>Western native cat, Murray and Darling Rivers</td>
<td><em>Kettris</em> ... inhabits the Murray scrub, solitary, nocturnal ... detected by the heap of feathers and bones generally collected at the foot of the tree upon which it dwells. It is eaten by the natives. The natives inhabiting the country near the junction of the Darling, have some superstitions regarding this animal and <em>Jacob</em>, an old chief on the river often assured me that <em>Kettris</em> make rain and rainbow.</td>
<td>Krefft 1866(1):87-8 1866(11):370</td>
</tr>
<tr>
<td><em>Phascologale adusta</em></td>
<td>Red-tailed Wambenger, Murray and Darling Rivers</td>
<td><em>Kultarr</em>, the interior of N.S.W. and Northern Victoria. The few specimens brought to me by the natives were generally found in the hollow limbs of trees.</td>
<td>Krefft 1864; 1866(1):8</td>
</tr>
<tr>
<td><em>Antechinus flavipes</em></td>
<td>Yellow-footed antechinus, Murray and Darling Rivers</td>
<td>The most abundant of the <em>Antechinus-Warum</em>.</td>
<td>Krefft 1866(1):10</td>
</tr>
<tr>
<td><em>Sminthopsis crassicaudata</em></td>
<td>Fat-tailed marsupial mouse, Murray and Darling Rivers</td>
<td><em>Mondellanella</em> - Murray and Darling scrub, the natives brought in females in July and August.</td>
<td>Krefft 1866(1):11</td>
</tr>
<tr>
<td><em>Sminthopsis murina</em></td>
<td>Common marsupial mouse, Murray and Darling Rivers</td>
<td><em>Tram-tramiti</em>, the natives caught this species frequently on the sand hills near our camp.</td>
<td>Krefft 1866(1):10</td>
</tr>
<tr>
<td><em>Antechinomys laniger</em></td>
<td>Kultarr, Murray and Darling Rivers</td>
<td><em>Kultarr</em>, two single specimens were obtained by the natives who informed me that the animal was very rare.</td>
<td>Krefft 1866(1):9</td>
</tr>
<tr>
<td><em>Myrmecobius fasciatus</em></td>
<td>Numbat, Darling River</td>
<td>Not found close to the Murray but by no means rare on the Darling.</td>
<td>Krefft 1866(1):11-12</td>
</tr>
<tr>
<td>RODENTS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MURIDAE</td>
<td>Water Rat</td>
<td>Gunbower Creek</td>
<td>All the specimens that I collected came from Gunbower Creek and Lake Bogga where the animal is very plentiful. This rat is not found on the Lower Darling, at least I was assured by the natives that they had never seen it.</td>
</tr>
<tr>
<td></td>
<td>Leporillus conditor</td>
<td>Darling River</td>
<td>The first nest of the Building Rats was found in the brushes of the Darling where they were numerous. I obtained [one] from one of the natives, who followed us to the camp.</td>
</tr>
<tr>
<td></td>
<td>Leporillus australis</td>
<td>White-tipped stick-nest rat</td>
<td>Lower Darling River</td>
</tr>
<tr>
<td></td>
<td>Leporillus sp.</td>
<td>Stick-nest rats</td>
<td>Moorunde</td>
</tr>
<tr>
<td></td>
<td>Notomys xanthophilus</td>
<td>Mitchell's hopping-mouse</td>
<td>NW N.S.W.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray River</td>
<td>A rare quadruped was found by the two Tommies, who had never before seen such an animal.</td>
</tr>
</tbody>
</table>

Krefft 1866(1):3-4
Sturt 1849(1):120-1; II Appendix page 4
Krefft 1866(1):4
Krefft 1866(1):4-5
Eyre 1845 II:268
Newland 1887-8:124
Sturt 1849 I:337; II Appendix page 7
Mitchell 1839 II:144-5
<table>
<thead>
<tr>
<th>Mammals (Cont'd)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rodents</strong></td>
</tr>
<tr>
<td><strong>Notomys mitchelli</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Notomys sp.</strong></td>
</tr>
<tr>
<td><strong>Pseudomys gouldii</strong></td>
</tr>
<tr>
<td><strong>Pseudomys heinmannsburgensis</strong></td>
</tr>
<tr>
<td><strong>Pseudomys desertorum</strong></td>
</tr>
</tbody>
</table>
### Mammals (Cont'd)

**Rodents**

<table>
<thead>
<tr>
<th>Location</th>
<th>Species</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray and Darling Rivers</td>
<td>All the rodents are eaten by the natives, but only in case of no other food being at hand, as a large number of these little creatures are wanted to satisfy the hunger of a blackfellow.</td>
<td>Krefft 1866(1):5</td>
<td></td>
</tr>
</tbody>
</table>

**Bats**

<table>
<thead>
<tr>
<th>Location</th>
<th>Species</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray and Darling Rivers</td>
<td>... the number of bats collected during my journey was very limited indeed owing to the superstitions of the natives, who look upon every bat as a departed friend and relative. I was seriously informed by the natives that the bat was brother belonging to blackfellow, who kill lubra if you kill him.</td>
<td>Krefft 1866(1):1-2</td>
<td></td>
</tr>
</tbody>
</table>

### Carnivores

**Canidae**

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canis familiaris</td>
<td>Moorunde</td>
<td>Wild dogs are speared, but young ones are often kept and tamed.</td>
<td>Eyre 1845 II:284</td>
</tr>
<tr>
<td></td>
<td>Barrier Ranges</td>
<td>We saw two young native dogs about a third grown, after which [our guide] bounded, he threw a stick and hit one, the other he chased and gave a blow on the head. He then sat down to take out their entrails ... he was careful in securing the little fat they had about the kidneys, with which he rubbed his body all over ... he then filled their insides with grass and secured them with skewers and proceeded to cook them in an oven.</td>
<td>Sturt 1849 I:156-7</td>
</tr>
<tr>
<td></td>
<td>Murray and Darling Rivers</td>
<td>He is as common as ever on the Lower Murray and Darling neither the guns nor spears of the Aborigines could exterminate the breed though they kill him on every opportunity and eat his flesh.</td>
<td>Krefft 1866(1):2-3</td>
</tr>
<tr>
<td></td>
<td>Wilcannia district</td>
<td>Bootkajah - wild dog, caught at waterholes in netted bags in the same way as the wallaby.</td>
<td>Bonney Ms., c.1881</td>
</tr>
<tr>
<td></td>
<td>Narran and Darling Rivers</td>
<td>Dingo pups were an esteemed delicacy.</td>
<td>Parker 1905:110</td>
</tr>
</tbody>
</table>

### Monotremes

**Tachyglossidae**

<table>
<thead>
<tr>
<th>Species</th>
<th>Location</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tachyglossus aculeatus</td>
<td>Narran and Darling Rivers</td>
<td>The natives cut out a porcupine with an axe and a digging stick from an old log.</td>
<td>Parker 1905:115</td>
</tr>
<tr>
<td></td>
<td>Central Darling River</td>
<td>Tikiptiller, the Echidna, was much esteemed as a food.</td>
<td>Dunbar 1943-4:176</td>
</tr>
<tr>
<td>SPECIES</td>
<td>COMMON NAME</td>
<td>LOCALITY</td>
<td>PART EATEN</td>
</tr>
<tr>
<td>------------------------</td>
<td>--------------------</td>
<td>--------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Fungi</strong></td>
<td>Moorunde</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FERNS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>MARSILEACEAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marsilea drummondii</td>
<td>Nardo</td>
<td>Bulloo River</td>
<td>Sporocarps 'Prepared a coarse meal out of the sporangiums of a marsileaceae, and out of that either cakes or porridge - <em>Inadua</em>'.</td>
</tr>
<tr>
<td>Wilcannia district</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Darling River</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bourke, Darling River</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narran and Darling Rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>FLOWERING PLANTS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CRUCIFERAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasturtium palustrum</td>
<td></td>
<td>Murray River</td>
<td>Leaves - most of the year.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N.W. Victoria and mailie</td>
<td>Leaves</td>
</tr>
<tr>
<td>Blennodica eremigera</td>
<td></td>
<td>N.E. South Australia</td>
<td>Leaves, stems, flowers Eaten after cooking. Winter annual.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lepidium sp.</td>
<td>Cress</td>
<td>Western Barrier Ranges</td>
<td>Leaves 'Lepidium ruderale is steamed in a ground oven'.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wilcannia district</td>
<td>Leaves 'Ponandyer - cooked in an oven and the vegetable matter squeezed through the fingers into a ball and then eaten'.</td>
</tr>
</tbody>
</table>
FLOWERING PLANTS (Cont'd)

Lepidium sp.

NW N.S.W. Leaves

CAPRARIDACEAE

Capparis mitchelli Native orange

Darling River Fruit Remains found by a fire. JULY.
Bogan River 'Mogulie'.
Lower Bogan River Natives assemble in great numbers to gather this fruit.
Macquarie and Darling Rivers 'Wild orange' most of the year.
Central Darling River

PITTOSPORACEAE

Pittosporum phillyreoides

Murray River Gum

PORTULACACEAE

Portulaca oleracea Pigweed

N.S.W., interior Seeds 'Manjoum bower, the plants are pulled up and put into heaps, the heaps are turned and the seeds fall and can be easily collected'.

N.W. Victoria and Mallee Seeds Summer, annual.

N.E. South Australia Seeds Seeds ground.

Portulaca intraterranea

N.E. South Australia Roots Eaten after cooking.

N.E. South Australia Leaves, stems Eaten raw.

Browne Ms. 1845-6

Mitchell 1839 I:286
Mitchell 1839 I:115
Mitchell 1848:36
Mitchell 1848:78
Dunbar 1943-4:175

Cleland in Cotton (ed) 1966:132
Black 1948-57 II:393

Maiden 1899:121
Morris 1943:168
Johnston, Cleland 1943:153 (Lawrence 1968:82)
Johnston, Cleland 1943:153 (Lawrence 1968:76)
Johnston, Cleland 1943:153 (Lawrence 1968:76)
<table>
<thead>
<tr>
<th>Family</th>
<th>Genus</th>
<th>Species</th>
<th>Habitat</th>
<th>Description</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portulaca sp.</td>
<td>Pigweed</td>
<td>Narran River</td>
<td>Seeds</td>
<td>A red stalked coral-like plant, seeds black and small like gunpowder - MARCH.</td>
<td>Mitchell 1848:98</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bulloo River</td>
<td>Seeds</td>
<td>'Tungworo - portulac abounds, it blossoms in January.</td>
<td>Beckler Ms. 1861</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wilcannia district</td>
<td>Roots, leaves, seeds</td>
<td>'The tops are eaten raw, the roots cooked in ashes and the seeds are ground with millstones'.</td>
<td>Bonney Ms. c.1881</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bourke, Darling River</td>
<td>Seeds</td>
<td>'Tongora, the seeds are bruised and kneaded into a paste between flat stones and eaten at this stage or baked into a cake'.</td>
<td>Tuelon in Curr, 1886 II:193</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Country between Lachlan and Darling Rivers</td>
<td>Seeds</td>
<td>'A species of portulaca, the seed resembles gunpowder in appearance. They are ground on large flat stones'.</td>
<td>Bennett, 1897:2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Narran and Darling Rivers</td>
<td>Leaves</td>
<td>Eaten raw.</td>
<td>Parker 1905:116</td>
</tr>
<tr>
<td>Calandrinia sp.</td>
<td></td>
<td>N.W. Victoria and Mallee</td>
<td>Leaves</td>
<td></td>
<td>Morris 1943:170</td>
</tr>
<tr>
<td>Sterculiaceae</td>
<td></td>
<td>Braehycthon populneus</td>
<td>Kurrajong</td>
<td>Central Darling River</td>
<td>Seeds</td>
</tr>
<tr>
<td></td>
<td>Braehycthon sp.</td>
<td>Narran and Darling Rivers</td>
<td>Seeds</td>
<td>'Noongah - a sterculia, seeds ground on flat stones and made into cakes and baked'.</td>
<td>Parker 1905:117</td>
</tr>
<tr>
<td>Linaceae</td>
<td>Linnu marginale</td>
<td>Native flax</td>
<td>Interior N.S.W.</td>
<td>Seeds</td>
<td>Mucoilaginous seeds eaten in late summer. AUGUST - NOVEMBER.</td>
</tr>
<tr>
<td>Zygophyllaceae</td>
<td>Nitridia schoberi</td>
<td>Nitre bush</td>
<td>Murrumbidgee and Murray Rivers</td>
<td>Fruit</td>
<td>'Fruit is eaten whole and is a staple item of food in summer.</td>
</tr>
<tr>
<td>Geraniaceae</td>
<td>Geranium pilosum</td>
<td>Crowfoot</td>
<td>Narran and Darling Rivers</td>
<td>Tubers</td>
<td></td>
</tr>
<tr>
<td>HABIT</td>
<td>COMMON NAME</td>
<td>LOCALITY</td>
<td>NOTES</td>
<td>REFERENCES</td>
<td></td>
</tr>
<tr>
<td>-------</td>
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<td></td>
</tr>
<tr>
<td>Geranium pilosum</td>
<td>Crowfoot</td>
<td>N.W. Victoria and mallee</td>
<td>Tubers</td>
<td>September to January.</td>
<td>Morris 1943:169</td>
</tr>
<tr>
<td>Geranium sp.</td>
<td>Wild geranium</td>
<td>Narran and Darling Rivers</td>
<td>Roots</td>
<td></td>
<td>Newland 1887-8:22</td>
</tr>
<tr>
<td>OXALIDACEAE</td>
<td>Oxalis corniculata</td>
<td>Sourgrass, sorrel</td>
<td>Central Darling River</td>
<td></td>
<td>Dunbar 1943-4:176</td>
</tr>
<tr>
<td>FLINDERSIACEAE</td>
<td>Flindersia maculosa</td>
<td>Leopard wood</td>
<td>Wilcannia district</td>
<td>Gum</td>
<td>'Yandarro'.</td>
</tr>
<tr>
<td>MELIACEAE</td>
<td>Oxentia acida</td>
<td>Gruie or Colane</td>
<td>Gwydir River</td>
<td>Fruit</td>
<td>Eaten by natives.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Central Darling River</td>
<td>Fruit</td>
<td></td>
</tr>
<tr>
<td>SAPINDACEAE</td>
<td>Atalaya hemiglauc</td>
<td>White wood</td>
<td>Central Darling River</td>
<td>Seeds</td>
<td>Gathered for bread.</td>
</tr>
<tr>
<td>LEGUMINOSAE</td>
<td>Acacia murraya</td>
<td></td>
<td>N.E. South Australia</td>
<td>Seeds</td>
<td>Roasted and eaten.</td>
</tr>
<tr>
<td></td>
<td>Acacia stemophylla</td>
<td>River cooba</td>
<td>Narran River</td>
<td>Seeds</td>
<td>Pods roasted in fires, most of the year.</td>
</tr>
<tr>
<td></td>
<td>Acacia aneura</td>
<td>Mulga</td>
<td>Wilcannia district</td>
<td>Seeds</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N.W. Victoria and Mallee</td>
<td>Seeds</td>
<td>Seeds are soaked for some days before cooking. Flowers irregularly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Central Darling River</td>
<td>Seeds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Acacia sp.</td>
<td>Castlereagh River</td>
<td>Gum</td>
<td>Gum from a mimosa made into large cakes in bark troughs during a drought.</td>
<td>Sturt 1833 I:118</td>
</tr>
<tr>
<td>Plant Name</td>
<td>Common Name</td>
<td>Habitat</td>
<td>Use/Comment</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
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<td>-------------------------------------------------------------------------------------------------</td>
<td>----------------------------</td>
<td></td>
</tr>
<tr>
<td>Acacia sp.</td>
<td></td>
<td>Moorunde</td>
<td>Gum. Natives collect mimosa gum exuding from trees.</td>
<td>Eyre 1845 II:273</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NW N.S.W.</td>
<td>Seeds. Roughs of trees broken down, the seeds threshed out and the pods heaped up.</td>
<td>Sturt 1849 I:226</td>
<td></td>
</tr>
<tr>
<td>Trigonella sawiussima</td>
<td>Trefoil</td>
<td>NW N.S.W.</td>
<td>Seeds. Natives live principally on grass and acacia seeds at this time.</td>
<td>Browne Ms. 1845-6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lachlan River</td>
<td>Leaves. 'Calomba, eaten by the natives'.</td>
<td>Mitchell 1839 II:65</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Willcannia district</td>
<td>Leaves. 'Boontah, the natives eat the top raw'.</td>
<td>Bonney Ms. c.1881</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bourke, Darling</td>
<td>Leaves. 'Poontah'.</td>
<td>Tielon in Curr 1846 II:193</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>River</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NE South Australia</td>
<td>Leaves, stems, flowers. Eaten raw most of the year.</td>
<td>Johnston, Cleland 1943:153</td>
<td></td>
</tr>
<tr>
<td>Indigofera sp.</td>
<td></td>
<td>Murray and Lower</td>
<td>Roots. 'Eat the roots of the Indigo, cooked in ovens'.</td>
<td>Browne Ms. 1845-6</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Darling Rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vigna sp?</td>
<td></td>
<td>NW N.S.W.</td>
<td>Roots. 'A kind of vetch called 'Tzo' is steamed in a heated pit'. MARCH.</td>
<td>Browne Ms. 1845-6</td>
<td></td>
</tr>
<tr>
<td>Vigna lanceolata</td>
<td></td>
<td></td>
<td>Roots. Taproot, 30-40 cms long is eaten by the natives. Irregular, various periods.</td>
<td>Black 1948-57:480</td>
<td></td>
</tr>
<tr>
<td>MYRTACEAE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eucalyptus microtheca</td>
<td>Coolabah</td>
<td>Narran and Darling</td>
<td>Nectar. Flowers are soaked in water in bark vessels.</td>
<td>Parker 1905:119</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NE South Australia</td>
<td>Seeds. The branches are broken and left to dry, seed capsules open after 5 days, collected and</td>
<td>Johnston, Cleland 1943:155</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>winnowed. The seeds are soaked, cleaned, dried and then ground. The paste is eaten baked into</td>
<td>(Lawrence 1968:81)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>leaves, FEBRUARY.</td>
<td>Krefft Ms 1856-7</td>
<td></td>
</tr>
<tr>
<td>Eucalyptus camaldulensis</td>
<td>Red or flooded</td>
<td>Murray and Darling</td>
<td>Manna. Sugar collected off the leaves, FEBRUARY.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>gum</td>
<td>Rivers</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FLOWERING PLANTS (Cont'd)

_Eucalyptus demusa_  White mallee  Moorunde  Roots  Bark is peeled off the small lateral roots, the roots are then roasted in the ashes and pounded later between two stones and then eaten.  Eyre 1845 II:250  Maiden 1899:285

_Eucalyptus mannifera_  Small spotted or white gum  Moorunde  Manna  Manna is collected early in the morning from beneath the tree.  Eyre 1845 II:273

_Eucalyptus sp._  Box tree  NW N.S.W.  Seeds  Women collect the manna which drips from the white gum (E. resinifera).  Krevatt Ms. 1856-7

_Eucalyptus sp._  Box tree  NW N.S.W.  Seeds  Natives collected the seeds of a dwarf box tree. MARCH.  Browne Ms. 1845-6

_Eucalyptus sp._  Box tree  Wilcannia district  Seeds  Collected during March.  Sturt 1849 I:296

_Eucalyptus sp._  Box tree  Narran and Darling Rivers  Nectar  The flowers of the bibbil or poplar-leaved box were soaked in water in bark vessels.  Bonney Ms. c.1881

_CUCURBITACEAE_

_Cucumis chalce_  Gwydir River  Fruit  Melon about the size of a plum.  Mitchell 1839 I:88

_Cucumis sp._  Narran River  Fruit  Natives eat great quantities of this melon. MARCH.  Mitchell 1848:110

_Cucumis sp._  Darling River  Tuber  A cucurbitaceous plant had been pulled up and put into small heaps; the little yam had been removed from some of them. JUNE.  Mitchell 1839 I:237-8

_RUBIACEAE_

_Canthium olefolium_  Wild lemon  Central Darling River  Fruit  Dunbar 1943-4:175

_COMPOSITAE_

_Microlaena selaginoides_  Daisy yam  NW Victoria and mallee  Roots  Commonly eaten  Morris 1943:169

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Location</th>
<th>Part(s)</th>
<th>Description</th>
<th>Reference(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FLOWERING PLANTS</strong> (Cont'd)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Picaria hieracioides</strong></td>
<td>Bogan River</td>
<td>Roots</td>
<td>'A small cichoraceous plant with a yellow flower. The children dig around with little wooden shovels and mostly subsist on its roots'.</td>
<td>Mitchell 1839 I:336 Maiden 1899:619</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mt Hope, Murray River</td>
<td>Stalks</td>
<td>The roasted stalks of this plant were found in a net bag near a fire. JUNE.</td>
<td>Mitchell 1839 II:149</td>
<td></td>
</tr>
<tr>
<td><strong>Sonchus sp.</strong></td>
<td>Sowthistle</td>
<td>Wilcannia district</td>
<td>Leaves, stems</td>
<td>- Autumn - spring. bonney Ms. c.1881</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bourke, Darling River</td>
<td>'Bullumba'.</td>
<td></td>
<td>Tuelon in Curr 1886 II:212</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Riverina generally</td>
<td>Leaves</td>
<td></td>
<td>Beveridge 1889:20</td>
</tr>
<tr>
<td><strong>ASCLEPIADACEAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Maredenia australis</strong></td>
<td>Native pear</td>
<td>Narran River</td>
<td>Fruit</td>
<td>Fruit is called Doobah and is eaten seeds and all, it is best roasted. MARCH.</td>
<td>Mitchell 1848:85</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray River and Western N.S.W.</td>
<td>Fruit</td>
<td>Natives eat only the pulp, reject the seed.</td>
<td>Sturt 1849 II Appendix page 81</td>
</tr>
<tr>
<td><strong>Maredenia sp.</strong></td>
<td>Wilcannia district</td>
<td>Fruit, roots, leaves, flowers</td>
<td>Fruit is called 'bucka' and the root 'windoo'.</td>
<td>Bonney Ms. c.1881</td>
<td></td>
</tr>
<tr>
<td><strong>CONVOLVULACEAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ipomoea polymorpha</strong></td>
<td>N.E. South Australia</td>
<td>Roots, seeds</td>
<td>Roots are roasted and eaten, seeds are eaten fresh, when sticky not when dry.</td>
<td>Johnston, Cleland 1943:134-5 (Lawrence 1968:76)</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
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</tr>
<tr>
<td><strong>Ipomoea sp.</strong></td>
<td>N.E. South Australia</td>
<td>Leaves, stems, flowers</td>
<td>Leaves are eaten like spinach.</td>
<td>Johnston, Cleland 1943:155 (Lawrence 1968:82)</td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>?</strong></td>
<td>Wilcannia district</td>
<td>Root</td>
<td>Root of a convolvulus.</td>
<td>Bonney Ms. c.1881</td>
<td></td>
</tr>
<tr>
<td><strong>SOLANACEAE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Solanum esuriule</strong></td>
<td>Tomato plant</td>
<td>Lachlan River</td>
<td>Fruit</td>
<td>The berries are gathered and eaten.</td>
<td>Mitchell 1839 II:43</td>
</tr>
<tr>
<td><strong>Solanum sp.</strong></td>
<td>Narran River</td>
<td>Fruit</td>
<td>Berry from a solanum, a runner spreading over several yards from one root.</td>
<td>Mitchell 1848:85</td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>Genus</td>
<td>Subspecies</td>
<td>Habitat</td>
<td>Part</td>
<td>Description</td>
</tr>
<tr>
<td>---------------</td>
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<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Solanum sp.</td>
<td></td>
<td>Wilcannia district</td>
<td>Fruit</td>
<td>'Umballa, a solanum or potatoe plant'.</td>
<td>Bonney Ms. c.1881</td>
</tr>
<tr>
<td>Nyroporaceae</td>
<td>Nyroporaceae platyaearpum</td>
<td>Sugar wood</td>
<td>Exudation</td>
<td>Exudation from the trunk and branches, either eaten immediately or dissolved in water. AUGUST - DECEMBER.</td>
<td>Bennett 1882:350-1</td>
</tr>
<tr>
<td>Eremophilae</td>
<td>Eremophilae longifolia</td>
<td>Emu bush</td>
<td>Fruit</td>
<td>Central Darling River</td>
<td></td>
</tr>
<tr>
<td>AIzoaceae</td>
<td>AIzoaceae</td>
<td>Western N.S.W.</td>
<td>Leaves</td>
<td>September - January.</td>
<td>Irvine 1957:120</td>
</tr>
<tr>
<td>Tetragonias</td>
<td>Tetragonias expansa</td>
<td>Warrigal cabbage</td>
<td>Leaves</td>
<td>Murray and Darling Rivers</td>
<td>Krefft (11)1866:270</td>
</tr>
<tr>
<td>Carpobrotus</td>
<td>Carpobrotus sp.</td>
<td>Pigface</td>
<td>Leaves</td>
<td>Moorunde and N.S.W. Riverine</td>
<td>Eyre II 1845:270</td>
</tr>
<tr>
<td>Amaranthaceae</td>
<td>Amaranthaceae</td>
<td>N.E. South Australia</td>
<td>Seeds</td>
<td>Wilcannia district</td>
<td>Flowers spring – autumn.</td>
</tr>
<tr>
<td>Amaranthus</td>
<td>Amaranthus macrocarpus</td>
<td>Desert amaranth</td>
<td>Seeds</td>
<td>N.W. Victoria and mallee</td>
<td></td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>Origin</th>
<th>Part</th>
<th>Season</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atriplex maritima</td>
<td>Old man saltbush</td>
<td>N.W. Victoria and mallee</td>
<td>Seeds</td>
<td>Spring and autumn.</td>
<td>Morris 1943:168</td>
<td></td>
</tr>
<tr>
<td>Atriplex angulata</td>
<td>Angular saltbush</td>
<td>N.W. Victoria and mallee</td>
<td>Seeds</td>
<td>Anytime except midwinter.</td>
<td>Morris 1943:168</td>
<td></td>
</tr>
<tr>
<td>Atriplex stipitata</td>
<td>Kidney saltbush</td>
<td>N.W. Victoria and mallee</td>
<td>Seeds</td>
<td>Morris 1943:168</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atriplex sp.</td>
<td>Small leaved saltbush</td>
<td>Wilcannia district</td>
<td>Seeds</td>
<td>'Funbee'.</td>
<td>Bonney Ms. c.1881</td>
<td></td>
</tr>
<tr>
<td>Erythraea tomentosa</td>
<td>Ruby saltbush</td>
<td>N.W. Victoria and mallee</td>
<td>Seeds</td>
<td>Spring and autumn.</td>
<td>Morris 1943:168</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Northeastern S.A.</td>
<td>Fruit</td>
<td></td>
<td>Johnston, Cleland 1943:153</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Lawrence 1968)</td>
<td></td>
</tr>
<tr>
<td>Salsola kali</td>
<td>Rolly polly</td>
<td>N.W. Victoria and mallee</td>
<td>Seeds</td>
<td>Spring and summer</td>
<td>Morris 1943:168</td>
<td></td>
</tr>
<tr>
<td>Polygonaceae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Johnston, Cleland 1943:153</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Lawrence 1968:82)</td>
<td></td>
</tr>
<tr>
<td>Rumex arctilinus</td>
<td>Dock</td>
<td>N.E. South Australia</td>
<td>Seeds</td>
<td>Most of the year.</td>
<td>Morris 1943:168</td>
<td></td>
</tr>
<tr>
<td>Nyctaginaceae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Johnston, Cleland 1943:154</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(Lawrence 1968:76)</td>
<td></td>
</tr>
<tr>
<td>Boerhavia diffusa</td>
<td>Hogweed</td>
<td>N.E. South Australia</td>
<td>Roots</td>
<td>Cooked.</td>
<td>Black 1948-57:333</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Roots</td>
<td>Eaten by Aboriginals. Summer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family</td>
<td>Species</td>
<td>Location</td>
<td>Type</td>
<td>Notes</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
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</tr>
<tr>
<td>PROTEACEAE</td>
<td><strong>Banksia sp.</strong></td>
<td>Moorunde</td>
<td>Nectar</td>
<td>Honey is procured by steeping the cones of the Banksia and other melliferous flowers in water.</td>
<td>Eyre 1845 II:273</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Hakea sp.</strong></td>
<td>N.W. Victoria and mallee</td>
<td>Nectar</td>
<td>Honey from flowers.</td>
<td>Morris 1943:168</td>
<td></td>
</tr>
<tr>
<td>LORANTHACEAE</td>
<td><strong>Lysiana linearifolia</strong></td>
<td>N.E. South Australia</td>
<td>Fruit</td>
<td></td>
<td>Johnston, Cleland 1943:153 (Lawrence 1968:78)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>?</strong></td>
<td>Mistletoe</td>
<td>Fruit</td>
<td>Small fruit with flavour like a grape.</td>
<td>Bonney Ma. c.1881</td>
<td></td>
</tr>
<tr>
<td>SANTALACEAE</td>
<td><strong>Santalum lanceolatum</strong></td>
<td>N.E. South Australia</td>
<td>Fruit</td>
<td>August - January.</td>
<td>Johnston, Cleland 1943:153 (Lawrence 1968:78)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Santalum acuminatum</strong></td>
<td>Narran River</td>
<td>Fruit</td>
<td>Abundant stones around old fires of the natives.</td>
<td>Mitchell 1848:105</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moorunde</td>
<td>Fruit</td>
<td>'Kutango' spring or summer.</td>
<td>Eyre 1845 II:270 Maiden 1899:732</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Central Darling River</td>
<td>Fruit</td>
<td></td>
<td>Dunbar 1943-4:175</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N.W. Victoria and mallee</td>
<td>Fruit</td>
<td>Fruits spring and summer (Black 1943-57 II:275).</td>
<td>Morris 1943:170</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Murray River</td>
<td>Fruit</td>
<td></td>
<td>Cleland in Cotton 1966:132</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Santalum murrayana</strong></td>
<td>Murray River; Swan Hill</td>
<td>Roots</td>
<td>Tasteless, nutritious root roasted in hot ashes.</td>
<td>Maiden 1899:733</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Santalum sp.</strong></td>
<td>Lake Victoria</td>
<td></td>
<td></td>
<td>Sturt 1849 I:100</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Santalum sp.</strong></td>
<td>Quondong</td>
<td></td>
<td>Quondongs and a root the size of a radish were all the vegetables I have ever noticed these people to eat. Spring and summer.</td>
<td>Krefft 1866(11):371</td>
<td></td>
</tr>
</tbody>
</table>
FLOWERING PLANTS (Cont'd)

Santalum sp.  Quondong or native peach  Wilcannia district  Fruit  'Kalbooka'.  Bonney Ms. c.1881

AMARYLLIDACEAE

Crinum flaccidum  Darling lily  Western N.S.W.  Tuber  December - June.  Irvine 1957:118


JUNCAGINACEAE


TYPHACEAE

Typha sp.  Bulrush or cumbungi  Lachlan River  Roots  'Balym is a principal food of the inhabitants, they gather the roots and carry them in great bundles within a piece of net. Bark is peeled off and the root is cooked in the ashes the root is then twisted and a gluten resembling flour shakes free of the fibre. Summer probably T. muelleri.'  Mitchell 1839 II 53, 61

Wongal  Murray and Darling Rivers  Root  Typha shuttleworthii - women collect the roots and they are roasted in ovens and eaten hot or else taken as a sort of provision on hunting excursions. The fibre is collected by the women and spun into threads from which fishing nets and other domestic utensils were manufactured. January - September.  Krefft 1866(11):361

Kumpung  Lower Murrumbidgee, Murray, Lachlan and Darling Rivers  Roots, stem  Typha muelleri - a species of flag with a farinaceous root, the stem is also eaten when young. The root furnishes fibre for making nets and bags.  Beveridge 1889:19-20, 70

N.W. Victoria and mallee  Tubers  Morris 1943:169
FLOWERING PLANTS (Cont'd)

**Typha sp.**
- Lake Menindee
- Roots
- "Barilla root, at this period (early spring) they subsist on a species of rush pounded into cakes.
- Sturt 1849 I:135

**Cyperaceae**

**Sporus sp.**
- Sedge
- N.W. Victoria and mallee
- Seeds
- Morris 1943:168

**Gramineae**

**Enicochloa punctata**
- Plains grass
- N.W. Victoria and mallee
- Seeds
- Morris 1943:168

**Paspalidium gracile**
- Graceful panic
- N.W. Victoria and mallee
- Seeds
- December - April.
- Morris 1943:168

**Panicum effuse**
- Hairy panic
- NW N.S.W.
- Seeds
- The natives were living on the seeds of a kind of rice which grew abundantly on the flooded banks near the creek. Summer.
- Browne Ms. 1845–6

**Panicum decompositum**
- Native millet
- Central Darling River
- Seeds
- Grass pulled up for many miles and piled into heaps like hay ricks, seed still on grass. June (Grass matures in late summer).
- Mitchell 1839 I:237–8

- Narran River
- Seeds
- Dry heaps of grass pulled to gather the seed, the grass is pulled green with the seed ears full. After the grass has dried and the seed falls the heaps can be removed and the concentrated seed swept up.
- Mitchell 1848:90, 98 and 104

- Northwestern N.S.W.
- Seeds
- A large quantity of this grass was spread out on the sloping bank of the creek to dry, or ripen in the sun.
- Sturt 1849 I:285

**Panicum proluteum**
- Coolah grass
- N.W. Victoria and mallee
- Seeds
- Summer.
- Morris 1943:168

**Panicum decompositum**
- Native millet
- Central Darling River
- Seeds
- Grass pulled up for many miles and piled into heaps like hay ricks, seed still on grass. June (Grass matures in late summer).
- Mitchell 1839 I:237–8

- Narran River
- Seeds
- Dry heaps of grass pulled to gather the seed, the grass is pulled green with the seed ears full. After the grass has dried and the seed falls the heaps can be removed and the concentrated seed swept up.
- Mitchell 1848:90, 98 and 104

- Northwestern N.S.W.
- Seeds
- A large quantity of this grass was spread out on the sloping bank of the creek to dry, or ripen in the sun.
- Sturt 1849 I:285

**Panicum proluteum**
- Coolah grass
- N.W. Victoria and mallee
- Seeds
- Summer.
- Morris 1943:168
<p>| <strong>Panicum sp.</strong> | Barley grass | Narran and Darling Rivers | Seeds | The grass is gathered in quantities and put into a brush yard and then fired. The grass is picked green but it is full in the ear. The ashes and roasted seeds are collected and put into a round hole about 1' deep dug into the ground and threshed by trampling. A stick pounded into the hole husks the seed, it is then put into a bark dish and shaken to winnow it. The seed is put into skin bags until it is required. | Summer. | Parker 1905:118-9 |
| <strong>Setaria sp.</strong> | Pale pigeon grass | N.W. Victoria and mallee | Seeds | Summer. | Morris 1943:168 |
| <strong>Phragmites communis</strong> | Common reed | N.W. Victoria and mallee | Tubers | Morris 1943:168 |</p>
<table>
<thead>
<tr>
<th>LOCALITY</th>
<th>NOTES</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRUBS AND CATERPILLARS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Darling River</td>
<td><em>Laabka</em> - the caterpillar of the gum-tree moth was procured out of the ground, at the foot of these trees, with long twigs like osiers, having a small hook at the end. The twigs were sometimes 8-10' long.</td>
<td>Sturt 1849 I:135</td>
</tr>
<tr>
<td>Wilcannia district</td>
<td><em>Kopudger</em> - a white grum with a brown head and brown spots on its sides 2-2½&quot; long and rather thick was found in the roots of the broom bush (<em>poortree</em>) it was cooked in the ashes and was a food especially for babies. Another kind - <em>poonoo</em> - of brownish and yellow colour found under the bark of trees was a food of babies and devils. <em>Kaprurtie perrite</em> - a black caterpillar spotted with red and yellow was found in large numbers on Mulga and other bushes. It was cooked in an oven or in the camp ashes.</td>
<td>Bonney Ms. c.1881</td>
</tr>
<tr>
<td>Central Darling River</td>
<td>Grubs from Leopard wood (<em>Flinderia marulosa</em>), whitewood (<em>Atalaya hemiglauca</em>) and Acacia were dug from the ground or from rotten and living wood and formed an important article of food.</td>
<td>Dunbar 1943-4:175-6</td>
</tr>
<tr>
<td><strong>ANTS AND TERMITES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Darling River</td>
<td>A variety of the common kind of ant which constructs mounds, are eaten by the native women and children, who carry wooden shovels for the purpose of digging them out.</td>
<td>Mitchell 1839 I:309</td>
</tr>
<tr>
<td>White ants</td>
<td></td>
<td>Eyre 1845 II:274</td>
</tr>
<tr>
<td>Moorunde</td>
<td>Are dug in great numbers out of their nests in the ground, which are generally found in the scrubs. They are a favourite food of the natives in the spring of the year.</td>
<td></td>
</tr>
<tr>
<td>Ant larvae</td>
<td></td>
<td>Parker 1905:110</td>
</tr>
<tr>
<td>Narran and Darling Rivers</td>
<td>Are thought good by camp epicures.</td>
<td>Mitchell 1839 I:74</td>
</tr>
<tr>
<td><strong>WILD HONEY</strong></td>
<td></td>
<td>Mitchell 1839 I:173</td>
</tr>
<tr>
<td>Gwydir River</td>
<td>January.</td>
<td>Ridley 1872:271</td>
</tr>
<tr>
<td>Bogan River</td>
<td>April.</td>
<td>Parker 1905:114</td>
</tr>
<tr>
<td>Namoi and Barwon Rivers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narran and Darling Rivers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX 2

FAUNAL REMAINS FROM THE DARLING BASIN

Dr Jeanette Hope

DASYURIDAE

_Dasycercus/Dasyuroidea_

_Dasycercus cristicauda_ is represented by an almost complete skull from Mungo. A right mandible from Mulurulu and a left mandible from Burke's Cave could belong to either genus; but the Mulurulu specimen is more similar to _Dasyuroidea byrnei_ in that it has wide and heavy molars, while the Burke's Cave mandible is closer to _Dasycercus cristicauda_ in this respect.

_Dasyurus geoffroyi_ or _viverrinus_

Several fragments from Mulurulu belong to one or other of these species. They include a right maxilla with the four molars in place, an edentulous right maxilla, a left mandible, with P₃, M₁, M₂ in place, and fragments of two more left mandibles. Two right mandibles come from Mungo, and a right mandibular fragment from Burke's Cave. A left mandible with M₁ present, from Meadow Glen, is somewhat different from the above specimens in the size of the alveoli and depth of the ramus.

_Dasyurus maculatus_

One specimen of _Dasyurus maculatus_ was collected from Mulurulu; this is a palatal fragment consisting of left maxilla and premaxillae and nasals. The left teeth, P₃ to M₄ are in place and a fragment of the right maxilla carries M² and M³. Associated left and right mandibles were also collected. This specimen is a little larger than modern _D. maculatus_, but similar in size to specimens from Holocene cave deposits in Victoria.

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¹ Department of Prehistory, I.A.S., A.N.U.
Sarcophilus harrisii

A right maxilla and part of premaxilla, left maxilla, and right and left mandibles from Mungo are close to modern specimens of Sarcophilus harrisii. The alveolar length of upper molars M1-3 is 30.5 mm, slightly smaller than Green's (1967) figures for modern Tasmanian specimens (males:34-36 mm, females:33-36 mm). Several isolated upper teeth, right and left canines and molars M1, M2 and M3, were collected from Tandou. These are also small and are attributable to S. harrisii rather than to the large Pleistocene species S. laniarius. An edentulous mandibular fragment, including the symphysis, from Mulurulu, may be referrable to the smaller species of Sarcophilus.

Thylacinus cynocephalus

Two fragments of a right mandible of a thylacine were collected from Mungo. One consists of the coronoid process and ramus with M3 and M4 still in place and a separate fragment contains P3. Some loose lower incisors were associated with these fragments. The length of M4 is 13.7 mm, which falls outside the range of the modern Tasmanian thylacines and the large eastern Australian cave fossils. It is, however, within the range of western Australian fossil thylacines, which were smaller than those from the east (Ride 1964). This may be the easternmost record of the smaller western thylacine.

PERAMELIDAE

Four genera of bandicoots are present in the collection, but most fragments of mandibles and maxillae are small and lack teeth, making identification difficult.

Perameles sp.

Mandibles definitely attributed to Perameles have included part of the ascending process. In Perameles the angle between the ascending process and the horizontal body of the mandible is very oblique, while in the other three genera this angle is closer to 90°. Some maxillary fragments undoubtedly belong to this genus, but no attempt has been made to distinguish them from those of Isoodon. The specimens of Perameles are similar to P. bougainville in size, but P. gunnii may also be in the collection as this species has been recorded from Pleistocene deposits at Lake Victoria.
Isoodon sp.

Fragments of Isoodon have been distinguished from Perameles by the angle of the ascending process, and from Macrotis and Chaeropus by the form of the buccal process and by their smaller size. The fragments are similar in size to I. obesus, and I. auratus may possibly also be included as it has been recorded from Lake Victoria.

Chaeropus ecaudatus

A mandibular fragment attributed to this species possesses the very distinctive buccal process seen in Chaeropus (Merrilees 1967). A maxillary fragment has been assigned to the species because of the wide spacing of the molars, also characteristic of Chaeropus.

Macrotis lagotis

One maxillary fragment has been assigned to M. lagotis because of the very large size and the curvature of the tooth row. The teeth are missing, but the lateral widening of the alveoli suggests that the teeth were very worn. This specimen matched several M. lagotis in the National Museum of Victoria. Mandibular specimens have been attributed to this species on grounds of size and the possession of a distinctive buccal process.

PHALANGERIDAE

The large sample of possum mandibles and maxillae from Mt Grenfell and Meadow Glen are all attributed to Trichosurus vulpecula. A right mandible and right premaxillae from Mulurulu are also T. vulpecula, but these latter two specimens are considerably larger than those from the rock shelter sites. This is not surprising, considering the difference in age between the deposits, as the modern populations of Trichosurus in different regions are very variable in size.

VOMBATIDAE

Wombat molar fragments in the collections are close to Lasiorhinus in size and morphology, the molar lobes being well-rounded at the edges and not sharp as in Vombatus (Merrilees 1967).
MACROPODIDAE

Bettongia penicillata
Bettongia lesueur

All the bettong material identified to species consisted of maxillae or mandibles which retained the adult or deciduous premolar. Specimens which lacked these teeth have been identified as 'B. penicillata or lesueur'. The two species are easily distinguished by the shape and position of the premolars. In B. penicillata the axis of the premolar is flexed outwards at the front, and the tooth rows diverge, while in other species the toothrows are parallel and the premolars do not turn out. Bettongia lesueur also has longer premolars than B. penicillata.

Caloprymnus campestris

One left mandible has been assigned to this species. It has the large masseteric fossa typical of potoroines, but has a short, coarsely grooved premolar very different from those of Bettongia.

Onychogalea fraenata

Only one mandibular fragment of Onychogalea retained a premolar, and this matched the description given by Tedford (1966) of the lower permanent premolar in O. fraenata from Lake Menindee. Other specimens attributed to the genus were identified by the tiny alveoli for the premolars, and by the form of the molars. Only one species seems to be present in the material from all localities.

Lagorchestes sp.

The specimens attributed to Lagorchestes fall into two fairly distinct morphological types. In the first of these the permanent upper premolars are evenly grooved and have a posterior basin. The molars associated with these have additional folds of enamel in the central valley labial to the midlink. The mandibles assigned to this form have premolars which are sharply grooved and which have a posterior labial cusp. The second form of Lagorchestes has coarsely grooved permanent upper premolars which have a posterior lingual cusp, and the molars do not possess the additional folds next to the midlink. The lower premolars have illdefined grooves and no posterior
cusp. The two forms overlap in tooth size, but both have longer premolars than the two species of *Lagorchestes* that might be expected in this area, *L. leporides* and *L. hirsutus*. There are also some similarities between some of the material and a third species, *L. asomatus*. The species of *Lagorchestes* are very poorly known so it is difficult to put a name to fragmentary material such as this collection. It is possible, however, that it represents one, or more species ancestral to some or all of the modern species.

**Macropus**

One left mandible with two molars in place (AM F54700) collected from Mungo was identified (by R.H. Tedford) as belonging to the extinct species, *Macropus (Macropus) ferragus*. A right mandible of *M. (M.) giganteus* also came from Mungo.

Macropod specimens from Mulurulu included a lower molar of *Macropus (Megaleia) rufus*, (AM F54702), two juvenile left mandibles and a fragment of an adult left mandible, all possibly referrable to *M. giganteus*.

Macropod specimens from Mulurulu included a lower molar of *Macropus rufus* (AM F54702), a fragment of an adult left mandible, possibly referrable to *M. giganteus*, and an isolated upper molar which is probably *Macropus (Osphranter) robustus*. A right mandible fragment retaining the premolar and molars M1, M2, and M3 has been identified by L.G. Marshall as *Macropus (Osphranter) cooperi*, a large, extinct precursor to the modern species *M. robustus*.

Two juvenile left mandibles from Leagthur may be referrable to *M. giganteus*, and a right mandible from this locality is probably *M. rufus*. Two isolated molars from Ratcatcher's Lake are probably *M. giganteus*, and one from Garnpung may be *M. rufus*.

Apart from the above material from the lunettes, many small fragments of the molars of large kangaroos were recovered from Burke's Cave, and a few from Meadow Glen. These usually consisted, at most, of the anterior or posterior half of a tooth, but some fragments were even smaller. Both unerupted and erupted worn teeth were included. The majority could not be identified to species, but tentative identifications have been given for a few of the larger fragments. The diagnostic criteria used to distinguish the teeth of the three large kangaroos are as follows. In the upper molars of
M. giganteus the anterior shelf is shallow with a well-developed forelink, in M. robustus it is shallow with a small incipient forelink, while in M. rufus, the shelf is broad and there is no forelink. The first two species overlap somewhat in the size of the forelink, so some specimens may have been attributed to the wrong species. The lower molars were distinguished by the presence or absence of grooving on the back of the hypolophid. In M. giganteus a vertical groove or a pit is present, though this may not be apparent in M1. In M. robustus there is a shallow diagonal groove and in M. rufus there is no groove. There is individual variation in all species in this character. Anterior fragments of lower molars were distinguished on the width of the anterior shelf and the shape of the forelink. In M. giganteus the shelf tends to be broad and high, and the forelink is kinked; in M. robustus, the shelf is generally narrower and low, with the forelink kinked, and in M. rufus the shelf is narrow and low and the forelink straight. There is certainly considerable overlap between the three species in this character, as in the others, but when all are considered it seems likely that the three different species of large kangaroo are all present in Burke's Cave. The material from Meadow Glen was too fragmentary to be identified to species.

Procoptodon sp.

A molar fragment from North Lake has been identified as Procoptodon, an extinct Pleistocene macropod. The fragment retained some of the complex enamel folds characteristic of this genus and matched closely the metaloph of the upper molars of specimens of Procoptodon from Lake Victoria.

RODENTS

The rodents in this collection were identified by Mr J. Mahoney, University of Sydney. He commented that the specimens of Leporillus are indistinguishable from L. conditor, while those of Conilurus are indistinguishable from C. albipes. He has tentatively assigned two mandibular rami of Rattus, which lack the posterior talon on M1 and M2, to R. lutreolus. The remaining mandibles have talons (or could have had them reduced by wear) and are closer to typical specimens of R. villosissimus or R. tunneyi than to typical mainland R. lutreolus or R. fuscipes.
APPENDIX 3

HUMAN REMAINS FROM THE DARLING BASIN

A.G. Thorne

Tandou Lunette III

This is a collection of some 500 very small fragments of human bone. There are a few eroded pieces of skull and teeth. The vault bone is thin. Sutural areas indicate advanced fusion. Most of the material is coated with cemented sand particles.

Tandou Lunette I - cremation

Two individuals are represented in this large collection of fragments. One is adult, the other aged between four and six years. Apart from a few shattered tooth segments, the bulk of the material consists of relatively thin postcranial fragments. The cranial pieces of the adult are moderately thick and include sutural lengths that are open. All areas of the postcranial skeleton are represented.

The remains of both these individuals are charred. Variation in colour and texture, together with crazing, cracking and splitting of long bone shafts, indicate the cremation of cadavers. Although similar in this respect to the Lake Mungo I cremation there is no evidence here that the bones had been smashed after incineration, or that refiring had occurred. Despite erosion movement of much of the adult remains it is clear that at least part of the skeleton resulting from incineration was not moved after cremation took place. The distribution of the in situ fragments also suggests that the cadaver was in a flexed position, lying on the left side, when cremation took place.

Tandou Creek I - surface

This collection consists of about 130 small fragments of what is probably a single individual. Six fragments demonstrate the cranium and mandible. In the postcranial remains no fragments of vertebrae, ribs or the feet were recognised. Many pieces are thinly coated with

1 Department of Prehistory, I.A.S., A.N.U.
carbonate. The cranial bone is thin and smooth. One section of sagittal suture is open externally but obliterated internally. Small portions of the supraorbital and occipital tori are present; both appear to have been poorly developed. The mandibular fragments are small and thin. The mental trigone is small.

Walls of China I

It is probable that these remains are from a single skeleton as no duplication could be found. There are several hundred small pieces of bone, but only a few postcranial areas can be reconstructed. All bone is thin and delicate, suggesting a female. All areas of the skeleton are represented. Incomplete epiphyseal fusion and the degree of occlusal wear of a maxillary first molar and two mandibular premolars suggest an adolescent.
APPENDIX 4

OTOLITHS FROM FRESHWATER FISH OF THE MURRAY-DARLING RIVER

SYSTEM AND GRAPHS SHOWING ESTIMATIONS OF WEIGHT AND LENGTH

OF FISH FROM OTOLITH LENGTHS AND VERTEBRAE DIAMETERS.
Fig. 9: Correlations between fish attributes

GOLDEN PERCH
Fish weight/Otolith length

GOLDEN PERCH
Fish weight/Vertebrae diameter

Fish length/Otolith length

Fish length/Vertebrae diameter
Pleistocene human remains from Australia: a living site and human cremation from Lake Mungo, western New South Wales

J. M. Bowler, Rhys Jones, Harry Allen and A. G. Thorne

I Stratigraphy and Chronology (J.M.B.)

During a recent survey of the stratigraphy and Quaternary geology of dry lakes in western New South Wales, I recorded evidence of human occupation on ancient Quaternary strandlines (Bowler 1970). Striking examples are located on lakes which once formed a terminal drainage system on the Willandra Billabong Creek, a distributary of the Lachlan River in the Murray–Darling drainage system (fig. 9). Interest in this area has quickened following the recent discovery of human remains in the eroded core of an ancient lake-shore dune. Radiocarbon dates from this site have established these as the most ancient human bones from a stratigraphically controlled site yet dated in Australia.

<table>
<thead>
<tr>
<th>Laboratory No.</th>
<th>Radiocarbon age (years B.P.)</th>
<th>Unit dated</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANU–312</td>
<td>16,530 ± 400</td>
<td></td>
<td>Charcoal from upper Zanci, L. Mungo</td>
</tr>
<tr>
<td>ANU–292</td>
<td>16,700 ± 600</td>
<td>Zanci</td>
<td>Charcoal from middle of aeolian clayey sands in Zanci unit, L. Mungo (fig. 3)</td>
</tr>
<tr>
<td>ANU–330</td>
<td>17,670 ± 550</td>
<td></td>
<td>Charcoal from base of aeolian clayey sands, L. Mungo</td>
</tr>
<tr>
<td>ANU–310</td>
<td>23,350 ± 550</td>
<td></td>
<td>Lacustrine carbonates from high water deposit, L. Mungo</td>
</tr>
<tr>
<td>ANU–303</td>
<td>30,250 ± 950</td>
<td>Mungo</td>
<td>Charcoal from aeolian phase, L. Mungo</td>
</tr>
<tr>
<td>ANU–331</td>
<td>32,750 ± 1,250</td>
<td></td>
<td>Unionid shells from high water phase believed to be approximately contemporaneous with human occupation (fig. 3)</td>
</tr>
<tr>
<td>*ANU–306</td>
<td>38,500 ± 2,950</td>
<td></td>
<td>Unionid shells from early high water phase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Golgol</td>
<td>Beyond range of radiocarbon</td>
</tr>
</tbody>
</table>

*Note: ANU–306 is an outlier and its age cannot be considered a reliable date.
Figure 10. L. Mungo, in the Willandra lakes system, showing the location of the human remains and stratigraphic sections (figs 11 and 12).

A degraded cliff to 80 ft (25 m.) high on the western margin contrasts with the high transverse dune or lunette to 120 ft (37 m.) above the flat lake floor on the east. This west to east asymmetry is typical of lunette lakes across southern Australia.
On 5 July 1968, I recorded and photographed a deposit of burnt carbonate-encrusted bones within the Mungo unit 1½ km. south-west from the site dated by ANU-331 and ANU-292 (plate 3). This deposit, in the form of a calcrete block undergoing disintegration after exposure on the deflation surface, was first thought to contain food bones burnt by early man. Its location within the Mungo unit provided presumptive evidence of human occupation of great antiquity thereby establishing it as important evidence. I marked the site with an iron peg and left it intact for detailed excavation by archaeologists.

In March 1969, a party of earth scientists including archaeologists from Canberra, accompanied me on a visit to the Willandra Lakes area. On inspection of the bone deposit at the Mungo site, the archaeologists of the party (H. Allen, R. Jones, C. Key and D. J. Mulvaney) immediately suggested their human origin, an identification which was later

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**Figure 12.** A. Topographic section across the southern end of 'The Walls of China' lunette, L. Mungo, at site of ancient human remains. The bones, cemented in a block of calcrete (arrow), were lying undisturbed on the deflation surface in the eroded core of the dune (see Plate 3). B. Stratigraphic section at the burial site, constructed from pits and surface exposures. The three stratigraphic units have a layer of high water beach gravels at their base and are conformably separated from each other by a zone of soil formation, including the development of calcrete. The location of the human bones is shown by the X.

Horizon numbers refer to those described in profile, table 2.
Plate 3. Pleistocene human remains from Australia: the Mungo Lunette, with calcite cemented human bones in situ.
**TABLE 2**

Soil-sedimentary profile through residual located 20 yd. (18 m.) east of burial site. The gradation between the Mungo 2 and 3 horizons corresponds to the stratigraphic position in which the burial was located. Carbon for radiocarbon analysis has been collected from Mungo 2 horizon.

<table>
<thead>
<tr>
<th>Depth</th>
<th>Soil sedimentary unit</th>
<th>Fig. 12 Horizon designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feet</td>
<td>Metres</td>
<td>Description</td>
</tr>
<tr>
<td>0-3</td>
<td>0-9</td>
<td>Grey calcareous clayey sands, weakly developed prismatic cleavage, traces secondary carbonate on planar voids grading to</td>
</tr>
<tr>
<td>3-6</td>
<td>9-18</td>
<td>grey calcareous clayey sands with bedding preserved sharp contact to</td>
</tr>
<tr>
<td>6-7</td>
<td>8-21</td>
<td>reddish yellow (7.5YR 6/6) non-calcareous sand grading to</td>
</tr>
<tr>
<td>7-7.5</td>
<td>2-1-2.3</td>
<td>light brownish grey (10YR 6/2) sands with dark humic matter, traces of shell and burnt bone grading to</td>
</tr>
<tr>
<td>7.5-8</td>
<td>2.3-2.4</td>
<td>grey (10YR 6/1) sands with calcrete horizon grading to</td>
</tr>
<tr>
<td>8-9</td>
<td>4-2.7</td>
<td>light brownish grey (10YR 6/2) sands with rounded calcareous gravels sharp contact to</td>
</tr>
<tr>
<td>9...</td>
<td>2.7...</td>
<td>Dark grey (10YR 4/1) sands cemented by hard calcrete</td>
</tr>
</tbody>
</table>

In summary, therefore, the three independent lines of evidence suggest the bones were interred in a shallow grave only a few inches deep, before the period of soil formation and contemporaneous with the other evidence of human occupation on the shores of the freshwater lake.

The reliability of the shell date (ANU-331) for determining the age of human occupation may be questioned both on the basis of contamination and on the inconclusive association with artefact bearing horizons. As far as the former is concerned, contamination is likely to be caused in this case more by younger pedogenetic carbonate than by older radioactively dead carbon (Deevey et al. 1954, Rubin et al. 1963). Contamination by limestone dilution is not considered a hazard in this environment from which geologically old limestones are absent. Contamination errors are therefore likely to produce a date which is too young rather than too old. The date obtained, however, is consistent with...
The lake stratigraphic sequence above indicates at least three dune-building soil-forming cycles in late Quaternary time, two of which occurred during the period of human occupation. The Mungo lake-full phase was followed by partial drying and soil formation approximately 25,000 years ago. The final high water Zanci phase (see high beach gravels, fig. 12) commenced about 23,000 and ended at 16,000 B.P. in response to drastic changes in the hydrological regime, when salinities increased and the lake dried for the last time. Both linear and lake-shore dunes were then stabilized and soils began forming on the youngest aeolian deposits.

The exact magnitudes of temperature and precipitation changes which controlled this sequence are difficult to specify, but their reality is beyond doubt. The effects recorded in the widespread changes in landscape, sediments and soils demonstrate the controlling influence of climatic change in this non-glaciated environment.

Although human occupation apparently continued in this area from near 30,000 B.P. until modern time, a period which witnessed extensive changes in the physical environment, Jones and Allen (pp. 47–56) observe little change in the typology and economy between the Mungo occupants and recent inhabitants of the area. But the climate and regional environment known to the Mungo people with its numerous large freshwater lakes was considerably different from that of the last 10,000 years during which the lakes were virtually dry. The relative absence of changes in the archaeological data throughout that period points to the wide adaptability in the living habits of early Australian man and to the diverse use which he made of his stone implements. Continuing studies will help to define the range of human adaptation involved and will establish more precisely the nature and sequence of the environmental history in what is now a semi-arid region.

2 Archaeology (R.J. and H.A.)

As soon as it was realized that the burnt and broken bones cemented into the Mungo unit by calcrite could possibly be human, the archaeologists in the party were in a quandary. We had not come prepared for an excavation, and yet here before us was a feature which could contain the oldest human bones so far discovered in Australia. The field identification was hasty and speculative, being based on two burnt fragments of parietal and mandible, and it was by no means certain that a later careful examination would confirm it. The calcrite block (plate 3) was in a state of fragmentation with only a central core still in situ. Other pieces had recently broken off and in the loose sand there were many wind-eroded pieces of bone. The blocks had an area of about 2 sq. ft., with a calcrite thickness of 6 in. With D. J. Mulvaney, we photographed and drew the features, collected the loose bones, then numbered and removed the broken carbonate blocks. The central carbonate block still in place was sectioned to confirm its stratigraphical position, undercut and then removed. The finds were packed into a suitcase and arrived back at the laboratory undamaged.

Having had the human identification of the bones confirmed, Bowler and ourselves returned to the site a week later to carry out a detailed survey, to collect dateable material and to look for other archaeological manifestations.
flakes, suggesting that most of the tools had been brought in ready made from elsewhere to receive only a final trimming or resharpening on the site. Most tools were made of silcrete, a known worked source of which is a lake-side gravel bed some 10 miles to the south-west.

### Table 3

Contents of hearths

<table>
<thead>
<tr>
<th>Hearth number</th>
<th>Mammal Large</th>
<th>Mammal Small</th>
<th>Bird</th>
<th>Fish</th>
<th>Shell</th>
<th>Emu egg</th>
<th>Stone tool</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<td>X</td>
</tr>
</tbody>
</table>

Most of the implements have been manufactured from flakes, some of which would have been large, up to 4.7 cms. thick. Other tools are made on well-shaped cores, and a few from naturally broken stones. Typologically, three general classes of implements can be detected. All of these are within the category 'scrapers', ranging from heavy worked cores to fine scrapers. We are carrying out a detailed statistical analysis to describe the assemblage and also to test the validity of our typological distinctions. The proportions of various types within the assemblages are set out in table 4, and some representative examples are shown in fig. 13.

**Core tools** (fig. 13, nos. 1, 2) These usually have one flat striking platform from which flakes have been struck forming a circular domed or elongated keeled core. A second pattern of flaking was superimposed on the first, causing the angle of the worked edge to become steep, with extensive step flaking. Typically this angle is 90° or more, forming an obtuse overhanging edge. Most tools have this steep worked edge around much of their perimeter and a few show it all the way round. These tools have traditionally been called
'horse hoof cores' in Australia (e.g. Tindale 1937: 49–56; McCarthy et al. 1946: 10–12). They are heavy, ranging from 100 to 1,000 g. in weight, and were probably used for pounding or heavy planing and scraping activities.

TABLE 4

Proportions of tool types

<table>
<thead>
<tr>
<th>Tool type</th>
<th>In situ number</th>
<th>Surface, calcere encrusted collection number</th>
<th>Total number</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>'Horse hoof' core tools</td>
<td>5</td>
<td>20</td>
<td>25</td>
<td>22.5</td>
</tr>
<tr>
<td>Steep edge scrapers</td>
<td>9</td>
<td>45</td>
<td>54</td>
<td>48.7</td>
</tr>
<tr>
<td>Flat scrapers</td>
<td>2</td>
<td>16</td>
<td>18</td>
<td>16.2</td>
</tr>
<tr>
<td>Multi concave scrapers</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Others</td>
<td>3</td>
<td>9</td>
<td>12</td>
<td>10.8</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>92</td>
<td>111</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Steep edge scrapers (fig. 13, nos. 3–6) These were manufactured on thick flakes, and they have one or more steeply retouched edges whose angles range from 70° to 90°, with an edge height of between 1.0 and 2.5 cm. Often the edges show steep step flaking and they are usually straight or slightly convex in plan. There does not seem to be any formal relationship between the position of the worked edges and the total implement; rather, any suitable part of the flake was chosen and retouched until a robust steep edge was formed. For this class of implements in Australian industries, we propose the term 'steep edge scrapers'. Functionally they would have been suitable for a wide variety of cutting or scraping and planing activities.

Flat scrapers (fig. 13, no. 7) This is a provisional name for a class of flat flakes with fine oblique retouch around parts of their margins, giving them a sharp working edge with an angle of between 45° and 70°. They would be suitable for cutting flesh or vegetable material.
The species has high salinity tolerance, but requires the introduction of large volumes of water into its habitat to begin breeding, which nowadays takes place in the spring when the floodwaters flow down the Murray-Darling rivers. Similar spring floods could be expected during glacial conditions with the annual melt of the periglacial snows in the catchment highlands. However, as the species nowadays can only breed with a water temperature of more than 23° C (74° F) (Lake n.d.: 28–30), this water must have been warmed during its passage through the network of channels and lakes of the drainage system of western New South Wales. The presence of immature fish at the Mungo site may mean that it was occupied soon after this spring period.

**Birds** Bird bones are present, but species cannot be identified. However they are all from small birds.

Many fragments of emu egg were found, both *in situ* and covered with carbonate on the surface. In this region, emus are widely distributed and common nowadays throughout the scrubby and open plains. They lay their eggs in late winter, the young being born in late winter to early spring.

**Mammals** In some cases, teeth and jaw fragments allow specific identification, which was carried out by Mr J. H. Calaby, CSIRO Division of Wild Life Research, Canberra. The data are tabulated in table 5, the ecological information being taken from Krefft (1866), Marlow (1962) and Calaby (pers. comm.). The bettong is a burrowing animal (Tedford 1967: 145), but the Mungo material is burnt, broken, and found in hearths, so we think that it represents food remains. With the exception of the thylacine and wombat these are all small animals, weighing a few pounds only. There were in addition many broken bone fragments which belonged to animals much bigger than the ones listed above. Judging from the diameters of the long bones, some of these came from animals weighing more than 20 lb. in weight, and the most likely candidates would be the macropods—wallaby and kangaroo.

**Comments** Although the faunal collection is a small one, it does raise several interesting points.

(a) **Faunal history** The fauna, both terrestrial and lacustrine, is similar to that found in the region at the time of European contact as described by Krefft (1866), and its continuity there over a period of some 25,000 years is most interesting.

Apart from the thylacine mandible, no bones of extinct animals were found at the site, nor eroding elsewhere from the Mungo Unit or more recent deposits. One heavily mineralized and rolled mandible of an extinct giant marsupial, probably a *Macropus*
1 The Mungo collection may be too small to be representative. However, no bones of
extinct fauna have been seen eroding out of the entire Mungo lunette, nor any other
lunette within the Willandra system.

2 At 25,000 to 30,000 years ago, there may have been large regional variations in the
occurrence of the giant fauna and/or in human dietary habits. However, the two sites
are both lake-side dune sites in a connected drainage system only a hundred miles
apart. Such a regional diversity of the entire giant fauna would be remarkable, even if
it were on the verge of becoming extinct.

3 Mungo and Menindee may not be of the same age. We feel that Bowler’s stratigraphic
work and series of C¹⁴ dates provide a good control on the age of the Mungo Unit.
From the published accounts (Tindale 1955; Tedford 1967) and from our own
observations, the stratigraphy at Menindee is complex, and possibly further stratig-
aphic and radiometric work is warranted there in view of the problem raised by the
Mungo site.

At present, there is no obvious answer to this question, but its solution has implica-
tions for the more general problem of the chronology and causes of the extinction of
Australia’s giant fauna, and the possible role of man as an important or decisive agent in
it. (Tindale 1959; Gill 1963; Tedford 1967: 151; Martin 1967: 105–6; Merrioles 1968;

(b) Human diet The diet of the prehistoric inhabitants of Mungo Lake was varied and
based on a wide exploitation of land and lake resources. From the sand dunes and plain they
obtained bettongs, from the scrub or open bush a range of small marsupials including
native cats and small macropods, and they caught larger animals as well. They foraged
for emu eggs and caught small birds. They dug into the mud near the lake shore for shell
fish and caught golden perch in the deeper water.

Some of this food could only be caught seasonally. Emu eggs are available in the
region in late winter. The shell fish are easiest to catch in summer and judging from the
ethnographic evidence, may not be available or palatable in winter. The young perch
would probably have been caught in late spring or early summer. To sum up the seasonal
evidence, the site was occupied at least during late winter and also late spring/summer.
From the stratigraphy and structure of the site together with the quantity of artefacts
and food remains, it is likely that it represents the débris of only a few visits by a small
group of say one or two dozen people. It was probably a seasonal camp on the lakeside,
occupied a few times over a period of a small number of years before being covered up or
abandoned.

This economy is remarkably similar to that practised by the ethnographically observed
Aborigines of the Murray-Darling river system in the last century (Lawrence 1968:
85–122; Allen 1968). These caught small and large marsupials, emus and their eggs,
shell fish and scale fish. Their usual seasonal movements were to the lakes and rivers
in late spring and summer, fanning out into the bush country in winter in search of bush
foods, camping near ponds and billabongs after the winter rains. The only major detect-
able difference between the two diets is that the modern Aborigines also ground a
variety of vegetable foods, particularly grass seeds. They did this with sandstone grind-
ing dishes. No such tools were found in the Mungo assemblage. They are, however,
Compared to recent Australian Aboriginal females the cranial vault and long bones are thin and poorly muscle-marked. Several features are typical of recent Aboriginals generally, including a rounded orbital border of the zygomatic bone and the general form of the basicranium and the zygomatic trigone. Metrics indicate a very broad basicranium. The brow ridges are divided, with no suggestion of a torus. There is no evidence of parietal bossing or of sagittal keeling. The mandible displays a distinct mental trigone and sigmoid notch. There is no trace of a genial pit and the minimum antero-posterior width of the ramus is more than 35 mm.

There are several palaeo-Australian characteristics present; their significance is increased in view of the individual's sex and age. There is considerable recession of the frontal squame behind the orbital margin, marked post-orbital constriction and moderate temporal crest development in the area immediately posterior to the zygomatic trigone. In view of the relationship which has been suggested for the Australian Aboriginal and the Solo population, it is important to note that in Mungo I the foramen ovale is single and does not lie in a pit, and that the petro-typanic fissure does not lie on the floor of the glenoid fossa.

The extraction of the bone from its matrix and its colour, size and form, permit some conclusions regarding the method of disposal. It is clear that the individual was cremated as a complete and fully-fleshed cadaver. The pyre was insufficient to achieve full incineration and most bones of the back and neck seem to have been little more than singed. (The neural arches of three mid-thoracic vertebrae, the axis, atlas and occipital condyles and the right mandibular condyle and glenoid fossa, were all in correct anatomical relationship.) The size and distribution of recovered fragments indicates total and thorough smashing of the burnt skeleton, particularly the face and cranial vault. In some instances the direction of the blow can be deduced. The state of the edges of the burnt fragments indicates that smashing of the bones took place after the pyre had been allowed to cool and that refiring did not occur. Finally, from examination of the calcrite blocks, it is clear that the ash and smashed bones were gathered together and deposited in a conical hole or depression 16–20 cm. deep and approximately 75 cm. in diameter. This deposition took place either beneath the pyre or immediately adjacent to it.

The method of disposal in this case has been recorded ethnographically in South-East Australia. It is also consistent with Tasmanian practice, both recent and, at least in the west of that island, more than 1,000 years ago.

**Conclusion**

The Mungo site is dated to between 25,000 and 32,000 years old. It is thus the oldest archaeological site so far discovered in Australia. Several cave sites from northern, southern and eastern Australia have basal deposits dated to a little over 20,000 years B.P. (Jones 1968), the Menindee site may date from 18,000 to 26,000 years B.P., and in the Keilor terrace system, Gallus (1968) claims human artefacts of the same order of antiquity as Mungo, though details of their typology have not yet been published. The human remains at Mungo, being by far the oldest dated skeletal material from Australia, are of considerable interest. The cranium displays some of the palaeo-Australian features


Abstract


Pleistocene human remains from Australia; a living site and human cremation from Lake Mungo, western New South Wales

A recently discovered Pleistocene archaeological site at Lake Mungo, western N.S.W., is announced and described. This was found within the core of a lunette sand dune at a level dated to between 25,000 and 32,000 years B.P., and is thus the oldest archaeological site so far discovered in Australia. The stratigraphy and chronology are described, and a palaeo-environmental reconstruction is made. Within the site were stone tools, hearths, faunal remains and a human cremation. The Mungo typology changes little in south-eastern Australia until about 6,000 years ago, and the diet is similar to that recorded in the ethnographic record. The cremation was of a young adult female; the bones had been smashed after burning. Morphologically, the remains show some resemblances to Australian Aborigines, but there are also some palaeo-Australian features.