CHAPTER 5

From the present to the past

5.1 Introduction

At c 18,200 BP the Lake Victoria area was receiving a more effective precipitation than at present. The lunette dune was stable. The faunal assemblage suggests that prior to 18,000, the environment around the lake could support koalas; a giant ancestor of the swamp wallaby, and a diverse suite of browsing animals, including Diprotodon and Stenurine kangaroos and large grazing macropods - some 30% larger than present species (cf Chapter 7). This suggests that the riverain forest/woodland was more extensive than today, and possibly a little more dense in some areas.

In contrast at the same time, areas on the Darling river to the north and the Willandra creek to the north east were changing, as catchment runoff decreased and, in some areas, flow ceased totally. As the riverain resources to the north shrank, human populations must have been disadvantaged by the decreased availability of resources and eventually by the diminution of potable water.

Human populations at Lake Victoria experienced major changes at a later date.

When the earliest occupation deposits outcrop in lunette and lake shore sediments at Lake Victoria (Fig 5.1), sediments in the lunette indicate that the area was still receiving hinterland precipitation high enough to maintain stable vegetation cover, and the fauna indicates that there was still adequate forage for "giant" species of kangaroo.

By 17,500 or shortly after, sediments on the lunette were again mobile, and sand blown from the lake shore indicates that the droughts which had desiccated areas to the north were beginning
to affect the local hinterland vegetation. Sand build up may be interpreted to mean the local loss of gallery forest between the lunette and the lake, which indicates some variability in riverain water flow.

Sedimentary evidence presented in Chapter 3 indicates that by c 16,000 BP the lake basin was experiencing intervals of severe desiccation, which even dried the deeper parts of the lake. The fact that flood pulse water failed to reach the lake basin could mean either flow failure in the Murray over a period of some years, or local or upstream variation in the path of the river in the flood tract, or sedimentation in the river channel.

The rapid accumulation of sandy sediments onto the lunette crest which occurred between 16,000 and 14,900 BP suggests that this time was extremely windy and that local precipitation in the hinterland was now unable to stabilize vegetation downwind of the lunette, or in the Woorinen formation dune fields.

Between 16,000 and 15,000 many of the remaining megafaunal species apparently died out locally. Despite this small mammal species persisted, although "desert"species replaced sympatric woodland species in hinterland habitats (Table 6.3). In the Lake Victoria basin human populations experienced the transition from 'lacustrine' to 'arid', and then to a climate similar to that of the present day.

What were the effects of these major changes in the habitat on human populations? Archaeological evidence for change might be

Insert this paragraph after paragraph 5:

The Lake Victoria lunette is 14 km long in its north south axis. A preliminary survey of sediments and occupation deposits in the southern 10 km of the lunette showed that there was a high frequency of occupation deposits in situ in the upper strata of the Talgarry Sand. These were middens, which tended to occur in clusters, as discrete lenses of shell, hearth and bone. Lenses were usually unstratified, and no more than 10 cm in depth. Middens were comparatively rare in exposures of the lower Talgarry Sand, and this evidence suggests that midden deposition increased after 15,000 BP.
deposits in Pleistocene sediments in the Gill's Gully area, where knowledge gained in sedimentary analysis could be used to determine climatic conditions at the time the middens were deposited.

In the Gill's Gully area there were several midden deposits. Middens exposed on the surface were not considered for excavation, as it was felt the possibility of contamination of these sites by later faunal and artefact material was too great. The deposits selected for investigation were chosen because they had been exposed.

A cluster of middens occurred in situ in the upper Talgarry Sand. A small shell lens was exposed in cliffed sediments directly below part of the upper cluster of middens. 130 metres to the north and 8 metres lower, one of the rare middens in the basal Talgarry Sand was exposed. A deposit close to the top of the lunette, and in the lower areas of Silt A, was dated to 14,950 ± 200 BP. The upper, more recent midden site is called Gill's Gully 1. Locations of these middens relative to one another and relative to the Talgarry sand are shown in Figs 5.2 and 5.3. See also Fig 2.1.

Questions which data recovery was designed to answer related to foraging range, group size, group activities, and the nature of occupation deposit preservation and the frequency of occupation deposit per unit area of ancient land surface.

(i) Foraging range -
Data were sought on the faunal species present, the habits of the species present and on the size range of species present in midden deposits.

(ii) Group size -
The overall size and depth of the occupation deposit, the number of individual hearths or fireplaces within the deposit, the distribution of food waste within the occupation, the quantity of food represented by
Fig 5.2

Sketch showing Archaeological occupation deposits in relation to stratigraphy Gills Gully Facing east

Key:
- Silt A
- Silt B
- Silt C
- Red land surface
- Shell midden
- Macaranaal fossil
- Gills datum

14.950 Gills Gully 1
16.170 Gills Gully 2
discarded shell and bone were all considered as evidence for group size.

(iii) Group activities -
Activities of humans during site formation was documented by the amount of labour necessary to procure and process food, and the artefacts, manuports and other traces of activity within deposits.

(iv) Occupation deposit preservation -
Information on the nature of occupation deposit preservation was important, in view of the fact that comparative preservation could alter the survival of middens of various ages. It must first be established that site frequency, and the contents of surviving sites are not simply the results of selective preservation or visibility.

Excavation techniques ideally would have been designed to expose as much of the shell midden surface as possible, to map the surface features, and to recover faunal material from a wide areas. Unfortunately this approach was precluded by available resources and labour - shell middens were partly covered by three metres of sediment, and both covered areas at least 30 x 50 metres. It was therefore decided to

- establish the total extent of shell and hearth deposits in relation to ancient land surfaces as well as possible,
- recover as much detailed information about faunal remains and site preservation from the areas of midden which were accessible, and
- derive information on preservation and content - partly as a guide to methods which could be effectively applied in future excavations.
Plate 5.1 Gill's Gully 1 taken from Gill's datum facing north west towards lake shore, showing relative height of lunette crest, Silt A foreground arrowed, Silt B arrowed and Silt C.
5.2 Description of the midden deposits in their present settings

Both occupation deposits are shown in Fig 2.1, and their relative location is sketched in Fig 5.3. They are shown relative to the cement bench mark referred to earlier as Gills Datum. This cement marker was used as the datum point for archaeological excavations, as well as stratigraphic surveying.

Plate 2.3 shows the survey area from the air, Plates 5.2, 5.3 and 5.4 illustrate the local geography of earlier site, Gill's Gully 2. In these plates it may be seen that Silt C is overlain by Sand C/B. Gill's Gully 2 occupation deposit underlies Silt C, and is at least 1,000 years older than Gill's Gully 1.

One hundred and thirty metres to the south south east, and eight metres higher, close to the top of the lunette is a second midden complex, named Gill's Gully 1. This midden deposit and the cliffed residual which the excavated area abuts may be seen in Plates 5.1 and also in Plates 2.17 and 2.18 which have been used to illustrate the stratigraphy in previous chapters.

5.3 Excavation methods

1. Prior to excavation, the local topography of the present landsurface was surveyed, using a Dumpy Level and staff. The extent of the midden exposures on the surface, and in subsurface deposits was determined by surface survey and by an auger grid. Areas of the midden complexes which were buried, but accessible were selected for excavation. A grid of metre squares was superimposed on these areas.

Gill's datum was used as site datum for Gill's Gully 1 and an arbitrary datum, tied in to the datum at Gill's Gully 1 was used at Gill's Gully 2. Metre square grids are illustrated in Fig 5.3.
2. Grid squares were labelled from the south east corner with letter and number co-ordinates. Number axis co-ordinates increased from south east to north west (Johnson 1980).

3. Stone artefacts and manuports exposed on the surfaces were collected and labelled with the co-ordinates of the metre square.

4. Metre squares containing buried shell midden which did not show signs of fluvial reworking were selected for excavation. Excavated squares and portions of squares are shown in Fig 5.4 and 5.9.

5. Surface exposures of midden shell and hearth were left intact. Overburden was cleared from the buried squares, working back from surface exposures, until the surface of buried midden was exposed. Overburden was excavated horizontally with trowel and brush, and excavated overburden was removed from the site and dry sieved through nested sieves of one half inch and one quarter inch mesh diameter. Once shell or hearth material was encountered excavation proceeded with brush to reveal the top of the midden layer.

6. When midden deposit was exposed in plan the levels of the top of the midden were taken, and a plan of the exposed surface constructed.

7. Each metre square containing midden was divided into nine equal squares approximately 33 cm square. These divisions are referred to as subunits. In several cases it may be seen that full metre squares were not excavated - in these squares the edge of the midden was encountered, and subunits were used only in part of the square.

8. Corners and centre of the subunits were levelled using the Dumpy Level.
9. Midden material was excavated carefully, and placed in 10 litre buckets. As each bucket was removed the following information was recorded on sequentially numbered forms, one for each bucket.

(i) the initial elevation of the midden surface,

(ii) the elevation prior to excavation of the bucket load, and the elevation after excavation of that bucket load,

(iii) the weight of the bucket load,

(iv) the volume of the bucket load,

(v) the nature of the sediment matrix,

(vi) the subsequent treatment of the bucket load.

A copy of the bucket record form which was designed to record this information is included in Appendix A.

10. Bucket loads were treated in one of three ways:

(a) bulk bagged for laboratory analysis,

(b) transported to the dry sieving area, and gently sieved through nested sieves of one half inch and one quarter inch mesh. Dry sieving was reserved for areas in which midden was apparently absent - such as overburden or substrate.

(c) transported to the lake shore for wet sieving.

Bone or artefacts located during excavation were removed and placed in vials labelled with the three dimensional co-ordinates of the findspot, and the bucket sequence number of the excavated sediment.
The true history of a subunit

A2

256

256

BULK BAG 2

256

BULK BAG 1

254

ORGANIC RESIDUE

254
Wet sieving was done at the lake shore. Bucket loads of excavated deposit were hand sorted to remove fragile bone or plant material. Sediment was then washed gently through flywire sized sieves to remove sand and silt. Sieve residue was air dried. When dry, shell was weighed, hand sorted, and bone and fragile material removed and placed in vials labelled with the bucket sequence number. Sieve residue was bagged and returned to the laboratory for processing (Fig 5.3b).

Laboratory processing:

In the laboratory, bulk bagged samples were wet sieved through fly wire mesh sieves, sediment was retained and oven dried, and archaeological material was processed as earlier described.

Sieve residues from both wet and dry sieving were sorted under magnification. All bone, charcoal, carapace, scute and plant material was separated from shell. Whole shell was measured (see Appendix A), broken and whole shell were examined for damage and fracture patterns including breakage patterns and burning.

Bone fragments were examined under a light microscope. Details of fragment size, breakage patterns, burning and chemical coating were recorded. Identifiable fragments of bone were sent to Dr. D. Horton of the Australian Institute of Aboriginal Studies for identification and comment.

Sample shellfish valves were identified by Dr B. Smith NMV and Dr K. Walker, Adelaide University (see Appendix A). Fragments of fish, crustacean carapace, and lizard scute I identified myself (Kefous 1977; 1980).

5.4 Gill's Gully 2

Extent of Midden:

Velesunio shell and hearth material outcropped below Silt C, at depths from 30 to 50 cm, in residual walls, and in auger probes
Plate 5.2 Location of Gill's Gully 2 site, facing south east showing occupation deposit below Silt C arrowed far left, far right. Excavated squares A, B, 1, 2 visible on left.

Plate 5.3 Gill's Gully 2 facing west towards the lake, showing squares A, B, 1, 2 arrowed, A, B, 7, 8 centre, and B to D 30, 31 arrowed right.

Plate 5.4 Gill's Gully 2 residual of Sand B/C overlying the occupation deposit. Arrow right shows location of the excavation shown in previous plate. Arrows left show where auger probes encountered shell below the surface. A lag deposit of artefacts is shown in the foreground.
put through surface exposures of Silt C, and on the surface, where Silt C had been breached by erosion. Midden shell was traced in this way over an area 50 metres by 30 metres around the large residual illustrated in Plates 5.2, 5.3 and 5.4. It was concluded that this midden was laid down during the same occupation event because

. midden layers all outcropped in fine buff sand, 30 to 50 cm below Silt C,

. midden shell exhibited a gentle dip of 6° from north to south,

. archaeological investigation established the contiguity between surface shell exposures and shell deposits in situ below Silt C,

. archaeological deposits were visible over long distances at the foot of the residual illustrated in Fig 5.3,

preservation of archaeological material suggests that the midden was buried rapidly, soon after formation. It was buried by sand, then by Silt C, which suggests that the same sedimentation event affected the entire midden.

Area of Excavation

Within the larger midden complex one in situ area of midden, and one surface exposure were selected for excavation. These areas are shown in Fig 5.4 and Figs 5.6 to 5.10

(a) total area of excavation

(b) areas of midden shell and hearths within the area excavated

(c) the quality of shell present in the excavated midden deposit.
The reader is referred to Appendix A for detailed data on midden volume, midden material weight, and methods used for analysis of midden contents. It must be stressed that the maximum depth of midden encountered in any excavation area was less than 15 centimetres.

After removing overburden from areas selected for excavation, it became clear that the midden was not contiguous shell. Deposits in A, B 1 and 2 were isolated from the larger body of shell which was visible on the surface, and in cliffed residual walls (see Figs 5.4, 5.6 and 5.7). Midden was continuous from squares with number co-ordinates 9 to 35).

Because these two lenses were discrete occupation areas apparently within a larger complex, it was decided to present the data, and the analysis of data separately for each area - in view of the information which might be gained on the composition of sub groups, and open areas in the complex.

Squares A, B, 1 and 2

This lens was clearly separated from midden to the east by four metres of sterile sand, and appeared to occupy the extreme eastern edge of the midden complex, since midden was neither exposed in cliffed sections or in surface exposures to the east. (Fig 5.7) shows the area of midden excavated in relation to local topography (see also Plates 5.2 and 5.3) A hearth 60 cm in diameter was located in B2, and the hearth was surrounded by patches of ash and shell (Plate 5.6).

Artefact

One artefact was recovered from this lens, a bone point 8 cm long, made on a macropod longbone. The bone point was intact prior to excavation. It is illustrated in Plate B.7
PLAN VIEW GILLS GULLY 2 EAST SQUARES

Key
average valve equivalents at 5gm per shell

<table>
<thead>
<tr>
<th>Category</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-100</td>
<td></td>
</tr>
<tr>
<td>100-300</td>
<td></td>
</tr>
<tr>
<td>300-400</td>
<td></td>
</tr>
<tr>
<td>400-500</td>
<td></td>
</tr>
<tr>
<td>over 500</td>
<td></td>
</tr>
</tbody>
</table>

Fig 5.5
Faunal remains

Bone in this lens was recovered whole (foot bone), in other cases, bone was damaged during processing. Much bone was extremely fragmented before processing, fresh breaks could be distinguished from old fractures. The distribution of bone in relation to hearth layers is shown in Figs 5.5 and 5.6.

Table 5.1 Species Table Squares A, B, 1 and 2

<table>
<thead>
<tr>
<th>Species</th>
<th>Excavated weight</th>
<th>Minimum No</th>
<th>Flesh weight</th>
<th>Carry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. ambiguus</td>
<td>24.629 kg</td>
<td>2463</td>
<td>12.3 kg</td>
<td>36.9 kg</td>
</tr>
<tr>
<td>C. destructor</td>
<td>2.0 gm</td>
<td>1</td>
<td>5.0 gm</td>
<td>20.0 gm</td>
</tr>
<tr>
<td>Macropod -</td>
<td>230.0 gm</td>
<td>1</td>
<td>1.5 kg</td>
<td></td>
</tr>
<tr>
<td>Lagorchestes sp</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>maxillary fragments</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>tooth fragments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>hind foot fragments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lizard, unidentifiable</td>
<td>.5 gm</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>?Bird, unidentifiable</td>
<td>1.0 gm</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Carry weight refers to the estimated total weight of shell fish and contents which must have been transported to the midden site.

The macropod remains probably came from a single species, Lagorchestes sp the hare wallaby, a small macropod which was common in the area until after 1860.

It has been suggested that the bone preservation patterns characterised by small fractured fragments of bone, and comparatively unfragmented distal limb and foot bone may indicate a pattern of food preparation similar to that observed by Gould in the Western Desert where the bodies of small animals
Plate 5.5 Shell midden Gill's Gully 1 showing mixture of shell and charcoal, and charcoal stain on the surface, clearly superimposed on excavated shell lens, indicating that the deposits were not formed synchronously.

Plate 5.6 Gill's Gully 2 shell and charcoal in situ and sand RLS/C, showing depth of shell lens, and the characteristic mixture of shell and charcoal.

Plate 5.7 Shell midden in Silt A, including hearth greater than 1 metre in diameter, and showing shell preservation.
were pounded prior to consumption presumably to maximise the available food by pulverising weakly ossified bone (1980:23; see also Hayden 1979:155,141). While this remains a possibility for explaining the presence of such small slivers of bone, further work is necessary to establish the differences between breakage patterns due to post burial sediment pressure and those due to bone damage during capture or preparation of prey (Appendix B).

Squares A, B, 7 and 8

Squares A, B, 7 and 8 contained a single sharply bounded lens of mussel shell interspersed with shallow lenses of ash (Fig 5.6). The entire lens measured two metres by two metres and it abutted a second lens to the south, where it disappeared under the residual, but lenses out to the east, in what seemed to be the eastern margin of the whole complex. Lenses dipped at 6° to the south.

Shell

Shell layers were 10 cm thick at the maximum. Shells were well preserved mainly whole, or fractured in situ. In many cases lake muds were still clinging to the outside of the shell (Appendix B discusses this at length).

Plate 5.3 shows the full extent of this lens. Estimated numbers of whole shells in the midden lenses are shown in Fig 5.7 which also details the distribution of lenses of ash and charcoal. Data on shell quantities, including shell weight and shell volume/excavated unit of deposit are presented in Appendix A.

Bone

Between shells and below shells tiny fragments of bone were found. Some bone was also found which was intact prior to excavation. Twenty five tiny fragments of yabby carapace were found, including two cheliped tips. Five fragments of fish bone were found, the largest 8 mm in longest dimension.
Plate 5.8  Gill's Gully 1 showing squares F, G, 3, 4, 5 showing (i) aeolian sediments above Silt A, (ii) eroded Silt A, (iii) surface exposures of midden shell (foreground).

Plate 5.9  Gill's Gully 1 squares E, F, G in process of excavation facing west.

Table 5.2  Species list Squares A, B, 7 and 8

<table>
<thead>
<tr>
<th>Species</th>
<th>Excavated weight</th>
<th>Minimum No</th>
<th>Flesh weight</th>
<th>Carry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. ambiguus</td>
<td>11.652 kg</td>
<td>1165</td>
<td>5.8 kg</td>
<td>17.0 kg</td>
</tr>
<tr>
<td>Cherax destructor</td>
<td>2.0 gm</td>
<td>2</td>
<td>0.10 gm</td>
<td></td>
</tr>
<tr>
<td>Fish unidentified</td>
<td>0.3 gm</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mammal bone unidentified</td>
<td>5.0 gm</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ochre

Ten 2 mm diameter fragments of red and yellow ochre were recovered from this area of the complex. Under magnification this ochre proved to be richly coloured iridescent red clay with angular transparent quartz inclusions. These clays were quite unlike the reddened sands of the lunette, or the red clay rich layers in the Blanchetown clay, or the red ferricrete profile developed below the Blanchetown clay. It is likely that ochre was brought from outside the area. The ochre was discovered during wet sieving, when red streaks were noticed on shell, and on the siever's hands. It is possible that the pieces of ochre were partly lost during wet sieving. The distribution of ochre fragments is shown in Fig 5.5.

Squares F 30, F 31, E 31, D 31 and C 31

This lens was associated with the main body of the midden, but was exposed on the surface, where Silt C had been eroded (Fig 5.7). When a trench was dug from the surface exposures to Silt C, it became apparent that the midden was continuous, dipping from the surface under Silt C at 6°. Midden was continuously exposed in the trench wall.

Surface exposures of midden include the remains of a large black charcoal rich hearth, which had once been surrounded by thick piles of shell and bone. Much of this area was dissected, only
Key
Average value equivalents at 5m per shell
- 100 shells
- 100 - 300 shells
- 300 - 400 shells
- over 400 shells

GILLS GULLY 2 WEST SQUARES

Fig 5-7
2 metres
Table 5.3  Species list Squares F 30, 31, E 31, D 31 and C 31  Surface exposure

<table>
<thead>
<tr>
<th>Species</th>
<th>Excavated weight</th>
<th>Minimum weight</th>
<th>Flesh weight</th>
<th>Carry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>V. ambiguus</td>
<td>not estimated due to the eroded nature of the excavated area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cherax destructor</td>
<td>10.0 gm</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fish</td>
<td>2.0 gm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small macropod</td>
<td>260.0 gm</td>
<td>2</td>
<td>10.0 kg</td>
<td></td>
</tr>
</tbody>
</table>

Faunal Remains by sample F30, 31, C31, D31, E31 Surface exposure

Sample

F30  Small macropod - epiphysis, distal fibula, distal tibia

F31  (i)  small macropod, probably Lagorchestes - distal tibia, distal fibula, articulating cuboid, calcaneum, astragalus, metatarsal 4, metatarsal 5

(ii)  small macropod, probably Lagorchestes - two upper molars

(iii)  small macropod, probably Lagorchestes - astragalus, metatarsal 4, long bone fragments tabular and cancellous bone fragments, fragmented radius

Fish - two cranial fragments

Cherax destructor - carapace fragments

E31  Small macropod - long bone shaft fragments 10 mm by 15 mm, fragments of rib, basicranial bone

Fish - vertebral centrum, weathered

D31  Small macropod - phalange and articulated claw

Cherax destructor - cheliped tip, carapace fragments

C31  Small macropod - metatarsal 3, long bone fragments, tabular bone

Cherax destructor - cheliped tip
in situ areas were excavated (Fig 5.7). Details of fauna recovered from this area are given in the table above.

Areas adjacent to the central hearth were comparatively rich in bone. Much of the bone was whole when excavated, and subsequently fractured. The mammal species range is similar to those found in other excavated areas of this complex.

The hearth exposure in this section of the midden complex proved to be 5 to 10 cm in depth, and contained black and greasy sand with charcoal particles up to 20 mm in diameter. It differed from the lenses of grey ash and finely divided charcoal found between shell piles in other excavated areas. It is concluded that there were two types of 'hearth' (Plates 5.5 and 5.7), typically the first resulting from larger fire, and the second, thin grey ash and fine charcoal, associated with fires using smaller fuel which burnt quickly, and may have been associated with cooking shellfish (Plate 5.6).

5.5 Synopsis Gill's Gully 2

Gill's Gully 2 is a midden complex composed of lenses of shell mixed with fine charcoal and ashy lenses. The maximum thickness of deposit is 15 cm.

The complex covered at least 50 metres by 30 metres. Excavated areas of the complex covered some of the extreme eastern edge and portion of the centre of the midden in the west.

Excavated and surface exposures suggest that midden lenses were laid down on unconsolidated soft sand, a gentle south facing slope.

The deposit was buried soon after formation. This is suggested by several things; the excellent preservation of the shell; the presence of ochres which disintegrate in water; the fact that crustacea
shell was black, not reddened by cooking or exposure to hot sun; and the fact that the shell valves retained their coats of lake mud.

The complex apparently consisted of clusters of shell and hearth lenses - with clusters possibly representing the food waste of smaller groups within the larger group (cf Jones 1980:154-156). Within the complex there was at least one larger fire, which left a black greasy deposit of charcoal approximately 70 cm in diameter. Judging by the high frequency of macropod bone surrounding this fire it may have been used to cook small macropods.

Species present indicate that foraging range extended from the lake and to the lunette, or the mallee hinterland adjacent to the lunette. Considerable quantities of shellfish meat would have been available. Although the weight of bone is comparatively slight, the presence of bone, widely distributed suggests that small macropods were contributing significantly to the diet. Identifiable bones come from Lagorchestes spp, a species common in the mallee and occasionally found on lunette dunes.

The deposit was buried by fine aeolian sand, and soon after, by the deposition of silty sand - the first indication that the lake basin was desiccated and eroding.

Assuming that excavated sections of the midden were typical of other areas of the midden and that the midden formed in a single event, as preservation suggests, it is suggested that the deposit was left by a human group which might have numbered 30 or more. This is supported by

(a) the total extent of surviving midden deposits - over 50 by 30 metres of admittedly discontinuous deposit.
(b) the distribution of midden deposit, with discrete or contiguous lenses of shells interspersed with fine ashy patches, and an occasional larger fireplace, which may have burnt larger diameter fuel.

(c) The quantities of food represented by the midden deposits. It has been calculated from this and other excavated deposits, that one square metre of moderately high *Velesunio ambiguus* shell volume per unit sediment, to a depth of 10 cm will represent 3 to 5 kg of shell fish flesh. According to Feary, flesh of *Velesunio* provides 760k/cals per kg. (1981:68). Considered as a whole, this midden complex, which probably represents a single meal, may have represented something of the order of 270 kg of shellfish meat, say 9 kg per person for a group of 30. Alternatively, there was adequate shellfish flesh to provide a group of 82 persons with average daily k/cal requirements estimated at 2,500 k/cal per person. This broad estimate assumes midden 5 cm deep over an area 30 metres by 30 metres (which is not a large midden in comparison with others in the area; cf Table 3.2). When weights of macropod flesh are also included in the total meat weight, it becomes clear that this midden complex was deposited by a large gathering of people with healthy appetites. This remains true even if the occupation took place over a period of several days.

(d) The effort required to transport live shell from the lake to the crest of the midden. This is represented in the tables above by the column 'Carry weight'. One square metre of 5 cm of moderately high shell volume per unit sediment contains the equivalent of 20 kg of live shell, that is up to two tonnes of shellfish in a midden 30 by 30 metres. (see Appendix B for further discussion).
Preservation conditions were excellent. Preservation is discussed in detail in Appendix B.

It is likely that the deposits were buried, and subsequently compacted by weight of sediment deposited above Silt C. The implications of excellent preservation are that other midden deposits laid down at the contact between Sand RLS/C and Silt C should have been preserved. None were located in clifffed exposures along this contact zone in the Gill's Gully area.

5.6 Gill's Gully I

Extent of Midden:

In the Gill's Gully study area, the crest of the present lunette is protected by extensive surface exposures of fine sediment (Silt A). The lunette crest is very dissected, and exposures between Silt A and the underlying sand are frequent. Many separate midden deposits may be observed on the surface or in plan in the contact zone between Silt A and Sand B/A as shown in Figs 5.2 and 5.3. Gill's Gully I was selected for excavation, because it is part of what appeared to be a widespread episode of midden deposition which occurred c 14,900 BP along the then crest of the lunette.

Midden shell can be traced along the base of Silt A at and above the contact with Sand B/A in clifffed exposures from the cement bench mark at Gill's Gully for 10 metres, and midden outcrops in adjacent residuals along the base of Silt A for 30 to 50 metres (Plate 2.18). Layers are typically less than 15 cm deep, and occasionally are only the depth of a single crushed shell.

In this area, midden boundaries are truncated by gully erosion and clifffing, so it is not possible to establish the extent of deposits, nor is it possible to determine if all shell exposures were part of a single contemporaneous complex. It is believed, for reasons which will be outlined, that middens in the base of Silt A are traces of prolonged exploitation of shell fish rather than a single occupation.
Fig 5.8

GILLS GULLY 1 PLAN VIEW

0 5 metres

- bench mark
- excavated
- contour interval 50 cm
Plate 5.11 Gill's Gully 1 excavated squares G, H, I, 15 showing shell lenses (arrowed) separated by several centimetres of aeolian sand.

Plate 5.12 Shell orientation and preservation, Gill's Gully 1 surface exposure.

Plate 5.13 Close up shell orientation and preservation Gill's Gully 1, lens cap gives scale.
As in the case of Gill’s Gully 2, it was not possible to expose the full complexity of these deposits. Excavation was concentrated on a small area, where some midden was exposed on the surface, and some remained buried under Silt A.

The area excavated is shown in Figs 5.8 and 5.9. Additional information on the extent of midden was obtained by correlating surface exposures with outcrops of midden seen in section in the cliffed walls of the residual. Two large hearths similar to the one described in the previous section were exposed on the surface and one was exposed in plan (Plate 5.6) and by a grid of auger probes through Silt A along the surface of the residual (shown in Fig 5.3 and Plate 5.10).

Area of Excavation:

Excavation was restricted to areas within 1 metre of the cliffed residual edge, to minimise the chance of erosion of the residual. Two areas were exposed, one on the eastern end of the residual, and one within 1 metre of a large hearth, on the western lakeward margin of the residual. The two exposures were connected by a 50 cm trench (Fig 5.3 and 5.8, Plate 5.10).

Overburden was cleared to expose buried deposit. Surface features in exposed and excavated areas are shown in Figs 5.9 and 5.10.

Distribution of midden deposits

The distribution of shell lenses viewed in plan suggests that excavation removed overburden from along the edges of two concentrations of shell and ash distributed around central, larger hearths. The larger hearths were sectioned by the residual edge. Areas around these hearths could be seen to be bone rich, but they were not excavated. These two concentrations impinged on and overlapped a thin lens of older midden shell which occupied part of the centre of the residual.
Cills Gully 1, EFG 345

Key
average valve equivalents at 5gm per shell

- 0 - 100 shells
- 100 - 200 shells
- 200 - 400 shells
- 400 - 600 shells
- 600 - 1000 shells
- over 1000 shells

0 1 metre

Fig 3.9
It is inferred from the excavation that these were two episodes of midden deposition

middens overlap one another when viewed in section in the trench wall. They are separated by 10 to 20 cm of sterile silty sand.

fires appear to have been lit on top of previously discarded shell valves. Ash and charcoal overlie burnt shell (Plate 5.7).

Perhaps these midden deposits were separate events, which occurred within a short space of time. The implications of this are that the deposit of shell and charcoal at Gill's Gully 1 should not be interpreted as food wastes of a large group before further investigation clarifies the spatial interrelations between lenses.

Squares E, F, G, 3, 4 and 5:

Excavation exposed shell piles laid down on the northern perimeter of a hearth, which was exposed in section - but had been almost all lost through erosion (Plates 5.8, 5.9). Shell was apparently once arranged in small piles, which were later compacted by pressure of sediment from above (Plate 5.12).

Table 5.4    Shell and bone, excavated portions Squares E, F, G, 3, 4, 5

<table>
<thead>
<tr>
<th>Species</th>
<th>Excavated weight</th>
<th>Minimum No</th>
<th>Flesh weight</th>
<th>Live weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>V ambiguous</td>
<td>81.665 kg</td>
<td>8166</td>
<td>40.83 kg</td>
<td>122.4 kg</td>
</tr>
<tr>
<td>Bettong sp</td>
<td>1</td>
<td>0.5 kg</td>
<td>840 ± 70 gm</td>
<td></td>
</tr>
</tbody>
</table>

(Allen 1972:209)
NMV Bench mark
Site Datum

Gills Gully 1 GHI 15

Shell Outcrop
on Surface

Key
average value
equivalents
at 5 gm per shell

0-100 shells

100-200 shells

Fig 5.10
This area contained the highest volumes of shell per excavated unit (Appendix A). Despite careful searching, little bone was found (three fragments of maxilla, with molars intact, identified as *Bettongia* sp). The deposit otherwise consisted entirely of shell valves, finely divided charcoal and small ashy lenses (Fig 5.9).

The northern edge of this lens terminated sharply along the axis of the G grid line.

Along the G axis it appeared as if two separate layers of shell occurred. The lower layer dipping towards the west before lensing out and the upper layer extending for 2 metres at least towards the east (Plate 5.11).

Squares G, H, I, 15

Excavation exposed midden which was peripheral to a large hearth, clearly exposed in cliffed sections to the west. The hearth included bone and greasy charcoal, and was apparently the remains of a larger fire. Excavation revealed a fringe of shell piles around the edges of this hearth. No bone or artefacts ochre or carapace were recovered, only *Velesunio* shell valves, from layers which were apparently only one shell thick. Most of Square 15 was sterile (Fig 5.10, Plate 5.11).

5.6 Synopsis Gill's Gully 1

The excavated portions of shell midden in Gill's Gully 1 indicate that small middens were formed in and along the Sand BA/Silt A contact zone. The fact that these middens are superimposed, and separated by 5 - 10 cm layers of fine aeolian sand suggests that they were not all deposited in a single event. This argument is supported by the fact that in some middens the shells have been scorched by fires which were lit on top of older midden (Plate 5.10).

A survey of surface exposures and cliffed exposures, plus some auger probing has established that small midden lenses were
deposited over an extensive area of the basal layers of Silt A in the Gill's Gully study area. In this area there is a real variation between midden frequency between the underlying Sand B/A and the sand/silt contact, which cannot simply be explained in terms of preservation factors. Elsewhere on the lunette the contact between the top sand and the top silt is also comparatively rich in midden deposits.

Although further research is necessary to establish the wider picture of midden boundaries in Silt A, it is likely that the middens found in the excavated area were mostly deposited in small lenses.

Although the Gill's Gully area covers less than 20% of the whole lunette, a preliminary survey indicates that sediments younger than 15000 BP in the southern 10 km of the lunette contain many more shell middens than underlying sediments. The increase in deposition after 15,000 BP may show real changes were occurring in foraging strategies during the terminal Pleistocene. Some of the implications of this possibility are explored in later sections.

5.7 Other occupation deposits in the survey area

In the survey area, there were many areas where stone artefacts were exposed on the surface. These deposits have not been considered here, as it is likely that all stone artefacts are undatable reworked lag deposits. One of these lag deposits is shown in Plate 5.12. A second concentration of stone artefacts was found in lake beach sediments. The artefacts on the beach are probably derived from reworked beach occupation deposits, supplemented by artefacts reworked from lunette and lake shore deposits. Many of them appear to have been wave rolled, as they are characteristically rounded. Others bear traces of carbonate encrustation. The most striking characteristic of these beach washed artefact assemblages is the diversity of stone utilized in their manufacture. Since these deposits cannot presently be dated, they are not further considered here, but the stone artefacts and the shell midden deposits which survive on the
beach and the lake shore are worthy of further consideration, as they will provide information on Aboriginal activity in a lake shore zone, to include some evidence for activities of the recent past, which may be compared with the ethnohistoric evidence for human activity. The location of large artefact concentrations is shown in Fig 2.1.

5.8 Review and discussion

The Gill's Gully survey area is approximately 1/14th of the total area of the Lake Victoria lunette. As Fig 5.1 indicates, this lunette is rich in the traces of human occupation and the deposits were laid down over a period of 18,200 years. Survey of the Gill's Gully area and excavation of portions of two Pleistocene occupations have demonstrated first, that preservation of lunette occupation deposits is excellent, second that excavation techniques which utilize wet sieving are likely to recover a great range of small or fragile particles, which will add much to the total information on Pleistocene occupation. These practical considerations should prove of benefit to future investigations in the Lake Victoria basin.

On a wider scale, the stratigraphic history of the Lake Victoria basin presented in Section 1 will mean that occupation deposits on the surface, or in situ, may be assigned minimum ages by association with sediments of known age.

In lunette sediments, middens of the late Pleistocene 'lacustral' period may now be compared with middens of the arid period between 16,000 and 15,000 BP. In the Gill's Gully area, sediments of the lacustral phase are not widely exposed, but a preliminary investigation suggests that there are few middens of this age, and that the middens which do outcrop tend to be small.
In the Gill's Gully area portions of two sites were excavated. Gill's Gully 2 dates to 16,000 BP, a period when the lake was still receiving water but when the hinterland and the lunette was increasingly affected by strong winds. It is the only midden deposit which is exposed in sediments of this age.

The Gill's Gully 2 midden recalls descriptions of middens recently formed by Gidgingali Aboriginals of the Blythe river area where a group of perhaps 30 people lived and consumed shellfish:

When people come to any location to rest or sit down their first activity is to clear a small roughly circular area of a metre or so in diameter each, in order to sit on clean sand or clay... often with several people sitting down together. The cleared off areas join to form a single feature which in plan has a sinuous shape... on the inner edge of the cleared area people build fires, usually several even when only a family is present. Members of each hearth group attend to their own fires... where shellfish bivalves were cooked... the gaping pairs of valves were usually piled up onto a bed of fresh cut green leaves and the lightly steamed meat removed. The bulk of the shells were usually left in these piles, unless the space is required for some other activity, in which case they were tipped leaf bed and all onto the nearest edge of the cleared area. Often shells were picked up individually by people and the meat removed by their teeth, [shells were] dropped casually on the cleared sand around the eaters (Jones 1980:155)

The shells, ash and other traces of activity in the excavated portions of Gill's Gully 2 could almost have been produced by activities such as those described above. In future research, it is hoped that excavation of a whole Pleistocene shell midden complex will be able to establish the similarities between activities of the past and present with more authority. The volume and weight of the shell valves excavated from some small areas of the Gill's Gully 2 complex show that large numbers of people must have camped for a brief time on a soft sandy slope facing south, lit fires, cooked some larger animals at larger more substantial fires, and lit smaller 'hearth group' (see also Hayden 1971) fires in which to prepare shellfish. Occupation was brief, and the deposit was buried by mobile sand very soon
after it was formed. This area does not appear to have been revisited regularly by people cooking and discarding shellfish, for there are no traces of other shell middens in sediments of the same age, or superimposed sediments of the next six hundred years.

The only hint of Aboriginal presence in the period between 16,000 and 15,000 BP is one small shell lens dated to 15,570 BP. This midden is separated from Gill's Gully 2 by 4 metres of sediment. Middens formed in this time would have had ample opportunity for being buried and preserved in this rapid accumulation of sand, so we must assume that shell middens were not being regularly deposited in the Gill's Gully area in this thousand year period.

In contrast, sediments deposited after c 14,900 BP buried many middens. The nature of these midden deposits was explored by the excavations of Gill's Gully 1, which showed that the middens of this time period were small superimposed lenses of shell and hearth material, where the areal spread of shell and the quantity of food waste present suggest that these deposits were formed by small groups. In the Gill's Gully area, there is definitely evidence for a late Pleistocene change in shell discard patterns which cannot be explained by site preservation or site visibility. It is premature to conclude that this change can be correlated with changes in either population or custom. We are in a position to say that the change in shell midden deposition occurred during a period when the lake basin (and by inference the river tract) was experiencing long episodes of drought. Nevertheless, it is noteworthy that this change, which essentially means that more shellfish were being carried up to the top of the lunette - did not occur in earlier episodes of severe drought and riverain failure. The causes of this change remain obscure, however interpretations of a switch to shell carrying and shell consumption are suggested by a consideration of the changing range of available foods and water resources within the Gill's Gully area during droughts.
During droughts, the perimeter of the lake shrinks, leaving a few pools of fresh water. These pools are attractive to large game, particularly during periods of hinterland drought, when larger animals cannot gain adequate water from forage (Simpson 1973). The present topography of the Lake Victoria basin floor indicates that it is possible that one such pool could have remained in the lake to the east of the Gill's Gully area (cf Gill 1973a: Fig 13:23). People camped on the lunette crest rather than the lake shore would be less likely to disturb game which came to drink at the few remaining pools. During the period after c 16,000 BP it is likely that such game would include magafauna species, other large animals and large birds. Aboriginal desert dwellers of the present time sometimes observe the custom of camping a respectable distance from the nearest water source (Gould 1980), so it is possible that the relative increase of site formation on the crest of the lunette in the terminal Pleistocene could be related to a similar practice.

The fact that most of the occupation deposits contain shell and remains of small animals could be explained by an increased emphasis on less desirable foods during periods of riverain failure. This interpretation is supported by the observation that middens of this age tend to be small isolated lenses, such as might have been formed by a single 'hearth group' in a short visit.

In a previous chapter it was suggested that shell middens, containing mammal and reptile bone may have been formed more frequently under specific circumstances of river failure, either seasonally or during longer periods of low water, when less favoured riverain resources such as shellfish, could be supplemented by the resources of the hinterland.

The patchy or ephemeral nature of resources would imply that 'ecotone foraging' would tend to rapidly exhaust the resources of a single area within walking distance of a single pool. This would account for the fact that the occupation deposits in Silt A are never deep stratified deposits, documenting long term
residence. It is concluded that the small shell middens found in Silt A represent a particular specialized kind of subsistence strategy, related to changes in adaptation which occurred during the terminal Pleistocene.

If this is accepted, then previously held reconstructions of the patterns of Pleistocene foraging and adaptation are called into question (Allen 1972; Jones 1971). It is likely that the most frequently preserved occupation deposits are in fact typical not of 'normal' exploitation patterns, but typical of a widespread pattern which was a response to foods available in low lake waters during drought, and therefore, a highly specialised foraging pattern, which was possibly widespread during times of drought stress, but by no means necessarily typical of Pleistocene adaptation. We are very aware of this pattern because

(a) the traces of it are preserved in lunettes and around lake shores, up to c 20 km from the lake. Those deposited in aeolian sand dunes would be highly likely to be preserved and thus survive in disproportionately high numbers

(b) the deposits have been sought out, because they contain datable shell valves and charcoal, and are hence preferentially selected for excavation.

It is considered that little is yet known of the patterns of Pleistocene adaption in the Lake Victoria area, and that Pleistocene occupation traces in or near the riverain tract may document lifeways which were perhaps more typical of the foraging patterns of Aboriginals through time. It is thus premature to conclude that there was little or no change through time in foraging strategies.
In this section some of the problems of interpreting the archaeology of Pleistocene occupation patterns have been considered. Several important aspects of the range and scope of human activity have been isolated. First, it has been argued that upper bounds to human activity, population density and population mobility were set by the variation in pulses of water flowing down the Murray. Second, it has been suggested that when riverain resources were diminished by flood failure, it is likely that exploitation of the resources in areas away from the river (but still within walking distance) would have been more intensively utilized. Since it is this area which contains most of the surviving archaeological deposit, interpretations of the archaeology of this area must be strongly influenced by the understanding of the patterns of resource availability in the trunk river itself. If the river was experiencing drought conditions, it would be likely that foraging would have been undertaken in small groups, commensurate with the less clustered mature of resources available in drought periods (cf Silverbauer 1972).

Archaeological evidence for human behaviour recovered from areas within the ecotone between the river and the hinterland must be considered as evidence of specialized activity, either involving the exploitation of clustered, 'seasonally' available hinterland resources or exploitation during famine periods induced by flood failures in the river tract.

Current interpretations of Pleistocene human activity based on ecotone occupation deposits should not be considered typical of the full range of Pleistocene human activity. In fact, it must be recognised that most of the evidence for Pleistocene human activity will be found in and around the riverain tract, and in hearth and oven deposits if it has survived at all.

The archaeological evidence from the Gill's Gully excavation deposits are here interpreted as evidence for ecotone foraging.
In the case of Gill's Gully 2, it is likely that a large group assembled for some undefined purpose, on the lunette. The paucity of occupation deposits in sediments of this age indicates that the lunette was not a regular camping place at this time, nor for thousands of years thereafter. Increased rates of shell midden formation after severe droughts had afflicted the riverain and the hinterland may be tentatively interpreted as reflecting increased stress on ecotone resources, in the period between 14,9000 and 14,000 BP, although this does not mean to imply a simple correlation between droughts and the increased formation of midden deposits, and the links between human populations and the formation of midden deposits remain unclear.

The next section examines aspects of two specific problems relating Pleistocene human activity to observed changes in the natural environment in the Lake Victoria basin.