PREHISTORIC ARCHAEOLOGICAL INVESTIGATIONS
ON KING AND FLINDERS ISLANDS,
BASS STRAIT, TASMANIA.

by

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Except where otherwise stated in the acknowledgements and in the text, this thesis is based solely on my own fieldwork and research.

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ABSTRACT

This thesis examines the question of prehistoric land use patterns in the Bassian region, and specifically addresses the problem of Holocene human occupation on King and Flinders Islands in the period after these islands became separated from mainland Tasmania. Although the islands were not occupied at the time of first European contact, prehistoric archaeological evidence has been found on them. It was suggested that these remains were from human populations who had been stranded on the islands as a consequence of the last marine transgression, and who subsequently became extinct. This proposition formed the main focus for this thesis research.

Extensive field work was undertaken on King and Flinders Islands to provide a data base from which the nature of island occupation could be examined. This comprised test excavations on King Island, and collection of charcoal and cultural shellfish remains from midden sites on both islands. Analysis and radiocarbon dating results indicate that although both islands were occupied in the island phase, sometime after the sea reached a level similar to that at present, the nature of human occupation on both islands was markedly different. The evidence from Flinders Island is considered to be that of a stranded extinct population whereas that from King Island strongly suggests that the island was being visited from northwest Tasmania in recent Holocene times. This latter evidence is of considerable interest in light of previous assumptions regarding the prehistoric maritime technology of the Tasmanians.
ACKNOWLEDGEMENTS

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I wish to convey my thanks to the following people for assistance generously given on King and Flinders Islands: the Paterson family, Tom and Jessie Lewis, Denton Corker Marshall Pty Ltd, the Currie Police, Len and Cecily Sullivan, Robyn Eades, Anne and John Shimmins, Cynthia and Louis Vivian, Steve and Ricci Bishop, David Bowden, Michael Crowe, Peter and Jill Daniels, Peter Smith, Snowy Laker, Derek Smith and his family, Bruce and Gwen Wheatley, and Phyllis Pitchford. Derek Smith also put me in contact with other people engaged in research on Flinders Island, including
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INTRODUCTION

This thesis addresses the question of prehistoric Aboriginal occupation in the Bassian region. Although the Bass Strait islands are now separated from Tasmania by up to 80 km of sea, they represent relict parts of past Bassian landbridges. The Bassian landbridge has connected mainland Australia and Tasmania at least once, if not several times, during the known span of human occupation of the Australian continent (Cosgrove 1989:1708). When Europeans first arrived in the Bass Strait area, there were no Aboriginal populations on the remote Bassian islands. Despite the large size, abundant food and water resources of King and Flinders Islands, both were truly terra nullius two hundred years ago. Furthermore, mainland Tasmanian Aboriginal populations had no knowledge of the use of these two islands (Jones 1976:256).

The presence of archaeological evidence on these islands however attests to Aboriginal use of the Bassian region in prehistoric times (Jones 1979; Orchiston 1979a). The nature and duration of Aboriginal habitation of the Bassian islands, after they became isolated from greater Tasmania in the mid-Holocene, is somewhat enigmatic. This thesis specifically addresses the question of what happened to the people who were living in the Bassian region as rising seas flooded the landbridge, and focuses on the archaeological evidence on Flinders and King Islands, the two largest Bass Strait islands [Fig. 1].

Archaeological finds on these islands have previously been used to support an extinction model for Holocene human populations presumed stranded on King and Flinders Islands. It has also been suggested that this model may be of some relevance to the mainland Tasmanian Aboriginal population (Orchiston 1979b:135). When the idea of extinct stranded populations on the islands was first suggested, data regarding post-glacial sea level changes were relatively limited. Furthermore, there were no
secure dates for human occupation on either island. The only radiocarbon dates for sites on King and Flinders Islands, had been obtained from charcoal from aeolian dune contexts (Jones 1979; Orchiston and Glenie 1978). There was no indication that dated charcoal from either the Flinders or King Island sites was of anthropogenic origin. Moreover, the results of more recent archaeological research on these islands, cast some doubt on the interpretation of archaeological remains on both Flinders and King Islands as being of evidence of 'island occupation' (Sim 1988, 1989).

During 1988 and 1989, I undertook prehistoric site survey projects on King and Flinders Islands. The results of these two surveys led me to believe that the islands were possibly abandoned as rising seas separated and distanced them from mainland Tasmania during the last post-glacial sea rise (Sim 1988, 1989). This raised questions about the evidence previously presented for prehistoric occupation of these islands — especially in regard to the interpretation of its antiquity and the assumptions drawn from the evidence in regard to stranded island populations (Jones 1979; Orchiston 1984; Orchiston and Glenie 1978). It was readily apparent that prehistoric occupation of these islands in the remote island phase had to be satisfactorily demonstrated before it was appropriate to begin to address questions regarding the ultimate fate of these people, and the causes and processes of extinction of purportedly stranded island populations.

The research aims of this thesis were therefore to examine the archaeological evidence from the larger Bassian Islands in order to,

a) determine when in fact the islands were occupied in prehistoric times, and
b) how prehistoric occupation related to the palaeoenvironmental dynamics of the Bassian region.

From this investigation I intended to gain a clearer and more accurate picture of Aboriginal use of the Bassian region in the past. Most specifically, I aimed to address
the question of whether or not people became stranded on the remote plateau regions of the Bassian landbridge as it became subsumed by the postglacial sea rise, and thus became inexorably doomed to extinction. In light of the general acceptance of Jones' (1979) and Orchiston's (1984) suggestions that there were stranded human populations that became extinct on these islands, and the absence of a secure data base for island occupation on either King or Flinders Islands, the question of island occupation provided the initial focus for the thesis field investigations.

Figure 1: The Bass Strait Region showing bathymetric contours relevant to landbridge and island formation phases.
Chapter 1

A REVIEW OF THE HISTORICAL AND ARCHAEOLOGICAL BACKGROUND

HISTORICAL BACKGROUND

There are three large islands, or groups of islands, in the Bass Strait which offer an abundant range of terrestrial and marine food resources and permanent fresh water sources. These are King Island, the Furneaux Group of Islands, and the Hunter Islands [Fig. 1]. The largest of these islands, the more remote King and Flinders Islands, are both more than 1,000 km² in size, and thus appear capable of sustaining a human population. When Europeans first arrived in the Bass Strait region at the end of the eighteenth century however, the more remote Bassian Islands such as the Furneaux Group and King Island were devoid of human inhabitants (Baudin 1803; Cumpston 1973:44-45; Flinders 1801, 1814; Peron 1802 in Micco 1971:11). Furthermore, no shell middens or other evidence was observed by the first non-Aboriginal visitors, to suggest that these islands had previously been occupied.

In reference to this absence of Aboriginal people on remote Bass Strait islands, Flinders noted that while there were constant 'smokes' being sighted (and thus Aboriginal inhabitants) in Tasmania, there was 'none upon the islands' (Flinders 1814:cxvi). This he found difficult to understand because of the richness of food resources available on the larger Bass Strait Islands.

Similarly, the French Scientific Expedition were also surprised to find the islands uninhabited by Aboriginal people when they visited the Bass Strait under the command of Nicolas Baudin in 1801-2. Peron, one of the expedition's naturalists, commented;
Over the whole extent of King Island we saw no trace of humans, and everything indicates that this island is equally unknown both to the wild tribes of Van Diemen's Land and of New Holland. ... On the other hand there are few places in the southern regions that nourish so many useful animals. (Peron 1802 in Micco 1973:11)

Tasmanian Aboriginal people were however observed visiting the less isolated Hunter Islands by early European explorers (Bowdler 1980:12-13; Meston 1936). These islands are relatively close to mainland Tasmania and are accessible by sea crossings of less than 5 km. According to the early historic accounts, Aboriginal people visiting the Hunter Islands swam between islands in the Hunter group (Bowdler 1980:12-13). Bowdler (1988) and Meston (1936) suggest that watercraft were probably used too in prehistoric times to make the crossing between the northwestern tip of Tasmania and Hunter Island itself. Although there are no historic accounts of the use of watercraft by Tasmanian Aborigines living along the north or northwestern Tasmanian coastal areas, it is considered highly unlikely that people would have been able to swim the treacherous strait between Hunter Island and northwest Tasmania (Robinson in Plomley 1966:176).

ARCHAEOLOGICAL BACKGROUND

Until the twentieth century, few people could conceive that Tasmania was occupied by an Aboriginal population in Pleistocene times — let alone for the vast time span of thirty thousand years or more now indicated in the archaeological record (Cosgrove 1989). When anthropologists first began to address the question of the origin of the Tasmanian Aboriginal people, it was assumed that the first Aboriginal colonisers had arrived in Holocene times (Abbie 1951:91; Casey 1940: 26-29; Macintosh 1949:142; Mitchell 1949:3; Noetling 1911; Wood Jones 1934). Furthermore, it was generally believed that the indigenous Tasmanian people were a separate race from the mainland Australian Aboriginal population. For many years it was widely believed that the
Tasmanian Aboriginal ancestors arrived there by direct maritime voyages from the Pacific and other foreign regions (Casey 1940:22; Macintosh 1949:142; Mitchell 1949:3).

In light of early preconceptions about the Aboriginal colonisation of Tasmania, the original absence of archaeological evidence on the remote Bass Strait islands was not considered anomalous. In fact, it was seen to support the explanation that cultural and physical variation between Tasmanian and mainland Australian Aboriginal populations was a product of the foreign, or a non-Australian, origin of the Tasmanians.

In the 1920s, geographers were finding increasing evidence that Tasmania was connected to mainland Australia at a phase of lower sea level associated with the terminal Pleistocene glacial maximum (David 1924). This caused some debate about the origins and antiquity of the Tasmanian Aboriginal population as it was soon recognised that Tasmania could have been initially colonised in times of lower sea levels, by people travelling overland via a Bassian landbridge (David 1924:125-128; Tindale 1941:144). Since there was no evidence as to the antiquity of human occupation in Australia or Tasmania, the debate concerning the initial colonisation Tasmania continued until well after the advent of radiocarbon dating (Abbie 1969:196-198).

The first archaeological evidence of Aboriginal use of the Bass Strait islands was found on Flinders Island in the 1930s (Mackay 1946). Unfortunately the discovery of stone artefacts on Flinders Island in the 1930s did not provide conclusive evidence of landbridge migrations as there was some doubt as to the prehistoric status of the artefacts. It was suggested that the stone artefacts had been left on Flinders Island in historic times by the group of Tasmanian Aborigines who had been taken to the island during the 1830's by G. A. Robinson (Bowdler 1979:39; Jones 1968:200).
Despite the stone artefact finds during the 1930s and 40s on Flinders Island, no further archaeological work was undertaken on the Bass Strait islands for several decades. Jones' excavations in the 1960's at Rocky Cape however focused archaeological attention on the Bass Strait region again, and Bowdler's subsequent discovery of 23,000 year old human occupation at Cave Bay Cave on Hunter Island provided the first Pleistocene dates of human occupation in Tasmania (Jones 1965, 1971; Bowdler 1979). This confirmed the then generally accepted belief that Tasmania was colonised by mainland Australian Aboriginal populations traversing a Bassian landbridge. Prior to Bowdler's investigations, the oldest dated Tasmanian archaeological site was Rocky Cape where radiocarbon dates for the lowest level of cultural remains were obtained by Reber and Jones in 1960s (Jones 1971; Reber 1965). These were 8120 ± 165 BP (GXO-226) and 7465 ± 150 BP (V-86) respectively (Jones 1971:198).

**Hunter Island**

Excavations at Cave Bay Cave revealed a number of occupation phases in the period between about 23,000 and 1,000 years ago (Bowdler 1979, 1984). The Cave Bay Cave evidence suggested that palaeoecological changes over time were reflected in the archaeological remains. Bowdler (1979:360, 1984:138) suggests that the earliest occupation period between about 23,000 and 18,500 years ago, represents use of the cave when it would have been an inland plateau shelter. This initial occupation phase represents use of the cave during the coldest period of the last glacial, when sea levels were more than 100 metres below the present level and Tasmania was connected to mainland Australia by a vast Bassian landbridge.

The archaeological evidence indicates that at this time, the cave was probably being used ephemerally by people exploiting the terrestrial fauna of the open grassy steppe or lowland plains of the Bassian landbridge (Bowdler 1984:136). Human visits to the
cave virtually ceased for over ten thousand years after this early occupation period. Apart from one sporadic visit to the cave about 15,500 years ago, it appears that the cave was not reoccupied with any intensity until about 6,600 years ago when shellfish remains first appear in the deposit. At this time the post-glacial sea level rise would have brought the shoreline and littoral resources to the immediate vicinity of the cave (Bowdler 1984:136).

There were two major occupation phases evident in the Holocene sequence from the Cave Bay Cave site. The lower midden, the earlier of these phases, is associated with the initial arrival of the shoreline. Use of the cave appears to have continued for several thousand years from this time until about 4,000 years ago. Occupation of the site ceases at this time and does not recommence until about about 2,500 years ago. Dates from this upper midden phase suggest that it was deposited between about 2,500 and 1,000 years ago. The Cave Bay Cave site then appears to have been abandoned once again, although people appeared to have continued to visit the Hunter Islands from the adjacent northwest Tasmanian coast until historic times (Bowdler 1988:46).

Radiocarbon dating of remains from other midden sites on Hunter Island, and the nature of the remains, indicate that the island was probably visited seasonally during the last two thousand years or so (Bowdler 1988:46; Geering 1982; O'Connor 1982). The resource exploitation pattern evident in the more recent sites and in the upper midden level in Cave Bay Cave is at variance with that evident in the lower Cave Bay Cave midden. Whereas there was no evidence of intensive exploitation of sublittoral shellfish, crayfish, or albatross in the lower midden, these were present in the more recent sites and the upper midden in the cave. Seal bones were also present in most of the open sites, with the Little Duck Bay remains indicating a focus on seal resources similar to that at West Point on the west coast of mainland Tasmania (Bowdler 1979:309, 1988:50; O'Connor 1982:136).
Hence, it has been suggested that the most recent phase of Holocene occupation on Flinders Island represents seasonal use of the island, by people who were part of the broader west coast Tasmanian economic system which appears in the archaeological record from about 3,000 years ago (Bowdler 1988:52). One salient point about this evidence from both the recent and earlier Holocene phases of occupation on Hunter Island, is that people almost certainly possessed watercraft capable of crossing from northwest Tasmania to Hunter Island (Bowdler 1980:13, 1988:48; Meston 1936).

**Flinders Island archaeological research**

Between 1975 and 1979 further stone artefacts were found on Flinders and several other of the more remote Bass Strait islands (Jones 1979; Jones and Lampen 1978). More importantly, prehistoric shell middens were also discovered in several locations along the west coast on Flinders Island (Orchiston and Glenie 1978). From the latter evidence Orchiston (1979b:134) concluded that there was a relict human population which, after becoming stranded on Flinders Island about 8,500 years ago, survived for 'at least 1500 years' before they eventually became extinct. His findings were based on midden excavations he conducted in an extensive dune blowout at Palana, on the northwest coast of Flinders Island (Orchiston and Glenie 1978; Orchiston 1979a; 1979b, 1984).

During these investigations he attempted to establish the chronological relationship between a palaeosol horizon containing stone artefacts, shellfish food remains and charcoal, and the deposition of these cultural remains. Three radiocarbon dates were obtained from charcoal samples excavated from the palaeosol; 9890 ± 175 BP (SUA-640), 7150 ± 135 BP (SUA-641) and 6520 ± 130 BP (SUA-642) (Orchiston and Glenie 1978:130-131). Although the dated charcoal was recovered from a stratigraphic unit containing cultural remains, no radiocarbon dating of the remains that were clearly of cultural origin was carried out by Orchiston. There was no evidence to suggest that
charcoal in the palaeosol was anthropogenic in origin (for example charcoal associated with hearths) although burnt calcareous nodules which Orchiston interpreted as hearth stones were recorded in the midden vicinity (Orchiston 1979a).

However, no hearth arrangements or constructions were recovered during the Palana investigations and furthermore, similar calcareous stones were observed in many places both at Palana and also in locations on the west coast of Flinders Island where no flaked stone or shellfish remains were found (pers. obs.). Since these type of stones appear to be a natural formation changed by fire, and that natural bushfire activity is clearly evident at the Palana site, there is no evidence to support the interpretation of these rocks as hearth stones. Hence, the charcoal in the palaeosol also containing cultural remains, was not necessarily associated with hearth fires or other human activity, and could not provide a secure occupation date.

The oldest charcoal sample of 9,890 BP was recovered from what Orchiston refers to as 'the occupation palaeosol', although it was collected from a stratigraphically lower level than that containing the archaeological remains (Orchiston 1984:54). It is stated that the more recent dates of 7150 BP and 6520 BP 'relate directly to the occupation' because of their stratigraphic association with cultural remains (Orchiston 1984:56).

In the absence of directly dated cultural remains however, it is difficult to assess some aspects of Orchiston's Palana midden investigations since no section drawings have been published. Although there has been a number of articles published, which outline Orchiston's interpretation of the evidence, these do not include a detailed site report (Orchiston 1979a, 1979b, 1979c, 1984; Orchiston and Glenie 1978). A full report of the primary data obtained from the Palana excavations, and the results of other excavations and radiocarbon dating reportedly undertaken on other Flinders Island middens (Orchiston 1979b:134), has not been published to date.
Prime Seal Island Cave Excavation

In 1988 and 1989 Brown excavated Mannalargenna Cave site on Prime Seal Island about 5 km west of Flinders Island (Brown 1988, 1990; Harris 1988) [Fig. 1]. The most recent occupation of this site in prehistoric times appears about 8,500 years ago according to radiocarbon dating of charcoal from the uppermost occupation levels. The cave appears to have been in use, probably sporadically, from at least 20,000 years ago until about 8,500 years ago. A number of worked shell and stone artefacts were recovered from over three and a half metres of archaeological deposit (Brown 1990). The shell artefacts appear to have been manufactured from shells collected from fossil shell beds, and therefore do not represent coastal exploitation. There is no evidence in Mannalargenna Cave indicating that the cave was used since Prime Seal Island, or the greater Furneaux Group, would have become islands with the last sea level rise.

Aboriginal site surveys on King and Flinders Islands 1988 -1989

Flinders Island

In 1989, I located previously unrecorded shell middens in more than ten localities on the west coast of Flinders Island during an Aboriginal site survey contract (Sim 1989:24). The results of the survey suggested an alternative prehistoric occupation model to the extinction scenario proposed by Orchiston (1979a). Prior to the 1989 survey it had been assumed that because the Flinders Island archaeological evidence consisted of shellfish remains, it must have been deposited by people on the island when the sea was at level similar to that at present. The implication of this being that the presence of middens per se was satisfactory evidence of occupation more recent than about 6,600 BP on Flinders Island (Orchiston 1979b:134).
The survey results however questioned this latter assumption (Sim 1989). It was argued that local topographic conditions could result in the distance of a midden from the shore being constant, despite considerable changes in sea level (Sim 1989). This situation being best exemplified by middens on steep headlands or cliffs, where the steep underwater topography results in deep water being found very close to the shore. In such locations a major change in sea level may effect virtually no change in the distance to the sea from the middens.

The Flinders Island survey results identified a clear coincidence between the location of shell middens, and places where the sea floor dropped away sharply. Since prehistoric middens were absent in other areas, this coincidence suggested that the middens had possibly been deposited in times of lower sea level but when when the shoreline was within close proximity to the shellfish middens. Hence, the survey results suggested an alternative island occupation model, whereby the island was abandoned rather than being occupied by a stranded population. The abandonment model suggested that the island inhabitant left either before the last land link to mainland Tasmania was inundated by the sea, or sometime shortly after this when the islands had already formed and the seas were still somewhat lower than at present (Sim 1989).

In this latter scenario, in terms of a watercrossing Tasmania would not have been as distant from Flinders Island as at present. For a thousand or more years, it may have been possible that the distance between the Furneaux Group and mainland Tasmania was within the range of prehistoric watercraft. Ultimately however, with the continuing sea level rise and concomitant increase in distance to Tasmania, the islands became beyond the range of watercraft. Visits to the island thus would have ceased sometime before about 6,600 years ago when the sea reached its present level. It was clear however, that until secure dates for occupation of the Flinders Island midden sites
were obtained, the question of whether the island was either abandoned or continued to be occupied by a stranded population, could not be resolved further.

King Island

On the western side of Bass Strait on King Island, the first evidence of prehistoric Aboriginal occupation was not recorded until 1979, nearly fifty years after the first discovery of stone tools on Flinders Island. The first prehistoric site on King Island was recorded by Jones (1979) when he found stone artefacts at the Petrified Forest in the southwest of the island. Here, charcoal was recovered from an eroding section of an aeolian dune, which also contained stone artefacts in the same stratigraphic context as the charcoal. The radiocarbon date of the charcoal indicated that it was about 7,500 years old (Jones 1979). Jones suggested that these King Island artefacts, like the Flinders Island middens, were deposited by people who had been 'stranded' on the island for some thousands of years as a consequence of the Holocene marine transgression (1979:92).

In 1988, I conducted an Aboriginal site survey on King Island (Sim 1988). The results of this survey indicated that there was little evidence to support Jones' suggestion. While a considerable number of prehistoric sites was found and recorded on both islands between 1988 and 1989, there was little evidence to suggest that the island was occupied after it became isolated from Tasmania. During the King Island survey, only one site was recorded where there were shellfish remains which were clearly of prehistoric antiquity (Sim 1988, 1990).

The geomorphological context of this latter site suggested that the cultural shellfish remains had been deposited in the mid to recent Holocene period (Sim 1990). Although other shell accumulations were observed in many deflated lag deposits in sand dune blowouts on the island, it was unclear if these were in fact prehistoric human
food remains. It was also possible that the deflated remains could be associated with historic Aboriginal occupation of the island in the early nineteenth century (Sim 1990).

Current research

In order to investigate the question of occupation of Flinders and King Islands by stranded populations, it was clearly apparent that it would initially be necessary to establish more precisely the age of both the islands' midden sites. It was also clear that in order to evaluate this data within the more general framework of prehistoric land use patterns in the Bassian region, further archaeological data were also required. It was intended that this project would provide datable stratified long-term sequences of cultural remains, and a series of short-term occupation sites, spanning phases of major palaeoenvironmental changes in the Bass Strait region.

Evidence of this nature would enable the question of regional human response to palaeoenvironmental dynamics related to sea level changes, to be addressed in a broader context than the midden sites alone could provide.

Test Excavations

Subsequent to the site survey work that I had undertaken on King and Flinders Islands, several test excavations were carried out in caves on King and Flinders Island (Sim 1988, 1989). The test excavations on King Island in 1989 were funded by a research grant from the Australian Institute of Aboriginal Studies. These were test excavations because it was not clear from the initial survey work whether it would be possible to recover stratified datable archaeological material from the open sites or caves on the island. Although none of the caves had cultural remains visible on the surface deposits, five caves had been recorded as 'potential sites' (Sim 1988). It was apparent that sediments had built up in these caves in the recent prehistoric past, and possibly after
the time the island regions were inhabited by people. Therefore, the absence of surface artefacts was not necessarily an indicator of the absence of human use of such places in the past. Since the caves may have been used in prehistoric times and thus contain cultural material buried in the cave deposits, these potential sites provided one focus for the excavation project.

Several months were spent on King Island, between August 1989 and February 1990, excavating in the caves and also at several open sites in order to obtain stratified datable cultural remains. Charcoal and shell were collected for dating purposes, both from some excavated deposits and from dune blowouts. In order to obtain comparative data from Flinders Island, and to test the occupation models suggested for Flinders Island, further field work was also carried out there between November 1989 and March 1990. Two small coastal limestone rockshelters were excavated and a number of shell and charcoal samples collected from open midden sites for comparative radiocarbon dating.

The data collected from these investigations on King and Flinders Islands have been used in this thesis to investigate the prehistoric occupation of the Bassian region, and the relationship of island use to palaeogeographical changes in the Bassian area associated with sea level changes. More specifically, the archaeological evidence has been assessed with regard to the widely accepted concept that these islands were occupied for some thousands of years in the mid-Holocene by (now extinct) groups of people, who inadvertently became stranded there after rising seas severed access to greater Tasmania (Jones 1979; Orchiston 1979b).

In the next chapter the physical environment of the region, including a discussion of the palaeoenvironmental changes that effected the formation of the Bass Strait Islands is outlined.
Chapter 2

THE BASS STRAIT ISLANDS PHYSICAL ENVIRONMENT

GEOGRAPHY

The island of Tasmania is separated from mainland Australia by the Bass Strait, a notoriously changeable stretch of sea some 200 km across [Fig. 1]. There are reportedly 126 exposed rocks and islands in the Strait, the largest of which are Flinders Island in the east, and King Island in the west (Murray-Smith 1987:13). Due to their marked topographic relief, Flinders and other islands in the Fumeaux Group can easily be sighted from mainland Tasmania, whereas King Island can only be sighted from the Hunter Islands (Edgecombe 1986:75; Robinson in Plomley 1966:663).

King Island is the most geographically isolated island in the Bass Strait, being 55 km distant from Black Pyramid, and some 85 km from Hunter Island [Fig. 1]. Black Pyramid is a large rock southeast of King Island. It is approximately 2 km in circumference, and rises steeply to a height of 75 m above sea level. It is accessible by a small boat landing and has a large dry cave above sea level. There is another landing on Reid Rocks, midway between King Island and Black Pyramid. Reid Rock, the main rock in this group is about 8 hectares in area and is about 12 m above sea level. Unlike Black Pyramid, the Hunter Isles and King Island, this rock is not visible from any great distance due to its low topographical relief.

Flinders Island is much more readily accessible by sea from Tasmania than King Island. The greatest open sea crossing between Flinders Island and mainland Tasmania is the 16 km Banks Strait traverse via Swan Island [Fig. 1]. The distances between the Tasmanian and Australian mainlands, and the Bass Strait islands, is discussed more
fully with reference to the archaeological data and the prehistoric use of watercraft in
Chapter 7.

The Bass Strait region is bounded by the eastern and western edges of the continental
shelf between mainland Australia and Tasmania [Fig. 1]. Consequently it is a
relatively shallow stretch of water, the deepest areas being the Bassian basin and that
between Cape Otway and northwest of King Island, both of which are about 90 m deep
(Jennings 1959a, 1987:22). The infamously rough seas of the Bass Strait region are
due to the combined effects of the shallow bathymetry, and exposure of the strait to the
seasonal swells and winds of the roaring forties coming directly from the Southern
Ocean.

PALAEOGEOGRAPHICAL CHANGES AND ISLAND FORMATION

Palaeoenvironmental reconstruction is a crucial factor in determining when the Bass
Strait islands were initially formed, and thus what chronology of archaeological
evidence can be attributed to island occupation as opposed to landbridge or peninsula
occupation. It is also relevant to determining when the islands would have become too
distant from larger land masses to be accessible without the aid of watercraft. There are
however inherent limitations in the data available, not only in regard to past sea levels,
but also other factors such as shelf sediment movements and hydrological processes.
These latter factors are often overlooked although they have undoubtedly played a
major role in the palaeoenvironmental dynamics in the Bassian region (K. Black pers.
comm.).

Aeolian dune formations which at present reach heights of 30 m on the islands and in
northeast Tasmania, are testament to past dune building activity on the Bassian plain
(Bowden 1983:171-72; Jennings 1959b; Kershaw and Sutherland 1972). There is also
evidence that submarine scouring and movement of sediments has occurred in the Bass
Strait as a result of past sea level changes (Jones H.A. and Davies 1983; Jones H.A. and Holdgate 1980). The present bathymetry of Bass Strait therefore cannot be regarded as representing the palaeo-bathymetry (or past topography) of the region. At best, it can be regarded as an approximation of past land and seabed topography.

Hence, there is an inherent degree of uncertainty when using current bathymetric data in conjunction with past sea level curves, to reconstruct the palaeogeography of the Bassian region. Sea level curves are similarly problematic and are therefore represented by a range of levels for any particular point in time. The late Pleistocene and Holocene sea level curve for the Bassian region has been reconstructed from Chappell (1990:40) (based on Thom and Roy 1985; Chappell et al 1982; Hopley 1987), and incorporates a correction offset for variation in continental shelf areas as advised by Chappell (pers. comm.) [Fig. 2]. These data indicate that according to the present bathymetry, Flinders Island would probably have first become an island sometime between about 9,000 and 11,000 years ago, and King Island between about 11,000 and 12,500 years ago.

Since there is evidence of seabed scouring which suggests that the sediments have been removed from the seabed in the straits between the islands and Tasmania, the dates for initial island formation are probably somewhat older than the actual time of first cut-off (Jones H.A. and Davies 1983; Jones H.A. and Holdgate 1980). Due to the presence of sediments which would have been removed with the breaching of the critical sills and subsequent tidal scouring, the depths of the relevant channels between the islands and Tasmania were probably shallower in the past. Therefore if sediment thickness were in the past up to 10 m more than at present (in the strait areas between the islands and mainland Tasmania), the initial island formation date for Flinders would be between about 10,000 and 8,000 years ago, and for King Island between 11,500 and 10,000 years ago [Fig. 2]. Hence the cut off time for the islands was probably up to several
thousand years more recent, than indicated by a direct correlation between the sea level curve and the current depth of the straits between the islands and mainland Tasmania.

Figure 2: Sea level curve and King and Flinders Island formation

The process of island formation would have involved the prior breaching of the land bridge connecting Australia to Tasmania, most probably with a strait to the north of both Flinders and King Islands, and possibly an embayment in the Bassian depression (Blom 1988). At this stage both of these islands would have existed as broad peninsulas attached to Tasmania. Further increases in sea levels would have seen the island areas as promontories, each connected to Tasmania by an isthmus for some period prior to the final breach and island formation stage; with the King Peninsula being breached first, and the Flinders Peninsula one or two thousand years later.
The actual breaching of the isthmus may have also involved both dune building and sediment scouring as the encroaching seas cut narrow swift flowing channels through the isthmus (Black pers. comm.). The complex nature of the geomorphological processes associated with isthmus inundation, makes it difficult to determine just when the islands would have become inaccessible without watercraft. It is apparent however, that by about 8,000 years ago, both islands were well beyond the range of people swimming from mainland Tasmania, as the sea would have been only about 10 m lower than it is at present [Fig. 2]. By about 6,600 years ago the sea in this region probably reached a level slightly higher than that of today, although at this time the islands' shorelines would have principally been in their present location.

Palaeoecological changes would have been effected by the changes in sea level in the terminal Pleistocene and Holocene times in the Bassian region. Distribution patterns of faunal species in the Bassian region would have altered dramatically with the broader environmental changes. Not only would extinction of some terrestrial species have occurred on the islands, but also colonisations by seal and seabird populations, and marine invertebrates, would have occurred in new coastal regions (Bowdler 1984; Hope 1973, 1987).

KING ISLAND

Topographic Description

Although of similar size, King and Flinders Islands are markedly different in terms of their topography. While Flinders Island is typified by mountain ranges with peaks up to 756 m, King Island has a markedly lower relief with its highest point, Mt Stanley, being less than 159 m above sea level. King Island is 65 km long from north to south, and 25 km wide from east to west, and covers an area of 1099 km² (Pryor 1987:52).
The northern part of King Island is generally below 40 m and markedly flatter than the plateau area in the southern area of the island.

To the north of the southern plateau region, the low lying northern swamps and flats are relieved by a small range of hills on the east coast, and by aeolian coastal dune formations in the west [Fig. 3]. These aeolian dunes are found virtually along the entire west and northwest coastal regions. They are also evident to a lesser extent on the west coastal fringe of the southern plateau area where, in places, the dunes are found perched on top of 60 m high sea cliffs (Jennings 1959b; Jones 1979). Stephens and Hosking (1932) have identified two west coast dune formations;

a) an early formation of low relief with distinctive dark red/brown calcareous sediments known as the 'Yambacoona Sands', and

b) the more extensive, and markedly higher, more recent dunes of the 'Currie Calcareous Sands', a distinctive pale yellow, coarse shelly sand.

The latter dunes are known as 'new dunes' (Jennings 1959b:7) and are an extensive formation, often 70 m or more in absolute height and extending up to 3 km inland. The dune heights however in places reflect the underlying landform, and the actual thickness of the new dune sediment deposits themselves are up to 30 m (Jennings 1959b:7). In places these new dunes clearly overlie the darker 'old dunes', with the older dunes extending further inland (Jennings 1959b; Stephens and Hosking 1932) [Fig. 3]. There are also several buried palaeosols which form extensive stratigraphic horizons in the new dune sediments. These are exposed in eroded sections in dune blowouts along the west coast, and in most locations the palaeosols are flecked with charcoal fragments. These horizons mark episodes of dune mobility associated with firing of dune vegetation in both historic and prehistoric times.

The east coast of King Island is bounded by generally low to medium energy shorelines, characterised by long sandy beaches in the north, and some rocky shore
areas and smaller bays in the southeast plateau region. The west coast is predominantly high energy, hard rocky shores in the south, and long beaches interspersed with rocky headlands in the north. While all coastal areas on the island are exposed at times to strong prevailing winds, high energy coastal regions are generally found on the west coast. This coast has a strong similarity to the exposed west coast environments of mainland Tasmania.

Geology

Most of the island bedrock is covered by Quaternary alluvium and aeolian dune deposits. These more recent sediments overlie the four major bedrock formations that form interlaying longitudinal bands [Fig. 4]. The western-most geological zone is the Precambrian granite, extending nearly the full length of the island. In contrast, the eastern most side of the island is predominantly a zone of unmetamorphosed sedimentary bedrock. Between these two zones are two metamorphic bedrock formations. These have been metamorphosed to varying degrees by the intrusions of the west coast granite formation, and include grey quartzite formations in the granite contact zone. Also along this contact zone are a few more recent intrusions of a rhyolitic dyke material.

Several smaller, more recent Devonian granite intrusions along the east coast have caused additional localised metamorphic contact zones. These intrusions are located near Grassy in the southeast, and further north near Sea Elephant River. These granitic intrusions are reflected in the island's topographic relief, that is the elevated southern plateau and east coast hill areas.
Figure 3: King Island dune formations (after Jennings 1959b)
Figure 4: King Island geology (after Gresham 1972)
Artefact Stone Sources

On King Island there are few sources of the fine-grained, hard siliceous rock types with conchoidal fracturing properties (such as silcrete and chert), which are generally preferred for knapping or flaking (Sutherland 1972:2). There are however, a number of sources of quartzitic rock types on King Island which were exploited for stone artefact manufacture in prehistoric times. There are also numerous quartz outcrops associated with the granite formations, and widespread float sources of quartz on the island. These are located in both granite and metamorphosed quartzite areas where aeolian sediments are absent.

One other potential quartz stone source on the island is crystal quartz. Artefacts from this material have been recorded on sites on the island although the use of crystal quartz was not common (Sim 1988:66). Large well-formed quartz crystals have been found in the upper reaches of Sea Elephant River in the centre of the island (L. Sullivan pers. comm.).

There is also a rhyolitic dyke stone suitable for flaking found in small outcrops in places along the coastal cliffs of the southwest region. One of these outcrops is in close proximity to an extensive artefact scatter on the Cataraqui Point south headland. There is evidence at this site of on-site working of the rhyolitic stone and quartz from outcrops in the immediate vicinity.

The Precambrian quartzite belt in the southern and central parts of the island, is found inland of the west coast granite. This formation is evident in at least two surface outcrops of fine-grained grey quartzite. These boulder outcrops have a distinctive weathering fracture pattern which produces large flat surfaced blocks. The outcrops have only been observed along the coastal zone in the west and southwest of the island and the majority of these sources have been exposed by wave activity sometime since
the shoreline was established at or near its present position (about 6,600 years ago, Chappell and Shackleton 1986).

At the contact zone of the west coast granite in the far northeastern tip of the island there is a localised source of fine-grained and highly siliceous granite. This stone has been quarried in historic times to provide building material. Although granite is not normally employed for artefact manufacture in Tasmanian assemblages, one highly siliceous granite artefact was recorded on New Year Island, a small island about 5 km off the west coast of King Island (Sutherland 1972:2).

Contact zones in the southeast of the island contain a range of hornfels rocks including fine-grained types which fracture conchoidally when knapped. Artefacts from these stone types have been recorded on the island (Sim 1988:66) and hornfels is one of the more common artefact stone types used in mainland Tasmanian assemblages (Sutherland 1972). Outcrops of hornfels in the southeast contact zones are uncommon but the stone is accessible in some river channels downcutting from the elevated granite regions.

Along the southeast coast of King Island there is another source of artefact stone in the conglomerate tillites found along the coastal strip between Grassy and Naracoopa [Fig. 4]. This rock is of ancient glacial origin and contains a wide range of stone types including quartzites, jasper, siliceous dolomite and gabbro (Gresham 1972:15). The tillite matrix also contains highly ferruginous materials which are a good ochre source. Pebble beaches along this stretch of coast include water rounded pebbles and large ochre cobbles and pebbles from the eroding tillite formation. The consistency of the ochre varies from soft powdery and greasy material to more consolidated rock.

Exposure of the conglomerate formation at present however, is limited to a few creek beds and, most predominantly, the shore margins. In times of lower sea levels this
stone source may not have been so readily accessible as the conglomerate formation is generally overlain by other rock sequences and alluvium (Gresham 1972). By and large, there are few stone sources on the island which would have been generally accessible before the marine transgression, except for the quartz and quartzite outcrops on the west coast. Sources of higher quality stone types found more generally in Tasmanian assemblages, were limited to localised sources exposed by coastal processes in the southeast coast.

FLINDERS ISLAND

Topographic Description

Flinders Island is slightly larger in area than King Island, and is the largest of the Bass Strait Islands. It is about 65 km long, northwest to southeast, by 28 km wide and covers an area of 1374 km² (Pryor 1987:52).

In sharp contrast to the gentle undulations of King Island, the Strzelecki Peaks on Flinders Island rise dramatically from sea level to a height of 756 m. There are also a number of other peaks higher than 400 m on the island. These are part of several mountainous granite ridges that rise steeply from the surrounding low lying, swampy flats and coastal plains. The coastal zone of the west and southwest coasts is characterised by high energy rocky shores, interspersed by long sandy beaches. The east coast is somewhat different in nature, being generally flatter terrain with extensive stretches of sandy beach, several inlets and estuaries, and few rocky shore areas.

Flinders Island, like King Island, has extensive dune formations evident both around the coast, and as lunettes fringing the shores of some of the island’s existing and extinct (or drained) lagoons. There is also on Flinders Island, a broad similarity to King Island coastal landforms with calcareous aeolian sand dune formations fringing the west coast,
and highly silicious mobile dunes in the lower energy eastern coasts.

Geomorphologically, the dune systems on Flinders Island present a palimpsest of numerous late Pleistocene and Holocene depositional episodes. Consequently, the depositional history of the Flinders Island dune formations is somewhat more complex than that of the King Island 'new' and 'old' dunes (Jennings 1959b:7, Kershaw and Sutherland 1972). Well developed palaeosols are evident in west coast dune blowouts which suggest periods of dune stability in the past, although the chronological relationship between palaeosols in different locations is unclear (Kershaw and Sutherland 1972).

Geology

The bedrock geology is more apparent on Flinders Island than it is on King due to the greater exposures and outcrops of rock. These are a consequence of the great diversity in topographic relief that has resulted from an Upper Devonian granite intrusion. This is the predominant geological sequence on Flinders Island of which the Strzelecki Range, The Patriarchs, the Darling Range and the peaks around Kiliecrankie are composed.

These mountainous areas are part of a larger granite batholith which intruded the regional sedimentary siltstone, sandstone and mudstone beds (the Lower Devonian Mathinna sequence) and a patch of older Precambrian granite near Pat's River (Pinkard and Richley 1982:10; Sutherland and Kershaw 1971) [Fig. 5]. Some metamorphic rocks occur at granite contact zones, although these are generally not exposed as weathered granite alluvium with quartz float comprises the surface geology in most areas of the island.
Figure 5: Flinders Island geology (after Pinkard and Richley 1982)
Subsequent to the Upper Devonian granite intrusion, there were a number of small basalt flows in the area and a sedimentary marine limestone formation was laid down in what are now the lowland areas of the island. This latter sequence is classified as a Miocene event (Pinkard and Richley 1982).

More recent geological sequences are a) the alluvial deposits of the lowlands and plains, and, b) the aeolian late-Pleistocene and Holocene deposits associated with sea level changes and other coastal geomorphological processes (Kershaw and Sutherland 1972:6-8; Pinkard and Richley 1982:10). The alluvium sediments are originating from the weathering of the upland granites, whereas much of the coastal dune formation sediments probably originated from what are now offshore sources. The Pleistocene limestone found principally along the west coast is a calcareous aeolianite formation which directly overlies the granite foreshore boulders and platforms along the coast (Jennings 1961:82-84; Kershaw and Sutherland 1972). Holocene coastal processes have formed rockshelters in the calcareous aeolianite limestone in places along the west coast.

Artefact Stone Sources

On the island, there are few sources of the rock types commonly found in Tasmanian artefact assemblages (Sutherland 1972:2). The main sources of hard siliceous stone are the contact zones surrounding the Upper Devonian granite intrusions which have formed the mountainous upland areas. Some fine-grained and siliceous quartzites and cherty hornfels outcrops are located in the contact zone areas (Sutherland 1972:8), although there is no evidence of intensive exploitation of these stone sources apparent in surface scatters on the island (Sim 1989:33-34).

The granites themselves, have on occasions been employed as knapping stone. Although on Flinders Island there are a few granite flakes recorded, the predominant
use of this stone type is for grinding and hammer stones. These artefacts are generally made from granite beach and/or river cobbles. Although watercourse sources are not common on the island, there are extensive hard shore areas on the west coast where granite cobbles are found in abundance.

Another artefact stone associated with the granite outcrops and shoreline exposures, is reef quartz. Similarly, both clear and smokey quartz crystals are found in association with the granites. All three types of quartz have been exploited for artefact manufacture by people in the region in the past (Orchiston and Glennie 1978; Sim 1989:33). Flakes knapped from pieces of indurated coastal limestone were also recorded on some of the west coast midden sites although this was not a widely employed flaking material neither on the island nor in Tasmania (Sutherland 1972).

Naturally-occurring ochre nodules were evident in situ in direct association with the calcareous limestones along the coast in the northern part of the island. Although no such material has been recovered from excavated archaeological deposits on the island, there were several pieces observed in geologically foreign contexts in the Palana midden scatters (pers. obs.).

Near Lady Baron on the southern coast of Flinders, there is a mineralised (chalcedonic) wood formation. Although similar material has been recorded in flaked mainland Tasmanian assemblages (Sutherland 1972:7), no evidence of exploitation of this island source has been discovered (Sim 1989:9).

REGIONAL CLIMATE

King and Flinders Islands are both located in the forty degree latitudes, and thus bear the unimpeded brunt of the roaring forties during the winter months. These strong prevailing westerly winds of the southern latitudes, sweep across the southern edge of
the continent seasonally bringing rain-producing depressions and cold fronts from the Southern Ocean (Gaffney 1986:7). Consequently the Bass Strait islands are subject to intense prevailing westerly winds, with a predominance of a northwesterly pattern in winter and southwesterly between October and February (Langford 1965). The strait is also subject to less frequent but equally intense northeasterly squalls throughout the year.

In the summer months, the southerly migration of the mid-latitude low pressure belt (which brings the roaring forties to Bass Strait), has an ameliorating effect on the weather conditions in the Bass Strait, and long stretches of fine clear weather with light winds are common (Edgecombe 1985:18; Gaffney 1986:6-7;). The Flinders Island average monthly rainfall for January is 41 mm, whereas the July average is 90 mm. Summer droughts are not uncommon on the Bass Strait Islands, particularly on Flinders Island, as the majority of the annual rainfall occurs seasonally in winter (Pinkard and Richley 1982:8).

The Bassian region in general reflects the west - east cline in rainfall evident in Tasmania where the western region has a significantly higher rainfall than the east (Langford 1965). This pattern extends to Bass Strait with King Island having the annual average rainfall is about 850 mm, whereas Flinders is about 750 mm. The greatest contrast is however in the number of rain days per year which is on average 212 on King Island yet only 111 on Flinders Island (Hope 1973:164).

Island temperatures reflect the moderating effects of the maritime environs, with an average maximum of about 21° C in summer and 13° C in winter on both islands. Minimum seasonal temperatures are 14° and 6° C on Flinders Island and 13° and 7° C on King Island (Edgecombe 1985:18; Hope 1973:164). Thus the climatic extremes experienced in more southerly, and higher altitude areas on the Tasmanian mainland, do not extend to the Bass Strait Islands. Despite the exposure of the Bass Strait region to
the roaring forties, the islands there generally have a relatively mild mediterranean climatic regime.

WATER SOURCES

King Island

There are numerous permanent freshwater lagoons and swamp areas on the island. The majority of the lagoons are located on the inland junction of the coastal dune system and the flatter inland areas. They tend to be present in depression areas on the geomorphologically older flats, although often the lagoons are being encroached upon (on their seaward side) by the steep inland border of the new dune formation. The lagoons however do not generally appear to be a consequence of the new dunes blocking past drainage channels (Jennings 1957). Jennings (1957:61,62) suggests that the King Island lagoons were probably formed about 125,000 years ago during the last inter-glacial period, and, that their formation is most likely related to local watertables and old landforms rather than recent dune building episodes. Some lagoons do however show evidence of shoreline alteration due to new dune deposits encroaching on former lagoons (Jennings 1957:62).

Two larger lagoons located on the northern flats, Egg Lagoon and South East Lagoon, have been drained in historic times for stock pasture. The latter now discharges into the brackish coastal swamp formed principally by the discharge of the Sea Elephant River on the east coast. There are a number of substantial creeks and small rivers draining the elevated southern area of the island. In the southeast these are down cutting into the plateau, forming steep gorges where they discharge into the ocean along the southeast coast. On the west coast, most water drains into the lagoons although three small rivers, do cut through the coastal dune formation to discharge into the sea [Fig. 3].
There are also a number of locations on the west coast where drainage from the new
dune sands appears to be feeding coastal springs.

**Flinders Island**

There are only two permanent rivers on Flinders Island, Pats River on the western
watershed of the Darling Range, and Big River which is the main drainage channel on
the eastern watershed of the Strzelecki Peaks. Both these rivers have relatively short
watercourses which cross the narrow coastal plain before discharging into the sea.
There are however numerous lagoons and inlets on the low lying flats areas of the
island. Although many of the east coast lagoons now are brackish, others are
permanent fresh water sources and many more are ephemeral or seasonal sources.
Earlier this century, there were also extensive swampland areas on the eastern flats and
north of Emita on the west coast. Prior to their being drained for pastures, these
would have also been relatively reliable fresh water sources (Edgecombe 1986:41).

**VEGETATION**

The vegetation on both King and Flinders Islands has undergone extensive
modification in historic times with widespread firing and clearing for pastoral purposes
(Edgecombe 1986:41; Green 1969:3; Green and McGarvie 1971). Some areas with
natural vegetation have been preserved, and historic accounts and surveys provide good
descriptions of the islands' vegetation prior to European pastoral settlement (Barnard
1826-7; Brown 1887a, 1887b; Harris 1988). On King Island large eucalypt butts are
relics of the former forests with trees reportedly ninety metres high (Barnard 1826-7;
Micco 1971).

The regional eastern rainshadow effect is to some degree reflected in present Bass Strait
island vegetation patterns. An historic survey indicates that the small patch of wet
sclerophyll forest still present on King Island, extended over much of the southern part of the island prior to European clearing (Barnard 1826-7; Hope 1973:164). The predominant vegetation for most of the remaining area on the island was coastal heath and shrubland, with extensive stands of dense paperbark (*Melaleuca ericofolia*) and tea tree (*Leptospermum laevigatum*).

The undulating new dunes of the west coast support a complex of coastal vegetation virtually devoid of trees, and are dominated by introduced marram (*Ammophila arenaria*) and melilot (*Melilotus indica*) grasses. The introduced African Boxthorn is also common on many of the Bass Strait islands as it was used as windbreaks and fences by early settlers (Hooper 1980:22; Kirkpatrick and Dickinson 1984; Stephens and Hosking 1932:15,17). On King Island the new dune country is sharply delineated by a change in vegetation along the inland dune border. Inland of these grassy dunes, bracken fern (*Pteridium esculentum*) appears, giving rise to the term 'fernbank' for the particular type of areas where this occurs (Stephens and Hosking 1932).

Because of the generally lower rainfall, the natural vegetation on Flinders Island is less lush than King Island. The diversity in the topography of Flinders Island is reflected in its plant communities. These range from the open dry sclerophyll forests, to coastal spinifex or tussock grasslands, saline and freshwater wetlands, she-oak (*Casuarina stricta*) woodlands, wet sclerophyll forests and cool temperate rainforests in the gullies of the Strzelecki peaks (Cullen pers. comm.; Kirkpatrick and Dickinson 1984).

Coastal margins on Flinders comprise a foreshore area dominated by tussock grass (*Poa poiformis*) and small salt resistant bush and shrub species such as kerosine bush and coastal beard heath (*Leucopogon parviflorus*). The immediate hinterlands are generally characterised by dense scrub of tea tree (*Leptospermum laevigatum*), banksia (*Banksia marginata*) and she-oak (*Casuarina stricta*).
The most widespread vegetation type on Flinders Island is however 'scrub-heath mosaic' (Kirkpatrick and Dickinson 1984), and is largely a product of firing episodes. This is found on the lowland hill and plains areas, and is described as closed and open areas of heath and/or scrub with the principal genera being *Leptospermum, Banksia, Melaleuca, Casuarina* and *Xanthorrhoea*. Areas with this type of vegetation are in the main closely wooded although also generally interspersed with small patches of open scrub or heath. These contain *Xanthorrhoea* and eucalypt species commonly found in the dry sclerophyll forests of the island. Both King and Flinders Islands have wetland plant communities of shrubs, reeds, sedges and grasses, around low lying salt and fresh water swamps and lagoons areas (Kirkpatrick and Harwood 1983:441).

The coastal heathlands on both King and Flinders Island include a range of plant food resources which were recorded in ethnohistorical accounts of mainland Tasmanian Aboriginal dietary habits (Hiatt 1967; Labillardiere 1800; Robinson in Plomley 1966; Roth 1899:95-97). The more common plant foods such as bracken roots and coastal beard bush, are all commonly found on both islands.

The vegetation regime on both islands also suggests that plant materials suitable for the construction of watercraft such as those documented in mainland Tasmania, would have been available in prehistoric times (Jones 1976; Roth 1899:155-88). The craft documented in ethnographic accounts were made principally of bark from a range of eucalypt species, paper bark and tea-tree. These comprise the predominant larger tree species on both islands, both at present and in former times.

The natural vegetation on both Flinders and King Islands is of particular interest as the flora of these islands includes both the most southerly recordings of some mainland Australian species, in addition to some Tasmanian species not evident in mainland Australia (Edgecombe 1985:19, 1986:99, 135-140). Hence, vegetation on the Bass Strait islands is the focus of ongoing research into questions of island biogeography.
and palaeoenvironmental effects on both island plant and faunal distributions (Hope 1973, 1987:85-94; P. Cullen, J. Grinrod, A. McNess, pers. comm.).

FAUNAL RESOURCES

Terrestrial fauna and sea mammals

The range of Tasmanian mammals living on Flinders and King Islands is more limited than that on mainland Tasmania. Fourteen of the thirty-five indigenous species known in Tasmania are extant on Flinders Island, and ten on King Island (Edgecombe 1986:145; Hope 1973:176). Additional Tasmanian species have also been recorded as fossil or sub-fossil remains on both islands (Hope 1973). Some of these, such as the wombat (*Vombatus ursinus*) on King Island and the spotted quoll or tiger cat (*Dasyurus maculatus*) on both islands, have become extinct in the times since Europeans first arrived on the islands (Hope 1973) [Appendix I - Terrestrial and marine resources of King and Flinders Islands].

Carnivore predatory species such the Tasmanian Devil (*Sarcophilus harrisii*) are noticeably absent from the islands' present range of terrestrial mammals. This is of interest in light of the role played by the dingo, thylacine and Tasmanian Devil in prehistoric mammal extinctions on the Australian mainland and Tasmania, and the palaeoenvironmental history of the Bassian region and landbridges. Although no thylacine fossil remains have been recovered from any of the Bass Strait Islands, Tasmanian Devil bones have been recovered from coastal rockshelter deposits on Flinders Island (Hope 1973; Sim 1989:22). The context of these indicates that Flinders Island was probably populated by Tasmanian Devils for several thousand years after it became isolated as an island around 9,000 years ago.
Remains of other species now extinct locally on the islands, but still extant in Tasmania and/or mainland Australia are further testament to the existence of Bassian landbridges. These include the Eastern Barred Bandicoot (*Perameles gunnii*), the Forester or Eastern Grey Kangaroo (*Macropus giganteus*), the Eastern Quoll or native cat (*Dasyurus viverrinus*), and Pleistocene megafauna including three different diprotodon species on King Island. A more recent extinction has occurred on King Island with the disappearance of the wombat there early last century. The historic accounts of slaughter of the defenceless wombat by early European island inhabitants, strongly suggests that they were most probably the cause of their extinction on King Island (Hope 1987:91).

On both islands the most commonly sighted species of the present terrestrial fauna are the wallaby (*Macropus rufogriseus*) and brushtail possum (*Trichosurus vulpecula*). The largest macropod is the wallaby (locally known as 'roos') which are regarded as vermin by most farmers on the islands and regularly culled. In earlier historic times however, they were one of the mainstays of the island’s resources. The meat and skins provided food and income for snarers and hunters living on the Bass Strait islands in the mid-nineteenth century, after the decline of the sealing industry (Edgecombe 1986:125; Pryor 1987:54; Sullivan 1976:19).

Thus, both King and Flinders Islands have a range of edible mammal resources not dissimilar to those being exploited in Tasmania and southeast Australia in prehistoric times (Bowdler 1979; Bowdler and Lourandos 1982; Hope 1987; Jones 1971; Vanderwal and Horton 1984). Furthermore, the presence of exploited species (such as red necked wallaby, wombat, and possums) in historic times, attests to their presence on the islands from the time that the islands initially formed. Sea mammals such as fur seals (*Arctocephalus* spp.) and the Southern Elephant Seal (*Mirounga leonina*), are another resource which was available in prehistoric times on Bass Strait islands, and
which was known to have been exploited by Tasmanian Aboriginal people in the past (Bowdler 1979; Jones 1966; Lourandos 1968; Vanderwal and Horton 1984:54-87).

Although a few Australian fur seal colonies have survived in the Bass Strait area, the Southern Elephant Seal which seasonally inhabited Hunter and King Islands early last century was hunted to extinction in this area in less than twenty years (King 1983:120; Micco 1971). This creature was commercially exploited from the arrival of the first sealers in the area about 1800, and was highly prized because of its plentiful accumulation of body fat. The elephant seal rendered copious quantities of naturally clear, odourless oil which fetched optimum prices for use in foodstuffs, oil lamps and industrial processes such as cloth manufacturing (Micco 1971:33).

The elephant seal has no known breeding grounds in Australia now although this century, the occasional stray has come ashore and two births have been reported on the coast of Tasmania (King 1983:120). This situation is in marked contrast to early historic times when a dense elephant seal population annually visited Hunter and King Islands to breed (Micco 1971). Elephant and fur seal bones have been recovered from archaeological deposits in a number of Tasmanian Aboriginal sites along the northwest, west and southwest coasts (Bowdler 1979; Jones 1966; Lourandos 1968; Vanderwal and Horton 1984: 54-87). This indicates not only human predation of these resources, but also a wider distribution of Tasmanian breeding grounds of the elephant seal in prehistoric times (King 1983:120).

Fur seal colonies are still present on small, offshore islands around Tasmania and a few of the Bass Strait islands. Prehistoric evidence however suggests that the distribution of fur seal colonies, like the elephant seal, was wider in the past and included some colonies on the mainland coast as well as the extant island colonies (Jones 1966; King 1983).
Avian Fauna

Both King and Flinders islands support a large range of seabirds, waterfowl and native forest bird species. The lagoons and swamps abound with native fowl, swans, ducks and other waterbirds. On Flinders Island, Cape Barren Geese are resident in the lowlands and swamp areas. Although the Cape Barren Geese almost became extinct in recent times, they are now flourishing on the islands. The Cape Barren Goose population is presently expanding and birds have re-established residence on King Island after many years absence (local informant). Both these and other birds, and their eggs, have been exploited as food resources by island inhabitants and visitors in historic times, and may have been an important seasonal resource in prehistoric times (Edgecombe 1986:56,111).

On King Island, a report in 1971 indicated there were 149 species of birds sighted on the island. These included resident breeding populations of native pigeons, quail, ducks, cormorants, the black swan, the swamp harrier, the brown hawk and the Nankeen kestrel. Recent introductions to the island's resident avian fauna include the magpie, starling, blackbird, the European pheasant and wild turkey. The seabird population includes both pied and sooty oystercatchers, Pacific gulls, silver gulls, the white-breasted sea eagle, terns, penguins and muttonbirds (Green and McGarvie 1971; Hooper 1980:26-27).

The King Island emu (*Dromaius ater*), which was present on the island in early sealing times, appears to have rapidly become extinct as there is no mention of it in an extensive survey of the natural history of the King Island undertaken in 1827 (Barnard 1826-7). It is also absent from the Victorian Field Naturalists' descriptions of the island's fauna in the accounts of their expedition to King Island in 1887 (Campbell 1888). The value of the emu as a food resource is attested to in historic accounts of
sealers' hunting activities on the island, and by the subsequent extinction of the King Island emu due to the sealers' predation (Peron in Cumpston 1973:56).

The present range of indigenous bird species on the Furneaux Group is similar to that on King Island although a rare gannet (Morus serrator) rookery is to be found on Cat Island, a small island a few kilometres from the east coast of Flinders Island (Edgecombe 1986:146-149; Green 1969). Cat Island is one of only five gannet islands in Australia, and the bird population there is endangered as a result of human predation in historic times (Hope 1987:91). Both gannet and albatross (Diomeda cauta) rookeries may have been a focus of prehistoric activity as these birds, and their eggs, are easily obtained from the rookeries.

Other seasonal bird rookeries on the Bass Strait Islands include numerous muttonbird (Puffinus tenuirostris) colonies. Despite commercial and local domestic exploitation, the distribution of the colonies at present is expanding. The muttonbird is Australia's most numerous bird species and migrates annually from afar as the northern Pacific Ocean and southerly regions of the Bering Straits, to southern Australia where it breeds (Serventy et al. 1971; Simpson 1972:20). Although hundreds of expansive rookeries are to be found on the smaller islands of the Furneaux Group, there is only one colony on Flinders Island itself. Historical accounts from King Island indicate that at the time of first contact, there were no muttonbird rookeries on King Island although colonies were present on a few small islands close to the main island (Barnard 1826-7). In the late 1890s however, large numbers of muttonbirds began nesting on King Island proper, and there are now vast rookeries in about twenty locations around the island's coast (Skira and Davis 1987:3). The total muttonbird population on King Island is currently estimated to be in the region half a million birds (from burrow number estimates in Skira and Davis 1987:4).
Clearly, the emu on King Island, and seasonal seabird colonies on other Bass Strait islands, could have provided a constant and reliable food source in prehistoric times since the Bassian region became Bass Strait.

**Reptilian Fauna**

Both King and Flinders Islands have dense populations of the three snake species also present on mainland Tasmania, the Tiger snake (*Notechis ater*), the Copperhead (*Austrelaps superba*) and the White-lipped Whipsnake (*Drysdalia coronoides*). The Tiger and Cooperhead snakes are highly venomous and the Whipsnake poisonous although to a lesser degree. In addition to the snake species, there is a range of skinks and lizards including the Blue-tongued Lizard (or goanna) present on the islands. Although reptiles may have contributed a minor component to prehistoric diets, there is no evidence to suggest intensive human predation of these species.

**Feral Animals**

Unlike Tasmania and mainland Australia, neither King nor Flinders Islands have rabbit, hare or fox populations. At present feral pigs (*Sus scrofa*) are common on Flinders Island and, although they are not currently a problem on King Island, there were reports of feral pigs there around 1900. Although wild dogs (*Canis familiaris*), a legacy of early wallaby hunters, were problematic in the past on the islands they have now been exterminated. Feral cats (*Felis catus*) however are still widespread on both islands (Skira and Davis 1987:1). The effects of feral animals on the island's indigenous fauna have not been documented, although hunters' dogs and feral cats are possibly responsible for the extinction of Tiger Cat populations on King and Flinders Island in historic times (Edgecombe 1986:105; Hope 1973).
Marine and Coastal Invertebrate Food Resources

The rocky shores and tidal platforms which are found on the west coasts of both King and Flinders Islands provide a variety of edible molluscs and crustacea [Appendix 1]. Limpets (*Cellana solida*) are particularly common and large in size around the granite shores of Flinders Island, as also are a number of smaller edible gastropods known collectively by the local Aboriginal people as 'periwinkles'. The most common of these are *Austrocochlea* and *Nerite* species which are also found in abundance in areas on King Island. Other edible shellfish species also found in the intertidal zone are *Chiton*, some whelk species (*Cabestana spengleri*, and *Dicathais textilosa*), warrener or turban shells (*Subninella undulata*) and *Scutus antipodes*.

Bivalve mollusc food resources on both King and Flinders Islands are relatively limited, being generally confined to mussel (Mytilidae) species in the intertidal zone, and mud oyster (*Ostrea angasi*). On the islands, mud oyster is generally found in subtidal marine zones rather than tidal estuarine environments. Two species of abalone, the green-lip (*Haliotis laevigata*) and black-lip (*H. ruber*) species are also readily obtainable in the subtidal zone around both islands.

Although some mud oyster is obtainable by diving, neither island appears to offer abundant supplies such as those available around the lower energy coastal regions of mainland Tasmania (local informants and fishermen pers. comm.). The relative scarcity of mud oyster on the islands may actually be a factor of visibility as abalone are currently being commercially harvested whereas there is no call for the mud oyster and it therefore is not being sought after. Dense natural accumulations of mud oyster in fossil shellbeds at Northeast River estuary, indicate that this species has been prolific at least in the Flinders Island area in the past.
Both islands presently have sufficient crayfish (*Jasus lalandii*) resources to support commercial fishing industries, and Aboriginal exploitation of this resource has been recorded in prehistoric and historic contexts on Hunter Island and mainland Tasmania (Bowdler 1979, 1988:49). Bull kelp, which was used in ethnographic times to make water carriers and also as a food source, is found in abundance around the west coast of King Island, and occasionally on Flinders Island although it is not as commonly found there (Labillardiere 1800:96, 302-06). Scale fish are also obtainable in coastal waters around both Islands, with especially prolific numbers of wrasses evident around the rocky west coast of Flinders Island. Wrass remains have been recorded in Tasmanian archaeological deposits predating about 3,500 BP (Bowdler 1984:73; Colley and Jones 1987). Despite their absence in more recent Holocene archaeological contexts, fish does represent an exploitable food resource of possible relevance to human occupation in the Bassian region.

Overall, the physical environment and range of resources available on both King and Flinders Islands appears more than sufficient to support a human population. The presence of a range of terrestrial mammals attests to the island’s capacity to support animal populations. It could be argued that, in past times, these islands were not such conducive environments for human habitation. Nevertheless, the present range of exploitable resources on the islands does not suggest that the absence of human island populations is attributable to a scarcity of food or other resources.
PROJECT OUTLINE: RESEARCH AIMS, STRATEGY AND METHODOLOGY

The absence of Aboriginal populations on King and Flinders Island when Europeans first visited the region inevitably raised the question as to why these islands were not occupied, and if in fact they had ever been occupied in the past. The question of past occupation was not seriously considered until artefacts, and more recently shellfish middens, were found on the islands (Orchiston and Glenie 1978; Jones 1979). Investigation of prehistoric island human occupation was initially undertaken by Orchiston at Palana on Binders Island in the 1970s (Orchiston and Glenie 1978; Orchiston 1979a, 1979b, 1984). The subsequent site surveys I conducted on both King and Flinders Islands questioned his conclusion that Flinders Island was populated by an extinct relict population, stranded for some thousands of years after Flinders became separated from mainland Tasmania (Sim 1989).

RESEARCH AIMS

As a result of the surveys on both King and Flinders Islands, I proposed an alternative occupation model of island abandonment rather than the stranded/extinction scenario envisaged by Orchiston (1984). Assessing the alternative model was however problematic as no unequivocably cultural remains had been radiocarbon dated from either of the islands. Although three Flinders Island midden sites had been excavated by Orchiston, the only published results of these investigations comprised preliminary reports discussed in Chapter 1. It was readily apparent that more primary archaeological data was required before questions of regional occupation patterns could
be assessed. In fact the formulation of occupation models themselves were possibly somewhat premature given the fundamental lack of dated archaeological evidence.

The overall aims of this project were therefore;

a) to establish the nature and duration of human habitation of the Bassian region,

b) to investigate the question of when and why prehistoric use of the remote Bassian island region ceased sometime prior to the arrival of the first Europeans 200 years ago,

b) to examine the relationship between changes in prehistoric land use patterns and palaeoenvironmental changes.

There was a marked absence of dated cultural remains since charcoal samples dated from sites on both King and Flinders Islands were not demonstrably of anthropogenic origin (Jones 1979; Orchiston and Glenie 1978). Hence, the initial aim was to establish secure temporal frameworks for human occupation on both of the islands, and thus expand the regional archaeological database. This would provide a basis from which higher level questions related to the nature of prehistoric occupation on the islands could be addressed. More specific knowledge of the regional archaeological record would enable;

a) the island population extinction and abandonment models to be evaluated,

b) the human response/s to the dynamic changes in the early Holocene Bassian environment to be investigated, both on an island, and regional scale, and,

c) an examination of the relationship between land use patterns on Flinders and King Islands, and, those in other Tasmanian coastal regions.

RESEARCH STRATEGY

In order to address the questions outlined above it was decided that a range of sites from both Flinders and King Islands would be investigated. To examine how the archaeological record reflected people's response to the post-glacial palaeogeographical
changes in the region, evidence was required that spanned different
palaeoenvironmental phases. In particular, sites pertaining to both the critical island
formation and post formation periods were required to evaluate the alternative
abandonment occupation model. Site surveys previously undertaken on the islands
indicated that the evidence from only one of either King or Flinders Islands, would be
insufficient to provide the basic data to answer the research questions.

Furthermore, the nature of prehistoric sites previously recorded on Flinders and King
Islands was generally short term and most were open artefact scatters and unstratified
shell middens (Jones 1979; Orchiston 1984; Sim 1988, 1989). None appeared to
contain stratified occupation sequences, although many had remains which could be
radiocarbon dated. In light of the nature of the general research aims, it was therefore
decided that a range of different types of sites from both islands needed to be
investigated. It was anticipated that a synthesis of data from these sites would provide
a broad regional picture of different land use patterns over a span of time.

A strategy often adopted in Australian regional archaeological investigations is to
survey for sites which may contain deep stratified sequences of cultural remains. One
or two of these sites are then excavated and the data used to construct a chronological
framework for regional land use patterns. This approach uses very localised data to
posit broader general models. The sites from which the data are recovered are
frequently cave or rockshelter sites as these are generally good environments for
sediment deposition and preservation of organic and other cultural remains. In cave
environments, erosion activity is also usually less active than in open sites and therefore
less of a taphonomic problem.

This 'find and dig a cave' approach was not adopted for this research, principally
because the questions being addressed required a range of data which was unlikely to
be recovered either from a single cave deposit or from one or two midden sites.
Moreover, by investigating only cave deposits, there was the additional problem that the archaeological evidence (if it were to be recovered), may be reflecting aspects of human behaviour specific to cave use. It is possible that evidence of direct relevance to the question of island occupation, is more likely to be found in open sites such as middens. Without knowing the role of cave environments in the total land use scenario, the representativeness or usefulness of cave sites is questionable in regard to the particular research aims of this project.

Nevertheless, cave deposits, along with data drawn from a range of different site types, did offer the potential to contribute to the broader pattern of land use. The caves were some of the few places offering shelter on the islands, and are also known from other regions to often be a focus of human activity. Since there was a paucity of stratified archaeological deposits suitable for excavation, the islands' caves did warrant further investigation because of their potential for preserving stratified deposits. The previous surveys recorded the caves precisely because they were the only depositional environments where long stratified cultural sequences, of substantial antiquity rather than short term events, could expect to survive. Hence, three caves on King Island, and two rockshelters on Flinders Island were included amongst the sites targeted for investigation during the project, despite the fact that there were no surface indications of prehistoric human use.

Radiocarbon dating potential was another major factor in the selection of the sites, as the basic problem underpinning the research aims, was one of determining the length and antiquity of human occupation. Thus, a range of sites was selected which it was believed would provide datable cultural remains from which occupation spans could be defined. The particular site types and individual sites, and the reasons for the selection of these for further research, are detailed below.
The sites chosen for investigation were of three types;
a) caves and rockshelters,
b) open artefact sites, and,
c) shell middens.

**Caves and Rockshelters**

Caves and rockshelters on both Flinders and King Islands were identified as areas for excavation during the project. The geomorphology of the coastal landforms in which the Flinders Island rockshelters were located indicated that these shelters were formed when the coastline reached its present location about 6,600 years ago (Sim 1989). Thus they are recent Holocene landforms, with the sediments they contain being of similar, or more recent age. That is, the deposits in these shelters would correlate with the time span after the sea level rise had separated the Flinders Island from the rest of the Furneaux Group, and the coastline had stabilised in its present position.

There are few coastal shelters on the island, and these coastal limestone shelters were conveniently located adjacent to shellfish rich rock platforms. There was also historic midden evidence in at least one of them indicating that the shelters had been used by Aboriginal people last century. Additional European occupation debris was recorded in a number of other shelters similarly attesting to the utility of these landforms as shelters (Sim 1989).

It was decided to investigate two of these shelters in order to examine the deposits for evidence of occupation from the island phase of Flinders Island. In light of the abandonment model I proposed (which suggested that people left prior to the sea reaching a level similar to present, that is about 6,600 BP), it was anticipated that these shelter deposits on Flinders Island would be archaeologically sterile. On the other hand, if Orchiston (1984) was correct, and there were people stranded on the island,
then the shelter deposits could be expected to contain evidence of this occupation phase. Two of the larger shelters were therefore selected, one of which had historic Aboriginal midden remains in the surface levels, and both of which were close to fresh water and abundant shellfish sources.

Whereas the Flinders Island shelters could potentially provide evidence pertaining to the most recent phase of human occupation on the remote Bassian Islands, the King Island sea caves were chosen as research areas because of the great antiquity of the deposits they contained (Goede et al. 1979). Although no artefacts were present on the surface in any of the caves, the presence of substantial deposits and the recovery of cultural material from deposits in a similar sea-cave on Hunter Island (Bowdler 1979), suggested that the King Island caves warranted further investigation. Given the recent Holocene aeolian sediment transport and dune migrations evident in the immediate vicinity of the King Island caves, and the absence of a contact period indigenous human population, the absence of surface artefacts in the caves was not unexpected.

Although geomorphologists had undertaken a preliminary examination of deposits in two of the caves, no archaeological or other systematic excavation had been carried out in the King Island caves prior to the investigations associated with this thesis (Goede et al. 1979). The potential of these caves to provide long stratified occupation sequences was thus untested. The King Island sea caves were therefore included in the excavation programme. Furthermore, there were no other locations on either King or Flinders Islands which potentially could provide evidence in stratified sequences, and of any considerable antiquity. The one large cave known on Flinders Island, Ranga Cave, had previously been excavated by Hope (1973) who was investigating prehistoric faunal distributions on the Bass Strait islands. No evidence of human occupation was however recovered from this cave.
It was clear that even if cultural deposits were to be recovered from the caves on King Island, other types of sites would also need to be investigated. It seemed highly improbable that evidence from the sea caves *per se* would provide sufficient data to investigate the broader questions relating to the islands' shell middens and the occupation span on Flinders Island. To examine the relationship between the evidence on both islands, and the implications of this in terms of the human response to palaeoenvironmental changes, other types of sites needed to be investigated.

**Shell Middens**

Shell middens were one of the main site types focused upon because of their direct relevance to questions regarding the possible mid-Holocene occupation or use of the islands. Archaeological evidence of littoral exploitation was the most recent evidence of human presence on the islands that could be detected during the surveys. This suggested these sites were prime targets for testing the alternative abandonment and extinction models that had been proposed. It was also possible that such sites could indicate a re-occupation of the island by people using watercraft in mid or recent Holocene times. The midden sites therefore offered a vital source of information about human use of the islands in their most recent occupation phase.

There was a consistent pattern of low density cultural remains on shell midden sites recorded during previous surveys on both King and Flinders Islands. The middens comprised small deflated and *in situ* scatters, and small numbers of shells stratified in palaeosols in eroding dune sections (Orchiston and Glenie 1978; Sim 1988, 1989). On Flinders Island, the geomorphological context of the middens, and previous palaeosol dating by Orchiston indicated that these sites were definitely of Holocene antiquity (Orchiston 1979b). While being crucial evidence in regard to the question of a possible prehistoric occupation phase on Flinders Island, the scant nature of evidence in the midden sites limited their excavation potential.
As individual sites the middens offered little opportunity to examine changes in resource exploitation over time, or exploitation of non-littoral resources. Nevertheless, taken together as a suite of sites, the Flinders Island middens could possibly provide a range of useful information about chronological and geographical variation in Holocene littoral exploitation on the island. More importantly, by determining the time span of occupation of these sites, it would be possible to examine the question of human use of the island and the nature of island occupation.

The shell middens on King Island were more variable than those recorded on Flinders Island. Whereas the latter middens displayed a marked consistency in terms of site location and range of species represented, shellfish remains on King Island were located in a diverse range of environmental contexts and there was a great variation in the types of shellfish species. The geomorphological contexts of the King Island shellfish remains identified during survey work, suggested that there was;

a) at least one recent Holocene but prehistoric midden,
b) a number of historic shell deposits associated with the historic occupation of King Island during the early sealing and hunting period, and,
c) ambiguous shell deposits which may be either prehistoric or historic deposits, in sand dune blowouts. It was also possible that some of these latter shell remains had been deposited by birds.

Further investigation of the areas with shellfish remains on King Island was of particular importance to the question of possible island phase occupation. While it had been shown that shellfish middens on Flinders could possibly date to a time when Flinders Island was still accessible to mainland Tasmania, the situation on King Island would have been different. Because of the local topography on King Island, and its greater distance from other islands and Tasmania, it is highly unlikely that shellfish
middens now present on King Island would date from the time before the coastline reached its present location about 6,600 years ago.

Survey results which indicated that there was at least one prehistoric midden site on King Island, therefore suggested that people were on the island in mid Holocene or more recent times. This raised the problem of discerning whether the midden evidence was deposited a) by people who had remained on the islands after they became severed from greater Tasmania, or, b) by people using watercraft to travel around the Bass Strait region in the mid to recent Holocene times.

The question of possible island occupation on both Flinders and King Islands was thus twofold. Not only was it necessary to radiocarbon date the cultural remains, it was also desirable that a way of detecting differences between evidence of stranded populations and island visitors be devised (should there be evidence of island phase occupation). Since this problem was unlikely to be resolved by examining the midden evidence alone, other known sites with excavation potential were also targeted. In light of the presence of ambiguous shellfish remains present in lag deposits in dune blowouts on King Island, it was also necessary to devise a method to distinguish between bird deposited shellfish remains and those of anthropogenic origin.
Stone Artefact Sites

On King Island there were three open artefact sites where there appeared to be stratified archaeological deposits. No such sites were located on Flinders Island except for two palaeosol midden sites containing several stratified flakes and manuports (Sim 1989:27). The three King Island sites were therefore chosen as excavation locations. One of these was the Cataraqui Monument quartzite quarry site in the southwest coastal dune country. This site was of especial interest because of the strong resemblance between the surface artefacts on this site, and those on Kartan sites described by Lampert on Kangaroo Island (Lampert 1981:44-51). This site therefore offered the opportunity to further pursue the questions already raised by Jones (1979) in regard to the presence of possible Kartan sites on King Island, and also variation between stone artefact types present on different sites on the island (Sim 1990). This question was somewhat tangential to the main aims of the investigation and the analysis that would be required to determine the statistical similarity between the King Island sites and those on Kangaroo Island, was beyond the scope of this project. The Cataraqui Monument evidence did however suggest that stratified deposits containing *in situ* Kartan like assemblages could exist at this site.

The open artefact sites were also selected because it was possible they could contain evidence of occupation of greater antiquity than the shell middens. As previously discussed, it was unlikely that evidence of human occupation from the initial island formation phase, prior to 6,600 BP, would be found in midden sites. Because of the association of artefact sites with stone sources (rather than the shoreline), these sites had the potential to provide evidence of human occupation from any period of human occupation of the region or island. Therefore, while artefact and midden sites may have been contemporaneous, the artefact sites also had the potential to be considerably older than the shell middens. If evidence of occupation from the island formation phase were
to be recovered, then it would be expected that it would be obtained from artefact sites rather than midden sites.

METHODOLOGY

Due to the diverse nature of the range of sites being addressed, a number of different methodological approaches was employed. Principally, these involved shell and charcoal collections from midden sites, and excavation of open artefact sites and cave deposits.

Midden site methods

Since the research question in regard to the Flinders Island middens was primarily that of chronology, a number of these sites was selected where there were in situ shellfish remains and charcoal in what appeared to be a palaeosol unit contemporaneous with that dated by Orchiston at Palana (1984). These sites also afforded the opportunity to evaluate the methodology used by both Orchiston (1984) and Jones (1979) to date occupation of the sites on Flinders and King Islands. Since the Flinders Island middens contained both shell remains and charcoal within the same stratigraphic context, both of these materials could be radiocarbon dated. By dating the cultural shellfish remains this would enable the actual occupation of the site to be dated. By comparing the shell dates with charcoal dates from the same palaeosol, the usefulness of the charcoal dates in terms of occupational indicators (and other problems regarding the depositional relationship between stratigraphically associated charcoal and anthropogenic remains), could be investigated further.

The problem of the association between charcoal, which is not demonstrably from hearths, and cultural remains is particularly relevant to the previous dating of sites on both King and Flinders Islands. Human occupation at both the Palana middens on
Flinders Island and the Petrified Forest stone artefact site on King Island, was assumed to directly relate to charcoal in the same stratigraphic unit (Jones 1979; Orchiston 1984). Although there was no indication that the charcoal being dated was necessarily anthropogenic, there was an *a priori* assumption that the deposition of cultural remains was chronologically associated with stratigraphically associated charcoal.

The methodological dating problem outlined above is inherent in any investigation of sites where there are no unequivocably anthropogenic organic remains to radiocarbon date. It is generally accepted practice in these situations to define occupation chronologies by the dates of stratigraphically associated charcoal. Given the 4,000 year range in radiocarbon dates obtained by Orchiston and Glenie (1978) from charcoal recovered from one palaeosol unit at the Palana midden site, this raises questions about the appropriateness of using stratigraphic association as a method of dating sites in many instances.

By collecting samples from a number of the Flinders Island middens of both charcoal and cultural shell remains for radiocarbon dating, this would circumvent the problem of dating by stratigraphic association. Moreover, it would provide data to facilitate further investigation of this more general archaeological dating problem. The collection method for these middens therefore involved taking samples of both *in situ* shell and charcoal from sites where these two types of remains were found together in the same palaeosol or in another similarly homogeneous stratigraphic context. There were three sites on Flinders Island, and one on King Island where this was possible. Shell samples for radiocarbon dating were also collected from other midden locations on both islands as these were present in different geomorphological contexts, and could possibly have represented a different occupation period than the palaeosol middens.

Since there was no apparent variation in the types of middens in terms of the range of resources being exploited (Sim 1989), the only method of discerning variation in the
depositional chronology was by radiocarbon dating the remains. Thus because of the similarity in geomorphological contexts of the evidence in the three sites where both charcoal and shell was sampled, shell samples for dating were also collected from two other types of midden contexts. This was to ensure that similarity in occupation (shell) dates from the first three sites was not reflecting preferential use of certain types of environments at a particular point in time.

A similar sampling method was employed on the one site on King Island which was thought to be of recent prehistoric Holocene antiquity. This site was somewhat similar to the Flinders Island midden sites in that the shellfish remains were found in situ, and deflating from, a palaeosol horizon exposed in eroding dune sections in a large dune blowout. The palaeosol unit also contained dense accumulations of charcoal. This was distributed widely throughout the extensive exposed horizon areas and was not confined to the areas where shell was evident. Both charcoal and shell were collected for dating in this instance. While the geomorphological context of some other midden sites on King Island strongly suggested they were of historic antiquity, there were shellfish remains in some dune blowout lag deposits which could have been either prehistoric or historic remains. Furthermore, these latter deposits could have contained shellfish remains deposited by birds as the lag deposits also contained some species not known to be predated by humans.

Radiocarbon dating of the cultural midden remains could determine if the cultural remains were prehistoric, or more recent historic remains resulting from the activities of the sealing women. However, the problem of distinguishing between lag deposit shellfish remains attributable to human activity and those which were the result of bird behaviour, was somewhat more complex. This was also of prime importance given that there were accumulations of shellfish remains in numerous dune blowouts along the island's west coast. These may well have been deflated midden remains despite the general paucity of humanly deposited shell middens on King Island.
Since ground visibility was generally poor along the coast except for dune blowout areas, this may have been influencing the recognition of midden sites during surveys. It could be that midden remains were only visible in disturbed areas, and appeared as lag deposits along with animal and other naturally deposited material. In most instances no stone artefacts were observed in the lag deposits. However, the absence of stone artefacts in some middens on Flinders Islands suggested that presence or absence of stone artefacts alone was not sufficient criterion for determining whether a shell deposit was of anthropogenic origin or not.

It was therefore necessary to undertake some research into bird, human and other animal behaviour that would facilitate the recognition of human food remains as opposed to animal deposited shell accumulations. Other factors such as the geographical location of shell deposits and their geomorphological contexts were also assessed as possible indicators of anthropogenic versus animal deposition.

In order to examine the question of evidence of bird behaviour, samples of shellfish remains were collected from an active gull rookery on King Island, and observed roosting spots on King and Flinders Islands. Samples of warrener (*Subninella undulata*) shell operculae were collected from bird activity areas and also dune blowouts for comparative purposes. It had been previously noted that bird deposited operculae had a high incidence of fractures and cracks present, and that these were generally found on particular parts of the operculum (Sim 1988:86). Further bird midden remains were collected from the feeding area of a sooty oyster catcher on Big Green Island, a small island offshore from Flinders Island. It was possible that analyses of bird deposited shell could provide archaeologically useful indicators of non-human origins of shell deposits.
Methods used to collect materials for radiocarbon dating and other midden analyses did not involve excavation. The research question in regard to the midden sites was primarily one of chronology. Excavation was not required to obtain either charcoal or shellfish samples from the midden sites. The dating samples were collected either by cleaning back exposed sections and removing *in situ* shell and charcoal, or in some cases by collecting shell from the surface.

**Open Artefact Site Excavations**

Excavations were undertaken at three site locations on King Island. These site locations were open stone artefact scatters, two of which were also quarry sites. There was no evidence of littoral exploitation at these sites although all are now in close proximity to the shoreline and littoral resources. This suggested that human use of these sites could possibly pre-date the arrival of the sea at its present level, and, thus may provide information regarding use of the area when it was a northwest Tasmanian peninsula or part of the Bassian landbridge.

Excavation was undertaken as it was the only method by which it could be expected that material suitable for radiocarbon dating could be recovered from a stratified cultural sequence. Open artefacts sites with deposits considered to have such excavation potential, were accordingly chosen as test excavation sites. Two of these were on King Island, and one on a small islet a few kilometres offshore from the west coast of King Island. Several test pits were opened in each of these locations. These were undertaken not only to recover archaeological remains, but in some instances to establish the stratigraphic relationship between different geomorphological events, the dune palaeosols and the archaeological deposits.

Charcoal samples were collected from a number of archaeologically sterile palaeosols adjacent to site locations in order to establish an understanding; a) of the
geomorphology of the dune deposits, and, b) of the chronological relationship between the dune palaeosols and human occupation in the region. If a chronological correlation between what appeared to be similar palaeosols in different places in the west coast dunes could be established, then these palaeosols could provide chronological markers in the dune blowout sites. This would be a useful indicator in addressing problems such as determining the origin of the shellfish remains in the lag deposits. Palaeosol dating could also provide archaeologically relevant palaeoenvironmental data pertaining to climatic changes, dune migrations, faunal extinctions, and past vegetation and firing regimes (Murray et al. 1982; Jennings 1959b).

The cave and rockshelter test excavation methods

The King Island sea cave excavations were principally undertaken to test the archaeological potential of these environments as there was no evidence on the surface to indicate that any of them had been used by people in prehistoric times. A series of up to three 1 m by 1 m pits were dug in selected locations in each cave. Similarly, the Flinders Island rock shelter investigations were test excavations since there was no surface evidence to indicate prehistoric human occupation of these shelters (although as mentioned above, one had Aboriginal artefacts from historic use of the shelter).

Excavation methods varied slightly according to different site deposits and conditions. The different techniques employed are fully described in the relevant site reports in Chapters 4 and 5. Generally, the test pits were standard 1 m by 1 m pits, which were excavated in measured spits as stratigraphic changes were a rare phenomenon. Deposits were sieved using wet or dry techniques depending upon the nature of the sediments and water availability. Similarly, the use of the smaller sized sieves was not always constant as often it was neither possible, nor appropriate, to employ the smaller 2.5 mm and 1.25 mm meshes. For example, clay levels in the Iron Monarch Cave (which were archaeologically sterile) were sieved using a 5 mm sieve, and larger hard
lumps were examined by soaking and squashing them manually to feel for rock or artefacts since they were too dense to pass through the even the largest (10 mm) sieve. Bulk samples were collected from each excavated level in all the test pits for laboratory examination. This was to facilitate the detection of small animal bone or other macroscopic and microscopic remains that may not have been recovered on site. Since the research objective in investigating the caves was primarily to establish if in fact they were archaeological sites, they were initially regarded as exploratory investigations rather than site excavations. Detailed records were made of all stages of deposit removal, and collection of all animal remains, charcoal and other possibly non-anthropogenic evidence from both archaeological and sterile deposits excavated.

RADIOCARBON DATING

All dating associated with this project was carried out at the Radiocarbon Dating Research Laboratory in the Research School of Pacific Studies at the Australian National University, on either shellfish remains, or charcoal samples. The dates were obtained using the conventional beta counting radiocarbon dating technique and reported as conventional ages (Stuiver and Polach 1977). On advice from J. Head, the radiocarbon dates were not calibrated, principally because of uncertainties in calibration factors due to unknown variation in the interchange of CO$_2$ between the atmosphere and the ocean (see also Polach 1983:153-44). The dates cited in the following chapters therefore are uncalibrated.

All shell dates have however been corrected by -450 years for oceanic reservoir effects (Polach, Golson and Head 1983). This standard correction factor moreover has been demonstrated to be accurate for shellfish remains recovered from similar environmental contexts on Great Glennie Island. At this cave site, dated shellfish remains were consistently were 450 years younger than those obtained from charcoal recovered from the same depositional units (Head et al 1983:106).
In regard to the shellfish remains there was however, a more fundamental question than that of their antiquity. This was the problem of determining whether some were of anthropogenic origin. The initial analysis of the remains collected was therefore aimed at determining if bird behaviour could be detected in shellfish remains, and if distinctive indicators of this were detectable. The methods and results of this analysis are described in the following chapter.
Chapter 4

BIRD BEHAVIOUR AND SHELLFISH REMAINS

BACKGROUND

There were many low density shell accumulations in coastal locations on both King and Flinders Islands, the deposition of which was of ambiguous origin. While there were stone artefacts or manuports spatially associated with some shellfish accumulations on Flinders Island, there was a marked absence of such obvious indicators of human activity in other shell deposits on the islands (Sim 1988:3, 1989:28). The location of some shellfish remains (in relation to past and present shorelines), the range of species and sizes of shell observed, and the condition of the shells clearly precludes many shell deposits being attributable to storm or wave deposition (Bowdler 1983:137; Hughes and Sullivan 1974). There were two other possible explanations for their presence; they had been either deposited by people or by birds.

Some preliminary investigation of the problems involved in distinguishing between bird and human shell deposits had previously been addressed by Horton (1978), and Jones and Allen (1978). The latter investigation involved the excavation of a bird midden on a small Bass Strait island. In regard to the shellfish recovered, Jones and Allen (1978:144) state that similar evidence might easily be mistaken for light scatters of humanly deposited shell. When dealing with low density shell deposits they suggest that, 'the possibility of an avian origin must first of all be discounted' (Jones and Allen 1978:144).

A literature search on the feeding habits of birds of the Bass Strait Islands indicated that the only species whose food remains were likely to resemble human midden material
were Pacific Gulls (*Larus pacificus*), Kelp Gulls (*Larus dominicanus*), and Pied and Sooty Oystercatchers (*Haematopus longirostris* and *H. fuliginosis*) (Green 1969; Green and McGarvie 1971; Pringle 1987; Serventy et al 1971; Slater 1970; Smith 1985:198-199; Watson 1975). Oystercatchers also use chips of shell and stones as nest materials (van Tets pers. comm.).

In light of the low numbers of shellfish remains on most of the King and Flinders Island middens, it was considered necessary to establish diagnostic criteria for distinguishing between bird and human shell refuse deposits. To facilitate this, shells were obtained from bird middens on Flinders and King Islands for analysis. Bird deposited remains were collected from feeding and roosting areas known to be inhabited by Pacific Gulls (*Larus pacificus*), Kelp or Dominican Gulls (*Larus dominicanus*), and Oystercatchers (*Haematopus longirostris* and *H. fuliginosis*). The following factors were considered in the examination of the bird deposited shells collected from the islands;

a) species range, size and relative representation,

b) fracture patterns on individual species,

c) other material associated with the shellfish remains which was also a product of bird feeding activity, and,

d) location of the bird deposits.

**Species range**

The range of shellfish species observed in bird middens on the Bass Strait Islands is listed in Table 1 (from Jones and Allen 1978; Sim 1988; Teichert and Serventy 1947; Watson 1975; and Lauro pers. comm.). This list also includes a periwinkle, (*Austrocochlea* sp.), which has been recorded in gull deposits in Western Australia, but which has not in bird middens in eastern Australia. This species is however abundant in southeastern Australia and commonly exploited as a human food resource (Bowdler
Predation on several other shellfish species specific to Western or Northwestern Australia have also been recorded on gull middens (Teichert and Serventy 1947). Since these are not relevant to the region being investigated they have not been included in Table 1.

<table>
<thead>
<tr>
<th>Shellfish species</th>
<th>Gull</th>
<th>Oystercatcher</th>
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<tr>
<td>warrener shell (<em>Subninella undulata</em>)</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>warrener opercula (<em>Subninella undulata</em>)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>limpet (<em>Cellana solida, Patelloida</em>)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>periwinkle or nerite (<em>Austrocochlea, Nerita atramentosa</em>)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>whelk (<em>Cabestana spengleri, Pleuropoca australasia</em>)</td>
<td>X</td>
<td></td>
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<tr>
<td>mussels (Mytilidae)</td>
<td>X</td>
<td>X</td>
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<tr>
<td>chiton (<em>Chiton</em>)</td>
<td>X</td>
<td>X</td>
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<tr>
<td>scutus (<em>Scutus antipodes</em>)</td>
<td>X</td>
<td></td>
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<tr>
<td>abalone (<em>Haliotis</em>)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>pheasant shell (<em>Phasianella australis</em>)</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>bubble shell (<em>Bulla botanica</em>)</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**Table 1:** Bird midden shellfish species
The range of shellfish recorded in the bird midden deposits, shows a strong coincidence with species commonly observed on southeast Australian and especially Tasmanian middens. With the exception of the pheasant and bubble shells, all species tabled comprise shellfish remains commonly found in Tasmanian archaeological midden sites (Bowdler 1979:206; Brown 1986, Gaughwin 1985:50; Jones 1971:556; Kee 1987; Vanderwal and Horton 1984:80). There is a noticeable absence of mud oyster (*Ostrea angasi*) in bird predated shellfish species. Since mud oyster is a predominant species in numerous Tasmanian midden sites, and is not taken by birds for food, the presence of mud oyster would strongly suggest that human activity may be involved in the deposition of shellfish remains which include this species.

Some bird roosts contained a limited range of species, in particular some gull deposits were recorded which contained no shell other than warrener opercula. Scatters of opercula in particular were common in active gull rookeries. The operculum is regurgitated after the bird has previously extracted and ingested the mollusc with the opercula attached. The soft body parts are detached from the outer shell by first smashing the shell by dropping it onto coastal rock platforms. Although there were areas where clearly no other shell remains were being deposited by the birds, in some other bird middens the sole presence of warrener opercula is more likely to be due to differential preservation (Teichert and Serventy 1947).

The warrener opercula, being especially robust, survive longer in exposed conditions than most other shellfish remains recorded on the bird middens (Teichert and Serventy 1947). Arguably, the same process of differential preservation on humanly deposited middens could also result in discrete scatters of warrener opercula. This is not however likely to occur principally because human middens usually contain other equally robust remains such as the central spiral (columella) of warrener and whelk shells, and the lip of abalone shells. These are absent in bird feeding roosts where the birds are disgorging hard stomach contents, rather than extracting the shellfish.
On King Island such roosts were recorded around ephemeral coastal ponds. These contained warrener opercula, small fragments of warrener and whelk shell, chiton plates, fish mandibles and fin cartilage and crab claw fragments. Bird deposits containing predominantly warrener and whelk shells including the robust columella, and where opercula were scarce, were found in rocky areas where the birds were dropping the shells from some height to smash them.

Scatters containing only opercula could therefore be confidently designated as bird roosts, and, the absence of other remains being due generally to bird feeding habits and preservation factors (see also Teichert and Serventy 1947). As such, discrete scatters of opercula provide a useful indicator of bird rather than human activity.

On bird middens containing mixed shellfish species however, the range of species was typical of those commonly found in humanly deposited middens (see also Jones and Allen 1978). Therefore other criteria such as fracture patterns were examined to see whether these could be used to securely differentiate between human and bird shell deposits.

Shell fragmentation and condition

A noticeable degree of fragmentation of warrener and whelk shell was observed, both in the deposits in birds' shell-dropping locations, and at roosts where disgorged material was recorded. The comparison of shell fragmentation and condition was complicated by the possible post-depositional fracturing (of both bird and human transported shell) as a result of stock, vehicle and/or human trampling. In light of this, shell fragmentation and fracture patterns were initially considered to offer little potential as indicators of bird versus human activity. Nevertheless, some observations were made, regarding other aspects of the bird midden shell condition, which are pertinent. These are outlined below in regard to different kinds of shellfish.
Warrener and whelk

The gulls initially facilitate the removal of warrener and whelk from their shells by dropping them from some height onto coastal rocks. This results in the shell breaking in a variety of ways, depending on the height from which it is dropped and, the size and species of shellfish involved. In one location which is believed to be relatively unaffected by post-depositional trampling, whelk shells appeared more fragmented generally than the warreners, and few pieces with a dimension greater than 30 mm were recorded. Warreners on the other hand were often more complete shells, although these usually had large holes smashed in the main body whorl. This pattern was typical of the remains in most shell dropping locations on both King and Flinders Islands.

There was also an interesting fracture pattern observed in the warrener opercula recovered from all the bird deposits [Fig. 6]. In the sample collected from a square metre in a gull rookery on King Island, 31 of the 37 opercula recovered were edge damaged, and some of these were also cracked. The chipping and cracking pattern was remarkably consistent, with the damage generally being located in one quadrant of the opercula. Similar damage was apparent in the majority of opercula recovered from known bird deposits, and also from areas where discrete opercula scatters (discussed above) were recorded (see also Sim 1988).

Similar damage was absent in a comparative sample collected from an historic Aboriginal warrener midden on King Island. In this latter archaeological site, the entire complement of warrener shell and opercula was undamaged. Similarly there has been no opercula damage documented in prehistoric Tasmanian sites, and it is not evident in east coast Tasmanian middens currently being investigated by Dunnett. Many of these latter sites contain a large component of warrener, including numerous opercula (Dunnett pers. comm.).
This strongly suggests that gulls are involved in shell deposits containing opercula fractured or chipped in the manner described above [Fig. 6]. This does not necessarily preclude the use of the same location by people. It does indicate however that birds are in part at least, responsible for shellfish remains if such opercula damage is present.

Limpet

There are numerous descriptions of gull predation of limpet species (Pringle 1987:493; Serventy et al 1971:200,201; Teichert and Serventy 1947:326; Watson 1985:215). Investigation of the Kelp gull stomach contents have revealed whole limpets with the animal attached. As with warrener opercula, whole limpet shells are regurgitated after the mollusc body has been digested (Watson 1985:215, Serventy et al 1971:201).

No limpet was recovered from gull middens on King Island although limpet species were recorded by Jones and Allen (1978) on a Bass Strait island bird midden. Nevertheless, it is highly unlikely that damage to limpet rims would result from gull feeding behaviour, principally because gulls bills are softer than the limpet shell (Van Tets pers. comm.).

Limpet shells were recovered from a Sooty Oystercatcher roost on Big Green Island offshore from Flinders Island. B. Lauro (pers. comm.) who is currently studying oystercatchers in the Furneaux Group, has recorded a density range from 2 to 150 shells in the oystercatcher deposits. More generally these scatters consisted of about 30 shells, with limpet as the predominant species.
Figure 6: Warrener opercula fracture and cracking attributable to gull predation.

Plate 1: Bird fracture patterns on limpet, nerite and mussel shells (unfractured mussel valves also shown for comparative purposes).
All limpet shells in the sample collected from one scatter had a consistent rim fracture pattern. There were varying degrees of edge fracturing and chipping resulting from the bird levering the limpets from the rocks with their bills [Plate 1]. The example shown is a typical example of the limpet damage resulting from oystercatcher predation. Although fracturing tended to be more marked on larger limpets, most commonly it consisted of a distinct arc shaped hole, between 1 to 2 cm across, in one place on the rim (pers. obs. Lauro's collections). Some shells also had smaller chips removed from other places along the rim. Presumably this damage resulted from unsuccessful attempts to remove the shell. The jagged nature of the fractured edge attests to the hammering behaviour noted in the feeding habits of the oystercatchers (Pringle 1987:46). No such fracturing was evident on limpet shells collected from deposits where stone artefacts or manuports were also located.

Mussel

Records of gull behaviour associated with mussel predation indicate that these shells are dropped from a height of between 6 m and 20 m onto hard rock surfaces and roadways (Wheeler 1943, 1946 in Teichert and Serventy 1947:327). Considerable damage is likely to result from this behaviour and it is considered unlikely that such damage would be identifiable in mussel shell fragments subsequently deposited in roosts or rookeries. As would be expected, only small fragments less than 1 cm in size were observed on the King Island gull deposits.

The mussel shell collected from the oystercatchers' roosts however displayed a markedly consistent fracture pattern. The damage was normally restricted to the anterior margin on either one of the two valves [Plate 1]. A hole between about 2.5 cm and 4 cm long had been pierced as the bird used its bill to lever open the mussel. The hole was generally located towards the umbo, and directly opposite the main ligament on the dorsal margin. By piercing the shell along the anterior edge, the bird was able to
facilitate opening the shells by taking advantage of the additional leverage provided by the width of the shell.

Unlike limpet shells, which were transported and deposited in specific areas by the oystercatchers, the mussel shells were not transported. They were discarded on the intertidal flats where the mollusc was obtained and also consumed (Lauro pers. comm.). Thus, while oystercatchers predation on mussel is readily detectable (due to the distinctive fracture pattern resulting from their feeding habits), accumulations of these shells on shore are not attributable to oystercatcher activity. Similarly, accumulations of whole, or principally whole, mussel shells would not result from any known gull feeding behaviour. Deposits of whole freshwater mussel shells are also unlikely to result from bird behaviour. These mussels are known to be taken by the Australian White Ibis (*Threskornis mollusca*). A large degree of fragmentation would be expected in mussel shell deposited by these birds because their predation behaviour involves use of large rocks as anvil stones to break open bivalve shells (Vestjens 1973:71-2).

In light of the observations in regard to mussel shells and bird behaviour, the presence of relatively dense accumulations of mussel shell in the Palana and Boat Harbour South locations, and the condition of these shells, indicate that they are the product of human activity. Stone artefacts were also recorded on middens in both these locations.

Periwinkle and nerite

There was no evidence of gull predation of any of the periwinkle species, either in the ornithological literature or bird rookery or roosts on King or Flinders Island. These species were similarly absent in the bird midden excavated by Jones and Allen (1978), and which is attributed to the Pacific Gull.
Nerita atramentosa however, is recorded in low densities, along with two periwinkle (Austrocochlea) species in Sooty Oystercatcher middens (Lauro pers. comm. and her collections sighted). The nerites from these locations had a consistent fracture pattern resulting from the bird piercing the main body of the shell to obtain the soft body parts. This behaviour produced an elliptical hole generally about 110 mm in diameter in the main body of the shell [Plate 1].

Fracturing on nerite shells is atypical in Tasmanian midden deposits which contain this species (pers. obs.). Because of the durable nature and small size of these shells it is unlikely that such fractures could result from post-depositional trampling in humanly deposited middens. This fracture pattern evident on the periwinkle and nerite is therefore regarded as an indication of bird rather than human activity.

Chiton

There was no fracture pattern or breakage evident on chiton collected from either the gull or the oystercatcher middens. The condition of the chiton therefore is not regarded as a diagnostic indicator either of bird or human activity.

Pheasant shells

This species was only found on the oystercatcher shell deposits, and these consistently displayed a hole fracture pattern similar to the nerites described above. There is no record of human predation of this species. The presence of this species with this fracture pattern thus is a clear indication that bird activity is responsible for at least some of the shellfish remains found in the same location as this species.
Other shellfish species recorded in bird deposits

There was a small component of abalone recorded in the oystercatcher deposits. Although these were whole shells with no discernible fracture patterns, they were singularly remarkable for their small size range. The average size of the abalone was between 3 cm and 4 cm in their largest dimension, and none exceeded 6 cm (B. Lauro pers. comm., and pers. obs. Lauro's collections). The small size range of the bird deposited abalone provides another indicator of bird activity, although it is highly unlikely that such immature abalone shells would be attributed to human exploitation.

Other material found in association with bird deposited shells that result from bird feeding behaviour

Fish and crustacean remains

Fish mandibles, fin plates, vertebrae and other bones have been recorded in association with shellfish remains on the gull middens. These were found with small clusters of warrener opercula, shell fragments and crustacean remains. The crustacean remnants generally comprised pieces of small rock crab claws. Small crustacea constitute a staple food in the gull diet. Fish bone and crustacea are somewhat less durable than shellfish remains and are unlikely to survive as long in exposed situations. Therefore, while the presence of such remains may indicate bird activity in some cases, the converse is not necessarily true.

Shy Albatross nesting colonies are characterised by dense clusters of squid beaks and fish remains. These are from the birds' regurgitated stomach contents. There is a marked absence of other mollusc remains in albatross sputum because shellfish are rarely consumed by these birds (Green 1974; Pringle 1987).
The scavenging behaviour of the larger seabirds can also account for the presence of bone remains in some locations. Muttonbird and other bird bones were recorded in the gull midden excavated by Allen and Jones (1978), and sawn lamb chop bones have been recovered from inaccessible bird activity areas on King Island (pers. obs.).

Some of the non-shellfish remains described above do provide indicators of bird feeding behaviour. These types of remains, in isolation, are unlikely however to be confused with human midden sites. Nevertheless, if rock crab claws, fish bones, squid bills and/or bird bones were to be recovered from a dense accumulation of shellfish remains, then the possible role of bird activity in these deposits would need to be considered.

**Transported shellfish—species and weights**

Ornithologists have recorded gulls transporting live whelks weighing up to 350 gm (Teichert and Serventy 1947:325; Serventy et al 1971:197). This exceeds the upper size range of warreners. There is no evidence of gull predation of either abalone or mud oyster although oystercatchers may transport exceedingly small immature abalone and other small shellfish species [Table 1]. Furthermore, abalone remains found in one King Island midden represent live weights in excess of 450 gm (based on abalone shells recovered and shell/meat weight ratios from Bowdler 1979:227). The presence of transported shellfish remains which would represent live weights in excess of 350 gms, therefore is not likely to be a result of bird activity. Moreover, transported mud oyster or mature abalone are not attributable to bird activity primarily because they do not comprise part of bird diets.
Location of bird deposited remains

Although many locations of the bird shell deposits investigated were in most aspects similar to human midden locations on the Tasmanian coast, some were in places which were clearly not suitable for human use (Jones and Allen 1978; pers. obs.). These sorts of locations included exposed, cliffed rookery areas and isolated nests. Bird deposits of squid and fish remains have also been observed on small remote islets off the Tasmanian coast which would have been difficult to visit. Some of these islets offer little in the way of known humanly exploited resources, and thus represent a high risk voyage for minimal resource return. In these cases therefore, the location per se strongly suggests that bird activity is the most likely explanation for the remains. Location of the deposits alone however can only suggest that a deposit may be bird rather than humanly deposited. Other factors such as described above, can also be used to investigate further the role of bird activity in deposits located in places considered unsuitable for human habitation.

SUMMARY OF BIRD MIDDEN INVESTIGATIONS

The investigation of bird deposited food remains has provided useful indicators of bird activity associated with shell deposits. Distinctive evidence of bird behaviour can be detected in the types and condition of the shellfish and other marine faunal remains, the sizes of the shellfish, the presence of non-humanly exploited remains, and in some cases the location of the shell deposits.

Some indicators of bird activity are probably more archaeologically useful as they pertain directly to the problem of distinguishing between bird and humanly deposited shellfish remains.
The main indicators of bird behaviour identified in the remains examined are:

a) the presence of chipping and fractures on warrener opercula,
b) arc shaped rim fracture patterns on limpet shells,
c) longitudinal fractures on the anterior edge of mussel shells opposite the ligament,
d) hole piercing in nerite shells,
e) the presence of pierced pheasant shells,
f) the presence of dense accumulations squid bill and rock crab claws, and

g) the location of deposits in cliffed and very exposed situations.

Furthermore the presence of shells representing live weights in excess of 350 gm in transported shellfish remains, or the presence of either transported mud oyster or mature abalone shell is clearly not attributable to bird activity. Thus, if there is no other natural explanation for the presence of such shellfish remains (such as storm activity or changes in sea level), these provides a clear indication that they are a product of human activity.

The results of the analysis of bird deposited remains, confirmed field observations that the shellfish remains recorded as midden sites on Flinders and King Islands were in all cases a product of human behaviour. These results also confirmed that some of the deflated lag deposits in dune blowouts on King Island contain humanly deposited shellfish remains. In light of this, further investigation of other lag deposits in King Island dune blowouts appears warranted.
Chapter 5

FLINDERS ISLAND INVESTIGATIONS AND RESULTS

FLINDERS ISLAND SITES—GENERAL BACKGROUND

As discussed in previous chapters, the principal focus of research on Flinders Island during this project was the Holocene midden deposits. Most specifically it was directed at establishing the chronological span of human occupation associated with these types of sites. Two rockshelters suitable for human occupation were also excavated to further explore the question of island occupation. Geomorphological evidence suggested that the deposits in these shelters were of Holocene antiquity and therefore could contain pertinent archaeological remains.

Charcoal and shell for radiocarbon dating were collected from five of the midden sites on Flinders Island. Two of these sites, Palana and the Cave Beach had been previously recorded in the 1970s, and excavations had been undertaken at that time at these and one other site at Killiecrankie Beach (Orchiston 1979b:134). Although material from the Cave Beach and Killiecrankie site was collected and submitted for radiocarbon dating by Orchiston (1979b:134), no results of this investigation have been published. There were also inherent problems with the dating of human occupation in the published results from Palana since Orchiston's dates were obtained from charcoal which was not shown to be a product of human activity (Orchiston 1984; Sim 1989). In order to clarify the question of the date of human occupation at these sites, charcoal and shellfish remains were collected from a number of midden sites including the Palana and Cave Beach sites, for radiocarbon dating analysis [Fig. 7].
Figure 7: Flinders Island site locations
Three sites, where charcoal was present in the same stratigraphic context as shellfish remains, were sampled for dating purposes specifically to investigate the question of the chronological relationship between the charcoal and the cultural evidence. All previous radiocarbon dates for human occupation on the Flinders Island had been obtained from charcoal rather than shellfish remains (Orchiston 1984). It was therefore vital to establish whether in fact palaeosol charcoal was a reliable chronological marker for human occupation as had previously been asserted (Orchiston 1979b, 1984). That is, it was necessary to determine if the stratigraphic correlation between shellfish remains and charcoal was reflecting a depositional association resulting from contemporaneous human activity, or, if the charcoal was a by-product of natural fire events and its depositional association with cultural remains merely a result of taphonomic processes.

Radiocarbon dates obtained from shellfish samples discussed in this and following chapters, have been corrected by a factor of -450 years to allow for the oceanic reservoir effect (Polach et al. 1983). All shell dates referred to in the main body of this thesis, and in the tables and figures, have been corrected by this factor of -450 years [uncorrected dates are tabled in Appendix II].

Samples for radiocarbon dating were collected from two different types of midden sites on Flinders Island;

a) palaeosol middens, that is, in situ contexts where shell, charcoal and in some cases stone artefacts were evident in a palaeosol unit exposed in eroding sections of back beach dunes,

b) deflated surface shell scatters, some of which had shellfish remains embedded in the uppermost stratigraphic unit along with charcoal and stone artefacts, but where no palaeosol unit was present.
The condition of shellfish remains in the Flinders Island middens did not suggest that birds were responsible for the deposition of these remains. There was a marked absence of fracture patterns on the shells and the range of species present and their location did not concur with shell deposits known to be deposited by birds (as described in Chapter 4) [Table 2]. Furthermore, most of the shell middens recorded on Flinders Island also contained flaked stone artefacts and manuports, indicating these areas were foci of human activity (Sim 1989:35).

<table>
<thead>
<tr>
<th>SITE</th>
<th>Palana</th>
<th>West End</th>
<th>Cave Beach</th>
<th>Old Mans Head Sth</th>
<th>Boat Harbour Sth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Est. number of shells on site</td>
<td>&gt; 250</td>
<td>40</td>
<td>70</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>SPECIES - (estimated %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limpet (<em>Cellana solida</em>)</td>
<td>50</td>
<td>90</td>
<td>90</td>
<td>80</td>
<td>30</td>
</tr>
<tr>
<td>Chiton</td>
<td>20</td>
<td>7</td>
<td>5</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Mussel (<em>Mytilus planulatus, Trichomya hirsuta</em>)</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>periwinkles (<em>Austrocochlea constricta, Bembicum nanum, Nerita atramentosa</em>)</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>warrener (<em>Subninella undulata</em>)</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>whelks (<em>Cabestana spengleri, Pleuropoca australasia, Dicathais textilosa</em>)</td>
<td>2</td>
<td>-</td>
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</tr>
<tr>
<td>other</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*Table 2:* Flinders Island midden sites - shellfish species
The spatial correlation between stone artefact concentrations and the location of shellfish remains, and their stratigraphic association in several sites, further supported the identification of these middens as human food debris. Moreover, it strongly suggested that both the stone artefacts and the shellfish remains were contemporaneous occupational evidence in site locations. With the exception of the Cave Beach site, all middens where shell and/or charcoal was collected for dating purposes, were sites that had stone artefacts in the same stratigraphic or geomorphological context as the shellfish remains. There were however some similar concentrations of shellfish remains also recorded but where there were no worked stone artefacts exposed. As described above, these middens were easily distinguishable from bird shell dumps.

MIDDEN SITES INVESTIGATED

Palæosol middens

Palana

The Palana middens consist of a number of concentrations of shellfish remains and stone artefacts exposed in extensive dune blowouts in the northwest of the island [Fig. 7]. These sites were the principal focus of previous archaeological investigations by Melbourne University researchers (Orchiston 1984). As previously mentioned, the midden sites at Palana were regarded by these researchers, as evidence that the island was inhabited by a stranded, relict population.

The middens are located between 50 and 300 m inland, in a calcareous dune formation 10 to 15 m above sea level [Fig.8]. Although Palana Bay is principally a long sandy beach, there are rock platforms and hard shoreline areas in close proximity to the site. A range of edible shellfish species including limpet and chiton are currently obtainable in abundant quantities from these platforms and rocks. Crayfish and abalone are also
available from rocky headland areas in the Palana vicinity (local informants). Less than one kilometre to the south of the site there is a fresh water source. This is the mouth of Edens Creek, one of the island's few permanent creeks or rivers.

The middens are being exposed as the recent white sand dunes migrate inland, forming large coastal dune blowouts. The shellfish material and stone artefacts are in areas where the underlying darker palaeosol sands and calcrete gravels, have been exposed. In addition to archaeological remains, the palaeosol sediments also contain abundant quantities of charcoal. The shellfish remains however are rather scant, and in even the denser midden areas, generally comprise less than 40 limpet, or 9 mussel shells per square metre (Orchiston and Glenie 1978:130; Sim 1989). Limpet, chiton and mussel are the predominant species represented in the midden remains although several whole whelk shells and fragments of these, and a few isolated periwinkle shells were also recorded [Table 2].

The shellfish remains are evident as surface scatters and most of the shells are partially embedded in the exposed palaeosol sediments. In some places the palaeosol unit is exposed in the sides of erosion gullies. Although no shellfish or stone artefacts were observed in the section faces in the gullies, pieces of charcoal were widespread throughout the upper 40 cm of the palaeosol.

During Orchiston's excavations no stone artefacts were recovered from the palaeosol deposit although one was uncovered which was resting on the surface of the palaeosol. Excavated shellfish remains were stratified within palaeosol sediments in one of the middens he investigated at Palana (Orchiston and Glenie 1978:130-31). Despite the absence of stratigraphically associated in situ shell and stone artefacts at Palana, there was a marked coincidence in the spatial distribution of both shellfish remains and stone artefacts. Stone artefacts were most commonly found in the same proximity as shellfish remains, and hence suggested an original depositional association.
Figure 8: Palana site sketch plan

Figure 9: Palana relict dune stump and occupation level—schematic section
Collection of material for dating

Limpet was selected as the species for radiocarbon dating because it was present in suitable quantities for dating purposes, on all the midden sites recorded on Flinders Island. This avoided problems that may have been encountered due to the possible variation in differential loss of C\textsubscript{14} in different shellfish species.

While unexposed, buried charcoal material could be recovered, the paucity of stratified shellfish remains meant that shell material collected for dating purposes had been partially exposed to weathering. This was not only the case for the Palana samples, but also for all other shell samples collected from Flinders and King Islands. Exposure of the shell has not however affected the radiocarbon dating results because of the sample preparation method used in the laboratory (J. Head pers. comm.).

Limpet shells (Cellana solida) for radiocarbon dating were collected from two square metres in the location indicated on the site plan [Fig. 8; Plate 2]. This limpet shell sample F3, should securely date the period of human activity. Chiton was the only other shellfish species observed in the collection area, and one quartz artefact was also present. These latter remains were recorded but not collected. The sample area was selected because it contained a relatively high number of whole limpet shells. These are preferred to fragmented shell for dating purposes.

In addition to the collection of limpet shells (Cellana solida), two charcoal samples were also taken. The sample F1 was taken from a stump of a consolidated sand dune unit which was clearly overlying the occupation level and the palaeosol unit. There was only one relict portion of this consolidated sand dune unit visible in the site area. The local topography and geomorphological processes evident at the site, suggest that this sand unit was probably quite extensive in the past [Plate 3]. The relict dune pedestal was archaeologically sterile, and the only remains visible in the exposed sections were
several dense clusters of charcoal. A sample of the charcoal in the consolidated dune remnant was collected from the southern section for radiocarbon dating [Fig. 9; Plate 3]. This sample, F1, should provide an *ante quem* date for human activity, as the relict dune overlies the palaeosol containing the cultural remains.

Charcoal sample F2 was collected from the palaeosol sands in the square from which the limpet sample was collected. The F2 charcoal sample was taken after the shellfish (limpet) had been collected from the exposed surface level for radiocarbon dating purposes. After the shell sample F3 was collected, between 1 and 2 cm of surface soil was removed, and buried charcoal lumps collected from the upper 3 cm of the palaeosol sands. No bones were present in the square, although the exposed surface of the entire area was covered by calcrete gravel and nodules. The stratigraphic relationship of the two charcoal samples F1 and F2, and the shell sample F3 is illustrated schematically in Figure 9. It was expected that the age of the F2 charcoal sample would closely correspond to the age of prehistoric human use of the Palana area, that is the date obtained from the shell sample F3.

*Radiocarbon dating results*

A shell corrected radiocarbon date of 4730 ± 70 BP (ANU-7400) was obtained for sample F3, the limpet (*Cellana solida*) shell. Radiocarbon dates obtained for the two charcoal samples F1 and F2, were 4052 ± 90 BP (ANU-7407) and 4090 ± 150 BP (ANU-7399), respectively [Table 3].

When taken to one standard deviation, both radiocarbon dates obtained from charcoal samples indicate there is at least a 66% probability that both are between 3,940 and 4,240 years old and that they may be separated by some 300 years. When taken to two standard deviations, there is a 99% probability that the cultural shellfish remains are older than the charcoal by at least 200 years [Fig. 10]. The charcoal dates obtained
from the cultural level of the palaeosol by Orchiston and Glenie (1978) are at least 1,390 years older than the shellfish remains dated during this project.

The stratigraphic position of the charcoal samples F1 and F2 suggests that they were probably by-products of separate fire events, despite their similar radiocarbon dates and possible contemporaneity. The consolidated dune stump from which the F1 sample 4052 ± 90 BP (ANU-7407) was collected, stratigraphically overlay the palaeosol from which the F2 sample, 4090 ± 150 BP (ANU-7399), was obtained. The palaeosol and the dune charcoal were in fact separated by 40 cm of sterile sand, and on the basis of these dating results, probably by no more than about 300 years [Figs. 9, 10]

The date of the shellfish remains indicates that these are unlikely to be connected with the firing events producing the charcoal pieces present in the palaeosol and dune stump. A non-anthropogenic origin for the charcoal is further supported by the widespread and relatively constant abundance of charcoal in the palaeosol unit, not only where shellfish remains or other cultural evidence are present, but also in vast areas where such evidence is markedly absent. Unlike the charcoal which was distributed throughout the palaeosol, the in situ shellfish remains were restricted to a single band in the palaeosol (also described by Orchiston 1984), and do not appear to present long term occupation at this site. The shell date is thus considered representative of the one occupation period evident in the remains.

Thus the radiocarbon dates indicate; a) that the in situ palaeosol charcoal and shellfish remains are not associated archaeological evidence, b) that the charcoal probably derives from a number of different fire events that are not associated with the use of the site by people, and which occurred after people ceased using the site, and, c) that the dates obtained by Orchiston and Glenie from the same palaeosol probably relate to earlier firing episodes about 6,700 years ago rather than the occupation period of the site.
Figure 10: Radiocarbon dates from the Palana site—two standard deviations
<table>
<thead>
<tr>
<th>SITE</th>
<th>SAMPLE ID</th>
<th>C14</th>
<th>RESULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PALANA</td>
<td>F1 Charcoal</td>
<td>4052 ±90</td>
<td>ANU-7407</td>
</tr>
<tr>
<td></td>
<td>F2 Charcoal</td>
<td>4090 ±150</td>
<td>ANU-7399</td>
</tr>
<tr>
<td></td>
<td>F3 Shell</td>
<td>4730 ±70</td>
<td>ANU-7400</td>
</tr>
<tr>
<td>WEST END</td>
<td>F4 Charcoal</td>
<td>6770 ±80</td>
<td>ANU-7401</td>
</tr>
<tr>
<td></td>
<td>F5 Shell</td>
<td>5920 ±80</td>
<td>ANU-7402</td>
</tr>
<tr>
<td>CAVES BEACH</td>
<td>F6 Charcoal</td>
<td>4660 ±70</td>
<td>ANU-7403</td>
</tr>
<tr>
<td></td>
<td>F7 Shell</td>
<td>5560 ±90</td>
<td>ANU-7404</td>
</tr>
<tr>
<td>OLD MANS HEAD STH</td>
<td>F8 Shell</td>
<td>5070 ±80</td>
<td>ANU-7405</td>
</tr>
<tr>
<td>BOAT HARBOUR STH</td>
<td>F9 Shell</td>
<td>6250 ±90</td>
<td>ANU-7406</td>
</tr>
</tbody>
</table>

**Table 3:** Radiocarbon dates from Flinders Island sites

West End

The West End midden is located in an eroding bank abutting a small sandy bay half a kilometre northwest of West End Beach [Figs. 7, 11, 12]. There are limestone calcarenite outcrops in the bay which extend seaward of the high water mark, forming expansive intertidal rock platforms. Numerous species of edible shellfish are currently obtainable from these platforms at low tide, and abalone is also present in the subtidal zone in this area.

The nearest source of fresh water is an ephemeral soak less than 200 m inland from the beach. The coastal limestone found along this region of the coast also acts as an acquifer, and beach springs and soaks are found in the area. The limestone formation
produces beach soaks from which freshwater can be readily obtained by digging shallow wells. The top of the cliff area is well vegetated by she-oak trees and coastal heathland plants. The present vegetation provides shelter from the prevailing winds and good campsites. The she-oak trees, and the less common grass trees or yacca gums, are also a potential source of firewood.

A six metre cliff is being formed by the erosion of dune deposits along the back of the beach just above the high water mark. In the upper two metres of this exposed section there is a continuous dark palaeosol unit visible [Figs. 11, 12; Plate 4]. Shellfish remains and flaked stone artefacts are present both stratified in situ in the section, and also eroding from it. Erosion of the cliff face is currently active and numerous shells have been dislodged from the palaeosol. Some of these are still embedded in lumps of consolidated palaeosol sediments on the scree of the eroding face.

The archaeological remains comprise a discontinuous lens of shellfish remains, and several flaked stone artefacts and manuports. The in situ remains were located between 20 cm and 30 cm below the buried surface level of the palaeosol unit [Fig. 12]. The exposed palaeosol was studded with charcoal flecks and lumps, both in areas where midden remains and artefacts were clustered, and also in other archaeologically sterile areas. Several dense in situ clusters of charcoal were located in close proximity to some of the stratified shellfish remains. There was no evidence such as ash lenses, hearth stones or burnt food remains, to indicate that the charcoal was from hearths. The widespread distribution of charcoal lumps and burnt roots in the palaeosol suggested that it was evidence of a natural bushfire rather than a direct by-product of human activity.

The shellfish species represented in the exposed section comprised: limpet (*Cellana solida*), *Chiton*, periwinkles (*Austrocochlea constricta* and *Merita atramentosa*) and warrener (*Subninella undulata*). The shellfish remains were neither dense nor
numerous, with less than 40 limpet shells in total observed. This was the most common species present and represented 36 (about 90%) of the shells observed. Chiton accounted for the most of the remaining shell, with a minimal component of periwinkles and warrener fragments [Table 2].

Collection of material for radiocarbon dating

A lump of charcoal, sample F4, was excavated from within the palaeosol for radiocarbon dating. It was collected from a charcoal concentration immediately adjacent to a limpet and other shellfish remains exposed in the section face [Fig. 12]. Limpet shells were also removed from the same level for dating purposes. These comprised sample F5.

Radiocarbon dating results

A shell corrected date of $5920 \pm 80$ BP (ANU-7402) was obtained for the shellfish remains, sample F5. According to the dating results, the charcoal sample F4, was considerably older. The date obtained for the charcoal was $6770 \pm 80$ BP (ANU-7401) [Table 3; Fig. 10].

The chronological relationship between the cultural remains and charcoal

The radiocarbon dates indicate that there is a greater than 99% chance that the shellfish remains and the charcoal concentration in the palaeosol are not contemporaneous, and that the shellfish remains are at least 500 years younger than the charcoal [Fig. 10]. Although there is a stratigraphic association between the charcoal and the shellfish remains, this most probably reflects taphonomic processes rather than an anthropogenic cause. There is no evidence to support an anthropogenic origin for the charcoal.
Figure 11: West End site sketch plan

Figure 12: West End section drawing
Furthermore, the widespread occurrence of charcoal in the palaeosol unit, including sections where no cultural remains were present, strongly suggests that it results from fire events not associated with occupation at the site. The West End charcoal date also overlaps the two obtained from the Palana occupation palaeosol by Orchiston and Glenie (1978). This supports the interpretation of the palaeosol charcoal at West End originating from widespread fire events occurring on the island about 6,700 years ago.

Cave Beach

Cave Beach is located at the southern end of Marshall Bay on the west coast of the island [Figs. 7, 13]. It is a sandy beach just less than one kilometre long with granite and limestone rock platforms and rocky headlands. There is presently no permanent water source closer than one and a half kilometres to the site. Ephemeral fresh water coastal springs and ponds provide water after rain in the immediate vicinity. Less than one kilometre from the site is the Settlement Point muttonbird rookery, the only rookery recorded on the main island.

At Cave Beach prevailing westerlies have eroded a vertical section of an earlier dune formation, exposing a buried palaeosol unit which extends over a distance of about 250 metres [Figs. 13, 14; Plate 5]. In the eroded dune face is a sub-surface palaeosol unit containing a discontinuous band of scattered shellfish midden remains. The midden material consisted of limpet (*Cellana solida*), *Chiton*, whelk and periwinkle (*Austrocochlea constricta*) species. The limpet shells were numerically predominant, comprising 63 or more than 90% of the shellfish remains observed [Table 2].
Figure 13: Cave Beach site sketch plan

Figure 14: Cave Beach dune section
In total the shellfish remains were scant, with less than 50 whole shells recorded, in addition to a number of shell fragments. This included loose shells eroding from the archaeological deposits which were lying at the foot of the exposed section, along with fallen portions of the palaeosol, some of which also contained stratified archaeological remains.

The *in situ* shellfish remains were consistently located between 20 cm and 30 cm below the top of the palaeosol level. Charcoal was also present in concentrations and isolated small pieces, in the same level as the shellfish remains in the palaeosol unit [Fig. 14; Plate 5]. No stone artefacts or other cultural remains apart from the shellfish remains were observed at the site.

There is at present, clear evidence of active erosion of the embankment containing the palaeosol unit and midden remains. The area excavated by Orchiston in the mid 1970s was pointed out by the owner of the property adjacent to the site (Orchiston 1979b). A large consolidated portion of the palaeosol which included the excavated area has broken off from the main embankment. From this it is estimated that wind and water are currently eroding the bank (back from its vertical face) at a rate of about 1 m per 15 years.

*Collection of material for radiocarbon dating*

Limpet (*Cellana solida*) shells were removed from the palaeosol for radiocarbon dating. These comprised sample F7. The charcoal sample F6, was obtained after cleaning back the face of a charcoal concentration evident in the palaeosol at the same level as the shellfish remains. The sample was recovered from within a concentration of semi-consolidated charcoal pieces.
Radiocarbon dating results

A shell corrected radiocarbon date of $5560 \pm 90$ BP (ANU-7404) was obtained from the limpet shell sample F7. The radiocarbon date for the charcoal sample F6 was $4660 \pm 70$ BP (ANU-7403) [Table 3; Fig. 10].

As with the two other Flinders Island midden sites described above, the radiocarbon dates obtained from stratigraphically associated shellfish remains and the charcoal at Cave Beach are not contemporaneous [Table 3; Fig. 10]. Similarly, this site also lacked evidence of humanly constructed hearths although charcoal pieces and concentrations were widely distributed in the palaeosol. The 500 year disparity between the radiocarbon date obtained from the charcoal sample and that for the shellfish remains (at two standard deviations), strongly suggests that charcoal in the same level of the palaeosol as the shellfish is unlikely to be associated with human occupation.

Deflated midden sites

Boat Harbour South

There are numerous light surface scatters of shellfish remains associated with calcareous soils and limestone formations along the west coast of the island. These middens are predominantly scant scatters of limpet shells with a smaller component of chiton, and rarely contain more than 15 shells per square metre [Table 2]. These middens are found on the headland and rocky coastal margins along the coast in the Boat Harbour vicinity [Fig. 7; Plates 6, 7]. More than one hundred stone artefacts were previously collected from the Boat Harbour locality in the first archaeological survey work undertaken on the island by Casey and others in 1946 (Mackay 1946). Further sites were recorded in this locality in the 1970s by the Melbourne University
Bass Strait Biogeography Project team (Orchiston 1979b:304). However, the shell middens in the Boat Harbour South area were not reported by these investigators. They were first identified during fieldwork associated with this project (Sim 1989:24-26).

At Boat Harbour South, a small sandy embayment mid-way between Boat Harbour and Cape Frankland, there were a number of low density shellfish scatters, some of which had scatters of flaked stone artefacts and manuported quartz pieces amongst the shellfish debris [Plate 7]. Midden shellfish remains included two concentrations of mussel shells (*Trichomya hirsuta*) in addition to more than fifteen discrete scatters of the limpet and chiton scatters which typify the Flinders Island midden sites. Six unmodified, indurated limestone flakes and two pieces of fractured quartz were found lying amongst a scatter of limpet and chiton shells, along with the only whelk shell observed on any of the middens in this locality. These were less than two metres from the mussel shell scatter and appeared to be eroding from the same stratigraphic context. No charcoal or evidence of hearth construction was observed in the vicinity of the shell scatters.

There are extensive granite intertidal rock platforms in the immediate vicinity and these are presently colonised by a range of edible shellfish species. The most readily obtained, and most numerous of these, are limpets. In this particular locality however, there was a general absence of the periwinkle species which are abundant on most of the west coast rocky shores. The granite rock platforms in the immediate vicinity of the Boat Harbour South sites do not appear to be a conducive environment for these smaller intertidal species. Thus the differences in shellfish species in the Boat Harbour South sites is probably attributable to geological differences in the coastal rock formations.
Plate 2: Palana midden scatter—collection of limpet shell for dating

Plate 3: Palana—relict dune stump overlying occupation palaeosol

Plate 4: West End—*in situ* artefacts and shellfish in dark occupation palaeosol level with the top of the ranging pole

Plate 5: Cave Beach exposed section with shellfish remains and charcoal in dark palaeosol level
Plate 6: Boat Harbour South locality showing typical erosion patches where shellfish remains, stone manuports and artefacts were located (top)

Plate 7: Boat Harbour South light shell scatter with quartz manuport (lower left)

Plate 8: Old Mans Head South midden scatter where sample of limpet for dating was collected (lower right)
Plate 9: Striated and pitted limestone manuport from Old Mans Head South midden

Plate 10: The Docks North limestone shelter viewed from shoreline

Plate 11: Settlement Point rock shelter
The shellfish scatters observed along the coast south of Boat Harbour were generally found in small erosion patches amongst the small coastal bushes and grasses. The middens were generally less than 20 m from the high water mark on sandy limestone ridge areas which abut the granite boulder shores. Some lower density shell scatters were recorded however up to 100 m inland. These were generally exposed as a result of fire trail and access track construction. Most of the midden sites however were in closer proximity to the shore. The nearest permanent supply of freshwater is at present more than one kilometre from the Boat Harbour South sites. Ephemeral sources and beach soaks in the vicinity provide predictable supplies which, in times of greater rainfall, may well have been permanent supplies.

*Collection of material for radiocarbon dating*

Limpet shells were collected from the midden scatter which also contained flaked stone artefacts. This was sample F9. Shells which were partially buried were collected in preference to totally deflated remains although none was buried in entirety.

*Radiocarbon dating results*

The shell corrected date obtained from the limpet (*Cellana solida*) sample, F9 was 6250 ± 90 BP (ANU-7406) [Table 3; Fig. 10].

Old Mans Head South

Old Mans Head is situated on a high energy rocky shore area, environmentally similar to the Boat Harbour South vicinity [Fig. 7]. There is a permanent creek 800 m from the site at the northern end of Killiecrankie Beach, and typical ephemeral coastal soaks and springs are located closer to the site. The shoreline consists of large intertidal rock platforms and fissured granite formations. It is generally a high energy coast although
small gullies in the fissured granite and the tidal platforms are relatively sheltered. These are currently colonised by limpet, chiton, periwinkle and other intertidal shellfish.

The shellfish scatters are located about 5 m above high water mark on a limestone ridge [Plate 8; Fig. 14]. The limestone formation is typical of the west coast in that it immediately overlies the granite which is exposed a few metres below in the shoreline. Several habitable rock shelters are also located in the overlying limestone formation, and these are less than 200 m from the middens. There are however no surface remains in these shelters which indicate their use by Aboriginal people. Burrowing activity by wombats in one shelter has unearthed animal bones. These include extinct island fauna such as the Tasmanian Devil which was not present on the island when Europeans first arrived there about two hundred years ago (Hope 1973:173).

![Figure 15: Old Mans Head South midden scatters—sketch site plan](image-url)
No shellfish remains however have been exhumed in these shelters, either by wombats or by the property owner's recent excavation of the deposit in the largest shelter. This latter shelter has been excavated to a depth of more than one metre by the property owner. It is believed the excavation was carried out to enable the shelter to be used for a bomb shelter in the event of a nuclear war. The owner is believed to be living at present on an ashram in India (local informant). Thus, it was not logistically feasible to check with him regarding the deposit he excavated. Inspection of the exposed excavation sections in the shelter and spoil outside the cave indicated that the deposit was archaeologically sterile.

The middens south of Old Mans Head consisted of light scatters of predominantly limpet (*Cellana solida*), and *Chiton*, although a smaller component of periwinkles (*Austrocochlea constricta* and *Nerita atramentosa*), warrener (*Subninella undulata*) and whelk was also recorded [Table 2]. The densest scatter had less than 25 individual shells present in total. There were three pieces of limestone rock also lying within one square metre of the shellfish remains. When these three pieces were conjoined, they formed a flattened elliptical stone and it was possible to discern striations along one side consistent with use of the rock to remove limpets [Plate 9]. The rock was clearly a manuport, and was also of a suitable size and shape to facilitate the removal of limpets. Pitting was also evident on one end of the rock.

Two other similar artefacts were recorded on other Flinders Island midden sites during survey work (Sim 1989:27). During the course of this survey, Ronnie Summers, the Aboriginal consultant from Flinders Island, was observed employing a similarly sized piece of rock to remove limpets from the granite boulders. He struck the limpets from the rock using an oblique blow rather than attempting to lever them off with his knife or other tools on hand. As he demonstrated, the limpets were most easily removed by a quick sideward blow. The presence of similar manuported rocks on midden sites suggests that a similar method was probably employed to collect limpets in the past.
Collection of material for radiocarbon dating

Limpet shells were collected from the densest midden scatter (which was also associated with the limestone manuport). This was sample F8. Most shells were loose on the surface, having deflated from the surrounding calcareous sediments, and most still contained consolidated sediment infilling the underside concavity of the shell. No charcoal was observed in the sediments.

Radiocarbon dating results

The shell corrected date obtained from the limpet (*Cellana solida*) sample, F8 was 5070 ± 80 BP (ANU-7405) [Table 3; Fig. 10].

ROCKSHELTER EXCAVATIONS

As outlined in chapter 3, the coastal rockshelters found in the west coast limestone on Flinders Island, are believed to be Holocene landforms formed as the result of coastal geomorphological processes around 6,600 years ago (Kershaw and Sutherland 1972; Sim 1989). Although there was flaked glass and other evidence of historic Aboriginal occupation on the surface of the shelter deposits, subsurface archaeological remains could have provided useful evidence in regard to human occupation on Flinders Island from mid-Holocene times.

Alternatively, an absence of cultural material in the deposits would also be of interest; a) in terms of how people used the landscape in the past if they were on the island and yet not using the shelters, and, b) the abandonment model previously proposed (Sim 1989). In light of the abandonment model I had previously suggested, the absence of human debris in the shelters would not be anomalous. The deposits in two rockshelters
were therefore tested for evidence of prehistoric use by undertaking 1 m by 1 m excavations.

Settlement Point

A small test excavation was carried out in a rockshelter in the coastal limestone formation at Settlement Point [Figs. 7, 16, 17]. The shelter is near the historic Wybalenna Aboriginal site where the group of Tasmanian Aboriginal people taken to Flinders Island by G.A. Robinson in the 1830s, lived for over a decade. There are several historic midden sites around the coast in the settlement area (Sim 1989) and the surface level of the shelter deposit also contained historic midden material from the historic Aboriginal settlement period. Shellfish remains, retouched bottle glass flakes and a brass button, were recovered from the surface of the shelter deposit, along with charcoal and partially charred wood.

The shelter is about 5 m above, and 20 m inland from, the present high water mark. The interior space is about 9 m by 2 m, and between 1.5 and 1.8 m high in most places [Fig. 16]. It has been formed by coastal erosion of the limestone formation which overlies the granite coastal boulders, and in the rear of the shelter the granite bedrock is exposed at floor level in places. The calcareous deposit sediment is derived from erosion of the limestone shelter parent rock.

A test pit one metre square was opened in the shelter deposit. After the removal of the historic midden upper level, the pit was excavated in measured spits to the granite bedrock about 75 cm below the surface [Fig. 17; Plate 10]. At a depth of 55 cm below the surface, the test pit was reduced to 75 cm by 75 cm due to large pieces of roof-fall impeding progress in one area in the square [Fig. 17]. Other pieces emerged which intruded into the smaller square but these were extracted or worked around. All excavated deposit was dry sieved using 5 mm and 2.5 mm mesh sizes.
Figure 16: Settlement Point Shelter - plan and section views
Figure 17: Settlement Point excavation sections

SOUTH
- Pale yellow/grey coarse sand
- Historic midden base
- Limestone
- Granite
- Pale yellow calcareous coarse sand
- Granite gravel
- Granite bedrock

NORTH
- Abalone
- Ash lens
- Periwinkle
- Limestone roof fall

1 Pale yellow/grey midden deposit
2 Paleo yellow limestone sands with roof fall
No prehistoric archaeological remains were recovered from the test pit. The deposit contained some small patches of bone fragments entwined in a fibrous brown material which appear to be carnivore coprolites. The fragmentation pattern and the type of bone fragments are similar to those attributed to Tasmanian Devil predation activity described by Douglas et al (1966) and Marshall and Cosgrove (1990:110). Similar remains were also recovered from Ranga Cave on Flinders Island by Hope (1973:170, 178). There is no extant devil population on Flinders Island although prehistoric remains of unknown antiquity have been recovered from sand dune deposits at Palana (Hope 1973:172, 178) and in west coast rockshelters along the west coast of Flinders Island (Sim 1989).

Apart from the bone fragments described above, the only other organic material recovered from the prehistoric deposit levels were seaweed fibres from the lower spits. These indicate that the cave sediments were deposited after the sea was in close proximity to the cave, and are therefore younger than about 6,600 years old. The vertical distribution of seaweed fibres in the pit, accords with Chappell and Roy's (1985 in Chappell 1990:40) Holocene sea level curve [see also Fig. 2]. This indicates that between 6,600 BP and about 4,000 BP the sea level was between 1 and 2 metres higher than at present. The closer proximity of the high water mark to the shelter at such times of a higher sea level would explain the presence of seaweed in the basal levels, and its absence in the more recent upper levels. The absence in the upper levels suggests that these sediments were deposited in the post 4,000 BP phase, when the shoreline would have been further from the shelter, probably at a similar distance to that at present.

The non-cultural remains recovered from the shelter, and the absence of cultural remains in the lower deposit, indicate that people were not using the shelter in the prehistoric island period.
The Docks North Shelter

This shelter was one of several coastal limestone shelters in the vicinity of the Docks in the northwest of the island [Fig. 7]. The largest of the shelters, which was about 600 m north of the Docks, was selected for excavation. In plan, the shelter is crescent shaped as it is tucked under, and follows the ridge line of a small embayment [Plate 11]. The shelter was located about 5 m above sea level and was less than 10 m from high water mark in the gully below. It is well sheltered from the prevailing westerlies, due in part to its orientation and also the coastal shrubs which were dense enough to obscure the ocean view in places.

Like the Settlement Point shelter, the Docks North shelters are located in close proximity to extensive rock platforms and rocky shores abundant with a wide range of edible shellfish including limpets, chiton, periwinkles and abalone. Freshwater is generally obtainable from a small creek less than 500 m from the shelters. It is also present in beach soaks which wallabies exploit, and which can be detected by the concentration of tracks and the holes they dig above high water mark on the beaches.

There were several low density limpet midden scatters in the vicinity of the shelters, none of which however contained more than ten shells. Several isolated stone artefacts were also found in the Docks vicinity, indicating prehistoric use of the area. There were no artefacts or shellfish remains on the surface of any of the Docks rockshelter deposits. In the excavated shelter, there was an active wombat burrow at the rear of the shelter and a number of immature wombat bones were concentrated around the burrow entrance.

A test pit, one metre square, was excavated in measured spits to a depth of 1.8 m below the surface. As with the Settlement Point shelter, large pieces of roof-fall were encountered, and the lower 75 cm of the pit was stepped down in size to 50 cm by 1 m.
Bedrock was not reached as the excavation was discontinued for safety reasons. The increase of roof-fall towards the base of the pit made it logistically unfeasible, to safely continue the excavation. The base of the pit was augered and this indicated that there was a further 30 cm of sand, resting on either a large piece of limestone roof-fall or bedrock.

All the excavated deposit was dry sieved using 5 mm and 2.5 mm mesh sizes. With the exception of less than 75 gm of wombat and murid bones recovered in the uppermost 10 cm, the deposit consisted entirely of sterile coarse sand and pieces of parent rock. The sediment component was a homogenous deposit of highly calcareous, pale coarse sands derived from the parent rock of the shelter. Apart from a slightly darker upper surface unit about 10 cm in depth, there were no stratigraphic changes. The highly alkaline nature of the sediments (pH 8.5 to 8.7) suggest that the absence of organic remains is not likely to be attributable to preservation factors, and is rather a reflection of lack of prehistoric use of this shelter by humans or other animals.

SUMMARY OF THE FLINDERS ISLAND INVESTIGATIONS

Coastal Rockshelters

More than ten rockshelters suitable for human habitation were located during site surveys (Sim 1989). Two of these were selected for test excavations to investigate the chronology of human occupation on Flinders Island. There was no evidence of prehistoric human occupation, either on the surface of any of the coastal rockshelters on Flinders Island, or recovered from the test excavations. Despite the absence of cultural remains in the shelters, non-anthropogenic organic remains recovered from the Settlement Point shelter excavation indicate that the basal deposits correlate to a time of slightly higher sea level. According to palaeoenvironmental data, this would date the
basal deposit at Settlement Point to between about 6,500 and 4,000 years ago [see chapter 2; Fig. 2].

In light of the radiocarbon dates obtained for the Flinders Island shell midden sites, the absence of evidence of human use of these shelters could be interpreted as either; a) a consequence of the sediment deposition occurring in the period after people had ceased to inhabit Flinders Island, that is that the deposits are more recent than about 4,500 BP, or, b) a reflection of human behavioural factors—that people on the island were choosing not to use the west coast rockshelters. Although there is no secure depositional history for these shelters, palaeoenvironmental indicators, such as the seaweed in the Settlement Point shelter lower deposits, suggest that the shelters were not conducive human habitats during the occupation span indicated by midden dating results.

Midden Sites

Faunal remains

All of the Flinders Islands middens were characterised by scant numbers of shellfish remains, clear targeting of a small range of intertidal species, and an absence of more subtidal species such as abalone and mud oyster (*Notohaliotis ruber*, *N. laevigata* and *Ostrea angasi*). These latter species were probably available but are generally procured by diving. The predominant species in most midden sites were limpet (*Cellana solida*) and *Chiton*. There was a small but consistent component of a range of other intertidal species present on most sites. These included; mussels (*Trichomya hirsuta* and *Mytilus planulatus*), three types of periwinkles (*Austrocochlea constricta*, *Bembrium nanum*, and *Nerita atramentosa*), warrener (*Subninella undulata*) and whelks (*Cabestana spengleri, Pleuropoca australasia and Dicathais textilosa*) [Table 2]. This
suggests that shellfish exploitation strategies did not encompass use of the subtidal zone.

No bone was observed in association with the shellfish remains. Wombat, macropod and other bones were observed in erosion swales in the Palana blowouts although there was no spatial association between these and the shellfish remains or stone artefacts.

Stone artefacts

Stone artefacts were found on the majority of Flinders Island midden sites although these were often isolated finds or few in number [Appendix III]. These include grindstones, fractured quartz pieces, cores and unmodified flakes made from a range of locally available stone types, and manuports which may have been used to collect limpets. Although retouched implements were collected from Palana by Orchiston and Glenie (1983:133), none were located at this or other midden sites during subsequent investigations (Sim 1989:28). Previous artefact collection from site locations on the island, preclude accurate analysis of stone assemblages from surface sites on the island, because much of the collected material is still held in private collections (S. Brown pers. comm.).

Burnt calcarenite stones were evident in the Palana site and it is believed that these were the stones identified by Orchiston and Glenie as hearth stones (1978:130). The widespread occurrence of burnt calccrete nodules, in both site and non-site locations, in the Palana dune blowouts does not support the interpretation of these as cultural remains. Furthermore, nearly all the exposed calccrete was obviously affected by natural fire episodes. Remnants of burnt vegetation in the blowouts demonstrated that extensive bush fires had occurred here in recent, and probably also prehistoric, times. In the absence of evidence other than heat effects, the interpretation of the calcrete nodules as 'hearth stones' (Orchiston and Glenie 1978:130) is speculation.
Chronology

Charcoal

As discussed above (in the results of the Palana, West End and Cave Beach investigations), palaeosol charcoal dates do not chronologically correlate with cultural evidence found in the same stratigraphic context. Neither is there any consistent pattern in the divergence between the charcoal and shell dates at any of these sites [Fig. 10]. This series of shell and charcoal dates highlights problems inherent in the common archaeological practice of using non-anthropogenic organic remains to date stratigraphically associated cultural remains. This is a complex taphonomic problem which has major implications particularly relevant to the interpretation of archaeological remains from dune sites on King and Flinders Islands.

Nevertheless, when the charcoal dates from all the midden sites are compared with the dates obtained from the shellfish remains an interesting pattern is revealed. There is a distinct hiatus from about 4,700 to 6,500 years ago, in the sequence of palaeosol charcoal dates. The absolute dates obtained from cultural remains all fall within this hiatus in the charcoal dates [Fig. 10]. Hence, rather than charcoal dates in these sites being a chronological marker of human occupation, the converse appears to be true—the presence of charcoal is chronologically associated with an absence of human occupation at these sites.

Thus, the evidence from Flinders Island indicates that in aeolian depositional contexts, charcoal does not provide a reliable chronological marker for human occupation unless it can be unequivocally demonstrated that the charcoal is attributable to human activity.
Cultural remains

When taken to one standard deviation, the radiocarbon dates obtained from shellfish (limpet) remains encompass a span of nearly two thousand years from 4,660 BP to 6,340 BP [Table 3; Fig. 10]. This demonstrates that people were using these sites after the sea had reached a level similar to that of today about 6,600 years ago, and, several thousands of years after the sea level rise had isolated the Furneaux Group of islands from mainland Tasmania.

Although there were possibly other coastal middens deposited in the period after the island formed, and before the sea reached its present level (between about 8,500 and 6,600 years ago), it is considered unlikely that middens from this time period will be found on Flinders Island. There were no shell midden dates earlier than 6250 ± 90 BP (ANU-7406). The chronological coincidence between the appearance of midden sites and the shoreline reaching its present location, suggests that earlier middens have been subsumed in the final phase of the sea level rise.

The evidence from the nearby Prime Seal Island cave site shows that the Furneaux region was occupied in late Pleistocene and early Holocene times (Brown 1990). There is no reason to believe therefore that Flinders Island was unoccupied prior to about 6,300 BP, the oldest date of occupation from Flinders Island. The steep topography in several locations around the west coast of Flinders Island, could contain midden evidence predating 6,600 BP. While further dating of midden sites in these locations may extend the mid-Holocene chronology of island occupation, it is considered highly unlikely that middens of any greater antiquity than about 7,000 BP will be found on Flinders Island. The absence of dated cultural remains from the early island phase is thus considered to be reflecting site preservation factors rather than an occupational hiatus.
Radiocarbon dates obtained from cultural shellfish remains from five different midden localities indicate that these sites were occupied between about 4,700 and 6,300 years ago [Fig. 10; Table 3]. The consistency in the types of remains on the undated midden sites, and their geomorphological contexts, did not suggest that any of the undated midden sites recorded were likely to be either substantially older or younger than the occupation span indicated by the dated sites.

The absence of middens or other sites, in more recent Holocene coastal landforms supports an absence of prehistoric occupation on the island more recent than about 4,500 years ago. Therefore, the current data suggest that the 4,700 occupation date is probably associated with the final period of prehistoric island use. This raises the question as to the ultimate fate of the people who were occupying the island in Holocene times. Were they a stranded relict island group who became extinct or, did they acquire the means to leave the island and choose to leave? Alternatively it could be suggested that Flinders Island was being visited by mainland Tasmanians who chose to cease visiting the island about 4,500 years ago.

While further midden radiocarbon dates may broaden the known span of prehistoric human use of the island, further dating per se offers little potential in terms of elucidating the problem of the nature of the island occupation—that is, permanent occupation versus island visits. The question regarding the nature of prehistoric use of Flinders Island is discussed further in chapter 7, in reference to broader regional data and the use of islands by Tasmanian mainland groups in Holocene times.
Chapter 6

KING ISLAND INVESTIGATIONS
AND RESULTS

KING ISLAND SITES—GENERAL BACKGROUND

In addition to the first reported prehistoric site discovered by Jones in 1979, I recorded a further 23 prehistoric Aboriginal sites on the island (Sim 1988, and further site recording 1989). Several midden sites were recorded in what appeared to be modern geomorphological contexts, and which were thought to be from the period of early nineteenth century occupation of the island by Aboriginal women (Sim 1988). These latter sites generally comprised warrener predominated shellfish scatters in close proximity to historic sealing camp locations. Only one midden, the Quarantine Bay site, was recorded in what was clearly a prehistoric geomorphological context. The predominant shellfish species on this site was abalone, and these were stratified some 15 m above sea level, 350 m inland in an aeolian dune formation. Both the geomorphological context and the presence of large, mature abalone and mud oyster shells indicated that these were human food debris. Apart from one manuported stone at the Quarantine Bay site, no stone artefacts or manuports were recorded on midden sites.

The majority of prehistoric sites on King Island however, were low density stone artefact scatters and included three isolated finds. Most sites were located in close proximity to freshwater sources, particularly the lagoons which are found in numerous locations on the island (Sim 1990).

Prehistoric archaeological evidence found on King Island was markedly different from that on Flinders Island in that previous survey located only one site containing prehistoric shellfish remains (Sim 1990). On King Island there was somewhat less
visibility in coastal areas since most of the west and southwest coast of the island had been inundated by a Holocene dune formation (Jennings 1959a). Hence, it may be that prehistoric midden sites on King Island were inundated not only the rising sea as suggested by Jones (1977), but also by aeolian Holocene dune deposits. The one stratified midden site recorded on the island (Sim 1988) was in fact exposed in a dune blowout, and several other large dune blowouts also contain accumulations of shellfish and bone remains.

These latter remains presented the problem of determining whether some faunal remains in dune lag deposits were in fact prehistoric cultural remains. Although the analysis of bird deposited faunal remains provided some useful diagnostic indicators of bird activity, it was not always possible to detect bird activity in some remains such as warrener shells. Since many lag deposits contained both shellfish that was clearly attributable to bird behaviour, and some that was ambiguous in this regard, it was decided to further investigate remains from one of these lag deposits. To determine the origin of the ambiguous shell, further analysis was undertaken as to identify characteristics attributable to human behaviour. This would provide another comparative basis for examination of shellfish remains in the lag deposits, and one directly related to human behaviour.

Because the evidence of prehistoric coastal exploitation on King Island was scant, and that data pertinent to the period when the island first became separated from Tasmania were unlikely to be recovered from coastal midden sites, the main focus of the King Island investigations was on artefact sites and cave locations. It was anticipated that these locations would provide data relevant to questions regarding the nature of Holocene occupation on King Island. This would facilitate testing of Jones' suggestion, that King Island was analogous to Flinders Island in that archaeological evidence indicated that it was occupied by a stranded relict human population in Holocene times (1979:92).
Figure 18: King Island site locations and places mentioned in the text
Jones' interpretation was based on a palaeosol charcoal date of 7,500 BP he obtained from a stratigraphic unit which also contained in situ stone artefacts at the Petrified Forest site [Fig. 18]. The fundamental problems underpinning Jones' interpretation of the evidence are;
a) the assumed chronological association between charcoal obtained from an aeolian dune palaeosol, and cultural evidence stratified within the same palaeosol, and,
b) the assumption that if people were on the island after it became severed from mainland Tasmania, then these people lacked watercraft technology.
These same assumptions are also inherent in Orchiston's interpretation of the Flinders Island midden sites (1979b).

If however, people were on the island after the sea reached its present level, as the prehistoric midden site on King Island suggested, then other evidence of this occupation could expect to be found in caves and in stratified deposits in open sites on the island. It was therefore crucial that the cultural remains in the Quarantine Bay midden site be radiocarbon dated, and that other sites be investigated in order to securely determine if they contained evidence of prehistoric human occupation from the period after King Island became separated from Tasmania.

Locations regarded as having the potential to provide relevant archaeological data to both the late Pleistocene landbridge to early Holocene peninsula/island phase, and, the more recent phase from about 6,600 years ago when the island would have been a similar size to today, were identified from survey work previously undertaken on King Island (Sim 1988, 1990). These locations included sea caves, both stratified and lag deposits of shellfish remains in dune blowouts and open artefact sites. The latter sites included the Cataraqui Monument site, a quarry site where there was an assemblage of artefacts reminiscent of Kartan sites on Kangaroo Island described by Lampert (1980, 1981). This site was of particular interest because there appeared to be stratified
archaeological deposits which could possibly reveal further information regarding the antiquity of such assemblages.

KING ISLAND SHELLFISH DEPOSITS

Shellfish remains were recorded in a number of locations on the west coast of King Island during extensive site surveys around the coast of the island (Sim 1988, 1990). Several locations were investigated where shellfish remains clearly attributable to human deposition were evident. These included the prehistoric site at Quarantine Bay and an historic Aboriginal midden. The geomorphological context of the remains at Quarantine Bay indicated that the shellfish remains were deposited prior to European occupation, and probably sometime after the sea reached a level similar to that at present about 6,600 years ago (Sim 1990).

Apart from the one prehistoric midden identified previously, shellfish deposits recorded on King Island were either historic Aboriginal middens in the vicinity of early sealing campsites, or deflated deposits of unknown origin and antiquity in dune blowout lag deposits. Since archaeological evidence of coastal resource exploitation was crucial to the research questions being addressed, a typical deflated blowout lag deposit at Cataraqui Point was selected for further investigation. The Cataraqui Point blowout lag deposit also contained dense accumulations of other faunal remains including bones of two extinct bird species and several locally (King Island) extinct terrestrial mammal species. Primarily the investigation was aimed at determining if any of the faunal remains (particularly the shellfish) in these types of deposits were demonstrably of anthropogenic origin, and if so, what occupation period they represented.

One midden site believed to be from the early sealing period was also selected for further investigation. This site was a warrener midden in a dune blowout at Middle Point in Seal Bay (Sim 1988, 1990). This site was in close proximity to one of five
sealing camp locations documented in early nineteenth century historic accounts (Barnard 1826-27; Micco 1971). Barnard recorded a try pot at Seal Bay, and in two other camp locations around the island, while undertaking a government survey of King Island in 1826. (These are heavy cast iron pots over 1 m in diameter which were used by whalers and sealers to render fat from animal carcasses. One salvaged from Half Moon Bay is currently housed in the King Island Historical Society museum at Currie.)

Radiocarbon dates were required to establish a secure chronology for human occupation of the King Island region, since the previous chronological interpretation of the island's sites was based on geomorphological evidence (Sim 1990). Two of the sites selected for dating were similar to some of the Flinders Island middens, in that the shellfish remains were stratified in charcoal rich palaeosol units in aeolian dune formations. In addition to shell samples, palaeosol charcoal samples were also collected from these two sites for radiocarbon dating. This was to enable further investigation of the question regarding the chronological relationship between cultural remains and charcoal found in stratigraphic association in palaeosol dune contexts.

**Middle Point midden**

The Middle Point midden is situated in the lee of a small rocky headland dividing the long sandy beach of Seal Bay [Figs. 18, 19]. The faunal remains are located about 30 m inland, and are deflating from a palaeosol level in the dunes, about 5 m above sea level. The palaeosol is a very weakly developed burn level containing large pieces of charred and burnt wood, the size of which indicates that this area was much more heavily vegetated in the past. At present vegetation is principally confined to marram and other grasses and small coastal shrubs.
Boobialla scrub

Area with charcoal rich palaeosol exposed.

Grass vegetated dunes.

Middle Point

Figure 19: Middle Point site sketch plan

<table>
<thead>
<tr>
<th>SITE</th>
<th>Middle Pt</th>
<th>Quarantine Bay</th>
<th>Cataraqui Pt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Est. total no. of shells on site</td>
<td>50</td>
<td>60</td>
<td>&gt; 100</td>
</tr>
<tr>
<td>SPECIES - (estimated %)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warrener (Subninella undulata)</td>
<td>40</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>Abalone (Haliotis)</td>
<td>10</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>Limpet (Cellana)</td>
<td>20</td>
<td>2</td>
<td>15</td>
</tr>
<tr>
<td>Mussel (Mytilus planulatus)</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Mud Oyster (Ostrea angasi)</td>
<td>-</td>
<td>15</td>
<td>-</td>
</tr>
<tr>
<td>Whelk (Dicathais textilosa)</td>
<td>4</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Chiton</td>
<td>10</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Other (small gastropods, scutus)</td>
<td>16</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 4: King Island midden sites - shellfish species
Middle Point is less than one kilometre from the mouth of Seal River and the Surprise Bay lagoons which are permanent freshwater sources. The remains of a sealing camp were recorded nearby, at the southern end of Seal Bay, in 1826 by Barnard.

The Middle Point midden comprised a scatter of faunal remains including shellfish, sheep and macropod bones, and a number of round beach pebbles between 3 cm and 8 cm in diameter [Table 4]. Several of the warrener shells (*Subninella undulata*) were embedded in a palaeosol unit exposed in the vicinity of the faunal remains and surrounding blowout areas.

Collection of material for dating

Warrener shells were collected as there were insufficient limpet shells (*Cellana solida*) to provide an adequate sized sample for dating purposes. The Middle Point 1 shell sample, was collected from an area 2 m by 2 m, where the shells and other cultural remains were resting on or embedded in the palaeosol burn horizon. Charcoal was collected from the same area as the shell, and was obtained after cleaning back the upper 2 cm of exposed charcoal. The charcoal sample was labelled Middle Point 2.

Radiocarbon dating results

A shell corrected radiocarbon date of 160 ± 60 BP (ANU-7423) was obtained from the warrener shell sample, and 101.44 ± 1.36% BP (ANU-7424) from the charcoal sample [Table 5].
<table>
<thead>
<tr>
<th>SITE</th>
<th>SAMPLE ID</th>
<th>AGE BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quarantine Bay</td>
<td>Charcoal 1</td>
<td>490 ± 70</td>
</tr>
<tr>
<td></td>
<td>Shell 1</td>
<td>1100 ± 70</td>
</tr>
<tr>
<td>Cataraqui Pt</td>
<td>Shell 1</td>
<td>1980 ± 60</td>
</tr>
<tr>
<td>Middle Pt</td>
<td>Shell 1</td>
<td>160 ± 60</td>
</tr>
<tr>
<td></td>
<td>Charcoal 2</td>
<td>101.44 ± 1.36 %M</td>
</tr>
</tbody>
</table>

Table 5: King Island midden sites radiocarbon dating results

The radiocarbon dates confirm the previous interpretation (Sim 1990) that the midden remains date to the historic occupation of the island by sealers and Aboriginal women in the first decades of the nineteenth century. The charcoal however may be more recent; possibly a product of firing associated with the initial clearing of land for pastoral purposes (Hooper 1980:96-97). One of the first properties cleared was the Surprise Bay farm on which the Middle Point site is located. The charcoal date indicates firing there about 100 years ago, which accords precisely with the first vegetation clearance of this property in 1888 (Hooper 1980:152).

This suggests that the historic midden was located in the shelter of the coastal scrub, and that subsequent burning in the area removed this scrub, and destabilised the dunes. Dune mobility activated by the removal of the natural vegetation buried the faunal remains. These have more recently been exposed in active dune blowouts at Middle Point.
Quarantine Bay Midden

This site is located in a series of large dune blowouts on the northwest coast of the island [Figs. 18, 20]. It is some 5 km southwest of New Year Island where Aboriginal skeletal remains of unknown antiquity were recovered (Murray et al. 1982), and stone artefacts have also been recorded (Sim 1988). There is freshwater obtainable from swamps in relict Holocene stranded shorelines (Jennings 1959a:20,29), less than 150 m seaward of the site area. A coastal dune formation rises steeply inland of these swamps, and is up to 30 m high immediately inland from the dune blowout area where the midden deposits are located. Water is also obtainable from Yellow Rock River, one of the few permanent rivers in the north of the island, about one kilometre to the west of the dune blowouts.

The site area is located about 300 m inland, and is between 15 m and 20 m above sea level in active blowouts in the aeolian Holocene dune formation. Stratified shells and deflated midden scatters occur as sporadic, low density concentrations in foredune areas of the blowouts. Shell scatters were generally found beneath eroding stratified dune sections. Some isolated shells were still stratified in situ, in the exposed sections above these scatters. The stratified shells were evident at a number of widespread locations in the dune blowouts. They were however consistently located in the seaward area of the dunes, and all stratified shell was between 35 cm and 45 cm below the surface of a charcoal rich palaeosol unit [Figs. 20, 21; Plates 12, 13].

None of the shellfish remains displayed characteristics consistent with bird predation behaviour, and only human transport can explain the presence of abalone and mud oyster 15 m above sea level in this inland aeolian dune deposit (see also chapter 4).
Quarantine Bay

Stranded Holocene shorelines (ridges)

- Charcoal samples collected from dune sections for dating
- Shell collected for dating
- Locations with deflating and in situ abalone and shell concentrations

Figure 20: Quarantine Bay site sketch plan

Current soil profile

1. Pale yellow calcareous Aeolian dune sand
   Charcoal sample 490±70 BP (ANU-7059)
   Buried palaeosol upper level 10cm studded with charcoal and some burnt roots
   In situ abalone shell sample 1100±70 BP (ANU-7058)

2. Dark grey charcoal level graduating to yellow calcareous unit (relict "C" horizon) coarse sand
   Secondary hard calcarenite formation
   Present base of blowout
   Shellfish and bone eroding from section above

3. White/cream finer Aeolian sand unit

Figure 21: Quarantine Bay eroded dune section showing location of stratified shellfish remains
One stone manuport, a large waterworn quartzite cobble, was recorded in the site location. The nearest source of such stone is the rocky headland at Whistler Point, one kilometre southwest of the site. A number of amorphic weathered quartz pieces, the maximum dimension of which did not exceed 5 cm, was present in the deflated dune areas. While this stone was clearly geologically foreign in the calcareous aeolian dunes, none of the pieces was large enough to preclude their being bird or seal gastrolith stones (van Tets pers. comm.). Although the quartz may have been carried onto the site by people, it cannot securely be interpreted as cultural evidence given its weathered condition, and the equally plausible natural explanation for its presence.

Similarly ambiguous were the mammal bones also present amongst the deflated shellfish remains. Macropod, snake, wombat, emu and quoll bones were recorded. These latter three species became extinct on the island during the early historic period (Hope 1973, also see chapter 2). There was no evidence to indicate that these were human food remains apart from their spatial association with deflated shellfish remains in some areas in the blowout. Given the complex taphonomic processes which can result in lag deposit accumulations, it was not possible to determine there was an original depositional relationship between the bone and shellfish remains. It is possible that the bone remains are the result of natural deaths or carnivore predation. Since there was no clear indication that human activity was involved in the bone deposition, they were not included in the analysis of cultural remains from this site.

The shellfish remains recorded at the site were predominantly large green lipped abalone (*Notohaliotis laevigata*), mud oyster (*Ostrea angasi*) and warrener shells and opercula (*Subninella undulata*), with a minor component of chiton, whelk (*Dicathais textilosa*), limpet (*Cellana solida*), mussel (*Mytilus planulatus*), and scutus (*Scutus antipodes*) [Table 4]. The abalone were predominantly whole, large specimens with most between 17 and 20 cm, and none less than 12 cm amongst more than 30 recorded. The estimated live weight of the larger abalone, as gathered, would be between about
400 gm and 450 gm (using *Notohaliotis* shell/complete live weight ratio of 1 to 1.6 from Bowdler 1979:227).

Collection of material for dating

A sample of mud oyster shell (*Ostrea angasi*) was collected from stratified sections for radiocarbon dating. This was sample Quarantine Bay S1. Two charcoal samples were collected from just beneath the palaeosol horizon 20 cm above the shell [Figs. 20, 21; Plate 13]. One of these samples, Quarantine Bay C2, was submitted for radiocarbon dating. This sample comprised consolidated lumps recovered from a dense concentration of charcoal in the section. Several centimetres of the exposed section surface was removed prior to the collection of the charcoal samples.

Radiocarbon dating results

The shell corrected radiocarbon date obtained from the shell sample was $1100 \pm 70$ BP (ANU-7058); that from the charcoal sample was $490 \pm 70$ BP (ANU-7059) [Table 5].

The radiocarbon dating results accord with the relative stratigraphic positions of the shellfish remains and the charcoal [Fig. 21]. The absence of a buried surface horizon at the shell level indicates that either the shells were deposited on an open sand dune and are still in their original depositional context, or that they have been redeposited by natural processes associated with dune mobility. Since the shells were not found with a range of evidence such as one would expect from a reworked lag deposit, it is believed that the shell is probably in its original depositional context, and that at the time of deposition the dunes were unvegetated and possibly mobile sand dunes.

Charred root remains and large charcoal pieces in the palaeosol indicate that in the recent past the dunes had become more heavily vegetated, and that subsequent
destabilisation of the dunes probably resulted from natural fire episodes in the last millennium destroying the dune vegetation. The stratigraphic position of charcoal in the exposed dune sections indicates that firing in this locality occurred some time after the deposition of the shellfish remains. The radiocarbon dates confirm this interpretation. There was no charcoal present in the stratigraphic level where the shellfish remains were recorded *in situ*, nor in underlying deposits exposed in the blowouts.

**Cataraqui Point Blowout**

Dense accumulations of faunal remains were recorded in lag deposits in an extensive dune blowout at Cataraqui Point [Figs. 18, 22; Plate 14]. The active blowout is presently a muttonbird rookery, and faunal remains are also being exhumed by the burrowing activity of the birds. The lag deposits consist of bones of sea and terrestrial mammals, bird bones and egg shell, reptiles, fish and shellfish remains. These are scattered, in varying concentrations, over an area of about 1,000 square metres. No stone artefacts were present in the immediate blowout area although an artefact scatter was recorded less than 500 m from the site on the Cataraqui Point headland (Sim 1988:62).

The density of faunal remains in the lag deposit appeared to be unnaturally high, and led a zoologist investigating muttonbird rookeries on the island, to record the remains as an historic site (Tas. Dept. Parks, Wildlife and Heritage Aboriginal site index 3271). This initially suggested that bones, or shellfish remains in the blowout could provide evidence of human exploitation patterns. Furthermore, the presence of abalone remains which are not collected or consumed by birds, and some other shellfish remains in the deposits, strongly suggested that at least some of the shells were human food debris. Hence further investigation regarding the anthropogenic origin and antiquity of
deflated remains in this blowout were undertaken. This analysis was intended to complement the bird midden analysis to provide further indicators useful for field identification of human activity in shellfish remains.

Figure 22: Cataraqui Point dune blowout site sketch plan
Bone remains

*Fracture patterns and species*

The area has been grazed by cattle and sheep during the last century, and is currently stocked with sheep. In light of the trampling that may have occurred as a result of pastoral activities, analysis of fracture patterns on bone remains offered little potential to investigate the question of their association with human activity. Compared with the shellfish remains, the bone was relatively fragile, and thus more prone to trampling damage.

Similarly, the range of species, the relative quantities of different species or the presence of particular species offered little potential in determining the origin of the bone remains. The range of species was consistent with prehistoric and historic faunal species recorded on the island (Hope 1973). The predominance of macropod remains in the blowout deposit was also not anomalous with the present natural faunal regime. The presence of now extinct wombat and emu was not necessarily indicative of a prehistoric anthropogenic origin because these species were present on the island in the early historic period (Micco 1971). Thus, it was considered that field indicators of either the origin or antiquity of the bone were unlikely to be detected.

*Evidence of burning on bone*

It is often considered that evidence of burning of bone in some archaeological sites can constitute strong evidence of human activity being associated with the deposition of such remains. However, on King Island there is evidence of widespread natural firing in the past in many locations, including the Cataraqui Point blowout. A palaeosol in the mobile dune deposit contained dense charcoal flecks in the upper 30 cm of the unit, in all places where it was exposed. The widespread occurrence of the charcoal, and the
absence of associated hearths, strongly suggests that the palaeosol charcoal is a product of natural fire events. Therefore, while evidence of burning of the faunal remains in these contexts could originate from the animals being cooked on hearth fires, it could equally be a result of bush fires. Evidence of burning of bone in the lag deposits thus offered little potential for detecting indicators of human activity.

Shellfish Remains

The presence of numerous large whole abalone (*Notohaliotis* sp.) shells indicated that birds were clearly not responsible for the deposition of all the shellfish remains in the blowout, and hence human activity was implicated in the deposition of some of the remains. This posed two problems; a) determining which of the remains were humanly deposited, and b) if they were in fact human food debris, then establishing whether the remains were from the historic or prehistoric occupation phases. It was possible also that remains at the site had been deposited over a span of time, and thus reflected both historic and prehistoric human activity at the site.

The fundamental problem was therefore to determine if shellfish remains were present which could be confidently attributed to human behaviour. While the range of species in the stratified Quarantine Bay midden was restricted almost entirely to species not known to be taken by birds, the remains in the Cataraqui Point blowout deposits included numerous limpets, warreners, whelks, chiton, mussel other bird predated species. It was possible therefore that some of the remains at Cataraqui Point could be bird deposited, and also others the product of human activity. The investigation of possible human predation evidence therefore focused on species which were not consistent with those observed in bird deposits.

These comprised numerous, whole and slightly damaged warrener (*Subninella*
undulata) shells and abalone (Notohaliotis sp.) shells. It was the presence per se of the abalone that discounted bird behaviour as an explanation for their presence (see chapter 4). Scatters of abalone shell were also frequently found along the west coast of the island, in what were known to be local diving and picnic spots. Since it was possible that the abalone in this location was a very recent addition to the deflated blowout remains, the investigation focused on the warrener remains. These were considered less likely to be associated with twentieth century recreational activities.

Moreover, the condition of the warrener remains was not consistent with those found in bird deposits (see chapter 4). Warrener opercula examined on site did not have fracture patterns commonly present in bird deposited opercula and the majority of the warrener shells were principally complete. There was also an absence of accumulations of fragmented warrener shell such as those typically found in the deposits produced by the Pacific Gull (Larus pacificus) (Teichert and Serventy 1947). Furthermore, the occurrence of concentrations of warrener, or other complete shells, in such sand dune deposits, is not attributable to any known bird behaviour. Although there are a few instances where gulls have been observed dropping shells in dunes; these, however, were isolated shells. Concentrations were seen only on limestone' [rock platforms] (Teichert and Serventy 1947: 323).

Since there was no other natural explanation (such as storm wash) for the presence of the warrener shells in the dune blowout, it was assumed that these were transported to the site by people. This could be further supported by direct evidence of human predation in the warrener remains themselves. A sample of warrener shells was therefore collected from the Cataraqui Point blowout for shell damage analysis. The sample was collected from an area of 3 square metres in a dense accumulation of faunal remains in the eastern end of the blowout [Fig. 22]. Although many of the warrener shells were complete, a large number also had holes in the main body whorl and damage to the spiral [Table 6]. Investigation of shell damage thus appeared to be one
avenue which could provide indicators of human predation of warrener.

Of the total of 29 warrener shells collected from the 3 square metre sample area, 17 were undamaged. Of the remainder, 10 had minor, and 2 displayed major fracturing. Minor fracturing was defined by the presence of the complete columella and more than half of the body shell intact. Shells with minor fracturing were consistently holed in the body whorl opposite the aperture, and the majority of these also had parts of the upper spiral missing [Table 6]. Major damage constituted shells with less than half the body shell complete and/or columella damage.

<table>
<thead>
<tr>
<th>Damage type no's.</th>
<th>Shell damage</th>
<th>%</th>
<th>No</th>
<th>Columella incomplete</th>
<th>Top spiral holed</th>
<th>Body whorl hole &lt; 1 cm</th>
<th>Body whorl hole &gt; 1 cm</th>
<th>Aperture fractured</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>58</td>
<td>17</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>Minor</td>
<td>35</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>3</td>
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<td>Major</td>
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<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total No.</td>
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<td></td>
<td>1</td>
<td>11</td>
<td>3</td>
<td>8</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>% of total with damage type</td>
<td>3</td>
<td>38</td>
<td>10</td>
<td>28</td>
<td>17</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*shells with more than one type of damage represented in more than one category

Table 6: Cataraqui Point blowout warrener shell sample damage

People generally heat or cook warreners prior to consumption, principally to facilitate removal of the edible soft body part of the shellfish from its outer shell. Methods employed to heat the warreners are most commonly, boiling in billies in historic times, or the traditional method of roasting them on hot coals (Plomley 1983:20-23; pers. obs. Flinders Island Aboriginal shellfish preparation methods). When heated, the mollusc
contracts and separates from the hard shell, and can be removed with the aid of a thin, sharpened stick or similar implement.

A cooking experiment was therefore undertaken to examine damage caused to warrener shells heated on coal beds. This provided a sample for comparative analysis of damage patterns on warreners in the blowout lag deposit. Nine warrener shells were placed in an inverted position on a bed of glowing coals produced from a small hearth fire. Seven of the shells were placed on the coals for a period of between 3 and 5 minutes. Two were left on the coals for eight minutes, in order to see if heating for this length of time would cause disintegration of the shell. These shells did not disintegrate and there was only a minor increase in damage on these shells compared with those cooked for a lesser period. Overall the damage pattern was consistent on all the cooked shells.

<table>
<thead>
<tr>
<th>Damage type (No's)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell damage</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>Minor</td>
</tr>
<tr>
<td>Major</td>
</tr>
<tr>
<td>Total No.</td>
</tr>
<tr>
<td>% of total with damage type *</td>
</tr>
</tbody>
</table>

* total > 100% due to some shells having more than one type of damage

Table 7: Warrener shell damage from cooking experiments
Plate 12: Quarantine Bay duneblow out site location (top)
Plate 13: Quarantine Bay stratified shellfish (left)
Plate 14: Cataraqui Point blowout faunal remains (right)
Damage due to heating was visually evident in two forms on the shells cooked experimentally; a) holes on the body whorl and the upper spiral, and, b) differential fragility of the shell due to alterations in the crystalline structure of the shell [Table 7; Plate 15].

The pattern of holes on the spiral and body whorl areas appears to be caused by direct contact with the heat source. Other areas of the shell, not in close contact with the hot coals did not disintegrate. Nor did these parts of the shells display fragility due to heating. A small pointed wooden probe was used to test the hardness of the entire shell body. Areas which had been in direct contact with the hot coals, but which were still intact, were considerably more fragile and disintegrated when probed. Other parts of the shell however were much harder and not damaged by the probe. The cooking experiment thus indicated that holes in the upper spiral, the main body whorl, and/or fragility of the shell in these parts, are diagnostic traits indicative of the shells having...
been deliberately heated on hearth fires. It is highly improbable that the consistent pattern in terms of the specific location of damage on the shell body, could be caused by the more general heat source produced by natural bush fires.

Although the sample number used for the experiment was limited (due to problems in procuring warrener shells from non-midden contexts for the experiment), there is nevertheless a marked similarity in the external damage incurred by experimental cooking, and damage observed on warrener shells in the blowout sample [Table 7; Plate 15]. This strongly supports other evidence, which indicates that the warrener shell in the blowout are attributable to human exploitation.

*Limpet damage patterns*

As discussed above, the type of damage found on warrener shells in the blowout, is consistent with damage occurring on those which have been cooked in an inverted position on hot coals. Limpets are also placed on a hot bed of coals in an inverted position (pers. obs. of Flinders Island Aboriginal people cooking limpets). The effect of direct contact with the heat source on limpets however is somewhat different from warrener. Whereas the latter shells tend to weaken and often disintegrate, direct heat on limpet shells has the reverse effect. The heat causes localised alteration of the internal crystalline structure of the shell in the cap region. In this part of the limpet, aragonite is replaced by a durable form of calcite when subjected to the direct heat source (J. Head pers. comm, pers. obs. burnt and unburnt sectioned limpet shells). The structure of rim of the limpet shell however does not alter as this part of the shell is subjected to lesser heat than the cap during cooking. The rim section frequently separates from the heat hardened cap region as the shell cools, or post-depositionally.

In limpet shells cooking of the shells is readily identified by the chalky appearance in sections across the cap region of the burnt shell. Limpets collected from bird middens
however, have translucent aragonite present in the entire shell section, including the cap region. (Unaltered aragonite is readily identifiable to the naked eye, by its lustrous and micaceous flaky appearance. J. Head pers. comm., and pers. obs.).

A small sample of limpet remains collected from the Cataraqui Point blowout were examined for evidence of crystalline alteration consistent with hearth cooking. There was clear evidence of heat alteration in the cap region in nine of the ten shells sectioned. This further supports the interpretation of at least part of the faunal remains in the lag deposit being attributable to human predation behaviour.

Radiocarbon dating results

The shell corrected radiocarbon date obtained from the warrener (*Subninella undulata*) sample, Cataraqui Point 1, was 1980 ± 60 BP (ANU-7422).

Summary

The bone remains in the Cataraqui Point blowout are problematic since their status as cultural evidence is somewhat ambiguous. In blowout lag deposits such as those found on King Island, spatial association with cultural evidence is more likely to reflect taphonomic processes rather than a primary depositional or chronological association. In the absence of clear indications of human butchering or transport of bone remains, the bones remain ambiguous as to their status as archaeological evidence.

At least some of the shellfish remains however, are demonstrably attributable to prehistoric human activities. The condition of the warrener and limpet remains strongly resembles that of shell which has been deliberately cooked. Since there is no other animal behaviour apart from human activity which could account for either the presence of some of the shellfish remains present, or the condition of these remains, it is
considered that they are evidence of prehistoric human occupation of the site. Radiocarbon dating of the warrener shell indicates that this site was being used about 2,000 years ago.

The radiocarbon date implies;
a) that people were on the island about 6,000 years after the island became isolated from mainland Tasmania during the last marine transgression, and,
b) that similar lag deposits in numerous blowouts around the island may also be prehistoric midden sites.

The implications of the findings from the Cataraqui Point midden are discussed in reference to other sites on the island, in the following chapter.

STONE ARTEFACT SITES

Excavations were undertaken at the Cataraqui Monument and the Cataraqui Airstrip sites, two of more than twenty stone artefact scatters I had previously recorded on the island. These two sites were the only open sites where it appeared that artefacts could possibly be recovered from stratified deposits. The Cataraqui Monument and the Cataraqui Airstrip sites were the two densest artefact sites. There was however a marked difference in the types of artefacts and range of raw materials present on each site.

The King Island artefact sites were somewhat analagous to the Kangaroo Island sites in that some contained discrete assemblages of artefacts reminiscent of Kartan artefacts, whereas others contained additional elements such as small cores and flakes, and retouched tools made from a range of materials including high quality exotic stone types (Lampert 1981; Sim 1990). The Cataraqui Monument site had a surface assemblage which appeared to be similar in many aspects to Kartan sites described from Kangaroo Island (Lampert 1981).
The similarity between some of the King Island artefacts and those from Kangaroo Island has been previously remarked upon by Jones (1979:91-92). He chose to interpret the similarity between these artefacts and those from Kangaroo Island, as; 'already typologically 'archaic' or retarded' (1979:92), the implication being that this was a consequence of isolation of a stranded island population.

Jones interpretation is questionable, fundamentally because of the absence of secure evidence of occupation of King Island by a stranded relict population. Problems with this interpretation are also compounded by the underlying question regarding the antiquity of Kartan assemblages elsewhere (Lampert 1981). The similarity between components of the Petrified Forest site stone assemblage, and those from Kartan sites on Kangaroo Island however is of interest in light of the more recently discovered sites on King Island. Site survey results indicated that there was at least one site on King Island, where the entire assemblage comprised artefacts reminiscent of those found in the Kartan sites described on Kangaroo Island site, and where a secure occupation date for the site could possibly be obtained (Sim 1988).

Generally artefact sites on King Island were associated with either stone or water sources (Sim 1990). Freshwater lagoons which are found in inland areas of the island appear to have been a focus of activity although the density of artefacts at these sites was lower than those associated with stone sources. All the lagoon sites were deflated scatters and none appeared to have undisturbed archaeological deposits. The two sites chosen for excavation appeared to be associated with exploitation of stone sources in the immediate vicinity of each site. Fresh water sources were also in close proximity to these sites, although these were less reliable, ephemeral sources rather than permanent lagoons.
The Cataraqui Airstrip Site

Site description

This site was the most extensive artefact scatter found on King Island. It was located adjacent to the Cataraqui Point airstrip on the southwest coast of the island [Figs. 18, 23]. The site is situated in an extensive erosion area at the top of the 60 m cliffs that fringe the coast of the southwest of the island. Calcareous aeolian dune sediments, derived from an offshore limestone formation, have been deposited here at times of lower sea level, and these are presently being mobilised by wind and water activity. Siliceous quartzose relict dune stumps are also present in the vicinity of the sites. The quartzose sediments appear to be originating from weathering of the coastal cliffs and soils underlying the calcareous dunes.

Precipitation from the site area is at present draining seaward, via erosion gullies up to 2.5 m deep. Quartzose sand is being washed down these gullies and redeposited by wind back onto the site area. As a result of this erosion and deposition cycle, the quartzose sands are overlying the calcareous dunes in some places. The reworking of dunes and sediments on these types of exposed sites posed problems in regard to dating human occupation of the site. This site was in a similar environment to the Petrified Forest site recorded by Jones (1979). This latter site is less than 6 km south of the airstrip site, and in an area where both calcareous and quartzose dune units were eroding in major sandblows. As previously discussed, the 7,500 BP date for human occupation of this site was obtained from charcoal contained in the same stratigraphic dune context as stone artefacts.
**Figure 23:** Cataraqui Airstrip site sketch plan

**Figure 24:** Cataraqui Airstrip site dune stump excavation section
The Cataraqui Airstrip site offered the potential to obtain further radiocarbon dates, hopefully from organic remains of anthropogenic origin. If as Jones (1979) suggested, there were people living on King Island after it was severed from Tasmania, then it could be expected that evidence of coastal exploitation would be found in the southwest cliffed coastal region. At Cataraqui Point the offshore topography plunges steeply to a depth of 25 fathoms, that is, nearly 50 metres lower than the present sea level. The shoreline would therefore have been relatively close in times of lower sea level. The Cataraqui Airstrip site is located at the top of the cliffs in the Cataraqui Point area. This suggested that if people were, as Jones proposed, on the island for up to 4,000 years after it became severed from Tasmania, then this site is the type of location at which evidence of coastal exploitation could expect to be found in undisturbed stratified deposits.

The focus of prehistoric activity evident in the exposed surface remains at the Cataraqui Airstrip site did not reflect exploitation of the littoral zone. The remains consisted entirely of stone artefacts. The predominance of quartz and rhyolitic stone types in the surface assemblage suggested that activity on the site was related to the exploitation of stone sources in the immediate vicinity of the site. There was an extensive quartz outcrop on the site in addition to an outcrop of rhyolitic contact rock. The site is located on a contact zone between the island's main sedimentary bedrock, and the more recent west coast Devonian granite formation [Fig. 4]. Metamorphic processes associated with the granite intrusion have produced a number of stone outcrops suited to stone artefact manufacture, along the southwest coast. Although artefacts recorded on the Cataraqui Airstrip site reflected the use of the stone sources in the site area, there was also a number of artefacts made from stone sources exotic to the site. These included a number of small formal tools of types identified by Jones at Rocky Cape (Jones 1971:450-52; Sim 1988:66).
Plate 16: Spongolite surface artefacts from the Cataraqui Airstrip site (dorsal and ventral views)

Plate 17: Cataraqui Airstrip dune stump prior to excavation
Spongolite

Five flaked pieces of spongolite have been recorded amongst the surface finds at this site [Plate 16]. Spongolite is a distinctive fine grained, siliceous, spicular chert with excellent properties for knapping. It is common on west coast Tasmanian midden sites, and widely distributed in northwest Tasmanian sites (Bowdler 1979:313, 1988:47; Cosgrove 1987; Jones 1971:255). There is only one known source of spongolite in Tasmania and this is at Rebecca Creek near Smithton (Cosgrove 1987). The presence of this stone on King Island is somewhat enigmatic because spongolite has only been found in dated archaeological contexts more recent than about 2,500 BP (Jones 1971:255). Furthermore, despite extensive detailed geological survey work and mapping of the island's stone resources, there is no known source of spongolite on King Island (Gresham 1972).

The spongolite was examined by Simon Stephens, a geologist from the University of Tasmania who has studied the composition of spongolite samples from the Rebecca Creek outcrops (in Cosgrove 1987). The mineral composition of the King Island pieces was within the range of those found at Rebecca Creek (Stephens pers. comm.). It is not possible to securely source the spongolite found on King Island however since this type of chert generally has no distinctive compositional features that enable it to be conclusively sourced to the one known source (Stephens pers. comm.). Other undiscovered sources could also exist either offshore or on land, in western Tasmania (Stephens and Sutherland pers. comm.).

It is possible therefore that the King Island spongolite may have come from sources accessible in times of lower sea level, and that have subsequently been inundated by rising seas. The presence of spongolite on King Island sites therefore could be explained either by a) transport from mainland Tasmania, which would imply occupation in recent Holocene times, or b) earlier exploitation of offshore sources. If
the latter were the case, then it would be expected that evidence of early Holocene or Pleistocene exploitation of offshore sources would be found in other mainland Tasmanian sites—and yet such evidence is not found (the implications of the presence of spongolite artefacts on King Island are discussed further in chapter 7).

Excavation Method

All deposit removed from both pits was passed through 5 mm and 3 mm sieves. The volume of deposit removed was recorded as bucket volumes and included the consolidated pieces of hardpan which were removed. Standard 10 litre buckets (0.01 m$^3$) were used although these were not completely filled. Each bucket contained between 0.0075 m$^3$ and 0.008 m$^3$ of excavated deposit.

The pits were excavated both stratigraphically and by measured spits. Where stratigraphic levels were apparent these took preference over measured spits. Measured spits were generally 5 cm in depth although some sterile dune sand was removed in larger spits. Sediment samples were collected during excavation from each of the stratigraphic units. Charcoal samples, artefacts and wood remains were collected and plotted three dimensionally on the recording forms. Black and white, and colour photographic documentation was undertaken progressively during excavations at the Cataraqui Airstrip and during all other excavations.

The excavations

Square A

A 1 m$^2$ square test excavation was opened in the main site area [Fig. 23]. Artefacts were present on the hardpan surface in close proximity to the square. It was not apparent however if these had eroded from the hardpan level, or were from geomorphologically younger contexts. An area was selected therefore where the
compact dark red-brown hardpan surface, appeared to be undisturbed. The square contained areas of hardpan interspersed with grey quartzose sand patches.

Square A was excavated down through the grey sand and hardpan patches to a compact wet grey sandy clay unit, about 30 cm below the surface. The hardpan areas were very consolidated and removal of these required the use of a hand mattock. No artefacts were recovered from the excavated deposit, and it was clear from exposed sections in erosion gullies on the site, that the clay unit was stratigraphically lower than the unit from which the artefacts were deflating. The excavation of this square was therefore discontinued. The only organic remains recovered were some friable wood or bark, which occurred in variable quantities across the entire square about 15 cm below the surface.

Square B
In several locations on the site there were relict grey quartzose sand dune stumps. Since these were overlying the dark red-brown hardpan level on which the artefacts were resting, I selected one of the stumps which appeared undisturbed to open another test pit [Plate 17]. There were surface artefacts resting on the surface of the surrounding hardpan which suggested that these probably deflated from similar grey sand dune units which are now eroded [Fig. 23].

Unit 1
The upper levels of the dune stump consisted of a homogeneous coarse grey quartzose sand which was loosely consolidated [Fig. 24]. No artefacts or organic material were recovered from the uppermost unit. Underlying this, at about 45 cm below the surface of the dune, a more compact darker sand unit appeared. One quartz artefact was recovered from the junction of these two units. It was partially embedded in the uppermost level of unit 2. Some decomposing friable wood was also recovered from
this level. The pH value of this unit was varied between 6 and 7, and the Munsell colour 10YR 5/2 (dry sediment sample).

Unit 2
This upper 5 cm of this unit was consistently flecked with charcoal and also contained numerous charcoal lumps about 1 cm in length. One piece of flaked quartz was recovered from this unit, 2 cm below the junction of unit 1. Several charcoal lumps were collected for radiocarbon dating from the deposit immediately adjacent to this artefact. The pH value of this unit was 7.5, and the Munsell colour 10YR 2/2 (dry sediment sample).

Unit 3
About 65 cm below the surface of the dune a hardpan level emerged. This was extremely consolidated and as with the test square A, required a mattock for its removal. The hard pan was not evident across the entire area being excavated and was interspersed with light grey quartzose sands. The hardpan level was archaeologically sterile, and no charcoal or other organic remains were recovered from this unit. The pH value of this unit was 7, and the Munsell colour 10YR 3/2 (dry sediment sample).

Unit 4
This was principally a coarse pale grey sand unit similar to that also found underlying the hardpan level in square A. The unit sand was similar to the unit 1 unit, although somewhat more compact and wetter. It became increasingly wet with depth and the excavation was discontinued due to the water inundation. The water table was reached variably between 10 cm and 20 cm below the hard pan level. Apart from some wood or root remains recovered from Unit 4, the unit contained no other organic remains or stone artefacts. The pH value of this unit was 7, and the Munsell colour 10YR 5/2 (wet sediment sample).
Radiocarbon dating results

A radiocarbon date of 11540 ± 190 BP (ANU-7421) was obtained from the charcoal collected from the upper level of unit 2 in square B [Fig. 24].

Summary and discussion

Two artefacts were recovered during the excavation of square B. Both of these were flaked quartz pieces. One of the artefacts was found at the junction of units 1 and 2, and the other from within the uppermost level of unit 2. The stratigraphic position of the artefacts in the excavated dune stump suggests that levels below the hardpan formation are probably archaeologically sterile. This accords with the contexts of exposed surface artefacts which were either found resting on top of the hardpan in many areas of the site, or on a ridge of mobile calcareous sand. There was a marked absence of artefacts in situ in exposed sections of the erosion gullies. These gullies were located in areas of the site which had eroded down to the hardpan surface. Three quartz artefacts were recorded in situ in a section of an eroding quartzose sand dune stump overlying the hardpan in the eastern area of the site.

The stratified evidence indicates that use of the site was probably more recent than the original deposition of the quartzose dunes, and more recent than the hardpan formation. The radiocarbon date from charcoal in the excavated dune stump however does not necessarily date the time of human activity at this site. Since there was no evidence to suggest that the charcoal was anthropogenic in origin, the radiocarbon date obtained from the charcoal may not relate to human activity on the site. This is demonstrated by the lack of correlation between dates obtained from charcoal and those from cultural remains recovered from the same stratigraphic context on dune sites on Flinders Island, as discussed in the preceding chapter.
The absence of evidence of exploitation of coastal resources is similarly not indicative of the antiquity of the site. Initially it was expected that stratified deposits could in this site contain stratified evidence of littoral resource exploitation. Apart from charcoal, no organic remains were present in this unit. The extremely exposed location of the site, and the extensive area of deflated surface artefacts, suggests that it is unlikely that prehistoric faunal remains would have survived in this particular location. The absence of faunal remains is therefore equivocal. It could either be a reflection of preservation factors, or that of human site use.

In summary, this site produced ambiguous evidence, akin to that found by Jones (1979) at the Petrified Forest site. In light of the dynamics of erosion and redeposition of dune sediments evident in both these exposed cliff top sites, it cannot be assumed that stratigraphic association in these contexts is a reflection of the original deposition of either the dune sediments, or the charcoal and stone artefacts stratified within these sediments. It is highly probable that these deposits are buried lag deposits. In the absence of datable remains of anthropogenic origin, little can be concluded regarding the antiquity of the stone artefacts recovered.

**The Cataraqui Monument Site**

**Site Description**

The Cataraqui Monument site is on a ridge about 7 m above sea level which runs inland for about 200 m from the present shoreline [Figs. 18, 25, 26]. Recent mobilisation of Holocene aeolian dune sediments has exposed an earlier palaeosol along the ridge. At the inland apex of the ridge is a prominent outcrop of grey quartzite boulders. Active sand dune blowouts adjacent to the quartzite outcrop are occurring in dune sediments that have migrated inland from the foreshore area. Palaeosols exposed in eroded dune sections in the blowouts indicate that there have been major phases of dune mobility.
here in the past, and that these have been interspersed by periods of dune stability when the sands were revegetated (Murray et al. 1982). The Holocene dune formation containing the palaeosols clearly overlies the earlier palaeosol sediments which are exposed on the adjacent ridge area [Fig. 26].

The present vegetation in the outcrop vicinity is typical of the west coast dune country, with introduced marram grass and indigenous coastal grasses and bushes less than 1 m in height. On the exposed surface of the ridge however, there are calcified root formations and weathering tubes. The roots suggest that in the past the area was under a much more substantial vegetation regime, such as dry sclerophyll eucalypts or similar sized trees (Jennings 1959a). Calcified tree formations are also present in other areas and sites along the southwest coast where erosion has removed or mobilised more recent dune sands (Jones 1979; Sim 1988).

The site has been grazed by cattle intermittently for at least fifty years. Site disturbance by stock is at present evident around the outcrop, and probably has contributed to the erosion and sand mobility in the area. There were extensive areas of good ground visibility in the calcareous aeolian dune blowout inland of the outcrop, and on the earlier palaeosol areas exposed on the ridge. Apart from the blowout area however, ground visibility on the dune deposit was poor as it is vegetated by marram grass. Nevertheless, the absence of cultural remains in the blowout suggests that the visible distribution of artefacts at this site probably reflects the depositional distribution pattern.

An extensive scatter of stone artefacts and manuports is on the surface of the exposed palaeosol on the ridge, and in the immediate vicinity of the outcrop. The artefacts were more concentrated on the ridge, and were noticeably absent both in the recent dune blowouts adjacent to the outcrop and in dune areas flanking the ridge [Fig. 25].
Plate 18: Surface artefacts from the Cataract Monument site - quartz manuports and flaked pieces (top left), pitted cobble (top right) and grey quartzite block core implements (below).
Figure 25: Cataraqui Monument site sketch plan

Figure 26: Cataraqui Monument site—schematic section of site and Holocene dunes
The surface artefacts at the Cataraqui Monument site were predominantly large quartzite flaked blocks, cores and other pieces of grey quartzite from the outcrop source. There were also many pieces of flaked and fractured quartz in the same area as the quartzite artefacts and one pitted cobble [Plate 18]. This latter implement had pitting consistent with its use as an anvil stone for the bipolar working of quartz and a ground face on the underside. It is a volcanic rock type, the closest known source of which is at least 10 km from the site (Gresham 1972).

Warrener opercula and Chiton plates were scattered on the ridge and in the dune swales near the outcrop. These however were not numerous and, on average, there was less than one operculum or chiton plate per square metre. The shellfish remains strongly resembled remains recorded on Pacific Gull middens in the vicinity. There was no evidence to suggest that they were associated with the stone artefacts, and the condition of the opercula indicated gull predation. Similar sparse scatters of opercula and chiton are a common occurrence all along the island's coast. When compared with bird middens present in active gull rookeries, these shell scatters are clearly the product of bird behaviour (see chapter 4).

Excavation Strategy

At this site, the types of artefacts in the surface assemblage, and the raw materials from which they were manufactured was relatively restricted compared to some other artefact scatters recorded on the island (Sim 1988; Jones 1979). Apart from the quartz component no small retouched flaked artefacts or exotic stone types were observed in the stone artefact surface assemblage. Predominantly, it consisted of large grey block cores or implements, horsehoof cores, and flaked pieces of the outcrop stone [Plate 18]. There was a marked absence of exotic stone apart from the quartz and the pitted cobble (Sim 1988).
As previously discussed, the Cataraqui Monument site was characterised by a discrete surface assemblage of artefacts reminiscent of those described by Lampert on Kangaroo Island Kartan sites (Lampert 1981). Reconnaissance investigation indicated that there were possibly stratified archaeological deposits still undisturbed at this site and it therefore appeared to offer the potential for such an assemblage to be dated.

The principal aim of the investigations at this site was to locate *in situ* artefacts in order to date the period or span of occupation, and possibly provide further data as to the antiquity of the surface assemblage. An area was selected for excavation where sediments underlying the Holocene dune deposits were undisturbed, and, where it could be expected that *in situ* artefacts could be recovered. This area was both in close proximity to the outcrop and where there were consolidated areas of the palaeosol sediments from which the ridge artefacts appeared to be deflating.

Two areas were selected for excavation, one close to the crest, and another slightly downhill on the inland side, of the outcrop. During an earlier reconnaissance trip, one quartz flake had been recovered from the upper 3 cm of a palaeosol, while charcoal was being collected from an exposed palaeosol on the eastern edge of the outcrop. This was the area initially selected for further investigation.

**Excavation Method**

All deposit removed from both pits was passed through a 5 mm sieve. Random samples of deposit from each spit were also sieved using a 2.5 mm sieve to ensure that small murid bones, stone chips or other material was not being missed in the 5 mm sieve.

The volume of deposit removed was recorded as bucket volumes and included rock removal where practicable. Larger rocks removed were recorded separately. Standard
10 litre buckets (0.01 m³) were used although these were not completely filled. Each bucket contained between 0.0075 m³ and 0.008 m³ of excavated deposit.

The pits were excavated both stratigraphically and by measured spits. Where stratigraphic levels were apparent these took preference over measured spits, although measured spits were the most common method of deposit removal. In the archaeologically sterile sand units, measured spits up to 12 cm in depth were removed. The deposit in square B was removed entirely in measured spits of 5 cm depth with the exception of one level where a change in soil colour could be followed.

Soil samples were collected from each stratigraphic unit. Munsell colours were obtained from dry sediment samples. Where stratigraphic changes were not evident as distinct depositional units, then soil samples were taken from each excavated spit.

Larger bone, charcoal pieces or concentrations and stone artefacts recovered during excavation were plotted three dimensionally. All quartz, including rounded unworked pieces, recovered either by the excavator or from the sieves, was also collected.

Excavation Results

Square A

A pit 2 m by 1.5 m, was opened near the outcrop in an area where the palaeosol from which the quartz artefact had previously been recovered, was partially exposed. As the excavation progressed however, it became apparent that considerable erosion had taken place in the past in this location [Plate 19]. Although a portion of the cultural palaeosol was intact, no pieces of stone with diagnostic flake features were found in situ in this deposit.
Plate 19: Cataraqui Monument relict palaeosol portion in square A

Plate 20: Cataraqui Monument excavation square B

Plate 21: Stone artefacts excavated from square B - grey quartzite flakes (top) from spits 7, 7, 9, 4 (l to r), and quartz cores and flakes from spits 1, 6, 8, 8 (l to r)
Figure 27: Cataraqui Monument square B section drawings and spit levels
Several pieces of fractured quartz were excavated from the junction of the disturbed dune sediments and the consolidated palaeosol formation in square A. Although the pieces had been fractured, there were no diagnostic features indicating that they had been worked. These quartz pieces may have washed in either from uphill deposits, or from the palaeosol section as there was evidence of an erosion gully. The palaeosol remnant appeared to have been washed out on its eastern section, and loose dune sediments nearly half a metre in depth were excavated from the adjacent gully.

The remnant palaeosol unit was excavated to a depth of 50 cm. No artefacts were recovered from within this unit. Charcoal lumps and flecks were found throughout the upper 40 cm of the unit although no other organic remains were recovered. Excavation of this square was discontinued and another square opened in a less disturbed area of the site.

Square B

Square B, a 1 m by 1 m pit, was opened in a level area at the crest of the ridge, near the stone outcrop [Fig. 25; Plate 20]. Here the palaeosol from which artefacts appeared to be deflating in other areas, was not overlain by the dune formation. No artefacts were on the surface of the square although some were present in adjacent areas where the upper levels of the palaeosol had been eroded. In the immediate vicinity of square B however, the deposit appeared to be undisturbed. The surface level was a thin layer of topsoil mixed with a lesser component of more recent aeolian dune sediments.

Most of the square was covered by moss, and one small fescue bush (*Festuca littoralis*) about 30 cm high was growing in the northwest portion of the square. There were burnt mammal bone fragments and charcoal visible on the surface where moss was not covering the sediment. These were mostly located on a slightly raised area surrounding the stem of the bush. This raised area, which was less than 5 cm high, was excavated
to a level surface after the removal of the surface humus and top soil layer (Spit 1). That is, the deposit from the hump was incorporated in the Spit 2 removal. Although burnt mammal bone and charcoal was excavated from this, and several other underlying spits, there was no distinct evidence of a hearth *per se*. No hearth stones, burnt earth patches and/or clusters of large pieces charcoal were found in any of the Square B deposits. Square B was excavated to a depth of between 55 cm and 60.5 cm below the surface, with about 0.57 m$^3$ of deposit and rocks being removed.

**Stratigraphy**

Four stratigraphic units were identified in the 13 spits excavated [Fig. 27; Plate 20]. From the excavation sections it was apparent that the deposit was an eroded palaeosol; with the A horizon absent, some portion of the B horizon present and the C horizon still intact. The stratigraphic units identified are:

**Unit 1.**

A dark red-brown (Munsell 10YR 3/3) consolidated medium to coarse consolidated sand unit with a minor clay component. The uppermost 2 cm of this unit had some shelly light aeolian dune sand mixed in the darker sediments. The pH value for this unit sediment was 7.5. Unit 1 represents the B horizon of the eroded palaeosol.

**Unit 2.**

There was a gradual but distinct colour change in the deposit about 15 cm below the surface. This lower unit was lighter in colour (Munsell 10YR 5/3), more consolidated and the sediments were generally coarser. There was also an increase in the clay component. Large rocks emerged in the deposit in this unit, some of which were decaying. Small rounded quartz pebbles were evident in the lower levels of this unit, along with some lateritic nodules. Unit 2 represents the upper level of the C horizon of the truncated palaeosol.
Unit 3.
This unit was a lighter (Munsell.10YR 6/4) gravelly, but well consolidated deposit composed of decayed rock sediments, with an increase in clay and quartz gravel.

Unit 4.
The decaying and solid rock decreased in the basal levels of the pit and there was a gradual change in the deposit sediments. The basal levels contained more clay than overlying units, were more compacted and lighter in colour (Munsell.2.5Y 6/4). This unit was principally clayey-sand and some discrete clay patches were evident in the base of the pit.

Radiocarbon dates
Six charcoal samples from the Cataraqui Monument site were submitted for radiocarbon dating. Four of these were obtained from square B deposits, and two were collected from palaeosol levels in exposed sections in the aeolian dune blowouts flanking the inland border of the site [Figs. 25, 26].

<table>
<thead>
<tr>
<th>Aeolian dune palaeosols</th>
<th>Dune Upper palaeosol</th>
<th>3820 ± 140 ANU-7426</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dune Lower palaeosol</td>
<td>4000 ± 250 ANU-7427</td>
</tr>
<tr>
<td>Stratigraphic unit 1</td>
<td>Sq. B Spit 2</td>
<td>4330 ± 190 ANU-7417</td>
</tr>
<tr>
<td>(eroded B horizon)</td>
<td>Sq. B Spit 4</td>
<td>3630 ± 220 ANU-7418</td>
</tr>
<tr>
<td>Stratigraphic unit 2</td>
<td>Sq. B Spit 6</td>
<td>2540 ± 240 * ANU-7419</td>
</tr>
<tr>
<td>(C horizon)</td>
<td>Sq. B Spit 9</td>
<td>10180 ± 240 ANU-7420</td>
</tr>
</tbody>
</table>

*Aberrant date - contaminated

Table 8: Cataraqui Monument radiocarbon dates
Figure 28: Cataraqui Monument Radiocarbon date chart - to two standard deviations
Dune palaeosol charcoal dates

The dune blowout areas where the palaeosols were exposed were archaeologically sterile. The palaeosols were visually very distinct but were weakly developed. Samples of charcoal for dating were collected from the dune palaeosols in order to investigate the depositional (and possibly erosional) history of the site [Fig. 26].

The radiocarbon dates obtained from the aeolian dune palaeosol samples were 3820 ± 140 BP (ANU-7426) for the upper palaeosol, and 4000 ± 250 BP (ANU-7427) for the lower palaeosol. These levels were separated by between 1.5 m and 2 m of aeolian calcareous sediments [Table 8; Fig. 26]. The relative contemporaneity of these two dates suggests that the successive fire events about 4,000 years ago caused destabilisation of the dune deposits, probably as a result of removal of the vegetation. The present surface level (A horizon) exposed in the top of the dune blowout sections has evidence of charcoal from historic firing. The absence of intervening palaeosols suggests that firing events were not as common or extensive in the vicinity of the site between 4,000 BP and historic times.

Radiocarbon dates from square B

Two dates were obtained from charcoal recovered from within the upper stratigraphic unit, the eroded B horizon of the palaeosol profile [Fig. 26]. A date of 4330 ± 190 BP (ANU-7417) was obtained from a sample collected from one area of spit 2. The sample collected from this spit was located between 2 cm and 3.5 cm below the surface of the eroded palaeosol, and was in stratigraphic association with burnt macropod bone fragments. Another sample from this same upper stratigraphic unit was collected from small charcoal pieces evident in the western half of the upper 1 cm of spit 4. The date obtained for this sample was 3630 ± 220 BP (ANU-7418) [Fig. 27; Table 8].
A further two dates were obtained from samples taken from deposits in the underlying stratigraphic unit 2, the C horizon of the palaeosol profile. One of these samples was collected from spit 6, and the other from spit 9. The radiocarbon dates obtained from these samples were $2540 \pm 240$ BP (ANU-7419) and $10180 \pm 240$ BP (ANU-7420) respectively. The charcoal samples in each of these cases, were collected from flecks recovered from entire spit deposits during excavation. The spit 6 sample from which the $2540 \pm 240$ BP (ANU-7419) was obtained, was the smallest sample collected. This date is considered to be aberrant due to contamination. The radiocarbon date was obtained from this sample of less than 0.7 gm using the conventional dating method. Therefore, no direct dating is available for the upper level of stratigraphic unit 2.

The charcoal sample from spit 6, for which the $2540 \pm 240$ BP (ANU-7419) date was obtained, was possibly contaminated by younger charcoal from higher exposed sections, or the adjacent surface area. Because of the small sample size, and the fact that this sample was a combined sample of small charcoal flecks, this is a distinct possibility as it would only require a minute amount of more recent charcoal in a sample of this size to produce an aberrant date (J. Head pers. comm.). In light of the sample size and the windy conditions under which it was collected, contamination of this sample is believed to have occurred.

The relationship of the radiocarbon dates from Square B and the overlying dunes

The $3630 \pm 220$ BP date obtained from spit 4 in the truncated B horizon (stratigraphic unit 1), initially appeared anomalous because it was somewhat younger than that obtained from spit 2, several centimetres above. However when taken to two standard deviations, the dates from both spits 2 and 4 overlap [Fig. 28]. Both charcoal dates from stratigraphic unit 1 in Square B overlap the palaeosol dates at two standard deviations. This strongly suggests that charcoal in both stratigraphic unit 1 and that in the dune palaeosols is a product of relatively contemporaneous fire events about 4,000
years ago. The widespread distribution of charcoal in the dune and exposed ridge palaeosols, does not suggest that this charcoal is a product of hearth fires, and is therefore probably a result of natural fire events.

The presence of contemporaneous charcoal in both the sterile dune formation, and the eroded occupation palaeosol on the ridge area further suggests that the latter palaeosol was not overlain by dune deposits when the firing events occurred. The inclusion of the charcoal in the occupation palaeosol is considered to be a post-depositional event, associated with burning of the vegetation on the ridge area. Erosion of the uppermost (A horizon) of this palaeosol appears to have occurred as a consequence of the denudation caused by the firing episode/s. Radiocarbon palaeosol dates from the nearby aeolian dune formations indicate remobilisation of dune sediments similarly occurred at the time of firing [Figs. 26, 28].

Since there is no evidence of human involvement in the charcoal deposition, and the charcoal inclusion is considered to be a post-depositional inclusion in the occupation palaeosol. The radiocarbon dates from unit 1 in Square B, therefore may not be reflecting the period of human activity at this site. Similarly, a maximum antiquity of the surface artefacts cannot be ascertained from dates obtained in charcoal from the deposit on which they rest. Not only is the charcoal in the occupation palaeosol considered to be non-anthropogenic, it may well be substantially younger than the stratified unit from which it was obtained. It cannot be assumed therefore that the charcoal is dating either the deposition of the upper unit of the palaeosol sediments, or the artefacts contained within these sediments.

However, what the dates from both the dune palaeosols, and the eroded occupation palaeosol on the ridge, do suggest, is that the outcrop area was not buried under the aeolian dune formation about 4,000 years ago. How long this ridge area had been exposed however is indeterminable. Nevertheless, the 10,180 BP date from the
stratigraphic unit underlying the surface unit on the ridge indicates that the deposition of the surface artefacts and those in the upper stratigraphic unit are clearly more recent than this date.

The absence of artefacts in the aeolian dune deposits could suggest that use of the site had probably ceased sometime before the arrival of the aeolian dune sediments in immediate site area—that is, sometime prior to about 4,000 BP. Poor ground visibility in the vegetated dune areas and post-occupation dune migration may be playing a role in the distribution pattern of artefacts recorded at this site. If the surface artefacts have deflated from dune sediments overlying the ridge in past times, then this would suggest occupation more recent than 4,000 BP. Hence, it is considered that resolution of the chronology of the more recent occupation at this site cannot be ascertained with any confidence from the range of dates obtained.

The earliest phase of occupation can be determined with somewhat more certainty. The 10,180 BP date was recovered from the lower levels of cultural remains in stratigraphic unit 2, the palaeosol C horizon. Although it is possible that more recent charcoal could have filtered down to this level, the converse situation where older charcoal has been included in the deposit post-depositionally is highly unlikley to have occurred in this lower stratigraphic level. Unlike dune contexts where sediment reworking and secondary deposition of charcoal can occur, the excavated palaeosol deposit resulted from the accretion of local sediments and weathering of the outcrop rock, and was thus in it original depositional state. Under these depositional conditions, it is highly improbable that charcoal would be found overlying deposits younger than the charcoal. Thus the 10,180 BP date provides a secure minimum antiquity for the deposition of artefacts in the dated and underlying spits. It is also considered to closely reflect the period of human occupation associated with these artefacts.
The radiocarbon dates from the excavated pit therefore suggest that the site was being used at about 10,200 years ago since stone artefacts were recovered from deposits within this dated level, and underlying and overlying deposits. It may also be that the site was being used prior to this time, although the scant number of stone artefacts recovered from underlying levels suggests that this is unlikely.

**Stone artefacts**

Although there were no surface artefacts in square B, flaked stone was recovered from the uppermost spits, and in total 52 flaked pieces of stone were recovered from the pit [Plate 21]. In addition to the clearly flaked stone, two small quartz pebble manuports and 50 pieces of ambiguous fractured quartz were also excavated from square B. The fractured quartz pieces were ambiguous in that they appeared to be unnaturally broken although they lacked diagnostic flaking traits. The size and colour of the quartz pieces suggested that they were geologically foreign to the site. Unfractured small rounded pieces of quartz weathering from rocks in the deposit were also collected for comparative analysis of the quartz component.

**Stone distribution**

For initial analytical purposes, the stone was divided into three groups;

a) flaked or worked artefacts and manuports,

b) ambiguous fractured quartz,

c) naturally occurring rounded quartz pieces.

This data is detailed in Table 9 which lists the numbers and vertical distribution of stone in each of the three categories. The numbers are corrected for differences in spit volumes, and graphed as number of stones/m$^3$ in each spit in Figure 29. This gives an indication of the relative frequency of each category in each spit, and the distribution of the different categories in the pit.
<table>
<thead>
<tr>
<th>Spit No.</th>
<th>Flakes, Cores and Manuports</th>
<th>Fractured Quartz Pieces</th>
<th>Rounded Weathered Quartz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>13</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>13</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>6</td>
<td>7</td>
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<td>8</td>
<td>7</td>
<td>12</td>
<td>5</td>
</tr>
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<td>9</td>
<td>7</td>
<td>10</td>
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<td>10</td>
<td>1</td>
<td>1</td>
<td>17</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>12</td>
<td>-</td>
<td>-</td>
<td>15</td>
</tr>
<tr>
<td>13</td>
<td>-</td>
<td>-</td>
<td>8</td>
</tr>
<tr>
<td>N</td>
<td>54</td>
<td>50</td>
<td>91</td>
</tr>
</tbody>
</table>

**Table 9: Stone distribution square B**

The graph [Fig. 29] indicates a strong coincidence in the frequency of the worked stone artefacts, with the ambiguous fractured quartz pieces. The natural quartz distribution however is at variance with both the worked stone artefacts, and fractured quartz pieces. The small rounded quartz pebbles, which were unequivocably weathering from decaying quartzite in the lower levels of the deposit, increased in frequency with depth [Figs. 29, 27].
Figure 29: Cataraqui Monument square B stone distribution

Figure 30: Cataraqui Monument square B distribution of flaked stone and fractured quartz pieces combined
The frequency of ambiguous fractured quartz pieces in the lower levels however declines along with the frequency of flaked artefacts. This strongly suggests that the deposition of fractured quartz pieces is of anthropogenic origin. This also is supported by site observations that fractured quartz pieces were geologically foreign to the site area. The fractured quartz pieces were substantially larger in size and of a different colour to the rounded quartz pieces naturally weathering from the quartzite.

<table>
<thead>
<tr>
<th>SPIT No.</th>
<th>Flaked Quartz</th>
<th>Fractured Quartz</th>
<th>Rounded Quartz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. x gm</td>
<td>No. x gm</td>
<td>No. x gm</td>
</tr>
<tr>
<td>1</td>
<td>1 0.9</td>
<td>2 1.7</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>1 2.4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>2 0.9</td>
<td>3 1.0</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>13 1.3</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>13 2.8</td>
<td>8 1.3</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>5 6.4</td>
<td>6 4.1</td>
<td>7 0.9</td>
</tr>
<tr>
<td>8</td>
<td>7 2.0</td>
<td>12 1.4</td>
<td>5 1.0</td>
</tr>
<tr>
<td>9</td>
<td>5 1.0</td>
<td>10 1.8</td>
<td>9 1.2</td>
</tr>
<tr>
<td>10</td>
<td>-</td>
<td>1 2.3</td>
<td>17 0.8</td>
</tr>
<tr>
<td>11</td>
<td>1 1.0</td>
<td>-</td>
<td>30 1.2</td>
</tr>
<tr>
<td>12</td>
<td>-</td>
<td>-</td>
<td>15 1.1</td>
</tr>
<tr>
<td>13</td>
<td>-</td>
<td>-</td>
<td>8 0.9</td>
</tr>
<tr>
<td>N.</td>
<td>49</td>
<td>50</td>
<td>91</td>
</tr>
</tbody>
</table>

Table 10: Comparison of weight of flaked quartz, fractured quartz and weathered rounded quartz pieces from square B.
The size difference is best demonstrated in the weight comparison between flaked, fractured and rounded weathered quartz pieces [Table 10]. This comparison indicates a significant difference in size between rounded and fractured quartz pieces, and a similarity in the size of fractured and flaked quartz pieces.

In light of the comparative distributions of the different categories of stone recovered, and essential differences in the nature of naturally occurring quartz and the fractured quartz pieces, it is concluded that it is highly probable that the fractured quartz is in fact a product of human activity at the site.

Fractured quartz pieces and flaked stone were found both in the upper truncated B horizon unit and in the lower level deposits. Unlike aeolian dune deposits, which can be deposited relatively rapidly, the truncated soil profile evident in the pit deposit represents a slow accretion of sediments (J. Magee pers. comm.). It is probable therefore that the vertical distribution of the stone artefacts reflect use of the site over a period of time rather than intensive use associated with a single occupation phase.

The distribution of flaked and worked stone, and fractured quartz combined is graphed in Figure 30. This represents all stone recovered which is considered to be of anthropogenic origin. The distribution of the anthropogenically derived stone, accords with the bi-modal distribution of the clearly flaked and worked stone [Figs. 29, 30]. There is a low density of anthropogenic stone in the upper two spits separated from the higher density levels below, by a hiatus in spit 3. This could be reflecting an occupational hiatus between the period represented by the C horizon (units 2, 3, and 4) and the upper level of the eroded B horizon (unit 1).

The well formed soil profile and absence of evidence of disturbance in the lower levels of the B horizon unit, indicates that the artefacts in spits 1 and 2 are unlikely to have been churned to the surface from lower levels. This is further supported by the
presence of numerous surface artefacts resting on the top of the B horizon of the eroded palaeosol on the ridge area. The bi-modal artefact distribution pattern could be assessed by undertaking further excavations at the site. The evidence recovered to date however, indicates that the pattern of site use in the area excavated, reflects the more general site use. This bi-modal distribution pattern could reflect a more recent but less intense use of the quarry following a period of abandonment sometime after 10,000 years ago.

*Artefact types and raw materials*

No retouched artefacts or formal tool types as defined by Jones (1971) were recovered from the deposit. These types were also markedly absent amongst the surface artefacts. The excavated assemblage reflected the smaller elements of the surface assemblage, and all were made from quartz or quartzite available from the outcrop on the site. No large quartzite block implements or horsehoof cores such as those recorded as surface finds on the site, were present in the excavated material. Overall, the excavated assemblage comprised an amorphous assemblage of unretouched flaked stone, predominated by quartz [Table 11; Plate 21].

The flaked and worked stone was sorted according to artefact type and raw material. The increase in flaked artefacts and fractured quartz pieces in spits 5 to 9, coincides with the presence of cores [Figs. 29, 30; Table 11]. Cores were absent in the upper spits which contained relatively few artefacts. This suggests that localised stoneworking activity may be effecting a variation in density of artefacts present in different levels. Hence the increase in artefacts in the lower spits could be explained by; a) changes in site function, b) more intensive site use than in more recent times, or, c) it may be a reflection of the small sample size represented by a 1 metre square pit in a site covering some 2,000 square metres.
### Table 11: Square B stone artefact types and raw materials

Since the number of artefacts recovered from the upper two spits of square B was consistent with the density of surface artefacts, the excavated square is considered to be a representative sample at least of the eroding palaeosol deposit. Therefore, the last explanation for the variation in density is untenable. Similarly, the surface evidence suggests that change in site function is an equally unsatisfactory explanation.
The surface artefacts indicate that this site was primarily associated with the stone source available there. There was no evidence in the excavated deposit to suggest that the site has been anything other than a quarry site principally associated with exploitation of the outcrop stone. It is therefore considered that the increase in density in artefacts in the lower spits is a reflection of more intensive site use in the earlier occupation phase, rather than a product of changes in site function over time.

<table>
<thead>
<tr>
<th>Spit no.</th>
<th>wgt gm</th>
<th>% burnt (gms)</th>
<th>% broken &lt;2 cm*</th>
<th>identifiable elements</th>
<th>Species or level identifiable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.5</td>
<td>50</td>
<td>58</td>
<td>part femur</td>
<td><em>Thylogale billardierii</em></td>
</tr>
<tr>
<td>2</td>
<td>23.5</td>
<td>42</td>
<td>60</td>
<td>phalanges, humerus</td>
<td>(pademelon)</td>
</tr>
<tr>
<td>3</td>
<td>18.5</td>
<td>78</td>
<td>44</td>
<td>phalanges, part pelvis</td>
<td>small macropod</td>
</tr>
<tr>
<td>4</td>
<td>3.5</td>
<td>57</td>
<td>42</td>
<td>metatarsal</td>
<td><em>Thylogale billardierii</em></td>
</tr>
<tr>
<td>1 to 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>66.0</td>
<td>x = 57</td>
<td>x = 51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>5.5</td>
<td>0</td>
<td>52</td>
<td>part long bones</td>
<td>large macropod</td>
</tr>
<tr>
<td>6</td>
<td>5.0</td>
<td>0</td>
<td>50</td>
<td>clavicle &amp; long bones</td>
<td><em>Macropus rufogriseus</em> (red-necked wallaby)</td>
</tr>
<tr>
<td>6 section</td>
<td>63.0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 to 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>73.5</td>
<td>x = 0</td>
<td>x = 51</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* % of no. of bones

Table 12: Faunal remains square B
Faunal remains

The quantities of bone recovered and their distribution in the excavated deposit from square B, is tabled above [Table 12]. No shellfish or other faunal remains were recovered apart from some burnt and unburnt bone.

Two macropod species were the only species identified in the bone remains. These were pademelon (*Thylogale billardieri*) and the red-necked wallaby (*Macropus rufogriseus*). All pademelon remains were found in the uppermost 4 spits that comprise stratigraphic unit 1. The wallaby remains were found in the lower spits 5 and 6, in stratigraphic unit 2. The size of unidentifiable bone pieces found in stratigraphic association with the identifiable elements, suggests that these are most probably assignable to the same species, and probably to the same individual. The minimum number of individuals represented in both sets of remains was one pademelon and one wallaby.

Some of the pademelon bone showed evidence of burning. The widespread presence of charcoal in the same stratigraphic unit suggests that the bones could have been burnt in natural fire events. There was no burnt bone recovered from the lower spits containing the wallaby remains. Charcoal density in this unit was markedly less than in the upper unit. Moreover there was no archaeological evidence of hearths or other remains which could indicate cooking, and thus human predation associated with the faunal remains. None of the bones had damage patterns consistent with other animal predation such as carnivores (Marshall and Cosgrove 1990; Sadek-Kooros 1975). The bone in the deposit therefore is considered to be attributable to natural deaths.

The presence of pademelon remains suggests that there has been a denser vegetation regime in the locality of the site in the past. Whereas wallabies are now commonly found in the grassy west coast dune country, pademelon distributions are generally
restricted to areas of dense coastal scrub or forested east coast regions. A denser vegetation regime also accords with the presence of burnt wood in the dune palaeosols.

Summary and Discussion

The excavation demonstrated that this site was being used about 10,200 BP, and that use may have continued into more recent Holocene times. Precisely how recently this site was used was not clearly evident, although the radiocarbon dates from the upper stratigraphic level suggest it could have been in mid to recent Holocene times. The absence of evidence of coastal resource exploitation could indicate that use of the site was abandoned sometime before the sea reached a level similar to present. Alternatively it could be argued that the focus of activity at this site was associated with stone exploitation, and that evidence of occupation at the site in more recent times is reflecting this activity rather than subsistence activities which were taking place elsewhere.

At present however, there is no unequivocal evidence of use of the site from the time after King Island became severed from Tasmania. Given the problems already outlined in regard to the inclusion of more recent charcoal in the upper level of the occupation palaeosol, conclusions based on the radiocarbon dates in the upper unit can only be tentative. Further excavation at this site could possibly provide datable organic cultural remains, and thus secure dates relating to the more recent period of use.

The information obtained from the site in regard to the antiquity of the surface assemblage which resembled those from the Kangaroo Island Kartan sites, suggests that at least on King Island it is not reflecting any great antiquity. Moreover the surface assemblage, and the artefacts excavated from the lower stratigraphic unit could represent two separate occupation phases. The surface artefacts had deflated from deposits considerably more recent than 10,200 BP, and represent the most recent phase of
occupation. The association of the surface assemblage with the grey quartzite outcrop suggests that these types of assemblages are most probably reflecting the mode of exploitation of the particular stone source in more recent times. (As with the Cataraqui Monument site, the main Kartan sites described by Lampert (1981: 44) were similarly located near outcrops of quartzite). The evidence at the Cataraqui Monument site therefore could suggest that these type of assemblages may relate to expedient use of the particular type of stone, and that this may be associated with resource exploitation specific to islands.

CAVE EXCAVATIONS

During reconnaissance surveys, three sea caves in the cliffs along the southwest coast were identified as having potential for test excavations. These caves were the only known caves accessible on the island. Local residents said there was one other cave in the cliffs just south of Blister Cave, but it could only be visited by swimming in from a boat in exceptionally fine weather. It was not logistically possible to investigate this latter cave during the project so test excavations were undertaken in each of the three more accessible caves.

The caves are located in a Precambrian quartzitic rock which forms the southwestern sea cliffs between Cataraqui Point and Surprise Bay [Fig. 18]. The quartzite formation results from metamorphism of the island's sedimentary sandstone and mudstone bedrock sequence, by a granite intrusion belt which flanks the west coast of the island. [Fig. 4]. Substantial calcareous aeolian dune deposits, typical of the dunes found along the lower lying areas of the west coast of the island, occur intermittently along the top of the southwest cliffs (Jennings 1959a).

Bathymetric contour charts of the offshore topography in the southwest region of the island indicate that the cliff face plunges some 40 to 50 metres below the present sea
level. The submarine topography levels out at about this depth and slowly declines over a distance of 45 kilometres, to a depth of 120 metres near the edge of the continental shelf. From this point the seabed plunges steeply to a depth of more than 300 metres [Fig. 1].

Two of the caves investigated, Iron Monarch and Blister Cave, are deep narrow caves formed by wave action along fault lines in the quartzite cliffs at times of higher sea level, more than 125,000 years ago (Goede et al 1979; Jennings 1959a). Test excavations were also undertaken at Cliff Cave, a cave perched higher in the cliffs, about 1 km south of the Iron Monarch Cave, and 1 km north of Blister Cave [Fig. 18]. Although the Cliff Cave was much smaller than the deep sea caves, and had a more open aspect, it offered an area of sheltered habitable space comparable to that in the larger caves.

Although one possible artefact was found outside the entrance to Iron Monarch, no archaeological surface evidence was found inside any of the caves to indicate that these caves were used by people in prehistoric times. Considering that the island was uninhabited when Europeans first arrived, and was thought to have been so for several thousand years or more, this was not unexpected. It was regarded highly probable that any prehistoric archaeological remains in the caves, would have been buried by sediments accumulating in more recent times.

All the caves had evidence such as beer cans, candles, rope, milled driftwood and hearths, attesting to the presence of visitors in recent times. No shellfish remains were evident in the surface debris in any of the caves.
Figure 31: Cliff Cave plan and section views
Cliff Cave excavations

The deposit in this cave was principally comprised of lightly consolidated and loose calcareous aeolian sediments. The lack of consolidation in the aeolian sediments in the cave presented excavation problems, and section collapses caused two pits to be abandoned at less than 1 m in depth. A shoring method was devised that eventually enabled a third pit to be excavated to a depth of 2.9 metres below the surface [square c in Fig. 31]. This pit revealed Pleistocene evidence of human occupation in the King Island region.

Excavation method

The deposit was removed in measured spits within the stratigraphic units, and stratigraphically at the unit junctions. Spit depths varied according to the nature of the unit being excavated. On average the sterile sand units were removed in 10 cm spits whereas the cultural unit (unit 4), was excavated in 5 cm spits. As detailed below, an area approximately 50 cm by 30 cm by 40 cm was excavated sideways into the southwest corner of the pit sections, about 2 m below the surface in square C. This facilitated removal of some of the skeletal remains.

All excavated deposits were dry sieved using 5 mm and 2.5 mm sized screens, and bulk samples were collected from each stratigraphic unit. In some cases bulk samples were taken from both the upper and lower levels of the unit.

In square C, a travelling box shoring technique was employed to overcome excavation problems posed by the nature of the deposit. This entailed progressively lowering a prefabricated timber box into the pit as the excavation proceeded. Eventually the pressure of the deposit outside the box prevented the box from travelling down. When this occurred, another smaller box was placed inside the existing one, decreasing the
size of the hole to the internal size of the box already in place. Three boxes were required before the consolidated level which contained archaeological remains was uncovered. As a consequence of the shoring system, the original 1 m by 1 m square opened was reduced in size to an 80 cm square when the cultural level was first encountered (about 1.8 m below the surface).

Excavation results

Squares A and B
Square A, a pit 1 m by 1 m was excavated to a depth of 35 cm. A total of 7 spits were removed, passing through a stratigraphic change from a red-brown (Munsell 10YR 3/4) coarse sand surface deposit to the underlying pale yellow (Munsell 10YR 6/4) coarse shelly sand of stratigraphic unit 2, about 10 cm below the surface. Some quartzitic rocks, of the same parent rock of the cave formation, were removed from the upper stratigraphic unit. The underlying paler sand unit was very loose and major section collapses occurred in the south and east sections. Excavation of this square was temporarily halted while an adjoining 1 m by 1 m pit, Square B, was opened in order to facilitate shoring of the deposit.

Square B was excavated to similar depth as square A, and excavation of the two squares was continued in tandem. The stratigraphy in square B was consistent with square A although more rocks were recovered from the Square B upper unit. Progressive panel shoring proved unsuitable as installation of the panels was causing destabilisation of the sections. Excavation of the two squares was discontinued at a depth of 1 metre due to total collapse of three sections.

The base of the pit which comprised squares A and B, was probed with a 25 mm hollow metal tube. This indicated that the pale sand unit was another metre or so in depth, and that under this unit was a wet dark red-brown clayey-sand deposit. The
stratigraphic change detected by the probe was about 2 m below the surface of the cave deposit. After probing the deposit, the pit was backfilled to surface level.

No archaeological remains were recovered from the deposits in the pit comprising squares A and B. Apart from a few murid and small passerine bones recovered from the surface and upper unit, the deposit was sterile. There was a marked absence of rocks in the underlying homogenous pale sand unit. Five small shell fragments, bivalve shells less than 3 mm in size were recovered from this unit (stratigraphic unit 2). These are believed to derive from the same shelly limestone formation as the coarse sands, and were blown into the cave along with the sand.

Square C

After devising a new shoring method, another 1 m by 1 m pit, square C, was opened [Figs. 31, 32]. This square in part overlapped the backfilled area of square A. The upper stratigraphic units, described below, accorded with those excavated in the previous pit.

Stratigraphic description

Unit 1 (Spit 1)

On the surface there were some large rocks which appeared to weathered cave rock. Some of these had been used in recent times as hearth stones and there was charcoal and burnt wood present on the surface along with a quantity of firewood which had recently been carried into the cave. The uppermost deposit was a slightly consolidated coarse sand unit with a pH level of 8.5. It was red-brown in colour (Munsell 10YR 3/4), and the sediments were aeolian, coarse shelly sands with post-depositional staining due to animal activity. This staining results from weathering of the parent rock and associated soil oxidation processes (J. Magee pers. comm.).
Figure 32: Cliff Cave section drawings and spit levels - square C

- a = undisturbed Square C deposit
- b = Square A backfill deposit removed separately

1. Surface: dark orange/brown sand - loose
2. Pale coarse yellow/orange shelly sand - loose/slight consolidation
3. Wet dark orange sand
4. Compact fine wet brown/chocolate soil with charcoal flecking - over rock levels
5. Chocolate brown soil with rock - very compact sandy clay
6. Looser sandy orange lens
7. Pale yellow coarse sand (similar to 2)
Unit 2 (Spits 2 to 7)
There was a distinct colour change in the sediment between 10 cm and 12 cm below the surface. The sediment in this unit was a calcareous, very pale yellow aeolian coarse shelly sand, (Munsell 10YR 6/4) and with a PH level of 8.5. It was similar in texture to unit 1 although generally looser and less consolidated. Unit 2 was between 1.6 and 1.8 m in depth and was homogeneous in sediment colour and texture in its entirety. No charcoal was evident in this unit.

Unit 3 (Spits 8 and 9)
Underlying the loose pale sands of Unit 2 there was a sharp stratigraphic break with the emergence of a compact, damp dark clayey-sand deposit. It was dark brown in colour (Munsell 10YR 2/2), with a pH value of 8. There was a marked concentration of small charcoal lumps and flecks within this unit. The depth of Unit 3 varied across the excavated square although on average it was between 5 cm and 7 cm thick. Charcoal was collected from this unit for radiocarbon dating.

Unit 4 (Spits 10 to 15)
A much less distinct change was evident below unit 3 as the darker deposit continued but changed to a slightly more reddish-brown colour (Munsell 10YR 3/6). Although less damp than the overlying unit, unit 4 was a similarly alkaline (pH 8), coarse clayey-sand deposit. Less charcoal was however present in this unit. Like unit 3, this unit was also well consolidated and did not require shoring to excavate. A large number of rocks, similar to those found lying on the surface of the cave's deposit, were located within this unit. This unit varied between about 40 cm and 60 cm in depth, and the junction between this and the underlying unit was extremely uneven.

As detailed below, human skeletal remains were discovered within the unit 4 deposit. Charcoal samples for dating were collected from spits 14 (ANU-7116) and 15. (The spit 15 sample subsequently proved too small for dating using the conventional
radiocarbon method). Another charcoal sample (ANU-7039), was also collected from an area which was excavated into the sections to remove skeletal remains.

Unit 5 (Spit 16)
Underlying the compact sediments of Unit 4 was another loose pale calcareous aeolian sand unit (Munsell 10YR 6/6). This lowest unit was almost indistinguishable in texture, colour and sediment type from unit 2. It was similarly highly alkaline with a PH value of 8.5. Unit 5 was homogeneous with the exception of a thin band of coarse orange sand (Munsell 10YR 5/6) present in some places at the junction between this and the overlying Unit 4. No charcoal was evident in unit 5.

The excavation did not progress to the basal level of the unit 5 sediments as it was established that the bones present in unit 4 were human remains. Since the Tasmanian Aboriginal Centre wished that no further work be undertaken at the site, excavation ceased in unit 5. A 25 mm by 1 m long hollow tube was used to probe the base of the pit. This indicated there was at least 1 m of the unit 5 loose sand beneath the pit.

Radiocarbon dating results

<table>
<thead>
<tr>
<th>Stratigraphic Unit</th>
<th>Spit 9</th>
<th>8540 ± 390 BP</th>
<th>ANU-7057</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratigraphic Unit 3</td>
<td>Spit 9</td>
<td>8540 ± 390 BP</td>
<td>ANU-7057</td>
</tr>
<tr>
<td>Stratigraphic Unit 4</td>
<td>Skeleton embayment</td>
<td>14270 ± 640 BP</td>
<td>ANU-7039</td>
</tr>
</tbody>
</table>

Table 13: Radiocarbon dates from Cliff Cave [see also Fig. 32]
Stratigraphic interpretation

Excavation and probing in the cave deposit indicated that there was a minimum sediment depth of 3.5 metres. The sediments comprise principally two aeolian units of pale, coarse shelly sand, each capped by a more consolidated darker unit. These darker units have a component of the aeolian sands but also contain staining and, in the case of the lower consolidated unit (unit 4), a predominant clay component.

The stratigraphy suggests that there have been two major depositional events involving rapid accumulation of aeolian calcareous sands such those evident in the pale sterile units. The homogenous nature of the paler sand units, and the total absence of organic remains in these deposits, despite their high alkalinity, strongly suggests that these units were deposited in a relatively short time.

The two aeolian events have been separated by a substantially longer period of time during which oxidisation and post-depositional changes have occurred in the uppermost levels of the calcareous sands. During periods of depositional hiatus, mammal and bird activity in the cave, fire events in the vicinity of the cave, and weathering of the parent rock have contributed to the material evident in the darker upper level of the deposit. In the case of the lower deposit capped by unit 3, this was subsequently buried by another relatively rapid depositional event, occurring sometime more recently than about 8,500 years ago.

Little deposition has occurred since about 6,600 BP as the source of the aeolian sediments, of which the deposit is comprised, was subsumed in the final phase of the marine transgression.

Since the charcoal is believed to have been included in the deposit sometime after the sediments were originally deposited, the period of deposition of the lower aeolian unit
is indeterminable. What is clear from the radiocarbon dates however, is that it was deposited sometime prior to about 14,500 years ago. Overall, this suggests that there was a hiatus in aeolian sediment deposition, minimally between 8,500 BP and 14,500 BP. That is, there was a major depositional event sometime before about 14,500 BP and one more recent than about 8,500 BP.

Human skeletal remains

A portion of a human rib and a metatarsal bone were discovered about 10 cm below the top of unit 4. During the excavation of unit 4, a number of larger rocks more than 15 cm in size began to appear in the deposit. The proximal ends of two human tibiae and a piece of broken long bone were uncovered in the south section 1.955 m below the surface of the cave deposit [Fig. 32]. A small embayment was excavated in the southwest corner of the pit to facilitate removal of the tibia, and during this process the cranium was exposed. Dr Alan Thorne was consulted regarding the find, and attended the excavation to complete the removal of the human remains and undertake metrical analysis prior to their reburial (Sim and Thorne 1990).

In total, the excavated human remains included the cranium and mandible, six cervical vertebrae (including atlas and axis), eight thoracic vertebrae, the left femur, the left and right tibiae and fibulae, the heads and partial shafts of six left and two right ribs, a 12 cm length of humeral mid-shaft, two partial metatarsals, a left cuneiform and three pedal phalanges [Appendix IV]. These were excavated from the embayment excavated in the southwest section, and spits 10 to 15 inclusive. The majority of the skeletal remains were recovered from spits 13 and 14.

Several small pieces of bright pinkish-orange ochre about the size of a matchhead were found adhering to cranium and the femur. These were geologically foreign to the cave environs and their presence is therefore attributable to either mortuary practices or
personal ornamentation of the deceased. Apart from the human skeletal remains and the ochre, no stone artefacts or other cultural remains were recovered during excavations at this site.

Antiquity of the human remains

Two radiocarbon dates were obtained from charcoal within the same stratigraphic unit as the human skeletal remains. These were;

a) 14270 ± 640 BP (ANU-7039) which was obtained from a sample found adhering to one of the bones in the undercut embayment, and,

b) 11815 ±1370 BP (ANU-7116) from charcoal excavated immediately adjacent to a human vertebra in spit 14. This sample was located between 5 and 15 cm below the ANU-7039 sample [Fig. 31].

The radiocarbon date obtained from charcoal collected from the overlying stratigraphic unit, sealing the deposit that contained the skeletal remains, was 8540 ± 390 BP (ANU-7057).

When taken to two standard deviations, the overlap between the two radiocarbon dates from the stratigraphic unit containing the human skeletal remains, indicate that the samples could be contemporaneous and thus between 13,000 and 14,500 years old. An alternative explanation is that the charcoal samples were of substantially different ages, and the inverted chronology a product of human disturbance of the deposit associated with the disposal of the human remains. Nevertheless, since both the charcoal and the bones were sealed under rocks in the deposit, it is highly improbable that either charcoal sample is of more recent antiquity than the time of disposal of the bones.

The radiocarbon dates therefore strongly suggest that the human skeletal material was deposited between about 12,000 and 14,000 years ago, and most probably between
about 13,000 and 14,500 years ago. The King Island skeleton is therefore of similar antiquity to the Kow Swamp and Keilor remains, and thus among some of Australia's oldest known human remains (Sim and Thorne 1990).

Disposal of the human remains

The position of the bones indicated that the skeleton was dismembered or disarticulated prior to disposal. Although the tibae and fibulae were in approximate anatomical relationship to one another, the left femur was displaced in the deposit, and found lying over the cranium and mandible. Ribs, vertebrae, the cranium and the mandible were mixed together as if gathered into a pile. Other remains including phalanges and a few teeth were scattered across the 80 cm square area of the pit at different levels within the unit 4 deposit. All the bones were recovered from areas covered with large pieces of rock and some were also overlying rocks [Fig. 32].

There was extensive cracking on the cranium which suggested to Thorne that it had been exposed in a defleshed state for sometime prior to final disposal. The presence of the rocks, and the condition and position of the bone thus suggest the following scenario in regard to the disposal of the skeleton. A decomposed cadaver was present in the cave, either as a result of someone dying in the cave or the body being carried there. After lying on the surface for sometime, the bones were gathered together and placed in a pile, then covered with rocks and surface dirt, possibly in a burial mound.

Current bathymetric data and late Pleistocene sea level curves indicate that at the time of disposal of the human remains about 14,000 years ago, the cave would have been between 20 and 25 km inland, perched high in the cliffs overlooking a coastal plain (Chappell and Shackleton 1986). Subsequent to the disposal of the remains, sediments from this coastal plain were blown into the cave, burying the earlier aeolian deposit containing the remains.
It was not possible to be more precise about the disposal method of the skeletal remains due to the confined conditions under which it was excavated. The lack of consolidation in the overlying sediments precluded a larger area being excavated to facilitate removal of the skeletal remains.

*Morphology of the skeletal remains*

Metrical data obtained by Thorne from the human skeletal material led him to conclude that they were the remains of an individual Aboriginal male, aged between 25 and 35 years at the time of his death [Appendix IV]. Thorne described the skeleton as morphologically gracile, with cranial features which were well within the range of southeastern Aboriginal remains from the recent past. The cranium was fully rounded, the face quite flat and moderate in size, and there was no pronounced development of the supercilliary or malar regions. Thorne also commented on the strong similarity between the King Island remains and the Keilor cranium (Sim and Thorne 1990).

*Faunal remains recovered*

A small quantity of murid and bird bone was recovered from the surface deposit, unit 1. The total of the bone in unit 1 from squares A, B and C combined was less than 2 gm [Table 14a, 14b]. In terms of MNI's, the remains represented one small passerine bird and one murid (*Rattus lutreolus*). One fish vertebra, two small chiton plates, and one fragment of whelk shell were also recovered from this upper unit. The littoral remains were probably deposited in the cave by penguins. The rear of the cave was the nest site of a pair of fairy penguins until their roost was usurped by archaeologists.

There was a marked absence of bone in unit 2. This aeolian shelly sand deposit was sterile, both in regard to cultural and naturally deposited remains. No bone was recovered from the unit 2 deposit in either square A, B or C.
In contrast, the darker underlying units 3 and 4, had abundant numbers of murid bones in addition to a lesser component of other mammal and bird bones [Table 14a, 14b]. Specific species identified in the remains are listed in Appendix V.

<table>
<thead>
<tr>
<th>Spit</th>
<th>Total gm</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>1</td>
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<td>9</td>
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<td>10</td>
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<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td></td>
</tr>
</tbody>
</table>

| Muridae (rats) | 0.7 | 1.5 | 11.3 | 7.6 | 22.3 | 10.6 | 21.7 | 21.1 | 96.8 |
| Dasyuridae (quoll, antechinus) | 0.2 | 0.1 | 2.0 | 0.5 | 0.3 | 0.5 | 3.6 |
| Peramelidae (bandicoot) | 3.2 | 0.6 | 0.4 | 4.2 |
| Macropodidae (pademelon) | 8.0 | 0.4 | 8.4 |
| Burramyidae (pygmy possum) | 0.2 | 0.2 |
| Vespertilionidae (bats) | 0.3 | 0.3 |
| Small mammal | 0.2 | 2.5 | 0.3 | 7.8 | 1.4 | 1.9 | 0.9 | 15.0 |
| Medium mammal | 2.0 | 18.5 | 5.4 | 15.2 | 37.5 | 20.1 | 9.6 | 108.3 |
| Birds | 1.1 | 10.2 | 0.9 | 0.4 | 2.1 | 14.7 |
| Reptiles | 0.6 | 0.1 | 0.4 | 0.2 | 0.1 | 1.4 |
| TOTAL gm | 1.8 | 4.3 | 40.9 | 24.0 | 51.8 | 50.4 | 44.7 | 34.6 | 0.4 | 252.9 |

**Table 14a:** Faunal remains from Cliff Cave square C—weight
There was no indication that human activity was involved in the deposition of any of the non-human bone remains. The range of species and relative densities evident in the remains strongly suggests that a substantial proportion of the remains were probably deposited by predatory birds roosting in the cave in past times (Bowdler 1979:154-87). Some of the bird and mammal species represented in the remains provide useful palaeoenvironmental markers.

There are a number of species whose habitats are predominantly freshwater wetlands. These included an extinct swan species, for which this is only the second recording of

### Table 14b: Faunal remains from Cliff Cave square C—MNIs

<table>
<thead>
<tr>
<th>Spit</th>
<th>1</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>Total MNI</th>
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</thead>
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<td>13</td>
<td>9</td>
<td>24</td>
<td>17</td>
<td>26</td>
<td>26</td>
<td></td>
<td>120</td>
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<tr>
<td>Dasyuridae (quoll, antechinus)</td>
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<td>2</td>
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<td>5</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>Peramelidae (bandicoot)</td>
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<td>2</td>
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<td></td>
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<td>7</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Burramyidae (pygmy possum)</td>
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<td></td>
<td></td>
<td>5</td>
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</tr>
<tr>
<td>Vespertilionidae (bats)</td>
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</tr>
</tbody>
</table>
this species in Australia (van Tets pers. comm.). The presence of the broad-toothed rat (*Mastacomys fuscus*) and a range of wetland avifauna also suggest that when these remains were deposited in the cave, there were different environmental conditions in the vicinity. The local watershed indicates that it is highly probable that at times of lower sea level, swamplands or lagoon habitats existed on a broad coastal plain between the cliffs and the edge of the continental shelf.

This scenario accords with radiocarbon dates obtained from the stratigraphic units containing the bird and other faunal remains. These dates indicate that faunal remains in this deposit accumulated in late Pleistocene and early Holocene times, when sea levels were substantially lower than at present, and a broad coastal plain exposed at the foot of the cliff.

**Summary and Discussion**

There are two major aeolian depositional phases evident in the excavated deposit in the cave, one of Pleistocene antiquity, and a more recent early-Holocene deposit. These depositional events have been separated possibly by some thousands of years, during which time the cave was occupied by birds and small terrestrial mammals. Also during this major depositional hiatus, human skeletal remains were gathered together in one area of the cave, and covered with rocks and surface soil. Weathering of the parent rock and localised sediment movement within the cave, subsequently covered these remains with several centimetres of deposit. This deposit was in turn, inundated relatively rapidly, by nearly 2 metres of aeolian sediments. These were deposited in the cave sometime between about 8,500 and 7,000 years ago.

The absence of stone artefacts, food debris or other evidence of prehistoric human occupation in the cave was almost as remarkable as the discovery of a human skeleton of Pleistocene antiquity. There are several stone artefact sites within several kilometres
both north and south of the Cliff Cave site, attesting to the presence of people in the area in prehistoric times. The cave also affords excellent shelter and commands fine views. Abundant food resources and freshwater, are also available in the immediate vicinity of the site. There was however, no evidence recovered from Cliff Cave that indicated that it had been visited or used as a shelter in prehistoric times, at least since the skeleton was disposed of there.

**Iron Monarch and Blister Cave**

Excavations were also undertaken in the two larger sea caves, Iron Monarch and Blister Cave. Unlike Cliff Cave which was formed high in the cliff in a rock overhang, the two larger caves were located lower down in large fissures. The deposits in these lower sea caves were in the main composed of sediments and rock weathering from the quartzitic parent rock, and material filtering down via fissure planes. This latter process has resulted in speleothem decorations and flowstone formations in these sea caves, from carbonates leaching down from calcareous dunes that are present on the top of the cliffs. The presence of such cave decorations in sea caves, or caves other than those formed in limestone or karst formations is very unusual. Hence, these caves have been the focus of past speleological and geomorphological investigations (Goede *et al.* 1979; Jennings 1959a).

Both of these caves have talus cones formed at the entrance by material weathering down from the cliffs [Fig. 33]. Almost vertical sections have been cut on the exterior face of the talus cones by water running off the cliffs, and possibly by wave action in times of higher sea level (Goede *et al.* 1979). The presence of the talus cones severely restricts natural light penetration in both caves, although it is possible to still see adequately in the foremost chamber of Iron Monarch. In Blister Cave artificial light was required in all areas inside the cave. Prior to the deposition of the talus cones
however, these caves would have had more open aspects and therefore been more suited to human occupation.

Iron Monarch test excavations

Two square metres were excavated in a level area in the front chamber of the Iron Monarch cave [Figs. 33, 34]. This was the only area of the cave which was considered to be suitable for human habitation. The inner chambers have sloping floors, ponding present in some areas and are relatively difficult to enter.

Initially a 1 m by 1 m test pit, square A, was opened. When it became apparent however that the deposit was of substantial depth and would require shoring, another metre, square B, was opened for safety reasons. A total of 5.1 m$^3$ of deposit was excavated; 3.8 m$^3$ from square A, and 1.3 m$^3$ from square B. No stone artefacts or other evidence of human activity was recovered from the excavated deposits. Apart from a few small fragments of what is possibly modern charcoal excavated from the surface deposit, no other charcoal was recovered during the excavations.

*Stratigraphic description*

The deposits basically comprised five units:

1) An uppermost thin band of consolidated dark calcareous sand.
2) Clay bands interspersed with sand and gravel levels.
3) A layered deposit of fragmented parent rock of various sizes and with a minor clay component.
4) A translucent, stalagmite (flowstone) layer varying between 3 and 8 cm in thickness.
5) A coarse, shelly sand unit unit of aeolian origin [Fig. 35].
Figure 33: Iron Monarch Cave schematic section (after Goede et al 1979)

Figure 34: Iron Monarch Cave front chamber plan
Figure 35: Iron Monarch Cave excavation drawing north section, square A
The underlying sand, unit 5, was somewhat unexpected as it was not visible in the talus section outside the cave, nor did it feature in the Goede et al (1979) description of the deposit in Iron Monarch. After the lower sand unit was uncovered during the excavation, the exterior talus cone section was cleaned back to determine the extent of the sand deposit. The sand unit also was located at the base of the vertical section of the talus cone at the mouth. There was over a metre of the sand unit exposed in the cleaned back section, and this was overlain by more than 4 metres of rock and clay talus deposit [Fig. 33].

Depositional chronology

Two samples of the flowstone formation capping the basal sand were radiocarbon dated. The result of one sample (ANU-7056) indicated that the antiquity of the flowstone was beyond the range of the dating method. The second sample (ANU-7055) gave a date of 41000 ±4500 -3000 BP although the distinction between the countrate of the sample and the background was borderline. Hence, it is considered that the flowstone formation is greater than 40,000 years old, and possibly substantially older. It is highly improbable therefore that archaeological remains would be recovered from this lower sand unit.

Faunal remains

Faunal remains were recovered from both the the uppermost sand unit, and the basal sand unit. None were found in the intervening rock rubble and clay levels. Bone recovered from the lower unit was very friable although a wombat and a small macropod mandible were excavated along with several large pieces of long bone and vertebrae. There was a marked absence of murid remains in the lower unit. This could well be a product of differential preservation given the condition of the larger bone recovered from this unit, and the antiquity of the deposit.
None of the species represented in the remains, or the condition of the bones suggest that human activity was involved in their deposition. These remains are therefore considered to be a product of natural deaths of the animals in the cave.

*Other organic remains*

Although no charcoal was found in the deposit, the clay levels contained pieces of decomposing wood and/or bark. In one clay level, a thin friable piece of wood nearly one metre in length was uncovered. Wood was also evident as stained impressions in three clay levels. The wood appears to have been preserved due to anaerobic conditions provided by localised ponding in the cave (Goede *et al* 1979).

Blister Cave test excavations

A test pit was opened in a dry level area inside the cave, some metres in from steep interior side of the entrance talus cone. There was evidence of previous small pit about 25 cm in diameter and 30 cm deep, having been dug in one corner of the excavated area. The excavation was undertaken in an area 1.35 m by 1.1 m and bounded on two sides by the cave wall [Fig. 34]. Fill from the disturbed pit area was taken out separately from the rest of the deposit removed. The area was excavated to a cobble bed, between 41 cm and 620 cm below the surface level.

No artefacts or other evidence indicating human use of the cave was encountered in the investigations in Blister Cave.

*Stratigraphic description*

The deposit comprised principally of roof spall and small rocks from the immediate cave environs. A lesser sediment component was evident in all levels, and this comprised medium-fine dark brown sand which became increasingly wet with depth.
A minor clay component was also increasingly evident with depth. Charcoal was evident as small flecks throughout the upper 30 cm of the deposit, although no large pieces were evident. The charcoal decreased with depth and was entirely absent in the lower deposits.

At about half a metre below the surface, the nature of the deposit changed to a grey sandier sediment and water rounded pebbles and marine cobbles emerged. Several small whole shells, including a whelk and a cowrie shell, and shell fragments were also found jammed between rounded cobbles in the base of the pit. The excavation was halted at this level as it was apparent from the types and size of shellfish remains that they were not humanly deposited. Furthermore, the presence of a bed of marine cobbles indicated that this level of the deposit dated to a previous sea level high, probably associated with the last interglacial 125,000 years ago or so (Goede and Murray-Wallace pers. comm.).
A small quantity of other faunal remains were recovered from the uppermost 30 cm of the deposit. These comprised small murid bones and several pieces of unidentifiable larger bone, one of which was a bird bone.

Chronology of the deposits
As discussed above, the littoral nature of the deposit at the basal level provided a useful chronological marker, dating this level of the deposit to about 125,000 years ago. The chronological relationship between the overlying deposits inside the cave, which are principally derived from weathering processes of the cave parent rock, and talus cone formation however is unclear. The talus cone at the entrance is however obviously is more recent deposit than the marine cobble bed inside the cave.

Iron Monarch and Blister Cave — Summary and discussion

There was no evidence recovered from either Iron Monarch or Blister Caves to indicate that either of these caves had been visited by people in prehistoric times. In light of the paucity of other places affording similar shelter on the island, the absence of cultural remains in the caves was surprising. It is now considered that the entrances to these two caves were probably obscured in the past by the entrance talus cones for a substantial part of the possible time of human occupation in the region (Goede et al 1979). The excavation results from Iron Monarch suggest that the talus cone deposition occurred more recently than the dated flowstone formation. As discussed above, the age of the flowstone is probably in excess of 40,000 BP. Thus it appears that the period in which the caves would have been conducive for human habitation, probably predates human occupation in this region.

If, as the stratigraphy in the caves suggests, Iron Monarch and Blister Caves were inaccessible for some period of time from the late Pleistocene until mid-Holocene times, then this could explain the absence of cultural remains in these caves. The absence of
more recent Holocene occupation is probably attributable to the lack of light and their
difficult access due to the talus formations.

Other Investigations on King Island

New Year Island
Previous research on New Year Island suggested that it was a site where prehistoric
cultural remains could possibly be recovered from stratified deposits. Several artefacts
embedded in the surface of an exposed palaeosol were recorded along with numerous
surface finds, during survey work on the island in 1988 (Sim 1988, 1990). Aboriginal
skeletal remains had also been recovered from a dune blowout on New Year Island in
the 1970s. Although these could not be dated due to post-depositional contamination,
they are believed to be of prehistoric antiquity (Murray et al. 1982).

Three test pits were therefore excavated on New Year Island in an attempt to locate
stratified stone artefacts and datable anthropogenic remains. All were one metre square,
and less than 30 cm deep. They were all located in areas where consolidated palaeosol
sediments were exposed. During the more recent excavation project, artefacts which
had previously been recorded embedded in the surface of the palaeosol could not be
relocated, primarily because mobile dune deposits had covered most of the area
previously surveyed. The test pit locations therefore were selected on the basis of their
proximity to the area where most surface artefacts were present, and also where there
were consolidated palaeosol deposit.

Two of the pits were sterile except for a small quantity of charcoal in the uppermost 10
cm. The third pit contained palaeosol charcoal in addition to small macropod bones and
shellfish remains. Charcoal was recovered between 25 cm and 75 cm below the
surface for dating purposes from this test pit. A radiocarbon date of 8660 ± 240 BP
(ANU-7425) was obtained from this charcoal sample.
The shellfish remains were present both as a small scatter on the surface of the test pit area, and embedded within the upper 12 cm of the palaeosol. The shellfish comprised in the main, species whose preferred habitat is estuarine mud flats rather than open coastal environs, such as presently surround the island. At times of lower sea levels it is probable that estuarine conditions were in close proximity to New Year Island since one of the King Island's main rivers, Yellow Rock River, discharges into the sea on the adjacent coast of the main island. The types of remains in the palaeosol, and the radiocarbon date of the charcoal, suggests that this unit was probably deposited sometime prior to 6,600 years ago.

The absence of larger edible shellfish species commonly exploited by humans (and the presence of consistently small bivalve and gastropod species not normally found in human midden sites), suggested that other animal behaviour was responsible for this shell deposit. Furthermore, the types of remains did not resemble seabird deposits (see chapter 4). Some ibis species however are known to take bivalve molluscs (Vestjens 1973). It is probable that the shellfish remains are therefore a product of waterbird feeding behaviour, from a time of lower sea level when estuarine conditions, and wetland fauna were in the vicinity.

Bones of a large macropod, the Grey Forester Kangaroo (*Macropus giganteus*) and emu bones were also discovered embedded within the palaeosol unit in close proximity to the excavated bird midden area. The presence of the kangaroo and emu, along with a range of other large mammal species similarly suggests that the palaeosol sediments were deposited at times of lower sea level. At present, New Year Island covers an area of less than two square kilometres and hence is too small to support the range of species deflating from the palaeosol (Murray *et al*. 1982).

The depositional relationship between surface artefacts and the palaeosol was however indeterminable since none were recovered from stratified deposits.
Seal Point Rockshelter

The Seal Point shelter is a large rock overhang located in a small limestone outcrop on the south coast of the island. Although this shelter appeared suited to human habitation, preliminary augering of the deposit indicated that it was not feasible to undertake test excavations there. Large pieces of rock were consistently encountered during the augering, and no area of suitable size to excavate with unencumbered deposit was located.

SUMMARY OF KING ISLAND INVESTIGATION RESULTS

The King Island investigations provided a range of dated evidence of prehistoric Aboriginal occupation of the region. This spanned from late Pleistocene human skeletal remains, to recent Holocene shellfish middens. No stratified sequences of cultural remains or other evidence to suggest continuous occupation of King Island during this time span were recovered. Overall, the securely dated evidence of prehistoric human occupation on King Island comprised:

a) human skeletal remains about 14,000 years old from Cliff Cave,
b) use of the Cataraqui Monument quartzite outcrop site about 10,000 years ago,
c) midden sites at Quarantine Bay and Cataraqui Point, dated to 1,100 and 1,980 years ago respectively.

This evidence represents human occupation respectively, from the time when King Island;

a) was part of the vast Bassian landbridge connecting Tasmania to Australia,
b) was in the final peninsula, or initial island phase,
c) was an isolated island, separated from Tasmania by about 85 kilometres of sea for some thousands of years.
There were also stone artefacts at the Cataraqui Monument site that clearly related to occupation of the site in times more recent than the deposit dated to 10,180 BP. Thus there is possibly further evidence of island occupation apart from the dated midden sites. This undated evidence includes the surface assemblage that was similar in many aspects to those described on Kartan sites on Kangaroo Island. The evidence from the Cataraqui Monument site suggests that the surface assemblage at the site is of Holocene antiquity, and probably dates to the island phase.

Apart from the skeletal remains from the Cliff Cave site, no cultural remains were recovered from the sea-cave excavations on King Island. This appears to be attributable to the lack of access to these caves at various times in the past, and the non-conducive habitats in the caves from at least 40,000 years ago.

Radiocarbon dating results also confirmed that some of the island's midden sites are from early historic times, when the island was occupied by Aboriginal women taken to the island by European sealers. Therefore, secure evidence such as radiocarbon dating of cultural remains is required if one is to suggest that midden, or cultural remains in blowout lag deposits on the island, are of prehistoric antiquity.

The dating results obtained from cultural shellfish remains from two prehistoric midden sites indicate that there were people on the island in recent Holocene times, some 8,000 to 9,000 years after the island was first severed from mainland Tasmania. The implications of this evidence in regard to the question of a stranded island population is discussed in the following chapter.
Chapter 7

IMPLICATIONS OF ARCHAEOLOGICAL EVIDENCE FROM KING AND FLINDERS ISLANDS

The results of the investigations undertaken during this project indicate that there were people on both Flinders and King Islands, several thousand years or more after the sea reached a level similar to that at present, about 6,600 BP. Prior to these current investigations, it had been thought that human occupation on these islands ceased sometime before 6,000 years ago (Orchiston and Glenie 1978; Jones 1979). Radiocarbon dating of shellfish remains from archaeological middens now indicates that people were on Flinders Island as recently as about 4,700 years ago, and on King Island as recently as 1,100 years ago. This Holocene archaeological evidence raises the question as to why these islands were devoid of Aboriginal populations at the time of European arrival in the Bass Strait region.

As previously discussed, prehistoric archaeological evidence on both islands has until now been attributed to stranded Aboriginal island populations. These stranded groups were believed to have become extinct within a few thousand years of the islands being severed from mainland Tasmania by the sea-level rise associated with the post glacial climatic amelioration (Orchiston and Glenie 1978; Jones 1979). Underlying previous interpretations of archaeological finds on both islands was the assumption that Tasmanian Aboriginal watercraft were not capable of undertaking the open sea crossings necessary to reach the larger and more remote Bass Strait islands. The new evidence of more recent Holocene prehistoric occupation on King and Flinders Islands raises questions regarding the validity of extinct stranded population models, and suggests that other explanations for this occupation should also be considered.
The evidence obtained during this project not only indicates that people were present on both islands more recently than previously thought, but also suggests that the islands may not have been occupied continuously from the time the islands were separated from Tasmania. In view of the results of the investigations of Holocene sites on both islands, the possibility that people did travel between the islands and mainland Tasmania using watercraft cannot be dismissed. Furthermore, despite the current focus on the simplicity of Tasmanian watercraft, and the limitations of such craft (Jones 1976, 1977), there are historic accounts extolling the seaworthiness of some types Tasmanian watercraft at the contact period (Macintosh 1949; Ling Roth 1899).

The new data from King and Flinders Islands also suggest that patterns of prehistoric occupation on Flinders and King Islands are not necessarily similar. For his interpretation of evidence of archaeological remains on King Island, Jones (1979) used the extinct island population model suggested by Orchiston for Flinders Island (Orchiston and Glenie 1978; also see Jones 1976, 1977). New evidence suggests however, that the situation was possibly quite different on the eastern and western sides of Bass Strait, and that a generalised model of island occupation by extinct stranded groups, is inherently limited in its usefulness. Moreover, the fundamental question appears to be whether or not there were in fact stranded extinct populations, rather than, why people stranded on the islands became extinct. Thus the problem is basically that of determining the nature of occupation on the islands from the archaeological evidence.

The evidence on both King and Flinders Island will therefore be reviewed in relation to evidence from both island, and mainland Tasmanian sites. From mainland Tasmanian data, models of Holocene land-use patterns will be constructed to provide a comparative basis for interpretation of the King and Flinders Islands data.
It is not possible to construct a model of relict stranded island occupation principally because there is no comparative data in the Australian archaeological record. Although there are many instances of both permanent and ephemeral island use of smaller offshore islands (of comparable size to the larger Bass Strait islands) in Australia, none were known to be permanently occupied by isolated groups of people in Holocene times. Contact between these other island populations and mainland groups is known to have occurred (Barker 1989; Rowland 1980, 1981, 1986; O'Connor 1989). Since these cases do not represent physically and genetically isolated populations, they do not provide a useful basis for assessing the viability of the stranded Bass Strait population models.

It could be expected that the extinction of any relict population which had been viable for thousands of years, would have been a relatively rapid event, possibly occurring within the span of several generations (Jones 1977). Thus it is unlikely that the actual process of decline of a stranded island population would be archaeologically visible on Flinders or King Islands (Jones 1977:352). Therefore the evidence on these islands is taken as representing occupation either by a) an isolated population of sufficient numbers to constitute a viable population, or b) that of people using the islands on an ephemeral basis.

Several broad geographical and chronological patterns are evident in Holocene Tasmanian sites, and which are also relevant to the question of watercraft technology (Bowdler 1982, 1988; Jones 1976, 1977; Lourandos 1968, 1970; Vanderwal 1978). The majority of Holocene evidence in Tasmania comprises coastal sites more recent than 8,000 BP. This is believed to be reflecting a general littoral component in Holocene Tasmanian economic systems (Bowdler 1977). Although some patterns in resource exploitation strategies, such as the cessation of fish consumption about 3,500 years ago, appear to pan-Tasmanian phenomena, there are other marked changes occurring on a more restricted, regional scale (Jones 1971; Lourandos 1970).
Holocene land-use patterns in the western Tasmanian region

Evidence indicates that people were exploiting marine littoral resources in northwest Tasmania from at least 8,000 years ago until the ethnographic present (Jones 1971; Bowdler 1979, 1980). Occupation outside the immediate northwestern area does not appear in the archaeological record until more recent times (Bowdler 1988). From about 3,500 years ago, numerous midden sites appear in the archaeological record in the broader western Tasmanian region. Prior to this time the coastal margin in the west and southwest region appear to have been uninhabited (Jones 1971).

The west coast sites suggest that this region was a major focus of activity in western Tasmania in more recent Holocene times. Although surface sites have been recorded in more inland areas in western Tasmania, only one site has provided a stratified sequence of cultural remains. This is the Warragarra rock shelter site in the Mersey River Valley, in the central region of northwest Tasmania (Lourandos 1983). At this site, stratified archaeological deposits were excavated which indicated human occupation of the site from about 10,000 BP, to sometime more recent than about 3,800 BP. The vast majority of dated evidence of Holocene human occupation in western Tasmania however comprises west coast midden sites, predominantly more recent than about 3,500 years old (Stockton 1981).

Associated with the more recent expansive west coast occupation phase, are the coastal rock engraving sites of the west and northwest coasts, extensive midden sites with hut depressions, intensive seal exploitation sites, and the first evidence of spongolite exploitation. The only dated engraving site is the Mount Cameron West site. From archaeological deposits at the site, Jones surmised the engravings were between 1,000 and 2,000 years old (Jones 1977:345). It is generally accepted that these west coast art
sites are associated with the recent Holocene occupation of the west coast midden sites (White and O'Connell 1982:167)

The florescence of coastal sites in more recent Holocene times along the west coast coincides chronologically with a change in stone artefact assemblages, and littoral resource exploitation strategies evident in longer stratified sequences in northwestern sites.

Two phases were identified by Jones in the Rocky Cape stone artefact sequence, with a change in the evidence occurring principally from about 3,500 BP (Jones 1971). The change as described by Jones (1977:194), is primarily one from an early and mid-Holocene assemblage which predominantly contains larger unretouched implements and cores made from locally available materials, to one containing a higher percentage of formal, retouched smaller tool types and the introduction of high quality, transported exotic raw materials including spongolite.

As previously discussed, spongolite first appears in the Tasmanian archaeological record from about 2,500 years ago. It is a distinctive fine-grained spicular chert, for which there is one known source about 9 km inland from the west coast near Temma (Cosgrove 1987). Spongolite has been recorded in the recent Holocene west coast middens, and several northwestern sites including Rocky Cape, Hunter Island, and the more recent occupation phase of the Warragarra shelter (Cosgrove 1987; Bowdler 1988; Jones 1971).

The absence of this stone type in archaeological contexts earlier than about 2,500 BP suggests that; a) denser vegetation regimes prior to 2,500 BP precluded access to the source,

b) occupation of the known source region did not occur until this time, or,
c) that exploitation of the source was associated with technological changes related to changes in exploitation strategies.

The geographical distribution of Holocene sites pre-dating the exploitation of spongolite in western Tasmania, strongly suggests that spongolite use is related to general changes in the western Tasmanian economic system associated with the first occupation of the west coast regions about 3,500 years ago. These changes are possibly most marked by the colonisation of the west coast, and, by the littoral resource exploitation patterns.

From about 3,500 years ago there is evidence of intensive exploitation of the subtidal zone in both the earlier northwestern sites and the west coast region (Bowdler 1988:48). Whereas earlier contexts contain a very small component of subtidal shellfish species, these increase dramatically from about 3,500 BP, along with crayfish and seal remains. This change chronologically concurs with the loss of fish both in the western and eastern Tasmanian sites. This pattern of changes in resource exploitation was reflected in the remains from the Rocky Cape sites. In the same stratigraphic unit where fish remains cease to be found, Jones described a marked change in the faunal remains, specifically the appearance of large quantities of abalone. This change occurs about 3,500 BP (Jones 1966:5, 1971:165). Preliminary results of more recent analysis of shellfish remains from this site have confirmed Jones' findings (Dunnett pers. comm.).

A remarkably similar pattern was also evident in shellfish remains recovered by Bowdler from the upper and lower Cave Bay Cave middens (Bowdler 1979, 1988). Bowdler has suggested that the change from intertidal species in the lower mid-Holocene midden, to subtidal abalone and crayfish exploitation in the recent Holocene upper midden, represents an economic rescheduling possibly associated with the pan-Tasmanian cessation of fish exploitation (Bowdler 1988:49). Lourandos (1968:43, 1970) has further suggested that the west coast rescheduling, evident also in the appearance of the extensive west coast middens, is associated with an increased
dependence on seal exploitation in late Holocene times. Although seal remains were recovered from all levels of the Rocky Cape sequence (Jones 1971), intensive exploitation of seal, such as that evident in the West Point midden, is not apparent in any earlier Tasmanian archaeological contexts. Horton (1979) and Allen (1979) have argued that in earlier Holocene times, seal may have comprised a less important dietary component.

Aboriginal use of offshore islands, such as the Hunter Islands and Maatsuyker Island in the southwest, is known both from archaeological evidence and historic accounts of people visiting these islands to obtain seal and other seasonally available resources such as seabirds and eggs (Bowdler 1988; Vanderwal and Horton 1984). Although there is evidence of human occupation on Hunter Island in the early to mid Holocene, the archaeological evidence suggests that more intensive use of the island occurred from about 3,000 BP. This more recent occupation phase appears to be related to exploitation of the island's seasonally available resources (Bowdler 1988; Geering 1982; O'Connor 1982). Similarly, use of Maatsuyker Island, for which there is no dated archaeological evidence older than about 500 BP, appears to be principally associated with exploitation of seasonal resources (Vanderwal and Horton 1984). Thus, the recent Holocene evidence from the closer offshore islands suggests that seasonal use of these islands appears to be associated with the broader pattern of changes in resource exploitation evident in western Tasmania.

A model of Holocene human occupation in Western Tasmania

The western Tasmanian site distribution pattern suggests that the focus of early to mid-Holocene occupation was centered in the northwest, and possibly northern region, and included occasional use of Hunter Island. This was followed by an expansion into the wider west coast region in more recent Holocene times, although occupation of the northerly areas also continued in this phase. Concurrent with the geographical
expansion of occupation about 3,500 years ago, were major changes in resource exploitation patterns, and the economic system generally.

Changes in the economic system associated with this more recent expansion period, are characterised by: a marked increase in subtidal resource exploitation, the cessation of fish eating, more intensive seal exploitation, exploitation of the west coast spongolite source, and changes in stone artefact assemblages to include increasing numbers of smaller retouched implements and evidence of transport of high quality raw materials. From about 3,000 years ago, there is also evidence of increasing use of offshore islands, probably to access seasonally available resources such as seabirds and seals (Bowdler 1988; Lourandos 1968).

Land-use patterns in the eastern Tasmanian region

The west coast Holocene model, which incorporates a major change in the economic system in the recent Holocene, contrasts markedly to that suggested by Holocene data from southeastern Tasmania (Lourandos 1968). Archaeological evidence from the east indicates that open marine resource exploitation including offshore island use and estuarine shellfish exploitation was widespread from at least 7,000 years ago until ethnographic times (Lourandos 1968, 1970; Reber 1965; Vanderwal 1978; Gaffney and Stockton 1980; Gaughwin 1985; Dunnett pers. comm.).

Preliminary results from current investigations on Bruny Island, including radiocarbon dating of midden sites, strongly suggest that the island has been continuously occupied for at least the last 7,000 years (Dunnett pers. comm.). There is no archaeological evidence to suggest that resource exploitation patterns (with the exception of the cessation of fish consumption), or occupation patterns have altered significantly since about 6,600 years ago, from those recorded in the ethnographic present. There is no reason to believe therefore, that people were not making sheltered water crossings to
Bruny and Maria Islands at least since the time of sea-level stabilisation. In
ethnographic times, both these islands were occupied by groups of people based
residentially on the islands who used watercraft to travel between these islands and the
nearby mainland (Jones 1977:254).

The southeast coast is generally bounded by lower energy shorelines than the west
coast, and consequently littoral resources are more readily accessible in the east, even in
less clement climes. The mid to recent Holocene evidence of widespread littoral
exploitation on the east coast thus suggests that local palaeoclimatic factors favoured
coastal occupation throughout this period. Similarly, since littoral coastal resources are
generally obtained more easily on the east coast, less specialised strategies were
possibly required to exploit the lower and subtidal species such as abalone, mud oyster
and crayfish.

Variability in shellfish species being targeted on the east coast appears to be directly
reflecting local availability of species (Lourandos 1968:41). Although no specific
analysis has yet been undertaken regarding changes in species from different tidal zones
over time, both the crustacean evidence in the Little Swanport midden and shellfish in
dated Bruny Island sites suggest that subtidal exploitation was occurring in the mid
Holocene (Lourandos 1970; Reber 1965; Dunnett pers. comm.). Thus the pattern of
shellfish and crustacean exploitation strategies on the east coast, does not conform to
that on the west coast. The data indicate that the southeast coast (and possibly broader
eastern Tasmanian) Holocene economic system endured until the ethnographic present
with no major changes.

Numerous artefact and quarry sites have been recorded in inland Tasmania, five of
which have Holocene radiocarbon occupation dates (Cosgrove 1985, 1989; Lourandos
1970; Jones and Kee pers. comm.). Lourandos has suggested that eastern inland sites
represent an equally important hinterland hunting facet of the eastern Tasmanian
Holocene economic system (Lourandos 1970, 1977). This is supported both by the
distribution pattern of stone quarry sites in Tasmania, and the generalised nature of
littoral exploitation in eastern Tasmania. This is in contrast to the more recent western
Tasmanian system which encompasses a more highly specialized pattern of marine
exploitation.

No evidence of generalised or marked changes occurring in the economic system in
eastern Tasmania in Holocene times was recovered from excavated inland sites.
Variability in the excavated remains from the inland eastern Tasmanian sites attributed
to site function (Lourandos 1977). The only more general changes evident in either
coastal or inland sites in eastern Tasmania are the disappearance of bone points and fish
remains—changes which are also evident in western Tasmanian sites.

A model of eastern Tasmanian Holocene occupation

In contrast to western Tasmania, the model for Holocene eastern Tasmania is one of
relative stability. There is no evidence to suggest any major changes have occurred in
the southeastern Tasmanian economic system since at least about 7,000 years ago
(Lourandos 1968). Eastern Tasmanian sites generally are geographically dispersed
throughout the Holocene, with both coastal and inland facets to the economy
(Lourandos 1970). The pattern of coastal resource exploitation reflects use of all tidal
zones depending upon local availability or resources.

Variation in eastern stone artefact assemblages appears to be a factor of site function
rather than generalised trends. The eastern Tasmanian evidence suggests no major
changes in stone artefact technology or material exploitation patterns in Holocene times.
Evidence from Bruny Island also suggests that use of close offshore islands has also
been a constant part of the eastern economic system from at least 6,000 years ago.
There is no evidence of seasonal use of smaller offshore islands, and larger islands appear to have been permanently settled by resident groups (Brown 1986).

TASMANIAN WATERCRAFT

A detailed compilation of ethnographic and historic accounts of the use of watercraft by Tasmanian Aboriginals is to be found in Jones (1976) and Roth (1899). From these accounts and the archaeological evidence from offshore islands around Tasmania, it can be surmised that watercraft were in use from at least about 7,000 years ago in Tasmania. The only region where the Tasmanians were not using watercraft at the contact period was the northeast region (Jones 1976:248).

It has been suggested that the development of watercraft was a relatively recent event in Tasmania, possibly related to changes in the archaeological record about 3,000 years ago (Vanderwal 1978). This idea is however not supported by archaeological evidence from Hunter and Bruny Islands which indicate that people were using watercraft to travel between closer offshore islands from at least 6,600 years ago (Bowdler 1988:48; Dunnett pers. comm.). Bowdler (1988:48) has recently suggested that the mid-Holocene lower midden in Cave Bay Cave represents visits to the island, by people from northwest Tasmania using watercraft between 6,600 and 4,500 years ago. While people may have been able to undertake the sheltered trip to and from Bruny Island using crude log rafts or flotation aids, the longer and more dangerous open sea crossing to Hunter Island would almost certainly have required more substantial craft (Meston 1936).

Thus, it is considered highly probable that people in both southeastern and western Tasmania were using watercraft from at least about 6,600 years ago. The archaeological evidence from offshore islands also indicates more intensive use of offshore islands in both northwestern and southwestern Tasmania in the recent
Holocene. Evidence of seasonal use of both the Hunter Islands in the northwest, and Maatsuyker Island in the southwest in recent Holocene times, suggests that maritime technological improvements may have occurred in western Tasmania, to facilitate access to island resources.

Although ethnographic and historical descriptions of watercraft in use at the contact period in Tasmania often emphasise the crude nature of Tasmanian craft, there are descriptions and illustrations of some craft developed to withstand open sea environments. The feature which distinguishes this type of vessel from the commonly depicted Tasmanian canoe rafts which were used in more sheltered conditions (Lesueur in Peron 1807-16; also see Jones 1977:324), is a prominently raised stern and bow. The raised stern and bow type of craft have been documented both pictorially and in historic accounts from western Tasmania (Robinson in Plomley 1966: Plate 2a). A photograph of an Aboriginal model (or toy) of one of this type of craft is also depicted in Roth (1899:Plate 22). Also in Roth is an historic account of this type of craft being used by Tasmanian Aboriginal people for sealing expeditions to Maatsuyker Island: 'The head and stern were raised high above the water like horns. ... An old whaler told me he had seen one of them go across to Witch Island, near Port Davey, in the midst of a storm.' (Bonwick in Roth 1899:156).

From this evidence it appears that different types of craft may have been employed in different areas in Tasmania, and that the distribution of craft specifically adapted for open sea use was confined to the western Tasmanian region. How long this type of raised bow and stern canoe had been in use in prehistoric times however, is uncertain. Nevertheless, the archaeological evidence from the southwest islands per se verifies that craft capable of open sea voyages were used, and that higher risk voyages were being undertaken in more recent Holocene times (Vanderwal and Horton 1984). There is no evidence of open sea voyages being undertaken on the east coast of Tasmania, despite the presence of seasonally available resources on offshore islands in the region.
(Jones 1976; Lourandos 1968)—nor are there any ethnographic descriptions of open sea adaptations in watercraft from eastern Tasmania.

Range of watercraft

It is clear from the archaeological evidence on Maatsuyker Island in the southwest, that the watercraft being used in recent Holocene times in western Tasmania were capable of high risk open sea crossings of about 30 km (this distance represents a return voyage to Maatsuyker Island via De Witt Island) (Jones 1976:252; Vanderwal and Horton 1984). In eastern Tasmania however, there is no evidence of watercraft being used for crossings greater than 5 km, and furthermore, the use of watercraft in eastern Tasmania appears to have been confined to sheltered waters (Jones 1976).

Jones (1976:248) argues that some Tasmanian watercraft may have been capable of open sea voyages of '5 to 10 miles or even more' in fair-weather conditions. There is also an historic account of a Tasmanian 'catamaran, sufficiently tight and strong to drift for sixteen or twenty miles' (West in Roth 1899:158).

According to historic accounts and archaeological evidence on Maatsuyker Island, crossings to this island were undertaken to exploit seal and other island resources (Vanderwal and Horton 1984). The craft on these trips carried up to eight men, sometimes in quite adverse weather conditions in the notoriously rough southwest Tasmanian seas (Roth 1899:156; Jones 1976:244). The strait between Hunter Island and the mainland is also notorious for its strong tidal rips and difficult navigation conditions, and yet appears to have been traversed in recent Holocene times on a seasonal basis (Bowdler 1988). Of this latter crossing Meston (1936:161) states; 'That they could make the extremely difficult crossing between the mainland and the Hunter Islands proves them expert and fearless seamen.'
A range of watercraft, from mere log flotation aids and rudely constructed rafts, to the larger well described and most commonly depicted rolled bark constructions, are mentioned in eastern Tasmanian accounts (Jones 1976; Roth 1899:154-159). The common belief that Tasmanians possessed only flimsy watercraft of very limited capacity, probably stems from descriptions of such eastern Tasmanian craft which were basically designed for estuarine and calmer water travel. In a detailed investigation of sea travel in relation to prehistoric Tasmanian migrations, Macintosh (1949:142) stated; 'The Tasmanian craft are shown from the literature to be more varied and more capable of seaworthiness than is generally supposed.'

Nevertheless, even if both navigators and their craft were capable of the minimum open sea crossings of 16 km and 55 km required to land on Flinders and King Islands respectively, motivational factors would undoubtedly be also involved if people were to undertake these longer, high risk voyages. Visibility of land masses could also be expected to have been a decisive factor in the use of more distant islands (Macintosh 1949).

Island visibility

Flinders Island and the rest of the Furneaux Group are easily sighted from mainland Tasmania in fine weather conditions. It is not possible to see King Island except from Hunter Island (local informant) on particularly clear days. Nevertheless, there are two small islands, Albatross Island and Black Pyramid off shore from Hunter Island, from which King Island can be generally sighted [Fig. 1]. It is also possible to land a small boat on both Albatross Island and Black Pyramid, and both have large dry caves which could provide suitable shelter. They also have breeding colonies of seals and seabirds. If people were visiting these smaller islands from Hunter Island, the larger landmass of King Island would have been easily visible to them. Although archaeologists have examined Albatross Island, no prehistoric evidence has yet been discovered there.
(Jones and Townrow pers. comm.). Black Pyramid has not been examined for archaeological sites.

Island resources

Evidence of use of the western Tasmanian offshore islands strongly suggests that the higher risk open sea voyages were undertaken primarily to obtain seasonally available resources such as seals, and possibly seabirds such as albatross, muttonbirds and/or their eggs (Bowdler 1979, 1988; Vanderwal and Horton 1984). Abundance of such prime resources, and the relative scarcity of these from more readily accessible sources, appears to have provided the impetus in recent Holocene times for offshore island use. It could be expected that resource availability on these islands would be a critical factor if people were to be sufficiently motivated to undertake such high risk voyages to more remote islands.

Bowdler recovered remains of white-capped albatross (*Diomedea cauta*), in the upper midden in Cave Bay Cave which she interprets as human food remains (Bowdler 1984:63). There are no albatross remains in the lower midden in Cave Bay Cave although other seabird remains from this level are also thought to result from human predation (Bowdler 1984:63). The albatross remains in the upper midden indicate that these birds were being exploited, at least in more recent times.

Albatross remains recovered from the southwest coast Louisa River and Maatsuyker Island sites, similarly suggest that longer sea crossings were being made to albatross colonies in the more recent times in western Tasmanian (Vanderwal and Horton 1984:62). Two breeding colonies of the White-capped Albatross are known in Australia; Albatross Island, about 14 km northwest of Hunter Island, and Mewstone Rock, a small steep island some 15 km southeast of Maatsuyker Island.
On land, albatross are relatively defenceless and can be readily harvested in their breeding colonies. Although sick birds have been known to occasionally land or get washed ashore in other areas, generally albatross only come ashore on their breeding grounds, and spend the rest of their time at sea (van Tets pers. comm.). Therefore, since these birds would be difficult to obtain except from a colony, the evidence of exploitation of this species suggests that colonies were being visited.

Although the possibility that in the past colonies existed in more accessible places cannot be dismissed, albatross remains in the Cave Bay Cave upper midden, and those in the Louisa River and Maatsuyker Island sites, do suggest that the Albatross Island and Mewstone Rock colonies were being visited. If this is the case, then the range of recent Holocene Tasmanian watercraft is significantly increased as a return trip to Mewstone Rocks colony (via De Witt or Maatsuyker Island) represents a total voyage of between 55 and 60 km in distance.

Like albatross, elephant seals (*Mirounga leonina*) are also easily obtained when they land in the breeding season. At contact time, King Island was the only Australian breeding ground for these large sea mammals. The colonies on King Island were hunted to extinction there in less than two decades by British and American sealers. There are numerous midden sites in Tasmania which contain prehistoric remains of both fur and elephant seal, including West Point midden which contains dense accumulations of elephant seal bone (Jones 1965). This indicates not only that the elephant seal was a targeted resource, but also that colonies existed on the Tasmanian mainland coast in the prehistoric past. It has been suggested that the extinction of such colonies may be associated with human predation (King 1983). The elephant seal colonies on King Island therefore may have provided the impetus for visits to this more remote island:
Ochre is another resource which is available on King Island. Abundant quantities of fine quality ochre pebbles are presently eroding out of an east coast tillite sequence. Artefacts on King Island sites indicate that people were exploiting the east coast tillite formation for stone, although there was no ochre recovered from Holocene sites. This is not unexpected considering the soft nature of the ochre rocks, and the extremely exposed aspect of the open sites. Pebble artefacts with concave ground surfaces suitable for ochre grinding were also recovered from sites with tillite sourced artefacts (Sim 1988).

Resources such as ochre, and bird and seal colonies on the more remote Bass Strait islands could have provided the incentive for island visits such as those evident on closer islands such as Hunter Island and Maatsuyker. Furthermore, it appears that at least in more recent prehistoric times, the Tasmanians may have possessed a maritime technology capable of undertaking such voyages. The question remains however as to whether in fact they undertook such voyages.

In the following discussion, the archaeological evidence from both islands will be reviewed in light of the occupation models suggested from the Tasmanian mainland archaeological evidence, and evidence of watercraft use in Tasmania. Underlying any discussion of human occupation of the more remote islands is the palaeoenvironmental evidence from the region. Of particular relevance are sea-level changes (discussed in chapter 2) which effected the initial isolation of Tasmania, and subsequently the Bassian islands [Fig. 2]

FLINDERS ISLAND

As described previously in chapter 5, the archaeological evidence on Flinders Island is comprised of isolated or low density stone artefact surface finds, and fifteen midden locations with light scatters and/or in situ shellfish remains (Orchiston and Glenie
Many of the middens also have stone artefacts and manuports associated with the shellfish remains. Remains in all of the midden sites appear to be a product of short term occupation as they comprise low density deflated scatters, and, single stratified lenses of shell.

The range of stone artefacts found on Hinders Island concurred with those found in the earlier occupation levels of the Rocky Cape sequence. The pattern of exclusively intertidal shellfish exploitation in the earlier phase of the northwestern Tasmanian model, however, is a more definitive characteristic of the northwest region. The shellfish remains on Flinders Island sites reflect a similar intertidal exploitation strategy, with a marked absence of remains of subtidal fauna. It does not accord with the model suggested by sites in the southeast, where exploitation of the subtidal zone prior to about 3,500 BP is evident (Lourandos 1970; Dunnett pers. comm.).

Arguably, the similarity in shellfish exploitation strategies in sites on both Flinders Island and northwestern Tasmania could suggest that the island was being used by people who were part of an economic system similar to that in northwest Tasmania in the early to mid-Holocene. If this were the case then use of the island in the occupation span indicated by dated midden sites on Flinders Island are unlikely to be reflecting visits to the island from mainland Tasmania.

Archaeological evidence from mainland Tasmania however, strongly suggests that voyages such as that required to visit Flinders Island were not being undertaken between about 6,300 and 4,500 years ago, that is during the time that people were occupying Flinders Island. The model of island use at this time from western Tasmania suggests that offshore islands were not being intensively used, and island visits restricted to those involving sea crossings of less than 5 km distance (Jones 1976). This strongly suggests that Flinders Island was not being visited from mainland Tasmania, and that as suggested by Orchiston (1979b, 1984), the midden sites on
Flinders Island represent occupation of the island by a group of people living permanently on the island until about 4,500 years ago.

This poses the question as to the ultimate fate of the island occupants. It could be suggested that the island occupants developed a maritime technology which enabled them to leave the island about 4,500 years ago. Archaeologically this proposition could be tested by investigation of islands between Flinders Island and mainland Tasmania. The current database from islands in the eastern Bass strait region however does not support this interpretation (West 1990).

There is no evidence of occupation in the Prime Seal cave site more recent than 8,500 BP, that is from about the time it became separated from Flinders Island. This island represents a watercrossing of less than 5 km in distance from Flinders Island. Thus there is no evidence of watercraft use by Flinders Islanders in the Prime Seal Island site—nor have prehistoric middens been recorded on the several other small offshore islands in the Furneaux Group examined by archaeologists (pers. obs. and West 1990). Therefore, it is considered highly unlikely that people living on Flinders Island possessed a watercraft technology that would enable them to travel to mainland Tasmania.

Hence, the most viable explanation as to the ultimate fate of the island population is that of extinction. The evidence clearly indicates that people were occupying the island for about 4,000 years after the Furneaux Group was first severed from mainland Tasmania, and also strongly suggests that these people lacked watercraft capable of travelling to mainland Tasmania. The most satisfactory explanation for the absence of evidence more recent than 4,500 BP is therefore one of extinction.

There is however, no indication in the present database as to why a population that proved viable for some 4,000 years, should have ultimately died out. Moreover, the
multiplicity of causal factors that could have been involved in the process of extinction of an isolated island group, probably render such a problem beyond the scope of the archaeological record.

PREHISTORIC USE OF KING ISLAND

Prehistoric archaeological evidence discovered on King Island comprises: surface and stratified stone artefact sites, deflated shellfish scatters in dune blowouts, one stratified midden, and human skeletal remains recovered from a cave deposit. Although more than twenty prehistoric sites are now recorded on King Island, the cultural remains are generally of a low density. There is little evidence that would suggest intensive occupation of King Island, either in the landbridge or island phase.

Palaeoenvironmental data indicate that King Island probably became separated from Tasmania between 11,000 and 10,000 years ago, a thousand or more years earlier than Flinders Island [Fig. 2]. The radiocarbon dates thus indicate that the human skeletal evidence found in the one cave site, is clearly associated with occupation during the landbridge phase prior to island formation. Evidence of early or mid Holocene human occupation in the initial island phase is less certain. Although there was evidence of human occupation at the Cataraqui Monument site that is more recent than 10,200 BP, the chronology of this more recent site use could not be resolved from the data recovered. Similarly, excavations at other sites did not provide evidence of occupation of the island in the early to mid Holocene. Nevertheless, radiocarbon dates obtained from cultural shellfish remains in the Quarantine Bay and Cataraqui Point middens, clearly demonstrate human occupation in the recent Holocene island phase.

Jones (1979) has suggested that there was evidence of human occupation at the Petrified Forest site, in the early to mid Holocene period. Evidence of occupation of this antiquity could strongly suggest that there was a relict population stranded on King
Island. However, Jones' interpretation of the antiquity of cultural remains at the Petrified Forest site was based on dates obtained from charcoal which he found in stratigraphic association with *in situ* stone artefacts. While the artefacts could possibly be of similar antiquity to the charcoal, this has not been demonstrated, primarily because there is no evidence to suggest that the charcoal is of anthropogenic origin.

Evidence from similar aeolian dune contexts on Flinders Island indicates that charcoal found in stratigraphic association with cultural remains can be both older and/or younger than the cultural remains, by several thousands of years [Fig. 10]. Therefore, some caution is required in accepting this charcoal date alone as evidence of human occupation on the island in the early to mid-Holocene phase. Hence, there is no secure archaeological evidence on King Island which would support the suggestion that the island was occupied for several thousand years after initially becoming isolated from mainland Tasmania.

Nevertheless, some stone artefacts recorded at open sites on King Island do suggest that the sites were being used in more recent Holocene times. A number of other surface scatters located on the west and southwest coast contained smaller retouched implement types and cores of high quality transported exotic stone materials. Two surface sites also contained spongolite artefacts although these were not common and comprised in total, six artefacts. Five of these were recovered from a surface site which contained an extensive artefact scatter including a number of smaller formal tool types, all made from exotic materials. None of these artefact types however has been recovered from securely dated contexts so the question of the antiquity of these on the island is uncertain.

Evidence from mainland Tasmanian sites indicates that these features in stone assemblages are characteristic of more recent Holocene assemblages (Jones 1971). This suggests that some use of the open artefact sites on King Island may have
occurred in the recent Holocene. Although there is as yet no securely dated evidence of this at artefact sites on the island, the presence of prehistoric shell middens of recent Holocene antiquity, indicates that people were on the island at this time. It could be expected therefore that some evidence of this more recent occupation could be found in artefact sites on the island.

Although there was no unequivocal dated evidence of island phase occupation *per se* recovered from the stone artefact sites, the nature of the evidence in some sites shows marked affinities with the more recent phase of the western Tasmanian model. In particular, a high degree of curation and transport of fine grained siliceous stone types, and small retouched implements manufactured from exotic stone, were present on a number of surface sites. This evidence shows a strong affinity with recent Holocene evidence from northwest Tasmania (Jones 1971). Moreover, spongolite, which only occurs in recent Holocene Tasmanian sites, was also present on two sites on King Island.

Shellfish exploitation patterns and Tasmanian models

Direct evidence of island occupation on King Island is provided primarily by the two dated shell midden sites. These were; a) the Quarantine Bay site where *in situ* abalone and mud oyster shells dated to 1,100 BP, were recorded, and, b) the Cataraqui Point dune blowout deposit which contained cultural shellfish remains 1,980 years old.

The shellfish exploitation strategy evident in the remains at these sites, strongly concurs with the evidence from recent Holocene sites in western Tasmania. These latter sites are characterised by a predominance of subtidal species, in particular abalone. Therefore, both the subtidal exploitation pattern, and the chronology of the King Island midden sites accords with the more recent phase of the western Tasmanian model. Accumulations of shellfish remains in deflated blowout lag deposits, which also were
characterised by subtidal species, may be further evidence of recent prehistoric Holocene occupation. It has been shown here that some lag deposits may contain remains from Aboriginal use of the island in historic times. Therefore, shellfish deposits require further investigation, to determine the antiquity of cultural remains before these can be confidently considered to be evidence of prehistoric island occupation.

Nevertheless, both the midden and stone artefact evidence on King Island generally accord with the more recent phase western Tasmanian model; there is evidence of subtidal shellfish exploitation and the use of high quality transported stone to manufacture small retouched implement types.

Recent Holocene prehistoric mariners or a relict population on King Island?

The comparisons between evidence on King Island and the mainland models suggest that people on the island were part of the recent west coast economic system. The implication of this is that people were making deliberate sea voyages between King Island and northwest Tasmania at least from about 2,000 years ago. This also implies that some watercraft in use at this time in western Tasmania, were capable of open sea crossings of more than 50 km distance, and that their navigators possessed the skills required to undertake such voyages.

The alternative explanation for the presence of recent Holocene evidence on King Island, is that a stranded relict population existed on the island from the time that it became separated from mainland Tasmania, and that this population survived until at least about 1,000 years ago. The viability of each of these explanations will be discussed in regard to the King Island and other Tasmanian evidence.
A relict population

Implicit in the scenario whereby King Island was inhabited by a stranded human population, is the notion the people on the island lacked a watercraft technology capable of voyages to mainland Tasmania. If the 1,000 year old midden site represents the final phase of their existence, then this implies that prior to their extinction, the island population managed to survive for about 9,000 years in total isolation. It would be expected therefore that evidence from a human population of sufficient numbers to survive this time span, would exist in both coastal and inland regions on the island, and that some of this evidence would date to the intervening period between about 10,000 and 2,000 years ago.

Jones (1977:197) has suggested that an index of population density of between 1 or 2 people per km of Tasmanian coastline can be extrapolated from Aboriginal population estimates from ethnographic and historic sources. If the Bassian region population density, about 10,000 years ago, was similar to that suggested by Jones for Tasmania in the more recent past, then it could be expected that the number of people stranded on King Island was of the magnitude of 200 to 400. This would constitute a viable King Island population, in terms of resource availability. What one could expect to constitute a genetically viable island population, given the scenario of 9,000 years of a closed gene pool, is a complex problem somewhat tangential to the fundamental problem.

The density of midden sites recorded on King Island was considerably lower than that in similar environments in Tasmania. Arguably this could be a direct reflection of a lower population density on the island. However, if a stranded population of sufficient numbers to survive 9,000 years were exploiting littoral resources on King Island, then evidence of this from at least 6,600 years ago could be expected. Evidence from Rocky Cape indicates that people in the region in early Holocene times had a well developed maritime component to their economy (Jones 1971). Thus, it would be expected that
people stranded on King Island about 10,000 years ago would have had a similar coastal aspect to their economy and that evidence of littoral exploitation from at least mid Holocene times would be found on King Island. This however was not the case, and the dated middens were less than about 2,000 years old. There was also no evidence found to suggest earlier coastal exploitation on the island.

It could also be expected that some midden sites would contain stratified accumulations of debris, resulting from occupation over a considerable period of time. However, midden sites on King Island were rare; a total of two middens and a number of ambiguous shell deposits were recorded in total. Moreover, no middens with sequences of dense shell accumulations were recorded on King Island. Shellfish remains in the one stratified site recorded, were evident as a low density, discontinuous single lens of shells.

There was also a marked absence of artefact sites, middens, or ambiguous shell deposits in dune blowouts along the east coast of King Island. These are lower energy coasts with estuarine environments similar to areas on the east coast of Tasmania. If there had been people living on the island continuously for some 9,000 years in Holocene times, then the absence of sites on the east coast is somewhat enigmatic. The site distribution pattern reflected low intensity occupation of the higher energy west coast area of King Island, an environment remarkably similar to that found on the west coast of Tasmania.

While some of the west coast blowouts contained shellfish remains in deflated lag deposits, others did not (see also chapters 4 and 6). It is also estimated that in total, shellfish remains observed in the dune lag deposits comprised less than 1 m$^3$ in volume. Should these lag deposit remains be evidence of prehistoric littoral exploitation, then they are similar to the identified midden sites in that they do not
suggest long term occupation on the island by a population of sufficient numbers to survive some 9,000 years in isolation.

Overall therefore, neither the density of the island's midden sites, nor the sparse nature of evidence in them suggests long term occupation of the island. Similarly, the sparse nature of evidence from inland sites does not suggest long term continuous island occupation. Visibility in inland areas is variable although unvegetated lagoon fringes, burnt and freshly ploughed and cleared areas, and a myriad of unsurfaced access tracks had excellent ground visibility. In all, these areas provided a large area of high visibility, in a range of inland environmental zones. Few sites however were recorded in inland areas. These were primarily low density scatters and isolated finds, and no site located more than 1 km from the coast contained more than 7 artefacts (Sim 1988:57).

It is considered that the evidence overall does not suggest a stranded relict population was present on King Island from about 10,000 to 1,000 years ago. Furthermore, if people were stranded on the island and thus had no access to the northwest Tasmanian spongolite source, the presence of spongolite artefacts on King Island is somewhat enigmatic. It could be argued that the spongolite on the island came from a source that was submerged by rising seas prior to 6,600 BP. As previously discussed however, this is a somewhat unsatisfactory explanation because if such a source existed, then it would have been accessible in past times when King Island was part of the Bassian landbridge or connected to Tasmania. One could expect therefore to find spongolite from the submerged source also in sites in Tasmania sometime prior to 6,600 BP. This however is not the case, and spongolite is regarded as a chronological marker of recent Holocene occupation in mainland Tasmanian sites.

Overall, the evidence in support of a stranded population on King Island is sparse. Despite thorough investigation of a number of cave deposits and open sites, the only
securely dated evidence of human occupation on the island in the period after the island became severed from Tasmania, is provided by the two recent Holocene midden sites.

_Ancient mariners_

The alternative explanation for the presence of recent Holocene prehistoric sites on King Island, is that people were using watercraft to visit the island from Tasmania. It is considered highly improbable that visits were made from the Victorian coast primarily because King Island cannot be seen from the Victorian coast (Macintosh 1949). Moreover, such a journey would involve an open sea crossing of at least 100 km, against prevailing winds and currents (Macintosh 1949). It is presumed therefore that if people were travelling to the island in recent Holocene times, then they were travelling from northwest Tasmania.

Since there is no securely dated evidence of human occupation from the island phase until about 2,000 years ago, this supports the interpretation that prehistoric use of the island was confined to the recent Holocene. As previously discussed, the type of midden sites do not appear to reflect either long term or intensive exploitation of the littoral resources.

The pattern evident in the shellfish remains on the midden sites, and the presence of exotic stone and tool types is markedly consistent with that found in western Tasmania in the more recent Holocene. Moreover, although not definitive, the presence of pieces of well curated spongolite on King Island strongly suggests that people from northwest Tasmania were visiting King Island in the recent Holocene. Inherent in the interpretation of recent Holocene sites as a recolonisation of King Island (after an earlier island phase occupational hiatus), is the implication that people were using watercraft to travel to the island. That is, that at least 2,000 years ago, Tasmanians had watercraft
capable of crossing 55 km between the smaller islands (15 km or so offshore from the Hunter Islands), and King Island—in all a total sea voyage of at least 70 km [Fig. 1].

If this was the case, as the evidence suggests, then there must have been a high degree of motivation for the undertaking of such intrepid voyages. While most King Island resources were more readily available from closer sources, elephant seal and fur seal may have provided the impetus for visiting King Island. Despite the absence of breeding colonies of these sea mammals on mainland Tasmania in the ethnographic present, seal remains have been recorded in numerous Tasmanian coastal sites (Lourandos 1968). This attests to the presence of mainland breeding colonies of both elephant and fur seals in prehistoric times, particularly on the west coast of Tasmania where there are no offshore island sources from which seals could have been obtained. At the contact period, elephant seals colonies were not present on the mainland Tasmanian coast, and King Island was home to the one Australian breeding colony of elephant seals.

Intensive exploitation of both elephant and fur seal, evident at West Point and other western Tasmanian coastal sites, indicates that seal was a major resource in the west coast economic system. Seal colonies are particularly vulnerable to human predation, and it has been suggested that the prehistoric mainland seal colonies were depleted by intensive exploitation associated with the western Tasmanian coastal expansion in the recent Holocene (Lourandos 1968; King 1983). Furthermore, offshore island use in western Tasmania is clearly associated with accessing seal resources (O'Connor 1982; Lourandos 1968; Vanderwal and Horton 1984). Meston believed that the capabilities of both Tasmanian Aboriginal sea-farers and their craft were frequently under estimated, and suggests that they were also visiting Albatross Island in prehistoric times, to hunt seals (1936:161).
Thus, declining mainland fur seal and particularly elephant seal populations in more recent Holocene times, could well have provided the impetus for higher risk sea voyages to islands such as Maatsuyker, the Hunter Islands (and possibly Albatross Island). Although King Island would present the ultimate risk factor in terms of island voyages, it could have been deemed warranted because of gains offered by the island's elephant and fur seal colonies, and possibly other resources such as birds and ochre.

This raises the question as to why there is no similar evidence of more recent Holocene visits to Flinders Island, since seal and seabird colonies were evident in the Furneaux Group of islands in the ethnographic present. This could be because northeastern Tasmanian groups were not a part of the more recent western coastal economic system. This latter system incorporated high risk sea-crossings to exploit seal and other seasonally available offshore island resources (Lourandos 1968; Vanderwal and Horton 1984). Furthermore, the presence of seal colonies in northeast Tasmania in ethnographic times indicates that voyages to the Furneaux Islands would not have been required to access this resource (Lourandos 1968:44). The absence of watercraft in the northeast region of Tasmania in ethnographic times, further suggests that people in the northeast region were not visiting offshore islands (Jones 1976).

**SUMMARY**

There is a major variation in both the chronology and resource exploitation patterns evident in Holocene sites on King and Flinders Islands. The nature of the evidence suggests that Flinders Island, was occupied in the mid Holocene by a stranded relict Tasmanian population. This study has provided not only the first secure evidence of occupation on Flinders Island, but also evidence that these people managed to survive until at least 4,700 years ago, a period of some 4,000 years after the Furneaux Group was initially severed from mainland Tasmania. The evidence to date suggests that the
island population probably became extinct about 4,500 years ago although investigation of other islands in the region may resolve this question further.

Occupation on King Island on the other hand, strongly reflects the more recent phase of the western Tasmanian model. This more recent phase involved expansion from the northwest into previously unexploited west coast territory, changes in littoral and stone resource exploitation patterns, and more intensive use of offshore islands for seasonal resources, and longer distance sea voyages. The results of the King Island investigations indicate that people were visiting King Island in recent Holocene times. This suggests that the island represents the outlying boundary of the western Tasmanian coastal system, and was possibly incorporated into the economic system in order to obtain seasonally available resources.
Chapter 8

CONCLUSION

The research undertaken for this project was originally aimed at providing a database of Holocene occupation on King and Flinders Islands in order to examine the question of whether these islands were inhabited after they became separated from Tasmania in the early Holocene. Although it had been suggested that both islands had been occupied by stranded extinct populations, more recent investigation of archaeological remains on the islands had indicated that these propositions warranted further investigation (Jones 1979; Orchiston 1979; Sim 1988, 1989). The investigations carried out during this project produced new data, including numerous site recordings and the first radiocarbon dates of cultural remains from both islands. From this expanded database, the question of how the Holocene inundation of the Bassian region affected use of the larger islands of the region was examined. Moreover, these new data enabled the previous proposition, that King and Flinders Islands had been inhabited by a extinct stranded island populations, to be re-evaluated.

The findings suggest that while Flinders Island may have been occupied by a stranded population, a similar scenario for King Island is extremely unlikely. The evidence from Flinders Island suggests that after the island was initially formed about 8,500 years ago, it was occupied by a group of people who remained on the island until about 4,500 BP. Unfortunately there are no sites known on Flinders Island which contain evidence of occupation in the immediate period after the island was first formed. The chronological coincidence of the appearance of midden sites on the island and the sea level stabilisation at 6,300 BP suggests that the absence of earlier sites is probably attributable to the submergence of these due to the marine transgression.
Furthermore, there is a strong similarity in the intertidal shellfish exploitation pattern of the Flinders Island sites, to that in early to mid Holocene northwestern Tasmanian sites. This suggests that the initial Flinders Island population may have been part of the same economic system evident in northwest Tasmanian sites, and that this system was therefore geographically more extensive than previously believed. There is however no evidence in any Tasmanian mainland sites that could suggest that sea voyages of the distance required to reach Flinders Island were being undertaken during the occupation period of Flinders Island. Thus, the evidence on Flinders Island is interpreted as that of a relict mainland population, possibly from the same northern Tasmanian economic system, or one similar to that evident in the early and mid Holocene remains from Cave Bay Cave and Rocky Cape.

While early Holocene midden sites on Flinders Island have probably been submerged, the absence of more recent Holocene sites cannot be attributed to geomorphological processes. It is therefore regarded as a true reflection of an absence of human occupation. While it is possible that the Flinders Island population acquired the means to leave the island, there is no evidence at present to suggest that this was the case. The conclusion is therefore that the absence of more recent sites on the islands indicates that at about 4,500 years ago, the island population died out.

The question as to whether these people did acquire watercraft enabling them to leave the island is however a possible area for further investigation. This proposition could be tested by undertaking site surveys of the other islands in the eastern Bass Strait region. Middens or other Holocene sites on islands that are both too small to support a human population, and that are too distant from Flinders to have been accessible without watercraft, could suggest that people on Flinders Island did in fact possess watercraft. An archaeological team will be surveying the offshore islands of the Furneaux Group in 1991 as part of a National Estate Grant Programme project to document historic and prehistoric use of these islands. It is anticipated that results from
this project will shed further light on the question as to the ultimate fate of the Flinders Island population. As the data presently stand however, it appears that the Flinders Island middens do represent occupation of Flinders Island by a stranded island population that became extinct in the early to mid Holocene period.

The evidence from King Island was markedly different in many aspects from that found on Flinders Island. It included evidence of both Pleistocene occupation and more recent Holocene evidence. However, unlike Flinders Island, the data obtained from King Island do not suggest a period of continuous occupation during the island phase. The securely dated remains comprise; a Pleistocene human skeleton dated to about 14,000 BP, stone artefacts about 10,000 years old, and two midden sites 1,100 and 1,980 years old. Although Jones has suggested that the 7,500 year old charcoal date is of similar antiquity to stone artefacts he recovered from the same stratigraphic context, there are inherent problems with dating by stratigraphic association in aeolian dune contexts.

Results obtained from dating of stratigraphically associated cultural remains and charcoal in similar dune contexts during this project demonstrated that charcoal can be both substantially younger and/or older than the cultural remains in the same stratigraphic context. At the Palana site on Flinders Island, there was a difference of nearly 3,000 years between the age of the charcoal and that of shellfish remains in the same context. Some caution is warranted therefore in accepting the charcoal date obtained by Jones, as a date for human occupation. Furthermore, the presence of high quality exotic stone at this site could suggest occupation in more recent Holocene times. Therefore there is no secure evidence for occupation on King Island from the time it was first separated from mainland Tasmania, until about 2,000 years ago.

It is considered highly improbable that the recent Holocene middens on King Island are attributable to an extinct stranded relict population, who managed to survive some
9,000 years but died out less than 1,000 years before the first Europeans arrived on the island. Neither the site distribution pattern nor the nature of occupation evident in the sites on the island suggests long term or continuous Holocene occupation. Furthermore, there is a strong correlation with the types of stone and littoral exploitation patterns evident in the King Island sites, and those in recent Holocene western Tasmania generally.

The use of watercraft suggested in the evidence of seabird and seal remains in recent Holocene sites in western Tasmania indicates that high risk sea voyages possibly were first undertaken in this more recent phase. In face of the evidence on King Island, the possibility that longer voyages were also undertaken to obtain sought after scarce resources such as elephant seal, cannot be dismissed. In fact, the evidence from King Island does strongly suggest that people were visiting the island from at least 2,000 years ago. More conclusive evidence of this may be discovered on Black Pyramid or Albatross Islands, small islands between Hunter and King Islands which one would expect to have been used as stopover points en route to King Island.

For reasons previously discussed, it is considered unlikely that long stratified sequences, such as those recovered from the Cave Bay Cave site, will be found on King Island. The main avenue for future research on King Island itself appears to be further dating of shellfish remains in the west coast dune blowout lag deposits. While this may provide more information as to island use in the recent Holocene, it is unlikely that evidence of sea crossings between King Island and Tasmania will be found in the archaeological record on King Island itself. As suggested, evidence of this could however be found on Black Pyramid or Albatross Island.

The conclusion that Tasmanians were using watercraft to undertake voyages to King Island in the recent Holocene raises an interesting question in regard to the eastern Bass Strait region. If as the evidence suggests, Tasmanians were using watercraft to
undertake open sea crossings of at least 55 km in western Bass Strait, then why did they not make similar voyages to Flinders Island and to mainland Australia? The island groups in the eastern Bass Strait form a chain between Tasmanina and mainland Australia, and the greatest open sea crossing required to land on Wilsons Promontory in southern Victoria is less than 45 km. And yet there is no evidence that voyages of even the 16 kms required to land on Flinders Island were undertaken in the eastern Bass Straits region.

Since evidence from Maatsuyker and Hunter Islands (Bowdler 1988; Vanderwal and Horton 1984) indicates that in some regions of Tasmania, craft capable of a voyage to Flinders Island were being used in recent Holocene times, the absence of sites of this more recent antiquity on Flinders Island suggests that people in northeastern Tasmania were not utilising offshore island resources. This is supported not only by the absence of watercraft in this region in the ethnographic present, but also by the archaeological evidence from eastern Tasmania more generally (Jones 1976; Lourandos 1968). This is also supported by Lourandos' argument for the restriction of a highly specialised coastal economy to the western region of Tasmania (1968).

Hence, evidence suggests that people in the northeast Tasmanian region in more recent Holocene times may not have possessed watercraft with similar capabilities to those being used in the western regions. Nor did their economic strategies encompass intensive targeting of offshore island resources, that would provide the impetus for them to visit the Bass Strait islands. Thus, by a mere quirk of geographical fate, rather than their technological limitations, Tasmanians remained in isolation from mainland Australia. Had a chain of islands existed in the western region of Bass Strait, Tasmanians may possibly have recontacted mainland Australia in recent Holocene times. An intriguing scenario perhaps, but as it stands, the evidence from King Island suggests that it would have been possible.
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APPENDIX I.

TERRESTRIAL AND MARINE RESOURCES OF KING AND FLINDERS ISLANDS.

MARINE INVERTEBRATES

Shellfish
- Green-lipped Abalone (*Haliotis laevigata*)
- Black-lipped Abalone (*Notohaliotis Ruber*)
- Orange-edged Limpet (*Cellana solida*),
- Keyhole Limpet (*Amblychilepas javanicensis*)
- Ribbed Top Shell (*Austrocochlea constricta*)
- Wavy Top Shell (*A. concamerata*)
- Keeled Top Shell (*Clanculus limbatus*)
- Rock Whelks (*Pleuropaca australasia* and *Cabestana spengleri*)
- Dog Whelk or Cartrut Shell (*Thais orbita*)
- Warrener or Turbo Shell (*Subninella undulata*)
- Black Nerite (*Nerita atramentosa*)
- Elephant Snail (*Scutus antipodes*)
- Mud Oyster (*Ostrea angasi*)
- Beaked Mussel (*Mytilus planulatus*)
- Small Black Horse Mussel (*Modiolus pulex*)

Crustacea
- Crayfish
- Crabs
- Barnacles

EXTANT MAMMALS OF THE FURNEAUX GROUP (From Edgecombe 1986; Green and McGarvie 1971)

- Echidna or Spiny Anteater (*Tachyglossus setosus*)
- Bennetts Wallaby (*Wallabia rufogrisea*)
- Pademelon (*Thylagale billardierii*)
- Potoroo (*Potorous tridactylus*)
- Wombat (*Vombatus ursinus*)
Brush-tail Possum (*Trichosurus vulpecula*)
Ring-tail Possum (*Pseudocheirus peregrinus*)
Pigmy Possum (*Cercartetus nanus*)
Swamp Antechinus or Tasmanian Pouched Mouse (*Antechinus minimus*)
White-footed Dunnart (*Sminthopsis leucopus*) [Still live on Inner Sister Island].
Eastern Water Rat (*Hydromys chrysogaster*)
Easter Swamp Rat (*Rattus lutreolus*)
Australian Fur Seal (*Arctocephalus pusillus*)

**EXTINCT MAMMALS** (From Hope 1973)

Eastern Quoll (*Dasyurus viverrinus*)
Tiger Quoll (*Dasyurus maculatus*)
Tasmanian Devil (*Sarcophilus harrisii*)
Eastern Barred Bandicoot (*Perameles gunnii*)
Eastern Grey or Forester Kangaroo (*Macropus giganteus*)
New Holland Mouse (*Pseudomys novaehollandiae*)
Broad Toothed Rat (*Mastacomys fuscus*)
Elephant Seal (*Mirounga leonina*)

**AVIAN FAUNA**

Nearly 150 species of birds have been recorded on the Bass Strait Islands (Green and McGarvie 1971; Green 1969). There are numerous wetland and coastal birds which represent exploitable food resources. These include:

Muttonbird or Short-tailed Shearwater (*Puffinus tenuirostris*)
Shy or White-capped Albatross (*Diomedea cauta*)
Pacific Gull (*Larus pacificus*)
Australian Pelican (*Pelicanus conspicillatus*)
Australasian Gannet (*Morus serrator*)
Black Swan (*Cygnus atratus*)

Cape Barren Goose (*Cereopsis novaehollandiae*)
**APPENDIX II.**

**RADIOCARBON DATING RESULTS, KING AND FLINDERS ISLANDS**

**KING ISLAND RESULTS**

<table>
<thead>
<tr>
<th>SITE</th>
<th>SAMPLE ID</th>
<th>MATERIAL C= charcoal, S= shell, F=flowstone</th>
<th>AGE BP</th>
<th>ANU No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q’tine Bay</td>
<td>Q’tine Charc.</td>
<td>C</td>
<td>490 ± 70</td>
<td>7059</td>
</tr>
<tr>
<td></td>
<td>Q’tine Shell</td>
<td>S</td>
<td>1550 ± 70 *</td>
<td>7058</td>
</tr>
<tr>
<td>Cat’qui Pt</td>
<td>Cat Pt shell</td>
<td>S</td>
<td>2430 ± 60 *</td>
<td>7422</td>
</tr>
<tr>
<td>Middle Pt</td>
<td>Mid. Pt 2</td>
<td>C</td>
<td>1014.4 ± 1.36%M</td>
<td>7424</td>
</tr>
<tr>
<td></td>
<td>Mid Pt shell</td>
<td>S</td>
<td>610 ± 60 *</td>
<td>7423</td>
</tr>
<tr>
<td>Cat. Airstrip</td>
<td>Sp.1/2 j’nctn</td>
<td>C</td>
<td>11540 ± 190</td>
<td>7421</td>
</tr>
<tr>
<td>Cat. Mon.</td>
<td>Cat. Mon. 1</td>
<td>C</td>
<td>3820 ± 140</td>
<td>7426</td>
</tr>
<tr>
<td></td>
<td>Cat. Mon. 2.</td>
<td>C</td>
<td>4000 ± 250</td>
<td>7427</td>
</tr>
<tr>
<td></td>
<td>Cat. Mon. 3</td>
<td>C</td>
<td>4330 ± 190</td>
<td>7417</td>
</tr>
<tr>
<td></td>
<td>Cat. Mon. 4</td>
<td>C</td>
<td>3630 ± 220</td>
<td>7418</td>
</tr>
<tr>
<td></td>
<td>Cat. Mon. 5</td>
<td>C</td>
<td>2540 ± 240</td>
<td>7419</td>
</tr>
<tr>
<td></td>
<td>Cat. Mon. 6</td>
<td>C</td>
<td>10180 ± 240</td>
<td>7420</td>
</tr>
<tr>
<td>Cliff Cave</td>
<td>K.I. 2c sp 9</td>
<td>C</td>
<td>8540 ± 390</td>
<td>7057</td>
</tr>
<tr>
<td></td>
<td>K.I. 2c sp 14</td>
<td>C</td>
<td>11815 ± 1370</td>
<td>7116</td>
</tr>
<tr>
<td></td>
<td>K.I. 2c sp 15</td>
<td>C</td>
<td>too small</td>
<td>7117</td>
</tr>
<tr>
<td></td>
<td>K.I 2c skel’n</td>
<td>C</td>
<td>14270 ± 640</td>
<td>7039</td>
</tr>
<tr>
<td>Iron Mon’ch</td>
<td>K.I/1a Sp.31</td>
<td>F</td>
<td>41000 ± 4500 - 3000</td>
<td>7055</td>
</tr>
<tr>
<td></td>
<td>K.I/1a Sp.31</td>
<td>F</td>
<td>Background</td>
<td>7056</td>
</tr>
<tr>
<td>New Yr Is.</td>
<td>KI/NY 1 Sp2</td>
<td>C</td>
<td>8660 ± 240</td>
<td>7425</td>
</tr>
</tbody>
</table>

*Shell - not corrected for oceanic reservoir effect.*
## FLINDERS ISLAND MIDDEN DATING RESULT

<table>
<thead>
<tr>
<th>SITE</th>
<th>SAMPLE ID</th>
<th>MATERIAL</th>
<th>AGE BP</th>
<th>ANU No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>C= charcoal</td>
<td>S= shell</td>
<td></td>
</tr>
<tr>
<td>Palana</td>
<td>Palana F1</td>
<td>C</td>
<td>4052 ± 90</td>
<td>7407</td>
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<tr>
<td></td>
<td>Palana F2</td>
<td>C</td>
<td>4090 ± 150</td>
<td>7399</td>
</tr>
<tr>
<td></td>
<td>Palana F3</td>
<td>S</td>
<td>5180 ± 70*</td>
<td>7400</td>
</tr>
<tr>
<td>West End</td>
<td>West End F4</td>
<td>C</td>
<td>6770 ± 80</td>
<td>7401</td>
</tr>
<tr>
<td></td>
<td>West End F5</td>
<td>S</td>
<td>6370 ± 80*</td>
<td>7402</td>
</tr>
<tr>
<td>Caves Beach</td>
<td>Cave Bch F6</td>
<td>C</td>
<td>4660 ± 70</td>
<td>7403</td>
</tr>
<tr>
<td></td>
<td>Cave Bch F7</td>
<td>S</td>
<td>6010 ± 90*</td>
<td>7404</td>
</tr>
<tr>
<td>Old Mans Head</td>
<td>Old Mans Head F8</td>
<td>S</td>
<td>5520 ± 80*</td>
<td>7405</td>
</tr>
<tr>
<td>South</td>
<td>Boat Harbour Sth F9</td>
<td>S</td>
<td>6700 ± 90*</td>
<td>7406</td>
</tr>
</tbody>
</table>

* uncorrected for oceanic reservoir effect
### APPENDIX III

**FLINDERS ISLAND MIDDEN SITES WITH STONE ARTEFACTS (from Sim 1989)**

<table>
<thead>
<tr>
<th>SITE - (MIDDENS WITH ARTEFACTS)</th>
<th>SMASHED PIECE</th>
<th>UNMOD. FLAKE</th>
<th>RETOUCH FLAKE</th>
<th>CORE</th>
<th>CHOPPER</th>
<th>STEEP-EDGE SCRAPER</th>
<th>MANUPORT &amp; MOD COBBLES</th>
<th>TOTAL NO.</th>
</tr>
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<tbody>
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<td>1 Trousers Point</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2 Trousers Point</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Killiecrankie Beach Nth</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Old Hans Head Sth Hidden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 West End North Midden</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 West End Boat Ramp Nth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19 Bun Beeston Pt Hidden</td>
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<td></td>
<td></td>
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<tr>
<td>21 Killiecrankie Beach Sth.</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>24 Sandblow Sth Limestone Bay</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>29 Docks North Blowout</td>
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<td></td>
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<tr>
<td>30 Boat Harbour Beach North</td>
<td>3</td>
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<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 Limestone Bay</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>46 Boat Harbour South</td>
<td>2</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL NO. (ALL SITES)</strong></td>
<td><strong>7</strong></td>
<td><strong>10</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>47</strong></td>
</tr>
<tr>
<td><strong>AVERAGE (E) NO. (PER SITE)</strong></td>
<td><strong>1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

*Possibly Historic Hearthstones

**NOe OF STONE ARTEFACT TYPES ON MIDDEN SITES**
APPENDIX IV.

OSTEOLOGICAL DATA FROM KING ISLAND

Skeletal measurements (mm) obtained by Thorne from Pleistocene human remains recovered from Cliff Cave, King Island (from Sim and Thorne 1990).

**Cranium**
- Glabella-opisthocranium: 186
- Nasion-Opisthocranium: 177
- Nasion-Bregma: 130
- Bregma-lambda: 94
- Auriculare-lambda: 118
- Bifrontomalar sutures: 112
- Bidacryon: 32
- Bizyamaxillare: 99
- Nasal Breadth: 29
- Malar Height (left): 43
- Palate Length: 60
- Palate Height: 14.7

**Tibia**
- Maximum Length: 347

**Mandible**
- Ramus Ht: 67.5
- Ramus Breadth: 43
- Sigmoid Notch Depth: 12.5(R)
- Symphyseal Thickness: 16
- Corpus Thickness: 17.5(L)
- Condylar Breadth: 26.5(R) 26.4
- Condylar A-P: 11.2(R) 12

**Femur**
- Maximum Length: 426
- Oblique Length: 422
- Head Diameter: 49
- Nutrient Foramen A-P: 31
- Nutrient Foramen M-L: 29

**Fibula**
- Maximum Length: 339
- Midshaft A-P: 36
- Midshaft M-L: 21
APPENDIX V.

KING ISLAND, CLIFF CAVE: FAUNAL REMAINS FROM SQUARE 2C

DASYURIDAE
Swamp Antechinus *Antechinus minimus*
Eastern Quoll *Dasyurus viverrinus*
Tiger Quoll *Dasyurus maculatus*

PERAMELIDAE
Eastern Barred Bandicoot *Perameles gunnii*

BURRAMYIDAE
Eastern Pigmy-possum *Cercartetus nanus*

MACROPODIDAE
Red-bellied Pademelon *Thylogale billardierii*
Red-necked Wallaby *Macropus rufogriseus*

PTEROPODIDAE
Grey-headed Fruit Bat *Pteropus poliocephalus*?

VESPERTILIONIDAE
Lesser Long-eared Bat *Nyctophilus geoffroyi*

MURIDAE
Swamp Rat *Rattus lutreolus*

AVIAN
Swamp Quail *Coturnix ypsilophora* also known as *Coturnix australis*
Black Duck *Anas superciliosa*
Swan *Cygnis*? (Extinct species yet to be described)