

Chapter 3: Previous Research in the Lower Macleay

3.1 Introduction

This chapter provides a summary and review of the published research on the Lower Macleay. Although the research discussed here is not all of an archaeological nature, it is vital to the present research to understand how studies in the Macleay (by people from various disciplines) have built up the picture that we currently have of this area. The review is divided into three sections: first, the research published prior to 1970, which includes geological and geomorphological studies which were later taken up and used by archaeologists. This time period also includes the first extensive archaeological surveys carried out in the region. In the second section I examine the extensive archaeological excavations and analysis carried out by Connah and students from the University of New England in the 1970s, and also other surveys both archaeological and geological. While these reviews are primarily from published work, I also cite some unpublished documents such as B.A.(Hons) theses to obtain a full picture of previous research. The third section of the review focuses on work carried out since 1980. Following presentation and discussion of each time period of prior research, I provide a summary of the prevailing understanding of the time in regard to prehistoric Aboriginal occupation of the region and the environmental factors which may have affected that occupation. The final section of this chapter then deals with questionable assumptions and questions which remain unanswered despite all the research that has been carried out in the Lower Macleay. In beginning this chapter I present some background information on the climate and natural resources of the Lower Macleay.

3.2 Climate and Natural Resources of the Lower Macleay

3.2.1 Climate

Climate is an important variable in the ecology of marine fauna, so I will briefly describe the present climate of the mid-north coast region of New South Wales here. The Macleay Valley is temperate to sub-tropical with an average minimum temperature of 12 degrees C. and an average maximum temperature of 21 degrees C. (Commonwealth Bureau of Meteorology). The rainfall averages from 25 mm in September, to 100 mm per month in the months from October to June. Average rainfall annually is 1200mm (Commonwealth Bureau of Meteorology) (Table 3.1).

In its present environmental setting, flooding can be a major disturbance of aquatic fauna in the Lower Macleay River. Serious flooding in February/March 2000 caused a major fish-kill in the river, causing all fishing activity to cease for a period of at least three months. Although rainfall reaches its average annual maximum in the summer months, winter flooding is also not unknown. Records kept from 1862 to 1970 show that of a total of 49 flood episodes, 17 of these occurred between June and August (Callaghan 1980:115). The damage caused by flooding in the Macleay can be recognised by the extensive amount of effort which has gone into creating flood mitigation barriers/weirs in the river system.

Sea surface temperature on the mid north coast of New South Wales shows a marked lack of variability over a twelve month period. Bureau of Meteorology information shows a variation of only 7 degrees between the highest sea surface temperature in February of 28 degrees, and the lowest in July and August of 21 degrees. The warm ocean currents travelling down the coast from tropical waters to the north affect the species of fish which can be expected to be found in the region. Available species compares favourably to those inhabiting the waters of Moreton Bay (south east Queensland), rather than to inhabitants of the Central coast of New South Wales, and the Sydney region.

Table 3.1 Climate Information for the Macleay River Floodplain (Bureau of Meteorology 2003)

Month	Min Temp deg C	Max Temp deg C	Average Rainfall mm	Sea Surface Temp
January	18	27	100	24
February	18	27	100	28
March	15	24	100	26
April	15	24	100	24
May	15	21	100	24
June	9	18	100	22
July	9	18	50	21
August	9	18	50	21
September	12	21	25	22
October	12	24	100	22
November	15	24	100	23
December	18	24	100	23
Annual Average	12	21	1200	

3.2.2 Natural Resources

The natural vegetation of the Lower Macleay is characterised by littoral rainforest, wet and dry sclerophyll forest, mixed forest, mangrove forest, and the salt marshes.

Descriptions of these vegetations types have been covered fully in other dissertations and publications (Coleman 1978, Callaghan 1980, Hayes 1999, Graham 2000, and Mundell 2000). As well as the resources obtainable to Aboriginal people directly from these vegetation groups, many species of terrestrial animals are also available. Early European explorers gave varied descriptions of the landscape, commencing with Oxley in 1820 who travelled some twenty miles up the Macleay River, but who described the floodplain quite disparagingly, as being of little interest to the white settlers (Weingarth 1921:176). Hodgkinson (1845) presented a more optimistic perspective of the viability of the Macleay region from the point of view of its possible use for European settlers both for agriculture and forestry. He described dense and abundant forests, open grasslands, extensive mangrove flats and lagoons and swamplands extending to the base of the

ranges. Hodgkinson's description gives a description of the landscape as it would have been at the time of European settlement. I will now give a brief summary of the natural resources available in relation to the sites of Clybucca 3 and Stuarts Point I (Coleman 1978, Callaghan 1980, Strahan 1987; Hayes 1999, Graham 2000, and Mundell 2000).

The littoral rainforest vegetation contains a high species diversity, with an almost continuous canopy incorporating a number of layers, with the predominant species being tuckeroo (*Cupaniopsis anacardioides*), along with plum pine (*Podocarpus eleatus*), black plum (*Diospyros australis*), yellow tulip (*Drypetes australasica*), yellowwood (*Sarcomelicope simplicifolia*), climbing fishbone fern (*Arthropteris tenella*) and birds nest ferns (*Asplenium australasicum*). This section of the vegetation would also have included red cedar (*Toona australis*) before the arrival of the European loggers. Animal resources found within this type of vegetation would include small marsupials such as wallabies (*Wallabia bicolor* and *Macropus dorsalis*), pademelon (*Thylogale thetis* and *Thylogale stigmatica*), possum (*Pseudocheirus peregrinus*), antechinus (*Antechinus stuartii* and *Antechinus swainsonii*), bandicoot (*Parameles nasuta*), and numerous flying foxes and gliders (*Pteropus scapulatus*, *Pteropus poliocephalus*, *Pteropus alectio* and *Schoinobates volane*). Brush turkey (*Alectura lathami*) and smaller bird species would also be found in rainforest areas along with many types of reptiles. Neither of the sites of Clybucca 3 and Stuarts Point 1 is immediately adjacent to rainforest vegetation, but these resources would have been available within a short distance, close to the slopes of Mt. Yarrahappini.

The wet sclerophyll forest would have contained a more limited number of tree species than the rainforest environment, with the trees forming a canopy covering a more dense growth of shrubs. The main species in the wet sclerophyll forest would have included swamp mahogany (*Eucalyptus robusta*) and paperbark (*Melaleuca quinqueneriva*), along with swamp oak (*Casuarina glauca*), pink bloodwood (*Corymbia intermedia*), maidens wattle (*Acacia maidenii*), and the ear swamp water fern (*Blechnum camfieldii*). Animal resources available in this environment would be very similar to those found in the rainforest. Dry Sclerophyll forest would have consisted of a more open canopy of

eucalyptus and angophoras situated in drier soils, with and underbrush of shrubs and grasses. Animal resources obtainable in this environment included the grey kangaroo (*Macropus giganteus*), along with many of the other smaller marsupials mentioned in the previous vegetation types. Emu (*Dromaius novaehollandiae*) could also have been found in the open areas of the forest.

Some of the environments surrounding both of the sites could be termed mixed forest types of vegetation, consisting of open and closed canopied forests, with a mixture of both wet and dry vegetation. An open canopy would feature northern scribbly gum (*E. signata*), forest red gum (*E. tereticornis*), and sometimes stringybark (*E. resinifera*), and swamp mahogany. A middle layer canopy could consist of coast banksia (*Banksia integrifolia*), willow bottlebrush (*Callistemon saligna*), golden wattle (*Acacia longifolia*) and forest oak (*Allocasuarina torulosa*). Ground covers could consist of bracken ferns (*Pteridium esculentum*) and blady grass (*Imperata cylindrica*). The closed canopy mixed forest would be dominated by eucalyptus species, scribbly gum and blackbutt (*E. pilularis*). A mix of the animal resources found in both the dry and wet forests could be expected to inhabit these areas. Clybucca 3 would probably have been surrounded by a mixture of both wet and dry sclerophyll forests with the accompanying range of fauna.

The mangrove forests which are prominent at the southern end of Stuarts Point would be dominated by the grey mangrove species (*Avicennia marina*) and would include shrubs such as the river mangrove (*Aegiceras corniculatum*). As well as marine fauna the mangroves would contain both the red and grey headed flying fox (*Pteropus scapulatus* and *Pteropus poliocephalus*).

Salt marshes extending across the floodplain between the two sites, are dominated by streaked arrowgrass (*Triglochin striatum*) in the wetter areas, and samphire (*Sarcocornia quinqueflora*) and couch (*Sparganium angustifolium*) in the drier areas.

Other vegetation types may include heaths, mainly located on the coastal dunes and headlands, and sand dune swamp vegetation. Animal resources from these areas would

have been limited to small marsupials and the long necked tortoise (*Chelodina longicollis*) could be found in the inland waterways.

From these descriptions of natural resources which can be found in the Lower Macleay floodplain it can be seen that there would have been an abundance of resources, both animal and vegetable, available to Aboriginal people, without even taking into account the marine fauna which will be described in Chapter 4.

3.3 Research carried out in the Lower Macleay prior to 1970

Geological research was the earliest research carried out in the Macleay region by Voisey in 1934. Voisey was interested in geological formations of the north coast of New South Wales and carried out extensive surveys. Hails (1967) followed up this research with a geomorphological examination of the formation of the sand barrier systems of the Macleay region. Hails produced two maps of the region, one of which has continued to be used in one form or another by archaeologists up until the end of the century. On this map Hails (1967) calls the chain of low relief hills running in an arc from Grassy Head to Crescent Head (Figure 3.1) the 'coastline prior to barrier formation' (p. 134). However, this naming has evolved into the term 'Pleistocene Coastline', perhaps because on the first map produced in his research he refers to the Clybucca Pleistocene coastline and the Pleistocene Coast, inland of Crescent Head (Hails 1967) (Figure 3.4). This will be further discussed in a later section of this chapter.

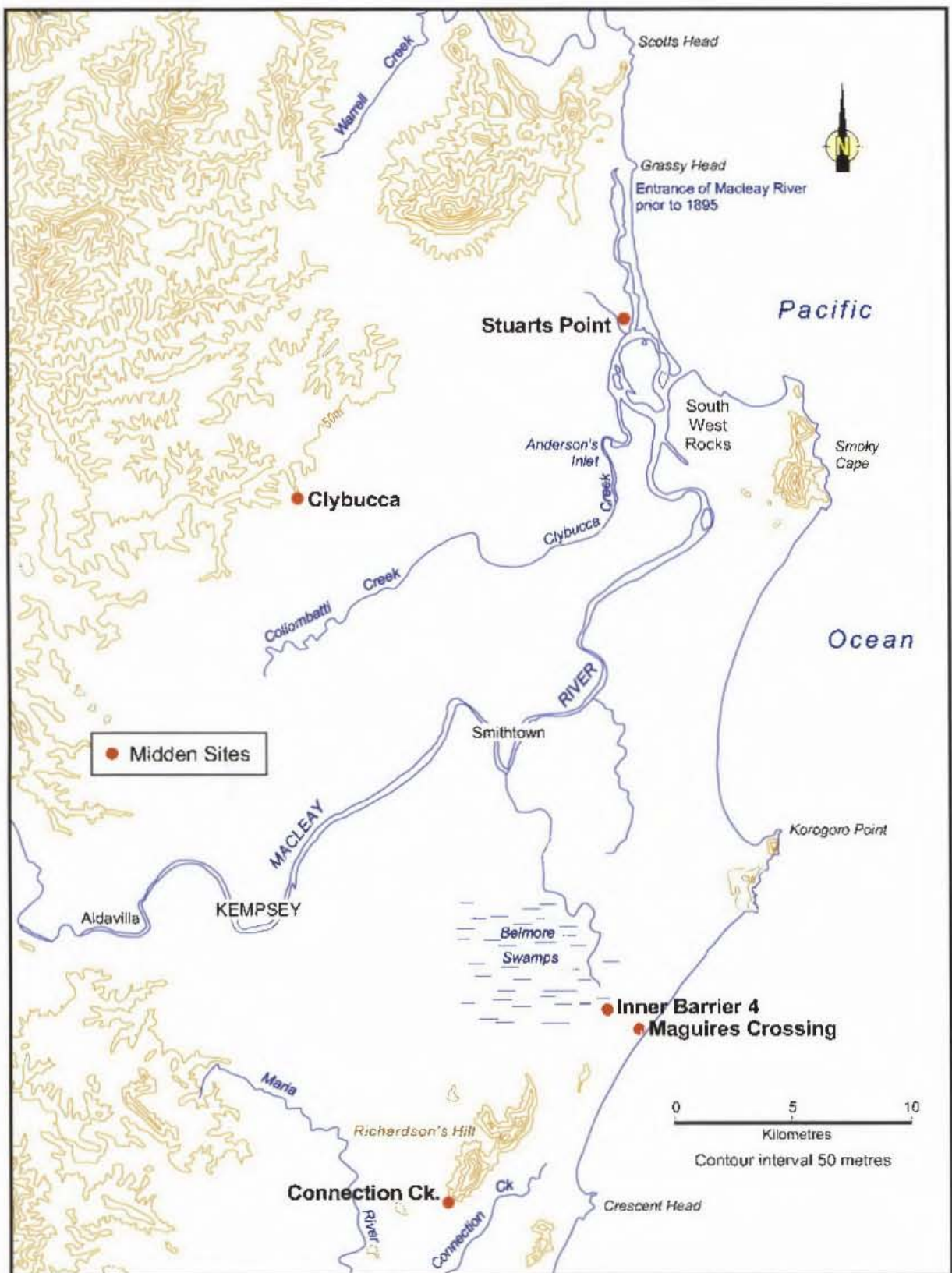


Figure 3.1 The Lower Macleay - Midden Locations Referred to in Chapter 3

3.3.1 Research by Voisey, 1934

In 1934 A.H. Voisey, a geologist from Sydney University published an account of 'The Physiography of the Middle North Coast District of New South Wales' which contained his research on the formation of the Macleay floodplain. Prior to this research the only work carried out on the Macleay pertained to the formation of the coast and the movement of sand (Halligan, 1906; Woolnough, 1911). In his paper Voisey described the Lower Macleay floodplain as 'extending inland as far as' the town of 'Kempsey, [it] covers 250 square miles', and is approximately '10 feet above sea-level' (Voisey 1934:91).

He describes the floodplain as being 'horizontal', though he also points out that the plain is broken at Smoky Cape, Rudder's Hill (Southwest Rocks), Richardson's Hill, Korogoro Point, and Smithtown (Figure 3.1) by 'older rocks' (Voisey 1934:91). The western limit of the floodplain is described as being delineated by 'a very definite break of slope, and low cliffs' approximately '50 feet high' (Voisey 1934:92). The western hills form an arc from Grassy Head to Crescent Head in a 'rough semi-circle' (Voisey 1934:92) (Figure 3.2).

Voisey suggested that during the Pliocene the region was located further to the south, at a higher latitude, than it is today. The Great Dividing range was *in situ*, but reached only approximately 3000 feet (915 metres), and was comprised of New England granites and Lower Palaeozoic schists and slates. On the Macleay River the Upper Palaeozoic sediments had been worn down to 'an undulating plain' (Voisey 1934:99). Volcanic activity had in-filled the plain, and filled river valleys causing the drainage to deviate.

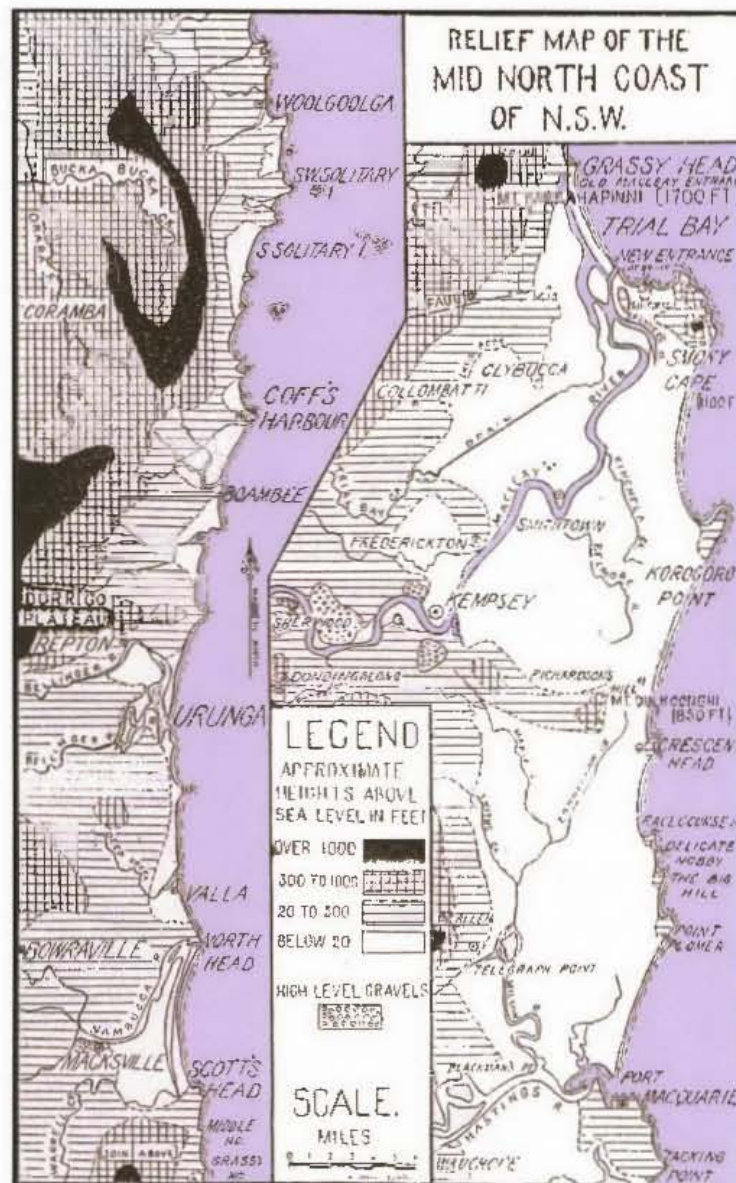


Figure 3.2 Voisey's Relief Map of the Mid-North Coast of NSW

Voisey (1934) describes the formation of the Lower Macleay as having been the result of four stages of 'evolution' (p.100) (Figure 3.3), beginning at the end of the Tertiary Era.

Voisey's (1934:100-101) Quaternary history of the evolution of the Macleay River Floodplain (Figure 3.3) was as follows:

- I. The Great Divide was elevated by another 2,000 feet (610 metres) and tilted towards the coast. The river cut rapidly downwards (due to the uplift) and formed deep V- shaped gorges. The Macleay River flowed through soft sandstones and tuffs from Bellbrook to the coast. A broad coastal plain of 'denudation with residuals of harder tuffs and intrusive rocks' was formed. The river carried down boulders of jasper, quartzite, slate and sandstone which were scattered over the valley floor. Quartz gravel and silt were deposited near where Kempsey now stands.
- II. The flooding of the plain by the rising sea – a submergence (transgression) inundated the coastal plain and turned the residual hills into islands. A shallow protected bay was formed, the western limit of which was Kempsey.
- III. The development of an internal delta and sandspits – i.e. the sediment of the river built up on the floor of the valley and an internal delta was formed. Sandspits extended from island to island forming a barrier to the open sea, and the bodies of salt water to the west of the barrier became isolated from the sea.
- IV. Final stage, deposition – i.e. alluvium spread over the swampy, mangrove floodplain.

Voisey did not have a means of directly dating these events. He does, however, suggest that Aboriginal people were living on the floodplain by the final stage in the evolution of the Macleay, depositing large accumulations of shell along the water margins (Voisey 1934:101). Modern research (Mundell 2000) suggests that while Voisey's sequence of change is not unreasonable, the time frame may be much longer than the Quaternary span he suggested, and there have been several rises and falls in sea-level during the time which the Macleay was evolving.

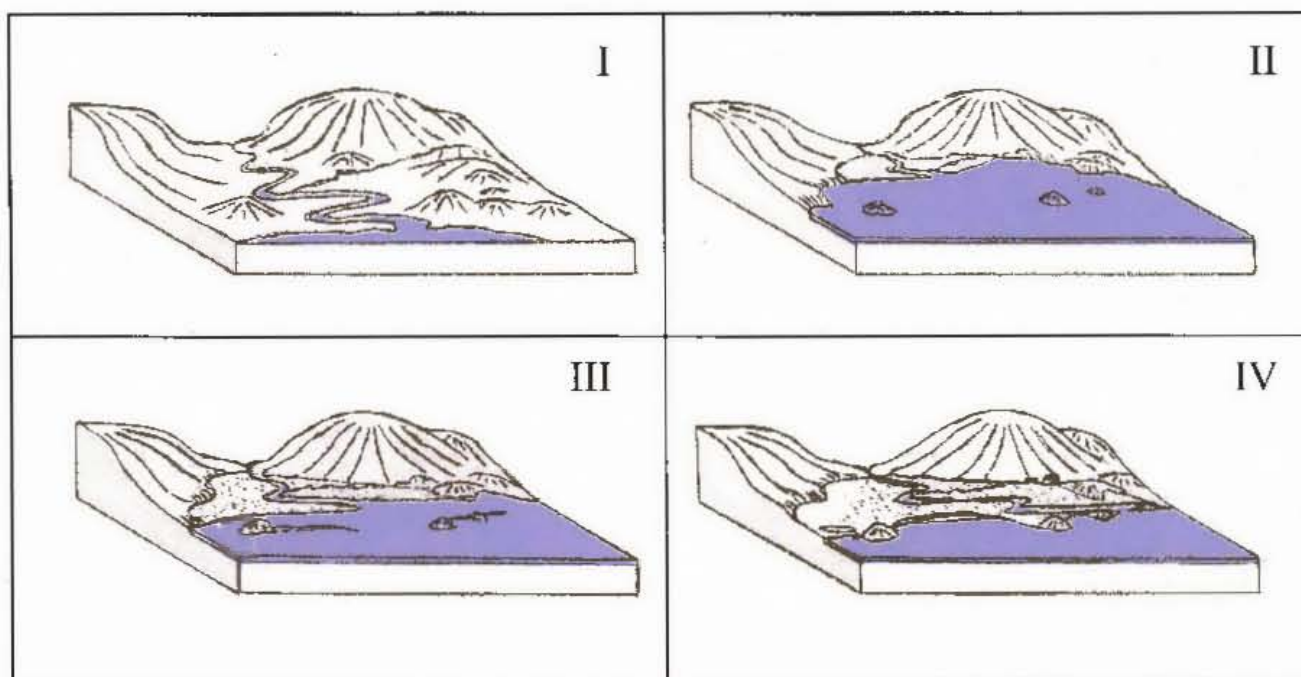


Figure 3.3 Stages in the Evolution of the Lower Macleay Plain (Voisey, 1934:100)

Voisey (1934:98) proposed that the entrance of the Macleay River moved from south of its present position (south of Smoky Cape, Figure 3.1) to north of its present position (near Grassy Head, Figure 3.1) during further uplift of the land surface which had caused a narrowing of the lagoons, and also draining a lot of the swamps. Voisey (1934:96) claimed that the major factors which brought about the evolution of the Lower Macleay floodplain were a combination of the formation of the barrier dunes during the Quaternary, the sediments being carried down from the tablelands and being deposited on the floodplain, and a series of uplifts of the underlying strata. This accords in general with modern thinking. Due to wind and current influences, the present entrance was formed in 1895, and the more northerly entrance has now completely closed.

Whilst carrying out his physiographic investigations on the mid-north coast, Voisey recognised Aboriginal shell middens in the area of the Lower Macleay along what he proposed was the 'old' coastline between Grassy Head and Collombatti (Figure 3.2). Voisey declared that all of the *Arca* (*Anadara*) shells had been broken on the posterior margin, thus indicating an Aboriginal kitchen-midden, rather than the remains of a raised beach; and that the emergence which had moved the sea eastward had occurred 'after the advent of aborigines' (Voisey 1934:94). Voisey made the assumption, as have the researchers working on sea-level change in Brazil (Suguio et al. 1991) and North America (Josenhans et al. 1997; Fedje and Christensen 1999), that the sea would have had to be higher in order for the Aboriginal people to accumulate large quantities of marine fauna in the area where the middens are located. However, it is again a question of the time frame suggested for this event, which Voisey was not able to identify because of the lack of a means of directly dating the sites.

Voisey also located other shell deposits in the Clybucca region, which he believed were the result of a submergence (rising of the sea-level) of at least 70 feet (approximately 21 metres). The shells (*Spistula* and *Arca*) belonged to estuarine species, which Voisey suggests could not have formed with the sea at its present level (Voisey 1934:94). Such a high sea-level is not consistent with current knowledge of any Quaternary sea-levels,

which are now believed to have reached five metres higher than the present at approximately 120,000 years ago, prior to the arrival of Aboriginal people.

Voisey (1934) paved the way for future studies both geological and archaeological in the Lower Macleay. He raised the concept of a 'Pleistocene coastline' through his proposed inundation of the floodplain during the Quaternary. Voisey appears to have recognised only one transgressive phase during the whole of the Quaternary, unlike the number of fluctuations which we now recognise in sea-level during the Pleistocene (Figure 2.8). He also proposed that the Macleay floodplain had emerged due to formation of the barriers between the 'islands' of Scotts Head, Smokey Cape and Korogoro Point (Figure 3.1) and also through the sediments being carried down from the tablelands spreading out over the floodplain. His speculation on the presence of Aboriginal 'kitchen' middens placed the archaeology of the floodplain possibly within the time-frame of the Holocene, but also suggested that the sites located further inland in the Clybucca region may have been of Pleistocene origin, but a specific date within the Pleistocene was not identified.

Archaeological research was commenced by McCarthy in 1941 when he examined the middens at Clybucca. McBryde conducted a survey of Anderson's Inlet sites in 1967, after which Campbell followed in 1969 with an extensive survey of shell midden sites. In this section of the chapter I will review all of the findings from their research, and follow with a summary of what was known about the Macleay archaeological sites and sea-levels in the region by 1970.

3.3.2 Research by McCarthy, 1941-1943

McCarthy surveyed in the areas of Crescent Head and Clybucca Creek (Figure 3.1) in the 1940s (McCarthy, 1941:21; 1943:164). He described two archaeological sites at Crescent Head – a quarry and 'pipi' middens – and described the shell middens at Clybucca as 'grass-covered mounds extending for some miles along Clybucca Creek' (Figure 3.1). In the style of research most common for this time, as absolute dating

techniques were not available, the main focus of McCarthy's attention was the characterisation of the stone-tool industries of the mid-north coast. However, he also made observations of the range of shellfish remains from both of the sites. The foredune middens of the Crescent Head site consisted 'almost entirely' of pipi (*Plebidonax deltoides*). In comparison the inland middens along the Clybucca Creek showed a wider range of shellfish taxa including oyster (*Saccostrea glomerata*), cockle (*Anadara trapezia*), Sydney whelks (*Pyrazus ebinenus*), and a sea snail. Making observations in an area where 'lime-burners' had excavated a pit into the Clybucca midden he noticed a large number of 'reddish firestones' and, even though the pit had been dug to 7 feet, the base of the midden had not been reached. McCarthy estimated that the inland middens on Clybucca Creek may have been dated to between 11,000 BP and 5,000 BP, based upon a statement from Professor Cotton, Department of Geology, University of Sydney (McCarthy 1943b:166), of the amount of time taken after the glacial maximum of 25,000 BP for the cutting of the rock benches by wave action of the former coastline, and the subsequent subsidence of the sea to its present day level. "...the kitchen-middens would have accumulated in a period lying between seventeen and five thousand years ago" (Cotton in McCarthy 1943:166). The statement of the subsidence of the sea was in agreement with Voisey's (1934) hypothesis that the sea-level had been higher at some time in the Pleistocene.

McCarthy's 1940s studies appear to have been the first archaeological studies carried out in the Macleay region. He classified the stone artefacts into typologies in the context of other research in Australia at the time, finding them to be of a 'Hoabinhien' I type (McCarthy 1941:21). This typology consisted of large cores, pebble core implements, Karta (split pebble implements), uniface pebble artefacts, and large flakes. He also noted horse-hoof cores, worimi (large crescent-shaped artefacts) in the shell middens. McCarthy (1941:24) also noted three specimens of a ground edge axe, one of which was in the quarry, and two found in the middens. Along with publishing the first archaeological research in the Macleay, McCarthy also whetted the appetite of future archaeologists by suggesting a late Pleistocene, or early Holocene date for the creation of the shell middens along Clybucca Creek.

3.3.3 Research by Hails, 1965-1967

Following on from Voisey's 1934 geological study of the Macleay region, Hails spent three years, prior to the publication of his 1967 article, studying the geomorphological and sedimentological history of areas of coastal New South Wales (Hails 1967:133). He presented an extensive study which he termed a 'summary' of late Quaternary history of the coastal areas between Scotts Head and Crescent Head (Figure 3.1) New South Wales (Hails 1967:133). In his introduction to this all-embracing work, he characterised the mid-north coast as 'a series of arcuate bays separated by bedrock headlands' (Hails 1967:133). The bedrock headlands being offshore islands until the late Pleistocene, after which the coastline had been straightened by the formation of coastal barriers, an Inner Barrier (Pleistocene) and an Outer Barrier (Recent).

Although Hails recognised substantial conflict worldwide amongst geologists and geomorphologists on Quaternary sea-level changes, which had confused understanding of how coastal barriers form, he went on to give a substantial explanation of the formation of the coastline on the mid-north coast, and opposed any suggestion of sea-level changes during the Late Holocene as an explanation for the landforms now seen in the Lower Macleay (Hails 1965:214). The reason for this was that he hypothesised that coastal barriers formed not at times of emergence (when land formerly under water is exposed), but that they formed as dune or beach ridges next to the pre-existing shorelines during periods of submergence (when the water was rising relative to the land elevation) (Hails 1967:135). Even though the shoreline may have occupied many positions during a period of submergence, Hails proposed that features such as coastal barriers formed during the major still-stands (that is at maximum submergence) in any sea-level fluctuation. He held that this is the case on the mid-north coast as he found no evidence of growth of barriers by elongation. If barriers had formed by elongation (longshore drift), the barriers would not present a uniform width along their length, but would show signs of intermittent growth on the landward side.

The Inner Barrier (Figure 3.4), which Hails defined as Pleistocene sands (Figure 3.4), was proposed to have formed during a major 'still-stand' at a time of maximum submergence approximately 4-5 metres above the present sea-level (Note that this is now dated to c. 120,000 BP, see Figure 2.7). North of Crescent Head (Figure 3.1), the dissected ridges of the south joined to form a single ridge. The ridge crests are approximately eight metres above the present mean sea-level, which equates to approximately three metres above the height of the sea during the last interglacial, when the sea rose to approximately five metres higher than the present level. The inner barrier was modified by accretion, the addition of more recent sand or sediment, and also in parts by deflation, where parts of the barrier ridges were worn away, particularly at the northern ends of each bay along the coast. Hails proposed that the inner barrier ridges formed a continuous barrier between Smokey Cape and Crescent Head in the past, but some of the ridges have been completely destroyed or covered by vegetated, transgressive dunes (Hails 1967:136). His explanation for the dissection or destruction of the inner barrier was breaching by floodwaters carried down the Macleay River. Hails (1967:137) proposed that the Macleay floodplain between the inner barrier and the low-relief, bedrock hills to the west (Figure 3.4) was occupied by a large lagoon during the last interglacial (c.120,000 years ago), but that eustatically controlled sea-level changes do not have to be considered to explain the present landforms of the Macleay coast and floodplain.

The Outer Barrier, proposed by Hails (Figure 3.4), was extensively eroded, though in parts it reaches an elevation of 18-24 metres (1967:138). Hails proposed that since a transgression or submergence 18,000 years ago, and the subsequent emergence, the sea levels then rose 'rapidly' during the Holocene until 7,000 years ago, after which he argues for either a 'slow, continuous rise of sea level' or a 'standstill since 3500-5000 BP' (1967:138).

Hails research into the barrier formations along the Macleay coast can be summarised as an inner barrier which formed prior to 18,000 BP to a height of eight metres above the

present sea-level, and an outer barrier which had formed since that time, but probably between 5,000 and 3,500 BP. He also produced a relatively complicated map of the geomorphology of the coastline between Trial Bay and Crescent Head. This map (Figure 3.4) shows, amongst other landforms, the dual barrier system, an area west of Crescent Head termed 'Pleistocene Coast', and the area west of Smokey Cape termed 'Pleistocene Clybucca Shoreline'.

Initially it appears that Hails' first map (Figure 3.4) was somewhat ignored by archaeological researchers, who preferred to use a simplified version which shows what Hails termed 'coastline prior to barrier formation', inland of the Inner Barrier (Figure 3.5) and less detail of landforms such as the inner and outer barriers. The second map produced by Hails (1968:134) was said to be the 'first geomorphological map of the area' (p. 133) (Figure 3.5). This map has become very important since its publication in 1967 – as it has been used, in some form or other, by archaeologists until the 1990s. On this map Hails describes the hatched area to the west of the map as the 'coastline prior to barrier formation' (Figure 3.5). However, it appears that archaeologists have used information from the first map (Figure 3.4), and had interpreted the chain of low-relief hills to the west of the floodplain as the 'Pleistocene Coastline' (Knuckey 1999). Hails proposed that the sea had risen to the west of the floodplain during the last inter-glacial of the Pleistocene, to the point where the elevation of the land precluded any further incursion by the sea. However, successive archaeologists made use of Hails (1967) research, publishing and re-publishing the geomorphological map (Figure 3.5) along with the terms 'Pleistocene' coastline (Knuckey 1999), cliffs (Callaghan 1980) or landforms (Campbell 1969; Coleman 1978). This is despite the fact that archaeological texts had represented sea-level curves with no post-glacial higher sea-level than the present. The ad hoc use of the term 'Pleistocene Coastline' is discussed further in later sections of this chapter.

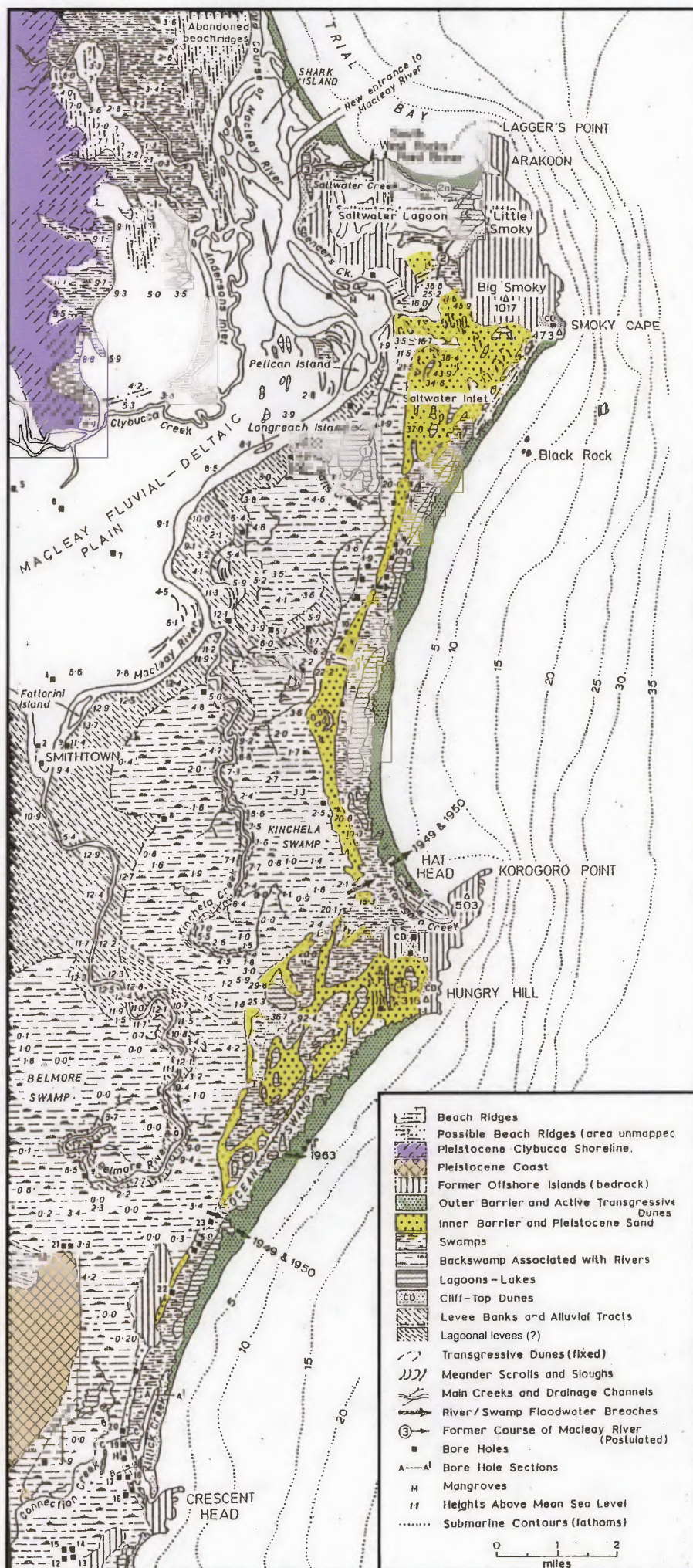


Figure 3.4 The surface morphology of the Mid-North Coast of NSW (Hails, 1967)

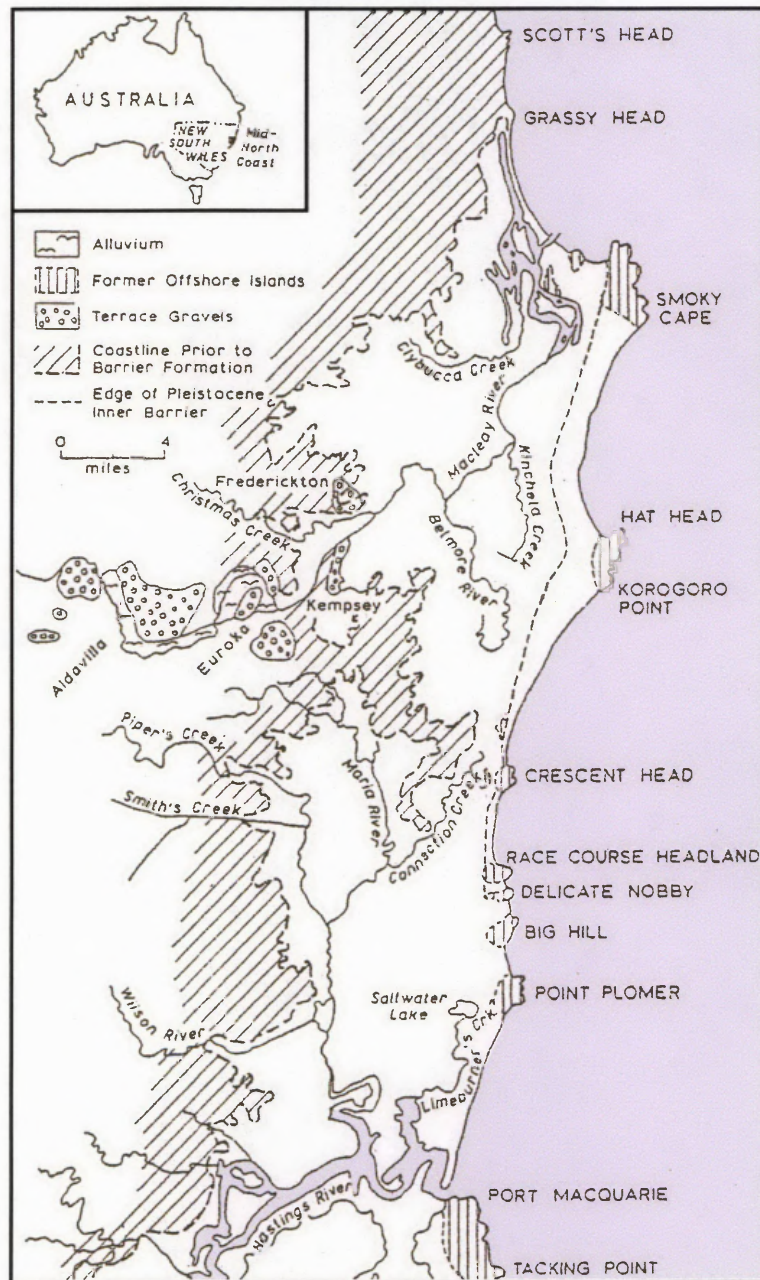


Figure 3.5 Hail's (1967) Geomorphological Map of the Lower Macleay

3.3.4 Research by McBryde, 1967.

McBryde conducted a regional survey of the archaeological sites in the Lower Macleay Valley for the National Parks and Wildlife Service NSW in May 1967, one of which was an extensive midden site at Anderson's Inlet (Figure 3.1) (McBryde 1967). McBryde describes the site as being 'a long, virtually continuous, mound extending along the west bank of Anderson's Inlet for at least one and a half miles' (McBryde 1967:1). At some points the mound is recorded to have been approximately 20 feet wide, and four feet high. The archaeological deposits appeared to have been less continuous at the southern end of the mound, where more distinct separate mounds can be seen. McBryde observed eroding stone artefacts from the mound along the shore line, and stated that the shell consisted of oyster and cockle shells [*Saccostrea glomerata* and *Anadara trapezia*].

McBryde noted that some of the 'vital evidence' had already been lost due to the incursions of flood mitigation works, road construction, and sand-mining. McBryde concluded her report with:

'In its extent this midden is one of the most important in the lower Macleay, in view of its geomorphological context it should also provide valuable evidence to complement that from sites located near the Pleistocene shore lines to the west of Clybucca' (McBryde 1967:2);

and that therefore, all of the Macleay sites should be protected from 'any interference' (McBryde, 1967:2).

The 'geomorphological context' that McBryde found so important, and rare, was that the shell middens deposits were 'directly associated' with 'Pleistocene and post-Pleistocene shore lines' (McBryde 1967:1). Further, she believed that the presence of these shell middens would allow for the past landscape and the history of cultural activity in the area to be reconstructed in future research of the sites.

3.3.5 Research by Campbell, 1969

Campbell (1969) surveyed and recorded approximately 33 shell middens in the Lower Macleay Valley region with the intent of describing their potential for research for her B.A.(Hons) thesis. She located middens on what were thought to be Pleistocene features in the west of the region, sites adjacent to tidal creeks, and also coastal sites (Figure 3.6).

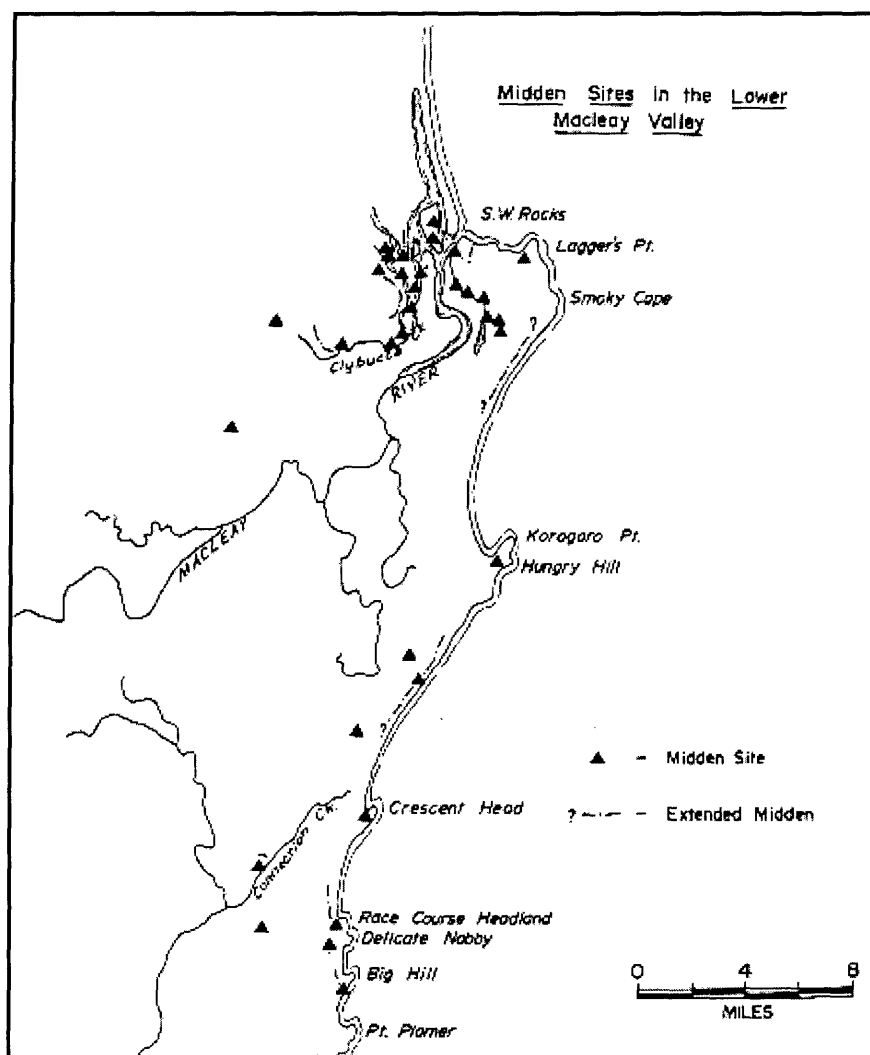


Figure 3.6 Campbell's (1969) map of Macleay Shell Midden sites

While the focus of the survey was to locate and record all sites in the lower Macleay, selected sites were sampled by auger for extent of deposition, stratigraphy, and for any observations in changes in the shellfish species over time (Campbell, 1969:IV).

Campbell located middens in what she believed were three different and distinct microenvironments –

1. adjacent to tidal creeks,
2. regions where sand banks and mud flats are exposed at low tide,
3. beachfront dunes (Campbell 1969:V)

As Campbell felt that one of the most important questions from her research was to establish the antiquity of the occupation of the inland sites, following from the suggestions made by McCarthy (1943) that the sites located inland from Clybucca Creek (Figure 3.6) could possibly be of a Pleistocene age, four radiocarbon dates were obtained from three of the sites surveyed (Table 3.2).

Table 3.2 Radiocarbon dates obtained on Macleay Sites (Campbell 1972)

Site	Location	Lab Ref	Date	Provenance	Dating Sample	Reference
Clybucca I	Inland	GAK2457	3850±140	24-30 inches	charcoal	Campbell, 1972
Connection Ck I	Inland	GAK2459	3460±120	25 inches	shell (oyster)	Campbell, 1972
Connection Ck I	Inland	GAK2458	4850±160	28 inches	shell (oyster)	Campbell, 1972
Maguire's Crossing	Sandy shore	GAK2456	1210±90	4-7 inches	charcoal	Campbell, 1972

Following is a brief summary of the sites recorded by Campbell (1969), organised into the microenvironments as classified by Campbell (1969).

Clybucca

Eight sites were located on the western margins of the Macleay floodplain, some 6 to 12 kilometres inland from the present coastline (Campbell, 1969:25). Four of the sites located were adjacent to, but to the north of, Clybucca Creek (Figure 3.7) and were designated as Clybucca 1, 2, 3, and 4. Campbell (1969:26) sampled all four sites and found all to contain similar shell species, the most prominent being oyster (*Saccostrea*

glomerata) and Sydney cockle (*Anadara trapezia*). Other shellfish species located in smaller numbers were the Australian mud whelk (*Velacumantus australis*), *Chama reflexa*, *Mamilla sordida*, and *Bembicium auratus*. *Pyrasmus ebinemis*, the Hercules' club whelk was found in all sites except for Clybucca 1.

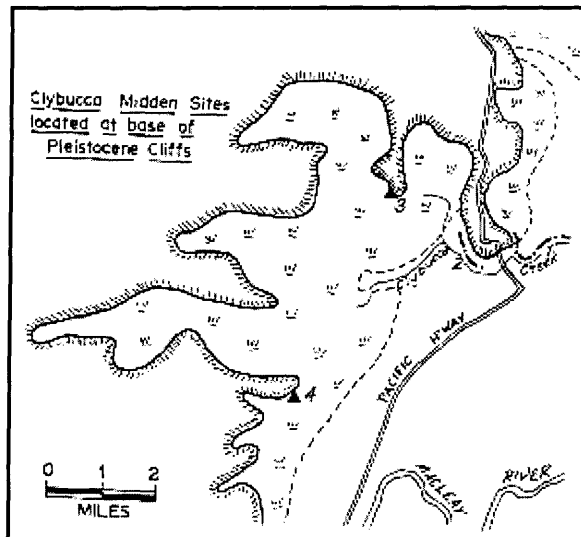


Figure 3.7 Clybucca Midden Sites (Campbell 1969)

The site 'Clybucca 1' was described as 'an extensive midden running for over a mile, but abutting against the Pleistocene cliff only at the western end' (Campbell, 1969:26) (Figure 3.7). This site was sampled and shows a change in shellfish composition from (*Saccostrea glomerata*) in the upper layers to cockle (*Anadara trapezia*) in the lower layers. The apparent change in the predominant species of shellfish from oyster (*Saccostrea glomerata*) to cockle (*Anadara trapezia*) occurred at 30 inches (76cm) below the surface, which is 'just below' the level for which the radiocarbon date of 3850 ± 140 BP (Table 3.1) was obtained (Campbell 1972:285). Campbell (1972) concluded that the evidence from this site suggested:

'the existence of the lagoon between seven and four thousand years ago, during which time the Aborigines arrived and began to exploit the molluscs living in its waters' (pp 285).

She further suggested that more radiocarbon dates from basal levels were required for this site before the arrival date of the Aboriginal people in the region could be inferred.

Clybucca 2 ran along the base of the cliff to the west of Clybucca 1 (Figure 3.7), but even though it had the appearance of being quite extensive, it had been considerably disturbed.

Clybucca 3 was located 'one and a half miles' north-west of Clybucca 2 (Campbell 1969:27) (Figure 3.7), and was of a considerable size running in an east-west direction for approximately 130 yards (119 metres). Two auger tests were made, revealing in auger 1 a predominance of oyster (*Saccostrea glomerata*) to a depth of approximately 16 or 17 inches (45 cm), overlying cockle (*Anadara trapezia*) remains to a depth of approximately 25 inches (64 cm); and in Auger 2, oyster (*Saccostrea glomerata*) to a depth of 35 inches (89 cm), overlying cockle (*Anadara trapezia*) to a depth of 48 inches (122 cm).

Clybucca 4 was located on the 'western edge of Clybucca Swamp about one and a half miles north of Collombatti (Campbell 1969:27) (Figure 3.7). The extent of the midden was difficult to gauge, but Campbell estimated it ran for approximately 65 yards before grading into higher ground. Again two auger samples were taken: Auger 1 revealed a mixture of oyster (*Saccostrea glomerata*) and cockle (*Anadara trapezia*) to a depth of 24 inches (61 cm), below which were 33 inches (84 cm) of cockle (*Anadara trapezia*) to a total depth of approximately 58 inches (147 cm). Auger 2 exposed an upper layer of 9 inches (23 cm) consisting of a silty loam, overlying a mixture of cockle (*Anadara trapezia*) and oyster (*Saccostrea glomerata*) to a depth of approximately 35 inches (89 cm).

Campbell located a further four inland sites to the south of Clybucca Creek, three of which she proposed were located on the former Pleistocene coastline at Connection Creek (Figure 3.8).

Connection Creek

Connection Creek 1, 'three miles inland from Crescent Head' (Figure 3.1) and located approximately 200 yards south of a small tributary of Connection Creek. Even though this site was located on a ridge Campbell did not feel that it related to the former coastline (Campbell 1969:28). Two auger holes sunk on the crest of the ridge did not reveal any shell deposits, however the third auger test showed oyster (*Saccostrea glomerata*) predominating to a depth of approximately 47 inches (119 cm), overlying a thin lens of cockle (*Anadara trapezia*) measuring only perhaps 2 inches (5 cm).

Radiocarbon dates obtained on oyster (*Saccostrea glomerata*) shell provided ages of the deposit as 3460 ± 120 BP

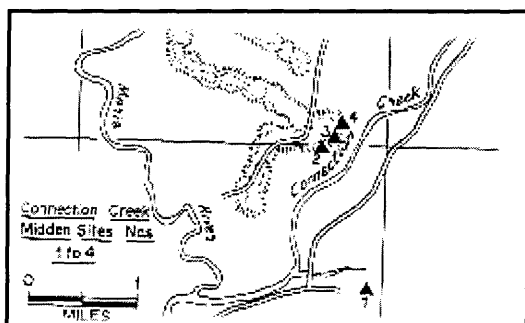


Figure 3.8 Connection Creek midden sites (Campbell 1969)

at a depth of 25 inches (64 cm), and 4850 ± 160 BP at 28 inches (71 cm) (Campbell 1972:285). Both of these dates were above the point (47 inches) where Campbell perceived a change of predominant species from oyster (*Saccostrea glomerata*) to cockle (*Anadara trapezia*).

Connection Creek 2, 3 and 4 – were all located on the margin of the swamp at the base of the hill (Figure 3.8). Connection Creek 2 was not sampled, and 3 and 4 were badly disturbed.

Stuarts Point

Campbell (1969:38) located 8 sites at Stuarts Point, and a further 2 at Shark Island, 1 at South West Rocks, and 6 at Spencer's Creek (Figure 3.9).

Two of the sites at Stuarts Point (Stuarts Point 1 and 2) were surveyed in detail, however neither were radiocarbon dated. Campbell described Stuarts Point 1 (Figure 3.9) as 'an extensive midden running for over a mile along the western margin of Stuarts Point' (1969:38), and suggested that the entire column sample was dominated by cockle (*Anadara trapezia*). However, her auger contents illustration shows an area between 6 and 12 inches (15 cm and 30 cm) which appears to contain large amounts of oyster (*Saccostrea glomerata*) (Campbell 1969:37).

Stuarts Point 2 (Figure 3.9) is described as being 'located at the tip of the promontory and is a circular mound, rising about 10 feet above the flat surface of the surrounding country, and is approximately 'twenty yards in diameter' (Campbell 1969:38). The auger illustration shows concentrations of mud whelk (*Pyrazus ebinenus*) at the top of the sample to a depth of 36 inches (91 cm), overlying oyster (*Saccostrea glomerata*) and cockle (*Anadara trapezia*) between 36 and 52 inches (91 cm and 132 cm), whereupon the remaining cultural deposit, to a depth of approximately 80 inches (203 cm) is dominated by cockle (*Anadara trapezia*).

Two samples were taken from a site at South West Rocks (Figure 3.9), described as a discontinuous shell midden running for approximately half a mile through rocky, thickly vegetated country. Sample 1 shows an upper layer of mud whelk (*Pyrazus ebinenus*) to a depth of 12 inches (30 cm), but the contents of the lower 12 inches could not be determined. Sample 2 revealed a lens of 6 inches (15 cm) of concentrated oyster shell (*Saccostrea glomerata*), overlain by 12 inches (30 cm) of sand, with sand below the lens.

The other sites shown on Figure 3.9 were located and mapped, but not sampled in detail. An auger sample taken from Spencer's Creek 5 (Figure 3.9) revealed 24 inches (61 cm) of oyster (*Saccostrea glomerata*) deposit overlying fine, white sand (Campbell 1969:41).

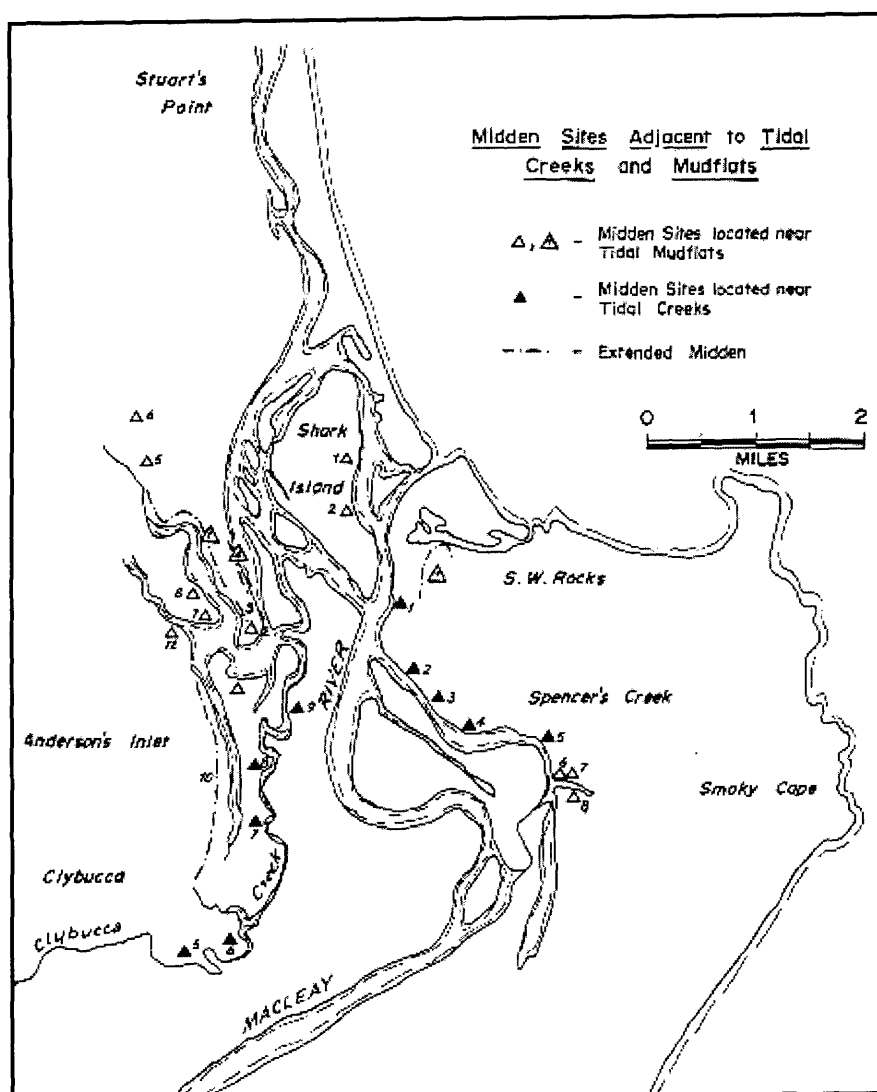


Figure 3.9 Midden sites at or adjacent to Stuart's Point (Campbell 1969)

Maguires Crossing

Campbell's final radiocarbon date was obtained from the site of Maguires Crossing, described as 'a shallow shell midden in eroding sand dunes' (Campbell 1972:285). The radiocarbon date of 1210 ± 90 BP was obtained on charcoal collected from between a depth of 4 and 7 inches (10 cm and 18 cm) of the total depth of 9 inches (23 cm) of archaeological deposit. Campbell felt this date was 'well within the range anticipated' for a site located on a foredune barrier system. This midden was entirely composed of pipi (*Plebidonax deltoides*).

An aspect of Campbell's research which has been taken up in subsequent archaeological research was the hypothesis that the Macleay sites showed a marked change to oyster (*Saccostrea glomerata*) in the upper layers of her auger samples, from cockle (*Anadara trapezia*) in the lower layers. While this is a valid point in some auger samples, a comparison of all of the auger samples presented in Campbell's (1969) thesis shows that the findings are not as consistent as expected. Figure 3.10 shows all of the depictions of the auger samples in relation to each other. While Clybucca 1 (Figure 3.10 Cly 1), Clybucca 3 (Figure 3.10 Cly 3-1, Cly 3-2), one sample from Clybucca 4 (Figure 3.10 Cly 4-1), and Connection Creek (Figure 3.10 CC 1-3), do show a change from oyster (*Saccostrea glomerata*) in the upper layers to cockle (*Anadara trapezia*) in the lower layers, these changes occur at markedly different levels in the test samples and may possibly represent different dates for the transition.

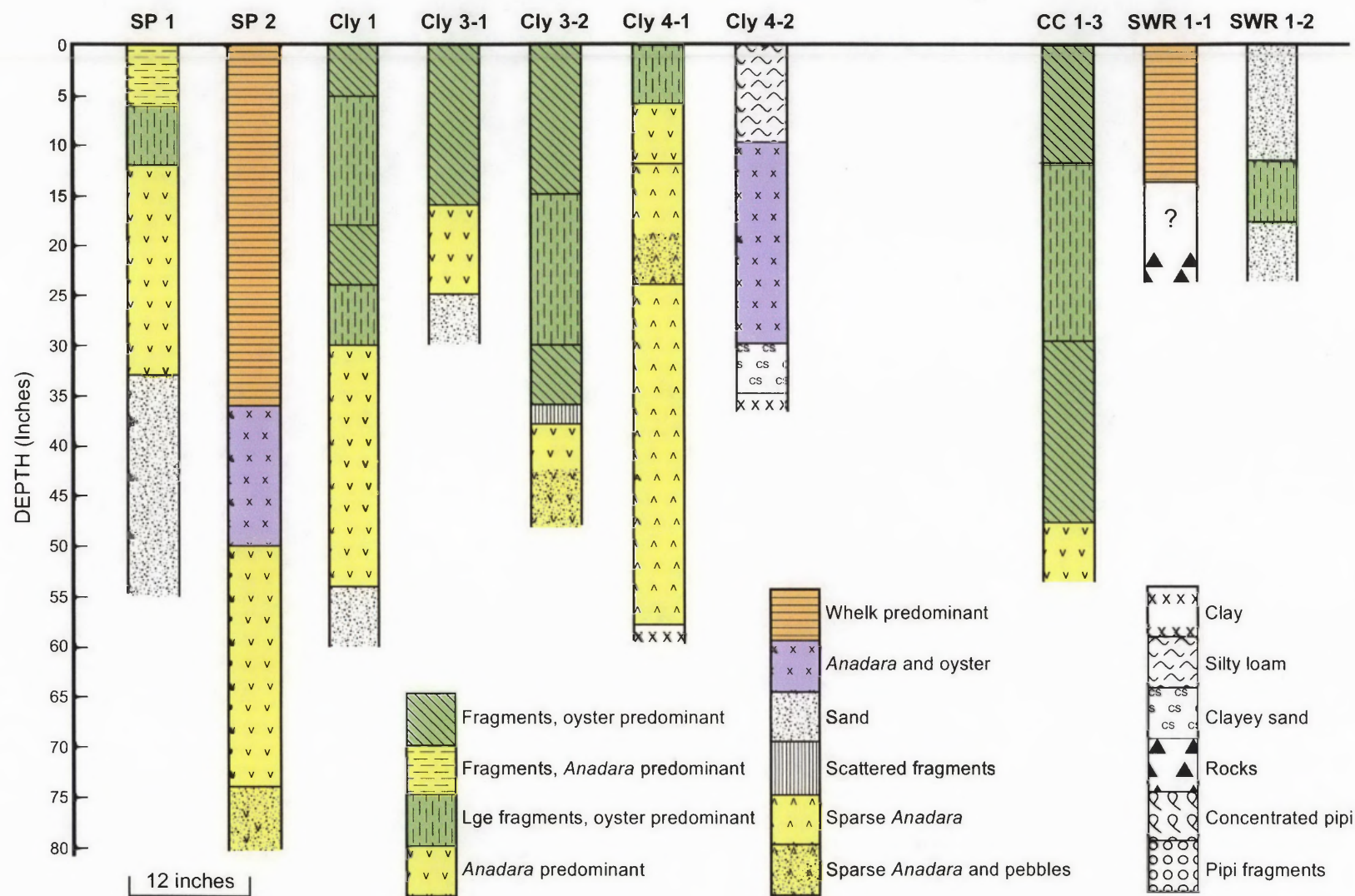


Figure 3.10 Archaeological Samples taken by Cambell in the Lower Macleay (1969)

The discrepancy between Campbell's perception of a change from cockle (*Anadara trapezia*) to oyster (*Saccostrea glomerata*) and the illustrations of the samples could be the result of where the samples were taken in relation to the midden as a whole, length of occupation of the sites, or a wide range of valid reasons for the differences. However, the samples taken from Stuarts Point 1 and 2 (Figure 3.10 SP 1, SP 2), and one sample from Clybucca 4 (Figure 3.10 Cly 4-2) do not appear to repeat the sequence of a definite change from oyster (*Saccostrea glomerata*) to cockle (*Anadara trapezia*). Stuarts point 1 indicates that cockle (*Anadara trapezia*) dominated the upper 6 inches (15 cm) of the deposit and at Stuarts Point 2 mud whelk (*Pyrazus ebinenus*) is the dominant species in the upper 36 inches (91 cm), followed by 14 inches (36 cm) where oyster (*Saccostrea glomerata*) and cockle (*Anadara trapezia*) appear to be in equal amounts (Figure 3.10). The Clybucca 4 sample 2 (Figure 3.10 Cly 4-2) shows equal distributions of oyster (*Saccostrea glomerata*) and cockle (*Anadara trapezia*), overlain by 10 inches (25 cm) of silty loam.

Campbell (1969) concluded that shell middens were the only type of occupational sites 'located in significant numbers' in her survey of the Lower Macleay, and that these sites offered significant opportunities for future research of 'man as part of the total environment' (pp 105). Campbell's (1969) broad survey brought the existence and the extensive nature of the shell midden complexes of the Lower Macleay to the notice of Australian archaeology with her recording of at least 33 sites. In many ways she laid the foundations for the questions which would be asked by researchers in the following decades. This was an important study, carried out by someone with limited experience, in a very capable and thorough manner (G. Connah pers com).

Campbell (1969:25) indicated in her thesis that all of the inland sites except for Connection Creek 1 were located at the base of 'steeply rising ground that represent remnant cliffs, cut at a time when sea levels were higher, and the present plain was submerged'. She also describes these cliffs as the floodplains western boundary 'determined by the bedrock of the Pleistocene coastline' (Campbell 1969:12). She was

probably the first archaeologist to use the research on the Macleay floodplain carried out by Hails (1967). Sea-level curves for the Pleistocene had not been published in Australian archaeology texts at this time, so it is perhaps understandable that she used terms such as 'Pleistocene Coastline' without fully comprehending the extent of sea-level fluctuation during the Pleistocene.

3.3.6 Research by Thom, Hails and Martin, 1969

Thom, Hails and Martin (1969) challenged the hypothesis that sea levels had reached levels up to two metres higher than the present in Eastern Australia during the Holocene, as had been proposed by other researchers in the early 1960s (e.g., Fairbridge 1961; Gill 1961; Ward 1965). The authors presented eight radiocarbon dates, four of which had been taken on material from the Crescent Head area (Figure 3.1), the remaining four coming from southern Queensland and the Sydney region of New South Wales.

Peat beds form along the coastline at or near the water-table, and in this environment the water table is 'likely to be at or slightly above mean sea-level' (1969:166). The peat becomes exposed as dunes and beaches retreat under the constant wave action along the coast, leaving outcropping peat beds in the 'backshore zone' (1969:162). Peat beds may extend parallel to the coastline for several kilometres and often contain 'large, *in situ* stumps' (1969:162). By using pollen and macro plant analysis, Thom et al. proposed that the environments from which the peat derived were all freshwater in origin, and were lacking in any marine or brackish sediments overlying the peat which would have indicated the sea covering the peat beds after their formation in a freshwater environment. The Crescent Head peat dates ranged from 3100 ± 115 to 4600 ± 130 BP, two of the dates being derived from material one foot (30 cm) above the present high water mark, and the remaining two samples from at the present high water mark. Radiocarbon dates taken on samples from three in-situ stumps were considerably older (5700 ± 140 to 9350 ± 200 BP), however these samples were collected from regions ranging from near Brisbane to Far North Queensland, and not from the Macleay region.

The authors concluded that the results of their research supported the argument that there have been no higher sea stands on the eastern coast of Australia during the Holocene, and that evidence presented which contradicted this result should be 'carefully reviewed'.

Thom was a vehement opponent of any evidence which supported sea-level fluctuation in the Late Holocene (Thom, Hails, Martin and Phipps 1972), dismissing such evidence as 'sparse and piecemeal' (Thom and Chappell 1975:91), and continuing to argue for 6,000 years of sea-level stability on the coast of Australia, despite his own evidence for this theory being somewhat fragmentary (Thom et al. 1969:163). He did, however, suggest that evidence from other non-tectonic countries could be used 'to gain a better understanding of relaxation behaviour of the earth' (Thom and Chappell 1975:93).

In summary, the earliest research in the Macleay was primarily of a geological nature, assessing the formation of the landforms from Woolgoolga (30 km north of Coffs Harbour) to Port Macquarie. Voisey (1934) recognised the change in topography running in an arc from Grassy Head to Crescent Head, and termed it the old coastline. Hails (1967) took this theory one step further and used the term 'Pleistocene Coastline', producing a geomorphological map which has been in use by researchers ever since. The 'Pleistocene Coastline' is perhaps an unusual term for the formation of bedrock cliffs inland from the coast near Kempsey, given that the Pleistocene lasted for approximately 2.5 million years, during which period many Ice Ages, and consequently changes in sea-level, occurred. But this was perhaps consistent with the thinking of the time. We now believe that the 'coastline' during the glacial maximums would have been east of the present coast, along the continental shelf, as the sea-level lowered. However this term has continued to be used to refer to the cliffs between Grassy Head and Crescent Head until the 1990s.

A map (Figure 3.11) produced by Campbell in her 1969 thesis, shows archaeological sites located on Pleistocene landforms, and uses the term 'Pleistocene Coastline' in her legend, is perhaps the best illustration of the use of the geological and geomorphological information of Voisey (1934) and Hails (1967) in archaeological research. These sites were proposed to have been situated on the former Pleistocene coastline, evidenced by 'steeply rising ground that represents remnant cliffs, cut at the time when sea-levels were higher...' (Campbell, 1969:25). The use of terms such as the 'Pleistocene coastline' is a means of relatively dating the Macleay shell midden sites, but shows a misunderstanding of Hails' (1967) term, which referred to one period during the Pleistocene when sea-levels rose to perhaps five metres higher than the present (and is now dated to approximately 120,000 BP), and was prior to human occupation of the continent as was understood at the time of writing her thesis (Mulvaney 1969:178). Campbell wrote her thesis prior to receiving the radiocarbon dates on the samples taken from the inland sites. In her 1972 journal article, Campbell presented the radiocarbon dates for Clybucca and Connection Creek, acknowledging that although it had been speculated that these sites would prove to be of a Pleistocene age, they were in fact dated to the Mid- to Late-

Holocene (Campbell 1972:283-285). Despite the dates of the sites, Campbell's map (Figure 3.11) of former landforms appears to have gone unchallenged for considerable time.

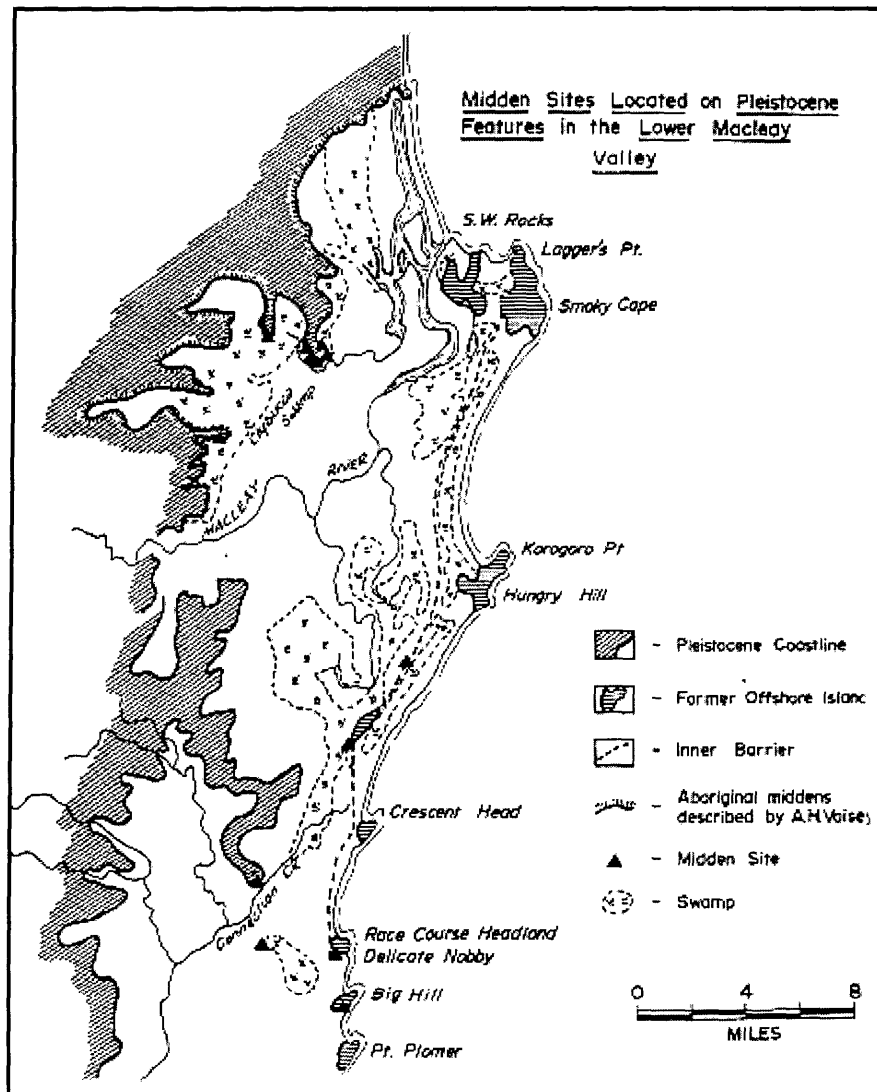


Figure 3.11 Campbell's 1969 map of 'Pleistocene' landforms

Archaeological research carried out prior to Campbell in 1969 was primarily concerned with establishing the antiquity of human occupation of the Macleay sites, mainly through the typological analysis of the stone artefacts recovered from the Clybucca area (McCarthy 1943). The 'antiquity of man', tool typology and distribution, 'man's' exploitation of the environment, origin of the Tasmanians and Australian Aborigines, and rock art documentation and explanation, were described as issues deemed significant in Australian prehistory during the 1960s (Frankel 1995:650; Attenbrow 1999:195). These studies were carried out without the benefits to archaeological research of radiocarbon dating. The advent of a means of directly dating archaeological remains would open up new areas of research, and in time offered a means of viewing the Macleay sites in a different light to that of McCarthy (Bailey 1983:165). Campbell (1969), though also interested in establishing the antiquity of the Macleay sites, was perhaps more concerned with issues of economy and the environmental setting of the occupation sites. She found that the number of stone artefacts recovered in her auger samples was relatively small (Campbell 1969:74), but that even this small number was indicative of the tool-kit in use at the time that the sites were occupied, and was thus important in establishing a regional sequence of artefact use on the mid-north coast of New South Wales.

Campbell proposed that shell middens could provide 'valuable keys' in the answering of questions regarding 'seasonal activity, cultural adaptation and specialisation' (Campbell 1969:80). Campbell (1969) wrote at length about the possibilities of research on archaeological shell middens in general, and in particular those located on the Lower Macleay River. She believed that numerous research questions could be addressed with these sites, and that she had only taken the first step by surveying and mapping the region.

3.4 Research carried out in the Lower Macleay in the 1970s.

Archaeological research in the Lower Macleay in the decade of the 1970s is dominated by the work of Connah and students from the University of New England. First I will briefly mention a geological survey carried out in the Clybucca region in 1974, as I wish to present the excavations of Connah (1972-1975) in a single section. I will then summarise the results of the large excavations which were carried out over the period of four years, along with research that followed these excavations.

Questions of where the sea-level had been during the formation of the archaeological deposits in the Macleay were not specifically examined in the 1970s research. On the whole, Hails' (1967) research was used to explain the landforms of the Lower Macleay. Connah chose the locations for his excavations because they represented different environments, and he was also interested in investigating a midden containing marine fauna which was now located inland (Connah pers com, 2002). Coleman alludes to an 'environmental change' occurring in the region in her thesis when she describes one of the aims of the research as being 'to provide information on man's adaptation to a changing environment' (1978:4). But a fluctuating sea-level in the Late Holocene was not an issue at the time of the research which I am reviewing in this section. As I have shown in Chapter 2, it was assumed by archaeologists that sea-levels had stabilised in the Mid-Holocene, though the term 'Pleistocene Coastline' persisted in the 1970s research.

3.4.1 Research by Roy and Peat, 1974.

Roy and Peat carried out a geological survey of the shell deposits at Clybucca and Andersons Inlet in 1974 (Figure 3.1). They found, on the banks of Clybucca Creek approximately 12 km from the coast (Figure 3.1), a 35 metre length of shell deposits consisting of whole shell and fragments of mainly oyster (*Saccostrea glomerata*), with less than one percent of cockle (*Anadara trapezia*) and whelk. The eastern end of the deposit contained a 20cm-thick lens of shell grit. The concentrated shell, with a

maximum thickness of one metre, was underlain by shelly, sandy, grey clay, downgrading to grey, clayey sand without obvious shell fragments. The base of the shell deposits was approximately 30cm below low water level in Clybucca Creek. The researchers proposed that the underlying deposits and the overlaying shell suggests a slow transformation of the original estuarine environment into an environment subjected to fluvial processes within the last 3000 to 5000 years (Roy and Peat 1974).

They also investigated shell mounds on the flood plain and found them to be 'artificial' concentrations which had been deposited by the Aboriginal people. This finding was made on the basis of the shell being totally underlain by orange-brown sand, with the shell limited to a surface expression only (Roy and Peat 1974).

A 4.5-kilometre discontinuous, elongated strip of shell from Clybucca Creek to Andersons Inlet was also investigated. The thirty centimetre thickness of the shell formed a surface deposit on the dunes at the highest level of the lens, and was underlain by thin, black, organic-rich sand, and also by peat in one section in the lower levels. The grey sand underlying the organic layer was proposed as an indication of an estuarine deposit. The authors interpret the geomorphology of Clybucca Creek/Andersons Inlet as suggesting an origin in fresh water swamps associated with fresh water drainage systems, within the dune, between the Macleay estuary and the dunes. Roy and Peat (1974) believed the estuary was in-filled with wind-blown sand, except in protected sections where decaying vegetation allowed the formation of peat beds. It was proposed that the swamp beds indicated a low-energy and protected depositional environment. As this protected environment was incompatible with a process of waves depositing the shells, they believed that the shell accumulations are again, an 'artificial' deposition, a point which had already been made by Campbell in her 1969 survey.

3.4.2 Research by Connah, 1972 – 1975

Graham Connah, along with teams from the University of New England, carried out excavations at Clybucca, Connection Creek, Maguires Crossing, an Inner Barrier site, and Stuarts Point, located by Campbell in 1969, during 1972 to 1975 (Figure 3.1).

Connah chose these sites for their variety of environmental contexts (Connah pers com, 2002), Clybucca being inland, Stuarts Point on a tidal estuary, Connection Creek adjacent to the back swamp, and the Inner Barrier and Maguires Crossing sites, though both close to the ocean, provided a slight variation in depositional environments. The summary of this research is taken from publications in the Australian Archaeological Association Newsletter (Connah 1975 and 1976), reports to the National Parks and Wildlife Service NSW (1974 and 1975), Connah, Emmerson and Stanley (1976), Connah (1978), and Knuckey (1999). More detailed descriptions of the excavations from the Field Notes supplied by Professor Connah will be used in Chapters 5 and 6.

Clybucca 3 – 1972

The Clybucca 3 midden, excavated in 1972, is described as being ‘composed of oyster (*Saccostrea glomerata*) and cockle (*Anadara trapezia*) shells, formed over a beach sand-ridge of a small bay in the Pleistocene shoreline some 10 kilometres inland from the present shoreline’ (Connah 1975:29). Two excavation pits were dug revealing large amounts of oyster (*Saccostrea glomerata*) and cockle (*Anadara trapezia*) shell, along with fish and animal bone, the fragmented remains of a human burial, and cultural artefacts which consisted of a backed blade industry with some worked bone (Connah 1975:29). The three radiocarbon dates obtained from Cutting IV-VI (I) returned ages of 3360 ± 120 BP (SUA274), 4260 ± 120 BP (SUA275), and 5120 ± 150 BP (SUA276) (Table 3.2), which Connah felt compared favourably with Campbell’s 1972 date (Table 3.1) and Thom et al (1969) for samples taken from the Clybucca area.

Table 3.3 Radiocarbon dates obtained on the Clybucca 3 site (Connah 1975:29)

Site	Location	Lab Ref	Date	Provenance	Dating Sample	Reference
Clybucca III	Inland	SUA274	3360±120	30-40cm	charcoal	Connah, 1975
Clybucca III	Inland	SUA275	4260±120	60-70cm	charcoal	Connah, 1975
Clybucca III	Inland	SUA276	5120±150	90-110cm	charcoal	Connah, 1975

Connection Creek 1 – 1973

The Connection Creek 1 site was excavated in 1973, and the dates published in 1975. This site is described as being situated approximately 4 kilometres inland from Crescent Head (the present shoreline), in an area which is now low-lying and rather swampy, but which Connah suggests may have formerly been a part of the Macleay estuary (Connah 1975:29). The oyster (*Saccostrea glomerata*) shells exhibited marked grooves on their dorsal surface suggesting they had grown attached to roots of mangroves. Two sets of paired radiocarbon dates were obtained on charcoal and shell from depths of 50-60 cm and 100-110cm, and these are marked on Table 3.3 by asterisks. These sets of dates SUA395/1 and 2 from 50-60cm below the surface, and SUA396/1 and 2 from 100-110cm below the surface were taken to determine ‘the reliability of techniques for dating shell’ (Connah 1975:30). A further two radiocarbon dates were obtained from 130-140 cm below the surface and from 40-46 cm below the surface (Table 3.4).

Table 3.4 Radiocarbon dates obtained on the Connection Creek 1 site (Connah 1975:29)

Site	Location	Lab Ref	Date	Provenance	Dating Sample	Reference
Connection Ck	Inland	SUA395/2	3340±100	50-60cm *	shell (oyster)	Connah, 1975
Connection Ck	Inland	SUA396/2	3380±100	100-110cm **	shell (A. trap)	Connah, 1975
Connection Ck	Inland	SUA396/1	3400±100	100-110cm **	charcoal	Connah, 1975
Connection Ck	Inland	SUA395/1	3720±100	50-60cm *	charcoal	Connah, 1975
Connection Ck	Inland	SUA397	3790±130	130-140cm	charcoal	Connah, 1975
Connection Ck	Inland	SUA394	4110±100	40-46cm	charcoal	Connah, 1975

Stuarts Point – 1974 and 1975

In 1974 a section of the Stuarts Point midden complex was cleaned back and a column sample taken from where a commercial backhoe trench had been dug through the midden. Figure 3.13 shows the Section drawing of Stuarts Point 4, drawn at the time of the salvage. This drawing is believed to be the most comprehensive section drawing of a midden produced in Australia at that time (Connah pers com, 2004).

Analysis of this column revealed a change in shellfish over time consistent with that which was reported for other sites in the region – with the predominant species in the lower layers being cockle (*Anadara trapezia*), and oyster (*Saccostrea glomerata*) dominating the upper layers (Connah 1976:3; Campbell 1972; Sullivan and Hughes 1978). Connah interpreted the change in shellfish deposition within the midden as ‘a possible indication of environmental change and of changing exploitation patterns’ (Connah 1976:3). A radiocarbon date obtained on oyster (*Saccostrea glomerata*) shell from the site Stuarts Point 4, taken from 2-9 inches (5 cm to 23 cm) below the surface, returned an age of 1670±90 BP (SUA398 Connah 1975:31) (Table 3.5)

Table 3.5 Radiocarbon dates obtained on the Stuarts Point site (Connah 1975, 1976)

Site	Location	Lab Ref	Date	Provenance	Dating Sample	Reference
Stuart's Pt 4	Adj tidal m'flats	SUA398	1670±90	2-9 inches	shell (oyster)	Connah, 1975
Stuart's Pt I	Adj tidal m'flats	SUA482	3750±280	Cut 1/Lay 2/Spit 8 & 9	charcoal	Connah, 1976
Stuart's Pt I	Adj tidal m'flats	SUA484	9320±160	Cut 1/Layer 2/Spit 13	charcoal	Connah, 1976

In 1975 more extensive excavations were undertaken on the Stuarts Point shell midden complex. Four cuttings were made into the midden, at right angles to the long axis of the midden (Figure 3.13), and Cutting II will be the subject of the present research.

STUARTS POINT: 1974, South Section

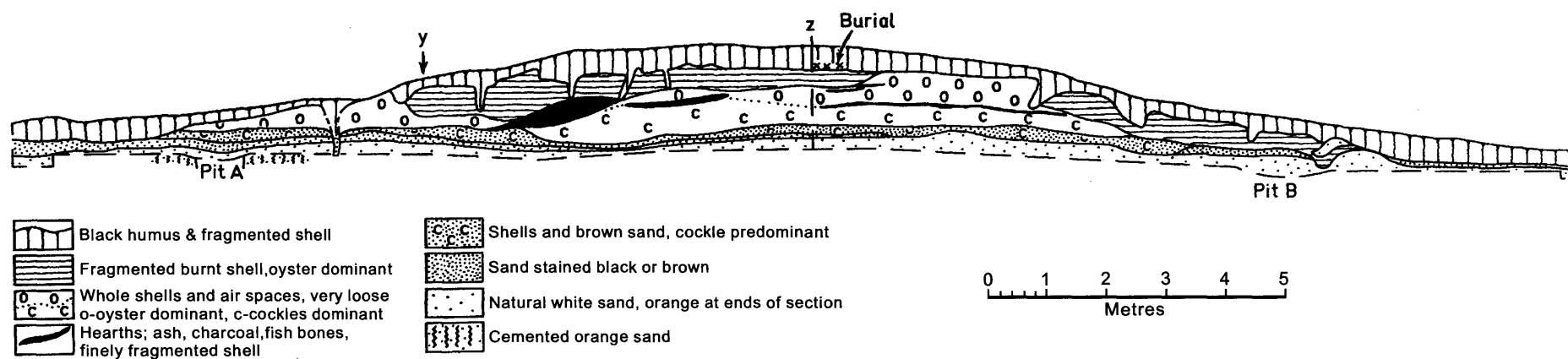


Figure 3.12 Cross Section of Stuarts Point 4 (Connah, 1975)

Radiocarbon dates obtained on charcoal from Layer 2, Spits 8 and 9 of Cutting I (90-110cm below the surface) returned an age of 3750 ± 280 BP (Table 3.5), and a further date taken from the base of the excavation (Layer 2, Spit 13) of the same cutting returned an age of 9320 ± 160 BP (Table 3.5). Connah commented that the radiocarbon dates for Stuarts Point indicated human occupation of the mid-north coast from an 'earlier time than had been assumed' and that the previous earliest date of occupation had been c. 6,000 years obtained by McBryde (1974) on the Seelands site to the north of Stuarts Point (Connah 1976:3). The 6,000 year difference in occupation time represented by the Stuarts Point dates was explained as possibly 'representing a long halt in shell deposition', and it was proposed that the change in shellfish species deposited in the midden over time could have some 'significance' (Connah 1976:3).

Maguires Crossing – 1974

This was the same site identified by Campbell (1969), located on the sand dune of the present shoreline, and consisted of two densely packed pipi shell (*Plebidonax deltoides*) bands separated by layers of shell-free sand, overlying a hearth. Charcoal from the hearth provided the material for the first radiocarbon date of 925 ± 105 BP (Table 3.6). Beneath the hearth was a thick layer of shell-free sand underlain by thin bands of pipi shell. Charcoal was scattered throughout the thin bands and was used to obtain the second radiocarbon date of 915 ± 105 BP (Connah 1976:2).

Table 3.6 Radiocarbon dates obtained on the Maguires Crossing site (Connah 1976:2)

Site	Location	Lab Ref	Date	Provenance	Dating Sample	Reference
Maguire's Cross	Sandy shore	SUA486	915 ± 105	Cut I/Layer 6	charcoal	Connah, 1976
Maguire's Cross	Sandy shore	SUA485	925 ± 105	Cut 1/Layer 4a	charcoal	Connah, 1976

The Maguires Crossing site was totally destroyed by a storm only a month or two after excavation (Connah pers com, 2002).

Inner Barrier 4 – 1974

This site was located approximately 1 km inland from the Maguires Crossing site on the inner barrier described by Hails (1967) which lies behind a swamp separating the two sites. This was a single lens shell midden. Charcoal from the lens was radiocarbon dated to 1060 ± 100 BP, and charcoal from below the lens was dated to 2550 ± 105 BP (Table 3.7) (Connah 1976:2).

Table 3.7 Radiocarbon dates obtained for the site Inner Barrier 4 (Connah 1976)

Site	Location	Lab Ref	Date	Provenance	Dating Sample	Reference
Inner Barrier 4	near swamp	SUA483	1060+100	Cut 1-4/Layer 2	charcoal	Connah, 1976
Inner Barrier 4	near swamp	SUA487	2550+105	Cut 1-4/Layer 3a	charcoal	Connah, 1976

The predominant shell species recovered from the Inner Barrier 4 excavation was pipi (*Plebidonax deltoides*), a species which inhabits sandy, surf beaches, where it occupies a habitat at low tide level, in large colonies (Coleman 1975:199; Edgar 1997:303). The presence of a significant lens of pipi shell in a site now separated from the ocean by the Outer Barrier sand ridge appears to indicate that the outer barrier may not have formed at the time that the site was occupied.

Ryans Cutting – 1974

A very minor salvage excavation was also carried out at the Ryans Cutting site, south of Maguires Crossing, in 1974. No radiocarbon dates were obtained for the site

By the end of 1975 large amounts of material had been excavated from the Macleay sites. Radiocarbon dates were published in 1975 and 1976, but it was to take more time before some of the material excavated could be analysed. Though the expectations of the researchers may have been for the dates of the sites to become older as they moved away from the coast, because of the assumption that the Clybucca sites were located on what researchers had described as the 'Pleistocene coastline', Stuarts Point provided the 'oldest' date. The dating proved to be somewhat controversial (White and O'Connell 1982:99; Beaton 1985:15), because the Stuarts Point site appeared to be so much older than other sites located near the coast. The expected pattern of inland sites being older

than those located close to the coast was reversed by the research by Connah from 1972-1975. However, the research on the collections which followed the excavations was carried out by different people looking at a single aspect of the assemblages, not really allowing for an overall discussion of the implications of the dating, or a comprehensive investigation of the environmental changes which appeared to have occurred on the floodplain.

3.4.3 Research by Coleman, 1978

Coleman analysed the vertebrate faunal remains from the excavations carried out by Connah 1972—1975 in the Lower Macleay River as a B.A. (Honours) research project in 1978. All of the vertebrate faunal remains excavated from the sites were analysed and conclusions made on a spit by spit basis, as she said ‘I was unable to locate the section drawings’, and each cutting and each spit was treated as ‘an autonomous unit’ (Coleman 1978:51). Her main conclusions from the Clybucca and Stuarts Point sites after this analysis were:

1. At Stuarts Point fish comprised 96% of the faunal material recovered by MNI and 72% of the estimated meat weight. At Clybucca fish accounted for 83% by MNI and 40% of estimated meat weight.
2. Fish were caught using both spearing and netting techniques at Stuarts Point.
3. The occupants of the Clybucca site had a greater reliance on hunting mammals as a food source, and would have had greater access to this resource. However, occupants from both sites drew upon mammals from the neighbouring dry sclerophyll forest and woodlands.
4. Fishing at both sites was adapted to the selection of particular species, predominantly those which prefer shallow water close to shore, and those which feed on or near the bottom of the estuary. Eight species of a possible 31 present in the estuarine resource zone were identified.
5. The composition of the shellfish and fish identified suggested a summer occupation of the sites.

6. No mullet (*Mugil cephalus*) remains were identified, a finding which supported the argument for a summer occupation of the sites.
7. The absence of bird remains in any great numbers suggested that the sites were not occupied in spring or early summer.
8. The Macleay sites were abandoned by 2000 BP due to changes in resource availability, particularly marine resources, caused by the siltation of the estuary.

3.4.4 Research by Callaghan, 1980.

Callaghan analysed the invertebrate remains excavated from the Lower Macleay in 1972-1975, as a B.A. (Honours) research project in 1980. Callaghan's aim in this research, along with a complete analysis of the invertebrate fauna, was to study growth increments of *Anadara trapezia* on the basis of identifying seasonality of procurement of this resource by Aboriginal people in the Lower Macleay. Again, this research was carried out on a spit by spit basis. From his study of the shellfish remains Callaghan concluded:

1. The salinity of the estuary must have been similar to the sea; and, as the salinity was relatively stable and high, the opening of the estuary to the sea must have been relatively large.
2. A relatively stable marine environment is suggested by the presence of *Anadara trapezia* throughout the archaeological deposits at Stuarts Point, even though there is a change in the predominance of cockle (*Anadara trapezia*) to oyster (*Saccostrea glomerata*) over time.
3. The biological evidence suggests a spring/summer occupation of the site.
4. The oyster (*Saccostrea glomerata*) could have had a very wide distribution within the estuary, and can tolerate a wide range of salinity levels, and even turbulence once it has attached to its substrate. A definitive time of the year in which the oysters (*Saccostrea glomerata*) were collected could not be determined.
5. The mud whelks also have a wide tolerance for salinity levels. Although present in large numbers in the Macleay middens, Callaghan thought that their economic importance was only minor.

6. There is a greater percentage of small *Anadara trapezia* in spits 9 and 10 of the Stuarts Point midden, and overall numbers of *Anadara trapezia* decrease from spit 8 to the top of the deposit.

Based upon these findings, Callaghan presented a map describing where he believed the shore of the estuary would have been at the time of occupation of the Clybucca and Stuarts Point sites (Figure 3.13). This places the middens at water's edge, and shows the Macleay as a large open estuary, rather than a floodplain bisected by the river. Callaghan has left the opening of the estuary to the ocean in its present position, north of Laggery Point, between Trial Bay and Goat Island. However the opening of the river/estuary has moved in historical times, and previously emptied into the ocean south of Smokey Cape, as was noted by Hails (Figure 3.4).

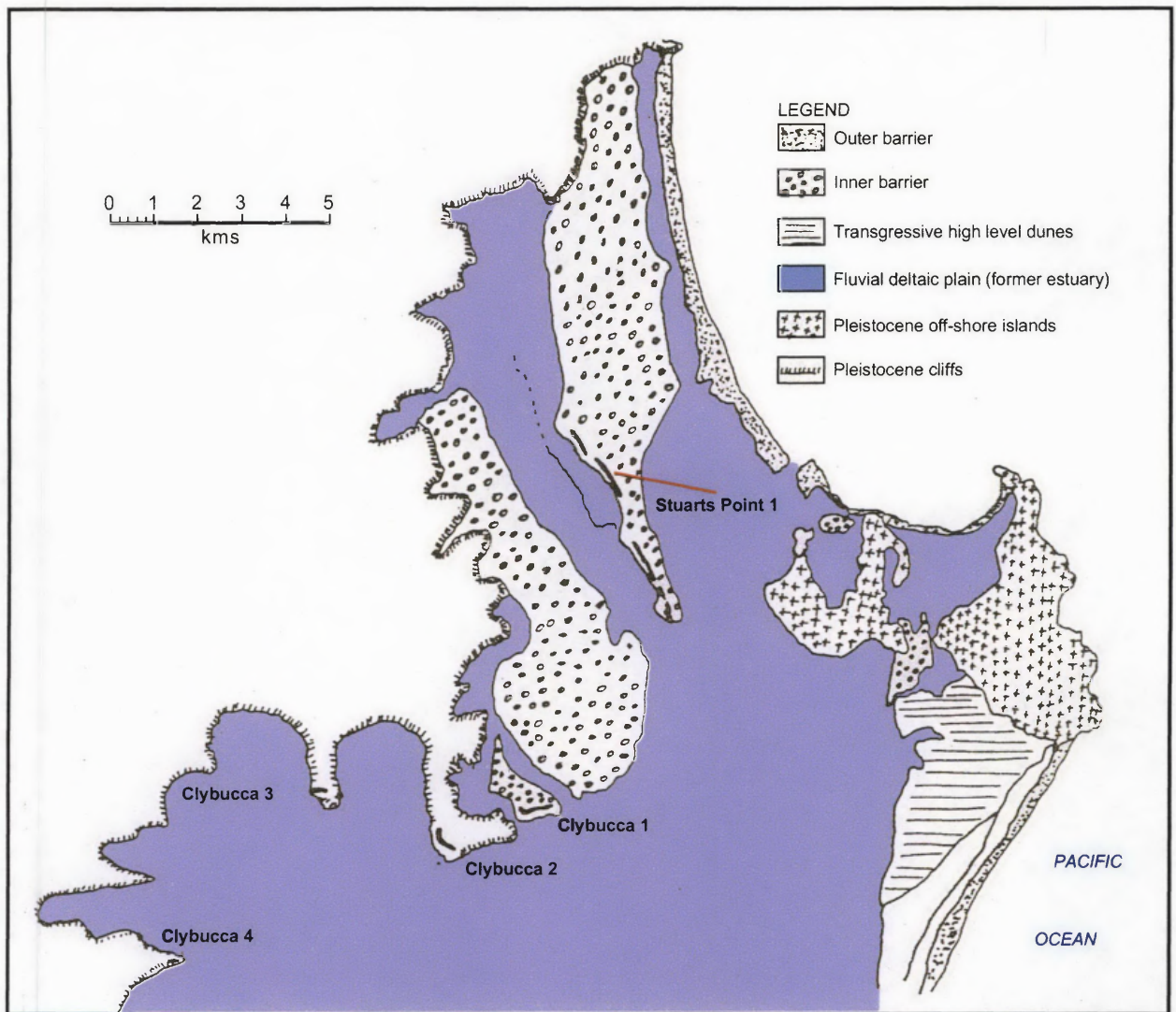


Figure 3.13 Landforms - Clybucca and Stuarts Point (Redrawn after Callaghan, 1980:118 by M. Roach)

In summary of this period, as the 1970s drew to a close a large amount of excavation had been carried out on archaeological sites in the Lower Macleay by Professor Connah of U.N.E.. Radiocarbon dating had been carried out on samples retrieved from sites at Clybucca, Connection Creek, Stuarts Point, Maguires Crossing, and the Inner Barrier (Figure 3.1). All of the dates (apart from one from Stuarts Point) had pointed to a Mid- to Late- Holocene occupation of the sites. The radiocarbon dates had been published, and some controversy later arose over whether the circa 9000 BP date for Stuarts Point was a correct representation of the age of the site (White and O'Connell 1982:99; Beaton 1985:15). The re-dating of the Stuarts Point 1 midden was undertaken as part of the present research, and the results of this are presented in Chapter 6.

Two B.A. (Hons) theses had investigated the vertebrate fauna (Coleman 1978) and shellfish remains (Callaghan 1980), and another had examined the stone artefacts (Kelly 1980), which will not be considered in detail in the present research. Both faunal studies concluded that the Macleay sites had been abandoned due to siltation of the estuary and the subsequent loss of an environment which allowed the procurement of a large amount of marine fauna.

The possibility of changing Holocene sea-levels was not proposed by any of the researchers reviewed in this section. Everyone 'knew' that sea-levels had stabilised on the Australian coast at approximately 6,000 BP (Mulvaney 1975:137; Chappell and Thom [in Allen, Golson and Jones] 1977:281).

3.5 Research carried out in the Lower Macleay since 1980

Very little archaeological research was carried out in the Lower Macleay between 1980 and 1999. Two research papers were published, Sullivan and Hughes (1982) and Knuckey (1999). The first was a result of a survey for the National Parks and Wildlife Service, and the second was a re-examination of stone-artefacts and a human burial from Clybucca. In the year 2000, Mundell researched the Northern Macleay floodplain for his B.Sc (Hons) thesis on sedimentary and geochemical processes, and an hypothesis for changing sea-levels in the region was proposed. In this section I will firstly review Sullivan and Hughes (1982) and Knuckey (1999) before examining Mundell's (2000) theories of sea-level change during the Late Holocene.

3.5.1 Research by Sullivan and Hughes, 1982.

Sullivan and Hughes surveyed the Stuarts Point midden complex (Figure 3.14) in the early 1980s for the National Parks and Wildlife Service of NSW, concentrating on mapping the extent and the boundaries of the midden complex. The map produced from this exercise (Figure 3.14) shows the extent of the remaining linear section of the midden, as well as the extent of the zone of scattered shell along the western edge of the Macleay Arm. The section of the midden on Portion 186 (Figure 3.14) had been exposed to view by a backhoe trench being cut during 1974. At this point the midden averaged 2m in height and 30m wide, and contained 'compact, well preserved, stratified shell' (Sullivan and Hughes 1978:2). To the south of this section of the midden in Portion 125 (Figure 3.15) the shell deposited was less regular and varied in width from 'a few metres to more than 20m [in diameter], and in depth from 0.5 to 1 m' (Sullivan and Hughes 1978:2-3). One mound of shell was located in Portion 125 measuring 15m diameter and 2m deep. The section of midden in Portion 125 measured around 800 m in length but had been 'breached through natural erosion' (Sullivan and Hughes 1978:3).

Further south from the 800 m length of midden on Portion 125, the deposits ceased for 50 metres, only to appear again on what appeared to be 'a distinct curved beach ridge' (Sullivan and Hughes 1978:3). This section of the midden measured 200m long by 30m wide and 50cm deep. At the southern end of the shell midden another mound was located, this one being oval in shape and measuring 50m x 30m and 2.5 m above the surface of the surrounding ground. Sullivan and Hughes noted that the predominant species of shell in the lower part of all of the sections of the midden appeared to be *Anadara trapezia* (cockle), with *Crassostrea commercialis* [*Saccostrea glomerata*] (oyster) and *Pyrazus ebenius* (whelk) becoming more dominant in the upper sections of the midden (Sullivan and Hughes 1978:2).

Sullivan and Hughes noted that the midden complex had suffered great disturbance from quarrying and the position of the access road in the southern section of the peninsula. They recommended that the midden complex 'should be protected from any further disturbance; in the case of the southernmost mound the road should be re-routed' (pp 6).

Sullivan and Hughes proposed that 'the relationship between...environmental change and prehistoric land use as reflected in shell middens is well illustrated in the Macleay River deltaic floodplain.' (1982:31). They suggested that when the sea reached its present level 6,000 years ago, the lower Macleay was a 'large open estuary' (1982:32), but has since become swampy, lowlands crossed by migrating river channels, and has in-filled with alluvial sediments. The authors believed that by 3500 BP the estuary had been largely in-filled, and estuarine sediments had given way to alluvial sediments. They also speculated that Aboriginal burning of the landscape in order to encourage more land mammals to the area may have contributed to the rapid rate of sediment accumulation.

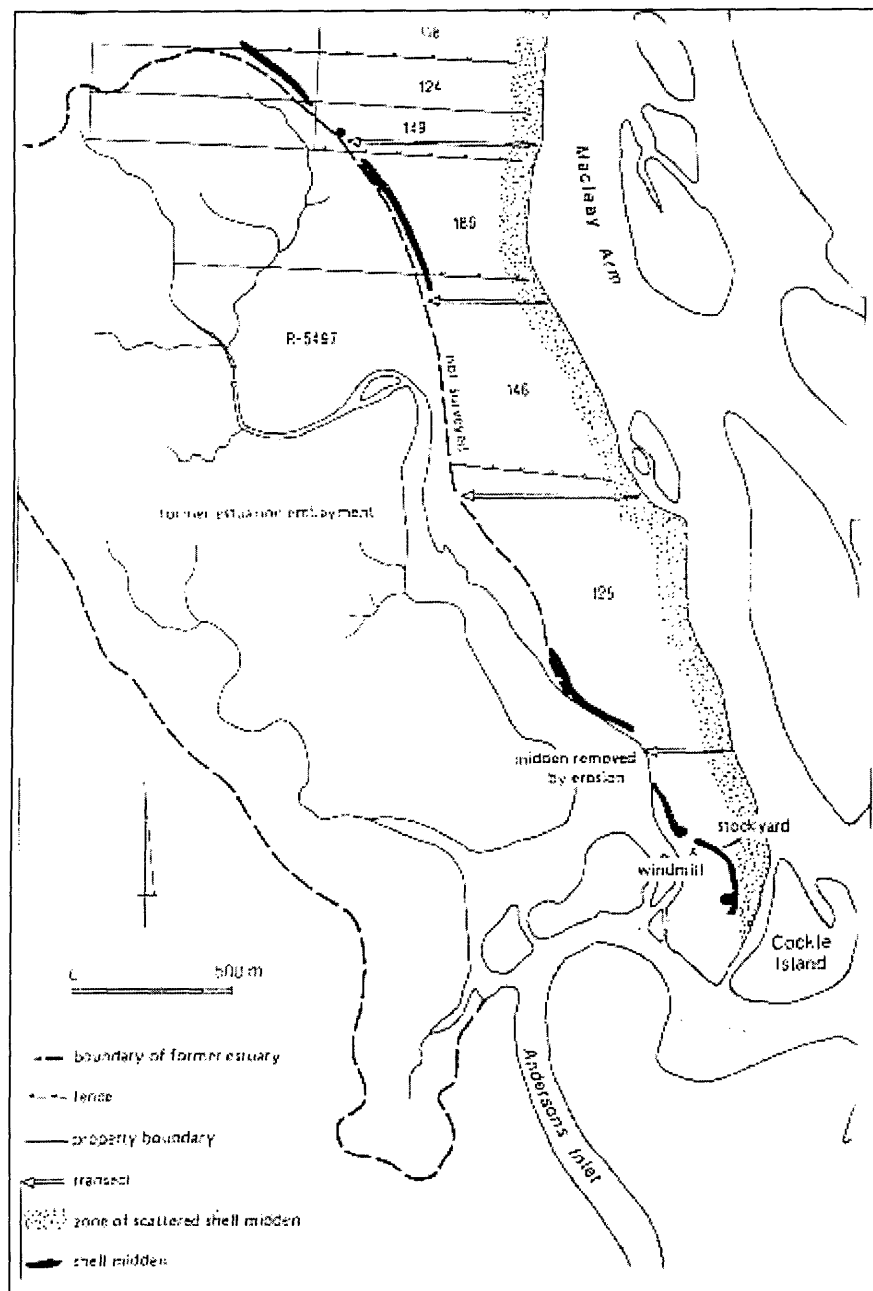


Figure 3.14 The Stuarts Point shell midden complex (Sullivan and Hughes 1982:28)

This infilling of the estuary would have affected Aboriginal use of marine resources and changed the nature and location of shell middens over time. Sullivan and Hughes state that the earliest evidence of occupation is between 5000 BP and 2000 BP, when the Stuarts Point and Clybucca shell middens would have been on the shoreline of a large open estuarine environment. The contrast between cockle (*Anadara trapezia*) in the lower deposits and oyster (*Saccostrea glomerata*) in upper deposits was seen as a reflection of the changing environmental nature of the estuary – as *Anadara trapezia* prefer a fine-textured bed, whereas *Saccostrea glomerata* will thrive in mangrove environments which provide the ‘firm substrate’ on which they grow (Sullivan and Hughes 1982:32). This concurred with the findings of Coleman (1978) and Callaghan (1980).

Sullivan and Hughes argued that the deltaic floodplain has continued to infill to the point where it now provides a suitable habitat for estuarine fish and shellfish. The authors suggest that the Stuarts Point shell midden was abandoned ‘simply because the filling of the embayment eliminated the locally available supply of estuarine food’ (Sullivan and Hughes 1982:32). This study also confirmed the large extent of the shell middens at Stuarts Point, as had been postulated by Callaghan (1980:155).

3.5.2 Research by Knuckey, 1999.

Knuckey analysed the findings of three B.A. (Hons) theses (Coleman 1978; Callaghan 1980; Kelly 1980), and re-analysed some of the excavation data for Clybucca 3 (Figure 3.12) in order to establish why subsistence strategies may have changed at the site over time (Knuckey 1999:1). It is interesting to note that the map used by Knuckey in this article also contains the ubiquitous ‘Pleistocene Coastline’ (Figure 3.15).

Knuckey examined the stratigraphic drawings made at the time of the excavation of Clybucca and concurred with the other researchers that the stratigraphy of Cutting II was

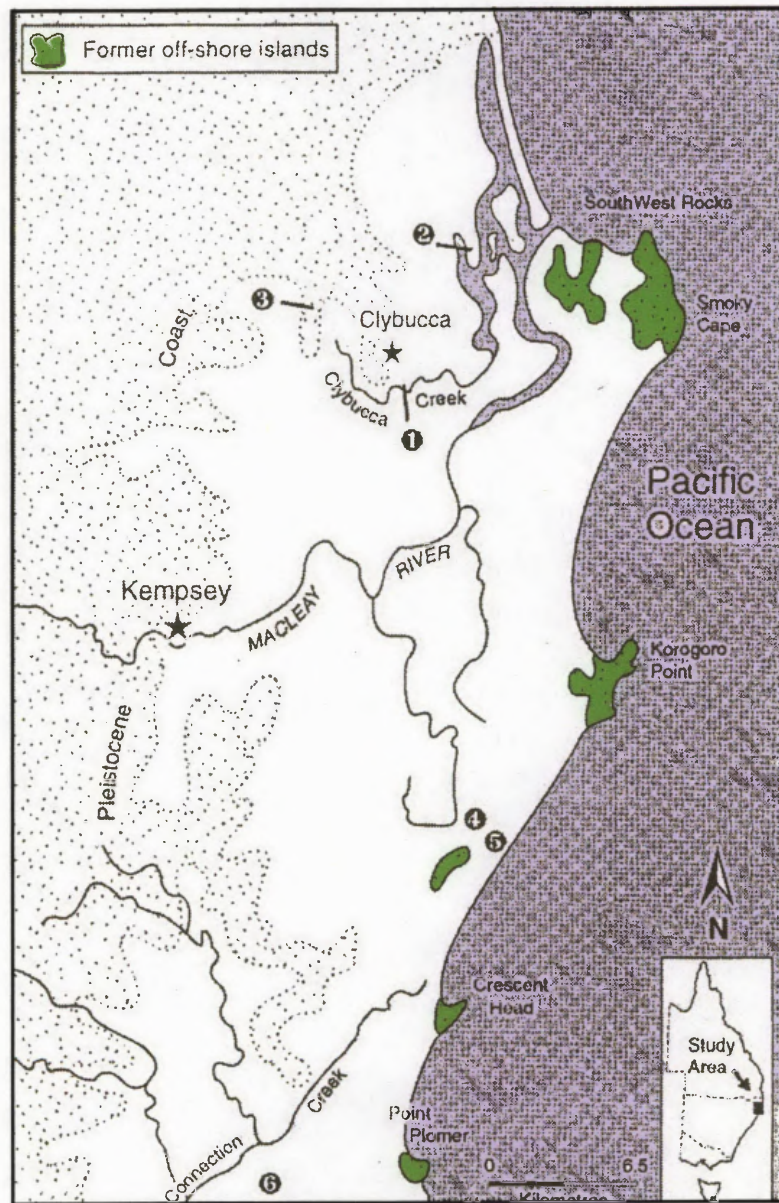


Figure 3.15 Archaeological Sites in the Lower Macleay (Knuckey 1999:1)

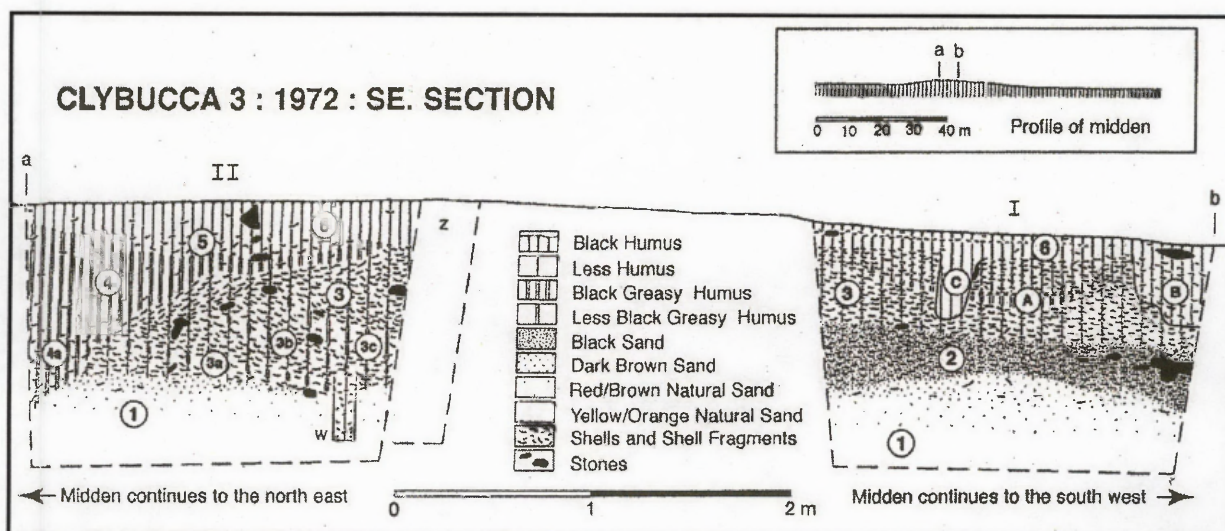


Figure 3.16 Interpretation of Clybucca 3 Stratigraphy (Knuckey, 1999)

indeed “complex” (1999:3). He identified six depositional units, five of which appeared in Cutting II, and three which appeared in Cutting I (Figure 3.16).

After his re-examination of the fish and shellfish data from Coleman (1978) and Callaghan (1980), and a re-analysis of the stone artefacts retrieved from the site, Knuckey concluded that –

1. At 5,000 BP the subsistence strategy at Clybucca was dependent upon shellfish from the tidal estuary.
2. As time passed the inhabitants of Clybucca began to incorporate more estuarine fish, and small and medium-sized terrestrial animals into their diet.
3. There was inadequate evidence to point to increasing population as a motivation for the change in resource exploitation.
4. The relatively large number of small retouched stone tools may be an indication of evidence of a ‘risk-reduction’ strategy in response to changing environmental conditions.
5. Clybucca 3 was abandoned at approximately 2,300 BP, probably because of the siltation of the estuary, and the subsequent lowering of salinity, which would have caused the loss of food resources.
6. The presence of stone tools and human remains along with food remains indicated that the site had a wide variety of uses at different times (Knuckey 1999:9-10).

In this publication Knuckey collated all of the scattered research on the Clybucca site into one piece of research, and re-analysed stone tools from a more modern perspective. However, the conclusions he reaches are basically the same as those proposed by Coleman (1978) and Callaghan (1980).

3.5.3 Research by Mundell, 2000.

Along with research into acid sulphate soils in the Lower Macleay River, Mundell researched the Quaternary sedimentary history of the Lower Macleay floodplain and estuary for his B.Sc (Hons) thesis in geology. Mundell was supervised by Peter Flood, so he was completely familiar with the Holocene higher sea-level argument and data. He questioned the theories of coastline development between 8,000 BP and the present (Mundell 2000:19), and in particular the theory that sea-levels have remained stable since 6,000 BP as proposed by Hails (1967), Chapman et al. (1982), Thom et al. (1981), Thom et al. (1985) and Lambeck (1993). Mundell's hypothesis for the formation of the Macleay estuary and floodplain incorporated the formation of two sets of beach ridge systems (The Inner Barrier) during the Pleistocene, probably at the last interglacial some 120,000 years ago. One set of ridges border the western side of the Macleay Arm, whilst the second set are located approximately 3 kilometres inland (see Figure 3.4). The Pleistocene beach ridges are separated by the Yarrahapinni Wetlands (Mundell 2000:30). Mundell stated that transgressive barrier ridges form under the influence of longshore drift when the sea level is rising, unlike Hails (1967) who proposed that barrier ridges form when a stillstand is reached when the sea has reached its highest level for that phase of transgression. Mundell found that the barrier ridge formation was some 40 metres thick near Stuarts Point, thinning towards the west. Hails had not examined the Stuarts Point area, concentrating his efforts on the region south of the Macleay River (Figure 3.4). Mundell dates the formation of the Pleistocene inner barrier to the period between 145,000 BP and 120,000 BP, based upon the dating of coral at the base of the ridges (Marshall and Thom 1976). The ridges reach a height of nine metres above mean sea level, and therefore would probably not have been inundated during sea level fluctuations in the Holocene.

Roy (1998) proposed that the Outer Barrier of the dune ridge formation formed approximately 6,000 years ago after sea level stabilisation, however Mundell proposed that these formations may be somewhat younger, and are presently still forming and transgressing (Mundell 2000:32). Mundell hypothesised fluctuating Late Holocene sea-levels based upon world-wide research into sea-levels of the Holocene, sedimentology studies, and radiocarbon dating of marine shells retrieved from coring at Clybucca and the Belmore Swamp.

Mundell proposed that during the period 3500 before the present to 1000 before the present, estuarine sedimentation was at its highest point due to marine water embayment, and that the Macleay River entrance was located near where the town of Kempsey is now situated, some 20 kilometres inland of the present river entrance (Mundell 2000:37). This is the same point that Voisey (1934) proposed as the highest point of sea transgression in his early research. Voisey could not directly date the events he was describing. He did describe the formation of the Macleay as occurring 'after the Tertiary Period', but perhaps he was not considering as late as 3,500 years ago. Mundell's model of a higher sea-level at 5,000-3,500 BP fits with the fluctuating sea-level curve proposed by Baker et al. (2001) (Figure 2.8), though Baker et al. proposed that the sea-level would have been at its highest in the Late Holocene at two metres above the present at approximately 4,000 cal BP. Baker et al. also proposed another rise in the sea-level at c. 2,000 cal BP to a height of approximately 1.25 metres above the present. Mundell's hypothesis of changing sea-level proposes that the Macleay floodplain developed from a higher sea-level of some two metres at 5,000 BP, embaying the entire floodplain during a marine transgression (Figure 3.17). The discrepancy of one thousand years between the two hypotheses, indicates a need for further research, particularly of the type that archaeology can offer. By examining the marine faunal assemblages from the Macleay midden sites, indications of any changes in the species represented in the middens may help to resolve some of the questions posed by geomorphologists and geologists.

Mundell proposed that as sea level fell after c. 3500 BP, fluvial sedimentation occurred from the point where Kempsey now stands towards the coast, developing the deltaic

floodplain which is present today. The river probably would have changed its course several times during this period, as has been witnessed in historical times with the cutting of a new entrance in the 1890s (Mundell 2000:38) and the breaching of the outer barrier in the 1900s (Hails 1967).

Mundell produced two maps illustrating how he envisaged the Lower Macleay would have been in the period c. 5,000 BP and c. 3,000 BP (Figure 3.17 and Figure 3.18). Figure 3.17, showing the Lower Macleay at 5,000 BP depicts an inland sea with the Pleistocene dune ridge evident above the water at Stuarts Point; to the east, the bedrock of Smokey Cape, and to the west, the low relief hills often referred to by researchers as the “Pleistocene Coastline” are also exposed. The second map (Figure 3.18) presents a more complex picture for the time period c. 3,000 BP. While the Pleistocene dune ridges and bedrock are still evident, much of the floodplain has now been covered by Holocene fluvial deposits, and the beginnings of the Holocene dune-building phase are evident. The north arm of the Macleay River is now evident, separating Stuarts Point from the ocean.

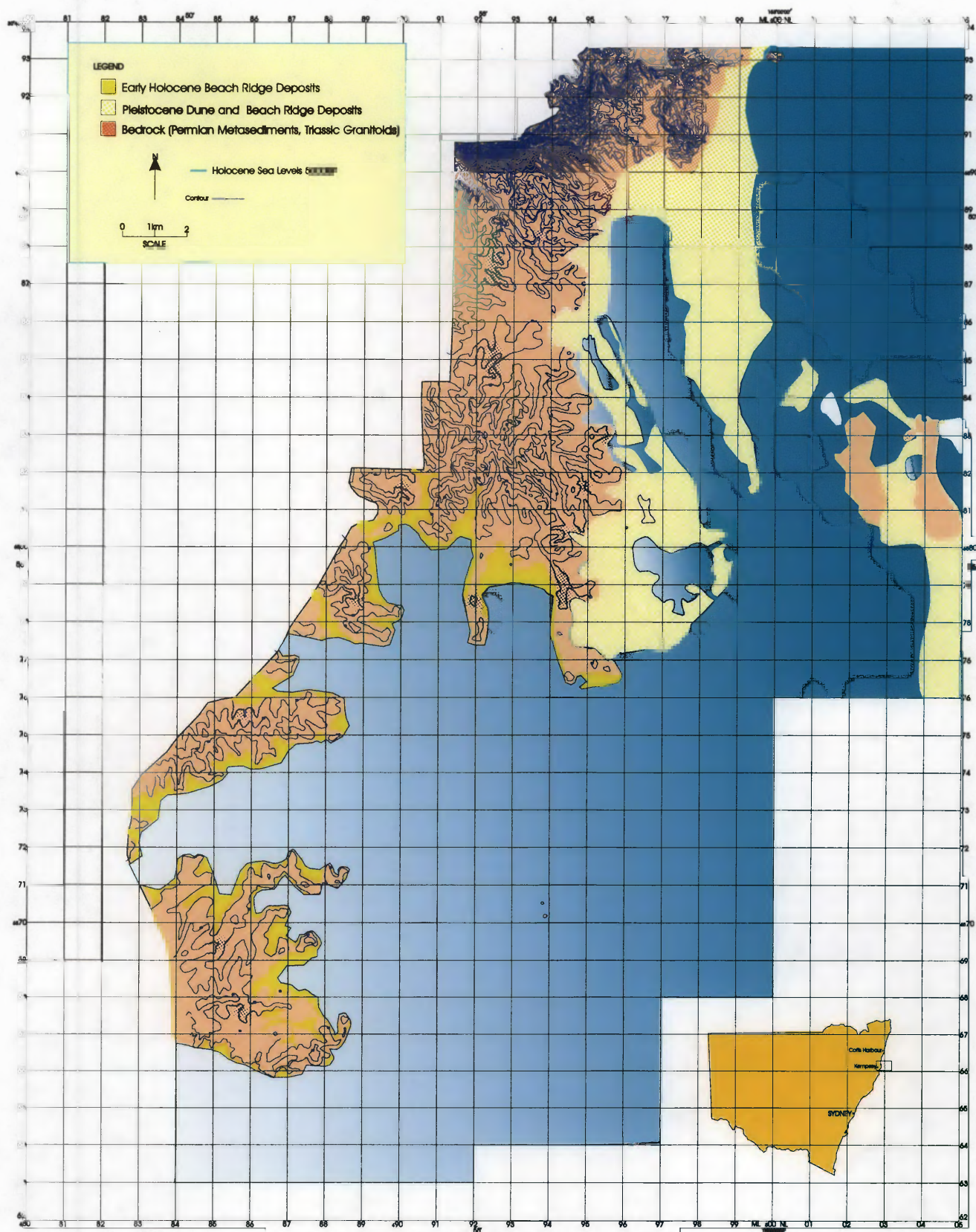
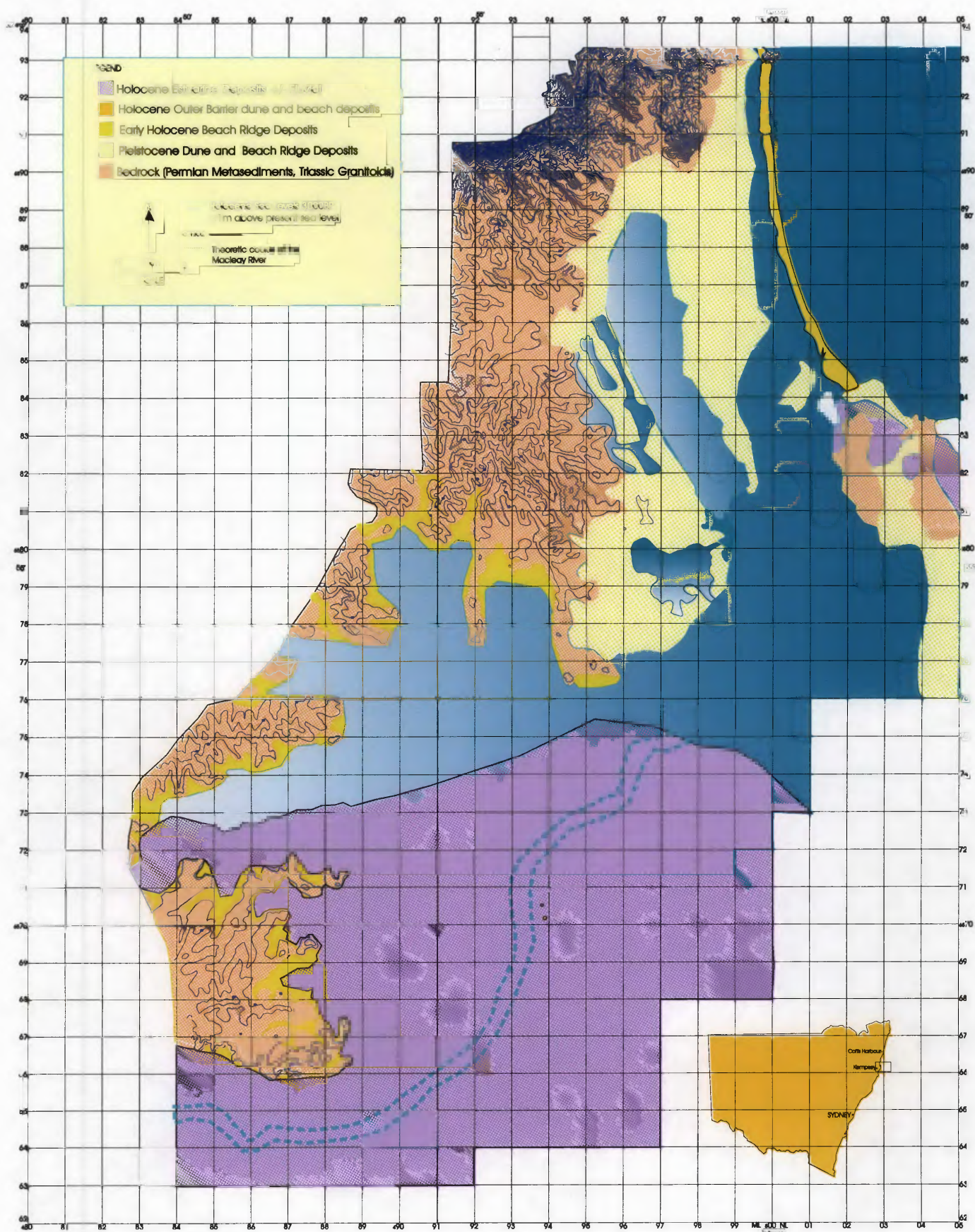


Figure 3.17 The Macleay Floodplain 5,000 BP (Mundell, 2000)



3.6 Assumptions and Remaining Questions Concerning the Lower Macleay

As can be seen by the review of previous research carried out in the Lower Macleay River, very little thought was given to the issue of sea-level changes in relation to the archaeological research undertaken in the area. This is largely because archaeologists believed that sea-levels, and therefore the coastline, had stabilised at approximately 6,000 BP. If any consideration of environmental change was given to the Macleay region, it was thought that the Macleay floodplain had probably been a more open estuary than it presently appears, but that sediment carried down from the Northern Tablelands had in-filled the shallow waters resulting in the environment which we now know. However, not enough fine-grained analysis of the sites within the specific time periods had occurred.

The importance of Mundell's (2000) hypothesis, in conjunction with research by others into sea-level fluctuation in the Holocene, is therefore that it provides a mechanism to explain environmental change in the Macleay estuary. If the sea-level had risen some two metres as proposed (Mundell 2000; Baker et al. 2001), this would have created a different environment to that proposed by the in-filling, shallow estuary hypothesis. According to Baker et al's model, the water of the estuary would have become two metres deeper at around 4,000 BP, rather than becoming shallower due to infilling by sediments. The low-relief chain of hills near Clybucca could just as easily be called the Holocene coastline, though this would be as incorrect as calling it the Pleistocene coastline. What they really are is the limit to which the sea is able to extend inland at any point in time before striking higher relief bedrock.

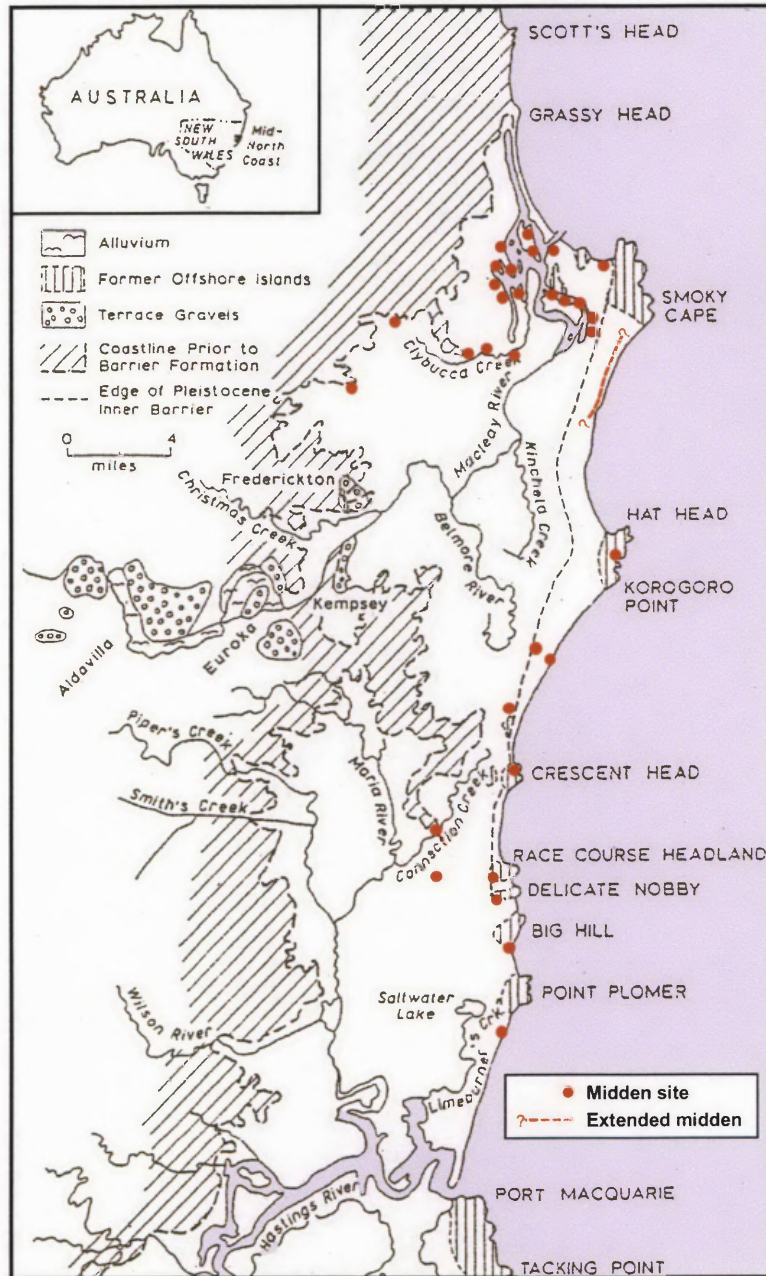


Figure 3.19 Macleay Shell Midden Sites in Relation to Landforms (after Hails, 1967; Campbell, 1969)

Midden location, relative to the coastline, was one of the variables which were identified as being important in research into changing sea-levels and midden sites in Chapter 2. When the middens located by Campbell (1969) (Figure 3.6), some of which were later excavated by Connah (1972-1975), are placed on a map such as the geomorphological map produced by Hails (1967) (Figure 3.4), it can be seen that they are not scattered randomly over the floodplain (Figure 3.19). The sites are located on the Inner Barrier, beach ridges which formed below the western hills, or the residuals (Voisey 1934), the former islands. Sites which were located on the foreshore such as Maguires Crossing have now been removed by storm activity. There are no sites located on the floodplain itself. This may be because the floodplain was under water, or because the area would have been too swampy for occupation.

Figure 3.20 shows a cross-section of the Macleay from the south-west, commencing at the 50 metre contour in the Tamban Forest (Figure 1.1), running across the floodplain in a north-easterly direction to Back Beach (Figure 1.1). The line of the cross-section crosses both the Clybucca 3 and Stuarts Point 1 midden site locations. When a line representing a sea-level two metres higher than the present is drawn on the cross-section, it can be seen that Stuarts Point is still just above the level of the sea, and Clybucca 3 is near the waters edge. Other landforms now present on the Macleay floodplain such as the land between Clybucca Creek and the Macleay Arm and Shark Island would be under water, Doughboy Swamp and the marsh area between Clybucca and Stuarts Point would have contained much more water than at present. One of the aims of this thesis is to test, through the archaeological marine faunal assemblages, if there is evidence of more water being present over the Macleay floodplain in the Mid- to Late- Holocene than there is at present.

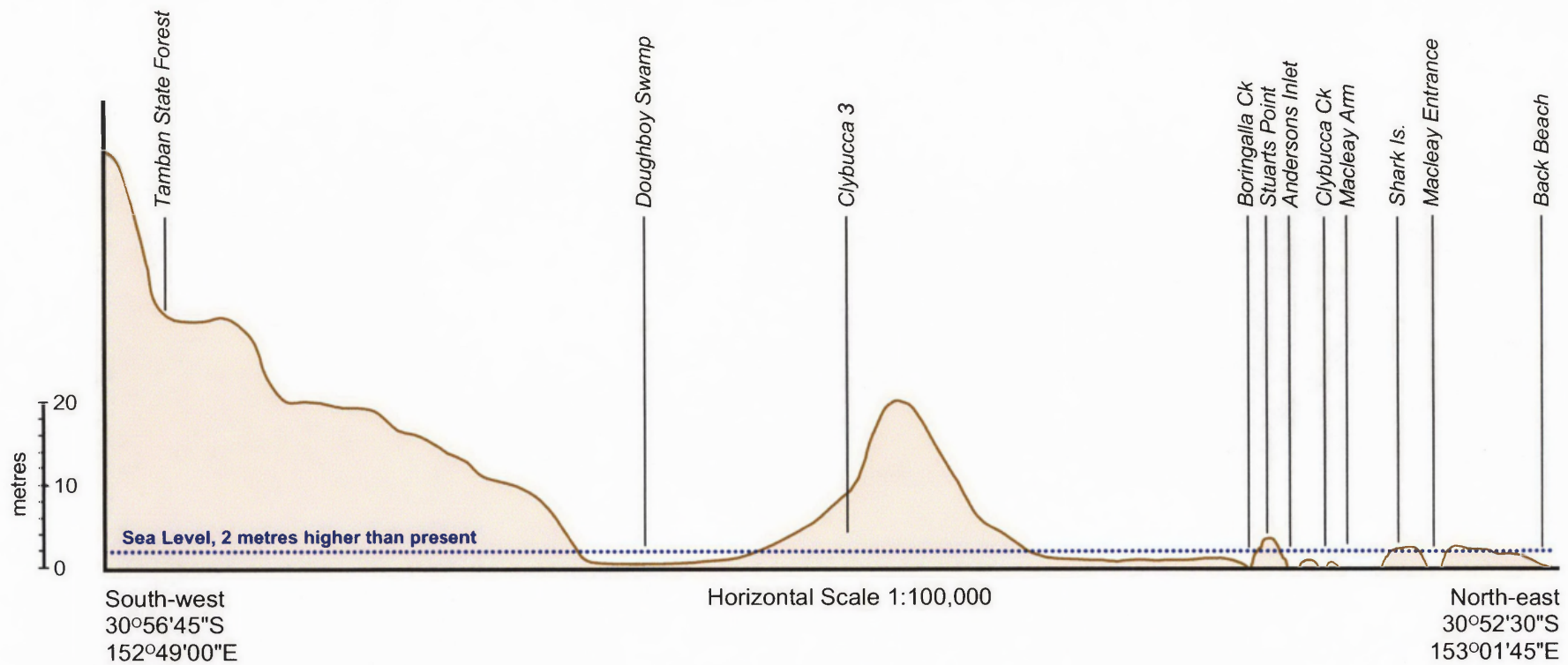


Figure 3.20 Schematic Cross-Section of the Macleay Floodplain from the Tamban Forest to Back Beach

The antiquity of the Stuarts Point I shell midden which was dated to over 9,000 BP in the 1970s also needs to be tested. As has been seen in the previous chapter, the dates proposed for archaeological sites are integral to placing palaeo-environments in their temporal context. The date obtained on charcoal at the base of the midden (Connah 1975) has been questioned by other archaeologists (White and O'Connell 1982:99; Beaton 1985:15) because it was thought that the charcoal could have been introduced into the midden from older burning of vegetation; and also because was so much older than other radiocarbon determinations obtained for middens in the Macleay (Table 3.8).

Table 3.8 All Radiocarbon Dates Published for Lower Macleay Sites to 2000

Site	Location	Reference	Date	Provenience	Dating Sample	Reference
Clybucca I	Inland	GAK2457	3850±140	24-30 inches	charcoal	Campbell, 1972
Clybucca III	Inland	SUA274	3360±120	30-40cm	charcoal	Connah, 1975
Clybucca III	Inland	SUA275	4260±120	60-70cm	charcoal	Connah, 1975
Clybucca III	Inland	SUA276	5120±150	90-110cm	charcoal	Connah, 1975
Connection Ck	Inland	GAK2456	1210±90		shell	Campbell, 1972
Connection Ck	Inland	SUA395/2	3340±100	50-60cm *	shell (oyster)	Connah, 1975
Connection Ck	Inland	SUA396/2	3380±100	100-110cm **	shell (A. trap)	Connah, 1975
Connection Ck	Inland	SUA396/1	3400±100	100-110cm **	charcoal	Connah, 1975
Connection Ck	Inland	GAK2459	3460±120	25 inches	shell (oyster)	Campbell, 1972
Connection Ck	Inland	SUA395/1	3720±100	50-60cm *	charcoal	Connah, 1975
Connection Ck	Inland	SUA397	3790±130	130-140cm	charcoal	Connah, 1975
Connection Ck	Inland	SUA394	4110±100	40-46cm outside	charcoal	Connah, 1975
Connection Ck	Inland	GAK2458	4850±160	28 inches	shell (oyster)	Campbell, 1972
Stuart's Pt I	Adj tidal m'flats	SUA482	3750±280	Cut 1/Lay 2/Spit 8 & 9	charcoal	Connah, 1976
Stuart's Pt I	Adj tidal m'flats	SUA484	9320±160	Cut 1/Layer 2/Spit 13	charcoal	Connah, 1976
Stuart's Pt IV	Adj tidal m'flats	SUA398	1670±90	2-9 inches	shell (oyster)	Connah, 1975
Maguire's Cros	Sandy shore	SUA486	915±105	Cut 1/Layer 6	charcoal	Connah, 1976
Maguire's Cros	Sandy shore	SUA485	925±105	Cut 1/Layer 4a	charcoal	Connah, 1976
Maguire's Cros	Sandy shore	GAK2456	1210±90	4-7 inches	charcoal	Campbell, 1972
Inner Barrier 4	swamp	SUA483	1060±100	Cut 1-4/Layer 2	charcoal	Connah, 1976
Inner Barrier 4	swamp	SUA487	2550±105	Cut 1-4/Layer 3a	charcoal	Connah, 1976

The Stuarts Point midden is situated on top of a late Pleistocene sand dune dating to approximately 135,000 – 120,000 before the present (Mundell 2000), so it is credible that it might not have been as greatly affected by fluctuating sea levels as the topographically lower sections of the floodplain. It may have been the actual foreshore prior to the formation of the outer barrier. Re-dating of the midden might help to clarify the depositional history of the midden, and contribute to the present research by more

precisely positioning, in time, any changes in the marine fauna identified in the re-analysis.

Another of the variables which was found to be important in researching sea-level change and shell middens is change over time in the contents of the midden. If a significant sea-level change had occurred in the Macleay region, the marine fauna should show some evidence of this – as species either adapt to the changing environmental conditions, or disappear through death or moving to a more suitable habitat. Campbell's (1969) assertion of a change through time from cockle (*Anadara trapezia*) to oyster (*Saccostrea glomerata*) provides a tantalising hint that the shellfish of the Macleay may have been subject to such changes. Re-examination of the excavated shell data may therefore help to clarify the reasons behind Campbell's finding; and, in conjunction with the re-dating of Stuarts Point, serve to identify any links between changing patterns of marine fauna and the dates proposed for emergence and transgressive episodes along the eastern coast of Australia.

The idea of the sites having been occupied in summer because of the lack of mullet remains has been shown to be based upon inaccurate analysis or interpretation of the evidence of the fish remains assemblage (Vale 2002). This was the result of identification practices which did not take into account the skeletal morphology of some fish. When only using bones of the cranium or dentition for identification, species which have very fine dentitions, such as mullet, will be missed as they will probably not survive burial. Re-analysis of the fishbone assemblage from Clybucca and Stuarts Point will test the relative abundance of mullet compared to the other species identified.

Overall, the Macleay sites have lacked holistic analysis – with one researcher concentrating on one particular aspect, while another would look at a different aspect. All of the archaeological research proposed environmental change for the changes evidenced in the faunal assemblages, and for the final abandonment of the sites. However, all proposed an infilling of the marine embayment by riverine sediments. The opportunity to re-examine and re-analyse all of the archaeological material from

Clybucca 3 and Stuarts Point I, in conjunction with the new theories on sea-level fluctuations in the Late Holocene, should provide a clearer picture of the middens' history, and consequently, of the life of Aboriginal people in the Lower Macleay during this period.

3.7 Conclusion

The Lower Macleay region can be seen to have generated considerable, though episodic, research in archaeology as well as geology and geomorphology throughout the twentieth century, but more research is needed to test hypotheses of sea-level change in the Mid to Late Holocene. In this chapter I have also shown how the archaeological view of the Macleay sites came to be influenced by early researchers who assumed that the sea-level in the region was higher in the Pleistocene than in the present. I outlined the problems inherent in this view, and in the failure of archaeologists to take into account the many variations of the sea-level during the Pleistocene period – nor to consider that sea-level may not have remained constant since 6,000 years before present. This led to my discussion of recent geological research which, together with theories of fluctuating sea-levels that have been reintroduced in the last decade (see Chapter 2), provides the basis for my stated intention of testing whether the placement and content of Lower Macleay shell middens supports a stable or a changing coastline during the Late Holocene. In the following chapter I discuss the methods I chose for re-analysing and re-interpreting the Clybucca 3 and Stuarts Point 1 sites. I also present the methodological basis upon which the archaeological evidence can be used to test the hypothesis that sea-levels have not remained stable in the Mid- to Late-Holocene.