

ARCHAEOLOGICAL INVESTIGATIONS IN THE NORTHCLIFFE DISTRICT, WESTERN AUSTRALIA

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ABSTRACT

Traditional Aboriginal land use and subsistence in the Northcliffe district, Western Australia was probably similar to that recorded in other south western coastal districts during the 19th century. Examination of prehistoric Aboriginal campsites in the vicinity of Northcliffe and on the coastal plain reveals that Aboriginal stone workers used local chert, silcrete, quartz, and other stone. They quarried silcrete extensively at an outcrop near Northcliffe from before 6780 years BP until at least 3000 years BP. Area stone artifact assemblages contain diverse retouched tools made on flakes and blades, notably geometric microliths.

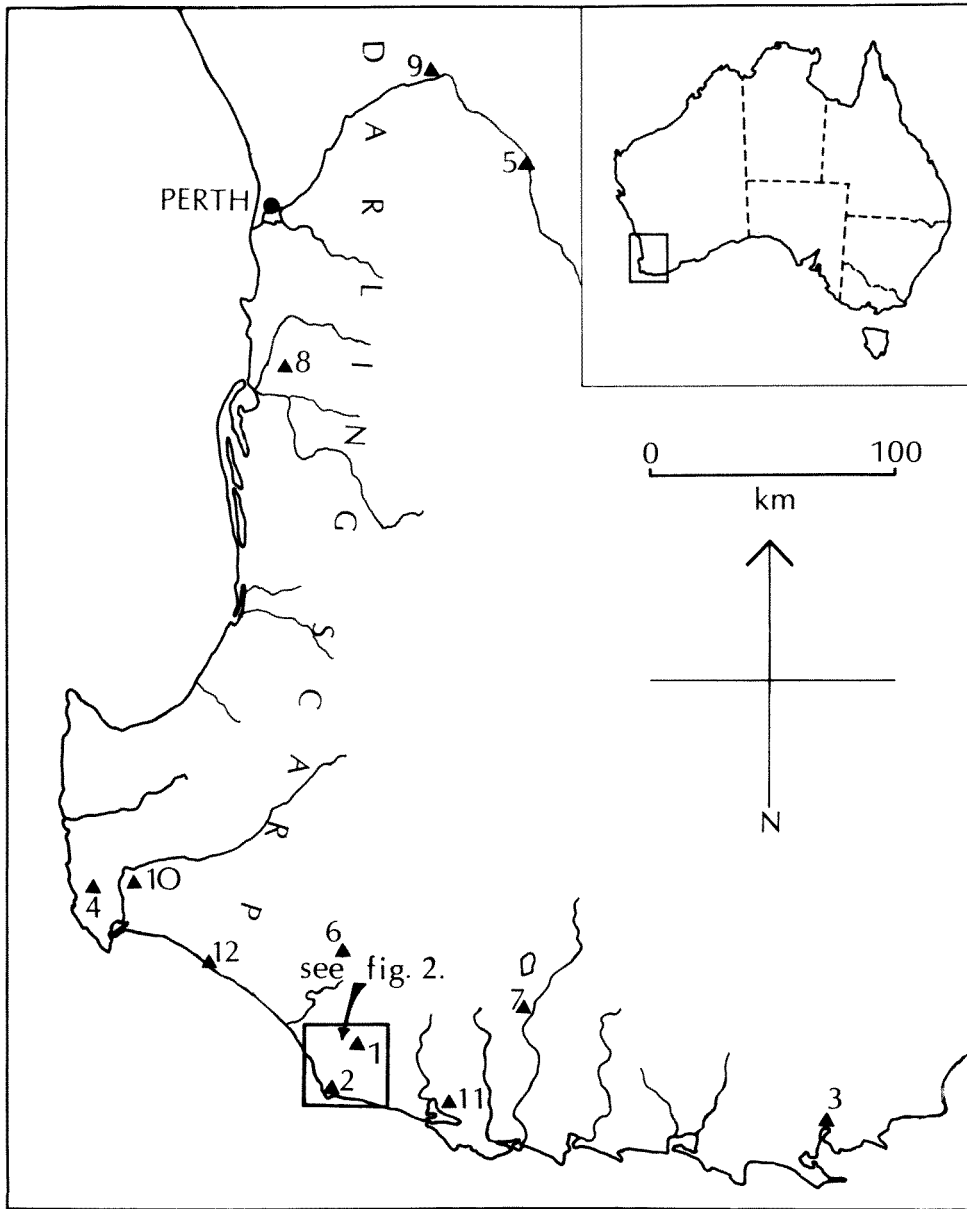
A wooden fish trap on a freshwater creek near Point d'Entrecasteaux suggests that traditional freshwater fishing methods were highly developed. Marine mollusc shells at archaeological sites in coastal dunes around Malimup are tentatively interpreted as food remains. The scarcity of biotic material in known archaeological deposits at present prevents definitive assessment of prehistoric Aboriginal subsistence and land use.

INTRODUCTION

For the past few years Mr A. Jackson and ourselves have recorded archaeological sites in the area around the town of Northcliffe, W.A. and on the coastal plain between Northcliffe and Point d'Entrecasteaux 25 km to the south (Maps 1, 2). In this account we describe some of these sites and

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Map 1: South western Australia. The map numbers refer to the following localities mentioned in the text.

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|-------------------------------|----------------------------------|
| 1. Northcliffe | 7. Frankland River |
| 2. Point d'Entrecasteaux | 8. Serpentine, Murray Rivers |
| 3. King George Sound (Albany) | 9. Swan-Avon River |
| 4. Devil's Lair | 10. Hardy Inlet, Blackwood River |
| 5. York | 11. Broke Inlet |
| 6. Pemberton | 12. Cape Beaufort |

archaeological material collected from them and assess traditional Aboriginal economy in the district.

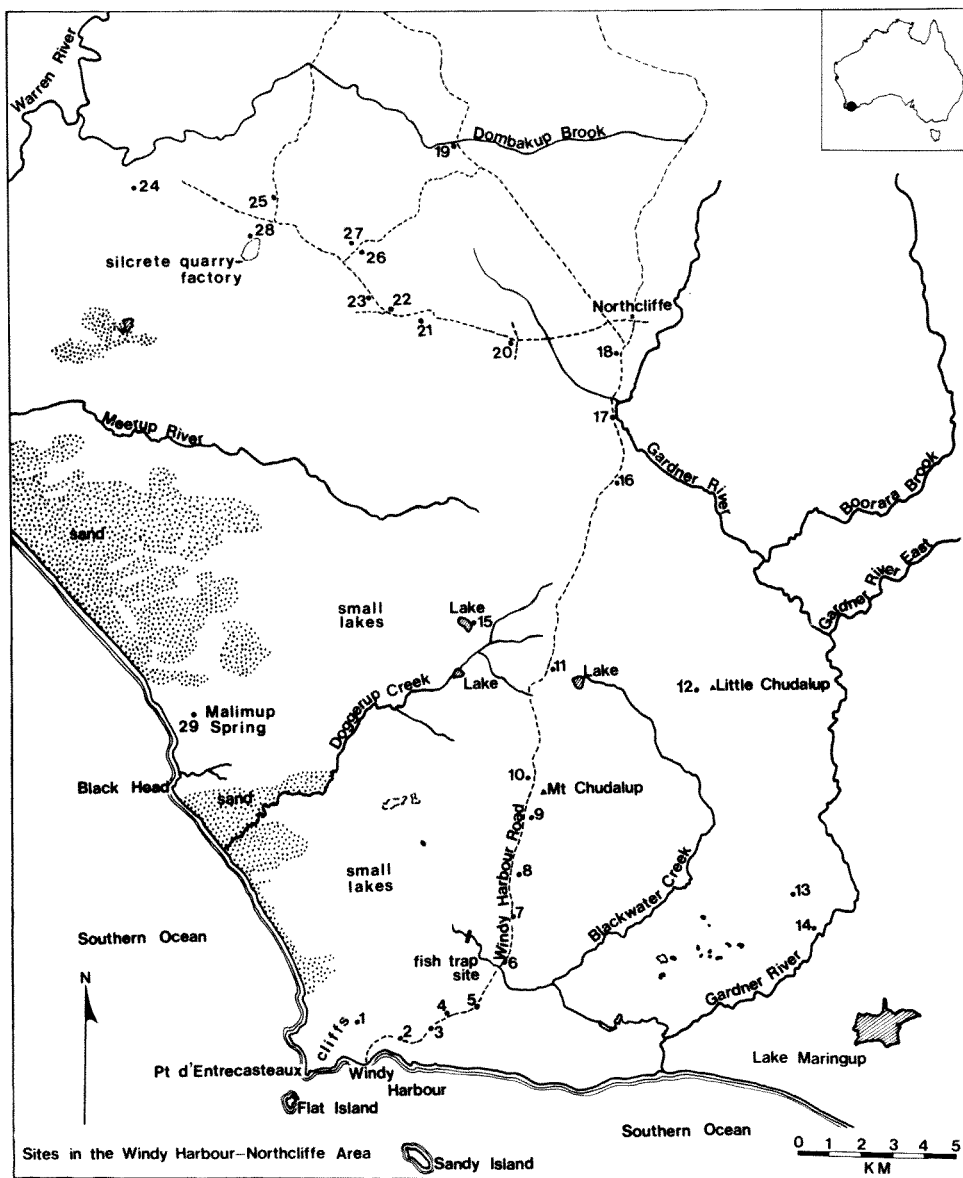
Prior to the early 1920s the Northcliffe district had not been settled by Europeans. At that time the district began to be farmed by British migrants of the group settlement scheme, and timbering became important, the main trees exploited being karri (*Eucalyptus diversicolor*) and jarrah (*E. marginata*). The coastal plain to the south has never been occupied or used by Europeans on a year-round basis, and except for a small summer resort at Windy Harbour one km east of Point d'Entrecasteaux, the coastal plain remains unsettled. The Malimup Spring area (Map 2) was used by pastoralists for summer cattle grazing as early as the 1880s and for several decades following. Traditional Aboriginal culture disappeared on the south coast during the 19th century, and the last visits to the Northcliffe district by small groups of culturally disoriented south western Aborigines took place in the 1920s.

THE AREA

The study area comprises the zones of forest, woodland and open plain between Dombakup Brook and Point d'Entrecasteaux (Map 2). The Gardner River forms the area's eastern boundary; its western boundary is a line extending from the junction of Dombakup Brook and the Warren River southward to Malimup Spring. The climate here is of a very wet Mediterranean type with an annual rainfall average exceeding 1400 mm (McArthur and Clifton 1975: Fig. 1, Table 2) and a nine month growing season. Periods of summer drought are not usually prolonged. Frost is rare and the winter is characterised by drizzle, rain and occasional periods of high winds.

In broadest terms area stratigraphy comprises leached sands of Quaternary age overlying a Pre-Cambrian basement of igneous and metamorphic rocks (Western Australia, Geological Survey 1975). Siliceous stone of probable Tertiary age outcrops locally though until now these have not been described, and their stratigraphical positions are not fully resolved. Formations of Quaternary limestone occur along the coast, the most dominant of these being the 105 m high headland of Point d'Entrecasteaux. The soils of the district consist very largely of podzols and podzolised sands. There are also smaller areas of gravelly red earths and patches of laterite (McArthur and Clifton 1975). The coastal plain, particularly the southern part, is covered by extensive marshes separated by east-west oriented low sand ridges. Further to the north west are massive inland sand hills (notably the Yeagerup Dunes) which encroach on a vast area of heathland and scrub. These sand hills consist of undifferentiated white siliceous

sands, whereas extensive beach and coastal dunes are unconsolidated calcareous sands (McArthur and Clifton 1975, Fig. 6). The principal streams are the Gardner River and its western tributaries, Doggerup Creek, the Meerup and Warren Rivers and Dombakup Brook (Map 2). There are numerous small lakes and swamps in the poorly drained northern part of



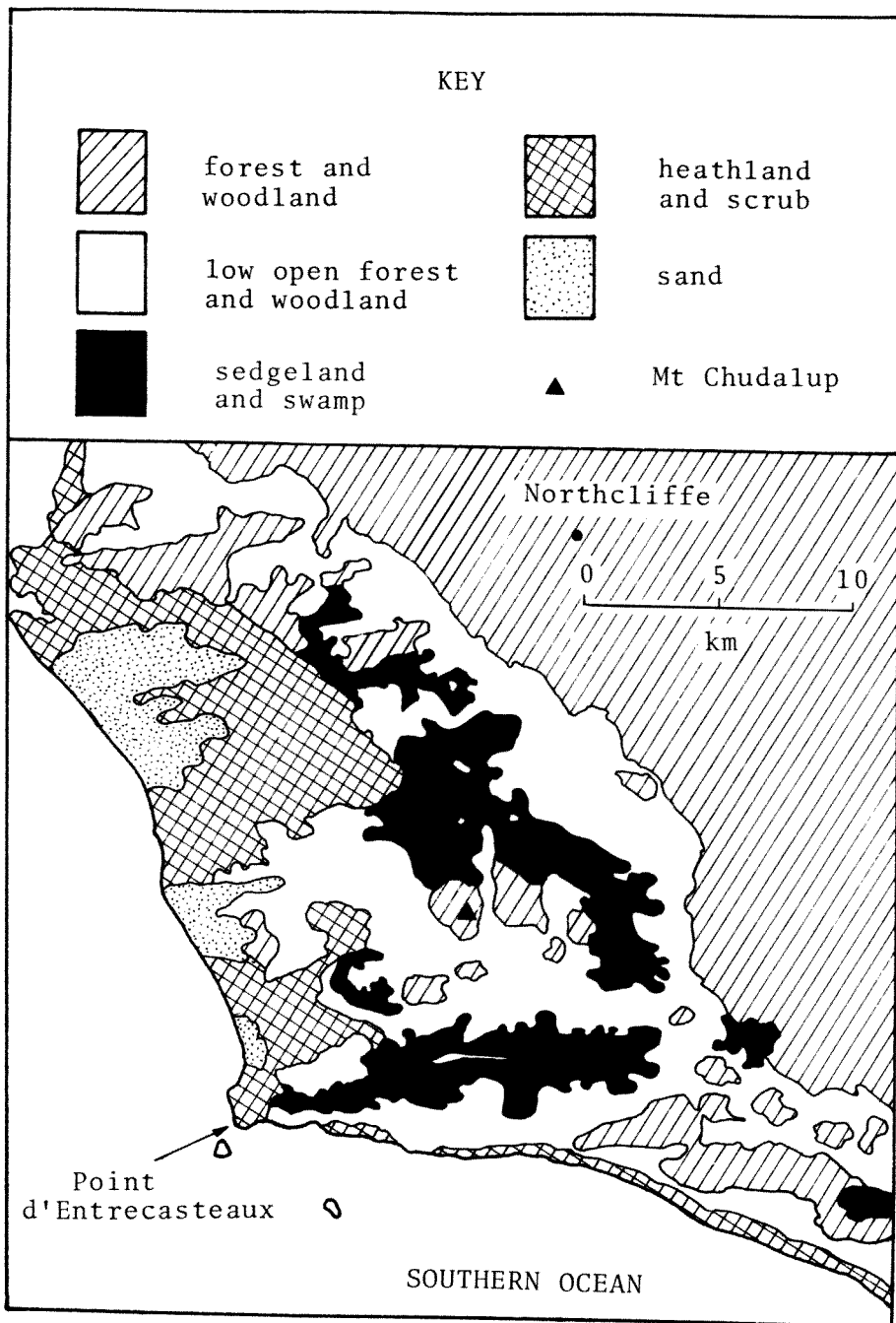
Map 2: The Northcliffe district, Western Australia with numbered archaeological sites.

the coastal plain. The southern part of the plain is drained by several tributaries of the Gardner River, the most important of these being Blackwater Creek.

The headland of Point d'Entrecasteaux and coastal dunes to the north west are covered with heath vegetation and stunted trees, principally banksias (*Banksia* spp.), peppermints (*Agonis flexuosa*) and acacias (*Acacia decipiens*) (McArthur and Clifton 1975; Smith 1972). Malimup, a complex of heath covered dunes and interdunal woodland and swamps, is notable for its abundant freshwater springs and caves developed in the limestone substrate. The northern part of the sandy coastal plain is interspersed with numerous outcrops of Pre-Cambrian granite with Mt Chudalup, the highest (185 m a.s.l.) and most conspicuous of these, occupying a central position (Maps 2, 3). The soils derived from the granite outcrops support stands of eucalypt forest and woodland of the same species which are found around Northcliffe. The sand ridges and some well drained sandy soils of the coastal plain support eucalypts (*Eucalyptus* spp.), banksias, acacias, (*Acacia* spp.), peppermints and occasional Christmas trees (*Nuytsia floribunda*). Large trees do not occur on the plain except in the well sheltered interdunal swales at Malimup, on the granitic outcrops in the Mt Chudalup area, and on the timber islands of the northern part of the plain. The chief tree species in the swamps are paperbarks (*Melaleuca* spp.), *Banksia littoralis* and Warren River cedar (*Agonis juniperina*). Smith (1972, pp. 13-14) lists the species of rushes, sedges, herbs and shrubs which dominate the swamps and sedgeland.

Uncleared areas in the sandy soils around Northcliffe support forest and woodland dominated by five species of eucalypts: jarrah, karri, marri (*E. calophylla*), blackbutt (*E. patens*) and bullich (*E. megacarpa*). Other trees, including understorey forms, are peppermints, banksias, sheoaks (*Casuarina* sp.), acacias and blackboys (*Xanthorrhoea preissii*). North of Dombakup Brook (Map 2) there are extensive stands of high karri forest growing on soils developed on the Pre-Cambrian country rocks. Karri forest extends over the whole of the dissected plateau around Pemberton 30 km north west of Northcliffe.

Thus a north-south transect of this area (Maps 2, 3) begins with karri or jarrah-marri forest or woodland formations which about eight km south of Northcliffe give way to the sedgeland, swamps, small lakes, low sand ridges and timber islands of the northern or upper part of the coastal plain. South of Mt Chudalup the lower part of the plain with its east-west oriented sand ridges and broad areas of swamp, sedgeland, heathland, scrub and low open woodland extends to the coastal dunes.



Map 3: Vegetation formations in the Northcliffe district, Western Australia, based on Smith (1972).

ABORIGINAL ECONOMY

Meagher (1974) and Hallam (1975) have used the abundant ethnohistorical sources available to infer Aboriginal land use and subsistence patterns in the south west (Map 1) at the end of traditional times. In broadest terms these seem to be that the economy was based on the systematic and to a very large extent seasonal exploitation of a very wide variety of food resources of coastal and adjacent inland districts; that economic activities often required co-ordinated group effort within a system of group land tenure; and that regular burning, used in vegetation management and animal drives, was a significant controlling device.

Hallam (1975) shows that Aboriginal economic activities as observed at King George Sound (Albany) 160 km east of Northcliffe (Map 1) were much the same as those recorded in the Perth district and other parts of the Swan (or western) Coastal Plain. The similarities in economy, and also in the food resources and environments of the Swan Coastal Plain and the South Coast, suggest to us that traditional Aboriginal economy and land use in the Northcliffe district was little different from that recorded ethnohistorically in the above mentioned districts. Therefore in the following we have used this body of ethnohistorical data in inferring some aspects of traditional land use and economy in the area round Northcliffe.

Ethnohistorical data for the Northcliffe district are minimal. Virtually the only published observation of Aboriginal activities here was recorded in April 1831 by a British naval party who before stranding their boat west of Point d'Entrecasteaux had 'heard the natives and saw their fires about a mile up the river.' (Anon. 1833, p. 116.) There is no indication whether these Aborigines were engaged in fishing, burning off the vegetation, or other likely autumn economic activities. The river referred to is the Gardner (Map 2).

A number of ethnohistorical accounts (for detailed references see Hallam 1975; Meagher 1974) suggest that to the south western Aborigines the food and other resources of the coastal plains were at least as important as those of adjacent inland districts (e.g. the Darling Scarp). Ethnohistorical accounts, notably Grey (1841, vol. 2, pp. 258-299) and Moore (1884), emphasise the variety of the coastal plain food resources which included not only marine and freshwater fish but also many terrestrial and freshwater plant and animal foods. Certainly many of the latter were available both on the coastal plains and in the interior, including most genera of mammals, many species of reptiles and amphibians and some of the same plant foods. However the wetlands of the coastal plains have a much more varied component of plant species with edible roots such as herbs, rushes and sedges, orchids,

lilies and lily-like species (Erickson *et al.* 1973), and some of these are recorded by Grey (1841, vol. 2), Moore (1884), Nind (1831) and others as being regular items of diet. Meagher, in her detailed account of south western foods writes:

'Roots, bulbs and tubers appear to have been the main sources of vegetable food, some of which were available throughout the year. Those collected and eaten by the Aborigines included species of *Caesia*, *Dioscorea*, *Haemodorum*, *Platysace*, *Prasophyllum*, and *Typha*.' (1974, pp. 24-25.)

Most of these genera occur in the coastal plain south of Northcliffe or in swamps and streams in the eucalypt forest and woodland around Northcliffe. The notable exception is *Dioscorea* (*D. hastifolia*) which is confined to soils on and east of the Darling Scarp (Erickson *et al.* 1973).

Other plants with edible parts which occur in the area are zamia palms (*Macrozamia riedlei*) the fruit of which was processed to remove toxins and then eaten raw or roasted by south western Aborigines (Grey 1841, vol. 2, p.296; Hammond 1933, p.28). Moore (1884, p.3) reports that part of the crowns of blackboys (*Xanthorrhoea preissii*) and gum from (the flower stalks of) these plants were eaten. The fruits of several plants, e.g. those of the 'emu plum' (*Podocarpus drouynianus*), were eaten by south western Aborigines (for references see Meagher 1974). Eucalypt and banksia nectar was a favourite food, and acacia seeds and gum were in some districts seasonal staples (Hammond 1933; Moore 1884). The Aborigines also ate several species of fungi (Meagher 1974, p.26). One of these, 'blackfellows' bread' (*Polyporus mylittae*), appears in quantity following burning in the karri forests, including those occurring in the Northcliffe district, and this fungus may have been commonly eaten during the summer and autumn months (pers. comms T. Macfarlane, D. Phillips-Jones). Plant genera with edible parts which may have been eaten in the Northcliffe district but have not been clearly identified in the south western ethnohistorical sources (cf. Meagher 1974, Appendix 4) include several species of aquatic herbs (e.g. *Triglochin* sp.), some of the sedges (e.g. *Scirpus* sp.), some of the lily-like plants (e.g. *Anigozanthos flavida*), and fruits or berries of *Leucopogon* sp., *Persoonia* sp. and other shrubs.

Animal foods of the coastal swamps, streams and marshes included several species of fish and water fowl, freshwater crayfish, frogs and tortoises. Grey (1841, vol. 2, pp. 280-284, 287-88) provides detailed accounts of the snaring or gathering of these animals. He observed that the streams, lagoons and marshes were utilised most in summer when their waters were shallow or dried up and the animals most easily obtained. Freshwater and

estuarine fish were taken in quantity especially during summer and autumn according to sources quoted above and others listed in Meagher (1974). Freshwater and marine molluscs abound in the waters of the district, yet evidence of Grey (1841, vol. 1, pp. 292-7; vol. 2, pp. 263, 288), Moore (1884, p.51) and Nind (1831, p.34) suggests that south western Aborigines did not eat these animals. The coast below Northcliffe has no large estuaries such as Hardy or Broke Inlets (Map 1), and it is debatable whether the open coast was ever fished. Possibly Aborigines were able to spear or trap fish in the relatively sheltered waters of Windy Harbour (Map 2). Evidence for freshwater fishing is provided by an Aboriginal fish trap located on Blackwater Creek (Map 2; see below).

Meagher (1974) provides a comprehensive ethnohistorical source list and summary of hunting methods used by south western Aborigines, and we assume that many of these methods were used by Aborigines of the Northcliffe district in hunting game both large and small. Large game, such as emu or kangaroo, was usually speared either following stalking by individual hunters, or during the course of various kinds of large scale hunts in which numbers of people co-operated in driving animals into ambushes or various kinds of traps. In summer fire drives were commonly carried out (Grey 1841, vol. 2, pp. 270-1, 290-1; Nind 1831, p.28). No animal traps are known in the Northcliffe district. However kangaroo traps consisting of narrow trenches or small pits have been recorded by Miss S.J. Meagher near the Frankland River some 70 km to the north east (Map 1; pers. comm. S.J. Meagher), and others have been reported from the district east of Hardy Inlet (Map 1; pers. comm. M. Ellis). Some of the smaller marsupials which were probably eaten by Aborigines of the Northcliffe district are small wallabies, including quokkas (*Setonix brachyurus*), bandicoots, possums, rat-kangaroos and native cats. Native rats (murids), various kinds of game birds (particularly water fowl), snakes, large lizards, frogs and freshwater crayfish were also probably eaten.

With the potential exception of the fish trap described below we have no archaeological data which can be related to specific seasons of occupation of the coastal plain. However summer and autumn was the time when many plant and animal foods of the coastal plain were in season or most easily available. This was also the time when controlled burning could be carried out to facilitate game drives and the gathering of some wetland plant foods such as sedge roots, to maintain control over the vegetation, and to enable ease of movement.

Several ethnohistorical accounts relating to Aboriginal land use and economy suggest that the south western Aborigines congregated on the

coastal plains during the summer and autumn and roamed the inland areas during the winter. Scott Nind, a medical officer at the British settlement at King George Sound (Map 1) during the late 1820s, records this in the following:

'During the winter and early spring they are very much scattered; but as summer advances they assemble [on the coast] in greater numbers.' (Nind 1831, p.28.)

He states further:

'They begin to return to the coast about September or October and at this season they chiefly subsist on roots. In calm weather, however, they procure a few fish. . . . I believe that during the winter they are in small parties and much scattered [in the interior], living upon possums, bandicoots, kangaroos, etc.' (*ibid.*, p.36.)

Stirling (1827) recorded a similar seasonal pattern in the Swan River district (Map 1).

Summer and autumn occupation of the coastal plain below Northcliffe seems particularly plausible when one compares the very pleasant conditions prevailing there in these seasons with the high winds, heavy rain, cold and floods which characterise the winter, and which at times would certainly have made the area unattractive for human occupation. This fact, in addition to the above ethnohistorical observations which suggest that the south western coastal plains were predominately occupied during summer and autumn, could lead one to conclude that this was probably the case, at least for as long as climate and other environmental factors were the same as or similar to those of the present. However in the Northcliffe district it seems unnecessary to envisage a clear division between seasonal inland and coastal occupation such as may have existed in the Swan Coastal Plain and much more arid adjacent inland districts, or inland and coastal areas around King George Sound. Instead traditional occupation patterns around Northcliffe and other parts of the high rainfall zone of the extreme south west (McArthur and Clifton 1975, Fig. 1) could have been loose-knit and subject more to a variety of ephemeral economic and environmental factors than to a strict adaptation to the seasonal availability of water and associated resources. We suggest then that advantages of topography and availability of resources, especially plentiful water, enabled many localities, either coastal or inland, within and on the margin of the high rainfall zone to be occupied at any season.

ARCHAEOLOGICAL SURVEY

Site location and stratigraphy

We have recorded 30 archaeological sites or site complexes in the Northcliffe-Point d'Entrecasteaux area (Map 2). Nearly all of the sites have been identified through the presence of stone artifacts exposed in road sections or scattered on recently bulldozed surfaces of limited size (i.e. four to 700 square m). Most sites contain less than 20 artifacts though in most cases it is probable that only a small part of the site is exposed. However hundreds of artifacts, including many retouched tools, have been collected at sites 1 and 2, located immediately east of Point d'Entrecasteaux, and at site 28, a silcrete quarry-factory (Map 2, Tables 1,2). An exceptional site not designated by a number is the Blackwater Creek fish trap (Map 2; Figs 3,4).

Very thick understorey vegetation and ground cover in most parts of the area effectively prevents intensive, systematic archaeological survey. Our survey then is essentially a compilation of sites in the better cleared areas around Point d'Entrecasteaux, the Northcliffe town site, and the road which connects them. At present we know very little about the distribution of sites in the district as a whole, and even in the above areas there are probably a number of surface sites not recorded.

It is likely that many of the known sites are broadly contemporaneous, and stratigraphical and typological considerations suggest that all are Holocene in age. This is substantiated by two radiocarbon dates relating to the stone industrial sequence identified in a test excavation in an undisturbed podzol at the silcrete quarry-factory described below. The only site of post-European age is the Blackwater Creek fish trap.

All of the stone artifacts recovered from horizontal graded exposures or road cuttings had been covered by 20-100 cm of undisturbed sandy soil. Most specimens found *in situ* in road cuttings occur in the leached zones or A2 horizons of the podzols which predominate in the district (McArthur and Clifton 1975). Similarly the horizontal exposures containing artifacts (e.g. site 1) are either the leached zones of podzols or leached, undifferentiated dune sands. Thus there has been wholesale deposition and no or only minimal deflation or erosion since the sites were occupied.

It is possible that the general inhumation of prehistoric occupation surfaces in the district is the result of sand movement within the unstable phase of a periodic soil cycle such as conceived by Butler (1959). The soil profile development which now characterises the coastal plain and sandy areas around Northcliffe may represent a stable phase, though movements of massive sand hills to the north west and natural erosion of coastal dunes at Malimup (Map 2) could perhaps equally be interpreted as the beginning of a new cycle.

Our survey suggests that the most typical sites on the coastal plain south of Northcliffe are located on dune ridges or sandy hummocks overlooking extensive marshes and small lakes which, as noted above, harbour a variety of plant and animal foods. It seems reasonable to infer that these sites are the remains of open camps used by bands of hunter gatherers engaged in the exploitation of varied wetland resources. Scatters of stone artifacts in fire breaks and other modern exposures in the forest and woodland around Northcliffe can also be interpreted as open camping places, though here the sites seem smaller in area and artifacts are generally few in number and include few retouched tools, suggesting that occupation may have been less intensive and of a more transitory nature.

Relatively few sites (Map 2) have been identified in the vicinity of Mt Chudalup. There is a large rock shelter near the hill which could have been occupied though it shows no signs of use. A few artifacts have been found in cracks in horizontal granite outcrops in the Chudalup area, and it is possible that people used these as camping areas.

Campsites in coastal calcareous dunes have until now been identified only at Malimup (see below). The limestone headland of Point d'Entrecasteaux seems devoid of archaeological sites, including such potential features as a large cave and a line of shallow shelters along the 'inland cliff' on the east face.

Stone resources

The great majority of artifacts from sites in the Northcliffe district are made of local stone. The four most important of these are silcrete, whose source we describe below, gneiss, quartz and a form of fossiliferous chert similar in several respects to that found in artifact assemblages from Devil's Lair (Map 1; Glover 1974) and numerous sites on the Swan Coastal Plain (Glover and Cockbain 1971; Glover 1975). Two small outcrops of this chert located in swampy, thickly vegetated areas within the karri forest ten to 15 km east of Northcliffe may have been sources used by prehistoric Aborigines. However we have not yet discovered signs of quarrying or any archaeological material at either outcrop.

Most of the chert used for artifacts is soft, porous and opaque grey. Nodules of this stone often contain inclusions of much finer grained chert with a flinty appearance, and sometimes this grades into opal (pers. comm. J. Glover). A number of opal artifacts have been recovered from local sites, particularly sites 1 and 2. Silicified sponge remnants (spongolite) and spicules which are sometimes incorporated in nodules of fossiliferous chert are also found on archaeological sites. (In Table 2 opal and spongolite artifacts and

sponge spicules are listed under chert artifacts.) We have also noted three artifacts (e.g. Fig. 8:15) made of a form of banded chert which may come from Cape Beaufort 60 km to the north west (Map 1).

Clear and milky white quartz was quarried from veins in the Pre-Cambrian rocks of the district, or collected as pebbles from the beaches. Clear quartz crystals and a form of translucent quartz with a yellow tinge are also found on archaeological sites. The Aborigines made use of local gneiss, either in the form of beach pebbles or fragments taken from outcrops, and including a form of highly siliceous gneiss resembling quartzite. Other stone used for tools includes amphibolite which occurs in the Archean metamorphic rocks in the north and east of the district (J. Clarke, pers. comm.), and a black glossy rock similar to obsidian which is found as vein filling in the basalt exposed at Cape Beaufort (Map 1). There are relatively rare basalt artifacts, the nearest known source of this being Cape Beaufort. We have also collected a few pebbles and fragments of a whitish-grey quartzite which probably comes from local Pre-Cambrian rocks.

Table 2 shows that at sites 1 and 2 silcrete, quartz and chert were all used extensively whereas there is a very marked preponderance of silcrete artifacts at sites within a few km of the silcrete quarry-factory and at this site itself (Table 1).

The silcrete quarry-factory (site 28)

Until now we have carried out only one systematic test excavation in the district. This was made in the face of a bulldozer cutting in a sandy soil overlying a silcrete formation (site 28) 11.5 km west north west of Northcliffe (Map 2). The excavation (Trench 1) and the finds, mostly silcrete artifacts, are described in more detail in Dortch (1975); and the latter are listed in Table 1. We estimate that the silcrete formation is at least 15 hectares in area. The stratigraphy of the site is not fully resolved; however, in exposures the silcrete, probably of Tertiary age, is only about 30 cm thick, and it overlies brown clayey sediments whose upper part contains some limonitic concretions. We interpret site 28 as a quarry-factory and the source of the numerous silcrete artifacts found throughout the district. Two radiocarbon dates based on charcoal samples taken in the Trench 1 excavation (Table 1; Fig. 1) show that the quarry-factory was in operation from before 6780 years BP until at least 3000 years BP.

Mr W.M. McArthur, Land Resources Management, CSIRO, Perth has identified the archaeological deposit as an iron humus podzol in which there is no evidence of sand movement after profile differentiation (pers. comm. W.M. McArthur). Thus, barring possible minor dislodgement by animal

Table 1: Distribution of stone artifacts in Trench 1, Northcliffe quarry-factory site, Western Australia (based on Dortch 1975: Table 2).

Radiocarbon dates in years BP.	Depth in cm below datum	Silcrete artifacts							Artifacts of other stone	
		Geometric microliths ¹	Notched flakes and other retouched tools	Blades	Bladelets	Flakes	Chips ²	Cores	Debris	
ANU-1131 3080 ± 75	46-51					2				
	51-53					2	8	6+		
	53-57	1 atypical	1			3	39	47+		
	57-59	2 atypical	2			2	48	57+		
	59-60		2			6	57	110+		1 quartz chip
	60-62		3	2		2	76	50+	2	2 quartz chips 1 quartz flake
	62-64	2	1			1	54	50+		1 quartz bladelet
	64-66		2	6		5	81	50+	3	
	66-70	6, 2 atypical	2	3		11	149	250+		
	70-72	4, 1 atypical	2	4		2	106	250+	2	6 quartz flakes and fragments
	72-74	2	4	5		1	97	250+	5	3 quartz fragments
74-78	1 atypical	3	1		11	112	250+	4	2 quartz fragments 1 fragment of gneiss	
78-82	3			1		38	100+	1		
82-85	1				1	14	20+		8 quartz chips	
SUA-379 6780 ± 120	85-90		2				20+	1	1	1 quartz fragment
	90-96		1				5	2+	1	1 quartz flake
	96-98						5	9+		1 quartz core 1 quartz flake
	98-103						7	1+		1 quartz bladelet 2 quartz flakes 2 quartz fragments
	103-c,120						5	4+	2	1 quartz fragment 2 quartz flakes 2 chert flakes
		18 typical	25	22	46	903	1526+	12	11	39 (Artifact total 2609+)

¹ atypical indicates irregular or partly retouched specimens.

² + indicates that total chips were not recovered.

activity or growing roots, contained archaeological specimens are in primary position. The stone artifact assemblages (Table 1) are concentrated in the leached zone or A2 horizon of the soil (Fig. 1). These assemblages include many silcrete artifacts including retouched tools, flakes, cores, some blades and bladelets, numerous chips and some quarrying debris (i.e. irregular fragments of all sizes and large thick flakes often with cortex surfaces). We also excavated a number of quartz artifacts, a fragment of gneiss, and two chert flakes from the lower part of the excavation, one of which came from a deep depression in the B horizon or iron-enriched organic hard pan at the base of the section.

About half of the retouched silcrete tools are geometric microliths (Table 1). The radiocarbon dates (Table 1; Fig. 1) show that these were being manufactured here from 3000 to about 6000 years BP, thus making the earliest of these among the oldest radiocarbon dated geometric microliths presently known in Australia (Pearce 1974: Table 2). The geometric microlith in Fig. 6:8 is the lowermost one recovered in the deposit. It came from one to three cm above the upper limit of the 10 cm zone from which charcoal for SUA 379 (6780 ± 120 BP) was collected, and so is about 6000 years old.

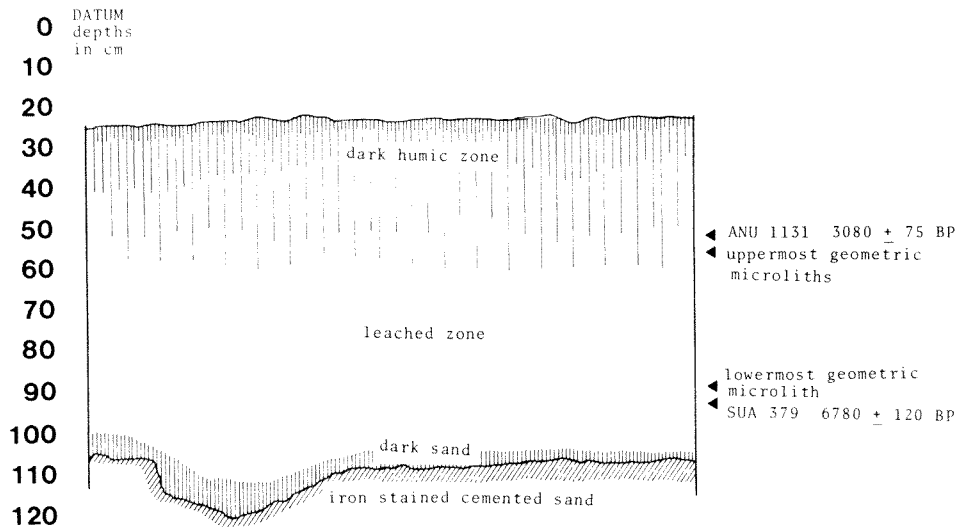


Fig. 1: North section, Trench 1, silcrete quarry-factory (site 28), near Northcliffe, Western Australia (after Dortch 1975, Fig. 2).

The presence of several stone artifacts in the channels and depressions of the hard pan but none apparently within it shows that either this eroded

surface was actually occupied or that the artifacts dropped down to it following the stripping away of the A horizons of an earlier soil. In either case the presence of the artifacts in this position and the eroded condition of the hard pan surface shows that it had been exposed before the present soil accumulated. Thus at least one full cycle of soil destruction, deposition and soil profile development began here more than 6780 years ago and was completed sometime after 3000 years BP.

Four pollen samples collected at different depths in Trench 1 (Fig. 1) were submitted to Dr B.E. Balme of the Geology Department, University of Western Australia for analysis. His report (pers. comm. B.E. Balme) states that a sample from a depth of 47 cm contained pollen grains, the dominant species being *Eucalyptus calophylla* and *E. diversicolor* though some grains 'of *E. marginata*-type were also fairly common.' A sample from 68 cm contained a similar plant microfossil assemblage though a sample from 87 cm contained no pollen. The lowermost sample from the dark sand resting on the hard pan (depth 121 cm) contained pollen grains of the three above *Eucalyptus* species with *E. diversicolor* appearing to be 'relatively more abundant' than in higher samples.

These three *Eucalyptus* species are at present dominant in the district (McArthur and Clifton 1975; Smith 1972); the pollen analysis suggests then that local climate was at various times during the Holocene perhaps much the same as it is at present. In his recent study Churchill (1968, p. 146) shows that 'the climate [of the lower south west] from 4000 to 3000 B.C. was favourable for *E. diversicolor*'. The stratigraphical position of the lowermost pollen sample within the radiocarbon dated deposit described here suggests that conditions were favourable for *E. diversicolor* even earlier during the Holocene. (Note: There is an incorrect passage in the Abstract of Dortch [1975, p.59] which, in referring to *E. diversicolor*, *E. calophylla* and *E. marginata*, states that 'the two former species and possibly the latter were present at times since [6780 years B.P.]'. In fact as noted above *E. marginata* pollen does occur in both samples dated less than 6780 years B.P.)

Silcrete artifacts are scattered in ploughed ground or bulldozer cuttings throughout the vicinity of the silcrete formation. In 1973 one of us (G.G.) found a recently uprooted blackbutt (*Eucalyptus patens*) stump located near Trench 1 which has numerous silcrete artifacts in the mass of sandy soil adhering to its base and roots (Fig. 2). The artifacts occur in two distinct layers, both of which could be seen in 'section' and one of which is seen in 'plan' at the base of the stump (Fig. 2). It is apparent that a large amount of archaeological deposit was brought up when the tree was bulldozed over.



Fig. 2: End view of base of uprooted tree stump (*Eucalyptus patens*) at silcrete quarry-factory (site 28) near Northcliffe, Western Australia. Numbers of silcrete artifacts are visible in the sandy soil adhering to the roots. The range pole is marked in 10 cm units.

Two marine shells have been collected from archaeological horizons at the quarry-factory. The first of these is a turban shell (*Turbo* sp.) found in sand exposed when the blackbutt stump described above was uprooted. The second shell, a giant creeper (*Campanile symbolicum*, Iredale: pers. comm. G.W. Kendrick) was found 20 cm below the surface in undisturbed sand overlying silcrete in another part of the site.

A fish trap on Blackwater Creek

Over the past few decades several wooden structures thought to be Aboriginal fish traps or weirs have been locally known in freshwater streams of the Northcliffe district. The only one of these which can be located at present is on Blackwater Creek, a sluggish tributary of the Gardner River which passes through several peaty swamps and sandy areas on the coastal plain (Map 2). The structure (Figs 3, 4) is situated on a winding channel which extends for approximately one km between two swamps. When one of us (G.G.), together with Messrs R.G. Hardie and A.T. Jackson,

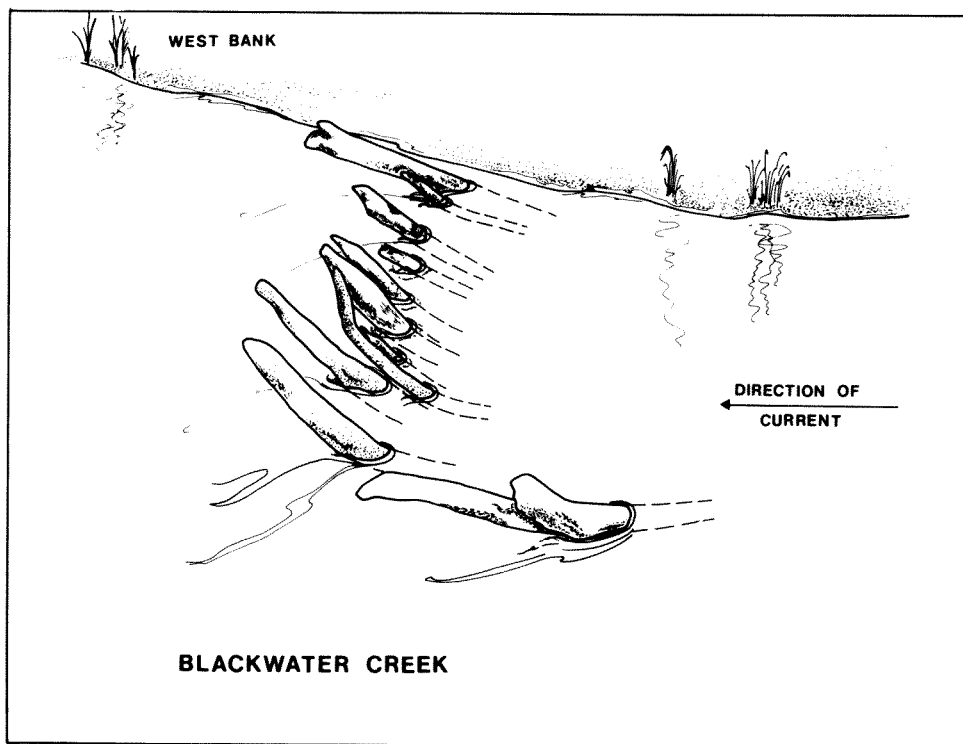


Fig. 3: Perspective view of a wooden fish trap on Blackwater Creek, Northcliffe district, Western Australia.

examined the site the channel was approximately 5.5 m wide and about 1.2 m deep (Fig. 4).

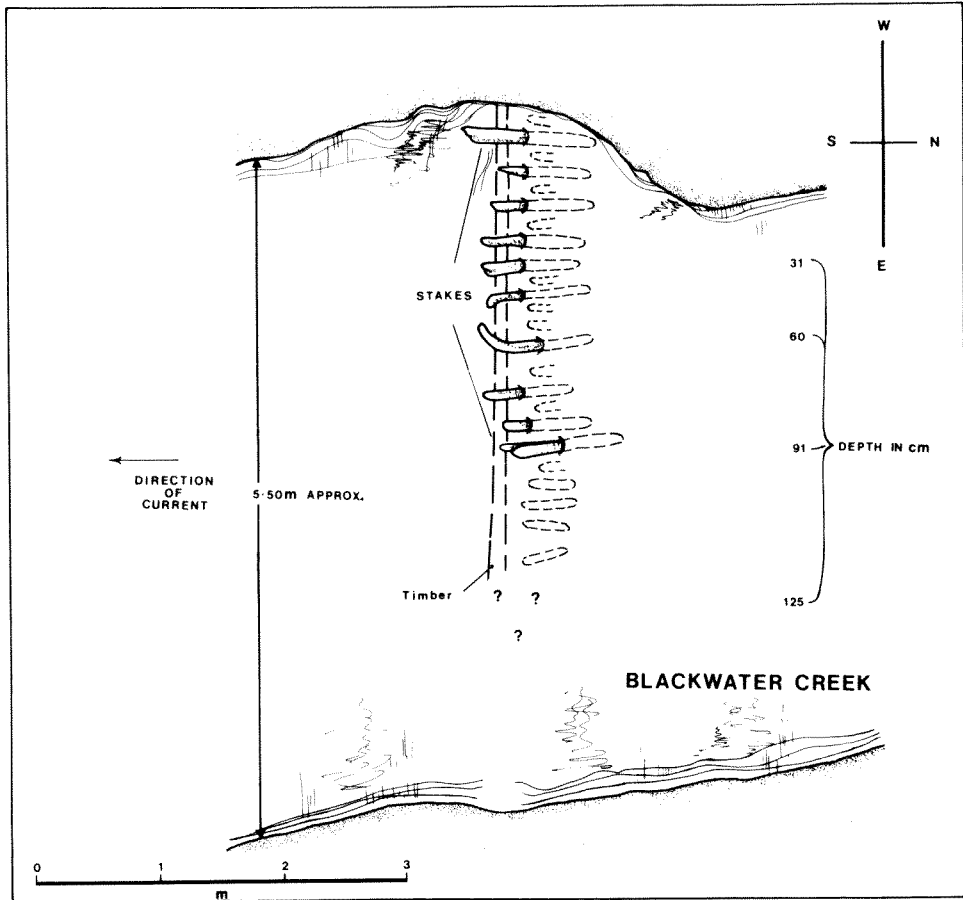


Fig. 4: Plan of the Blackwater Creek fish trap, Northcliffe district, Western Australia.

At present the structure consists of a row of over 20 wooden stakes extending about 3.5 m from the west bank of the stream, and a single horizontal timber lying alongside the stakes. The stakes are imbedded in the stream bed and lean downstream at an angle of about 45° . Between each of the stakes visible in Fig. 3 is a small, submerged stake (Fig. 4). The easternmost stakes are also smaller than the ones shown emerging from the water in Figs 3 and 4. The structure dates to the European era, as the larger stakes, which appear to be made of *Agonis* or *Banksia* wood, have pointed ends which have been cut with a steel axe. It is probable that when

in use the stakes extended right across the channel in an unbroken row, and that the channel shown in Fig. 4 is wider than it was when the trap was in use.

We interpret the Blackwater Creek structure as a fish trap or weir though it seems to be somewhat different in concept from one on the Serpentine River near Barragup (Map 1), described and illustrated by Hammond (1933, pp. 46, 47), and other south western traps observed by Armstrong (1871) and Paterson (1896). According to Hammond the main feature of the Barragup trap was a 'wicker fence' containing a central race or gap. People standing on platforms positioned on each side of the gap were able to snatch fish as they passed through the race. The anthropology collection, Western Australian Museum contains a c. 1900 photograph of a trap on the Murray River (Map 1) of this kind. A line drawing based on this photograph is illustrated in Fig. 5, and clearly shows the central gap.

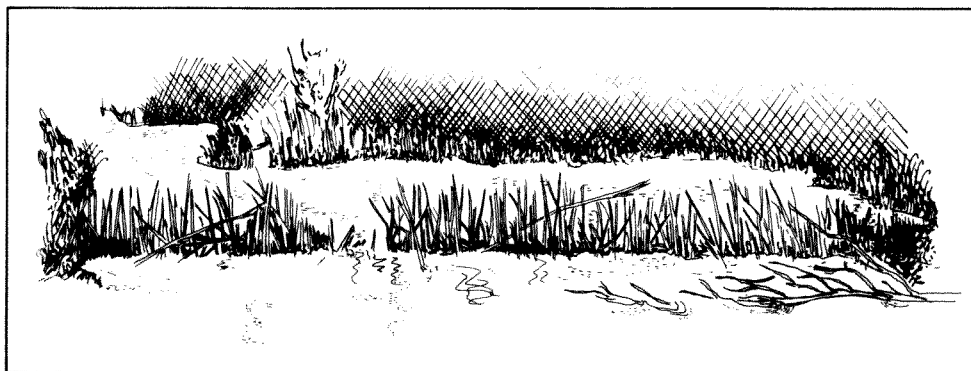


Fig. 5: Sketch of a wooden fish trap on the Murray River, Western Australia, based on a c. 1900 photograph in the anthropology collection, Western Australian Museum.

We do not at present know how the Blackwater Creek fish trap was used, or which fish species or other animals were caught in it. Nor do we know if the trap was used during particular seasons. The construction is solid, and it is obvious that the trap was intended to last for a long time. The wooden stakes are all submerged during the high water levels of winter, and the trap would have been unusable then, unless there were upright sticks which enabled a mesh of sticks and brush to be raised above the stakes.

Hammond reports that the Barragup fish trap was used 'at the commencement of winter to catch the fish that were forced down the stream by the fresh water' (1933, p. 46). Paterson (1896, p. 280) writing of fish traps on the Serpentine and Murray Rivers (Map 1) also noted that they were used most extensively at the beginning of winter. Blackwater Creek is always

fresh or only slightly brackish at the trap site, and so the trap described here was not used in the same way as those observed on the Murray River and the Serpentine. At no time does Blackwater Creek have a high velocity water flow. Therefore some agency other than changes in salinity or water current seems to have been necessary to force fish or other animals into the trap. It is likely that fish were driven into the trap by people creating a disturbance at the downstream end, or perhaps either end of the channel in which the trap is centred. A clue to the trap's likely function is the way in which the stakes are angled downstream. Mr R.G. Hardie suggests that fish were driven into the trap from downstream; and that they were speared from between the angled stakes by fishermen standing on the horizontal timber (pers. comm. R.G. Hardie).

A review of the fish species likely to be living in Blackwater Creek (pers. comms R. Lenanton, R. McKay; Lenanton 1974) suggests that there are a number of different species which may have been caught, and that there are various seasons during which the trap could have been used. Further field analyses of these problems, including detailed study of the aquatic fauna of Blackwater Creek, re-examination of the trap's structure, and tests of stream salinity and water flow during different seasons will be necessary before the trap's function and mode of use can be defined clearly. Ethnographic inquiries and examination of other archaeological sites in the locality could also provide significant data.

Malimup Spring

The coastal area around Malimup Spring (Map 2) is environmentally and geomorphologically probably the most diverse in the district. Stone artifacts and sparse scatters of edible marine molluscs occur in blow outs in the calcareous coastal dunes, showing that either the present blow outs were occupied or that occupation took place on aggrading surfaces which have been subsequently exposed. The chief significance of these sites is that they show that people camped in coastal dunes, and that their subsistence may have been in part based on the exploitation of marine molluscs. (At present the Malimup sites are designated by a single number - 29.)

One of the Malimup archaeological sites is a cluster of stone artifacts and marine molluscs in a blow out, discovered by Mr G.W. Kendrick of the Western Australian Museum. The site consists of several flaked stone artifacts, several gneiss beach pebbles or boulders, and a cluster of several edible marine molluscs including 11 shells of *Nerita atramentosa* Reeve, one abalone shell (*Haliotis rolli* Gray), one limpet shell (*Patella laticostata*) and one shell of *Dicathais orbita*. This small cluster of shells hardly constitutes a shellfish midden, yet Mr Kendrick tentatively interprets this site as

the remains of an Aboriginal meal (pers. comm. G.W. Kendrick'. The shells are registered in the Western Australian Museum palaeontological collection 70.906-70.909.). This site is thus one of the very few known in the south west (cf. Dortch 1974, p. 205) whose evidence does not agree with ethnohistorical records (Grey 1841, vol. 2, p. 288; Moore 1884 p. 51) which suggest that molluscs were not eaten by south western Aborigines.

The Malimup site complex is notable also for the relative abundance of pebble tools made of gneiss or amphibolite (Figs 9: 12 and 13; see below). These tools may be evidence for special activities (e.g. cracking mollusc shells); or they may simply reflect these sites' proximity to abundant beach pebbles.

A series of limestone caves in the neighbourhood of Malimup Spring have potential archaeological value as they may contain occupation deposits.

STONE ARTIFACT ASSEMBLAGES

The stone artifact assemblages collected from sites in the Northcliffe district feature a dominant flake technology. There is a small blade and bladelet element, and a smaller still but clearly characterised pebble tool component. The evidence for stone grinding is limited to a few grindstones and a single edge-ground axe. We have identified no tools shaped by hammer dressing (pecking) or polishing.

No more than 5 to 7% of the stone artifacts from any site are retouched or otherwise shaped, and thus classifiable as 'formal tools'. However the assemblages from the three most prolific sites, the silcrete quarry-factory and sites 1 and 2 (Tables 1, 2) include, in addition to retouched tools, large numbers of very small flakes and chips (i.e. flakes with maximum dimension <1 cm) showing that tools were being manufactured in quantity.

The stone artifact assemblages excavated from Trench 1 at the silcrete quarry-factory make up the only systematic samples for the area, and they are also the only large assemblages which have not been mixed by ploughing or bulldozing. The assemblages from sites 1 and 2 are simply very extensive collections of artifacts exposed on two artificially truncated sandy hummocks. Each exposure is almost certain to consist of portions of several old surfaces, and so these must be regarded as mixed assemblages. Nevertheless the tool and by-product (*débitage*) categories listed for each in Table 2 give some idea of the likely composition of typical stone artifact assemblages in the lower part of the coastal plain.

Artifact totals
 Site 1 — 1856
 Site 2 — 1013

TABLE 2
 Classification of stone artifacts from Sites 1 and 2,
 Point d'Entrecasteaux, Western Australia.

	silcrete		chert		quartz		other stone	
	site 1	site 2	site 1	site 2	site 1	site 2	site 1	site 2
backed microliths (geometric) (other)	7 segments 2 trapezes 1 rectangle	5 segments 1 trapeze	1 triangle (opal)		5 segments 3 trapezes	2 segments 1 trapeze		
	1 asymmetric point 5 irregular	2 asymmetric points 2 irregular			12 irregular	2 irregular		
flake scrapers (adze-like) (non-adze)	1 adze-like scraper 2 flat adze	1 flat adze	1 adze-like scraper					
	1 end-scraper			3				
notched pieces	2 blades 3 bladelets 16 flakes	11 flakes	21 flakes	9 flakes	7 flakes 3 bladelets			
denticulated pieces	13 flakes	4 flakes	6 flakes	5 flakes	7 flakes			
other retouched tools	6 retouched flakes 8 abruptly retouched flakes 1 dihedral burin	1 retouched flake 6 abruptly retouched flakes	5 retouched flakes 1 abruptly retouched flake 1 very small 'core-scraper'	1 retouched flake	2 very small retouched flakes	1 retouched flake		1 basalt edge-ground axe
blades	12	9	1	1	3	2		
bladelets	24	16	4	6	9	9		
flakes, chips and fragments	416	358	275	222	864	285	6 flakes and fragments made of black glossy rock (vein filling in Black Point basalt?)	4 flakes of black glossy rock (Black Point?)
cores	2 bipolar (scalar) 7 single platform flake 2 double platform flake 2 multi-platform flake 1 bladelet	4 bipolar (scalar) 3 discoidal 1 bladelet	8 bipolar (scalar) 2 discoidal 1 multi-platform flake 4 multi-platform flake	7 bipolar (scalar) 4 amorphous	22 bipolar (scalar) 2 single platform flake 2 double platform flake 27 amorphous flake	2 bipolar (scalar) 6 amorphous		1 discoidal core made of black glossy rock (Black Point?)
other stone artifacts	2 crested bladelets 1 Levallois flake? 2 flakes with use-smoothed edges	4 Levallois flakes? 6 flakes, from discoidal cores?	1 flake with use-smoothed edge	1 flake, from discoidal core?	2 split pebbles 2 crystals (manuports)	2 crystals (manuports)	1 gneiss hammerstone 5 gneiss pebble fragments	2 gneiss fragments
TOTALS								
retouched tools	69	33	36	18	39	6		
blades and bladelets	36	25	5	7	12	11		
cores	14	8	15	11	53	8		
total artifacts	540	434	332	259	972	312	12	8

The following brief description of major tool types, cores and other by-products is based on the examination which one of us (CED) has made of all the assemblages known from the district. Specimens considered to be diagnostic and in most cases typical are illustrated in Figs 6-9. These pieces come from a number of different sites though the majority are from sites 1, 2 and 28.

Backed microliths

Backed microliths as described in Australia by Campbell and Noone (1943); Glover and Lampert (1969, pp. 224-5); McCarthy (1967, pp. 40-45); and Mulvaney (1961, pp. 79-80) are tools made on small flakes, bladelets or parts of blades whose diagnostic features are very small size; and backing or abrupt retouch, sometimes bipolar, along part of their margins. All of the Northcliffe backed microliths conform to this definition, and nearly all have maximum dimensions of less than three cm.

The great majority of the Northcliffe backed microliths recovered so far are of the geometric category, a form very well known in Australian and other Old World stone industries, and one which is most clearly defined in one of the latter (Tixier 1963, p. 127). Geometric microliths, when viewed at right angles to their dorsal or bulbar faces, conform to one or another regular geometric shape, the three dominant ones in the Northcliffe and some other Australian assemblages being segments (crescents), trapezes (trapezoids) and triangles. Most of the Northcliffe geometric microliths have length:width ratios $<2:1$; the exceptions to this are discussed below. Nearly all of the geometric microliths which we have found are made of silcrete or quartz. The only typical specimen made of other stone is a very small opal triangle from site 1 (Fig. 7:4).

Here we use the term 'segment' (Campbell and Noone 1943, p. 500; Tixier 1963, p. 129) in preference to the more commonly used but less accurate labels 'crescent' or 'lunate'. The Northcliffe segments are characterised by neatly curved backs and straight, unretouched chords. They vary in their proportions between the broad specimens illustrated in Figs 6: 1, 2 and 4, and the much less common, more elongated form in Fig. 7:1. We have also identified several segments which are very elongated with length:breadth ratios $>3-4:1$, and are readily classifiable as backed bladelets. A typical example of this form is the piece in Fig. 8:1 which has a slightly curved back made by bipolar abrupt retouch extending the length of one edge. It will be necessary to obtain a larger sample of segments in order to determine whether there is a continuum between the short or robust and the elongate forms. Other of the Northcliffe segments have

asymmetric surved backs and are similar to the 'rudder-like' segments of Campbell and Noone (1943: Figs 82-84).

The trapezes are simply double obliquely truncated pieces. As with the trapezes of many Australian and other Old World microlithic assemblages the Northcliffe specimens can be divided between those in which the shorter

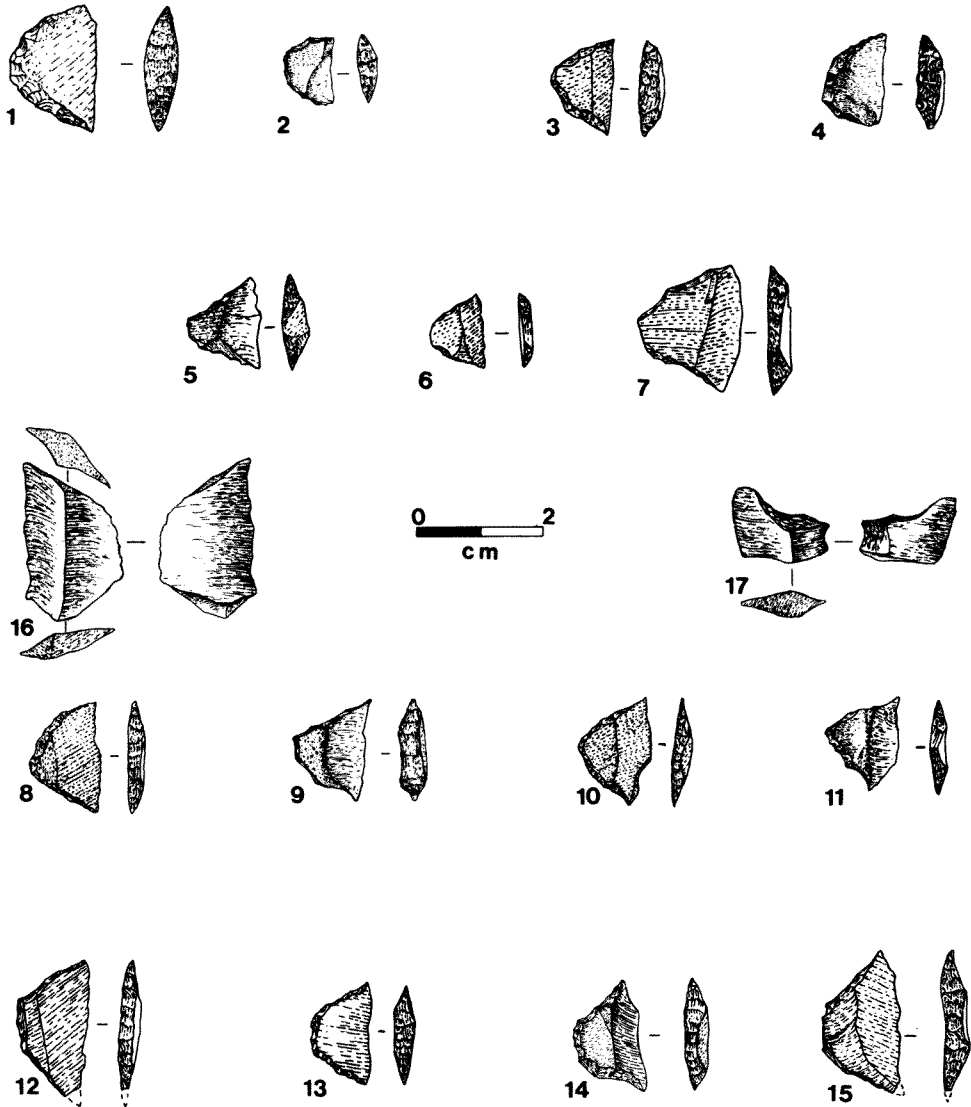


Fig. 6: Geometric microliths and other silcrete artifacts from the Northcliffe district, Western Australia.

lateral edge between the two oblique truncations has been abruptly retouched (Figs 6:9, 12, 14, 15); and those in which this is left unretouched (Figs 6: 5-7). In the latter form then the retouched 'back' is confined to the truncated extremities. We have collected only one elongated trapeze, an exceptionally large piece from the Malimup site complex (Fig. 8:8).

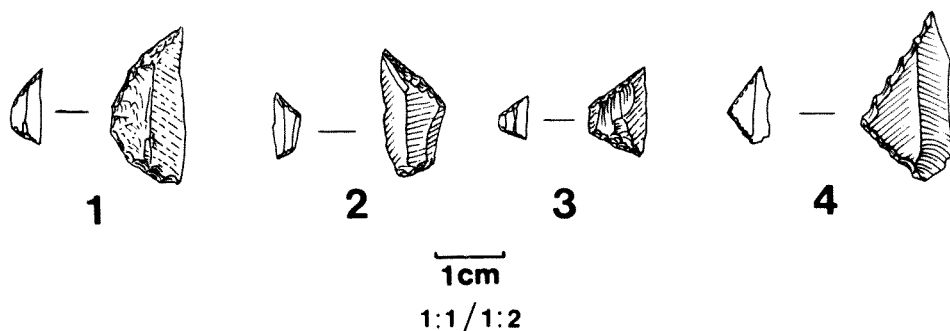


Fig. 7: Geometric microliths and an obliquely truncated bladelet from Site 1, Point d'Entrecasteaux, Western Australia.

The Northcliffe assemblages also contain a few obliquely truncated bladelets (i.e. pieces with only one extremity truncated by abrupt retouch); a minute example is the quartz specimen in Fig. 7:2.

Triangles (Figs 6:11; 7:4) are much less common than the two previous forms. Intermediate forms between the three occur frequently, and it is unrealistic to draw too fine distinctions between the differences in shape. For instance the specimen in Fig. 6:8 is illustrated in Dortch (1975, Fig. 3b) and is described there as an example of the crescentic form (*ibid.*, p. 61). However it is perhaps more accurate to regard this specimen as intermediate between the crescentic (or segment) and triangular forms. Figures 6:3 and 10 are similarly intermediate between triangles and segments, and Fig. 6:13 between the segments and trapezes.

A special feature of some Northcliffe silcrete geometric microliths of all three forms is the marked incurving of the proximal and distal retouched edges. Two specimens with very clearly incurving edges are illustrated in Figs 6:11 and 14; and Figs 6:7, 9 and 10 are examples with one incurving edge.

Many of the silcrete geometric microliths appear to be made on obliquely or transversely snapped blades or bladelets. The local silcrete is very brittle and thin blades of this stone can easily be snapped or fractured obliquely or transversely between one's fingers. A blade which was probably snapped manually is illustrated in Fig. 6:16. The transverse fracture at the lower end

of the piece consists of two fracture surfaces, and though we have been unable to replicate this fracture experimentally, we suggest that it was produced by snapping. A number of other possibly deliberately snapped blades or bladelets have been identified.

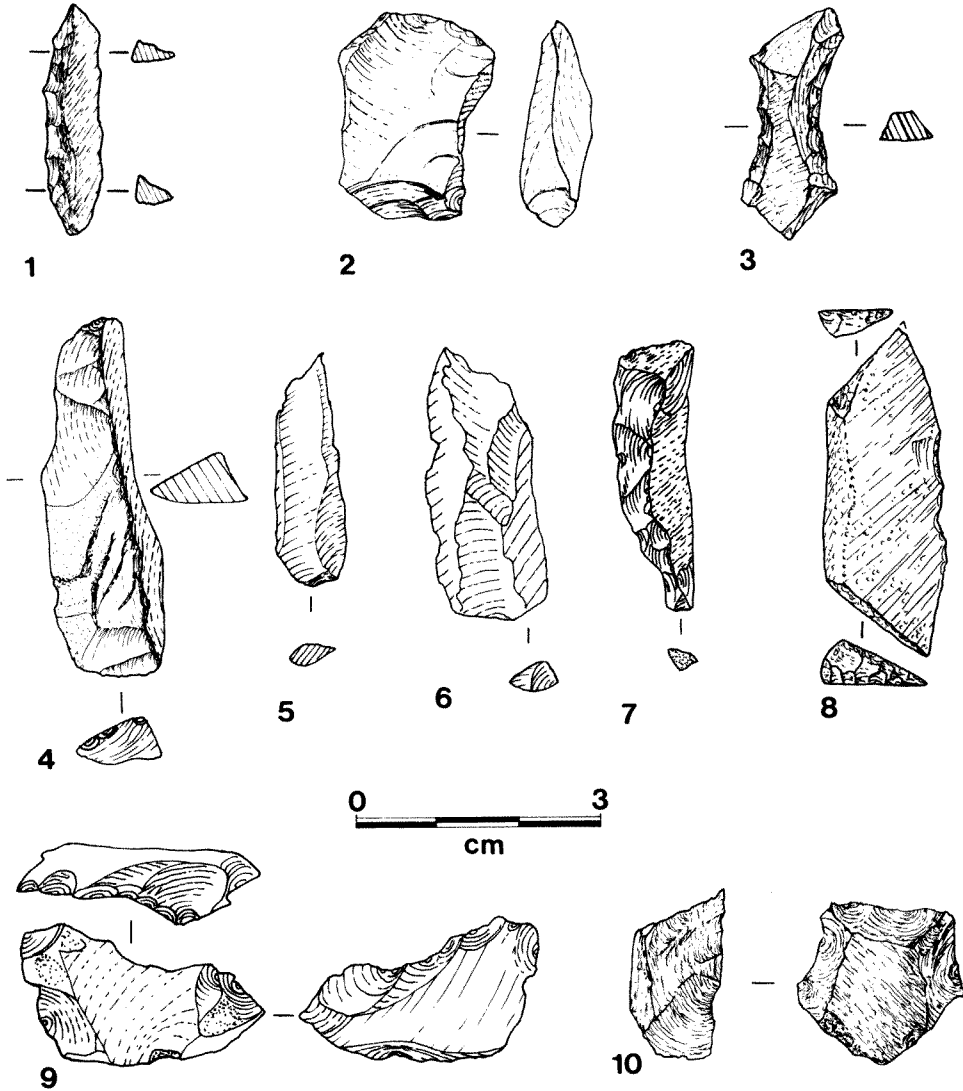


Fig. 8: Selected flaked stone artifacts from the Northcliffe district, Western Australia.

The quartz geometric microliths include far fewer typical specimens than does the silcrete group. They are also generally smaller in size than the

silcrete specimens; some are extremely small as shown by the tiny trapeze in Fig. 7:3.

We have identified three atypical but no typical asymmetrical backed points of 'bondi' form (McCarthy 1967, p. 40). There are no rectilinear backed bladelets, as occur in some of the Pilbara assemblages in the archaeology collection, Western Australian Museum (e.g. B3020), and as Glover (1967, p. 419) notes in Newall's Millstream collection. Again a larger sample of the very elongated segments (Fig. 8:1) may show that these merge into a rectilinear form.

There are a number of atypical or irregular specimens among both the quartz and the silcrete geometric microliths. These are numerically important (Tables 1, 2) though they cannot be dealt with in detail here. However all are similar in size and proportions to the more regular forms.

Other small retouched tools

The Northcliffe assemblages contain a variety of other small retouched tools made on flakes or blades, usually quite small with maximum dimensions in the range 2-5 cm. In the following we describe briefly the most numerically important and clearly defined of these.

notched pieces — These are perhaps the most common form of retouched tool in the area. Most are simple flakes of silcrete, chert or quartz with one or more small retouched notches. Some have larger notches, produced by a single blow with the hammerstone, sometimes described as 'Clactonian notches' (*encoches clactoniennes*: Bordes 1961, p. 35). The silcrete flake in Fig. 9:2 has both kinds of the above notches. It has several small retouched notches on its right lateral edge and a single inverse 'Clactonian notch' on its left proximal corner.

denticulated pieces — These differ from the above only in that they feature a number of very small, closely adjacent notches sometimes resulting in a saw-like or serrated edge. Most of the Northcliffe denticulates are rather irregular and poorly made. There are also numbers of flakes with series of extremely small notches sometimes resembling very fine denticulation. These are likely to be the result of accidental edge-damage or use rather than retouch.

scrapers — The present sample of scrapers, i.e. tools usually made on small flakes or fragments and having robust retouched working edges which in contour are rounded, straight or irregular, comprise a relatively numerous and varied group. It is useful here to divide the scrapers into two categories. The first consists of pieces whose working edges resemble those of adze

flakes, i.e. flake scrapers used as hafted woodworking tools; the second is composed of pieces whose working edges do not have the characteristic features of adze flake edges. In broadest terms Australian adze flakes are small flake scrapers which have relatively steep angles (60° to 80°) between the planes of the flaking face and the lower (generally bulbar) surface; and working edges whose diagnostic features result from a combination of use and resharpening. These features include marked crushing or rounding along the periphery of the working edge and undercutting (sometimes referred to as 'step-flaking') coming from the working edge and encroaching more or less over the flaking face (cf. Gould, Koster and Sontz 1971; Hayden and Kamminga 1973). Such characteristic wear features must be present to enable purely archaeological specimens such as these here (i.e. specimens for which no direct historical or ethnohistorical functional data exist) to be classified as probable adze flakes, and not simply as scrapers. We have been able then to classify only a minimum number of specimens as the former. Many pieces which we regard here as flake scrapers may well have been intended for use as adzes, or were used in woodworking tasks which involved little re-sharpening and left few signs of wear. For example two flake scrapers, the first of which is made of quartz and the second of silcrete, are illustrated in Figs 8:10 and 9:4. Each is of the approximate size and proportion of many known adze flakes; however neither shows the characteristic adze flake use wear patterns on its working edge which would enable it to be classified as a probable adze flake.

We have not identified adze flakes of tula form (Mulvaney 1969, pp. 71-74) in our present sample. The pieces classifiable as probable adze flakes are mostly irregular; most are made on chert or silcrete flakes or fragments. The only typologically distinctive probable adze flake which we have identified is a small flattened form, very similar to the 'flat adze' of Gould and Quilter (1972). The best Northcliffe example of this form is Fig. 8:3. The piece has opposed concave working edges typical of the form which Gould and Quilter (*ibid.*, p. 5) describe as 'strangulated' or of 'hour glass shape'. These authors note that flat adzes are known from sites at Walynunga and South Bullsbrook near Perth, and other parts of the south west. The Northcliffe specimens help to strengthen their conclusion that these tools are a standard part of south western assemblages.

Likely adze flakes include the small silcrete specimen in Fig. 6:17 which has a very heavily crushed and undercut concave flaking face. There are also the chert specimens in Figs 8:9 and 9:14. These two come from site 2, and the latter is similar to probable adze flakes made of chert which have been identified at Devil's Lair (Map 1; Dortch 1974; Dortch and Merrilees 1973).

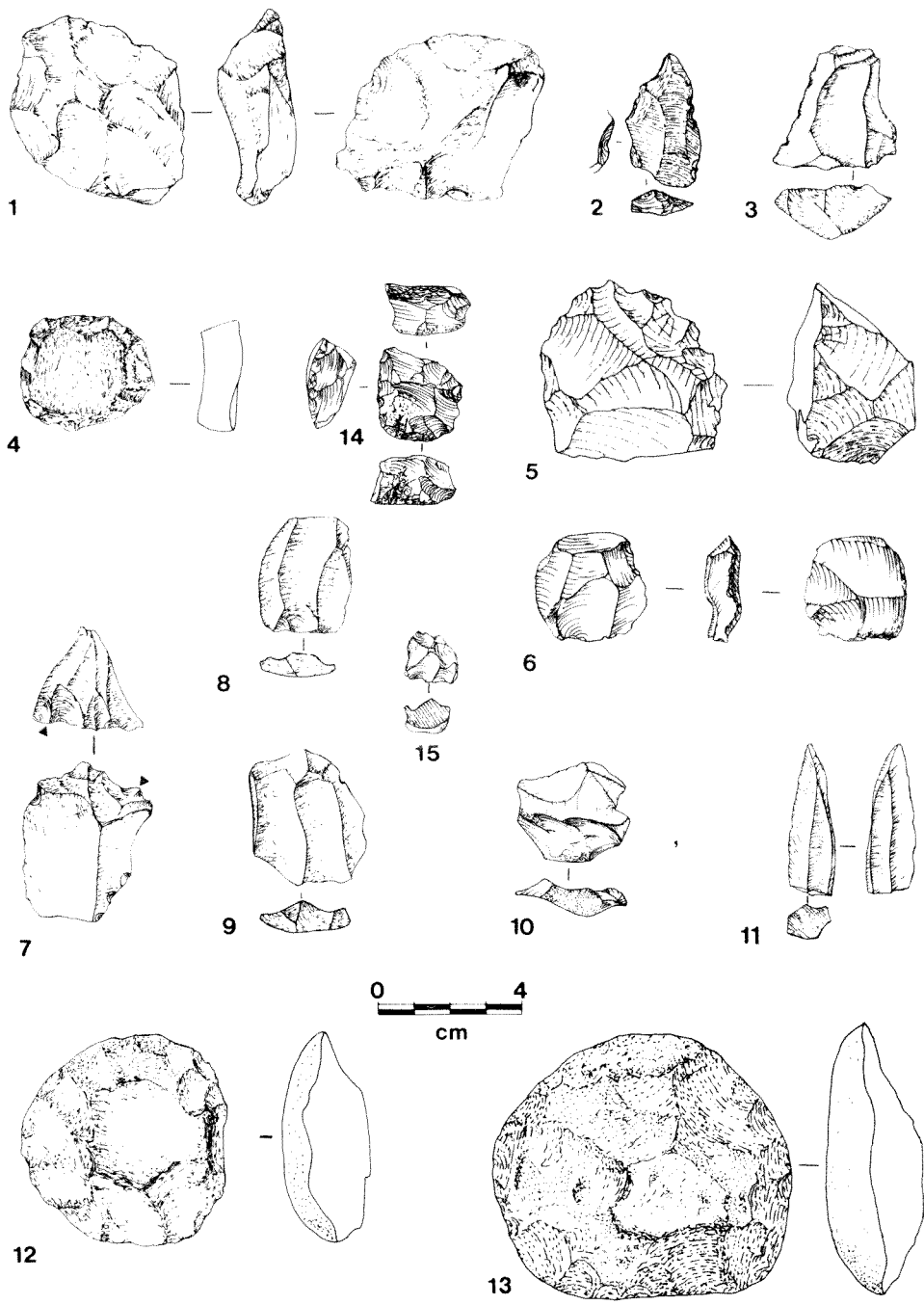


Fig. 9: Selected flaked stone artifacts from the Northcliffe district, Western Australia.

We have collected two end-scrapers on bladelets. There are also a few core-like pieces on thick flakes the peripheries of whose flaking faces have secondary chipping resembling that found on scraper working edges. Some of these 'core-scrapers' are made of quartz or gneiss; others are made of silcrete. One of the latter is illustrated in Fig. 9:7. The piece has a flaking face resembling that of a core though the periphery of this has been regularised by retouch, suggesting that it has been used as a tool. The piece is one of several from the district which closely resemble the carinated scraper (*grattoir caréné*) of the European and Middle East Aurignacian (Movius and Brooks 1972).

Most of the cores which we have recovered (e.g. Fig. 9:5; see below) lack secondary retouch along the periphery of their flaking faces, suggesting that cores or pieces resembling cores were not usually used as tools. We have found no horsehoof cores (McCarthy 1967, p. 18) though these occur in stone artifact assemblages from other parts of the south west (e.g. in the Swan-Avon valley between Perth and York, Map 1). The well known elouera of eastern Australia (McCarthy 1967, p. 26; Mulvaney 1969, p. 81) also seems absent; however one of the microlithic segments is very robust, and if it were found in an eastern assemblage it would probably be classified as an elouera.

We have identified several burins in our sample, including a few on truncation and one dihedral burin. Abruptly retouched flakes are fairly common (Table 2) though it is not certain whether the abrupt edge chipping is in fact retouch or the result of heavy use. We have also identified a few flakes with edges worn smooth through use.

Pebble tools, an axe, grindstones and hammerstones

We have relatively few pebble tools in our present sample. Because of this it is difficult to delineate the likely major types of forms among them, except by referring to those described in syntheses of regional or continental stone tool forms (e.g. Davidson and McCarthy 1957; McCarthy 1967; Mulvaney 1961; 1969). A number of gneiss, quartz or amphibolite pebbles have one end or one side removed by flaking, so enabling them to be defined as 'pebble choppers' in the sense of Movius (1944, pp. 10-11), though equally they could have been cores.

Two specimens from Malimup (Figs 9:12 and 13), respectively made of amphibolite and gneiss, have each been multi-convergently flaked over the whole of one face, leaving the opposing face an unmodified pebble surface. Unifacially flaked pebbles such as these have been collected on Kangaroo Island (Cooper 1943, Figs 66-75), in other parts of Australia (McCarthy

1967, pp. 19-20), and also in Indonesia (van Heekeren 1957, p. 73; pl. 20) and elsewhere in south eastern Asia. McCarthy (1940), Matthews (1966), Movius (1944) and Mulvaney (1961; 1969) discuss the distribution and significance of Australian and south east Asian pebble tools.

We have recovered only one stone axe in the district. This specimen is bifacially flaked and has a bifacially ground cutting edge. Davidson and McCarthy (1957, Fig. 7) considered that axes of this kind did not occur in the south west, but Ride (1958) and more recently Akerman (1973) showed that this is not the case. The Northcliffe specimen comes from site 2 and is made of basalt whose origin, as noted above, may be Cape Beaufort (Map 1).

Some of the Northcliffe sites contain simple grindstones, upper or lower; and hammerstones, most of which are simply gneiss beach pebbles or fragments of silcrete which have become rounded or abraded through use.

We have also collected a few percussion/grindstones, a form of multi-purpose tool which is a common feature of south western assemblages. These are squat, cylindrical pieces with grinding surfaces or percussion pits on one or both flat faces. Davidson and McCarthy (1957, p. 441) state that some of these tools were used as 'hammer, anvil and muller'. These artifacts are one of the most characteristic south western stone tools though unfortunately their specific functions were never recorded ethnographically. The Northcliffe specimens are made of gneiss or amphibolite.

Cores and other by-products

There are a variety of cores in the Northcliffe assemblages. The most common kinds are multi-platformed, usually amorphous or globular, and bipolar or 'scalar' cores (Dortch and Merrilees 1973; White 1968). Single platform flake cores are common and are sometimes made on thick flakes (Fig. 9:5 is a silcrete specimen).

Discoidal cores are well represented as are flakes probably produced on discoidal cores (e.g. Fig. 9:10). The pieces in Figs 9:1 and 6 are bifacially flaked discoidal cores respectively made of silcrete and chert. The very small unifacially flaked discoidal core in Fig. 9:15 is made of a banded chert whose possible source of Cape Beaufort is noted above. A few silcrete cores (e.g. Fig. 9:3) resemble Levallois flake cores, and there are numbers of silcrete flakes (Figs 9:8, 9) which are very similar to Levallois flakes. However the present sample is too small to enable us to determine with certainty whether a Levallois technique of flake production (Bordes 1961) was used in the district.

The silcrete artifacts provide by far the best evidence for blade and bladelet production. (We divide blades and bladelets on the basis of size and proportions, following Tixier 1963, Fig. 7. A silcrete bladelet is illustrated in Fig. 8:5, and a small quartz blade in Fig. 8:6.) Blade or bladelet ('prismatic') cores are rare though some silcrete cores of all kinds have flake scar facets showing where bladelets or blades were removed along with flakes. Figure 9:11 shows a silcrete bladelet core which has been worked down to a very small size.

There are a few unilaterally flaked crested blades or bladelets made of silcrete (e.g. Figs 8:4, 7) in the Northcliffe assemblages. We interpret these as the principal preparatory pieces (*lames à crête*: Barnes and Cheynier 1936) removed from the flaking faces of bladelet or blade cores. We have found no bilaterally flaked crested blades; however, the tabular silcrete used in blade and bladelet production can be broken into sharp-edged fragments which require little or no flaking to prepare them for successive blade removal. Bordes and Crabtree (1968, p. 3) point out that only 'slight modification or unifacial trimming' is necessary when using 'angular' material.

We have found no chert blade or bladelet cores; chert blades are absent; and the very few chert bladelets so far identified, all from sites 1 and 2 (Table 2), are irregular. Furthermore the only chert cores which seem typical in our present sample are bipolar (scalar) and discoidal cores. All of the others seem to be casual fragments from which a few flakes were randomly removed from convenient corners. It should be emphasised that chert nodules from the two outcrops east of Northcliffe are small, irregular, full of spongolite masses or spicules, or chalky inclusions, and are thus unsuited for blade or bladelet production. However as noted above these nodules contain small masses of very fine grained chert grading into opal. Assuming that the local chert was quarried we suggest then that it was valued by stone workers largely because of the presence of small quantities of high quality stone. It seems likely, drawing on analogies from ethnographically recorded Aboriginal quarrying methods (notably Tindale 1965, pp. 140-1), that chert nodules were simply split or smashed into pieces and the more valuable bits collected. These then could be flaked by more formal techniques.

It is clear that the raw material has had a very marked influence on tool forms and stone working techniques in the Northcliffe assemblages. Silcrete was favoured for blade and bladelet production whereas chert was used only for flake production. Quartz seems to have been the main stone used in bipolar production of flakes, and sometimes small blades and bladelets, judging by the blade-like (*lamellar*) form of the flake scar facets on some of

the quartz bipolar cores; and by the bipolar dorsal flake scar facets on a few quartz small blades or bladelets (e.g. Fig. 8:6).

We regard these assemblages as the product of three interacting influences: raw material, functional need and cultural (or typological) modes. These three working together combine to give these assemblages their special character. For example the marked predominance of geometric forms among the silcrete microliths may be as much due to the limitations of the brittle material, in which bladelets often snap, as to any cultural or functional criteria. Detailed quantitative analyses of more representative samples than are presently available should enable these findings to be developed in more detail.

TABLE 3

A. Western Australian Museum registration numbers of artifact samples from the Northcliffe district.

A17370 - 75	A21916 - 27	B1042 - 65	B1714 - 26
A17410 - 19	A22053 - 55	B1682 - 86	B1730 - 34
A21840 - 46	B295	B1689 - 90	B1765 - 67
A21901 - 02	B298 - 99	B1692 - 1710	B2400 - 23

B. Western Australian Museum registration numbers of artifacts illustrated in Figs 6 - 9.

Fig. 6

1 B1053	5 B2409	9 B2405	13 B1059
2 A219101	6 B2409	10 A21846	14 B2413
3 B2407	7 A21842	11 B2113	15 B1692
4 A21842	8 B2414	12 B2410	16 B1683
			17 B1044

Fig. 7

1 B1059	2 B1059	3 B1059	4 B1059
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Fig. 8

1 A21901	4 B1683	7 B2409	9 A21846
2 A21901	5 B2409	8 B1723	10 A21846
3 21901	6 B1696		

Fig. 9

1 B2412	5 B1043	9 B1683	13 B1690
2 A21844	6 A21901	10 A17413	14 B1694
3 B1683	7 B2412	11 A17375	15 B1051
4 B1058	8 B1683	12 B1694	

SUMMARY

Here we have used ethnohistorical and environmental data to outline tentatively some aspects of Aboriginal land use and subsistence in the Northcliffe district, and to assess the functions of some archaeological sites and assemblages. Archaeological investigations in this district are only in their early stages, yet already present data are of considerable value in evaluating various aspects of prehistoric cultural ecology. These can be summarised as follows.

1. Site function. The known archaeological sites are located within exploitative range (i.e. within two km) of a number of diverse vegetation formations or topographical features offering varying suites of food and other resources (Maps 2, 3). The functions of most of these sites and the stone artifacts by which they were identified cannot, in the almost total absence of other associated classes of archaeological material, be interpreted specifically at this stage. However we believe that some of the larger and more diverse assemblages, notably those from sites 1 and 2, represent campsites where people were employed in stone tool manufacture and other domestic tasks such as food preparation and woodworking. These two and other sites located on the edges of freshwater swamps may have been occupied by groups whose subsistence was based on the wetland foods noted above.

2. The silcrete quarry-factory. We interpret this site as a long established centre for the dispersal of an economically important commodity, and one which may have had far reaching influences upon group movement, economy, and intergroup contact.

3. Malimup. The presence of some marine molluscs and stone artifacts at several coastal sites around Malimup suggests that on this coast Aborigines occasionally ate shellfish. This proposition should be tested in field investigations in the Malimup area and other undisturbed south western coastal districts before all coastal dunes become contaminated by modern development.

4. The fish trap on Blackwater Creek. This site shows that the freshwater creeks were fished, and that fishing may have involved a relatively high degree of long term planning and co-operative effort. Food yields from traps such as these may have been sufficiently high to have enabled quite large groups of people to remain here for prolonged periods. (cf. Hammond 1933, p. 46).

5. Environmental data. It is not clear at this stage whether the soil periodicity for which there is evidence in this district results from instability brought on by Aboriginal firing of the countryside (see Hallam 1975), naturally caused

bushfires or other localised natural phenomena, climatic change or any combination of these. The preliminary pollen studies resulting from the investigations at the silcrete quarry-factory mark an important first step in reconstructing the vegetational history of this area.

More systematic field investigations will be necessary for the recovery of archaeological and other material, particularly biotic remains, which can be used in formulating and testing hypotheses concerned mainly with ecological aspects of prehistoric Aboriginal culture in this district.

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