An archaeological investigation of the Koichab River region of the south-western Namib Desert, centred on the activities of Holocene hunter-gatherers

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ABSTRACT

The 1986-1988 archaeological investigations of the previously largely unresearched Koichab River region of the south-western Namib Desert are described. The sites studied are those of Holocene hunter-gatherers. Included are the analyses of archaeological remains from two excavations and three surface collections. The investigations resulted in the recovery of the oldest dated archaeological material from the entire Namib coast, and the halving of the duration of the previously established Holocene hiatus for the southern Namib. It is suggested that the resources of the Koichab River region were subjected to opportunistic utilization, a subsistence strategy which may have been more extensively resorted to in all of southern Africa than has so far been suspected.

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CHAPTER ONE:
INTRODUCTION

Previous archaeological research

In 1986 a literature survey revealed that very little was known about the prehistory of the Koichab River region. Due to the inaccessible terrain and the extent of the restricted diamond zone, research had been limited to preliminary investigations and observations (Avery 1985, Range 1910, Rudner and Grattan-Bellew 1964, Sandelowsky 1977, Vogel and Visser 1981, Wendt 1975, 1980). Even so, the existence of MSA and LSA assemblages in both open sites and rock shelters had been established. Wendt, who had done the most work in the area, including the only two excavations, had not yet published a full report. His evidence, however, consisting mainly of the discovery inland of marine shell fragments and pendants, rock art with coastal motifs, and beads made from coastal plant sap, suggested that coastal visits were the norm thousands or even tens of thousands of years before trade with ships developed.

Geography

The presently dry Koichab River largely forms the dividing line between the central sand sea and the southern gravel plains of the Namib Desert (Fig. 1). It originates south-east of Aus at at height of 1 555 m above sea level, some 127 km from the coast. In a sweeping curve to the north it covers 140 km before ending in a pan, 40 km from the sea, its passage westwards blocked by a barrier of high dunes (Barbour and Dippenaar 1986). The Koichab palaeo-valley runs below and to the north of the present river, continuing beneath the sand to reach the Atlantic Ocean at Anichab, 35 km north of Luderitz. It is about 10 km wide, 100 m deep, filled with water-saturated alluvium and covered by dry dune sand. The water reserves were probably accumulated during the latest pluvial period, some 10000 years B.P. (Barbour and Dippenaar 1986). For the purpose of this study, "Pluvial period" is being used in its geological sense, as merely referring to a period of prolonged rainfall. No archaeological parallels to the northern hemisphere are intended. Recently it has been suggested that the latest pluvial period actually lasted from about 16000 B.P. to 11000 B.P. in the Namib (Deacon and Lancaster 1988). In this study, the post-pluvial period will be taken as referring to the time after 11000 B.P. The present-day recharge of these fossil water reserves, which have supplied the town of Luderitz with fresh water since 1969, is not considered significant. The initial post-pluvial reserves, as well as the rate of outflow at the coast, are considered to have been much higher than they are today (Barbour and Dippenaar 1986).

Climate

The present climate of the region is extremely arid. Aus receives a yearly average of 92,9 mm of rain, mainly in summer, while Luderitz

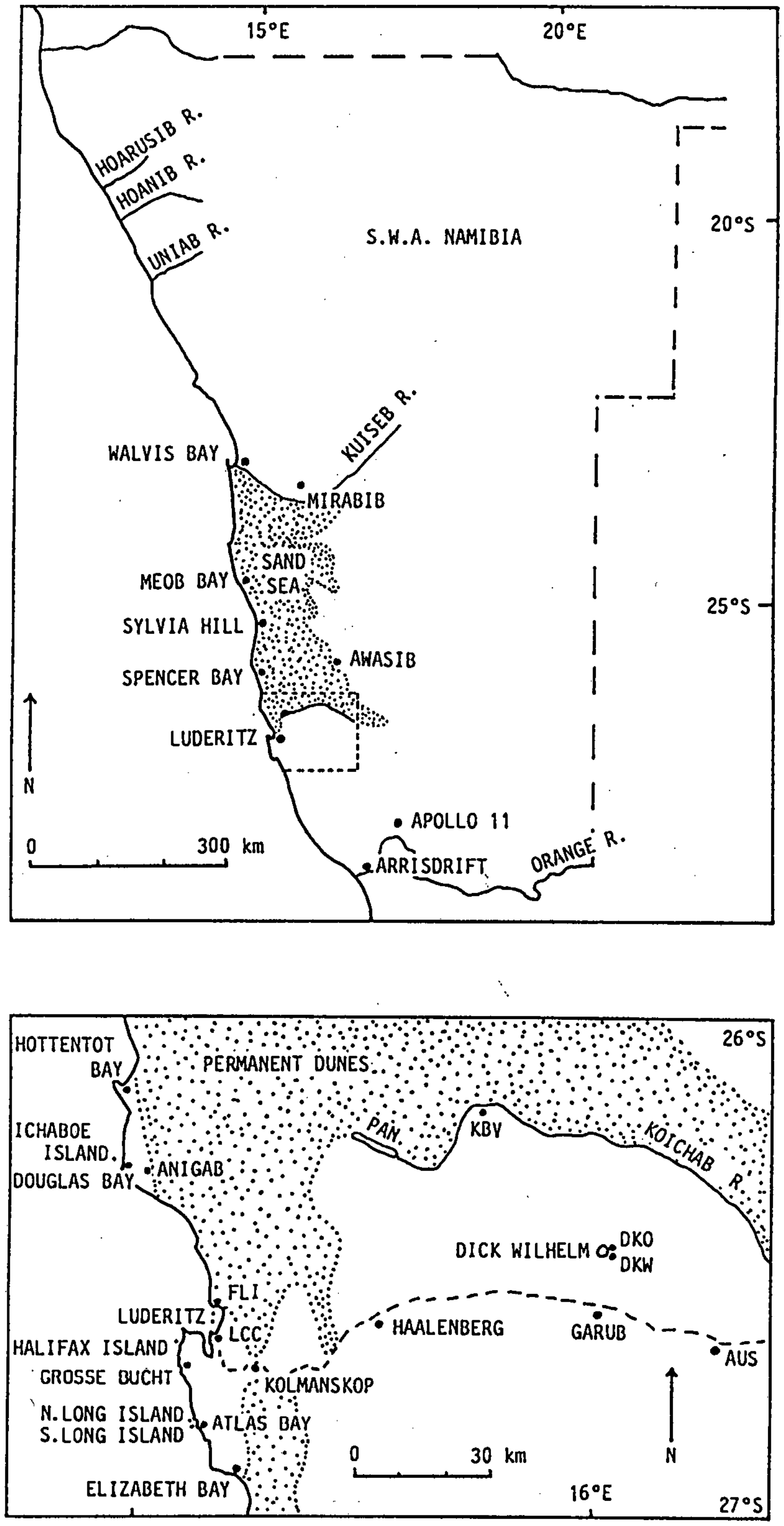

Fig. 1. Maps showing the location of the Koichab River research area, as well as the main sites and features mentioned in the text.

receives a yearly average of 14,8 mm of rain, mainly in winter (Weather Bureau 1953). Kaiser (1926), however, cautions against the use of averages when dealing with the region's rainfall, stressing its irregularity and the extreme variations which can occur. He cites the example of Kolmanskop, some 10 km inland from Luderitz, where 112,4 mm of rain was recorded in 1917, 37,2 mm of it in a single day. More recently, the Koichab pan was flooded in 1967, 1974, 1976 and 1985 (Barbour and Dippenaar 1986). Due to the sharply rising terrain, the coastal fogs seldom penetrate more than 5 km inland, and it is only on low-lying coastal flats, such as in the Anichab area, that dew contributes significantly to the precipitation (Kaiser 1926). The coastal region tends to be cool, with a mean temperature of about 15,7°C which, with a range of 7,2°C, is not given to much variation (Weather Bureau 1986). For the interior, on the other hand, temperatures of 45°C in the shade have been recorded from near the Koichab pan (Barbour and Dippenaar 1986), while snow and frost have been experienced at Aus (Kaiser 1926). Moderate to strong southerly winds, often accompanied by sandstorms, prevail throughout the year in the whole region. In winter these are interrupted on the coast by a rain-bringing north wind, while an occasional east wind, chilling in the interior, arrives as a hot and unpleasant sandstorm at the Atlantic shoreline. While sandstorms can last unabated for days, the southerly winds often only start in mid-morning and settle in the evening. Sometimes they manifest themselves as light breezes, or not at all, resulting in extremely pleasant conditions (Kaiser 1926).

Working hypothesis

It was speculated that, in the early post-pluvial period, when increasing aridity (Deacon and Lancaster 1988) would have resulted in the occupation of marginal regions by hunter-gatherers, the Koichab River region would have been a linear oasis in just such a marginal area, thus encouraging denser prehistoric occupation by man than in adjacent areas. Another attraction would have been the fact that it probably formed a natural route between the coast and the interior beyond the desert. Being a winter-rainfall area, it also would have been a potential refuge from the dry, cold winters of the interior. When and whether the Holocene hunter-gatherers vacated the region would have depended on the level of the Koichab ground-water reserves, but they would have reoccupied it during the last quarter of the Holocene, when their territory was put under pressure by a drastic increase in the population of southern Africa (Deacon and Lancaster 1988).

Research outline

On the basis of the foregoing hypothesis, it was decided to subject the Koichab River region to an intense archaeological investigation, centred on the activities of Holocene hunter-gatherers. It was intended that such a research programme would eventually be able to supply at least some detail for what was at that stage a rather blank spot on the archaeological site distribution map. It was hoped that specific excavations and surface collections would significantly add to the understanding of the local sequence and the special relationship the prehistoric inhabitants of the desert must have had with their environment to ensure survival. In the course of this investigation, it was also hoped to address the hiatus which had been suggested for the latter half of the Holocene in the southern Namib (Wendt 1975, Vogel and Visser 1981, Parkington and Hall 1987), as well as the lack of any archaeological material predating 2690 B.P. from the entire Namibian shoreline.

CHAPTER TWO:
METHODS AND PROBLEMS

Access to the area

Due to the extent of the diamond zone and current diamond retrieval operations, ready access was only obtained to the area north of the Luderitz-Aus road, within about 20 to 30 km of the sea, as well as the shoreline within 10 km of the Luderitz Townlands. While this meant that the highly promising Douglas Bay-Anichab area and Hottentot Bay were excluded from the ground survey, the inclusion of the whole Koichab River valley, as far as the pan, as well as the sheltered waters of Luderitz Bay and the lagoon, was considered more than adequate for the purpose of this investigation.

Terrain and logistics

Apart from an initial introduction to the area by G. Noli and a three-day field trip with Dr E. Wendt, the survey of the interior as well as the surface collections and the excavations were done by myself without any assistance. Combined with the nature of the terrain, which demanded the use of an off-road vehicle, the size of the research area, and the time and funds available, this severely restricted the scope of the investigation. Furthermore, the vulnerability of the gravel plains to ecological damage resulting from uncontrolled vehicle use necessitated the use of existing tracks, which meant that many areas had to be left out or investigated on foot. Due to constraints imposed by time and safety, both the central Namib sand sea and the mountains had to be avoided. On the positive side, existing tracks followed the lines of least topographical resistance - the same lines hunter-gatherers would probably have followed.

Due to the general lack of vegetation, rock shelters could be identified from a distance of several kilometers because of the contrast between their shady interiors and the desert glare. Similarly, the existence of vegetation heralded from afar the presence of ground water and the sites with which it was inevitably associated.

Sea-level changes

On the basis of the evidence provided by radiocarbon dates for shell samples collected on the continental shelf between the Orange River Mouth and Luderitz, the postglacial rise in sea level had reached, in comparison to today's mean sea level, -75,5 m by 13300 B.P. (Pta-955, 951, 957, 949) and -20,4 m by 7130 B.P. (Pta-1099, 1098). Marine platforms above the present beach near Luderitz suggest a marine transgression of +3,6 m by 4940 B.P. (Pta-149) which had dropped to +1,5 m by 1180 B.P. (Pta-417) (Vogel and Visser 1981). Since no part of Luderitz Bay or the lagoon is deeper than 15 m (Walters 1971), this means they were only created some time after 7130 B.P. and before 4940 B.P. Consequently, the occupation of all sites along the present shoreline is likely to have occurred mainly during the latter half of the Holocene, earlier sites having been drowned. By the same token, the salt- and mud-flats stretching from

Anichab to Hottentot Bay at a height of less than 3 m above sea level would have been flooded during the marine transgression, creating a lagoon some 25 km long, as well as several islands. This would appear to be substantiated by the fact that Eden (1846:36) described the salt-flats as follows: "... this district appeared as if the sea had but recently left it, the rocks surrounding it are water worn, and the beds of shells still retain the impression of the waves ..." Also, a deposit of guano which was so old that it had lost its smell was recovered from under 2 m of sand at Hottentot Bay in 1883, indicating that the area had once been an island harbouring a breeding colony of sea-birds (Joint Commission 1885). Thus, at the height of the marine transgression, the Luderitz area would have been rivalled by the Anichab area as a sheltered shoreline, the latter having the added advantage of a plentiful supply of fresh water. This casts further doubts on how representative sites from the Luderitz area would be for the occupation patterns of the coast of the whole Koichab River research area. Consequently, for the purpose of surface collection and excavation, every effort was made to locate sites which were well clear of the last marine transgression, and which, in addition to their proximity to the bay, had an additional attraction in the form of providing shelter from the prevailing winds.

Surface collections

Flamingo Island (FLI): This site is a scatter of shell and a concentration of stone tools on the surface of a vantage point, backed by a low hillock some 8 km from Luderitz, which overlooks the largest shell midden complex in the Luderitz area. It is well clear of the last marine transgression area and is protected to a limited extent from south-westerly winds.

A linear grid of ten 1 x 1 m squares was laid out down the slope (Fig. 2). Half a bucket (5 litres) of the surface material of each square was removed and put through a 4 mm and a 1,8 mm sieve. All material recovered was kept for later analyses.

Dick Wilhelm Open (DKO): This site is a scatter of stone tools crowning a partly vegetated dune which lies against the western base of Dick Wilhelm Mountain, some 90 km from the coast and 25 km from the Koichab River. It has a panoramic view over a valley which includes a temporary waterhole 6 km away.

A rectangular grid 5 m long and 2 m wide was laid out in 1 m squares on the dune summit (Fig. 3). One bucket (10 litres) of the surface material of each square was removed and put through a 4 mm and a 1,8 mm sieve. All material recovered was kept for later analyses.

Kirchberg Vorkuppe (KBV): This site is an extremely dense concentration of stone tools lying on the slope in front of a large rock shelter overlooking the bed of the Koichab River, about 80 km from the sea.

It is the closest rock shelter to the river bed, as well as being situated about halfway down the length of the river course. In spite of a very promising deposit in the shelter itself, logistic and time constraints, as well as the limited scope of the present investigation, prevented its

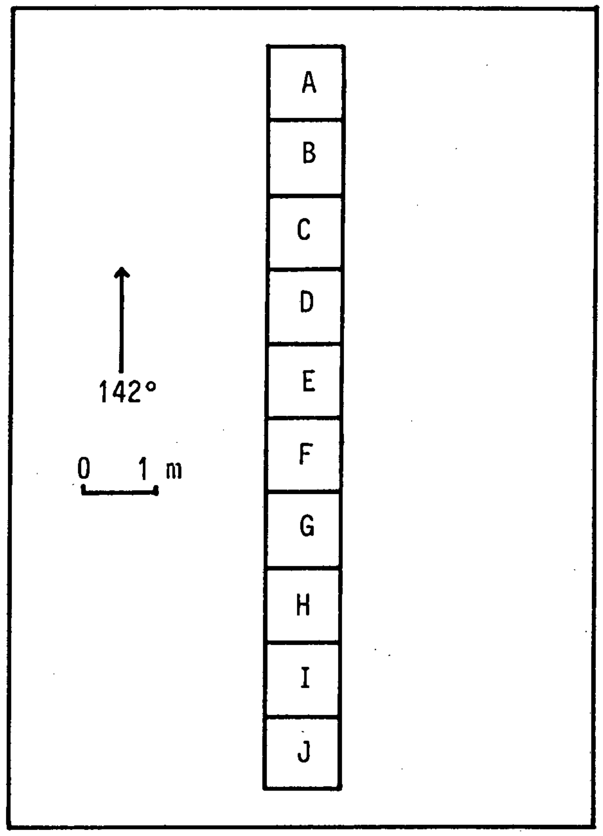

Fig. 2. Plan view of surface collection FLI.

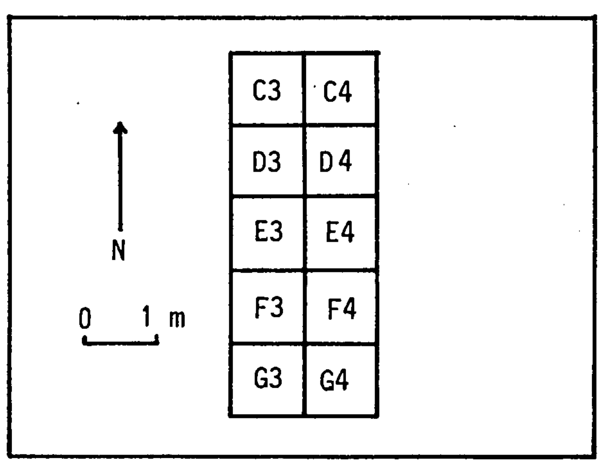

Fig. 3. Plan view of surface collection DKO.

excavation. A surface collection on the slope in front of the shelter was considered the best alternative. A previous, random collection of formal tools had already been done by E. Wendt. Although this material was made available to me, it created serious sampling problems, in that I did not know how representative any 10 m^2 selected by me would be. The whole sandy slope was also completely churned up by gemsbokke, who evidently were making extensive use of the shelter's shady interior. Consequently it was decided that, as far as a spatial analysis was concerned, the site had been destroyed, and that the most reliable information would be obtained by collecting all the material and adding it to that collected previously by Wendt. The total area of 744 m^2 (Fig. 4) was divided into 1 m transects and all lithic evidence visible on the surface was collected by hand, except for quartz, grindstones and obvious natural pieces of granite. For quartz, estimated at a total weight of ±200 kg, an area of 6 m^2 was sampled, whereas the 126 upper and lower grindstones and grindstone fragments, estimated at a total weight of ±170 kg were simply counted, as the removal of such large samples was not possible. While every effort was made to locate clear quartz artefacts, it has to be accepted that some pieces, especially the smaller ones, were not located because of the intense glare off the desert sand. Ostrich eggshell (OES) beads were collected as well, while pottery, OES fragments, bone, pieces of metal and glass were recorded and left in place.

Excavations

Luderitz Coastal Cave (LCC): This site is a shell midden in a rock shelter on the western side of a 92 m high granite hill overlooking

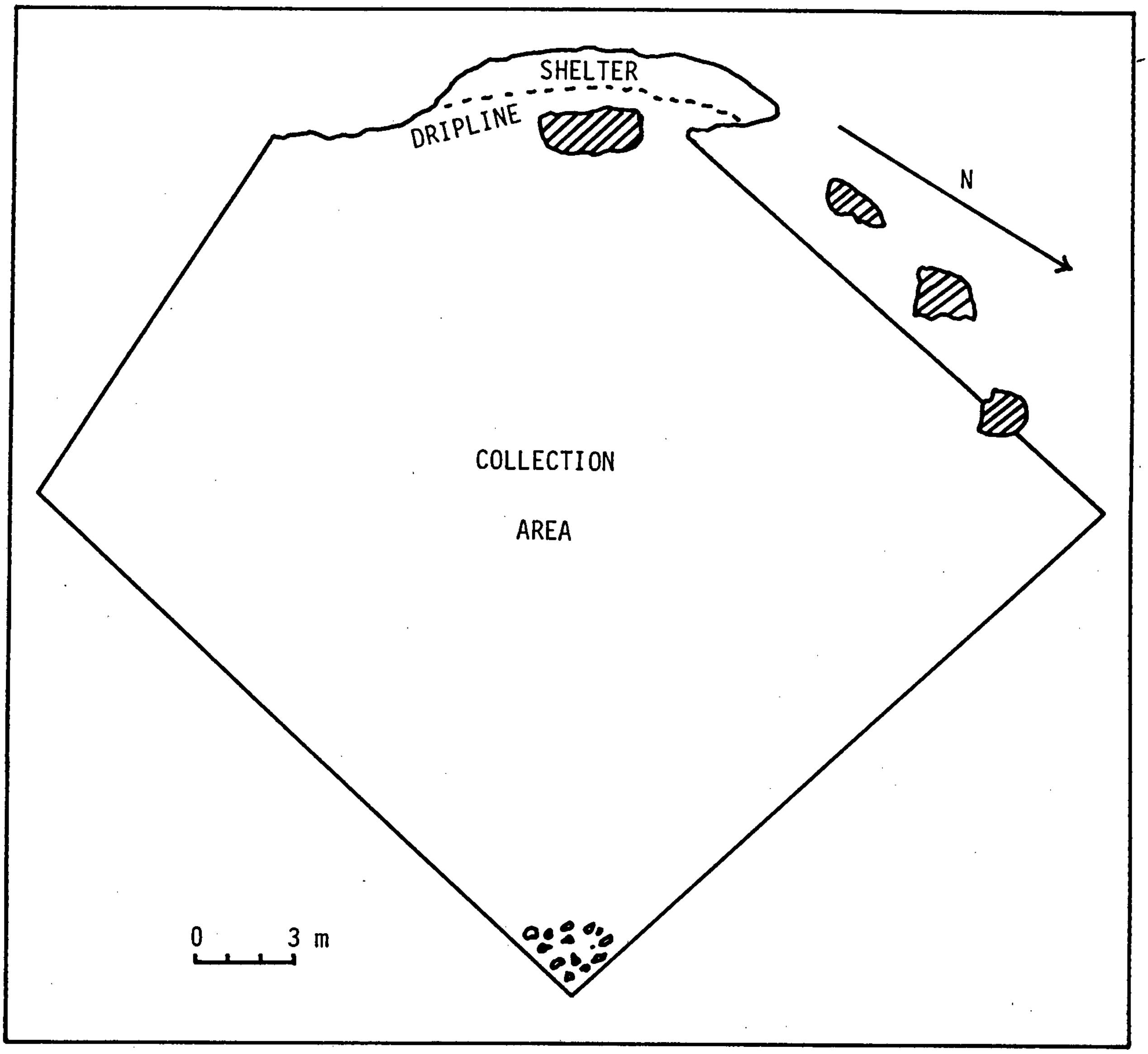

Fig. 4. Plan view of surface collection KBV.

Luderitz bay. While the sea cannot be seen from the shelter itself, the latter lies just below the summit of the hill, from which an excellent view of the whole bay can be obtained. At a height of some 80 m above sea level and a distance of 1,7 km from the present shore, the site was well out of reach of the marine transgression. It was selected because the excellent protection it gives against the prevailing winds was speculated to have made it less susceptible to sea level changes or the existence of superior water sources at Anichab than the open station shell middens, and hence more representative of overall Holocene activities in the coastal strip of the Koichab River research area. A linear grid of 3,5 1 x 1 m squares was laid out from the back to the front of the cave (Fig. 5). The deposit was excavated in nine layers, two of which were adjacent. Natural stratigraphy, based on texture and content, was followed wherever possible. The deposit in the back of the cave was soft and became unstable once it had dried out, but the deposit in the front of the cave was compact and relatively stable. The excavated material was put through a 4 mm and a 1.8 mm sieve, the proceeds from the 4 mm sieve being sorted on site into stone, charcoal, bone, eggshell, plant material, metal, glass and pottery/stoneware and kept for later analysis. All the material remaining in the 1,8 mm sieve was retained for laboratory sorting and analysis. Labelled paper bags were used, but fragile bone was first wrapped in aluminium foil, where necessary after having been stabilised with acetone-based glue. Charcoal was handled with tweezers and placed in plastic bags.

Plan and section views of the excavation were drawn on site. Due to the density of shell in the deposit, it was not considered practical to keep

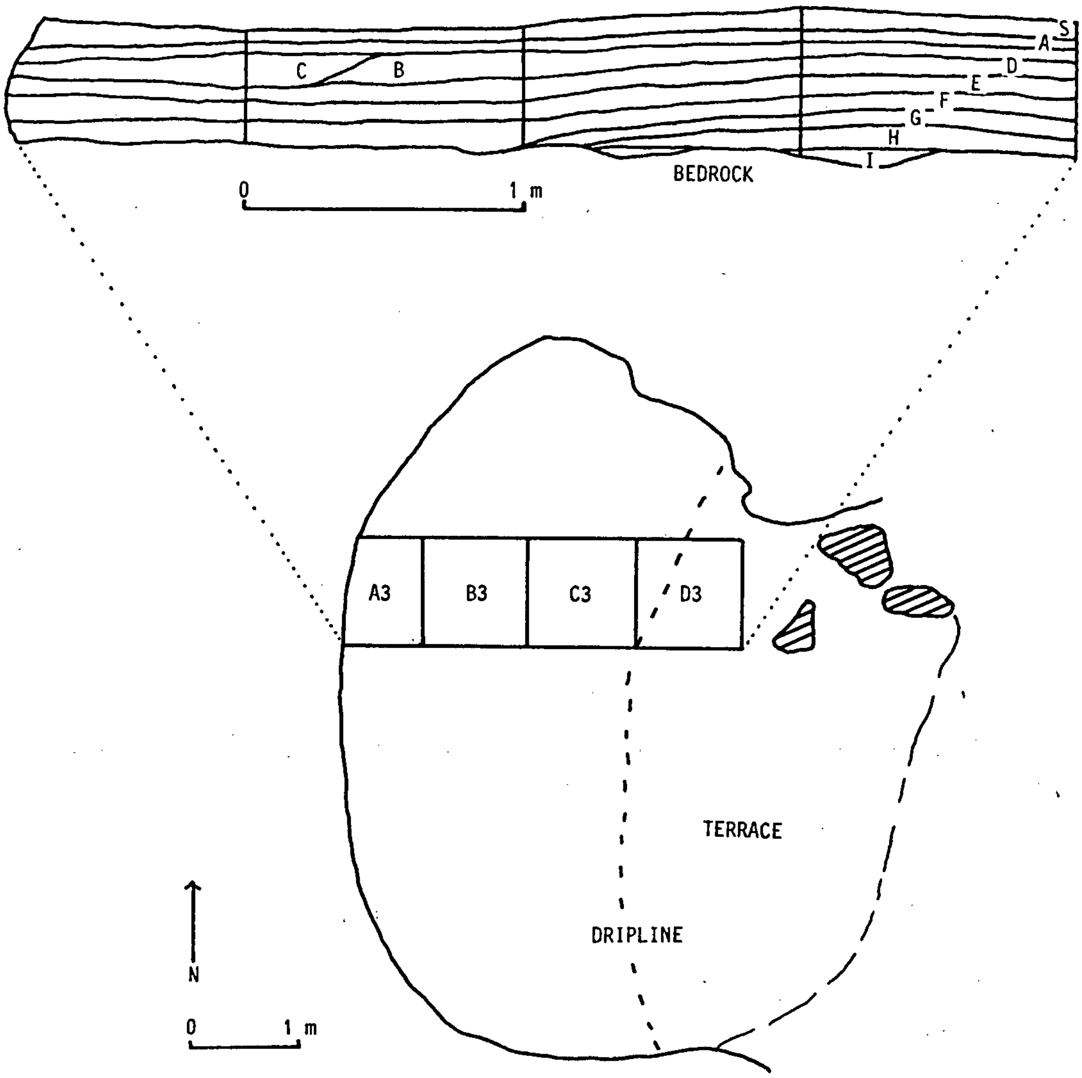

Fig. 5. Plan and section views of excavation LCC.

all of it. For each square, one bucket of deposit per layer (about 18% of the excavated deposit) was sampled for shell, the proceeds being bagged for later analysis.

Dick Wilhelm (DKW): This site is a rock shelter on the western side of the lower reaches of Dick Wilhelm Mountain, and lies some 300 m higher up the slope than DKO. It is easily accessible, affords excellent protection against the prevailing winds and has a very good view.

One square of 1 x 1 m was laid out in the shelter (Fig. 6). The deposit was excavated in thirteen 50 mm spits. Four units were identified by texture and content. The deposit was compact and very stable. The rest of the excavations followed the same procedure as in the case of LCC, with the exception that shell was not present.

Composition of samples

For the excavations, the relative proportions, by mass of bone, OES, charcoal, plant material and shell of the respective layers were calculated where applicable as a percentage of the total deposit excavated. These are illustrated as graphs for purposes of comparison. In the case of stone, the relative frequencies of the artefacts were calculated and graphed. This was done because the percentages based on mass would have been biased by the occurrence of several large artefacts, while in fact the majority of artefacts were of microlithic proportions. For LCC, the relative frequency of granite spalls in one square was also calculated, as it was hoped that, assuming a constant rate of rock

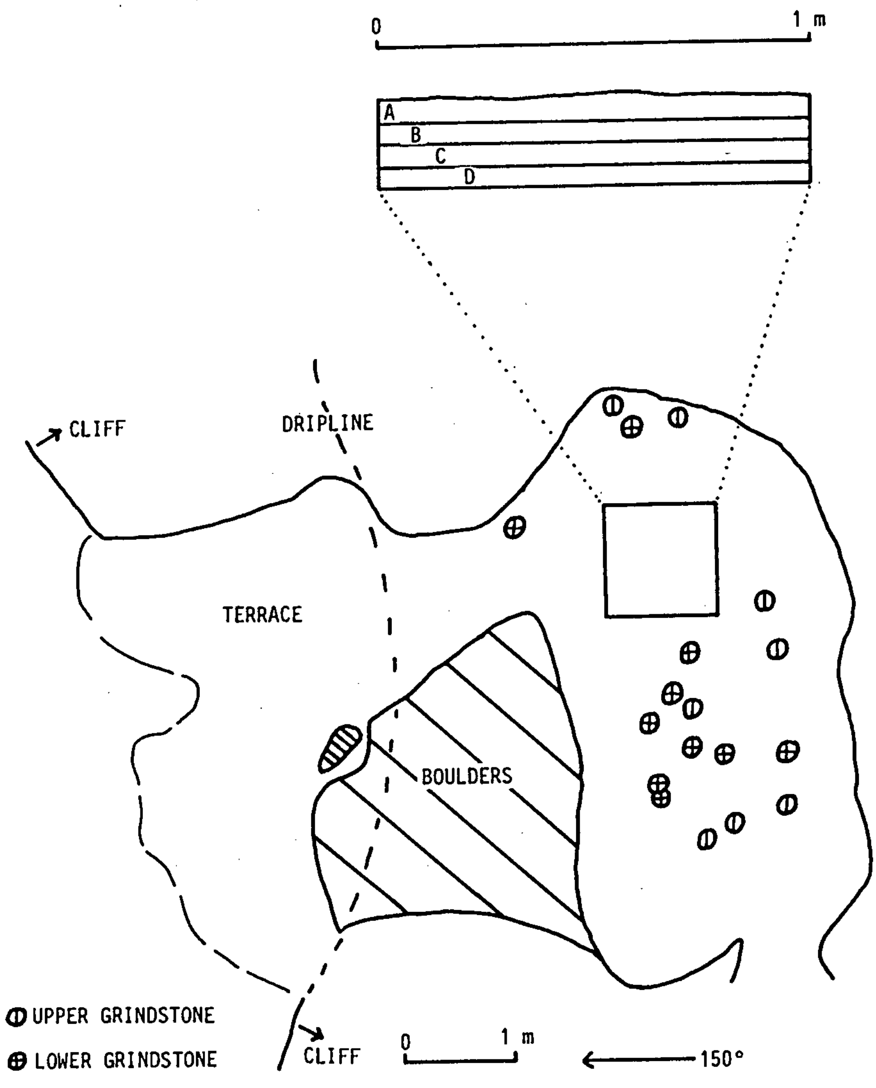

Fig. 6 Plan and section views of excavation DKW.

exfoliation from the ceiling of the shelter, the frequency of these spalls would give some idea of the rate at which the deposit had accumulated.

Analysis of cultural materials

Stone artefacts were sorted into types and into raw material classes according to the system developed by Deacon (1972). In order to ensure compatibility with the original classification system, a sample of sorted material was submitted to Deacon for verification. Ostrich eggshell beads were described, measured and weighed. Engraved OES, as well as OES container rim pieces, bone and metal artefacts and pottery fragments, were counted, weighed and described. Charcoal was weighed and three samples from DKW were submitted for radiocarbon dating.

Faunal analysis

The faunal analyses were done by G. Avery, the exception being shellfish, which I did myself. For fish, reptiles, birds and mammals, the faunal remains were first identified to species level, after which the body parts were used in the standard manner to calculate the number of identified specimens per species (NISP) and the minimum number of individuals (MNI) (Klein and Cruz-Uribe 1984) for the individual layers. For Cape rock lobsters, the MNI values were calculated using only the left mandibles. Six species of shellfish were identified for LCC. The MNI values were obtained by counting the apices for limpets and whelks, and either left or right hinges for mussels. The relative proportions of species per layer were calculated as percentages and graphed for comparison. All whole limpets were measured across the widest part of their margins, while black mussel lengths were obtained by multiplying the width of the blue band by ten, as suggested by Buchanan (1985). The mean, standard deviation, range and 95% confidence interval of measurements for some shellfish species were calculated for each layer. Five shell samples from LCC were submitted for radiocarbon dating.

CHAPTER THREE:

RESULTS

Site distribution

A total of 27 shell middens was found within 3 km of the coast. Surface inspections revealed that most of them contained microlithic stone tools, OES and pottery fragments. Also well represented were bones of sea-birds, seals and whales, while ten of the middens had upper or lower grindstones visible and two of the middens were in rock shelters. Two open sites without shell or pottery, a cluster of stone circles, two groups of graves and the site of David Radford's 1862 trading station were also located. Most of the sites were adjacent to Luderitz Bay and the Lagoon, with not a single one being found on the 10 km of exposed coastline between Halifax Island and Grosse Bucht (Fig. 7). The sites at Atlas Bay and Elizabeth Bay were found as a result of specific visits based on information received, and no survey was made of the rest of the 20 km coast between Grosse Bucht and Elizabeth Bay. The most extensive midden complexes were at the northern end of Luderitz Bay, in the lee of Penguin and Seal Islands, and along the south-eastern extremity of the lagoon, where a spring of brackish water was found.

A total of 46 rock shelters with artefacts was located in the interior, 39 of them with grindstones, 11 with deposits which looked promising, and three with rock art. At three sites there were stone circles and cairns associated with the rock shelters. Seven of the shelters were in the

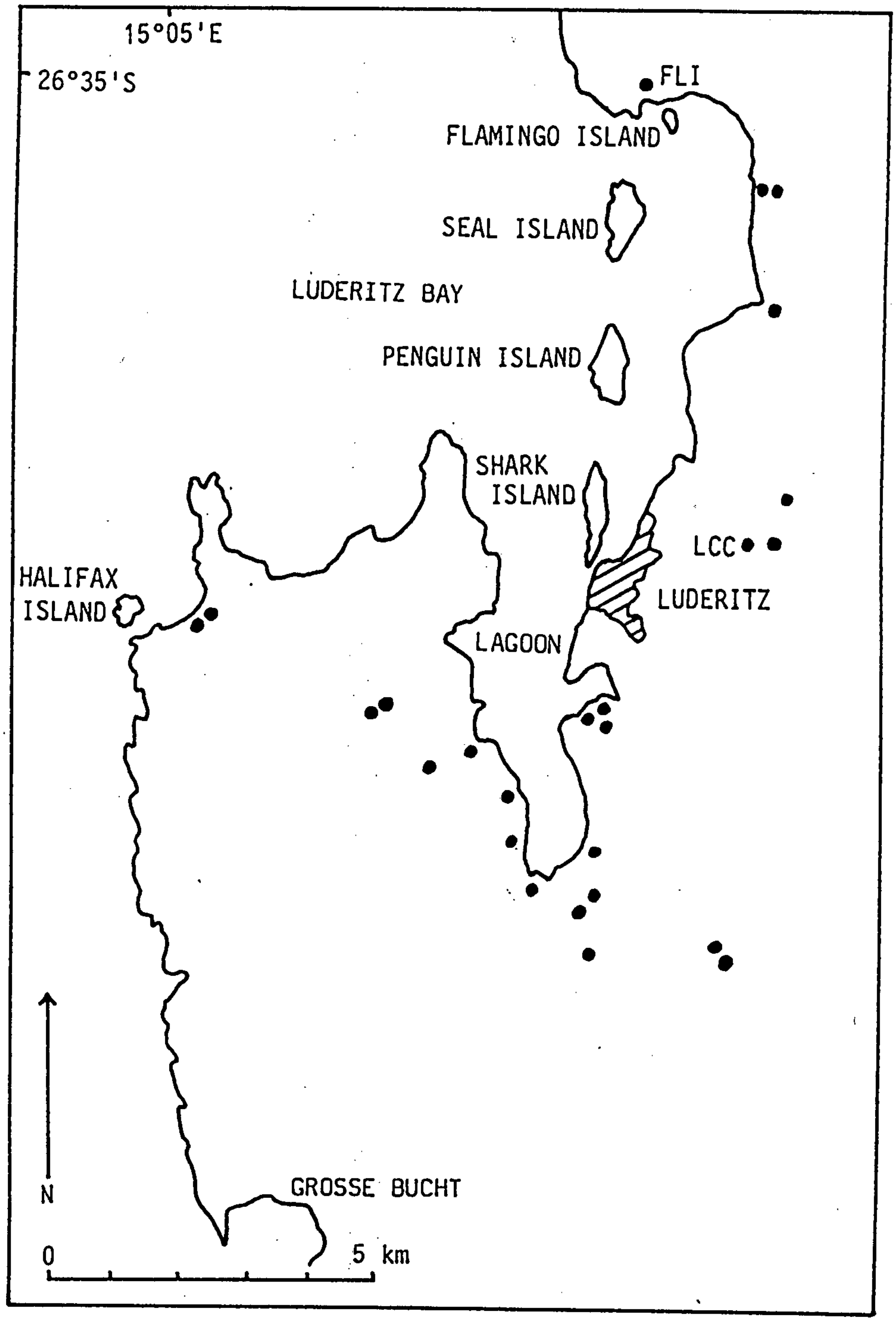

Fig. 7. Map showing the distribution of sites in the vicinity of the Luderitz Townlands.

vicinity of water holes. Of the eight open sites found, three were in the vicinity of water holes, two had grindstones and two were MSA sites in the Koichab River bed (Fig. 8). Most of the sites in the interior were in mountains or rocky outcrops, usually facing north, away from the prevailing southerly winds. Some had pottery fragments, several had panoramic views and most contained OES fragments and microlithic tools. Two had fragments of sea-shell. The most striking feature of the whole area was, however, the vast number of both upper and lower grindstones. One site alone, a rock shelter overlooking the Koichab River (KBV) had 114 upper and 35 lower grindstones, while four other sites had nine or more lower grindstones.

Surface collections

FLI: Table 1 shows that, of the total number of artefacts (n = 6 523), 82,9% are of quartz, 10,2% of translucent chert, 4,7% are of crypto-crystalline silicates (CSS), 0,1% are of clear quartz and 2,2% of other stone. Only 1,0% of the artefacts are formal tools, of which 55,2% are of translucent chert, 29,9% are of CCS, 10,4% are of quartz, 1,5% are of clear quartz and 3,0% are of other stone.

Of these formal tools collected (n = 67), 23,9% are miscellaneous retouched pieces, 19,4% are segments, 19,4% are backed flakes, 10,4% are scrapers, 10,4% are backed bladelets, 7,5% are with notched retouch, 4,5% are spokeshaves and 4,5% are borers. All the formal tools are of microlithic proportions.

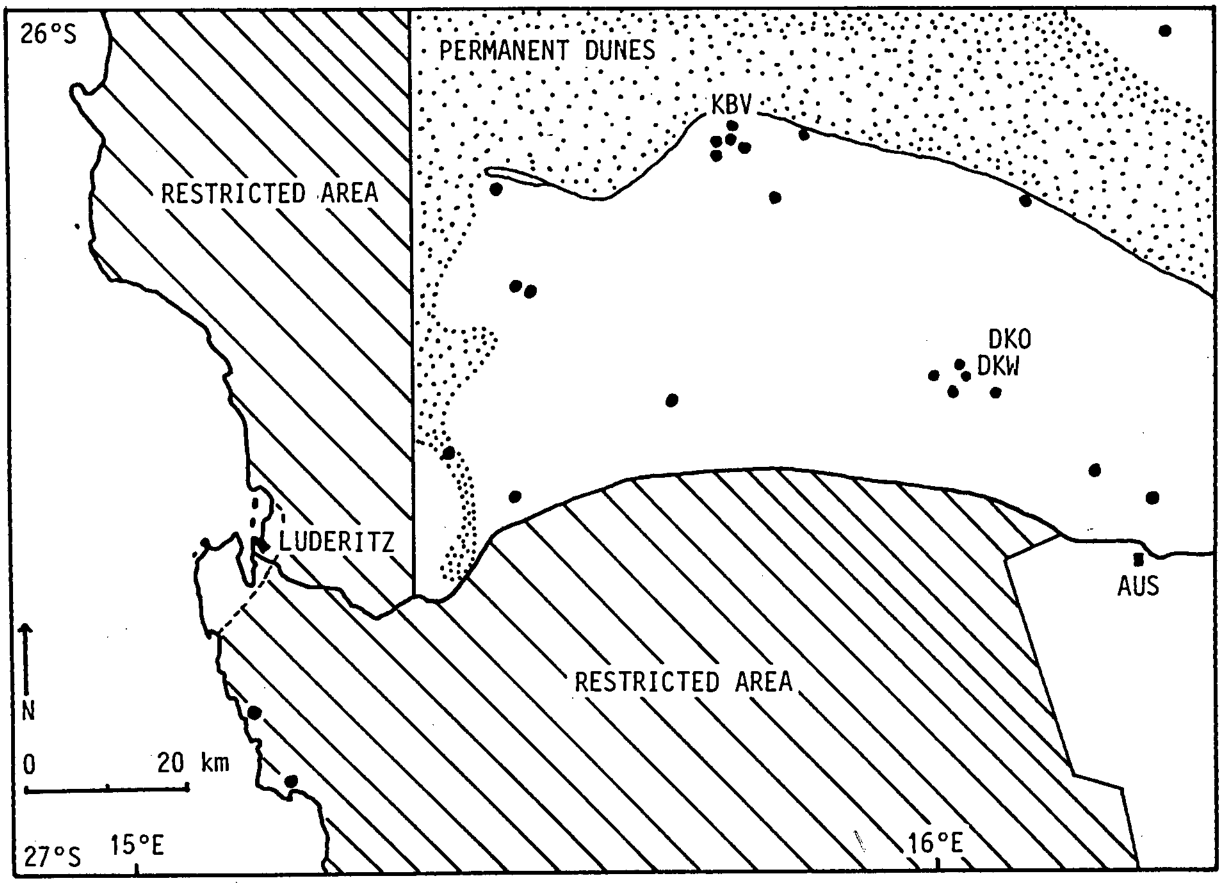

Fig. 8. Map showing the distribution of sites not in the vicinity of the Luderitz Townlands.

Table 1. The frequencies of stone artefact types and raw material classes for FLI.

	CCS (n)	CLEAR QUARTZ (n)	TRANSLUCENT CHERT (n)	QUARTZ (n)	OTHER (n)	SITE TOTAL (n)	% OF SITE TOTAL	FORMAL TOOLS (n)	% OF FORMAL TOOLS
CHUNKS	51	-	86	3841	24	4002	61,4		
CORES	8	-	11	20	3	42	0,6		
CHIPS	102	1	307	239	4	653	10,0		
FLAKES	122	1	211	1295	104	1733	26,6		
BLADELETS	3	-	10	1	-	14	0,2		
UTILIZED FLAKES	3	-	4	1	2	10	0,2		
UPPER GRINDSTONES	-	-	-	-	1	1	-		
UPPER GRINDSTONE FRAGMENTS	-	-	-	1	-	1	-		
SCRAPERS	2	-	-	5	-	7	0,1	7	10,4
SEGMENTS	3	1	9	-	-	13	0,2	13	19,4
BACKED BLADELETS	2	-	5	-	-	7	0,1	7	10,4
BACKED FLAKES	4	-	9	-	-	13	0,2	13	19,4
SPOKESHAVES	-	-	1	-	2	3	0,1	3	4,5
BORERS	1	-	2	-	-	3	0,1	3	4,5
NOTCHED RETOUCH	-	-	3	2	-	5	0,1	5	7,5
MISCELLA-NEOUS RETOUCH	8	-	8	-	-	16	0,3	16	23,9
SITE TOTAL	309	3	666	5405	140	6523			
% OF SITE TOTAL	4,7	0,1	10,2	82,9	2,2	-			
FORMAL TOOLS	20	1	37	7	2	67			
% OF FORMAL TOOLS	29,9	1,5	55,2	10,4	3,0	-			

DKO: Table 2 shows that, of the total number of artefacts (n = 813), 48,8% are of quartz, 30% are of CCS, 12,5% are of carbonatite, 7% are of clear quartz, 1% are of translucent chert, 0.1% are of rhyolite, and 0,7% are of other stone. Only 3,1% of the artefacts are formal tools, of which 72% are of CCS, 12% are of quartz, 8% are of clear quartz and 8% are of other stone.

Of the formal tools collected (n = 25) 52% are scrapers, 24% are backed scrapers, 8% are segments, 8% are grooved stones, 4% are backed flakes and 4% have miscellaneous retouch. All the formal tools except the grooved stones are of microlithic proportions.

KBV: Table 3 shows that, of the total estimated number of artefacts (n = 72 716) 95% are of quartz, 3,5% are of CCS, 0,8% are of clear quartz, 0,2% are of rhyolite and 0,3% are of other stone. Only 0,5% are formal tools, of which 86,9% are of CCS, 5,6% are of translucent chert, 3,1% are of clear quarts, 2,1% are of rhyolite and 2,3% are of other stone.

Of the formal tools collected (n = 389), 48,3% are scrapers, 18,8% are backed scrapers, 8,7% have miscellaneous retouch, 8,2% are segments, 3,9% are borers, 3,3% are denticulated pieces, 2,3% are backed bladelets, 2,3% are backed flakes, 2,1% have notched retouch, 1,0% are spokeshaves, 0,5% are adzes, 0,3% are backed blades and 0,3% are pipe fragments. All the formal tools, except for three rhyolite scrapers made from re-worked MSA tools, are of microlithic proportions.

Table 2. The frequencies of stone artefact types and raw material classes for DKO.

	CCS (n)	CLEAR QUARTZ (n)	RHYO-LITES (n)	CARBONA-TITE (n)	TRANSLU-CENT CHERT (n)	QUARTZ (n)	OTHER (n)	SITE TOTAL (n)	% OF SITE TOTAL	FORMAL TOOLS (n)	% OF FOR-MAL TOOLS
CHUNKS	41	7	-	31	3	119	3	204	25,0		
CORES	3	5	-	-	-	9	-	17	2,1		
CHIPS	30	18	-	31	3	134	-	216	26,6		
FLAKES	141	24	1	38	2	128	-	334	42,3		
BLADES	1	-	-	1	-	-	-	2	0,2		
BLADELETS	2	-	-	-	-	-	-	2	0,2		
UTILIZED FLAKES	7	1	-	1	-	4	-	13	1,6		
SCRAPERS	10	2	-	-	-	1	-	13	1,6	13	52
BACKED SCRAPERS	4	-	-	-	-	2	-	6	0,7	6	24
SEGMENTS	2	-	-	-	-	-	-	2	0,2	2	8
BACKED FLAKES	1	-	-	-	-	-	-	1	0,1	1	4
MISCELLA-NEOUS RETOUCH	1	-	-	-	-	-	-	1	0,1	1	4
GROOVED STONE	-	-	-	-	-	-	2	2	0,2	2	8
SITE TOTAL	243	57	1	102	8	397	5	813			
% OF SITE TOTAL	30,0	7,0	0,1	12,5	1,0	48,8	0,7	-			
FORMAL TOOLS	18	2	-	-	-	3	2	25			
% OF FORMAL TOOLS	72	8	-	-	-	12	8	-			

Table 3. The frequencies of stone artefact types and raw material classes for KBV.

CLASS	CCS	CLEAR QUARTZ	RHYOLITES	QUARTZITE	TRANSLUCENT CHERT	QUARTZ		OTHER	SITE TOTAL	% OF SITE TOTAL	FORMAL TOOLS	% OF FORMAL TOOLS
						SAMPLE	ESTIMATED TOTAL					
	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)	(n)		(n)	
CHUNKS	729	142	63	2	17	303	37572	41	38566	53,0		
CORES	48	48	3	-	2	9	1116	-	1217	1,7		
CHIPS	402	39	1	-	9	13	1612	1	2064	2,8		
FLAKES	852	264	57	12	24	227	28148	26	29383	40,4		
BLADES	-	1	1	-	-	-	-	-	2	-		
BLADELETS	11	13	1	-	-	-	-	-	25	-		
UTILIZED FLAKES	135	44	5	4	7	6	744	5	944	1,3		
UPPER GRINDSTONES	-	-	-	-	-	-	-	87	87	0,1		
UPPER GRINDSTONE FRAGMENTS	-	-	-	-	-	-	-	18	18	-		
LOWER GRINDSTONES	-	-	-	-	-	-	-	4	4	-		
LOWER GRINDSTONE FRAGMENTS	-	-	-	-	-	-	-	17	17	-		
SCRAPERS	174	3	1	-	7	-	-	3	188	0,3	188	48,3
BACKED SCRAPERS	58	-	3	-	9	-	-	3	73	0,1	73	18,8
SEGMENTS	23	5	-	-	2	-	-	2	32	-	32	8,2
BACKED BLADELETS	7	-	-	-	2	-	-	-	9	-	9	2,3
BACKED BLADES	1	-	-	-	-	-	-	-	1	-	1	0,3
BACKED FLAKES	5	4	-	-	-	-	-	-	9	-	9	2,3
SPOKESHAVES	4	-	-	-	-	-	-	-	4	-	4	1,0
BORERS	13	-	-	-	2	-	-	-	15	-	15	3,9
NOTCHED RETOUCH	7	-	1	-	-	-	-	-	8	-	8	2,1
MISC. RETOUCH	33	-	1	-	-	-	-	-	34	0,1	34	8,7
DENTICULATED PIECES	13	-	-	-	-	-	-	-	13	-	13	3,3
ADZES	-	-	2	-	-	-	-	-	2	-	2	0,5
PIPE FRAGMENTS	-	-	-	-	-	-	-	1	1	-	1	0,3
SITE TOTAL	2515	563	139	18	81	-	69192	208	72716			
% OF SITE TOTAL	3,5	0,8	0,2	-	0,1	-	95	0,3	-			
FORMAL TOOLS	338	12	8	-	22	-	-	9	389			
% OF FORMAL TOOLS	86,9	3,1	2,1	-	5,6	-	-	2,3	-			

Coastal rock shelter LCC

Excavation: The stratigraphy was not clearly recognisable. After having been put through a 1.8 mm sieve, sand samples taken from each layer had the appearance and texture of wind-blown dune sand, the only difference being a greyish tinge due to the ash content. Below layer F, a reduction in the ash content allowed some of the natural red hue of the dune sand to come through, but the difference in colour was very slight. Consequently, distinctions between the layers were based, where possible, on their faunal and cultural content, rather than the colour of the sand. In spite of the whole deposit being pre-pottery, the surface (layer S) and layer A had clearly been subjected to recent disturbance, and contained a large number of metal flakes, as well as glass fragments, some plant material and artefacts as diverse as the cap from a soft-drink bottle and a German coin (5 Pfennig) from 1897. The shell on the surface had also been highly fragmented by trampling. Layer C, adjacent to layer B and situated at the back of the cave, was of loose, sterile sand, and appeared to have been accumulated by the wind. All the other layers, down to and including F, showed relatively consistent signs of occupation with much of shell. At that point, however, the deposit turned to reddish brown sand with very little shell, which decreased to nothing by layer J, while the amount of granite gravel increased considerably as bedrock was approached. Apart from the surface, the whole deposit was damp, the last three layers being positively wet. There was a general increase in the faunal and cultural content of the deposit from the back to the front of the cave, which can be directly linked to the low ceiling at the back of the shelter. The following radiocarbon dates were obtained from marine shell samples processed by the South African E.M.A.S.T. Laboratory. These dates have been corrected to allow for the error caused by the apparent age of sea water (400 years: J.C. Vogel in litt. 1989).

Layer A (60 - 80 mm): 2430 ±45 B.P. (Pta-4925)
Layer D (160 - 220 mm): 2550 ±45 B.P. (Pta-4969)
Layer F (290 - 350 mm): 3140 ±60 B.P. (Pta-4968)
Layer G (350 - 420 mm): 5060 ±70 B.P. (Pta-4970)
Layer H (420 - 500 mm): 5600 ±60 B.P. (Pta-4922)

The dates indicate that layers A - F accumulated far more rapidly than layers G - H, a suggestion which is supported by the relative frequencies of exfoiliated granite (see below).

The major components: The relative percentages of the deposit components (Fig. 9, Table 4) show that most of their frequencies decline markedly below layer G, the exceptions being stone artefacts and spalls, which show considerable increases as bedrock is approached. A third component which shows a tendency to increase with increasing depth is sea-bird eggshell, which peaks in layer G and then drops off rapidly. Marine shell, charcoal and OES show a general tendency to decrease from the top to the bottom of the deposit, while formal tools, beads and bone peak in layers B, D and E respectively. Layer C has relatively low frequencies of everything except

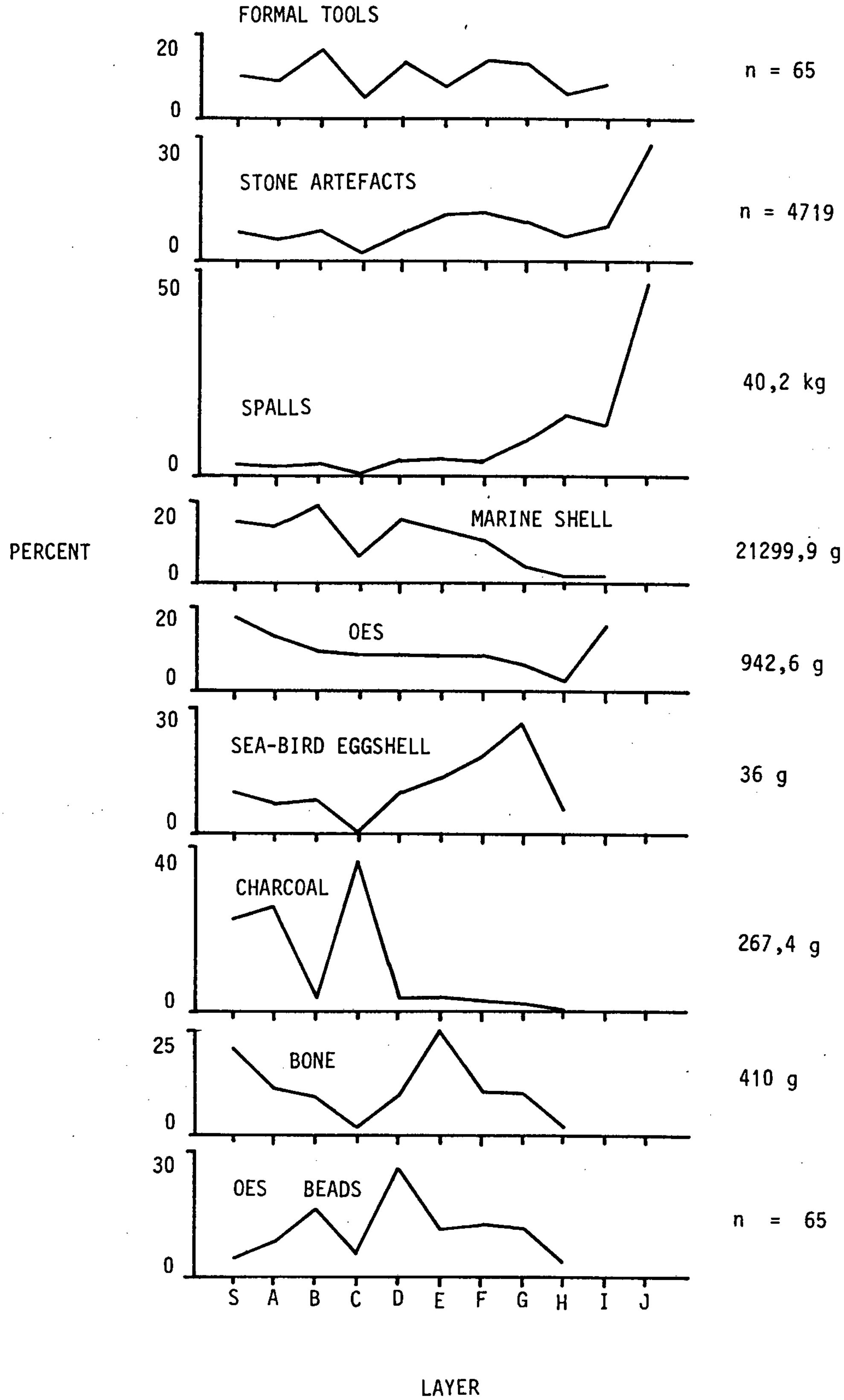

Fig. 9. The relative proportions (%) of the various components of LCC.

Table 4. The relative frequencies and percentages of the deposit components of LCC.

LAYER	S	A	B	C	D	E	F	G	H	I	J
BUCKETS EXCAVATED	19	20,5	21	11,08	24	21,25	19,05	10	9	3,25	0,3
FORMAL TOOLS (n)	7	7	13	2	12	6	10	5	2	1	-
TOOLS/BUCKET	0,37	0,34	0,62	0,18	0,5	0,28	0,53	0,5	0,22	0,31	-
% OF SITE TOTAL	9,6	8,6	16,1	4,8	13,0	7,3	13,8	13,0	5,7	8,1	-
STONE ARTEFACTS(n)	508	417	596	70	637	898	855	376	212	113	37
ARTEFACTS/BUCKET	26,73	20,34	28,38	6,31	26,54	42,26	44,88	37,6	23,56	34,77	112,12
% OF SITE TOTAL	6,6	5	7	1,6	6,6	10,5	11,1	9,3	5,8	8,6	27,8
CHARCOAL (g)	68,8	84,2	13	63,5	13,6	12,8	8	3,1	0,4	-	-
CHARCOAL/BUCKET	3,62	4,1	0,62	5,73	0,57	0,6	0,42	0,31	0,04	-	-
% OF SITE TOTAL	22,6	25,6	3,9	35,8	3,6	3,8	2,6	1,9	0,2	-	-
BONE (g)	84,6	50,8	42,1	3,3	48,4	113,3	41,4	21,4	4,3	-	-
BONE/BUCKET	4,45	2,47	2	0,3	2	5,27	2,17	2,14	0,48	-	-
% OF SITE TOTAL	20,9	11,6	9,4	1,4	9,4	24,8	10,2	10,1	2,3	-	-
OES (g)	119,2	158,5	118,8	56,5	121,4	107,4	97,3	38,5	14	31	-
OES/BUCKET	10,48	7,73	5,65	5,09	5,06	5,05	5,1	3,85	1,55	9,5	-
% OF SITE TOTAL	17,7	13	9,6	8,6	8,6	8,6	8,6	6,5	2,6	16	-
SEA BIRD EGG-SHELL (g)	3,9	3,3	3,8	-	4,8	5,9	7,5	5,7	1,1	-	-
SHELL/BUCKET	0,21	0,16	0,18	-	0,2	0,28	0,39	0,57	0,12	-	-
% OF SITE TOTAL	10	7,6	8,5	-	9,5	13,3	18,5	27	5,7	-	-
OES BEADS (n)	3	6	12	2	21	8	8	4	1	-	-
BEADS/BUCKET	0,16	0,29	0,57	0,18	0,88	0,38	0,42	0,4	0,11	-	-
% OF SITE TOTAL	4,7	8,6	16,8	5,3	26	11,2	12,4	11,8	3,2	-	-
SPALLS (D3) kg	2,6	1,9	2,6	-	2,6	3	3	6,2	11,3	4,9	2,1
BUCKETS SAMPLED	6	5,5	6	-	5	5	5	5	5	2,6	0,3
SPALLS/BUCKET	0,43	0,35	0,43	-	0,52	0,6	0,6	1,24	2,26	1,88	7
% OF SITE TOTAL	2,8	2,3	2,8	-	3,4	3,9	3,9	8,1	14,8	12,3	45,7
MARINE SHELL (g)	4244,8	3877,6	4076,8	925,3	433,7	3654,9	2984,1	604,6	282,4	215,7	-
BUCKETS SAMPLED	4	4	3	2	4	4	4	2	2	1,5	-
SHELL/BUCKET	1061,2	969,4	1358,9	462,7	1084,4	913,7	746,0	302,2	141,2	143,8	-
% OF SITE TOTAL	14,8	13,5	18,9	6,4	15,1	12,7	10,4	4,2	2,0	2,0	-

charcoal, for which it has the highest frequency. In general, displacement was not considered a factor in creating these patterns. Most of the deposit accumulated as a result of marine shell acting as a trap for wind-blown sand.

Cultural components: Table 5 shows that, of the total number of artefacts (n = 4 719), 84,6% are of quartz, 6,0% are of clear quartz, 3,1% are of CCS, 1,7% are of translucent chert, 1,4% are of carbonatite and 3,2% are of other stone.

Only 1,4% are formal tools, of which 41,5% are of clear quartz, 21,5% are of translucent chert, 20,0% are of CCS, 15,4% are of quartz and 1,5% are of other stone. Of the formal tools (n = 65), 27,7% are segments, 21,5% are borers, 21,5% are scrapers, 13,8% are backed flakes and 9,2% have miscellaneous retouch. All the formal tools are of microlithic proportions. The relative frequencies of the various formal tools per layer (Table 6) show that the basic composition of the stone tool-kit remains unchanged throughout most of the deposit, the exception being an increase in scrapers as bedrock is approached.

Of the 11 fragments of tortoise-shell bowls found in layer D, E and F, five fragments from layer E and one fragment from layer F can be re-fitted to form two larger pieces. One worked bird-bone tube was recovered from each of layers S, B and E, one Cape Cormorant ulna tube from layer E, one worked fragment of a Cape Cormorant ulna from each of layers A and G, one Cape Gannet ulna tube from layer F and one worked fragment of a Cape Gannet ulna from layer E.

Table 5. The frequencies of stone artefact types and raw material classes for LCC.

	CARBONATITE (n)	CCS (n)	CLEAR QUARTZ (n)	QUARTZITE (n)	TRANSLUCENT CHERT (n)	QUARTZ (n)	OTHER (n)	SITE TOTAL (n)	% OF SITE TOTAL	FORMAL TOOLS (n)	% OF FORMAL TOOLS
CHUNKS	1	6	3	-	4	668	81	763	16,8		
CORES	-	-	1	-	-	18	-	19	0,4		
CHIPS	21	70	171	-	39	2166	56	2523	53,5		
FLAKES	46	55	78	1	20	1130	4	1334	28,3		
BLADELETS	-	-	1	-	-	-	-	1	-		
UTILIZED FLAKES	-	1	-	-	2	1	-	4	0,1		
UPPER GRINDSTONE	-	-	-	-	-	-	4	4	0,1		
LOWER GRINDSTONE	-	-	-	-	-	-	1	1	-		
LOWER GRINDSTONE FRAGMENTS	-	-	-	-	-	-	3	3	0,1		
OCHRE PALETTE FRAGMENTS	-	-	-	-	-	-	2	2	-		
SCRAPERS	-	4	2	-	4	4	-	14	0,3	14	21,5
BACKED SCRAPERS	-	2	1	-	-	-	1	4	0,1	4	6,2
SEGMENTS	-	-	13	-	-	5	-	18	0,4	18	27,7
BACKED FLAKES	-	-	7	-	1	1	-	9	0,2	9	13,8
BORERS	-	5	2	-	7	-	-	14	0,3	14	21,5
MISCELLANEOUS RETOUCH	-	2	2	-	2	-	-	6	0,1	6	9,2
SITE TOTAL	68	145	281	1	79	3993	152	4719			
% OF SITE TOTAL	1,4	3,1	6,0	-	1,7	84,6	3,2	-			
FORMAL TOOLS	-	13	27	-	14	10	1	65			
% OF FORMAL TOOLS	-	20,0	41,5	-	21,5	15,4	1,5	-			

Table 6. The relative frequencies of the various formal stone tools per layer for LCC.

	S	A	B	C	D	E	F	G	H	I	J	SITE TOTAL
SCRAPERS	1	1	2	-	2	1	2	3	1	1	-	14
BACKED SCRAPERS	-	1	1	-	-	-	1	1	-	-	-	4
SEGMENTS	2	1	4	1	2	3	5	-	-	-	-	18
BACKED FLAKES	1	-	3	1	3	-	-	-	1	-	-	9
BORERS	3	3	2	-	4	-	2	-	-	-	-	14
MISCELLA-NEOUS RETOUCH	-	1	1	-	1	2	-	1	-	-	-	6
LAYER TOTAL	7	7	13	2	12	6	10	5	2	1	-	65

Table 7. The size distribution, in mm, of OES beads in the various layers of LCC.

	S	A	B	C	D	E	F	G	H	SITE TOTAL
MEAN	4,07	4,32	4,14	3,95	3,70	4,08	4,69	3,65	4,3	4,05
STANDARD DEVIATION	0,21	0,46	0,41	0,07	1,01	0,90	0,41	1,50	-	0,83
95% CONFIDENCE LEVEL	8,72	4,67	4,23	53,08	3,96	4,91	4,86	7,18	-	3,93
RANGE	3,9-4,3	3,5-4,8	3,5-4,8	3,9-4,0	2,2-5,1	2,4-5,0	3,8-5,0	2,3-5,0	-	5,1-2,2
n	3	6	12	2	21	8	8	4	1	65

A total of 65 OES beads, with a mean size of 4,05 mm, ranging from 5,1 to 2,2 mm, were found in layers S to H, with the largest bead, the smallest bead and the most beads all coming from layer D. The size distribution of the beads in the various layers (Table 7) show no significant dimension variations.

Faunal components: The faunal list excluding the shell (Table 8) (see below), as it was based on a sample, is made up of a total, by layer, of 255 individuals from 23 species.

Twenty-one rock lobsters were identified, spread relatively evenly from the surface to layer H.

Five species of shellfish consisting of 1 315 individuals were identified from the excavated samples. The relative shellfish frequencies and percentages (Table 9) show that 56,5% is Patella granatina, 38,5% is P. granularis, 3,5% is Choromytilus meridionalis, 1% is P. argenvillei and 0,5% is P. barbara. P. granatina dominates all the layers with larger samples ($n > 60$), and the size distribution of P. granatina and P. granularis in the various layers (Table 10) shows no significant dimension variations. For P. granatina the mean sizes per layer ($n > 20$) ranged from 61,65 to 63,35 mm. For P. granularis they ranged from 49,99 to 51,82 mm.

For fish, only one kabeljou and four sea catfish, all of them from layers S and A, were identified.

Table 8. The faunal list for LCC, excluding shellfish, showing the number of identifiable specimens/the minimum number of individuals. Juveniles are shown in brackets.

SPECIES	S	A	B	C	D	E	F	G	H	SITE TOTAL
CAPE ROCK LOBSTER	2	3	4	-	1	3	4	3	1	21
TOTAL CRUSTACEANS	2	3	4	-	1	3	4	3	1	21
KABELJOU	1/1	-	-	-	-	-	-	-	-	1/1
SEA-CATFISH	3/2	1/1	-	-	-	-	-	-	-	4/3
TOTAL FISH	4/3	1/1	-	-	-	-	-	-	-	5/4
ANGULATE TORTOISE	-	-	1/1	-	1/1	4/1	3/1	-	-	9/4
TOTAL REPTILES	-	-	1/1	-	1/1	4/1	3/1	-	-	9/4
JACKASS PENGUIN	12/1	3/1	3/1(4/1)	1/1	-	2/1	1/1	(1/1)	1/1	28/9
CAPE GANNET	-	-	-	-	-	2/1	1/1	-	-	3/2
WHITE-BREASTED CORMORANT	-	2/1	(6/1)	-	1/1(4/1)	1/1	-	-	-	14/5
CAPE CORMORANT	4/1(7/1)	1/1(9/1)	1/1	-	1/1(5/1)	4/1(3/1)	2/1(2/1)	2/1	-	41/12
CROWNED CORMORANT	-	-	1/1	-	-	1/1	-	2/1	-	4/3
GREATER FLAMINGO	-	1/1	-	-	-	1/1	-	1/1	-	3/3
KELP GULL	-	-	-	-	-	-	1/1	-	-	1/1
HARTLAUB'S GULL	-	-	-	-	(1/1)	-	-	-	-	1/1
SWIFT TERN	(1/1)	(2/2)	-	-	-	(3/1)	(2/1)	(1/1)	-	9/5
DOMESTIC FOWL	2/1	1/1	-	-	-	-	-	-	-	3/2
TOTAL BIRD	26/5	19/8	15/5	1/1	12/5	17/8	9/6	7/5	1/1	107/43
HARE	15/1	5/1	-	-	-	-	1/1	-	-	21/3
BLACK-BACKED JACKAL	-	-	-	-	-	-	-	3/1	1/1	4/2
CAPE FUR SEAL	7/1	8/1	2/1(3/1)	-	9/1(4/1)	7/1(1/1)	7/1	-	1/1	49/10
SPRINGBOK	-	1/1	-	-	1/1	2/1	-	-	-	4/3
KLIPSPRINGER	-	-	1/1	-	4/1	1/1	1/1	1/1	-	8/5
STEENBOK	-	3/1	1/1	-	4/1	4/1	6/2	1/1	-	19/6
GEMSBOK	2/1	-	-	-	1/1	1/1(1/1)	-	-	-	5/4
DOMESTIC DOG	1/1	-	-	-	-	-	-	-	-	1/1
DOMESTIC PIG	(1/1)	-	-	-	-	-	-	-	-	1/1
TOTAL MAMMALS	26/5	17/4	7/4	-	23/6	17/7	15/4	5/3	3/2	113/35
LAYER TOTAL	58	40	27	1	37	41	31	15	5	255

Table 9. The relative shellfish frequencies and percentages for LCC.

	PATELLA ARGENVILLEI	P. BARBARA	P. GRANATINA	P. GRANULARIS	CHOROMYTILUS MERIDIONALIS	SITE TOTAL
S	4	1	82	56	2	145
A	3	1	123	75	8	210
B	2	1	122	94	9	228
C	-	-	25	26	1	52
D	1	2	147	89	11	250
E	3	2	117	85	10	217
F	-	-	107	48	4	159
G	-	-	11	21	1	33
H	-	-	4	7	-	11
I	-	-	5	5	-	10
SITE TOTAL	13	7	743	506	46	1315
% OF SITE TOTAL	1	0,5	56,5	38,5	3,5	100

Table 10. The site distribution of unbroken Patella granatina and P. granularis shells in the various layers of LCC.

PATELLA GRANATINA	MEAN (mm)	STANDARD DEVIATION (mm)	RANGE (mm)	n
S	63,11	5,44	50,6 - 73,0	51
A	62,10	6,41	38,6 - 79,3	78
B	61,65	4,86	46,8 - 73,0	82
C	64,30	5,14	50,5 - 73,3	18
D	63,35	5,55	51,1 - 77,6	101
E	61,68	5,34	46,7 - 74,5	82
F	61,89	5,19	48,8 - 76,5	85
G	65,48	3,32	62,2 - 69,5	4
H	67,45	3,18	65,2 - 69,7	2
I	64,45	10,43	56,1 - 79,4	4
P. GRANULARIS				
S	50,53	4,94	40,1 - 62,0	35
A	51,82	4,76	42,5 - 62,7	59
B	50,77	4,83	38,8 - 64,5	76
C	52,94	5,64	43,4 - 66,0	19
D	51,73	5,09	39,2 - 63,7	69
E	50,31	4,30	38,2 - 61,3	69
F	49,99	3,93	40,6 - 55,4	40
G	51,92	5,70	41,8 - 62,7	18
H	51,52	3,47	47,6 - 56,5	6
I	52,38	8,19	37,9 - 56,8	5

One angulate tortoise was identified from each of layers B and D, four for layer E and three from layer F.

Of the 107 individual birds from ten species, 41 (38.8%) are Cape Cormorant, 28 (26,2%) are Jackass Penguin, 14 (13,1%) are White-breasted Cormorant, 9 (8,4%) are Swift Tern, 4 (3.7%) are Crowned Cormorant, 3 (2,8%) are domestic fowl (from layers S and A), one (1,9%) is Kelp Gull and one (1,9%) is Hartlaub's Gull.

113 individual mammals from nine species were identified. These are 49 (43,4%) Cape fur seals, 21 (18,6%) hares, 19 (16,8%) steenbok, 8 (7,1%) klipspringers, 5 (4,4%) gemsbok, 4 (3,5%) each of Black-backed jackal and springbok, and one (0,9%) each of domestic dog and domestic pig, both from layer S.

Plant remains: Plant material was limited to a total of 38,6 g in layers S, A and B, and consisted only of parts of shrubs and bushes, possibly unburned firewood. The remains of edible plants were not identified.

Inland rock shelter DKW

Excavation: The stratigraphy was not complex, the deposits having been laid down on bedrock in four main units to a maximum depth of 650 mm. The sand throughout the deposit was consistently fine-grained in spite of colour variations. The surface layer A, was dark brown, relatively loose and was rich in stone artefacts, plant remains, charcoal, bone and OES, as well as having a very high concentration of ash. Layer B was also brown, but not quite as dark as layer A. In other respects it was similar to A, but was more compact and had a considerable amount of bedding in it.

Layer C was decidedly less rich in plant material and bone, but had a considerable amount of charcoal. In spite of this, the dark colouring of the previous two layers changed to a pale yellow. This continued to layer D, which had a generally poorer deposit content than the previous layers. After layer D, the deposit turned grey-brown, with no charcoal or plant material. The stone artefacts were so heavily encrusted with a carbon-based deposit that neither the type of raw material nor their shapes could be determined. When even industrial-strength hydrochloric and sulphuric acid failed to remove the encrustation, it was decided to omit all layers below D from the analyses. Layer A had 15,3 g of pottery fragments in it, and layer B had 5,2 g, but these were attributed to post-depositional disturbance. Seven fragments (4,5 g) of limpet shell were found distributed throughout the first four layers.

The following radiocarbon dates were obtained from charcoal samples processed by the South African E.M.A.S.T. Laboratory:

Layer B (50 - 100 mm): 2180 ±50 (Pta-4920)
Layer C (100 - 150 mm): 3640 ±50 (Pta-4997)
Layer C (150 - 200 mm): 8420 ±80 (Pta-4918)

The major components: The relative percentages of the deposit components (Fig. 10, Table 11) show that plant, bone and stone show a tendency to decrease from the top towards the bottom of the deposit, while OES rises

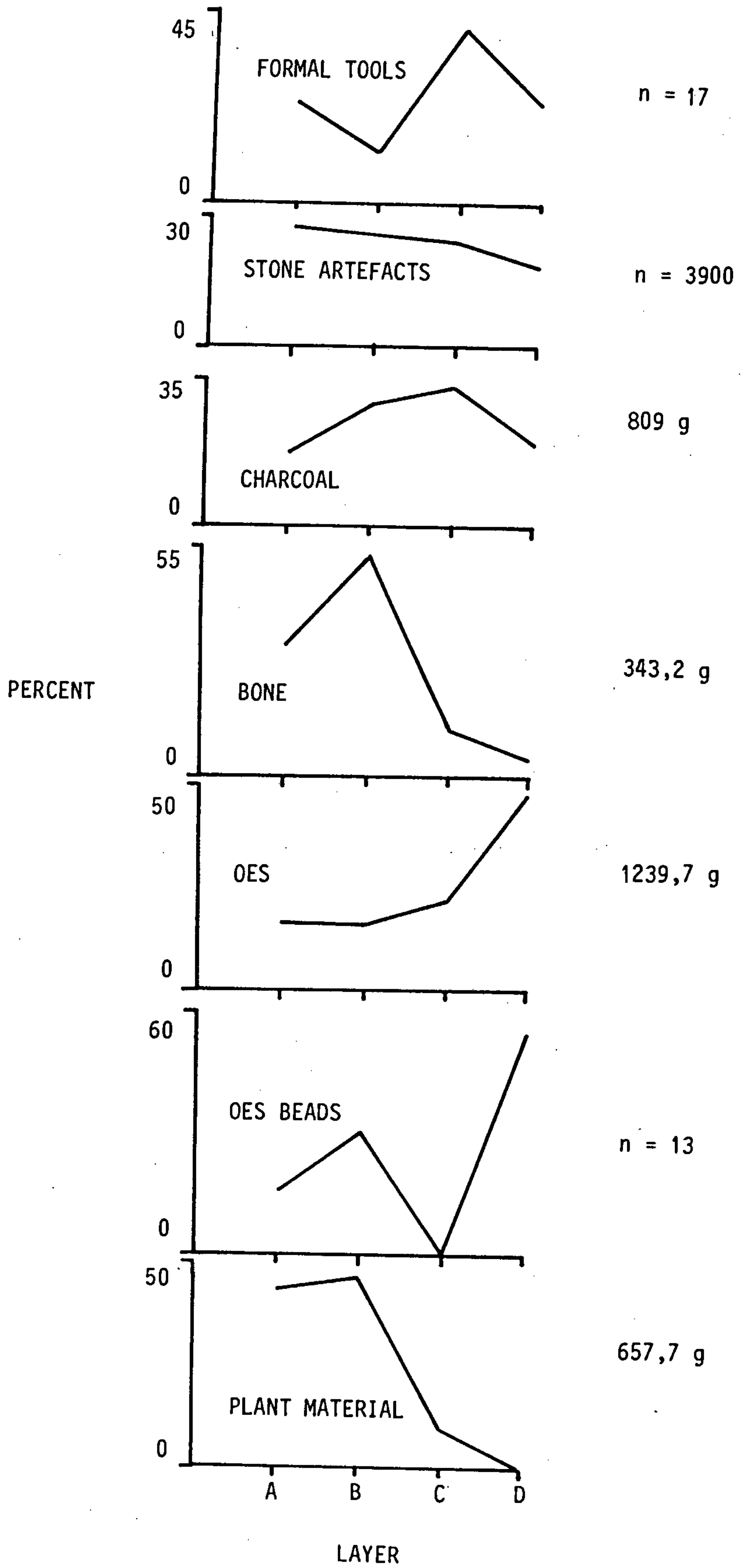

Fig. 10. The relative proportions (%) of the various components of DKW.

Table 11. The relative frequencies and percentages of the deposit components of DKW.

LAYER BUCKETS EXCAVATED	A 5	B 5	C 5	D 5
FORMAL TOOLS (n) % OF SITE TOTAL	4 23,5	2 11,8	7 41,2	4 23,5
STONE ARTEFACTS (n) % OF SITE TOTAL	1097 28,1	1051 26,9	979 25,1	773 19,8
CHARCOAL (g) % OF SITE TOTAL	138,3 17,1	236,6 29,2	270,3 33,4	163,8 20,2
BONE (g) % OF SITE TOTAL	108 31,5	182,3 53,1	38,1 11,1	14,8 4,3
OES (g) % OF SITE TOTAL	198,5 16	197,7 15,9	263,7 21,3	579,8 46,8
OES BEADS (n) % OF SITE TOTAL	2 15,4	4 30,1	- -	7 53,8
PLANT MATERIAL (g) % OF SITE TOTAL	283,1 43	308,5 46,9	64,3 9,8	1,8 0,3

sharply. Charcoal increases in layers B and C, and then decreases again in layer D. Both formal tools and OES beads display an irregular distribution pattern. Layer B has the most plant material and the most bone in it, while layer C has the most formal tools and the most charcoal. There is a sharp decrease in both plant material and bone from layer B to layer C, which could indicate less intense occupation.

Cultural components: Table 12 shows that, of the total number of artefacts (n = 3 900) 47,1% are of carbonatite, 42,3% are of quartz, 7,9% are of CCS, 1,6% are of clear quartz, 0,1% are of quartzite, 0,1% are of translucent chert and 1,0% are of other stone. Only 0,6% are formal tools, of which 47,1% are of CCS, 23,5% are of clear quartz, 17,8% are of carbonatite, 11,8% are of quartz.

Of the formal tools (n = 17), 17,6% are scrapers, 17,6% are backed scrapers, 17,6% are backed flakes, 11,8% are segments, 11,8% are backed bladelets, 11,8% have miscellaneous retouch, 5,9% are borers and 5,9% are denticulated pieces. All the formal tools are of microlithic proportions. The relative frequencies of the various formal tools per layer (Table 13) show that, apart from the fact that backed scrapers are limited to layer A, the basic composition of the stone tool-kit remains reasonably constant in spite of the small sample size. Worked bone was limited to one broken bone point from layer A.

A total of 13 OES beads, ranging in size from 6,2 to 3,9 mm with a mean size of 4,35 mm, was found in layers A, B and D. The most beads and the smallest bead came from layer D, the largest bead from layer B. The sample

Table 12. The frequencies of stone artefact types and raw material classes for DKW.

	CARBONA-TITE (n)	CCS (n)	CLEAR QUARTZ (n)	QUART-ZITE (n)	TRANSLU-CENT CHERT (n)	QUARTZ (n)	OTHER (n)	SITE TOTAL (n)	% OF SITE TOTAL	FORMAL TOOLS (n)	% OF FORMAL TOOLS
CHUNKS	501	30	1	-	2	197	17	748	19,2		
CORES	9	3	1	-	-	8	-	21	0,5		
CHIPS	511	64	32	-	-	1043	16	1666	42,8		
FLAKES	802	200	22	1	3	400	3	1431	36,7		
BLADELETS	6	2	1	-	-	1	-	10	0,3		
UTILIZED FLAKES	3	1	-	1	-	-	-	5	0,1		
UPPER GRINDSTONE FRAGMENTS	-	-	-	-	-	-	2	2	0,1		
SCRAPERS	-	2	-	-	-	1	-	3	0,1	3	17,6
BACKED SCRAPERS	-	3	-	-	-	-	-	3	0,1	3	17,6
SEGMENTS	-	1	1	-	-	-	-	2	0,1	2	11,8
BACKED BLADELETS	2	-	-	-	-	-	-	2	0,1	2	11,8
BACKED FLAKES	-	-	3	-	-	-	-	3	0,1	3	17,6
BORERS	-	1	-	-	-	-	-	1	-	1	5,9
MISCELLA-NEOUS RETOUCH	-	1	-	-	-	1	-	2	0,1	2	11,8
DENTICULATED PIECES	1	-	-	-	-	-	-	1	-	1	5,9
SITE TOTAL	1835	308	61	2	5	1651	38	3900			
% OF SITE TOTAL	47,1	7,9	1,6	0,1	0,1	42,3	1,0	-			
FORMAL TOOLS	3	8	4	-	-	2	-	17			
% OF FORMAL TOOLS	17,6	47,1	23,5	-	-	11,8	-	-			

Table 13. The relative frequencies of the various formal stone tools per layer for DKW.

	A	B	C	D	SITE TOTAL
SCRAPERS	-	1	1	1	3
BACKED SCRAPERS	3	-	-	-	3
SEGMENTS	-	1	1	-	2
BACKED BLADELETS	-	-	-	2	2
BACKED FLAKES	-	-	3	-	3
BORERS	1	-	-	-	1
MISCELLANEOUS RETOUCH	-	-	2	-	2
DENTICULATED PIECES	-	-	-	1	1
LAYER TOTAL	4	2	7	4	17

Table 14. The faunal list for DKW showing the number of identifiable specimens/the minimum number of individuals. Juveniles are shown in brackets.

SPECIES	A	B	C	D	TOTAL (BY LAYER)
ANGULATE TORTOISE	2/1	1/1	1/1	-	4/3
TOTAL REPTILES	2/1	1/1	1/1	-	4/3
HARE	-	-	-	1/1	1/1
DASSIE	4/1	(8/1)	1/1	-	13/3
GEMSBOK	(3/1)	5/1	1/1	2/1	11/4
SPRINGBOK	1/1	2/1	1/1	-	4/3
STEENBOK	3/1	-	-	1/1	4/2
TOTAL MAMMALS	12/5	15/3	3/3	4/3	33/13
GRAND TOTAL	14/6	16/4	4/4	4/3	37/15

size is too small to comment on the size distribution of the beads in the various layers.

Faunal components: The faunal list (Table 14) is made up of a total, by layer, of 37 individuals from 5 species. Two angulate tortoises were identified from layer A, and one each from layers B and C. 33 individual mammals from five species were identified. These are 13 (39,4%) dassies, 11 (33,3%) gemsbok, 4 (12,1%) springbok, 4 (12,1%) steenbok and one (3%) hare.

Plant remains: There were 283,1 g of plant material in layer A, 308,5 g in layer B, 64,3 g in layer C and 1,8 g in layer D. While most of it appeared to be bedding and unburned firewood remains, four corm casings were identified from layer B, and one from layer C.

CHAPTER FOUR:

SUMMARY AND DISCUSSION OF SITES

Dating and stratigraphy

Observations made in the course of the survey of 83 sites, as well as the analyses of the faunal and cultural material recovered during three surface collections and two excavations, demonstrate that by 8420 ±80 B.P. (Pta-4918) Holocene hunter-gatherers were well established in the interior of the Koichab River research area. Limpet shell fragments associated with the same date indicate contact with the coast, although in the coastal region no dates from before 5600 ±60 B.P. (Pta-4922) have been recorded. Based on the relative frequency of the main deposit components, as well as radiocarbon dates and the nature of the stratigraphy of the two sites excavated, it appears that both the coast and the interior experienced a hiatus in occupation during the course of the later Holocene. The evidence suggests a hiatus from 5060 B.P. to 3140 B.P. for LCC, and from 8420 B.P. to 3640 B.P. for DKW. In the latter site, however, the highly concentrated nature of the deposit, together with the fact that whole layers rather than specific features were sampled for charcoal, suggest that averages of several events rather than individual events were dated. Consequently the dates obtained from LCC are probably a more accurate reflection of the extent of the later Holocene hiatus of the Koichab River area.

Faunal remains

The LCC sample was dominated by Patella granatina and P. granularis, which is in keeping with their present ready availability along the rocky shoreline of Luderitz Bay. The fact that the shell sizes remained constant throughout the deposit indicates either that shellfish exploitation was not heavy enough to affect the shellfish population profile, or that there was time between short-term occupations for the populations to recover. As both fish and rock lobster are abundant in the bay today, their relative paucity in the deposit seems to reflect diet choice rather than availability. The large amount of sea-birds, particularly Cape Cormorants, Jackass Penguins, White-breasted Cormorants and Swift Terns, mirrors the extensive breeding colonies of these birds that can presently be found both on the various islands and on the mainland of the bay. Similarly, the fact that the mammal remains are dominated by Cape fur seals and steenbok directly reflects present local availability. For DKW, the presence of gemsbok, springbok, steenbok, hare and angulate tortoise, as well as the comparative importance of gemsbok, can again directly be linked to present local availability. The domination of the site by juvenile dassies is problematic as there are no dassies within 20 km of the site today. If, however, dassies did occasionally frequent the site in the past, it would also explain the fact that the site had a strong smell of ammonia, such as is normally associated with dassie habitations. As dassies are herbivores, their presence could also have coincided with periods of higher rainfall and lusher vegetation.

Cultural remains

The location of the various sites sampled in relation to lithic raw material sources appears to have been instrumental in determining the raw materials used for the stone assemblages (Table 15, Table 16). Over 80% of the artefacts from FLI, KBV and LCC are quartz, which is readily available in the area. For DKO and DKW, however, which are at Dick Wilhelm, a ready source of carbonatite and CCS, the quartz content dropped to below 50%, being partly replaced by carbonatite and CCS. Similarly, the formal tools of the interior sites are dominated by CCS, although FLI, which is in the vicinity of a source of translucent chert, has its formal tools dominated by translucent chert. LCC, which is only some 8 km from FLI, has more translucent chert than any of the inland sites, but is dominated by clear quartz. All the formal tools, except for the two grooved stones, the two ochre palettes and three scrapers made from re-worked MSA tools, are of microlithic proportions (Fig. 11). The inland sites are dominated by scrapers, while segments outnumber or equal scrapers on the coast (Table 17). In the coastal cave deposit, grindstones were found to have "sunk", in that they were scattered throughout the deposit. Inland, in spite of the fact that there were 18 grindstones on the cave floor at DKW, there were none in the deposit. They had "floated", remaining on the surface by virtue of their constant use. This indicates that the actual utilization of grindstones was probably much higher than their numerical value suggests.

Most of the sites surveyed contained microlithic assemblages, and some had a scattering of pottery fragments. Grindstones were found in 84,8% of the

Table 15. The percentages of the various raw materials used for stone artefacts at FLI, DKO, KBV, LCC and DKW

	CARBONA-TITE	CCS	CLEAR QUARTZ	RHYOLITES	QUARTZITE	TRANSLU-CENT CHERT	QUARTZ	OTHER
FLI n = 6523	-	4,7	0,1	-	-	10,2	82,9	2,2
DKO n = 813	12,5	30	7	0,1	-	1	49	0,4
KBV n = 72716	-	3,5	-	0,2	-	-	95	0,3
LCC n = 4719	1,4	3,1	6,0	-	-	1,7	84,6	3,2
DKW n = 3900	47,1	7,9	1,6	-	0,1	0,1	42,3	0,7

Table 16. The percentages of the various raw materials used for formal stone tools at FLI, DKO, KBV, LCC and DKW.

	CARBONA-TITE	CCS	CLEAR QUARTZ	RHYOLITES	TRANSLUCENT CHERT	QUARTZ	OTHER
FLI n = 67	-	29,9	1,5	-	55,2	10,4	3,0
DKO n = 25	-	72	8	-	-	12	8
KBV n = 389	-	86,9	3,1	2,1	5,6	-	2,3
LCC n = 65	-	20,0	41,5	-	21,5	15,4	1,5
DKW n = 17	17,6	47,1	23,5	-	-	11,8	-

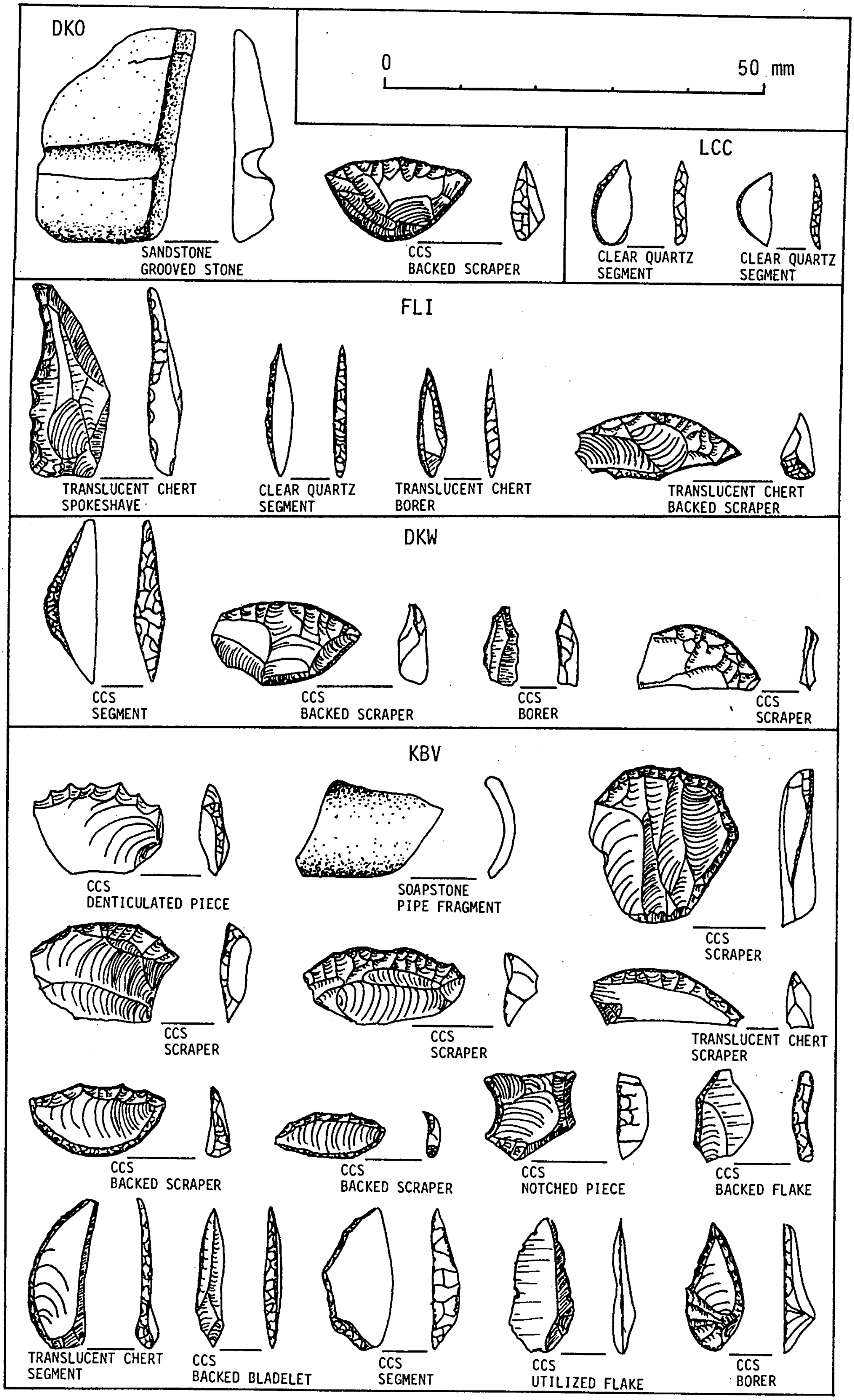

Fig. 11. Artefacts from the Koichab River area.

Table 17. The percentages of the various formal stone tools at FLI, DKO, KBV and DKW.

	FLI n = 67	DKO n = 25	KBV n = 389	LCC n = 65	DKW n = 17
SCRAPERS	10,4	52	48,3	21,5	17,6
BACKED SCRAPERS	-	24	18,8	6,2	17,6
SEGMENTS	19,4	8	8,2	27,7	11,8
BACKED BLADELETS	10,4	-	2,3	-	11,8
BACKED BLADES	-	-	0,3	-	-
BACKED FLAKES	19,4	4	2,3	13,8	17,6
SPOKESHAVES	4,5	-	1,0	-	-
BORERS	4,5	-	3,9	21,5	5,9
NOTCHED RETOUCH	7,5	-	2,1	-	-
MISCELLANEOUS RETOUCH	23,9	4	8,7	9,2	11,8
DENTICULATED PIECES	-	-	3,3	-	5,9
ADZES	-	-	0,5	-	-
GROOVED STONES	-	8	-	-	-
PIPE FRAGMENTS	-	-	0,3	-	-

rock shelters of the interior (n = 46) and 37% of the coastal shell middens (n = 27). This means that, for the entire Koichab River region, but especially for the interior, an activity based on the use of grindstones must have been of crucial importance.

CHAPTER FIVE:
ETHNOGRAPHIC EVIDENCE

Early travellers and the first settlers

The earliest ethnographic report on the Koichab River region dates from 1677, when the Dutch ship "De Bode" sent a party ashore in the vicinity of Elizabeth Bay, some 30 km south of Luderitz, then known as Angra Pequena. 16 - 18 men were found, who were joined the following morning by 10 - 11 women. They were described as being real Hottentots, but with a dialect different from that of the Cape Hottentots the Dutch had on board. Even so, communication was possible, and it was discovered that their huts lay some three to four day's journey inland. Apparently they also had some stock, but it had been stolen (Moritz 1918).

In April 1786, the British sloop "Nautilus" surveyed Angra Pequena, where they met about 20 natives with 15 to 20 dogs. The dogs led the British to a small natural reservoir with fresh water in it. The commander of the vessel, Captain Thompson (1786:7) described the natives as follows: "They were rather a small race of people with the smallest feet I ever saw, very active; of a dark copper colour, which they appeared to have darkened by a black dye; their clothing was of the skin of some animal hung over their shoulders, and another hung round their waist; with a number of thongs tied about their necks and middle; their hair appeared long but woolly, and twisted into rolls behind, which extended across the back of the neck from ear to ear, but they had nothing about them by which I could discover their having had any intercourse with Europeans." He also observed that they were armed with "short club sticks and small poles sharpened at the end like lances", and that each carried a "smaller one with the brush of some animal affixed to one end." As the British did not have a native interpreter, they could not establish whether these peole had stock further inland or not. Certainly they had none on the coast.

In 1793 a shore party from the Dutch ship "Meermin", including Cape Hottentots, found a Hottentot kraal, some four hours' march inland of Elizabeth Bay. They were told that a further six hours of travel would bring them to another kraal with lots of stock. Subsequently the ship put into Angra Pequena, where a "Namaqua" kraal was found next to a hole with some brackish water in it (Moritz 1915:197).

Morrell (1844:62), who discovered the guano on Ichaboe Island in 1828 and skinned about 1 000 seals there, made the following observations about Douglas bay, some 42 km north of Luderitz: "The south-east part of the bay, on the mainland, directly opposite the island, is the finest place on this part of the coast for jerking beef, it being only four miles from a Hottentot village and the springs of fresh water before mentioned, which will supply any number of cattle." This statement, however, is to be treated with caution, as Morrell did not always report things quite the way they were (Wendt 1975).

By May 1845, when Eden (1846:13) landed at Elizabeth Bay while searching for nitre and guano, the natives who met him could already speak a few words of English. He describes them as follows: "They who were not fortunate enough to be clothed in sailors' old clothes, had a mantle of skins, which being square, was folded after the manner of a shawl, and worn with the fur next to the body. They were of middle stature, of an olive-brown complexion, short woolly hair, most of them with none about the face, but one or two with a slight show of beard and moustaches; slim in proportion and straight limbed, with an upright gait and only a slight tendency to the Hottentot protuberance."

Eden and his party were led more than four miles inland to a spring of brackish water. The natives used broken ostrich egg-shells as drinking cups and carried the water back to their kraal on the beach in leather bags. Eleven days later the British group again landed in Elizabeth Bay and proceeded south along the beach. Eden (1846:27-29) recalls the event: "After about half an hour's walking we came to the encampment of the natives, if it may be so termed, consisting of a circular space of about seven feet in diameter, surrounded with bushes, two or three feet in height, stuck in the sand, having the embers of a fire in the centre, around which were sitting four or five wretched-looking women, as many men and three children. The place was strewn with mussel and limpet shells, which form their chief food ... Three of the men readily undertook to accompany us, and fetched their shoes, also of native manufacture ... [Just before sunset, slightly north of Possession Island] Here we encamped; the natives soon made a fire, and stuck bushes in the ground, after their own fashion; after which they roasted some geranium bulbs, which they had collected on the journey for their supper ... the natives unfolded their mantles of skins, rolled themselves up in them and slept on the sand as soundly as we should have done on a bed of down." Continuing his investigation of the coast, Eden found no natives at Luderitz, and only one "Namaqua Hottentot" at Hottentot Bay, 49 km north of Luderitz. From this individual he obtained some nara seeds, native tobacco and the skin of a wild cat, in exchange for needles, a file, clothes and food.

A British chart (Owen and Aldrich 1893) based on observations from 1844 and 1864, shows a "Hottentot village" at Douglas Bay.

In 1862 David Radford settled at Radford Bay, on the shore of the Luderitz lagoon. At first he worked for the firm De Pass, Spence and Co, but later he became a trader and a fisherman in his own right, being joined by his wife in 1897 (Joint Commission 1885). Von dem Hagen (1943:2-6) obtained the following information from an interview with one of Radford's daughters, Emma, in 1943: "... there was a water-hole between Radford and Griffith Bay, as well as behind Schmidtfeld, but the latter was rather salty ... in difficult times the natives had to fetch water from Anichab in animal bladders, seal stomachs, leather bags and eggshells ... The 'Strandlopers', a type of bush people, were there in great numbers. There were large settlements, both at Schmidtfeld and between Radford and Griffith Bay. During the guano time the natives moved with their families onto the islands; inbetween they lived from hunting. Radford traded with them; they brought him ostrich feathers, horns and "karosse". They did not have any permanent huts. They built their wind shelters from whaleribs covered with bushes, from stones and piled up brush. Radford gave them sacks to tie onto the whalebones. Their main food source was shellfish; apart from these they lived off fish they speared or hit in the water. They also hunted with bows and arrows and with their dogs ... An important role was played by plant food. By the sackful the "wild carrots", which the natives liked so much, were brought by them from the Gertrudtal and from Nautilus. "Wild potatoes" were also brought by the sackful from Aus; the narras were brought from the Kowis mountains and during the narra time all the natives were fat. From May to July they were all sick with diarrhoea; roasted geraniums were used as an antidote. Often, however, their legs got swollen during diarrhoea; eventually their whole bodies got swollen and death occurred." Both the symptoms and the cure are reminiscent of nutritional stress caused by a diet consisting of too much protein (Noli 1986, Noli and Avery 1988).

Schultze (1907:101) found a group of "Namib nomads" including three women, living in a kraal between Douglas Bay and Anichab. He obtained from them a bow and some poisoned arrows, in exchange for rice, tobacco, coffee and a blanket. Schultze also recorded that one Namib nomad sometimes hunted springbok by taking along two gemsbok stomachs full of water and relentlessly pursuing one animal until it collapsed from exhaustion.

A German chart (Sprigade and Lotz, 1913) showed a "deserted Hottentot village and graves" at Douglas Bay. It also showed nara plants at Anichab, some 7 km inland.

The last hunter

Personal history: The last hunter-gatherer of the Koichab River region was "Tjaaiman" (fast running), who roamed the area in the 1930's. Of Bushman decent (according to his son) he stayed mainly on Dick Wilhelm, but also frequented the other mountains around Aus. When jailed in Luderitz during the course of the drought of 1933 for stocktheft, he escaped into the desert, easily eluding his mounted pursuers, to become an outlaw and a legend in his own time. He had many friends, and continued to look well after his wife and son in Aus, bringing them sacks of meat at night when the police were not looking. Tjaaiman traded some of his meat for sugar, salt, mielie-meal and tobacco, but was fully capable of subsisting off the land alone right through the year. After eventually being recaptured, he was in jail for less than a year, before being released on account of his age.

Water utilization: Tjaaiman obtained his water from small, natural rock basins all over Dick Wilhelm. After rainwater had collected in them, he preserved it by covering the basins with flat stones. He also utilised various springs in the Aus mountains. The water was transported in a gemsbok stomach carried over his shoulder on a gemsbok horn or a stick, or in OES containers sealed with beeswax. The latter were stored with their openings down, and were, according to his son, each equal to about one day's water requirements.

Hunting methods: When hunting with a bow and arrow, the quarry was stalked, without any dogs being used. The arrows were iron-tipped and were not poisoned, with an effective range of well over 20 m. The bow was made from "Tjana", for its strength, being straightened in a fire before the bark was removed. Most of his hunting was however done with a short throwing spear, some 900 mm long with a 230 mm blade, and which was fletched with a cluster of ostrich feathers. His main quarry was the gemsbok, which was approached from behind while being held at bay by up to three dogs. He never hunted thin gemsbok, going chiefly for bulls, who had lots of fat around their necks. Neither were pregnant cows hunted. Sometimes he also used his dogs to go after dassies or steenbokke, occasionally even hunting aardwolf, which had lots of fat.

Food preparation: The meat was salted and dried, the fat being cooked out and stored in tins, where it kept for a long time. It was eaten by pounding the dried meat to shreds and mixing it with warmed fat. Ostrich eggs were prepared for eating by putting their contents on a flat stone next to a fire and whisking the egg with a stick.

Plant food and honey: The tjaba, a sweet, white, slightly watery tuber was dug up and eaten raw, being available throughout winter in the mountains around Aus. When good rains fell, it could also be found in the vicinity of Dick Wilhelm. In summer the nests of harvester ants, which could be seen as low mounds, some 150 mm high, could be raided for seeds in three ways: Firstly, the seeds could be removed after the ants had piled them up outside the nests to dry them prior to storage. Secondly, the seeds could be dug up once they were in storage. Lastly, once the seeds were in storage, one could pour water into the nest, wetting the seeds. The ants then carried all the seeds out again to dry them, enabling them to be harvested with ease. The fatty seeds lasted very long in storage and were eaten after being ground fine between two stones and rolled out. Tjaaiman also collected and ate honey, as well as making honey beer.

Most of the information was obtained as personal comments from his son, Gamaseb, who in October 1987 was some 70 years old and working on a farm 65 km north of Aus. Additional information, as well as confirmation of Gamaseb's recollections, was obtained as personal comments from Jan Plaatjies, the Nama in charge of the Garub borehole, Mr Coleman, the son of the transport driver who founded Kolmanskop and Mr Andries Schlemmer, a local farmer who had hunted with Tjaaiman.

The credibility of these sources is supported as much by their differences as by their correlations: Gamaseb, for instance, hotly denied that his father had ever stolen stock or eaten aardwolf. That, however, was because he was protecting the family name. Jan Plaatjies, who had seen Tjaaiman with a slaughtered aardwolf, recalled it so clearly because it was, to him, unusual and because he found the amount of fat on the carcass astounding. Mr Coleman could vouch for at least some of the stolen stock, as it was on his family farm that Tjaaiman had been caught slaughtering sheep. The praises for Tjaaiman's abilities as a hunter and a gatherer were unanimous, and were related with pride by his son, and with admiration by those who had known him.

CHAPTER SIX:
THE RESOURCE BASE

Water

Old German maps (Range 1911, Sprigade and Lotz 1913) show 15 permanent and 45 temporary water-holes in the Koichab River region (Fig. 12). These include the water-holes which were reported for Elizabeth Bay and Anichab by early travellers, but do not include the two which were observed by them adjacent to Luderitz Bay and the Lagoon. Presumably these were considered too meagre or too brackish for German needs. How many additional water-holes were known to hunter-gatherers in the course of the Holocene remains a matter of speculation, but there must have been a substantial number, some of them not immediately obvious to the uninitiated traveller. A fascinating example of the latter is the water-hole at Prinzen Bucht, some 40 km south of Luderitz. Its location was revealed to Schultze (1907) by a Frenchman who had been told about it by his "bushman" wife. While accompanying a German survey vessel, Schultze was not only able to verify its existence, but also had its exact position (15° 15' 59" E, 27° S' 25" S) pinpointed with the aid of the ship's navigational equipment. The water-hole lies in the back of a cave which can only be entered at low tide. Even then the low ceiling of the cave's entrance forces any prospective drinker into sea water up to his chin.

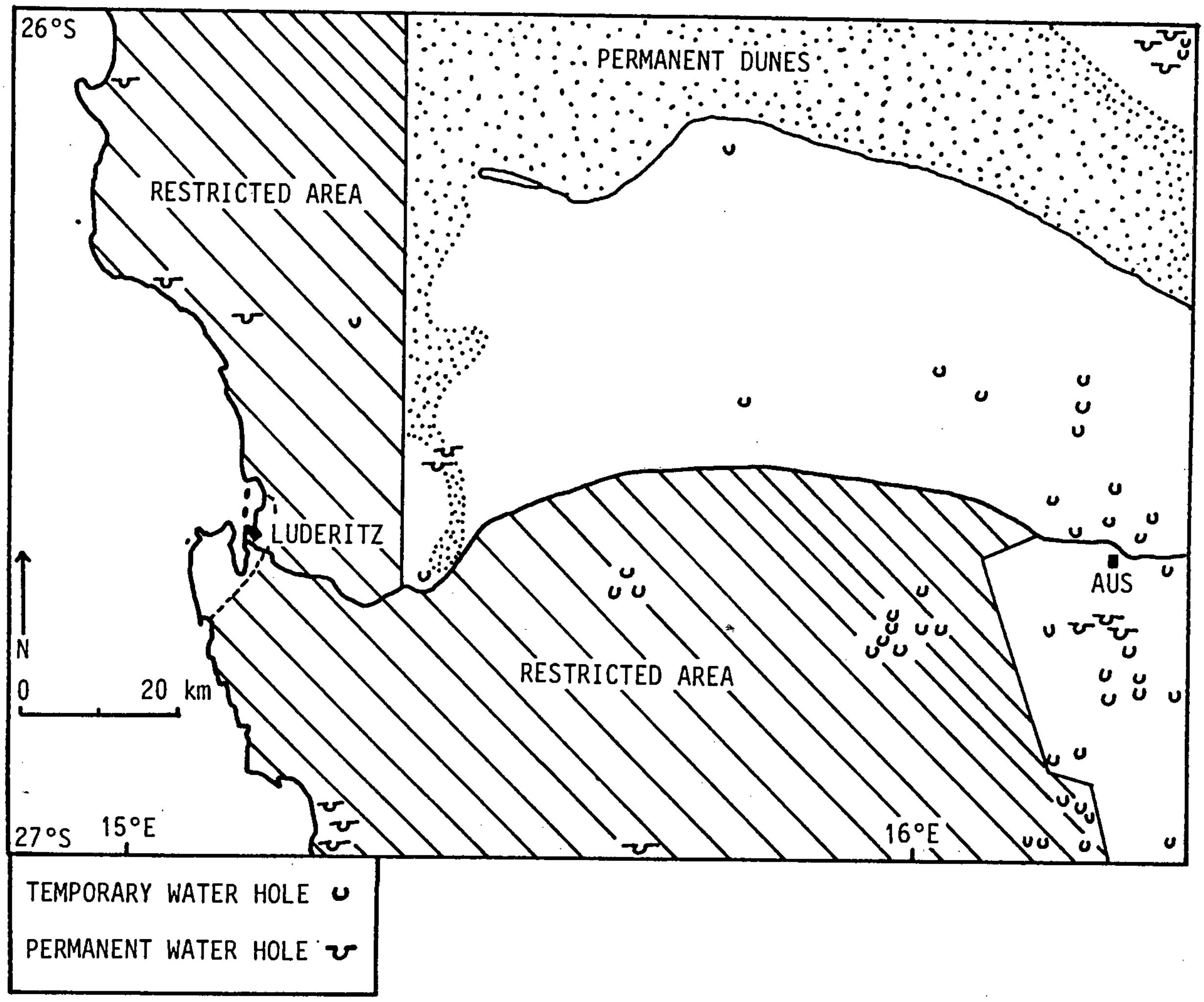

Fig. 12. Map showing water-holes in the Koichab River region, after Range (1911) and Sprigade and Lotz (1913).

The interior of the cave widens out, revealing a basin of water 3 m long, 1 m wide and 1,5 m deep, which looks as if it was left by the retreating tide, but in fact is only slightly brackish, being refilled at a rate of about 20 litres per hour (Schultze 1907).

Four kinds of temporary water holes were observed in the course of the site survey, all of them dependant on rainfall. The most numerous ones are natural holding tanks in the granite bedrock, such as found at Klein Garub, the water hole 6 km east of Dick Wilhelm. They can last several months, depending on their capacity and surface area. Some barely hold a litre, while others can hold several hundred litres. A more obscure water hole is the natural rock basin which has been filled with sand. While this prevents evaporation, it means that the water is more difficult to detect and has to be dug for. In the case of one example, investigated 5 km west of Aus on the farm Klein Aus, 400 mm of sand had to be removed before perfectly fresh water was obtained. Another source of water is a temporary spring, resulting when rain water, seeping along a subterranean channel, is forced to the surface or to the vicinity of the surface by impervious geological formations. A typical example is the water hole at the south-eastern end of the Luderitz lagoon. The final type of temporary water source is the shallow rain-water pool, several of which were observed in the vicinity of Luderitz. These, however, soon evaporate, rapidly becoming too salty for utilization (Kaiser 1926).

Permanent water-holes occur when perennial subterranean water courses are forced to the surface or to the vicinity of the surface by impervious geological formations. The water holes at Anichab, representing the subterranean estuary of the Koichab River, are prime examples (Schultze

1907, Kaiser 1926, Barbour and Dippenaar 1986). Another example is Haris, 20 km east of the northern end of Luderitz bay, where perfectly fresh water was revealed at a depth of only 300 mm. As these water-holes are normally reliant on large aquifers, they are immune to short-term climatic variations. Their resultant dependability would have made them of crucial importance to Holocene hunter-gatherers.

In spite of their relative scarcity in relation to the size of the Koichab River research area, water-holes are not difficult to detect. Where the lack of sand does not prevent it, their presence is revealed by comparatively lush vegetation. If they are reasonably accessible, they form the terminal point of numerous game paths, and game concentrations can be observed in their vicinity. Open water, even when it is inaccessible to game and surrounded by bedrock, can be detected by observing the flight paths of birds and bees. Bees, in particular, can be highly efficient and insistent water procurers. During a dry spell in October 1988, at Dick Wilhelm, they descended upon a wet T-shirt with such enthusiasm that the garment had to be abandoned.

While it could be argued that the temporary water-holes would have been useless due to their unreliability, personal observations made at Haalenberg suggest the opposite. Large amounts of OES fragments and stone artefacts around the water-hole and in the two rock shelters in its vicinity show that this water source was extensively utilised whenever it was available. Thus, while of a transient nature, the occurrence of water was repeated on a regular basis during past periods of sufficient rainfall. As hunter-gatherers, following game concentrations and areas of relatively lush vegetation, would only have been interested in an area after it had rained, it could well be that, as far as they were concerned, most of the temporary water-holes would in fact have been "permanent", in that they were there when they were needed. This, combined with the numerous permanent water-holes of the Koichab River region, would have ensured that small bands of Holocene hunter-gatherers always had sufficient water for their requirements, especially during the pluvial and immediate post-pluvial periods.

Marine fauna

Even today, after nearly three decades of systematic over-exploitation, the sea off the Namib shore remains one of the richest fishing grounds in the world (Branch and Branch 1981). This is attributable to numerous upwelling cells (Shannon 1985), which retrieve nutrients from the depth of the Atlantic Ocean, bringing them within reach of sunlight where, utilised by plankton, they form the beginning of a food chain supporting a biomass of such dimensions that it yielded a catch of 1,5 million tonnes of pelagic fish in 1968 (Branch 1981). The largest and most prolific of these upwelling cells is situated just off the sheltered waters of Luderitz Bay (Shannon 1985), which in turn is within 50 km of seven islands ideally suited for seal and sea-bird breeding colonies (Joint Commission 1885).

Both Cape rock lobsters and shellfish are readily available along the rocky shoreline, while flamingoes frequent the sandy shallows of Luderitz Lagoon and the northern end of Luderitz Bay. In the late 19th century penguins, gannets and cormorants bred on Possession Island, 40 km south of Luderitz, on Halifax Island, 7 km west of Luderitz, and on Ichaboe Island, 45 km north of Luderitz. Penguins and cormorants had colonies in Luderitz Bay, on Penguin Island and Seal Island. 20 km south of Luderitz there were extensive seal colonies on South Long Island and North Long Island, the latter harbouring penguins as well. Seals also frequented Staple Rocks, 35 km north of Luderitz, but had at that stage abandoned Seal Island, inside Luderitz Bay (Joint Commission 1885), which in 1786 had been covered in seals (Thompson 1786). The birds reportedly bred from the end of July to the middle of February, but only vacated the islands from May to the end of July, the number of birds as well as the length of their stay being regulated by the availability of fish. The absence of breeding colonies on Shark Island was attributed to its being accessible to jackals at spring tide (Joint Commission 1885). In 1988 Hartlaub's Gulls and Swift Terns were observed to breed both on the mainland adjacent to Shark Island, as well as on Shark Island itself, which is now joined to the mainland by a causeway. In April 1786 many whales and whale skeletons were observed in Luderitz Bay (Thompson 1786), while in June 1845 numerous right whales and finback whales, often in pairs, were seen on a daily basis in the vicinity of Ichaboe Island (Eden 1846). According to P. Best (pers. comm., 1989) commercial whaling on the Namib coast was started in the 1780's, eventually reducing the number of Right whales and humpback whales, the two types most likely to strand, by about 90%. Best also stated that, while the adult right whales would have sought out protected bays with sandy bottoms for calving in winter and early spring, juveniles could well have remained throughout the year. He suggested that the original donor population of right whales alone could have consisted of as many as 10 000 - 12 000 individuals.

Terrestrial fauna

Ostriches (Eden 1846), gemsbok (Eden 1846, Shortridge 1934), springbok, steenbok, duiker, klipspringer, dassie, porcupines (Shortridge 1934, Smithers 1983), black-backed jackals, aardwolf, Cape hares (Smithers 1983) and mountain zebras (Shortridge 1934) have been reported from the Koichab River region. Due to their scale, however, the distribution maps of Shortridge (1934) and Smithers (1983) are not always clear. The fact that Smithers (1983) fails to mention gemsbok, the most numerous game in the area (see below), is an indication of the sometimes superficial nature of the information he had at his disposal, and demonstrates the importance of personal observations when dealing with inaccessible and poorly researched regions.

During the site survey ostriches, hares, black-backed jackals, gemsbok, springbok, klipspringer and steenbok were seen in the Koichab River research area. The most numerous were gemsbok, with one herd of more than 75 individuals being observed in the Koichab River bed. All populations were found to be highly variable in number and highly localised, depending entirely on where and how much rain had fallen. Even so, the permanent carrying capacity of the Dick Wilhelm area was confirmed by a standing herd of some 300 wild horses (D. Clark pers. comm. 1989), which obtained their water from the Garub borehole (J. Plaatjies, pers. comm. 1987). According to the nature conservation officer in charge of the Koichab River region, it was also frequented by aardwolf, with dassie along the eastern margin. He stressed the variable nature of the population sizes, estimating the maximum number of gemsbok at 3 000, that of springbok at

1 000 and that of ostriches at 500. He pointed out that whereas at times not a single one of any of these three species could be found in the whole area, he had observed a concentration of some 600 springbok in the vicinity of Dick Wilhelm in 1988.

Terrestrial flora

According to Giess (1971) the vegetation of the largest part of the Koichab River region is desert and succulent steppe, the northern margin having both southern Namib and semi-desert/savanna transition vegetation, with dwarf shrub savanna forming the eastern border. In addition to these four vegetation types, which have their confluence about 30 km north-east of Aus, there are also riverine woodlands, mainly of camelthorn, which occur along all larger river-beds. Near the coast of the desert and succulent steppe region there are large barren desert plains and sand dunes, with the stony hills and the inland mountains being relatively densely covered by various succulents. Perennial vegetation increases to the east, as the summer rainfall area is approached, with the growth and flowering of annuals in the whole region being dictated by rainfall. Towards the east the desert merges into a grassland which extends northwards as far as the Kunene River, the main species in the south being *Stipagrostis ciliata* and *Stipagrostis obtusa*. The northern part of the Koichab River region merges into the southern Namib, where plants such as *Monsonia ignorata* and grasses such as *Stipagrostis gonatostachys*, *S. sabulicola* and *S. lutescens* occur. Giess (1971), however, points out that the southern Namib is, botanically speaking, practically unexplored, and that all of his work has to be regarded as preliminary until a more intensive botanical survey of the whole territory is made.

By virtue of its present status as a desert (Giess 1971), most of the Koichab River region has extremely sparse vegetation cover, the main exception being the summer rainfall area along its eastern margin. The other exception is the central 30 km of the Koichab River bed, adjacent to and east of KBV, which has what amounts to a scattered forest of camelthorn trees and vast nara stands. While only two male nara plants were seen at the permanent water-hole at Haris, a stand with 30 female, 25 male and six indeterminate nara plants was found 4 km north-east of Haris during a site survey in October 1988. This stand was something of an enigma, as it was located on a southward facing dune slope running up the side of a low mountain, which ruled out the possibility of access to ground water. It was concluded that the dune itself acted as a moisture trap, refurbishing its supply from the occasional rain run-off from the mountain and the rare occasions when moist sea air penetrated that far (25 km) inland. As the Kowis mountains, 12 km south-east of this stand and only 20 km east of Luderitz, has similar slopes, the possibility exists that those slopes too, will have naras on them. Due to access difficulties this could not be confirmed, but it lends credibility to the claims of early settlers (von dem Hagen 1943) that naras were brought from the Kowis mountains. Extensive nara stands had also been reported from Anichab (Sprigade and Lotz 1913), while only a small cluster of plants was seen in the north-eastern Koichab River region in 1986. Whereas, in October 1988, the naras in the central Koichab River bed were decidedly green, the nara stand north-east of Haris displayed the whole range from flowers to fully ripe fruits. North of the central Namib sand sea, in the

Kuiseb river valley, naras only ripen in November, the season lasting until April (Budack 1977).

Neither the "wild carrots" nor the "wild potatoes" reported respectively from the Luderitz and Aus areas (von dem Hagen 1943) were found during the site surveys. Presumably, based on the descriptions given by Gamaseb and Jan Plaaitjies, the "wild potato" was the tjaba tuber which Tjaaiman had been reported to have utilised in winter, obtaining it from the mountains around Aus and from the vicinity of Dick Wilhelm. The "geranium bulbs", on the other hand, which had been consumed roasted by natives near Elizabeth Bay in May 1845 (Eden 1846) and which were used as a cure for diarrhoea at Luderitz (von dem Hagen 1943), were found in great numbers both in the vicinity of Luderitz and at the Haris water-hole in October 1987. The bulbs, looking like peanut-sized potatoes, could be harvested with great ease, being arranged around the plant (Monsonia ignorata) in a circle about 200 mm in diameter at a depth of about 30 mm below the surface. Raw they were very bitter, but roasted they tasted like a slightly tangy cross between a peanut and a potato. Individual plants were found to yield as much as a handful of bulbs each.

The most striking vegetational feature of the Koichab River region, however, is its grass cover, which, when activated by sufficient rains, can give formerly completely barren terrain the appearance of a wheatfield. At such times the harvester ant (Messor barbarus capensis) collects large quantities of grass seeds in the Namib, storing them in underground chambers, where they form a readily accessible food source for hunter-gatherers (Jacobson 1984). According to Schultze (1907), the seeds most prized by the raiders of ant nests were those of _Aristida_ grasses. Nests were easily identified, and ants taken from one near KBV in 1988 were identified as _Messor denticornis forel_ by H. Robertson of the S A Museum's Entomology Department.

Apart from the camelthorn trees from the central Koichab River, firewood is also available in the form of low shrubs and bushes on the slopes of the various inselbergs, in dry water channels and on vegetated dunes. On the coast these are also supplemented by driftwood, sometimes in the form of a "large tree of the iron wood kind" (Thompson 1786:8).

Several of the cactus-like _Euphorbia virosa_, reputedly used as an arrow poison by Namib "bushmen" (Shaw _et al._) were found in the Koichab River region.

Bees and honey

One beehive was found on the slopes of Dick Wilhelm, some 400 m north of DKW. Due to the presence of a large and highly active swarm, both in summer and in winter, its location in a cave could not be fully investigated. A "bushman's ladder" (Gamaseb pers. comm. 1988) made from a forked branch propped against the rock face below the hive's entrance and steadied by a pile of stones, could, however, be seen from a safe distance. A second beehive, equally unapproachable, was found in a cave at the southern base of the southernmost of two rocky hillocks, about 1 km southwest of the Klein Garub water-hole.

Lithic and mineral resources

White vein and pebble quartz is readily available in the whole Koichab River region, while carbonatite, in all stages of silicification, can be obtained from Dick Wilhelm. Large amounts of both red and yellow ochre have been reported from the vicinity of Elizabeth Bay (Eden 1846). B. de Jager, the local head of security for Consolidated Diamond Mines (CDM) reported a rich source of coloured crypto-crystalline silicates from the same area (pers. comm. 1988). Large chunks, cores and flakes of honey-coloured translucent chert found at Flamingo Bay, 8 km north of Luderitz, suggest a possible coastal source, but it has not yet been located. Similarly the origin of the numerous quartz crystals utilised at archaeological sites has not yet been discovered. Diamonds, which were discovered at Kolmanskop in 1908 and for which the Namib coast became famous (Brittan 1979), have to date not featured in a single archaeological site. Wendt (pers. comm. 1988) put this down to the fact that they lack conchoidal fracture and would therefore have been useless for making stone tools. They were, however, instrumental in the creation of the Sperrgebiet, which has to a large extent protected the natural and archaeological heritage of the Koichab River region.

CHAPTER SEVEN:

RELATED ARCHAEOLOGY AND ETHNOGRAHY

The hiatus

According to Wendt (1975, 1976) the microlithic Later Stone Age (LSA) of the southern Namib, characterised by small scrapers, segments and borers started around 10500 B.P., continuing until about 5500 B.P., when a hiatus occurred which only ended at about 500 B.P. in association with the use of ceramics. At some sites it appeared as if ceramics and microlithic LSA assemblages had co-existed during the latter stages of this development, but the association was not clear. Several sites had ceramics associated with coarse stone tools, with no typical microliths being present (Wendt 1975). Later it was pointed out that the complete lack of dates for the southern Namib was limited to the period from 5100 B.P. to 2300 B.P. (Vogel and Visser 1981). This did not, however, contradict Wendt's proposal for a hiatus of 5000 years, as relatively few dates fell within the time-span he had suggested (Parkington and Hall 1987).

Even so, Wendt (in lit. 1989) is of the opinion that the current research programme, which has reduced the completely dateless period to the time between 5060 B.P. and 3640 B.P., indicates that the hiatus may have been less severe than had originally been suspected. He also sees the fact that all dates from between 6000 B.P. and 2000 B.P. come from the Koichab River area as an indication that it may have been the tip of a "wedge" of hunter-gatherer infiltration, driven in from the as yet archaeologically unexplored interior.

Coastal dates

The earliest coastal date from the southern Namib was 2100 ±50 B.P. (Pta-1045) from a pre-pottery LSA shell midden with a microlithic assemblage at Steenbras Bay, 4 km southwest of Luderitz (Vogel and Visser 1981). This site, originally excavated by Wendt (1975), was later associated with the systematic skinning of penguins, presumably for the manufacture of karosses (Avery 1985). Wendt (1980), using as evidence the inland discovery of marine shell fragments and pendants, rock art with coastal motifs, and beads made from coastal plant sap, suggested that coastal visits were the norm for the whole southern Namib since well before 45000 B.P. A pre-Holocene coastal presence would also appear to be suggested by the finding of both Middle Stone Age and Later Stone Age sites within 2 km of the southern Namibian coastline (Rudner and Grattan-Bellew 1964, Sandelowsky 1977) as well as the recovery of Early Stone Age material from diamondiferous raised beaches (Davis and Walsh 1955, Corvinus 1983). Sandelowsky(1977) attributed the relative absence of material predating the Later Stone Age from along the coast to post-Pleistocene sea level changes.

Pottery and domestic animals

The earliest southern Namibian dates associated with pottery, 1960 ±45 B.P. (Pta-1918), 1670 ±55 B.P. (KN - I 870) and 1460 ±55 B.P., (KN - I 846) were obtained from the Apollo 11 cave excavated by Wendt (1972, 1975, 1976). A site at Arrisdrift, 30 km inland of the Orange River mouth, which was associated with sea shells, coarse stone flakes and pottery, was dated at about 1250 B.P. (Vogel and Visser 1981). At Mirabib Hill shelter, 100 km southeast of Walvis Bay, the microlithic LSA assemblage was terminated after 5190 ±80 B.P. (Pta-1011) with a hiatus which lasted until the advent of sheep and pottery, associated with a date of 1550 ±50 B.P. (Pta-1348). Forty-five grindstones were found on the surface of this shelter, and grindstones and grindstone fragments were also found at lower levels in the excavation, the oldest being associated with a date of 8200 ±80 B.P. (Pta-1013) (Sandelowsky 1977). All other sites associated with pottery from the southern Namib fall within the last 500 years. (Vogel and Visser 1981). Based on potsherds associated with a date of 1745 ±35 B.P. (Gr N - 5297), it has, however, been suggested that ceramics may have preceded herding in the Namib (Sandelowsky et al. 1977). It has also been suggested that goats and sheep may have preceded cattle (Wadley 1979).

Early settlement patterns and social relationships

Wendt (1975) combined the reports of early travellers with the results of his archaeological investigations. He came to the conclusion that hunting and gathering Nama in possession of ceramics had entered the southern Namib some 500 years ago, either displacing or absorbing the remnants of the original population. These Nama, according to him, were the "bushmen" referred to by the early travellers. While he did not suggest any identity for the original inhabitants, Wendt pointed out that small groups of Damaras had lived at least as far south as the 26th parallel prior to the 19th century. In the course of the 19th century both the "bushmen" and the Damara were displaced, enslaved or exterminated by various waves of nomadic Nama herders, who had first crossed the Orange River in the 17th century (Wendt 1975).

Wadley (1979) suggested that hunting and gathering Damara had been present in central South West Africa before the advent of pottery and pastoralism. According to Wadley, some of them subsequently adopted these two innovations, while others specialised in working metal, trading or agriculture, sometimes as voluntary clients of the Nama. Wadley also suggested that Damara hunter-gatherers may have peacefully co-existed with Damara goat herders, who in turn may have had amicable relationships with Nama sheep and cattle herders. These suggestions were based respectively on the comparative genetic isolation of the negroid Khoikhoi-speaking Damara and the fact that goats can utilise grazing which is useless to cattle. The Damara may in fact have formed a loose buffer zone between the southern Nama herders and the northern Herero herders and Ovambo agriculturalists. It was only in the 19th century that relationships amongst all groups deteriorated to the point where some of them, particularly the hunter-gatherers, were displaced, forced into servitude or exterminated (Wadley 1979).

The equipment used by the Nama and the Damaras was essentially the same (Wadley 1979). The Nama, however, had round-topped, mat-covered, cattle-transported temporary huts, while the Damara had conical, grass-or bark-covered permanent huts with circular stone bases (Alexander 1838). Consequently, while former Nama hut sites may not be recognisable, those of the Damara entered the archaeological record as stone circles (Wadley

1979). According to Noli and Avery (1987), however, not all the numerous stone circle complexes which have been reported from the western Namib can be attributed to the Damara. They suggested that the constraints of a harsh environment could mask the usual social differences that might be expected to affect the building practices of different groups. This would appear to be substantiated by the fact that the oldest date presently available for stone circles, 1070 ±60 B.P. (Pta-3295), was obtained for the skeleton of a Khoisan male, excavated by Shackley (1983) at Sylvia Hill, some 160 km north of Luderitz.

Both Wendt (1978) and Wadley (1979) made extensive use of the reports of early travellers, be these explorers, missionaries, traders or potential settlers. Wadley (1979) pointed out that apparent contradictions in some of these reports need not necessarily imply inaccuracy, as different settlement patterns and different social interactions were taking place in different regions at different times.

Subsistence strategies

Recent investigations into dietary reconstructions have revealed that the physiological limits of protein utilization for energy amount to 20 - 50% of daily needs, which would have forced coastal hunter-gatherers to provide for a nutritional balance between protein and fat- or carbohydrate-rich sources of food (Noli 1986, Noli and Avery 1988). This discovery rendered unlikely the view that marine resources alone could provide adequately for the food and nutritional needs of prehistoric hunter-gatherers over periods ranging from days to seasons, that the visible predominance of shellfish in shell mounds reflected the main component of the coastal diet, and that calculations of the relative contributions of the various types of marine resources and the reconstruction of the palaeodiet and subsistence strategies could be made via determination of meat weight and calorific value (e.g. Greengo 1952, Shawcross 1967, Parkington 1972, Bailey 1975, Buchanan 1985, 1987). Furthermore, the role of protein in the supply of essential amino acids and the problems of poisoning from its over-consumption was found to represent an important constant, being both an input and a control for dietary reconstruction, in that excess protein had to be limited, whereas sometimes archaeologically invisible fats and carbohydrates had to be accounted for (Noli 1986, Noli and Avery 1988). This is of crucial importance for the Namib coast, with its limited vegetation (Giess 1971) and consequent lack of carbohydrates, where whole whales, a rich source of both fat and protein, have at times effectively managed to evade the archaeological record (Smith and Kinahan 1984).

Trenk (1910a) estimated the number of "bushmen" living in the southern Namib at some 900 to 1 000 individuals. According to him these people, who were physically and linguistically identical to the Nama - with the exception that some of them had thicker hair - had evolved from a mixture of Nama and other (unspecified) indigenous population groups. Families stayed together as a unit, following the game into the Namib dunes when it rained, and occupying caves with good views in the vicinity of the water-holes in the mountains fringing the desert when it did not, or when the nara or tsama fruit of the area "owned" by the family had been depleted. While mainly hunters, they resorted to stock theft in bad times, a strategy which led to their being largely annihilated by the Nama, particularly in earlier times. Dressed in skins, they wore "veld-shoes" and carried a leather bag or a net knotted from sinew. Their karosses were made from jackal or dassie skins. They hunted with spears, throwing sticks and bows with poisoned arrows. Sometimes the poison, obtained from the Euphorbia candelabria (virosa), was also used to poison water-holes frequented by zebras. When hunting in regions without water, caches were established in containers made of OES or gemsbok stomachs. Another source of moisture was the gemsbok, the body fluids of one animal sufficing to quench the thirst of two men (Trenk 1910a).

A "hottentot and bushman" camp, with a fire burning in it, was found in March 1908 near a water hole at Spencer Bay, some 100 km north of Luderitz (Rappard 1909), while "bushmen" were seen living in August 1909 at the Meob water-hole, some 240 km north of Luderitz (Trenk 1910b). Apparently the "natives" took five days to cross the desert to the coast at Anichab, starting from the Awasib water-hole, some 130 km to the north-east (Rappard 1909).

Budack (1977) made a detailed study of the subsistence strategies of the Topnaar Nama of the Kuiseb river mouth at Walvis Bay, who were first observed in 1677. They made extensive use of the seeds of the nara plant, which have a fat content, by mass, of 57% (Dentlinger 1977). The nara seeds were dried and were thus available throughout the year. Sometimes they were crushed and eaten with sandshark meat. The Topnaar also extracted fish oil from fish heads and obtained whale oil from the blubber of beached whales. They furthermore dipped pieces of dried fish in whale oil prior to consumption and also stored whale oil in dried kelp containers (Budack 1977). It would thus appear as if their subsistence strategies would have been an effective guard against protein poisoning. Budack (1977) pointed out that the Topnaar had been, and still were, divided into two sections, the coastal people and the inland people. He also was of the opinion that the coastal Topnaar were not involved in seasonal mobility between the inland and the coast. As he saw it, the coast could support hunter-gatherers right through the year, and the inland pastoralists did not possess the degree of specialization required for seafood exploitation.

As they were not made in the southern Namib, the following three observations could be considered to be beyond the scope of the present research program. They have been included, however, as they demonstrate a high degree of continuity in subsistence strategies along the entire Namib coast, an observation which could be indicative of environmental determination in marginal regions.

In February 1896 von Estorff met a group of 30 "bushmen" who were largely living off nara fruit at the Uniab River mouth, some 300 km north of Walvis Bay (Kutscher 1982).

During a severe drought in 1906, Elers (1907) found some "Berg-Damaras" and "bushmen" living close to the sea along the northern Namib shore between the Hoanib and Hoarusib Rivers, some 400 to 470 km north of Walvis Bay. Apparently they were constantly walking up and down the coast in search of beached whales. Unfortunately this observation, made during the latter half of winter, could not have covered more than a few weeks. It did, however, overlap with the calving season of the right whales. An old "sea bushman" also told Elers that he remembered killing nesting coastal birds for food and taking their eggs.

As pointed out by Jacobson and Noli (1987), the northern Namib coast provided few economic incentives for European settlement, and few safe landing places. Consequently local settlement and subsistence patterns would have remained relatively unaffected by European contacts at the times von Estorff and Elers made their respective journeys.

Dart (1955) described three "Strandlopers" from Sesfontein, some 70 km inland of the Hoanib River mouth, who had been seen in 1953. Their "patrons", the local "Topnaars" (Nama), described them as being the last remnants of a large group of "Strandlopers" who had, until bad seasons over three or four years prevented them from doing so, made an annual trip to the coast to exploit nara fruit.

It would therefore appear that, apart from occasionally visting the coast, some hunter-gatherers also walked up and down the Namib shore. Consequently the term "Strandlopers" (beach walkers), used as an economic rather than a racial classification, could in fact be applicable to some of the prehistoric inhabitants of the Namib coast. M.L. Wilson (in lit. 1989), however, is of the opininion that the term should be discontinued, as it implies the exclusive use of marine resources, a subsistence strategy which has yet to be linked by indisputable evidence to the hunter-gatherers of southern Africa.

The following report adds little to what is known about the subsistence strategies which were practised in the Namib. It does, however, show the official evaluation of these strategies in the eyes of the legal representatives of His Majesty, the King of England in 1931.

In July 1931 a group of Namib hunter-gatherers was found by a police patrol at the Aurus mountains in the southern Namib. Comprised of seven men, six children and two women, and accompanied by seven dogs, the group appeared to have been living off plant food and honey. In August 1931 two men accompanied by 10 dogs were found to have been hunting with bows and poisoned arrows some 50 km further north. Except for three men from the first group who eluded capture, all these people were removed from their haunts, the adults being variously charged with tresspassing in the diamond area, having unlicensed dogs and weapons, and the possession of klipspringer and gemsbok skins and gemsbok meat. The jail sentences subsequently imposed ranged from four days for the women to five months for the hunters (Wendt 1981).

The hunter-gatherers, it would seem, were themselves hunted down in their last refuges, gathered together and punished for the very activities which had ensured their continued existence for thousands of years. Once their subsistence strategies had been curtailed, the Namib nomads ceased to exist.

CHAPTER EIGHT:

DISCUSSION

Climate and hiatus

The suggestion has been made that the Namib was relatively wet from 16000 B.P. to 11000 B.P., after which it was only slightly wetter than today, with a dry interval around 2500 B.P. (Deacon and Lancaster 1988). This does not match very well with the archaeological evidence from the Koichab River region, which indicates that the area could have been occupied from about 8400 B.P. to 5100 B.P., and then again from about 3100 B.P. until recent historic times. The southern part of the Kalaharian ecozone, however, which is a summer rainfall area adjacent to the southern Namib, was relatively dry from 12000 B.P. to 8000 B.P., with increased humidity from 8000 B.P. to 4000 B.P., after which it was drier, with wetter intervals from 3000 B.P. to 2000 B.P. and from 1600 B.P. to 1000 B.P. (Deacon and Lancaster 1988). While still not a perfect fit, this scenario does match the Koichab River region slightly better than the one suggested for the Namib, indicating that the Kalaharian summer rainfall regime may at times have penetrated well into the southern Namib. Consequently, while being climatically out of phase with the rest of the Namib, the southern Namib may still have fitted reasonably well into the general trends hypothesised for Holocene southern Africa by Deacon and Lancaster (1988).

There are, however, factors other than the climate of the southern Namib which may have influenced the timing of the hiatus observed in the Koichab River area. These could have included a desiccation, not of the southern Namib itself, but of the southern Namib in relation to other areas, which would then have been preferred by Holocene hunter-gatherers. In some regions in northern Namibia (Wendt 1972, Rudner 1973, Vogel and Visser 1981, Parkington and Hall 1987) and in the central Orange River area (Sampson 1972, 1982, Parkington and Hall 1987) periods of occupation coincided with the hiatus of the southern Namib, making them likely examples of areas with comparatively better conditions. Wendt (1975), however, cautions against the assumption of a gradual preference for these areas, pointing out that the three regions involved display cultural differences. He also draws attention to the fact that most of the dates confirming the hiatus of the southern Namib come from caves, so that an apparent hiatus would also have been created by a preference for open sites, regardless of the fact that the inhabitants may never have left the region. While the relevant open sites with microlithic assemblages have yet to be found, Wendt's suggestion cannot be discounted until the southern Namib has been more fully surveyed. There is, after all, the precedent from the south-western Cape, where open sites were preferred to caves from 2900 B.P. to 1700 B.P. (Parkington 1987).

Neither can the question of population pressure be discounted. According to Deacon and Lancaster (1988) the fact that, throughout Africa, the increase in dated archaeological occurrences took place several thousand years before the appearance of food production is an indication that food production was a consequence of Holocene population increases. Their data show that these increases started at about 10000 B.P. in north and east

Africa, at about 5000 B.P. in west Africa and about 2500 B.P. in southern Africa. This sequence, however, can also be explained by the spread of food production driving before it a wave of displaced hunter-gatherers. Both scenarios, however, would have had hunter- gatherers in the Khoichab River region by 2500 B.P. - not because it was better than the area they had left, but because it was the best alternative open to them.

The role of the climate in the prehistory of the Koichab River region is also complicated by the fact that the area lies in the vicinity of the confluence of the Namib Kalaharian- and Karoo/Namaqualian ecozones (Deacon and Lancaster 1988). Apart from having the highly mobile border between the summer and winter rainfall areas running right through it, the region is also at the equally mobile confluence of four major types of vegetation (Giess 1971). Further intricacies arise from the fact that generalizations and averages can be extremely misleading when dealing with a climate which is given to as much irregularity and extreme variations as that of the southern Namib (Kaiser 1926). Even primary data, while being able to identify the strongest signals of palaeoenvironmental changes in southern Africa, are incapable of providing a unambiguous record of these changes (Deacon and Lancaster 1988).

This does not mean that attempts to fit the palaeoclimate of the Koichab River region into the existing environmental models should not be made. It merely highlights the need for additional information, as well as cautioning against the expectation of a perfect fit, or a critique of the existing models which is not warranted by the evidence this study has added to the data base. Similarly, while there is every indication that a hiatus induced by the local climate did in fact take place in the Koichab River region during the latter half of the Holocene, the exact location of the hiatus, its nature and extent will have to remain largely in the field of speculation until the southern Namib has been more fully researched.

Seasonality and subsistence strategies

In spite of the fact that the concept of seasonality is somewhat problematic in the Koichab River area because of the highly variable nature of the seasons, it has to be considered in order to ascertain what effect, if any, seasonal changes may have had on the viability of the resource base, and hence on Holocene subsistence strategies. For the purpose of this discussion, the summer half-year is taken as the months from October to March, with the winter half-year lasting from April to September, as suggested by Kaiser (1926) and Rutherford and Westfall (1986). As specific information was available for the coast at Luderitz and the eastern margin at Aus, these have been considered in detail, the situation in the interior being based mainly on extrapolation and personal observations. (Fig. 13).

The coast can be considered a true winter rainfall area, in that it receives 85% of its rain from April to September (Weather Bureau 1953). Allowing one month for the rains to soak in and for plant growth to establish itself, and assuming that the vegetation may remain for a further month when the rain has ceased, grass, geranium bulbs and game could potentailly be available from May to October. The main calving season for right whales and the associated peak in juvenile strandings,

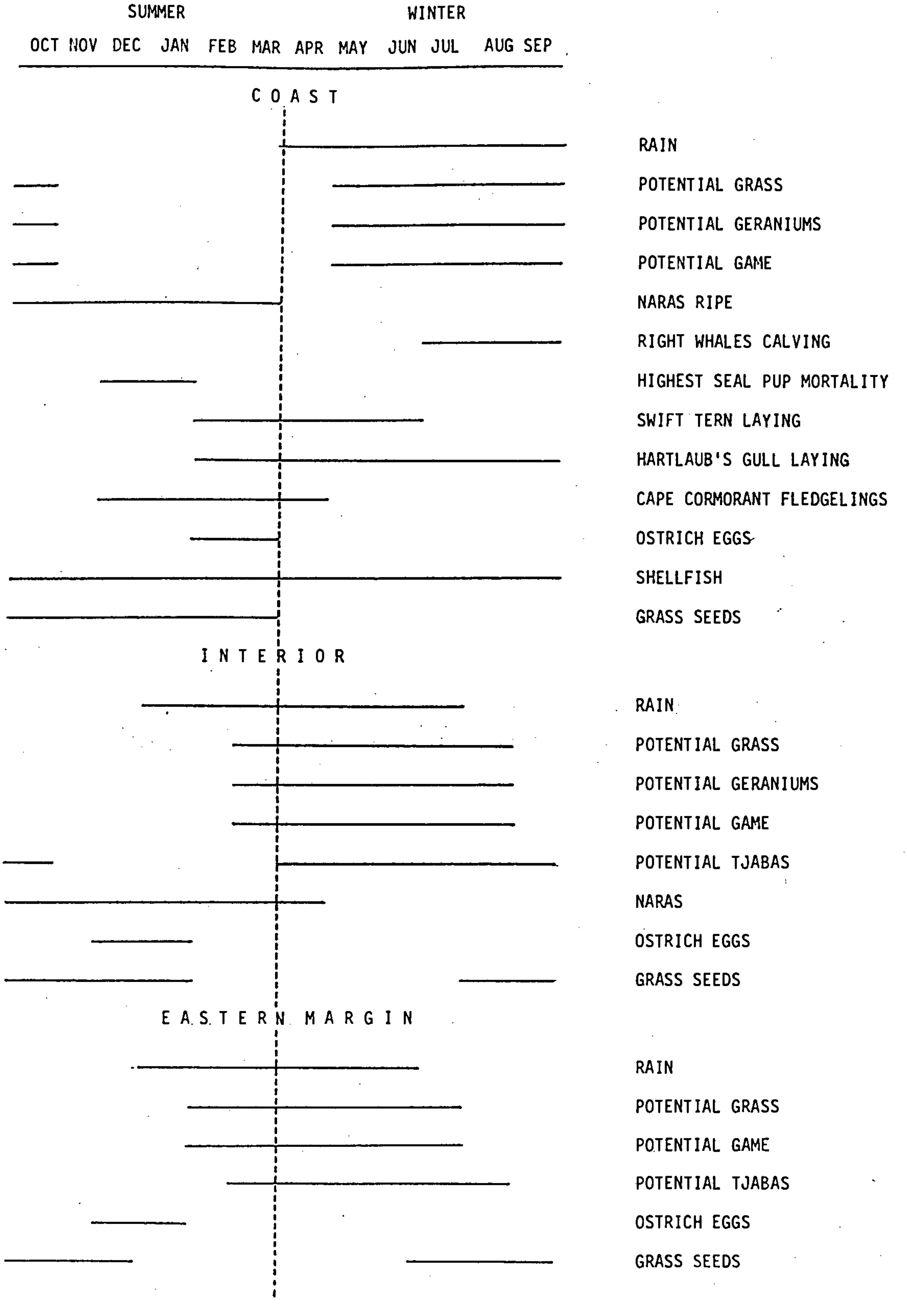

Fig. 13. The seasonality of resources in the Koichab River area.

from July to September, also fall within this period (Best pers. comm, 1989). This does not, however, mean that the coastal resource base is in any way biased against summer utilisation. Although no data from the coastal nara stands from the Anichab areas is available, observations from the Kuiseb River mouth (Budack 1977) and from the interior of the Koichab River area (pers. obs. 1988) indicate that the nara season could well last from October to April, providing a substantial summer resource. Also falling into summer is the period of highest seal pup mortality, in December and January (Roux pers. comm. 1989) as well as the most likely time for ostriches to lay their eggs, in February and March (Brown 1982), and most of the time during which Cape Cormorant fledgelings can be found, from January to April (Avery 1984). While both seals and Cape Cormorants breed on islands, the prevailing winds ensure that many dead individuals get washed up on beaches, making them readily accessible resources (Roux pers. comm, 1989). Falling into both the summer as well as the winter half-year are the laying periods of the Swift Tern, from February to May, and the Hartlaubs Gull, from February until September (Britton 1986). Both of these birds are known to nest on marine shores (Britton 1986) and were nesting on the shores of Luderitz Bay in March and April 1988 (pers. obs. 1988), making their eggs and their young easy prey for exploitation by hunter-gatherers. Throughout the year adult Cape Cormorants and seals, both easily approached, frequent the shores of the mainland (pers. obs. 1987, 1989). The most reliable all-year resources are shellfish and crayfish, while whale strandings may well have been more frequent and regular before the advent of commercial whaling.

In spite of being classified as a summer rainfall area (Kaiser 1926), it may be more appropriate to describe the eastern margin as an all year rainfall area, due to the fact that only 52% of the rain actually falls in summer (Weather Bureau 1953). The rainy season lasts roughly from January to July, making it longer during the summer than during the winter (Weather Bureau 1953). Consequently the potential for grass and game should be best between February and August. Considering their size, tjabas might take somewhat longer to form, and may also last longer, possibly being available from March to September. The potential "lean" period thus formed, from October to January, is partially alleviated by the fact that ostriches are most likely to lay their eggs during November and December (Brown 1982).

The interior, from the point of rainfall, is likely to be a highly variable combination of the coast and the eastern margin, with a mainly winter precipitation lasting from February until September (pers. obs. 1987, 1988). Thus, grass, game and geranium bulbs could be available from March to September, and tjabas from April to October. The potentially resourceless period, in this case from November to March, would be adequately supplied by naras from October to April, and by ostrich eggs in December and January.

Thus, even without considering the possibility of storage, the coast, the eastern margin and the interior of the Koichab River would probably, and the region as a whole would definitely, have had resources available throughout the year. While the storage of nara seeds can turn them into a permanent resource (Budack 1977) this strategy necessitates the presence of the user during harvest time. With grass seeds this is not the case, due to the activities of the aptly named harvester ants, whose nests were raided mainly in summer (Gamaseb, Plaatjies pers. com. 1988) when the potential for grass is fairly low. The extent of the grass seed resource is not easy to establish, but the relative frequencies of grindstones could indicate that they were more heavily exploited in the interior and on the eastern margin than on the coast. This tallies both with observations made of the availability of grass (pers. obs. 1987, 1988) and the decrease in rainfall as the coast is approached. No figures exist to determine the exact gradient of the latter decrease. The fact, however, that Kolmanskop, which is only 10 km inland and 124 m above sea level, receives over twice as much rain as Luderitz does (Weather Bureau 1953), indicates that the interior could be better watered than expected. Theoretically, the grass seed hoards would be at their maximum size just after the rainy season. As the seeds have to tide the ants over the dry, grassless times, and as it is likely that the ants will - rainfall permitting - rather collect too much than too little, there is a strong possibility of at least some seeds being available throughout the relatively resourceless periods between the rains in the Koichab River region. This would amount to the months from October to March on the coast, August to December on the eastern margin, and September to January in the interior.

While the faunal remains from the two excavations failed to deliver any evidence suggestive of ostrich hunting, a rock painting in a shelter 1 km south of KBV, depicting two men carryng an ostrich (pers. obs. 1988), indicates that the concept was not unknown to Holocene hunter-gatherers. From the vast amounts of OES fragments found at sites throughout the Koichab River area, it would, however, appear that the eggs themselves were exploited on a regular basis. That some of the eggs were used as drinking bowls, water containers and raw materials for OES beads is clearly demonstrated by both ethnographic and archaeological evidence. The fact, however, that the shell of an ostrich egg weighs about 300 g, (Brown 1982) and that the 1 239.7 g of OES recovered from DKW included only two rim fragments and 13 beads, indicates that consumption may have formed the main type of ostrich egg utilisation. This could also be deduced from the situation at LCC, where the occurrences of sea-bird and ostrich eggshell fragments are inversely proportional to each other. As sea-bird eggs are useless for anything but eating, ostrich eggs, if used as a substitute, must also have been eaten.

The amount of ostrich eggs originally available to Holocene hunter-gatherers on a yearly basis is difficult to estimate, since the size of the pre-colonial ostrich population is not known. Early in the 20th century, when the diamond rush was well under way in the Namib, a hunter found several diamonds in the gizzard of an ostrich he had shot near Walvis bay. This incident, ascribed to the habit of ostriches to swallow up shiny pebbles to help them digest their food, resulted in an ostrich hunt of unprecedented proportions, at the height of which 12 000 ostrich skins were exported from Walvis Bay over a five-month period (Green 1933). How many skins were exported from Luderitz, and how many of them were just left on the slaughtered birds is not known, but is unlikely that the present ostrich population of the Koichab River area is in any way representative of the past.

Ostriches are completely independent of free water, and have a preference for inhabiting open short-grass plains at densities from 0,6 to 0,8 per km^2 (Brown 1982). Consequently, even if only half of the 13 200 km^2 of the Koichab River area was suitable for ostriches, it would still be able to support some 4 000 to 5 600 of these birds. Again assuming that only one quarter of the ostriches were laying hens, and considering that hens lay an average of 8 eggs a year, 64% of which are surplus and are rolled out of the communal nest (Brown 1982), a minimum of 5 000 eggs would be available during the yearly two-month laying and incubation period - if only the surplus eggs are collected. As the contents of each egg weigh 1200 g, that figure translates into some six metric tons of edible egg. In captivity, however, ostriches that have had their eggs continually removed from their nests have been induced to lay up to 90 eggs each year. (Brown 1982). The implications of a similar strategy by hunter-gatherers, translated into edible egg, are probably beyond the scope of the present research programme. It does not, however, appear as if there would have been a shortage of ostrich eggs in the Koichab River region. The actual location of the nests would not have been problematic, due to the eggs being laid in the grassless time before the rains, when their white shells make them clearly visible on the gravel plains (pers. obs. 1987). In the Namib ostriches have also been known to congregate conveniently in herds of up to 600 birds near water-holes (Brown 1982), the very areas hunter-gatherers would in any case frequent.

The question remains as to how exactly all these resources were combined by Holocene hunter-gatherers into a viable subsistence strategy. Several archaeologically visible seasonal indicators were excavated at the coastal site of LCC. These were Swift Tern/Hartlaub's Gull eggshell; Swift Tern, Hartlaub's Gull and Cape Cormorant juveniles, as well as OES fragments. Combined, they suggest an occupation from February to April. This period would also overlap partially with the potential for grass seeds, explaining the coastal grindstones. As the coastal grasses, however, are very limited, compared with the interior and the eastern margin (pers. obs., 1986, 1987, 1988) and as the ethnographic evidence (von dem Hagen 1943) indicates that plant resources were fetched from as far afield as the eastern margin, it cannot be ruled out that the grass seeds could in fact have been brought from the interior in leather bags similar to the ones used for carrying water. In that case the coastal grindstones, while limited in numbers compared to the interior, could still represent an occupation, or at least occasional visits that lasted throughout the summer. Another seasonal attraction which should be considered is the fact that March and April are the two most pleasant months of the year at Luderitz, bringing with them wind-still days and ideal temperatures (pers. obs. 1987,1988).

In the interior, nara kernel husks found on the surface of several of the rock shelters (Wendt pers. comm, 1988; pers. obs. 1988) suggest an occupation from October to April. At Haalenberg, a cave excavated by Wendt contains what amounts to an OES midden (pers. obs. 1988). Combined with the high frequency of OES in the rest of the interior, this suggests the presence of hunter-gatherers during December and January. An overall summer occupation, based on the exploitation of grass seeds, is also indicated by the numerous grindstones. This is somewhat surprising, considering the summer lack of both game and water, as well as the extreme heat for which the region is known. On the other hand, the gemsbok and springbok remains recovered from DKW suggest a winter occupation, based on hunting, in spite of the extremely cold nights (pers. obs. 1988). Notwithstanding the current lack of evidence, a similar situation probably existed for the eastern margin, with minor differences due to the slightly earlier start of the rainy season and the somewhat higher rainfall.

Consequently, the archaeological evidence for seasonality is not very conclusive, especially if one takes into consideration archaeologically invisible resources, such as whale meat, seal/whale fat, geranium bulbs and tjaba tubers, and archaeologically indeterminate resources, such as shellfish. Stored resources, such as dried meat, fat or plant food could also have played an important role. The seemingly permanent resource base of the Koichab River area does not, however, necessarily mean that it was ever occupied on a continuous basis for any length of time in the course of the Holocene. The highly variable climate makes it far more likely that it was utilised periodically during favourable conditions, regardless of the season in which the favourable conditions occurred. Neither were all parts of it necessarily utilised at the same time. There are indications that when upwelling occasionally falls away, this has detrimental effects on marine life, but leads to heavy rains and flooding in the interior (Tomalin and Noli 1989). Consequently, ideal coastal and inland conditions could well have been mutually exclusive, so that the two resource areas would have been used as substitutes for each other, rather than for simultaneous exploitation. This would explain the report of hunter-gatherers visiting the drought-stricken coast of northern Namibia in 1906 (Elers 1907). From a practical point of view, there would have been no such thing as a bad season, only a time when it was advisable to travel, either inside the Koichab River region or beyond its borders. The result would have been not a regular seasonal round, as proposed by Parkington (1972) for the south-western Cape, but a highly erratic flexibility, completely at the mercy of the whims of the weather.

If an area was utilised in an opportunistic manner, the archaeological deposits of its sites would only accumulate during periods of exceptionally favourable conditions. Even if these periods were separated by as much as ten years, it is unlikely that this would be detected in the course of subsequent excavations. The scenario which the archaeological record is likely to suggest is one of continuous utilization during an extended period of favourable conditions. The error would only be detected if independently generated climatic information was available to check the archaeological data. Consequently a clash between archaeological and non-archaeological climatic reconstructions, especially when accompanied by relatively slow deposit accumulation, could well be an indication that the region concerned was subjected to opportunistic utilization.

This may in fact be how much of the archaeological material in the Koichab River region was deposited. DKW, where two layers separated by some 6 200 years are only 50 mm apart, and where there is no sterile lens visible to indicate a hiatus, is a clear example not only of the slow rate of archaeological deposition in the area, but also of the absence of natural deposition. The slow rate of accumulation could be attributed to a gradual deposition from the activities of widely spaced single events, such as represented by opportunistic utilization. The lack of natural deposition is probably due to the combination of dry material and strong prevailing winds with three entirely different directions. Whatever one of the winds blows into a shelter, one of the others will manage to blow out again, so that the surface will remain at the same level, unless items such as bones, sticks, trampled down bedding, OES, stones or shellfish remains are present to hold windborne material. As ash would also be blown out, this could easily result in a telescoping and superimposition of relatively widely spaced single events into an apparently continuous deposit.

Many of the subsistence strategies represented by the archaeological record of the Koichab River region would not be viable under normal conditions. KBV, for instance, with its vast number of grindstones and microlithic tools, is some 45 km from the nearest water found during the site surveys of 1987 and 1988. It is, however, only 28 km from the Koichab Pan, which was flooded four times from 1967 to 1985 (Barbour and Dippenaar 1986). Assuming 20 floods a century, the pan would have been flooded some 2 000 times in the last 10 000 years. As such floods would probably have been accompanied by a regional abundance of grass and game, as well as other water sources even closer to KBV, this could account for the seed-based economy indicated by the grindstones, as well as the hide-working suggested by the scrapers. In a similar vein, the brackish water supply at Luderitz, while drinkable, is so limited and unpalatable under average conditions that its extended utilization by people who are free to choose is somewhat unikely. Neither the Germans nor their labourers were ever recorded as having used the local water, which even oxen refused to drink (Coleman pers. com. 1988). This increases the likelihood of intermittent visits during unusually wet times. It would therefore appear as if the Koichab River region was indeed utilized only in an opportunistic way during the course of the Holocene.

It could, of course, be argued that the original inhabitants were so good at both locating and utilizing the local resources that they could comfortably live in the area at all times. While it is certainly possible that their techniques were more effective than is currently suspected, and while it was claimed that hunter-gatherers like Tjaaiman could in fact remain in the desert at all times, the ethnography suggests otherwise. The very fact that the "bushmen" risked extreme unpopularity and punitive expeditions by repeatedly resorting to stock theft in unfavourable times shows that they could not survive perpetually in the Namib. They would have left when it suited them. The problems started when they had to leave, but had nowhere to go to, when their alternative haunts were occupied and their alternative resources were decimated by herders and settlers.

From a dietary point of view, the lack of the possibility of reliable quantification of the relative importance of the various dietary components makes it inadvisable to deal extensively with the question of protein poisoning. However, the emphasis the ethnographic evidence puts on the exploitation and storage of fish oil, animal fat and plant food suggests that subsistence strategies may have been geared to avoid excessively high protein intakes. While it could be argued that these strategies were merely indulged in for dietary variation, it would be a considerable indulgence indeed to walk from the coast to the Kowis mountains or even all the way to Aus if the readily available limpets represent a nutritionally satisfactory diet. The vast effort involved in first collecting and then grinding up grass seeds in the interior would also seem unnecessary, since the options of either going down to the coast or following the game to greener pastures would have been readily available.

Comparative advantages and attractions

While the exact nature of their occupation patterns and the finer details of their subsistence strategies have not yet been determined, Holocene hunter-gatherers left extensive archaeological traces in the Koichab River region. Their reasons for doing so are not immediately apparent. Indeed, the most often asked question about the area is: "Why would anyone want to go there?" (pers. obs. 1987, 1988, 1989). Considering the highly inhospitable reputation of the Namib desert, the question is fully justified. Even if it is accepted that the Koichab River area was somewhat less arid in the early Holocene, the archaeological evidence suggests that the basic resources have remained unchanged. Consequently the wet events need not have been wetter, just less widely spaced. Viewed from the escarpment, the desert would have appeared every bit as daunting as it does today. Yet it was entered repeatedly even before 2500 B.P., when population pressure could not have been an important factor. As the hunter-gatherers were free to choose, there must have been some comparative advantage, some attraction that made them step over the 100 mm isohyet and turn their backs on grasses that were - literally, at any rate - considerably greener.

While the occurrence of rain may have been erratic, this need not necessarily have constituted a disadvantage with regard to opportunistic utilization. By definition its practitioners would not have indulged in long-term planning. Consequently their purposes would have been adequately served by knowing when, where and how much it had recently rained, with complete irrelevance attached to the question as to when it was going to rain again. Hunter-gatherers would have received all the information they needed by monitoring game movements, especially those of the highly nomadic ostriches and gemsbok, both of which have an uncanny knack of turning up in an area as soon as it has rained. In addition, the desert is only some 120 km wide, so that towering rain clouds are clearly visible from great distances.

The point is that the desert biomass has developed into a system which is both capable of waiting under extremely adverse conditions for rainfall, and of taking full advantage of the rain as soon as it has fallen. This makes its response to rainfall highly predictable, bringing with it a reliability of great value to hunter-gatherers. The grass has to grow fast, while the moisture lasts, and has to produce seeds which in all likelihood may have to wait several years before being able to germinate, and which therefore have a relatively high fat content. These seeds are collected in vast amounts by ants, whose very existence depends on the size of their hoards. The grass and the seeds are also consumed by the game, which strives to put on as much fat as possible while the food supply lasts. Other plants, such as tjabas, geraniums and naras, also take full advantage of the situation, and in turn are taken advantage of. Long periods of inactivity are interrupted by short bursts of activity, when the emphasis is on reproduction and storage. Consequently, once the rain has passed and most of the grass and the surface moisture is gone, the region is anything but depleted. It is in fact one big larder, with seed hoards, fat game and replenished temporary water-holes. While a lot of the game will soon leave as the grazing is reduced, some will remain for a while, content to forage in small, scattered groups over large areas.

Holocene hunter-gatherers would have been able to tarry well into the following dry period, secure in the knowledge that, while most of their proteins had departed, their carbohydrates, in the form of stored grass seeds, had been unable to follow. In keeping with the rest of the desert biomass they too would have had stores of plant food, fat and dried meat, in addition to what nature had stored for them. They may even have had substantial stores of personal fat, which would have granted them temporary immunity from protein poisoning, so that they could have wandered down to the coast and indulged freely in shellfish exploitation, even in the absence of naras, geranium bulbs, stranded whales, seals and seabird eggs. In this context it also has to be mentioned that, whatever the weather conditions, and no matter how long a drought may have lasted, there would still have been shellfish, crayfish and water at the coast, with a more than reasonable chance of the occasional beached whale or washed up seal, making it a somewhat meagre, but highly reliable last resort.

Consequently, in the Koichab River region, long periods of drought-induced paucity were interspersed with short periods of abundance, triggered by even relatively minimal rainfalls. At such times the desert was the place to be, and it is likely that these occasions were responsible for most of the archaeological record of the area. This does not mean that the Koichab River region was completely ignored at all other times. Particularly the coast in the Anichab - Hottentot Bay area would have had its attractions at any time, especially during the nara season. In order to compete fully with better watered regions, however, the desert would have had to wait for the rain - however erratic it may have been.

Wider implications

While the Koichab River region may have a relatively unique combination of terrain, resources and weather patterns, it is not the only arid part of southern Africa which is also given to the occasional wet event. Consequently there is a strong possibility that the opportunistic utilization of resources may have been more extensively resorted to than has so far been suspected.

According to Humphreys (1979) an exploitation based on seasonal mobility can only exist where the environment is rigidly structured with considerable seasonal or zonal variations, such as in the Kalahari or the south-western and southern Cape. Where the environment is unstructured, such as in the northern Cape, predictible seasonal strategies are unnecessary. This results in low intensity occupation, a slow deposit accumulation, a high degree of faunal fragmentation, low MNI's for hunted animals, site variations which can be explained in terms of the immediate environment, the obscuring of minor idiosyncrasies, and a high degree of inter- and intra-site variability (Humphreys 1979). This is somewhat reminiscent of the situation in the Koichab River region. Humphreys (1979), however, assumed that people would have been able to stay in the area throughout the year. This assumption could be seen to be at odds with his own observation of ephemeral low intensity occupation. It is far more likely that, like the Koichab River region, the northern Cape was only utilised during particularly wet periods. A similar situation has been hypothesised for the central Namib Desert (Jacobson 1981, Richter 1984).

In terms of the total area utilised, as well as group size and the time spent at each site, the scale of these utilizations would have varied from region to region, depending on the different combinations of terrain and climate. The more marginal a region, the larger the area utilized by hunter-gatherers, the smaller their groups and the shorter their visits would have been. Furthermore, while some highly inhospitable areas, like the central Namib sand sea, would have been utilized opportunistically from without its borders, for instance from the escarpment or the coast, other, less marginal regions, like the northern Cape, could possibly have been utilized opportunistically from environmentally secure enclaves, like river valleys or permanent water holes. Unfortunately, however, the appropriate methods needed to monitor the past parameters of the scale of landscape use have not yet been developed (Binford 1983). Even so, current observations have indicated that groups of 30 to 40 hunter-gatherers, such as the Nunamiut Eskimos in Alaska and the Aborigines in the Central Desert of Australia, typically utilize an area of more than 300 000 km^2. While only about 25% of the land may actually be exploited at any given time, all of it has to be available to provide a secure set of options, something which is not always appreciated by archaeologists with a modern sedentary view of the world (Binford 1983). Consequently, while the whole question of scale may be beyond the realistic scope of the present research programme, the vast sizes of the tracts of land involved in the opportunistic utilization of arid areas by small groups of hunter-gatherers should not be underestimated.

This does not, however, mean that the opportunistic utilization of resources is a coherent response by hunter-gatherers which is limited to the arid areas of southern Africa. Strictly speaking, seasonal mobility is a form of opportunistic utilization in which the opportunities coincide with certain seasons on a regular basis. At which point the opportunities are regular enough to qualify as seasonality is open to discussion, especially since archaeologists are more likely to detect the intense occupations associated with seasonality than the vague features associated with opportunism.

The elusive nature of the evidence for opportunistic utilization should not be allowed to detract from its significance. In the south-western Cape, for instance, there may well be several indications that the coast was utilized in winter and the interior in summer (Parkington 1972), but it has not yet been established whether this was the exception or the rule. The region could just as easily have been exploited only during particularly good seasons, or when alternative areas, such as the Karoo, were experiencing droughts or extreme cold. After all, Parkington's (1972) "interior" is only 60 km from the sea, a distance unlikely to represent the maximum range of Holocene hunter-gatherer mobility.

Similarly, while the seasonal mobility patterns of modern Kalahari Bushmen have been extensively documented (Lee 1965, 1968, 1969, 1972) so has the limiting factor of an adequate water supply (Yellen and Lee 1976) and the extreme variability in rainfall from year to year from and from place to place (Lee 1976). It follows that the driving force in seasonality is not the season, but the weather conditions which normally accompany the season. If the weather conditions change, so does the alleged seasonality, demonstrating that the subsistence strategies are actually based on opportunistic utilization.

The archaeological record left by Holocene hunter-gatherers represents at best a highly decomposed average of the physical remains of events which resulted from actions that were decided upon on a daily, if not hourly basis. The opportunistic utilization of resources, which is easily concealed by such averages, was most certainly not limited to the Koichab River region, and in all likelihood not even to the arid parts of southern Africa. It may have formed the only subsistence strategy open to hunter-gatherers. If correct, this scenario means that the archaeological record of southern Africa will be most easily understood if seen against the background of the opportunities which made its creation possible. As the opportunities would have depended on the environment, this attaches great importance to detailed environmental reconstructions. In order to prevent circular arguments, and especially in view of the illusions created by opportunistic utilization, it would, however, be inadvisable to base the environmental reconstructions on the very archaeological evidence they are supposed to explain.

The methodology needed to cope with the complexities of opportunistic utilization is still in its infant stage. Eventually it will evolve, not out of the data from a single site, or even from an entire research area, but rather out of the combined information gleaned from the archaeological record of southern Africa. Even so, the key to the problem could well lie in obtaining a resolution which is high enough to enable archaeologists to differentiate between a continuous, a seasonal and an opportunistic utilization of resources. In this respect, highly marginal regions, such as the Namib Desert, can make a very definite contribution, due to the fact that their opportunities are further apart on the time scale, and hence more visible in the archaeological record. Consequently the Koichab River region research programme has been fully justified, not only as a highly area-specific archaeological exploration, but also as a crucial step towards a better understanding of the prehistory of southern Africa.

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