

BURROWS AND BEDDING

SITE TAPHONOMY AND SPATIAL ARCHEOLOGY

AT TORTOISE CAVE

T. S. ROBEY

SPATIAL ARCHAEOLOGY RESEARCH UNIT

UNIVERSITY OF CAPE TOWN

**THESIS SUBMITTED FOR THE DEGREE OF
MASTER OF ARTS IN ARCHAEOLOGY
AT THE UNIVERSITY OF CAPE TOWN
1984**

The University of Cape Town has been given
the right to reproduce this thesis in whole
or in part. Copyright is held by the author.

The copyright of this thesis vests in the author. No quotation from it or information derived from it is to be published without full acknowledgement of the source. The thesis is to be used for private study or non-commercial research purposes only.

Published by the University of Cape Town (UCT) in terms of the non-exclusive license granted to UCT by the author.

ABSTRACT

Excavations at the Late Stone Age site of Tortoise Cave, a shell midden accumulation in the western Cape, South Africa, were carried out from 1978 to 1983. The author supervised this project from 1981 onwards with the aim of expanding the cultural sample and defining more clearly the stratigraphic sequence. At the same time, to increase the objectivity of the written record, some improvements to the normal recording techniques were tested. These included the use of context sheets and a stratigraphic matrix, methods often used elsewhere but very uncommon in South Africa. It was felt that archaeologists had been ignoring the vital difference between stratigraphy that is observed and excavated and the actual sequence and circumstances of deposition. For this latter, the term 'Site Taphonomy' has been coined, to end the confusion that has existed concerning the meaning and correct application of the words 'Stratigraphy' and 'Stratification'. These terms should now be restricted to refer to the archaeological constructs alone. The amount of disturbance at the site led to an investigation of the processes and effects of disturbance, the implications of which are outlined here. It is thought that Tortoise Cave is not an isolated case and that considerable artefact displacement may be a common feature of local sites. Despite this, an attempt was made to find and use appropriate statistical methods of spatial analysis. It was found that some positive results, if somewhat generalised, could be obtained. The major theme of the thesis is, however, neither a description of the finds and findings from the site nor simply a spatial analysis of the deposits and their contents. It attempts instead to illustrate how the understanding of the central concept of site taphonomy is essential to every aspect of the interpretation of a site and the assessment of the results.

Finally, an appeal is made for future research to include programs of experiments on site formation processes, coupled to the excavation of small, simple deposits. This should serve to improve our limited understanding of Site Taphonomy which is essential if the complexities of the southern African Late Stone Age sequence are ever to be reliably unravelled.



FRONTPIECE: TORTOISE CAVE, 1982, FACING WEST. SQUARES AA & AA2 ARE JUST
BEHIND THE FIGURE, V9 & W9 BEYOND THE TRIPOD.

ACKNOWLEDGEMENTS

Without the help of a great number of people, this project would not have been possible. I would like first to offer my profound thanks to my wife, Tina, without whom I would never have finished writing. Her assistance with the drawings and tables, the sorting and cataloging of finds, and in many ways throughout the project are probably the main reason this thesis is now complete.

I would like to thank Martin Hall for his supervision and sympathetic help during the final stages of the project, and John Vogel for providing the radiocarbon dates! so many for a junior archaeologist, but without them the taphonomic reconstruction would not have been possible. Thanks are also due to John Parkington, whose advice during the earlier part of the work was always useful, and who was instrumental in shaping the project into its present form.

For their stimulation and ideas, as well as for their unstinting help in the fieldwork, I wish to thank my fellow students and members of the S.A.R.U., especially Royden Yates, Tony Manhire, Judy Sealy, Mary Patrick, Jim Jobling, Jo Golson, Ann Solomon and Dave Halkett. Special thanks are due to Cedric Poggenpoel for his work with the fish remains and assistance throughout, and to Mike Herbert for the plates. Many other students helped over the two years of fieldwork and sorting and their contributions are not forgotten.

Funding for the project came from the Spatial Archaeology Research Unit and from a research grant from the University of Cape Town. I hope they will consider the money well spent.

This volume is dedicated to Tina, and to my mother, who never saw it finished.

CONTENTS

LIST OF FIGURES	1
LIST OF TABLES	2
LIST OF PLATES	3
CHAPTER 1: THE AIMS OF THE PROJECT	4
Introduction	
The Need for Further Excavation	
The Stratigraphic Problem	
Towards a Systematic Record	
Disturbance and Artefact Dispersal	
Statistics and Spatial Analysis	
Summary	
CHAPTER 2: A CRITICAL ^{RE} VIEW OF THE EXCAVATIONS	17
The Environmental Setting	
The Excavations	
CHAPTER 3: STRATIGRAPHY AND SITE TAPHONOMY	21
Introduction	
Site Taphonomy	
The Stratigraphic Sequence	
Summary	
CHAPTER 4: THE CULTURAL REMAINS	34
Introduction	
The Fauna	
The Artefacts	
Conclusions	

Introduction

The Techniques in Outline

Application of Court's Method for Map Comparison

Application of Dimensional Analysis of Variance

Analysis of the Basin Deposits

Conclusions

CHAPTER 6: DISCUSSION AND CONCLUSION

61

Introduction

The Seasonal Mobility Model

Environmental Change

The Emerging Model

Tortoise Cave in Context

Comments on the Use of Space at Tortoise Cave

Methodology and Further Research

REFERENCES

76

APPENDIX A: SOME NOTES ON EXCAVATION METHODS AND INTERPRETIVE

81

TECHNIQUES FOR SHELL MIDDENS AND OTHER UNCONSOLIDATED

DEPOSITS

APPENDIX B: TORTOISE CAVE 1978 - 83: STRATIGRAPHIC LIST OF

88

CONTEXTS AND LAYERS

LIST OF FIGURES

FIGURE 1.1	PLAN OF EXCAVATIONS SHOWING SALIENT FEATURES	4
FIGURE 1.2	ARCHAEOLOGICAL SITES IN THE SOUTHERN CAPE	5
FIGURE 1.3	SECTION THROUGH THE BASIN; DRAWN WITHOUT LABELS	7
FIGURE 1.4	MASTER CONTEXT SHEET (ANNOTATED)	10
FIGURE 2.1	THE ELANDS BAY AREA; SITES AND ECOSYSTEMS	17
FIGURE 3.1	SECTION THROUGH SOIL AND BEDDING UNITS	23
FIGURE 3.2	SECTION SHOWING TWO PHASES OF BASIN	23
FIGURE 3.3	SECTION THROUGH LOWER TALUS DEPOSITS	24
FIGURE 3.4	SECTION THROUGH OUTER CAVE DEPOSITS	25
FIGURE 3.5	SECTION THROUGH MIDDENS AND ASH HEAP, FRONT OF BASIN	27
FIGURE 4.1	TORTOISE CAVE BURIAL #1, LAYER 9	38
FIGURE 5.1	COURT'S METHOD OF MAP COMPARISON: THEORY	50
FIGURE 5.2	COURT'S METHOD: LAYER 9	52
FIGURE 5.3	COURT'S METHOD: LAYER 11a	52
FIGURE 5.4	COURT'S METHOD: LAYER 13	53
FIGURE 5.5a	DIMENSIONAL ANALYSIS OF VARIANCE: LAYER 9	54
FIGURE 5.5b	DIMENSIONAL ANALYSIS OF VARIANCE: LAYER 9	54
FIGURE 5.6	TORTOISE CAVE: LAYER 1	55
FIGURE 5.7	TORTOISE CAVE: LAYER 2a	55
FIGURE 5.8	TORTOISE CAVE: LAYER 2b	56
FIGURE 5.9	TORTOISE CAVE: LAYER 3	56
FIGURE 5.10	STYLISTED DROP ZONE/TOSS ZONE AROUND HEARTH (After Binford 1978)	57
FIGURE 5.11	2 X 2 CONTINGENCY TABLES FOR CHI SQUARED: OBSERVED & EXPECTED VALUES	

LIST OF TABLES

TABLE 1: RADIOCARBON DATES FROM TORTOISE CAVE	22
TABLE 2: SPECIES OF FISH BY LAYER, TORTOISE CAVE 1978-1981	35
TABLE 3: MAMMALIAN FAUNA	37
TABLE 4: LITHIC RAW MATERIAL FREQUENCIES BY LAYER	40
TABLE 5: TORTOISE CAVE LITHIC ASSEMBLAGE: FREQUENCY ANALYSIS	41
TABLE 6: LAYER 9, QUARTZ AND SILCRETE WASTE	51
TABLE 7: LAYER 11, QUARTZ AND SILCRETE WASTE	51
TABLE 8: LAYER 13, QUARTZ AND SILCRETE WASTE	51
TABLE 9: VALUES OF THE COEFFICIENT OF MEDIAL CORRELATION	52
TABLE 10: LAYER 9, DATA FOR DIMENSIONAL ANALYSIS OF VARIANCE	54
TABLE 11: DIAGNOSTIC TORTOISE FROM LAYERS 2 & 3	57

LIST OF PLATES

FRONTESPIECE: TORTOISE CAVE, 1982, FACING WEST. SQUARES AA & AA2 ARE JUST
BEHIND THE FIGURE, V9 & W9 BEYOND THE TRIPOD.

- PLATE 1: THE ROCK STEP IN S2, SHOWING LAYER 10 AT TOP OF SECTION TO THE 24
LEFT, SHELL LENS AND GREY ASHY DEPOSIT.
- PLATE 2: SQUARE AA2 PARTIALLY EXCAVATED. WASP IS MARKED IN SECTION. NOTE THE 30
START OF THE ROCKS PILED ON BEDROCK.
- PLATE 3: SECTION ON Y/T INTERFACE SHOWING SHELL MIDDENS (PISSARRO, RUBENS, 32
FELIX), BURNT SHELL LAYER AND WHITE ASHY LENS (DOGMATIX).
- PLATE 4: BORED WOOD, BONE POINTS AND DECORATED BONE TUBE (SCALE IN CM). 42
- PLATE 5: GRASS BUNDLE BOUND WITH TWINE, LEATHER FRAGMENT, PIECES OF 43
KNOTTED GRASS TWINE.
- PLATE 6: BONE SPATULAE, TOP & BOTTOM LEFT ARE OCHRE STAINED. 44
- PLATE 7: PENDANTS. ALL MARINE SHELL EXCEPT CENTRE LEFT OF BRASS. 45
- PLATE 8: SHELL PENDANTS AND BEADS. 45
- PLATE 9: BEADS. SEED (2x), GLASS (3x), BRASS/COPPER, SHELL, BONE DISC (2x), 46
BONE TUBE (2x).
- PLATE 10: OSTRICH EGGSHELL: PIECE AT TOP RIGHT DECORATED, TOP CENTRE SHOWS MASTIC 46
TRACES, BOTTOM CENTRE & LEFT HAVE GROUND EDGES.

CHAPTER 1: THE AIMS OF THE PROJECT

INTRODUCTION

When I undertook in 1981 to re-excavate Tortoise Cave, it was to support the Spatial Archaeology Research Unit's Sandveld sampling program focussing on open artefact scatters, in particular to provide a comparable, dated sequence of artefacts which earlier excavations had shown to be present. The 1978 excavations at the site had raised a number of questions which could only be answered by an extension of the excavations. In addition, there were indications that the deposits to the rear of the shelter would reveal some useful spatial data (Parkington 1979) from a coastal site comparable to that obtained from other excavated sites inland: Diepkloof (Parkington 1977), De Hangen (Parkington & Poggenpoel 1971a) and Andriesgrond (Parkington 1979). For my part, I saw in the excavation a chance to try out some ideas I had concerning the role and reality of stratigraphy and some methods of improving recording techniques to test these ideas. I also felt that there was too great an emphasis in the S.A.R.U. on inter - site (geographic or landscape) patterning and saw in the Tortoise Cave project a way to redress this imbalance and add to our rather general ideas on intra - site patterning and use of cave sites. Initially only one field season was planned, but more were added as the complexity of the problems became apparent, and the project has evolved into the work presented in this volume.

THE NEED FOR FURTHER EXCAVATION

During the 1978 excavations and the subsequent preliminary analyses, a number of queries concerning the finds had been raised which could not be answered without further excavation, larger samples in some cases, and a clearer general understanding of the stratigraphic sequence at the shelter. The excavations had concentrated on the area immediately outside the cave, extending inside the drip-line in only a few squares; yet clearly there were a number of important distinctions between the inner and outer deposits and their cultural content which required explanation.

"The division between the shell, ash and vegetation rich layers inside the cave and the grey, apparently poorly stratified deposits outside the cave falls very noticeably along the line marking the penetration of sunlight and rainfall. The very low roof of

TORTOISE CAVE
GRID PLAN & CAVE FLOOR

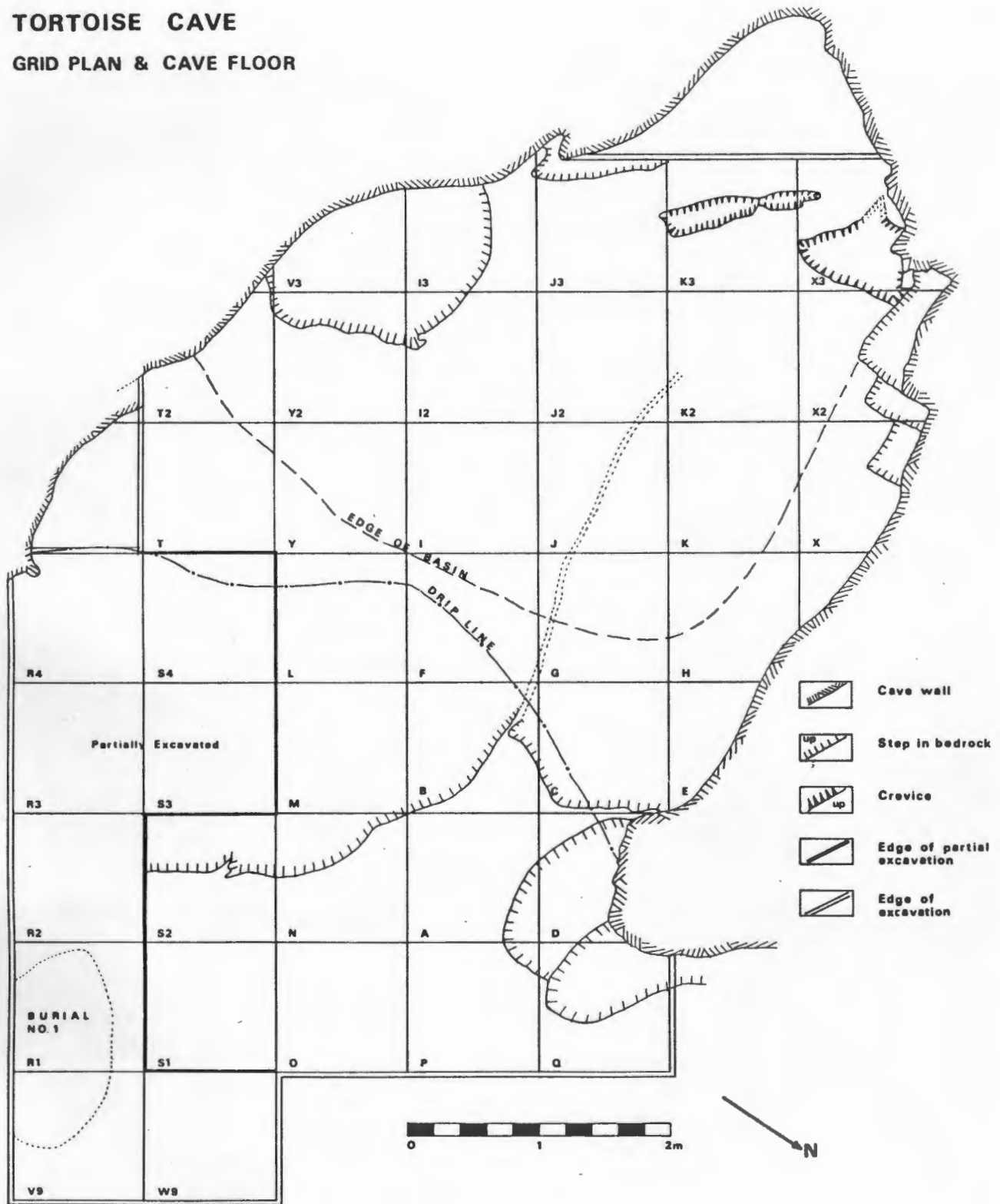


FIG. 11. PLAN OF MAIN EXCAVATION

the shelter... has also helped to prevent trampling and preserve stratigraphic distinctions inside the cave" (Parkington 1979:19).

Thus this distinction was at first seen as one of post-depositional leaching and disturbance. This made more puzzling the findings of Cedric Poggenpoel, who analysed the fish remains from the excavation.

"Whereas the white steenbras and the haarder dominated the internal lenses of the site, white stompnose were clearly more common outside the dripline. It is not yet clear what this means." (Ibid).

Again, preliminary analysis of the artefactual material proved difficult to interpret.

"Similarly stone artefacts have proved fairly abundant on the talus slope but are very rare behind the dripline. In this case it seems the cave was simply too restrictive to allow much stone-tool making and using within its confines" (Ibid).

From Rawlinson's (1979) work on the lithic artefacts, it was apparent that a dichotomy existed in the formal tool component between the interior of the shelter and the talus slope beyond. He showed that whilst scrapers and adzes predominated inside the drip line, scrapers and backed pieces were the most common tools in the outer deposits. The surface samples (Mazel 1978) showed an intermediate pattern. Parkington noted that:

"Inside the cave pottery has been found down to within 0,1m of the bedrock floor... [whilst] outside the cave there may have been quite a volume of talus slope accumulation prior to the appearance of pottery but the stone tool typology suggests few changes... in this episode. A small number of small bladelet cores and silcrete bladelets from a localised area immediately on bedrock offer tantalising hints of something similar to the Late Pleistocene of EBC. Otherwise the sequence seems likely to correspond to the post-hiatus deposit at EBC." (Ibid:20-21).

The possibility that there were deposits at the site dating to the Terminal Pleistocene or Early Holocene meant that a better, dated sample might confirm or refute the regional hiatus proposed

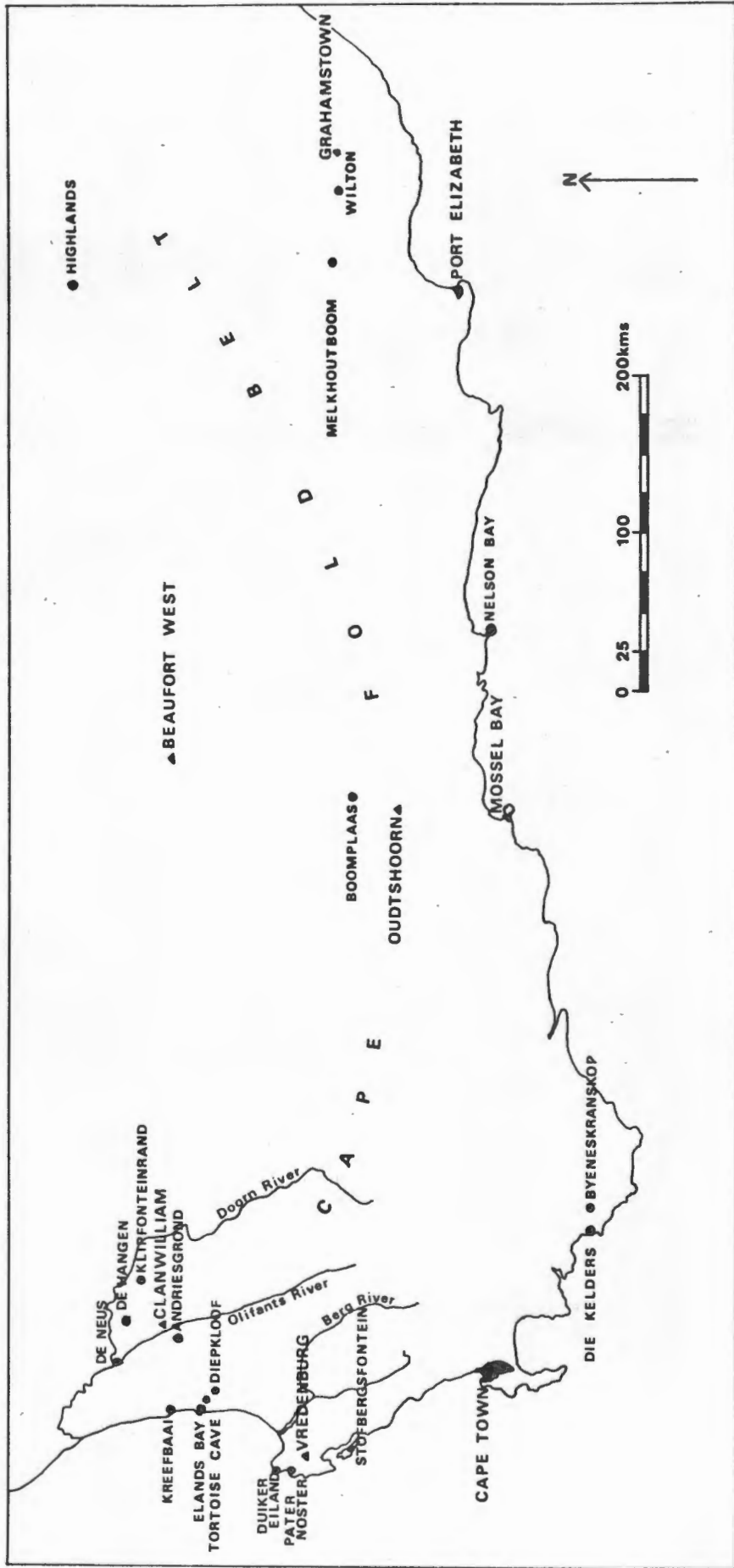


FIG.1.2. ARCHAEOLOGICAL SITES IN THE SOUTHERN CAPE

by Parkington (1977, 1980), on the basis of the Elands Bay Cave sequence, for the period between about 4000 BP and 8000 BP.

Finally, the model of Late Stone Age seasonal movement between the West Coast and the Cape Fold Belt (Parkington 1972, 1980, Hazel & Parkington 1981) had come under strong criticism (Deacon H.J. 1980, Deacon J. 1980, Sampson 1980). This criticism centred on the assumption of contemporaneity for the Sandveld (with backed pieces important) and mountain (adze rich) assemblages, in the face of conflicting evidence not only from elsewhere in the Cape at Melkhoutboom, Hilton Rock Shelter, Highlands Rock Shelter (Deacon H.J. 1976, Deacon J. 1972, 1980) and Die-Kelders (Schweitzer & Wilson 1982), but also within the western Cape at Klipfonteinrand, Andriesgrond and the De Neus open sites (Parkington 1979, 1980) which suggested that adzes were a more recent phenomenon. These topics are dealt with in greater detail when the relevance of the Tortoise Cave data is reviewed in the final chapter. For the moment, however, this serves to demonstrate the need to obtain a control sample for the Sandveld data both to address these questions and to build a temporal framework for future research in the area (Manhire in prep.) There can be little doubt that the resolution of these problems required a re-excavation of Tortoise Cave accompanied by detailed stratigraphic recording of the site which has been referred to as "one of the keys to Sandveld settlement" (Manhire et al 1983a).

THE STRATIGRAPHIC PROBLEM

Systematic excavation is often considered as one of the cornerstones of "scientific" archaeology. Yet an abstract work of art is hardly less objective than the craft of excavation, from the choice of grid size and orientation to the interpretation of the sections. The site and its deposits are objects and the modes of formation of both are in no way dependent on the investigator. Theoretically, at least, this lends itself to objective examination. Nevertheless there seems to be no practical way to excavate without making subjective interpretations throughout.

This problem of interpretation applies both horizontally, in the constraints placed on the excavator by the choice of grid and the excavation technique selected, and vertically, in the understanding of the depositional sequence. These are interdependent variables in that a choice to improve or change the one automatically has an effect on the other. The discussion of the

horizontal variable, the effects of grid size and placement and the merits of clearing and penetrating excavation methods, is not relevant here and this section concentrates on the problem of stratigraphic interpretation. The importance of stratigraphy is stressed in many basic texts on archaeological method:

"In practice, the identification of the strata or layers... of a site is one of the principal tasks of the excavator and will occupy the major portion of his time."
(Wheeler 1954:59).

"[Stratigraphy] is perhaps the single most important principle on which proper excavation techniques are based" (Joukowsky 1980:156).

It is equally widely recognised (Wheeler ¹⁹⁵⁴ 1960:60, Pyddoke 1961:17, Sharer & Ashmore 1979:219, Joukowsky 1980:153) that the process of interpretation is one of inference from observation and therefore not necessarily a description of the depositional reality.

Whilst there is general agreement on the difference between the actual depositional sequence and the post-excavational interpretation of observed strata, there is disagreement on the appropriate terminology. Wheeler (1954) sees both 'stratigraphy' and 'stratification' as referring to the depositional sequence itself, normally qualifying interpretation as such. Sharer and Ashmore (1979), by contrast, appear to use both as interpretive terms referring respectively to "the archaeological evaluation of the... meaning of observed strata" (Ibid:215) and "the observed layering" (Ibid:214) itself. The terms are differentiated by Hole and Heizer (1973:136), who "consider stratigraphy to be the actual sequence of events at a site, whereas stratification refers to the levels that are excavated." On the other hand, Joukowsky (1980) and Harris (1976⁴) understand stratigraphy to be the study of excavated layering and stratification to be "the existence of superimposed layers" (Joukowsky 1980:150). This is a semantic argument which appears to sidestep and confuse the issue: how to distinguish interpretation from reality and which data relate to which.

In point of fact, the word 'taphonomy' refers to the way in which objects become buried (from the Greek 'taphos': a burial or grave, and 'nomos': a law) and therefore to the mode of deposit formation. This term, first coined by Efremov in 1940 (Bowers et al 1983) is usually restricted to the study of faunal accumulation (Brain 1974, 1976) but in reality has far wider connotations

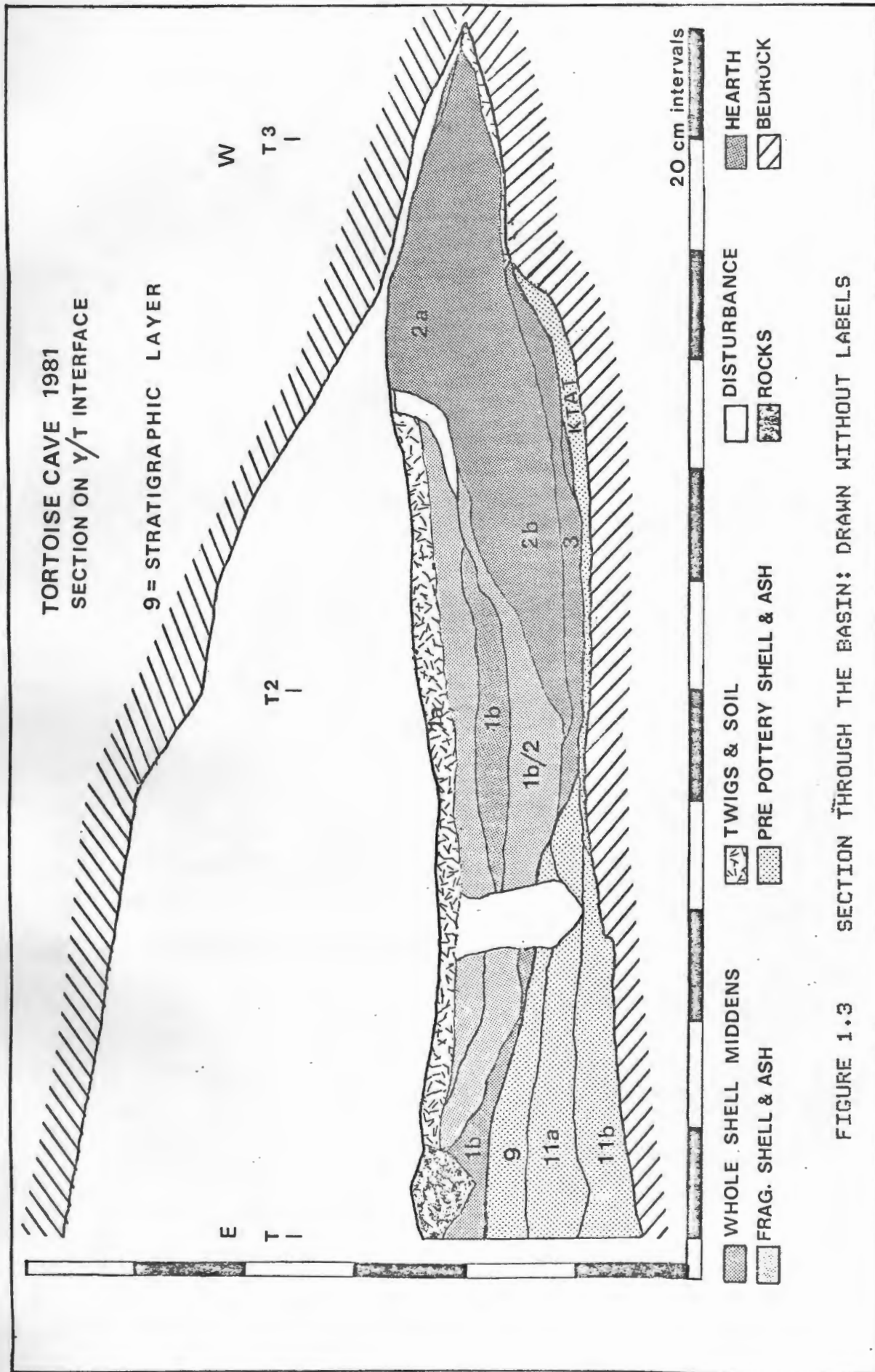


FIGURE 1.3 SECTION THROUGH THE BASIN: DRAWN WITHOUT LABELS

and is appropriate in the present context. Stratigraphy, and all the derivatives of the word, should be used to denote archaeological constructs: the way in which archaeologists interpret deposits. All too often, the two are seen as synonymous, and a discussion of stratigraphy is seen as one of site taphonomy. All too often, this is wrong. The excavator digs according to his understanding of stratigraphy and this is only an accurate reflection of taphonomy insofar as his ability and the limitations imposed upon him by the subjective choices of grid location, starting point and time allocated for digging will allow. With clearly defined units in a firm, undisturbed deposit, a good excavator can hope to approximate his stratigraphy to the site taphonomy.

Shell middens are composed of relatively large particles (the shells) in unstable heaps within a matrix of loose, windblown debris and other discarded objects. Except where substantial gaps in occupation occur, they rarely form clearly defined units and only occasionally result in firm, well compacted deposit. In the western Cape, at least, I suspect that they are almost never undisturbed. Thus the excavator's chances of recreating the taphonomic process with his stratigraphic units and thereby achieving an element of objectivity in his excavation are greatly reduced.

It is from an analysis based on an understanding of the taphonomy of midden accumulations, rather than from one based on intuitively defined stratigraphic units, that a study of spatial or temporal patterning should be made, and I believe that there has been too great a tendency to assume a validity in stratigraphic units that does not necessarily exist. An understanding of site taphonomy and its implications when the process of stratigraphic division becomes untrustworthy can only be reached through detailed recording of the deposits which is sufficiently objective as to be capable of overriding the established stratigraphy when necessary.

It may be argued that since artefacts are analysed and stored according to their stratigraphic context, there is little point in introducing a system which may require subdivision of the basic units of excavation. If, however, the stratigraphy is not a true replication of the process of deposition, a detailed sub-stratigraphic record is the best means by which to identify such errors. Also, since for the purposes of analysis individual contexts are usually

combined into relatively contemporaneous clusters, a clear knowledge of site taphonomy makes a better basis for such clustering than does a dubious stratigraphic sequence.

TOWARDS A SYSTEMATIC RECORD

"Proper records of an excavation are just as crucial to its interpretation as proper methods of actual excavation" (Sharer & Ashmore 1979:213).

My major interest, from the outset, has been in reassessing and improving the methodology of shell midden excavation and I believe the most effective way to approach this is through improvement of the objectivity of the written record. By recording, for every context, details of particle size, shape, colour and relative concentration, and in particular all variations within each so as to allow direct comparison between contexts, the excavator can to some extent overcome the problems inherent in a subjective division of the deposits into stratigraphic units. This will tend to reduce errors derived from the need to assume the validity of the interpreted sequence which may lead to a study of spurious patterning. It would not be practical in most cases to record even all macroscopic detail of taphonomic significance and I do not propose this. Even such detail as is already recorded by most competent excavators when it is considered necessary to justify a stratigraphic decision could be sufficient if recorded systematically for all contexts.

To improve the detail and objectivity of recording, I used descriptive forms or "context sheets" (Fig. 1.4) to supplement the field notebook. These standard forms are filled out as digging proceeds, to create as objective a record of the deposit and its content as possible and to ensure that all units have a comparable written record in the same way that site recording forms are used during initial surveys. The concept is not a new one and is widely used in Britain and the Americas on excavations of all types (Joukowsky 1980, Sharer & Ashmore 1979). The system I have employed is adapted from that used by the Department of Urban Archaeology, London (Schofield 1980). This adaptation also employs extensive use of levelling on each context, and the levels taken require immediate reduction and checking on plans and sections before further digging occurs. Yet to the best of my knowledge, only one other "Stone Age" archaeologist in Southern Africa employs such a system (John Kinahan pers. comm.). The reason for this could be that although the context sheet system will "increase recording accuracy and speed" (Sharer &

Ashmore 1979:249), in practice the system will slow down excavation unless there is greater on-site organisation of labour and more experienced staff than is common on excavations here. To run efficiently, the proposed system of context sheets and levelling requires the almost full employment of one staff member to cross check the data content, maps and plans to allow for corrections before the evidence disappears for ever. This is particularly true of the levels, as instrument or, more often, reading errors can easily render the effort useless unless they are picked up in time.

The supervisor's notebook now serves as an excavation log and a cross check on the context sheets. Entries concentrate on discussion of stratigraphic relationships, problems of excavation and consequent decisions, rather than on description per se.

At Tortoise Cave, there were too few experienced archaeologists or students available to run continual cross checking, and the system suffered accordingly, with a consequent loss of potential data. Despite this, the use of these methods greatly increased the data available and enabled a detailed study of the stratigraphy and site taphonomy to be made. The major drawbacks of the method lie in the need for greater on-site organisation of the work force, requiring more experienced personnel, and the loss of speed which may result from the continual conflict between the need to utilise fully the available labour whilst still trying to achieve more complete recording. I am, however, convinced that the approach is a good one. The problems are not inherent in the method but are in the organisation and management of the site crew which can soon be overcome with experience.

DISTURBANCE AND ARTEFACT DISPERSAL

The basic assumption that underpins all spatial analysis in archaeology is that the patterns formed by discarded objects in prehistoric sites are the result of non-random (stochastic) processes (Orton 1982). More specifically, the assumption is that these patterns reflect patterning in human activities with some degree of accuracy. Recently, many archaeologists have given cause to doubt that this assumption holds. The analysis of cultural remains is almost always undertaken on the basis of stratigraphically derived layers of homogeneous deposit, which are said to represent events or groups of similar events closely linked in time. In fact, "layers or levels are regarded as containers of some sort" (Villa & Courtin 1983:270) but these

SITE Name/number	CONTEXT TYPE Lens, layer, pit	SECTOR Square	CONTEXT Name/number
---------------------	----------------------------------	------------------	------------------------

DESCRIPTION OF CONTEXT

FILL: 1) COLOUR: Munsell no. or light, mid, dark and one or two colours e.g. mid grey brown, light yellow brown.

1) TEXTURE: Fine (dust) medium (gritty) coarse (grains visible) sand, gravel, clay, loam, ash, humis e.g. fine ashy loam.

11) COMPACTION: Loose (blows around, moved with fingers)
light (can be brushed or moved easily with trowel)
medium (firm scraping with trowel or digging with point of trowel)
hard (picking with trowel or heavier instrument)

1V) INCLUSIONS: Size (flecks, small-large fragments), frequency.

SHAPE: 1) LENSES: Lenticular, domed, bowl-shaped, or basin
thickens (direction) slopes (direction and gradient)

11) CUTS, PITS, POSTHOLES: Shape (profile) gradient, edge/bottom shape as square, rounded, bevelled, sides smooth, uneven recurved.

VARIATION: Note changers across context or compare to those above or below.

FAUNA

Species or types identified on site. Note if none present, rare, common.

FLORA

DIMENSIONS/DEPTHS

EDGE DEFINITION
clear/fair/poor/bad

RISK INTRUSIVE FINDS
high/med/low/unknown

a) Covers whole square, half square or dimensions N-S, EW.
b) Depth at prominent points.

F
I
N
D
S

INORGANIC: e.g. stone, pottery, ochre.
ORGANIC: e.g. ostrich eggshell, donax scrapers.
SPECIAL: e.g. glass/bone beads, copper pendants, mastic.

B
K
T
S

UNSIEVED: no. buckets dug.
RESIDUAL: after sieving/sorting.
BULKS: Not included in residual count. Whether sieved or unsieved.

SAMPLES TAKEN: Charcoal, soil, archaeometric. (other than bulks)

STRATIGRAPHIC
RELATIONSHIPS

SAME AS: New allocation to old.
PART OF: Context which feature is part of.
CONTAINS: Features in this context.
ABOVE: Unit above this context.
BELOW: Units below this context.

CUTS: Context cut by this one.
CUT BY: Context which truncates this one.
ABUTTS: Runs against or merges into.
UNCERTAIN: When edges disturbed/unclear
OTHER ASSOC.: Similar features or contexts of same age or type.

COMMENTS

By excavator on ease of digging, light, weather, wind or anything which might bear on accuracy of data recorded.

PLAN SHEET No. and Date	SECTION NO.	PROFILE NO.	LVLs. TKN. Date/Name	PHOTOGRAPHS b/w c.s
DUG BY	TIME Not	S/P/U used	DATE	LVLs. DRWN Date/Name
				CHECKED Supervisor
				DATE

INTERPRETIVE NOTES

By supervisor-final corrections or correlations prior to or during write up-for permanent record.

SIGNED

DATE

containers "appear to be rather leaky" (Ibid). Experience from a number of sites and a series of simulation experiments with artefact dispersal (Stockton 1973, Cahen & Moeyerson 1977, Siriainen 1977, Bowers et al. 1983, Villa & Courtin 1983) shows that they may be more akin to sieves.

Stockton's (1973) experiments in Australia showed vertical displacement of small glass fragments in a sandy matrix of up to 16 cm after one day's intensive trampling, with over 20% of the pieces moving 2 to 5 cm upwards. Villa and Courtin (1983) found similar, though smaller, displacements during their experiments with intermittent trampling. These involved impregnating sand in the sorting and refreshment areas of an excavation with a variety of artefacts under slightly different conditions, and recovering and re-plotting them after intervals of 20 and 36 days. They suggest that the degree of displacement varies with the intensity of trampling, the degree of sediment compaction, the thickness of deposit over the pieces (in 'real' situations, this would equate to the rate of deposition) and the mass of the pieces. They found no correlation between displacement and material type. In the same experiment, horizontal displacements of up to 85 cm were recorded on the flat surface.

In studies of biogenic displacement, Bowers et al. (1983) recorded notable horizontal movement on a consolidated surface primarily caused by frost heaving and slope effect. Cahen and Moeyersons (1977), in laboratory experiments concluded that alternative wetting and drying of unconsolidated deposits can cause the vertical redistribution of artefacts. The effect that animals, such as rodents and termites, and climatic conditions can have on sites is amply demonstrated by Hood and Johnson (1978), giving rise to another possible problem: that not only may artefacts move, but such things as termites and frost can totally redistribute the soil in which they were deposited, forming quite different boundaries for the archaeologist to follow.

These studies were undertaken generally as a result of refitting exercises carried out at research sites which in all cases demonstrated larger displacements than the factors controlled for allowed in experiments. Villa and Courtin (1983:270), for instance, state that:

"Recent evidence provided by conjoined pieces in Old World sites has shown that vertical migration and dispersal of artifacts across different cultural levels is a fairly common phenomenon."

Whilst closer to home, in Zaire, Cahen and Moeyersons (1977:815) have said:

"At Gombe, the reassembly shows that strictly contemporaneous artefacts are scattered irregularly over the whole thickness of the homogenous sand mantle... The... facts strongly suggest that this process of redistribution has a general and systematic character in the entire area covered by Kalahari type sands in Central Africa."

They conclude that this is the result of the wetting/drying biogenic process and anthropogenic disturbance by termites. Cahen and Moeyersons (Ibid) add to this such potential factors as animals, earthworms, tree roots, trampling and digging and levelling by prehistoric inhabitants.

Faced with evidence such as this, the whole concept of the assemblage as a stratigraphically defined time - capsule of human activity is cast open to doubt. If single events or phases of occupation can be effectively delimited, then spatial study can proceed with some degree of precision (Villa and Courtin, 1983). For this reason, many spatial studies have been conducted on what are defined as 'living floors' or occupation surfaces. The term 'living floor' was coined by J.D. Clark (Binford 1981) in his Kalambo Falls report and described by Bond (1969:207), who notes:

"the floors are only one stone thick, and every stone is either an artifact, flake, or anvil...they were all left in their present position by prehistoric man...They were factory floors in the best sense of the word"

The term has, however, been corrupted to allow the inclusion of lenses many centimetres thick. If indeed the base of these 'floors' are formed by a "palaeosol or old land surface" (Leakey 1971:258) there is some suggestion of disturbance. Whether the identification of 'living floors' can be justified in sites where the deposit is largely the result of human occupation (there are few 'sterile' units) is questionable. Yet the term has gained surprising popularity and is used widely, often without qualification throughout the archaeological community.

In any event, the loosely compacted sand and ash matrix common to most western Cape sites does not normally form anything resembling a 'living floor' in the strict sense of the term. The complex stratigraphy of Tortoise Cave provides a good example of the difficulties inherent in any spatial analysis of such sites. The problem is exacerbated here by the presence of shell in the deposits. Where middens of relatively whole shells exist in primary context, they are

unconsolidated and unstable, which makes it impractical to plot the exact location of every artefact. This would require the careful lifting of every shell and, in view of the evidence cited above concerning artefact movement in loose deposits, it seems unlikely that such an effort would be justified.

In addition, Tortoise Cave contains evidence of considerable anthropogenic disturbance. The rear of the shelter was badly churned and in places cemented by termite activity, and there was evidence of burrowing by rodents, small carnivores, blindworms, beetles and scorpions in various places throughout the deposit. That trampling and prehistoric excavation were primary elements of disturbance is demonstrated in Chapter 3, but it should be noted here that much of the deposit on the talus slope has been redeposited there and is in secondary context. These elements are not restricted to this site alone and are probably common to most sites in the region.

STATISTICS AND SPATIAL ANALYSIS

Alongside the call for objectivity in archaeological method, there has been a move away from site and sequence oriented research to a wider study of the patterns of synchronous utilisation of the prehistoric landscape (Trigger 1967, 1978, Chang 1968, Binford 1980, 1983) and of the organisation of space within sites (Whallon 1973a, 1974, Binford 1980, White 1980, Stark & Young 1981). It is particularly the latter which is of interest in this discussion.

Studies of intra-site spatial patterning, especially those concerned with artefact dispersals, have increasingly made use of statistical techniques of analysis, using methods borrowed most frequently from geography, ecology and the social sciences (Hodder & Orton 1976). These are often adapted for archaeological use without due regard to certain underlying assumptions which make them inappropriate for generalised use in this field (Orton 1982). One of the aims of this project has been to examine the applicability of statistical methods to intra-site pattern analysis on shell midden and other sites in the Western Cape.

Statistical techniques of spatial analysis belong to the class of inferential statistics (Norcliffe 1977) and many of the better known methods would classify as a form of parametric statistics, in which the null hypothesis calls for a random (usually a Poisson) distribution

rather than the more common Normal distribution for the sample population (Siegel 1956). Such methods include the various types of Nearest Neighbour Analysis (Whallon 1974, Stark & Young 1981), permutation tests (Berry et al 1980, 1983) and cluster analyses.

These techniques all incorporate two basic assumptions: that planned human activities are responsible for variations from the random pattern; and that the data population being tested was created in an archaeologically synchronous set of events. The tests mentioned also require an exact point location for each element of the data set.

For sites where artefact provenience is by grid square (quadrat) only, and where exact plotting may be impractical, a variety of analysis of variance (ANALOV) tests have been utilised (Orton 1980, 1982, Hodder & Orton 1976). The best known of these is Whallon's (1973a, 1973b) Dimensional Analysis of Variance (also called the Contiguous Quadrats method), adapted from a botanical survey technique. This method has been criticised on several counts: the effect of quadrat size and placement on the resultant patterns; the rigid format of grid shape required; and the use of 'dummy' quadrats to counteract this (Riley 1974, Hodder & Orton 1976). Most criticism seems to have been aimed at Whallon's uncritical use of archaeological data (Schiffer 1974, Clay 1975). To this last I would add that Whallon has assumed that the rejection of his null hypothesis proves the validity not only of the observed patterns but also of the inferred behaviour behind them. This is untrue. In Popperian terms, the only thing proven is that which is proven to be false (Magee 1973). Many other agents or activities could be responsible for the establishment of spurious patterns on a large site and these must be eliminated until the behavioural correlate suggested remains the one hypothesis still valid. Probably because of the pressure on archaeologists to incorporate statistical substantiation of their conclusions, these aspects of criticism seem equally valid for many such applications (Orton 1982).

It is worth stressing the adaptation of these methods from the social and life sciences because the latter deal largely with the present on a modern landscape. They need not allow for temporal admixture, and they all study patterns established on a planar surface: the earth's surface today. These are not valid assumptions for archaeological deposits. The generation of new towns in geography, or of new plant communities in ecological studies is always profoundly affected by

existing patterns and changes the latter usually without totally obliterating the former. This is rarely the case in prehistoric archaeology: even surface scatters of artefacts suffer from overprinting which need bear no resemblance to any existing pattern.

In some cases, arbitrary levels are taken to approximate planar surfaces. Where these 'spits' can be shown to follow the depositional trend and artefact displacement appears likely to be a minor factor, this is reasonable. In the majority of cases, this assumption is unreliable and here less exacting (and therefore less exact) statistical methods should be used. There are many suitable non-parametric tests available for such instances. These include 'goodness of fit' tests such as the chi squared, Kolmogorov - Smirnov and Binomial tests (Siegel 1956), which can, by use of properly phrased hypotheses and data input, be used to demonstrate spatial correlations. Other tests, including Court's method of map comparison (Norcliffe 1977), are adapted specifically for spatial analysis. Because they make few assumptions about the distribution being tested and usually involve the comparison of samples rather than comparing one sample to an ideal distribution, there is less need when using most non-parametric tests to account for variation in the thickness of deposits involved.

It seems that in a site such as Tortoise Cave, if not in most archaeological sites, it is difficult or even dangerous to attempt the definition of spatial patterning in artefacts to identify tool manufacture or use areas with any exactitude. The artefacts here are recorded by grid square or at best by 50 cm quarters of squares, which immediately excludes the use of any exact plotting techniques. There is little that can be equated to a planar surface and even where individual events can be isolated there is evidence of disturbance which must have caused displacement of the cultural remains.

I hope to demonstrate, however, that the extent of this disturbance should not totally obliterate any patterns that might have existed, although it does obscure them to a degree that makes them statistically unverifiable. Tortoise Cave is not a good example on which to demonstrate such techniques, but I have felt it worth including some to show that with consistent use of the improvements in recording methods and the change in research design outlined here, simple statistical techniques can be used on somewhat disturbed sites for spatial analysis. The conclusions drawn from the analyses at Tortoise Cave are best seen as hypotheses for testing at other, more appropriate sites in the region.

SUMMARY

In this thesis I hope to demonstrate the usefulness of a taphonomically oriented system of recording and the importance of understanding site taphonomy to a study of the utilisation of space through time in a Western Cape shell midden site: Tortoise Cave. My ideas have evolved through the project, and my recording system was far from perfect when fieldwork was carried out. Despite this it enabled me to analyse both my own and earlier misconceptions about the site and to arrive at some conclusions only possible with the improved recording system used. I was also able to avoid assumptions which I would otherwise have had no reason not to make. I make no pretence of originality in the methodology outlined here, but I feel that the importance of the combination of techniques discussed has been largely overlooked because archaeologists have tended to place their faith in stratigraphy rather than attempt a reconstruction of site taphonomy.

Since the best test of any improvement to methodology is in the answers it provides, the bulk of the thesis is concerned with the analysis of data obtained from the Tortoise Cave excavations as a test case. Because this is not a site report, I have reduced to the relevant minimum discussion of the wider environmental situation of the site. The excavations are discussed to provide a background to the stratigraphic and taphonomic interpretations, which are dealt with in some detail. A full description of the artefactual and food remains is not relevant to the topic and these are therefore only briefly summarised in Chapter 4. This is followed by the application of some statistical methods of spatial analysis and an assessment of their applicability to sites such as Tortoise Cave, with appropriate examples. This section is included to demonstrate the use of data obtained through the recording system proposed as a moderating influence on the choice of appropriate analytical methods and the interpretation of results. The final chapter is a discussion of the results of the test case, including a review of research in the Sandveld and the effect of the Tortoise Cave excavations on current theories of prehistoric Sandveld settlement.

Appendix A contains a review of the methodology as it should be practised to be most effective. These suggestions are generally applicable, although as outlined here are specifically adapted to Stone Age research of the type proposed in the thesis. It is my hope that some of these proposals will find a wider acceptance.

THE ENVIRONMENTAL SETTING

Tortoise Cave (32° 18' 02"S 18° 23' 10"E) is a low, east facing rock shelter situated some 60m above and 500m from the south bank of the Vele^Xorevlei (Fig. 2.1). Access to the rocky shore at the vlei mouth involves a walk of 3,2km, whilst the journey south west over the ridge to Mussel Point is 4,6km long. Both the vlei and the rocky shores provide abundant sources of food in the form of molluscs, crayfish, fish and birds. The location of the site just below the crest of the ridge would have given access to game and plant foods in the coastal plain to the south and the numerous rocky outcrops that dot the landscape. Thus the cave is ideally situated for the exploitation of all the primary ecosystems of the region: the sea shore; the vlei; the plain and the kopjes.

The shelter itself is formed in Table Mountain Sandstone at the interface of a unit of coarse conglomerate, which forms the roof, and a layer of smoother orthoquartzitic sandstone. A vertical plane of fracture crosses both strata, running through the centre of the cave from the mouth almost to the back, and the weathering and enlargement of this and the horizontal bedding plane caused the formation of the shelter. Tortoise Cave is about 5m across at the drip line and some 7m deep, with a maximum height from bedrock to roof of 1,65m. Weathering of the orthoquartzite also created a series of rock shelves or steps on the slope in front of the cave and the area immediately below each is littered with irregular exfoliated rocks and boulders from both strata. Wind and water erosion appear to have maintained a relatively bare rock surface in front of the cave, except in the shelter of the rock steps, where small localised patches of soil have built up. To the south and east, deposits of aeolian sand cover much of the T.M.S. bedrock to a depth of a metre or more, whilst to the north a sandy slope leads down to the vlei.

It was on the bare, stepped rock slope that the large shell midden which forms the archaeological site accumulated. The size of this midden makes Tortoise Cave one of the few large sites in the Elands Bay area and the largest single accumulation at any distance from the coast. It is interesting to speculate on the reason for such extensive occupation of one shelter among so many others of equable size, many of which show at least ephemeral signs of occupation (Buchanan *et al* 1983). Several have flattish, open areas next to the shelters, suitable for camp

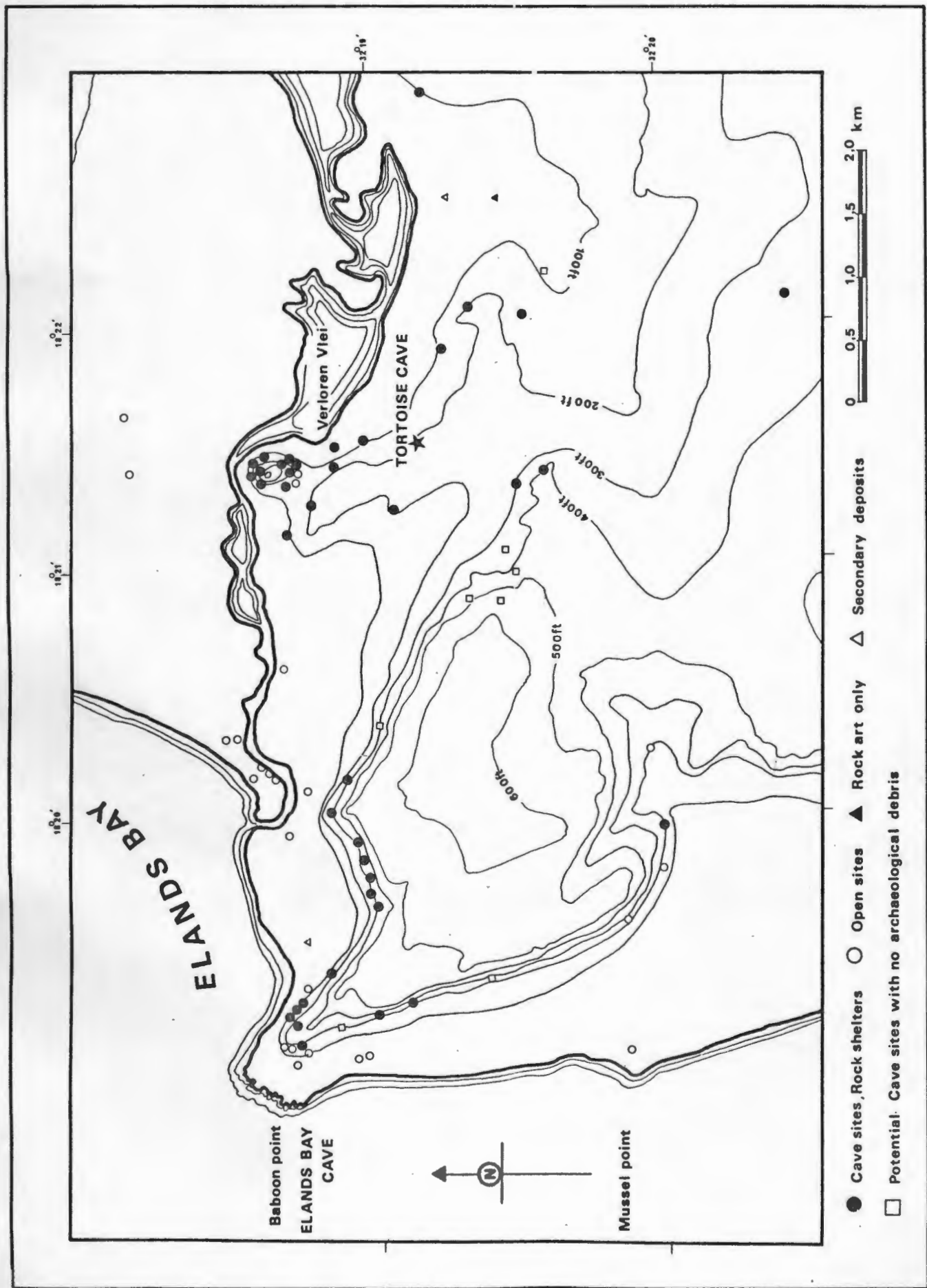


FIG. 21. THE ELANDS BAY AREA: SITES AND ECOSYSTEMS

activities and accommodation of people in groups too large to all fit within the confines of the shelter. Some are situated in equally good locations to exploit the various resource zones and some provide the same shelter from rain. Tortoise Cave, however, provides all these in one site and in addition is well protected from both the South Easterly and North Westerly prevailing winds. This is most definitely not true of the talus slope, which becomes decidedly unpleasant in even a moderate wind from either quarter. The strong South Easter blows more frequently in the summer, but the wind is rarely strong in the mornings and late evenings. Assuming that few people would be on site in the afternoons and possibly a more frequent winter occupation (Parkington 1972, 1977) there is every reason to suppose that Tortoise Cave would provide adequate shelter for a hunter gatherer home base.

THE EXCAVATIONS

It is useful to view the excavations at Tortoise Cave as having been carried out in four phases. Briefly, these are: the digging of a test trench; the expansion of this into a larger excavation, concentrating on the outer cave deposits (Fig. 1.1); the excavation of the inner shelter; and digging alongside the phase two excavations to improve the stratigraphic correlation. Each phase was undertaken with different intentions and a different, if evolving, strategy and technique. In addition, the first three phases took place under no less than four different supervisors with varying manpower and experience. This has made analysis of the sequence and stratigraphy considerably more difficult and to facilitate understanding of the following chapter an historical overview of the excavations has been included here. I have added some criticisms both of my own and previous approaches in the hope that it will be of use to other researchers. It is easy to be critical with hindsight and the criticisms expressed are intended as constructive and informative, rather than remonstrative.

In January 1978, during excavations at Elands Bay Cave, a small party was sent to excavate a 1m² test pit in the midden at Tortoise Cave. Over four days some 50cm of midden deposit was removed from square A (Fig. 1.1) and a second square, B, was started and dug to about 15cm. Neither square was taken to bedrock. Square A was removed in three levels of varying depth: "Surface" being some 20 to 25cm deep, "Spit 1" about the same below it and a few cm of "Spit 2" coming from underneath this. In square B the approach was changed, starting with the removal of a few

cm of "Surface Scrapings" and the excavation in one corner of the edge of a distinct midden layer "Len". After this "Spit 1" and "Spit 2" were dug as 5cm spits, although Spit 1 is recorded as 11cm deep in the West (upslope) face of the square. The use of the terms "Spit 1" and "Spit 2" were continued in later work, but since they refer to units approximately 10cm thick, it seems wisest not to include the material from at least square A in any general analysis, without extreme caution.

On a second visit in April 1978 square B was taken to bedrock and ~~two~~^{three} adjoining squares, C, ^D_X and E, were started. More of "Len" was removed and the spits began to assume their later form. At the same time two unmapped surface collections of stone tools were made on the lower talus and labelled 'Surface A' and 'Surface B'. At this point it seems that a decision was made to organise a larger, more systematic excavation and the trial trench was abandoned.

Phase two took place over about two weeks at the end of 1978, when a wider area was excavated to bedrock. This involved squares F through to Q and X, as well as the completion of C, D and E. At the same time, a second test square (AA) was excavated to bedrock 10m downslope of square A, dug in arbitrary 5cm spits numbered 1 to 26 which are unrelated to those in the main excavation. During this excavation, several recognisable lenses, middens and features were identified and removed separately, particularly towards the inner cave. The undifferentiated middens of the outer cave were excavated in spits of varying thickness, four inside the shelter and six outside, where bedrock dropped away in an irregular exfoliation step (Fig. 2.3). The variation in depth of the spits resulted from attempts to follow the surfaces of apparent shell horizons which invariably petered out after a short distance, and from slumping of the deposits over the rock step or under large spalls off the roof, initially interpreted as crude pits. I can only sympathise with these efforts, having tried unsuccessfully myself to separate out similar occurrences on several occasions. Whilst every effort should be made to follow any possible stratigraphy, the result has been that it is now impossible to document the exact depth of the spits across the grid since no levels were taken and the only sections recorded were around the edges of the excavation. The written record was minimal, subjective and intermittent and without internal consistency. Description of the content of each unit is highly variable and the only record of some contexts is in the transparencies of the sections. Although radiocarbon samples

were taken, they were never submitted, and whilst interesting changes in time and space were evident from the lithic and faunal assemblage, the sequence remained poorly understood and rather enigmatic.

I began work on the deposits of the inner cave over a large surface area (Fig. 2-2). Most of the 1978 units were identified and in many cases subdivided still further. It was also possible in the field to identify, albeit late in the day, the mode of accumulation of the deposits and gain a generalised insight to the taphonomic problems inherent in them. That this level of understanding was not reached sooner was a function of the strategy employed, which involved piecemeal excavation of small sections of the grid to increase the number of control sections. In this case the simultaneous excavation of each unit across the grid would have shown up the patterns sooner, but in the event there were insufficient trained personnel on site to keep a constant cross-check on levels and mapping and I was justifiably unhappy about losing data through instrument error. The correlation of units in this excavation with the 1978 Spits proved unsatisfactory and I decided to extend the excavation along the southern edge of the 1978 dig to finalise the dating and stratigraphic link up.

Phase four was to involve the horizontal stripping of some $8m^2$ of the deposits of the outer cave and a $4m^2$ area immediately west of square AA over 1982/3. Bad weather, shortage of staff and the occurrence of a poorly preserved burial forced the curtailment of this venture and eventually only three squares were taken to bedrock, just sufficient to complete the analysis of the stratigraphy and the taphonomic study. It was possible to define and date the lower talus deposits in squares AA and AA2, and to settle many of the stratigraphic anomalies of the outer cave. Here, however, the stratigraphy was poor and excavation was again carried out using spits but to avoid confusion these were named rather than numbered and kept more strictly to 5cm levels. There are many problems with spit excavation and in this case the slope of the deposits and the slumping at the rock step make me dubious about the relationship of either series to the actual taphonomy of the outer cave deposits.

INTRODUCTION

By far the greatest proportion of the archaeological deposits at Tortoise Cave lies on the talus slope outside the shelter. These deposits comprise a fragmented shell midden within a matrix of sand, ash and humus. There are some features in the deposit visible on excavation, but by and large the midden appears to be an undifferentiated cone of shell and sand, in places over 1m deep. The midden, wherever sampled, lies directly on the stepped bedrock.

Inside the shelter the deposits are shallower (20 - 60 cm) and more clearly differentiated, with soil horizons interspersed with bedding units and hearths or ash heaps. Burrowing is far more visible, if not more frequent, than outside. A ternitarium towards the rear of the cave has caused limited disturbance and may have contributed to the fragmentation of the bedding in the upper units.

It appears from the radiocarbon sequence that the earliest occupation of the site occurred shortly after 8000 BP, and that the midden was formed by sporadic occupation until about 700 BP or later. There is no evidence of a pre-Holocene human presence in the immediate vicinity of the shelter.

The introductory discourse on 'taphonomy' and 'stratigraphy' clearly demonstrates the need to differentiate between decisions made on the basis of one or the other. In practice, the reconstruction of the taphonomic process is largely dependent on the available data gained through a study of the inferred stratigraphy and it is not possible totally to separate the two. It is, however, from the attempt to reconstruct site taphonomy that the ultimate stratigraphic divisions are derived, and a summary of the known taphonomic processes involved provides the necessary background to understanding the description of stratigraphy. The latter is divided into 'layers' which are deduced or assumed to be roughly contemporaneous in archaeological terms.

The combination of individual units into layers is, as far as possible, achieved through a study of the taphonomic implications of each unit and the repetition of patterns of unit type and association. The layers must be construed as approximations of taphonomic realities because the

subsequent analysis of content can only be divided on excavated contexts. This means that where an excavated unit does not conform to the taphonomic reality, as may occur when an undifferentiated shell midden is removed as one lens when in fact it is related to two separable prehistoric events or phases, the excavator has the choice of including it with one or other event, or to leave it 'floating' between the two and exclude it from any detailed analysis. This is a relatively common occurrence and to avoid the loss of too many such units these are often placed in one division or another, rather than 'floated' between layers. The use of taphonomic reconstruction enables a more meaningful subdivision to be made and where necessary sounds a cautionary note on the accuracy of the cultural analysis at any stage.

SITE TAPHONOMY

Taphonomic reconstruction of the Tortoise Cave shell midden is a complex task, given the wide lateral expanse of the midden and the localised nature of recognisable features. There is evidence for occupation both inside the shelter and on the talus slope and whilst it is likely that the bulk of the deposits derive from the shelter itself, this is by no means certain, as excavations have covered only a small part of the surface area of the midden.

The single most important discovery made during excavation was that the well stratified deposits inside the cave lay in a prehistorically excavated hollow or 'basin' that had been cut through previous units presumably to increase the amount of space in the shelter (Fig. 1.3). The layers in the basin comprise a patterned sequence of peripheral shell middens and ash heaps with a central area of soil and vegetation (FRAN, ERNST, THIG LEN, etc.). It is hypothesised that the soily matrix of these central units and those immediately below the surface is of aeolian origin and formed between occupations in the protected hollows left as the bedding units decayed or were broken down by termite and animal activity. In the periods between field seasons a build up of dust and sand several centimetres deep was noted in the shelter even after the removal of the protective frontal deposits. This depositional process would be increased when these deposits were present and the formation of the soil accumulations in layers 1 to 3 would require only a few years.

Further examination of the unit (KTAT) which lay on bedrock across most of the central cave showed it to be comprised of a variety of colours and textures, and therefore most probably the

LAYER	UNIT/SQ.	MATERIAL	SAMPLE NO.	DATE(yrs.)
1a	Fold-up bedding/J3	Restio	Pta-3600	760 \pm 50
2b	Fran/K2	Charcoal	Pta-3309	1580 \pm 50
3	ABD II/J2	Charcoal	Pta-3310	1620 \pm 50
3	Turner/Y2	Charcoal	Pta-3311	1610 \pm 50
3	Alvin/X3	Charcoal	Pta-3312	1680 \pm 50
6	SM2/AA2	Charcoal	Pta-3604	3520 \pm 60
8	FU2/3/AA2	Charcoal	Pta-3595	4020 \pm 60
10	Melanie/S1	Charcoal	Pta-3608	4190 \pm 60
13a	Delta/S1	Charcoal	Pta-3605	4330 \pm 50
14	Home/S1	Shell	Pta-3596 corrected to	8100 \pm 70 7700 \pm 70

TABLE 1: RADIOCARBON DATES FROM TORTOISE CAVE.

basal remnants of a number of lenses. To the rear of the cave, KTAT lay over and against two midden units (BLIND BOY & ALVIN) now dated to about 1700 BP, but to the front (East) it lay beneath a unit some 4000 years old. This suggested that the shelter had experienced prehistoric excavation, not once, but several times, throughout its history. This was confirmed during further analysis of the stratigraphy, which revealed evidence of a later partial clearance of deposits between layers 2 and 3, shortly after 1600 BP. The midden unit TURNER and the lenses SEURAT and LAUTREC in layer 3 all contained large amounts of small bone, charcoal and grit indicative of the rapid removal of shell and other material from immediately above them. A very similar unit (ENIGMATIX) was in fact created by the excavation in 1981 of the midden RUBENS in layer 2 and serves as a model for this inference.

At the outside edge of the hollow, a number of the basin units appeared to interdigitate with certain levels of the otherwise poorly stratified outer deposits, which were considerably older (Fig. 3.1). It remains possible that these units are younger than their dated eastward extensions and therefore badly mixed, but in view of the observations above and others detailed below, this now seems unlikely. The observed overlaps were mostly of the order of 10 or 20 cm, although between layers 2 and 3 one was over 50 cm in extent (X-RAY). The tight chronological sequence obtained for the basin deposits shows that they were deposited in a series of visits separated by at least several years. The ash/shell units of the talus are fairly unstable and it was noted that in the period between the 1978 and 1981 field seasons the unshored sections had slumped to produce a sloping deposit, in places as deep as 20 cm at the sections and extending 40 to 50 cm out from them. The slumping of the edges of the basin between visits and trampling during them would easily account for the observed interdigitation of units of widely differing age.

If it can be accepted that the shelter was periodically emptied, it follows that the material from this process was dumped on the talus slope. There is ample evidence to suggest that this is the case. Many of the ephemeral surfaces which were followed when the outer deposits were dug are best interpreted as tip lines, containing a quarter bucket or less of deposit, and the intricate intermingling of these with each other is more indicative of rapid dumping than either gradual accumulation or post-depositional disturbance. It is not true to say, however, that these deposits are wholly secondary and a result of this process. In the squares AA and AA2

TORTOISE CAVE 1981
SECTION ON I/Y INTERFACE

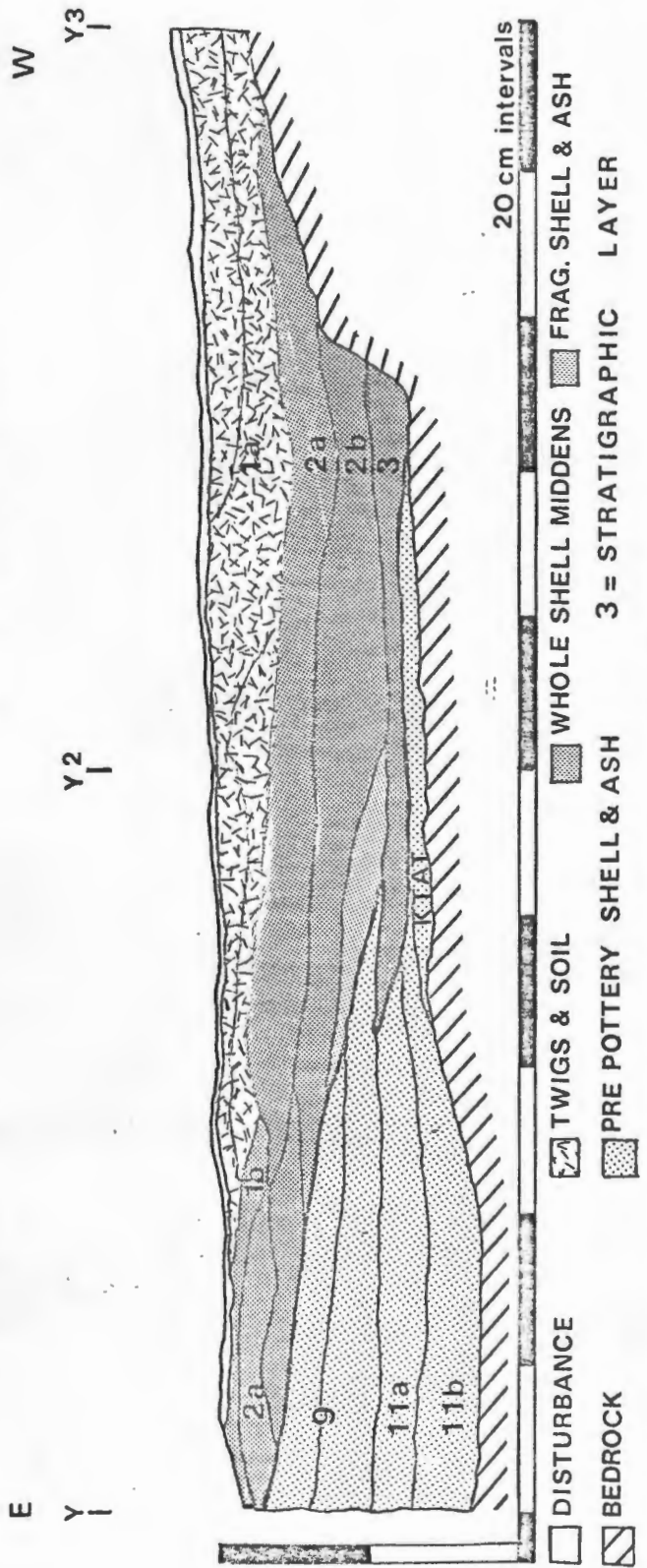


FIGURE 3.1 SECTION THROUGH SOIL AND BEDDING UNITS

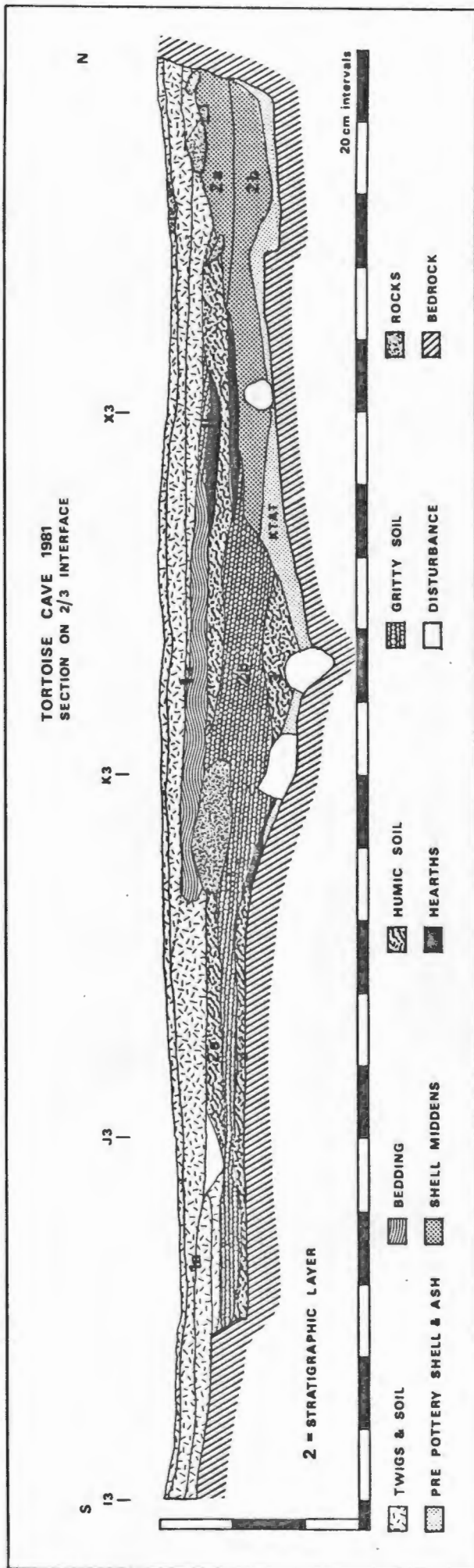


FIGURE 3.2 SECTION SHOWING TWO PHASES OF BASIN

there was a midden unit (SSL) quite clearly in primary context, lying conformably on an even, sloping layer of shell (SM). Immediately adjacent to this midden, in the top 10 cm of SM, were two ashy patches which marked the location of hearths that had once existed on the even surface above (Fig. 3.3). In addition, there are similar hearth markers in layers 13 and 14, close to bedrock just outside the cave, confirming that occupation extended beyond the confines of the shelter.

Layer 10 also appears to be a primary deposit, in this case an ash heap extending over several square metres, with some shell lenses stratified within the ash (Plate 1). In this it closely resembles the ash heap in the basin (ASH BELOW DAVE, layer 3) but appears to have no associated shell middens. It is possible that these existed to the north, in the 1978 excavation, but were not removed separately, or to the south beyond the burial in the unexcavated area. The edge of a shell unit was excavated in the south west corner of square R2, but not enough was dug to confirm its association with the ash heap (Fig. 3.4). There are also aeolian soil horizons in the more sheltered areas of the talus, notably at the base of square S2 (GLOW) and against the rock step in the cave mouth (AMONGST ROCKS). This means that all the types of unit found within the shelter with the exception of bedding and the build up of aeolian soils are present on the talus, albeit somewhat dispersed. The suggestion here is that the talus was also a focus of occupation, rather than simply an outdoor activity area.

The dating of the deposits in square AA2, some 8m west of the main excavation, is of interest. The dates fall in between those obtained for the basin and that from MELANIE outside the cave and there is therefore a distinct possibility that the midden accumulated outwards from the shelter rather than upwards across the entire area. This would seem logical if the primary mode of deposit formation is taken to be site clearance. Thus debris removed from the shelter may have been dumped beyond the limits of the living area at the time. The cluster of large rocks on bedrock in AA2 may indicate that the second rock step, which is visible where it projects from the edges of the talus, may run just upslope of the square. The flat ledge above this would provide an ideal activity or living area, and if the step itself was the site boundary, material dumped over the step would continue to accumulate until it reached the level of the ledge, thereby extending the living area. This seems to have occurred at the top of layer 6, where the in situ midden and hearth markers indicate the use of this area as a living zone. After this



PLATE 1: THE ROCK STEP IN S2, SHOWING LAYER 10 AT TOP OF SECTION TO THE LEFT, SHELL LENS AND GREY ASHY DEPOSIT.

E

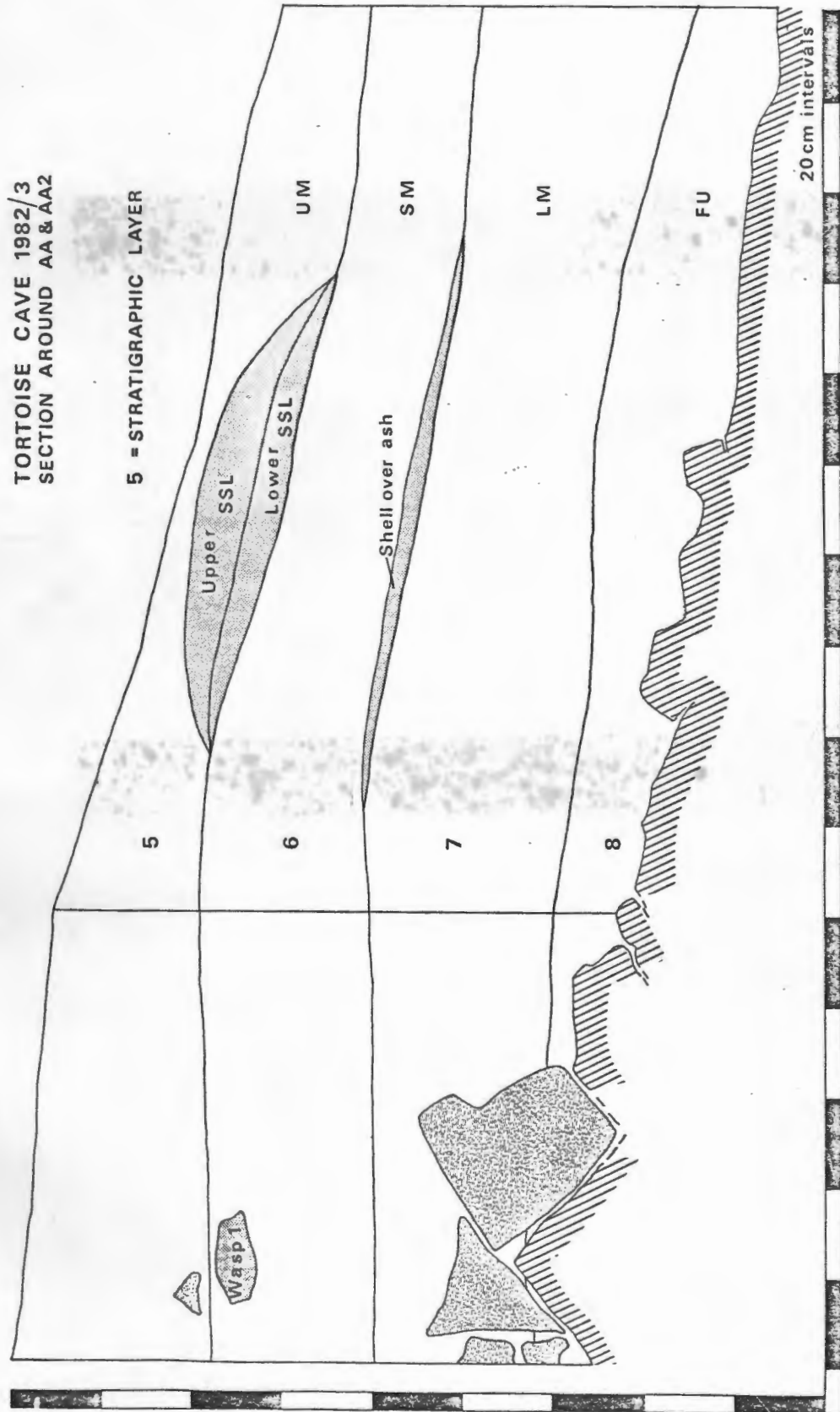
AA

TORTOISE CAVE 1982/3
SECTION AROUND AA & AA2

5 = STRATIGRAPHIC LAYER

N W
AA2

S
AA2



20 cm intervals

- SHELL & ASH
- ▒ SHELL LENSES
- HEARTH MARKER
- ▒ ROCKS
- ▨ BEDROCK

FIGURE 3.3 SECTION THROUGH LOWER TALUS DEPOSITS

alteration of space designation, the rate of accumulation could be expected to slow down as dumping occurred elsewhere at the new periphery of the site. This model, whilst the evidence is circumstantial, serves to explain not only the dates and the appearance of a single complex of features, but also the more soily nature of the deposit above that level.

The analysis of the cultural material from the talus deposits must therefore be viewed with caution. The deposits formed in any segment in time will be comprised of artefactual and faunal debris in primary context, an indistinguishable 'living floor', mixed with secondary dumped deposits of material periodically removed from the shelter. There is also evidence of burrowing and the slumping of tipped deposits over the steps in bedrock which means vertical movement of cultural debris which at times cuts across the arbitrary levels used in excavation. Thus there are the remains of sheep recorded from all but the lowest levels of the outer cave, from deposits dated to 4000 BP and older. Similarly there were a few human bones scattered through the spits which are most probably the result of vertical movement rather than the remnants of four or five burials. It is difficult to assess the areal extent of this disturbance but the implications if it is widespread are that no meaningful spatial analysis of the talus deposits can be made except within units confirmed as in primary context, and these are few.

In square S2 and most of S1, the disturbance seems to be localised, and the radiocarbon samples were selected from parts of these squares which showed least disturbance. Despite the apparent coherence of the sequence with respect to the date from layer 10 (Pta. 3608, Table 1), these dates should still be regarded as approximations to a greater degree than is normal. The date from layer 14 (Pta. 3596) came from a shell sample almost on bedrock, undisturbed and probably in primary context, and can be taken as more reliable.

Given that this is the case, there are still good grounds for concluding that a considerable hiatus in occupation occurred between about 7700 BP and at least the middle of the fifth millennium BP. There are only some 20 cm of deposit separating the pre - hiatus date from the date of 4330 BP immediately above it, of which half is attributed to the period before the break. There is also a distinct possibility of a second break in occupation between about 3000 BP and the post - pottery deposits dated to around 1700 BP. In both cases there is every possibility that the apparent gaps are simply periods of less occupation represented by limited deposits elsewhere in the site, or simply spread thinly across the talus.

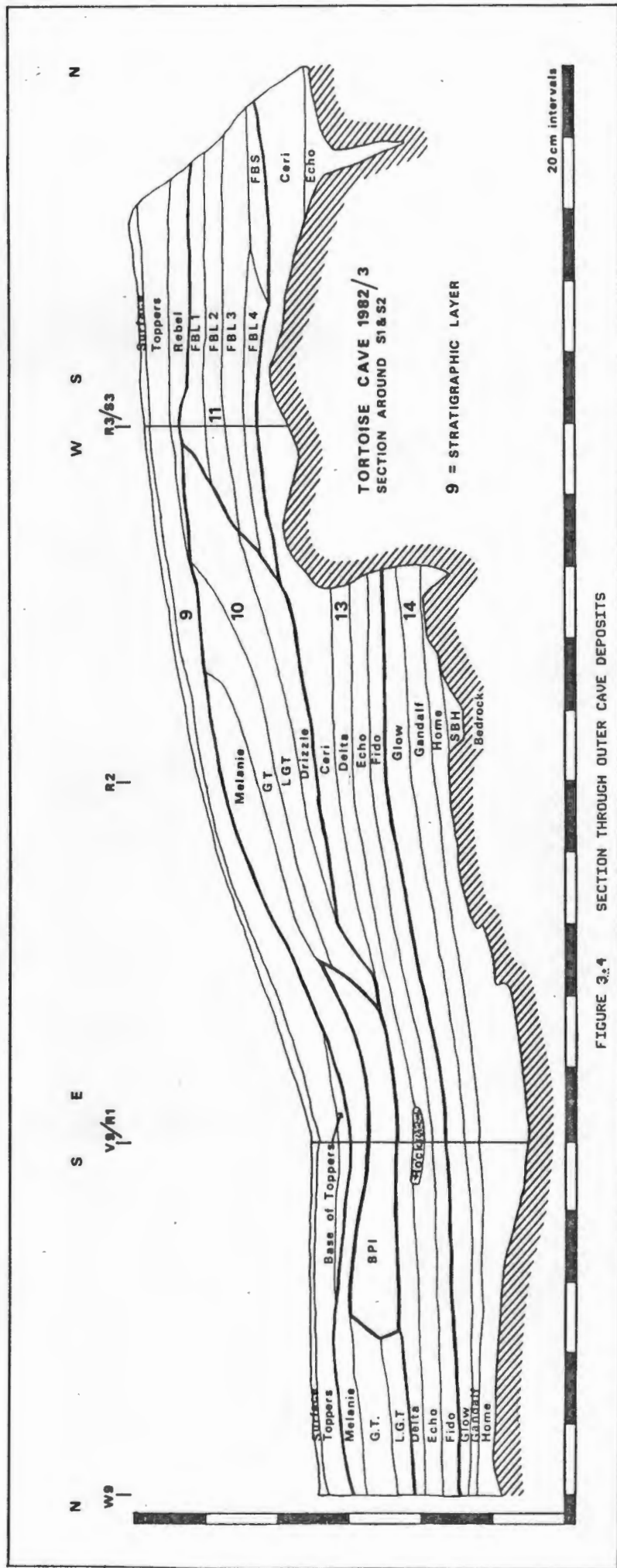


FIGURE 3.4 SECTION THROUGH OUTER CAVE DEPOSITS

There is an apparent discontinuity in the deposits spanning the earlier gap. The uppermost unit in layer 14 (GLOW) is a soily lens containing little shell and lying unevenly across the shell units below (Fig. 3.4). This suggests, as with the other soil units in the basin deposits, a period of non-occupation. Support for this may come from the cemented nature of the hearth markers in layer 14 (HASP, OBR), as those immediately above in layer 13 (GASH, GASP) are unconsolidated, perhaps a result of the former being cemented by water action over a long period whilst close to the surface. It is, however, also reasonable to suggest that cementation occurred through the effect of water percolation close to bedrock and that the time gap inferred by the soil accumulation need only represent a short break in occupation. Equally, it would be wrong to use the basin as a marker for the second ^{hiatus} Λ , although it may well be one, if it is to be seen simply as the final episode in a series of similar formations. There are 15 to 20 cm of deposit overlying layer 10 which could relate to the period between 4000 BP and 1700 BP in this part of the site.

THE STRATIGRAPHIC SEQUENCE

General

This section is largely a layer by layer description of the excavated deposits at the cave. In some instances, the layers can be interpreted as prehistoric events, representing individual visits or clusters separated by a very short span of time (of the order of one or two years). In others, particularly those covering the talus deposits, the layers are merely convenient subdivisions of the undifferentiated debris from several centuries of occupation. A full list of the stratigraphic units in each layer, with a diagrammatic matrix, is provided in Appendix B, and should be read in conjunction with this section.

Perhaps the most difficult and least satisfactory part of the stratigraphic reconstruction is the attempt to link the units of the 1978 season with those of the 1981 and 1982-3 field seasons. This, in the absence of more detailed information, is built around occasional suggestions of similarity in the field notes and section levels. The most problematic correlation is between the 1978 spits (layers 9 - 14) of the outer cave and equivalent units dug in subsequent seasons. A reasonable link has been established at the interface of squares S1/S2 with O/N (Fig. 3.4), but this is not the case along the section between squares Y/I and

L/F (Fig. 3.5). In this latter instance, fortunately, most of the deposit concerned west of the section is slump, with the exception of YANKEE on bedrock, which lies below the basin. Other problems lie in associating the 1978 shell lenses LOUBIE, LEN and DAVE with their 1981 counterparts. DAVE is now securely equated with the 1981 unit VINCENT (layer 2b) but LOUBIE (1978) was separated into LOUBIE and BELOW LOUBIE in 1981. The first of these is now placed in layer 1b whilst the other is in layer 2a. LEN (1978) was similarly separated into LEN and IVAN and again these units are now allocated to different layers. There is little that can be done about this and for the purposes of analysis the 1978 units have been incorporated with the later units of the same name, in both cases in the upper layer.

For convenience, the following discussion has been subdivided into three sections. These cover what have come to be called the 'outer cave' deposits (layers 14 - 9), the 'lower talus' or deep sounding units (layers 8 - 5) and the 'basin' deposits (layers 3 - 1). Layers 12 and 4 are held separate because whilst they are located inside the shelter, they are not part of the 'basin', and because their association and dating remain uncertain.

The Outer Cave

These are the poorly stratified layers of shell, ash and soil excavated from the area immediately in front of the shelter, extending up over the rock step and inside the drip line to the edge of the basin. They comprise the stratigraphic layers 9 to 14, excluding 12. For analytical purposes the thickest layers, 11 and 13 have each been split into two sub-layers, but this break is entirely arbitrary.

The lowest occupation horizon, layer 14, dates to about 7700 BP and is composed of three types of unit: pre-occupation aeolian soils containing cultural remains from the units above them (SBH, AMONGST ROCKS); shell and ash lenses with an admixture of humus and grit (GANDALF, HOME); and cemented ash and shell patches which are interpreted as hearth markers (HASP, OBR). The layer is capped with another soily unit (GLOW) which appears to represent a break in occupation and may contain some material from layer 13b above. The bulk of the material is, however, assumed to derive from the units below. A similar situation may pertain to the upper part of AMONGST ROCKS dug in 1978, as this unit and SPIT 5 are spatially exclusive. There is no record

TORTOISE CAVE 1978
SECTION ON L-N/V-Y-K INTERFACE

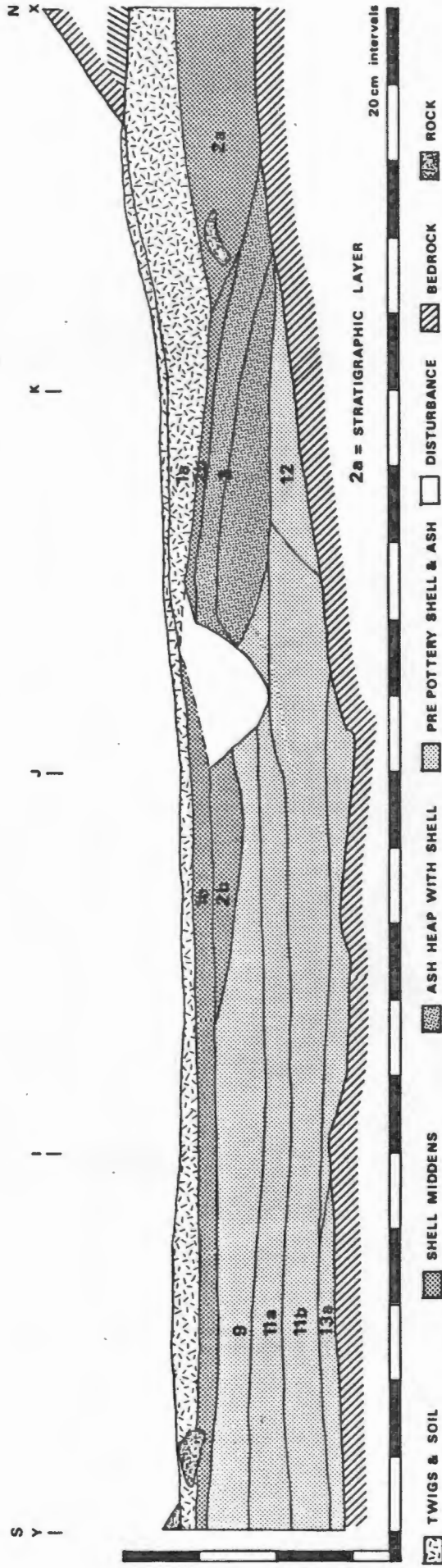


FIGURE 3.5 SECTION THROUGH MIDDENS AND ASH HEAP, FRONT OF BASIN

of the composition of AMONGST ROCKS at this level, or as to what criteria were used to differentiate it from SPIT 5, and it must be assumed that it was the same soil deposit recorded when the lower half was removed in 1981.

Layer 13 contains no soil horizons and the hearth markers (GASP, GASH 1, 2 & 3) are unconsolidated. The whole layer otherwise is composed of undifferentiated, insubstantial shell lenses with the appearance of tip lines in a gritty matrix of ash and soil. It was excavated in 5cm spits. CHARLIE and CERI (KERRY of 1978) are facies of the same spit, and both were removed as CERI in square S2. The soil to ash ratio of the matrix in layer 13 is greater than in layer 14 and it is therefore browner. It is noticeably more gritty in texture than layer 11 above, the major criterion for separating the two.

In square S2, directly over the rock step, the base of layer 11 is marked by a shell lens (FBS), which continues toward the drip line. Inside the shelter, the layer lies on or very near bedrock and becomes greyer and much more ashy. The link between the FBL series (SPITS 2 & 3) and the VEEBEE series (including VICTOR, VALIANT & VULCAN) is somewhat tenuous, as along the drip line a rock fall has compressed the deposits and caused considerable disturbance. Over most of the excavation, the division between layer 11 and layer 9 is entirely arbitrary, and the fine humic soil and ash matrix is the same through both layers to the surface. The break can be discerned with certainty only where layer 10 lies between the two (Fig. 3.4). The separation of layer 9 from layer 11 corresponds with the SPIT 1 - SPIT 2 division.

Layer 10 is an ash heap in primary context (MELANIE, GT, LGT) partially bounded by shell lenses (SHELL LENS IN MELANIE & SLIM above, DRIZZLE below) and dates to around 4200 BP. It is cut by the burial pit in square R1 which has caused the deposits of both this layer and layer 11 below to slump towards it. Thus what was removed as BPI in S1 (Fig. 3.4) is probably rather slumped GT, and it now seems reasonable to include PELMEL and FUBAR in layer 10. FINAL CLEANINGS in squares S1 and S2 lies between MELANIE and GT and can also safely be included. GREY TALUS is a unit in name only, being the outline of layer 10 seen in the 1978 section. It would seem that layer 10 was removed with SPITS 1, 2 & 3, except at its westernmost limit in square M, where it was removed as PIT INFILL. There is no way to estimate the degree of mixing except that much of

SPITS 2 & 3 in squares N and O may belong in MELANIE. In lithic content, at least, there seems to be little difference between layers 10 and 11 and for analysis the material from the spits in those squares has been kept with the rest of the relevant spits.

Layer 9 comprises the remaining deposits between MELANIE and FBL and the surface of the talus and consists of fragmented shell in a matrix of fine brown soil and ash. There is somewhat less shell in the uppermost part of TOPPERS, and just inside the shelter, around the rock fall, SCAR is an aeolian deposit. Otherwise the shell content is similar to that of layer 11, slightly more than in the ash lenses of layer 10, patchy and almost certainly in secondary context.

Layer 12

The units DOODLE and SPECKLE have been combined into layer 12 on the basis of a number of superficial similarities, although they are not directly linked in the stratigraphy. DOODLE lies in squares I and T2, occupying a hollow in the bedrock of the cave floor, just inside the shelter on the southern side. SPECKLE occupies a similar place at the northern edge of the shelter, just inside the rock step in squares C, E, G and H. Both lie below deposits incorporated into layer 11. Both have a matrix of brown soil with little ash, containing fragments of shell in noticeably smaller quantities than other midden units, and both contain comparatively little in the way of artefacts or faunal remains. In addition, the shell in these contexts is powdery and poorly preserved. This could be an indicator of even greater antiquity for layer 12, but in the absence of a date from either, there is no way to establish this.

The Lower Talus

The four layers comprising this section of the deposit form a unit both spatially and temporally separate from the rest of the site. They have been excavated in two squares, AA and AA2, downslope of the main excavation and are dated around 3500 - 4000 BP. The uppermost, layer 5, contains two different depositional events. UM (layer 5a) is a sequence of unstratified shell, ash and soil containing less shell than the layers below. It overlies SSL (layer 5b), a shell midden in primary context, which sits unconformably on the surface of layer 6. SSL does not cover the whole of either square, and has a domed upper surface which reaches to within 6 cm of the present surface. Both UM and SSL were taken out as SPITS 1 - 5 (AA) in 1978, so that for purposes of analysis all these units must be considered as one layer.

The two hearth markers, WASP 1 and 2, whilst apparently relating to hearths on the surface of SM and contemporary with layer 5b, must be presumed to contain mostly material from layer 6 (SM) and analysed with the latter. Although this might mean a degree of admixture, this is likely anyway since the surface of SM must have remained uncovered during the time taken for most of SSL to be built up. Also, although the 1978 SPIT 5 has been taken as the break between layers 5 and 6, in places SPITS 6 and 7 lie above the line now known to represent the top of SM, so that in square AA there will in any event be some contamination at the interface of the two layers.

SM was dug in 5cm spits to a depth of 60 to 85 cm below the present surface and was differentiated from LM below it by the presence in LM of numerous ephemeral grey ashy patches often less than a cm deep and a few cm in extent. These were noticed in 1978 in square AA and the base of SPIT 12 in that square can be reliably equated with the bottom of SM in AA2. At the base of SM there was a one shell thick lens of Patella spp. (P. argenvillei, P. barbara and P. granularis) which was taken separately as SHELL OVER ASH and marks the interface with LM as excavated. The two layers, 6 and 7, are conformable and in other respects very similar.

Similarly, there is no depositional reason for the break between LM and FU (layer 8). Large rocks had begun to appear in the midden and the change was made at this point. Perched on one rock was a small ash patch (HIGH) which had spread into the surrounding midden. The discolouration was thought to be an ash lens marking a stratigraphic break and was named HASH, but after cleaning the surface and section it was seen to be inconsequential and was removed with FU.

At the base of FU, in amongst the rocks in AA2 and in patches on bedrock in AA, there appeared to be traces of a mid - grey ash without much shell. This may relate to an earlier occupation in this part of the site but there was so little of this material that it was included with FU in square AA2.

Layer 4

This is not a layer in the normal sense, in that it ^arelly consists of only one stratigraphic _k unit. LOOSE MIDDEN is the uppermost level of the midden SOB, lying just below the loose aeolian soils on the surface. SOB is a fairly unfragmented shell heap reminiscent of SALLY or LOUBIE, but is stratigraphically below the basin and is probably pre - pottery in age. It lies

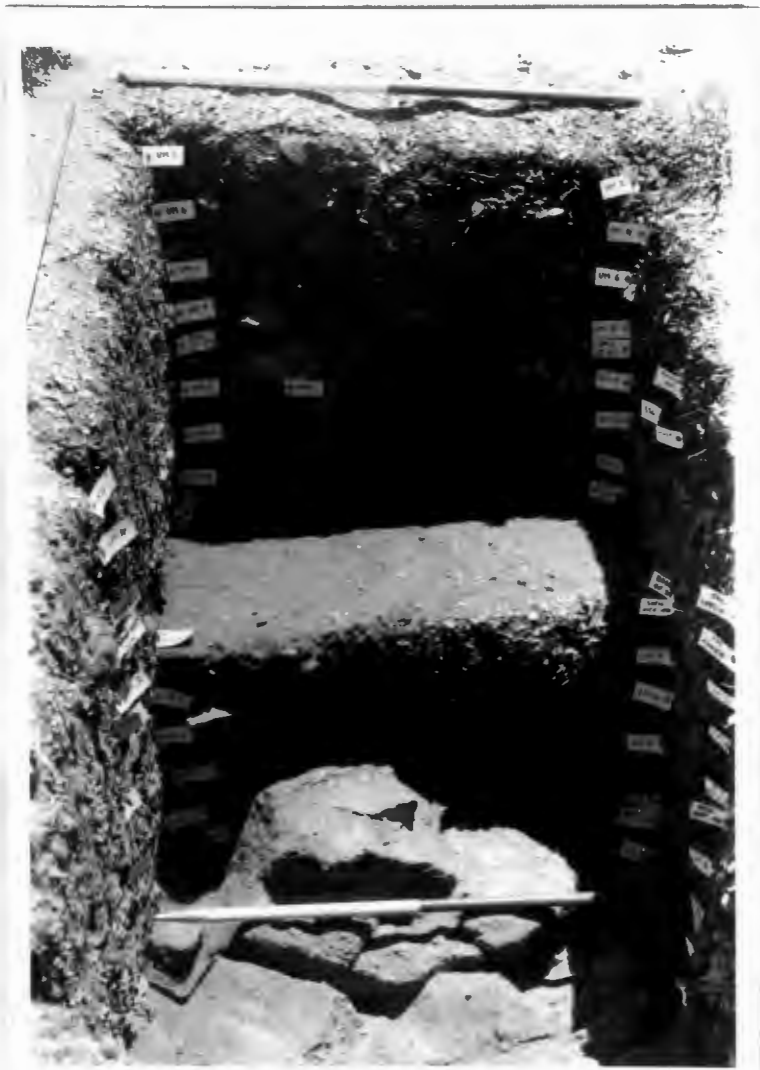


PLATE 2: SQUARE AA2 PARTIALLY EXCAVATED. WASP IS MARKED IN SECTION. NOTE THE
START OF THE ROCKS PILED ON BEDROCK.

unconformably on the VICTOR/VALIANT complex in squares T and T2, which may imply a pre - pottery excavation of this section of deposit, but this is still uncertain. Consequently the exact age of SOB and its position in the stratigraphic matrix are uncertain, except that it lies between layers 3 and 11, and it has been given layer status in the same way as layer 12.

The Basin

The deposits inside the shelter that post - date the introduction of pottery to the site lie in the hollow excavated there. These comprise the stratigraphic layers 1 to 3. Plans of the units described below are displayed in Figs. 5.6 to 5.9, in Chapter 5.

Layer 3 is perhaps the most complex of the post - pottery layers, in that some of it has been removed in a later, partial excavation of the basin. It contains the large ash heap ASH BELOW DAVE (I & II), the soil horizon MATISSE, shell middens TURNER, SEURAT, ALVIN and BLIND BOY, and some smaller units. Of these, ASH ABOVE SEURAT and ASH BELOW LAUTREC are probably disturbed lobes of ABD I and JEFF the remains of a burrow. ALVIN and BLIND BOY were at first thought to be pre - pottery, but the date obtained for the former (Pta. 3312) made this seem unlikely. Further examination showed that pottery is uncommon in the shell midden units, and that inclusion of these middens in layer 3 would form the same spatial pattern as for the units above (Figs. 5.7 & 5.8). TURNER and SEURAT appear to be remnant shell midden units, the tops of which have been removed in the subsequent digging, which would explain why it was not possible to distinguish them in the south of square I. LAUTREC is a gritty soil lens, and like others above it is the result of the decomposition of sandstone roof spalls which have since been removed.

Layers 2a and 2b form the 'typical' basin deposits, displaying the complete spatial pattern except for the absence of bedding. One remnant of this exists to suggest its place in the pattern: BEDDING IN FRAN, a small patch of bedding - base material in layer 2b. In both 2a and 2b, the edges of the basin contain the shell middens, LEN, BELOW LOUBIE, PISSARD, ASTERIX, ZULU and DJANGO in 2a and IVAN, JOSH, SALLY, DAVE/VINCENT, RUBENS and FELIX in 2b, whilst the central area is occupied by soil horizons of aeolian origin mixed with cultural remains (ERNST, GAUGUIN and FRAN). These horizons lens over the shell middens in their respective layers and are considered to have been formed largely between occupations of the site: the cultural material they contain is attributed primarily to the previous occupation, although there is bound to be a degree of mixture with later deposits. A terrarium in layer 2a caused the cementing of GAUGUIN

to the top of the midden below (DJANGO) and may have caused considerable disturbance of these layers and layer 1 above. The ash lens HALS in 2a may represent the start of an ASH BELOW DAVE type accumulation. FEATURE AMONGST ROCKS is a little enigmatic, but seems to be a hearth remnant below BEDDING B.

Layer 1b is the uppermost occupation horizon, dated to around 760 BP, and contains most of the bedding units still recognisable in the deposit. These have been damaged by small animal nests and sometimes appear to have been badly chewed (FUB), but two distinct types exist. FUB, SHELL & GRASS, BEDDING & SHELL and BEDDING C all have a basal layer of twiggy reeds covered by a thick wad of softer grasses. The others are composed of a single layer of grass with some reeds. There appears to be no stratigraphic significance to this dichotomy. The shell lens LOUBIE and the shell scatter FRAGMENTS have been allocated to this layer although the latter may be an outlier of PISSARRO from layer 2a. GANDP is an ash lens similar to, but larger than, HALS and appears to occupy the same position in the layer. The rest of layer 1 is a series of similar soil units with highly fragmented twigs and grass, some broken shell and bone and few artefacts. These again are primarily aeolian deposits and post - date the units of shell and ash.

Layer 1a has no associated shell middens as such, and may represent a visit during which no molluscs were collected. On the other hand, the shell debris from this layer could simply be distributed thinly across other midden units and be indistinguishable from them. ZULU, in layer 2a, was at first thought to be associated with the upper bedding units because of the clean, fresh appearance of the shell it contained. In section, however, it blended into ASTERIX and PISSARRO and the state of the shells was attributed to the effect of a rain water run down the cave wall at this point. BURNT SHELL is a lens some cm thick which is the result of the hearth above (DOCHATIX) and both of these units contain some shell from PISSARRO and possibly RUBENS. CLEANINGS AROUND HEARTH should be included with BURNT SHELL as the same unit.

SUMMARY

This is the taphonomic scenario presented at Tortoise Cave, remembering that it is an inferred reconstruction, albeit one that seems logical. It begins with a few visits in the early Holocene, followed possibly by a break until the mid - Holocene. When use of the shelter resumes the visits are more frequent, if not more regular, and most of the deposits at the site are



PLATE 3: SECTION ON Y/T INTERFACE SHOWING SHELL MIDDENS (PISSARRO, RUBENS,
FELIX), BURNT SHELL LAYER AND WHITE ASHY LENS (DOGMATIX).

attributable to the period between 4000 and 2000 BP. After the introduction of pottery and domestic animals into the area, there are a few occasions when the cave was used; these can be approximately counted by the successive patterned deposits in the basin, and number perhaps four or at most half a dozen. There is no evidence to suggest the existence of shell middens in primary context on the surface of the talus slope which might relate to this period. This indicates a further difference between these later visits and those of the pre - pottery era: that the talus was no longer a focus of occupation, a result either of reduced group size or of a more dispersed occupation pattern. These points require a wider perspective for resolution and will be reviewed in the final discussion. The reconstruction presented here is admittedly incomplete and therefore imperfect, but it provides the necessary detail for a fuller understanding of the excavated stratigraphy.

The deposits at the site are highly ^εdisturbed as a result of a variety of factors. The most important of these are: prehistoric excavation of the shelter; burrowing; trawling; and the slumping of deposits over steps in the bedrock or through the slope of the deposit. The burial in layer 9 caused considerable localised disturbance and slumping, and in view of the presence of scattered human bone elsewhere, this may be a more widespread effect than can be calculated. The effects of these factors is exacerbated by the unconsolidated nature of the deposits and the instability of the shell middens.

The net result is that the examination of the cultural remains by stratigraphic layer is at best a tenuous exercise, and that the only 'units' that may have real integrity are very loose groupings of these layers. This will tend to enlarge the sample size to a point where ^rintrusive elements will become insignificant. Even this is not certain, and ^rdemonstrably the presence of sheep remains throughout the post - hiatus levels must emphasise the need for extreme caution in the interpretation of results. What is needed is a program of refitting of both faunal and artefactual remains to derive some index of the degree of vertical displacement before the validity of any cultural variation is accepted.

CHAPTER 4: THE CULTURAL REMAINS

INTRODUCTION

Analysis of the faunal and artefactual remains recovered from Tortoise Cave is at present far from complete, with the exception of the lithic element, data from which are almost entire. In the light of what has been said concerning the stratigraphy and taphonomy of the site, there is little that can be said with conviction about faunal and artefactual frequency variation through time. Some apparent trends and clear changes are visible, and have affected the stratigraphic interpretation, either implicitly or explicitly. This discussion attempts to put these in their proper perspective, and to outline the cultural sequence as accurately as present knowledge permits.

It is important to note at this point that where analysis has been undertaken, it has been done using 'traditional' methods. Thus faunal M.N.I. (Minimum Number of Individuals) are calculated assuming the homogeneity of the stratigraphic units and the relative integrity of the derived layers. With the exception of the tortoise bone analysed from layers 2 and 3 for the spatial analysis in the next chapter, no attempt has been made to assess the degree of osteological displacement by matching body parts across the stratigraphic matrix. Before publication of a final report on the fauna, it is hoped that some attempt to do this will be made. Similarly, no systematic refitting program has been carried out on the lithic remains. This may in fact be quite impractical in that of the two most common lithic raw materials, quartz is remarkably homogenous^e in structure and silcrete may be highly varied, even within a single piece, in both colour and grain structure. Add to this the fact that the categories are somewhat subjective and that microscopic examination of both the 'quartz' and 'silcrete' classes is likely to show that they are composed of rocks of different types which are only superficially similar, and the prospect seems a daunting one.

The best chance for an effective assessment of disturbance therefore seems to lie with the fauna, but this in itself would require considerable work which the analysts themselves may be justifiably unwilling to undertake. This aspect of the project remains open and is the subject of future research.

THE FAUNA

Fish

From a sample in excess of 40 000 bone fragments from the 1978 and 1981 excavations, a total of 596 fishes from 9 marine species have so far been identified (Table 2). This count is based upon the identification of species from maxillae, premaxillae and dentaries. The M.N.I. from identified jaw bones is higher than that obtained from any of the 19 body parts used for counting or identification, and therefore constitutes the best count for the site as a whole. Although the addition of the remaining unsorted bone may affect the counts from layers 5 - 14 and will give some idea of the fish present in layer 10, some general trends are already visible.

The variation in frequency of the three most common species: the white steenbras (Lithognathus lithognathus); the white stumpnose (Rhabdosargus globiceps); and the haarder (Mugil cephalus) is particularly significant. The haarder, until recently common in the Velorevlei, is present throughout the deposit, although randomly distributed and in small numbers. Only in layer 2b is there significant concentration. Generally, the distribution of white steenbras is the same as that of the haarder, except that it is more common throughout. The concentrations of both species in layer 2b appear to be a combination of preservation and higher numbers of fish present. What is interesting in this respect is the relative increase in white stumpnose in the layers pre-dating 4 000 BP. Here the stumpnose rises in frequency to parity with the steenbras, at times even exceeding the latter in individual layers.

The other six species, present in low numbers prior to layer 9, virtually disappear after 4 000 BP. The sea-barbel, Tachysurus feliceps, is incidentally more common than the figures indicate, for otoliths are frequent in all units of the talus deposits. Whilst it is possible that this pattern reflects a change in human preferences and increasing concentration on selected species or even a change in fishing method, this seems unlikely and an environmental explanation is preferred. Both the white steenbras and the haarder can tolerate the low salinity of the vlei as it is today, when sea water enters the lower reaches once a year or less. The stumpnose and many of the other species, whilst often found in estuaries and vleis, require the higher salinity of a regular input of sea water. If, as is suspected, the inhabitants of Tortoise Cave were fishing in the middle reaches of the vlei below the shelter itself, this would suggest that the vlei at

LAYER	1a	1b	2a	2b	3	4	5	6	7	8	9	10	11a	11b	12	13a	13b	14	TOTAL
<i>Lithognathus lithognathus</i>	13	18	37	114	44	9	1	2	21	48	26	3	10	3	8	357			
<i>Mugil cephalus</i>	1	3	2	17	7			1	4	4	6	1	1	1	1	47			
<i>Rhabdosargus globiceps</i>	9	2	1	8	5	1	4	4	4	19	28	27	1	30	11	9	163		
<i>Argyrozomus hololepidotus</i>	1															2			
<i>Liza richardsonii</i>			1																1
<i>Pomatomus saltatrix</i>								3			4	1	4	1	13				
<i>Pachymelopoion blochii</i>												1							1
<i>Diplodes sorgus</i>											1		2	3	6				
<i>Tachysurus feliceps</i>													1	1	2	4			
Unidentified spp.																			2
TOTAL	24	23	40	140	56	10	2	5	6	5	48	85	62	4	4	48	20	20	596

TABLE 2: SPECIES OF FISH BY LAYER, TORTOISE CAVE 1978-1981.

that time was permanently open to the sea, and fully tidal as far upstream as the cave. The salinity provided by an input of sea water at spring tides would probably be insufficient to permit the penetration of these species some 4 km from the ocean.

Mammals

The species of terrestrial mammals recovered in the 1978 excavations and their relative significance are shown in Table 3. Not included here and as yet not fully studied are the seal bones found at Tortoise Cave. These were present throughout but did not appear to be common anywhere. Micromammalian remains were common in all levels, but in layer 1 it was noted that most bones of mice, shrews and small animals such as lizards and frogs were significantly fresher than the associated fish and bird remains, whilst larger mammals (lagomorphs, dune mole rats and small bovids) were mixed in appearance. It is suggested here that this implies a post-occupational input, and that the bulk of microfaunal remains may be the result of non-human utilisation of the shelter, rather than a part of the prehistoric diet.

The units in Table 3 are a coarse subdivision of the Tortoise Cave deposits into broad time segments. The M.N.I. provided for the 1978 excavations are based upon numbers in individual lenses, and the combination of these into the displayed rough groups of layers means that such figures are somewhat unreliable. For this reason, only an index of relative significance has been provided. This has been subjectively derived by estimation of numbers, animal size and probably dietary significance. Hence although there are four each of Bunolagus monticularis, Homo sapiens and Taurotragus oryx in layers 10 to 13, the first is considered of minor importance in dietary value compared to the third, whilst Homo sapiens is presumed present for totally different reasons. Similarly, three each of Sylvicapra grimmia and Ovis aries in the same units rate differently because it is apparent that the latter are intrusive at these levels.

In order of overall importance, antelope of the genus Raphicerus dominate the faunal list, and must account for about a third of the meat eaten at Tortoise Cave. The grysbok, Raphicerus campestris, is more common throughout than its counterpart Raphicerus melanotis, the steenbok. Even in the post-ceramic layers, this genus is three times as common as sheep. The M.N.I. of nine eland (Taurotragus oryx) is deceptive, and allowing for a fair amount of vertical movement,

the bones here could come from as few as two animals. In such cases it is exceptionally difficult to estimate the dietary importance of the animal concerned without a concerted effort at reconstruction and cross-checking. Of the others, the most important food species are the dassie (Procavia capensis), the dune mole rat (Bathyergus suillus) and the Cape hare (Lepus capensis), all of which could have been introduced to the site by agents other than man. The species marked '+' in Table 3 are represented by isolated bones and are considered as incidental inclusions in the faunal assemblage.

It is worth noting, although its significance is obscure, the fact that both the dassie and dune mole rat are far more frequent in the post-pottery levels. Conversely, the duiker (Sylvicapra grimmia) is present only prior to the introduction of sheep to the area. On this latter point, the obvious conclusion that these two species are mutually exclusive can be countered with reference to the present day situation, in which duiker are still available despite the importance of sheep farming in the region.

Other Vertebrates

This category comprises birds, tortoises and snakes, all of which are common throughout the deposits. Little work has been done on the identification of snakes in archaeological deposits, and at ^t_A Tortoise Cave the abundance of these reptiles can only be estimated on the basis of relative frequencies of vertebrae and costal fragments. From these, it would seem that snakes are far more common in the basin deposits after 1700 BP, but it may well be that this is due to the secondary nature of the outer cave deposits and that the bones are simply scattered over a wider surface when redeposited on the talus. It is uncertain whether snakes formed a part of the diet of the prehistoric hunter gatherers or of the several small carnivores represented in the faunal assemblage.

In square T2 a perfectly preserved burrow some 10cm below the surface was excavated, in which several abandoned tunnels had been completely blocked with the bones of micromammals and snakes. The tunnels were only some 6 to 8 cm in diameter, and would seem too small for anything as large as a mongoose. From the number of small carnivores such as shrews found in Tortoise Cave, it is possible that these animals were responsible for a substantial proportion of the snake and microfaunal element in the deposits.

SPECIES	LAYERS				
	1-3	4-8	9	10-13	14
<i>Lepus capensis</i> (Cape hare)	XXX		X	X	
<i>Bunolagus monticularis</i> (Hare)	X	X		X	
<i>Bathyergus suillus</i> (Dune mole rat)	XXX	XXX	XX	XXX	X
+ <i>Hystrix africae-australis</i> (Porcupine)				X	
+ <i>Papio ursinus</i> (Baboon)	X				
<i>Homo sapiens</i> (Man)	X		X	X	
+ <i>Canis mesomelas</i> (Jackal)	X			X	
<i>Ictonyx striatus</i> (Striped polecat)	X			X	
+ <i>Mellivora capensis</i> (Ratel)				X	
+ <i>Herpestes ichneumon</i> (Egyptian mongoose)				X	
+ <i>Herpestes pulverulentus</i> (Mongoose)	XX	X	X	X	
+ <i>Felis caracal</i> (Lynx)				X	
+ <i>Panthera pardus</i> (Leopard)	X				
+ <i>Orycteropus afer</i> (Antbear)				X	
<i>Procapra capensis</i> (Dassie)	XXX	XX	XX	XX	
+ RHINOCEROTIDAE (Rhino)	X				
<i>Taurotragus oryx</i> (Eland)	XX			XX	
<i>Sylvicapra grimmia</i> (Duiker)				XX	
<i>Raphicerus</i> spp. (Grysbok, Steenbok)	XXX	XXX	XX	XXX	X
<i>Ovis aries</i> (Sheep)	XX			X	
+ <i>Erinaceus</i> spp. (Hedghog)				X	

X- present, XX- noteworthy, XXX- significant.

TABLE 3: MAMMALIAN FAUNA. ENTRIES ARE A SUBJECTIVE ASSESSMENT OF IMPORTANCE ESTIMATED FROM M N I'S.

Tortoise remains are found in all units, and whilst there are variations between units (see Chapter 5) there seems little change through time in the proportion of tortoise to other bones. All sizes and both sexes are represented, and all bones seem likely to belong to one species, Chersina angulata.

Data on the species composition of the avian fauna are at present unavailable but the excavation notes and comment by the analyst (Graham Avery pers. comm.) suggest that there is an unusual predominance of vlei birds and waders. Flamingoes, darters, egrets and herons have all been noted, along with a number of small birds, although gulls, cormorants and penguins are also present. The indication is that the favoured hunting ground for birds, as for fish, might have been the vlei, although the sea shore cannot have been ignored in this context.

Human Remains

One fairly complete burial was excavated from the deposits immediately outside the cave (Fig. 4.1) and just in front of the rock step, probably in an area where slumping had already occurred. The disturbed nature of the deposits and the position of the skeleton close to what must have been the surface at the time have resulted in extremely bad preservation and the obscuring of the edges of the burial pit. What traces of this remain suggest that it was dug from just above the surface of layer 10, and that it therefore dates to between about 4100 BP and 3000 BP, although it is probably closer to the former. Most of the bone was treated with diluted cold glue to strengthen it for removal, and the ribs submitted were insufficient for a radiocarbon date.

Fragments of human bone from at least two other individuals have been recovered from the outer cave deposits, but these bones were scattered and did not constitute a burial.

Molluscs and Crustacea

The most obvious feature of the faunal assemblage at Tortoise Cave is the abundance of shellfish. Without exception, the shell middens are dominated by the black mussel, Choromytilus meridionalis, which provides about 75% of the total shell in samples by weight (range 65% to 92%). The rest of the middens are composed of the ribbed mussel, Aulacomya ater (2% to 26%), the whelks, Argobuccinum argus and Burnupena spp. (<1% to 22%) and limpets, particularly Patella granatina (1% to 5%) in various combinations. A number of other species are present in small

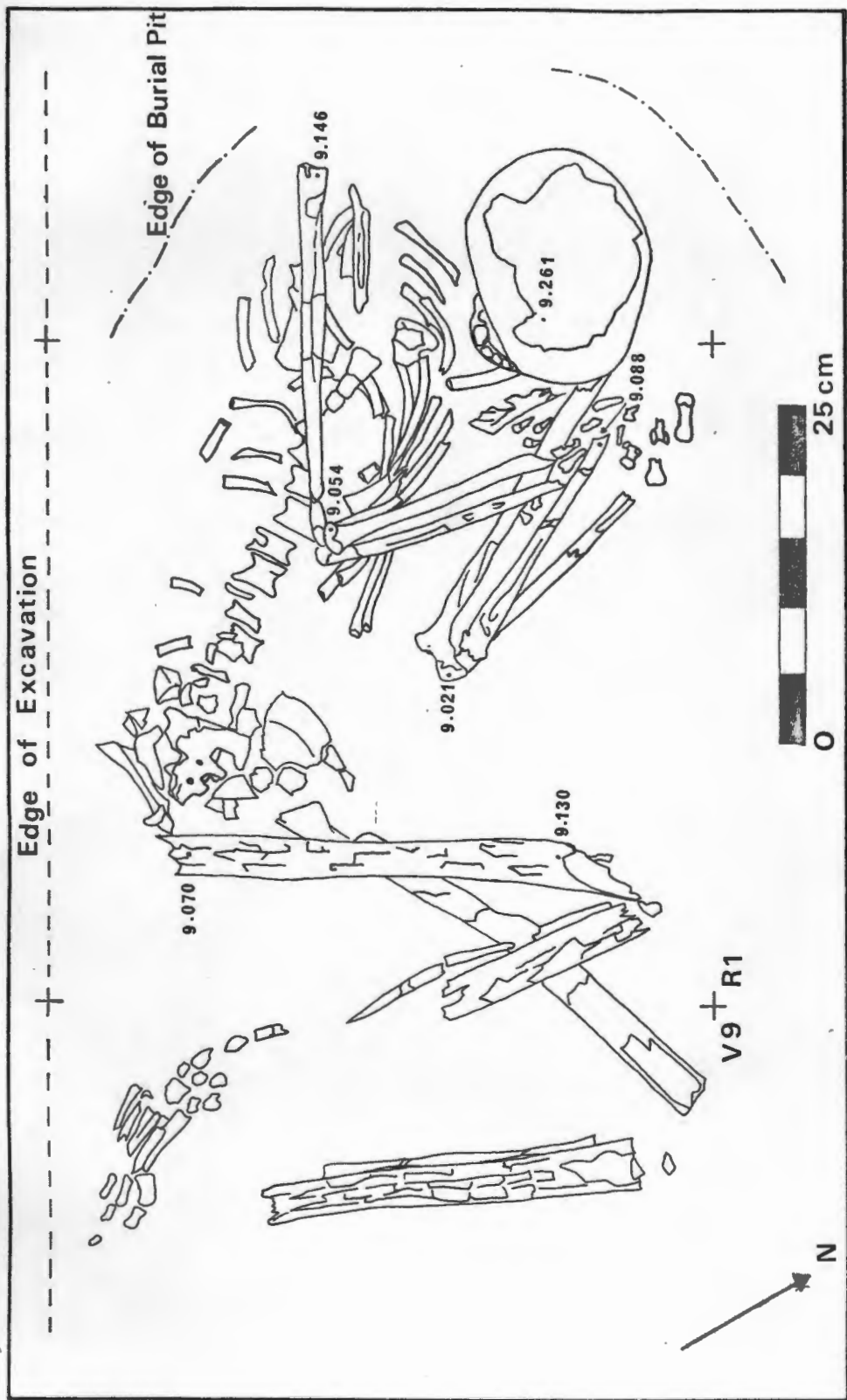


FIG.4.1. TORTOISE CAVE BURIAL NO.1

quantities. The high frequencies of Aulacomya (25,6%) found in RUBENS and Burrupena in ASH BELOW DAVE II (12,5%) may be spatially rather than temporally related phenomena, without which the Choromytilus content of the molluscan element would be consistently greater than 80%.

This pattern reflects a situation similar to that found at Mussel Point, the rocky outcrop south of Elands Bay Cave, and suggests that the shellfish may have been obtained from there rather than from Baboon Point, or the rocky southern shore of the bay itself. The alternative is that mussels were brought back to the shelter in preference to limpets, but this does not fully explain the presence of the limpets that are found in the midden.

There is no evidence of patterning in the molluscan fauna except that in the layers pre-dating 3500 BP the razor-claw Solens capensis is present. Although the numbers of animals of this species are noteworthy, their thin shell means that they have remained insignificant in contribution by weight. The presence of Solens capensis does, however, have environmental significance since these animals live in tidal mud flats and are not available in the ^rVelorevlei _k area today. As was the case with the fish, the evidence points to a situation in which the vlei was permanently open to the sea, saline and tidal well past Tortoise Cave, but still shallow and muddy.

Although some pieces which may be crab shell are present in the deposits, the most common crustacean represented is the rock lobster or crayfish Jasus lalandii. Generally only the mandibles of these animals survive, and these have been found in small numbers throughout the sequence. The mandibles represent animals of all sizes, and whilst they are perhaps not a major source of food, the regularity with which they occur suggests that they were deliberately sought and not merely scavenged. It is probable that prior to European predation, crayfish were more common and available in the larger rock pools of the intertidal zone, as the alternative seems to be systematic fishing, trapping or diving for them.

THE ARTEFACTS

Stone Artefacts

More than 10000 chipped stone pieces were recovered from acceptable units at Tortoise Cave. A standard typological analysis of these artefacts has been completed, using as its basis the stratigraphic layers described in the previous chapter. To improve the sample size and to reduce

errors of variation due to post-depositional processes, trends in the frequencies of artefact types and raw material use have been examined by combining these layers into four time segments. According to the ^{14}C dates these are as follows: the basin or post 2000 BP levels (layers 1 to 3); the lower talus levels from 2000 to 4000 BP (layers 4 to 9); the outer cave deposits from 4000 to 4400 BP (layers 10 to 13); and the pre-hiatus or 7000 to 8000 BP levels (layer 14). The lower talus layers in all probability date from 3000 to 4000 BP, but this is not proven by the sequence of dates obtained. The samples obtained from layers 1 to 3 and layer 14 are considerably smaller and perhaps less reliable than those obtained from the intermediate levels, and the dangers of attempting to compare samples of such disparate sizes is recognised. In the event, however, there seems little alternative if any analysis is to be undertaken at all.

(i) Raw Material: The lithic assemblage has been visually sorted into five categories of stone type, with only eight pieces falling outside this classification (Table 4). These latter pieces are shales or siltstones. It is worth noting that this visual classification is not always geologically sound. Thus some pieces classified as quartz may originate from metamorphic quartzite, and what is termed here as 'quartzite' is really orthoquartzitic sandstone from the T.M.S. formations. Hornfels or indurated shale tends to grade visually into 'quartzite' and the dividing line is established on a subjective assessment of both grain size and mineral content which affects the degree of patination. Perhaps the best category is the broadest, C.C.S. (crypto-crystalline silicates) which covers cherts, chalcedony, jasper and agate, but again there may be a certain admixture with fine-grained silcretes. 'Silcrete' as a raw material class has recently been shown by thin sectioning (undergraduate project, U.C.T.) to contain both true silcretes and a variety of complex volcanic rocks. It is understood here as a group of silicates having translucent quartz inclusions in an opaque matrix of micro-crystalline coloured silicates. Where the inclusions predominate, what are termed 'coarse-grained silcretes' phase into quartzite and sandstone, and where inclusions are rare small fragments may appear more akin to C.C.S. than silcrete as such. What is important in this classification is the range of availability and flaking potential of the rock types designated here. Quartz is common in the Sandveld, and despite its tendency towards blocky fracture is the predominant raw material used. It is less frequently used for the manufacture of formal tools, where more reliable conchoidal fracture is obviously preferred. Quartzite (sandstone) is the most available material, but is

LAYER	QTZ.	SILC.	CCS.	QTZITE	HORNF.	OTHER	TOTAL
1a	112	16	6	3	4		141
1b	28	2	2	4			36
2a	36	3	4	3			46
2b	49	14	6	4	2	1	76
3	108	22	7	6	3		146
TOTAL	333	57	25	20	9	1	445
%	74,8	12,8	5,6	4,5	2,0	0,2	99,9
4	6	1					7
5	351	76	12	6	2		447
6	574	95	11	8	7		695
7	543	217	16	12	3	2	793
8	396	120	8	17	3	2	546
9	1313	323	25	32	6		1699
TOTAL	3183	832	72	75	21	4	4187
%	76,0	19,9	1,7	1,8	0,5	0,1	100,1
10	737	400	9	37	4	1	1188
11a	350	185	8	17	3		563
11b	602	265	15	8	4	1	895
12	110	5	6	2	3		126
13a	566	160	1	33	3	1	764
13b	791	414	7	41	4		1257
TOTAL	3156	1429	46	138	21	3	4793
%	65,8	29,8	1,0	2,9	0,4	0,1	100
14	588	130	3	33	6		760
%	77,4	17,1	0,4	4,3	0,8		100

TABLE 4: LITHIC RAW MATERIAL FREQUENCIES BY LAYER.

too granular for most microlithic flaking, and tends to have been used only when larger pieces were sufficient. Silcrete is the most popular raw material for the manufacture of formal tools due to its local availability^b in an area where hornfels and C.C.S. are rare.
k

(ii) Typology: The classificatory system used here adheres for the most part to that generally used in southern Africa. A threefold division is made between waste (chips, chunks, flakes and cores), utilised pieces, and formal tools (retouched pieces). In the formal category, the important subdivisions are between scrapers, adzes, and backed pieces, whilst within the waste it is the proportion of flakes to blades or bladelets (blades under 25mm in length) that is normally deemed significant. Despite personal reservations, the exclusion of 'backed' scrapers from the backed category is adhered to here, but pièces esquillées are seen as an extreme product of bipolar core reduction and thus include core reduced pieces and are therefore classified with waste. Scrapers were sorted into 11 categories, which was reduced to 8 and is simplified in Table 5 to backed and convex scrapers. More detailed discussion of these subdivisions is not relevant here, but it should be noted that the observed variation appears in some cases to have functional rather than purely stylistic significance.

(iii) Size: All utilised pieces and formal tools were measured along their longest axis, and, for scrapers and segments, two measurements were taken on polar axes. Flakes, blades, chips and chunks were separated into size classes rather than measured individually, but an index of size per excavated unit or raw material is available.

(iv) Trends: An examination of the raw material distribution in Table 4 shows quite readily the preponderance of quartz and silcrete in the assemblage. Within this, two variations occur. In the post 2 000 BP levels, silcrete is less important relative to other raw materials. There is a commensurate increase in mean flake size during these levels. Layers 10 to 13 display a significant increase in the use of silcrete at the expense of quartz.

Table 4 shows further trends in time which may prove to be significant. Layer 14 has an exceptionally high frequency of waste material at the expense of both other major divisions. After the hiatus, however, waste percentages are steady at a little above 90%, whilst formal tools decrease in frequency with time as utilised pieces increase. The decreasing importance of the formal component would appear to be reflected in the declining frequency of silcrete in the

LAYER	CHIPS	FLAKES	BLADES	CORES	PIECES	UTILIZED	MRP'S	ADZES	UNIFACIAL	POINTS	DRILLS	BORERS	MISC. BKD.	SEGMENTS	BACKED	BLADES	BACKED	POINTS	BACKED	SCRAPERS	CONVEX	SCRAPERS	TOTAL	WASTE	BACKED	TOTAL	SCRAPERS	TOTAL	FORMAL	TOTAL	STONE
1a	77	48	2	2	2	7	2													1										141	
1b	22	11				3																								36	
2a	28	13				2	2													1										46	
2b	37	29	2	1	1	5														1										76	
3	66	55	5	6	6	6		6												1	1									146	
TOTAL	230	156	9	9	3	23	4	6							1	4	407			5	15									445	
§	51,7	35,1	2,0	2,0	0,7	5,2	0,9	1,3							0,2	0,9	91,5			1,1	33									100	
4	2	2			1	2																								7	
5	208	170	13	6	5	22	7	1							1	13				1										447	
6	271	324	32	11	7	25	5	2					1		4	2	11													695	
7	271	409	33	12	11	29	3	1					5	2	1	3	13													793	
8	235	255	12	7	6	6	9				1		2	1	1	3	7													546	
9	719	699	75	37	30	86	13		1		2		3	4	2	28														1699	
TOTAL	1706	1859	165	73	60	170	37	4	1		3	8	6	11	1	11	72	3863		26	83									4187	
§	40,7	44,4	3,9	1,7	1,4	4,1	0,9	0,1			0,1		0,2	0,1	0,3	0,3	1,7	92,3		0,6	2,0									99,9	
10	417	622	42	22	7	35	12	1					3	1	1	1														1188	
11a	204	249	27	16	7	31	8	2			1				1	1														563	
11b	341	392	42	29	9	40	8	1					2		6	3	1	21												895	
12	62	53	1	1	1	6										2														126	
13a	342	338	19	7	5	20						1	2	1	1	4	24													764	
13b	467	606	67	20	13	40	11						9	2	7	1	3	11												1257	
TOTAL	1833	2260	198	95	42	172	39	4	1		1	1	16	4	15	6	8	98	4428		41	106								4793	
§	38,2	47,2	4,1	2,0	0,9	3,6	0,8	0,1					0,3	0,1	0,3	0,1	0,2	2,0	92,4		0,9	2,2								99,9	
14	287	400	36	5	9	11	2						2	2	3	3														760	
§	37,8	52,6	4,7	0,7	1,2	1,4	0,3						0,3	0,3	0,4	0,4	0,4	97,0		0,5	0,8									100,1	

TABLE 5: TORTOISE CAVE LITHIC ASSEMBLAGE: FREQUENCY ANALYSIS.

assemblage. Within the formal category, the gradual reduction in the formality of tools is reflected in the decline of backed pieces and the increasing part played by miscellaneous retouched pieces (M.R.P.'s). There is a dramatic increase in adze frequencies after 2 000 BP, although actual numbers remain low.

In the waste category, two trends seem worth noting. There is an apparent increase in the ratio of chips and chunks to flakes and blades which is not raw material related, and seems to be part of the change towards increasing informality in the stone tool kit. At a less significant level, the flake/blade ratio remains constant prior to layer 3, but is almost doubled above this. Again, the trend is away from formalisation.

(v) Other Lithic Artefacts: Haematite and Limonite ochres of red, brown, yellow and black are found throughout the deposits, usually as small pieces of ferricrete or shale, although one very large piece of some 620 gms was recovered from VEEBEE. A few pieces of chalky calcrete indicate that white colourant was also used. Since there is no rock art associated with the site, it is suggested that the ochre was used primarily for body decoration. A similar explanation is offered for small amounts of specularite found in ALVIN (layer 3), but this latter is especially noteworthy in that the nearest known occurrence is some 200 km to the north-east. Upper grindstones, ground stone fragments, rubbers and hammerstones were randomly distributed through the deposits, and were made from locally available T.M.S. or conglomerate pebbles.

Non-Lithic Tools

Here the concern is with functional items of bone, shell, wood and other plant materials. There is little plant material preserved in the outer cave deposits, and no artefacts of wood, grass or reed. In fact, the only 'tools' of these materials are to be found in layer 1. The rest of the basin deposits contain only one or two seed beads, a few pieces of wood and the bedding in FRAN. This is either the result of long-term termite activity, or a lack of such items in the tool kit prior to the present millenium.

The assemblage from layer 1 includes a wide variety of functional items made from plant material: split reeds; twine; and two pieces of shaped wood. One of these last is probably a tip of a fine stick, cut off at one end, tapered and slightly charred at the other. The other is a



PLATE 4: BORED WOOD, BONE POINTS AND DECORATED BONE TUBE (SCALE IN CM).

cylindrical piece whittled to rounded ends, with a very small hole pierced at each end (Plate 4). The hole may run right through the piece, but is too small to thread. Its purpose is not known.

The twine is made from bark or grasses, and consists of several strands twisted together to form a cord 2 - 3 mm thick. Most specimens are knotted (Plate 5) and may once have been part of baskets or nets. Perhaps the most interesting piece comes from FOLD UP BEDDING, and comprises a wad of grass tightly bound together with thinner pieces of twine to form a curved cylinder some 14 cm long and 3cm in diameter. This may have been shaped as a handle of some sort. All specimens appear to have been chewed by termites or small animals, and this is perhaps why the knots alone have survived and why no such items, or bedding, are found in older levels.

Two pieces of split reed have survived to testify to the existence of reed mats in layer 1 at least. One piece has a clear perforation to allow a second reed through at right angles and is broken at the next split some 4,5 cm along the reed.

Other woodworking is implied by the presence of a few woodshavings and chipped or cut pieces of wood, but it is worthwhile noting that a number of bone pieces display similar working marks.

Bone tools are somewhat limited in type, and most pieces of 'worked bone' are either decorative or merely cut or scored by other tools. There were, however two recognisable bone tools, and again, these were most common in the basin units. In this instance it is thought that time, rather than preservation, may be the factor influencing distribution. By this is meant that since bone is preserved throughout the deposits, cultural change is the reason for the change in tool distribution. The bone implements in question are bone points, thought to be from projectiles such as arrows, and ground bone spatulas, generally believed to have been used to prise limpets from the rocks of the sea shore. Examples of these are shown in plates 4 and 6 respectively. Bone points are 4 to 5 cm long and about 3 mm in diameter. Apparently made from slivers of long bones, they have been ground round and tapered at each end, one end being brought to a point. In all specimens from Tortoise Cave, the sharp point at least has broken off. The spatulas vary in shape, at their best being ground to flat ^lellipses or flat ended pieces, whilst the most crude (Plate 6, Top) is simply a shapped metapodial ground to shape at



PLATE 5: GRASS BUNDLE BOUND WITH TWINE, LEATHER FRAGMENT, PIECES OF
KNOTTED GRASS TWINE.

one end to resemble a shoe-horn. All specimens have longitudinal surface striations apart from grinding marks, and two are rather intriguingly ochre stained.

One piece of leather (Plate 5) was recovered from the bedding in layer 1. It seems well cured but shows no signs of shaping or stitching.

Worked shell is uncommon, and limited to the species Donax serra, the white sand mussel. These shells, with extensively chipped edges and sometimes with a large central perforation, are known as 'Donax scrapers' although their real use is not understood. The consistency with which these implements were formed, however, negates any explanation other than deliberate manufacture as a tool. There is no consistent pattern of distribution of these implements at Tortoise Cave, although they may be marginally more common in the pre-pottery levels outside the shelter.

Pendants and Beads

Pendants are defined here as shaped, decorative pieces perforated off-centre to hang from a thread, whilst beads are centrally perforated for threading. Apart from one brass or copper pendant (Plate 7) all pendants were made from marine shells or pieces of them. Plate 7 illustrates pendants made from pieces of larger gastropods: Haliotis midae and Turbo sarnaticus. Every pendant is different: there are double and single perforations; milled and plain ground edges; and great variation in shape and size. By contrast, the whole-shell pendants in Plate 8 are remarkably uniform in style: several Bullia digitalis have the same triangular perforation opposite the aperture on the basal whorl, and all the Glycymeris pendants are pierced and ground in the same manner. Some of the latter are ochre stained rather like beads and it is possible that they were strung as such in a series of overlapping 'scales' rather than as hanging pendants. The other whelk has not been identified, but in view of its almost central perforation may also have been a bead and not a pendant.

The decorated avian long bone in Plate 4 is a somewhat unique piece which must have formed the central piece of a bead string. It is some 11 cm long, and along the central 8 cm or so is decorated with several rows of transverse nicks. The ends are ground or worn which is suggestive of stringing. Plate 9 illustrates the standard range of beads. An isolated copper bead from layer 1a is associated with the late glass beads, of which seven were found within a few cm of the surface inside the shelter.

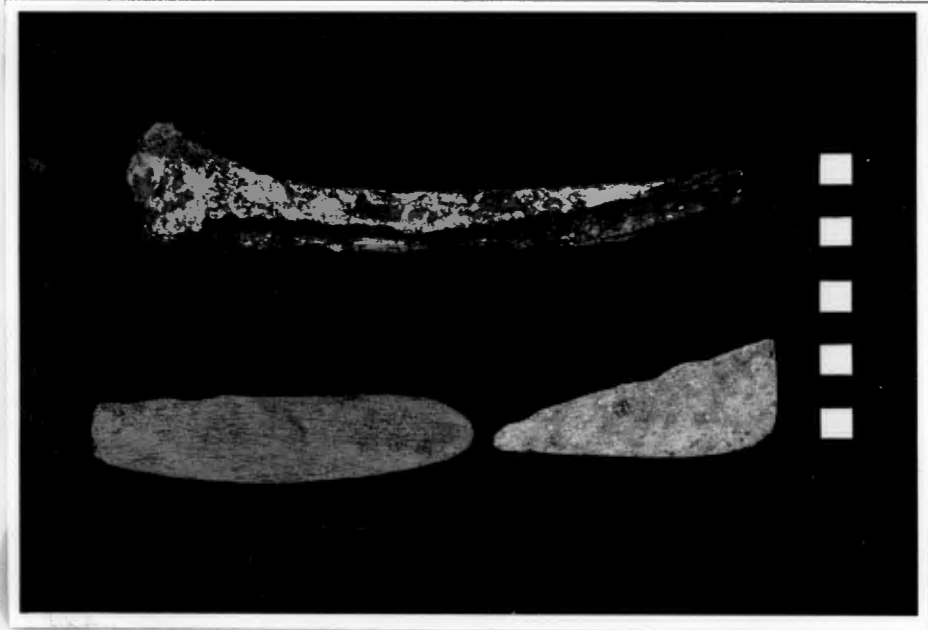


PLATE 6: BONE SPATULAE, TOP & BOTTOM LEFT ARE OCHRE STAINED.

Bone beads are of two types: discs and tubes. The former appear to be bone replicas of typical ostrich eggshell beads and are made from compact bone or possibly from tooth enamel. The latter are shaped and ground sections of avian long bone, generally undecorated. Seed beads are made from *Restionaceae* seeds, ground flat at both ends and bored out. Small periwinkles (*Natica* sp.) are made into beads by piercing the shell opposite the aperture in the same way as shell pendants were made. Many shell beads showed signs of ochre staining, but it seems likely that this may have rubbed off from body ochre, rather than applied deliberately to the beads themselves. All except the shell beads are found only in post-pottery levels in the shelter or near the surface (in TOPPERS or SPIT 1) outside, and it is likely that this diversity of bead making materials is a time related phenomenon.

Ostrich Eggshell

The most common non-lithic artefactual material at Tortoise Cave is ostrich eggshell (O.E.S.). Whilst much of this material is undoubtedly food residue, a great number of pieces show secondary working to make water containers, beads and other decorative items. Very few pieces of decorated O.E.S. (Plate 7) were found on the site, but several hundred finished, broken or partially completed disc beads were recovered from all levels of the dig. A preliminary examination of O.E.S. frequencies suggests that there is no significant time-related change in the amounts of O.E.S. and O.E.S. beads found at different levels. In FRAN (layer 2b), however, many of the O.E.S. pieces were ochre stained and may have formed a container for this commodity. The double perforated 'button' bead (Plate 7) is extraordinary and would seem to be most similar to shell pendants of the same form.

Pottery

Ceramic remains are limited to layers 1 to 3 and to the surface of the talus slope. In all, 36 pieces of pottery have been recovered, all plain, and with only two rim sherds. The bigger rim piece was externally thickened, round lipped and inverted. Sherd thickness ranges from 4 - 11 mm, with the mean just above 6mm. Colour varies from red to buff to black, and the temper is of

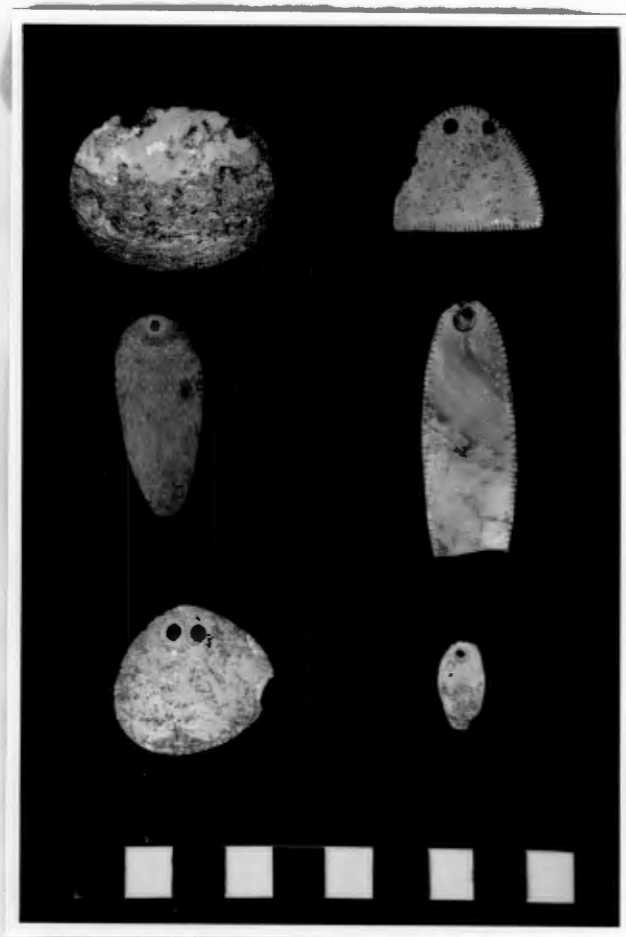


PLATE 7: PENDANTS. ALL MARINE SHELL EXCEPT CENTRE LEFT OF BRASS.



PLATE 8: SHELL PENDANTS AND BEADS.

unlikely that any reconstructions would shed light on vessel shape, as no pieces are larger than 7 cm in maximum dimension.

CONCLUSIONS

Even a cursory examination of the finds such as this shows that despite the disturbance evident everywhere at the site, changes and trends of a general nature can be identified where samples are large enough. The most significant breaks in all cases occur with the introduction of herding and ceramics to the area, causing shifts in artefact manufacture and possibly in diet. This latter applies in particular ^{to} the replacement of duiker in the diet by sheep and the utilisation of a greater variety of vertebrate fauna. Staple foods such as shellfish, grysbok and dune mole rat are unaffected. Artefactually, the change is evident in the increasing variety of decorative items and the use of bone wooden implements. It may be that bone points replace stone points (backed points and/or blades) for projectile tips at this time, accounting for the fairly radical change in the formal tool kit after 2 000 BP (Humphreys 1979).

Other changes in the faunal assemblage, such as the changes in fish species and the absence of the razor clam from the upper levels are thought to relate to changes in the vleis environment rather than to cultural factors.

The idea that there may be a terminal Pleistocene bladelet industry in the basal units at Tortoise Cave has been rejected on the evidence of the ^{14}C date from layer 14 (Pta 3596) and the similarity between this layer and those above it in lithic content. There is, however, evidence of a break in occupation and it is interesting to note how little change there is over this period.

It is only in the lithic assemblage that there is evidence of gradual change in the finds : a process which may have been exacerbated or expedited by the introduction of herding, but was not caused by it. This trend is in the gradual de-formalisation of the lithic assemblage, with the production of fewer flakes and blades, less formal tools and increasing use of unretouched or slightly modified (M.R.P.'s) flakes in their place. The low frequency of formal tools in layer 14 may possibly mean that the reverse of this process occurred during the hiatus, but it seems more likely that apparent changes are the result of a small sample from the basal units.

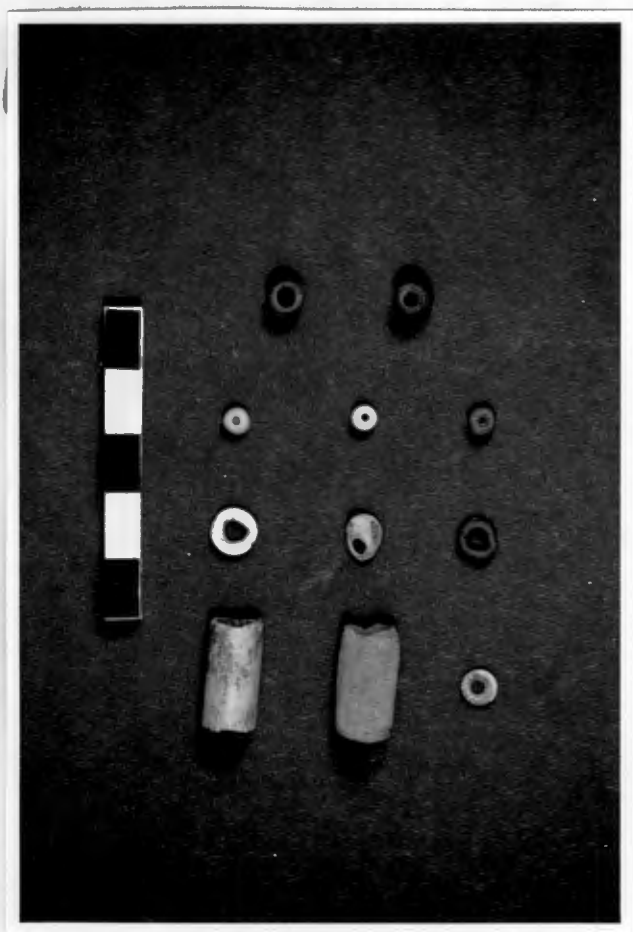


PLATE 9: BEADS. SEED (2x), GLASS (3x), BRASS/COPPER, SHELL, BONE DISC (2x),
BONE TUBE (2x).



PLATE 10: OSTRICH EGGSHELL: PIECE AT TOP RIGHT DECORATED, TOP CENTRE SHOWS MASTIC TRACES, BOTTOM CENTRE & LEFT HAVE GROUND EDGES.

It must be stressed here that only with more stringent controls on excavation and recording techniques, combined with post excavational programs to quantify the impact of disturbance, can more detailed comparisons of sites as Tortoise Cave be made with any degree of reliability.

CHAPTER 5: SPATIAL ANALYSIS

INTRODUCTION

One of the aims of this project was to investigate possibilities for the study of intra - site spatial patterning in the Western Cape. This chapter deals with the application of ~~of~~ certain statistical techniques for spatial analysis to some of the cultural remains from Tortoise Cave. For a number of reasons, the site is not very appropriate for effective spatial study, even with the low definition techniques described here. This outline should therefore be seen as a demonstration of the techniques and a step towards the establishment of some working hypotheses for further testing, rather than as a test of the hypotheses themselves.

Apart from the fact that Tortoise Cave is the first site in the western Cape on which a statistical analysis of this sort has been attempted, the rationale behind this decision lies in the failure of the site to meet the requirements of the underlying assumptions of spatial analysis: that the samples be shown to be homogenous^e and contemporary; that they are shown to be relatively undisturbed (ie that disturbance is insignificant); and that they be distributed on what can be equated to a planar surface. Added to this is the fact that many of the finer definition techniques cannot be used because they require exact-point plotting, which was not attempted at Tortoise Cave.

It was thought that a grid square analysis would be entirely inappropriate for the basin deposits, since the thickness and the extremely varied matrix of the layers would present too many variables to control for, given that post depositional disturbance might have had a marked influence on the location of materials. The outer cave deposits, having a relatively homogenous^e matrix and roughly similar volumes of deposit from square to square, showed more potential here. There was, however, one major problem: that the prehistoric excavation and redeposition of the shelter deposits on the talus would tend to obscure any patterning resulting from activities scheduled for the latter area.

In the post pottery basin layers, there is very little lithic material, but the same cannot be said of the faunal remains, which are common throughout. If this is as a result of a spatial preference; that stone working and tool use were much more common outside the cave it was felt that the re deposition process might not significantly affect patterning of lithic waste

established through activities performed on the talus, ^{The} alternative is that the change in quantities of lithic material might be time related, a theory out of keeping with evidence from layers 4, 12 and, to a lesser degree, from the VEEBEE series in layer 11a, most of which appears to be in a primary context. These units contain noticeably less stone than equivalent units outside the shelter such as HOME, MELANIE and DRIZZLE, and tend to add support to the spatial differentiation hypothesis.

It is possible, therefore, that some spatial patterning may be preserved on the talus, albeit at a rather coarse scale. Since the lithic component does not vary much in the pre - pottery levels, it is also possible that the arbitrary nature of the layers might not significantly affect this patterning, provided that the disturbance by burrowers has not been too extensive and has been directionally random. These are assumptions which cannot be tested here, but which are necessary for the interpretation of any observed spatial patterning.

Quartz and silcrete are the most common raw materials for stone working on the site, and were thus chosen for analysis. Further, it is argued that the high numbers of waste pieces (chips, chunks, flakes and blades) in these materials provides a safeguard against fluctuations through artefact displacement, and in particular through overprinting. The waste was initially separated by size into pieces of under 10mm and under 25mm in maximum dimension (the latter inclusive of the former). The reason for this was that most unbroken utilised or retouched pieces fall between the two sizes and the smaller size class is most likely to have remained at the locus of manufacture. It was also felt that this subdivision would act as a check against the possible effects of sorting by size during disturbance.

OUTLINE OF TECHNIQUES

The possibility that spatial patterning still exists in the outer cave deposits was tested by use of Court's method for map comparison (Norcliffe 1977:128). This method compares two variables over the same areas for spatial correspondence. Because the method compares two variables, which are here both contained in units of equal area and volume, and does not compare one spatial unit to another, the problems inherent in most quadrat methods of analysis are negated. Thus the choice of grid size and location, and of thickness of deposit are not relevant to establish correspondence. If the loci of correspondence are compared in their relative grid

positions, and this is not specifically part of Court's method, it is possible to observe patterns of a general nature, but it is important to note that here the thickness of deposit and the grid are as influential as in any other analytical technique.

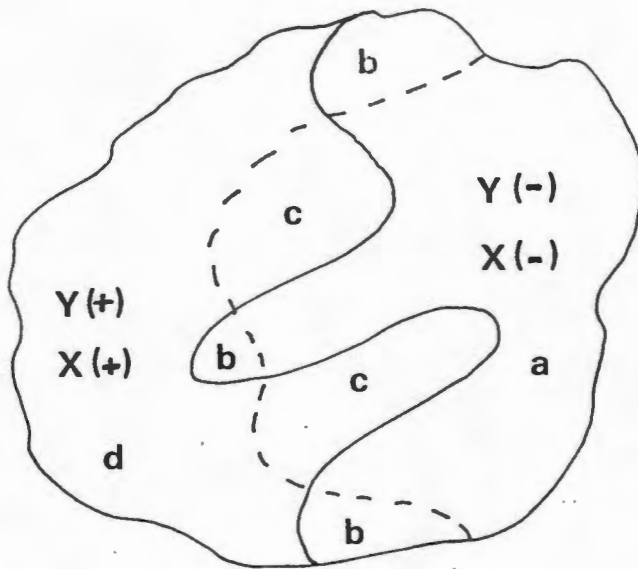
All data on each variable from each division of the 'map' are compared to the median value for that variable, and separated into areas above and below the median value. If the results from both variables are combined, the 'map' is divided into four zones (Fig. 5.1): areas where both values are above the median, areas where both are below, and two zones of areas where one variable is above its median and the other below. If there is no correspondence (ie the variables are distributed randomly with respect to each other), the four zones should be of roughly equal area. If the two are mutually dependent, the areas in which only one variable is above the median should be few, and the opposite is true if the variables are mutually exclusive. The measurement of significance is achieved through use of the coefficient of medial correlation (q), which can vary between +1 and -1. The formula for q is described below when the application of the method is outlined. Layers 9, 11 and 13a were chosen for this test, as layers 10, 12 and 13b were too limited in extent, and layer 14 contained AMONGST ROCKS which was not curated strictly according to grid square.

An attempt was then made to define the size and orientation of clustering by using Whallon's (1973a, 1973b) method of Dimensional Analysis of Variance. In this method, an area of the grid of specified dimensions is chosen for analysis. The entire grid must form a square or rectangle, the sides of which must be in the ratio 2:1. The total number of basic quadrats in the grid must also equate to some power of two (2, 4, 16, 32, etc).

The technique involves calculating within this grid the mean square values (see brackets below) for each geometrically increasing block size (j), beginning with the smallest quadrat and doubling the size at each step. In this way, mean square values (the average for the square of the variable values in each quadrat) are obtained, for each grid square, for each pair of squares (every quadrat belonging to only one pair), for each group of four squares and so forth, until only two quadrats are compared to cover the entire grid (ie the block size is half that of the grid). Basically, cluster sizes are then identified as high mean square values.

The problem is that archaeological grids rarely conform to such a stringent symmetry and

a/



--- Median X

— Median Y

b/

		Variable X	
		Below median (-)	Above median (+)
Variable Y	Below median (-)	a	b
	Above median (+)	c	d

FIGURE 5.1

COURT'S METHOD OF MAP COMPARISON: THEORY

invariably, to form a suitable grid format, quadrats at the edges of the excavation must be excluded from the analysis or extra, unexcavated, squares added as 'dummies'. Riley (1974) mentions that the exclusion of areas at the edge of the grid will tend to skew the results, but since no evidence was led to support this contention, its effect cannot be assessed immediately.

The other common criticism of the method involves the possible addition of 'dummy' quadrats to fill the corners of the analysis area where the excavation grid is irregular. Whallon (1973) suggests that these squares be given zero values, and that provided the number of 'dummy' quadrats is comparatively small this should not seriously affect the results. He does not state the minimum ratio of dummy to real squares, but experiments conducted during this project have shown that below a ratio of 1:12 the zero value leads to erroneous results. It was found in all cases that the mean value for all adjacent quadrats was more applicable and seems theoretically preferable. The limitation on the number of 'dummy' squares defined by experiment meant that only layer 9 could effectively be analysed by this method.

The position and orientation of the grid and the area of the smallest quadrats can totally alter the results of the analysis. Consider a dense circular concentration of artefacts, about 1m in diameter, located directly beneath a grid peg, and consequently spread equally between four grid squares. If the concentration is dense enough, it will show up as a cluster at the 4 square meter level! Conversely, it may be totally absorbed within the possible range of random variation and not show up at all. Similarly, small (for example 30cm diameter) concentrations centrally placed in a number of squares will only show as clusters at the smallest block size, in this case 1 square meter. Arcuate or linear concentrations at different scale or differently orientated will also produce anomalous results.

Equally important, and hardly mentioned in the literature, are the importance of the orientation and position of the analysis on the grid, as in itself this can create the same problems mentioned above.

One way around this is to create a controlled set of artificial data with concentrations of specific shapes, sizes and orientations located regularly across the grid. By representing the resultant mean square values graphically, it is possible to build up a set of characteristic 'spectra' of various cluster patterns. Up to the point where the patterns become obscured, it is

GRID SQUARE	<10		<25		TOTAL
	QTZ.	SILC.	QTZ.	SILC.	<25
R4	27	0	85	4	89
S4	6	0	19	0	19
L	17	1	39	1	40
F	7	0	11	0	11
R3	39	3	137	15	152
S3	22	0	69	11	80
M	6	1	26	2	28
B	1	0	9	0	9
R2	46	5	195	22	217
S2	14	3	69	19	88
N	16	4	33	11	44
R1	53	3	188	36	224
S1	4	2	18	8	26
O	22	3	39	14	53
P	12	1	27	6	33
Q	1	0	5	0	5
V9	29	3	92	33	125
W9	28	4	91	13	104
MEDIAN	16,5	1,5	39,0	6,5	

TABLE 6, LAYER 9: QUARTZ AND SILCRETE WASTE(CHIPS, CHUNKS, FLAKES, AND BLADES) BY SQUARE IN TWO SIZE CLASSES WITH A COMBINED TOTAL.

GRID SQUARE	<10		<25		TOTAL
	QTZ.	SILC.	QTZ.	SILC.	<25
T2	1	1	7	1	8
T	2	0	26	2	28
Y	5	0	21	7	28
J	1	0	2	0	2
S4	1	0	9	0	9
L	7	0	39	4	43
F	1	0	13	2	15
G	3	0	20	2	22
M	23	3	77	15	92
B	32	3	80	10	90
C	6	1	25	6	31
E	0	0	5	0	5
S2	52	18	116	86	202
N	44	16	152	82	234
D	4	1	32	5	37
O	33	13	104	53	157
P	3	2	27	13	40
Q	9	3	38	19	57
MEDIAN	4,5	1	26,5	5,5	

TABLE 7, LAYER 9: QUARTZ AND SILCRETE WASTE (CHIPS, CHUNKS, FLAKES AND BLADES) BY SQUARE IN TWO SIZE CLASSES WITH A COMBINED TOTAL.

GRID SQUARE	< 10		< 25		TOTAL
	QTZ.	SILC.	QTZ.	SILC.	< 25
L	2	5	6	11	17
M	5	3	27	9	36
C	27	0	62	0	62
S2	87	15	187	48	235
N	41	12	122	51	173
A					
D	14	5	69	18	87
S1	14	22	42	75	117
O	26	11	108	43	151
P	25	5	46	10	56
Q	3	0	26	18	44
MEDIAN	19,5	5	54	18	

TABLE 8, LAYER 13: QUARTZ AND SILCRETE WASTE (CHIPS , CHUNKS, FLAKES AND BLADES) BY SQUARE IN TWO SIZE CLASSES WITH A COMBINED TOTAL.

also possible to create 'spectra' of different combinations of patterns. This entails a considerable amount of time and effort and should only be attempted when a great deal of data requires analysis by this method.

Alternatively it is quicker, although less reliable, to simply run the data several times shifting the point of origin and orientation of the analysis. The size and location of concentrations is then determined deductively by comparison of the resultant 'spectra' of these runs. For the Tortoise Cave analysis, this latter method has been used, although a number of spectra have been assembled for future use.

APPLICATION OF COURT'S METHOD FOR MAP COMPARISON

Tables 6, 7 and 8 list the data employed in this test for each layer. Figures 5.2, 5.3 and 5.4 show the relevant grid layouts and correspondence matrices for the analysis in both size classes. Where individual readings fell on the median, both the best and worst possible placement of these on either side of the median line was tried. The coefficient of medial correlation (q) is defined with reference to these matrices (see Fig. 5.1b) as

$$q = \frac{(a + d) - (b + c)}{a + b + c + d} \quad (1)$$

The critical value of q (q_{α}) relevant to the desired level of significance (α) is defined thus:

$$q_{\alpha} = \frac{z}{N} + \frac{z}{\sqrt{N}} \quad (2)$$

where z is a constant related to the value of α chosen, and N is the number of observations involved. In this analysis, N refers to the number of grid squares analysed. Values for q_{α} were calculated at levels of significance $\alpha = 0,01$ and $\alpha = 0,05$.

Table ⁹ gives the results of the analysis which shows significance in only two instances where $\alpha = 0,05$ and none at $\alpha = 0,01$. This is due in part to the small number of observations (N), but may have more to do with the size of each unit. Obviously, had it been possible to analyse the entire grid in 50cm squares, N would be substantially increased and q reduced. This procedure is necessary to produce any results from an area the size of that containing layer 13a. But more than this, there is a visual pattern to the zonation of the grid plan which shows low stone densities around the mouth of the shelter and towards the steeper slope of the talus, with

a/

+	-	-	-	+	-	-	-
R4	S4	L	F				
+	+	+	-	-	-	-	-
R3	S3	M	B				
+	+	-	+	-	+	//	
R2	S2	N	A				
+	+	-	+	+	+	-	-
R1	S1	O	P	Q			
+	+	+	+				
V9	W9						

QUARTZ / SILCRETE WASTE < 10cm

b/

		QUARTZ	
		-	+
SILCRETE	-	6	3
	+	3	6

c/

+	-	-	-	⊕	-	-	-
R4	S4	L	F				
+	+	+	+	-	-	-	-
R3	S3	M	B				
+	+	+	+	-	+	//	
R2	S2	N	A				
+	+	-	+	⊖	+	-	-
R1	S1	O	P	Q			
+	+	+	+				
V9	W9						

⊕ = Value on median

QUARTZ / SILCRETE WASTE < 25cm

d/

		QUARTZ	
		-	+
SILCRETE	-	7	2
	+	1	8
Best case			
		QUARTZ	
		-	+
SILCRETE	-	6	3
	+	2	7
Worst case			

FIGURE 5.2

COURT'S METHOD: LAYER 9

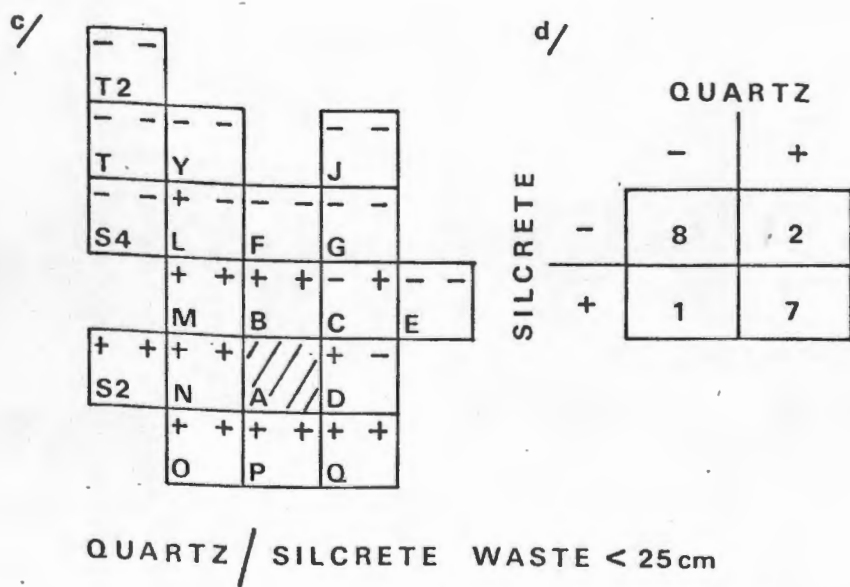
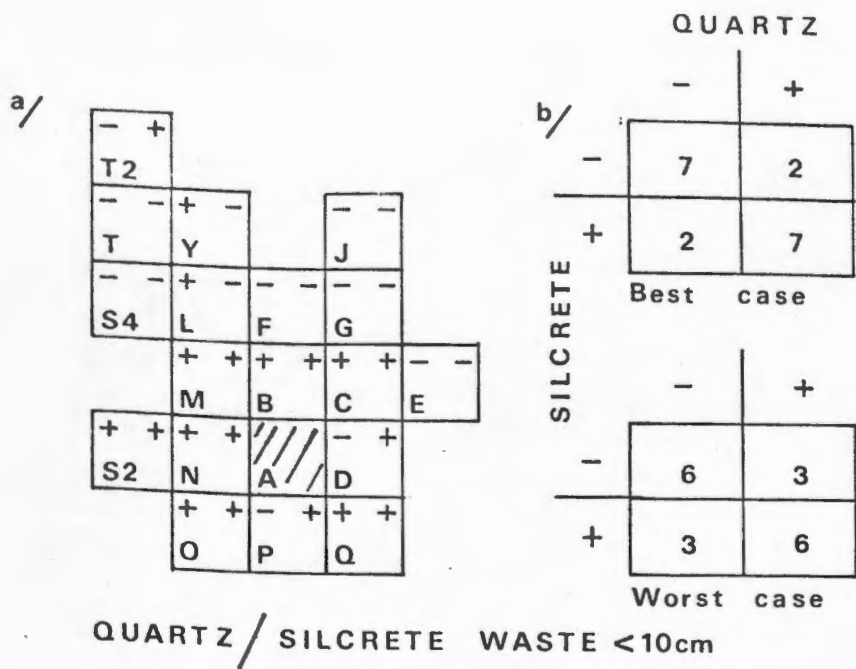


FIGURE 5.3 COURT'S METHOD: LAYER 11a

LAYER	SIZE	N	CRITICAL VALUES		FOUND VALUES	
			$q_{0,01}$	$q_{0,05}$	$q(\text{worst})$	$q(\text{best})$
9	10	18	0,719	0,573	0,333	0,333
9	25	18	0,719	0,573	0,444	0,667
11	10	18	0,719	0,573	0,333	0,555
11	25	18	0,719	0,573	0,667	0,667
T3a	10	10	1,016	0,820	0,200	0,600
13a	25	10	1,016	0,820	0,200	0,600

TABLE 9, VALUES OF THE COEFFICIENT OF MEDIAL CORRELATION (q) TESTING CORRESPONDENCE OF LITHIC FOCI.

increasing density towards the southern edge of the excavated area. If the grid squares were smaller, or subdivided, it is likely that the 'grey area' of non-correspondence would be substantially reduced relative to the number of observations.

The danger here is that the smaller the quadrat, the lower the artefact density, and therefore the more chance that the median value will be commonly represented. This means that a range of combinations will be possible, and that the subjectivity of the analysis will be increased. One further observation: the anomalous result obtained from square 5.1 in layer 9 may be caused by the extreme thinness of the deposit at this point and the domed surface of layer 10 below.

This is only visible by comparing results from adjacent quadrats thus attempting a more common style of spatial analysis. It is important to understand that it does not indicate a sensitivity to deposit thickness in Court's method itself.

APPLICATION OF DIMENSIONAL ANALYSIS OF VARIANCE

With such insignificant results from the preliminary analysis, any attempt at greater definition seems futile. In addition, the apparent gradient of increasing lithic density towards the southern extremity of the dig suggests that there is little chance of closely defining discrete areas of manufacture. Therefore this section, more than any other, should be seen as a demonstration of the method rather than an analysis in the true sense.

The concept of the contiguous quadrats method has been outlined above. The method involves an analysis of mean square values. These are calculated from the sum of squares (S_j) of all observations at block size (j):

$$S_j = \frac{1}{j} \sum_i^{T/j} N_{j(i)}^2 \quad (3)$$

where $N_{j(i)}$ is the observed value in a block i of a quadrat of size j , and T is the total number of quadrats of the smallest block size ($j = 1$). The variance between blocks is calculated as the 'mean square' (M) so that:

$$M_j = \frac{(S_j - S_{2j})}{(T/2j)} \quad (4)$$

a/

		-	-		
		L			
		-	-		
		M			+ -
+	+	+	+	A	- -
S2	N			D	
-	+	+	+	+	- -
S1	O	P		Q	

QUARTZ / SILCRETE WASTE < 10

b/

		QUARTZ	
		-	+
SILCRETE	-	4	1
	+	1	4
Best case			
		QUARTZ	
		-	+
SILCRETE	-	3	2
	+	2	3
Worst case			

c/

		-	-		
		L			
		-	-		
		M			+ -
+	+	+	+	A	+ +
S2	N			D	
-	+	+	+	-	- -
S1	O	P		Q	

QUARTZ / SILCRETE WASTE < 25

d/

		QUARTZ	
		-	+
SILCRETE	-	3	2
	+	2	3

FIGURE 5.4 COURT'S METHOD: LAYER 13

where $T/2j$ define the degrees of freedom. Hence S_{2j} is always less than S_j and M_j is always positive. Also, it is apparent that the largest block size for which a value of M can be obtained is half the grid size, at which level the analysis compares one half of the grid to the other.

The analysis was run on a micro-computer using a specially written BASIC program. In all, nine runs were taken on layer 9, four on layer 11 and two on layer 13. To produce different orientations for the two last layers, two 'dummy' squares were added. This was considered methodologically unsafe and the runs on layers 11 and 13 were not used. The results of seven runs from layer 9, tabulated in Table 10, are used here for demonstration. A graphic display of the mean square values for the various block sizes (Figs. 5.5a & 5.5b), and the interpretation of results is based on this graph. The inset grid plans show the location and orientation of the runs involved.

Comparing first the results of the east-west runs (Fig. 5.5a), the most obvious feature is the prominent peak indicating a concentration at block size 2 ($2M \times 1M$ quadrats) in the analysis originating from V9. In moving the point of origin one square west to R1, this peak is split between block sizes 1 and 2. This run is clearly off centre, and suggests that the size two clusters are focussed on V9 - R1, R3 - R4 etc, rather than in this framework. Now, by shifting the origin to S1, the split peak is still visible, augmenting the previous suggestion, but has become insignificant, adding to the definition by locating the concentrations in the V9 - R4 row of squares. The run originating in square 0 similarly shows no significant pattern.

The analysis is then re-orientated to run north-south and groups of eight grid squares originating in R4, R3 and R2 are tested (Fig. 5.5b). The runs from R2 and R3 both appear as mirror images of the V9 run, and are indicative of linear clusters at right angles to the axis of analysis. When the origin is in R4, the peak at block size one disappears and the peak at block size 4 ($2M \times 2M$) is significantly reduced. This defines the western edge of the clusters as occurring in R3 and S3.

One interpretation of this data set would be to conclude that a three square linear concentration exists in squares R1, R2 and R3 perhaps overflowing into V9 and R4, but not significantly affecting squares S1, S2 and S3. This ignores the data from the runs originating

ORIGIN	V9	R1	S1	0	R2	R3	R4
	92	188	18	39	195	137	85
	188	195	69	33	69	69	19
	91	18	39	27	188	195	137
	18	69	33	(27)	18	69	69
	195	137	69	26	33	26	39
	137	85	19	39	(27)	9	11
	69	69	26	9	39	33	26
	69	19	39	11	27	(27)	9
MEAN SQUARE VALUES							
BLOCK SIZE 1	2238,6	4891,7	509,2	26,1	5619,5	2603,1	1256
BLOCK SIZE 2	8359,6	4229,0	66,3	293,6	425,0	498,6	1328
BLOCK SIZE 3	820,1	12,5	8,0	210,1	14792,0	17578,1	6328

TABLE 10, LAYER 9: DATA FOR DIMENSIONAL ANALYSIS OF VARIANCE ON QUARTZ WASTE UNDER 25mm IN SIZE. ESTIMATED VALUES FOR SQUARE A BRACKETTED.

V9	R1	R2	R3	R4
W9	S1	S2	S3	S4
	O	N	M	L
	P	A	B	F

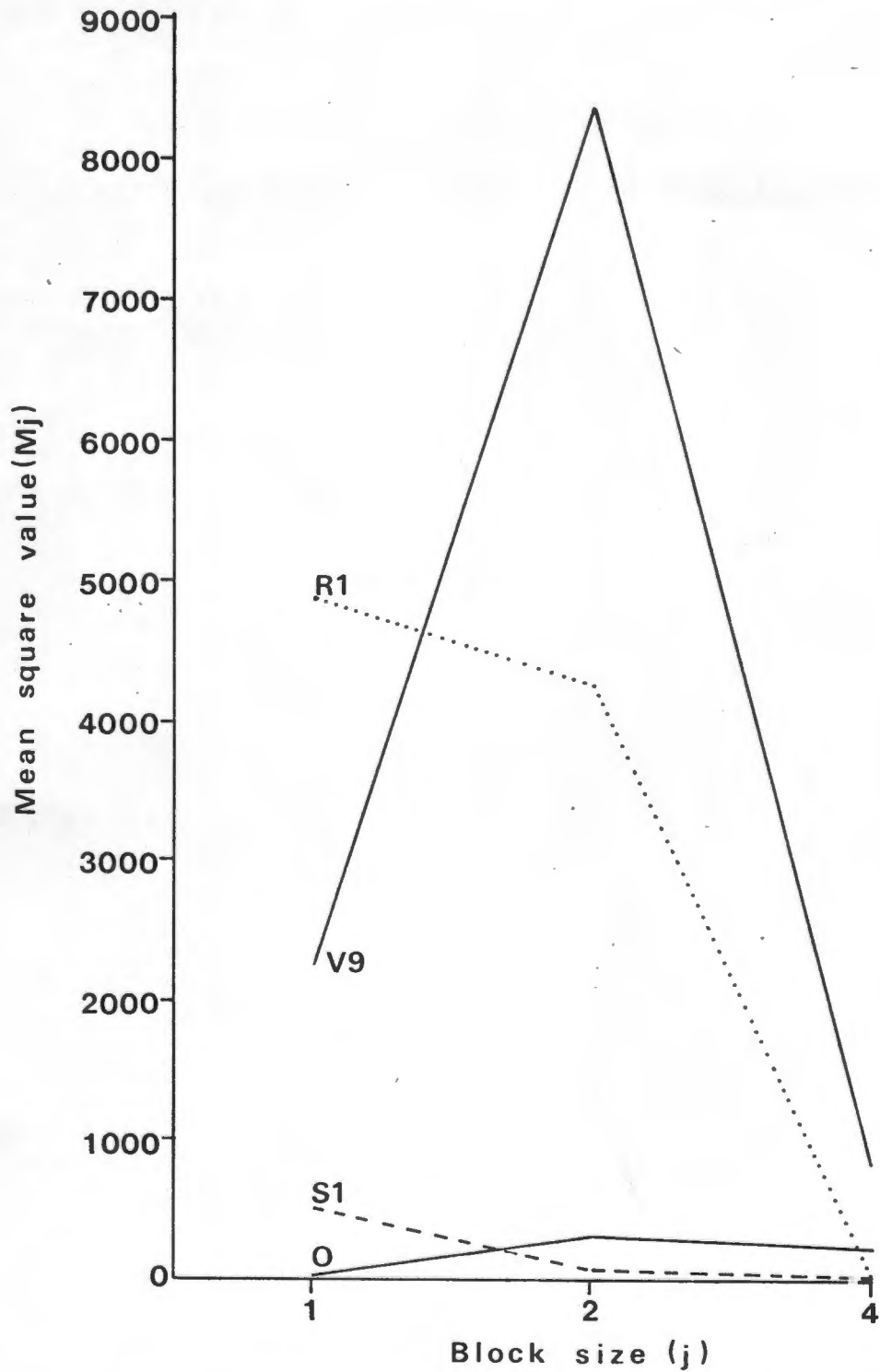


FIGURE 5.5a DIMENSIONAL ANALYSIS OF VARIANCE: LAYER 9

R1	R2	R3	R4
S1	S2	S3	S4
O	N	M	L
P	A	B	F

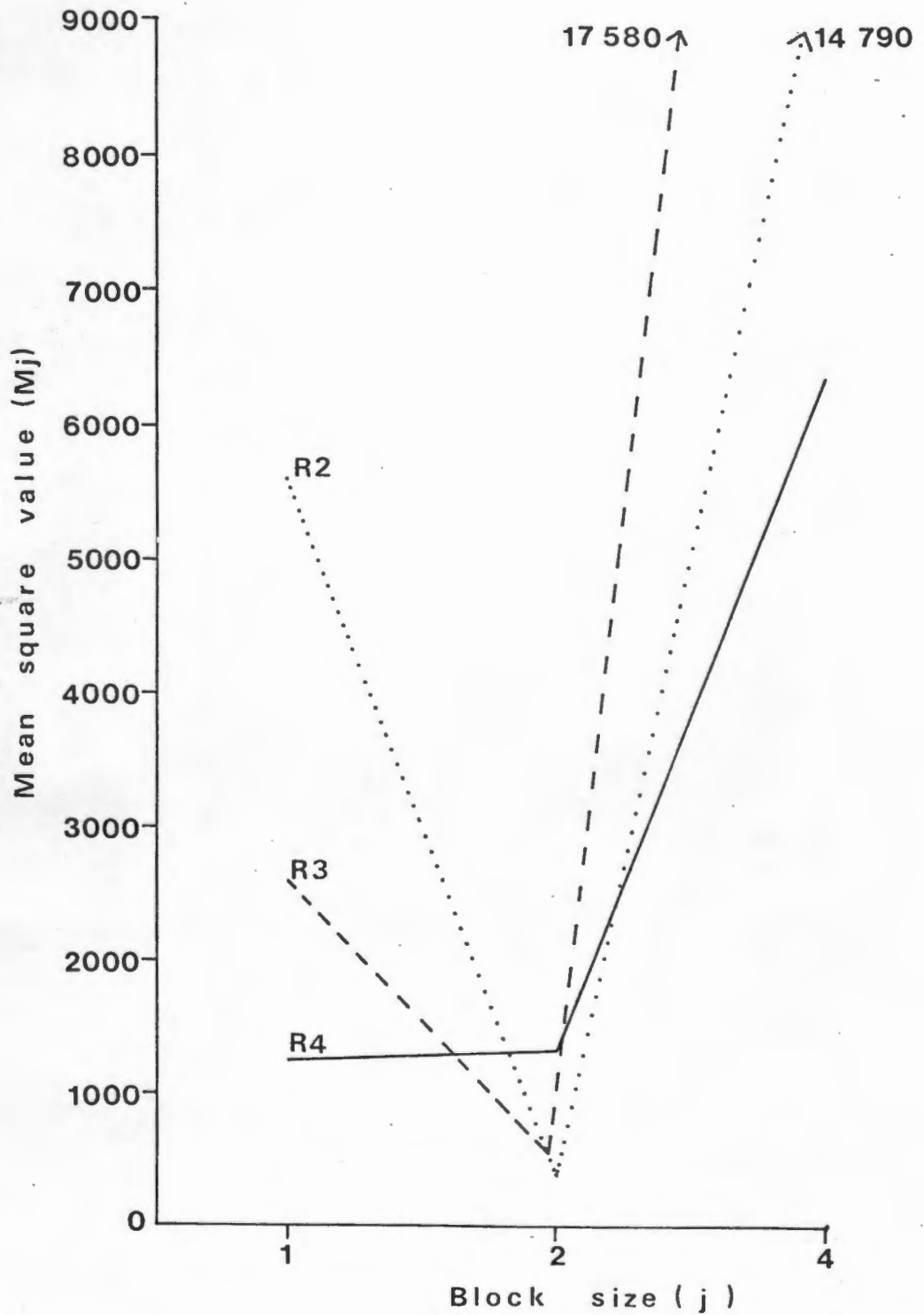


FIGURE 5.5b DIMENSIONAL ANALYSIS OF VARIANCE: LAYER 9

in S1, 0 and R4. If all results, both significant and insignificant, are examined, the only valid conclusion is to confirm that layer 9 contains a trend of increasing lithic density running approximately north-west to south-east from M to R1. It must be equally apparent that this conclusion could not be reached with only one or two runs even by utilising the sixteen square option available.

ANALYSIS OF THE BASIN DEPOSITS

The units inside the shelter can be divided into five types: shell middens; hearths; ash heaps; bedding; and soil dominated horizons. It has been asserted that the soil units (including the gritty lenses) are the combined result of post-occupational aeolian action and the movement and breakdown of existing cultural debris by termites and burrowing animals. They all contain more prominent quantities of bedding material, and it is felt that much of the area they occupy was used in prehistory as a bedding zone. This is particularly noticeable in layer 1, where recognisable bedding units still exist, and the presence of a remnant bedding patch in FRAN (layer 2a) suggests that the pattern existed then.

In the soil horizons, and therefore amongst the bedding units, there is ample evidence of the existence of small hearths. Probably, as in layer 1, these were placed alongside or between individual bedding units. The ash heap in layer 3 (ASH BELOW DAVE) is thought to be the result of numerous smallish hearths built in a central, generalised hearth area. This part of the pattern is not present in layer 2, but the beginnings of it are probably represented by GAWDP in layer 1. It is possible that HALS in layer 2a is a small version of the central hearth, as is the ashy FEATURE AMONGST ROCKS, but the scale of the ABD heap is never repeated. It is difficult to interpret the hearth-marker DOGMATIX, but the whiteness of the ash, low charcoal content and the effect it has had on the midden below are all indicative of a single large and hot fire.

The middens themselves form the most consistent part of the pattern: they ring the basin, but the greatest quantities of shell are found piled around the edges of the shelter, and their extension towards the drip line appears to be more of an overflow. Any serious build up of shell here would, of course, tend to make access to the shelter awkward and this may be the rationale behind this layout.

The generalised pattern which emerges from this and which is evident from the plans of the basin

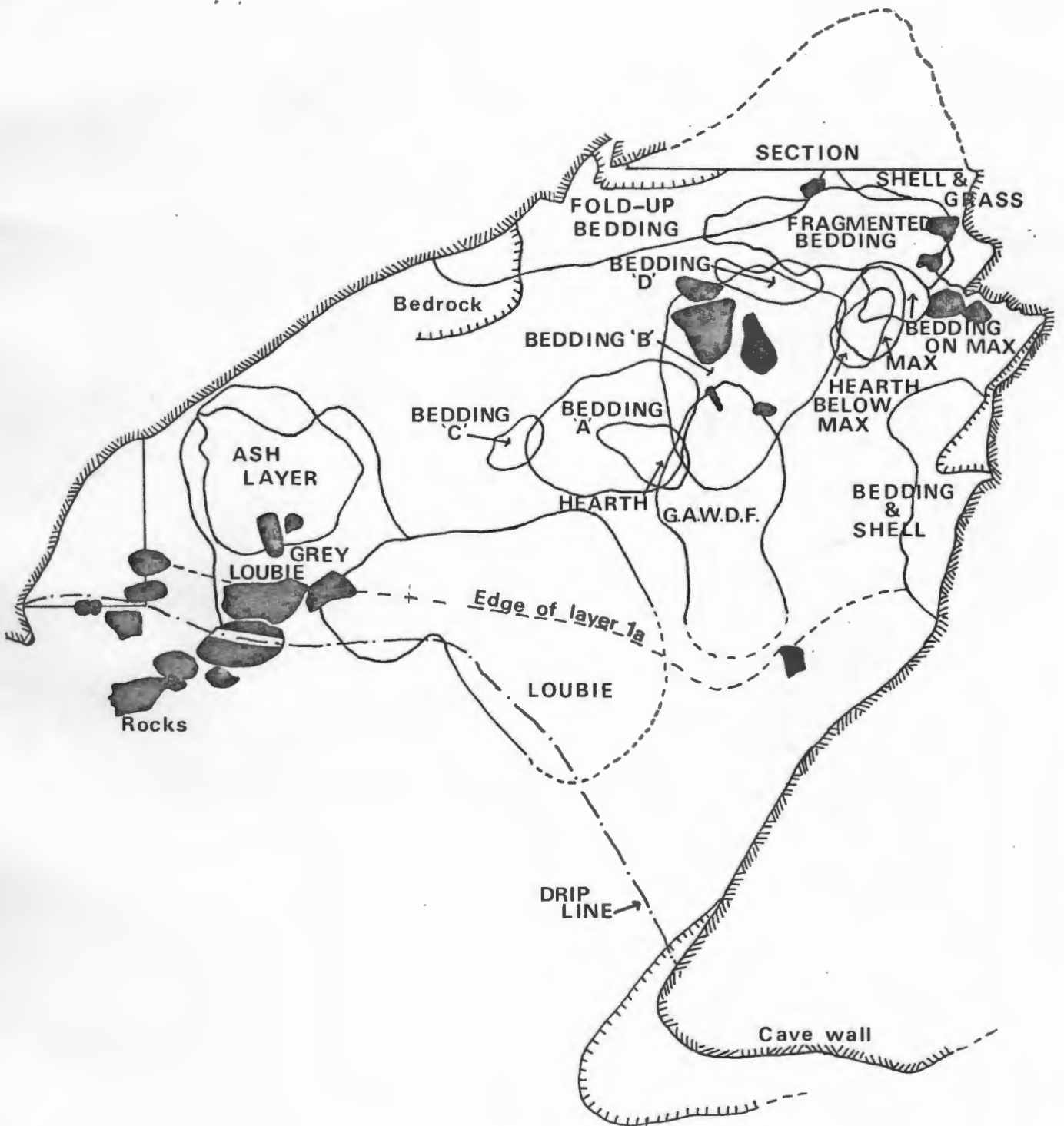


FIGURE 5.6 TORTOISE CAVE: LAYER 1

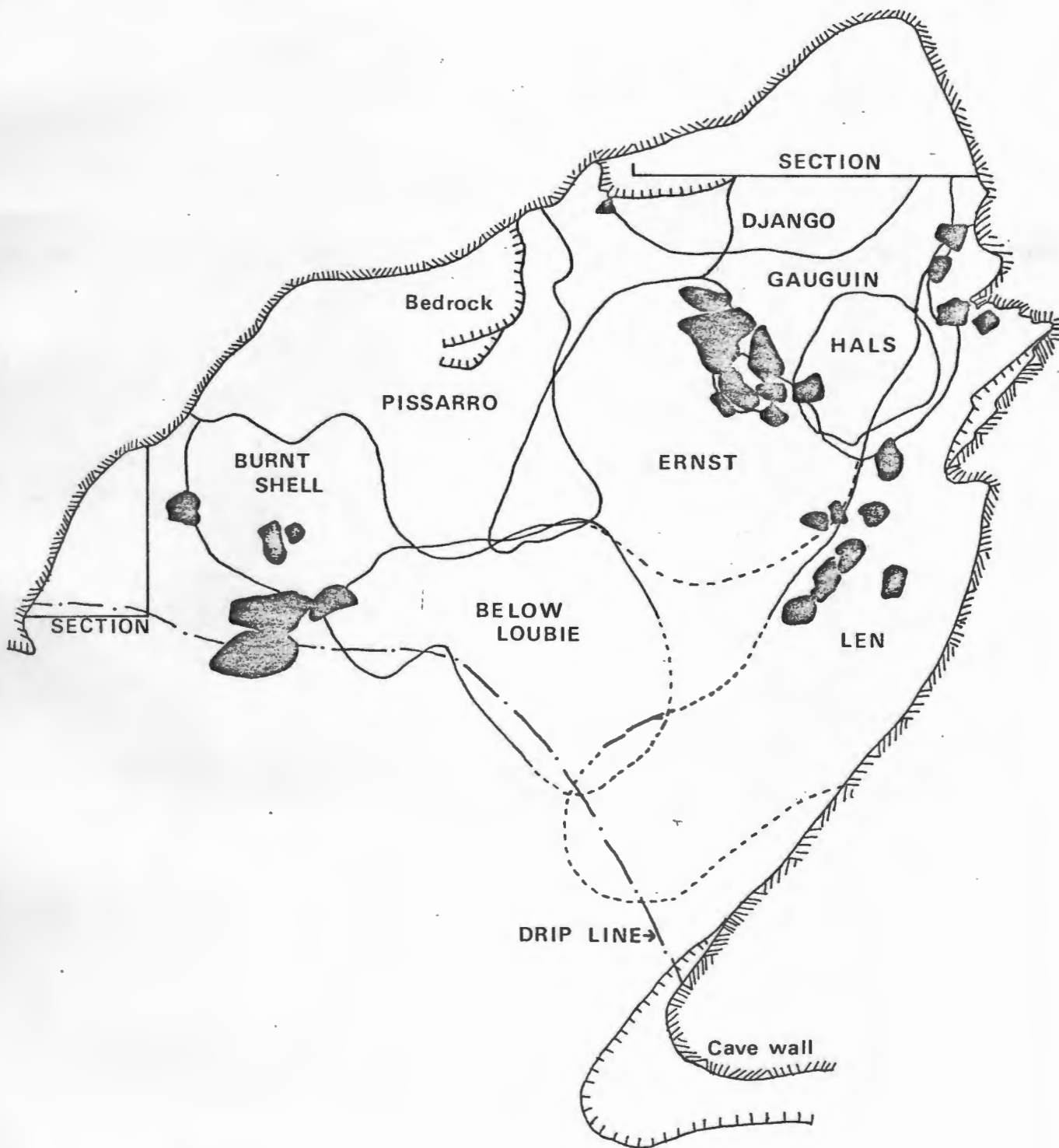


FIGURE 5.7 TORTOISE CAVE: LAYER 2a

units (Figs. 5.6 to 5.9) is this: large shell middens accumulate around the back and sides of the basin, to a large extent behind the bedding units, which would be interspersed with small hearths, and which occupy the central area of the basin behind the drip line. In front of the bedding or just inside the drip line is a communal hearth area which may often have been made up of small hearths, but in at least one instance appears to have been a single large fire.

It would appear that the bedding zone was kept deliberately clear of large pieces of shell and bone, and that these were moved out of the way to the sides of the shelter. This is reminiscent of Binford's (1978) model of the toss and drop zones around an Eskimo hearth (Fig. 5.10), and it seemed worthwhile to attempt to test this idea. Since most of the fauna from this part of the excavation has not been analysed, a small test case was devised. It seems that if, as has been suggested on a number of occasions, tortoises were cooked in their shells, the carapace would remain largely intact. This would be exactly the skeletal element of this animal which would tend to be 'tossed' aside, whilst endoskeletal bones such as the limbs would be dropped or tossed in a more random manner.

Initial estimates of carapace/limb fragment ratios tended to show that this was indeed the case, but it was pointed out (Poggenpoel pers. comm.) that differential breakage and preservation might skew the figures. Finally, a decision was made to test the distribution using only those body parts normally counted for M.N.I.'s: the humeri and femora for the limbs; and the epiplastron and xiphiplastron for the exoskeleton. Layers 2 and 3 were chosen for the test because the chances of a post-occupational input seemed too great in layer 1. Also, as it was not known whether ABD and HALS would constitute part of the drop or toss zones, they were included in the former category with the soil horizons. If they were wrongly placed, this should tend to skew the results towards rejection of a hypothesis concerning the existence of such zones.

The null hypothesis states that the difference in body-part distributions is so slight as to show no significant difference between shell-middens and other units. There are no real 'toss zones' present. The alternative hypothesis is that tortoise carapace is distributed in a non-random manner between the units as a result of prehistoric curation of the living area during consumption: ie. that a 'toss zone' exists in the Binfordian sense.

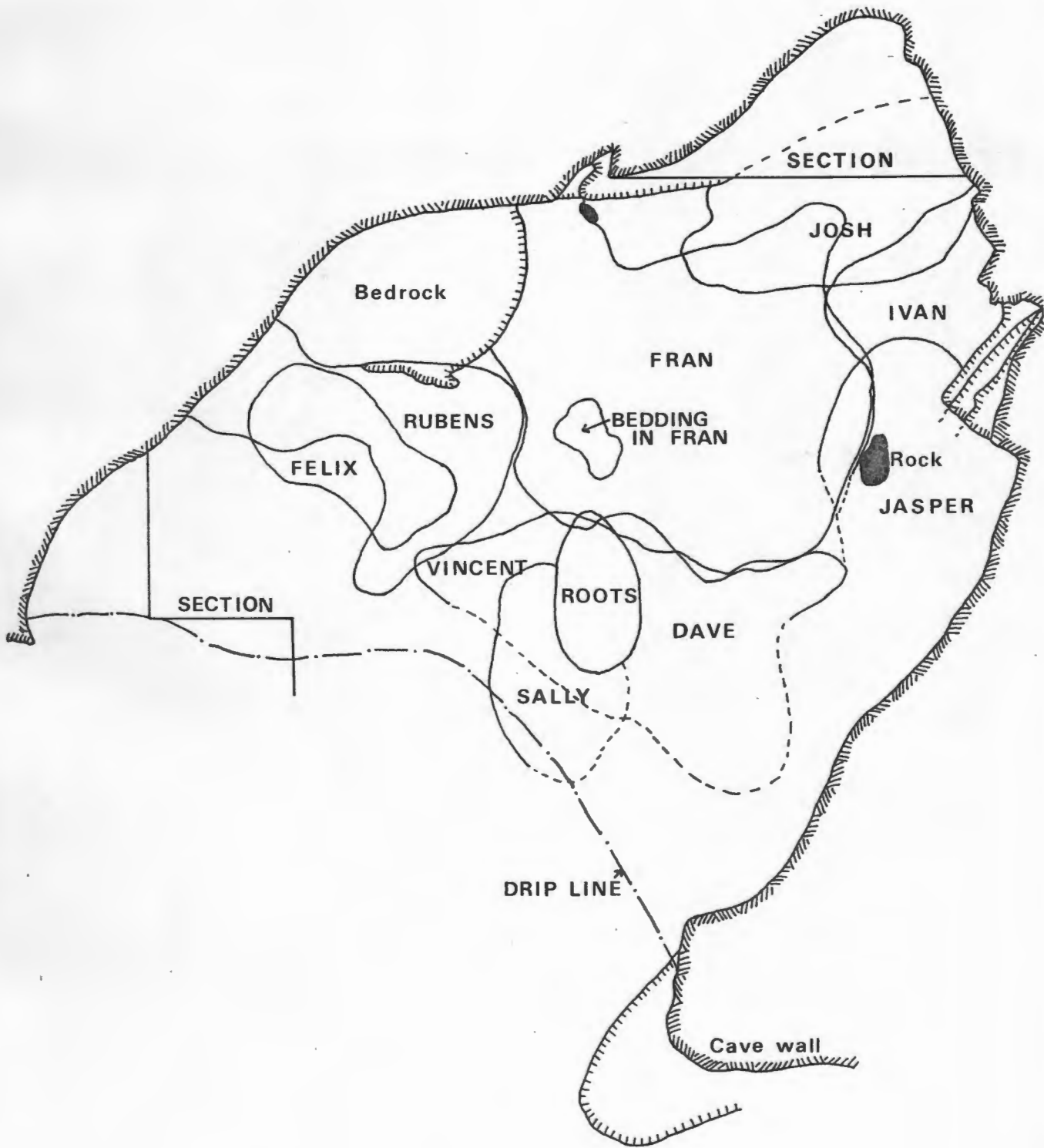


FIGURE 5.8

TORTOISE CAVE: LAYER 2b

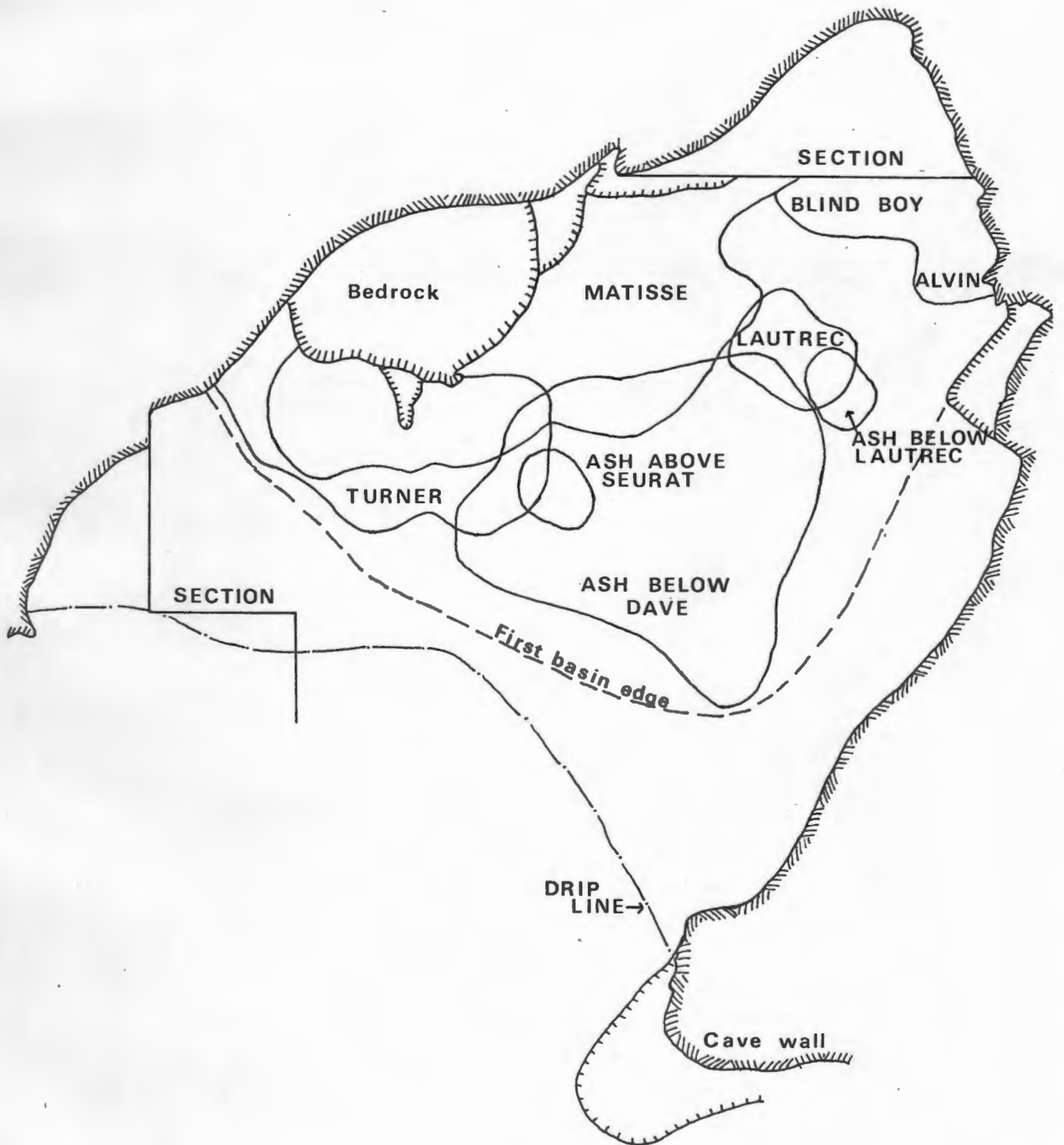


FIGURE 5.7 TORTOISE CAVE: LAYER 3

A summary of the data appears in Table 11. Layer 2 has been split into its component events to provide three observations if required.

A chi-squared test of association in a 2x2 contingency table was carried out to compare the frequencies of 'carapace' and limb bones in both the middens and other units of all three layers combined. This is presented in Fig. 5.11. The bracketed figures are the values expected under random conditions from a sample of the same size. These expected frequencies are calculated from the first table according to the formula:

$$E = \frac{\text{Row Total} \times \text{Column Total}}{\text{Sample Total}} \quad (5)$$

In a 2x2 matrix of this sort there is one degree of freedom ($df = 1$) and the test is one-tailed as the direction of variation has been predicted under H_a .

The formula for the chi-squared statistic is:

$$\chi^2 = \sum_{i=1}^{r+k} \frac{(O_i - E_i)^2}{E_i} \quad (6)$$

where O = observed frequencies, E = expected frequencies, r = rows, k = columns. Since $(O_i - E_i)^2$ is the same in each case, the formula becomes:

$$\chi^2 = (O_i - E_i)^2 \sum_{i=1}^{r+k} \frac{1}{E_i} \quad (7)$$

And substituting values from Fig. 5.11:

$$\begin{aligned} \chi^2 &= 64 (1/28 + 1/56 + 1/18 + 1/36) \\ &= 8.76 \end{aligned}$$

For a one-tailed test with $df = 1$, the critical value of χ^2 for $\alpha = 0,01$ is 3,32, so that the obtained value is well above this. It is, in fact, significant at $\alpha = 0,001$, where $\chi^2_{(\text{critical})} = 5,42$.

The above test was re-run to compare the observed and expected values for each of the following:

- a) Middens : carapace versus limbs

CARAPACE

LAYER	MIDDENS		OTHER		TOTALS	
	EPI	XIPH	EPI	XIPH	EPI	XIPH
	L R(Pr)	L R(Pr)	L R(Pr)	L R(Pr)	L R(Pr)	L R(Pr)
2a	3 4(2)	1 4 -	1 1 -	2 1 -	4 5(2)	3 5 -
2b	6 6(6)	3 5(1)	- - -	- 1 -	6 6(6)	3 6(1)
3	2 2(2)	- - -	1 3(1)	- - -	3 5(3)	- - -

LIMBS

LAYER	MIDDENS		OTHER		TOTALS	
	HUM	FEM	HUM	FEM	HUM	FEM
	L R	L R	L R	L R	L R	L R
2a	10 4	10 7	2 6	8 1	12 10	18 8
2b	2 4	1 1	6 3	7 5	8 7	8 6
3	2 -	- 7	1 1	4 -	3 1	4 7

TABLE 11a: DIAGNOSTIC TORTOISE IN MIDDENS AND OTHER UNITS FOR LAYERS 2 AND 3.

M N I

LAYER	CARA	LIMB	BEST	NBE	NBR CARA	% REC	NBR LIMB	% REC	NBE TOTAL	NBR TOTAL	% REC
2a	8	18	18	72	17	23	48	67	144	65	45
2b	8	8	8	32	21	66	29	91	64	50	78
3	5	7	7	28	8	29	15	54	56	23	41
TOTAL	21	33	33	132	46	-	92	-	264	138	52

TABLE 11b: DIAGNOSTIC TORTOISE M N I AND RECOVERY RATES FROM LAYERS 2 AND 3.

KEI: EPIplastron, XIPHiplastron. HUMerus, FEMur, CARApAce.

NBE - No Bones Expected, NBR - No Bones Recorded.

Pr - paired limbs (MNI is thus L + R - Pr)

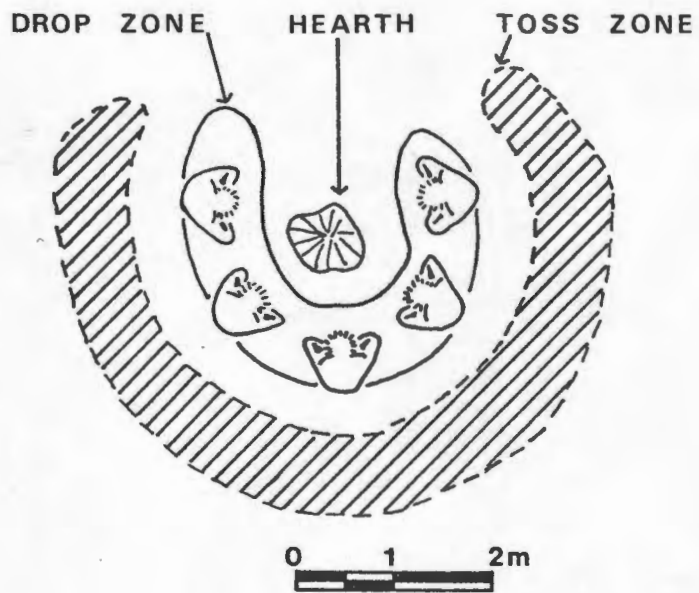


FIGURE 5.10

STYLISED DROP ZONE/TOSS ZONE AROUND HEARTH
(After Binford 1978)

	CARAPACE	LIMBS	
MIDDEN	36	48	84
SOILS & ASH	10	44	54
	46	92	138

a/ OBSERVED FREQUENCIES

	CARAPACE	LIMBS	
MIDDEN	28	56	84
SOILS & ASH	18	36	54
	46	92	138

b/ EXPECTED FREQUENCIES

FIGURE 5.11 2 X 2 CONTINGENCY TABLES FOR CHI SQUARED:
OBSERVED & EXPECTED VALUES

- b) Other units : carapace versus limbs
- c) Carapace : middens versus other units
- d) Limbs : middens versus other units

Only a) and c) showed significant results, demonstrating conclusively that it is specifically the high frequency of carapace in the shell middens that is causing the patterning. Burrowers tend to avoid these shell middens and are unlikely to have caused this pattern. All three layers were viewed in combination, so that vertical displacement is neutralised. This leaves horizontal displacement, termites and human activity as possible causal factors, and it seems reasonable to suggest that the human factor is the major contributor to the observed pattern.

Similar sets of tests were carried out on each layer individually, but only layer 2b ($\chi = 2,75$) showed any significance at $\alpha = 0,05$ (χ critical = 1,92). A possible reason for distortion in layer 3 has been mentioned above, and it is possible that vertical mixing of material in layers 1 and 2a could have distorted this sample. In the latter case it is again clear that the distortion and therefore lack of significance arises from the relatively high frequencies of limb bones. Referring to the percentage recovery rates in Table 11, it is apparent that layer 2a contains the greatest sample bias, and it is more probable that disturbance and movement here have caused skewed results than that the pattern as such is absent.

CONCLUSIONS

Even allowing for the inapposite use of Tortoise Cave as an example ^{for} of the techniques ^u described _h here and the problems that have arisen in attempting to identify causality, one point is inescapable. Without the attempt to find and use relevant statistical tests, none of these patterns or trends would have been as well understood as they now are, and without a detailed knowledge of Site Taphonomy, spurious assumptions concerning human behaviour might well have resulted from the test results.

The chi-squared analysis of the basin demonstrates the degree to which, even in primary deposits, disturbance and the nature of the deposit can affect faunal frequencies. Once again, it is vital to understand all the taphonomic elements present in the deposit before any analysis is attempted. The identification of possible randomising effects can only assist in the explanation of statistical results. It is further suggested here that where spatial analysis of

the faunal element is attempted, comparisons should always take account of estimated recovery rates, and only those that contain a reasonably complete data set should be used for comparative analysis. What is 'reasonably complete' is hard to assess objectively, and each case must be judged individually.

The statistical analyses of the talus deposits illustrate several archaeological problems, perhaps the most important being the effect of grid size, location and orientation on quadrat-based methods of spatial analysis. It is obviously not possible on most prehistoric sites to control for grid orientation or the location of corner points prior to excavation. It is feasible that in the future, techniques of sub-surface mapping (resistivity and magnetic, for example) may be developed which could be used to ease the present totally random layout of the archaeological grid, or that the use of a triangular or hexagonal grid might be shown to be effective in this way, but for the present these remain in the realm of science-fiction and the problem must be accepted as a random variable. Grid size, on the other hand, is easily controlled, and it is suggested that the smallest practical subdivision of the standard metre square be used in every circumstance. In shell midden sites, this may be only the 50cm quadrat which came into use at Tortoise Cave, but even this gives four times the spatial definition of the standard grid square. It can be argued that very little spatial patterning caused by human activity will be evident at a scale of less than a 50cm quadrat, but the use of smaller units makes it possible to 'shift' the grid more delicately for methods such as Dimensional Analysis of Variance. Small sub-squares can always be combined to increase individual values above the required minimum for a method, but definition can never be increased beyond the smallest provenience division used.

There is one final point concerning grid control. When a site is considered for excavation, it should be considered with major excavation in mind, even if this is not the immediate intention. The grid should be planned for such an event and, more important here, test pits should be confined wherever possible to the periphery of the grid. Where this is not desirable, they should be excavated with, if anything, greater care than any subsequent squares. This attitude would prevent the wasteful and awkward circumstances encountered at Tortoise Cave, where a central square has been deemed useless for analytical purposes.

The exercise has also brought to light a further shortcoming of the contiguous quadrats method: that whilst it may effectively recognise discrete patterning, it will tend to find patterns even where overprinting or other circumstances have left only general trends in point densities. The method has its merits if used wisely, but should always be used in conjunction with other tests to counter its somewhat indiscriminate desire to please.

As has been suggested, the sensitivity of parametric methods of spatial analysis to deposit volume is verified by the results from Tortoise cave. Whilst most ANCOVAR methods are considered to be non-parametric, the assumptions of circumstance made by Dimensional Analysis of Variance lift it almost to parametric status with the allowance that it may work effectively with data only recorded on a ranking scale.

There are, of course, results of the analysis relevant to Holocene prehistory in the region, but these are little more than hypotheses in the absence of comparative data from other sites, and will be dealt with in detail in the final discussion.

CHAPTER 6: DISCUSSION AND CONCLUSION

INTRODUCTION

In order to understand the implications of the Tortoise Cave project, it is necessary to see the site in the context of wider research: of Late Stone Age archaeology in general but particularly of western Cape L.S.A. archaeology. This chapter reviews the latter with reference to the wider field where necessary and attempts to show how past hypotheses and work need re-examination in the light of the evidence from Tortoise Cave.

The model that has governed research in the western Cape for the last decade is one of seasonal movement of the prehistoric hunter gatherer community between the West Coast and the mountains of the Cape Fold Belt (Parkington 1972, 1977a). This study deals only peripherally with faunal and floral remains, and hence it is not possible to assess fully the environmental tenets on which the model rests. The seasonal mobility model has undergone considerable metamorphosis in the last ten years, gradually being formulated into a set of working hypotheses. It has more recently come to rely rather heavily on lithic evidence and interpretation, one of the reasons why a larger and better defined sample was needed from Tortoise Cave, and on this aspect some detailed comment has been made.

The other aims of the project were to examine spatial distributions and the methodologies for this research, and to investigate techniques of excavation. These will be discussed in later sections of this chapter, with respect to the archaeological research outlined below.

THE SEASONAL MOBILITY MODEL

The model was proposed as a method by which the hunter gatherer population might have operated to maximise the different ecozones which made up the western Cape region. In the western Cape these zones run roughly along a north-south axis. From the coast the land rises gently across a sandy coastal plain (the Sandveld) broken by occasional residual ridges and kopjes of Table Mountain Sandstone and shale to the foothills of the Cedarberg Mountains which constitute the main element of the Cape Fold Belt in this region. The foothills are separated from the Cedarberg proper by the valley of the north-flowing ^fOlivants River, whilst to the west of the mountains the land slopes across a dissected landscape to the Doorn River and the Tanqua Karoo.

Each of these zones, the coast, the Sandveld, the mountains, and the Karoo has its own set of resources available for exploitation at different times of the year.

When first outlined, Parkington's (1972) model was relatively simple and was built around the excavation of two sites: De Hangen and Elands Bay Cave (E.B.C.). There was evidence from the former ~~latter~~, situated east of the Olifants^f River valley and some 60 km from the sea, of contact with the coast. The most incontrovertible part of this was the presence of marine shell in the deposit. In the area generally, there were known to be prehistoric paintings of what were apparently ocean going ships. If this interpretation can be taken literally, it suggests quite strongly that at least some individuals from the mountains had been to the coast since the arrival of Europeans at the Cape. The evidence suggests a summer occupation of De Hangen and comes from a number of sources: the abundance of corn cobs and fruit seeds, inflorescences on the bedding grasses, and the juvenile age distribution of Dassie (Hyrax capensis) samples from the shelter were cited and appear to remain as strong positive data. Parkington (1972) himself admits that it is hard to find proof that the site and other 'carbon copies' were deserted during winter, but adds:

"Perhaps the question can be approached by demonstrating that neighbouring complementary resource zones were occupied during winter, and by postulating that it was the De Hangen community which occupied them." (Ibid: 237).

Certainly the evidence for a winter occupation of E.B.C. in the late Holocene seems equally strong: the shell middens contain high frequencies of mussels, which are potentially toxic in summer as a result of dinoflagellate blooms or 'red tides'; there are few corn casings, seeds or inflorescences in the upper deposits, where organic preservation is good; dassies are less frequent and are almost all adult; and yearling seals are common, whilst pups and older animals are absent. The last particularly is indicative of a late winter/early spring season of occupation. The other evidence seems to rule out a late spring or summer occupation at E.B.C. One problem not addressed by this outline is where were the people during the early part of winter, when corns are less available and mussels may still be toxic? It seem^s that they were^A left to wander around in the 40 km wide strip of sandveld between their two major alternatives.

Interestingly, a second site (Klipfonteinrand) on the eastern edge of the mountains was

excavated in 1969 (Parkington & Poggenpoel 1971b) but was not utilised in the seasonal mobility model. It contained no deposits from the last 5000 years as these were removed by the local farmer to create a sheep pen, but in its early form the model was intended to apply for most of the Holocene and it is ^fstange that the site was never referred to in this context.

Fletemeyer (1974) undertook a study of growth rings on some 20 sectioned seal canines from E.B.C. and confirmed that the animals were killed between July and October, and most probably early in that period. This was at the time thought to be conclusive evidence but recently it has been suggested (Parkington and Mary Patrick pers. comm.) that his interpretation of the growth rings may have been over simplistic and that the data ^{are} of dubious value.

With the excavation of Diepkloof, some 12 km from the coast, in the early 1970 s, the picture became more complex. Here corms of Gladiolus spp. were found in quantity (Parkington 1977b), along with some patches of Nylandtia spinoza seeds (Parkington pers. comm.). Parkington (1977b) argues that the sandveld corm bearing genera such as Gladiolus and Morea ^awere likely to be invisible soon after flowering ended, thus limiting the available season to the period July to November.

Nonetheless, some changes were made to the original simple model and it was proposed (Parkington 1977b) that the ^fOligants River valley would provide a central focus for fishing during the dry months of summer, during which the prehistoric 'Soaqua' would naturally make full use of the other abundant resources. This alteration was suggested on the basis of observations of terminal Stone Age people by early travellers into the area, and it was further proposed that as water became more freely available in the Sandveld and Karoo, the population would begin to disperse into these areas.

"in effect this would involve ^msymmetrical emigration from the mountain folds in the wet season, in both easterly and westerly directions" (Ibid:155).

During 1977 and 1978 excavations were carried out at two sites near Clanwilliam in the ^fOligants River valley: Andriesgrond and Renbaan. These were expected to yield the fish remains needed to support the new version of the seasonal model. Neither site did so, and the fishing hypothesis remains unproven, dormant but probably not forgotten. The concept of a Cape Fold Belt focus has

been actively retained, relying solely on the density of sites and the distribution of group scenes in the rock art of the mountains. The latter seem to be absent from the Sandveld and the coast, although they extend eastwards as far as the Doorn River (Marhire et al 1983b).

By this time it was understood that there were many limpet dominated shell middens at the coast, both at Elands Bay and to the south between Langebaan Lagoon and Duiker Eiland (Robertshaw 1977, 1979, 1981). Robertshaw proposed a summer occupation of this stretch of the coast in contrast to the winter settlement season offered by Parkington. This argument had in some ways been pre-empted by Parkington (1976) who suggested that middens close to the coast tended to reflect closely the available species in the adjacent intertidal zone of the shore. This argument is interesting for several reasons and will be returned to later. In 1978 several limpet dominated middens around Elands Bay were excavated (Horwitz 1979) and again the same interpretation was offered. In addition, these middens were found for the most part to post-date the introduction of pottery.

Research in the western Cape in 1978 began to change direction, moving away from direct seasonal and environmental indicators and placing increasing emphasis on lithic technology and its indirect bearing on settlement and seasonality. This started with a study of open stone scatters in deflation hollows in the coastal plain and their counterparts in the mountains (Mazel 1978, Parkington 1979) which led to observations of contemporary activity scheduling differences between the two zones. Most significant among the emerging patterns was that sites in the mountains were dominated by adzes, accompanied where excavated by quantities of wood shavings, whereas the Sandveld sites contained few adzes but were rich in backed pieces such as segments, points and blades (Mazel & Parkington 1981). Adzes, it was thought, were used in the manufacture and maintenance of digging sticks, which accounted for the wood shavings. Digging sticks were essential for the exploitation of the underground plant foods which formed the staple diet of the 'Soaqua' in the Cape Fold Belt during summer. In the Sandveld, by contrast, wood and underground plant foods were scarce and demanded less technology, so that adze frequencies were correspondingly low. High frequencies of backed pieces were somewhat vaguely related to projectile points and therefore with hunting (Mazel & Parkington 1981, Parkington 1980) and it seems that this "greater interest in hunting with the bow and arrow" (Mazel & Parkington 1981:25) was considered to be the major contributor to the lithic assemblage. At this time, the

assemblage excavated from Tortoise Cave in 1978 was not fully analysed and the data from the surface collections indicated a situation similar to that from Diepkloof (Mazel & Parkington 1978⁸⁰) where, despite a number of wooden tools, there were few wood shavings (17 in all), few adzes and "a mere handful of underground plant food residue" (Ibid:382).

Growing criticism of these opinions led to the publication of a re-examination of the western Cape in the context of Late Stone Age studies in southern Africa (Parkington 1980) which provided a forum for debate. The whole artefact dichotomy revolved around the assumption of contemporaneity for the undated Sandveld scatters and surface collections and the late assemblages from the mountains. The interpretation centred on the assumption that the tools were use-specific and that these uses were reasonably well established. It seems that neither of these assumptions was widely shared.

Janette Deacon (1980) noted that historical evidence implied that adzes might be used for working bone as much as wood, that wood shavings did not necessarily equate with digging sticks, which could be used for more than excavating corns and that wooden tools will need attention (and therefore adzes) even in the sandveld. Inskip (1980:95) was more eloquent:

"The tool that whittled or scraped the digging stick may also have whittled spears, pegs, trap parts, throwing-sticks and bow staves, and in each case any one of a variety of artefact types may have been used."

Inskip, Deacon and Sampson (1980) all criticised Parkington on his assumption of contemporaneity, but it was Thackeray (1980 : 104) who saw the true anomaly in his logic:

"It is interesting that where his data does not fit, in the case of the De Neus sites, he is forced to conclude that the errant sites are of a different date."

Parkington (1980:77) reaches the same conclusion for Klipfonteinrand, dated earlier than the adze rich sites, and for Andriesgrond where in discussing the basal assemblage (undated) below the typical mountain assemblage with pottery and adzes, he notes:

"It is in many ways a sandveld like assemblage with a high frequency of scrapers, relatively few adzes and a relatively high drill frequency. There are no wood shavings from this assemblage and it is tempting to infer that it in fact predates the

patterning above and reflects a prior situation." (Ibid).

The ruling hypotheses did not die as a result of the criticism : rather it was temporarily cocooned while further research was undertaken. There was, after all, still a considerable body of environmental evidence to back the theory behind the model. This research has taken the form of a thorough re-examination of the sandveld open site pattern (Manhire in prep), the work on Tortoise Cave presented here, and an in depth study of the shell middens around Elands Bay and their meaning in terms of time and the economy (Buchanan in prep). In addition, a study of stable carbon isotope ratios in various parts of the regional food chain and its effect on skeletal isotopic values has been recently completed (Sealy 1984). Whilst this work has been in progress, a new permutation of the model has been proposed in the light of the new data (Buchanan et al 1983, Manhire et al 1983a).

ENVIRONMENTAL CHANGE

As a persistent theme throughout Parkington's work, and acting as a backdrop to many of his decisions, is the effect of environmental change on settlement patterns and the scheduling of activities (Parkington 1977a, 1979, 1980, 1981, ~~1983~~). Most references have centred on the Pleistocene-Holocene transformation, to explain the change of 'place' of such sites as Elands Bay Cave. It is interesting to note that whilst Parkington (1979) mentions both the suggested early Holocene arid conditions (Butzer 1978) for the southern Cape and a south western Cape mid-Holocene high sea level (Fleming 1977) and uses them to support the idea of an occupational hiatus in the western Cape between 8000BP and 4000BP, in a wider publication (1981 : 351) he states:

"Until more information is available the coincidence of the appearance of fully modern conditions and the cessation of occupation remains suggestive but inexplicable."

Yet it was the idea that possibly in the mid-Holocene the Sandveld was a rather unpleasant place to live, with a less productive coast due to a 2m - 3m high sea level which would effectively cover many of the rocky points along this stretch of coast, that lay behind the assumption that the sandveld deflation hollows were contemporary with the midden sites at the vlei mouth and

their Cape Fold Belt contemporaries and post-dated 3500 BP. They were, after all, patently not from the terminal Pleistocene - early Holocene in view of their artefactual composition.

The concept of a high sea level between 6000 and 4000 BP led Buchanan (1983) to conclude that the vast shell accumulations opposite rocky points north and south of Elands Bay (Kreefbaai and Mussel Point) could only have been formed some time after 3500 BP and more credibly after 3000 BP. Radiocarbon dates subsequently obtained for these middens have confirmed this hypothesis. Baboon Point, the rocky outcrop in front of Elands Bay Cave, stands high enough to have remained intertidal throughout the Holocene, and thus the midden deposits in the cave extend back to some 4000 BP, and can be said to define more exactly the occupational hiatus in the area.

THE EMERGING MODEL

The interpretation of the Tortoise Cave stratigraphy showed that the separation of adze-rich assemblages and those with few adzes and higher frequencies of backed pieces was primarily a time controlled event, and that the differential distribution patterns must therefore reflect changes in settlement patterns. This, in combination with the environmental data, was used to re-formulate the seasonal mobility model for the western Cape (Marhine et al 1983a, Buchanan et al 1983). The revised model also took into account the apparent large increase in the number of post-pottery sites recorded from the area around Velorevlei and the kopjes and rocky outcrops scattered across the Sandveld. A four phase model was offered for the Holocene settlement pattern in the Sandveld.

Prior to 8000 BP, the coast was rarely visited, and settlement there focussed on large shelters such as Elands Bay Cave. Initially, it was felt that such visits were scheduled for the summer months, but that by 8000 BP coastal occupation had been rescheduled for winter (Parkington 1981, Buchanan et al 1983). This is hypothesised on the basis of the change at Elands Bay Cave from limpet domination of the shell middens to a far greater emphasis on mussels. The alternative is preferred here, that the changing configuration of the shore line with the post-Pleistocene rise in sea level made available a changing habitat off Baboon Point, from one fairly sheltered and dominated by limpets to an exposed outcrop with far higher frequencies of mussels. The question

of what constituted the rest of the settlement pattern during this period is left open although it has been suggested (Parkington, pers comm) that the Karoo might have at this time been a major focus of settlement.

Between about 8000 and 4000 years ago this part of the west coast was apparently not a part of the regular settlement system. No sites have been found which date to this period, and the evidence is that the environment would have been arid and probably marginal for hunter gatherers. There is some evidence for occupation of the Cape Fold Belt during the mid-Holocene, from Klipfonteinrand and possibly Andriesgrond, but it seems that the coast and coastal plain were not part of a seasonal cycle of movement.

From the end of the Elands Bay hiatus onwards, population density appears to have increased steadily to around 1700 BP, and as a greater variety of coastal resource areas (ie rocky points) became available with the oceanic regression, so these were once again utilised, and scheduled for winter exploitation to take advantage of the large mussel colonies now available.

"It is likely that the heart of settlement systems at this time lay in the Sandveld plains to the east and that coastal visits were not designed to make extensive use of the range of marine resources" (Buchanan et al 1983).

From the focus of the deflation hollows parties of hunter gatherers moved to the coast or to the mountains, as the seasonal availability of desired food resources dictated.

This pattern was interrupted by the arrival of pastoralism and, faced with increasing competition for the resources of the coastal plain, hunter gatherers increasingly concentrated on the Cape Fold Belt and the coast, living for the most part amongst the hills and outcrops of the Sandveld where they could. It was suggested that group size was reduced in the coastal zone, but that aggregation occurred ^r_k in the mountains, resulting in an abundance of large, adze-rich sites and rock paintings (Manhire et al 1983b). At the same time, the introduction of domestic stock could have caused a reduction in the wild bovid biomass and led to a greater emphasis on plant foods and shellfish by the remaining communities of hunter gatherers (Buchanan et al 1983).

TORTOISE CAVE IN CONTEXT

The Tortoise Cave sequence begins at around 7700 BP (Pta 3596), at the start of the proposed regional hiatus. There is little deposit between this date and the date of 4330±50 BP (Pta 3605) and a gap in occupation has been suggested on taphonomic grounds between the two dates. This would seem to add a great deal of strength to the comparable dates from Elands Bay Cave, and to the hiatus theory derived from them. In terms of lithic artefacts, there is little in the site to suggest that any significant change in the basic tool kit occurred^r_k in the intervening 3400 years, and this means that the still undated deflation hollows may still extend back across the hiatus. There is, of course, a great deal of disturbance at Tortoise Cave and little control across the grid in the correlation of the dated units with the spits of 1978. Contamination of the lowest units by post-hiatus lithic material is not only possible, it is quite likely.

A second gap in the dates occurs between ²350±60 BP (Pta 3604) and 1680±50 BP (Pta 3312), which might also represent a break in occupation. There are deposits which lie stratigraphically between these dates, but it is interesting to note that only directly under units dating to after the introduction of pottery are adzes found in any quantities before the basin deposits themselves accumulated. In particular here I am referring to the mixed units KTAT, UNDER BLIND BOY and SOIL IN CREVICES. If indeed adzes became more common after 3500 BP or 3000 BP then it seems reasonable to suggest that occupation relating to these intervening deposits occurred^r_k in the next few centuries after 3500 BP, and that a substantial hiatus does exist here.

Another point that deserves consideration is that of the implied rates of accumulation and therefore frequency of occupation at Tortoise Cave described in Chapter 3. The conclusion that the site was regularly used as a base for the exploitation of marine shellfish between 4000 BP and 3000 BP, and that thereafter only a few visits were made to the site over a period of nine centuries or more is quite at odds with the model (Manhire et al 1983a) outlined above. On the other hand, the hypothesised reduction in group size after 1700 BP is quite in keeping with the data from Tortoise Cave. They suggest that this site may have been no more important than the many other small shelters on the lower reaches of the Velorevlei which were occupied over this latter period.

Since the faunal analysis is still incomplete, only a few general comments can be made here. Dossies from Tortoise Cave appear to be predominantly adult and seals juvenile, whilst tortoises are common but not dominant. Shell samples analysed so far indicate that the molluscan fauna is dominated by the black mussel, Choromytilus. All these factors show similarities with the Elands Bay Cave fauna, and appear in keeping with a winter occupation of the site and the scheduling of settlement in the area for this season. Two further points of interest here. Firstly, one very common element throughout the deposits is the abundance of fish and bird remains. The avian fauna represented is dominated by vlei birds and coastal species which still live around the vlei today. The fish are mostly of a size which could be caught in the vlei, but prior to 1700 BP, the species Rhabdosargus globiceps (White Stompnose) is as common as Lithognathus lithognathus, the white steenbras, which is present in large numbers throughout, and dominates the list of fish species from layer 3 onwards. Rhabdosargus cannot tolerate the low salinity of the vlei even as it would have been in historic times, and would normally have been found only near the mouth of the vlei. The second point is that the presence of the razor clam Solens capensis in the pre-pottery levels is suggestive of a change in the nature of the vlei, since these molluscs do not live in the present brackish water of the vlei. What I am suggesting here is not new in itself, but it is the first archaeological data which suggest^c that during the mid-Holocene the Vlei^r may have been a very different environment to what can be observed today. In was more probably fully tidal with tidal mud flats and a notably higher salinity. With the exception of the marine molluscs, the faunal evidence suggests the heavy exploitation of the vlei zone, quite plausibly in the immediate vicinity of Tortoise Cave. But prior to 3000 BP, discordant elements are present which would seem to indicate the utilisation of the vlei mouth as a major resource zone. In view of independent evidence suggesting a higher sea level in the mid-Holocene it seems more reasonable to suggest that it was environmental change in the region of Tortoise Cave, and not the abandonment of a valued resource zone, that caused the change in the faunal composition of the site.

This is relevant because it suggests a degree of conservatism in resource exploitation among the prehistoric hunter gatherers of the western Cape. Despite the loss of certain apparently popular resources, it is suggested that no attempt was made to change the location of exploitation ; people simply made do with what was left, if it was still sufficient. It is for this reason that

it is difficult to believe that the population of one region would reverse their whole pattern of seasonal movement because they suddenly developed a liking for a resource that was toxic in summer. Yet this is what was proposed for the change from the exploitation of limpets alone to a mixed exploitation of limpets and mussels at Elands Bay Cave around 8000 BP. The recent deposits at that site closely reflect the present molluscan population on the shore nearby, as do sites elsewhere on the coast, and there is no reason to suggest that the situation was ever otherwise. When the shore was further from the cave, it would be most logical to suggest that mussels, and not limpets, would have been brought back to the site if they were available. This is the pattern suggested by more recent sites which now stand a few km. from the shore (Buchanan et al 1983).

Until the analysis of the faunal remains from Tortoise Cave is completed, there is little of a more specific nature that can be said to test the assumptions of the seasonal mobility hypothesis. In the light of results obtained from the isotopic analysis of human skeletal remains in the western Cape (Sealy 1984) which argues against regular population movements between the coast and the mountains, there may soon be no seasonal mobility model to test. At least the model will have to undergo yet another metamorphosis.

For the moment, it would seem appropriate only to suggest that the model proposed in 1983 be altered in the light of the evidence from ^tToroise Cave. More specifically, I propose that:

1. In the period prior to the major hiatus at both Tortoise Cave and Elands Bay Cave, a small population of hunter gatherers moved around the western Cape, living around the rocky hills and outcrops of the coast and Sandveld, and among the mountains of the Cape Fold Belt. This pattern may extend back into the Pleistocene if Manhire's (pers comm) re-interpretation of the large-flake kopje sites as Middle Stone Age assemblages of a type similar to 'Howieson's Poort' assemblages elsewhere is correct. Some use may have been made of a few Sandveld deflation hollows. If mussels were not an important food resource until the closing centuries of this period, the element of seasonality need not be important here and marine resources could have been sporadically utilised in all seasons.
2. During the period 7700 - 4300 BP or thereabouts, a higher sea level greatly reduced the molluscan populations available for exploitation. Thus such sporadic use of these resources as

did occur remain archaeologically invisible, unless they may be seen in the scatters of sand mussels (Donax serra) which occur among the dunes (Parkington 1981). It is equally possible that these scatters are the result of gull predation. During this period drier conditions may have led to an increasing use of the open plains when shelter was less necessary. Alternatively, there could have been a general avoidance of the area if conditions became truly arid. This, however, remains to be demonstrated.

3. This pattern persisted in the centuries following 4300 BP, but with the re-appearance of rocky shores and the intertidal mussel beds, exploitation of this resource began once again. With settlement still focussed on the plains, certain shelters in convenient locations began to be intensively used for short periods of time when mussels were safe to eat, most probably in winter. This regular use of a few known points led to a rapid accumulation of deposit at shelters such as Tortoise Cave, although it may be that the duration of visits was quite short.

4. Gradually, a pattern of seasonal utilisation of the marine molluscan food supply developed, and population density at this time may have been increasing. With the full emergence of the rich mussel beds at points such as Mussel Point and Kreefbaai around 3000 BP, the focus of settlement during periods of shellfish exploitation shifted to the shoreline and the intermediate shelters such as Tortoise Cave were rarely used. Instead, vast middens were formed next to the rocky outcrops, and few shells were carried inland.

5. By 1700 BP, herding had been introduced to the western Cape coastal belt, and competition for the use of the plains was strong. Hunter-gatherers tended now to focus their settlement in the mountain belt inland where the resultant high population density created tensions and thence a floreat of painting. Possibly herding also affected the availability of game and thence caused a dramatic increase in the use of plant foods and perhaps a change in hunting techniques. This may have involved the abandonment of stone projectile points and game stalking in favour of bone points and poison for short range use in game drives or net hunting; a phenomenon suggested in elements of the rock art (Manhire & Yates, in prep). These factors resulted in the dramatic increase of adze rich sites in the region and a corresponding decline in the manufacture of backed stone pieces.

It is suggested here that the coast may have been rarely visited from the mountains in this late period. The numerous small middens may have been created by small bands who stayed near the coast and could support themselves within the limits of the kopjes and ridges of the sandveld, probably interacting with herders on the plains, and subsisting ^{on} ~~of~~ shellfish when the occasion allowed. This is not to propose that there was no contact between hunter gatherers in the mountains and the incipient 'strandlopers' of the coast. It is likely that a considerable flux existed in group composition and that some bands or small groups of individuals still visited the coast occasionally, perhaps again utilising some of the old sites, such as Tortoise Cave, during their stays at the coast.

Whether or not this reconstruction bears more resemblance to reality than its predecessor, it is clear that a simplistic model of movement on a strict seasonal basis between the mountains and the coast is no longer tenable to explain the Holocene prehist^ory of the western Cape. But then a model is never intended as a reconstruction of reality. The seasonal mobility model was first and foremost an heuristic device from which to develop hypotheses relating to the real situation, which could then be tested by further research. It has certainly fulfilled this purpose.

COMMENTS ON THE USE OF SPACE AT TORTOISE CAVE

This section is really a combined summary and review of the results of the taphonomic and spatial analysis at the site, which by way of a change will start with the newest deposits: the post-pottery basin layers 1 to 3.

The pattern established in these layers for Tortoise Cave is comparable in many ways to several other late sites in the western Cape. At De Hangen (Parkington & Poggenpoel 1971), Diepkloof (Parkington 1979), and Andriesgrond (Ibid) the pattern established consists of a ring or line of bedding units around the cave wall with a large central hearth complex or ash concentration. The pattern is skewed somewhat at Tortoise Cave by the presence of bulky shell middens which push the bedding towards the centre of the shelter, although as the basin filled up there is a suggestion in some of the bedding units that the tendency was to keep the bedding area as far into the shelter as was possible. There is evidence in the spatial distribution that the occupants tried to keep the central area free of larger pieces of debris and established a 'toss

zone' around the edges of the site. This is most likely the reason for the placement of the unfragmented shell middens : in any other position within a convenient radius, such rapid and bulky accumulations would create an obstruction to activity in the shelter and access to it.

Evidently it takes only a few visits to fill the shallow excavation in Tortoise Cave, and the process must have been repeated scores of times in the last 4000 years. This is not the case in a cave the size of Elands Bay Cave, from which three commensurately larger hollows are recorded. These were probably never totally re-excavated.

Stone artefacts were relatively rare inside the shelter, and it is proposed that this situation held throughout the accumulation of the site. Most lithic oriented activity seems to have focussed on the flattest areas of the talus slope, where high densities of artefacts may be the closest parallel to past occupation surfaces or living floors in the loose deposit.

There is evidence that the talus was also a focus for food preparation and probably sleeping, at least in the period 4300 - 3000 BP. This comes from the association of in situ middens and hearth markers at various levels, and from the presence of a large ash heap near the surface outside the cave, which seems to be in primary context. The negative evidence that no such units exist on the talus surface or which could be attributed to a time after the introduction of pastoralism and pottery has been cited as evidence of smaller group size during this period.

METHODOLOGY AND FURTHER RESEARCH

The aim of this volume has been to demonstrate that effective reconstruction of site histories is best achieved through attempts to understand the taphonomic processes of site formation at a micro-stratigraphic level, and that such understanding is gained by detailed and objective recording. The description of cultural content has been deliberately kept to a minimum in an effort to emphasise the importance of site taphonomy in all aspects of prehistoric^{or} reconstruction. Without a detailed knowledge of the causal factors in the creation of each stratigraphic unit, it is impossible to assess accurately the validity of any conclusion drawn from the cultural assemblage. Stone implements are not, in themselves, information (Parkington 1972b) when their context is defined only in terms of excavated provenience. It is the study of site taphonomy which allows evaluation of cultural context, and it is an aspect of archaeological knowledge which is very poorly understood, and researched in most cases only to

solve local and immediate problems. As such the record is somewhat scrappy and incomplete. Binford (1983) has called for 'middle range theory' in archaeology : this may be considered an appeal for some 'low range theory' concerning the principles of site formation processes. It is, in the end, the relationship between burrows and bedding that will open the door to the past.

"To gather the fruit,

One first must understand the nature

Of the growing tree"

REFERENCES

- BERRY, K.J., KVAMME, K.L. & NIELKE, P.W. 1980. A permutation technique for the spatial analysis of the distribution of artifacts into classes. American Antiquity 45.1:55-59.
- BERRY, K.J., KVAMME, K.L. & NIELKE, P.W. 1983. Improvements in the permutation technique for the spatial analysis of the distribution of artifacts into classes. American Antiquity 48.3:547-553.
- BINFORD, L.R. 1978. Dimensional analysis of behaviour and site structure: learning from an eskimo hunting stand. American Antiquity 46.2:285-300.
- BINFORD, L.R. 1980. Willow smoke and dogs tails: hunter gatherer settlement systems and archaeological site formation. American Antiquity 45.1:4-20.
- BINFORD, L.R. 1983a. Bones: ancient men and modern myths. New York. Academic Press.
- BINFORD, L.R. 1983b. Working at archaeology. New York. Academic Press.
- BOND, G. 1969. The geology of the Kalambo Falls prehistoric site. in Clark, J.D. Kalambo Falls prehistoric site, Vol. 1. Cambridge. Cambridge Univ. Press.
- BOMERS, P.M., BONNICHSEN, R & HOCH, D.M. 1983. Flake dispersal experiments: noncultural transformation of the archaeological record. American Antiquity 48.3:553-572.
- BRAIN, C.K. 1974. Some suggested procedures in the analysis of bone accumulations from the southern African quaternary sites. Ann. Tvl. Mus. 29.1:1-8.
- BRAIN, C.K. 1976. Some principles in the interpretation of bone accumulations associated with man. in Isaac, G.L. & McCown, E.R.(eds) Human origins: perspectives on human evolution Vol. 3. New York. W.A. Benjamin.
- BUCHANAN, H.F. 1983. Some implications from a quantitative analysis of prehistoric shellfish remains at Elands Bay, south western Cape. Unpubl. Seminar paper, U.C.T.
- BUCHANAN, H.F., PARKINGTON, J., ROBEY, T. & VOGEL, J. 1983. Shellfish, subsistence and settlement: some western Cape Holocene observations. Paper prepared for the S.A.A.A. conference, Gaborone, Botswana.
- BUTZER, K. 1978. Sediment stratigraphy of the Middle Stone Age at Klasies River Mouth, Tsitsikama Coast, South Africa. S. Afr. archaeol. Bull. 33:141 - 151.
- CHANG, K.C. (ed). 1968. Settlement archaeology. Palo Alto. National Press.
- CAHEN, D. & MOEYERSONS, J. 1977. Subsurface movements of stone artefacts and their implications for the prehistory of Central Africa. Nature 226:812-815.

- CLAY, R.B. 1975. Concerning the spatial analysis of occupation floors. American Antiquity 40.3:357-358.
- DEACON, H.J. 1976. Where hunters gathered: a study of Holocene Stone Age people in the eastern
- DEACON, H.J. 1980. Reply to Time and place. S. Afr. archaeol. Bull. 35: 86-88.
- DEACON, J. 1972. Wilton: an assessment after 50 years. S. Afr. archaeol. Bull. 27:10-45.
- DEACON, J. 1980. Reply to Time and place. S. Afr. archaeol. Bull. 35: 89-93.
- FLEMMING, B.W. 1977. Distributions of recent sediments in Saldanha Bay and Langebaan Lagoon. Transact. Roy. Soc. of S. Afr. 42:317-340.
- FLETENEYER, J. 1974. Age determination in the teeth of the Cape Fur Seal and its bearing on the seasonal mobility hypothesis. Unpubl. Hons. Project. Dept. of Archaeology, U.C.T.
- HARRIS, E.C. 1974. The stratigraphic sequence: a question of time. World Archaeology 7.1:36-54.
- HARRIS, E.C. 1979. Principles of archaeological stratigraphy. London. Academic Press.
- HODDER, I. & ORTON, C.R. 1976. Spatial analysis in archaeology. Cambridge. Cambridge Univ. Press.
- HOLE, F. & HEIZER, R.F. 1973. An introduction to prehistoric archeology. New York. Holt, Rinehart & Winston.
- HORWITZ, L. 1979. From materialism to middens: a case study at Elands Bay, western Cape, South Africa. Unpubl. Hons. Project. Dept. of Archaeology, U.C.T.
- HUMPHREYS, A.J.B. 1979. The Holocene sequence in the northern Cape and its position in the prehistory of South Africa. Unpubl. Ph.D. Thesis. U.C.T.
- INSKEEP, R. 1980. Comments on 'time and place'. S. Afr. archaeol. Bull. 35:104.
- JOUKOWSKY, M. 1980. A complete manual of field archaeology. New Jersey: Prentice Hall.
- LEAKEY, M.D. 1971. Olduvai Gorge, Vol. 3: excavations in Beds I and II, 1960-1963. Cambridge. Cambridge Univ. Press.
- MAGEE, B. 1973. Popper. Glasgow. Fontana.
- MANHIRE, A.H., PARKINGTON J.E. & ROBEY, T.S. 1983a. Stone tools and Sandveld settlement, Paper presented at the S.A.A.A. conference, Gaborone, Botswana.
- MANHIRE, A.H., PARKINGTON J.E. & VAN RIJSSEN, W. 1983b. A distributional approach to rock art in the south western Cape. S. Afr. archaeol. Soc. Goodwin Ser. 4:29-33.
- MAZEL, A.D. 1978. Stories in stones. Unpublished B.A. Hons. Dissertation, University of Cape Town.

- MAZEL, A.D. & PARKINGTON, J.E. 1980. Sandy Bay revisited: variability among Late Stone Age tools. S. Afr. J. Sci. 74:381-382.
- MAZEL, A.D. & PARKINGTON, J.E. 1981. Stone tools and resources: a case study from Southern Africa. S.Afr. J. Sci. 74: 381 -382.
- NORCLIFFE, G.B. 1977. Inferential statistics for geographers. London. Hutchinson.
- ORTON, C.R. 1980. Mathematics in archaeology. Cambridge. Cambridge. Univ. Press.
- ORTON, C.R. 1982. Stochastic processes and archaeological mechanism in spatial analysis. J. archaeol. Sci. 9:1-23.
- PARKINGTON, J.E. 1972a. Seasonal mobility in the Late Stone Age. African Studies 31: 223-243.
- PARKINGTON, J.E. 1972b. Stone Implements as information. S. Afr. archaeol. Soc. Goodwin Ser. 1:10-20
- PARKINGTON, J.E. 1976. Coastal settlement between the mouths of the Berg and Oliphants Rivers, Cape Province. S. Afr. archaeol. Bull. 31:127-140.
- PARKINGTON, J.E. 1977a. Follow the San. Unpublished Ph.D. thesis, Cambridge University.
- PARKINGTON, J.E. 1977b. Soaqua: hunter - fishers of the Oliphants River Valley, western Cape. S. Afr. archaeol Bull. 32:150-157.
- PARKINGTON, J.E. 1979. Soaqua. Unpublished research reports distributed at the S.A.A.A. conference, Cape Town.
- PARKINGTON, J.E. 1980. Time and place: some observations on spatial and temporal patterning in the Later Stone Age sequence in Southern Africa. S. Afr. archaeol. Bull. 35:73-83.
- PARKINGTON, J.E. 1981. The effects of environmental change on the scheduling of visits to Elands Bay Cave, Cape Province, S.A. In Hodder, I., Isaac, G. & Hammond, N. eds Pattern of the past: studies in honour of David Clarke. Cambridge: Cambridge University Press.
- PARKINGTON, J.E. & POGGENPOEL, C. 1971a. Excavations at De Hangen, 1968. S. Afr. archaeol. Bull. 26:3-36.
- PARKINGTON, J.E. & POGGENPOEL, C. 1971b. A late Stone Age burial from Clanwilliam. S. Afr. archaeol. Bull. 26:82-84.
- PYDDOKE, C.K. 1961. Stratification for the archaeologist. London. Phoenix House.

- RAWLINSON, R. 1979. Untitled draft of Archaeology Additional dissertation. University of Cape Town.
- RILEY, T.J. 1974. Constraints on dimensional analysis of variance. American Antiquity 38.3: 266-278.
- ROBERTSHAW, P.T. 1977. excavations at Paternoster, south-western Cape. S. Afr. archaeol. Bull. 32:63-73.
- ROBERTSHAW, P.T. 1979. Excavations at Duiker Eiland, Vredenburg district, Cape Province. Ann. Cape. Prov. Mus. (human Sci.), 1:1-26.
- ROBERTSHAW, P.T. 1981. Archaeological excavations at Langebaan Lagoon, Cape Province. in Van Zinderen Bakker, E.M. & Coetzee, J.A. (eds). Palaeoecology of Africa 10/11:139-148.
- SAMPSON, G. 1980. Comment on time and place. S. Afr. archaeol. Bull. 35: 103.
- SCHIFFER, M.B. 1974. On Whallon's use of dimensional analysis of variance at Guila Naquitz. American Antiquity 39.3:490-492.
- SCHOFIELD, J. (ed). 1980. Archaeological site manual, part 1: the written record, Museum of London.
- SCHWEITZER, F.R. & WILSON, M.L. 1982. Byneskranskop 1: a late quaternary living site in the southern Cape Province, South Africa. Ann. S. Afr. Mus. 88.1.
- SEALY, J. 1984. Stable carbon isotopic assessment of prehistoric diets in the south-western Cape, South Africa. Unpubl. M.Sc. Thesis, U.C.T.
- SHARER, R.J. & ASHMORE, W. 1979. Fundamentals of archaeology, Menlo Park, California: Benjamin Cummings.
- SIEGEL, S. 1956. Nonparametric statistics for the behavioural sciences, New York. McGraw Hill.
- SIRIAINEN, A. 1977. Pieces in vertical movement: a model for rockshelter archaeology. Proc. Prehist. Soc. 43:349-353.
- STARK, B.L. & YOUNG, D.L. 1981. Linear nearest neighbour analysis. American Antiquity 46.2:285-300.
- STOCKTON, E.D. 1973. Shows Creek shelter: human displacement of artefacts and its significance. Mankind 9:112-117.
- THACKERAY, A. 1980. Comments on 'Time and place'. S. Afr. archaeol. Bull. 35:104.
- TRIGGER, B.G. 1967. Settlement archaeology: its goals and promise. American Antiquity 32.1:149-160.

- TRIGGER, B.G. 1978. Time and traditions. Edinburgh. Edinburgh Univ. Press.
- VILLA, P. & COURTIN, J. 1983. The interpretation of stratified sites: a view from underground. J. Archaeol. Sci. 10.3:267-281.
- WHALLON, R. 1973a. Spatial analysis of occupation floors I: dimensional analysis of variance. American Antiquity 38.3:266-278.
- WHALLON, R. 1973b. Spatial analysis of palaeolithic occupation areas. in Renfrew, C. (ed). The explanation of culture change: models in prehistory. London. Duckworth.
- WHALLON, R. 1974. Spatial analysis of occupation floors II: the application of nearest neighbour analysis. American Antiquity 39.1:16-34.
- WHEELER, M. 1954. Archaeology from the earth. Pelican Books.
- WHITE, J.R. 1980. A closer look at clusters. American Antiquity 45.1:60-74.
- WOOD, R.W. & JOHNSON, D.L. 1978. A survey of disturbance processes in archaeological site formation. in Schiffer, M.B. (ed). Advances in archaeological method and theory, Vol. 1. New York. Academic Press.

APPENDIX A

SOME NOTES ON EXCAVATION METHODS AND INTERPRETIVE TECHNIQUES FOR

SHELL MIDDENS AND OTHER UNCONSOLIDATED DEPOSITS

INTRODUCTION

The comments in this section are intended as a methodological guideline for future research in the western Cape. Because this will inevitably involve both senior and junior researchers there are bound to be some statements which may appear obvious or trivial; nonetheless they are all important. To leave out certain basics would be to invite error among students and complacency among others; and complacency is as dangerous as ignorance. The methods discussed, whilst primarily intended for the excavation of shell middens, are often equally applicable to other loosely compacted deposits of sandy soils and ash.

Since in the western Cape, termite activity and the occurrence of burrowing animals are very common, all stratified sites should be considered disturbed until they can be shown to be otherwise. It is therefore of primary importance to be able to assess the degree and extent of disturbance and the effect it may have had on material remains, in particular the horizontal and vertical displacement of artefacts through the deposit. Without such an assessment, it is pointless to even begin to discuss such entities as faunal and artefactual assemblages, let alone attempt regional or cultural comparisons and syntheses. Some quantifiable estimate of disturbance is equally vital for any discussion of intra - site activity patterning. I have tried to show in the preceding chapters that the assessment of depositional integrity will be best achieved through consistent studies of site taphonomy, rather than simply on the recording of the units of excavation. In loose deposits in particular, great care must be taken to record such data, as disturbance is rarely well defined.

SITE CHOICE

If a degree of disturbance and post - depositional movement of material is to be taken as the norm, then it is reasonable to assert that the most coherent assemblages and patterning are to be obtained from sites which can be shown to have been visited only once, or a few times at most, over a relatively short period of time. That shallow deposits are likely to prove less

attractive to termites and burrowers can only serve to strengthen this assertion. The deeper the deposit, the more complex the stratigraphy and the taphonomic processes are likely to be. If we are to begin to understand the changing patterns of artefact use and ecological exploitation through time or across the landscape, we must first attempt to understand the simplest elements of the pattern.

Long term excavation of scattered sites with deep deposits should become a thing of the past: the data available at present are sufficient to gain a general impression of the patterns of change in the region. Research should now be concentrated on understanding the individual elements of the recognised patterns, and to do this it is necessary to be able to isolate these elements with confidence. Again, for this purpose, simple sites are the best choice. Too much effort has been expended in trying to extract detail from complex sites without first attempting to understand simple ones.

GRID SIZE AND ARTEFACT PLOTTING

It is not possible to control for the effect of grid shape and location on stratified sites and these are best treated as random variables. I have suggested earlier that the exact plotting of individual artefacts in unfragmented shell middens is impractical. This may not be the case in sand or ash dominated deposits and co-ordinate plotting of as many finds as possible is obviously desirable, in which case grid size is less important than accuracy. Where plotting is not a feasible proposition, however, the effect of grid size on quadrat methods of spatial analysis is an important consideration.

It is evident that to improve the definition and application of these methods, a grid size smaller than $1m^2$ is needed. In some instances a 50cm grid may be the smallest practical, but a smaller size of 25cm or even 10cm will increase the possibilities for statistical analysis. It can be argued that human activity areas are not visible at such a small scale, but whilst this may be true the concern here is to overcome the problems inherent in the use of a fixed grid for provenience. The definition of loci must improve as the grid approaches point size and it is for this reason that a reduced area is desirable. Generally, the finer and better sorted the depositional matrix, the finer the grid subdivision which may be used.

PLANS AND SECTIONS

Excavation is destructive! it is therefore the duty of the archaeologist to fully and accurately record every observation and all errors. For any spatial study, usable plans are as important as the establishment of contemporaneous horizons. The latter is achieved through the interpretation of taphonomic observations and neither can be achieved in a $1m^2$ test pit, whilst only the most mundane of observations can be made by doubling this area. The greater the area of open plan excavation, the more reliable the plans produced, but the fewer witness sections remain in the event of levelling or excavational errors. In the excavation of shell middens, an area of $2m \times 2m$ is, in my experience, a minimum working size, and the opening of areas up to $3m \times 3m$ will only serve to clarify spatial observations. This is not to suggest that excavation should be limited to these areas! on the contrary, the recommendation is for extensive open plan excavation rather than penetration. For this purpose, shallow deposits are ideal. The limitations suggested above are a compromise which ensures sufficient vertical control around areas which may, with care, be opened between witness sections.

Sections are no less a vital part of the interpretation of site taphonomy as they were for stratigraphy. The section provides a visual record to compare to stratigraphic and taphonomic observations made during excavation, as well as a back up to the levelling in the event of errors. Drawing the section with labels in place serves only to confirm the decisions already made and not to check them. The labels tend to distract from an attempt at impartial examination, and it may be advisable to remove all but the most vital of them, leaving only the pins in place, before attempting to check the correlation between what was dug and the layering visible in the section. In these checks, it is important to look not for confirmation, but for mistakes.

If reliable levelling equipment is used with frequent checks, open plan excavation should be possible. Where there is any doubt as to the reliability of equipment or operator, the use of the minimum area is advisable, or an alternative should be devised such as the excavation of alternate squares. This will then provide adequate back up, whilst still allowing considerable accuracy in mapping. Sections may be permanent (maintained to bedrock) or temporary (recorded and checked periodically before removal to the current level of excavation) depending on the nature of the deposit, the strata and the extent of the dig. Although the extensive or complete

removal of individual units in their stratigraphic sequence facilitates mapping, it does mean that error correction possibilities are limited, and should be undertaken with caution.

LEVELLING

The use of a level on site allows the excavator much greater freedom than simple use of sections and description for vertical control. Levels have been in common use for decades now, but still there appears to be a totally unwarranted trust placed in the results. Alternatively, they are used irregularly, and become of no more use and less reliable than sections. The level is a delicate instrument and is easily put out of true. Only regular checks on the accuracy of the bubbles, as recommended in the handbooks, and on the horizontality of the instrument when set up, can ensure accuracy. Even a moderate breeze can unsettle the instrument, especially when it is set up on loose archaeological deposit. Whenever possible, the instrument should be protected from wind, and in gusty conditions should be checked against two data points before each group of readings are taken. Archaeologists are not surveyors and it is best to check the results of levelling immediately. This is best done by keeping a series of 'running sections' based on reduced levels, which are added to after each new set is taken. This allows suspect readings to be retaken before more deposit is removed and keeps a constant check on the consistency of both instrument and operator.

RECORDING

The plea in this volume has been for more detailed and objective recording of excavations in order to maximise the potential for accurate and informed reconstruction. The use of standardised information sheets for description of all contexts is advocated as an excellent means of achieving this, to supplement the field notebook which can now be used mainly to record interpretive information and a diary of work carried out. The written record must aim to gather data relevant to site taphonomy and the notebook should include observations of this nature in detail. The importance of recording and checking levels immediately has been stressed above, but whenever possible, a parallel check should be run on working site plans. These can be transferred at regular intervals on to a set of master plans to ensure that the record is coherent and complete. All this imposes demands on the excavation team which require the establishment of a hierarchy of supervision and explicit allocation of responsibilities.

THE FIELD CREW

To operate the system outlined here efficiently, it is necessary to allocate specific duties to certain experienced members of the crew. This presupposes the presence of such people on site and it must be evident that a dig can no longer be undertaken with one or two qualified leaders and a score or so of novice sorters. Ideally the site supervisor should be free to control all aspects of the recording and recovery and not ^{be} personally involved full time with digging, but this is not always practical or desired. In this case the site assistants' duties must be extended to include supervision, and their experience must therefore be greater.

It is important that one such assistant be appointed to deal primarily with the drawing and checking of plans and levels and should have some draughting experience or ability to deal with problems of scale. This office may be doubled with that of surveyor, but then the assistant should have good experience in this field to cope with instrument problems.

A second assistant should be responsible for accessioning and curation of finds on site. This not only saves time later, but helps overcome labelling errors and damage sustained by artefacts through poor packaging. Ideally this post should be connected to a field laboratory to process soil samples and undertake preliminary sorting, and identification of materials. The more of this type of work which can be carried out during excavation, the more errors, anomalies and queries can be corrected whilst the evidence still exists.

The ^pphotographic record is a vital part of modern excavation and whilst it is not usually possible to include a photographer on the crew, when there is a competent person available he/she should be made solely responsible for photography, for film supply and processing in the field, if facilities can be made available. Other experienced personnel should be placed to supervise sorting and specific sections of the excavation, if it is extensive.

The allocation of these duties to responsible experienced personnel on the field crew is the best way to ensure the most complete and unambiguous field record of an excavation. Given that circumstances and finance vary from one project to another, it is not possible to lay down a

hard and fast structure to suit every instance, and these ideas represent a suggestion of the sort of organisation which will have to be considered if an improved field record is to be achieved.

ANALYSIS AND REFITTING

It is obviously not possible to predict prior to excavation whether even a shallow site might contain more than one occupation horizon. When multi-component deposits are encountered in fieldwork, particularly if those deposits are unconsolidated, an assumption of the homogeneity of excavated layers should no longer be valid. Even where taphonomic observations give no evidence of disturbance, some attempt must be made to refit artefacts from different levels to define in some way the extent of subsurface movement that has occurred.

Similarly, it must be apparent that the concept of faunal M.N.I.s calculated from tabulations of numbers in individual levels is not sufficient where subsurface movement is likely. The pairing of diagnostic elements of the most common species will enable an easy assessment of the degree of admixture of material and allow a more accurate analysis of the faunal component. More thought must also be given to the contribution made by carnivores, scavengers and rodents to the site fauna and an attempt made to account for this element.

Programs such as these allow for independent correlation of field observations of site taphonomy. In future research on shell middens and sandy or loose deposits, they must seriously be considered for inclusion in the overall design.

SUMMARY

I have suggested here that to obtain more reliable and objective data on prehistoric lifestyles and archaeological patterning, a change in research design and methodology is required. This is particularly true when dealing with the loose sandy deposits and shell middens of the western Cape, where post-depositional disturbance is a factor which cannot be ignored or simply assumed to be limited. More particularly I have suggested some improvements in excavation techniques and team organisation which will enable a better degree of control over taphonomic factors which may influence the reliability of retrieved data.

For logistic reasons of finance, transport and labour, the present economic climate is a poor one in which to introduce more stringent controls on field research methods. Yet it must be done now to avoid making redundant large quantities of data which will inevitably come out of the western Cape program and others in the next few years. To reduce logistic pressures whilst retaining the improved methodology, and to facilitate the understanding of the taphonomic and other factors affecting interpretation, a change in short term goals has been put forward.

I propose that future research be planned around the excavation of localised clusters of small sites with relatively simple and shallow deposits relating to one or a few occupations. The establishment of a series of localised intensive study areas across the landscape will supply more useful data on spatial and temporal variability than will the excavation of a few widely scattered complex sites. Since small sites are far more common than their large counterparts in the western Cape, it is ethically preferable to undertake open plan excavation in such shelters. There will be many similar sites which can be left as 'witness' cases for future researchers, allowing the excavation and removal of most of the deposit to investigate fully the spatial characteristics of each site. At the same time the risk of sample contamination from units of widely differing age will be reduced. Small sites lend themselves to rapidly completed excavation and analysis to allow for regular positive feedback to funding bodies. Finally, projects built around such easily divisible research provide better sources for student research and more complete training than do long term, single site projects. I am certain that this is the way in which the great potential of western Cape Stone Age studies can best be realised, but it must be built on a firm foundation of a knowledge of local taphonomic variables and their effect on spatial and temporal patterning. It is necessary now to plan for the next decade of research and to aim at producing graduate students capable of undertaking the detailed research and experimental work required to understand the sites with which we have to deal.

APPENDIX B

TORTOISE CAVE 1978-83: STRATIGRAPHIC LIST OF CONTEXTS AND LAYERS

LAYER 1a.

SURFACE [Squares T, T2, Y, Y2, I, I2, I3, J, J2, J3, K, K2, K3,
X, X2, X3, G, H.]

TOPSOIL, SURFACE SCRAPINGS [In squares as for SURFACE]

[All other Surface bags should be regarded as mixed contexts]

DEGAS, DEGAS AND TOPSOIL, BACK OF DEGAS

BENDIX, CONSTABLE, NIELLSON, OSCAR

TWIG LEN, BASE OF TWIG LEN, DUST OVER BEDDING

GREY ASH WITH DUNG PELLETS (GAWDP)

FOLD UP BEDDING (FUB), BASE OF FOLD UP BEDDING

FUB 760 ± 50
Pta 3600

SHELL AND GRASS, BEDDING AND SHELL

BEDDING A, BASE OF BEDDING A, BEDDING B

HEARTH NEXT TO BEDDING A, HEARTH BELOW TWIG LEN

LAYER 1b

CACOPHONIX, BEDDING C, BEDDING D

FRAGMENTED BEDDING, BEDDING ON MAX

MAX, HEARTH BELOW MAX, LOUBIE (LOOBY, LOUBY ETC.)

GREY LOUBIE, BURNT SHELL, FRAGMENTS, HEARTH ON GAUGUIN

DOGMATIX, BASE OF DOGMATIX, CLEANINGS AROUND HEARTH

LAYER 2a

ASTERIX, ZULU, PISSARRO, CLEANINGS ABOVE ERNST/GAUGUIN

ERNST, ERNST/PISSARRO, GAUGUIN, ERNST/GAUGUIN

HALS, FEATURE AMONGST ROCKS, BELOW LOUBIE (UNDER LOUBIE),

DJANGO, LEN (LENNIE, LAYER LEN), FRAGMENTED LEN, BACK OF MIDDEN

LAYER 2b

VINCENT, DAVE, SALLY, JOSH, KLINE, ROOTS

RUBENS, BASE OF RUBENS, FELIX, IVAN, JASPER, ENIGMATIX

FRAN, BEDDING IN FRAN (BEDDING IN BASE OF FRAN)

Fran 1580 ± 50
Pta 3309

BASE OF FRAN, BACK OF FRAN, COMPACTED FRAN

SOIL UNDER RUBENS

LAYER 3

ASH ABOVE SEURAT, SEURAT, LAUTREC, ASH BELOW LAUTREC

ASH BELOW DAVE, ASH BELOW DAVE I (AED I)

ASH BELOW DAVE II (ABD II), SHELL LENS IN ASH BELOW DAVE II ABD II 1620 ± 50
Pta 3310

TURNER, MATISSE, JEFF Turner 1610 ± 50
Pta 3311

BLIND BOY, ALVIN Alvin 1680 ± 50
Pta 3312

LAYER 4

LOOSE MIDDEN, SOB

[Dating and association uncertain but below Layer 3]

LAYER 5a

UM (Upper Midden) 1 to 9 [Square AA 2]

SPITS 1 to 5 [Square AA only]

LAYER 5b

UPPER SSL, LOWER SSL (Sloping Shell Lens)

[Square AA 2 only - it is not possible to separate finds from
AA Spits 1 to 5 into Layer 5a and 5b]

LAYER 6

SM (Shelly Midden) 1 to 9 [Square AA 2]

SM 2 3520 ± 60
Pta 3604

SHELL OVER ASH, WASP [Square AA 2]

SPITS 6 to 12 [Square AA]

LAYER 7

LM (Lower Midden) 1 to 8 [Square AA 2]

SPITS 13 to 18 [Square AA only]

LAYER 8

HIGH, FU (Final Unit) 1 to 5 [Square AA 2]

FU 3/4 4020 ± 60
Pta 3595

CLEANINGS ON HASH

SPITS 19 to 27 [Square AA]

LAYER 9

WRIGHT, X RAY, SPIT 1 [All squares except A, AA, AA2]

TOPPERS, BASE OF TOPPERS, REBEL, BASE OF REBEL

SCAR, BURIAL #1, FINAL CLEANINGS [S3, S4, R3, R4]

LAYER 10

MELANIE, GREY TALUS, GT, LOWER GT, DRIZZLE

Melanie 4190 ± 60
Pta 3608

SLIM, PELMEL, SHELL LENS IN MELANIE

FINAL CLEANINGS [S1, S2], FUBAR

LAYER 11a

VICTOR, VALIANT, VULCAN, BASE OF VULCAN, VEEBEE

FBL (Fine Brown Loam) I, II, SPIT 2 & 2a

LAYER 11b

YANKEE, FBL (Fine Brown Loam) III, IV

FBS (Fine Brown Shelly), SPIT 3, SPIT 3b

LAYER 12

DOODLE, SPECKLE

[Dating and association uncertain but below Layer 11b]

LAYER 13a

CHARLIE, CERI, KERRY, SPIT 4

DELTA, GASH (Grey Ashy Shell patch) 1, GASH 2

Delta 4330 ± 50
Pta 3605

LAYER 13b

ECHO, GASH 3, FIDO, COUGH, GASP

CLEANINGS UNDER FIDO, SPIT 5

LAYER 14

GLOW, HASP (Hard Ashy Shell Patch), GANDALF, HOME	Home	8100 ± 70
	Pta 3596	(on shell)
DER (On Bedrock), SBH (Soil Below Home)	7700 ± 70	
SPIT 6, AMONGST ROCKS		(corrected)

[Square Brackets indicate comments]
(Normal Brackets indicate alternative labelling)
All dates on charcoal except where stated.

MISCELLANEOUS CONTEXTS

BASE OF DAVE (This is a trampled cleanings unit which lies directly on SPECKLE and may be mixed)

UNDER BLIND BOY, SOIL IN CREVICES, KTAT
(These units are mixed and may contain material from even the earliest occupation)

CLEANINGS AROUND CRANIUM, CAC, BURIAL PIT INFILL, BPI, LOWER BPI (These units are mixed and contain material from REBEL and earlier)

SPECKLE (This unit lies on bedrock and seems to be old but may belong anywhere below LAYER 4; from its appearance it probably is contemporary with DOODLE in LAYER 11c and is tentatively placed with it).

