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# THE GETTING OF DATA

A case study from the recent
industries of Australia

by

IAN JOHNSON

Submitted for the degree of
Doctor of Philosophy
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Except where otherwise stated in the acknowledgements and in the text, this thesis is based entirely on my own fieldwork and research.

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Such knowledge as they possessed was a strange jumble, picked up at random:...The subject being thus chastely shrouded in mystery, they were thrown back on guesswork and speculation... Innumerable theories were afloat, one more fantastic than another; and the wilder the conjecture, the greater was the respect and applause it gained.

Henry Handel Richardson
The Getting of Wisdom



**Capertee 3** *circa* **1960**
*Photograph courtesy John Bland*

Acknowledgements

The origins of this thesis can be traced back well before the start of my research. My greatest debt is to my parents who encouraged and supported my interest in prehistory. Paul Callow and Jean-Philippe Rigaud influenced me to get involved in spatial analysis and the uses of computers whilst my interest in excavation techniques developed through participation on a number of excavations, notably those of Professor A. Leroi-Gourhan and Jean-Philippe Rigaud. Professor F. Bordes and Charlie Dortch put me on the road to the ANU.

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Abstract

Two obstacles stand in the way of satisfactory synthesis of Australian prehistory at more than a very general level. In the first place, excavation techniques have grown up piecemeal and have failed to come to grips with the difficult conditions posed by the undifferentiated sandy stratigraphies and low sedimentation rates typical of many Australian sites. In the second place, the piecemeal genesis of excavation techniques is reflected in the lack of established channels for the exchange of excavation data and in incompatibility between the information recorded by different workers.

The first part of this thesis examines the prehistory of the Blue Mountains area, starting with a general review and leading to a more detailed study of the Noola and Capertee 3 sites. The study of these two sites suggests that the model of a site as a chronologically continuous sample may not be applicable even to sites with rich assemblages and that horizontal patterning is an important feature which must be taken into account when designing site sampling strategies. New dating of Capertee Site 3 confirms that backed implements appear in the site at about 3000BP.

Following on from the Capertee 3 dating, a critical review of the literature relating to the appearance of backed implements and of other traits associated with the Australian Small Tool Tradition demonstrates that no dates older than about 5000BP have yet been substantiated for Small Tool Tradition assemblages. However it has not proved possible to tie the dating down accurately owing to the lack of data and imprecision of associations between dated samples and artefact assemblages.

The concluding chapters are aimed at resolving some of the problems identified in the preceding discussion. Attention is focussed on methods of data recording, since standardisation of this aspect of excavation not only helps establish a framework for excavation onto which individual strategies can be grafted, but represents a first step in the direction of greater comparability between data collected by different workers. The discussion is completed by the documentation of a computerised system for the recording and analysis of excavation data. The use of such a system facilitates the analysis of the material and also generates a catalogue which can be duplicated for storage with the collection. It is suggested that future developments should be aimed at standardisation of basic classificatory and attribute systems in order to promote comparability between collections and thus provide a better information base for the synthesis of Australian prehistory.

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cont'd

GLOSSARY

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APPENDIX II Attribute and classificatory system used in the analysis of Capertee site 3

APPENDIX III Blank field and computer coding forms

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BIBLIOGRAPHY

# CHAPTER 1

## Introduction

## Scope and direction of the thesis

Excavate, v.t.....; dig out (soil) leaving a hole; unearth, get out, by digging (O.E.D.)

Excavation is a destructive process. As such it must be judged not upon gross information yield but upon the efficiency with which we exploit the information potential of the deposits. Excavation is necessarily a compromise between information retrieval and research expediency.

There are three stages in the exploitation of an archaeological site. EXCAVATION involves the irreversible filtering of the site to eliminate information and material considered to be of no archaeological importance. ANALYSIS involves the selection of information and material for detailed study and description, either as a means of searching for interpretable patterning or to test specific hypotheses. The selective nature of analysis implies a third stage of STORAGE AND DOCUMENTATION, a stage which is all too frequently neglected as being unproductive for the individual research worker. Only if a collection is thoroughly documented and stored in an organised fashion is there chance that subsequent workers will be encouraged to rework the material for any of its unexploited potential.

The thesis of this work is that insufficient attention has been paid to the design and systematisation of excavation techniques or recording techniques and to the exchange of data from excavations. The methodological section of this thesis is therefore concerned with excavation techniques and, more particularly, with the recording and storage of data. I have concentrated on these aspects rather than on methods of analysis, for the following reasons:

1. Excavation is irreversible and it is therefore of paramount importance that we should excavate as little as possible for our research requirements. Improvements in excavation methodology will help to conserve sites or parts of sites by allowing questions to be answered from smaller excavations and eliminating some questions which should never have been asked.

2. By setting out an explicit excavation methodology it becomes possible to design standardised coding forms and computer programs. This reduces the drudgery of recording the data and opens the way to use of the computer for data storage and analysis.

3. Dusty shelves packed with boxes of uncatalogued material are the legacy of the past. Even in Australia, with a short history of archaeology, the backlog would take years to catalogue and bring up to a very basic standard of analysis. By providing a structure for data recording which automatically generates a systematic catalogue of the excavated material, I hope to help render the museum shelves of the future a little less imponderable. Since the data can be stored on magnetic tape it should be possible to incorporate it in the future into computerised museum catalogues or a centralised archaeological data bank.

4. Unlike excavation, storage and documentation, the analysis stage is difficult to standardise and standardisation could lead to stultification. I have therefore limited my consideration of the analysis stage to providing a few procedures to help calculate basic statistics and a framework for adding on problem-oriented analyses.

Development of the thesis

It is perhaps the nature of theses that they rarely end up following the topic that was originally planned. Whilst this is partly a function of fools rushing in where wise men fear to tread, it may also be an indication that the project has unearthed new avenues of investigation, or has found old avenues blocked by unseen debris.

The final form of this thesis owes much to these several factors. In a seminar towards the middle of 1977 I was able to show patterning in published tool counts through both time and space. This patterning suggested that it might be possible to look at variability within the recent Australian industries on the basis of published data and to investigate the correlation of this variability with factors such as physiographic and environmental zones, and of course chronology. With over 200 excavated and published sites in Australia, the way appeared open for an attempt at synthesis of the variability apparent within and between these industries, which are generally referred to by the collective term Australian Small Tool Tradition (Gould 1969a:235). Since over half the excavated sites are situated in the south-east of the continent, I intended to concentrate on this area and, in

particular, to look at the exploitation of the highlands through a detailed study of the Blue Mountains, west of Sydney (fig. 1).

Several obstacles stood in the way of such a project. First, few collections have been comprehensively analysed and documented and a number have seen the light of day only once since their creation. Secondly, even where material has been thoroughly documented, differences in technique at both the excavation and analysis stages hinders comparison between sites. Thirdly, the 'cowboy' phase of Australian prehistory has encouraged the uncritical use of simple 'spit' methodologies which, I shall argue later, are unable to cope with the difficult stratigraphic conditions encountered in sandstone rockshelters.

By the end of 1977 I had realised that I could not proceed with my original project without reanalysing large numbers of collections. This thankless task was fortunately well beyond the scope of a three year PhD. Far more urgent than any reanalysis or synthesis of extant collections was the basic groundwork of systematising and standardising excavation recording techniques in such a way that computer methods could be used in future to keep track of excavated material and data derived from it. I have therefore narrowed the strictly archaeological content of this thesis to a detailled reassessment of the prehistory of the Blue Mountains area and its impact on our concept of the Australian Small Tool Tradition. The methodological aspect of my thesis is illustrated in the context of my Blue Mountains study by the re-excavation of McCarthy's classic Capertee Site 3 (McCarthy 1964). I have used this analysis primarily as substantive material to demonstrate the need for systematisation and tightening of excavation and data recording techniques. In the latter part of the thesis I have concentrated my attention on the development of a rigorous yet flexible excavation recording methodology suited to Australian conditions. This shift in orientation of my topic has entailed the omission of much of my initial work some of which has been, or will be, published in a separate context.

Historical background to the problem of the Small Tool Tradition

In the first decades of this century the study of Australian prehistory was the province of the collector of stone artefacts. The prevailing view was one of a brief period of Aboriginal occupation and homogeneity of Aboriginal culture. Regional variations in stone tools were seen merely as adaptations to locally available stone types (Mulvaney 1961:59-60).

The death knell of this view was sounded by Hale and Tindale's report (1930) on their excavations at Devon Downs on the lower Murray. They found several metres of stratified deposits in which they distinguished three separate 'cultures' which could not be accounted for in terms of changing stone types. Hale and Tindale's excavations were followed soon after by Towle and McCarthy's 1934 excavations at Lapstone Creek (McCarthy 1948, 1978) which also showed marked changes in stone tools through time. However, it was not until the end of the 1950's and beginning of the 1960's that Australian prehistory really got off the ground with a series of reports on stratified sites and publication of numbers of C14 dates (e.g. Mulvaney 1960, 1961a, Mulvaney, Lawton and Twidale 1964). By the middle of the decade a number of local industrial sequences had been proposed (e.g. Tindale 1957, McCarthy 1958,1964, Mulvaney and Joyce 1966) and detailed regional studies were underway (e.g. McBryde 1966b, White 1967).

Mulvaney's excavations at Kenniff Cave (Mulvaney and Joyce 1966) have probably proved the most influential in generating the concept of the Small Tool Tradition. Mulvaney proposed a three phase local sequence, the earliest phase being characterised by the observation that 'varieties of scraper constitute 100 per cent of all classifiable artefacts' (Mulvaney and Joyce 1966:172). This phase was termed the 'pre-hafted' phase because scrapers were considered as probably hand-held rather than mounted as composite tools and the similarity with the Tasmanian industries was noted (ibid.:207). The latter were isolated by rising sea level considerably before the end of the 'pre-hafted' phase at Kenniff Cave and have to some degree 'fossilised' the characteristics of this phase (cf. Jones 1977, Bowdler 1977). The succeeding phase was termed the 'microlithic hafted' phase, characterised by a proliferation of more specialised types, such as geometric microliths, which were interpreted as elements of composite tools. At the end of the sequence a 'late hafted

phase' is characterised by the disappearance of microlithic backed implements and the appearance of a range of large scrapers different from those in the underlying levels and of the Juan Knife, a very large backed implement quite unlike the small microlithic backed implements of the preceding industry (ibid.:181,190-192, Tindale 1957:29).

Mulvaney (ibid.:193,209) warns against the danger of strict correlation between the three phases of his Kenniff Cave sequence and the phases or industries of Tindale's Murray Valley sequence (Tindale 1957) or McCarthy's Eastern Regional Sequence (McCarthy 1964). However he does suggest that, whilst specific 'cultural' or 'industrial' terminology has only regional validity, there may be overlying technological stages with widespread validity linking individual local sequences. His cautious twofold division into pre-hafted and hafted phases[1] has become an anchor point for Australian prehistory.

In the first edition of The Prehistory of Australia (1969) Mulvaney terms these two technological stages the 'Core and Flake Tool' and 'Inventive' phases. To this he added a tentative final phase, the 'Adaptive' phase, to cover changes observed in a number of southeast Australian sites over the last few centuries or millenia before the arrival of the Europeans (e.g. Lampert 1966, Mulvaney and Joyce 1966, Megaw 1968). More or less synonymous phases have been referred to by other workers, e.g. Phases I, II and III by Lampert (1971a), but the generally accepted terminology for the pre-hafted phase is now the Australian Core Tool and Scraper Tradition ( Bowler et al. 1970:52) and for the hafted phase Australian Small Tool Tradition (Gould 1969a). The Adaptive phase has not proved to be such a ubiquitous feature of local sequences as the other two phases and has not become such a widely accepted concept or achieved a consistent terminological status.

The Core Tool and Scraper/Small Tool dichotomy has proved a convenient way of characterising archaeological sequences across the continent. It has been identified from sites in Western Australia, e.g. Miriwun (Dortch 1977) and Puntutjarpa (Gould 1977), in the Northern Territory, e.g. Tyimede II (White 1967) and Ingaladdi

(1) The 'late-hafted' phase was absent at the nearby site of The Tombs and in any case represented a less fundamental technological change than the hafted/non-hafted dichotomy.

(Sanders 1975), in Queensland, e.g. Kenniff Cave (Mulvaney and Joyce 1966) and Native Well (Morwood 1979), in New South Wales, e.g. Burrill Lake (Lampert 1971a) and Burke's Cave (Allen 1972) and in Victoria, e.g. Clogg's Cave (Flood 1974). The dichotomy is not, however, found in Tasmania and this is widely attributed to the severance of Tasmania by rising sea level (e.g. Jones 1977) well before the period to which the changes in lithic industry are dated.

There is, however, a danger in the continent-wide application of such a predetermined terminology, that it will be applied across the board to situations in which it is not applicable, i.e. the data will be stretched to fit the terminology. It has long been apparent that there is a considerable degree of regional variation in the assemblages attributed to the Small Tool Tradition, expressed notably in the restricted distributions of particular artefact types (e.g. Mulvaney 1975,1978) and the definition of distinctive local sequences (e.g. Tindale 1957, McCarthy 1964, Mulvaney and Joyce 1966, Lampert 1972, Dortch 1977). This observation need not be at variance with the hypothesis of a continent-wide diffusion of ideas, but on the other hand it could indicate independent local inventions at widely different times.

In general the difference between the Core Tool and Scraper and Small Tool Tradition industries lies in a reduction of artefact size, better controlled flaking involving more careful core preparation (cf. Stockton and Holland 1974, Lampert 1971a, Mulvaney 1975) and better quality raw materials, in many cases of exotic origin (e.g. Hughes et.al. 1973). The most widely used criterion is, however, the appearance of new, smaller and more specialised tool types such as backed implements, unifacial and bifacial points and worn down adze slugs. The latter could only have been produced with the specimen hafted and similar specimens are still in use today hafted on the end of spear throwers or special purpose handles (e.g. Hayden 1976:212). Other direct evidence of hafting lies in gum stains observed on the blunted margin of backed implements, e.g. McBryde 1978 table 4, Mulvaney 1960:80) and in macroscopic gum fragments bearing the imprint of a stone artefact or the artefact itself (e.g. McCarthy 1964, pl. 24-2). However there are few ethnographic records of microlithic backed implements being hafted and those records of their use may well relate to archaeological specimens collected from prehistoric camp

sites (see for example McCarthy, Brammell and Noone 1946:42).

Whilst the ubiquitous presence of somewhat similar changes in lithic assemblages throughout the continent argues for the coherence of the Small Tool Tradition (without necessarily implying that it is a tradition), the changes involved have been dated from over 7000BP to less than 3000BP. This spread of dating may be partly attributable to errors of association between the dated samples and the assemblages that they are supposed to date, but I do not believe that this is sufficient to account for the entire spread of dates. If we could show a consistent geographical pattern for the dating of the appearance of Small Tool Tradition industries, e.g. a systematic chronological cline across the continent or radiating outwards from one point, we would not only have strong evidence for the coherence of the Small Tool Tradition but might also be a long way towards identifying its origin (introduced idea(s), single or multiple indigenous development). Unfortunately the imprecision of C14 dates for most assemblages does not at present allow much assessment of the relative dating of Small Tool Tradition industries in different parts of the continent.

The dangers in attempting such an approach without a sufficiently critical base are, I believe, well illustrated by Pearce's (1974) attempt to trace the spread of backed implements (compare Pearce's results with my discussion in chapter 6). It may be that, in the final analysis, we are unable to achieve sufficient precision to resolve differential dating between different parts of the continent, i.e. the start of the Small Tool Tradition may appear as an archaeologically instantaneous occurrence. However, on a more optimistic note, present dating does appear to resolve a difference in dating of the Small Tool Tradition industries between south-eastern New South Wales and surrounding areas (chapter 6).

A second obstacle to establishing the status of the Small Tool Tradition lies in lack of comparability between excavations, in terms of both collection and analysis techniques. We cannot hope to build up a coherent picture of inter- and intra-regional variation until we have a body of comparable data, preferably available as raw data rather than as published summary statistics.

The aim of the methodological section of this thesis is therefore to lay the foundations of a more systematic approach to the recording of excavation data. It has been suggested to me (Rhys Jones pers. comm.) that the methodology I am proposing is a new and more sophisticated methodology aimed at a generation of new and more sophisticated questions. Whilst I should like to believe that I am creating a new and more sophisticated methodology, this is largely untrue; I am simply systematising old ideas and replacing paper files with magnetic ones. Nor do I accept the proposition that the methodology I am proposing is needed simply to answer the more sophisticated questions of the 1980's. We are still addressing the same questions as during the early 1970's; What is the relative dating of the different Small Tool Tradition industries? What is their geographical extent and degree of internal variation? Do they represent external influences or internal development? Are they a tradition, related developments or simply unrelated phenomena grouped under a convenient label?

Until these relatively unsophisticated questions are answered we cannot properly address ourselves to the more important questions concerning the meaning of the changes observed, i.e. what do they represent in terms of human adaptation and social systems? To attempt to answer the latter questions without defining the basic framework of dating and variability is like trying to run before one can walk. The result is likely to be the generation of attractive theories based on shakey data. The danger in this scenario is that these theories will lead research in the wrong direction and divert attention from the questions which will be important in the long term developement of the subject.

## Importance of the Blue Mountains area

The definition of Core Tool and Scraper and Small Tool traditions owes much to the artefactual sequences observed in south east Australia. The area loosely known as the Blue Mountains is particularly interesting for a number of reasons. Firstly, it is roughly in the middle of the intense distribution of excavated sites along the coast and Great Dividing Range of Queensland, New South Wales and Victoria. Secondly, within an area 50 x 100 km, there are eight excavated sites with significant stratigraphies, nine dated

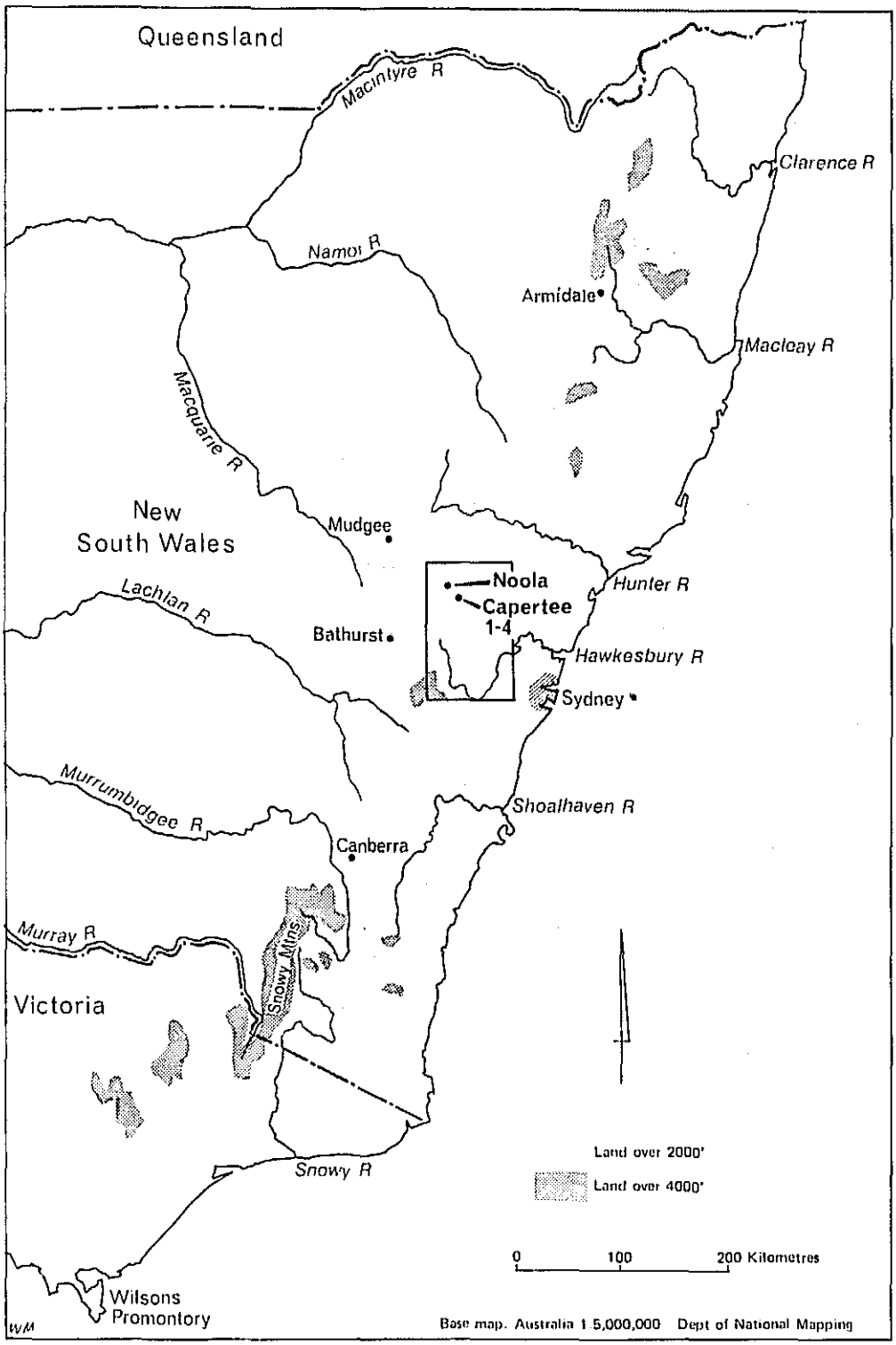



Fig. 1 Map of south-eastern Australia

sites (including six of the stratified sites) and a dozen other sites which have been reported in the literature.

More importantly, however, McCarthy's three phase Eastern Regional Sequence (1964) was based on the Lapstone Creek and Capertee sites within the Blue Mountains area. Both these sites have given rise to dating which is somewhat at odds with established thinking. At Capertee (Site 3) backed implements were dated to approximately 3000BP onwards (McCarthy 1964, Bermingham 1966) whilst backed implements were reported as being over 5000 years old in the nearby Noola site (Tindale 1961, Bermingham 1966). The latter date seemed more in line with other 5-6000BP dates from the Hunter River area (Bobadeen, Macdonald River (Moore 1972)), the south coast of New South Wales (Burrill Lake (Lampert 1971a)) and New England (Graman Site 1 (McBryde 1968,1974)). At Lapstone Creek (McCarthy 1948,1978) microlithic backed implements disappeared abruptly from the sequence some time before 2300BP, a situation not paralleled in neighbouring sites until 1000BP or later and never occurring with such abruptness, e.g. at Springwood Creek (Stockton and Holland 1974), Curracurrang ICU5/- (Megaw 1968), various sites in the Hunter Valley (Moore 1970, in press) and sites on the southern tableland (Flood 1973).

A final factor which makes the Blue Mountains particularly interesting lies in the marked physiographic relief of the area. Stockton and Holland (1974) propose that Aboriginal occupation of the higher parts would have been subject to climatic influence and claim a gap separating the Capertian (Core Tool and Scraper) and Bondaian (Small Tool) industries in the area. Stockton interprets this gap in terms of a colder and wetter period causing abandonment of the Blue Mountains plateau. The presence of such a gap, whether or not the proposed interpretation is correct, could have far reaching consequences. On the one hand it could simply affect the dating of either the earlier or later industries which might be expected to appear, respectively, later and earlier in more favoured environments. Equally, marked climatic effects at around the time of the appearance of the Small Tool Tradition industries might help, or hinder, the spread of new ideas through population pressure or the strengthening of physiographic barriers. In the absence of climatic factors, the presence of a gap might be symptomatic of a break in Aboriginal culture contrasting with the continuity suggested for the lithic

industries of Kenniff Cave (Mulvaney and Joyce 1966:178,210), Burrill Lake (Lampert 1971a:65) and other sites.

My fieldwork in the Blue Mountains has therefore been aimed at reassessing the published sequences, both from the collections excavated by Stockton and by the reexcavation of McCarthy's and Tindale's sites in the Capertee area. On the one hand I have been able to confirm McCarthy's dating of the appearance of backed implements in the Capertee 3 site, and this has lead me to reassess the published accounts of the dating of these tools (chapter 6). My discussion highlights the need for well controlled excavation techniques and leads into the methodological section (chapters 7 and 8).

My excavation at Capertee 3 has played a crucial role in the development of the methodology proposed by serving as a testing ground for new ideas. It also contributes to the picture of Blue Mountains prehistory which I have attempted to put forward in chapters 2 - 5. My intention in these chapters is not so much a problem oriented study of some aspect of the prehistory of the area, but rather a general collation of the information available with a view to providing an information base available to other workers. Broadly speaking I have been able to confirm McCarthy's basic three-phase scheme whilst adding detail to the sequence and information on the exploitation of the mountain area. On the other hand, I have shown that Stockton and Holland's (1974) proposal of an hiatus in the occupation of the area does not stand up to critical assessment.

# CHAPTER 2

## Environment and ethnography of the Blue Mountains area

> 'At no great elevation an almost level plain extends, which, rising imperceptibly to the westward, at last attains a height of more than three thousand feet. From so grand a title as Blue Mountains, and from their absolute altitude, I expected to have seen a bold chain of mountains crossing the country; but instead of this, a sloping plain presents merely an inconsiderable front to the low land of the coast... once on the sandstone platform, the scenery becomes exceedingly monotonous; each side of the road is bordered by scrubby trees of the never-failing Eucalyptus family' (Darwin 1839).

The Blue Mountains rise from the Cumberland plain approximately 50 km west of Sydney (figs 1 and 2). They were formed by the dissection of a sandstone plateau uplifted in the late Tertiary or early Pleistocene. From the top of the scarp forming the eastern margin one can see range upon range of undulating ridges, covered for the most part with dense scrub and separated by steep gorges, stretching as far as the eye can see to both the north and south as well as the west. This rugged and inhospitable country barred the way to the expansion of the newly founded British colony which, for the first twenty five years of its life, was restricted to the 50 km wide coastal strip.

It was pressure of population expansion on the availability of good grazing land which led Gregory Blaxland, William Wentworth and Lieutenant Lawson to organise an expedition to find a way across the mountain barrier (Blaxland 1813). Blaxland, Wentworth and Lawson's success was based on their use of the ridge that now carries the Great Western Highway and the towns of Springwood, Katoomba and Blackheath, as opposed to earlier attempts which often made use of valleys ending in unscalable cliff-lined cul-de-sacs. Their first crossing in 1813 took 3 weeks, largely due to the impenetrable vegetation rather than time spent searching for a route. They made the 80 km return journey along the same route in only 4 days (ibid.:2-12).

Assistant-Surveyor Evans took a similar time (4-5 days) to cross the Mountains later in the same year with one of Blaxland's men as guide, when he was sent to verify Blaxland's report of rich grazing land on the western side (Evans 1814). His report led to the construction of a road in 1814 under the direction of William Cox. The road was taken as far as the point which was to become the town of Bathurst, a distance of some 170 km completed in just over 6 months. Five months of this was spent on the 80 km taken to cross the mountains (Cox 1815). Twenty years later Darwin was able to cross the mountains on horseback in just over a day. Today, Bell's Line of Road, some 30 km further north, is the only other east/west road between the

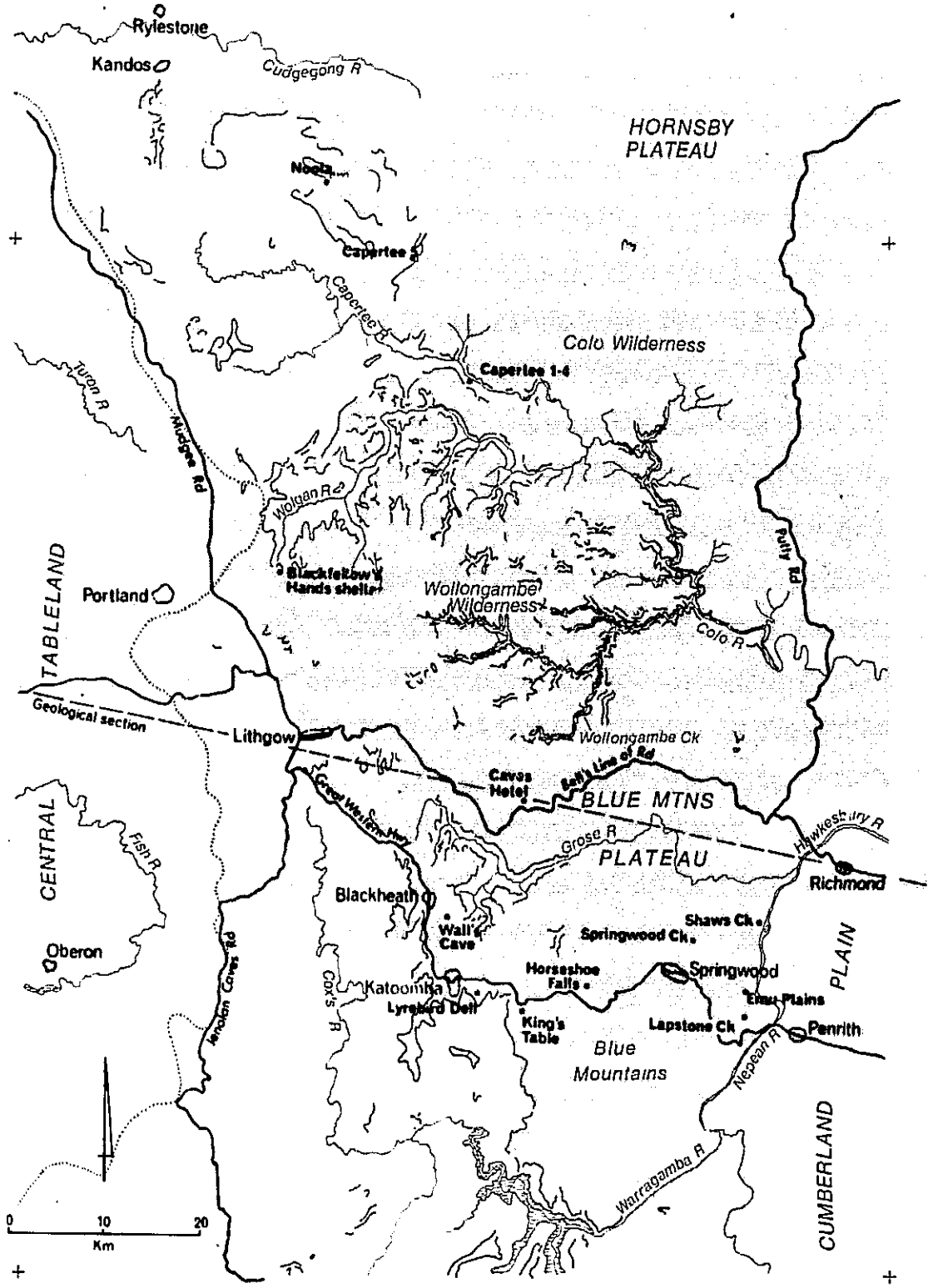



Fig. 2 Map of Blue Mountains area

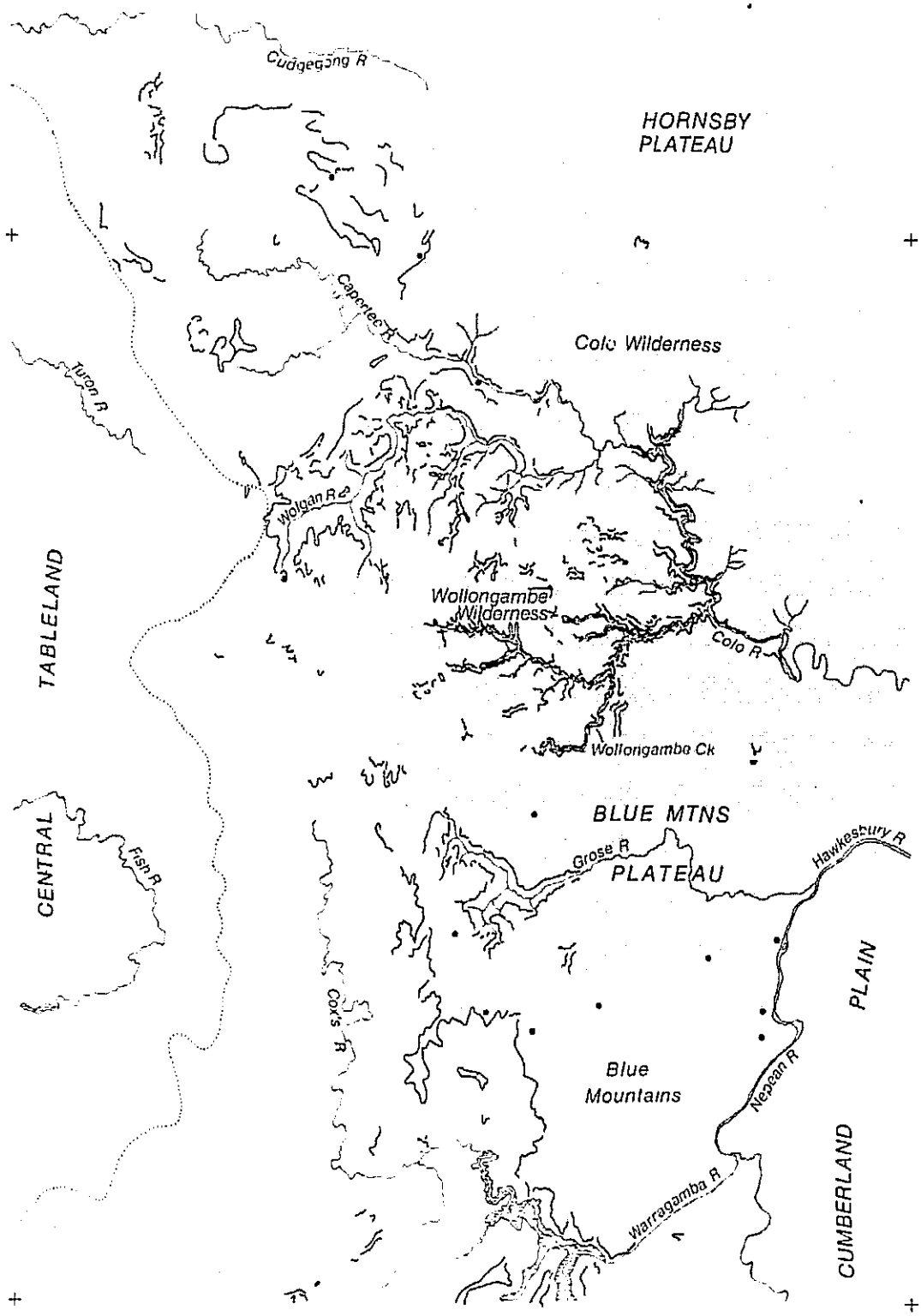



Fig. 2 Map of Blue Mountains area

Hunter Valley, 100 km north and the Hume Highway, 60 km south.

The accounts of these early crossings of the Blue Mountains all remark on the difficulties of finding feed and water for stock movements. One or two inns or depots were established where water was available, but once the road was in use feed had to be carried. Although Blaxland's party was able to kill a couple of kangaroos or wallabies at the beginning of their trip, they were obliged to live on the salt meat they had carried until they got over the mountains to find extensive parkland with rich grazing and an abundance of game (op.cit.). Here, apart from kangaroos or wallabies they saw numerous emu tracks and both Evan's and Cox's accounts comment on the abundance of kangaroos and emu, an unbelievable abundance of Murray Cod in the rivers and the excellence of the grazing.

Blaxland (op.cit.:3) mentions seeing several 'native huts' at different places in the early part of their journey, i.e. east of Faulconbridge, and also occasionally hearing Aborigines at various times during their crossing (ibid.:4,8), but it is not until they are looking down on the Cox's River that they see 'the fires of the natives below - by the number they computed they amounted to in all-about thirty Men Women and children' (ibid.:8). Once across the mountains Evans (op.cit.:20-29) records 'We have not seen any Natives but hear them shouting around us...We have not yet seen any Natives but can see their late tracks...I conceive it strange we have not fell in with the Natives; they are near about us as we find late traces of them; I think they are watching us, but are afraid and keep at some distance...The Natives seem to be numerous; there are fires in many parts not far from us'. Evans also remarks on the abundance of game; '...a Kangaroo can be procured at any time, there are also Emu's [sic]...the soil is exceeding rich and produces the finest grass intermixed with variety of herbs; the hills have the look of a park and Grounds laid out... there is Game in abundance; if we want a fish it is caught immediately' (ibid.:23-4) and later 'the Grass is so good and intermixed with variety of herbs. Emu's [sic] and Geese are numerous...we counted 41 Emu's [sic] this day' (ibid.:28). Evans found that the richest country in terms of grazing and animal life was not that bordering the Blue Mountains but further west, towards Bathurst, but the bordering zone was still sufficiently promising for Blaxland to state '...they saw forest land all around them sufficient to feed the Stock of the colony, in their opinions for the next thirty Years'

(op.cit.:10).

When Darwin made an excursion to Bathurst in 1836, only 21 years after the completion of the road, he wrote 'A few years since, this country abounded with wild animals; but now the emu is banished to a long distance, and the kangaroo is become scarce; to both, the English greyhound is utterly destructive' (ibid.:234). Darwin's acute observation of the country he passed through and the few Aborigines he met makes fascinating reading. Of the Aborigines he says 'The number of Aborigines is rapidly decreasing...This decrease, no doubt, must be partly owing to the introduction of spirits, to European diseases (even the milder ones of which, as the measles, prove very destructive), and to the gradual extinction of the wild animals...Wherever the European has trod, death seems to pursue the aboriginal' (ibid.:230). Though Aboriginal/European relations in the area were apparently still good, Darwin had no illusions about the Europeans' dispossession of the Aborigines.

The overall impression one gains from all these early accounts is one of the Blue Mountains as a formidable barrier of exceedingly rugged country, poor in food resources (specifically for grazing animals and consequently with few large macropods) and with a correspondingly low Aboriginal population. This barrier separated the original colony on the coastal plain from the open woodlands running along their western margin and extending out to Bathurst. The latter area was well-watered rich grassland with a corresponding abundance of large game animals, emu and various kangaroos, abundant fish and a correspondingly high Aboriginal population (even taking account of their greater visibility to the early travellers in this open countryside). Though we cannot rule out the possibility of natural fires, Darwin's observation that 'In the whole country I scarcely saw a place without the marks of fire; whether these had been more or less recent' (ibid.:234) and later '...we passed through large tracts of country in flames' (ibid.:236), and Evans' statement that 'The Mountains have been fired' (ibid.:30) suggest the probability of Aboriginal firing. Barrallier (1802:757) also mentions firing of the mountains by the Aborigines in the area of the Nattai and Nepean rivers.

Several authors (e.g. Flood 1973) have reviewed the ethnography of various parts of the Great Dividing Range, but none has treated an area approaching the rugged inaccessibility of the Blue Mountains.

Poiner (1971) treats the coastal strip at the foot of the range on the NSW coast, but does not discuss the use (if any) made of the scarp and country beyond. Ethnographic information for the Blue Mountains plateau is very sparse (Sananikone 1979). Several explorers skirted the mountains (e.g. Barrallier, Caley, Macquarie, Phillips, Evans on the eastern margin and Oxley, Blaxland, Lawson et.al., Evans, Bennett, Henderson, White, Macquarie and Phillips on the western margin), but few ventured into the upper reaches of rivers such as the Grose or onto the plateau (ibid.). Apart from Blaxland, Lawson and Wentworth, Barrallier (1802), Caley (Lee 1925) and Phillips (1788) are the main sources and none of these explorers saw much trace of Aborigines once they ventured into the plateau area. This is in marked contrast with their frequent observations of Aborigines or traces of Aborigines when travelling along the margins of the area. Phillips (1788:29) remarks on finding a hut 'so far inland' when in the 'Carmarthen Hills' north of the Grose Valley and remarks on the scarcity of game; '...though we were in want of provisions for the last 2 days....procured us barely sufficient for 2 meals'. All the accounts available for the area refer to the period from October to May or June, so that we have no information whatsoever on the presence or otherwise of Aborigines in the plateau area during the middle winter months.

The impression of poverty of food resources is confirmed by present day observation. On the plateaux (fig. 2), the vegetation is largely dry sclerophyll open to closed forest with canopy height up to 10 metres; this vegetation type grades into open heathland with occasional stunted eucalypts and banksia on more exposed areas with horizontally bedded sandstone giving rise to little more than pockets of soil. These communities appear to contain little in the way of food resources for human consumption compared with similar communities on the coast south of Sydney (Ron Lampert, pers. comm.), and I have not seen a great deal in the way of fauna in these areas when compared with, say, the Capertee valley on the western margin.

The richest environments in the Blue Mountains are probably the swamps to be found at the head of many of the creeks, occasional rainforest gulleys and the quite different floral communities to be found on the uncommon and restricted outcrops of Tertiary volcanics (notably basalt) such as Euroka clearing near Glenbrook. These have quite strikingly different and more productive flora and fauna . Euroka nowadays has superb meadows and patches of trees quite in

contrast with the surrounding forest. Mt Wilson and Mt Tomah, with the addition of an orographic rainfall factor, support an exceptional rainforest vegetation and open cultivated meadows of excellent grass. However, these resources are sufficiently restricted as to be unlikely to support any size of permanent population, but could well have served to support moderate sized groups of occasional visitors equipped with the knowledge to locate and exploit them. Water, whilst not abundant, can be reliably obtained from swamps and creeks, as well as from hollows on exposed sandstone areas which retain water for remarkably long periods (these hollows are frequently surrounded by axe grinding grooves taking advantage of the combination of a flat granular sandstone surface and water).

West of the plateau region the country is much more open and less rugged, although rising higher than the sandstone plateau itself before dropping towards Bathurst (fig. 3). Much of this area is now used for grazing. Although rainfall is lower than on the plateau region (30-40" (75-100cm) compared with up to 55" (140cm)), runoff is less rapid and the soils are richer and deeper, so this area would always have been a richer resource zone than the plateau area, as reflected by the accounts of Blaxland, Evans and Darwin. The Capertee valley belongs to this zone and will be described in detail in chapter 4.

## Physiography

The Blue Mountains lie approximately 50 km west of Sydney (fig. 1). The Cumberland Plain (fig. 2) is bordered to the west by the steep eastern margin of the Blue Mountains Plateau and to the north and east by the somewhat lower Hornsby Plateau. Both of these plateaux were uplifted during late Tertiary or early Pleistocene times (Bryan, McElroy and Rose 1966)[1] and are separated along an arbitrary line by the gorges of the Capertee and Colo rivers. They are heavily dissected sandstone plateaux, with gorges 6-700 metres deep forming spectacular cliffs and rugged and difficult terrain. Pl. 1 shows a satellite photo-montage of the area. The Blue Mountains Plateau rises from the Cumberland Plain along the north/south line of the Lapstone Monocline

(1) This and the following section are based largely on the cited reference and the Bureau of Mineral Resources 1:250,000 Geological maps for Sydney and Bathurst.

Plate I Satellite photo-montage of Blue Mountains area

(Compare with map, fig.2.) The dark colour of the forested sandstone plateau contrasts with the lighter colour of pastures and crops. Note the huge expanse of the Hornsby Plateau compared with the much narrower Blue Mountains Plateau. The Colo Wilderness, which forms the heart of the Hornsby Plateau and northern part of the Blue Mountains Plateau, is the largest remaining wilderness area in New South Wales. The Hunter River is visible in the top right-hand corner.

Montage from ERTS photographs, Band 7 (Infrared).

50 km



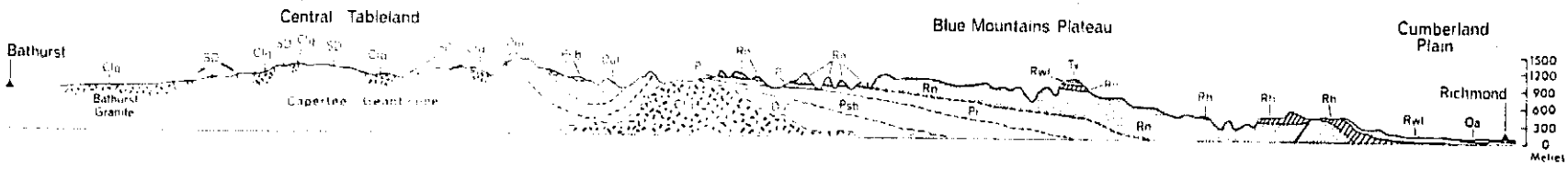
to a height of about 250 metres ASL at Glenbrook and around 700 metres ASL further north at Kurrajong Heights. The Cumberland plain is substantially below 100 m ASL. To the west, the Blue Mountains Plateau rises steadily to a height of some 1300 metres (fig. 3), where it is bounded by steep cliffs falling to the valley of Cox's River. West of Cox's River the country rises once again to the continental divide on the Central Tablelands, an area which, although generally less rugged than the Blue Mountains or Hornsby plateau, is in fact higher and particularly cold in winter. From there the land drops gradually westwards, with open plains and small ranges of hills.

Geology

The strata forming the Blue Mountains and Hornsby Plateaux dip towards the east in such a way that progressively older strata are exposed as one goes westwards (fig. 3). The surface geology of the eastern margin is the Hawkesbury sandstone, with quartz and some shale, of the Triassic Wianamatta Group. Along the western margin Triassic Narrabeen Group sandstones, shales and tuffs are exposed, whilst rivers incised along the western margin expose earlier Permian formations, notably the Illawarra Coal Measures (shale, sandstone, conglomerate and chert with coal and torbanite seams) and the Shoalhaven Group (shale, conglomerate and sandstone). This 'slice of cake' stratigraphy is clearly seen in the Capertee and Wolgan Valleys (see pl. V), along the western margin of the Blue Mountains Plateau in the Cox's River valley and as inliers in the upper reaches of the Grose River. Fig. 2 shows the extent of the sandstone plateau which correlates closely with the environmental zones of the area (compare fig. 2 with the vegetation cover apparent in pl. 1).

The massive sandstones of the plateaux are poor sources of lithic raw materials which may partly explain the poverty of the plateau sites (see chapter 3) in terms of lithic assemblages. On the other hand the Illawarra coal measures in particular are rich in varied workable stone and have undoubtedly contributed to the richness of the Capertee stone assemblages (chapter 5).

West of the edge of the Hornsby plateau and for all except the southern part of the Blue Mountains plateau, the Illawarra Coal Measures, the Shoalhaven Group and the underlying Lower Carboniferous granites of the Kanimbla Batholith form an easy corridor of lower and




| | | |
|---|---|---|
| Quaternary | Qa | Alluvium, gravel, sand, silt, clay |
| Tertiary | Tv | Basalt, dolerite, volcanic breccia etc. |
| Triassic | Rwl | Wianamatta Group<br>Shale with some sandstone beds |
| | Rh | Hawkesbury Sandstone<br>Sandstone, quartz, with some shale |
| | Rn | Narrabeen Group<br>Sandstone, shale and tuff |
| Permian | Pi | Illawarra Coal Measures<br>Shale, sandstone, conglomerate and chert with coal and torbanite seams |
| | Psb | Shoalhaven Group<br>Shale, conglomerate and sandstone |

UNCONFORMITY

| | | |
|---|---|---|
| Lower-Middle Carboniferous | Clg | Adamellite, granite, and granodiorite (including Bathurst granite) |
| Upper Devonian | Dul | Lambie Group<br>Quartzite, sandstone, siltstone and claystone |
| Silurian to Lower Devonian | SD | Cudal Group<br>Slate, siltstone, greywacke, tuff, andesite, conglomerate, quartzite, limestone |

Fig. 3 Geological section through the Blue Mountains plateau
(see fig. 2 overlay for section line)

less rugged country between the plateaux and the Continental Divide to the west (fig. 2). This corridor is drained by the Cox's River, which passes round the south end of the Blue Mountains plateau to join the Nepean and Hawkesbury, and by the Capertee/Colo system which cuts its way through the mass of the plateau in a deep, narrow and tortuous gorge to reach the Hawkesbury just upstream from Wiseman's Ferry. This area was the open forested area reached by Blaxland in 1813 which, though poorer grazing than that beyond the Divide around Bathurst, he considered ample reward for his arduous crossing of the mountains.

West of the corridor, the land rises once again to reach the Continental Divide at over 1300 metres, formed by the Capertee Geanticline (Silurian sedimentary series and Ordovician volcanics). The geanticline is split into northern and southern halves, separated by an intrusion of Carboniferous Bathurst granite, which forms a corridor of easier country through which the Fish River flows towards Bathurst. Bathurst itself lies in the centre of the granite outcrop, surrounded on all sides by hilly and dissected country formed by the truncation of, from east to west, the Capertee Geanticline, the Hill End Trough and the Molong Geanticline.

# CHAPTER 3

## A review of excavated sites in the Blue Mountains

New South Wales National Parks and Wildlife Service have records of a couple of hundred Aboriginal sites in the Blue Mountains plateau region alone. Whilst this is partly a function of the numerous interested amateurs in the area and the existence of the Blue Mountains National Park, it also reflects the enormous archaeological potential of the region. This potential is largely a function of the surface geology and dissection of the area giving rise to a profusion of two distinct types of rockshelter site - weathered cavities in cliff lines and overhangs formed by boulders derived from clifflines. The latter process is particularly important in areas such as the Capertee valley where major clifflines and massive jointed sandstones are underlain by softer bedded material which weathers rapidly to undercut huge blocks.

Though some large shelters are formed at the base of the major clifflines, most of the cliffline rockshelters in the area are small cavities formed by cavernous weathering where the edge of horizontally bedded levels is exposed as a small cliffline a few metres high. Such rockshelters often have a sloping rock floor with only a thin scatter of roof products but, where the right combination of softer and harder levels is present, well protected shelters with comfortable headroom and some depth of deposits are formed. This sort of rockshelter is often situated along small creeks which have incised into the top of the plateau and in several areas which come to mind they are associated with a seepage from above (e.g. a small swamp) which has maintained dampness in the shelter and perhaps aided the weathering process (cf Hughes 1977).

My own fieldwork has involved visiting sites previously excavated and a number of other recorded sites, a certain amount of generalised wandering designed to familiarise myself with the countryside and some specific site-searches, notably in the Capertee and Wolgan valleys. I have derived three major observations from this work:

1. The archaeological potential of the area is enormous and the number of sites recorded gives only the remotest idea of this potential. In areas that I have looked at in some detail, I would estimate at least one rockshelter with some depth of deposits for every km or so of exposed cliffline. In addition some areas have considerable open-site potential (see 2 below).

2. Site usage and intensity are strongly correlated with topographical situation. Large rockshelters on or just beneath the plateau areas display the most extensive artwork but yield little in the way of lithic material (e.g. Blackfellows' Hands Shelter (McCarthy 1939) and Capertee 5 (McCarthy 1964)). Other smaller plateau sites have a few engravings or stencils and generally poor stone assemblages, though some show a remarkable concentration of backed implements (e.g. Springwood Site G, Stockton 1970). Where the sandstone is massive and exposed as horizontal surfaces, hollows in the surface are often surrounded by axe-grinding grooves and occasional engravings are to be found. There are also a number of stone arrangements of a simple nature, but in a rugged area such as this where Europeans are likely to indulge in cairn-building I am inclined to treat most of these with suspicion. A well known case is 'Caley's Repulse', supposedly built by Lieutenant Caley in 1802, but more recently considered as of Aboriginal origin (McCarthy 1960) or alternatively built by Henry Hacking in 1794 (Mackaness 1965).

3. In contrast with the generally poor stone assemblages of the plateau region and their associated artwork and axe grinding grooves, the richest excavated assemblages and most promising surface collections are situated in and around small overhangs formed by fallen boulders in proximity to good water supplies and with access to less rugged country. For example, Capertee 1 and 3 (McCarthy 1964) are situated not far from the Capertee river at a level where communication up and down the gorge is made easy by a broad terrace. Shaw's Creek (Stockton 1973) and Lapstone Creek (McCarthy 1948, 1978) are both situated near reliable creeks and within easy reach of the Hawkesbury River and Cumberland Plain.

Exposures on tracks in the Capertee gorge have indicated that there is lithic material scattered liberally on terraces bordering the river, and trial soundings on a raised flat at a similar level to sites 1 and 3 (see report in Appendix I on the excavations at Freshwater Creek) indicate that this area alone could contain lithic material equivalent to a number of rockshelter sites (though distributed far more diffusely). Even the smallest rockshelter sites in the area also display rich surface collections of flaked stone material, contrasting with the appearance of stone in only the more favourable shelters on the

plateaux (note that this may be largely a function of raw material availability).

The distribution of excavated sites is shown on the overlay to fig. 2. Most of the excavations are reported by Stockton (1970, 1973, 1974), though work in the area was pioneered by McCarthy (1934, 1939, 1948, 1964, 1978). Tindale (1961) also excavated a site in the area which McCarthy had intended to excavate (Noola rockshelter = McCarthy's Site 6), an action inevitably engendering heated debate (McCarthy 1962a,b, Tindale 1962) and refrigerated relations. Unfortunately the site remains unpublished, apart from a brief 3 page note revealing tantalising possibilities, and the material is not available for study. On the other hand, McCarthy's material is freely accessible in the Australian Museum and I owe a considerable debt to him for allowing me to inspect this material and in making available a transcript of his excavation notes. The sites and published sources are listed in table 1.

## Excavated sites

In this chapter I shall discuss the lithic sequences (bone is practically absent) of the excavated sites in the Blue Mountains plateau and its eastern margin. These include all of Stockton's sites, Lapstone Creek and Blackfellows' Hands Shelter. The Capertee and Noola sites will be discussed in the following chapters. My aim in these chapters is twofold. On the one hand, to provide an up-to-date catalogue of the Blue Mountains material for use by other workers who may need information on this material. On the other hand, I hope to show what can be achieved by a detailed reassessment of published material with a little extra study of the excavated material. In chapter 5 I aim, apart from providing new data on Capertee Site 3, to demonstrate a limited scale application of the sorts of excavation and recording techniques proposed in chapters 7 and 8, in the hope that this will encourage other workers to make use of them.

| | Excavator's code | Excavated | Reported |
|---|---|---|---|
| Emu Plains Shelter | ? | McCarthy & Brammell 1934 | McCarthy 1934 |
| Lapstone Creek | Emu Cave | Towle & McCarthy 1935-6 | McCarthy 1948, 1978 |
| Blacktellows' Hands Shelter | ? | McCarthy 1939 | Note to Director of Australian Museum |
| Capertee Sites 1-5 | 1-5 | McCarthy 1958-61 | McCarthy 1964 |
| Capertee Site 1 | CP1 | Johnson 1978 | |
| Capertee Site 3 | CP3 | Johnson 1978 | Chapter V |
| Capertee Site 6 (Nocla) | 6 | Bland & Blunden 1961 | McCarthy 1964 |
| " " " | ? | Tindale 1961 | Tindale 1961 |
| " " " | NLA | Johnson 1978 | Chapter IV |
| Freshwater Creek I | FWC | Johnson 1978 | Appendix 2, (report to NPWS) |
| Abercrombie Arch Shelter | ACR | Johnson 1976 | Appendix 1 & report to NPWS 1977 |
| Caves Hotel | ? | Eadie et al. ca. 1970 | |
| Shaw's Creek | K | Stockton ~ 1970-3 | Stockton 1973* |
| Springwood Creek | W | " | Stockton & Holland 1974 |
| Springwood Grotto site | G | " | Stockton 1970 |
| Springwood S | S | " | " |
| Springwood E | E | " | " |
| Wall's Cave | B | " | Stockton & Holland 1974 |
| King's Table | M | " | " |
| Lyre Bird Dell a | La | " | " |
| Lyre Bird Dell b | Lb | " | " |
| Horseshoe Falls | H | " | " |
| Lawson P | P | " | Stockton 1970 |
| Lawson Q | Q | " | " |
| Lawson D | D | " | " |

* Several of Stockton's sites are also reported in more detail in typescripts submitted to NSW National Parks and Wildlife Service

Table 1 Excavated sites in the Blue Mountains

| Site & level | Estimated time range and industrial attribution | Lithic artefacts per m³ | Tools per m³ | Tools/artefacts (%) | Depths (cm) |
|---|---|---|---|---|---|
| **Shaw's Creek** | | | | | |
| Level 2 | Fabricators and rich in quartz | 8,700 | 350 | 4 | 5-15 |
| Level 3 | | 4,900 | 160 | | 15-25 |
| Level 4 | Microliths and peak of cherts | 13,000 | 870 | 7 | |
| Level 5 | | 22,500 | 1,400 | 6 | 25-40 |
| Level 6 | | 12,000 | 720 | 6 | |
| Level 7 | | 9,600 | 360 | 4 | 40-55 |
| Level 8 | Pre-microlithic | 3,200 | 90 | 3 | |
| Level 9 | | 2,100 | 60 | 3 | 55-80 |
| **Springwood W** | | | | | |
| | 'Bondaian' | | | | |
| Ph I | 200-600BP | 1,000 | 90 | 9 | 6-20 |
| Ph II | 600-1500BP | 1,300 | 40 | 2 | 20-28 |
| Ph III | 1500-2500BP | 1,200 | 80 | 6 | 28-36 |
| Ph IV | 2500-5000BP | 330 | 11 | 4 | 36-60 |
| | 'Capertian' | | | | |
| Ph V | 5000-7000BP | 240 | 8 | 3 | 68-86 |
| Ph VI | 7000-9000BP | 35 | 4 | (12) | 86-140 |
| **Springwood C** | 'Bondaian' | | 160 | | |
| **Springwood S** | 'Bondaian' | | 37 | | |
| **Lawson P** | 'Bondaian' | | 15 | | |
| **King's Table** | | | | | |
| | 'Bondaian' | | | | |
| Ph I | ~ 1000BP | 4,800 | 75 | 1.5 | 0-18 |
| Ph II | " | 7,400 | 170 | 2 | 18-25 |
| Ph III | " | 5,800 | 150 | 2.5 | 25-33 |
| Ph IV | " | 3,400 | 75 | 2 | 33-47 |
| Ph V | " | 3,300 | 90 | 2.5 | 47-71 |
| Ph VI | " | 800 | 12 | 1.5 | 71-90 |
| | 'Capertian' | | | | |
| Ph VII | ~ 14-22,000BP | 12 | 0 | 0 | 90-110 |
| **Wall's Cave** | | | | | |
| Ph I | 'Bondaian' | 1,200 | 160 | 12 | 12-19 |
| Ph II | 3360BP 'Bondaian' | 470 | 70 | (15) | 19-30 |
| Ph III | 12,000BP 'Capertian' | 27 | 5 | (18) | 82-122 |
| **Capertee 3** (McCarthy) | | | | | |
| | 'Bondaian' | | | | |
| Spit A | 0-1900BP | 4,800* | 50 | 5* | 0-15 |
| B | 1900-2900BP | 1,400 | 70 | 5 | 15-30 |
| C | 2900-3100BP | 2,300 | 160 | 12 | 30-45 |
| D | 3100-3300BP | 500 | 70 | 10 | 45-60 |
| | 'Capertian' | | | | |
| E/F | 3500BP | 700 | 30 | 6 | 60-90 |
| G | 3500-4200BP | 300 | 30 | 11 | 90-120 |
| H | 4200-5700BP | 800 | 30 | 9 | 120-150 |
| I/J | >5700BP | 400 | 15 | 12 | 150-210 |
| **Lapstone Creek** | | | | | |
| Spit F | 'Eloueran' | | 40 | | |
| E | " | | 60 | | |
| D | " | | 80 | | |
| C | 'Bondaian' | | 160 | | |
| B | " | | 150 | | |
| A | " | | 110 | | |

* For Capertee 3 these columns refer to section 9 only.

Table 2 Artefact concentrations for sites in the Blue Mountains

STOCKTON'S EXCAVATIONS

Our main source of information on the prehistory of the Blue Mountains area is the series of excavations carried out by Eugene Stockton up to 1973 (Stockton 1970, 1971, Stockton and Holland 1974). The material from these excavations is lodged in the Australian Museum, with a selection of pieces, notably utilised or retouched material, temporarily retained by Dr Stockton in his personal collection. Dr Stockton has generously allowed me access to these series so that I have been able to reassess and make further analyses of this material.

I should first stress that none of Stockton's excavations is very extensive. Only two sites, Shaw's Creek and King's Table, yielded over 1000 artefacts, both from an excavation of approximately 1 square metre. The other published sites yielded between 100 and 1000 artefacts. During the early stages of his archaeological survey of the area, Stockton dug a number of sites in which he found shallow deposits and varying amounts of material. These are scantily published in Stockton (1970). His later excavations are published in greater detail and further information is available as typescript reports to the NSW National Parks and Wildlife Service.

My own reanalysis of the collections consists of an examination of the raw material and size distribution of artefacts held in the Australian Museum for the two sites with sufficient sample size - Shaw's Creek and King's Table. This material comprises the vast majority of the artefacts excavated from each site, with the exception of backed implements.

Stockton's material contains a full range of artefact sizes down to a size congruent with the use of a 3/16" (4.5mm) mesh sieve. Dr Stockton is not now sure what mesh was used, but considers this to be a likely size. The material was dry sieved and the deposits are mostly dry and sandy. Bone was entirely absent and no charcoal was retained once the sites had been dated. Excavation was by spits, generally of 5 cm thickness, with attempts to follow the natural stratigraphy.

In his major article (Stockton and Holland 1974) Stockton suggests that several sites show a hiatus in occupation between the 'Capertian' and 'Bondaian' industries. He proposes that this is due to climatic variation in what he sees as a marginal zone, giving rise to abandonment of the area during a period of cold and damp spanning the

industrial change. I do not see the necessity of such an hypothesis in explaining the evidence from Stockton's sites, only one of which shows anything like a hiatus in an uninterrupted sequence of sedimentation and artefact deposition. I shall refer to Stockton's hypothesis where applicable and demonstrate that the data does not support it. On a more general level, I think it unlikely that the small changes in climate occurring in the southeast of Australia during the Holocene would have resulted in the wholesale abandonment, at one period, of an area which was used at another when the climate was slightly drier and/or warmer. In general terms, what one is dealing with is not a continuous occupation dependent on propitious climatic conditions but sporadic visits which, although possibly reduced by adverse climate, are unlikely to have undergone order-of-magnitude changes. If occupational hiatuses <u>are</u> demonstrated for the area, these are more likely to be simply gaps between sporadic visits to the site in question than occupational hiatuses of the whole area.

Springwood Creek (Site W)

Although the assemblage is meagre, this is one of the most important of Stockton's sites, with a sequence of six dates from 8730 ± 330 BP (SUA285) at 130-140 cm to 615 ± 80 (SUA204) at 20 cm depth. Unfortunately the rockshelter has a sloping rock-platform floor, and the only deposits have accumulated at the edge of this, more or less on the dripline.

The shelter has a westerly aspect and is situated in a small cliffline not far above Springwood Creek, at an altitude of 270 m and at the base of a steep hillside with scattered patches of bare rock and pockets of gravelly sediments supporting an open scrubby vegetation. This hillside must be considered as an important potential source of the deposits excavated.

The stratigraphy of the site is as follows (see fig. 4):

> <u>Surface, 0-5.6 cm, European debris</u> above a thin sterile band of clay.
>
> <u>Phases I-IV, 5.6-50 cm, 'Bondaian' industry</u>. The deposits gradually change from ashy grey sand to a finer, clayey yellow deposit, phases III and IV having an increasing proportion of rocks, classed as a 'major rockfall' in IV. Dates of 615 ± 80 BP (SUA204) at 20 cm and 2930 ± 165 BP

Charcoal

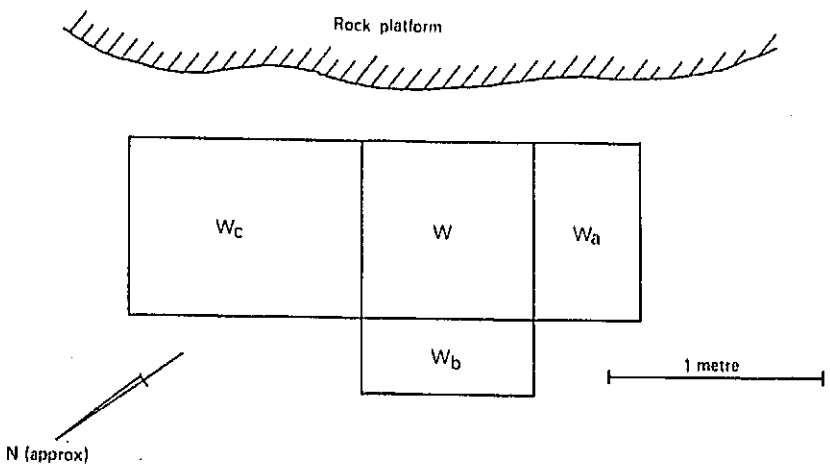
Ashy sand

Sand

Stony sand

| Excavation Unit | Date excavated | Maximum depth |
|---|---|---|
| W | 1971 | 1.2m |
| | 1973 | 1.4m |
| Wa | 1973 | 1.4m |
| Wb | 1973 | 1.4m |
| Wc | 1963,64 | 0.4m |
| | 1973 | 1.4m |

**Plan** Sketch plan, trench to scale from information in report to NSW NPWS (Stockton, 1973)




**Sections** Stratigraphic sections after report to NSW NPWS (Stockton, 1973)

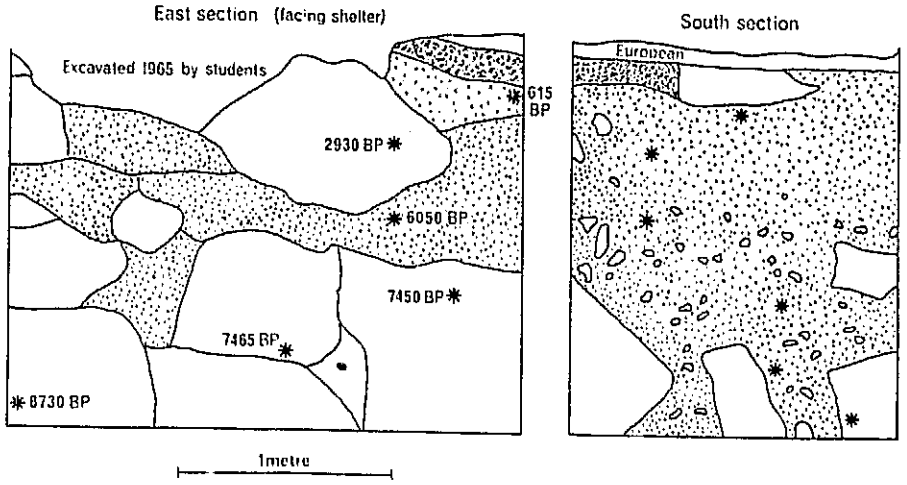



Fig. 4 Springwood Creek, sketch plan and section

(SUA17) at 40 cm.

Sterile band 5-10 cm thick. A mass of small stones.

Phases V and VI, 68-140 cm. 'Capertian' industry. The deposits are described as a tumble of large rocks with much charcoal. Dates of 6050 ± 170 BP (SUA18) at 76 cm, 7450 ± 120 BP (SUA205) at 90-100 cm, 7465 ± 120 BP (SUA206) at 112-120 cm and 8730 ± 330 BP (SUA285) at 130-140 cm.

Stockton claims that the sterile layer between phases IV and V represents an occupational hiatus between the Capertian and the Bondaian. Springwood is the only one of his sites at which the 'hiatus' occurs in an uninterrupted sediment sequence. Even at Springwood I think the case for a hiatus is weak. The deposits are, as I have indicated above, open to external sources of sedimentation dependent on local and regional environmental conditions. One might postulate, for example, that a bush fire on the slope above, followed closely by heavy rain, might result in the rapid accumulation of 5 or 10 cm of deposits. The charcoal which would be expected from the fire could be carried on out of the shelter leaving the coarser and heavier fractions. It is worth noting that the sterile layer consists of 'a mass of small stones', a situation which might well correlate with rapid runoff from the slope above and onward transport of the finer fraction. The rapid build-up of deposits in the lower rocky part of the deposits might also be a function of this sedimentation process; the rocks, probably deriving from the dripline of the shelter, would serve to trap sediments derived from above and this might also explain the presence of large amounts of charcoal, apparently scattered rather than concentrated in hearths.

The sterile layer at Springwood Creek centres on an interpolated date of 5000 BP. Three principal objections can however be made to accepting this date as applying to the 'Capertian'/'Bondaian' transition.

1. If the sedimentation rate is decidedly non-linear, as discussed above, then the true interpretation may lie anywhere between the enclosing dates of 2930 BP and 6050 BP.

2. The stratigraphy is complicated by rockfalls and is not clearly differentiated. In the period under consideration (2930-6050 BP), the mean sedimentation rate is less than 10 cm/Kyr[1]. Under these

(1) The term Kyr is used to signify thousands of years in order to make the text more readable.

sorts of conditions accurate differentiation of successive archaeological phases and precise dating of these phases is nearly impossible.

3. The sterile layer does not necessarily fall between the Capertian and the Bondaian, but may be within one or the other. In the 24 cm (phase IV) above the sterile layer there are 121 artefacts, of which only 5 are secondarily retouched (3 scrapers and 2 backed implements). In the 18 cm below the sterile layer (phase V) there are 85 artefacts of which only 3 are secondarily retouched (scrapers). Given the present state of definition of the technological changes distinguishing the Bondaian from the Capertian, I do not believe that we can ascribe the sterile layer to a gap between these industries on the basis of such small numbers of artefacts.

It should be noted, however, that there are definite differences between phase IV and phase V (see Table 3 and fig. 5). Phase IV shows very similar flake size and raw material types as phase III, with chert predominant (90% in IV, 94% in III). Phase V is more similar to phase VI - flakes are broader and thicker by about 25% than in II, III and IV (though the sample is small) and quartz, quartzite, basalt etc. rise from 6% in III and 10% in IV to 43% in V and 30% in VI (see fig. 5a). Phases V and VI also show greater mean debitage weight than the succeeding layers, largely due to the higher proportion of poorer quality raw materials which are found as little-reduced pieces rather than a mass of debitage. In conclusion, Springwood Creek provides us with a terminus ante quem of 2930 BP for material with a distinctly 'Bondaian' flavour.

The latter part of the Springwood sequence is of considerable interest. There appears to be a peak in artefact concentrations in phases II and III (20-36 cm) and therefore lying between dates of 615 BP and 2930 BP. However, when the artefact concentrations are expressed in terms of deposition rates (artefacts/sq.m./Kyr) (fig. 5b) there is a steady rise in rates throughout the sequence, with the last half millennium or so having much the highest rates. This phase (I) also has the highest proportion of recognisable tool types (10%) including 7 of the 8 'fabricators' (see glossary) in the site. This is coupled with a drop in flake sizes (mean L, B, T, and Wt measured by Stockton on whole flakes only) and a rise in the proportion of quartz

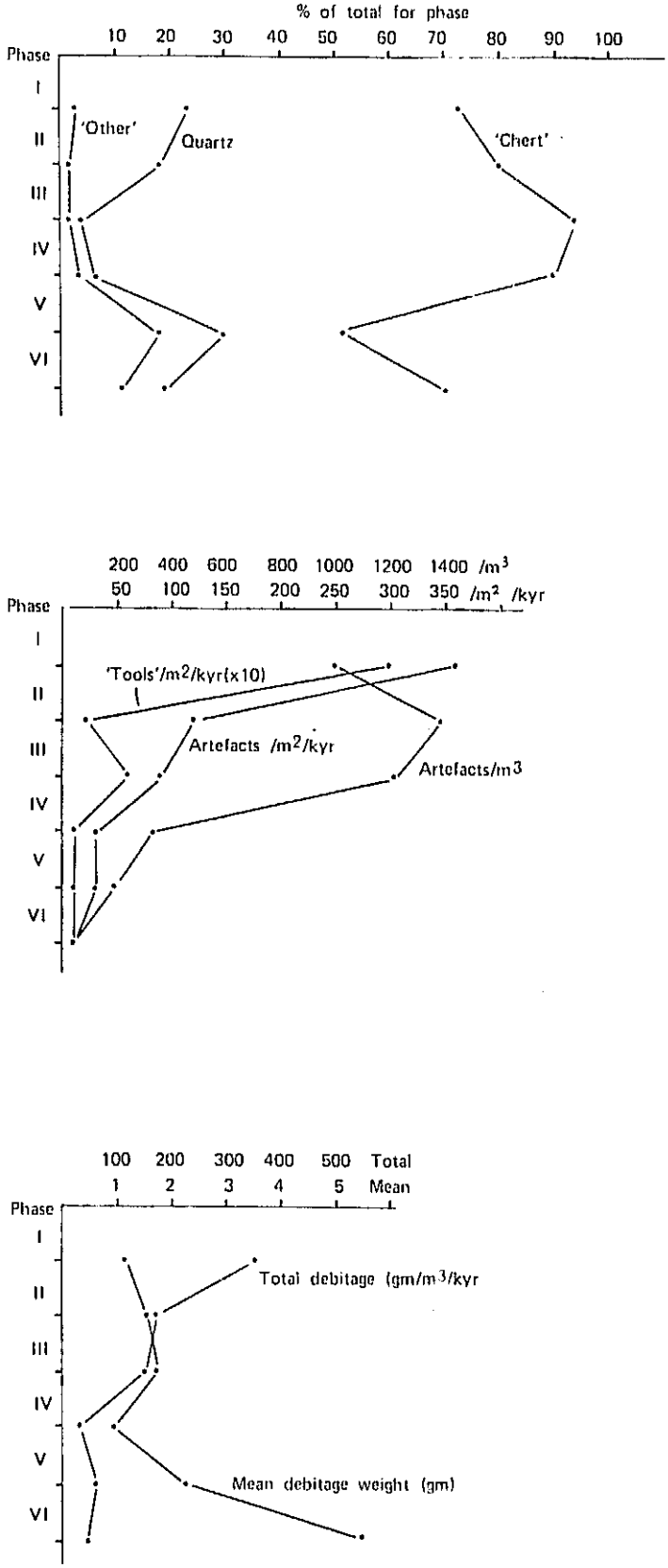



Fig. 5 Springwood Creek : distribution and characteristics of lithic artefacts

Data from Stockton & Holland 1974 and reanalysis 1978

| Phase | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| Industry | 'Bondaian' | 'Bondaian' | 'Bondaian' | 'Bondaian' | 'Capertian' | 'Capertian' |
| Depths (cm) | 6-20 | 20-28 | 28-36 | 36-60 | 68-86 | 86-140 |
| Estimated dates BP | 200-600 | 600-1500 | 1500-2500 | 2500-5000 | 5500-7000 | 7000-9000 |
| Sedimentation rate cm/Kyr | 35 | 9 | 8 | 10 | 12 | 27 |
| Tools | | | | | | |
| Cores | 1 | 2 | 1 | - | - | - |
| Debitage | 194 | 154 | 129 | 116 | 82 | 50 |
| Backed blades | 5 | - | 4 | 2 | - | - |
| Elouerıs | 2 | - | - | - | - | - |
| Fabricators | 7 | 1 | - | - | - | - |
| Redirecting spalls | 1 | 1 | 2 | - | - | - |
| Other | 4 | 1 | 3 | 2 | 3 | 6 |
| Total | 214 | 159 | 139 | 120 | 85 | 56 |
| Raw materials | | | | | | |
| Quartz (%) | 23 | 18 | 4 | 6 | 30 | 19 |
| 'Other' (%) | 3 | 2 | 2 | 4 | 18 | 11 |
| 'Chert' (%) | 73 | 80 | 94 | 90 | 52 | 70 |
| Area $m^2$ | 1.5 | 1.5 | 1.5 | 1.5 | 2.0 | 3.0 |
| Volume $m^3$ | 0.21 | 0.12 | 0.12 | 0.36 | 0.36 | 1.6 |
| Artefacts/$m^3$ | 1020 | 1330 | 1160 | 330 | 240 | 35 |
| Weight of all flakes (gm) | 210 | 220 | 220 | 110 | 180 | 270 |
| Mean flake weight (gm) | 1.1 | 1.5 | 1.7 | 0.9 | 2.2 | 5.4 |
| Tools/$m^2$/Kyr | 30 | 2.2 | 6 | 1 | 1 | 1 |
| All artefacts/$m^2$/Kyr | 360 | 120 | 90 | 30 | 30 | 9 |
| Tools as % of artefacts | 9 | 3 | 7 | 3 | 4 | 11 |

STERILE : Depths (cm) = 60-68

Note: 'Tools' excludes cores and 'bone sharpening tool'. 'Facetted butts' are included as debitage.

Based on data from Stockton Report to National Parks and Wildlife Service and Stockton and Holland 1974.

Table 3 Springwood Creek : summary data

in phases II and I. These trends echo the profound changes in lithic industries on the Sydney/South Coast occurring in about the last thousand years (cf. Megaw 1974, Lampert 1966,1971a,b) but contrary to the coastal situation there is no obvious diminution in backed implements - 5 of the 10 Bondi points in the site are from phase I (approximately 30% of tools), though the samples are too small to be taken as significant. The only two eloueras (see glossary) also come from this phase. The rise in quartz waste and reduction in waste size (fig. 5c) is a common correlate with the presence of fabricators (Lampert 1971a:44, Flood 1973).

Shaw's Creek

This site is situated at an altitude of 20 m ASL at the foot of the eastern escarpment of the Blue Mountains massif, in a rather similar topographical situation to McCarthy's Lapstone Creek shelter, 10 km to the south. Shaw's Creek itself is situated approximately 200 m from the site down a gentle slope. The site is nearer the level of the Nepean river running along the foot of the scarp on the Cumberland Plain than is the case for the Lapstone site which is in steep dissected and thickly wooded country, though still with moderately easy access to the Nepean. The site is a small domed overhang (area 12 sq.m., max. height 2 m) in the edge of an enormous flat slab which projects about 3 m from the surrounding terrain on a slope with northeasterly aspect. On top of the slab there are engravings of kangaroos (2) and emu tracks (McCarthy 1948:28). The site has unfortunately not been dated, and Stockton suggests that occupational disturbance has played an important role in blurring any changes in lithic remains. However the sequence closely parallels that from Springwood Creek.

The most obvious feature of the lithic material is the extreme richness of the site. Artefact concentrations are in the range 5000-20,000 artefacts/cu m in the middle layers, compared with a maximum of 1300 artefacts per cu m at Springwood Creek and similar values at other sites in the area (see Table 2). The tool concentrations are correspondingly high from 200-1250 tools/cu m in the middle levels, compared with a maximum of 90 tools/cu m at Springwood Creek.

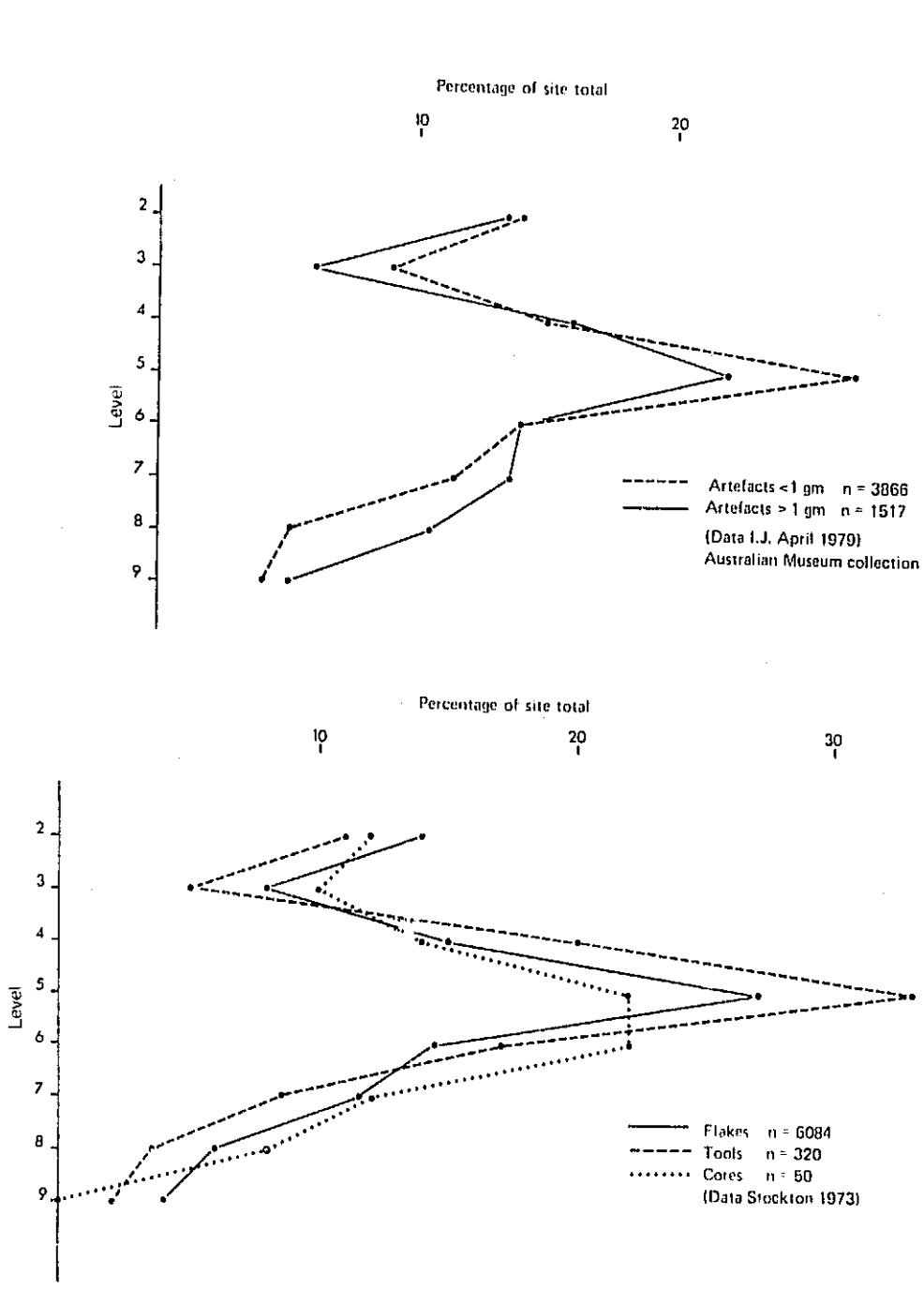



Fig. 6 Shaw's Creek : vertical distribution of lithic artefacts

| Level | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| Phase | II | III | IV | | V | | VI | |
| Depth range (cm) | 5-15 | 15-25 | 25-40 | | 40-55 | | 55-80 | |
| Estimated volume ($m^3$) | 0.1 | 0.1 | 0.15 | | 0.15 | | 0.25 | |
| No. of flakes (Stockton) | 831 | 471 | 917 | 1383 | 865 | 693 | 383 | 248 |
| Non-tool <1 g | 548 | 343 | 576 | 1050 | 542 | 444 | 201 | 162 |
| artefacts* >1 g | 204 | 91 | 238 | 339 | 209 | 203 | 161 | 72 |
| Artefacts* <1 g(%) | 73 | 79 | 71 | 76 | 72 | 69 | 56 | 69 |
| >1 g(%) | 27 | 21 | 29 | 24 | 28 | 31 | 44 | 31 |
| Mean flake weight (g) | 1.5 | 1.1 | 1.4 | 1.7 | 3 3 | 3.7 | 11.4 | 10.8 |
| 'Flakes'/cu m | 8300 | 4700 | 12,200 | 21,100 | 11,500 | 9200 | 3100 | 2000 |
| 'Tools'/cu m | 350 | 160 | 870 | 1400 | 720 | 360 | 90 | 60 |
| Raw material | | | | | | | | |
| Artefacts 'Chert' | 39 | 57 | 73 | 85 | 82 | 74 | 69 | 73 |
| <1 g* Silcrete | 1 | 6 | 8 | 12 | 6 | 8 | 5 | 4 |
| (%) Quartz | 51 | 34 | 19 | 4 | 10 | 15 | 23 | 20 |
| 'Other' | 8 | 3 | 1 | + | 3 | 3 | 2 | 2 |
| Artefacts 'Chert' | 31 | 53 | 73 | 72 | 69 | 44 | 49 | 49 |
| >1 g* Silcrete | 3 | 1 | 9 | 20 | 3 | 7 | 4 | 8 |
| (%) Quartz | 41 | 32 | 15 | 3 | 12 | 29 | 17 | 14 |
| 'Other' | 25 | 14 | 4 | 4 | 15 | 20 | 30 | 29 |
| Tools | | | | | | | | |
| Cores | 6 | 5 | 7 | 11 | 11 | 6 | 4 | - |
| Assymetric backed | 3 | 2 | 27 | 60 | 20 | 5 | 1 | - |
| Geometric microliths | - | 1 | 2 | 2 | 4 | 3 | 1 | - |
| Miscellaneous backed | - | 3 | 3 | 10 | 5 | 1 | - | - |
| Elouera | 2 | 2 | 6 | 2 | - | 1 | - | - |
| Redirecting spalls | 1 | - | 5 | 5 | 2 | - | - | - |
| Edge ground axes | 1 | - | - | 2 | - | - | - | - |
| Serrated flakes | - | - | - | 3 | 5 | 2 | 3 | 3 |
| Fabricators | 19 | 3 | 4 | 1 | - | 1 | - | - |
| Edge trimmed flake tools | 8 | 5 | 15 | 20 | 11 | 11 | 6 | 1 |
| Steep scrapers | 1 | - | 2 | 1 | 5 | 3 | - | - |
| Hammerstones and unifacial choppers | - | - | - | - | 2 | - | - | 3 |

* Data from Stockton (1973) supplemented by analysis of the collection deposited in the Australian Museum

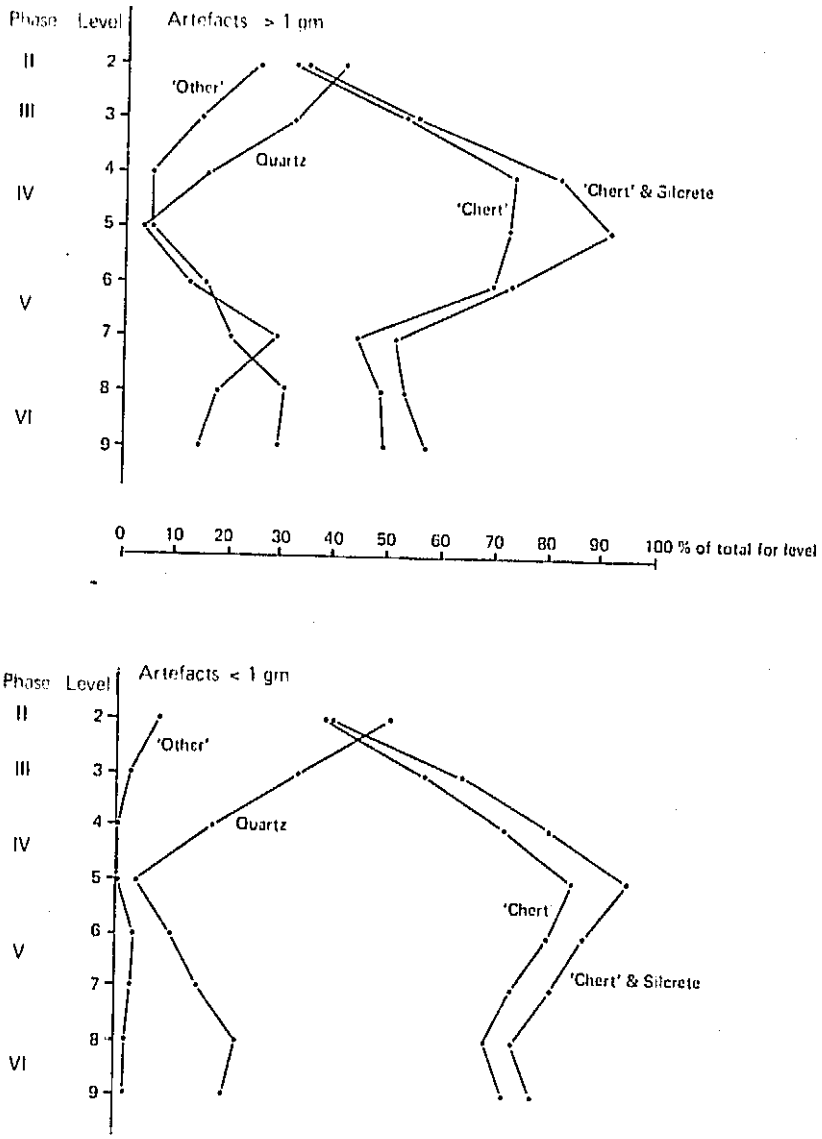
Table 4 Shaw's Creek : summary data

The distribution of artefacts and changes in raw material usage are illustrated in figs. 6 and 7. Artefact concentrations fall off at the base of the sequence (level 7 - 9,600 artefacts/cu m, level 8 - 3,200 artefacts/cu m, level 9 - 2,100 artefacts/cu m) and this is coupled with greater use of quartz, quartzites, coarse granular cherts and volcanic material (43-49% quartz and 'other' raw materials in levels 7-9, 8-28% in levels 4-6 (finds over 1 gm only)). The importance of poor quality materials, which I believe to be of local origin, in these basal levels is also reflected in the high mean artefact weights (11 g in levels 8 and 9 as against 3-4 g in levels 6 and 7 and <2 g in levels 2-5) which are largely dependent on the presence of a few large formless chunks of slightly retouched material. Artefacts over 1 gm make up 30-45% of all artefacts in levels 7-9, compared with 20-30% in levels 2-6. The base of the Shaw's Creek sequence thus closely parallels the base of the Springwood Creek sequence (phases V and VI with 30-50% quartz and 'other' raw material, a rise in mean artefact weight from <2 g to 2 g and 5 g and a fall off in artefact concentrations from 1160/cu m (phase III) and 330/cu m (phase IV) to 240/cu m (phase V) and 35/cu m (phase VI)). A similar tendency to the use of poor quality raw material also occurs in the lowest phases at Springwood Creek and to some extent in the Capertian industry at Capertee 3 (chapter 5).

The highest artefact concentrations in the site occur in levels 4-6 (13,100; 22,500; 12,200 artefacts/cu m respectively). These levels are characterised by a very high proportion of chert[1] (81-97% of artefacts over 1 gm) and backed implements (57% of tools level 6, 75% level 5, 66% level 4).

The upper levels, 2 and 3, show a drop in artefact concentrations (5000/cu m in level 3 and 9000/cu m in level 2), this drop being particularly marked for backed implements which form 50% of tools in level 3 and only 17% in level 2. The drop is due to a considerable number of fabricators in level 2, representing over 50% of tools. Elouera rise in importance relative to other backed implements in these levels as compared with levels 6-4.

(1) 'Chert' refers to all fine-grained isotropic materials and includes silcrete.




Australian Museum collection, excludes backed implements and some other tools
Analysed 1979, I.J.

Fig. 7 Shaw's Creek : vertical changes in raw material usage

These changes are accompanied by a marked change from chert usage to quartz usage - quartz rises from 34% in level 3 to 51% in level 2 (artefacts < 1 gm) and from 32% in level 3 to 41% in level 2 (artefacts > 1 gm). For comparison, quartz represents less than 5% of artefacts in level 5 and less than 20% in level 4. The more marked rise in quartz artefacts under 1 gm reflects the importance of tiny quartz chips which are a common correlate with the presence of fabricators (see earlier). The rise in quartz is also paralleled by a rise in 'other' raw material, particularly in the larger size range (> 1 gm, 14% in level 3, 25% in level 2).

Thus the end of the sequence at Shaw's Creek[1] fits well with the changes observed at Springwood Creek (rise in fabricators, greater use of quartz, persistence or rise in eloueras). There are minor differences, in the form of a decrease rather than increase in tool concentrations at the end of the sequence and a decrease in the numbers of backed implements (which persisted in the Springwood sequence). These differences may simply be a function of the slightly different dating of the phases in the two sites or the effect of small sample size, but on the other hand the degree of agreement in sequence is remarkable for two sites in such widely different topographic situations with such widely disparate artefact concentrations. One would be more inclined to expect similarities between Shaw's Creek and Lapstone Creek than between Shaw's Creek and Springwood Creek, yet this is not the case (see below).

It will be seen that the changes described for the Shaw's Creek sequence are not sharp changes but occur over the space of a couple of levels. For example the rise in quartz in the upper phases starts in level 4 with 16% quartz, through level 3 (37%) to the 50% of level 2. Stockton remarks on this and considers it to be an artefact of occupational disturbance. However, it will be seen from fig. 6 that there is a very close correlation between the vertical distributions of artefacts less than and greater than 1 gm in weight. This implies either that there has been little vertical movement or that the size-sorting model proposed by Stockton (1973, 1977a, 1979) is not applicable to this site. If we opt for limited vertical movement, the

(1) Phase I is not discussed here as Stockton considers it to be effectively disturbed material and the assemblage is small (41 artefacts).

implication is that the change in raw material occurred gradually, but this can only be verified by more intensive excavation including 3D plotting of finds (cf. Morwood 1979b), extensive analysis of conjoins (see glossary) and experimental study of size-sorting effects.

King's Table

This is a small rockshelter with easterly aspect just beneath the summit of the King's Tableland, an exposed heathland at an elevation of 880 metres near Wentworth Falls. It is well protected from the prevailing westerlies. Much of the floor area is a raised sloping rock platform. The deposit was divided into seven phases during the excavation, phases I to VI being considered as Bondaian and phase VII as Capertian. Dates on the Bondaian phases ranged from 980 ± 70 BP (SUA155) at a depth of 23-25 cm in Phase II to 1120 ± 80 BP (SUA229) and 1075 ± 90 BP (SUA157) in phase VI at depths of 71-76 and 76-84 cm respectively.

The junction of phases VI and VII lies at around 90 cm depth and Stockton claims that this was marked by a 10 cm sterile band. This band cannot however be taken as evidence of an occupational hiatus as a date at 100-110 cm gave 14,534 ± 300 BP (SUA194), which Stockton regards as indicating a truncation of the deposits prior to the more recent Bondaian accumulation.

It is clear that there have been drastic changes in sedimentation and erosion rates at this site, apparently independent of occupation by man, which invalidate any attempts to discuss tool deposition rates, first occupation or occupational hiatuses and even call into doubt the association between the C14 dates and the artefacts excavated. This must be borne in mind when assessing the earliest date from the site of 22,240 ± 1000 BP (SUA158), several thousand years earlier than any other date from the area (though even if we accept it at face value it only implies the accumulation of some 48 flakes in the following 10,000 years). Taking the more recent dates as valid, the occurrence of numerous (74 = 37% of tools) backed implements scattered throughout phases I to VI corroborates the evidence from Lyre Bird Dell that these types persisted until at least 1000 BP in the Blue Mountains. Consonant with the fairly late date of phases I to VI, fabricators are well represented (12% of tools, compared with 11% at Lyrebird Lb, dating to a similar period, and 35% in the top spit of

Springwood Creek dating to the last 600 years). Eloueras are also present (4% of tools, compared with 2 out of 20 tools at Springwood, 7% for Shaw's Creek I-III and 10-20% at Lapstone Creek).

By comparison with the other sites on the Blue Mountains plateau, King's Table is a rich assemblage, approaching the artefact concentrations of Shaw's Creek (table 2). The proportion of the assemblage identified as tools is low (from 1.5-2.5%) particularly when compared with the poorer plateau sites (e.g. Wall's Cave 14%, Lyre Bird Dell 7%, Horseshoe Falls 8%). This suggests that stone working played an important role at King's Table, perhaps in response to a locally available source. If we look at tool concentrations alone these seem to fall more in the range for the other plateau sites, supporting this interpretation.

The main and unresolved question concerning the King's Table assemblage is the apparently identical dates throughout the 1 metre of Bondaian deposits. Either this represents exceedingly rapid deposition over a very short period and none thereafter, or, as Stockton has suggested (1977a, 1979) some sort of homogenisation of the deposits by occupational disturbance. If deposition of the Bondaian sediments occurred <u>in situ</u> from the products of human activity, this would imply an unusually intense occupation, all the more surprising in view of the cessation of occupation thereafter (the shelter still maintained headroom). On the other hand, if homogenisation occurred through 90 cm of deposits by occupational disturbance, one would expect to find a similar situation in other dry sandy sites with very few sites showing any increase of age with depth. This we know not to be the case.

The most likely interpretation of the King's Table evidence I think lies in redeposition of the material. If we extrapolate the sedimentation rate from 22,240-14,534 BP up to 1000 BP, we arrive at about the level of the base of the Bondaian sequence. Most of the area of the shelter is formed by a rock platform, now bare of deposits. A change in microtopography (e.g. collapse of a section of the overhang) at about 1000 BP could result in material accumulated on the rock platform over a period of several thousand years finding its way into the deposits, together with an ample supply of contemporary (i.e. 1000 BP) charcoal. This hypothesis is clearly no more than an unsupported suggestion and requires further work (e.g. microtopographical study, sediment particle size analysis and study of the distribution of archaeological material) to validate it.

Wall's Cave

Wall's Cave is a huge rockshelter near Blackheath formed at the bend of a meander in a deeply incised creek bed. Access to the shelter involves scrambling along a steep cliff and the shelter is damp and shaded. The shelter faces east and is largely screened from sunshine by its depth and protecting walls to north and south. The deposits were divided into three phases, phases I and II being attributed to the Bondaian and phase III to the Capertian. Phases II and III are separated by half a metre of sterile deposits which are clearly waterlaid, with graded bedding of clays and silts and sub-rounded rocks; these deposits cannot be taken as any indication of an occupation hiatus, other than of the rockshelter itself for very obvious reasons. Phases I and II were not dated in the main trench, but Stockton considered Phase II to be equivalent with the lower of two distinct 8 cm occupation horizons in a trial trench 5 m away which was dated to 3360 ± 100 BP (GaK3446). This horizon contained '2 Bondi points near a well sealed charcoal cluster' (from which the dated sample was derived) and overlay 25 cm of sterile sands above bedrock. Phase I and II contained a total of 85 and 53 artefacts, including 6 and 2 backed implements respectively. Phase III yielded a date of 12,000 ± 350 (GaK3448) and contained a total of 11 artefacts. Phase III was underlain by 24 cm of sterile sands.

The evidence from Wall's Cave points to very sporadic use by man, becoming archaeologically visible at around 12,000 BP. The very small numbers of flakes are partly a function of the small size of the trench (1 sq m) in relation to the size of the rockshelter (estimated 400 sq m of potential deposits). It should also be noted that, although the site is near the main broad ridge of the Blue Mountains, it is in a narrow incised creek bed, is difficult of access from the plateau above and is not particularly inviting owing to its dampness and shade. Backed implements appear to date to around 3360 BP, following a period when the site was uninhabitable, or at least uninhabited and the creek deposited alluvial material in the shelter.

Horseshoe Falls

Horseshoe Falls is a very large shelter beside a waterfall in a deeply incised creek bed near the main Blue Mountains ridge. It is permanently damp. Stockton considers the excavated assemblage of 375

pieces of debitage and 32 cores and tools to have been disturbed by water action, and obtained a date on 'diffuse organic material' of 7280 ± 230 BP, which he considers as the date of formation of the reworked deposits. The assemblage contains several specimens comparable with McCarthy's Capertian 'saws', and no backed implements, suggesting that the date can be taken as a reasonable terminus ante quem for the appearance of the 'saws'. Little more can be said of this assemblage.

Lyre Bird Dell

There are two rockshelters at Lyre Bird Dell situated at an altitude of 900 m on the outskirts of Leura. The larger, La, faces west and is situated near a waterfall in a similar situation to the Horseshoe Falls site, though the valley in which it is located is much shallower and more open. The smaller, Lb, is approximately 200 m from La and is well above the level of the creek under a small cliff-line. It is very exposed to the prevailing westerly winds and affords little protection. It has a steeply sloping floor.

The material from La was reported as entirely Capertian (i.e. lacking backed implements and with a date of 12,550 BP) and that from Lb as entirely Bondaian with a date of 530 ± 80 BP. Stockton interprets this situation as being due to a climatic change at the end of the Capertian which made the larger shelter too damp for habitation (due to its proximity to the the waterfall) and thus transferred occupation to the smaller one. This explanation is to my mind extremely dubious, as any deterioration in the weather would render the smaller site, Lb, even less habitable than before, and would certainly not reverse their desirability. A much more likely explanation is that the smaller site was first occupied at a fairly late date as it offered little protection, whereas the larger shelter was occupied from at least 12,550 BP. The lack of layers with backed implements is attributable to the recent modification of the shelter to form a picnic spot, which involved removal of most of the surface of the deposits to build a terrace in front of the dripline. Stockton found no backed implements in the disturbed material he was able to examine, but a recent visitor to the site found three backed implements weathering from the dripline (Stockton, pers. comm.).

The larger shelter, La, was dated to 12,550 ± 145 BP, this date being derived from the lower of two occupation levels in a remnant of undisturbed deposit. This indicates that, as at Wall's Cave, occupation of the site first became archaeologically visible at around 12,000 BP. About 550 artefacts were collected from the disturbed surface.

The smaller shelter, Lb, was dated to 530 ± 80 BP, the dated material being derived from the middle of three occupation horizons, the lowest of which is underlain by sterile deposits. The two upper horizons contain a total of 14 backed implements, but no elouera or fabricators, in an assemblage of 321 artefacts and thus support the continuance of backed implements until at least recent pre-contact times. The lowest of the three horizons also contains backed implements (7), in a slightly smaller assemblage (202 artefacts). The surface collection from the site contains a lower proportion of backed implements (3 out of 329 artefacts), outnumbered by fabricators (5); this could be taken as reflecting the rise in fabricators in recent levels of many sites in the Blue Mountains/ Sydney region or selective collection by visitors to the site.

Stockton's Minor Sites

In his 1970 report, Stockton describes material from eight sites, including a preliminary excavation at the Springwood Creek site. The largest of the excavations is 2.7 cu m (Springwood S). I have been unable to locate the material, some at least of which was left at St Columba's College, Springwood, which owns most of the sites. Beyond the shallowness of the deposits in most cases and the corresponding presence of backed implements and fabricators, these sites can only serve to indicate the sort of artefact concentrations in the area. These appear to be lower in the Lawson area (site P,Q,D) than in the Springwood area (G,S,W,C and E) as noted by Stockton (1970:299, see also table 2). Springwood is at a lower altitude and closer to the edge of the plateau than Lawson, but otherwise the two areas are topographically similar.

Stockton suggests that site C, which is an open site on top of cliffs overlooking the Grose River exposed by a bulldozer clearing a vehicle turning area, is a knapping site for raw material brought up from the Grose before it is transferred to the 'living area' of the

broader main Blue Mountains ridge. He supports this suggestion by the observation that this assemblage contains few and imperfect 'tools' and was close to a group of axe grinding grooves. Though the evidence is by no means conclusive, the Grose does seem a likely source of the pebbles used as a raw material in this site.

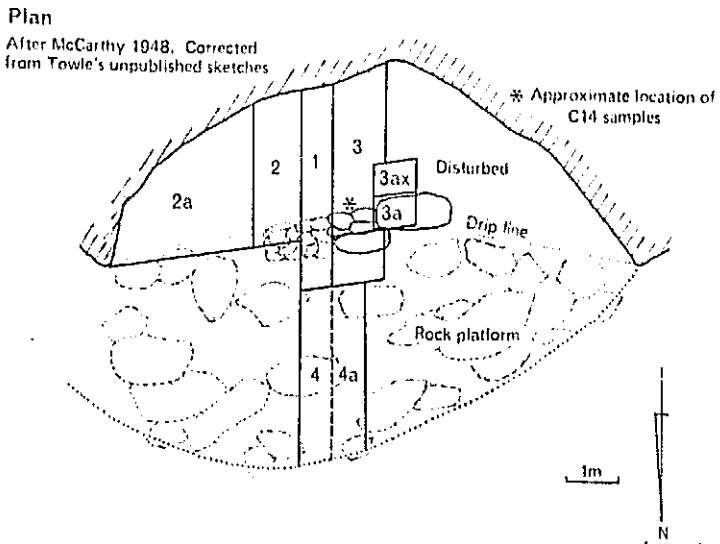
## MCCARTHY'S EXCAVATIONS

### Lapstone Creek

The Lapstone Creek rockshelter was excavated by C.C. Towle, with the assistance of F.D. McCarthy, over nine days in 1935/36. The results were published after Towle's death (McCarthy 1948), based on a report written by Towle and on McCarthy's analysis of the collection housed in the Australian Museum. A later paper (McCarthy 1978) adds new information derived from Towle's excavation notes which were not available at the time of the 1948 publication.

The shelter is situated about 10m above a creek which is deeply incised into the steep eastern margin of the Blue Mountains plateau near Emu Plains. It is approximately 10 km south of Stockton's Shaw's Creek site and situated further from the Nepean, approximately 70 m ASL. The Lapstone Creek terrain is rather more rugged than that in the vicinity of Shaw's Creek. The shelter faces north (fig. 8) and is approximately 10 metres long, 3 metres deep and 1.4 metres high (above the original surface of the deposits). In front of the shelter there is a platform formed by boulders and deposits built up on a rock base. These boulders are particularly concentrated along the dripline of the shelter where they have apparently been supplemented by smaller fragments to form a 'wall' (see fig. 8).

The floor of the shelter is a sloping rock platform, the maximum depth of deposits of 1.4 metres being situated just behind the 'wall' towards the centre of the shelter. The western end of the deposits were removed shortly before Towle's excavations, so that the total area excavated inside the shelter was around 170 sq ft (15 sq m) for the uppermost levels, reducing sharply for the lower levels due to the slope of the shelter floor. As far as I can tell, no deposits within the rockshelter were left unexcavated, although parts of the 'wall' were left intact (McCarthy, pers.comm.).



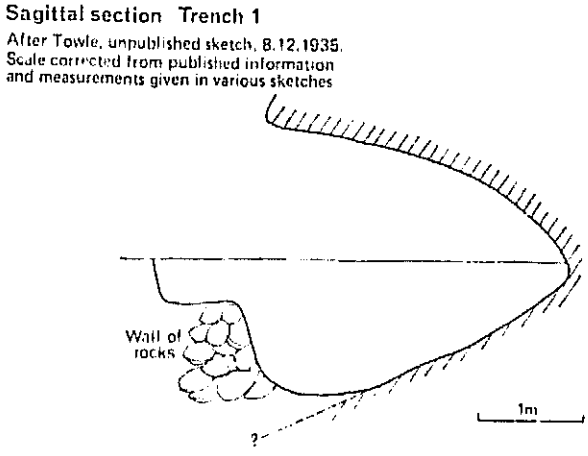




Fig. 8 Lapstone Creek : plan and section

The deposits were divided into two industrial phases, the lower three levels (A,B,C) being termed Bondaian and the upper three (D,E,F) Eloueran. McCarthy does not give any indication in the 1948 report, beyond a generalised section of the site, of the depth ranges represented by these levels. In the 1978 report, however, he gives spit boundaries for each trench and I have plotted these onto one of Towle's unpublished drawings (fig. 9). It is apparent that there is a problem in tying up the six levels (A-E) described in the 1948 report and the 4-7 spits which were excavated in different parts of the site. In addition McCarthy states 'There is a slight marginal overlap betwen the two industries, as excavated' (1948:4).

The sequence of lithic industries described by McCarthy has puzzled many people as it has not been reproduced in any other sites. Towle's diagram shows Bondi points as appearing only below 30" depth (75 cm). The lower 3 spits, A, B, and C, contain an industry with numerous backed implements (52% of tools in A, 37% in B and 38% in C) and a few eloueras and fabricators. The upper spits, D, E, and F, yielded no backed implements other than eloueras, which are numerous forming from 8-19% of tools as compared with 1% in the lower spits. These are accompanied by numerous fabricators (12% in D, 40% in E and 13% in F) The top spits, E and F, show a reduction in the size of these tools (in the form of an increase in the proportion of elouera less than 3 cm long) accompanied by a sharp increase in proportion of fabricators within this size range. Towle also noted (McCarthy 1978:51) that these upper levels contained a greater abundance of quartz than the lower levels. This sequence appears to parallel that found in the Sydney region (Megaw et.al. 1974), though the sharp and total disappearance of Bondi points above a particular level has not been paralleled elsewhere, nor at such an early date; ANU11 (2300 ± 100 BP ) at 51 cm below surface is quite well above the upper limit of Bondi points. As we have already seen, Shaw's Creek and other sites further into the Blue Mountains show parallel increases in quartz waste, fabricators and possibly eloueras, but only a decrease rather than a disappearance of Bondi points and geometric microliths.

McCarthy (1948:11) comments on the very nearly level surface of the Bondaian deposits in the site, presumably identified on the appearance of Bondi points in the deposit rather than on geological grounds as the deposits are described as not showing any perceptible change. However the second report (1978:51, 53) mentions a band of

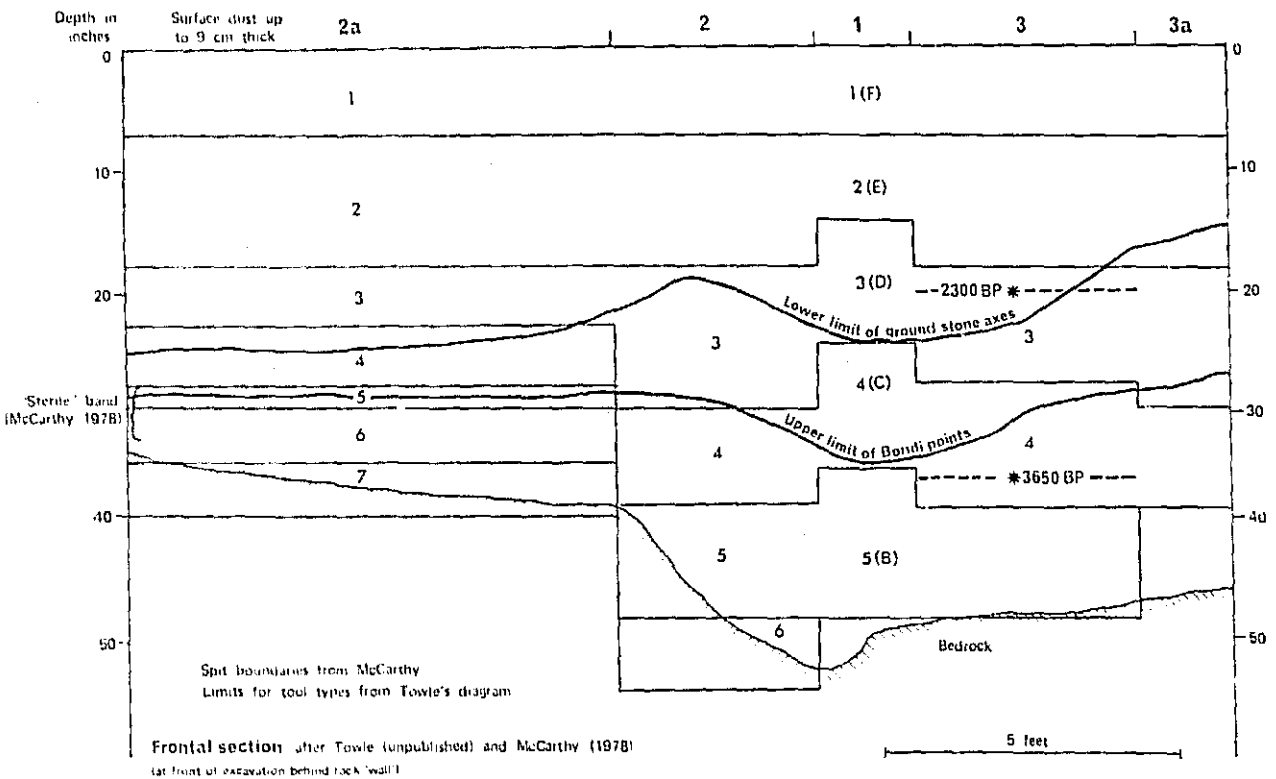



Fig. 9 Lapstone Creek : frontal section near dripline

light-coloured sediment at a depth of 7'-7½ cm in trenches 1 and 2 which Rowle considered to mark the transition from the Bondaian to the Eloueran. Rowle suggested that this band might mark a period of non-occupation, prior to reoccupation by Aborigines who no longer used Bondi points (ibid.:53). This seems a plausible explanation contributing to the sharpness of the industrial change, though it does not resolve the question of the early dating of a 'post-Bondaian' industry.

The second date for Lapstone Creek, 3650 ± 100 BP (ANU10) at 31 cm below the surface and therefore within the Bondaian levels of the site, also appears to be a little old in terms of the dating I have suggested for the appearance of backed implements in the Blue Mountains/South Coast area (chapter 6). Whilst such a date is within the tolerance of my estimate for the appearance of backed implements in the area, it does not come from the base of the sequence. Pending further information we must regard this date as inconclusive evidence for the appearance of backed implements in the area much before 3600 BP. It is worth noting that the samples were collected from an ashy area, described as a long-term fireplace (1948:4), at the front of section 3 near the 'well' across the front. Apart from this we have no information regarding their provenance - they were, of course, collected long before the C14 dating method was developed.

In conclusion it is not surprising, in view of the period when the site was excavated, that we have perhaps raised more questions than we have resolved. Broadly, the lithic sequence parallels that from the Sydney area and Blue Mountains, but the changes appear to be sharper and the dating is earlier than elsewhere. In reproducing Rowle's diagrams I have aimed not so much at resolving existing problems but at presenting the available data for other workers who may not have access to it or time to work through it to extract the information.

The final problem concerns the beginning of the Lapstone sequence - does the Bondaian really extend to the bottom of the site. In chapter 6 I suggest that the small tool tradition will tend to spread downwards where it is underlain by an industry lacking clearly retouchable tool types. With the data available, we are not in a position to say whether the Lapstone Creek shelter was first occupied during the Bondaian.

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Emu Plains Shelter

The year before Towle and McCarthy excavated at Lapstone Creek, McCarthy and Brammell excavated what remained of the deposits in a small shelter a few kilometres to the North. This shelter had been largely dug-out by collectors. They recovered 49 scrapers, 4 elouera, 51 Bondi points, 4 cores and 7 other tools, fragments of a human skull and a tooth plus faunal remains including freshwater mussel shells.

Though McCarthy says that 'there was not a great deal of stone for the making of implements, or of implements themselves' (1934:241), the size of the collection recovered in one day's work suggests that tool concentrations must have been of the same order as in the Lapstone Creek excavation. Both sites are, as far as I can judge fom the report, in a similar topographic situation on a creek leading down from the eastern margin of the Blue Mountains plateau to the Nepean River.

Blackfellow's Hands Shelter

This huge rockshelter is situated on the plateau region just south of the headwaters of the Wolgan Valley at an altitude of 960 metres and facing north. As its name suggests it contains a panel of stencilled hands in various colours, together with two stencilled boomerangs, all somewhat faded. McCarthy excavated there for one day in 1939 (McCarthy 1939), recovering 9 backed implements and 2 fabricators from 4 trenches scattered around the shelter. The deposit was described as sterile for the first 6" (15cm), with Bondaian material from 6-18" (15-45cm) underlain by a couple of feet (~50cm) of sterile deposits. In view of the small area excavated and the methods used, it is quite possible that this basal 'sterile' layer corresponds with the lower artefact densities typical of the earlier levels of other sites in the Blue Mountains. The Bondaian layer is described as rich in ash and charcoal. Estimating the area excavated as 2 square metres, the tool concentration is around 15 tools per cu m. Taking account of the probably low tool recovery and recognition in this early excavation, this concentration is of the same order of magnitude as the tool concentrations recorded for the Bondaian levels of the minor Capertee sites 2, 4 and 5, for Noola rockshelter and for the poorer sites on the Blue Mountains plateau (see table 2).

Caves Hotel

This site, situated near Mt Bell, has been known since the construction of Bell's Line of Road, at which time it was used as shelter by the convicts working on the road. At a later stage, when the road was straightened and sealed, the site was to have been destroyed by a cutting but was saved by a sympathetic road engineer so that it is now about 5 metres above the road in the wall of the cutting.

Unlike most Blue Mountains sites, Caves Hotel really is a cave rather than a rockshelter. It is nearly ten metres deep and 1.5-2 metres high over most of its area. The entrance is about six metres wide and developed in a low cliff. The walls are covered with engraved animal tracks (mostly of emu with some kangaroo tracks), numbering about 250, but there is some doubt as to whether all of these are Aboriginal rather than being attributable to more recent occupants.

Caves Hotel has probably been subjected to several amateur excavations owing to the fact that it is well known and easily accessible. National Parks records indicate that there are four feet of deposits. More recently excavations have been carried out by a group of amateurs including John Eadie, Department of Genetics, RSBS, ANU (Eadie, pers. comm.). The material is in the possession of one of this group, but I have been unable to see it. This excavation probably warrants following up as flaked material is to be found in the dripline and the excellent protection of the deposits might result in better-than-normal preservation of organic materials.

## Conclusion

The main features of the sequences discussed so far are as follows:

1) The richness of the lithic assemblages (in terms of numbers of artefacts per cubic metre) is closely related to topographic situation. This probably reflects both the sporadic nature of occupation on the sandstone plateau and scarcity of stone resources. Large rockshelters on the margin of the plateau (e.g. Blackfellows' Hands Shelter, Capertee site 5) have a rich suite (for the area) of parietal art and very poor lithic assemblages, suggesting their use for ritual purposes or brief encampments rather than occupation for significant periods by family groups. On the other hand, sites with

easy access to the richer environments of the Cumberland plain (e.g. Lapstone Creek and Shaw's Creek) have rich artefactual assemblages, but art is more limited. A similar situation is found in the more accessible Capertee sites which have rich assemblages when compared with those further away from sources of water and potential grassland areas (see chapters 4 and 5).

2) The first detectable occupation of the plateau area appears to have occurred at least 12,000 years ago (Wall's Cave, Lyrebird Dell a, King's Table) although a date of around 22,000BP at King's Table has been claimed as dating the first occupation of this site. However, the assemblage at King's Table is too meagre to be sure of its direct association with the dated sample. The early industries in the area are represented by poor assemblages, characterised by the use of a fairly high proportion (up to 50%) of poorer quality raw material such as quartz, tabular and granular cherts and crystalline pebbles. Mean artefact weight is high, of the order of 3-5gm, largely due to the influence of a few large chunks of these poorer quality raw materials. The early industries have been grouped under the term Capertian proposed by McCarthy for the industry in the Capertee sites dating from approximately 7-3000BP. In view of the rather negative definition of the Capertian and the small size of the early Blue Mountains assemblages, I think the term Capertian should be restricted to the type sites and the other assemblages should be simply referred to as early Blue Mountains assemblages or Core Tool and Scraper Tradition assemblages.

3) At some time before 3000BP, backed implements appear in the sequence and there is a general reduction in artefact size, proliferation of characterisable tools and shift in raw material usage. Fine-grained isotropic materials now make up 80-90% of the material used and large formless chunks of poorer quality materials disappear. At the same time there is a peak in artefact concentrations (number of artefacts per cubic metre) with concentrations an order of magnitude higher than in the underlying industry. This second phase of the sequence has been widely termed Bondaian.

4) Over the last thousand years there is a shift in tool types away from backed implements of the Bondi Point and geometric form towards the elouera form, and a marked rise in the occurrence of fabricators (scaled pieces). This shift is accompanied by an increase in the use of quartz at the expense of the finer isotropic materials used in the

Bondaian, although the latter still remain a more important component than in the early Blue Mountains assemblages. At Lapstone Creek the transition from the Bondaian to the later industry (termed Eloueran at this site) occurs sharply and at an early date (before 2300BP), but this early and sharp change has not been paralleled elsewhere and remains a puzzling anomaly. At other sites the change appears to be more or less gradual, although this may simply be a function of excavation techniques and stratigraphic conditions. Although artefact concentrations peak in the middle (Bondaian) phase, at Springwood Creek the rate of accumulation of artefacts (artefacts per square metre per thousand years) rises progressively throughout the sequence, illustrating the danger of assuming that the 'richness' of an assemblage is directly correlated with intensity of occupation.

5) Bearing in mind the dangers of extrapolating from artefact concentrations, there does appear to be a progressive increase in intensity of use of the plateau area through time. There is a proliferation of minor sites with rich Bondaian assemblages (perhaps masking an underlying less characteristic assemblage), a progressive rise in artefact and tool deposition rates at Springwood Creek and order of magnitude increases in artefact concentrations in other sites, as well as at Springwood Creek. The information available is insufficient to determine whether the rise in intensity of occupation is gradual or occurs in sharp jumps, but the sharp increase in artefact deposition rate between phase II and phase I of the Springwood Creek sequence suggests that use of the plateau area may only have reached its contact-period intensity during the recent past.

6) Contact period accounts of the Blue Mountains and surrounding areas point to very low intensity occupation of the plateau area. It is not possible to say whether there was a permanent very low density population or sporadic visits from surrounding areas, but the latter seems the more likely in view of the poverty of food resources in the plateau region. References to 'mountain people' by Aborigines living on the Cumberland Plain (Barrallier 1802) and references to quite large groups of these people by Caley (Lee 1925:138). suggests that the plateau area may have been exploited by people living along the margins and lower slopes of the mountains rather than by people coming from further afield.

# CHAPTER 4

## Topography and environment of the Capertee valley and reassessment of Noola rockshelter

Introduction

Archaeological work in the Capertee Valley began in the late 1950's when F.D. McCarthy began excavations on a number of sites in the Capertee Gorge approximately 6 km downstream from Glen Davis (fig. 10). These sites are known as Capertee Sites 1-4. Another site further upstream is known as Capertee Site 5. In 1961, N.B. Tindale, Curator of Anthropology at the South Australian Museum, Adelaide, excavated a further site which had been test excavated by McCarthy's assistants and is variously referred to as Capertee Site 6 (McCarthy) and Noola (Tindale). The results of McCarthy's excavations were published in 1964 (McCarthy 1964) but the only report on Tindale's excavation is a four page preliminary note (Tindale 1961). Because of references in the literature I shall refer to this site as Noola rather than Capertee Site 6.

A number of factors led me to carry out detailed fieldwork in the Capertee Valley region. In the first place many unanswered questions were raised by my preliminary assessment of the published accounts and excavated material. Most important of these questions was to establish the dating and nature of the transition from the Capertian industry (McCarthy 1964), lacking backed implements, to the succeeding Bondaian industry with numerous backed implements. At the time I started fieldwork McCarthy's dating of the transition at around 3000BP was very much younger than the accepted 5-6000BP dating of the appearance of backed implements (e.g. Glover 1967:425, Pearce 1971:300, Dortch 1975:59, McCarthy 1977:255, Mulvaney 1978:6). Equally the selective nature of McCarthy's collection (only 'tools' and a small selection of 'waste' were collected and sieving was carried out dry on a 1/4" (6 mm) mesh) made comparison with more recent collections difficult and did not permit the definition of differences in artefact size, flaking technique or raw material usage between the two industries. Re-excavation of the Capertee sites was chosen as having several advantages over excavation of new sites in the area or elsewhere.

1. Re-excavation avoided disturbing any new sites which would be better left undisturbed for detailed site-specific study (my study was necessarily a small area excavation more concerned with stratigraphy than with total assemblages and horizontal layout).

2. The Capertee sites, notably Site 3, were known to contain rich assemblages, so that a small area excavated would give a sufficient sample for defining the change in lithic industry from the Capertian to the Bondaian. Equally the richness of the sites would allow the distinction of the Bondaian and Capertian levels on archaeological[1] as well as geological grounds, allowing more reliable dating of the change.

3. Further work on these sites might in fact increase the amount of information available from McCarthy's collections by aiding in their critical reinterpretation.

4. Re-excavation of a previously disturbed site was preferable to commencing excavation of a virgin site when one of the aims of my excavation was to test a new excavation methodology.

Two of McCarthy's sites, Sites 1 and 3, showed a clear transition from an earlier industry lacking backed implements to a later one characterised by numerous backed implements, notably Bondi points. On the basis of these sites, together with the Lapstone Creek site which showed a third industry overlying the upper of the industries found at Capertee, McCarthy proposed his three-phase 'Eastern Regional Sequence' (McCarthy 1964:202). The three phases proposed were the Capertian, a pre- backed implement industry; the Bondaian, an industry characterised by numerous backed implements and notably elongated assymetric specimens known as Bondi points; and the Eloueran, characterised by the disappearance of Bondi points and geometric microliths and a marked rise in the numbers of elouera and fabricators

McCarthy's Eastern Regional Sequence appears to be roughly applicable to a number of sites in the Blue Mountains area (see Chapter 3). Stockton (Stockton and Holland 1974) and Megaw (1965, 1967, 1968) have both identified assemblages as Capertian. The dating of Stockton's assemblages indeed suggests that they predate the most optimistic estimates for the antiquity of backed implements, but the

(1) It is frequently stated (e.g. Gould 1969:229) that, in the absence of distinct stratigraphy, one's only recourse is to use arbitrary excavation levels. This overlooks the possibility of defining stratigraphy on the basis of concentrations of artefactual material at particular levels, the so-called 'cultural stratigraphy' of Morwood (1979, see also White 1972:89), a technique commonly applied to 'occupation floors' on open sites, but rarely applied in an explicit fashion to the excavation of stratified sites.

assemblages are too small to characterise satisfactorily (King's Table, Wall's Cave, Springwood Creek). Megaw's site (Curracurrang ICU5/-) has unfortunately not been analysed and is situated in a quite different topographic and environmental situation from the Capertee sites. I think the extension of such specific terms as Capertian beyond the type-site is dangerous at this stage, not simply for reasons of terminological purism but because such pigeon-holing is liable to gloss over differences between sites and stultify questioning of those differences. The strength of Australian prehistory lies in the ability of its generally unstandardised assemblages to tell us about activities and exploitation patterns, rather than in the construction of culture-historical frameworks.

In my discussion of Capertee Site 3 I shall make use of the terms Capertian and Bondaian for the lower and upper industries respectively. I am extending this terminology no further than to this group of immediately adjacent sites. None of the Capertee sites shows a marked change in lithic industry towards the end of the sequence which might be equated with McCarthy's Eloueran industry, although there is a marked fall-off in artefactual material towards the surface of Sites 1 and 3.

McCarthy's fieldwork at Capertee 1 and 3 is certainly one of the most important excavations in southeastern Australia, not only from an historical perspective in establishing the three phase Eastern Regional Sequence (in much the same way that Lartet and Christy established the sequence Mousterian - Aurignacian - Solutrean - Magdalenian from the sites of Laugerie-Haute, Le Moustier and La Madeleine (Bibby 1969)), but also through the richness of the lithic assemblage and its absolute size (partly a function of the volume of deposits excavated). However, the techniques employed have raised many questions, not least of which is the validity of McCarthy's dating of the appearance of backed implements to between 3600BP and 2800BP. Other problems associated with McCarthy's results concern the correspondence between McCarthy's excavated spits and the natural stratigraphies of the sites and the bias introduced by the use of a large sieve size (6 mm) and selection of 'tools' from the sieve and discard of the remainder. As a result of these biases, McCarthy's collection can give us little or no information on the size distribution of debitage, on the proportion of utilised and retouched

material, on the characteristics of the smaller categories of utilised and retouched material (notably backed implements) or on the composition of the faunal assemblage. My aim in re-excavating some of the Capertee sites was therefore, on the one hand, to collect data which would allow me to reassess McCarthy's results and on the other hand to fill in the gaps in McCarthy's data by collecting a sufficient sample of the two industries to investigate changes in the debitage and proportion of retouched and utilised specimens. My first priority was to collect datable material to pin down the appearance of backed implements in the site and, by extension, the region.

Fieldwork

My major field season took place in January and February of 1978, following a number of trips to the area both to visit the sites and plan fieldwork, and also to carry out site and area surveys. In the 1978 field season I concentrated on cleaning up McCarthy's Site 3, his richest and only dated site, which involved moving several cubic metres of excavated spoil and collapsed sections and excavating in situ sediments. My aim was to clean back sections for drawing and to sample the archaeological material and sediments. Other work carried out at this time included a test excavation of an open site (Freshwater Creek I, reported in appendix I), sieving of the spoil from Site 4 with a view to investigating bias in faunal collections (project carried out by Ken Aplin, Department of Prehistory and Anthropology, ANU) and general cleaning up of the Noola site. A further field season in May 1978 was directed towards the excavation of small areas in the Noola Rockshelter to try and tie up the stratigraphy between the two trenches (the test trench and Tindale's trench) and determine whether any deposits remained documenting the appearance of backed implements.

This chapter will be devoted to general considerations on the topography and environment of the Capertee Valley and the results of the re-excavation and reanalysis of the Noola site and Capertee Site 4. The following chapter (5) will be devoted exclusively to the reanalysis of Capertee Site 3.

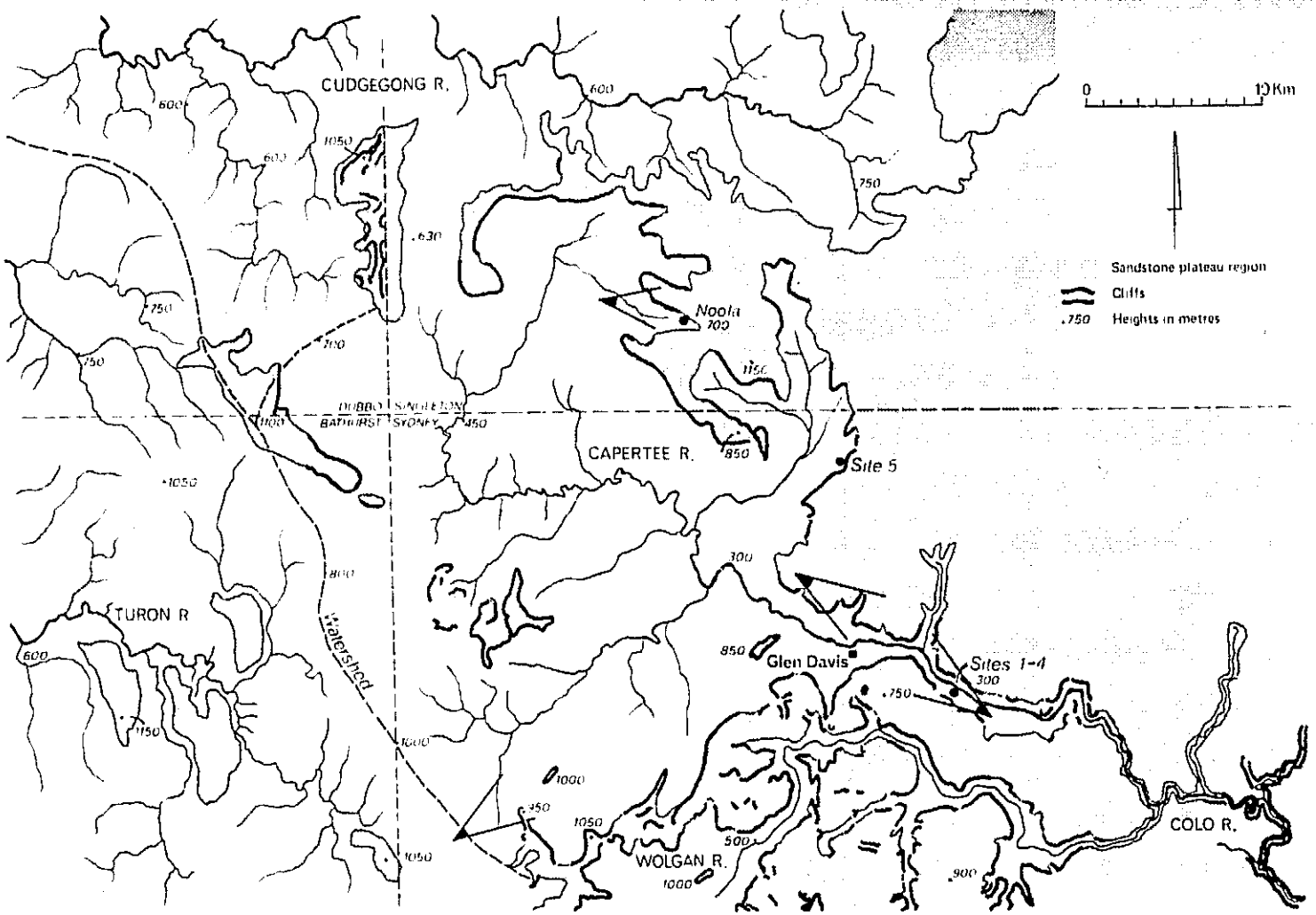



Fig. 10 Map of Capertee Valley area

Topography and Environment

The Capertee River rises in a broad basin of undulating country approximately 25 km across in a north-south direction and sloping down from the continental divide in the west (fig. 10 and pls. II and III). This headwater area is ringed to the north, south and east by massive cliffs of Triassic Narrabeen Group sandstone bordering the Blue Mountains and Hornsby Plateaux at an elevation of around 1000m (see pls. III, IV and V). The headwaters lie at an altitude of between 300 and 500 metres and are developed in Permian sandstone and conglomerate (Shoalhaven Group, Berry Formation). They are at present a mixture of open grazing land and closed eucalypt woodland, with occasional swamps and creeks with permanent pools. The watershed to the west presents no forbidding physical barrier as is the case for the cliffs to the east.

The Capertee River leaves this open country through a narrow gorge (pl. V) incised to a depth of up to 500 metres between the Blue Mountains/Hornsby plateaux[1], in which it continues for over 100 km to an eventual junction with the Hawkesbury River east of the plateau. The first 15 km of this gorge are fairly wide, with alluvial flats along the river and flattened pediment slopes higher up, and it is in this area that McCarthy's Sites 1-4 are situated, approximately 8 km from the entrance to the gorge.

Site 5 is a huge rockshelter just under the main cliffline bordering the plateau and looking out over the headwaters area. It is difficult of access from the valley, extensively decorated (unlike other sites in the area) and evidence of occupation is sparse (a trench 70 cu.ft. (2cu.m.) in volume yielded only 10 tools). I have suggested in chapter 3 that the combination of extensive artwork and very poor assemblages reflects the use of such inaccessible shelters for ceremonial rather than occupational purposes.

Noola (Site 6) is situated in the valley of the Bogee Nile Creek, a tributary of the Capertee river. The valley is a broad flat-bottomed area (pl. IV) opening out into the rolling countryside of the Capertee headwaters approximately 1 km from the site. The site is a large

(1) The Capertee/Colo Gorge is arbitrarily taken as the dividing line between the Blue Mountains and Hornsby plateaux, though the two are structurally equivalent (Bryan, McElroy and Rose 1956).

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Plate II Air photo-montage of the Capertee Valley area

(Compare with map, fig.10, which is at approximately half the scale.) The area covered extends from the Wolgan Valley in the south to the Noola site near the upper left-hand corner. Note the forested plateau and talus slopes and the dissected drainage pattern.

10 km

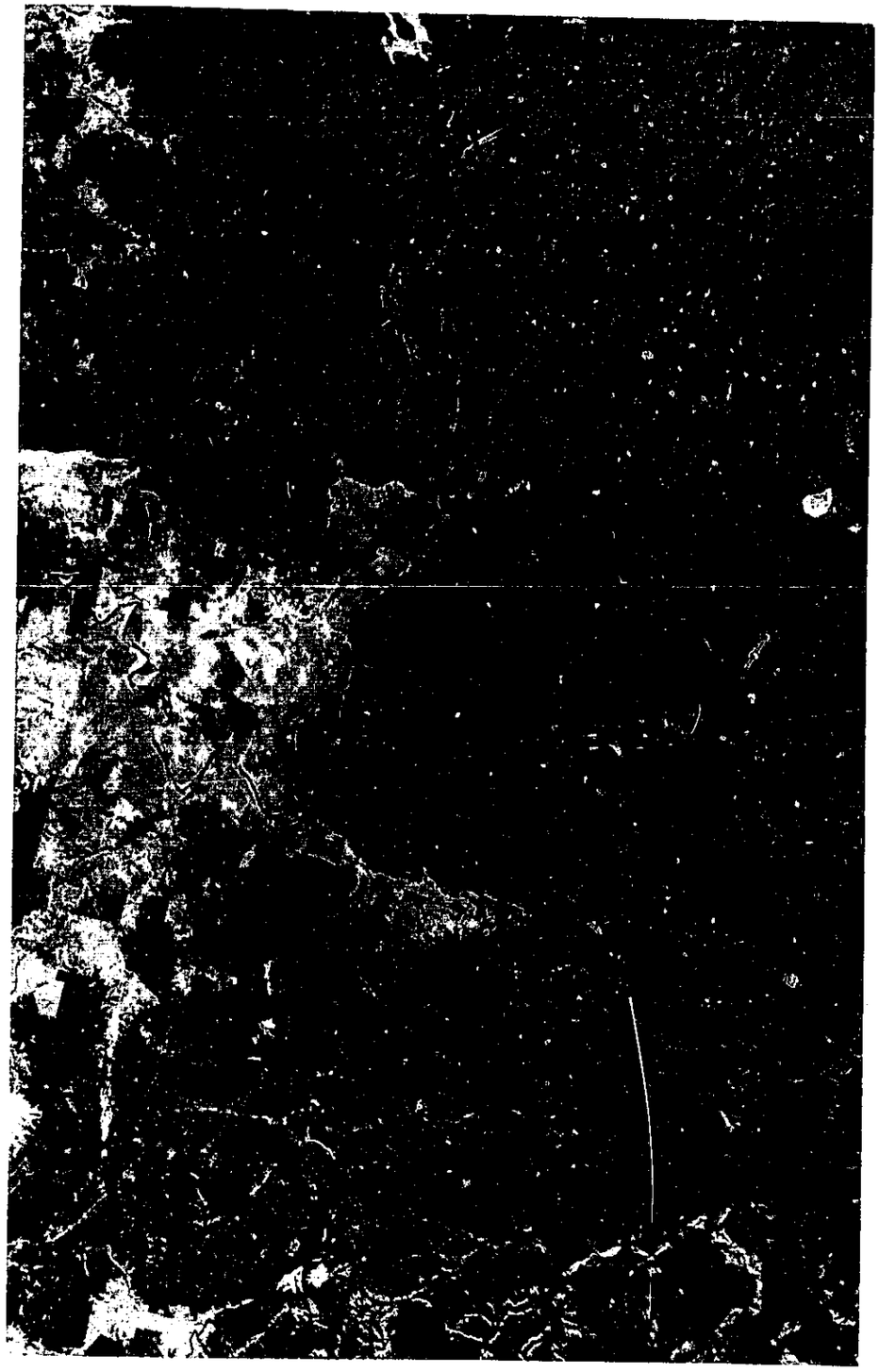
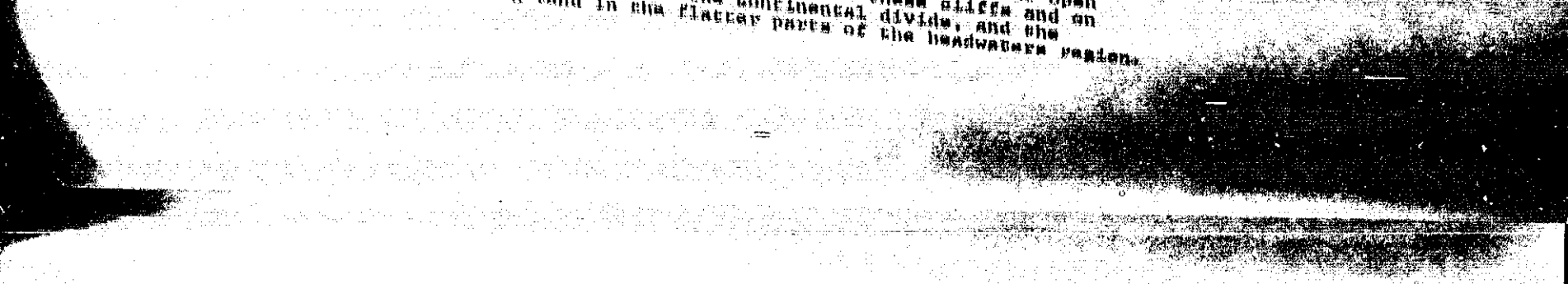


Plate III Capertee Headwaters from the Continental Divide

See fig.10 for viewpoint location. View looking northeast towards Pantoney's Crown (middle distance) and the Triassic sandstone of the Hornsby Plateau (background). The entrance to the Capertee Gorge is visible to the right of Pantoney's Crown, blocked by a second mesa, Mt Gundangaroo. The Capertee River flows to the left of Mt Gundangaroo. On the extreme left can be seen the volcanic cone of Tayan Peak which overlooks the Noola site (see Plate IV).

Note particularly the cliffs bordering the plateau, the open forested cover on the talus slopes below these cliffs and on the ground rising towards the continental divide, and the open grazing land in the flatter parts of the headwaters region.


the continental divide, and on
the headwaters region.

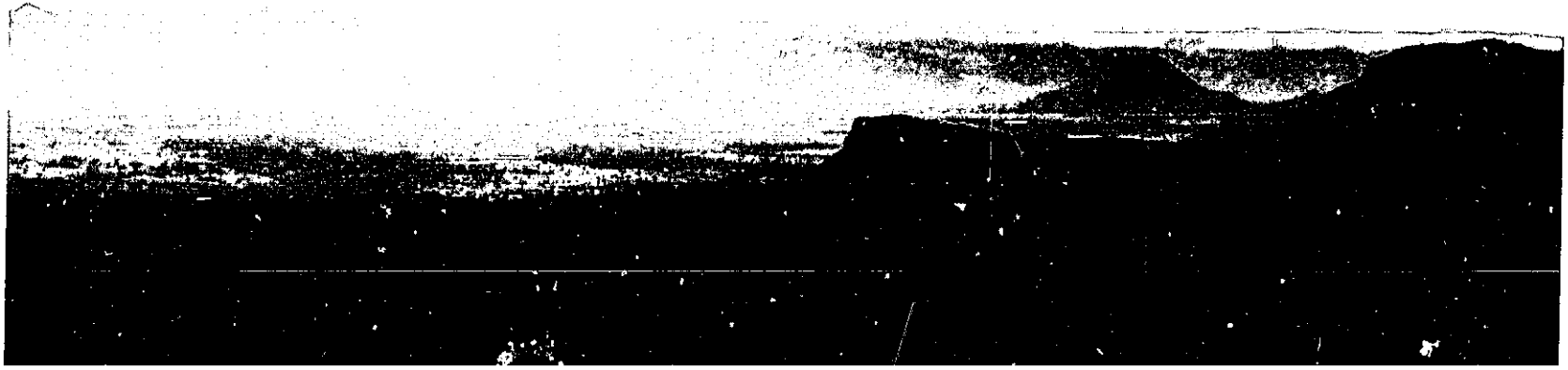


Plate IV Bogee Nile Valley from the West

The location of Noola rockshelter is arrowed. See fig.10 for viewpoint location. Note the conical volcanic neck, Tayan Peak, which also appears on the extreme left of plate III, and the level surface of the Hornsby Plateau in the background. An erosion channel formed by the intermittent creek which passes the Noola site can be seen joining the main creek. The latter is a near-permanent water source.

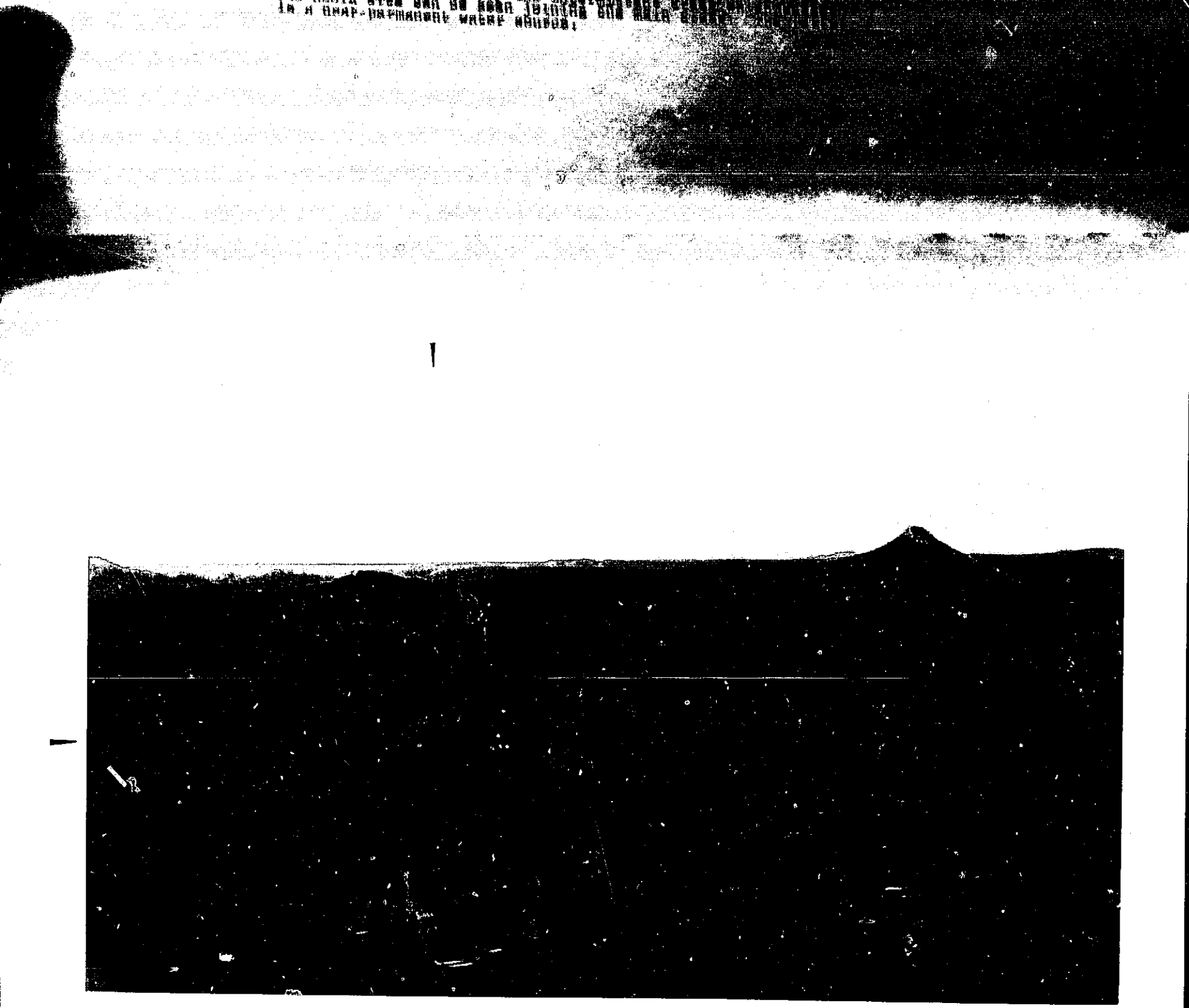
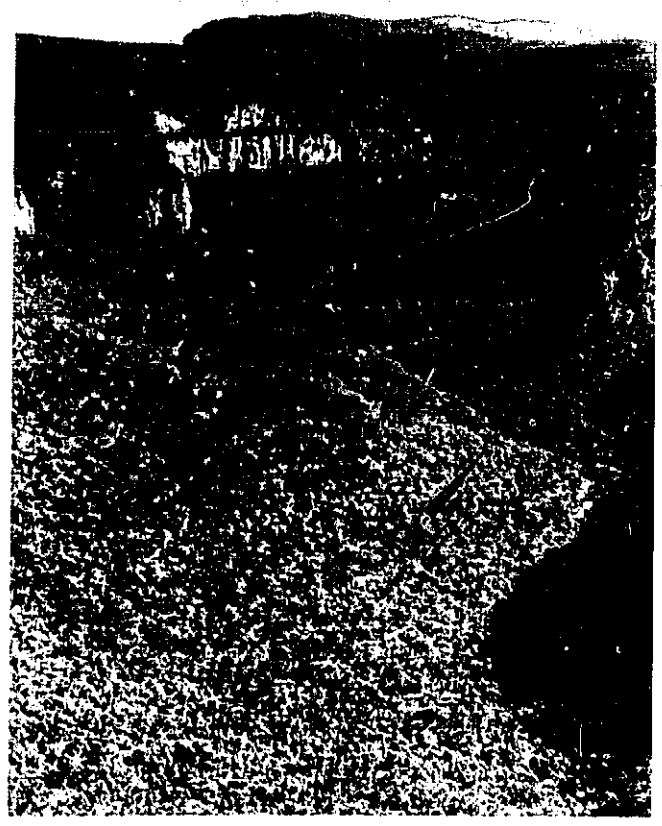


Plate V (upper) View southeast down Capertee Gorge
(lower) View northwest from within Capertee Gorge

See figure 10 for viewpoint locations. The two views are colinear and in opposite directions.

The location of the Capertee sites (1-3) is indicated by the arrows. In the upper photograph the sites are behind the ridge in the middle distance and Glen Davis is hidden by the bluff in the foreground. Note the level dissected surface of the sandstone plateau, the layering of the steep cliffs bordering the plateau and the forested cover on the talus/ pediment slopes below the cliffs. In the lower photograph, Freshwater Creek issues from the lefthandmost break in the cliffs. Note the short, steep slope on the northeast (right hand) side of the gorge, compared with the longer shallower slope on the southwest side.





rockshelter formed by a huge boulder approximately 100m above the valley floor and 30m from an intermittent creek. Despite the apparently favourable location, the artefactual material in the deposits is sparse and I think this can be attributed partly to the lack of nearby stone sources and partly to the southerly aspect of the site which makes it very cold and dark except in midsummer.

Environment in the Capertee Gorge

The upper part of the Capertee Gorge is incised approximately 500m between sheer cliffs up to 200m high formed in the massive Narrabeen Group sandstones. The incision of the gorge commenced with the late Tertiary uplift of the Blue Mountains/Hornsby plateau. It has proceeded by cliff fall induced by faster weathering of the Illawarra Coal Measures (Permian) which underlie the Narrabeen Group and removal of weathering products by the river. The area between the cliffs and the river, up to 1 km wide, is made up of talus and pediment slopes (see discussion of sediment transport, chapter 5), with alluvial flats in some places near the river. Much of the alluvial deposition appears to be associated with post-European erosion and flooding due to increased runoff in the headwaters region. The slopes, notably the pediment sections, are scattered with huge boulders derived from the Narrabeen Group sandstone of the main cliffline, and it is in these boulders that many small overhangs, including McCarthy's Sites 1-4, have been developed.

The present day flora within the Capertee gorge was studied by Len Cubis, (Department of Anthropology, Sydney University) during the 1978 field season. The following section is based on discussion with him and with Ken Aplin (Department of Prehistory and Anthropology, ANU) and I should like to thank them for their identifications and interpretations. I must however be held responsible for any errors or ommissions.

In his 1964 report on the Capertee sites McCarthy describes the Capertee gorge environment as '...open woodland eucalyptus forest, with comparatively dense epiphytic undergrowth. It could be described as an ideal environment for a hunting and gathering people of semi-nomadic habit' (1964:198). He goes on to say that 'Several species of yams, the seeds of kurrajong, Macrozamia, Acacias, Pinus

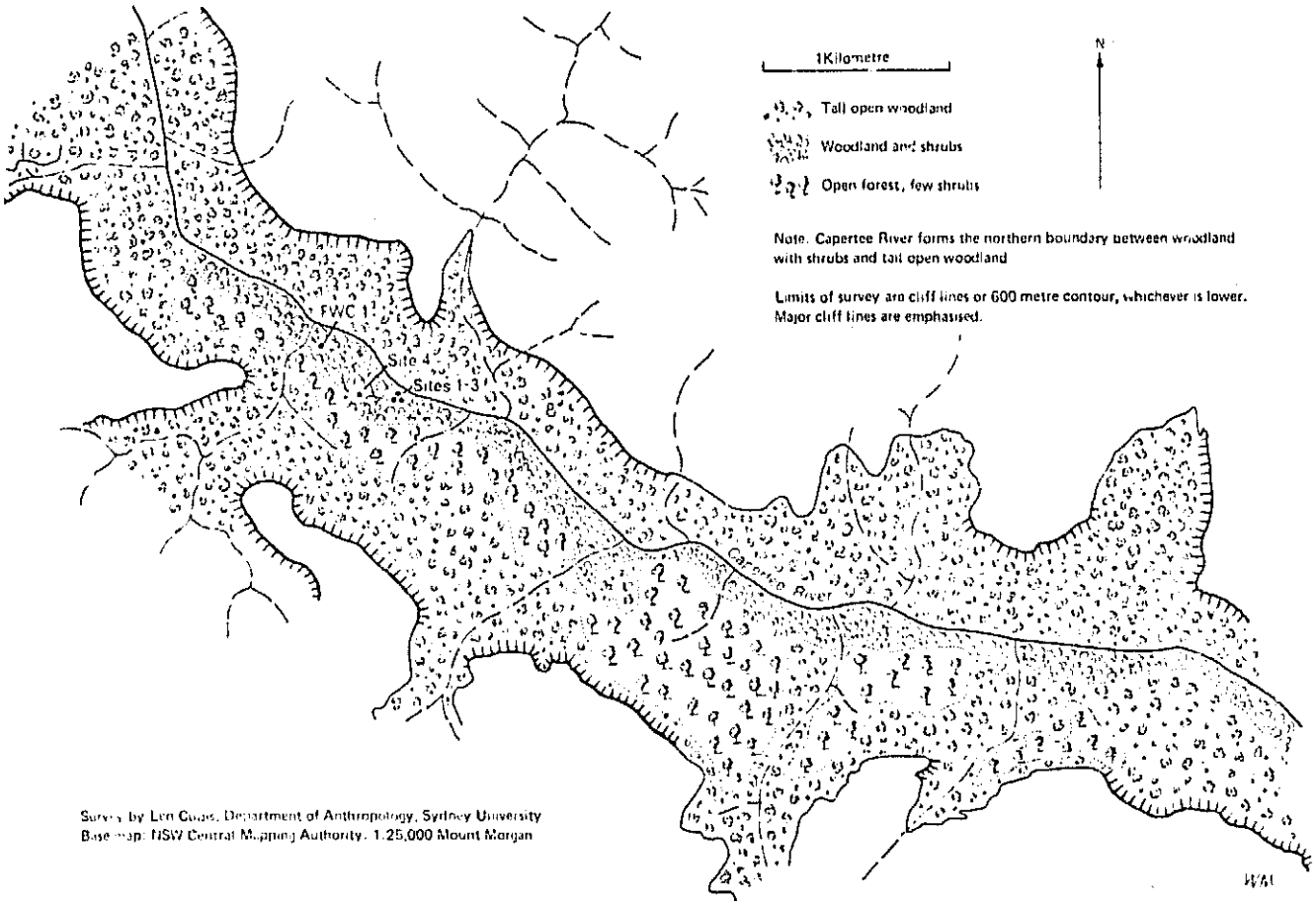



Fig. 11 Map of floral communities in the Capertee Gorge

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and other plants, and various leaves, berries and fruits added the vegetable element to a well balanced diet' (ibid.).

The area studied by Cubis is shown on fig. 11, together with the distribution of plant communities observed. The lower northerly aspect slopes support Angophora and Eucalyptus woodland with shrubby understorey, the dominant species being the rough-barked apple (Angophora floribunda), the Sydney Blue-Gum (E. soligna) and the Narrow-leafed Ironbark (E. crebra) with Casuarina cf. stricta bordering the river. Further away from the river, on the steeper slopes leading up to the scarp, there is tall open woodland with a similar range of species. In this steeper area, gullies are bordered with rich viney scrambler thickets, the dominant species being the Lillypilly (Acmena smithii). These thickets contain several edible plants, including native sasparilla, grape and fig, although these resources are scattered rather than concentrated. The plant communities appear to be largely related to local conditions of, particularly, soil thickness, aspect and drainage. Along the tributary creeks to the main river, there are ferny patches, whilst the flatter terraces support patches of tussock grassland with small stands of cycads under an open forest cover.

The northern side of the gorge is characterised by a much steeper and shorter slope between the river and the base of the scarp (pl. V) and is generally cooler and more humid than the southern side. This has lead to an extension of the lower slope communities with thick scrub along the river and closer spacing of the trees. The upper parts of the slope have thick scrub with extensive viney thickets. The species composition on both sides of the gorge is essentially similar.

The northern side of the gorge shows less signs of fire and there is a considerable amount of organic litter. There is a higher proportion of tall herbs, notably bracken fern (Pteris escalentum), Macrozamia communis and grasses. Due to the southerly aspect of this slope and the generally thicker vegetation this hillside is much damper than its opposing slope and this, together with the steep rock-covered talus nature of this side of the valley, provides a slightly better habitat for plants such as the rock orchid (Dendrobrium speciosum).

Cubis considers that only three species of plant occurring in the Capertee gorge have major potential importance as food plants. These are the rock orchid (Dendrobrium speciosum), clematis (Clematis sp.), and cycad ( Macrozamia communis). The pseudobulbs of the rock orchid and tubers of the clematis can be eaten with little preparation, whilst cycads requires extensive preparation (cf. Beaton 1977). Although bracken fern is common Cubis has noted (1977) that there are no first hand accounts of this potential food resource being utilised by the Aborigines. He considers that the vegetable food resources observed occur as a diffuse scatter and, with the exception of the cycads, would not be easy to exploit effectively. This he suggests is in contrast with the situation in the headwaters region of the Capertee valley, where fire pressure might well have maintained an open mosaic and swampy areas would have provided a concentrated source of vegetable foods.

It is hard to extrapolate back from the present day flora to that which existed before the arrival of Europeans in the area. Mining and grazing have extended well down the gorge and this is apparent, for example, in the depletion of large trees of usable timber type in the areas in which mining has occurred. Cubis noted that none of the cycad plants he observed appear to be old plants and suggests that this might be a function of plants being destroyed to protect cattle. Cycads are now quite abundant in small stands scattered at various levels on the valley sides and also occurs associated with a hearth in Site 3 (McCarthy 1964:199). Even if cycads were more abundant in the past than at present, it seems likely that the headwater area with its deeper soils and swampy areas would have provided a greater abundance of vegetable food than the shallow, rocky and porous soils of the gorge area. Also, if firing was practised on the headwater area one would expect a greater abundance of easily caught game than in the gorge area. With present day patterns of usage, large kangaroos, notably euros (Macropus robustus), are to be seen in the more open area of the headwaters and clearings in the upper part of the gorge, whilst the population of smaller macropods within the gorge appears to be largely depleted by the predation of feral dogs (observations of skeletons and faecal pellets by Ken Aplin). Aplin suggests that regular firing of the lower slopes along the gorge might result in an expansion of the tussock grass component and could provide a habitat suitable for red-necked wallabies, which are a significant component

of McCarthy's faunal collection from the gorge sites.

Reptiles are well represented in the modern fauna, the commonest being the Lace Monitor, Varanus varius, the Water Skink, Sphenomorphus quoyii and the Red-bellied Black Snake, Pseudechis porphyriacus. Reptiles also make up an important component of the faunal collections derived from the disturbed deposits sieved in 1978 (see below).

Fauna

Significant quantities of faunal material were recovered from McCarthy's excavations in Capertee Sites 3 and 4. At Site 3 McCarthy reported a total of 34 identifiable mammal jaws and one lizard jaw (1964:241), whilst no quantitative data was reported for Site 4. McCarthy's collections were reanalysed by Ken Aplin, Department of Prehistory and Anthropology, ANU, who found 94 'identifiables' (jaws and teeth) in the Site 3 collection and 19 in the Site 4 collection (see tables 5a,b). As a control on the bias introduced by the use of a 1/4" sieve (6 mm) during McCarthy's excavation, Aplin sieved the loose fill of McCarthy's Site 4 trench, apparently derived from the material excavated as the trench walls and surrounding areas appeared intact. A much larger collection of 'identifiables' (120 specimens) was recovered. Comparison of the excavated and 'disturbed' collections shows that there has been a strong bias against the recovery of the less common species and of course against the smaller species such as reptiles, rats and smaller marsupials. In the excavated collection 58% of specimens are macropods, compared with 37% from the two collections. Reptiles are represented by only one specimen in the excavated collection compared with 27 overall (5% against 20%). Rats, koala and various small marsupials are entirely absent from the excavated collection whilst forming a significant proportion of the total collection.

Thomas (1969) has reported one set of controlled experiments in which the collection efficiency of various sieve sizes (1/2" (12 mm), 1/4" (6 mm) and 1/8" (3 mm)) is compared with recovery by a 1/16" (1.5 mm) sieve for various sizes of mammal. Collection efficiency of the 1/4" (6 mm) sieve varied from 95% (mammals weighing less than 100gm) through 80% (100-700gm), 70% (700gm-5 kg), 60% (5 kg-25 kg) to no loss for mammals over 25 kg By way of comparison, a 1/8" (3 mm)

Abbreviations:

L = left

R = right

m = mandible

max = maxilla

pmax = premaxilla

I = incisor

$M^{x}_{x}$ = molar

PM = premolar

f = fragment

Table 5a Capertee Site 3 : organic materials from McCarthy's excavation

| Spit | Mollusc (bivalve) | Snail shell | Macrozamia | Melaleuca | Burnt bone | Unburnt bone | 'Identifiables' |
|---|---|---|---|---|---|---|---|
| 0-6" | X | X | X | X | X | X | Kangaroo - ulna, rib frags.<br>Petrogale sp. - Rmf: Lmf; Rm; Raf: Lm.<br>Wallabia bicolor - Lmf; RPmax; $LM_3$.<br>Petaurus australis - Lm.<br>Trichosurus vulpecula - Lmf; Lmf; Lmf.<br>Isoodon obesulus - Lm: Lmax.<br>Pseudocheirus peregrinus - Lm; Lm.<br>Macropus sp. Juv. - Rmf.<br>Macropod - $LI_1$.<br>Emu - radial frag.<br>Schoinobates - Rm. |
| 7-12" | X | X | X | X | X | X | Canis sp. - Canine frag.<br>Macropus rufogriseus - Rm.<br>Petrogale sp. - Lm: Lmax; Rmax; $RI_1$; Rmf.<br>Potorous sp. - Rmf; Lm.<br>Schoinobates volans - Lm.<br>Trichosurus vulpecula - Rmf; Lm; Lmf; RI; Rmf.<br>Vombatus sp. - tooth fragment.<br>Wallabia bicolor - Rmax; $LI_1$; Rmf; Lmf.<br>Macropod - Mf. |
| 13-18" | X | X | - | X | X | X | Isoodon obesulus- Lm; Rm.<br>Petrogale sp. - Rpremax; $RI_1$; $RI_1$; Lmax; Rm.<br>Physignathus sp. - Lm.<br>Trichosurus vulpecula - Lm; Rmax/premax; $LI_1$.<br>Wallabia bicolor - Lm; Rmax; $LI_1$; Rmax; $RI_1$; Rmf.<br>Emu - distal tibiotarsus (cut). |
| 19-24" | - | X | - | X | X | X | Canis sp. - almost complete dentition.<br>Petrogale sp. - Rmf; Rmf; $PM_3$f; Lmf.<br>Physignathus sp. - Lmf.<br>Potorous sp. - Lmf.<br>Schoinobates volans - Lmf.<br>Trichosurus vulpecula - Lm.<br>Wallabia bicolor - Rm: Rmax f.<br>Macropod - I; Lmf.<br>Vombatus sp. - 2sm. |
| 25-36" | X | X | - | - | X | X | Isoodon obesula - Lmf.<br>Petrogale sp. - Rmax f; Rmf.<br>Schoinobates volans - Rmf; Rmf.<br>Trichosurus vulpecula - Lmax f.<br>Macropus rufogriseus - Lmf; Lm..<br>Macropodinae - $RI_1$; $RM^{x}_{x}$; Rmf.<br>Wallabia bicolor - Lmf; L.max; $LI_1$; L.premax f; Lmf; Lmaxf; Lmf; Lmf; Rmf.<br>Vombatus - $LI_1$. |
| 37-48" | X | X | - | - | X | X | Petrogale sp. - Lmf.<br>Wallabia bicolor - L.max f; Rmf.<br>Macropus rufogriseus - Rmf. |
| 49-60" | - | - | - | - | X | X | ------ |

Identifications by Ken Aplin.

Table 5a Distribution of organic material and species list for McCarthy's Capertee site 3 collection

| Dentaries | McCarthy[1] | Disturbed[1] |
|---|---|---|
| *Wallabia bicolor* | 5 (2) | 5 (2) |
| *Petrogale penicillata* | 5 (4) | 2 (1) |
| cf. *Thylogale* sp. | | 3 (2) |
| Macropodidae | 1 (1) | 30 (2) |
| *Potorous tridactylus* | 1 (1) | |
| *Trichosurus vulpecula* | 2 (2) | 8 (2) |
| *Schoinobates volans* | 1 (1) | 1 (1) |
| *Pseudocheirus peregrinus* | 1 (1) | 2 (1) |
| *Acrobates pygmaeus* | | 1 (1) |
| *Phascolarctos cinereus* | | 1 (1) |
| *Vombatus ursinus* | 1 (1) | |
| *Sminthopsis/Antechinus* | | 4 (3) |
| *Isoodon obesulus* | | 8 (2) |
| *Rattus* cf. *lutreolus* | | 9 (4) |
| *Rattus* cf. *fuscipes* | | 3 (2) |
| Pseudominae sp. | | 6 (4) |
| Muridae | | 8 |
| *Morelia spilotes* | | 2 (1) |
| Elapidae | | 2 (1) |
| Scincidae | 1 (1) | 21 (10) |
| *Physignathus lesueurii* | | 1 (1) |
| Chelydidae | 1 (1) | 4 (4) |
| Total | 19 (15) | 120 (47) |
| All bone recovered | 809 gm | (#) 1968 = 311 gm |
| Burnt bone (by weight) | 5% | 9% |
| Unburnt bone (by weight) | 95% | 91% |

[1] Minimum number of individuals in brackets.

All except two of the dentaries from McCarthy's excavation are derived from the 0-18" spit.

Identifications by Ken Aplin.

Table 5b Species list for Capertee site 4, McCarthy's excavation and disturbed material

| Dentaries | Bland/Blunden trench[1] | Disturbed[1] |
|---|---|---|
| *Wallabia bicolor* | | 5 (2) |
| *Petrogale penicillata* | 1 (1) | 3 (2) |
| *Macropus* cf. *rufogriseus* | 1 (1) | |
| Macropodidae | | 10 (1) |
| *Potorous tridactylus* | | 3 (2) |
| *Aepyprymnus rufescens* | | 1 (1) |
| *Trichosurus vulpecula* | 2 (1) | 6 (3) |
| *Pseudocheirus peregrinus* | 2 (1) | 2 (1) |
| *Petaurus australis* | | 4 (1) |
| *Acrobates pygmaeus* | | 1 (1) |
| *Vombatus ursinus* | | 2 (1) |
| *Sminthopsis/Antechinus* | | 1 (1) |
| Muridae | | 14 (5) |
| Elapidae | | 1 (1) |
| Bird | | 1 (1) |
| Rabbit | | 2 (1) |
| Total | 6 (4) | 56 (24) |
| All bone recovered | 119 gm | (#) 1015 = 374 gm |
| Burnt bone (by weight) | | 9% |
| Unburnt bone (by weight) | | 91% |

[1] Minimum number of individuals in brackets.

Identifications by Ken Aplin. This table represents only part of the total disturbed material in the site.

Table 5c Species list for Noola rockshelter : Bland and Blunden's test trench and disturbed material

sieve lost no specimens for mammals over 5 kg and 60% for mammals less than 100gm. The bias against smaller animals is evident from these figures and appears to be of the same order of magnitude as that observed for Capertee 4. The bias against the less well represented species is, of course, a function of sample size (note that the identified specimens are not necessarily proportional in size to the size of the animal).

Although the Capertee 4 fauna may be partly the result of natural causes this is unlikely for most of the material. The site is not suitable as a roost and no bird pellets were found despite the good preservation apparent. There is no evidence of carnivore chewing of the bones. Marsupial mice and rock wallabies might make use of the shelter, but many of the other species are unlikely to have entered it of their own accord. Water skinks in particular must have been brought to the site since the site is on a dry hillside 50-100m above the main river and several hundred metres from the nearest tributary creek.

The fauna appears to indicate a slightly more open forest than today. Aplin considers that the present day forest is too closed for the red-necked wallaby represented by four specimens in Site 3. As noted earlier, he considers that regular firing of the gorge might have resulted in an extension of the tussock grassland and a more suitable habitat for this species. Swamp wallaby form an important component of the archaeological material and Aplin observed skeletons of this species although no live animals were seen. The presence of wombat as a consistent component throughout the history of Site 3 argues for the existence of some open grassed areas in the past, and such a patch still exists about 500m downstream from the sites.

The Noola fauna (table 5c) may well have a larger component of bone arising from deaths in the shelter or predation by animals using it as a lair. The fauna appears to represent a more closed forest environment than that reflected by the gorge sites with small glider forms such as Acrobates pygmaeus. On the other hand there is a significant component of the fauna which reflects a more open habitat. Aepyprymnus rufescens is a species now restricted to tussock grassland under open forest or woodland in northern NSW, and the site also contains wombat and red-necked wallaby. This dichotomy in the fauna can perhaps be explained in terms of a mixture of species from forested slopes surrounding the site and from the probably more open

environment of the valley floor a few hundred metres from the site.

Eastward Access

Eight kilometres southeast (downstream) of Sites 1-4, the Capertee Gorge becomes restricted, with a maximum width of the order of 500m and very steep slopes between the river and the foot of the enclosing cliffs. It is joined by the Wolgan River some 13 km further on, from where it continues as the Colo River for at least 50 km in an equally narrow and, if anything, steeper-sided meandering gorge (fig. 2 and pl. I). The Colo finally joins the Hawkesbury a further 40 km downstream. McCarthy considers the Capertee/Colo river as a route to the coast, but he hedges his bets by adding 'Inter-group contact probably took place along these streams, but to what extent is not known' (McCarthy 1964:203). Though travel up and down the gorge is possible, provided the river is low, it is exceedingly tedious. Present-day bushwalkers count 14 days to reach the Putty Road, a distance of approximately 70 km (Gold and Prineas 1978). Within the narrow gorge area food resources would probably have been even more restricted than in the area of the Capertee sites owing to the much reduced terrace areas and dominance of the steep rocky talus slopes on which few potential food plants occur. Game in the narrower parts of the gorge would probably be restricted by the absence of grazing.

I think we can therefore reject the idea of regular movement or intergroup contact along these gorges to the east, though this does not exclude the possibility of occasional intergroup contact, e.g. for ceremonial purposes or when people were exploiting waterholes along the river bed in drought periods. McCarthy (ibid.:203) mentions a rockshelter with stencils near the junction of the Capertee and Wolgan rivers,although access to this point via the Wolgan would have been easier than via the Capertee.

Westward Access

Eight kilometres west of Sites 1-4 the Capertee Gorge opens out into the area which I have termed the Capertee Headwaters. From here westwards the ground rises some 600m over a distance of 25 km to the watersned with the Turon River, which drains into the Macquarie north of Bathurst. The watershed is marked by a line of cliffs, but these

are much smaller and more broken than those to the east. Access between the Capertee area and further west would therefore have posed no physical problems, although the watershed area (altitude ~ 1000m) would have been cold in winter compared with the more protected area around the mouth of the Capertee gorge (altitude 300m). Despite this apparent ease of contact, there is no sign in the Capertee sites of the distinctive and very high quality raw material which is so characteristic of the assemblages in the Bathurst area. Our knowledge of the Bathurst area is based on the surface collections made by Percy Gresser and, as far as I can remember from a brief look at these collections, none of them (including those from the Turon) contain any of the Capertee type cherts. Without considerable further work, particularly in the Turon, we cannot say whether this indicates lack of communications to the west due, perhaps, to tribal boundaries, or simply the local availability of suitable stone and lack of exchange or transport of raw materials from further afield.

Access to the North and South

There is a broad corridor of easy country linking the Capertee headwaters with the Cudgegong river drainage to the north. Some collecting has been done in this area by Norman Blunden and some site survey by Mike Pearson. I have not seen any collections from this area, but I would expect the raw material available to be indistinguishable from that in the Capertee area as the geology of the two areas is similar.

To the south of the Capertee headwaters there are several passes leading up onto the plateau region and over into the Wolgan Valley. Archaeologist bushwalkers in the area have reported the presence of commodious rockshelters but, even where water is available in the vicinity, surface finds are meagre (one or two flakes). On the other hand a number of these sites contain stencils and drawings. This observation tends to confirm the model of sporadic, possibly ceremonially-linked use of rockshelters in less accessible or elevated positions.

NOOLA ROCKSHELTER

Noola rockshelter is situated in the valley of the Bogee Nile Creek, a tributary of the upper reaches of the Capertee River (fig. 10). The shelter is formed in a huge boulder, at least 20m long, 15m wide and 20m high. The roof of the shelter runs along the bedding plane of the sandstone at an angle of approximately 20* to the horizontal and the surface of the deposits (and underlying stratigraphy) follow a similar trend (see fig. 13). This leads me to suspect that the deposits may have accumulated on a sloping platform formed in the base of the monolith along a bedding plane. However, although Tindale's trench (Tindale 1961) reached a depth of 3.5 metres below the surface of the deposits, bedrock is not reported as having been reached.

A huge sandstone block runs along the front of the shelter 20-30 cm below the surface of the deposits. This block is visible in both major trenches and has been traced between and beyond these trenches (see plan, fig. 12). The block slopes steeply down from near the dripline towards the inside of the shelter (see sections, figs. 14 and 17) and the excavated deposits have accumulated between this block and the rear wall of the shelter. The visible stratigraphy shows clearly the effect of the sloping surface of the block on the accumulation of the deposits (fig. 17). The block may well be the result of roof fall as one can trace the base of the block, overlying deposits, in the outer end of both trenches. In addition a number of moderate sized blocks are scattered along the dripline on the surface and a 'sealing slab' measuring approximately 1 metre square was removed from Tindale's trench at a depth of 45-50 cm below the surface (Tindale 1961:193).

Few sites can have witnessed as varied a set of excavations as Noola rockshelter. As far as I have been able to piece together the history of the site, the following excavations have occurred:

1. Towards the end of 1960 parts of the surface material were dug out by the then owner, Norman Blunden. His finds were shown to Fred McCarthy and later to Norman Tindale. Blunden (in Tindale 1962:541) mentions finding around 2000 lithic artefacts in a trench which I estimate as being between 1 and 2 cubic metres in volume. This excavation appears to have been in the area later

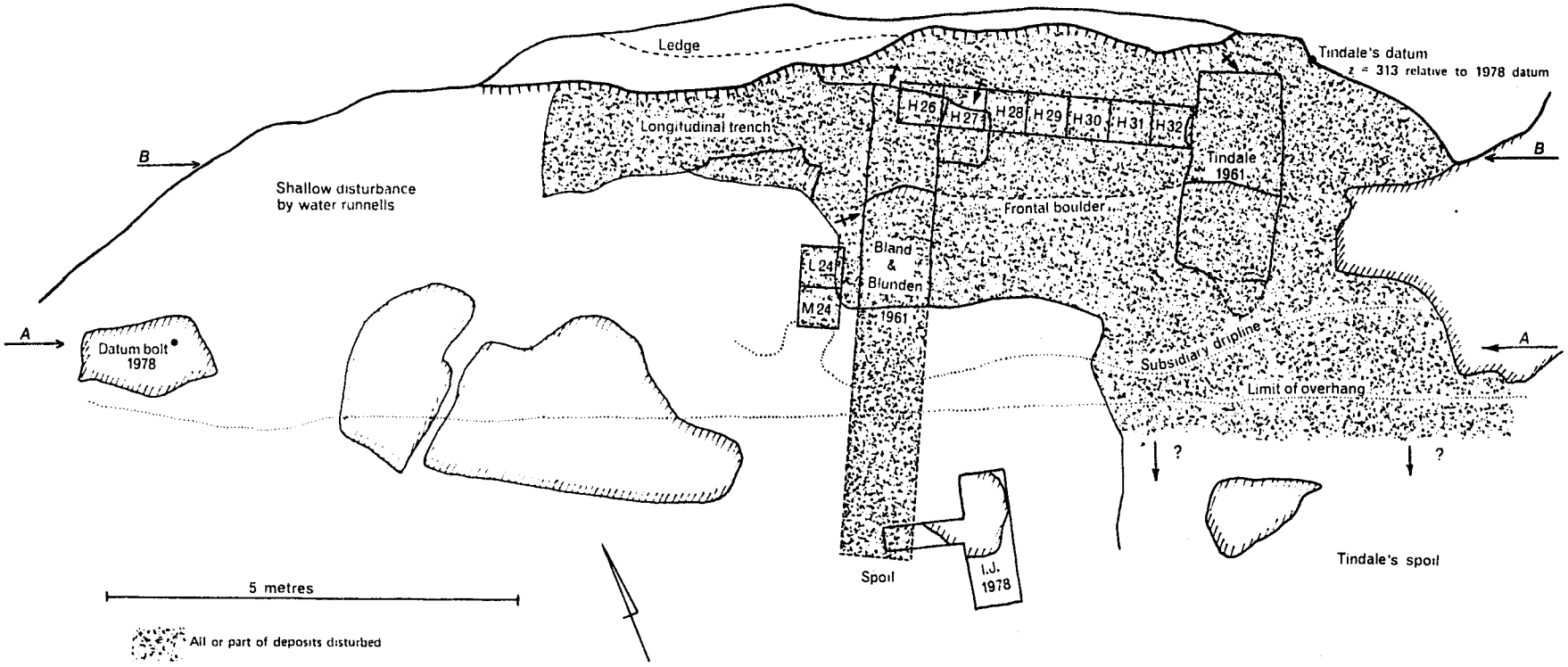



Fig. 12 Noola rockshelter : plan

excavated by Tindale, as it encountered the 'sealing' slab described by Tindale (1961:193).

2. In April 1961, John Bland and Norman Blunden excavated a trench 3'x18' (0 9x5.4m) and between 1' and 6' (30-180 cm) deep at the instigation of McCarthy. The results of this trench were published in McCarthy's Capertee report (1964:231-3). Thirty four tools were recovered from this trench, together with a considerable amount of faunal material, for a total volume excavated of 2-3 cubic metres.

3. In May 1961, Norman Tindale excavated a trench 8'x4' (2.4x1.2m), initially about 96" (2.4m) deep, but later extended to 122" (3.05m). Norman Blunden may, or may not, have further deepened this trench.

4. Norman Blunden dug out the surface material from the area between Tindale's trench and the east end of the rockshelter. He may also have been responsible for the 'longitudinal trench' marked on fig. 12.

5. In 1978 I cleaned up the site as far as possible and excavated a 50 cm wide band (H28-H32) connecting the Bland/Blunden trench and Tindale's trench, and a 1mx0.5m area (L24, M24) alongside the Bland/Blunden trench near the dripline. The location of these excavated areas is shown on fig. 12.

My excavations were a small scale investigation intended to answer three specific questions. Firstly, did the site still retain any potential for dating the appearance of backed implements? Secondly, what sort of artefact concentrations existed in the site? Thirdly, what information on the stratigraphy and dating could be collected which might help in the interpretation of the rather sketchy reports available?

The first of these questions was found to have an easy answer; most of the surface of the deposits has been removed to a depth of approximately 40-50 cm, corresponding roughly with the reported depth of the layers containing backed implements (this correspondence is probably not fortuitous). The only in situ deposits relating to the appearance of backed implements are situated on top of the huge boulder which runs along the front of the shelter. These deposits dip

Plate VI Noola rockshelter



Tindale's trench can be seen in the foreground behind the rock in the bottom right corner. The H26-H32 trench is visible running from Tindale's trench along the rear of the shelter to the Bland/Blunden trench (largely hidden). Beyond the Bland/Blunden trench can be seen the L24/M24 excavation (beneath ranging poles) and the irregular 'longnitudinal trench' at the rear of the shelter. The original surface of the deposits can be traced along the rear wall of the shelter.

Deposits along the dripline are very shallow, the whole area being underlain by a huge boulder. Most of the deposits outside the dripline are spoil heaps from previous excavations.

sharply into the space between the boulder and the back of the shelter (see stratigraphic section in fig. 17) and the probable thickness of deposits accumulated in this area since the appearance of backed implements appears to be only 20-30 cm. In addition artefact concentrations are exceedingly low and the area may have suffered disturbance from dripline activity and water percolating from the top end of the shelter. In all, the shelter therefore has little potential left as far as information on the last few thousand years is concerned.

My excavations confirmed the very low artefact concentrations in the site, both near the surface in L24 and M24 and stratigraphically deeper in the H28-H32 trench. For example, only nine pieces of flaked stone were recovered from the 0.5cu.m. of deposits excavated in H32. Unfortunately, since the surface has been stripped from within the main body of the shelter, it is impossible to say whether this may have contained higher artefact concentrations, but Ron Lampert (pers.comm.) remembers numerous backed implements coming from the upper deposits when he visited the site in the late 60's. However the character of the assemblage collected from the disturbed deposits is markedly different from that of the Capertee 3 assemblage, with a high proportion of retouched and utilised material and little in the way of waste products. This would appear to indicate that little stone knapping was carried out in the site and that people were rather bringing in and discarding worn out tools or utilised flakes. Visible use-rounding of flake scars on worked edges is present on a number of specimens.

The scarcity of lithic material at Noola contrasts with an abundance of faunal material. The H32 excavation yielded approximately twice as many identifiable bones (jaws, articular ends) as pieces of flaked stone. A similar pattern was found in the excavation of L24 and M24 and in the loose spoil which we sieved and sorted*. From these observations I would estimate that the whole site would contain several hundred mandibles and maxillaries and an even larger sample of identifiable specimens. Identification of the faunal material has not yet been completed but a provisional list of identifications is provided in table 5. This list gives data for the excavated material

(1) The spoil which we identified as coming from Tindale's trench appeared to have been well sorted, whilst other spoil appeared practically unsorted.

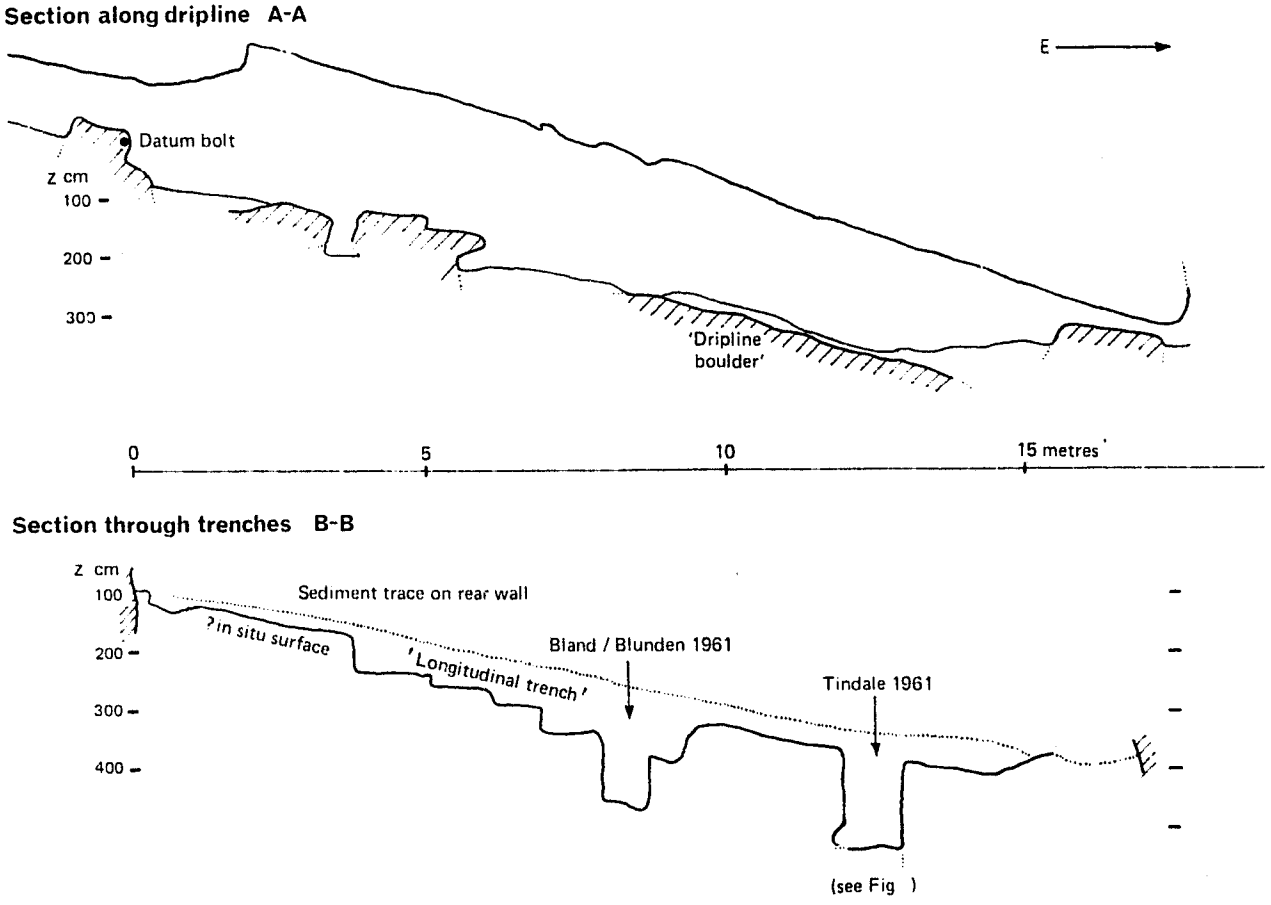



Fig. 13 Noola rockshelter : frontal sections

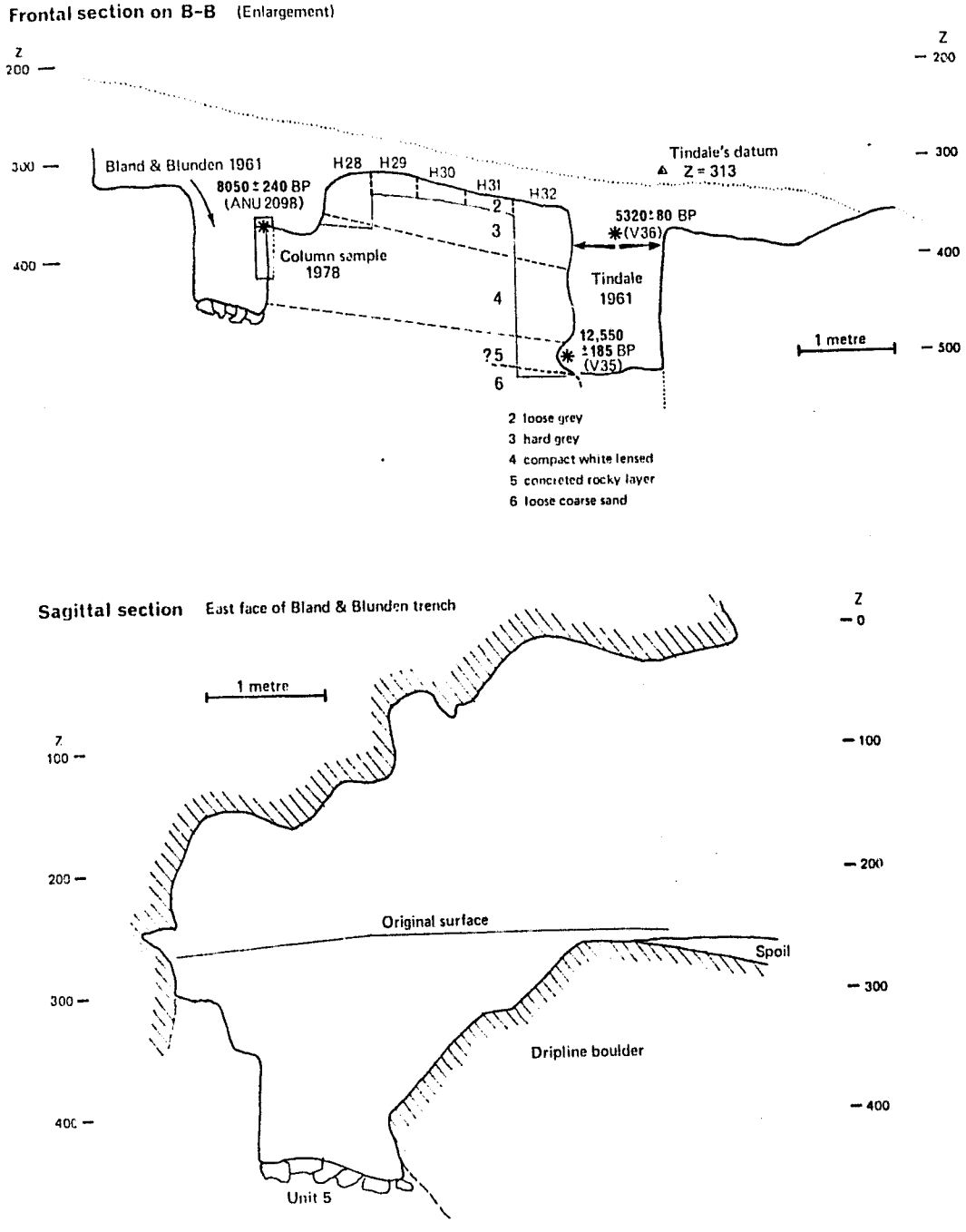



Fig. 14 Noola rockshelter : sections through excavated trenches

from the Bland/Blunden trench (now in the Australian Museum), together with data for the loose disturbed material removed from this trench during cleaning up of the site. The species present appear to represent a forest fauna, rather than the more open woodland fauna of the Capertee Gorge sites (see above). Len Cubis is studying the distribution of charcoal and other vegetable material from my excavation and this project is also, as yet, incomplete.

The major part of my excavation effort was directed towards obtaining information on the stratigraphy of the site and particularly on the relationsnip between the stratigraphy visible in the two major trenches. The stratigraphy of the Bland/Blunden trench is as follows, from the bottom upwards;

Unit 5: Cemented rocky floor.
Unit 4: Hard white coarse sandy deposits with clearly marked lenses of reddened sand underlying dark grey or yellowish brown ashy lenses with charcoal fragments. These lenses appear to represent simple unprepared hearths.
Unit 3: A sharp transition to a uniform very hard grey (10YR6/1) deposit with scattered charcoal and no visible structure.
Unit 2: An equally sharp transition to a loose uniform grey dusty deposit, largely removed by previous workers. In addition, photographs taken during the original excavations (see pl. VI) show a very dark layer which is described as greasy and rich in charcoal (Bland, field notes and pers. comm.). I shall call this layer, now removed from most of the shelter, Unit 1. This was in turn overlain by loose grey surface material which I shall designate as unit 0.

The lower part of the Bland/Blunden trench (unit 4), from the rocky floor up to the transition to homogeneous grey deposits (unit 3), is characterised by a series of grey ashy lenses, separated from one another by 'clean' sand, apparently roof weathering products. Some of these grey lenses rest on a reddened zone developed in the 'clean' deposits. These lenses are shown in fig. 15 and plate VI. I believe that they represent sporadic hearths which have not been destroyed by scuffage, owing to the infrequency of occupation of the site and the fact that the hearths were simple fires lit on the existing surface

Grey sand rich in charcoal fragments

Hard, light grey with scattered charcoal

Light yellow compacted sand

Yellow to grey sand with some charcoal fragments

Reddened compacted sand

Sandstone fragment

Charcoal fragment

Root

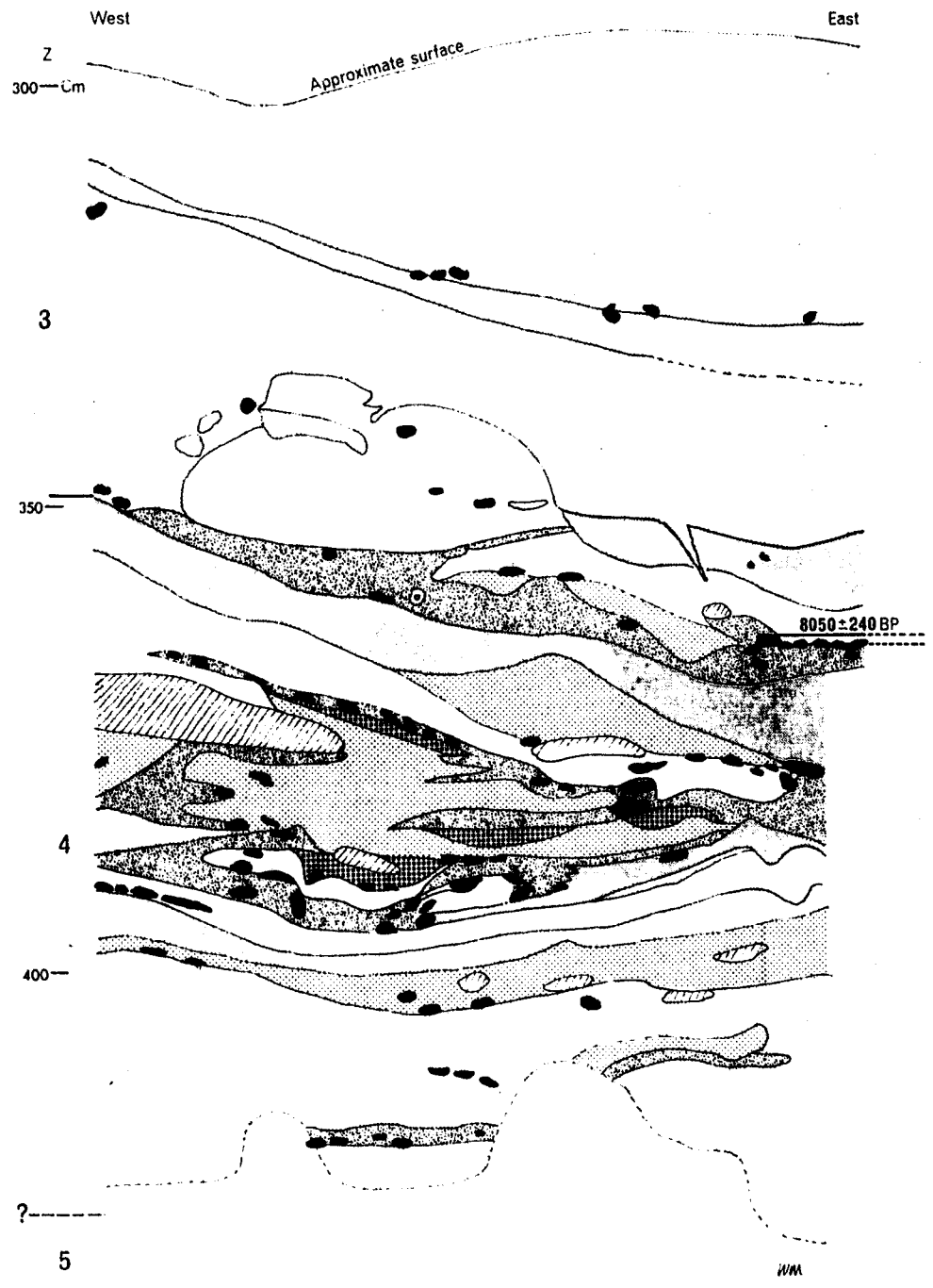



Fig. 15 Noola rockshelter : north section of Bland/Blunden trench
Field drawing S.Wild, April 1978

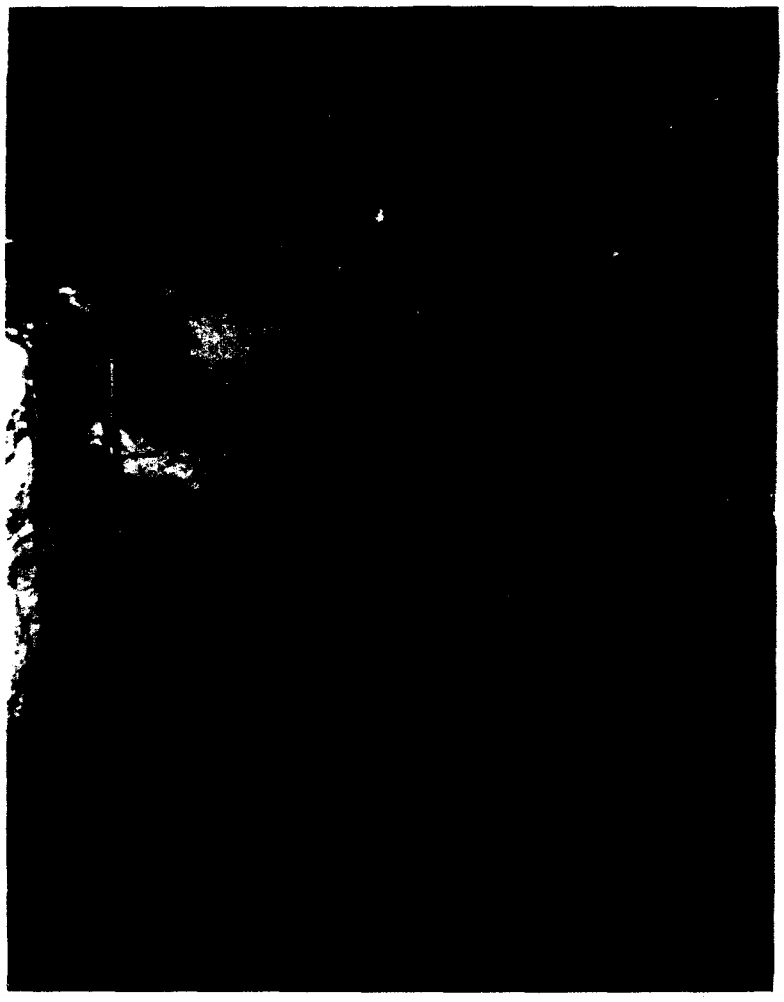
Plate VII Noola rockshelter - section at end of Bland and Blunden's 1961 trench

This section is situated at the back of the shelter. The 1961 photograph was taken before the trench was completed and the section is therefore further from the rear wall of the shelter than the 1978 section. Note the thick grey band (unit 2/3) overlying the lensed deposits (unit 4) and the thick light coloured band at the top of the latter. The base of this band is dated to approximately 8000BP. In the 1961 photograph unit 2/3 is overlain by a dark layer rich in organic material which has now been stripped from most of the surface of the site, presumably because of its high implement yield.

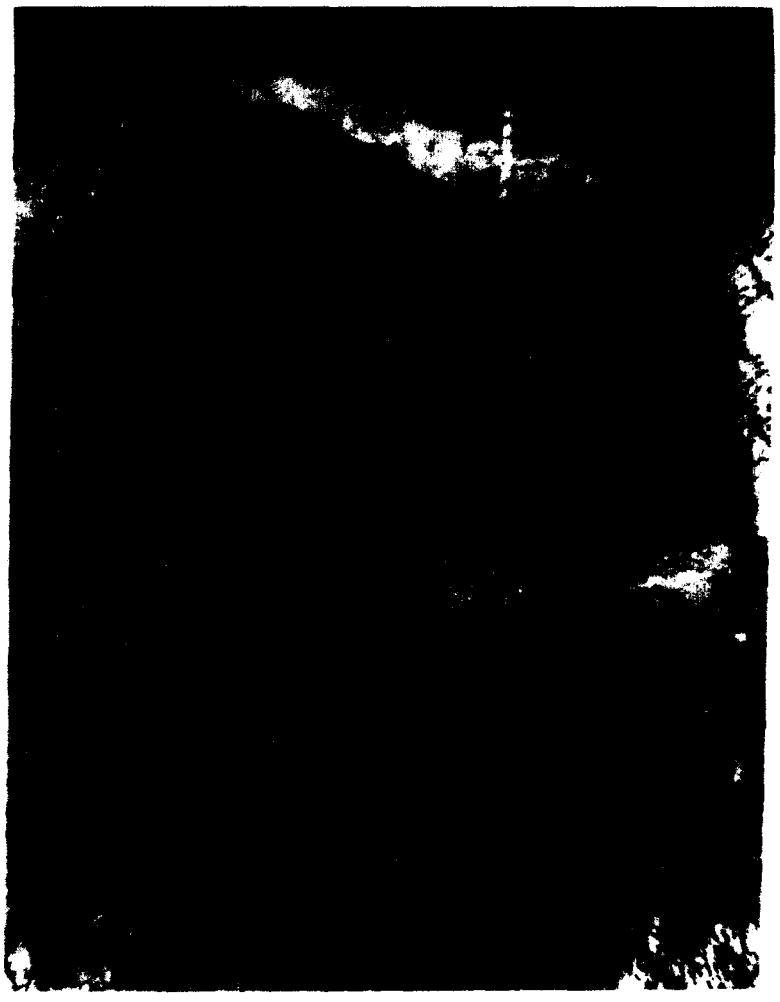
Scale : 1 metre in 20cm intervals

Photograph courtesy John Bland. Tape graduated in inches.

1978



1961



rather than prepared hearths. This assertion is supported by the fact that the bases of the lenses are flat rather than hollowed out and follow the general slope of the deposits. The thinness and limited area of the lenses also points to short-term, unprepared hearths.

The most interesting point about these hearths is that they do not extend into Tindale's trench, a matter of three metres away and offering a wider space between the boulder at the front and the rear wall of the shelter. One possible explanation is suggested by fig. 13, in which the shelter can be seen as a form of sloping chimney. Any fire lit near the bottom (east) end of the shelter would tend to fill the shelter with smoke, whilst a fire lit towards the middle would leave the lower and more spacious end of the shelter relatively smoke-free. In Tindale's trench the levels corresponding with the hearth lenses are characterised by a complicated set of interlocking darker and lighter lenses, some quite hard, some of exceedingly friable coarse sand. I would suggest that this material represents a considerable degree of post-depositional disturbance, perhaps associated with site maintenance activities occurring in the part of the shelter actually occupied. Whilst the explanation I am proposing may seem to step beyond the bounds of what we can generally extract from rockshelter sites, I do not believe it is unduly fanciful in view of the undoubted and positive patterning observed. Furthermore it is not unusual to find hearths reused or established repeatedly in a particular part of a rockshelter, even when the rockshelter does not have such a marked 'chimney' potential or floor-space restriction as at Noola (e.g. McCarthy 1948:4, 1964:199).

I obtained a date of 8050 ± 240BP (ANU2098) from a clearly marked charcoal lens approximately 1 cm thick, which overlies a lens of reddened sand approximately 10 cm below the top of unit 4 in the Bland/Blunden trench (see figs. 14 and 15 for sample location). This date confirms my impression that the clearly marked transition in the Bland/Blunden trench corresponds with a more complex feature at a lower absolute level in Tindale's trench (fig. 16) lying a little below Tindale's date of 5320 ± 80BP (V36). The location of my samples and Tindale's samples, together with my approximate stratigraphic correlations, are shown on fig. 14 and tabulated in table 6.

'Clean' (7.5-10YR7/1)

Even coloured grey (10YR6/1)

Do. with whitish inclusions

Do. with whitish and brown inclusions

Granular loose grey (10YR6/1)

Grey mottled with brown

Reddened zone (7.5YR5/4)

Weakly cemented stony sand

Unless otherwise indicated, all sediments are firm compact sands

| | |
|---|---|
| H | Hard |
| HH | Very hard |
| F | Friable |

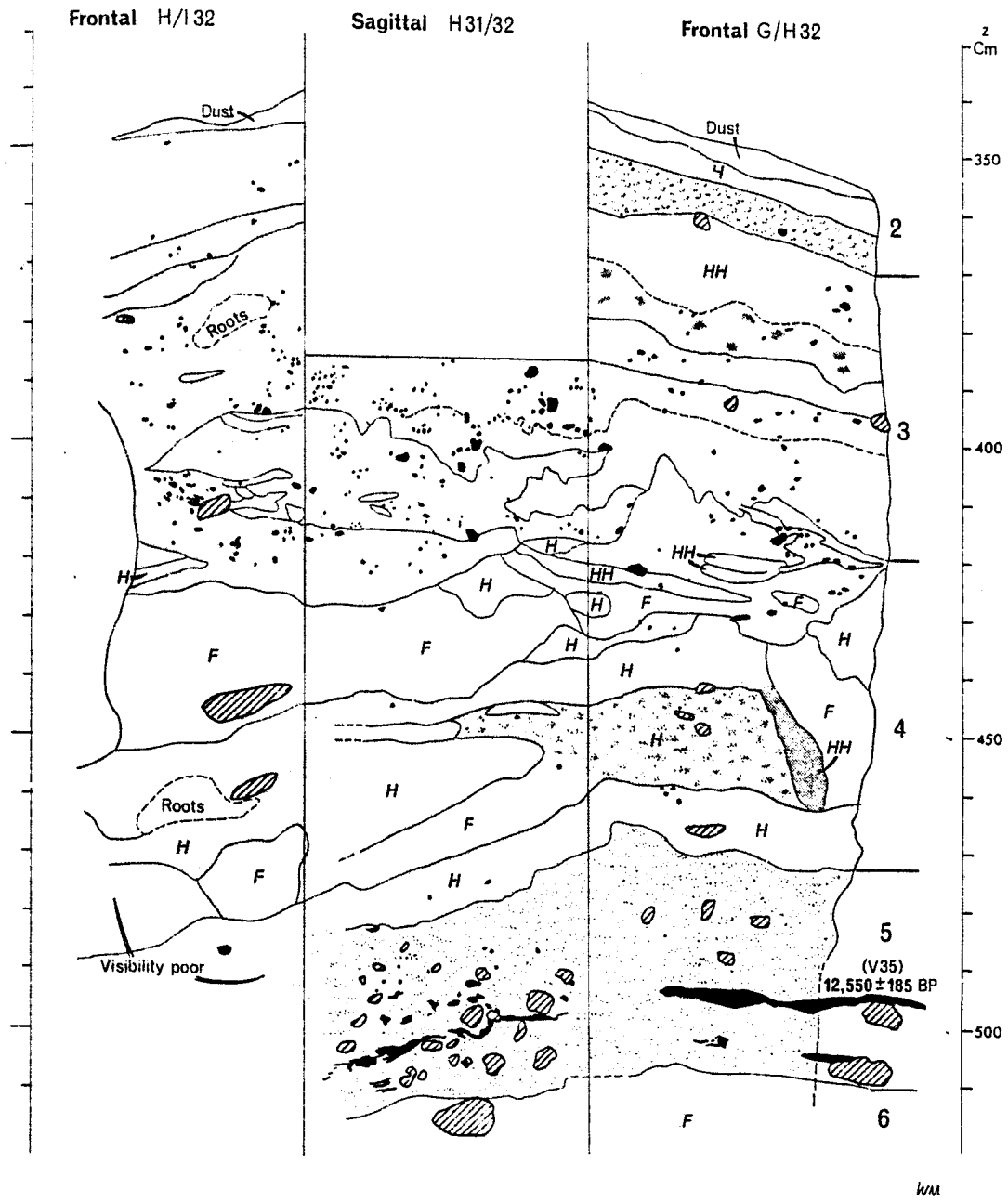



Fig. 16 Noola rockshelter : stratigraphic section, square H32

Overlying the lensed material (unit 4) in both trenches is a hard, homogeneous grey level approximately 40 cm thick (unit 3). Though subdivisions of this level can be distinguished locally (see fig. 16) they are too faint to be followed over any distance. The transition from the white and lensed material (unit 4) to the grey level (unit 3) is exceedingly abrupt and the latter can be removed to expose the surface of the underlying level. This surface is found to slope very steeply towards the back of the shelter, particularly in H27, and to be quite even with a few minor 'channels' running along the length of the shelter. However the form of the 'channels' and the steep slope across their alignment suggests that these are not erosion channels or the like, but were formed by slumping of the deposits (the 'channels' coincide with changes of slope of the deposits). I think this surface may represent compaction of the deposits creating a space between the deposits and the shelter wall which has subsequently filled with the overlying grey sediments.

I am unable to advance any firm interpretation of the change from clean roof fall and ashy lenses (unit 4) to homogeneous grey deposits (unit 3). It would be easy, but I believe facile, to say that this change represents a marked increase in occupation intensity of the shelter, with a consequent homogenisation of the deposits through scuffage. If this were indeed the case, one might expect a diffuse boundary and a marked increase in sedimentation rate and/or artefact concentrations, yet this does not appear to be the case. One possible explanation might lie in a change from roof weathering products to humanly-induced sedimentation, owing to the weathering of the roof being impeded by a band of hard ferruginous sandstone. At the present time, this band forms over 70% of the roof area, being broken only by one area of very active cavernous weathering (sectioned in fig. 14 and showing up as an irregularity in the otherwise plane roof in fig. 13). If this is the case, the surface I have interpreted as a compaction surface could represent the near cessation of roof weathering, followed some time later by increased human occupancy and the accumulation of the compact grey level. The time gap between the surface of the lower deposits, where accumulation ended a little after 8000BP, and the accumulation of the hard grey deposits ending towards 5000BP, is unknown, but a hiatus in sedimentation might help to account for the sharp change in sediment colour by allowing decay of comminuted organic matter in the lower deposits before accumulation of

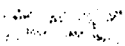


Dark grey (10YR3/1) compact sand
(absorbs water spray readily)

Lighter grey (10YR4/1) slightly loose sand
(water spray not absorbed)



Light grey (10YR6/1) compact sand



Mottled light grey (10YR4.5/1) compact sand



Charcoal



Sandstone fragments

Fig. 17 Noola rockshelter : stratigraphic section, L24 & M24

Frontal K L24

Sagittal L23/24

Sagittal M23/24

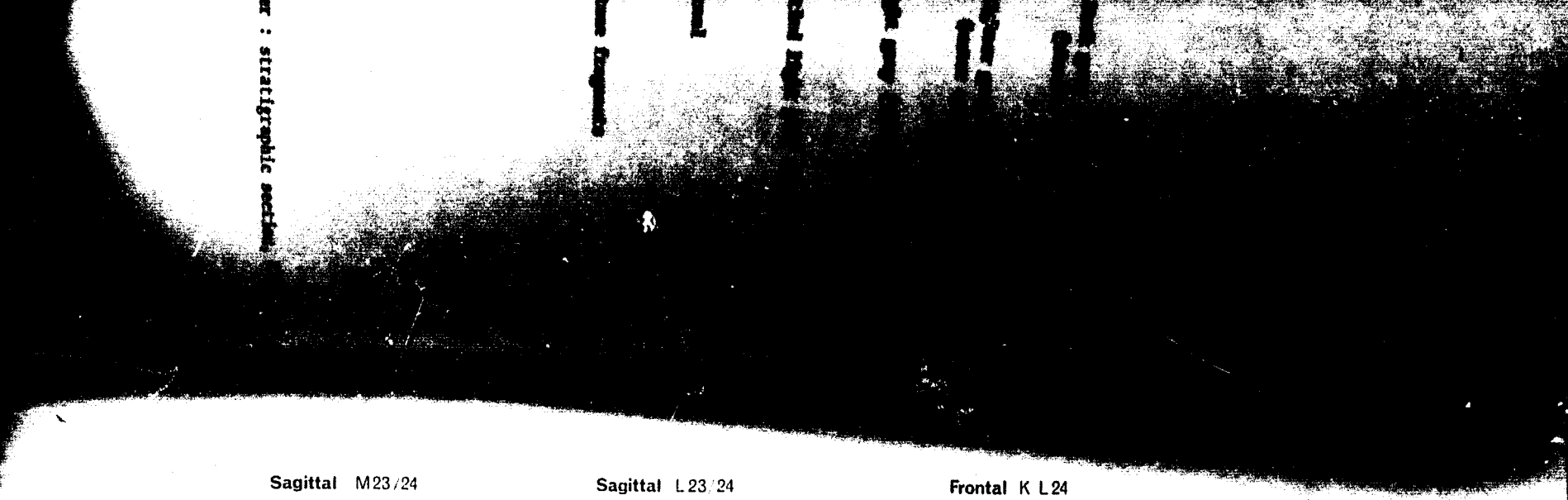
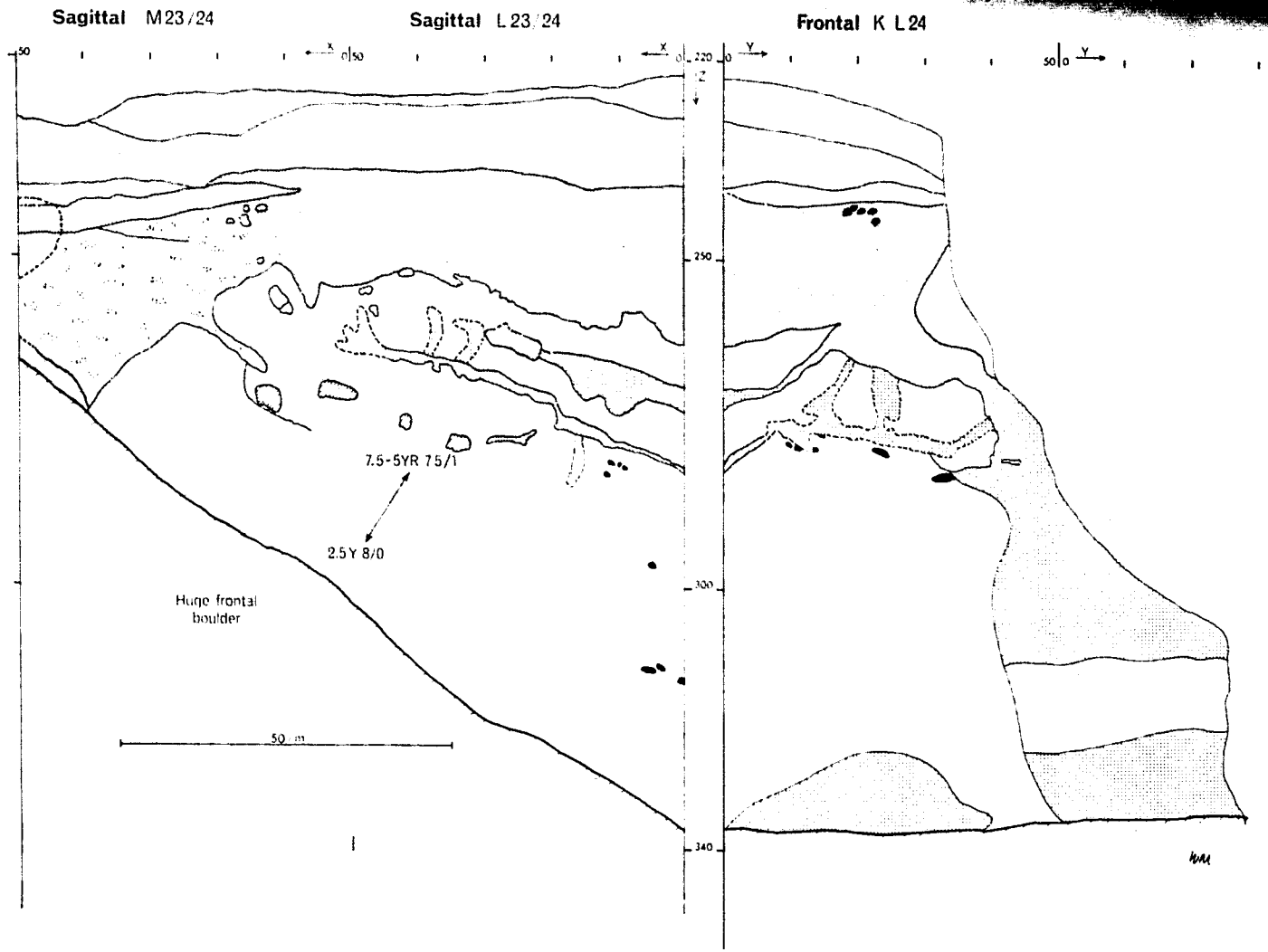


Fig. 3 : stratigraphic section



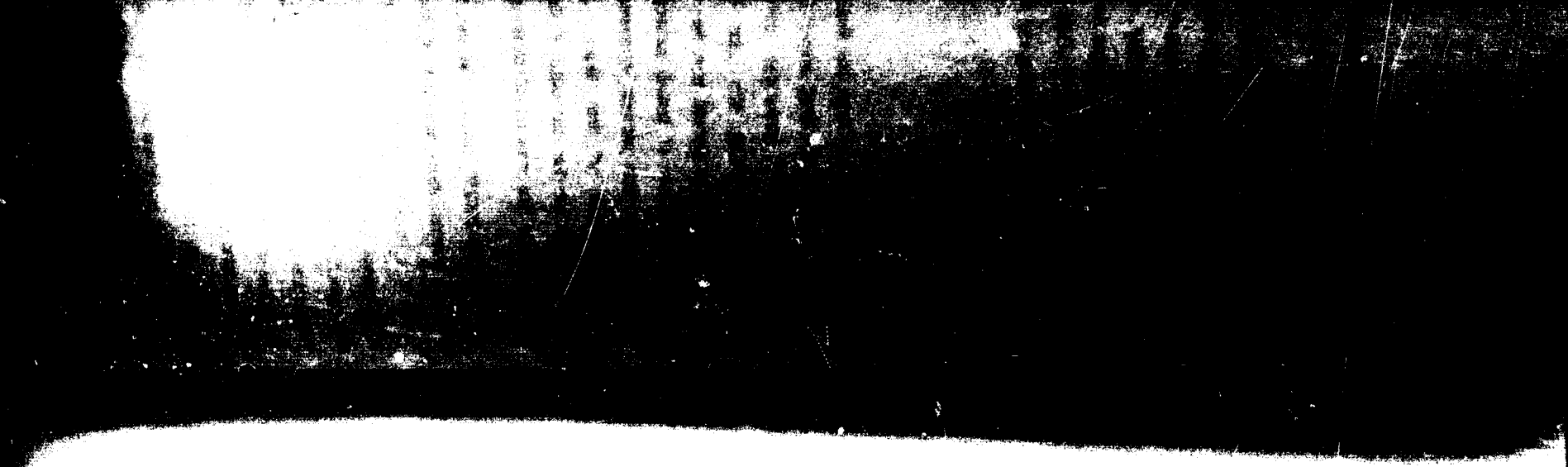
the overlying levels.

My best estimates of relative stratigraphic depths of the three upper C14 samples, indicate a reduction in sedimentation rate from 19 cm/KYr (12,550BP-8050BP-5320BP) to 10 cm/KYr (5320BP-present) within Tindale's trench. This conclusion cannot be reversed by reasonable juggling of the depths, though the change in sedimentation rate may not be quite as marked as indicated. I believe this reduction in sedimentation rate can be accounted for, not so much by changes in sediment supply rates, but by changes in area of the deposits; the deposits have accumulated in the restricted space between the rear wall of the shelter and the inward sloping surface of the huge boulder which runs, buried, along the dripline.

## Conclusion

Summarising the evidence from the Noola site, occupation appears to have been very sporadic from around 12,000BP to the present, but particularly before 8000BP. There may have been a period of more intense occupation spanning the last few thousand years, but the deposits relating to this period have been largely removed. The site contains a rich suite of faunal material contrasting with the poor stone assemblage and this perhaps represents natural rather than human introduction of much of the fauna. It may prove hard, without contextual information for the bulk of the faunal material, to decide what proportion is the product of human activities.

From 12,000-8000BP (unit 4) we can distinguish individual simple unprepared hearths whose position within the shelter can be explained in terms of a 'chimney' effect. Some time after 8000BP there is a marked change in sediment character to hard, compact, uniform grey sandy deposits (unit 3), with possible evidence for a halt in sediment accumulation and compaction of the underlying deposits of unit 4. Such a cessation of sedimentation could arise from the presence of a resistant band of ironstone protecting the softer sandstone above from weathering. At the present day 70% of the roof of the shelter is formed by such an ironstone band, broken only in one place, at which rapid weathering is occurring. Unit 3 does not appear to be markedly richer in artefactual material than unit 4, so the difference in colour may simply reflect decay of comminuted charcoal in the lower



| Date | Lab.no. | Depth (z) below 1978 datum[1] (cm) | Depth below Tindale's datum (in) | Relative stratigraphic depth in Tindale's trench (cm)[2] | Collector's description of sample | Sediment accumulation rate (cm/Kyr) |
|---|---|---|---|---|---|---|
| 5320 ± 90 BP | V 36 | 376 | 25 | $63 \pm {}^{0}_{20}$ | 'Single hearth, sealed below rock slab' (Tindale) | 10 |
| 8050 ± 240 BP | ANU 2098 | 364-365 | - | 105 | Clearly marked charcoal lens overlying reddened sediment, no sign of digging in of hearth (Johnson), 10 cm below unit2/unit 3 transition | 15 |
| 12,550 ± 185 BP | V 35 | 496-501 | 74 | 190 | 'Top layer of a hearth' (Tindale) | 11 |
| 11,600 ± 400 BP | GaK 334 | 620 | 121 | $305 \pm {}^{0}_{20}$ | 'Finely dispersed charcoal' (Tindale) | |

[1] Tindale's datum is at z = 313 relative to 1978 datum.

[2] We cannot give precise relative depths as we do not know where in Tindale's trench his samples came from, with the exception of V35. These depths have been calculated relative to the west face of Tindale's trench and Tindale's datum. The ± limits reflect the known slope of the deposits.

Table 6 Noola rockshelter : provenance of C14 samples

unit.

I have divided the uniform grey level into unit 3 and unit 2 on the basis of texture, but this division may well be specious and based on loosening of the surface exposed by previous excavation. Overlying the grey level in the 1961 excavations there was a band of dark, greasy deposits which is clearly visible on the 1961 photograph (plate V) but has now been removed throughout the area at the rear of the shelter. This band probably contained most of the lithic material recovered from previous excavations and I believe that it is for this reason that it has been stripped away so systematically.

Tindale's date of 5320 ± 80BP (V36) comes from the middle of the uniform grey band (unit 3/unit 2). My observations in square H32 indicate that lithic material is exceedingly sparse in this unit, and I doubt whether one would be able to attach a cultural label with any degree of certainty to the sort of assemblage Tindale might have recovered from his fairly small (8'x4') trench. Pending publication of Tindale's 1961 excavation it remains a distinct possibility that Tindale attached the material from unit 2/unit 3 to that found in unit 1 and called this series microlithic. His 12" sterile layer separating the microlithic and pre-microlithic phases is almost certainly the 6" light coloured band immediately underlying the grey unit in the Bland/Blunden trench and seen as a thicker and more complex feature in the H32 section diagram (pl. VI, figs. 15 and 16). It is obviously tempting to see this 'clean', and I presume sterile, band as separating the two major industrial phases in the site and thus to attribute the grey deposits of unit 2/3 to the upper industry, but it is my contention that this feature lies <u>within</u> the older industry, and probably dates from about 8-7000BP (on the basis of ANU2093 and extrapolated sedimentation for the deposits of unit 2/3).

Where does this leave the 5320BP date for backed implements? We have the problem that the 1964 preliminary report is rather vague about the association between the date and the 'microliths', and the added problem that Tindale's definition of a microlith does not coincide with general practice (cf. Mulvaney 1960:76, Stockton 1977a:51) viz. the use of the term microlith as a synonym for the smaller classes of backed implements. In addition I have shown that there might have been difficulty in attributing the levels containing the 5320BP date to either a pre-microlithic or microlithic industry,

and that the sterile layer supposedly separating these two industries probably dates to around 7-8000BP. On balance, therefore, I believe that Tindale's date has not been satisfactorily shown to be associated with backed implements.

# CHAPTER 5

## Capertee Site 3

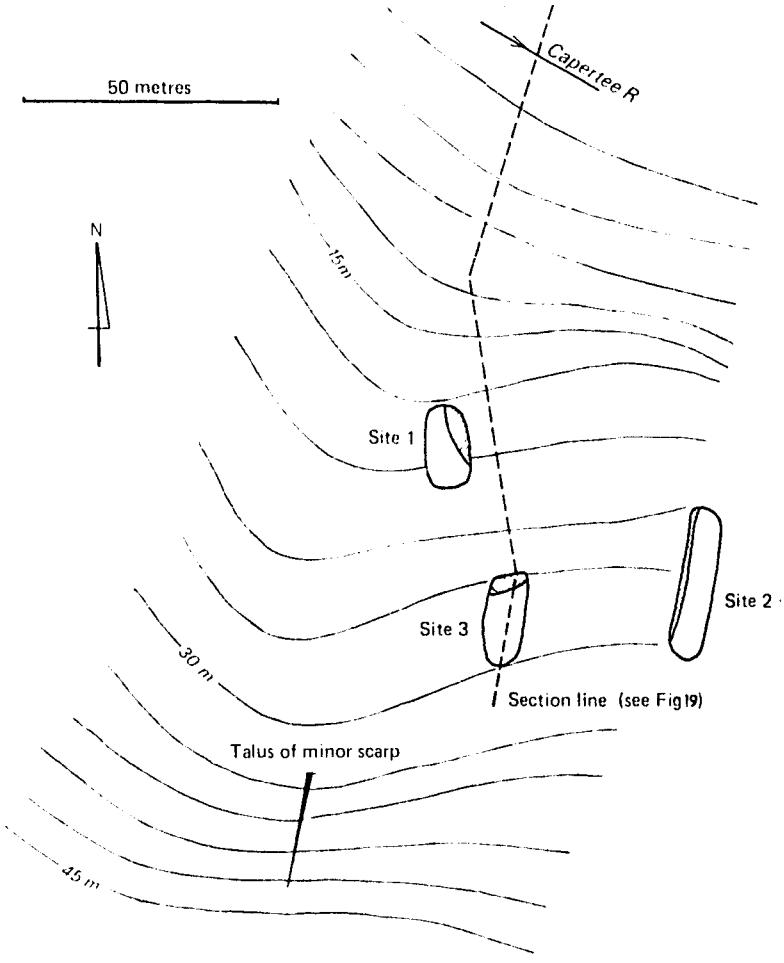
## Results of 1978 excavation and reassessment of published information

## Introduction

McCarthy's Sites 1 and 3, both of which showed a two phase sequence of Capertian and Bondaian, are separated by only about 25 metres. They are small rockshelters developed in the sides of massive sandstone boulders (see figs. 18-20) by a combination of the inclination of the face of the boulder and cavernous weathering of the inclined face. The shelters are situated approximately 25 metres above the Capertee river on a sloping pediment zone (see plan in fig. 18 and section in figure 19). Site 3 faces directly down the slope of the hillside with northerly aspect and presented a large sheltered area with level floor prior to excavation. Site 1, on the other hand, is in the side of a boulder and the deposits slope steeply, merging with the deposits on the hillside. The sheltered area in Site 1 is considerably smaller than that at Site 3 and has an easterly aspect. Given this combination of circumstances it is not surprising that McCarthy found a much richer assemblage in Site 3 and this, together with the better stratigraphic conditions afforded by the level, well protected deposits, lead him to make Site 3 his major excavation and the only one of his Capertee sites to be dated. Similar reasons, together with the orientation of McCarthy's work, led me to concentrate my efforts on Site 3.

## Capertee Site 3

During the January/February 1978 field season I concentrated on the cleaning up and re-excavation of McCarthy's Site 3. McCarthy's excavation had slumped into an irregular hole, surrounded by an arc of spoil-heaps. The approximate outline of this hole is shown on the site plan (fig. 21). Within the hole one could distinguish a step, shown by slope marks on fig. 21, separating the deepest part of the excavation, at the rear of the shelter, from a shallower area across the front. The shallower part of McCarthy's excavation was covered by deposits slumped from the surrounding section, together with rocks which appeared to have been removed from the deeper part of the excavation and piled on this area (fig. 22). When these disturbed deposits were removed, a firm, fairly level and rock-free surface was exposed at a depth of approximately 240 cm below 1973 datum level (Pl.VIII). This contrasts notably with the transition to rubbly and rocky deposits




After McCarthy 1964

Fig. 18 Capertee sites 1 - 3 : locality plan

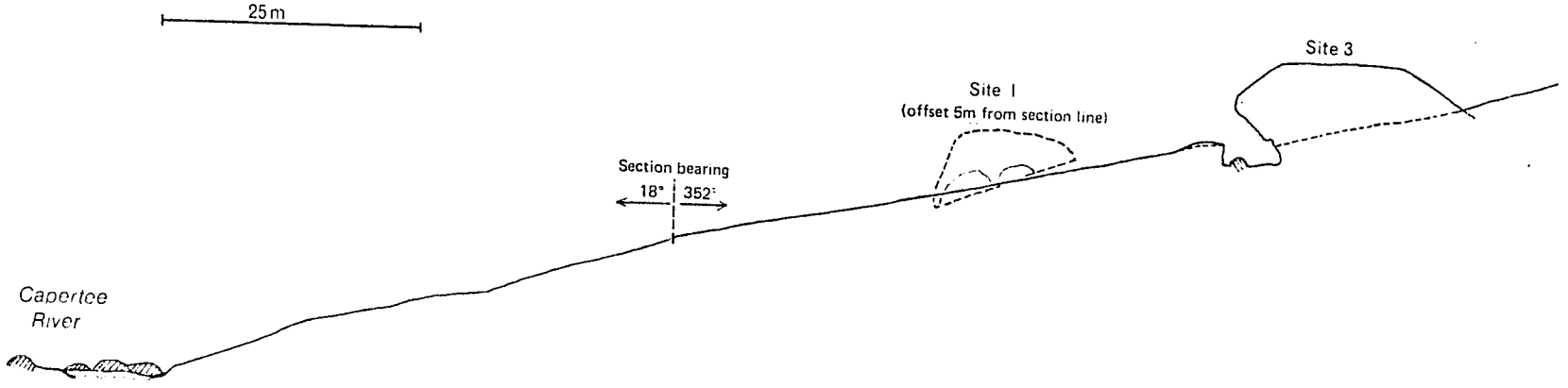



Fig. 19 Capertee sites 1 - 3 : section through pediment slope
(see fig. 18 for section line)



Fig. 20 Capertee site 3 : reconstruction of view from top of boulder containing site 1. Sketch by Mike Tabrett.

observed in my excavations at around 200 cm below datum in the North excavation (Q12, Q13, Q14, R13) and 150 cm below datum in the West excavation (K,L,M,N,O 20 and 21) and supports Walker's observation (Walker 1964a:248) that the sediments within the rockshelters were stone-free and contrasted markedly with those outside the sheltered area. McCarthy's excavation extended beyond the dripline, which partly accounts for the degradation of the walls of the excavation.

Two areas were opened up, which I shall refer to subsequently as the North excavation (Q12-14) and the West excavation (K,L,M,N,O 20 and 21). The plan of the site (fig. 21) shows the areas excavated at ground level, these areas increasing slightly as the excavation progressed due to the sloping edge of the intact deposits. In the North excavation the lower levels extended into P12-14, and in the West excavation the lower levels were excavated as far as K19 and L19. The excavation of this material was carried out as part of the cleaning up process, but it is difficult to tie up the stratigraphy between these small vestiges of <u>in situ</u> deposits and corresponding stratigraphic units in the main body of the excavation. They contribute little to the much larger samples from the latter and have not been processed.

The aim of the excavations was primarily to clean back to a vertical section which could be drawn and, if necessary, excavated back a further 50 or 100 cm to obtain a sufficient sample of artefactual material. In practice the deposits proved to be so rich that a satisfactory sample was obtained simply during the initial stage of cleaning back to a section and no further excavation was carried out.

Prior to backfilling, samples were collected for sediment and other analyses. For the North excavation these took the form of a column sample 20 x 20 cm in R13, as shown on the plan. This column sample was excavated in 5 cm spits or less and recorded in the same way as the rest of the excavation. For the West excavation the complicated stratigraphy could not be reconciled with a column sample and samples were therefore collected from the section for each observable stratigraphic unit or feature.

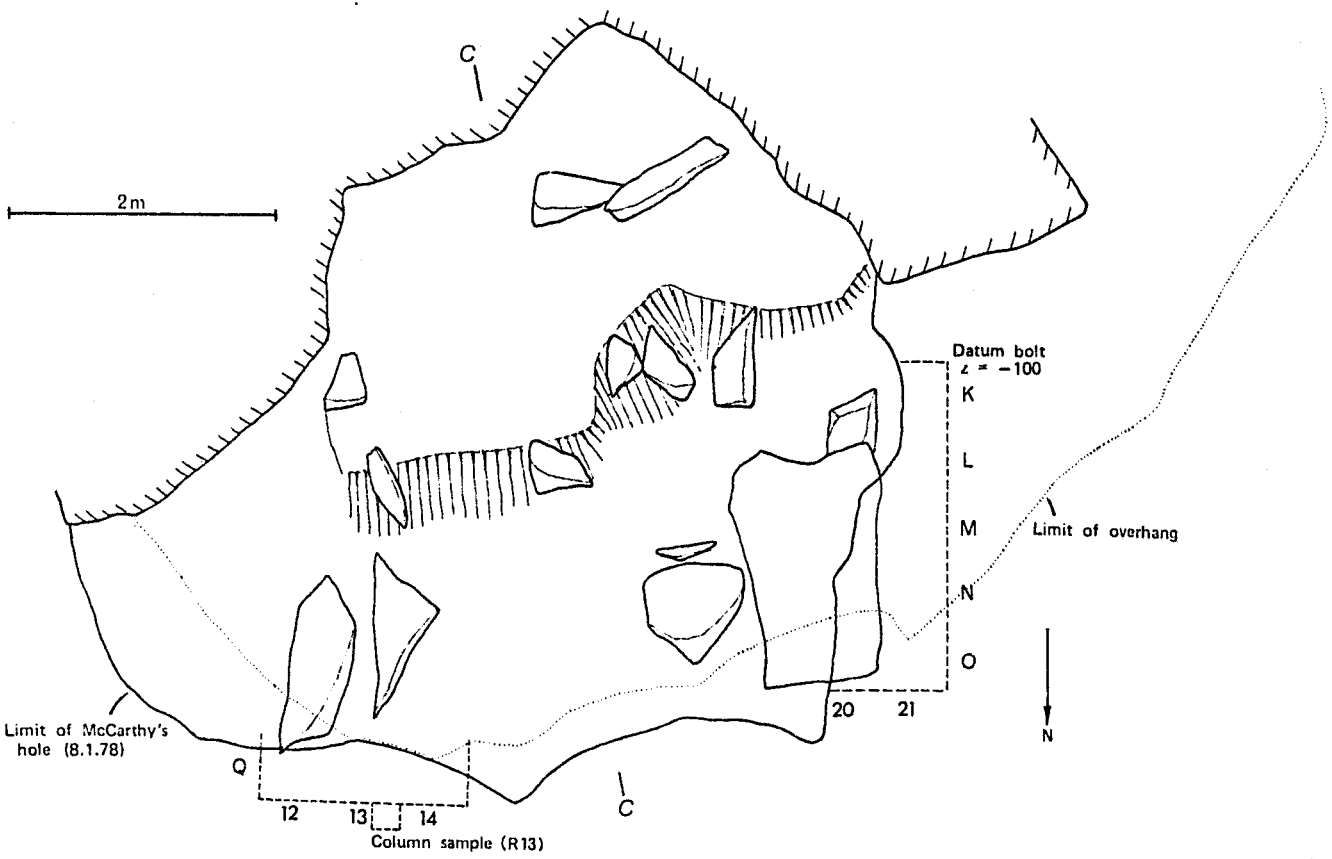



Fig. 21 Capertee site 3 : site plan

At the end of the season the West excavation was covered with a black plastic sheet with perforations to permit water transfer. A sloping wall of stones was built up against the section and filled with sediment from the spoil heap. The backfill was topped with washed fertiliser bags full of sediment to protect the fill from erosion. A visit two months later, after exceedingly heavy rainfall, confirmed the effectiveness of this protection. The section between the two excavated areas was protected with plastic sheeting weighted down with sediments. The North excavation was backfilled in the same manner as the West excavation in February 1979 - during the intervening year it was protected by plastic sheeting and suffered no degradation. The eastern section of the site was protected with plastic sheeting. A serious collapse occurred during exceptionally heavy rainfall between the end of my excavation and my return in April 1978. This section poses particular conservation problems as it is beyond the shelter of the overhang and stands nearly 2 metres high (including a pile of McCarthy's spoil on top).

Backfilling of the entire excavation is clearly impossible in view of the scale of the job (estimated volume of McCarthy's excavation in excess of 30 cubic metres). The state of the sections at the start of my work on the site is a sorry reflection on the results of not backfilling sites. I concur totally with Jones (1971:124), whose experience at Rocky Cape parallels mine at Capertee 3, in condemning any excavator who does not thoroughly backfill an excavated site - if this means transporting extra fill to the site to replace material removed, this is merely the price one must pay for the right to excavate.

McCarthy's plan and sections

McCarthy's published plan of the site is reproduced in fig. 23 together with contours of the shelter wall at various levels. McCarthy's plan cannot be matched precisely to any of the contours but appears closest to that at z=200, i.e. towards the bottom of the excavation, and I have used this contour in orienting McCarthy's plan relative to my own. Although McCarthy's excavation does not line up nicely with the roughly rectangular hole visible in 1978, the fit I have worked out is based on several (often conflicting) lines of evidence. If McCarthy's plan is lined up with the 1978 hole one cannot

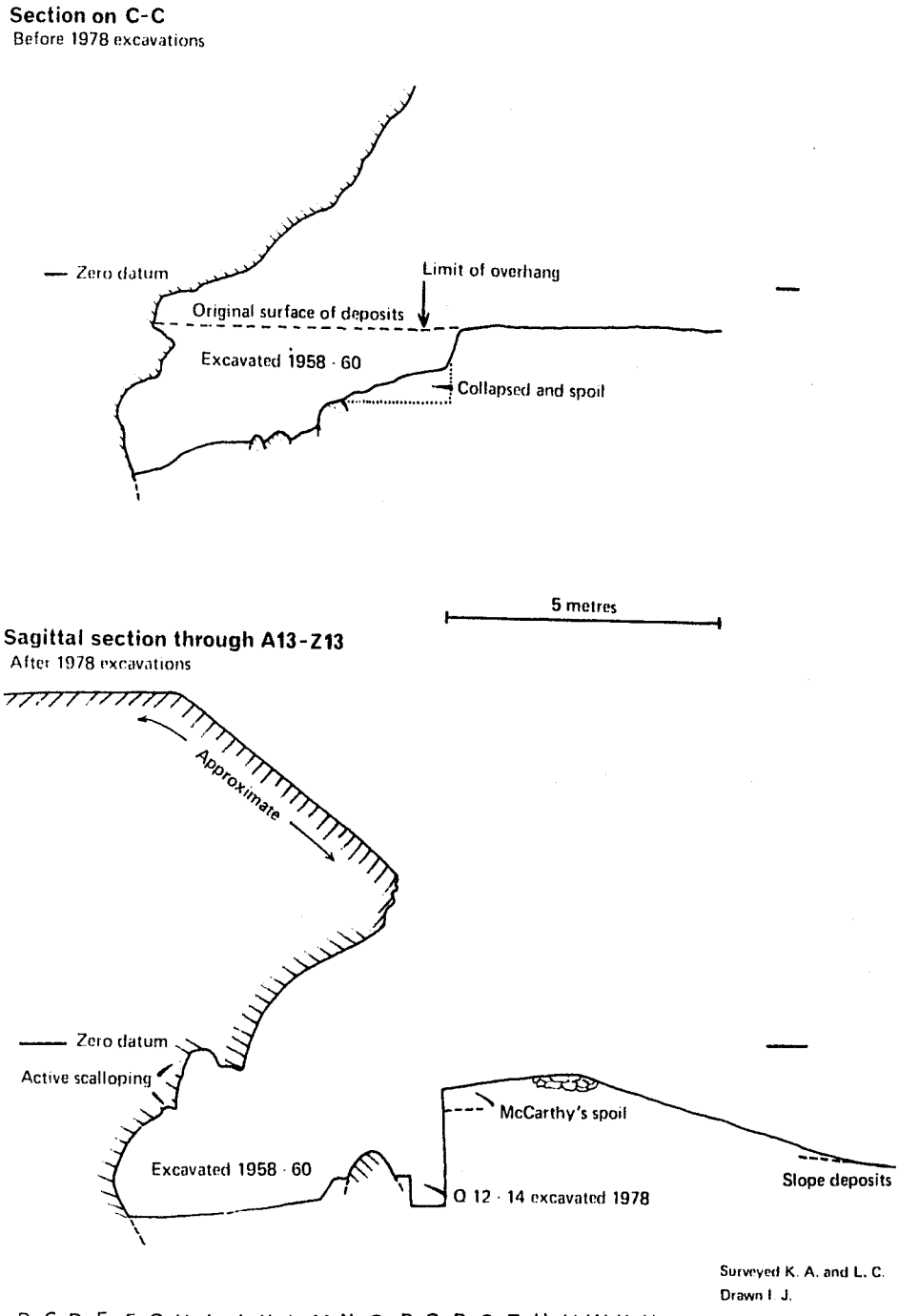



Fig. 22 Capertee site 3 : sagittal sections before and after excavation

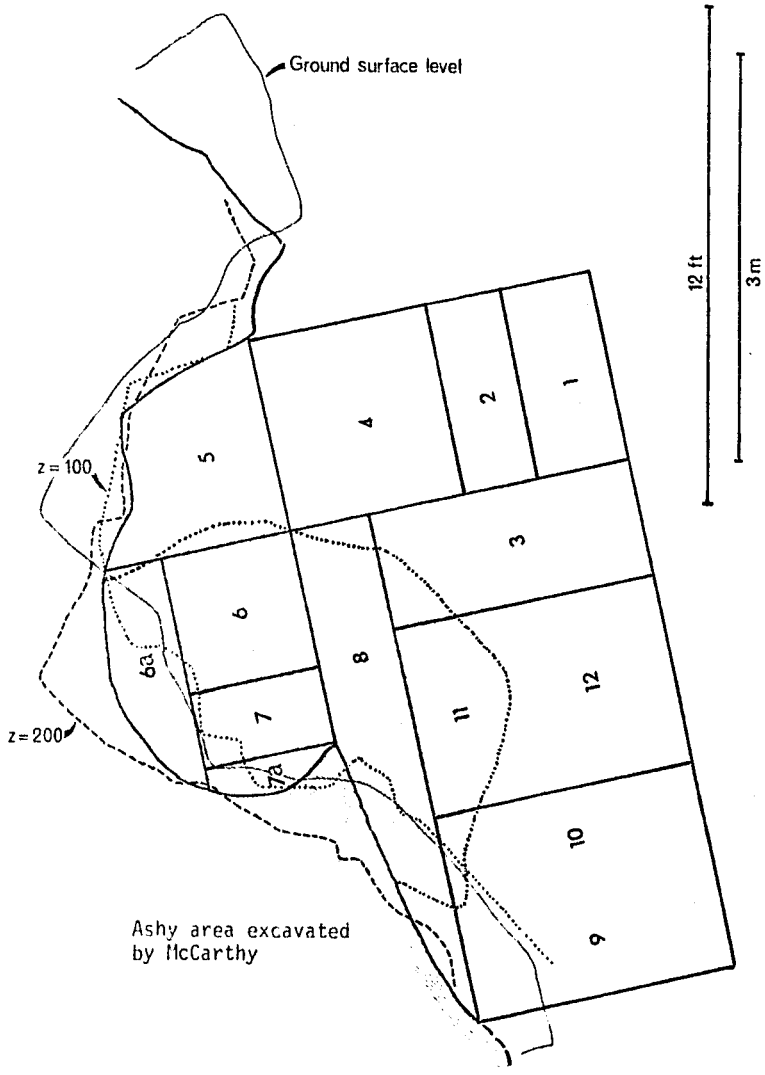



Fig. 23 Capertee site 3 : shelter wall contours superimposed on McCarthy's site plan (shaded outline)

tie it up with some of these observations, notably the transition from in situ to disturbed deposits visible in the section for P12/P13 and the shape of the shelter wall.

However there are still some discrepancies. McCarthy's West section drawing (McCarthy 1964:fig. 5) shows two large boulders above the level of the basal talus and no sign of the huge boulder which should appear in any section drawn along the western edge of the present hole (see pl. VIII). Equally, his section drawing shows the limit of the overhang as being 4' (120 cm) in from the end of the section. Yet the limit of the overhang runs very close to the edge of the present-day hole. There is no doubt that the present day hole represents the maximum possible extension of McCarthy's excavation, as the deposits around it are clearly in situ and the enlargement of the hole by slumping of the excavation walls is evident. The only solution I can muster is that an error was made in the drawing up of McCarthy's section diagram.

It can be seen from the plans in figs. 21 and 23 that the step observed in the bottom of the modern hole represents the junction between McCarthy's sections 1, 2, 3, 4, 12 and sections 5, 6, 7, 8, 11, the latter having been taken down to a greater depth, presumably because of the presence of an ashy 'pit' mentioned in McCarthy's report (1964:199) and shaded on fig. 23.

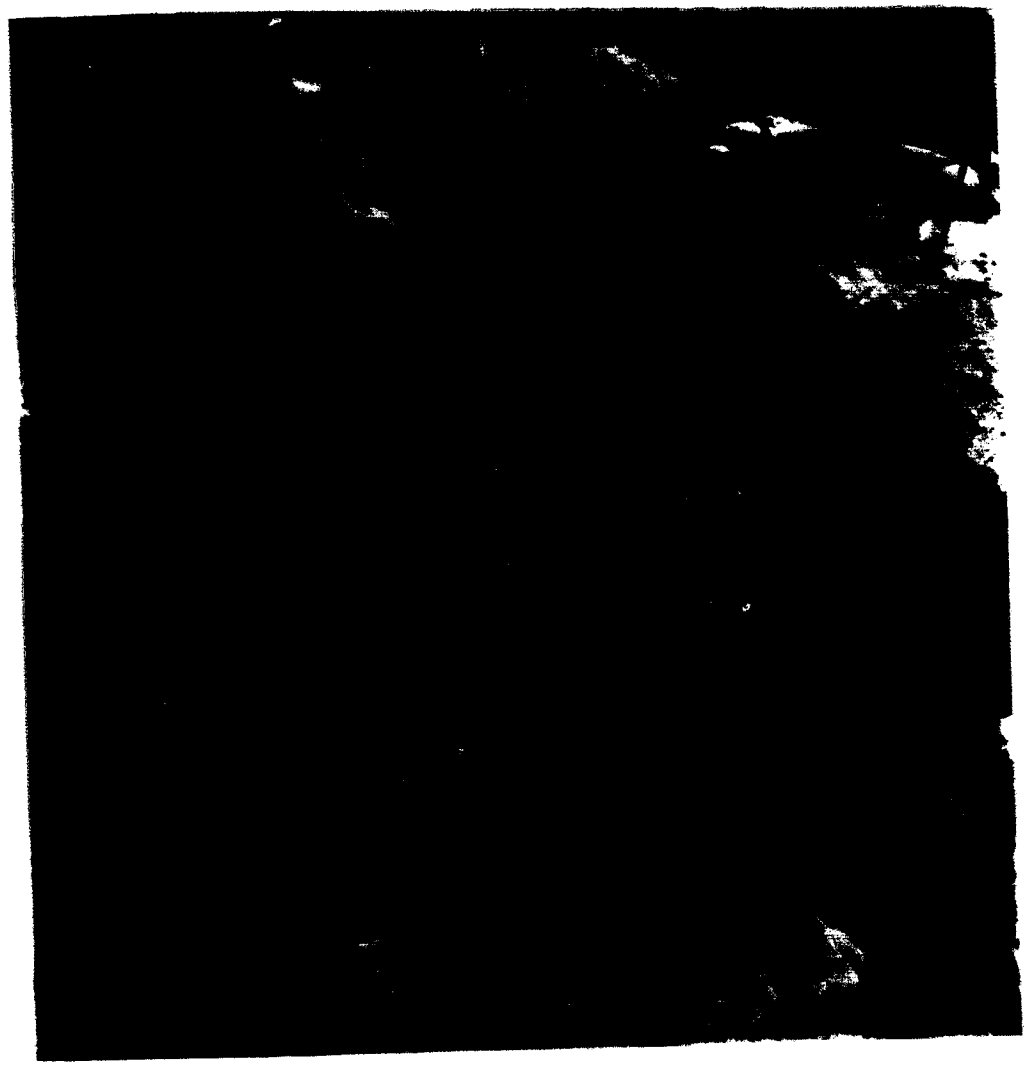
McCarthy's excavation methods

The published photographs (Walker 1964 pl.27) show spades in use and at least one flake in McCarthy's collection is marked 'spade chipped' against a large area of unpatinated flaking. The material is labelled by 6" (15 cm) or 12" (30 cm) spits, although the excavation report says that the spits were 3 - 6" (7 - 15 cm) thick (McCarthy 1964:199). Broadly speaking, 6" (15 cm) spits were employed for the Bondaian levels and 12" (30 cm) spits in the Capertian ones.

No indications are given as to how spit boundaries were determined. On the face of it a simple arbitrary level seems to have been employed, probably related to the surface of the deposits rather than to a fixed datum. No attempt appears to have been made to separate assemblages derived from individual features such as ash layers, hearths, etc., or to follow any natural stratigraphy (though,

Plate VIII Capertee site 3 - view towards West section showing 1978 excavation of squares KLMNO 20 & 21

Note the level fairly rock-free deposits at the base of McCarthy's excavation (foreground), the rubbly and rocky deposits at the base of the West section and the staining and features exposed in this section. The step separating the deeper and shallower parts of McCarthy's excavation is visible on the left. The grid system for the 1978 excavation is materialised by plumbobs suspended from steel wires stretched between the shelter wall and a metal frame.



with the exception of the ashy zones, this appears to have been too diffuse to be recognisable).

The sieve illustrated in one of the photographs (McCarthy 1964 pl.11-6) appears to be a 1/4" (6 mm) mesh, and the deposits were screened and sorted without washing. 'Waste' flakes were discarded, with the exception of a selection of 'typical' flakes from Site 3. There is an obvious selection in this material against smaller flakes. A count was made of all flakes from section 9 of Site 3, but the flakes were not retained.

Horizontal control was in the form of rectangular areas ('sections' shown on fig. 23) of varied size and shape ranging from approximately 1 to 4 square metres. All artefacts are labelled by site number, spit letter and section number (e.g. 3D5, 3F9, 1A4, 1E7).

The excavation teams consisted primarily of interested amateurs and scouts from Sydney University. At most times there were probably two or three people with some knowledge of archaeological material who did most of the sorting (McCarthy pers.comm).

## 1978 EXCAVATION METHODS

The rationale behind the decisions taken in designing the Capertee excavation procedure will be discussed in full in chapters 7 and 8. In this section I simply present the details of the procedure as applied to Capertee site 3.

### Coordinate system

A grid system using 50 cm squares identified by a letter and a number was set up to cover all the potential archaeological deposits in the site. This grid was materialised in the areas excavated by horizontal wires with plumbobs hanging at 50 cm intervals (pl. VIII). A permanent datum point was created by inserting a masonry expansion bolt in the shelter wall. This bolt is situated on the junction of squares K and L, 20 and 21, i.e. at the 0,0 point of square L21 (see fig. 21) and the axes of the grid system run along compass bearings of $3^{0}$ and $273^{0}$. The establishment of a permanent datum point in this way and definition of the grid system in terms of compass bearings or two permanent datum points is, I believe, an obligation on the part of

anyone excavating an archaeological site. I have worked on several sites where considerable time has been wasted and/or *in situ* deposits have been destroyed in the search for a previous excavator's trenches and where it has proved impossible to integrate the results of successive excavations.

The permanent datum point also serves as a depth datum - in the case of Capertee 3 the expansion bolt is situated at 100 cm above zero datum, i.e. z = -100.

Excavation technique

Excavation units consisted of approximately one 10 litre bucket of spoil removed, except towards the base of the excavation where the excavation unit size was doubled. The stratigraphy was followed as far as possible, initially by excavating parallel to the ground surface and subsequently following any observable changes in sediment texture or colour or concentrations of artefactual material. A new excavation unit was started immediately if a change in sediment or artefactual material was observed. Each 10 litre bucket of spoil corresponds with approximately 2-3 cm of deposits over a 50 cm square, though this may be increased if the square contains a large rock or has been partially removed by disturbance. Start and end levels (z values) were recorded for five points on the surface of the square each time a new excavation unit was commenced. In addition three dimensional coordinates were recorded for finds over a specified size or of particular interest (e.g. backed implements, utilised flakes etc.). In principle the cutoff point for three dimensional recording was 2 cm length, but in practice this criterion was poorly adhered to and many tiny unutilised flakes were recorded in three dimensions. In addition some excavators missed a significant number of artefacts in the 2-3 cm range. In future I would be inclined to set a slightly larger cutoff value, such as 3 cm length, and ensure that it was adhered to, thus avoiding time wastage on the recording of unexploitable data. The choice of cutoff value must obviously be made in terms of the artefact size which people can detect reliably *in situ* and the number and size range of artefacts in the site in question. A mean of about 10 artefacts per excavation unit is probably sufficient for constructing satisfactory backplots[1].

(1) Backplots are the projection of the three-dimensionally recorded artefacts onto a vertical plane, generally a drawn section (see for example fig. 35).

Processing

The spoil from each excavation unit was processed separately. Any sandstone fragments exceeding 300gm in weight were removed, weighed and counted and recorded on the field recording forms (see fig. 58). The remaining sediments were weighed, sieved dry on a 3 mm mesh to reduce the bulk and bagged for return to camp. At camp the residue was shaken through a 6 mm and 3 mm mesh sieve pair and the residues were washed, tipped onto a table for sorting and weighed on kitchen scales. The purpose of the coarser sieve is twofold. Firstly, it reduces damage to the artefacts and faunal remains by eliminating larger sandstone fragments and allowing a preliminary sort with very little shaking. Secondly, it is much easier to sort the finer fraction (3-6 mm) than to sort a 3 mm sieve residue containing pebbles of 1 or 2 cm diameter. In the case of the Capertee sediments and commonly in sandstone shelters in general, very little shaking of the sieves was necessary, particularly for the 6 mm sieve, so that the residue can be removed and sorted almost immediately before the artefacts in it are damaged. Equally little more than a quick rinse of the residues was required, so that we were able to do all our wet sieving with household strainers in a few gallons of water carried up from the river. To avoid contamination of charcoal samples this wash-water was skimmed frequently with a 1 mm mesh strainer and only pieces of 2-3 mm diameter or larger were submitted for dating. Although we changed the wash-water frequently this is by no means necessary, illustrating the point that one does not need large quantities of water for wet-sieving of sandy deposits. In practice wet-sieving can be carried out quite satisfactorily with a very low rate of water consumption by decanting off the mud accumulated or by use of a settling tank.

The figures obtained for sieve residue weights in my excavations can only be considered as approximate owing to the effects of varying water content. Equally the process was not sufficiently controlled to eliminate the possibility of error on the part of the sorters. This problem could be solved easily with little or no extra expenditure of effort by placing a responsible person in charge of residue weighing and the bagging and inventory of sieve finds.

Treatment of finds

Finds for which three-dimensional coordinates were recorded were wrapped in Alfoil labelled with masking tape. The Alfoil serves as excellent protection even without padding materials for both lithic material and fragile bones. On returning from the field the numbered finds were transferred to individual 0.125 micron plastic bags. Because of the sandy nature of the deposits finds were not washed unless this was necessary for further study. The use of individual plastic bags for individualised finds may seem somewhat extravagant but the expense is insignificant (approximately $6 per thousand bags) and is amply justified by the protection of the artefacts from damage. In addition individual bagging avoids the time-consuming business of washing artefacts simply so that one can write on them, when this is not required for study. The only inconvenience lies in manipulations requiring a number of artefacts to be spread out together, e.g. in attempting to reconstruct cores.

Sieve finds were sorted for retouched or utilised specimens or specimens exceeding a specified size (2gm weight or 3 cm length for Q12-14, 3gm weight for the remainder). The finds removed were added to the individually numbered finds with sequence numbers following those attributed in the field. The remaining lithic finds were sieved gently on a 4 mm granulometric sieve to eliminate very small chips and thus purify the sample. The material passing through the 4 mm sieve was weighed and bagged separately, whilst that retained in the sieve was classified into one of three raw material classes ('chert', quartz and 'other'), counted, weighed and bagged by raw material category. Bone material was sorted out for separate analysis and charcoal was weighed and bagged.

Data coded in the field on the field coding forms (fig. 61) included residue weights, coordinate data and preliminary classifications of the material. The latter included artefact weight, artefact type, presence of cortex and raw material for individualised finds, together with counts and weights for a number of raw material categories for the unindividualised finds. This data was used to establish a basic computer file of excavation data which was gradually updated and verified following the procedures laid out in the methodological discussion of chapter 8.

Storage

The material from each excavation unit is stored in a separate small cardboard box (two or more units may be stored in a single box if they contain very little material). This again may seem a rather extravagant method of storage, but the advantages are enormous when it comes to working on the collection. A particular find or finds from a particular excavation unit can be located in seconds, which is not always the case with collections stored in plastic bags in larger boxes. Equally the present system gives better protection and is more economical in space than tray storage, whilst less prone to mixing up of material. Labelling follows the system described in chapter 7, viz.;

CP3 Q13 b3

CP3 Q13 3-15

- 3-15: object number; excavation unit ('bucket') number
- Q13: excavation square
- CP3: Site (Capertee 3)

REANALYSIS OF McCARTHY'S INDUSTRIAL SEQUENCE

McCarthy has fortunately provided a very clear breakdown of the lithic industries for each of his Capertee sites. I have attempted to analyse this breakdown by grouping together certain implement types, partly as a device to get sufficient frequencies for each type, and partly because the finer divisions of McCarthy's typology are of doubtful utility, pending more thorough definition and assessment of their significance.

I wish to ask the following questions of McCarthy's typological counts:

1. What tool types best discriminate between the Capertian and the Bondaian?
2. Do all spits clearly segregate into one industry or the other?
3. Do all the new types appear at the same time?

4. Are there occupation gaps or changes in tool deposition rate with the introduction of the Bondaian, or at any other time?

(1) What types best discriminate?

It was clear from the raw data that there were marked differences in the proportions of different types between the Capertian and the Bondaian and that these differences were sufficient to be the prime determinants of the correlations between different tool types. I therefore carried out an R mode principal components analysis in the expectancy that the first factor would be much the most important and would grade types from the most typically Capertian to the most typically Bondaian. This was confirmed by the appearance of backed implements and related types at the positive extreme of the first axis which accounted for 71% of the variability (2nd factor 29%)[1].

Let us first consider the results of this R mode analysis (fig. 24). There is a clear segregation into three main groups:

1. Backed implements (Bondi points and geometric microliths), burins, redirecting slivers, elouera and, to a lesser degree, cores with two or more platforms.

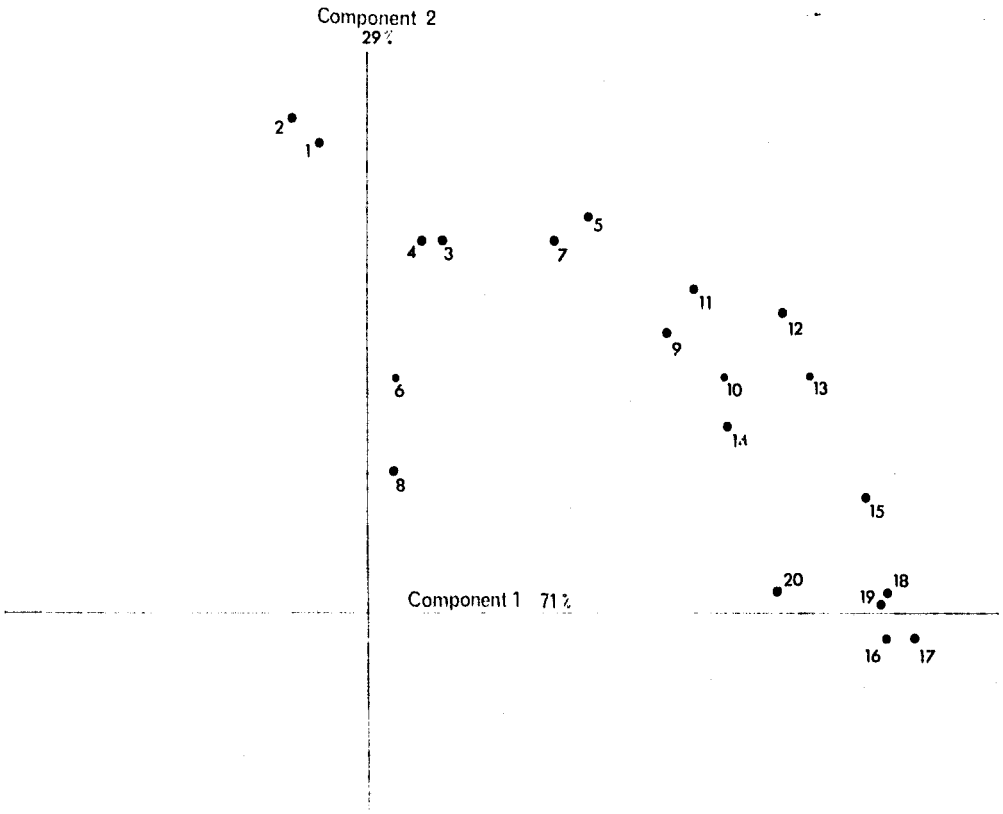
2. Side scrapers, end scrapers and single platform cores. To these we might be tempted to add mixed scrapers, though they lie almost as close to the first group, and notched end scrapers and fabricators.

3. Keeled, general and redirecting blocks, notched and nosed scrapers, coroids and the ubiquitous 'knife' (a flake with an acute edge showing use-wear).

These three groups can I think be interpreted as representing:

1. Typical Bondaian tools

(1) SPSS FACTOR procedure, 2 Principal factors with iteration, Varimax rotation, based on frequencies for tool types within each spit.




Variables = tool types (see table of typological groups for explanation of code numbers)

Fig. 24 Capertee sites 1 - 5 : R mode Principal Components Analysis of tool frequencies

| | |
|---|---|
| 1 | Saw |
| 2 | Concave and nosed scraper |
| 3 | Knife |
| 4 | Block - keeled |
| 5 | - general |
| 6 | - redirecting |
| 7 | Lateral edge notched or lateral concave scraper |
| 8 | Coroid - general |
| 9 | Fabricator - flake and coroid |
| 10 | Butt and distal concave scraper |
| 11 | Butt end or distal end or double end scraper |
| 12 | Single platform core |
| 13 | Side scraper |
| 14 | Side and end, double side and end, double side, semi-discoid or discoid scraper |
| 15 | Core with two or more platforms |
| 16 | Resharpening sliver |
| 17 | Bondi point |
| 18 | Burins - coroid, flake and microlithic |
| 19 | Geometric microlith |
| 20 | Elouera |

Types were ordered according to their position on the first component of the Principal Components Analysis described in the text.

Table 7 Composite tool types used in the Principal Components analysis of McCarthy's typological counts

2. Tools which are similarly represented in both industries

3. Tools which are preferentially represented in the Capertian industry.

It is notable that whereas the types characteristic of the Bondaian are very close together (i.e. have very similar distributions between spits), those more typical of the Capertian are far more scattered - this is because the latter continue on into the Bondaian, whereas the former are rare or entirely absent in the Capertian. The placing of nosed and notched scrapers in the Capertian group corresponds well with observations made by Jones in Tasmania (1970) and Lampert (1971a) on the mainland, that concave worked edges are proportionately more common in older sites. The chunkier and unspecialised forms, such as blocks and coroids, also occur in this group. Equally the placing of burins and redirecting slivers in the Bondaian group supports suggestions that these forms are the result of technological processes associated with blade manufacture, (Cundy pers. comm., Luebbers pers. comm.) and the same argument can be extended to cores with two or more platforms. Finally the inclusion of fabricators, miscellaneous scrapers and single platform cores in the middle-of-the-road group, reflects their common occurrence in both industries. It is perhaps to this last group that we should look for a best estimate of changes in occupation intensity, as being those least affected by changes in 'popularity' (see later).

2) Do all spits clearly segregate into one industry or another?

When dealing with industries such as those from Capertee we have no <u>a priori</u> scheme for grouping tool types along the axis of a histogram or cumulative diagram, as we would if we were dealing with a European assemblage. In order to establish an order for the tool types along the axis of (in this case) a tool frequency histogram, I have used the ordering determined by the first axis of the Principal Components analysis. The types thus grade from those most typical of the Capertian to those most typical of the Bondaian. This procedure should emphasise the difference between the histograms for the two industries. I have plotted the histograms in fig. 25 (for the Bondaian) and fig. 26 (for the Capertian).

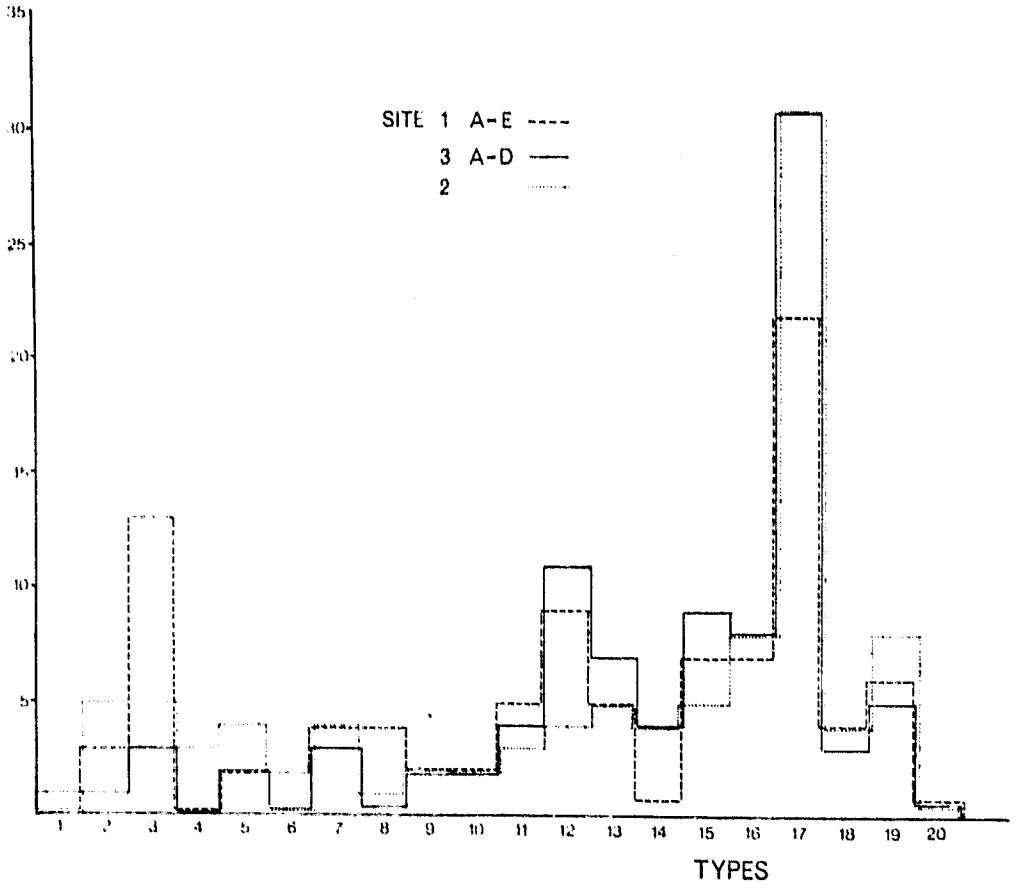



Fig. 25 Capertee sites 1 - 3 : histogram of tool frequencies, Bondaian levels

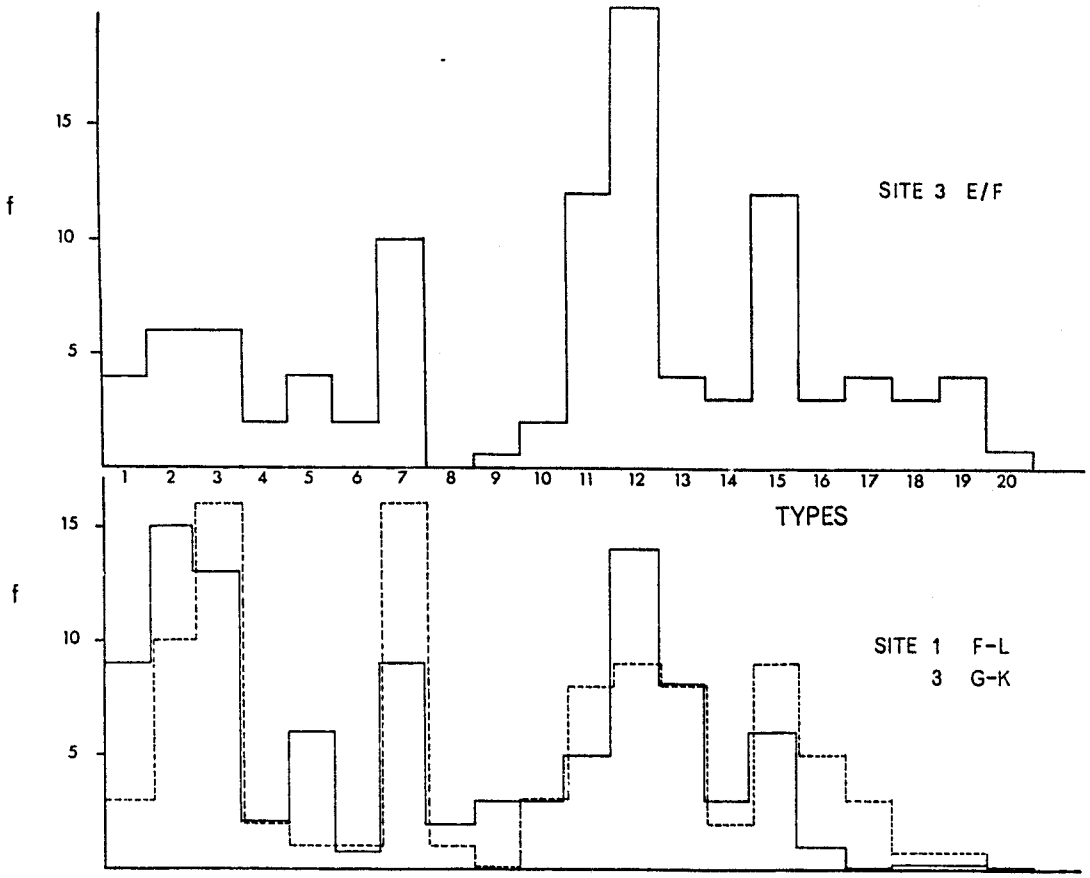



Fig. 26 Capertee sites 1 & 3 : histogram of tool frequencies, Capertian levels

I was puzzled by McCarthy's attribution of spit E/F in Site 3 to the Bondaian, as the proportion of typically Bondaian tool types is very low and could well be merely the result of occupational disturbance or the very top of the spit being Bondaian. Figs. 25 and 26 confirm that the distribution of type frequencies is very similar to that of the Capertian layers of Sites 1 and 3, with the exception of the under-representation of concave and nosed scrapers and 'knives' and quite dissimilar to that of the Bondaian levels. In addition, McCarthy's field notes state 'Bondaian finished at 22"[55 cm]', suggesting that spits E and F, at a depth of 24"-36" (60-90 cm) in fact belong to the Capertian. I have therefore reattributed spit E/F to the Capertian in subsequent discussion.

3) Do all new types appear at the same time?

McCarthy states 'It is important to note that the inhabitants did not acquire the various diagnostic specialised types of implements at the one time, but as a succession of new ideas' (op.cit.:199). He lays out the succession in a diagram for each site (1964:tables 1 and 2). Whilst not rejecting this hypothesis, there are insufficient specimens to say whether one type predates another and the spit excavation technique obscures the precise relationship between the occurrences of different types. As an example, one cannot judge the significance of the observation that elouera are absent below 18" (45 cm) in Site 1, since the site only contains a total of four specimens. Apart from the apparently earlier occurrence of 'fabricators', all the typically Bondaian elements appear at approximately (or exactly) the same time.

4) Is there a hiatus between the Capertian and the Bondaian?

McCarthy noted a relatively sterile layer in Site 1 corresponding with spit F (McCarthy 1964, Table 1). The tool concentration in this spit drops to less than half that of the preceding Capertian spits, and is a small fraction of the concentration in the succeeding Bondaian spits. This sterile zone was not apparently observed in Site 3, although definite Capertian and Bondaian peaks in artefact concentration occurred in my own excavations (see later). It may be that more intense occupation of Site 3 has blurred an impoverished zone similar to the one that McCarthy recognised in Site 1.

Both Site 1 and Site 3 show a peak in tool concentrations in the middle Bondaian spits - spit C in both sites.

## GEOMORPHOLOGICAL HISTORY OF THE CAPERTEE GORGE SITES

We are fortunate in that the major Capertee sites, 1 and 3, are some of the few archaeological sites in Australia to have been studied by a geomorphologist (Walker 1964a and b). Walker's articles are a valuable source of diagrams and descriptions of the deposits. He carried out a detailed analysis of the sediments both in the shelters and on the surrounding hillsides, concurrently with McCarthy's excavations. He concluded that the shelter sediments were derived from sediment transported on the surrounding slopes by surface effects (raindrop splash and wind coupled with gravitational effects), together with disintegration of the walls and roof of the shelters. This interpretation is not at variance with more recent work on sedimentation processes in sandstone rockshelters (Hughes 1977), though the second part of Walker's discussion, concerning the soil-history of the area, is based on models which are now not widely used in the explanation of landscape development.

Walker makes the point that the presence of stone-free sandy deposits within the rockshelters is strongly correlated with the presence of Aboriginal artefacts and says 'it is probable that the differences between soils inside and outside the cave are largely the result of human occupation' (1964:252). He distinguishes the following 'soils' within the shelters;

PQ - the most recent soil formation on the hillsides of the area, overlain by recent (post-European?) soil wash. Walker considers this soil layer to represent a period of stability.

R and S - these layers are chiefly characterised by the presence of fine clay banding, varying in thickness from 1/16" (1.5mm) at the top (R) to 1/2" (12 mm) at the bottom (S). These soils occur on the hillside in places where the soil mantle is well developed and typically continue to a depth of around 60" (150 cm). They are present from the edge of the overhang outwards in Site 1 and stretch further and further back into the sheltered area with increasing depth for Site 3 (layer S extends to the back of the shelter). In

Site 1, R and S are distinct both by the orientation and thickness of the clay bands (R steeply sloping, 1/16" (1.5mm) thick, S horizontal, 1/2" (14 mm) thick). Walker suggests that this represents some sort of hiatus in deposition, which is not however represented in the sequence from Site 3, where the clay bands are horizontal and simply become thicker with increasing depth.

T - this layer is the basal bouldery talus zone characterised by cementing. In Site 1, the upper part of this layer is relatively stone-free. Layer T contains very few artefacts and is considered by Walker to reflect a period of stability.

The stratigraphy found in the 1978 excavations broadly parallels that described by Walker and, owing to the position of the North excavation near the dripline, the clay banding is well developed in that area. In plan this banding was seen as lumps of clay adhering to artefacts and pieces of sandstone, and it was only when seen in section that it became apparent that the bands were continuous. These bands could probably be followed in any future excavation near the dripline of Site 3. They were not, however, visible in the West excavation, though traces of clay did appear.

McCarthy remarks (1964:199) that 'The change (from PQ)...to the second soil system R is within 6 in. [15 cm] of the bottom level of Bondi points and geometrics, the correlation being so close that it might be accepted as the Bondaian stratification'. In the North excavation the first appearance of clay was just into the Capertian, which fits with McCarthy's general observation. From this point (in unit VII) down to unit VIII, the sediments were relatively rock free, but from unit IX downwards there was a progressive appearance of large sandstone fragments and cementing. The increase in the coarser sediment fractions can be clearly seen from fig. 27 which is based on weighing of sieve residues in the field. The clay bands persist, becoming progressively thicker, right to the bottom of the excavation, though they become progressively more and more difficult to follow as the sediments become more rocky. As the very rocky deposits of Unit XI are practically sterile and yet contain by far the thickest clay bands, it seems initially unlikely that the clay bands might have formed as depositional features associated with Aboriginal occupation.

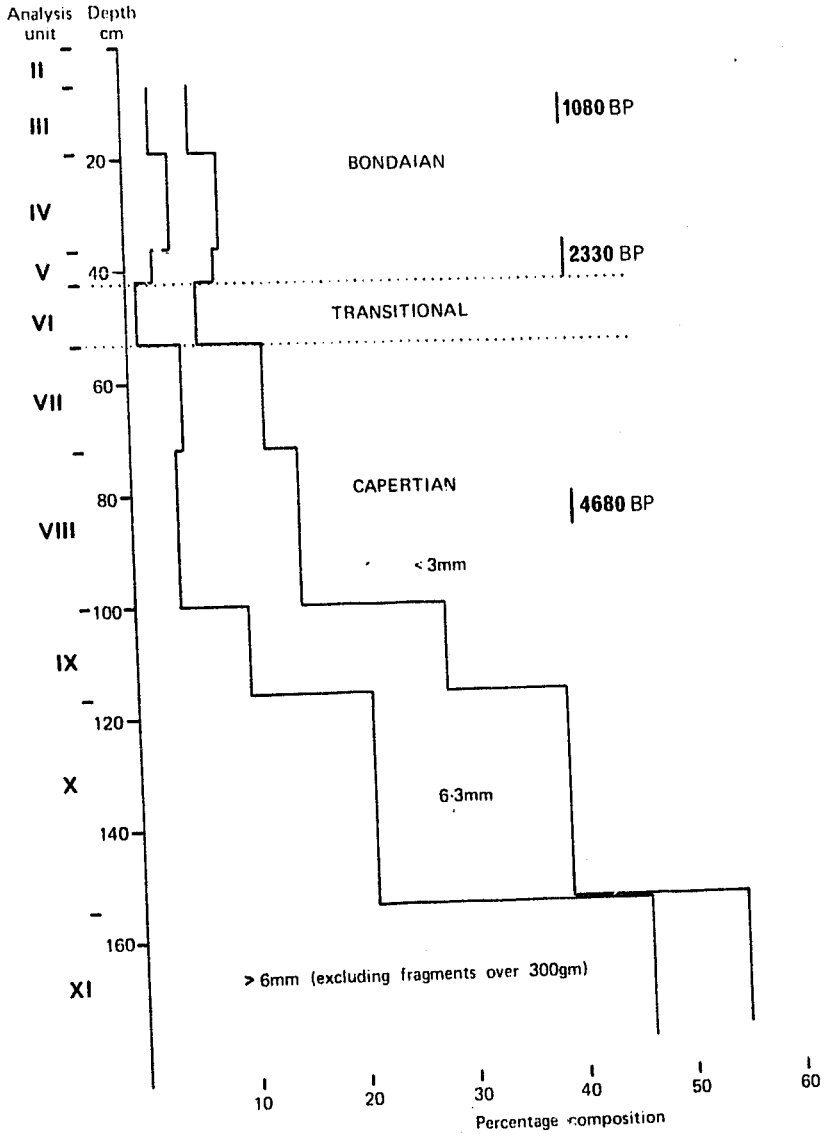



Fig. 27 Capertee site 3 : in-field analysis of sediment particle size

Equally, their very regular spacing and progressive decline in thickness with decreasing depth seem to argue for a post-depositional phenomena, probably not connected with periodic visits by human groups (such visits, if as infrequent as the formation of the clay bands, would be unlikely to occur at regular intervals). Thin section samples of the clay bands were collected with a view to investigating the processes involved in their formation, but it was not possible to have them processed in time for this thesis.

The basal rocky talus zone found in both the North and West excavations was explored to some depth in K19 and L19, and continued unchanged to the lowest point reached, about 350 cm below datum. These deposits appear to be absolutely sterile, deeply weathered and cemented and are, I would suggest, of a considerable age. The arrival of the Aborigines in the area has clearly changed the depositional environment of the shelter and promoted the rapid and relatively stone-free deposition of the upper metre and a half of deposits (2 metres at the back of the shelter where the basal talus dips).

## Hillside Morphology and Sediment Transport

Walker (1964b:328) describes the section of the hillside in the vicinity of sites 1 and 3 as consisting of two talus slopes (slope 20-25°) and two pediments (slope 5 10°), the sites being situated on the lower of these pediments approximately 25m above the level of the Capertee River. The lower pediment is developed on a strongly weathered and bouldery basal deposit with frequent, partially buried boulders of up to 1000 cu.m. volume. The sites are formed by the overhanging faces of such boulders, further developed by cavernous weathering.

Walker found that the talus deposits were very variable in particle size distribution with a high proportion of sandstone fragments. On the other hand, the pediment deposits are relatively uniform throughout, both across the pediments and down through the profiles. In addition these deposits were found to be closely comparable to those within the shelter of Sites 1 and 3. Analysis of the local sandstone showed that it contained 'an adequate range of particle size to supply all material for the unconsolidated sediment' (ibid.:331).

Walker interprets the talus deposits as representing initial breakdown of the sandstone into fragments and single-grained material, with little sedimentary transport. The pediment sediments, on the other hand, represent transport of finer material, with a depletion of material >5mm and increase of material <100μ. As there is no evidence for a 'dump' of coarser material at the transition from talus to pediment, Walker concludes that the >5mm fraction is relatively immobile on the talus slope. He suggests that the slight boost in the <100μ fraction on the pediment slopes is due to differential particle size transportation on the talus slopes supplying sediments enriched in this fraction to the pediment slopes. He suggests that transport on the steep (20-25°) talus slopes may be by particle suspension in sheet flow, causing preferential transport of the <100μ fraction, whereas transport on the pediment slopes (5-10°) might be due to raindrop splash which is said to transport a wide range of particle sizes with little selective effect up to 400μ (Ekern 1950, vide. Walker 1964b) (the pediment deposits show no systematic particle size variation which might be interpreted in terms of selective transport). Walker considers the change in process to be a function of the change in slope and of the high porosity of the pediment deposits which are of a much greater depth than those on the talus sections. The latter observation alone confirms the greater sediment transport capabilities of the talus slopes when compared with the pediment slopes.

## Sedimentation within the Rockshelters

The sediments within the shelter of sites 1 and 3 occur as 'islands' of relatively stone-free material in the pediment deposits. There is a sharp transition to stonier deposits outside the shelter of the overhang, particularly in the case of Site 1 where the shelter is in the side of the block rather than on the protected downhill side as in the case of Site 3, the major site. Sediment transport is evident from the way the hillside deposits are piled up on the uphill side of each block and 'flow' around the sides of the block. The shelter floor deposits could reasonably be expected to grow with the hillside deposits by a combination of water, animal/human scuffage and wind bringing in sediment from the sides of the shelter, plus roof weathering products. These processes would accelerate if the differential in level inside and outside the shelter increased, thus

restoring the balance. In practice, the level within the shelter will always be a little lower than that outside, and this is very clearly visible at Capertee 3 where the deposits slope quite sharply down into the sheltered area.

If we accept this line of reasoning we must conclude that approximately 2 metres of pediment deposits have accumulated in the vicinity of the sites since occupation by man became archaeologically visible, about 7-8000 years ago (Bermingham 1966). Underlying both the archaeological deposits and their counterparts on the hillsides, are deeply weathered bouldery talus deposits devoid of artefactual material (a considerable volume, at least 0.25cu.m., excavated in K19 and L19 yielded no artefactual material). Walker makes the same observation and refers the basal deposits both in the shelter and on the hillside to his soil layer T. Without wishing to comment on the validity of the soil layers distinguished by Walker, a field in which I am entirely incompetent, the sharp transition observed between the basal bouldery talus deposit and the overlying deposits (see discussion of stratigraphy of Q12 - Q14, also Walker 1964a:251) implies a fairly marked change in sedimentary regime at this time. Equally this change appears to coincide closely with the appearance of archaeologically visible occupation of Site 3 (a few small artefacts were found in interstices at the top of the basal layer but none beneath). Finally the sedimentation rate over the last 3000 years appears to have been several orders of magnitude faster than the very slow processes evidenced by the deep weathering of the surface of the basal talus deposits.

On the basis of these observations, I wish to propose the hypothesis that the rapid sedimentation of the past 3000 years and the sharp change in character of the deposits at or before this time results from human activities. We may in fact be looking at first occupation of the gorge, or we may simply be looking at a change from very sporadic use to rather more regular use involving modification of the vegetation cover and a change in slope stability. The most likely mechanism would be increased firing frequency, and the fauna collected provides some evidence that the gorge may have been fired during the period of human occupation (see discussion of faunal material in chapter 4).

According to my hypothesis of humanly induced sedimentation, the basal bouldery and deeply weathered talus deposits which underly the sediments of the lower pediment at a depth of around two metres, would represent a long term accumulation of rock fragments in an equilibrium situation in which sediment transport capability across and off the pediment exceeded sediment supply onto the pediment from well vegetated slopes above[1]. Under this regime the pediment acts as a trap for coarser material whilst finer material is eliminated, eventually by the river below the pediment.

Subsequent to increased fire pressure (or climatic change, e.g. associated with the Holocene and inducing changes in vegetation and/or runoff) pediment transport processes might prove inadequate to eliminate sediment supply, resulting in increased sedimentation rates and a change in sediment character with a full range of smaller particle sizes capable of being transported by slope wash, i.e. pebbles and smaller, and a boost in finer fractions relative to the talus slopes above.

In the formation of the bouldery basal talus zone we are looking here at slope stability, limited supply of sediment from the talus above and long term equilibrium of hillside deposits and deposits within the protection of the rockshelter sites. Only if the build up of the basal deposits is exceedingly slow can one account for the presence of identical deposits inside and outside the protection of these sites rather than a concentration of finer material within the protected area where transport processes are likely to be incapable of accumulating coarse material. The coarse material could accumulate from roof fall over a very long period (together with occasional chance arrivals from outside), the finer fractions being eliminated by equilibrium exchange with the surrounding hillside deposits. This hypothesis is further supported by the deeply weathered and sub-rounded nature of the sandstone fragments forming the basal talus deposits. This weathering extends right to the interface with the overlying sediments.

(1) An alternative hypothesis (Hughes, pers.comm.) is that the basal talus deposits have accumulated by a series of mass movement events followed by subsequent removal of the finer fractions by slope wash.

An alternative and inverse hypothesis is suggested by Walker (1964a:262), who considers that the soil layers he distinguished (layers PQ, R, S and the basal talus T) have been generated by periodic landscape events similar in principle to Butler's K-cycles. According to this hypothesis, successive soil layers correspond with periods of ground surface instability in which hillsides lose some or all of their soil mantle, followed by decreasing sediment mobility resulting in accumulation and subsequent soil development. Though one might see the basal talus as representing a denuded hillslope, subsequently buried by one, or as Walker suggests, several phases of sediment deposition and soil development, I feel that this hypothesis does not satisfactorily explain the basal talus deposits within the protection of the rockshelter. If denudation of the hillside was to extend to such well protected areas, other than by a long term equilibrium situation (see above), we would be dealing with exceedingly vigorous transportation/erosion processes and a hillside stripped bare of finer sediments on the steeper talus sections. In this case, what would be the source of the sediments which are supposed to demobilise and form the basis for soil development?

We therefore have two alternative and inverse hypotheses. The first perhaps appears the more attractive because it explains, in terms of man-induced sedimentation, the close association between the relatively stone-free and rapidly accumulated deposits within the shelters and traces of human occupation. These hypotheses could be tested by a detailed geomorphological study, concentrating particularly on the junction between the sediments of the shelter and of the hillside. Sufficient deposits still remain along the edge of McCarthy's excavations for this to be carried out. Particular aspects of the problem requiring further work are:

1. More detailed study of the sediment transport mechanisms operating on talus, pediment and shelter deposits.

2. Verification of the equivalence of the change from the basal bouldery talus deposits to the overlying sediments inside and outside the rockshelters and detailed analysis of the differences between the sediments.

3. The dating of the change in deposit character and verification of the simultaneity of first detectable human occupation.

4. Pollen and/or phytolith studies aimed at describing the changes in vegetation associated with the depositional phases.

5. Detailed study of the stratigraphy of the rockshelters and associated archaeological material (the latter is hindered, as in my own study, by the overwhelming proportion of each site which has been removed).

## 1978 EXCAVATIONS

### Stratigraphy of the North excavation (Q12-14,R13)

The location of my North excavation (Q12-14,R13) is shown in fig. 21 and the stratigraphy in fig. 28. The overlay on fig. 28 shows the boundaries of what I call Analysis Units. As explained in chapter 7, these units are formed by grouping together the original Excavation Units. The groupings were based on a combination of field observations of the stratigraphy and concentration and nature of the artefacts recovered, together with laboratory analysis of these aspects. Prior to grouping Excavation Units into Analysis Units, the computer was used to prepare histograms of artefact concentrations, artefact weights, ratios of coarse to fine sediments, etc., and these were used in conjunction with the field notes, the drawn stratigraphy, a backplot of numbered finds (fig. 33) and a plot of the boundaries of the excavation units, in determining the final groupings. It has thus proved possible, even where the trend of the deposits was not initially clear, to create reasonably intelligent Analysis Units where a conventional spit methodology would have cut straight across these trends. The stratigraphy of the West excavation is very similar to that of the North excavation and will not be discussed here as it is not required for the following discussions.

It should be noted that the representation of the 'synthetic' stratigraphy shown in the overlay to fig. 28, is not a perfect representation of the vertical location of each Analysis Unit, as it only shows the approximate intersection of the excavated volumes with the drawn section. The groupings of Excavation Units (Arabic numerals)

Dry compact dusty sand with gravel lenses (Unit I) - Disturbed

Dark grey (7.5YR1.7-2/2) humic layer rich in charcoal (Unit II)

Upper part of mottled transitional zone (7.5YR2/1-5/6) (Unit III)

Lower part of mottled transitional zone (primarily 7.5YR5/6) (Unit IV)

Light brown (7.5YR7/4) compact sand (Units V & VI)

Reddish yellow (7.5YR7/6-6/6) compact sand becoming gravelly with depth (Units VII-IX)

Strong brown (7.5YR5/6) weakly cemented gravelly sand with sandstone fragments (Unit X)

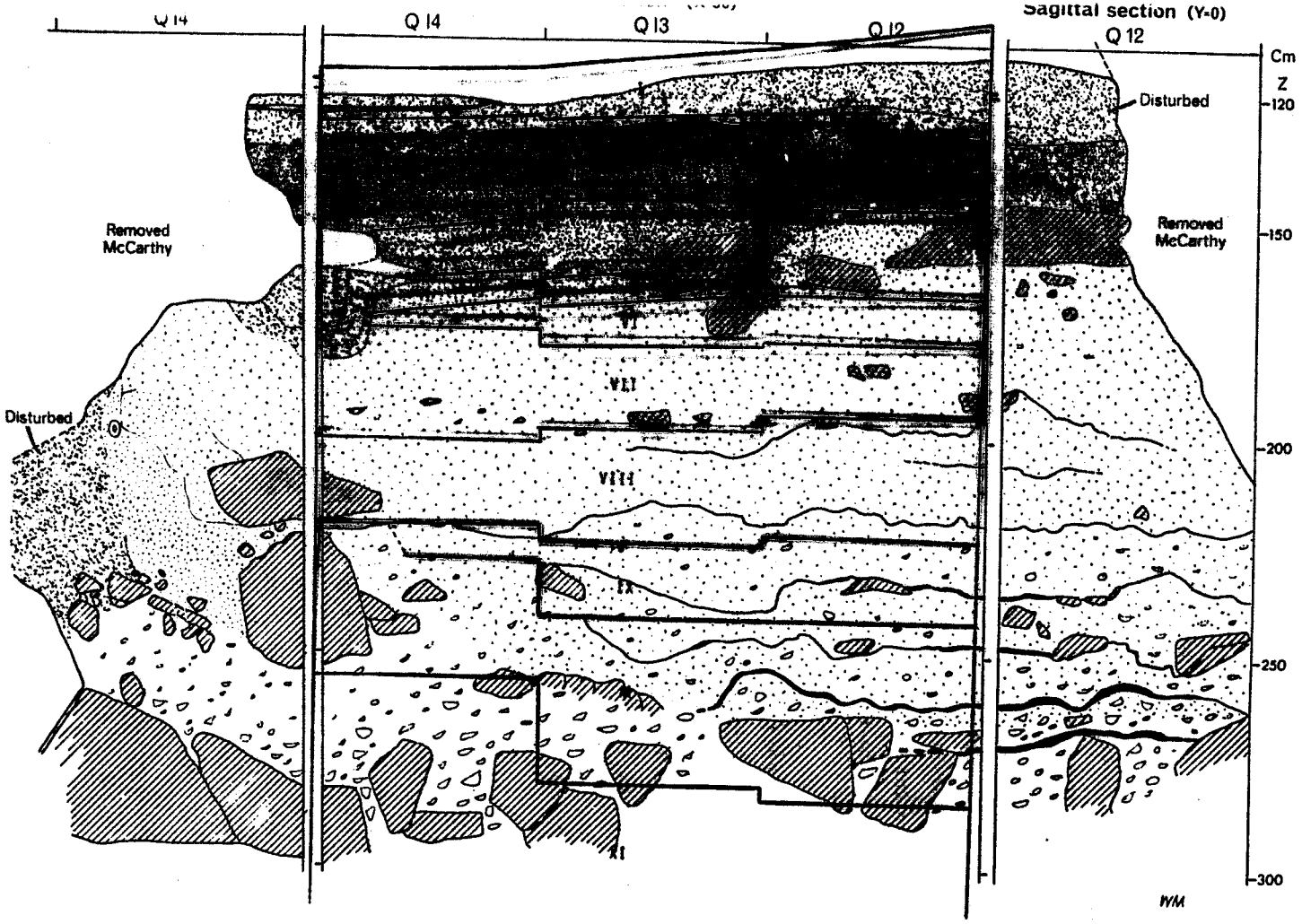
Light brown (7.5YR6/4) cemented gravelly sand with numerous sandstone fragments (Unit XI)

Clay band

Sandstone fragment




Fig. 28 Capertee site 3 : stratigraphy of the North excavation


Q 14
Q 14
Q 13
Q 12
Sagittal section (Y-0)
Q 12
Cm
Z
120
150
200
250
300
Disturbed
Removed
McCarthy
Removed
McCarthy
Disturbed
VI
VII
VIII
IX
XI
WM

into Analysis Units (Roman numerals) is detailed in Appendix VI, together with approximate depths for the unit midpoints referenced to the in situ surface at the centre of Q13. The following Analysis Units were distinguished:

Unit I Beneath the loose, lensed material of McCarthy's spoil heap one encounters a compacted surface of darker deposits. I now consider this unit to be disturbed, for a number of reasons which I shall detail later. Unit I contains a lot of charcoal and is dry and sandy with scattered gravelly patches.

Unit II Tnis unit is a compact dark grey (7.5 YR1.7/2 to 7.5 YR2/2) humic layer with many roots and much charcoal. It is clearly distinguishable from the overlying unit I by its moist, humic and very firm texture. lt is surprisingly poor in artefactual material (see later).

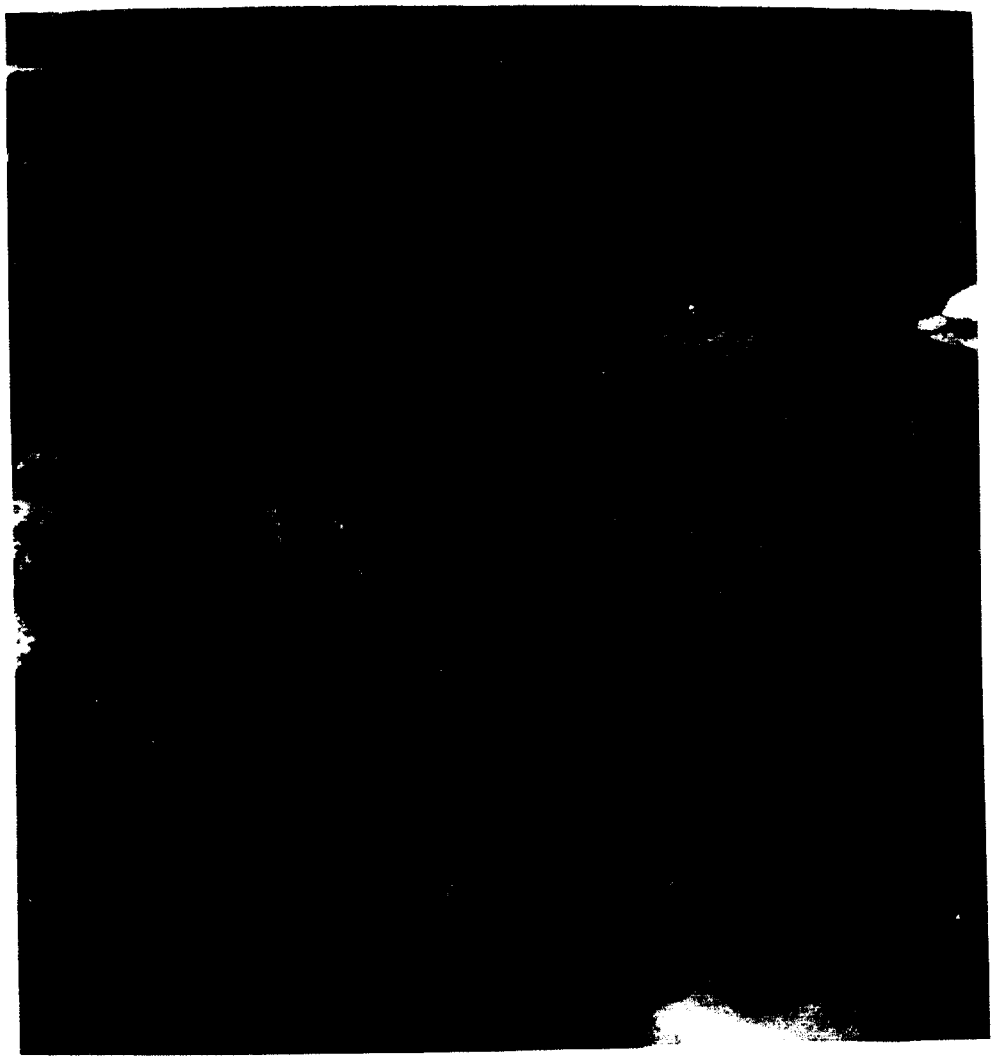
Unit III The junction between unit II and unit III is less clear than that between units I and II because the transition is primarily one of a reduction in humic and charcoal content. Unit III is the upper part of the transitional layer between the dark material of unit II and the 'clean' light-coloured sand of unit V and is therefore by nature diffuse. Unit III is mottled, 7.5 YR2/1 tending towards 7.5 YR5/6, and artefactual material is abundant, though less so than in the underlying unit IV.

Unit IV This unit is the lower part of the mottled zone, tending towards brown (7.5 YR5/6) in colour and containing the main concentration of Bondaian material. Its lower limit is fairly easily defined in section, though difficult to define in plan, and appears to be marked by the presence of moderate sized rocks in Q12 and Q13. Within the limits of the small area excavated there is no way of telling whether these rocks formed part of a structure or are purely natural. They do not appear to have been burned.

Unit V This unit is the upper unit of the 'clean' sandy deposits which form the lower part of the Capertee sequences. It is an evenly coloured light brown (7.5 YR7/4) smooth-textured compact sand. The artefact concentration is considerably lower than in the overlying unit IV, and the mean weight of artefacts (0.4gm) is half that in units IV and III (0.8gm). I am tempted to interpret unit V as a zone of downward drift of artefacts from the peak concentrations of unit

Plate IX Capertee 3 - North Section 1978
(Squares Q12-Q14 and R13 column sample)

The dark organic-rich upper levels of the in situ deposits are overlain by lighter coloured spoil from McCarthy's excavation. Note the concreted rubbly basal deposits dipping from Q14 towards Q12 (left to right of photograph) and the otherwise generally undifferentiated stratigraphy. The scale is divided in 20cm intervals.



IV, an interpretation which I would also apply to unit VI which has an even smaller mean artefact weight and which contains one or two tiny backed implement fragments.

Unit VI I have called this unit a 'transitional' unit between the upper Bondaian units (I-V) and the lower Capertian units (VII-X). It is characterised by a low mean artefact weight (0.3gm) and low artefact concentrations. It contains a few very tiny backed and redirecting fragments. I see this unit as being a zone of small artefacts which have moved up or down from adjacent zones of high artefact concentration. It also represent the zone of uncertainty for the appearance of the Bondaian industry.

Units VII-IX These units represent the peak concentrations of Capertian material. Their distinction is based primarily on changes in artefact concentration (see backplot in fig. 33 and histogram in fig. 35). There is a progressive increase in the proportion of small sandstone fragments towards the base of unit VIII, a trend which continues from there downwards. Deposits of reddish clay on artefacts and sandstone fragments, first appearing towards the base of unit VII, become thicker and more frequent in the units below this. The clay can be seen as continuous wavy bands in the section (fig. 28, compare with similar banding visible in the stratigraphy for Freshwater Creek 1, appendix I). These bands become progressively thicker with increasing depth. In unit IX both sandstone fragments and artefacts have large cemented accretions of clay and carbonate adhering to them. The colour of these units is reddish yellow (7.5YR 7/6-6/6).

Unit X This is a zone of decreasing artefact concentration consisting largely of sandstone fragments in a weakly cemented matrix. Most of the artefacts and sandstone fragments have clay and concretions adhering to them and the clay bands can still be followed in the section. The clay bands are roughly horizontal and up to a couple of centimetres thick. The matrix is a strong brown (7.5YR 5/6).

Unit XI This is the practically sterile cemented and weathered basal rubble. The clay bands are still present and approximately horizontal in trend (unlike the unit XI/unit X transition), but cannot be followed in the section (hence the dotted continuation of the lowermost band into the basal talus zone in fig. 28). This unit slopes steeply from Q14 down into Q12. There is a slight change in colour

towards light brown (7.5YR 6/4). A few very small flakes are found in the uppermost part of this unit.

Column sample analysis

A column of samples, each approximately 20 cm square by up to 5 cm thick, was removed from the section at the end of excavation. Mean sample weight was 3.3 kg, and the samples were returned to the laboratory unsieved. The location of the column is shown on fig. 21. It will be referred to subsequently by its square identifier, R13. Processing of the samples proceeded as follows, illustrated by the flow diagram in fig. 29.

1. A 20cc sub-sample of the sediment was collected in a plastic vial. Care was taken to make these sub-samples as representative as possible by spreading the bulk sample on a plastic sheet and taking spoonfuls from several parts of the deposit, avoiding large pieces of gravel as far as possible. These sub-samples were retained for determinations of organic and humidity content, chemical analysis, colour comparison or pollen analysis if required.

2. The samples were air-dried in shallow cardboard boxes in a drying cabinet for one day. As the samples were already fairly dry and sandy in texture this was sufficient for initial sieving to eliminate the gravel and coarse sand fraction (1 mm and above). It was not considered worthwhile to systematically determine humidity content of the material. However, a number of determinations were made on the 20cc sub-samples, the results being shown in table 9.

3. The samples were hand-sieved on a 4 mm mesh granulometric sieve and the residue was sorted for artefacts, faunal material and charcoal. This step was included for two reasons:

    1. to avoid damage to artefacts etc. during the mechanical sieving process. Note that the sieve mesh used is the same as that on which the artefactual material from the rest of the excavation was sieved before analysis, so the results from the column sample and other squares are comparable .

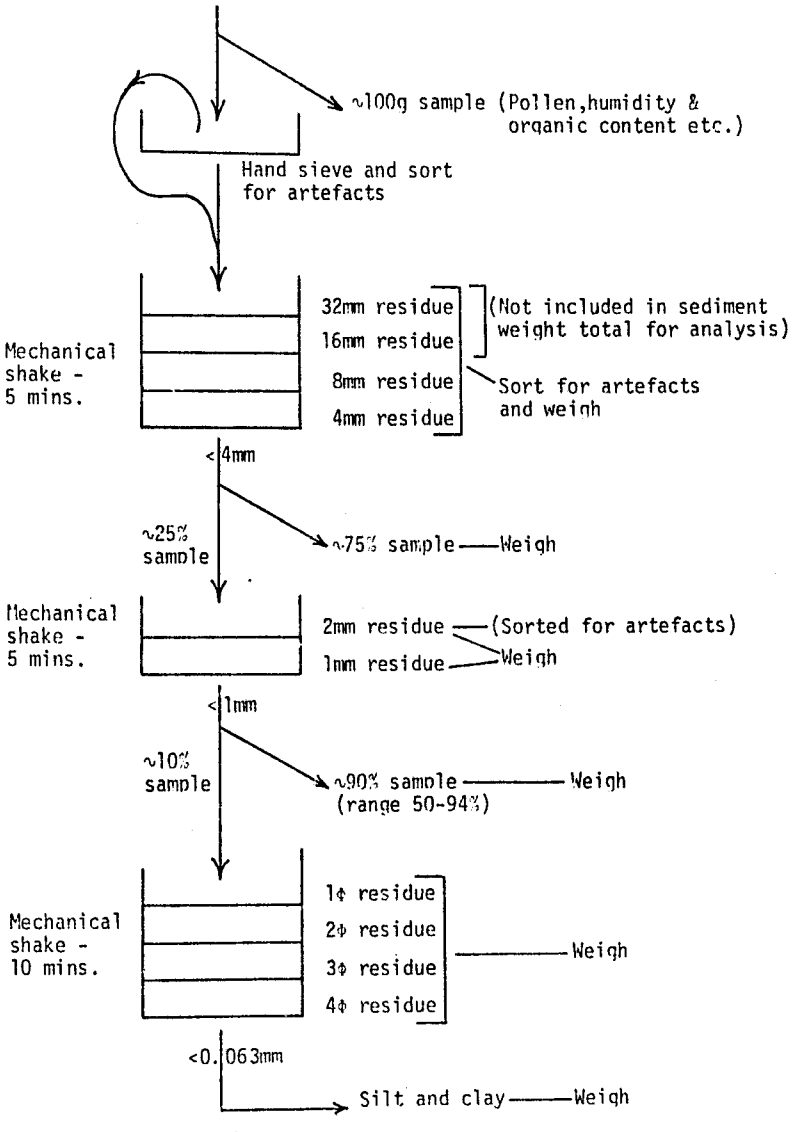



Fig. 29 Capertee site 3 : flow diagram of column sample analysis

2. the smaller granulometric sieves cannot handle large quantities of sediment, nor are large quantities required for the analysis. Since at least 80% of each sample falls below 4 mm diameter, this fraction required splitting before analysis. On the other hand, the complete sample was needed for the analysis of the fraction above 4 mm, particularly as far as the artefactual material is concerned.

4. The residue in the 4 mm sieve was shaken for 5 minutes (graduation 6.5 on Haver and Boecker shaker) on a stack of granulometric sieves of 32 mm, 16 mm, 8 mm and 4 mm mesh diameters (5.0-2.0 phi). The residue in each sieve was sorted again for artefacts e.g., and weighed.

5. Material which passed through the 4 mm sieve in either the hand sieving step (3) or mechanical sieving step (4) was combined and split into two fractions (75% and 25%) using a two-way sample splitter. The 75% fraction was weighed as a check that splitting had been carried out correctly (determined by comparison with the residue weights for the 25% sample).

6. The 25% sample of material less than 4 mm was shaken for 5 minutes (same setting as above) on 2 mm and 1 mm sieves. The residues were weighed and bagged separately for subsequent sorting for artefactual material.

7. The material which passed through the 1 mm sieve was air-dried for a further week, split further as required to avoid overloading or clogging of the sieves, and sieved on 0.5, 0.25, 0.125 and 0.063 mm sieves (10 mins, setting as above). The residues were weighed.

The sediment size classes thus determined are as follows:

Minimum Diameter for Class After Hughes 1977 Table 2.1

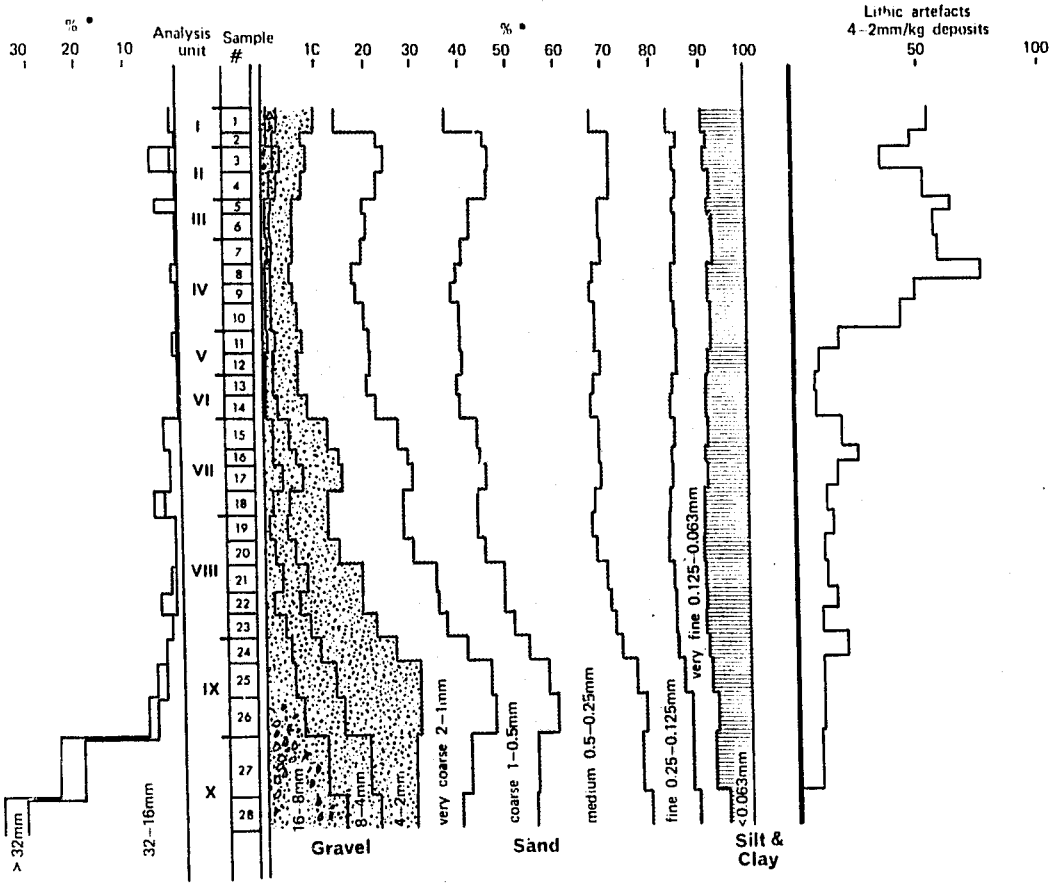
| mm | phi | | |
|---|---|---|---|
| 32 | -5 | Gravel | 100% analysed |
| 16 | -4 | | |
| 8 | -3 | | |
| 4 | -2 | | |
| 2 | -1 | Very coarse sand | First sub-sample (25% analysed) |
| 1 | 0 | | |
| 0.5 | 1 | Coarse sand | Second sub-sample analysed |
| 0.25 | 2 | Medium sand | |
| 0.125 | 3 | Fine sand | |
| 0.063 | 4 | Very fine sand | |
| <0.063 | | Silt and clay | |

All fractions down to 4 mm mimimum diameter were sorted for artefactual and faunal remains, whilst artefactual remains in the 2 mm sieve residue were counted but were not extracted from the residue.

The artefactual material collected was divided into two fractions, retained respectively in the 4 mm sieve (or above) and the 2 mm sieve. Observation of what little artefactual material remained in the sieves for the mechanical shaking (step 4) did not show fractures likely to generate chips in the 2-4 mm range, so the 2-4 mm fraction can be considered as uncontaminated by fractures occurring during processing.

Discussion of column sample analysis results

The results of the grain size analysis of the R13 column sample are plotted on figs. 30 and 31. The first of these diagrams is a conventional percentage representation histogram with the vertical scale plotted as the depth below the surface of unit I and divided into excavation (sampling) units and analysis units. The second diagram is a three end-member textural triangle for the gravel (16-2 mm), sand (2-0.063 mm) and mud (silt and clay) fractions. This diagram has been divided up into textural zones according to the system proposed for a sand-silt-clay textural diagram by Link (1966). Broadly speaking units I-VII fall in the 'sand' zone and units VIII-XI in the 'gravelly-sand' zone. The modal size of the sand fraction is medium sand. I have adopted the present system of terminology because



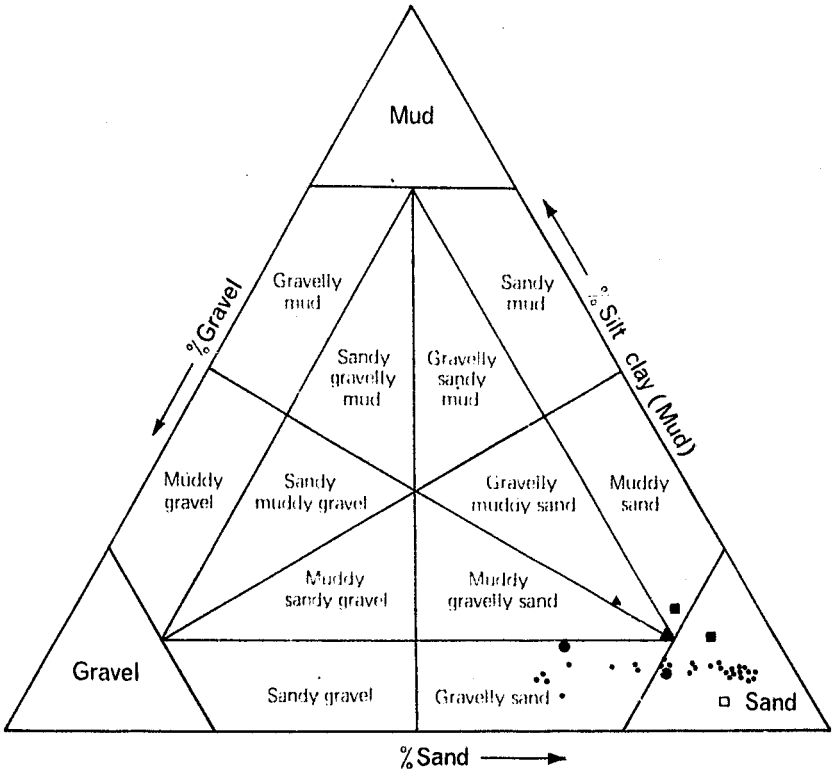

• Percentages are calculated excluding sediment particles retained in the 16mm sieve and above

Fig. 30 Capertee site 3 : granulometry of R13 column sample

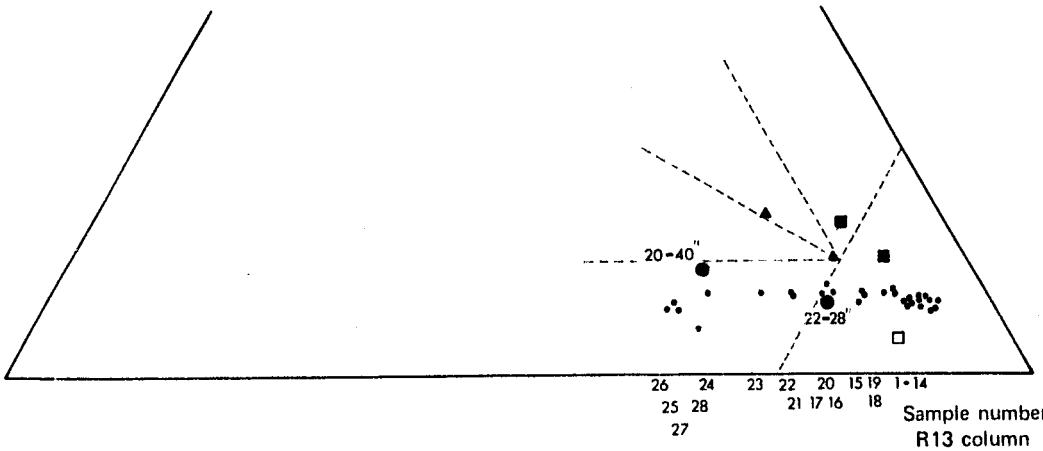
I feel that it gives a better description of the observed textures than the four end-member terminology used by Hughes (1977). In the latter system, all the sediments would be termed silty-clayey or clayey-silty gravelly-sand. In addition the present system is applicable where gravel is an important component and silt and clay have not been separated and is thus more useful in archaeological situations where sedimentological analysis has not been a prime concern of the project.

The main feature of the percentage and textural diagrams is the almost constant proportion of mud (silt + clay) and the finer sand fractions for much of the sequence. The fall off in the finer fractions for units IX and X reflects a rise in the coarse gravel fraction rather than a depletion in the finer sand or the clay + silt fraction. This constancy of the finer sediment fractions argues strongly for a situation of steady aggradation without periods of erosion. If erosion had occurred we would expect levels with a depletion of the finer sediment fractions. The vertical resolution of the individual samples is sufficiently fine that we can reject the suggestion that major deflation events exist within samples but are smoothed out by poor resolution. This is a particularly important observation, since some of the clay bands visible in the stratigraphy of the North excavation (fig. 28) appear to be related to concentrations of artefacts visible on the backplot (fig. 33) and might otherwise have been interpreted as deflation events. The scale of the artefact concentrations is certainly sufficient to overlap several of the samples.

I believe, therefore, that we are justified in stating that the artefact concentrations observed at different levels in the North excavation are not deflation events but represent varying intensity of artefact deposition in relation to sediment deposition. Whilst the clay bands are mostly too thin to contribute significantly to the granulometric results for the sample containing them, their apparent association with the artefact concentrations suggests that they may either be generated as a result of human occupation or represent post-depositional soil formation with the separating out of clay at a level defined by the compaction of the deposits by human occupation. These hypotheses might be tested by thin-section analysis. As mentioned above, I was unable to get these particular thin-section




3 end-member system adapted from Link 1966




Data from Walker 1964, except column sample

- □ Rock, Shelter 3
- ▲ Talus
- ■ Pediment
- ● Cave floor
- • R 13 column sample

Gravel 16 - 2mm  Sand 2 - 0.063  Mud < 0.063mm

Fig. 31 Capertee site 3 : textural diagram for R13 column sample

samples impregnated and sectioned.

Humidity and organic content

Table 9 shows the results of determination of the humidity and organic content at different levels in the column sample. Humidity content was determined on 50gm samples from the change in weight when air dried for two weeks. Organic content was determined by the loss on ignition of 3gm samples heated for 1 hour to 650°C; the samples used were in the condition in which they were collected so the loss is made up of the organic component plus the humidity component.

Humidity content was determined for a selection of samples and was generally low, the highest value being 1.5% for sample 4 situated in unit II. Humidity content decreases progressively with depth, a correlation which I believe to be largely a function of water retention associated with the higher organic content and finer sediment matrix in the upper levels. Unit I is an exception to this general trend, having only a third of the humidity content of unit II. Whilst this may be partly a function of surface drying, it should be noted that the column was protected by McCarthy's spoil layers until shortly before its excavation.

Unit I with 2.5-3.5% organic content is also an exception to the general trend, which falls from 5.5% in unit II through 3.5% in unit III to approximately 1% in the lower part of unit IV and below. The residual 1% loss on ignition for all samples to the base of the column is probably a combination of both leached organic acids and dehydration of the clay content of the samples. It can therefore be taken as a baseline in determining the primary organic content of the upper samples, i.e. the organic component remaining after the degradation and leaching of the organic material originally deposited. The remaining primary organic component falls from approximately 4.5% in unit II to near zero by the middle of unit IV. Decay of the original organic content in this area (outside the dripline) is therefore more or less complete in less than 2000 yrs (see later discussion of dating).

The lower organic and humidity content of unit I as compared with unit II confirms my field observations that unit I is less rich in finely divided organic matter and much drier than unit II owing to its

| Analysis unit | Excavation unit | Loss on ignition(%) | Humidity(%) | Estimated organic content[1] (%) |
|---|---|---|---|---|
| I | 1 | 3.2 | 0.5 | 1.5 |
| | 2 | 4.1 | | 2.5 |
| II | 3 | 7.0 | | 4.5 |
| | 4 | 6.9 | 1.5 | 4.5 |
| III | 5 | 5.0 | | 3.0 |
| | 6 | 5.2 | | 3.0 |
| IV | 7 | 3.6 | | 1.5 |
| | 8 | 2.6 | | 0.5 |
| | 9 | 1.9 | 1.0 | - |
| | 10 | 1.8 | | - |
| V | 11 | 1.5 | | - |
| | 12 | | | - |
| VI | 14 | 1.5 | | - |
| VII | 16 | 0.7 | 0.2 | - |
| | 18 | 1.5 | | - |
| VIII | 20 | 0.9 | | - |
| | 22 | 1.1 | | - |
| IX | 24 | 0.9 | | - |
| | 25 | - | undetectable | - |
| | 26 | 0.9 | | - |
| X | 27 | 1.0 | | - |
| | 28 | 0.8 | | - |

[1] Loss on ignition less estimates for humidity content and clay dehydration + leaching humus (1%)

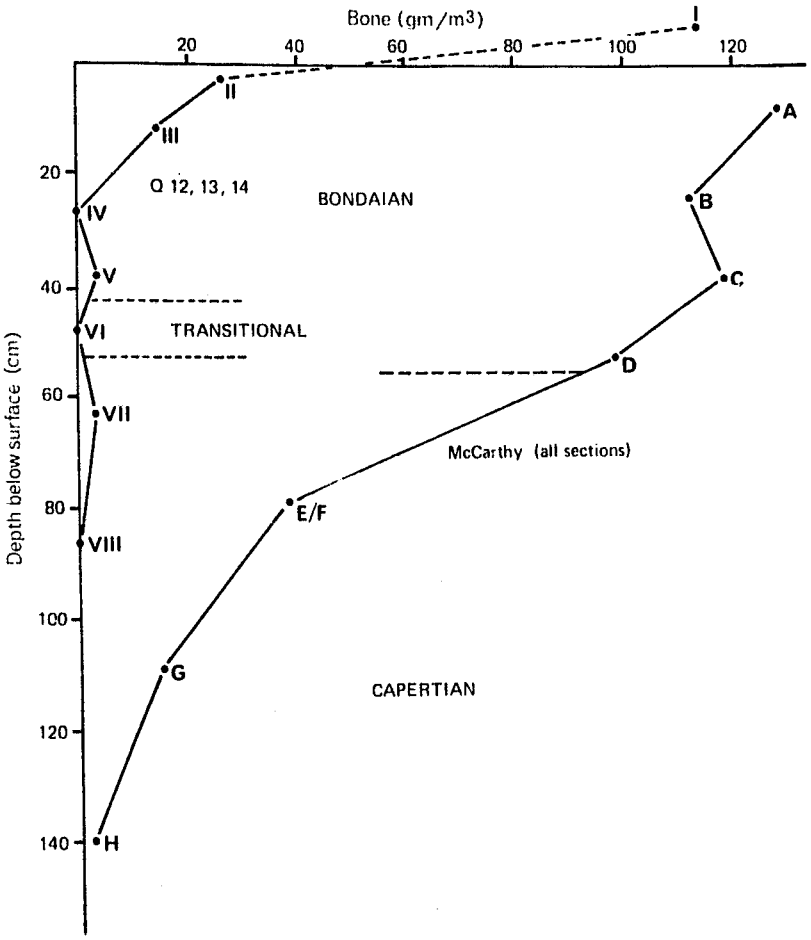
Table 9 Capertee site 3, R13 column sample : humidity and organic content

looser texture and lower organic content. On the other hand, unit I is as rich or richer than unit II in terms of charcoal fragments. This I believe fits well with the hypothesis that unit I is spoil derived from McCarthy's excavation, since sediment derived from the upper levels within the shelter might be expected to be rich in charcoal but poor in decaying vegetation (shelter floors in the area generally support little or no vegetation but are rich in scattered charcoal from bush and camp fires).

The progressive decay of organic materials is apparent in the fall off in bone recovered (fig. 32). This trend is not paralleled by the lithic remains, whose peak concentrations occur below the fall off point for organic materials in the lighter coloured 'clean' units. McCarthy found a similar situation, with a surficial 'dark grey ashy' layer ranging up to 24" (60 cm) thick, and a 'buff coloured sandy soil' below this. In the main body of the shelter deposits, under the protection of the overhang, McCarthy found 'hearths' preserved down to a depth of 84" (210 cm), particularly in a 'large pit of grey ashy soil, which lightened in colour towards the bottom, apparently constituted a traditional and long used fireplace...to a depth of 54" [135 cm]' (McCarthy 1964:199), at the rear of the shelter (see fig. 23). In my excavations, charcoal and ashy or humic stains persisted to a much greater depth in K - L 20 and 21 than in Q12-14. Without direct comparison of the stratigraphy and deposits inside and outside the shelter it is impossible to say whether the persistence of ashy features to a considerable depth is merely a function of preservation. However, the most likely explanation lies in a combination of preservation and the situation of hearths within the sheltered area rather than in front of it.

Thin-section samples

In order to verify my interpretation of unit I as being disturbed material I took block samples from two places in the sections of the North excavation for thin section analysis (cf.Catt and Weir 1976:57-9). These samples span respectively the transition from obvious spoil layers to unit I and from unit I to unit II. John Magee, Biogeography and Geomorphology, ANU, kindly had these samples thin-sectioned and provided me with the following information.




Figures for bone concentrations supplied by Ken Aplin

Fig. 32 Capertee site 3 : vertical distribution of faunal remains

Unit II contains some reworked cemented aggregations of quartz particles but is certainly in situ. It shows poorly developed bedding in the form of concentrations of very fine sand, clay particles and organic matter. These concentrations are being actively destroyed by rootlets which appear to preferentially follow them. Unit I does not have a structure of this sort, organic material and charcoal fragments being scattered throughout, together with reworked soil material (pedorelics). Though we cannot say on this evidence that unit I is disturbed, such an interpretation is entirely compatible with the observations. The spoil levels overlying unit I are more closely packed than units I and II, despite the field observation that unit I was more compact than the overlying spoil. However unit I appears to contain more fine-grained material than the overlying spoil, which may well account for the former's firmer texture.

Bone

Bone is almost equally distributed between the first four spits of McCarthy's excavation, i.e. down to a depth of 24" (60 cm) (see fig. 32). Similar bone concentrations were found only in unit I which, as I have noted above, is probably a disturbed feature derived from the areas excavated by McCarthy. There is a fall off from scattered bone in units II and III to almost none in units below this, a much more rapid decay of bone than that observed in McCarthy's excavation. This conclusion is accentuated if we look at the figures for McCarthy's sections 9, 10 and 12, being those nearest Q12-14, for which the peak bone concentrations are in the 18-36" (45-90 cm) depth range (Aplin, pers.comm.) One should of course bear in mind that the long-term preservation of bone is probably stressed in McCarthy's excavation by the collection procedures used; I suspect that if bone was rarer in the lower spits, a greater effort would have been made to pick out bones from the sieve than in the upper spits. It is very difficult to say exactly how the bone was sampled - for example, no bone at all is present from some of McCarthy's sections, whereas adjacent sections have large amounts of it.

Only one of the five identifiable bone fragments from Q12-14 exceeded 0.2gm. It is probable that, even wet sieving, small teeth or tooth fragments would have been missed owing to their similarity in appearance to rounded quartz fragments. The mean size of the bones

collected from McCarthy's excavation is several times that for Q12-14 (see table below) so we can estimate very roughly that at a maximum only about 20% of potentially identifiable bones were collected. My feeling is that this is probably a very conservative estimate.

| | McCarthy | Q12-14 |
|---|---|---|
| Number of bone fragments[1] | 2106 | 105 |
| Wt of bone recovered (gm)[1] | 1736 | 10.9 |
| Mean wt of bones (gm) | 0.8 | 0.1 |
| Area excavated (sq.m.) | 17.5 | 0.7 |
| Bones recovered/sq.m. excavated | 120 | 150 |
| (in gm) | 99 | 16 |

(1) Figures provided by K. Aplin

It can be seen that, although McCarthy's mean bone fragment weight is several times that for my excavation, he recovered nearly as many bones per square metre excavated. This implies that bones were considerably more common in the area excavated by McCarthy as compared with the dripline area Q12-14. It should be noted however that this conclusion is based on a rather small sample in the present excavations (n=105).

I have noted earlier that the small amount of scattered charcoal observed in Q12-14 and the large areas of ashy deposits and hearths observed by McCarthy in the shelter probably represent the preferential situation of hearths within the shelter rather than a simple preservation phenomenon. However, the Capertian levels in square Q12-14 contain a higher proportion of fire-crazed specimens than any of the KLMNO squares or than McCarthy's collection. The latter may be simply a function of selection (fire-crazed specimens tend to be shattered into irregular chunks which would not have been collected in McCarthy's excavation). However, if we accept that fires were probably situated within the shelter, it becomes a likely hypothesis that at least a proportion of the artefacts in Q12-14 were derived from within the shelter.

ARTEFACTUAL SEQUENCE

Owing to the exposed nature of most of the deposits excavated, my excavations yielded very little bone. I am therefore largely concerned with the lithic sequence of the site which McCarthy characterised as consisting of two phases, an upper Bondaian phase and a lower Capertian phase. My excavations broadly confirmed this sequence.

For the analysis which follows I have treated the Capertian and Bondaian without subdivision, except when discussing the vertical distribution of material in the North excavation. Equally, the more detailed analyses apply only to excavation square Q13. I have chosen these restrictions for the following reasons:

1. My requirements for the present thesis were a methodological demonstration of the recording system proposed in chapters 7 and 8 and confirmation of McCarthy's basic industrial sequence and dating. Both of these aims could be satisfied by a relatively low level of analysis.

2. The sequence observed in Q13 broadly duplicates that in the other excavated squares and the sample of artefactual material collected (approximately 25% of the total) is sufficient to define the general characteristics of the artefactual sequences.

3. Horizontal variation is an important factor in assemblage variability, so that any attempt at defining a more detailed artefact sequence would require a well planned and extensive sample of the site area; this could not be obtained owing to the marginal locations of the remaining deposits.

All data from my analyses have been recorded using the system described in chapters 7 and 8 and stored on magnetic tape. Copies of this tape will be lodged at the Australian Museum (together with the excavated material) and at the Department of Prehistory, ANU.

Vertical distribution of lithic artefacts

In McCarthy's excavations the Bondaian was found to be markedly richer than the Capertian, both in terms of absolute numbers of tools (and debitage where it was counted) and in terms of tool concentration

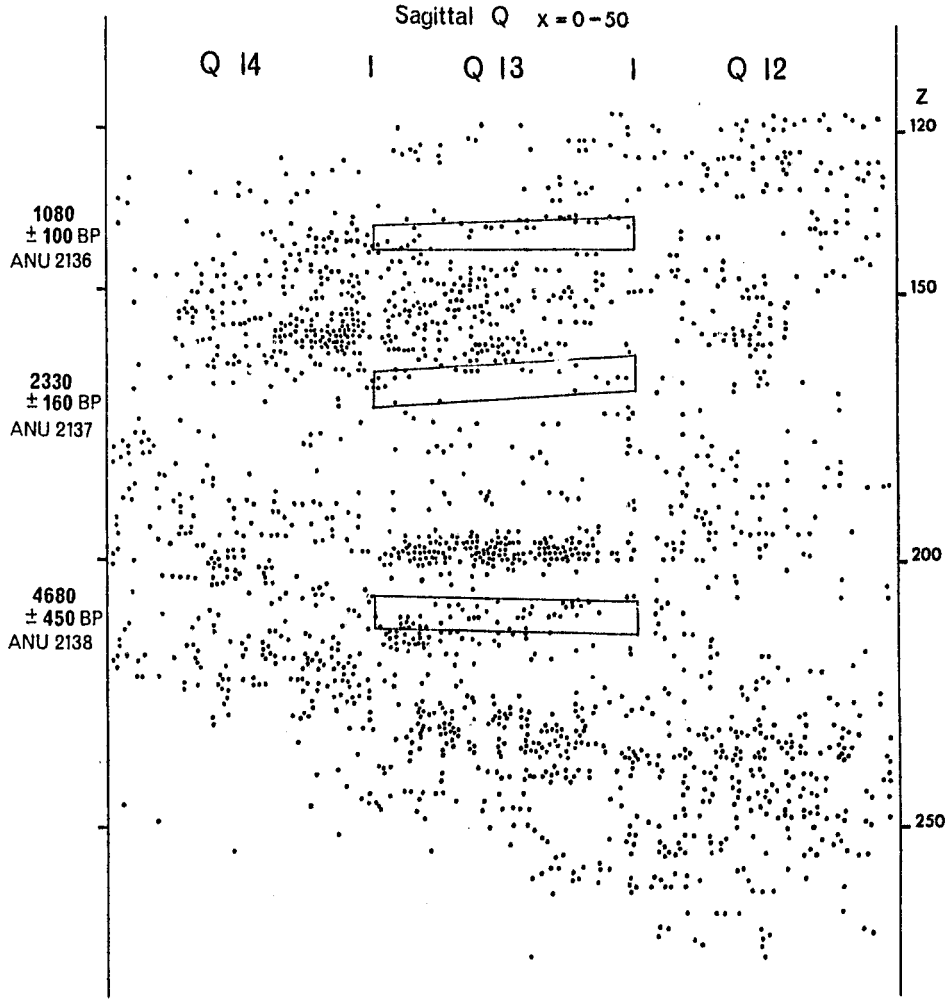



Fig. 33 Capertee site 3 : backplot of individualised finds, Q12 - Q14

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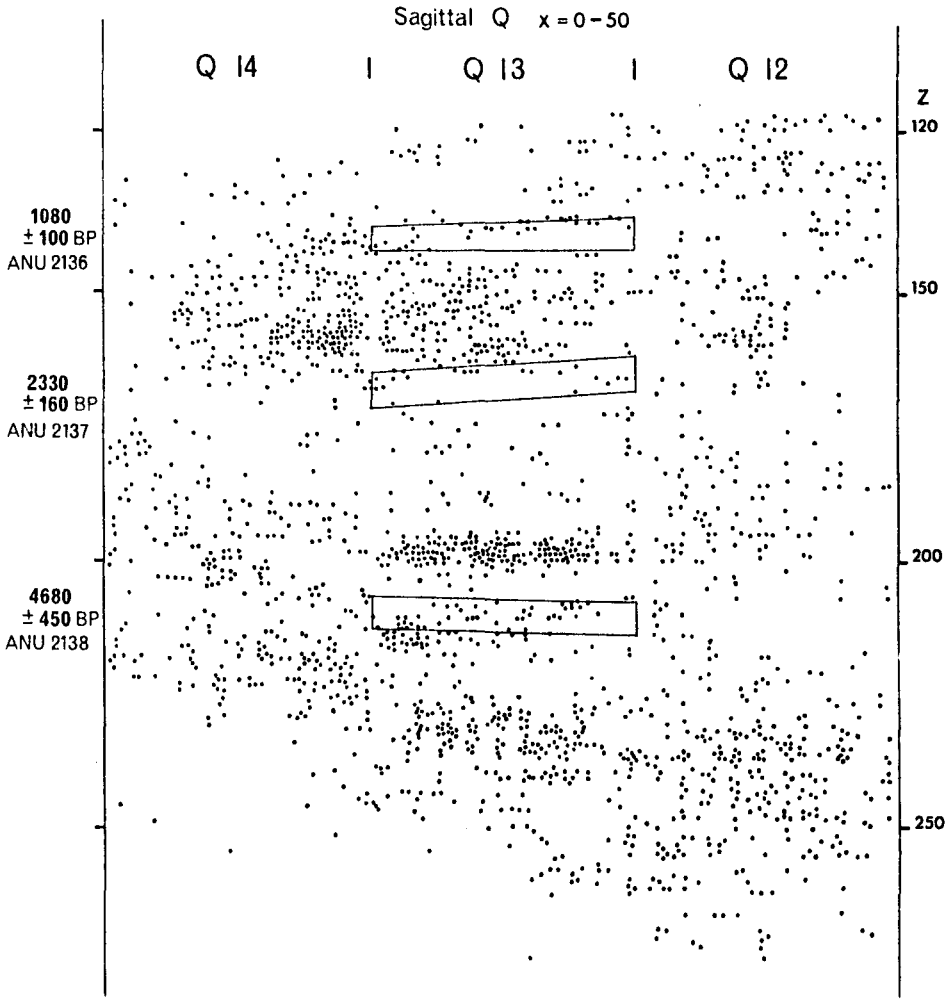



Fig. 33 Capertee site 3 : backplot of individualised finds, Q12 - Q14

indices. On average McCarthy found approximately 2.5 times as many tools in the Bondaian levels as in the Capertian levels, representing approximately five times as many tools per unit volume.

My results did not altogether duplicate this situation. Whilst the concentration indices were higher in the Bondaian than in the Capertian (see figs. 45,46), the difference was marginal for squares Q12-14 which yielded greater absolute numbers of artefacts in the Capertian levels (fig. 44). Of the squares along the west section Q21 which is situated, like Q12-14, just in front of the dripline showed the least disparity in concentration indices between the Capertian and the Bondaian. Whilst it would be risky to try and draw any conclusions from these results they may indicate a shift in the pattern of discard of lithic material between the two industries. This might warrant following up in other excavations to see whether it is a pattern specific to Capertee 3 or a repeated pattern (as I shall argue later for the concentration of lithic material in the vicinity of the dripline). Morwood (pers.comm.) has noted a similar shift in patterning at his Native Well site.

Fig. 34 shows the distribution of lithic artefacts by analysis unit for squares Q12-Q14 and R13. The most striking aspects of this diagram are the pronounced peaks in the Bondaian and Capertian units, separated by a unit (unit VI) of low artefact concentration. Unit VI has been termed transitional, primarily because the assemblage collected from it is too small to be characterised as belonging to one or other industry, but also as a buffer zone between the two industries. This relatively sterile zone was found throughout my excavations. Whilst this is an advantage in terms of reliably separating the Capertian and Bondaian assemblages, the lack of a large sample from excavation units in the 'transitional' zone renders their attribution to one or other industry rather difficult and thus hinders precise dating of the transition in my excavation. McCarthy also found peaks of artefact concentration in the two industries, but the existence of a practically sterile zone is masked by the problem of stratigraphic integrity of the excavated spits. Such a zone was however observed in McCarthy's excavation of Site 1.

A more detailed picture of the vertical change in artefact concentration is provided by the sequence for square Q13, plotted in fig. 35 as lithic artefact concentration (finds per kg of deposits)

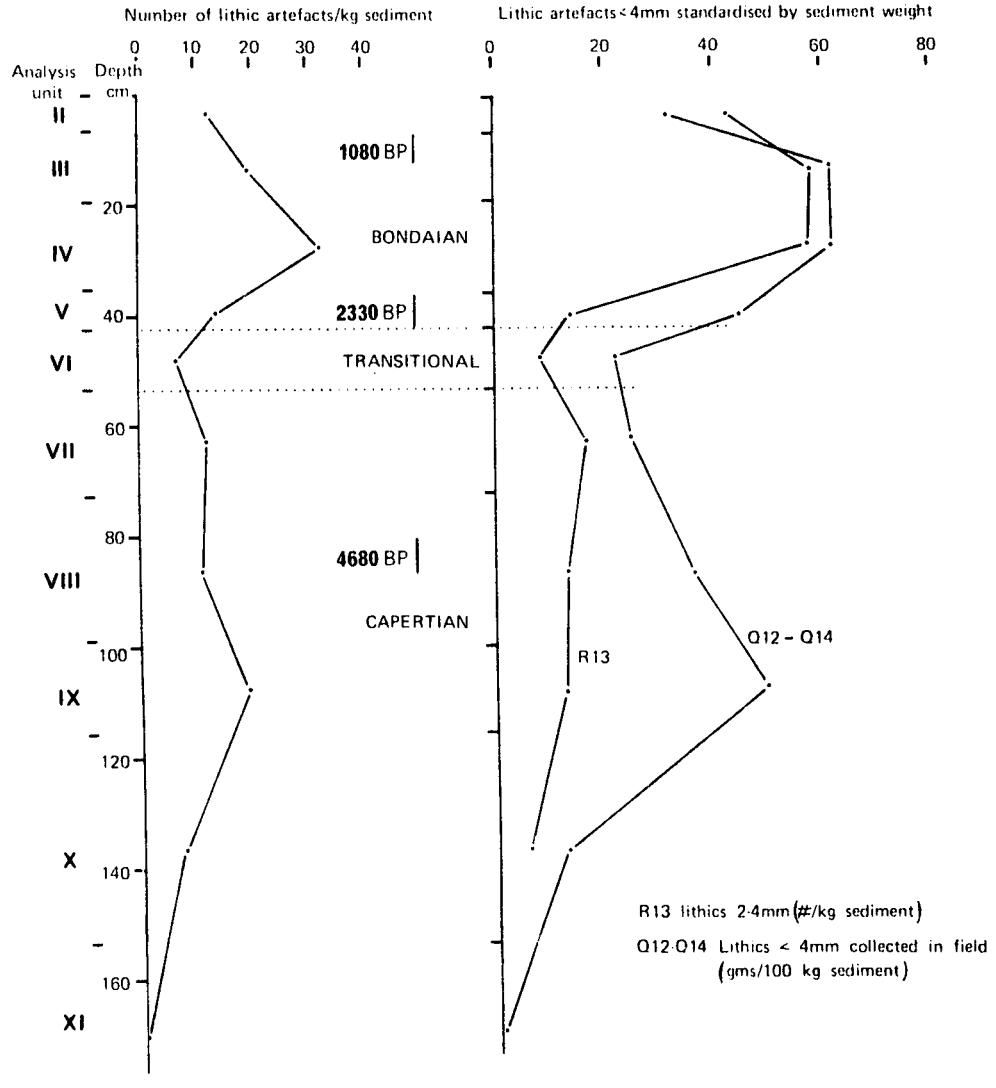



Fig. 34 Capertee site 3, Q12 - Q14 : vertical distribution of lithic artefacts

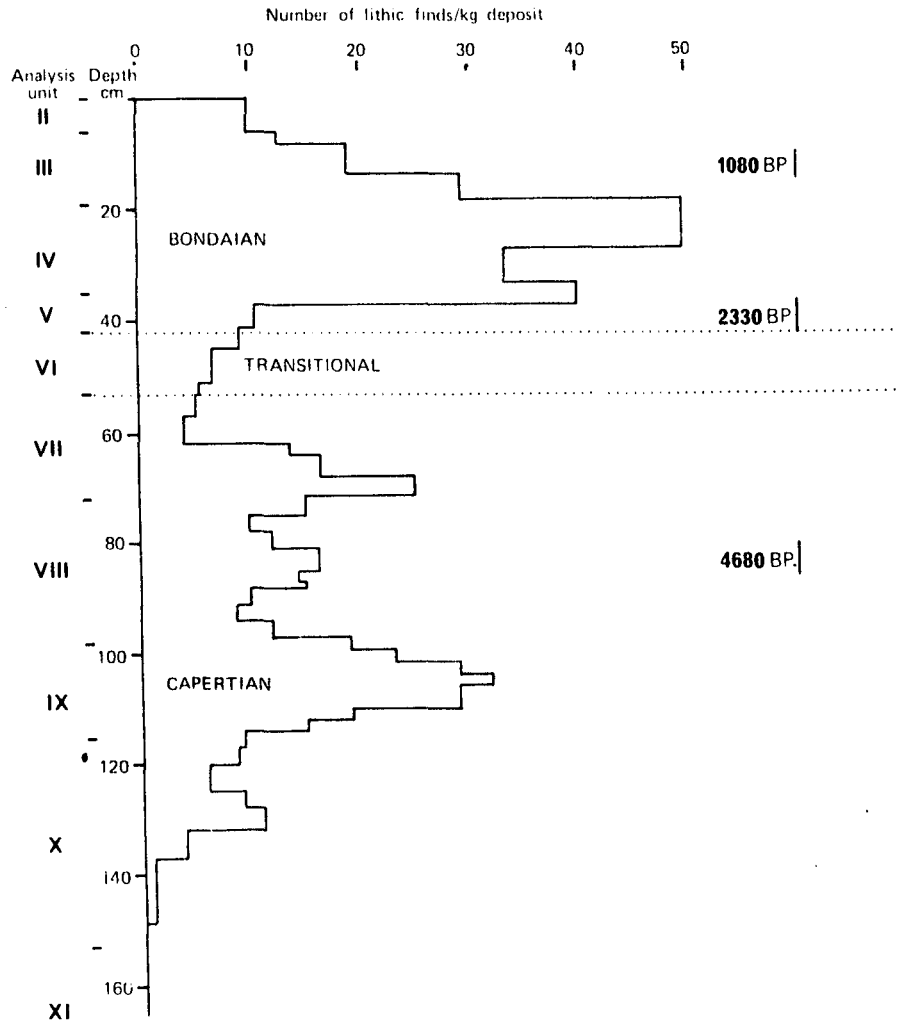



Fig. 35 Capertee site 3, Q13 : vertical distribution of lithic artefacts

for each excavation unit. On this diagram the Capertian can be seen as consisting of several peaks of artefact concentration. These peaks represent concentrations of artefactual material at particular levels which can be seen on the backplot for Q12-14 (fig. 33). However these concentrations are localised horizontally as well as vertically, so that they are not resolved on the diagram for the four squares Q12-14,R13. My feeling, based on subjective assessment of the excavated material, is that these concentrations of artefacts may each represent a small number of related events such as successive dumping of knapping waste in more or less the same place, together with some degree of post-depositional disturbance causing the concentrations to spread vertically.

Can these concentrations of artefacts be interpreted as dripline (deflation) features (cf. Stockton 1979) or are they direct artefacts of human activities? I have argued that concentrations of artefacts formed by deflation would be associated with a rise in the proportion of the gravel fractions in the sediment matrix. The individual samples in the R13 column sample are sufficiently thin (vertically) to resolve such a rise, yet the gravel fractions show a steady change without fluctuations and conversely there are no samples showing signs of depletion of fine sand or silt and clay. The absence of dripline deflation is also supported by the absolutely fresh and sharp nature of the vast majority of the lithic material. Only one or two pieces in these squares show rounding which might be due to erosional activity.

## Flaking technique and raw material usage

In excavating both the West and North excavations one encountered a practically sterile level after going through the peak concentration of Bondaian material. Below this sterile zone, artefact concentrations rose again and it was apparent that the material was more massive, less well flaked and lacking the specialised types of the Bondaian. The sharpness of the transition is accentuated by the fact that the first Capertian level encountered is characterised by chunkier artefacts than the levels below it, particularly in Q12-14,R13.

The presence of a relatively sterile zone between the last major Capertian horizon and the succeeding Bondaian occupation does not necessarily imply any out-of the-ordinary abandonment of the area.

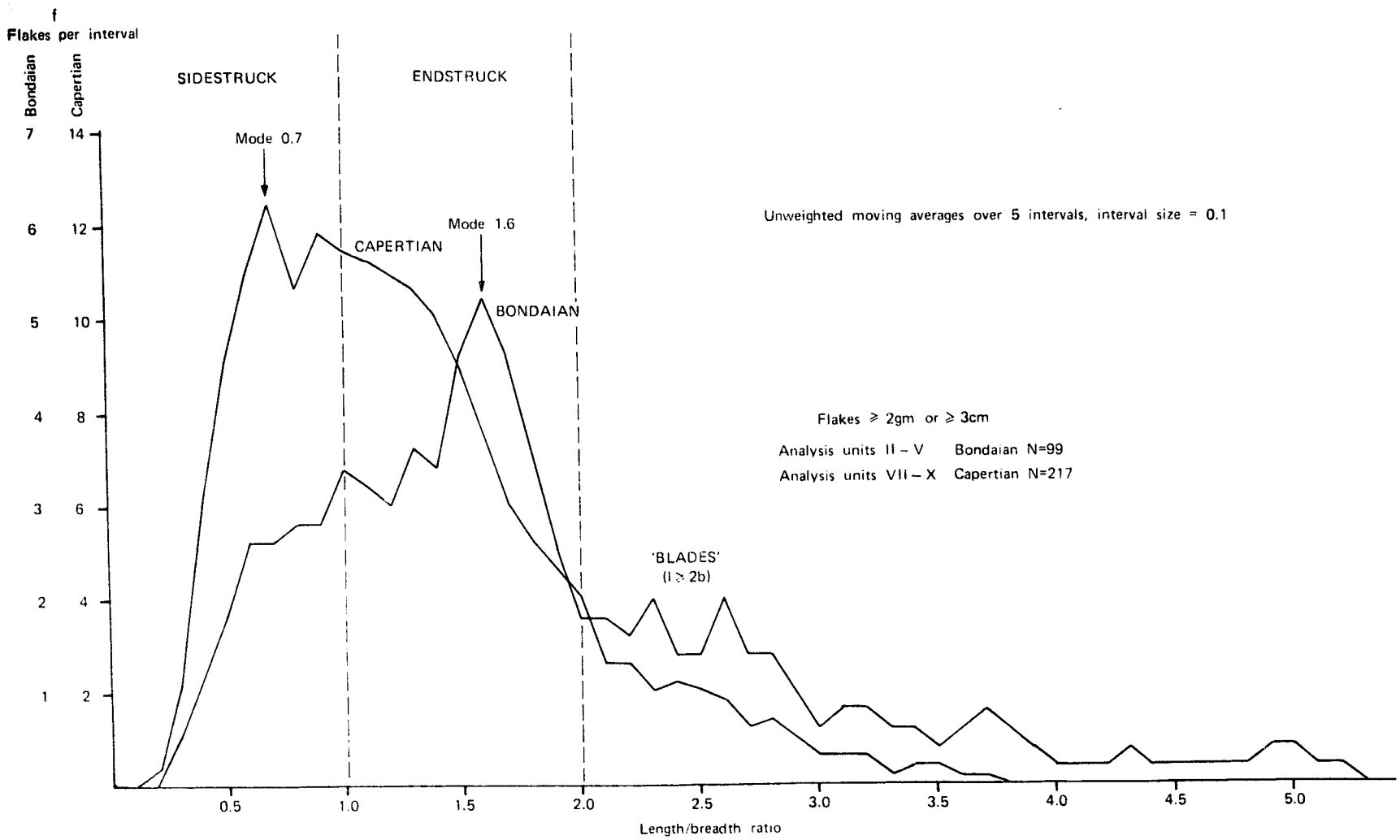



Fig. 36 Capertee site 3, Q13 : moving average graph of length/breadth ratios

There are two similar zones within the Capertian sequence and we may simply be looking at sporadic usage of the area. In the second place, McCarthy's dating suggests that any such abandonment was fairly short lived, since the Capertian is dated to 3623BP and the upper part of the Bondaian to 2865BP. The concentrations of material at particular levels may also reflect shifting patterns of site usage, so that any one part of the shelter was only used sporadically as a dumping or knapping zone. By extension of this argument, it is probably not very fruitful to look at changes within each of the two industries unless one is dealing with a fairly large excavated area, since any trends observed cannot be shown not to be localised and event-specific. In particular, there are two or three quite large series of flakes occurring together at particular levels in Q12-14 which appear to be the products of a single stone-knapping event. The influence of one of these alone could seriously skew the sequence observed. I have therefore restricted myself in the following discussion to treating the two lithic industries as separate units and analysing the differences between them. These differences are well above the level of variability within each industry, either spatially or through time.

Apart from the expansion in the production of specialised artefacts, the most striking change between the Capertian and the Bondaian lies in the general reduction in size of lithic waste, which tends to be more elongated and less chunky in the latter. The Capertian is characterised by large numbers of small shatter fragments which are largely absent from the Bondaian. These fragments are to some degree correlated with poorer quality raw materials, notably tabular cherts (grouped under gr nular cherts in table 10), which are largely absent from the Bondaian, but the difference may also arise from flaking techniques. In the Capertian large pieces of high quality white chert were worked to produce large well shaped flakes which have broad plane striking platforms. The unshattered cores indicate a similar technique and the production of fairly broad flakes. This sort of technique applied to material with incipient flaws would result in shattering of the cores.

In the Bondaian flaking techniques are more controlled and smaller in scale. At their best they result in the long triangular section redirecting spalls (fig. 40) so characteristic of this site and in well formed blades and blade cores. Flakes in the Bondaian are

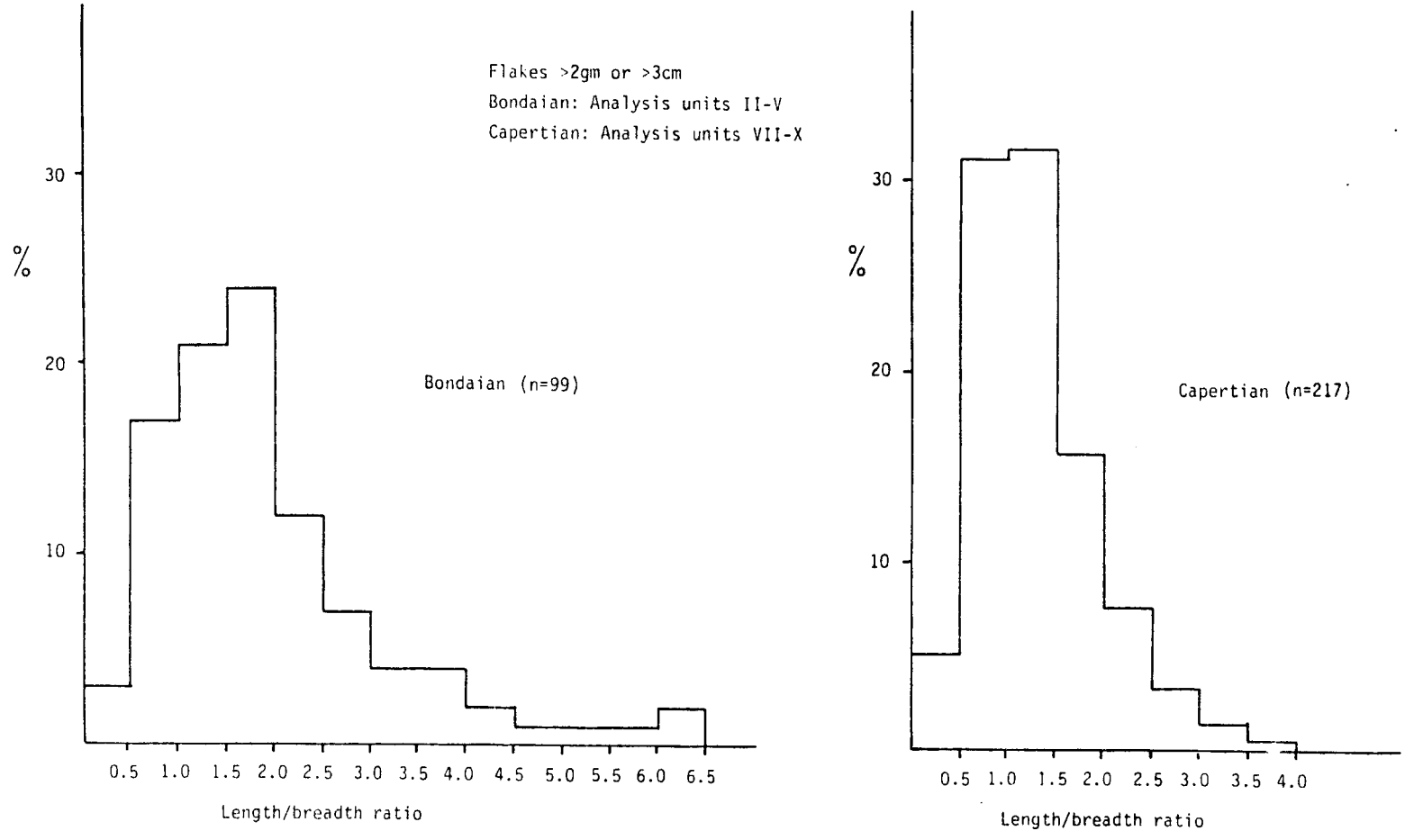



Fig. 37 Capertee site 3, Q13 : histograms of length/breadth ratio

generally more elongated and thinner relative to their width than in the Capertian. Although the makers of the Bondaian industry appear to have been more discriminating in their choice than were their predecessors, the range of raw materials used is similar in the two industries (table 10).

The change towards more elongated flakes is illustrated in fig. 36 which shows the distribution of length/breadth ratios for whole flakes in square Q13. The mode of this distribution falls in the sidestruck class (see glossary) for the Capertian and few flakes for this industry exceed a length/breadth ratio of 2:1. For the Bondaian the mode falls well into the endstruck class and a significant proportion of flakes fall into the blade category, with length/breadth ratios of up to 5:1. It should be noted that the distinction between the two industries has perhaps been emphasised by my method of measuring length and breadth (see appendix II).

I have included the graphs of distribution of length/breadth ratios for an extra reason, over and above the needs of my discussion of the Capertee artefactual sequence. It serves to illustrate both an exceedingly useful technique for the presentation of data (the use of a moving average) and the important role that can be played by the computer in allowing more sophisticated presentation of the data. I was able to prepare and draw both graphs in 35 minutes starting from a table produced by three lines of SPSS instructions. I would have required about twice as long to produce a simple histogram in intervals of 0.5 using a hand calculator and a reasonably well organised file of attribute data, and I might well not have attempted to produce a moving average graph without the computer output. For comparison I have included histograms for the same data (fig. 37).

Changes in artefact size

One possible explanation for the change from the Capertian to the Bondaian, with its attendant increase in specialised tool forms (see below), might lie in a shift from use of the site as a stone-working site to a living site with a broader spectrum of activities. In view of the universality of the Core Tool and Scraper/Small Tool transition in widely different geographical and environmental situations, I doubt whether many people would subscribe to such an explanation. I have

| Raw material | Bondaian | Capertian |
|---|---|---|
| Chert and jasperoid | 164 | 482 |
| Quartz | 4 | 22 |
| Quartzite | - | 26 |
| Other microcrystalline and granular cherts | 7 | 70 |
| Ferruginous sandstone | - | 10 |
| | 175 | 610 |
| Chert and jasperoid | 94% | 79% |
| Quartz | 2% | 4% |
| Quartzite | - | 4% |
| Other microcrystalline and granular cherts | 4% | 12% |
| Ferruginous sandstone | - | 2% |

Table 10 Capertee site 3, Q13 : raw material usage

spent many fruitless hours attempting to detect a systematic difference between the artefact size distributions of the Capertian and Bondaian levels, since any such difference might be examined in terms of either changes in activity or in knapping technique. The distribution of artefact size in the two industries is remarkably similar, the only systematic difference lying in the more extended tail of the Capertian artefact size distribution (i.e. there are relatively more very large artefacts in the Capertian).

In both industries the smallest size class (artefacts weighing less than 1gm) forms the bulk of the artefacts, with up to 90% of the total. For the one square (R13) in which I counted artefacts in the range 2-4 mm[1], more artefacts fell in this range than in the range 4 mm upwards (Total artefacts over 4 mm = 1544, artefacts 2-4 mm = 2080, the latter figure estimated from samples). It is apparent from the distributions shown in fig. 38 and the observation for R13 that there is a progressive rise in numbers of lithic artefacts with decreasing size, and I would postulate that this is the normal situation generated by lithic reduction and the trend would persist throughout the macroscopic size range. This points to the extreme importance of standardising sieve mesh sizes and sorting procedures if we are to make any inter- or intra-site comparison of artefact concentrations, 'waste':tool ratios etc. I should particularly like to stress the importance of sample purification by sieving the material collected, prior to laboratory analysis, through a slightly larger mesh than that used in the field (e.g. use of a 1/8th" mesh (5 mm) in the field and purification on a 4 mm mesh granulometric sieve in the laboratory).

The extended tail of the Capertian size distribution results from the presence of large, little-reduced chunks of stone, generally of poorer quality raw material. I cannot guess what the makers of the Capertian hoped to get out of these chunks which have had one or two flakes removed before being discarded, apparently without further use. The Capertian also contains large fragments and large well-shaped flakes of high quality raw material which are absent from the Bondaian

(1) The size ranges for this analysis are based on sieving through granulometric sieves (see sections on excavation procedures and column sample analysis).

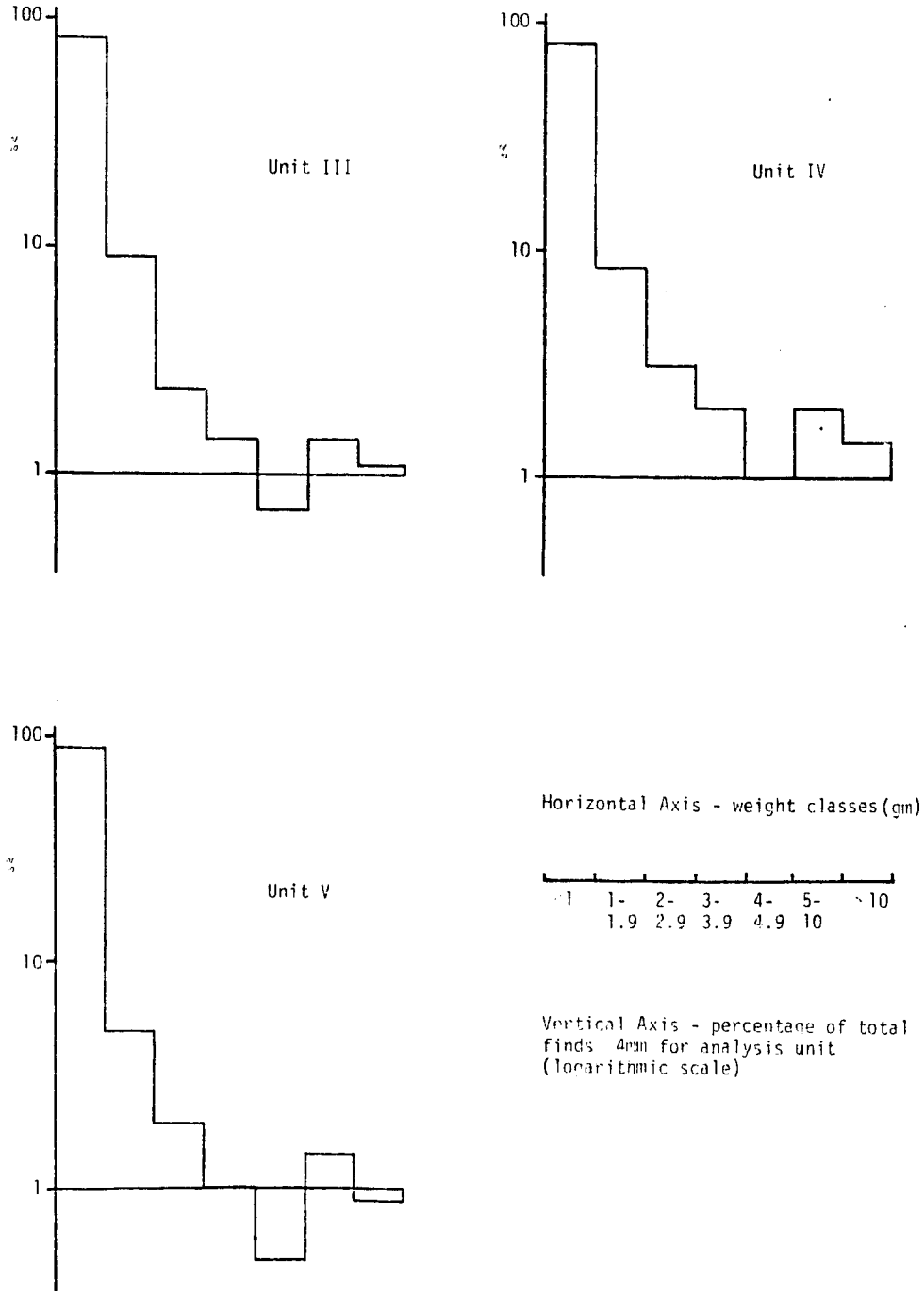



Fig. 38a Capertee site 3, Q12-14,R13 : size (weight) distribution of lithic artefacts, Bondaian levels

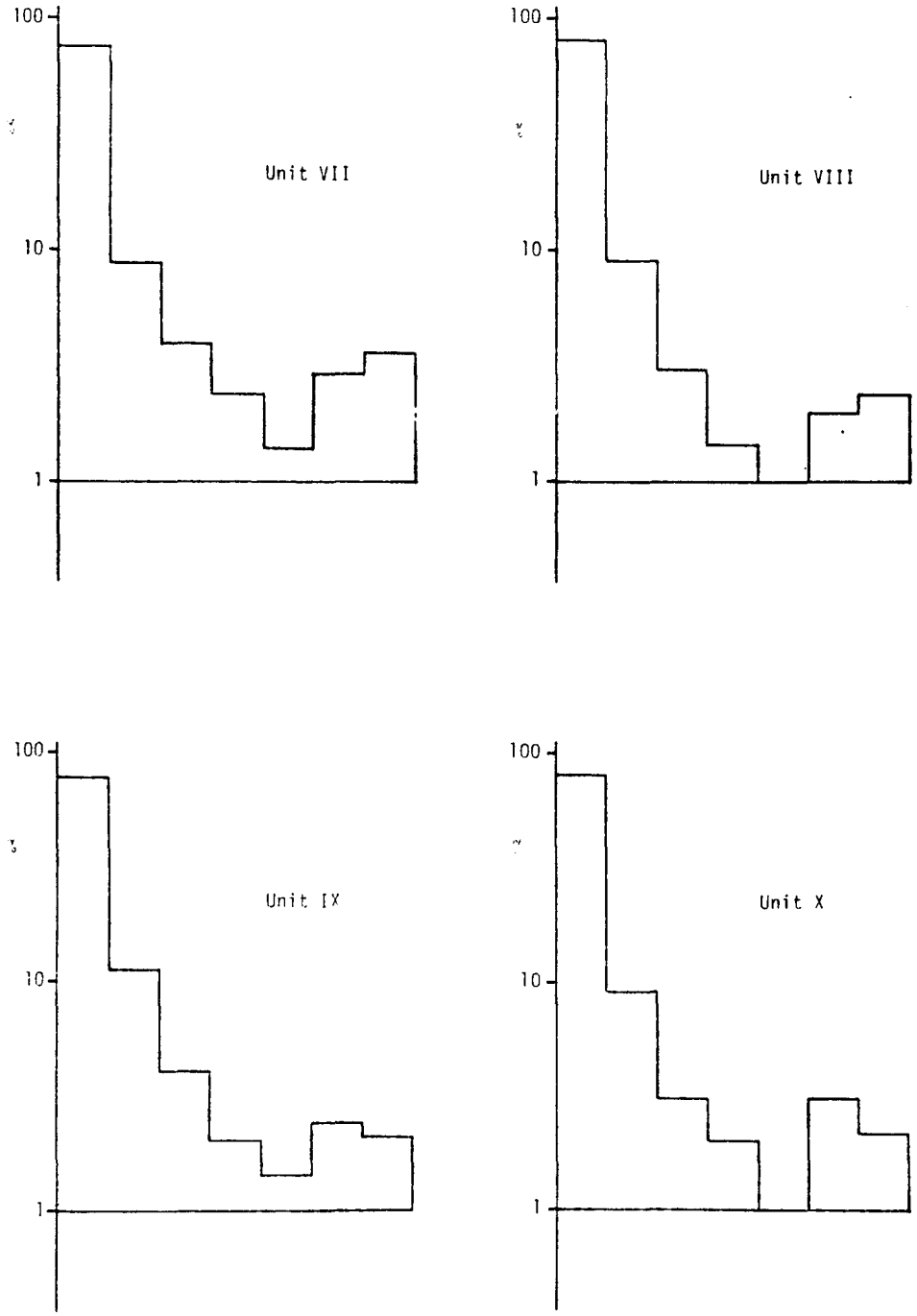



Fig. 38b Capertee site 3, Q12-14,R13 : size (weight) distribution of lithic artefacts, Capertian levels

levels where everything seems to have been worked down to smaller fragments. These large fragments and flakes occur in groups, obviously removed from one or two very similar cores, and I would suggest that they represent primary reduction of a large piece of good quality raw material. To explain their absence from the Bondaian and/or their presence in the Capertian we should perhaps look to the results of man-induced sedimentation. The jasperoid 'cherts' employed undoubtedly come from the Permian levels underlying the cliff-forming sandstones, but at the present day they are largely mantled with slope deposits so that we had great difficulty in finding any stone suitable for knapping. What little stone we did find came from the bed of the main river or deeply incised tributaries. A similar situation would probably have pertained throughout the Bondaian, during which time only a matter of half a metre of deposits accumulated. During the earlier part of the Capertian, however, much of the soil mantle on the lower slopes would have been absent. Raw material sources may well have been exposed in situ and in the vicinity of the site. The large, unutilised flakes and fragments of high quality raw material occur only in the lower Capertian levels, to be replaced in the uppermost Capertian level by a swing to larger chunks of poor quality raw material. Without wishing to base too much on the limited data available, this may be in response to the disappearance of readily available high quality raw materials. In the succeeding Bondaian levels, the disappearance of the poor quality chunks and lack of large pieces of high quality material may reflect a change in attitude towards lithic reduction, with stone being sought further afield and exploited to the full.

Forme type and cortex

The differences in flaking and raw material quality are also reflected in the proportions of different forme types (table 11). Whole flakes form a large proportion (57%) of formes in the Bondaian[1] but only 36% in the Capertian, whilst irregular chunks and tabular pieces are more common in the latter than in the former (33% against 11%). On the other hand, the proportions of different cortex ratings (table 12) are

(1) Finds exceeding 2gm weight or 3 cm length

| Forme type | Bondaian (II-V) | Capertian (VII-X) |
|---|---|---|
| Whole flake | 99 | 217 |
| Flake fragment | 40 | 150 |
| Core | 14 | 19 |
| Chunk | 17 | 160 |
| Tabular piece | 1 | 41 |
| Stick fracture | 0 | 14 |
| Pebble fragment | 4 | 9 |
| | 175 | 610 |
| Whole flake | 57% | 36% |
| Flake fragment | 23% | 25% |
| Core | 8% | 3% |
| Chunk | 10% | 26% |
| Tabular piece | 0.6% | 7% |
| Stick fracture | 0% | 2% |
| Pebble fragment | 2% | 1.5% |

Table 11 Capertee site 3, Q13 : forme type

| Cortex | Bondaian | Capertian |
|---|---|---|
| None | 106 | 372 |
| Flakes <10% dorsal surface | 22 | 81 |
| Non-flakes <10% of surface | 5 | 18 |
| Flakes 10-50% dorsal surface | 12 | 48 |
| Non-flakes 10-30% of surface | 7 | 19 |
| Flakes 50-90% dorsal surface | 9 | 22 |
| Non-flakes 30-70% of surface | 3 | 4 |
| Flakes >90% dorsal surface | 11 | 42 |
| Non-flakes >70% of surface | - | 1 |
| Indeterminable | - | 3 |
| | 175 | 610 |
| None | 61% | 61% |
| Flakes <10% | 13% | 13% |
| Non-flakes <10% | 3% | 3% |
| Flakes 10-50% | 7% | 8% |
| Non-flakes 10-30% | 4% | 3% |
| Flakes 50-90% | 5% | 4% |
| Non-flakes 30-70% | 2% | + |
| Flakes >90% | 6% | 7% |
| Non-flakes >70% | - | + |
| Indeterminable | - | + |

Table 12 Capertee site 3, Q13 : cortex rating

essentially identical, arguing against there being any fundamental difference in flaking activities between the two industries. These results support the hypothesis that there has been a change in emphasis on raw material usage and/or availability but that the flaking activities carried out in the site have not undergone a major change.

Vertical distribution of tool types

I have classified the Capertee 3 material into tool types according to the system set out in appendix II. The results of this classification are presented in tables 13 and 14 for the Bondaian and Capertian layers respectively. These tables also serve to demonstrate the sort of output available from the SPSS package used in conjunction with the recording system described in chapters 7 and 8 (note that the SPSS instructions required to generate these two tables are included at the top of table 13).

It is apparent that there is a much wider range of tool types in the Bondaian industry than in the Capertian, although it should be borne in mind that this may be partly a function of sample size (Bondaian - 341 tools, 47 types; Capertian - 39 tools, 24 types). However the total artefact samples in the Bondaian and the Capertian are practically identical (Bondaian 13,539, Capertian 13,964), so that tools in the Bondaian represent a much larger proportion of total artefacts than in the Capertian (2.5% as against 0.3%). However, if we look at those types present in the Capertian, all of which are also present in the Bondaian, we find that they represent a similar proportion of total artefacts in both assemblages (0.3%). Within the limits of the data, therefore, the specialised tool types of the Bondaian appear as an addition on top of a 'background' industry. It is perhaps to this 'background' industry that we should look when attempting to make statements about changes in the intensity of site usage through time, rather than relying on the full range of tools (e.g. Hughes 1977:68-9), at least some of which may have functional equivalents in different industries which are not recognised as tools.

The specialised types restricted to the Bondaian are backed implements (n = 191), redirecting spalls (n=66) and small adze flakes or scrapers (n=42).

```
TASK NAME      Distribution of typological categories
COMMENT        **********
*SELECT IF     (RAWMATER LE 10 AND TOOLTYPE NE 0)
CROSSTABS      TABLES = TOOLTYPE BY SQUARE BY INDUST
OPTIONS        3,4,5

***** Given WORKSPACE allows for    447 cells and    3 dimensions for CROSSTAB problem *****
```

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ANALYS.IND : Basic analysis of individualised finds — 30-Oct-79 — Page 3
Distribution of typological categories
File NONAME (Creation date = 30-Oct-79)

********** C R O S S T A B U L A T I O N O F **********
TOOLTYPE TYPOLOGICAL CLASSIFICATION FOR TOOLS AND by SQUARE SQUARE IDENTIFIER
Controlling for:
INDUST Lithic industry Value = 1. BONDAIAN
********** Page 1 of 2

| TOOLTYPE | Count / SQUARE | K21 | L21 | M20 | M21 | N20 | N21 | O20 | O21 | Q12 | Q13 | Q14 | R13 | Row Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10. | | 0 | 5 | 12 | 7 | 8 | 22 | 9 | 8 | 3 | 7 | 6 | 0 | 87 |
| | | | | | | | | | | | | | | 20.8 |
| 11. | | 0 | 2 | 1 | 1 | 4 | 9 | 2 | 0 | 2 | 3 | 5 | 0 | 29 |
| | | | | | | | | | | | | | | 6.9 |
| 12. | | 0 | 2 | 2 | 0 | 6 | 5 | 2 | 1 | 1 | 5 | 7 | 0 | 31 |
| | | | | | | | | | | | | | | 7.4 |
| 13. | | 0 | 1 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 4 | 0 | 10 |
| | | | | | | | | | | | | | | 2.4 |
| 14. | | 0 | 0 | 1 | 2 | 3 | 1 | 2 | 0 | 1 | 3 | 1 | 1 | 15 |
| | | | | | | | | | | | | | | 3.6 |
| 15. | | 0 | 1 | 2 | 0 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 10 |
| | | | | | | | | | | | | | | 2.4 |
| 16. | | 0 | 0 | 1 | 0 | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 7 |
| | | | | | | | | | | | | | | 1.7 |
| 17. | | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | | | | | | | | | | | | | | 0.7 |
| 19. | | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| | | | | | | | | | | | | | | 0.5 |
| 20. | | 0 | 2 | 1 | 1 | 4 | 2 | 3 | 2 | 1 | 7 | 4 | 1 | 28 |
| | | | | | | | | | | | | | | 6.7 |
| 21. | | 0 | 1 | 1 | 1 | 2 | 4 | 0 | 1 | 2 | 0 | 0 | 0 | 12 |
| | | | | | | | | | | | | | | 2.9 |
| 22. | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 5 |
| | | | | | | | | | | | | | | 1.2 |
| 23. | | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 2 | 1 | 1 | 0 | 7 |
| | | | | | | | | | | | | | | 1.7 |
| 24. | | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 |
| | | | | | | | | | | | | | | 1.0 |
| 25. | | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 1 | 3 | 0 | 9 |
| | | | | | | | | | | | | | | 2.1 |
| 27. | | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 3 | 1 | 1 | 9 |
| | | | | | | | | | | | | | | 2.1 |
| 28. | | 0 | 0 | 0 | 0 | 4 | 2 | 2 | 1 | 0 | 2 | 4 | 0 | 15 |
| | | | | | | | | | | | | | | 3.6 |
| 29. | | 0 | 2 | 1 | 1 | 3 | 1 | 1 | 0 | 1 | 1 | 3 | 0 | 14 |
| | | | | | | | | | | | | | | 3.3 |
| 30. | | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| | | | | | | | | | | | | | | 0.7 |
| 31. | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | | | | | | | | | | | | | | 0.2 |
| 32. | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 |
| | | | | | | | | | | | | | | 0.5 |

(continued)

Table 13 Capertee site 3, Bondaian : distribution of tools

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33. | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1<br>0.2 |
| 34. | 0 | 0 | 0 | 0 | 2 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 7<br>1.7 |
| 35. | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 5<br>1.2 |
| 36. | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1<br>0.2 |
| 40. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2<br>0.5 |
| 41. | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 5<br>1.2 |
| 42. | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 6<br>1.4 |
| 43. | 0 | 1 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 8<br>1.9 |
| 44. | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 0 | 5<br>1.2 |
| 45. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2<br>0.5 |
| 49. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1<br>0.2 |
| 50. | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 4<br>1.0 |
| 51. | 0 | 0 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 5<br>1.2 |
| 52. | 0 | 1 | 0 | 0 | 4 | 1 | 1 | 0 | 1 | 0 | 3 | 0 | 11<br>2.6 |
| [illegible] | 0 | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 6<br>1.4 |
| 59. | 0 | 0 | 0 | 0 | 3 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 8<br>1.9 |
| 68. | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 4<br>1.0 |
| 70. | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1<br>0.2 |
| 71. | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 5<br>1.2 |
| 72. | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 3<br>0.7 |
| 80. | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2<br>0.5 |
| 82. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3<br>0.7 |
| 83. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1<br>0.2 |
| 85. | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1<br>0.2 |
| 90. | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3<br>0.7 |
| 91. | 0 | 0 | 6 | 0 | 5 | 0 | 4 | 0 | 0 | 0 | 0 | 1 | 16<br>3.8 |
| Column Total | 2<br>0.5 | 23<br>5.5 | 37<br>8.8 | 23<br>5.5 | 70<br>16.7 | 70<br>16.7 | 41<br>9.8 | 27<br>6.4 | 18<br>4.3 | 42<br>10.0 | 59<br>14.1 | 7<br>1.7 | 419<br>100.0 |

Table 13 Capertee site 3, Bondaian : distribution of tools (cont.)

Distribution of typological categories
File NONAME (Creation date = 30-Oct-79)

C R O S S T A B U L A T I O N O F

TOOLTYPE TYPOLOGICAL CLASSIFICATION FOR TOOLS AND by SQUARE SQUARE IDENTIFIER
Controlling for:
INDUST Lithic industry Value = 2. CAPERTIAN



| Count | SQUARE | | | | | | | | Row Total |
|---|---|---|---|---|---|---|---|---|---|
| TOOLTYPE | L20 | L21 | M20 | N21 | O21 | Q12 | Q13 | Q14 | R13 | |
| 19. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | | | | | | | | | | 1.4 |
| 27. | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | | | | | | | | | 1.4 |
| 28. | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 3 |
| | | | | | | | | | | 4.1 |
| 29. | 0 | 0 | 0 | 1 | 0 | 1 | 3 | 1 | 0 | 6 |
| | | | | | | | | | | 8.2 |
| 33. | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 |
| | | | | | | | | | | 2.7 |
| 34. | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| | | | | | | | | | | 1.4 |
| 48. | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | | | | | | | | | | 1.4 |
| 49. | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 2 |
| | | | | | | | | | | 2.7 |
| 51. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | | | | | | | | | | 1.4 |
| 52. | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 5 |
| | | | | | | | | | | 6.8 |
| 53. | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 |
| | | | | | | | | | | 4.1 |
| 59. | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 3 |
| | | | | | | | | | | 4.1 |
| 68. | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 4 |
| | | | | | | | | | | 5.5 |
| 69. | 0 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 4 |
| | | | | | | | | | | 5.5 |
| 70. | 0 | 0 | 0 | 1 | 0 | 4 | 0 | 2 | 0 | 7 |
| | | | | | | | | | | 9.6 |
| 71. | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 0 | 5 |
| | | | | | | | | | | 6.8 |
| 72. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | | | | | | | | | | 1.4 |
| 80. | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 5 |
| | | | | | | | | | | 6.8 |
| 81. | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 3 |
| | | | | | | | | | | 4.1 |
| 82. | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 |
| | | | | | | | | | | 2.7 |
| 83. | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | | | | | | | | | | 1.4 |
| 85. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| | | | | | | | | | | 2.7 |
| 90. | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| | | | | | | | | | | 1.4 |
| 91. | 0 | 0 | 1 | 0 | 2 | 0 | 2 | 3 | 1 | 9 |
| | | | | | | | | | | 12.3 |
| Column Total | 1 | 1 | 2 | 7 | 2 | 22 | 18 | 19 | 1 | 73 |
| | 1.4 | 1.4 | 2.7 | 9.6 | 2.7 | 30.1 | 24.7 | 26.0 | 1.4 | 100.0 |

Table 14 Capertee site 3, Capertian : distribution of tool types

Small adze flakes or scrapers

Most of these artefacts, in particular the smallest specimens showing flat invasive scaling on a low-angled edge (e.g. Q14 8-25, 021 10-17, N20 10-38 (fig. 39)) must, I believe, have been hafted. It is my, admittedly subjective, opinion that this sort of edge modification could not have been produced by percussion flaking on an unmounted specimen with a hard hammer, since this would crush the edge or produce a 'nibbled' retouch such as that on 021 16-21. If the modification was intentional retouch with a soft hammer we might expect it to be more regular and the same observation would apply to pressure flaking. The edge modification observed is similar to that observed on many elouera (see for example McCarthy 1943, 1948, McCarthy, Brammell and Noone 1946, McCarthy and Setzler 1960:280) and often occurs on a low angled margin opposite a natural back, e.g. L21 6-10. It has been suggested (e.g. McCarthy and Setzler 1960:280, Kamminga 1977:211) that elouera and other flakes showing similar edge wear (notably the characteristic polish to be found on many elouera) were hafted adzes or scrapers used to work soft wood or bark, and I think this interpretation might well be extended to most of the specimens which I have classed in the small scraper/adze flake group. However I do not see specimens such as 021 16-21 or N21 17-59 as necessarily reflecting hafting although such specimens may have been hafted. The similarity in shape and size between the former and the obviously hafted specimens Q14 8-25 and 021 10-17 is perhaps suggestive of hafting. However 021 16-21 and N21 17-59 are distinguished from the clearly hafted specimens by their much more regular, finely nibbled unifacial retouch, contrasting with the irregular, bifacial retouch of the clearly hafted specimens (the latter often resulting in a sinuous edge). The larger specimens belonging to the small scraper/adze flake category e.g. 021 7-3 and Q12 8-10 could well have been produced by retouch and hand-held use or they too may have been hafted.

Backed implements

Backed implements require little description having been defined and discussed by many authors, e.g. Mulvaney 1975; Glover 1969; McCarthy, Brammell and Noone 1943. They are one of the few categories of artefact which are recognised consistently by most workers,

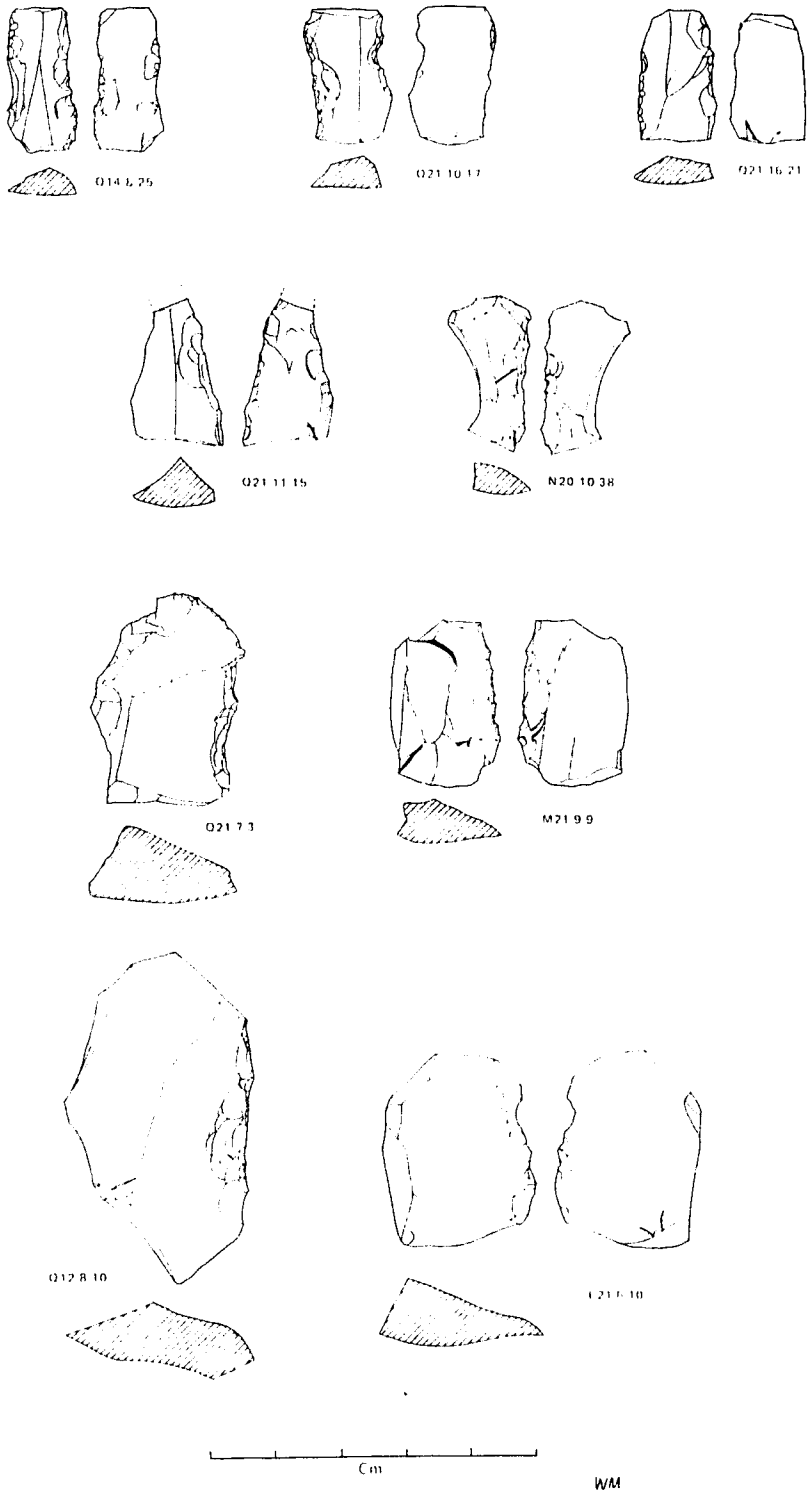



Fig. 39 Small scraper or adze flakes

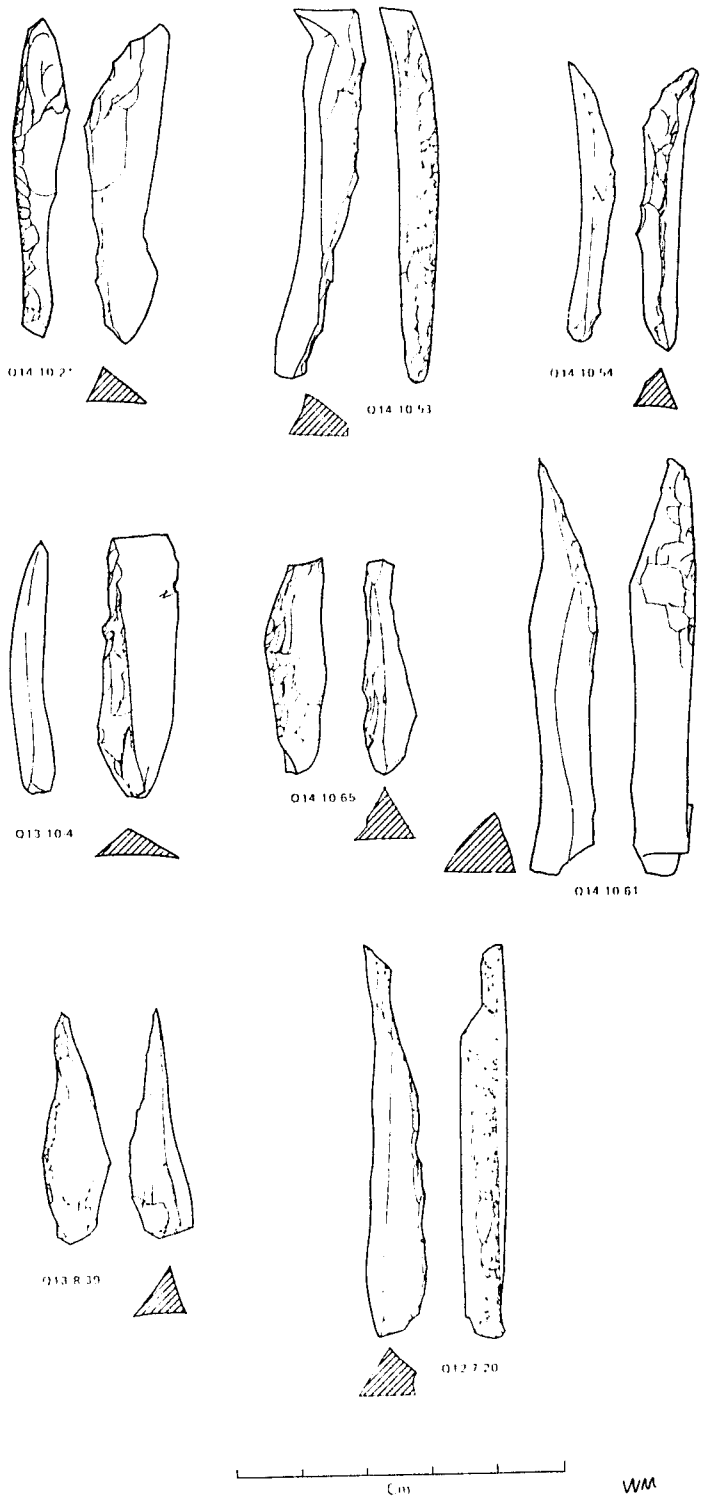



Fig. 40 Redirecting spalls

although there is a borderline zone separating backed implements from some specimens with fine nibbled retouch (such as that on N20 6-33 (fig. 43) in which it is not easy to take a positive decision one way or the other. N20 6-33 might be confused with a backed implement on the basis of morphology, but it forms one end of a continuum of which the other end is characterised by short, very convex steep edges on bladelets or flakes of approximately equilateral section which are quite unlike a backed implement. I have divided backed implements according to their completeness and the state of the chord (the margin opposite the backed edge). None of the backed implement fragments recovered (n=70, 36%) had indubitable chord use. A few had one or two tiny fractures which could well be the result of post-depositional disturbance. Amongst the complete backed implements (n=122, 64%) a number showed some chord damage, ranging from slight nibbling to the extensive damage characteristic of elouera. My excavation yielded three specimens corresponding with the strict definition of an elouera (see references in glossary) and similar to those from other Blue Mountains sites, notably Lapstone Creek (personal inspection), and a further seven specimens with similar edge damage but morphologically similar to a Bondi point, i.e. narrow and elongated rather than a wide crescentic or oblong shape. I have illustrated one such specimen in fig. 40 (021 15-9). In view of the close similarity in edge modification, I believe this type was functionally equivalent to the elouera and should perhaps be considered as an atypical elouera.

Amongst the remaining complete backed implements (n=112, 58%), twenty five (22%) showed some traces of chord utilisation in the form of slight edge damage or nibbling, e.g. M20 4-47 (fig. 40). This sort of edge modification need not indicate any very prolonged or specialised use such as I have suggested for the elouera. Grouping complete backed implements with and without slight chord modification, only 15% are type A backed implements (L/B ratio < 2 1, Glover 1967) and 85% are type B (L/B ratio > 2:1).

Redirecting spalls

The third major group of tools restricted to the Bondaian are redirecting spalls (n=66). These are blades or bladelets removed along the length of a ridge which has been retouched or utilised (fig. 40). They are generally thick relative to their width, approaching an

equilateral triangle in section, though some are quite thin, e.g. Q13 10-4, and can easily be confused with a backed implement.

Redirecting spalls are a very characteristic feature of the Capertee 3 site. In my excavation there was approximately one for every three backed implements and in McCarthy's excavation one for every four. At their best they show mastery of blade production which has prompted me to use the term 'classic' redirecting spalls for one subtype. These specimens have well defined regular retouch along the dorsal ridge with only slight crushing of the margin. If they were attached to a larger piece of stone they would be classic 'scrapers'. Initially I considered them to be retouched edges which were resharpened by removal of a blade along the length of the edge, but most of the 'classic' specimens would have left two obtuse angled edges quite unsuitable for a repetition of the sort of function represented by the original edge, which is a moderate to steep acute angle. Also the edges are not sufficiently damaged to warrant complete removal and could easily have been resharpened by a little additional retouch.

Luebbers (1979) has found strikingly similar specimens in his sites in South Australia and has been able to reconstruct the cores from which they were derived. He interprets them as an initial stage in the reduction of a blade core and postulates that they were a forerunner of backed implement production in which the backing retouch is produced on the core prior to removal (pers.comm.). However, I believe that redirecting spalls and backed implements represent quite distinct techniques and there is certainly no evidence at Capertee that redirecting spalls appeared any earlier than backed implements; both occur from the earliest Bondaian levels and are absent from the Capertian levels.

Very few redirecting spalls are morphologically analagous to a backed implement. Backed implements are normally made on thin flakes or blades, one margin of which is modified by steep retouch, generally from the ventral surface or bidirectionally, i.e. from both the dorsal and ventral surface (note the difference between bidirectional retouch, i.e. flakes removed from both of the margins of a surface and bifacial retouch, i.e. flakes removed from both of the surfaces which interesect to form an edge). Redirecting spalls are never retouched from the ventral surface and do not have bidirectional retouch on the

retouched surface(s). The dorsal ridge of a redirecting spall may bear bifacial retouch whilst backed implements never have bifacial retouch on the edges delimiting the 'back'.

The most obvious characteristics distinguishing redirecting spalls and backed implements are secondary morphological observations rather than primary technological ones. Redirecting spalls are generally much thicker than backed implements, approaching an equilateral triangle in section, whilst backed implements are flat trapezes or triangles (see figs. 40 and 41). Equally, backed implements are generally flat in the plane of their length and width whilst the ventral surface of redirecting spalls often has a pronounced longnitudinal twist, as illustrated by several of the specimens in fig. 40 (notably Q14 10-53, Q13 10-4,Q14 10-61). This is a common characteristic in European burin spalls and crested blades and arises from the effect of surface irregularities on the propagation of shock waves along the length of an acute-angled edge (cf. Speth 1972). This problem can of course be avoided in the case of backed implements by selection of thin regular flakes, but it is an obstacle to the production of a backed implement form using a redirecting technique. Thin redirecting spalls such as Q13 10-4 are the exception rather than the rule (approximately 10%) and could not, I believe, have been produced consistently.

Not all redirecting spalls are as characteristic as the 'classic' specimens. Of the 66 specimens, 28 are counted as 'classic' and a further 38 are less typical (types 21-25). These are generally smaller and retouch is less well developed, but their shape and technique suggest intentional use of the same process of removal as for the 'classic' specimens. In addition there are a number of very tiny bladelets, short flakes and chunky specimens (types 27-9) which are technologically equivalent, i.e. they represent the removal of a flake along a ridge bearing retouch or use modification. However such specimens can arise simply by chance when working a core from more than one direction and these specimens occur in both industries. I have not included them in the total for redirecting spalls nor on the plans of distribution for redirecting spalls (figs. 50 and 51).

What then are redirecting spalls? I see them as a technological step in the conversion of a large scraper into a quarry for blades or flakes. This interpretation fits with the picture of careful

conservation of raw material which I have suggested characterises the Bondaian. It also fits with the observation that most of the 'classic' redirecting spalls are on very high quality raw material similar to that used so profligately in the Capertian, although this may simply reflect the better flaking qualities of this material resulting in larger and more elongated blades. The fact that I have not found any artefacts bearing the sort of negative flake sear that these spalls would leave, also suggests that they are a stage in a reduction sequence, rather than a final stage as in the case of European burins where both the spall(s) and the parent piece are often found.

## HORIZONTAL VARIATION - THE PROBLEM OF PATTERNING

An underlying assumption behind most discussions of stone tool assemblages is that they are a sample of some wider population. In many studies this population will be viewed as the total material culture of an area integrated over a period of time of at least a number of generations. Other studies accept that the population sampled may only represent one facet of production or use of stone artefacts, and thus be strongly biassed to a particular set of activities and/or social group. Both these assumptions may be valid when one deals with large assemblages, but many Australian assemblages are very small. We must therefore give careful consideration to the possibility that they represent a small number of discrete events rather than a sample accumulated over a long period of time and be aware of the consequences of such a genesis.

Evidence of discrete events is apparent in the Capertee 3 site, not only in the form of well defined hearths (which may not imply an important event in terms of the formation of the lithic assemblage) but above all in the co-occurrence of sets of specialised tool forms. Dickson (1973) has remarked on the co-occurrence of sets of backed implements in open sites on the Kurnell peninsula, and the vast majority of backed implements from Capertee were concentrated in a restricted vertical zone. More striking however was the immediate juxtaposition of sets of backed implements, perhaps representing a group manufactured together, transported together or hafted together. I have illustrated specimens from one such group (fig. 41, specimens N21 17-20,21,22,24,26).

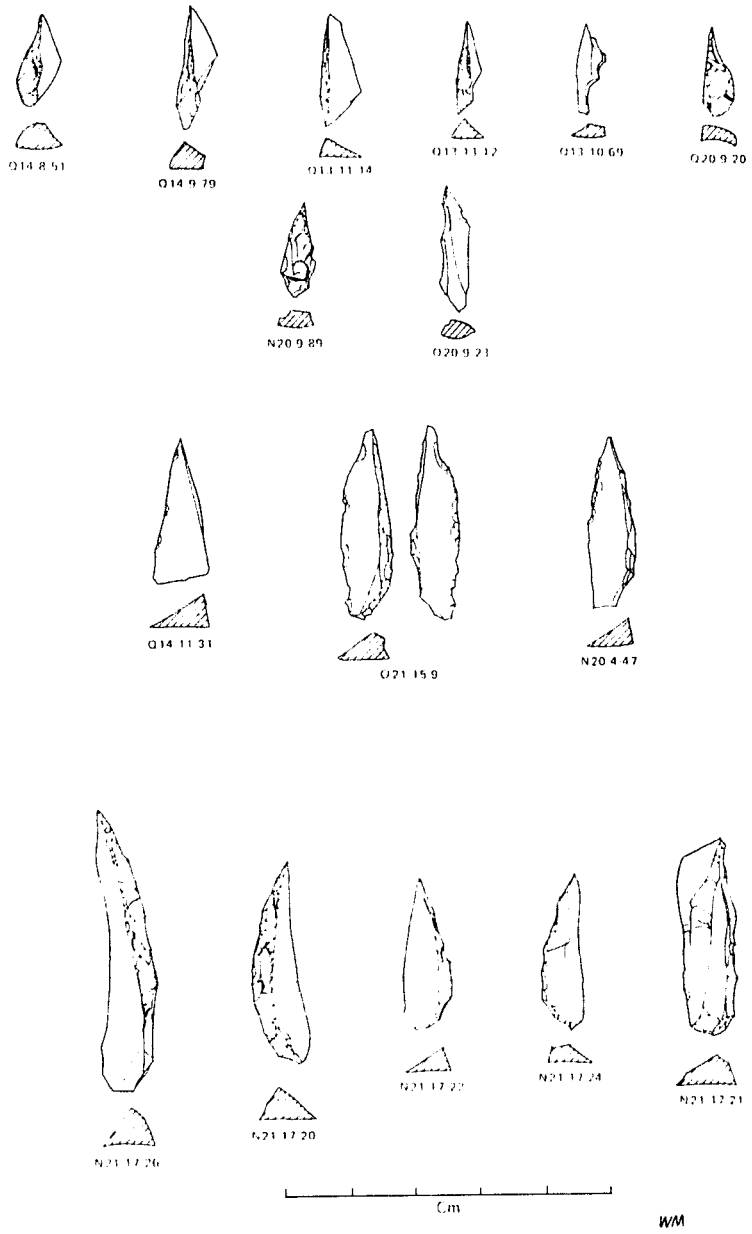



Fig. 41 Backed implements

Whilst it can be argued that the juxtapositions of backed implements are merely a chance occurrence in view of their frequency within the site and concentration at a particular level, the same cannot be said of two other striking juxtapositions. A series (five) of very characteristic small single platform cores or steep scrapers was recovered from adjacent excavation units in squares Q12 - Q14, and only three other specimens were recovered from the rest of the excavation. Four of these specimens are illustrated in fig. 42.

The group of cores also provides a nice illustration of the problems of defining a typology for the Capertee material. At one extreme we have specimen Q12 39-5 which is confidently classed as a scraper by numerous people to whom I have shown it. At the other extreme, specimen Q13 34-6 is confidently described as a core. The remaining specimens form a graded series between the two, whilst the degree of specialisation of form and their restricted distribution argues for a common rationale behind their production. The only solution is, I believe, to argue a duality of function behind a common technology, i.e. the removal of flakes around the perimeter of a flake generating a roughly circular form in plan. Should we classify these specimens as scrapers or cores? I do not believe that at present we know enough about the results produced by various sorts of intentional retouch and accidental retouch through use to be able to make a distinction. I believe in fact that a proportion of 'scrapers' identified in the literature may in fact be cores on which the preparation of the platform edge prior to striking has produced edge damage mistaken for utilisation traces. It is only in clear cases such as specimen Q13 34-6 that we can be positive that we are really dealing with a core or with a scraper.

The second notable juxtaposition is that of a set of 'classic' redirecting spalls in the North excavation. These specimens are illustrated in fig. 40 (Q13 10-4, Q14 10-21,53,54,61,65). Once again the similarity and specialisation of technique argues for a close relationship between these specimens, perhaps associated with a single knapping event.

If I am correct in assuming that the sets of tools found in juxtaposition with one another in fact represent single events, or perhaps a repetition of an activity over a very short (in archaeological terms) space of time, then this has serious

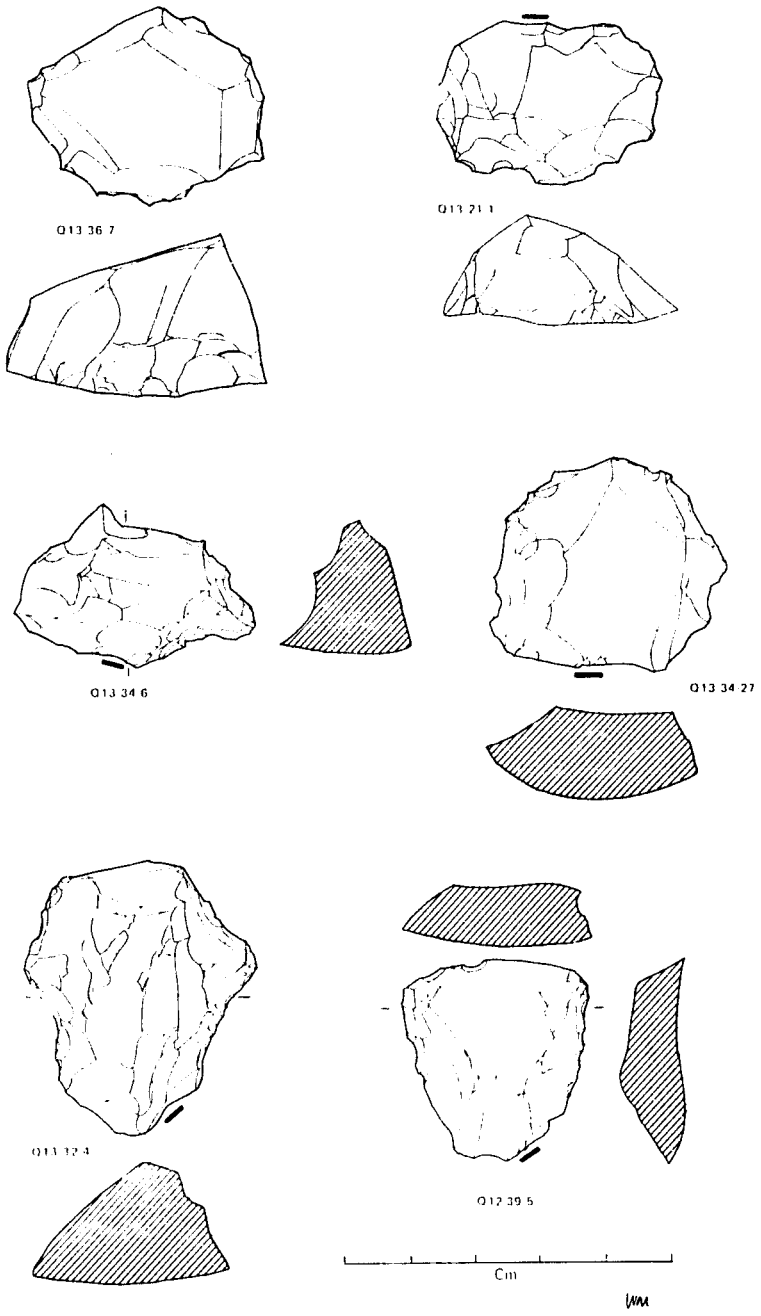



Fig. 42 Single platform cores and scrapers

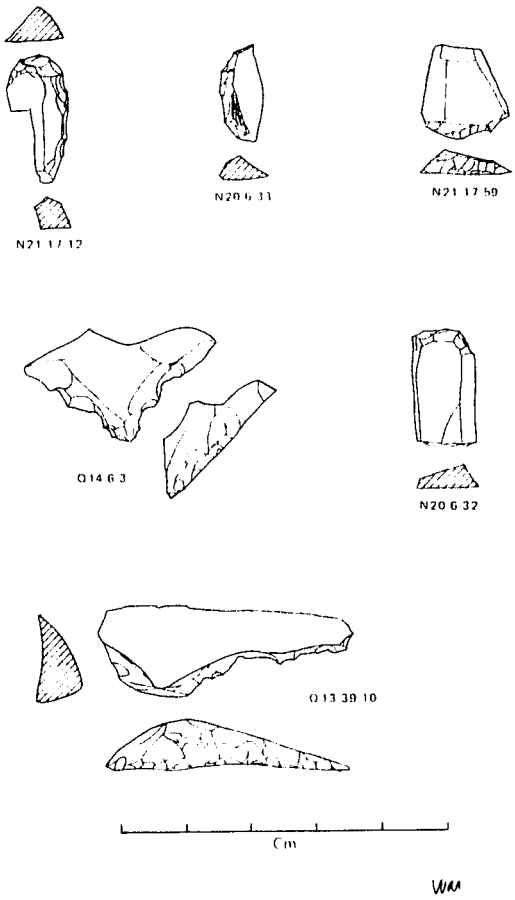



Fig. 43 Miscellaneous tools

implications for the comparison of assemblages. Even in the rich assemblage from Capertee 3, these sets of artefacts are of significant size with respect to the whole assemblage (e.g. the North excavation group of single platform cores/scrapers represents over half the total number in the site and the group of 'classic' redirecting spalls represent a quarter of the total). In poorer assemblages the presence or absence of a particular type, or its percentage importance, may be largely a function of particular events occurring or not occurring. If occupation of a site is sporadic, the assemblage recovered is likely to be largely a product of chance rather than a reflection of the range and relative importance of activities normally carried out in that sort of site.

A second problem that arises from internal site patterning is associated with the differential distribution of different artefact categories. At Capertee 3 most tools appear to be concentrated just behind the dripline (fig. 47), whilst the greatest concentration of debitage lies in square Q12-14 in front of the dripline (table 15, figs. 44-46). Squares Q12-14 contain nearly twice as many backed implements as redirecting spalls, whilst squares KLMNO 20 and 21 contain nearly four times as many (figs. 49-51). Clearly any one part of the site gives a biassed picture of the whole.

The obvious solution to this problem is to treat the site as a population and sample it. This is the implicit assumption behind scattered trenches or trenches crossing the width or length of a site, but to the best of my knowledge no-one has made an explicit attempt to estimate the total site population from such samples. This would seem to me to be the only satisfactory solution to the problem of partially excavated sites. However such an approach does require, first a carefully designed layout of the excavation and second a fairly large proportion of the site to be excavated if we are to satisfactorily determine the range and pattern of horizontal variation.

In the short term it may be more practical to restrict inter-site comparison to assemblages derived from similar areas, e.g. the area just behind the dripline. Where horizontal distribution in rockshelters has been noted, a consistent pattern of high artefact concentrations in the dripline area has been recorded (e.g. McBryde 1974, Morwood 1979, Stockton 1970) but no systematic study has been made. A pressing need is the open-area or structured-sample

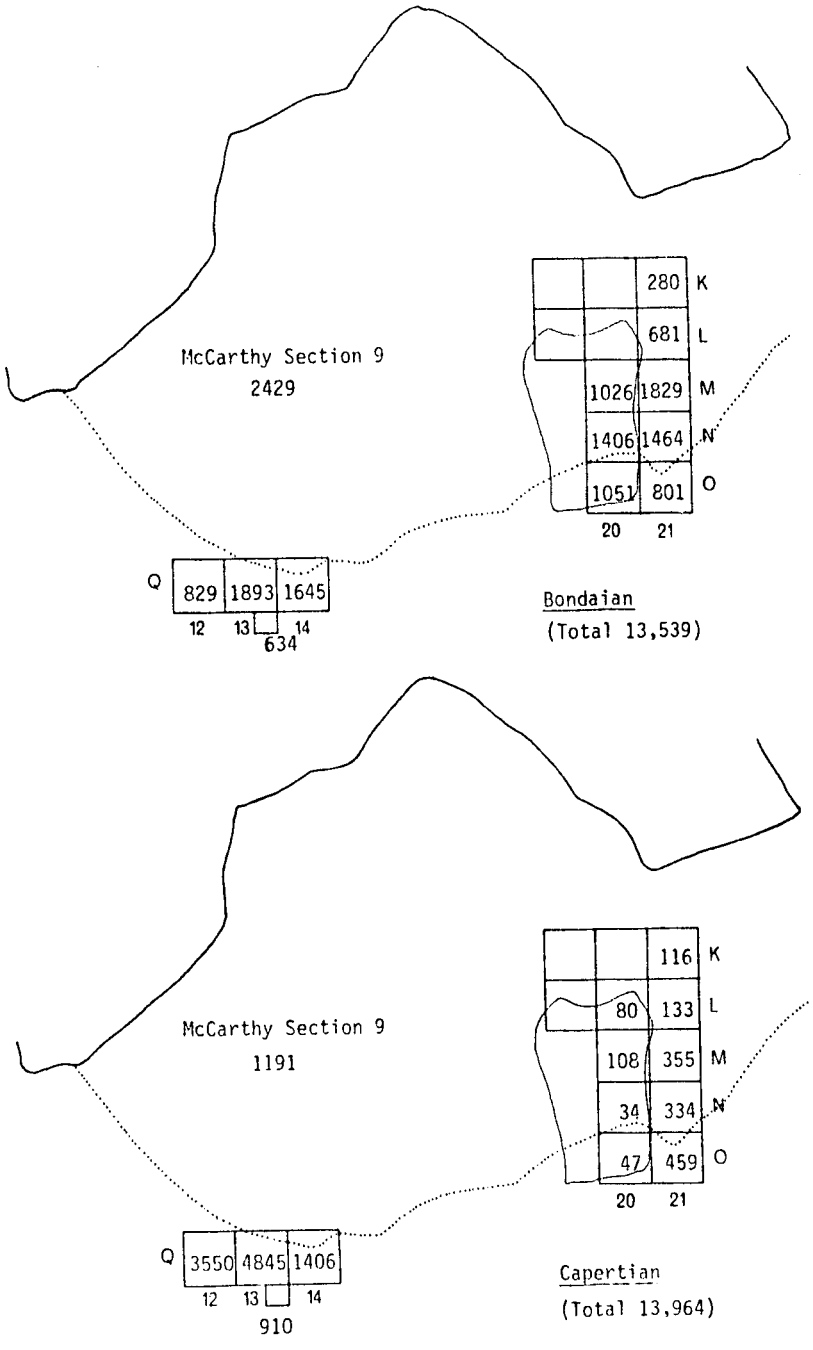
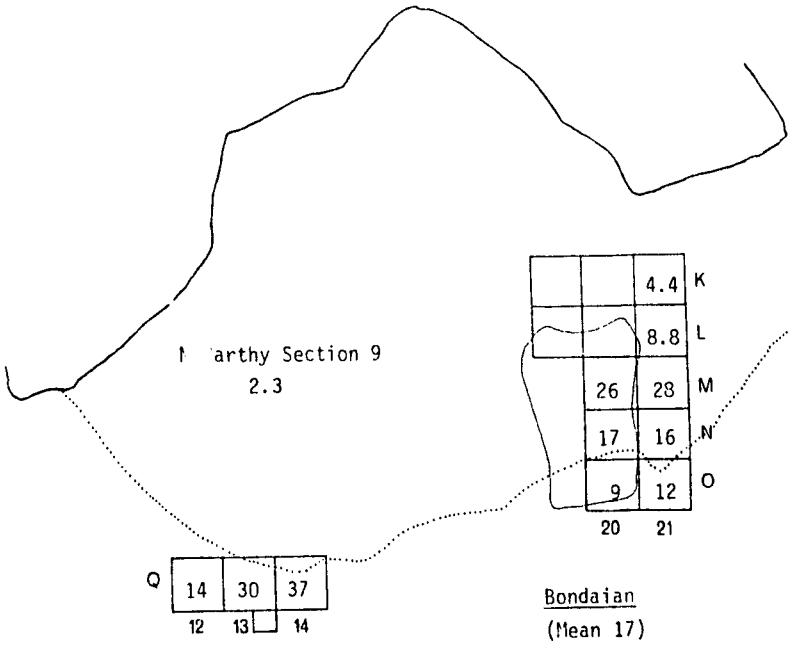



Fig. 44 Capertee 3 : distribution of all lithic artefacts



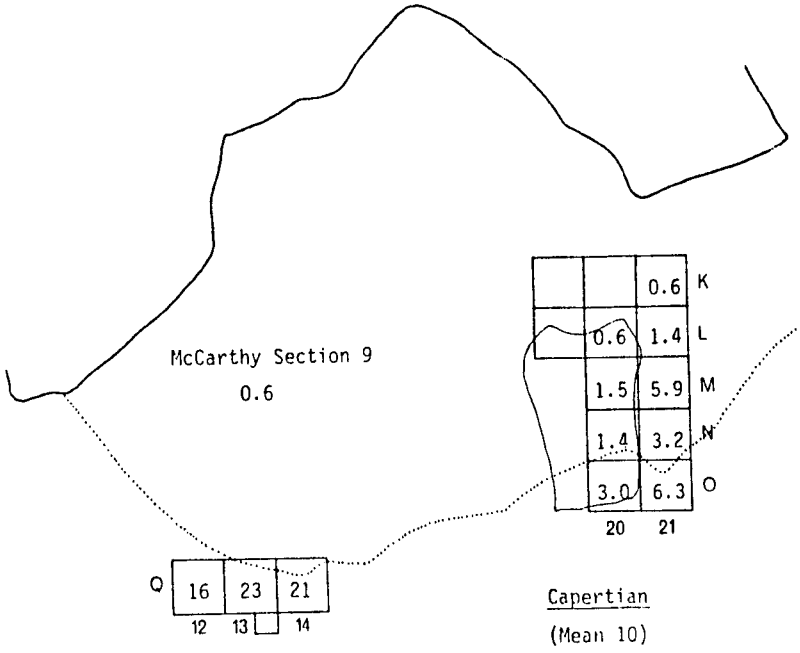
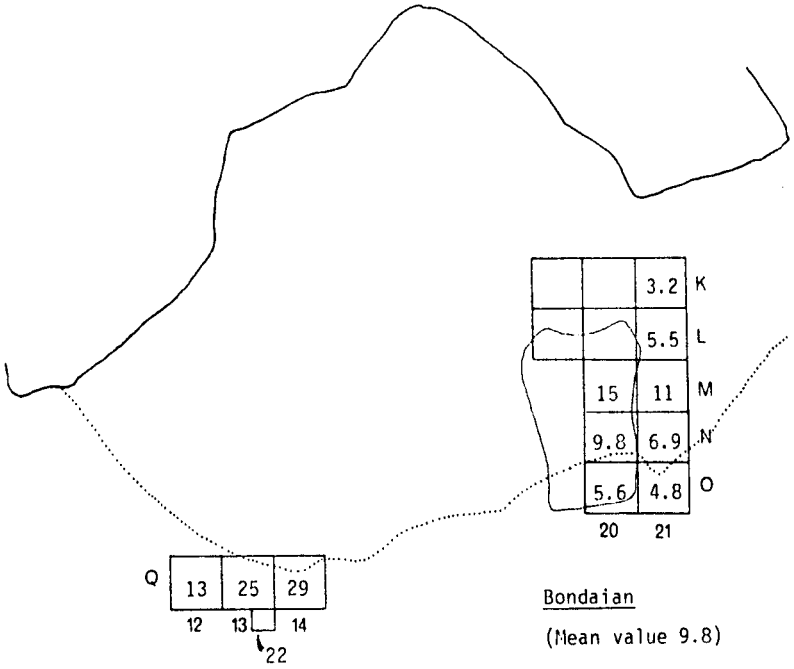




Fig.45 Capertee 3 : lithic artefacts per cu. metre (x1000)



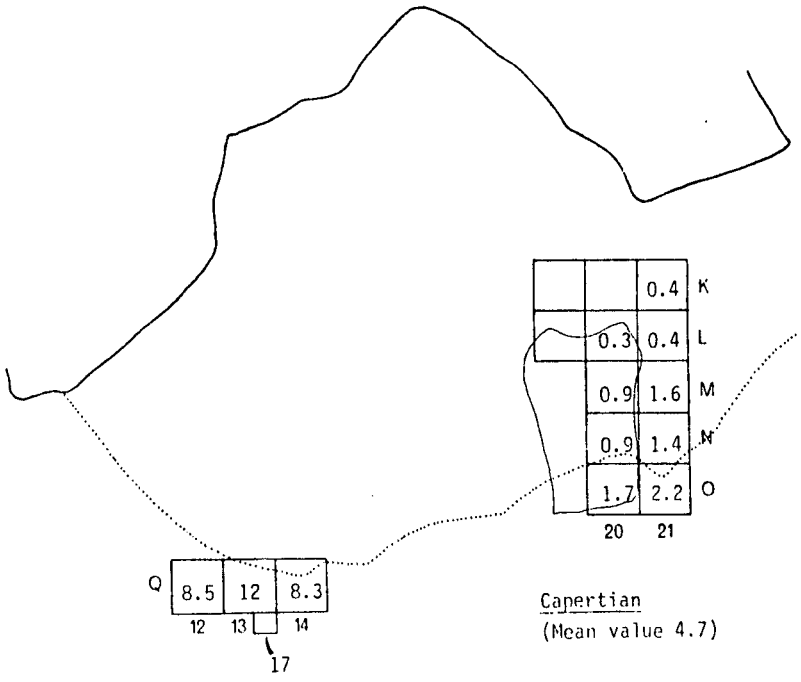




Fig. 46 Capertee 3 : lithic artefacts per kg. sediments excavated

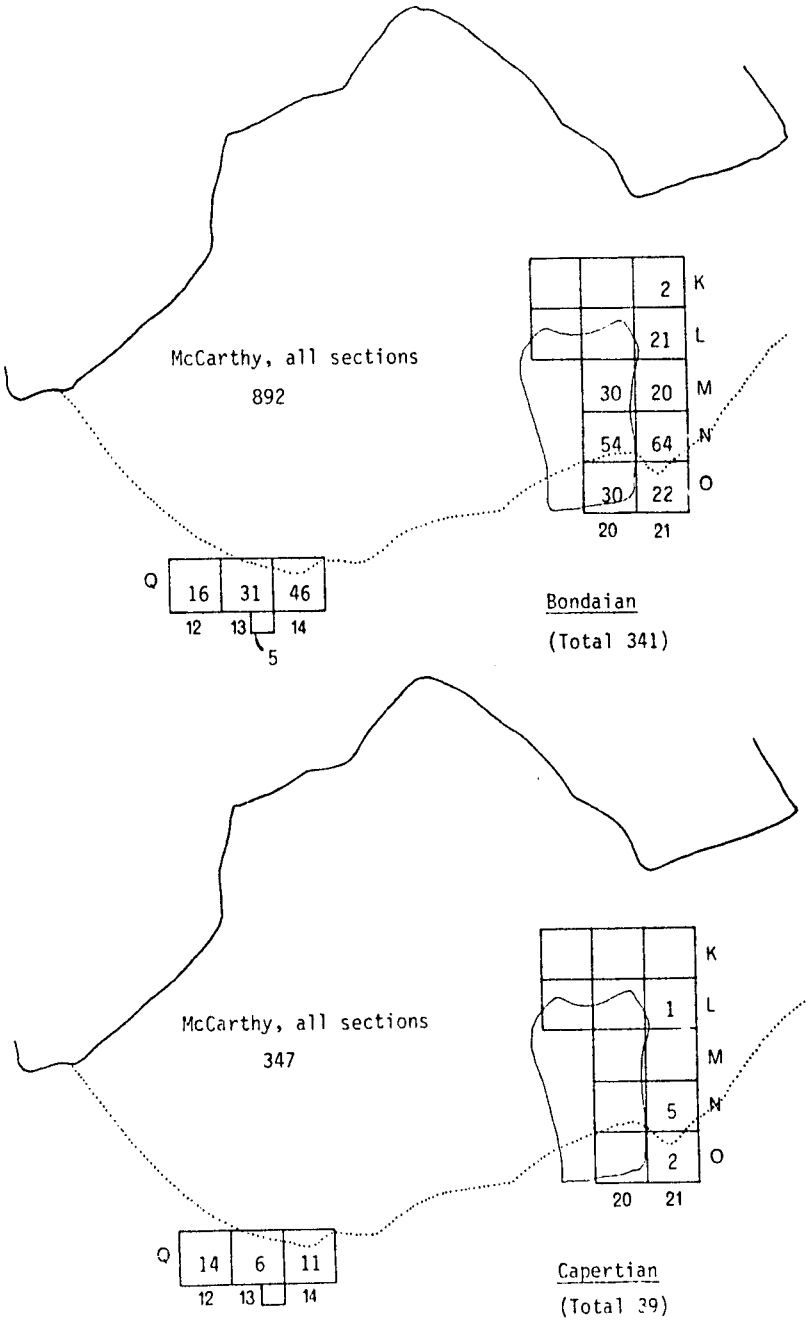



Fig. 47 Capertee 3 : distribution of tools

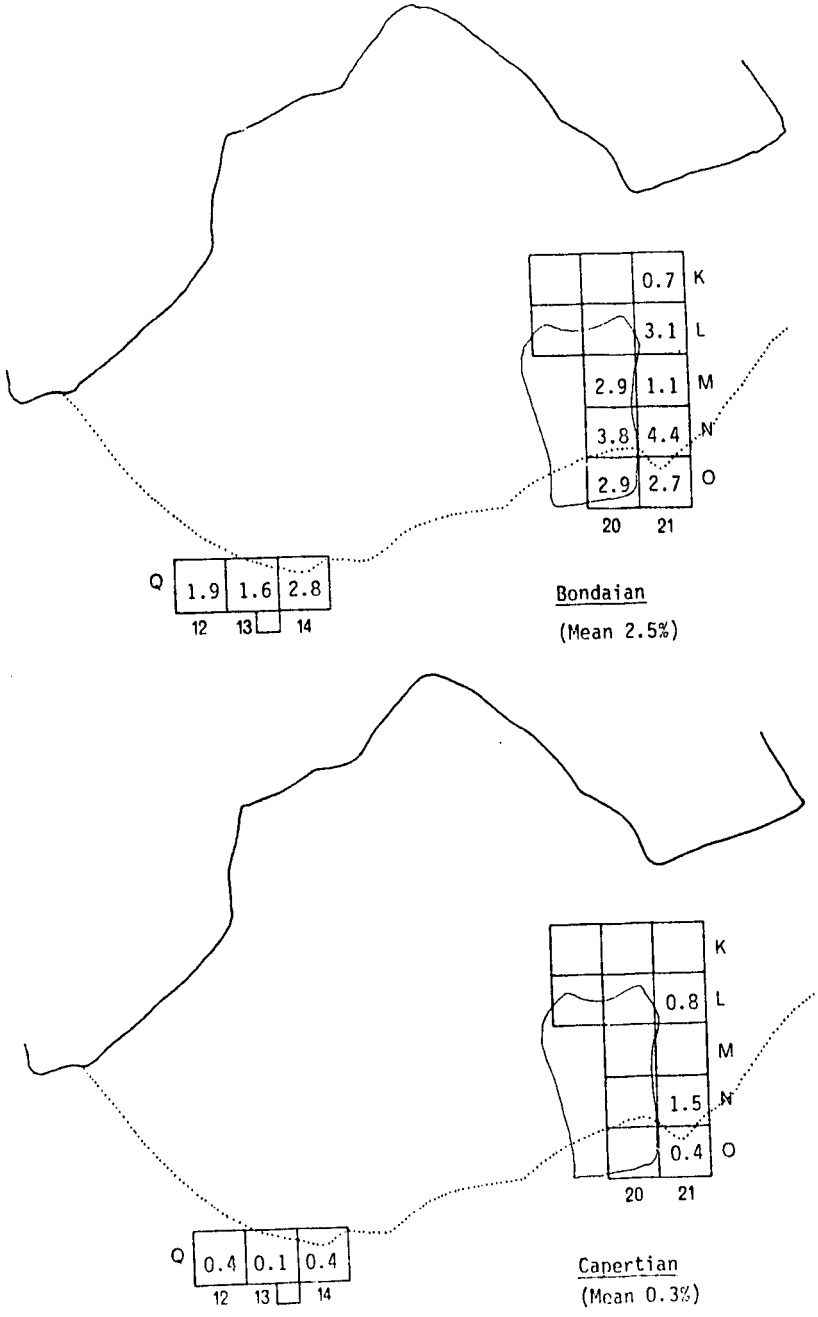



Fig.48 Capertee 3 : tools as a percentage of all lithic artefacts

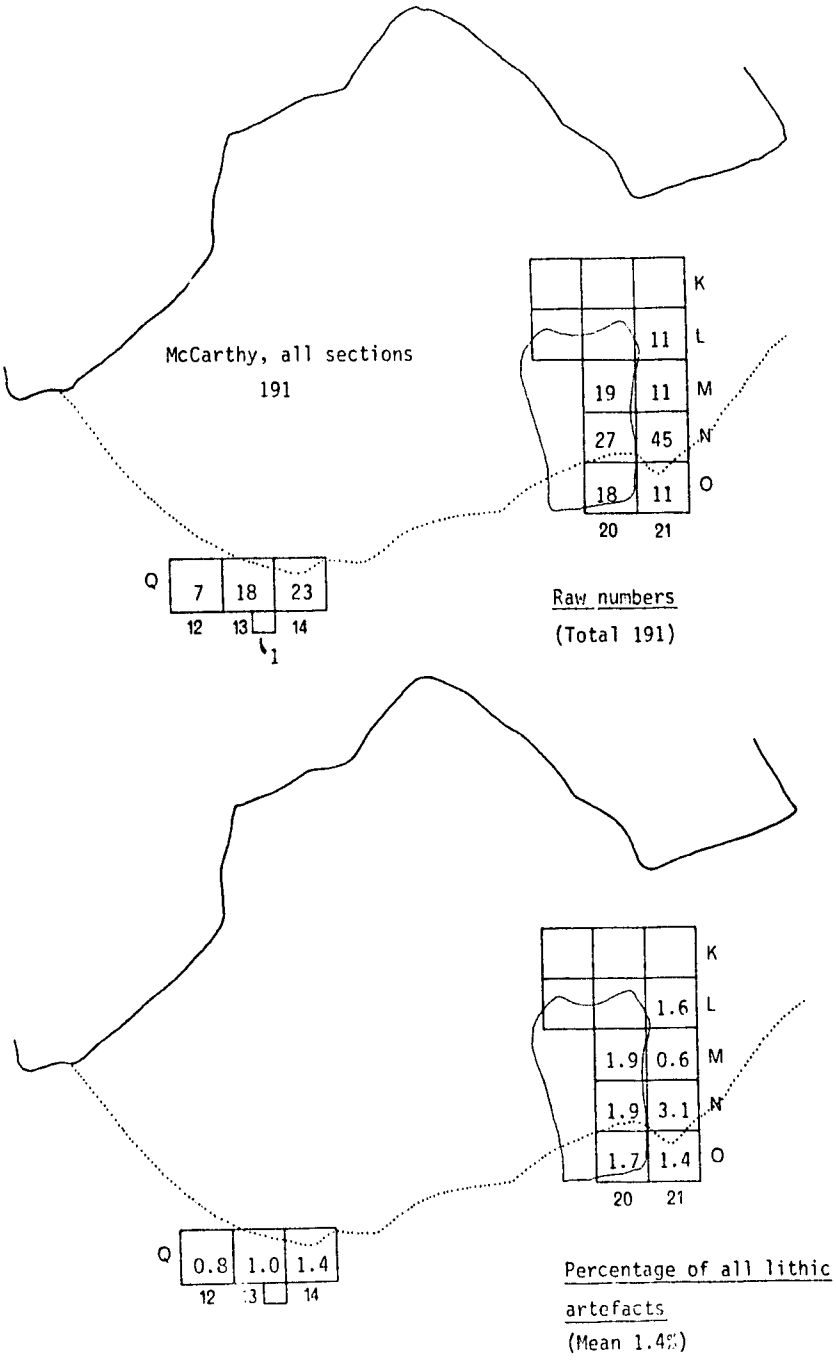



Fig. 49 Capertee 3 : distribution of backed implements
(Bondaian levels)

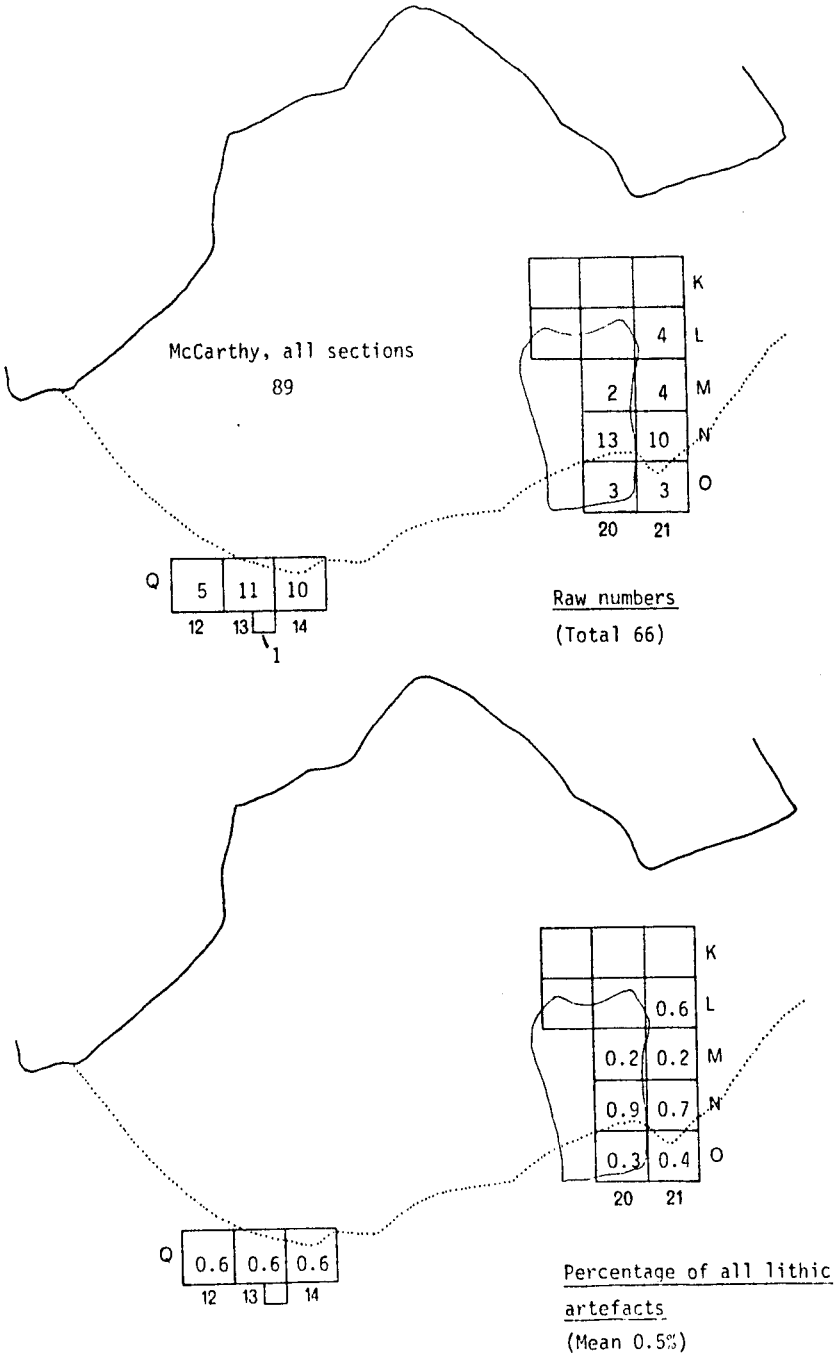



Fig. 50 Capertee 3 : distribution of redirecting spalls (Bondaian levels)

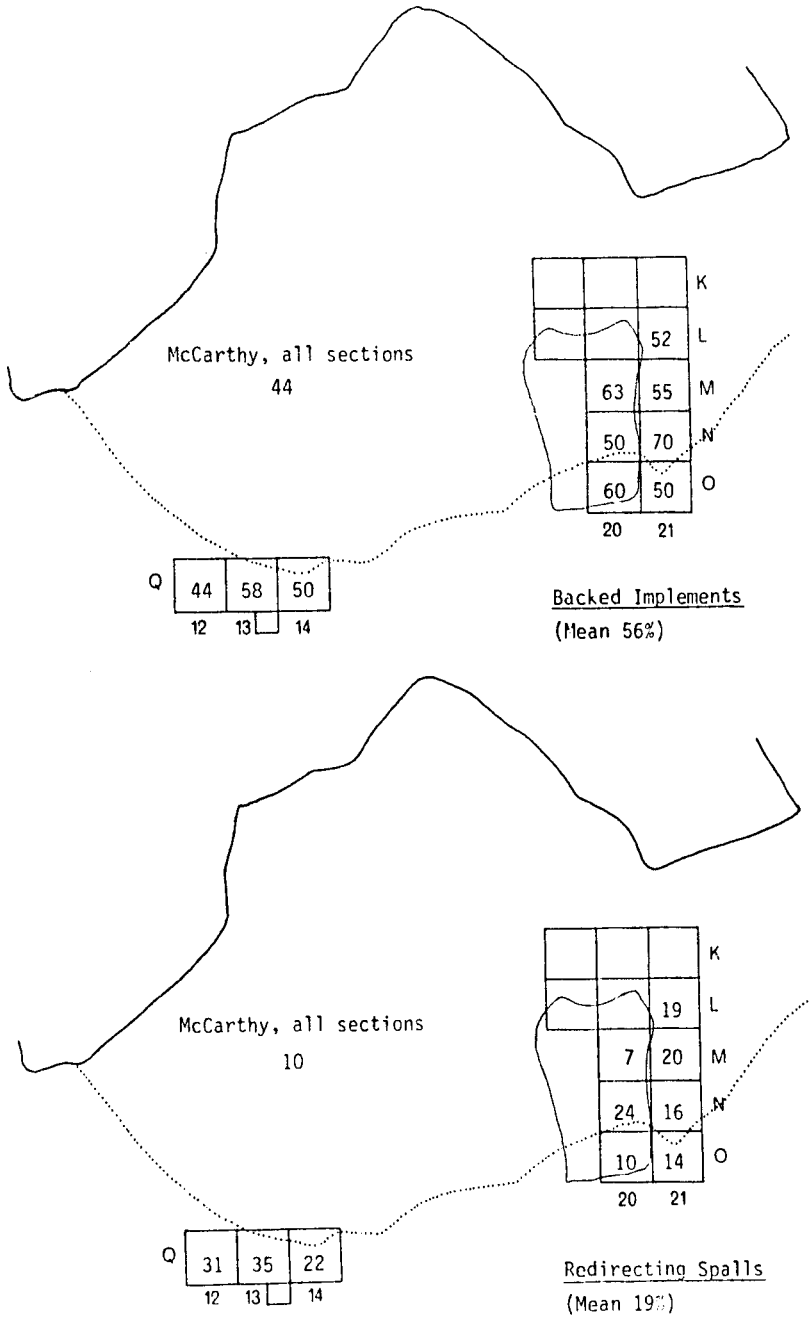
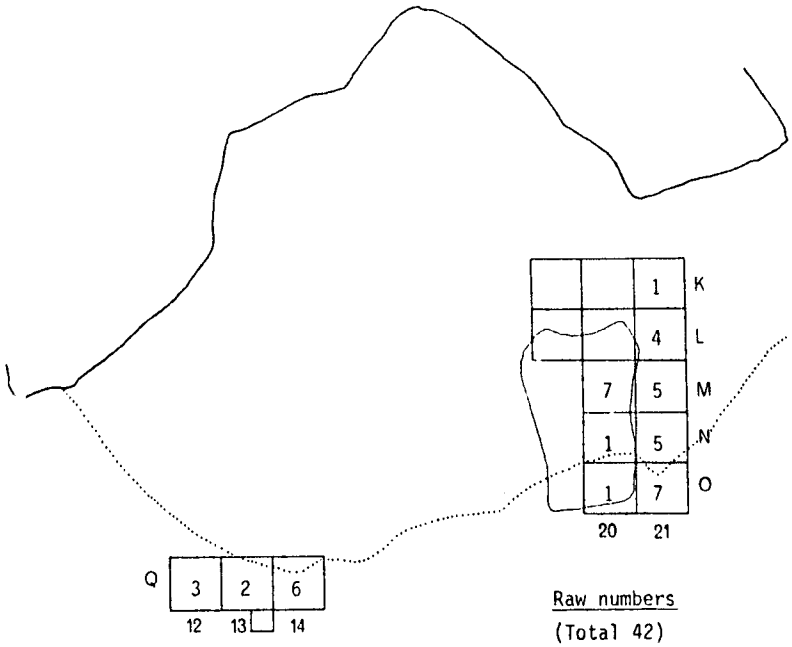



Fig. 51 Capertee 3 : Backed implements and redirecting spalls as a percentage of tools



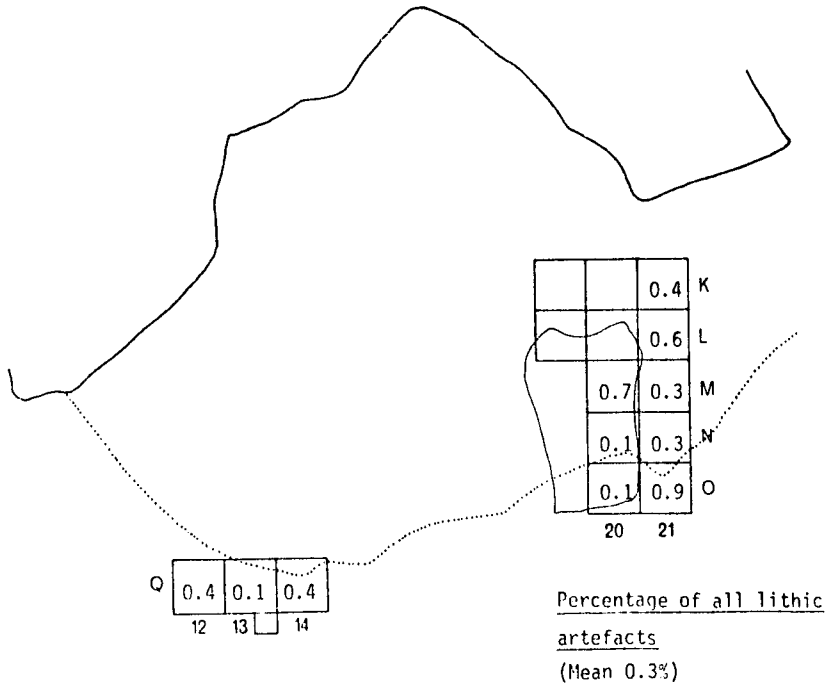




Fig. 52 Capertee 3 : distribution of small scraper/adze stones (Bondaian levels)

examination of a number of sites to determine whether there is consistency of horizontal patterning between sites. Without this essential step we are simply not in a position to make any but the grossest statements from inter-site analysis.

My experience from Capertee suggests that, for defining artefactual sequences, excavations near the dripline of sandstone rockshelters may be the most fruitful, not only in terms of sheer numbers of artefacts recovered for a given size of excavation but also in terms of stratigraphic clarity. The concentration of artefacts itself contributes to this by allowing more precise definition of changes in typology/technology and concentration, but in addition the area inside the shelter is likely to be dry, unvegetated and easily disturbed whilst vegetation and humus outside the sheltered area maintains a firmer base less subject to vertical disturbance. Equally the interior of the shelter is probably more suited to looking at the horizontal layout of successive occupations; it is perhaps better left largely undisturbed for future work when research orientations have changed and in-depth studies are possible. However these considerations may be partially offset by the need to recover faunal material or charcoal from older levels.

The dripline-bias in the distribution of lithic artefacts can, I believe, be explained in terms of a broad activity layout. This layout appears to have existed throughout the history of the site, since the Capertian and Bondaian levels show similar patterns (see figs. 44-48). Several authors (e.g. Yellen 1977:85 et seq., O'Connell, Meehan, Jones pers. comm.) have noted the rejection of debris from a central living area onto dumps encircling or along one side of hunter-gatherer camp sites. Hale and Tindale (1934) have noted a similar pattern in an ethnographically occupied rockshelter in Queensland, where they found a cleared space with hearths in the sheltered area and an accumulation of midden material along the dripline. A similar pattern was observed in the prehistoric camp-sites excavated at Pincevent (Leroi-Gourhan and Brezillon 1966, 1972, see also Johnson 1976, in press). I believe that the concentration of material along the dripline represents rejection of material from within the sheltered area, perhaps compounded by activities such as stone knapping being performed just within the sheltered area. If this is indeed the case, we might expect that the bulk of the faunal and vegetable debris accumulated in the

| | Lithic artefacts | | Lithic artefacts | | Volume excav' ($m^3$) | | Artefacts per $m^3$ | | Mean artefact wt (gm) | | Wt sediment (kg) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B # | C # | B Wt.gm | C Wt.gm | B | C | B | C | B | C | B | C |
| Q12 | 829 | 3,550 | 680 | 6,747 | 0.060 | 0.22 | 14,000 | 16,000 | 0.8 | 1.9 | 64 | 418 |
| Q13 | 1,893 | 4,845 | 1,569 | 7,044 | 0.063 | 0.21 | 30,000 | 23,000 | 0.8 | 1.5 | 76 | 396 |
| Q14 | 1,645 | 2,993 | 1,406 | 5,559 | 0.045 | 0.14 | 37,000 | 21,000 | 0.9 | 1.9 | 57 | 359 |
| R13 | 634 | 910 | 496 | 787 | 0.017 | 0.030 | 37,000 | 30,000 | 0.8 | 0.9 | 29 | 52 |
| K21 | 280 | 116 | 366 | 243 | 0.063 | 0.209 | 4,400 | 550 | 1.3 | 2.1 | 87 | 312 |
| L21 | 681 | 133 | 631 | 333 | 0.077 | 0.094 | 8,800 | 1,400 | 0.9 | 2.5 | 124 | 328 |
| M21 | 1,829 | 355 | 1,605 | 336 | 0.065 | 0.060 | 28,000 | 5,900 | 0.9 | 0.9 | 164 | 216 |
| N21 | 1,464 | 334 | 1,775 | 513 | 0.089 | 0.103 | 16,000 | 3,200 | 1.0 | 1.5 | 212 | 248 |
| O21 | 801 | 459 | 1,152 | 1,131 | 0.066 | 0.073 | 12,000 | 6,300 | 0.9 | 2.5 | 168 | 209 |
| | | | | | * | * | | | | | | |
| L20 | 0 | 80 | 0 | 115 | 0.0 | 0.14 | - | 580 | - | 1.4 | - | 235 |
| M20 | 1,026 | 108 | 1,013 | 150 | 0.04 | 0.07 | 26,000 | 1,500 | 1.0 | 1.4 | 67 | 123 |
| N20 | 1,406 | 34 | 1,806 | 30 | 0.08 | 0.02 | 217,000 | 1,400 | 1.3 | 0.9 | 144 | 40 |
| O20 | 1,051 | 47 | 2,178 | 25 | 0.11 | 0.02 | 9,000 | 3,000 | 2.1 | 0.5 | 189 | 27 |
| Total | 13,539 | 13,964 | 14.7kg | 23.0kg | 0.8 | 1.4 | 17,000 | 10,000 | 1.1 | 1.6 | 1,380 | 2,960 |

[1] Excluding large rocks

'B' = Bondaian
'C' = Capertian

[2] Unindividualised artefacts estimated from weight classification data

* Volumes estimated from weight of sediments excavated

Table 15 Capertee site 3 : summary data

site would also have been deposited in the dripline area, as in the case of Hale and Tindale's study (cf. above). The interior of a rockshelter is therefore likely to give a very impoverished picture of the overall faunal sample, probably biassed by size of the faunal material (see references above), and I believe one should seriously question the utility of obtaining such material before embarking on the extension of an excavation to the sheltered area. The sorts of questions that we are at present in a position to ask are probably best and least destrucively resolved by excavation at or in front of the dripline of smaller rockshelters. Information is not at present available on the spatial distribution of large rockshelters (e.g. Cathedral Cave, Blackfellows' Hands Shelter), but we might reasonably expect the patterning to occur at a scale smaller than the overall floor area, i.e. living and dumping zones may occur at several (shifting) points within the shelter.

## DATING THE CAPERTIAN/BONDAIAN TRANSITION

Table 16 lists the nine radiocarbon dates available from Capertee 3, six from McCarthy's excavation and three from my own. One of the original reasons for re-excavating Capertee 3 was McCarthy's date of 3623 ± 59BP (V34) for the Capertian, a supposedly pre-backed-blade industry. This date was in direct conflict with fifth millennium BP dates claimed to be associated with backed blades at other sites in eastern New South Wales (Noola, Bobadeen, MacDonald River, Burrill Lake, Graman GB1). I will examine these other dates in the following chapter.

Although McCarthy's dates cannot be reconciled with a steady build up of deposits (see table 16) they form a consistent series. His date for the upper part of the Capertian, 3623 ± 69BP (V34), is 17-19" (43-47 cm) below the transition to the Bondaian, and although it is based on a hearth or ashy area which was used repetitively for much of the history of the site (McCarthy 1964:199) I think we can assume that, barring gross error, it can be taken as a terminus post quem for the appearance of backed implements in the site. McCarthy's date of 2865 ± 57BP (V33), firmly situated in the Bondaian levels, provides us with a terminus ante quem for the appearance of backed implements. If the feature from which V34 was collected was in fact a pit 20" (50 cm) or more deep into the Capertian deposits and filled with Bondaian

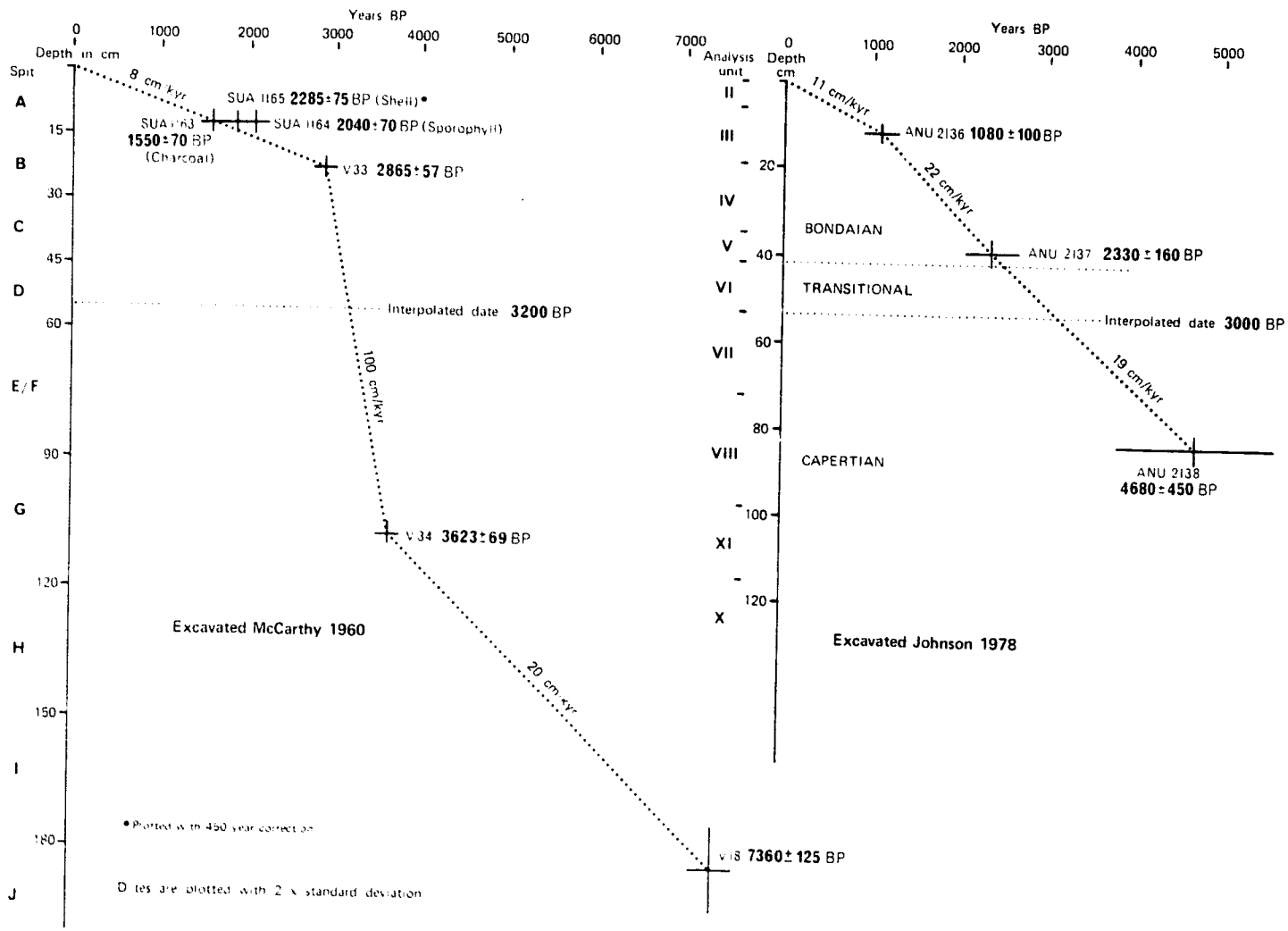



Fig. 53 Capertee site 3 : depth age diagrams

| | | Depth below *in situ* surface (cm) | Spit or excavation unit | Square or section |
|---|---|---|---|---|
| ANU 2136 | 1080 ± 100BP | 9-14 | 6 | Q13 |
| ANU 2137 | 2330 ± 160BP | 35-42 | 11 & 12 | Q13 |
| SUA 1163 | 1550 ± 70BP | probably 10-15 | A | 6 |
| SUA 1164 | 2285 ± 75BP | probably 10-15 | A | 6 |
| SUA 1165 | 2040 ± 70BP | probably 10-15 | A | 6 |
| V 33 | 2865 ± 57BP | 20-25 | B | ? 6 |
| V 34 | 3623 ± 69BP | 104-109 | G | ? 2 or 6 |
| ANU 2138 | 4680 ± 450BP | 80-86 | 24 & 25 | Q13 |
| V 18 | 7360 ± 125BP | 173-193 | I/J | ? 8 |

ANU dates based on charcoal fragments collected from wet sieving process (Johnson 1978).
V dates based on samples of 'ash layers' or 'hearths' (McCarthy 1958-61).
SUA 1163 on charcoal fragments, SUA 1164 on freshwater mussel shell (*velesunio*),
SUA 1165 on charred macrozamia sporophyll fragments (McCarthy 1958-61).

Table 16 Capertee site 3 : radiocarbon dates

| BETWEEN | PLOTTED LINE (cm/Kyr) | 90% CONFIDENCE[1] (cm/Kyr) |
|---|---|---|
| Johnson | | |
| 0 - 1080 BP | 11 | 8 - 14 |
| 1080 - 2330 BP | 22 | 14 - 32 |
| 2330 - 4680 BP | 19 | 13 - 29 |
| McCarthy | | |
| 0 - 2865 | 8 | 7 - 9 |
| 2865 - 3623 | 100 | 86 - 143 |
| 3623 - 7360 | 20 | 16 - 25 |

(1) Including allowance for extreme deviations within vertical span of sample.

Table 17 Capertee site 3 : sedimentation rates between dates

material, I would have expected McCarthy to recognise this from the ubiquitous presence of backed implements, redirecting spalls and the general appearance of the stone industry.

The dates from my excavation all come from square Q13 and present a more coherent picture. On a depth/age diagram all three lie very nearly on a straight line (fig. 53). We have seen from the granulometric analysis of the R13 column sample that there is no evidence for erosional events in the build up of the deposits in this area and the linearity of the depth/age curve suggests that there has been a uniform rate of deposition, within the limits of experimental error, over at least the past four and a half thousand years. The backplot of finds (fig. 33) shows that the older date is 'sealed' below a well marked concentration of artefactual material which is of firmly Capertian character, thus guaranteeing that it is not charcoal which has been dug in from a higher level perhaps belonging to the Bondaian. This illustrates one important use of backplots; as a means of detecting post-depositional disturbance.

The transitional level between the Capertian and the Bondaian is enclosed by the two older dates of 2330 ± 160BP (ANU2137) and 4680 ± 470BP (ANU 2138). On the basis of linear interpolation, authorised by the discussion above, this level would date to approximately 2500-3100BP. Combining this with the terminus post quem of 3623BP and terminus ante quem of 2865BP for the Capertian/Bondaian transition in McCarthy's excavations, we can state with a fair measure of certainty that backed implements appeared in this site at or just before 3000BP. Even if we ignore McCarthy's date of 3623BP for the Capertian, interpolation between his dates of 2865BP and 7360BP puts the transition at less than 4000BP, supported by the terminus post quem of 4680BP from well down into the Capertian in my excavations.

Richard Gillespie, Sydney University Radiocarbon Laboratory, kindly offered to date samples collected from a charcoal feature by McCarthy, as part of his study of the dating of freshwater shells. The feature, which McCarthy refers to as the 'macrozamia hearth', contained abundant charcoal, charred macrozamia sporophyll fragments and husks and freshwater mussel shell. It is labelled as coming from section 5 layer 1 (=A), and the feature 'began at 4 inches [10 cm], finished at 12 inches [30 cm]'. I assume therefore that the sample was collected from the top of the feature when first exposed, hence the

label 'layer 1', putting the sample at a depth of 4-6" (10-15 cm). This does not of course mean that deposits surrounding the feature at the same level are contemporaneous as the feature may have formed a pile above the surface level when it was formed. Given this proviso, however, the dates obtained support McCarthy's younger date (2865 ± 57BP) and imply a much reduced rate of sediment accumulation over the last 1500-3000 years (fig. 53 and table 17). The three dates obtained from McCarthy's charcoal feature are on charcoal (1550 ± 70BP SUA1163), charred macrozamia sporophyll (2040 ± 70BP SUA1165) and freshwater mussel shell (2285 ± 75BP SUA1164). The first two results are significantly different ($z = 4.9$).

Corrections for environmental effects on freshwater shell dates have not been established, but if they are of the same order as for marine shellfish, i.e. subtraction of 4-500 years from the date, SUA1164 would fall roughly midway between the charcoal and sporophyll dates. On the depth/age curve (fig. 53) I have subtracted 450 years when plotting this date.

## Conclusion

My excavation of the Capertee 3 site has served to verify McCarthy's definition and dating of the Capertian/Bondaian transition and to provide further information on the nature of the artefactual sequences. However, I see its more important contribution as lying in the field of methodology, and it is the methodological implications of my results that I wish to stress in this section.

As far as the sequence of the Capertee 3 site is concerned, occupation appears to have commenced some time before 7000BP and to have been accompanied by a marked increase in sedimentation rates. I have suggested that this increased sedimentation may be due to the effect of increased fire-pressure, but the verification of this hypothesis would require a considerable geomorphological and archaeological input. At some time shortly before 3000BP there is a marked change in lithic industry, characterised by a shift in raw material usage, more controlled flaking techniques giving rise to smaller and more elongated flakes and the proliferation of a range of characteristic tools, notably backed implements. Within the limits of the data, all these changes occurred together. The suite of changes

occurring at this time appear to coincide closely with those described from many other sites, and hence justify the application of the widely used terms Core Tool and Scraper Tradition and Small Tool Tradition to the lower and upper industries respectively. The implications of the dating of the industrial change at Capertee 3 will be discussed in detail in the following chapter.

The Capertee 3 sequence fits well with the picture derived from other sites in the Blue Mountains area. The older (Capertian) industry is characterised by the presence of large little retouched chunks of poor quality raw material.Fine grained isotropic material makes up a smaller proportion of the assemblage than in the succeeding Bondaian industry. A similar trend was apparent at Shaw's Creek and Springwood Creek (see chapter 3, figs. 5 and 7). As in those sites, the Bondaian levels at Capertee 3 are richer than the Capertian ones, although the difference is not as marked for the North excavation (Q12-14) as it is for the West excavation (K,L,M,N,O 20 and 21).

At the end of the Capertee sequence there is a marked fall-off in artefact concentrations, corresponding roughly with the last 500-1000 years. This is the period when elouera and fabricators are common in the other Blue Mountains sites and these types are uncommon in the Capertee sequence (5 bipolar specimens, 3 'classic' eloueras and approximately 14 other specimens with similar use-wear). I have suggested that the explanation of such an 'abandonment' of the site may in fact lie not so much in a shift in Aboriginal exploitation of the area but simply in the sporadic occupation of the site, so that sterile or largely sterile levels may be the norm rather than the exception.

If this is indeed the case for the very rich assemblage from Capertee 3, then it has far reaching implications for the sparser assemblages found in many sites. Sterile zones need no longer be hiatuses of occupation (e.g. Stockton and Holland 1974) and dense concentrations of artefacts may reflect length of stay and group size/composition rather than intensity of occupation of the area as a whole. Clearly we should put an effort into clearly defining vertical concentrations of material and determining whether these in fact represent a single visit to the site, relatively short term occupations stretching over a few years or decades, or longer periods of use and abandonment. Only if we can show that we are dealing with

the third situation is it possible to start discussing general trends in either intensity of exploitation of an area or changes in patterns of artefact manufacture, use or discard. If we are dealing with distinct occupations spanning perhaps a lifetime or less, down to a single visit of a few days or weeks, then we have to be much more cautious in seeing vertical variation as reflecting general trends rather than idiosyncratic productions. My discussion of excavation techniques in chapter 7 goes some of the way towards suggesting methods which will aid in the separation of material from successive occupations or periods of occupation, e.g. tighter horizontal and vertical control with a posteriori grouping of excavation units and the use of backplots and conjoins.

The Capertee 3 site shows a considerable degree of horizontal patterning. Throughout the history of the site the greatest concentration of artefacts is to be found around the dripline, with characterisable tools concentrating just inside the dripline (figs. 47-52). Similar patterning has been observed by a number of authors (cf. above). At a smaller scale, however, horizontal patterning may also be event-specific, as in the case of the co-occurrence of groups of similar tools (e.g. fig. 40) or the limited spatial distribution of artefact concentrations such as those appearing on the North excavation backplot (fig. 33). Such patterning has important implications for comparison between sites which have not been sampled systematically, as is generally the case. Ideally excavations should be set up as an explicit areal sampling procedure aimed at reconstructing the site population (of artefacts), but this will generally require extensive excavations which are at present difficult to justify in the context of most Australian research designs. I have suggested that, pending a detailed study of horizontal patterning of Australian rockshelter sites, inter-site comparison should be based on equivalent parts of rockshelters. I also feel that the requirements of current research orientations and the aspirations of future research may be best satisfied by excavation in the vicinity of, or outside, the dripline, leaving the interior inviolate for more intensive study. Had McCarthy's excavation at Capertee 3 followed this suggestion we would now be in a position to obtain detailed information on occupation layout and faunal and vegetable remains, information which contributed nothing to McCarthy's study. Equally, McCarthy would probably have recovered a similar or larger collection

of lithic material on which to base his typological study.

Probably the most important, yet largely invisible, contribution made by my excavation lies in the development of the recording forms, coding formats and computer programs described in chapters 7 and 8. It was through my work on the Capertee material that I came to realise the importance of having a single consolidated file of excavation data, rather than a number of special purpose files as I started out with, and of being able to update this file continuously as new data became available. Whilst I could undoubtedly have completed the analysis of the Capertee material by hand in a fraction of the time it has taken me to develop the necessary programs, I am satisfied that I have produced a workable and convenient system which will allow rapid recording and efficient analysis of data from future excavations.

# CHAPTER 6

## Wider implications: the problem of dating backed implements and other traits

## Introduction

The non-methodological aims of my excavation at Capertee 3 included the dating of the appearance of backed implements in the site, and it is to the wider implications of this dating that I wish to address this chapter. I shall adopt a '*fossile directeur*' approach and look specifically at the dating of backed implements, not because I feel that this approach is necessarily the most informative but because it is the only approach which can currently be applied to more than a limited range of sites. Backed implements are one of the few artefact types which are consistently recognised by most workers[1]. Equally backed implements have been the object of published discussions of dating which are, in my opinion, misleading and are widely quoted (see particularly Pearce 1974a).

I have no intention, in this chapter, of trying to explain why the changes associated with the Small Tool Tradition occur, or what is their significance in human terms. I am simply concerned with the tracing of one particular trait as a means of illustrating some of the problems of interpretation that can arise from poorly controlled data. In this way I shall highlight some of the problems with existing methods of excavation, recording and exchange of data. The role of chapters 7 and 8 will then be to attempt a systematisation and structuring of excavation and data recording methods in cognisance of the problems arising with the range of current methodologies.

## Backed implements as a *fossile directeur*

More attention has been given to the dating of backed implements, specifically to their first appearance, than to any other artefact type on the Australian continent. Whilst this is largely a function of their unequivocal identification in a wide range of dated sites, it also reflects the implicit assumption that they are a valid *fossile directeur* of the Small Tool Tradition.

I have noted in chapter 1 that the term Small Tool Tradition is a convenient pigeon-hole which implicitly links a range of regionally specific lithic industries appearing within the last 7000 years and

(1) Although see section on Puntutjarpa for an example where this is not the case and comment in chapter 5 on the possibility of confusion between backed implements and redirecting spalls.

before 2000BP. On the other hand backed implements can be considered as a trait and need not necessarily be strictly associated with other traits considered to characterise the Small Tool Tradition.

At Capertee 3 there was a clear break in lithic industry marked by changes in typology, technology and raw material usage. The appearance of backed implements was closely associated with this break. I am satisfied that, in the case of the Capertee sites backed implements are an effective fossile directeur of a general change in lithic industry. Unfortunately most site reports base their identification of the Core Tool and Scraper/Small Tool Tradition junction simply on the appearance of backed implements. In discussing the precise stratigraphic relationship between the appearance of backed implements and other changes in the lithic industries, we are often hampered by small assemblages or occupational disturbance. Where observations have been made, they have so far tended to confirm that, in Small Tool Tradition industries primarily characterised by backed implements, the appearance of backed implements correlates with other changes in lithic industry. My working hypothesis is therefore that, in areas where backed implements are a significant element of Small Tool Tradition assemblages, backed implements can be used as a fossile directeur for the Core Tool and Scraper/Small Tool transition. A corollary of this hypothesis is that, barring several independent inventions of backed implements, the Small Tool Tradition is a coherent phenomenon within the area in which backed implements are its dominant type.

Dating of the appearance of backed implements

The first detected appearance of backed implements on the Australian continent is conventionally considered to lie in the range 5-6000BP (e.g. Glover 1967:425, Pearce 1974a:300, Dortch 1975:59, Jones 1975:21, McCarthy 1977:255, Mulvaney 1978:6, McBryde 1978:1). Pearce (1974a) has attempted to detect chronological clines in the appearance of backed implements across the continent and stresses that 'the earliest dates so far recorded are in New South Wales' (ibid.:305). This view has recently been quoted by White and O'Connell (1979:26), though these authors point out that Stockton (1977) has raised doubts on the four oldest dates. My confirmation of McCarthy's late (approximately 3000BP) dating of the appearance of backed

implements at Capertee Site 3 throws new doubt on the earlier dates from this area. It focusses attention on the plethora of dates for backed implements within the last 3-4000 years and the paucity of dates before this time.

Pearce's 1974 article attempts, in my opinion, to squeeze too much out of the data available. It does this by making the uncritical assumption that the reported associations of lithic material with the C14 determinations are entirely correct. We have only to look at the problematical C14 reversals or inconsistencies at sites such as Puntutjarpa (Gould 1977) or Graman Site 1 (McBryde 1968, 1974) to be cautioned against such uncritical assumptions. I shall start, therefore, by looking at some of the critical questions we must ask when assessing the dating of backed implements (or other traits) and the sorts of uncritical assumptions that are commonly made.

The problem of association

The commonest, and in my opinion most misleading, assumption to be found in the literature is that a date derived from an excavated spit dates artefacts found in that spit. This assumption arises, I believe, from the subconscious equation of spits with geological strata. Such an equation is only permissible where geological strata can be followed, which is rarely the case in Australian sites, or where well marked concentrations of artefacts at particular levels can be followed on backplots and related to relatively short-term occupations of the site. This problem of stratigraphic integrity has been recognised by some authors who have been at pains to stress association of dated material and artefacts within a feature or a limited horizontal distance (e.g. Gould 1968:175, Stockton and Holland 1974:40, McBryde 1968:85,90).

Even if stratigraphic integrity of individual spits can be ensured (and in practice I suspect that the best we can hope for, under normal circumstances, is that our spit boundaries should lie within $\pm$ 5 cm of an isochronic surface) sedimentation rate in most Australian rockshelter sites is slow, of the order of 10-20 cm per thousand years for many sandstone rockshelter sites (table 18) and in some cases as low as 2-5 cm per thousand years. A 5 cm spit with 5 cm deviations from stratigraphic integrity may therefore incorporate

| Site | cm/KYr | Yrs BP From | To |
|---|---|---|---|
| Capertee 3 | 16 | 2330 | 0 |
| | 19 | 4680 | 2330 |
| | 20 | 7360 | 3623 |
| | 100 | 3623 | 2865 |
| Noola | 17 | 12550 | 5320 |
| Abercrombie | 110 | 1170 | 0 |
| Lapstone | ∿37 | 3650 | ∿300 |
| Springwood W | 14 | 2930 | 0 |
| | 9 | 2930 | 615 |
| | 11 | 6050 | 2930 |
| | 23 | 8730 | 6050 |
| Bobadeen | 13 | 5150 | 0 |
| Millbrodale | 20 | 630 | 0 |
| | 13 | 1410 | 630 |
| Sandy Hollow | 46 | 1300 | 0 |
| | 24 | 1300 | 530 |
| Macdonald R. | 19 | 5820 | 2370 |
| Burrill L. | 4 | 5320 | 1660 |
| | 3.5 | 12450 | 5320 |
| | ∿65 midden | 1660 | 0 |
| Currarong I | 11 | 3790 | 1990 |
| | 45 midden | 1990 | 0 |
| Currarong II | 11 | 5540 | 3250 |
| | 26 | 3250 | 1150/1620 |
| Jervis Bay | 173 midden | ∿1240 | ∿760 |
| Bass Point | 2.2 | 3490 | 17010 |
| | 20 | 0 | 3490 |
| | 35 | 0 | 985 |
| | 15 | 985 | 3490 |
| Clybucca 3 | 33 | 4260 | 3360 |
| | 41 | 4260 | 5120 |
| Sassafras I | 11 | 0 | 1695 |
| | 29 | 1695 | 3090 |
| | 39 | 3090 | 3770 |
| Puntutjarpa Hypothesis A | 4.5 | 4010 | 10170 |
| | 105 | 0 | 435 |
| Puntutjarpa Hypothesis B | 10 | 0 | 6740 |
| | 15.5 | 6740 | 10170 |
| Fromm's #2 | 57 | 0 | 3240 |
| | 180 | 3240 | 4055 |
| Fromm's #6 | 46 | 0 | 2950 |
| | 274 | 2950 | 3450 |
| Northcliffe | 11 | 3080 | 6780 |
| Skew Valley | 36 | 2320 | 3320 |
| | 66 | 3090 | 3700 |

Table 18 Sedimentation rates for selected archaeological sites

materials spanning a thousand years or more.

In addition several authors, e.g. Matthews (1965), Stockton (1973, 1977a, in press), Hughes and Lampert (1977), have pointed out that artefacts may move up or down through 'treadage and scuffage', animal disturbance or site maintenance. Stockton in particular predicts that smaller artefacts will tend to sink relative to larger ones and charcoal, although only one experimental test has been published and this is of a rather rudimentary nature (Stockton 1973:116). However, even in this short (1 day) test, small artefacts moved as much as 10 cm downwards through the effects of treadage and scuffage alone.

The outlook may now look rather gloomy as far as the accurate dating of lithic industries or particular traits is concerned. However we can get around some of these problems, first of all by choosing the right sorts of sites and secondly by careful controls on the depositional and post-depositional history of the deposits and of the artefacts they contain.

The best sites for dating purposes are either single occupation sites (generally open air camp-sites), sites in which individual short-term occupations can be distinguished (open camp-sites or infrequently occupied rockshelters) or sites in which the deposits have built up rapidly and/or where the matrix has hindered vertical displacement of artefacts. Many middens are prime examples of the latter type of site, as has been pointed out by Hughes and Lampert (1977:136).

Control on the depositional and post-depositional history of the deposits and artefactual material involves not only careful observation of the stratigraphy, detection of signs of disturbance and sedimentological analysis of the matrix, but also tight control on the provenance of artefacts including observation of vertical concentrations of artefacts (e.g. by the use of backplots) and reconstruction of objects broken in antiquity (conjoins). This control can give valuable clues as to whether vertical displacement of material has occurred, as well as helping to tie up the stratigrapny across a site lacking perfect geological markers.

A third approach to refining dating estimates for particular traits is by critical assessment of dating from a number of sites. This approach is particularly applicable to a situation such as the dating of the appearance of backed implements, because there is one obvious and predictable bias which is likely to occur in this case; whether or not Stockton (1973) is right in predicting that smaller artefacts will tend to sink, the backed implement industries are characterised by small, positively identifiable artefacts, whilst the underlying industries lack such distinctive traits. Any form of post-depositional disturbance or stratigraphic uncertainty is likely to cause backed implements and, by extension, the backed implement facies of the Small Tool Tradition, to creep insidiously back in time. This tendency may in addition be accentuated by a natural desire on the part of archaeologists to find the oldest occurrence of any trait which will encourage the acceptance of an old, but not unreasonably old, date at face value.

When looking for the first appearance of backed implements in an area we should therefore be looking not so much for the earliest assemblage containing backed implements but for the latest assemblage without them (with the proviso that this assemblage must be sufficiently large to exclude the possibility that the absence is due to sampling). The dating of this assemblage will then provide a terminus post quem for archaeological visibility of backed implements. This does not necessarily mean that backed implements did not exist before this date, but does imply that, if they did exist, they were very scarce and/or were discarded in different types of sites from the ones excavated. However the ubiquitous appearance of backed implements in all sites dating between approximately 3000-1000BP, and their sudden appearance as an important component of the assemblage where a transition from a pre-backed implement industry can be observed, argues for a sharp introduction rather than a slow gain in popularity. Where backed implements occur they appear to be well established by about 2000BP before declining towards the present, so I would therefore suggest that large assemblages lacking backed implements and older than about 2000BP, pre-date the appearance of backed implements in the area in which the site is situated.

Distribution of C14 dates through time

Given our premise that backed implements will tend to spread back in dating from their true date of appearance, what sort of pattern of distribution of dates would we expect? I would argue that numerous dates associated with backed implements would be younger than or as old as their introduction, whilst a small scatter of dates would lie in the millennia preceding their true date of introduction. Similarly no dates post-dating the introduction of backed implements should be associated with large assemblages lacking backed implements. This pattern should of course only apply within a limited area if, as may well be the case, the introduction of backed implements is not simultaneous across the continent.

Mulvaney (1978) has plotted a histogram of dates which are claimed to be associated with backed implements. I have adapted this histogram in fig. 54. This clearly shows a drop in number of determinations occuring at about 4000BP. Mulvaney found only nine dates older than 4,500BP 'associated' with backed blades (sic) and five dates between 4000 and 4500 BP, compared with 17 or more dates for each 500 year interval from 4000BP to 500BP. In addition we should note that a number of 'pre- backed implement' dates occur up to as late as 2500BP (see below).

The pattern observed would fit well with the hypothesis of a spread of dates back in time from a 'true' date for the appearance of backed implements in the 3000-4500BP range. On the other hand it can be argued that the drop in dates for backed implements simply reflects a drop in overall number of dates, perhaps associated with the effective limits for preservation of datable material in sandstone rockshelters. However the drop is not apparent in dates said to be associated with pre-backed implement industries. I have not been able to produce a comparable histogram for pre- backed implement dates because many dates are associated with small assemblages which, by virtue of their sample size, cannot positively be stated as preceding the appearance of backed implements.

As Stockton (1977) has pointed out, dates claimed to be associated with backed implements appear to fall into two distinct groups, those younger than about 4500BP and those older than about 5000BP. The latter group includes one or two for which the dating is

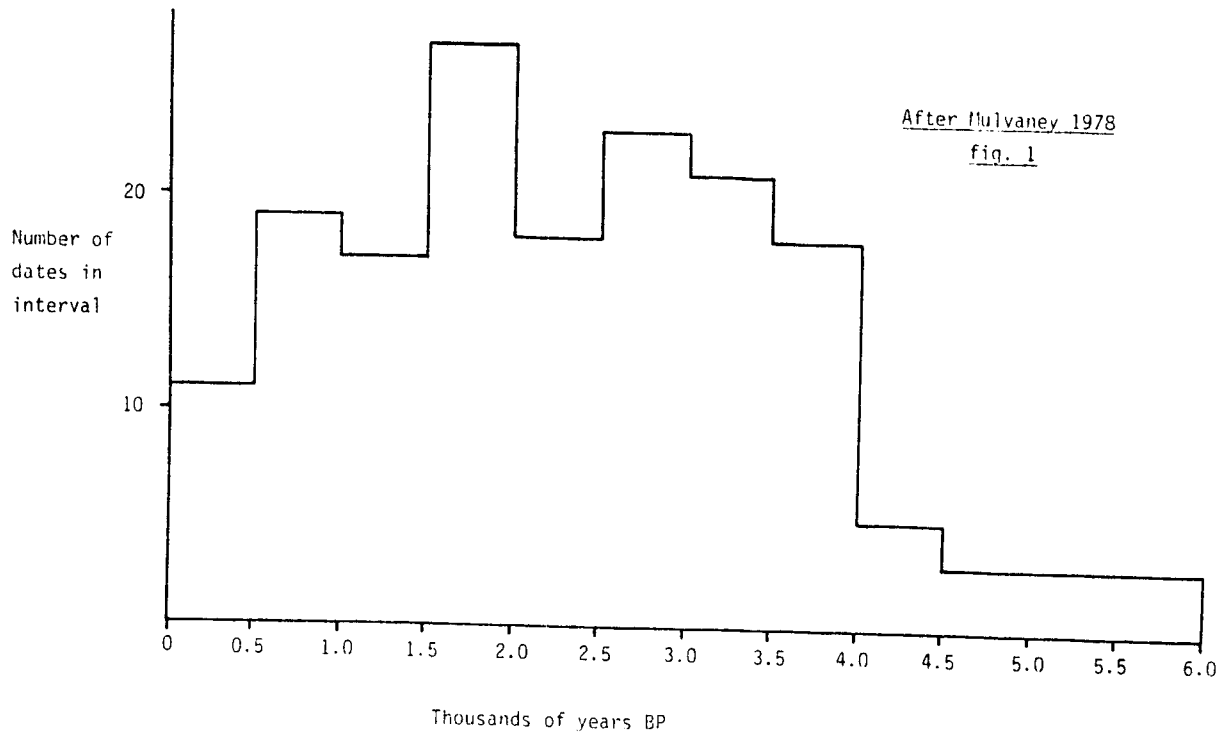



Fig. 54 Distribution of C14 dates 'associated' with backed implements

based on interpolation rather than direct association (e.g. Northcliffe). Initially I shall review the first category of dates, placing particular emphasis on sites for which a dated assemblage lacking backed implements is followed by one containing them. Later in the chapter I will take a critical look at the scatter of older dates to determine whether their stratigraphic credentials are sufficiently firm either to contradict the evidence of more recent dates from the same area, to suggest simultaneity of industries with and without backed implements in the same area, or to suggest a wide spread in dating for different parts of the continent.

## NEW SOUTH WALES

### Capertee Site 3

Backed implements appear sharply between a date of 3623 ± 69BP (V34) and 2365 ± 57BP (V33) in McCarthy's excavations and between dates of 2330 ± 150BP (ANU2137) and 4680 ± 450BP (ANU2138) in my excavations. On linear interpolation the first appearance of backed implements for both excavations occurs at around 3000BP. A full discussion of the dating appears in chapter 5.

The pre- backed implement Capertian industry is represented by a large assemblage (347 tools for McCarthy's excavation, 14,000 lithic artefacts including 39 tools from my excavations) and contains no backed implements. The overlying Bondaian industry (892 tools from McCarthy's excavation, 13,000 lithic artefacts including 341 tools from my excavations) contained numerous backed implements (McCarthy 389, Johnson 191). A similar situation was found in McCarthy's poorer Capertee Site 1 excavation (undated), although a few backed implements were found in the Capertian assemblage from this site and their presence was attributed to the faunal cavities observed.

The consistent dating from two separate excavations, together with the large assemblage sizes and lack of even sporadic backed implements in the Capertian assemblage makes Capertee Site 3 one of the firmest datings available for the appearance of backed implements.

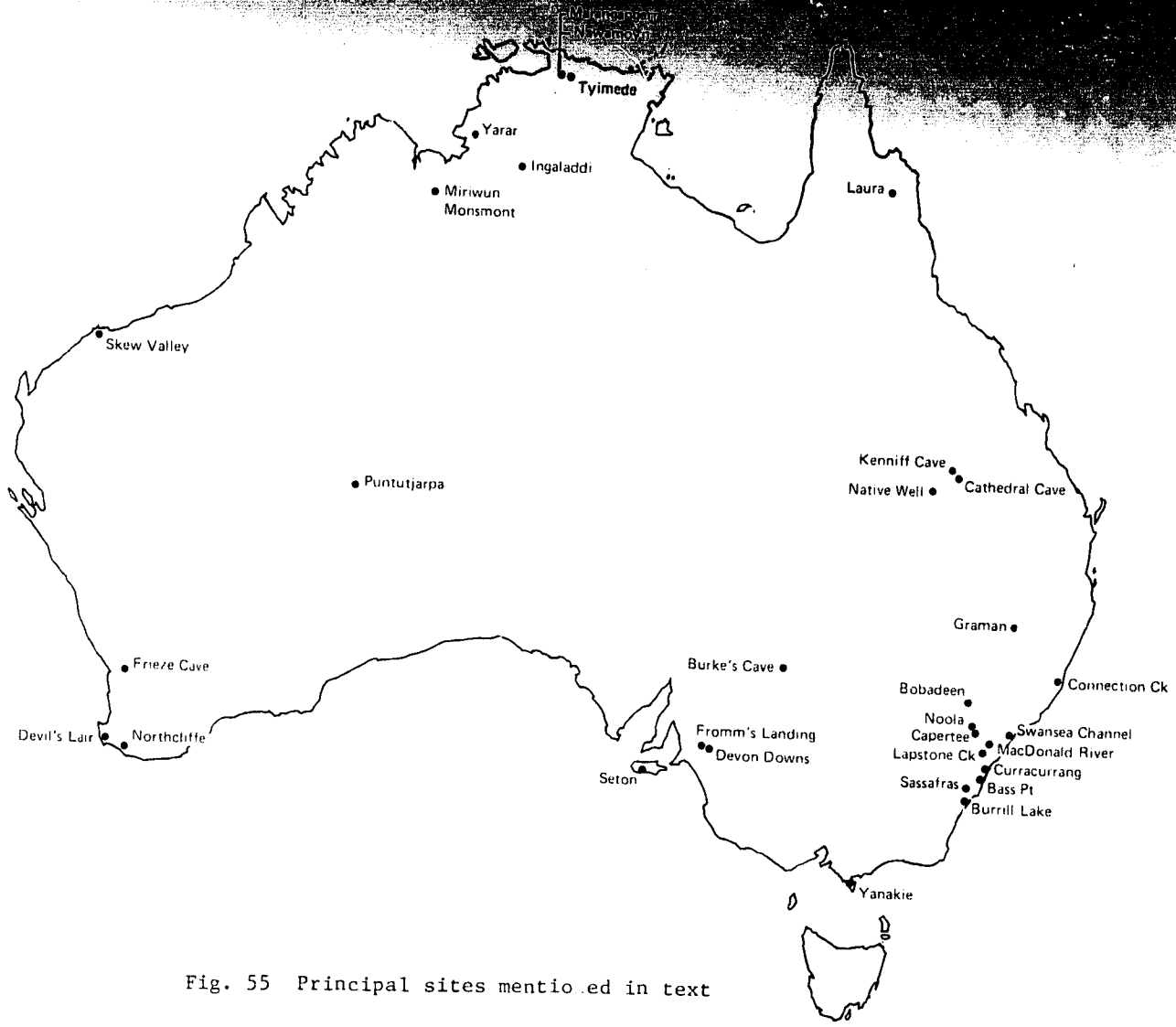



Fig. 55 Principal sites mentio ed in text

Curracurrang ICU5/-

Fourteen radiocarbon dates are available from this site, but it has only received sketchy publication in the form of 'Interim Reports' (Megaw 1965, 1966, 1967, Megaw and Nippard 1966). The stratigraphy is described as tripartite, consisting of a basal sand, a 'dark black-brown unctuous soil rich in carbon' and a capping of 'lightly packed midden'. Under the shelter these layers are approximately 45, 37 and 60 cm thick, respectively, but they change character and thin out down the slope outside the dripline. No stratigraphic diagram has been published, which renders assessment of the dates difficult. The only quantitative information on the litnic industries is given by Glover (in Megaw 1966) who gives counts for backed implements:

| | Elouera | Other backed |
|---|---|---|
| Midden | 51 | 63 |
| Midden - Black | 26 | 53 |
| Black (= 'Bondaian') | 71 | 329 |
| Black-Yellow | 10 | 61 |
| Yellow | 0 | 9 |

(Total yield of 'waste' flakes approximately 30,000.)

No mention is made of the black-yellow layer in the brief stratigraphic description, so I presume that this is a mottled zone associated with the reduction in organic carbon from higher levels in the 'black' to lower levels in the 'yellow'. A similar mottled zone is common in many sites (e.g. Capertee Site 3). As far as one can make out, the 'yellow' layer corresponds with a pre-backed blade industry similar to McCarthy's Capertian (Megaw 1967:28), and the 'black' layer is considered as Bondaian. Dates for the Bondaian range from 840 ± 90BP (GaK689) through 1580 ± 130 (GaK481), 2110 ± 90 (GaK896), 2230 ± 80 (GaK395) to 2360 ± 90BP (GaK688) reported as basal. The Capertian/Bondaian transition is dated to 2150 ± 130 BP (I1135), whilst the Capertian is dated to 2500 ± 400BP (GaK393b), 3000 ± 120BP (GaK394b) and 3880 ± 150 (GaK394a). The Capertian dates are based on widely scattered charcoal and can therefore only be taken as giving a general order of antiquity.

Whilst the Curracurrang dates cannot be interpreted in terms of a precise date for the appearance of backed implements, in view of the wide standard deviations, minor reversals and general lack of stratigraphic information, they seem to indicate a date somewhere in

the range 2000-3500BP. It is unfortunate that such an important and extensively excavated site, with reportedly clear stratigraphy, has not been published.

Bass Point

A considerable number of C14 dates (26) are available for this site and form a consistent depth/age series (Bowdler 1970, Hughes 1977). The stratigraphy consists of, from top to bottom, an upper midden and lower midden (distinguished on the basis of shell types), grey sand and white sand. Bowdler (1970 and pers. comm.) describes the grey sand as containing Bondaian-type material, although backed implements are rare, and obtained a date of 2975 ± 145BP (ANU535) near the base of this layer. On Hughes' (1977: fig. 5.10) depth/age curves the grey sand/white sand transition interpolates to just under 4000BP, but this curve ignores a date of 3490 ± 100BP (NSW 69) from the white sand. The industry from the white sand is described as amorphous and made on poor quality raw materials (Bowdler 1970, Hughes pers. comm.).

Bass Point, like Curracurrang but for different reasons, is not on its own solid evidence for the absence of backed implements before 4000BP. The dating depends on the identification of a 'Bondaian' industry, elsewhere known to be associated with numerous backed implements but here too poor to contain more than a handful. If we accept the identification of this industry and its relationship with the stratigraphy reported, Bass Point indicates the appearance of the Bondaian backed implement industry at around 3000-4000 years ago, most probably in the range 3000-3500BP.

Connection Creek I

Unlike the previous sites, Connection Creek I does not contain a backed implement industry. Seven dates, ranging from 4850 ± 160BP (GaK2458 on shell) to 3340 ± 100BP (SUA395/2 on shell) indicate a rapid buildup of midden material. Connah (1975:29) notes that 'backed blades were conspicuously absent', although the assemblage only comprises a few thousand artefacts (Connah, pers.comm.) The lack of more recent levels, which elsewhere in the area contain backed implements, can be explained in terms of changes in the local environment (Coleman 1978, Connah 1975).

Although there is some conflict and reversal between shell and charcoal dates from the site, only one date lies substantially outside (older than) the range 3000-3800BP (after correction of the shell dates). Three shell dates lie, after correction, at around 3000BP whilst charcoal dates from the same levels range from 3400-3800BP. Pending more detailed publication and assessment of the dating, this site appears to indicate the absence of backed implements in the area until some time after 3400BP.

## CENTRAL QUEENSLAND

### Kenniff Cave

Mulvaney's classic excavation at Kenniff Cave (Mulvaney and Joyce 1966) yielded a consistent series of radiocarbon dates for the last 5000 years. A small number (21) of backed implements (geometric microliths, Bondi points and 'miscellaneous microlithic retouch') were found between 2' (60 cm) and 3' (90 cm) below the surface, dated between 2300-3400BP from the depth/age curve. Five elouera, together with Pirri points (9) and Juan knives (7) were recovered between 3' (90 cm) and 4' (120 cm) below the surface, dating between 3400 and 4600BP. Between 4' (120 cm) and 4'6" (135 cm) below the surface (estimated date 5100BP), at which point there is a disconformity in the sediments, a similar density of artefactual material yielded none of these distinctive tool types. Backed implements (elouera), together with other 'Small Tools' or hafted tools, appear to date from approximately 4600BP in this site.

At the nearby site of The Tombs, one backed implement came from a depth of 47 - 51" (118-127 cm), below a date at 38 - 42" (95-105 cm) of 3500 ± 93BP (NPL31) which dates a level with a similar industry to the 'hafted' phase at Kenniff Cave. The levels from 51 - 81" (127-203 cm) were sterile, and a date of 9410 ± 100BP (NPL64) was obtained from an occupation level at 81 - 84" (203-210 cm) depth.

### Native Well 1

Morwood (1979) obtained charcoal dates of 4230 ± 90BP (ANU2171) and 4320 ± 90BP (ANU2003) from the base of a well defined occupation level containing backed implements and pirri points and separated by

relatively sterile deposits from levels without backed implements or pirri points dated to 6190 ± 100 (ANU2001).

Other sites in Central Queensland

Beaton (1977) claims that a number of sites were first occupied approximately 4000-3500 years ago and that these occupations were associated with backed implements. At Cathedral Cave the oldest date is 3560 ± 80BP (ANU1762) from a depth range of 135-150 cm (estimated from depths given for column sample) in excavation zones 1-3. A second date of 3330 ± 80BP (ANU1764) was obtained from a depth of 135 cm (estimated from stratigraphic drawing) in excavation zone 7, derived from a hearth. The occupation deposits are underlain by waterborn deposits or rockfall. At Rainbow Cave a similar date of 3600 ± 100BP (ANU1521) is reported as near basal from a depth of 40 cm, although the tool counts show the excavation zone in question as extending to the 50-55 cm spit. At Wanderer's Cave a date of 4320 ± 80BP (ANU1522) was obtained from between 5 and 10 cm above bedrock.

SOUTH AUSTRALIA

The Murray Valley sites (Devon Downs and Fromm's Landing) provide ideal dating conditions owing to the well defined stratigraphies and rapid build-up of sediments (Fromm's Landing 6: 270 cm/KYr from 3450 to 2950BP, Fromm's Landing 2: 180 cm/Kyr from 4055 to 3240BP, Devon Downs: approximately 100 cm/Kyr over the last 4000 years). Unfortunately lithic artefacts, including backed implements, are scarce. At Fromm's Landing shelter 2 a total of 8 geometric microliths appear in levels 10-8, dated to 4850 ± 100BP (R456/1), 4055 ± 85BP (P311) and 3881 ± 85BP (P309) respectively. At shelter 6, one geometric microlith came from level 16, dated to 3450 ± 90BP (NPL 63). At Devon Downs, several 'microliths' are claimed from levels X to VI (level IX is dated to 4250 ± 180BP (L271E)), but Mulvaney has examined these specimens and says that they are not backed implements (1960:76), whilst one backed implement from layer VIII was not recognised as such in the 1930 excavation.

The Murray valley sites, notably Fromm's Landing shelter 2, point to the presence of backed implements, primarily of the 'geometric' variety, at or before 4000BP. The rapid buildup of sediments, visible

stratigraphy and consistent dating of shelter 2 renders this dating practically incontrovertible. The backed implements are accompanied by similar numbers of pirri points at Fromm's shelter 2 and more numerous pirri points at Devon Downs, thus firmly placing the appearance of this type at or before 4000BP. Specimens identified as adze flakes appear from about 4000BP (Fromm's shelter 2 level 8, Devon Downs level VIII) and become common by Fromm's shelter 2 level 6 and Devon Downs level VII, appearing to be in inverse relationship with pirri points and backed implements which are largely restricted to the lower levels (Fromm's Shelter 2, levels 8-10, Devon Down's levels VIII-X). Mulvaney (1960:74-5) sees this transition as reflecting an increasing emphasis on wood-working at the expense of specialised stone working, rather than the distinct cultures claimed by Tindale (1957).

WESTERN AUSTRALIA

Backed implements have been reported from a number of sites in Western Australia. Unfortunately they are relatively uncommon so that it is difficult to date their first appearance.

At Walyunga (Pearce 1977, 1978) backed implements first appear in spit 14 dated to 3220 ± 100BP (SUA508), but there are only 275 artefacts between this spit and spit 19, dated to 6135 ± 150BP (SUA509). The period 6000-3000BP is also characterised by a marked drop in sedimentation rate: 35 cm/Kyr from 8000-6135BP, 9 cm/Kyr from 6135-3220BP, 22 cm/Kyr from 3220-1330BP. 'Flat adzes' also appear at around the same time as backed implements (spit 16). A change in lithic raw materials, interpreted in terms of submergence of raw material sources by rising sea level, occurs between spit 17 and spit 16, the former dated to 4550 ± 150BP (SUA635).

At Frieze Cave (Hallam 1972) basal levels containing two backed implements were dated to 3090 ± 240BP (ANU830). Insufficient published information is available to assess this date.

Backed implements were found at some time after 4500BP in two sites excavated by Bill Ferguson (pers. comm.) in SW Australia. At the Dunsborough axe site near Cape Naturaliste, seven backed implements were found above 50 cm below datum and a charcoal sample from 50-55 cm gave a date of 4530 ± 90BP (SUA886). At the Kalgan Hall site near Albany five backed implements were found between 50 and 80 cm below

datum, and a charcoal sample from 70-80 cm gave a date of 3825 ± 90BP (SUA1012). In both sites the artefactual material continued well below the dated sample, so the backed implements appear within a sequence and are absent, within the limits of sampling, from levels preceding the dates given.

Lorblanchet (in prep.) found 29 backed implements in his excavation of a shell midden at Skew Valley near Dampier. Fifteen backed implements were found between dates of 2320 ± 80BP (ANU1838) and 3320 ± 90BP (ANU1837), and another nine above the more recent date. Four backed implements were found in a second, smaller, excavated area, three of them between dates of 3460 ± 90BP (ANU1845) and 3700 ± 90BP (ANU1834) and one above the more recent date. All these dates are shell dates and form a consistent dating series, with sedimentation rates of 35 cm/Kyr for the larger excavation and 65 cm/Kyr for the smaller one, the latter being towards the middle and the former near the edge of the midden mound. Given the consistency of the dating, rapid sedimentation, shell matrix and care with which the excavation was carried out, Skew Valley places backed implements at a little over 3000BP (after correction of shell dates as suggested by Gillespie and Temple 1966). Unfortunately we cannot be positive about their absence before this time owing to the small sample size.

In the Ord river valley Dortch (1977) has excavated assemblages containing somewhat atypical backed implements dating to about the last three thousand years. The underlying industry lacks these backed implements. The earlier industry is dated to 2980 ± 95BP (SUA142) at Miriwun, whilst the later industry is dated to 3560 ± 100BP (GaK1767) at Pincombe Range and 3110 ± 85 (SUA56) at Kununurra. Dortch (ibid.: 110) regards the date from Pincombe Range as dating an early part of the upper industry, but the date overlies one of 2660 ± 90BP (GaK1768) and both were collected from an unpublished test excavation carried out in the early 1950's. If we therefore disregard this older date, the dates from Miriwun and Pincombe Range appear to place the industrial transition at around 3000BP, with dates for both industries lying within one standard deviation of one another.

VICTORIA

Yanakie

A date of 3480 ± 90BP (GaK970) is described as dating the earliest backed implements in site 9A and a date of 3920 ± 90BP (GaK968) is described as dating the uppermost occupation level at Site 11 (Coutts 1967a). The latter site is said to contain backed implements, but I was unable to assess this date from the detailed analysis of the site (Coutts 1967b).

EARLY DATES FOR BACKED IMPLEMENTS

Dates older than 5000BP and claimed to be associated with backed implements, have been obtained from the following sites:

| | | |
|---|---|---|
| Burrill Lake | 5320 ± 150 | (ANU335) |
| Noola | 5320 ± 90 | (V36) |
| Graman Site 1 | 5450 ± 100 | (GaK806) |
| Bobadeen | 5150 ± 170 | (ANU287) |
| Macdonald River | 5820 ± 110 | (SUA564) |
| Puntutjarpa | 6710 ± 125 | (I5475) |
| Swansea Channel | 7530 ± 140 | (SUA421) |

In addition, at the Northcliffe site in Western Australia, backed implements lie not far above a date of 6780 ± 120BP (SUA379) and below a date of 3080 ± 75BP (ANU1131).

Burrill Lake

The date of 5320 ± 150BP (ANU335) from Burrill Lake, described by Lampert (1971:9) as 'Bondaian; earliest backed blades at site', is often quoted as a reliable date for the appearance of backed implements (e.g. Mulvaney 1978). This may partly be due to the fact that Burrill Lake is one of the best presented publications of an Australian site documenting the appearance of the Small Tool Tradition, and because the presence of shell material during the buildup of deposits is argued as preventing occupational disturbance (Lampert and Hughes 1977). It is my opinion that the Burrill Lake date does not tell us anything about the dating of backed implements in the site.

The date of 5320 ± 150BP comes from the middle of spit 3 at a depth of 56 cm. Spit 3 contains a total of five backed implements[1]. It does not follow the trend of the visible stratigraphy either above or below it (they are different) and at one point it is in contact with the midden layer of spit 1, which is stratigraphically above a date of 1660 ± 70BP (ANU139). Thus the backed implements from spit 3 need be no older than a couple of thousand years.

Noola

The Noola site is another 'classic' site which has only received 'preliminary' publication (Tindale 1961). In the absence of stratigraphic sections or tabulation of the assemblage collected it is very hard to assess the reported date of 5320 ± 90BP (V36). My excavation (chapter 4) showed that the layers containing backed implements had been stripped from the area surrounding Tindale's trench, so no verification of the dating is possible. The date, which comes from a depth of 25" (62 cm), is from a hearth below a large slab of rock fallen from the roof. 'Microliths' are said to die out soon after (i.e. below) the rock slab, but Stockton (1977a:51) has pointed out that Tindale's usage of microliths does not restrict the term to backed implements (see also Mulvaney 1960:76). I have pointed out in chapter 4 that the sterile band which Tindale claims as separating the pre-microlithic and microlithic levels, dates to around 7-8000BP, i.e. 4-5000 years before the appearance of backed implements 30 km away on the same river system in Capertee site 3. This band therefore lies within the earlier industry rather than between the two industries, and this conclusion calls into doubt Tindale's assessment of the relationship between the 5320BP date and his upper industry. I think we are therefore bound to reject the association between the Noola date and backed implements until such time as further information allows it to be assessed.

(1) Spit 3 is 15 cm thick and extends for at least 6m in a 1m wide trench. The stratigraphic unit containing spit 3 varies in thickness from 60 cm to 105 cm thick within 3m along the trench, and the mean sedimentation rate is around 4 cm per 1000 years.

Macdonald River

This site gave a date of 5820 ± 110BP (SUA564) and is described as 'Bondaian throughout' in a preliminary note on the site (Moore 1976). In the final report (Moore in press) this date is described as coming from a depth of 46-50" (115-125 cm) in basal sterile sand in spit 10. The lowest backed implements are two from spit 9, below a date of 2370 ± 100BP (SUA387) from 21-24" (53-60 cm) in spit 5. In a second excavated area (square BB and CC) the base of the deposits is dated to 3550 ± 110BP (SUA676) on scattered charcoal from spits 8-10.

Bobadeen

At Bobadeen (Moore 1970) four backed implements were recovered from the lowest two levels (7 and 8) out of a total of 519 for the whole site. Tool concentrations fall from approximately 220 tools per cubic metre in levels 3, 4 and 5 to 75 in level 6, 30 in level 7 and 12 in level 8. Two dates were obtained for level 7, 7750 ± 120BP (ANU124) from the whole thickness of the level, i.e. 25-30" (62-75 cm) and 5150 ± 170BP (ANU287) from the top 2" (5 cm) of the level, i.e. 25-26" (62-65 cm).

The marked decline in artefact densities in the two lowest levels may well be evidence of downward spread of artefacts into nearly sterile levels from the rich levels overlying them, although this suggestion is unsubstantiated. More importantly, the two and a half thousand year difference between dates from the same spit clearly illustrates the difficulties of dating assemblages in sandstone rockshelters with low sedimentation rates and loose deposits. In such a situation, vertical movement or stratigraphic uncertainty of the order of a few centimetres could result in false association of material separated by one or two thousand years. I therefore feel that the Bobadeen dates are very inconclusive evidence.

Swansea Channel

No report has yet been published on this site, but several dates have been published (Gillespie and Temple 1976, 1977, 1979). Dates of 1965 ± 90BP (SUA238c - charcoal), 2590 ± 90BP (SUA238s1 - shell) and 2480 ± 90BP (SUA 238s2 - shell) were obtained from the surface of the

midden (0-4 cm) and a date of 2080 ± 100BP (SUA322) is reported from charcoal associated with a cremated skeleton. However at a depth of 24-29 cm a date of 7530 ± 140BP (SUA421) is reported, and the comment is made that this is surprisingly early for a level with a backed implement industry.

Until the site report appears we cannot assess this date. However it is worth noting that, for substantiation, the association between backed implements and the dated sample will require very clear stratigraphic credentials (e.g. common association within clearly marked occupational lenses) in view of the very low rate of accumulation between the 7500 and 2000 year old dates (approximately 4 cm/Kyr - note that this may represent two phases of occupation and sediment accumulation separated by five and a half thousand years, rather than a steady but very slow buildup).

Graman Site 1

This site presents a rather puzzling situation. The deposits were divided into two stratigraphic levels in each of two unconnected trenches, the upper level being grey, presumably rich in organic matter, and the lower level being light coloured. These levels gave markedly different dates from the two trenches. Trench 2 gave a consistent series of dates: 2040 ± 70BP (GaK1197) for level I, 2750 ± 55BP (ANU54) for level II spit 1 and 3950 ± 80BP (GaK1188) for level II spit 2. Trench 1 gave dates of 4640 ± 100BP (GaK805) for level I and 5450 ± 100BP (GaK806) for level II spit 2. Backed implements occurred within the same spit and trench zone (5' square) as each of the dates. The deposits within the shelter appear (from the drawn section) to be approximately two feet in depth.

The marked difference in dating between the two trenches can probably be explained in terms of lack of stratigraphic continuity between the trenches or between the area inside the shelter (dates for trench 1) and the area outside (dates for trench 2). There is no guarantee that colour changes represent true stratigraphic boundaries, particularly when passing from a sheltered environment to deposits exposed on or in front of the dripline. The dates obtained from trench 2 fit well with those for backed implement assemblages from other sites in the area. Those in trench 1 on the other hand appear rather

old, although the more recent date, 4640BP, is within a few hundred years of estimates from sites such as Kenniff Cave and Fromm's Landing 2. What is particularly surprising about the dates from trench 1 is the fact that sedimentation must have been rapid (of the order of 30 cm/Kyr) from 5450BP-4640BP, and must then have practically ceased for the following four and a half thousand years in which less than 15 cm of deposits accumulated, at a time when deposits and occupation debris were still accumulating in the area covered by trench 2.

The most economical explanation of the anomalies observed may lie in animal or human disturbance bringing older charcoal closer to the surface in the fairly shallow, loose, dry and sandy deposits of the rockshelter, whilst the (presumably) more compact deposits outside the shelter have built up progressively. If this explanation is correct, the backed implements associated with the dates within the shelter may in fact be considerably younger than the dated material. It is perhaps worth noting that McBryde (1968:81) observed a progressive decrease in artefact numbers with depth, a situation that might be expected if a rich assemblage with backed implements was being mixed into an underlying poorer and less characteristic assemblage with older charcoal.

Puntutjarpa

Puntutjarpa is another and more serious case of inconsistent dating. Ever since the publication of Gould's preliminary report (1969a), this site has appeared in the literature as representing an early appearance of backed implements and composite tool elements normally associated with the 'Small Tool Tradition' (e.g. Gould 1969b:234, though see Glover and Lampert 1969:224-6 and Mulvaney 1973:6 for a cautious rejection of Gould's typology). Now that a more detailed report has appeared (Gould 1977) it becomes possible to make a more concrete assessment of this site.

The full report covers both the initial, highly criticised excavation (viewed as a 'test trench' by Gould (1969a, b, 1977) and as an extensive and poorly executed excavation by Glover and Lampert (1969)) and the subsequent major field season. The test trench was approximately 13 square metres in area, and was excavated by 6" (15 cm) spits and not sieved. Subsequent excavations covered nearly 30

square metres, employing 3" (7.5 cm) or 6" (15 cm) spits and a 1/4" (6 mm) dry sieving procedure.

The dates obtained are, with two exceptions, plotted on fig. 56. The depths below surface used on this diagram are derived from Gould's stratigraphic relationship diagram (1977:fig. 34). The two dates omitted are 3810 ± 160BP (I3389) (considered by Gould (ibid.:60) as contaminated since it came from well below five other older dates and is said to be stratigraphically equivalent to a date of 10,170 ± 230BP (I5319)), and 3840 ± 105BP (I5321) derived from an extension of the main shelter (the 'west cave') which was not included in Gould's stratigraphic correlations. The remaining dates still show a major reversal, I5476 (4010 ± 105BP) being 2700 years younger and 3 'strata' (3" (7.5 cm) levels) lower down than I5475 (6710 ± 125BP) and I3387 (6740 ± 120BP). This reversal is attributed to 'stirring of fill within each natural level caused by wind and reuse of the cave by the inhabitants [so] these dates can be taken as providing a general indication of the age of the middle levels of the Feature 4 soil unit...' (ibid.:60). A less benevolent view of this reversal and the aberrant dating of I3389, might suggest that the site poses serious stratigraphic problems which have not been resolved by the excavators, possibly involving rapid buildup and scouring of sand lenses (ibid.:56,63) and/or modification of the surface by people or animals.

Where, then, does this leave the dating of the site? Clearly there is a problem of stratigraphic integrity, but I have attempted to reconstruct a possible depositional history of the site in fig. 56 (hypothesis A). I5320 (435 ± 90BP) at a depth of 17-19" (43-47 cm) in the middle of the 'upper rockfall' suggests a period of rapid deposition over the last 500 years. This is exactly what one might expect if Gould is right in saying that sedimentation is due to wind blown sand (ibid.:62), when the rockfall would tend to trap sand (cf. Hughes 1977 for a similar suggestion on the role of shells at Bass Point). If we extrapolate this rapid sedimentation back to the base of the rockfall, the rockfall would date to within the last thousand years. Three dates, I5319 (10,170 ± 230BP), I3383 (6590 ± 140BP) and I5476 (4010 ± 105BP) form a consistent pattern of much slower sedimentation during the period preceding the major ('upper') rockfall. The junction between these two suggested phases of sedimentation puts the top of stratum M5 and the base of the upper

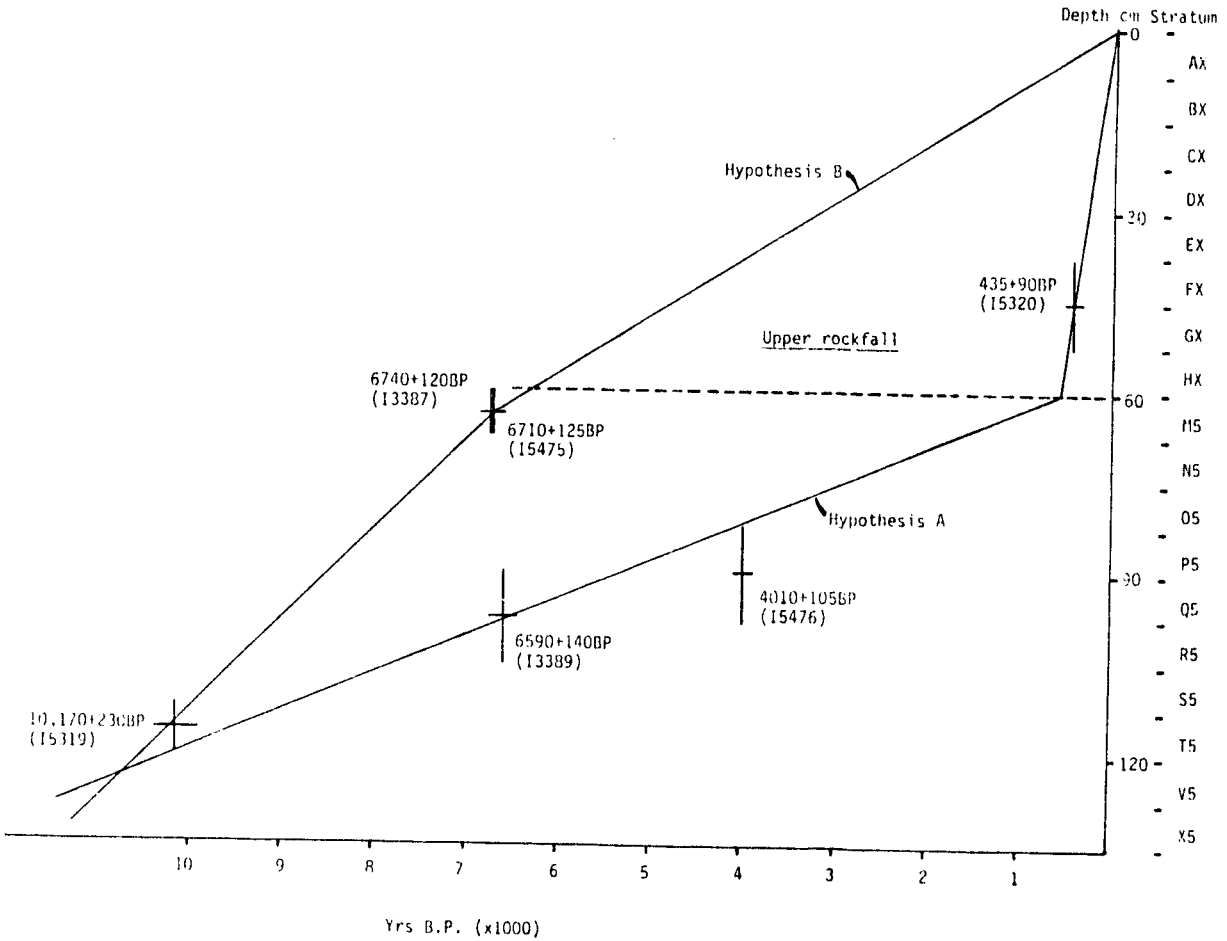



Fig. 56 Depth/age diagram for Puntutjarpa rockshelter

rockfall within the last thousand years.

The hypothesis I have proposed is radically opposed to Gould's interpretation (1977:60), summarised by hypothesis B on fig. 56, which accepts all except the obviously contaminated sample at face value, despite reversals, and places levels M5-R5 at around 4000-6700BP. My hypothesis is perhaps a little more consistent than Gould's, but it is based on the rejection of one pair of dates in favour of a contradictory pair. What I have attempted to point out is that widely divergent dating of an assemblage can occur if stratigraphic integrity of an excavation is not ensured.

The lowest backed implements claimed for Puntutjarpa come from stratum M5. None of the specimens illustrated (1977:fig. 84, 2,3,12,21,25,26) appears to be a backed implement, unlike a series of obvious backed implements from strata above M5. However Rhys Jones (pers.comm.) has inspected the original specimens and considers the specimens illustrated as numbers 3 and 26 to be definate backed implements, whilst the remainder are categorically not backed. The two backed implements in M5 may be in situ or they may have worked their way down through stratigraphic disturbance or 'treadage'. Even if they are in situ I have shown that M5 need not date to older than about 1000BP. Even if the stratigraphy and dating were sorted out and the older dating for M5 were confirmed, this site would not provide convincing evidence for backed implements at more than about 4000 years ago.

For an extensive excavation which is probably by far the most expensive in the history of Australian prehistory, Puntutjarpa has yielded remarkably ambiguous and frugal results. It illustrates well some of the problems associated with poor stratigraphic control and the excavation of large volumes to compensate for coarser methods. It is perhaps worth commenting on ways in which the Puntutjarpa excavation might have been made to yield more useful information. My comments refer more particularly to the second field season, since the indefensibly gross methods of the 'trial' trench have been amply criticised by Glover and Lampert (1969).

In the first place we know that there were very marked vertical variations in artefact concentration within the site (1977:57) and the possibility of periods of rapid sedimentation (1977:56, 63). These are

precisely the conditions under which the use of backplots can help ensure stratigraphic integrity and allow the unequivocal separation of 'occupation floors', which Gould claims to have observed (1977:57).

Under these conditions there is no excuse, barring accidents, for statistically significant dating inconsistencies. Though it could be argued that the extra recording required to produce backplots would have reduced the total volume excavated, squares 1-18, representing about 1/3 of the total area excavated, produced a sample of 76,000 'waste flakes' and nearly 1500 'tools' and cores. Such a sample, carefully excavated, would have yielded more information than the present sample from a much larger area.

A final criticism lies in the use of a 1/4" (6 mm) mesh sieve, sorted unwashed despite the availability of water (1977:55) and apparently without the minimal precaution of systematic sampling for screening on a finer mesh. This is a particularly severe criticism in view of Gould's statement (1977:14) that 'As a source of protein for the desert aborigines, lizards are of greater importance than mammals' (I have commented in chapter 4 on the collection bias against lizards etc. associated with the use of a 1/4" (6 mm) mesh). Equally Puntutjarpa is, potentially, an important site in terms of the history of the Small Tool Tradition. The lack of small chipping waste in the range 1/8-1/4" (3-6 mm) or smaller will prove a serious hindrance to the subsequent use of the Puntutjarpa collection for discussions of the date and nature of adaptations to the desert environment.

## SUMMARY OF BACKED IMPLEMENT DATING

Despite the large number of excavated sites in Australia, notably the south-east, we cannot place firm dates on the first appearance of backed implements in different parts of the continent. We owe this imprecision to a combination of two factors, first the problems inherent in the low sedimentation rates, sandy deposits and undifferentiated stratigraphies of many Australian sites and secondly the use of unsophisticated excavation techniques and sketchy reporting of many sites.

I have predicted that we should have large numbers of dates for backed implements falling at, or younger than, their 'true' date of introduction, with a small scatter of older dates arising from

incorrect association between backed implements and the dated samples. I see this scatter as represented by the small number (8) of dates greater than 5000BP which are claimed to be associated with backed implements. The vast majority of dates for backed implements fall at less than 4500BP and in some places there is evidence for backed implements being absent as late as 3500BP. Unfortunately it is difficult to find clearly stratified sequences in which one can confidently identify (by virtue of the absence of backed implements from a carefully controlled and sizeable assemblage) and date assemblages just preceding the appearance of backed implements. My assessment of the dating does not, in many cases, preclude the possibility that backed implements were present but were archaeologically invisible. This proviso does not however invalidate my conclusion that few if any of the 5-6000BP dates for backed implements are positive evidence for the existence of backed implements at this time.

The best dating evidence for the appearance of backed implements comes from New South Wales and Queensland. At Capertee 3 backed implements appear in a very rich artefactual sequence at around 3200BP (interpolated date) and bracketed by dates of 2865BP and 3623BP. Backed implements are entirely absent from the large sample of Capertian industry at this site dating from before 7360BP to the interpolated date of 3200BP. At Kenniff Cave, backed implements of elouera type appear at an interpolated date of 4600BP and there is a reasonable size sample of artefacts from immediately subjacent levels lacking backed implements (and other 'hafted' tool types).

Support for the Capertee 3 date comes from Curracurrang ICU5/-, Bass Point and further north from Connection Creek, as well as from the plethora of dates for backed implements in the last 3000 years. A cautious assessment of the dating evidence places the appearance of backed implements in eastern New South Wales in the 3-4000BP bracket.

Support for the Kenniff Cave date comes from Morwood's excavations at Native Well 1, where a well marked occupation level with backed implements was dated to around 4300BP but unfortunately separated from underlying pre- backed implement levels by a relatively sterile zone. My tentative assessment is therefore that backed implements were present in Central Queensland by about 4500BP, and therefore at least 500 years earlier than in south-eastern New South

Wales.

In South Australia, incontrovertible dates from Fromm's Landing indicate that backed implements were present at or before 4000BP, although the small number of specimens precludes setting a terminus post quem for their appearance. Similarly, in Victoria, Coutts claims backed implements in levels underlying a date of 3920BP.

In Western Australia backed implements are certainly present from around 3700BP at Skew Valley, supported by dates in the range 3000-3800 from Walyunga, Kalgan Hall and Northcliffe. However the sample sizes are once again too small to define the absence of backed implements from earlier levels. We must set against this dating the appearance of backed implements not far above a date of 6780 ± 120BP (SUA379) at Northcliffe.

The resolution of the dating available is insufficient to make firm statements on the date of first appearance of backed implements on the Australian continent. Equally it is insufficient to demonstrate or to reject chronological clines across the continent. As far as we can tell, however, backed implements appear to become archaeologically visible between 4500 and 4000BP over much of the southern half of the continent, but to be positively absent, on the basis of large artefactual samples, until some time towards 3000-3500BP in south-east New South Wales. This area of late dating appears to correspond with the peak distribution of the elongated Bondi point type of backed implement.

## OTHER SMALL TOOL TRADITION INDUSTRIES

In Arnhem Land there are assemblages dating to the last 5-7000 years which are characterised by invasively flaked points, of which the most characteristic is the unifacial pirri point. Unifacial points are also found in excavated sites in Central Queensland (e.g.Kenniff Cave, The Tombs, Cathedral Cave, Native Well) and in South Australia (e.g. Devon Downs and Fromm's Landing). The point forms appear to be absent from the industries of eastern New South Wales and Victoria and also from the assemblages in south-west Australia. This central north to south distribution is sufficiently marked to have been clear since the early days of serious archaeology in Australia (Mulvaney 1961), as is the case also for the southerly distribution of backed implements.

It has suggested to several authors (e.g. Mulvaney 1975:231) that the point industries may reflect external contacts rather than an indigenous development. In this context it is clearly essential to clarify the dating of the point industries for comparison with the backed implement industries of the south and with possible related industries outside Australia.

Point industries in Arnhem Land

These industries are characterised by unifacial and bifacial points, often occurring in considerable numbers. The concentration of numerous dated sites within a restricted area allows us to build up a fairly accurate picture of the dating of the appearance of the point industries. As with backed implements the points appear on present evidence to be a reasonable fossile directeur of a wider range of changes in lithic industry.

The appearance of the point industries is closely bracketed in two sites, Ingaladdi, excavated by Mulvaney (AIAS 1956, Sanders 1975) and Tyimede II, excavated by White (1967). At Ingaladdi the bracketting dates are 6780BP (+213 -218) (ANU60) and 4904BP (+220 -226) (ANU58). At Tyimede II the bracketting dates are 6650 ± 500 (ANU18) and 4770 ± 150 (ANU50), the latter date being described as the earliest point industry while the former is in the main body of the lower industry.

Contradictory dates were derived from the Malangangerr and Nawamoyn sites (White 1967) where the bases of midden levels attributed to the point industries were dated to 5980 ± 140BP (GaK627) and 7110 ± 130BP (ANU53) respectively.

A further inconsistent date is one of 10790 ± 200BP (GaK632) from Tyimede I, a site in which no pre-point industry was distinguished and from which a date of 3820 ± 100BP (ANU52) was derived only 5 cm above the older sample. The most reasonable explanation for this surprising age difference lies in the dated sample belonging to an older occupation which was not distinguished from the overlying point industry. The Tyimede I dating inconsistency illustrates the problem of accurate dating where sedimentation rates are low and the difficulty of distinguishing a less characteristic industry from an overlying industry with characteristic tool types.

The dates from Malangangerr and Nawamoyn suffer from the same problems. Both sites have dates of around 20,000BP only 20-30 cm below the supposed base of the point industries. In addition, the artefact samples from the lowest levels of the midden layer are small, hindering the precise definition of the transition point between the two industries. At Nawamoyn (7110BP) only four points out of a total of 39 implements were recovered from the midden levels. At Malangangerr (5930BP) the date is from a hearth resting on a raised area of bedrock or large boulder and the midden layer contains 17 points out of a total of 44 implements, most of which (including all the points) are concentrated in the upper half of the midden layer. These dates perhaps illustrate a general point. When a change in artefacts and a change in sediment characteristics occur at approximately the same level, it is often assumed that the two are strictly correlated. This is a very dangerous assumption unless some causal link can be demonstrated.

Points in Queensland and South Australia

At Kenniff Cave points occurred in the lower part of the levels attributed to the 'hafted' phase, dating from about 4600-3400BP on the basis of interpolation. Similarly they are present in the lowest Small Tool Tradition levels at Native Well 1 dating to approximately 4300BP. At Kenniff Cave points and elouera occurred together whilst microlithic backed implements appeared later in the sequence, but at Native Well the points and microlithic backed implements occur together, so the Kenniff Cave sequence may simply be a function of sampling.

At Devon Downs 21 pirri points were recovered from layers IX and X, the former dated to 4250 ± 180BP (L271E). At Fromm's Landing shelter 2, three pirri points came from layer 10 dated to 4350 ± 100BP (R456/1). However the precise relationship between the date and the points is not specified so we should perhaps take a conservative view and place a terminus ante quem for the appearance of Pirri points in the site of 4055 ± 85BP (P311), a date derived from layer 9. Microlithic backed implements accompany the earliest pirri points at Fromm's shelter 2, but backed implements are practically absent from Devon Downs and cannot be correlated with Pirri points in that site.

Thus, in both Central Queensland and South Australia, Pirri type points appear at or before about 4500BP. As far as we can tell backed implements appear at about the same time, but both the association and suggested dating are subject to the effect of small sample sizes and both points and backed implements could be present in these areas earlier than they have been dated. As is the case for the accurate dating of the appearance of backed implements, what we really need is rich well dated assemblages immediately preceding the appearance of points in order to be able to bracket the date of their appearance. Given these limitations, however, Pirri points appear to have a comparable antiquity in Arnhem Land, Central Queensland and South Australia. The Arnhem Land specimens may perhaps be marginally earlier, but we do not at present have the evidence to assess this.

## CONCLUSION

In this chapter I have concentrated on the dating of the appearance of backed implements on the Australian continent. My conclusions are largely negative, that is I have shown that none of the group of early dates (>5000BP) claimed for backed implements is incontrovertible evidence for their presence at that time. This illustrates the need for more sophisticated excavation methodologies and in particular for tighter control on provenance of dated samples and verification of stratigraphic integrity. In the following chapters I shall present the positive side of my argument by outlining an integrated excavation and recording methodology.

It should be clear from the discussion in the body of this chapter that we are not yet in a position to establish the chronological relationships between the different tool types or industries attributed to the Small Tool Tradition. The only clear chronological differential is the late appearance towards 3000BP of backed implements in south-east New South Wales. This observation is quite at variance with Pearce's (1974) assessment of backed implement dating and the latter, I believe, illustrates the dangers inherent in the uncritical acceptance of reported associations. The oldest firm dates for backed implements are around 4500BP, although this does not exclude their appearance at an earlier date.

Similar observations apply to the dating of the 'point industries'. Despite a reported date of 7110 ± 130BP (ANU53) for a Small Tool Tradition industry at Nawamoyn, I have concluded that industries with unifacial and bifacial points can only be dated firmly back as far as about 5000BP. There is therefore no firm evidence that points appeared on the continent earlier than backed implements, and where the two types are present together they seem to appear at the same point in the archaeological sequence (Central Queensland, Murray Valley and Ord Valley sites).

The only time differential we can see in the appearance of the traits characteristic of the Small Tool Tradition is the sporadic appearance, from the end of the Pleistocene onwards, of small heavily utilised stone artefacts which may have been hafted. Identification of these pieces rests on subjective judgement, but they have been claimed from Devil's Lair at about 12,000BP (Dortch 1979), Puntutjarpa from about 10,000BP (Gould 1977; Jones pers. comm.) and Seton at about 11,000BP (Lampert 1977). These finds may indicate that the concept of hafting small stone elements into a composite tool was around for some thousands of years before it became an ubiquitous feature of assemblages across the continent. If we accept these identifications, there is then no need to propose an external origin for the concept of hafting, which is such an important feature of the Small Tool Tradition industries. Equally, the fact that this concept failed to become a ubiquitous feature of Australian assemblages until at least a few thousand years after it was present in several parts of the continent, implies that such a widespread phenomenon as the Small Tool Tradition industries is not to be explained simply in terms of the introduction of an idea at one point followed by wildfire spread. I believe we should look to indigenous development as the most economical explanation for the origin of the Small Tool Tradition until such time as either information comes to light which cannot be explained in terms of indigenous origin or until someone demonstrates a likely precursor(s) with the right dating and strong typological and technological similarities, in the island chain linking Australia with the rest of the world. Indigenous development of backed implements, in particular, is strongly supported by their marked southerly distribution (Mulvaney 1975,1978).

What then do 'Small Tools' in general, and backed implements in particular, represent? Whilst we are not yet in a position to answer this question, some clues are emerging. Jones (1977) argues that population densities on the coasts of Tasmania and New South Wales were similar in the ethnographic present, despite the persistence of the old (Core Tool and Scraper) technology in Tasmania, and suggests that the increased efficiency of 'Small Tools' served to support a richer religious life rather than to increase population. He supports this suggestion with the observation that large scale religious gatherings are a common feature of mainland Aboriginal society, but did not occur on Tasmania. He sees the stress laid on religious activities in mainland society as a homeostatic mechanism which provided a safety factor in times of resource stress. Gould (1973,1977) has suggested a similar role for social organisation in the Western Desert.

It has been widely observed that large gatherings of people occur when a particular food resource becomes available and is capable of supporting such a gathering. In many places this involves the exploitation of cycads which Beaton (1977:197) suggests was a development associated with the Small Tool Tradition. However two objections can be made to Jones' argument.

In the first place, the accuracy of population estimates based on ethnographic accounts is unlikely to be sufficient to reliably detect differences of less than an order of magnitude. The detection of similarities lies within the same limits. However efficient 'Small Tools' might be as an extractive (or maintenance) technology we would not expect order-of-magnitude differences in population between the two coasts, simply because of the essential limiting factor of resources available or, more generally, of culling capacity.

Secondly, when comparing Tasmania with the New South Wales coast, we are comparing the Tasmanian culture which, according to Jones (e.g. 1977) has simplified its material culture and presumably the complexities of its social life, with the 'Post-Bondaian', which no longer contains the tools so characteristic of the early peak of the Small Tool Tradition. Those tools still in use on the New South Wales coast are the more obviously pragmatic and functional tools such as adze flakes of one form or another (e.g. elouera), whilst specialised forms such as geometric microliths and Bondi points appear to have

largely disappeared from the scene.

Jones has made the case that Small Tools are associated with social changes in the form of increased and more extensive religious activities. Whether or not we consider these changes as a homeostatic mechanism designed to limit overexploitation of resources, and whether or not we consider Small Tools to have an extractive advantage over their predecessors, the case remains unproven. The hypothesis is, however, an attractive one and gains support from the rapid rise and fall in popularity of those tool types which do not have an obvious functional role as a maintenance tool. Backed implements other than the elouera are present in enormous numbers in many sites between about 4-2000BP, but diminish or disappear altogether over the last thousand years or so. Pirri points in Central Queensland and South Australia tend to be concentrated at the base of the Small Tool Tradition levels and then drop out within perhaps a thousand years (Kenniff Cave, Native Well 1, Devon Downs, Fromm's Landing). They also appear to be absent from the upper levels and recent past of sites in Arnhem Land. On the other hand, adze flakes appear towards the end of the Pleistocene, gain slowly in popularity becoming common only after the rapid rise of the less obviously functional types, and persist as an important component of assemblages to the present day.

We have here, I believe, a dichotomy between hafted adzes as an essential maintenance tool with strong functional advantages over a massive hand-held scraper, and a non-essential refinement of tool form applied to elements which could just as well have been used unretouched, as in the 'Death Spear' or Taap saw-knife, or omitted altogether, as in the widely used plain wooden spear (assuming a function as spear barbs or tips cf. McCarthy 1976:51, Mulvaney 1960:80). This 'stylistic' interpretation of types such as geometric microliths, Bondi points and Pirri points closely parallels the European Upper Palaeolithic sequences, where a multitude of short-lived specialised tool forms succeeded one another and one can scarcely conceive of an equal number of specialised functions which they might have performed.

In common with the Upper Palaeolithic, the 'stylistic' types of the Small Tool Tradition have a more restricted geographical range than the functional maintenance tools. For example, microlithic backed implements are restricted to the southern part of the continent, and

particular types such as the Bondi point are further restricted so that their distribution peaks in a particular area[1].

On the other hand, various types of adze flake are found throughout the continent. It is perhaps significant that the most specialised form of adze flake, the tula adze, is largely restricted in distribution to the drier inland areas, unlike the ubiquitous burren adze or the elouera (although it is suggested that the latter is hafted differently in Arnhem Land as compared with New South Wales cf. McCarthy and Setzler 1960, Mulvaney 1975:232-3). It may be that these less specialised types are simply convergent products of common functional requirements (see for example Clark 1958:148), i.e. a small hafted flake used for working dense or less dense wood, whilst the more specialised tula may be a specific idea which has spread within a more limited range.

Summarising my argument, the Small Tool Tradition ushers in an expansion in the occurrence of long-lived and widespread functional tool forms and an explosion of shorter-lived specialised tool forms with a more restricted range[2]. My hypothesis is that the more specialised forms represent stylistic specialisation associated with the expansion of a new technology involving more controlled flaking and the hafting of composite tools. This expansion may or may not be symptomatic of social change, but this is certainly a question that we are far from resolving with the data presently available. The adoption of the new technology can certainly be explained in terms of increased efficiency of the maintenance toolkit, increased portability and increased economy of lithic raw materials. However it is not obvious that the same explanation applies to the extractive toolkit, notably to the more specialised backed and pointed tools (if they are indeed

(1) The fact that similar types occur in Western Australia may simply indicate convergence within a general backed-implement continuum rather than a widespread distribution of a particular specialised type. We do not have enough information on the range of variation within and between different parts of the continent to make any statements on whether we are dealing with convergence or with a common specialised type (the procedure of applying simple statistical tests which do not take account of within- and between- group variance (Pearce 1973) can of course tell us nothing about whether we are dealing with continuity or convergence (cf. Wright 1974)).

(2)Note, however, that the appearance of new specialised tool forms was not restricted to that period, cf. the later appearance of the Juan knife, Leilira blade and Kimberley point.

extractive tools), although similar technological developments are evident in their production and they seem to be directly associated with the dramatic changes characterising the transition from the Core Tool and Scraper to the Small Tool Tradition. I see these specialised types as stylistic responses to the new technology, symbols or identifications if one wishes, with a rapid rise, limited geographical spread and decline or demise following rationalisation of the new toolkit. Perhaps we should look at them as childish enthusiasm, followed later by a more reflected maturity.

One of the important sets of questions for the near future is to examine and account for the appearance, spread and 'decline' of Small Tools. Are they indigenous or introduced? How rapid is their spread and if it is very rapid, as at present appears, why did this happen? Why did the spread occur when it did? Why did particular tool types maintain restricted distributions? All these questions require accurate dating, detailed examination of both the diachronic and synchronic association between different categories of artefactual material, and above all the standardisation of recording techniques to allow inter-regional and inter-site comparison to be based on raw data rather than on published summary statistics or synthetic accounts. Only in this way can we hope to answer even the fairly gross questions of the present, let alone the more sophisticated questions we might hope to ask in the future.

In the following chapters I shall attempt to provide a framework for excavation and recording onto which particular analyses can be built. It is beyond my area of competence to systematise typological and attribute systems for Australian material, but this is clearly a pressing necessity which should be undertaken by someone, or preferably a group of people, with considerable experience of the material. Although it can be argued that we do not yet know enough to adopt a particular standard it gets us nowhere in the present or the future to have sites recorded with ill-defined and incomplete typological and attribute systems. Even an imperfect standardisation is better than none at all, provided it is up to the best contemporary standards.

# CHAPTER 7

## Towards a rationalisation of field techniques for excavation data recording

## Introduction

My aim in this chapter is not only to discuss a particular excavation recording technique, but to put forward a vocabulary with which one can discuss the concepts involved. I will propose a certain number of standardisations and make suggestions for overcoming the limitations of a conventional 'spits' approach. I would not argue that my proposals are original, but I have attempted to draw them together in one place and state them explicitely, an essential step which nas not been a common feature in the genesis of individual excavation techniques. In particular, I wish to stress the importance of orienting data collection towards computer analysis, because computer processing:

1. forces one to make an explicit formulation of recording techniques which obliges one to think about the reliability of the data being collected;

2. automatically generates a systematic catalogue of the excavated material in a form that can be readily copied for storage with the excavated material or for distribution to other workers;

3. allows a more sophisticated presentation of results and the processing of more detailed analyses of the excavated material, with a consequent gain in information extracted and effectiveness of results.

## Aims of excavation

I believe we can distinguish three fundamental requirements common to all excavations:

1. isolation of assemblages of manuports (both organic and inorganic) which are, as far as possible, chronologically discrete;

2. recording of the spatial distribution of these assemblages and their relationship with features;

3. sampling of the sediment matrix for evidence pertaining to the geomorphological or environmental history of the site and to the nature and distribution of activities carried out within the site.

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The importance attached to each of these aspects of excavation will be determined in part by the research aims of the excavator, but should depend primarily on the nature of the site excavated. The facile and convenient rejection of generalised or 'minimum standards' excavation techniques with an appeal to 'problem-oriented' research must be seen for what it is, an irresponsible and selfish approach to unique archaeological data. The flaw in the 'problem-oriented' argument lies not in the adaptation of methods to the problem in hand, but in the adaptation of a site to the methods in hand. In other words we should choose the site in relation to the questions we are asking and the methods in relation to the site, adopting the stance 'do it properly or leave it alone', even if this runs against our own personal research interests. Glover and Lampert (1969;223) expressed a similar view when they said 'if time and labour are limited, dig a small hole carefully rather than a big hole quickly; if you cannot screen the deposit from a cave site, do not dig it'.

In this chapter I am particularly concerned with the first of the three aims, i.e. the isolation of chronologically discrete assemblages. Sampling of the sediment matrix has received considerable attention in Australia (see Hughes 1979) and I shall therefore not discuss it in this chapter. The recording of spatial distributions has only recieved peremptory treatment despite the obvious patterning apparent in many sites (see references in chapter 5). Spatial analysis is an area in which systematisation of existing data might well bring us some insights into Aboriginal use of rockshelters, tool functions and lithic reduction sequences. It can also provide us with a firmer basis for inter-site comparison of assemblages, by allowing estimation of the bias introduced by unsystematic sampling of sites. At the present time, however, the greatest hindrance to spatial analysis in Australia is the large size of sampling units relative to the total area excavated in most sites, aggravated by the irregular size and shape of the sampling units used by some workers and lack of an explicit areal sampling strategy. Although I consider the recording and exploitation of spatial data to be an essential part of excavation, I do not intend to discuss this aspect of excavation since I have elsewhere reviewed in detail the issues and methods available (Johnson in press).

Although the isolation of successive assemblages has undoubtedly been the guiding principle of excavation in Australia, the explicit formulation of this aim has been largely obscured by the adoption of a spit methodology 'to examine changes through time', i.e. by the implicit assumption that the characteristics of the deposited archaeological materials vary continuously through time, being some sort of random sample of the contemporary 'culture' resulting from the superimposition of numerous indistinguishable occupations. Given this model, the use of intervals (spits) to allow the creation of frequency data, appears entirely justifiable. Whilst not denying the utility of such a device, I believe it discourages the search for true chronologically distinct assemblages and the asking of questions on the mode of formation of the excavated assemblage. I have shown in chapter 5 that the model of continuous variation of assemblage characteristics is not applicable to Capertee Site 3, and I have argued that it may be even less applicable to the majority of Australian sites.

A second danger with a spit methodology is that of grouping together all spits with the same number, and thus implicitely assuming that they are contemporaneous. This I believe to be the source of much inconsistent dating to be found in the literature. A common depth below some supposedly isochronic surface is a poor indicator of contemporaneity and is by no means the best effort we can make at generating diachronic assemblages. Morwood (1979) has demonstrated the blurring of changes in artefact assemblages which can arise with the use of such a technique.

The key to more effective distinction of diachronic assemblages lies in the flexibility of the excavation technique to follow minor changes in the deposit and to exploit all available information. In particular it is essential to be able to make <u>a posteriori</u> attributions of material to analysis units based not only on stratigraphic observations in the field but also on laboratory examination of the material, including the use of backplots, conjoins and the nature and number of finds excavated.

Excavation Recording

Although the distinction of assemblages and the comprehension of their structure through the observation of stratigraphy, features and the disposition of remains, are activities requiring skill, experience and empathy with the deposits (Rhys Jones, pers.comm.), much of the recording of information relative to the analysis of excavated material is better handled by a rigorous and even mechanical system. One cannot speak of a 'universal' excavation technique, but I do believe that one can conceive a widely applicable recording system, and this is undoubtedly the key to good excavation. A good recording system is, like writing, a means of expressing oneself for future reference in a precise and unambiguous fashion.

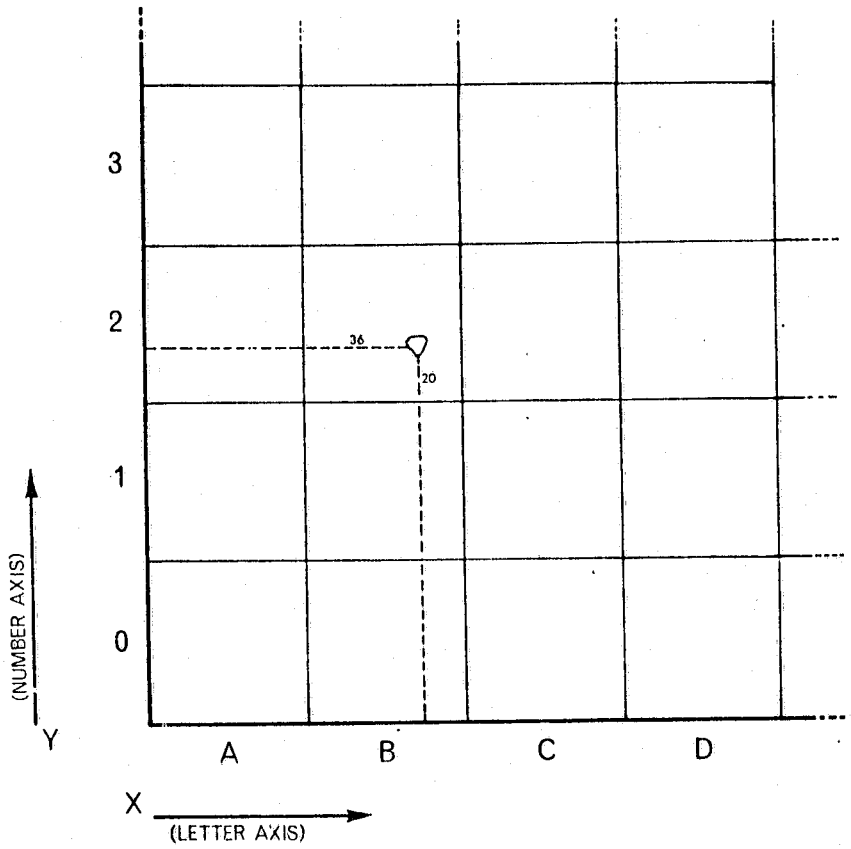
We can discuss excavation recording under a number of headings;

1. Coordinate system
2. Horizontal control
3. Vertical control and excavation units
4. Stratigraphic grouping of excavation units
5. Finds numbering system
6. Sieving procedures
7. Data coding
8. Organisation and safety checks

Coordinate System

Fundamental to efficient recording is an effective coordinate system. This should be capable of describing precisely and concisely the spatial location of points, areas, volumes and section lines. A well designed coordinate system enormously facilitates, and thus encourages and improves, note-taking and makes the final report far easier to read.

The most commonly used and, I believe, the most satisfactory coordinate system is a modified cartesian system involving 50 cm, 1m or 2m grid squares identified by a letter/number combination (see fig. 57). Points are specified by x and y coordinates measured within




Coordinates of object are: strictly B36, 220
for convenience B2 36,20

Fig. 57 Suggested standardisation of coordinate systems

each square. It is particularly important to establish standardisation of coordinate systems if generally applicable recording forms and computer programs are to be set up. This standardisation should extend to points of detail such as the relationship between the axes. I propose the following standardisations, the first two of which are based on current practice in SW France, described by Rigaud (unpub.).

Since I am suggesting that excavation squares should be referred to first by a letter, then by a number:

1. the X axis should be taken as the LETTERS axis, and the first coordinate should be recorded in this direction;

2. the Y axis should be taken as the NUMBERS axis, and the second coordinate recorded should be in this direction;

3. the X (letters) axis should always be CLOCKWISE from the Y (numbers) axis - note that this is a standard convention when drawing graphs;

4. vertical (z) coordinates should be measured as depths below a datum point established above all the deposits which might conceivably be excavated (in order to avoid a mixture of points with negative and positive z coordinates).

If coordinates are always specified in the same order (i.e. x,y,z), points, areas, volumes and section lines can be specified conveniently and concisely, viz;

POINTS B1, 47,53,142

AREAS B1, 30-50,40-50

VOLUMES B1, 30-50,40-60,141-143

SECTIONS can be specified by an x or y coordinate if parallel with one axis of the grid system,

e.g. 'section on C,x=50' or 'section on C/D'

or by two points on the section line,

e.g. 'section through B1, 0,0 and C5, 50,50'

In addition the terms FRONTAL and SAGGITAL are useful for identifying sections (or backplots) respectively parallel or at right angles to the general trend of the rear wall of a rockshelter.

BACKPLOTS of features or artefacts can be identified by a pair of x or y coordinates

e.g. 'Backplot, D, x=25-50'

For the sake of comparison, the same backplot described without the aid of a cartesian coordinate system might have read;

'North/South backplot,tr 1, 125-150E of datum'

It has been pointed out to me (Jones,pers.comm) that a commonly used coordinate system for mapping purposes is based on numbering of both axes. Such a system has the advantage of placing no limit on the length of either axis, but is less convenient in use and more prone to errors than a letter/number system. In practice the letter/number system can accommodate all but the largest sites by the use of a sector number or sector letter preceding the square identifier. Put another way, squares can be identified by a two (or more) character 'letter', such as AA,AB,AC....BA,BB,BC....ZX,ZY,ZZ and then, if neccessary, 1A,1B,1C.....9X,9Y,9Z. I have allowed for a one character sector number or letter (or a two character square 'letter') in designing my coding sheets, so that a 'letter' axis length of at least 900 excavation squares (i.e. 900 m with 1 metre squares, 450 metres with 50 cm squares) can be accommodated.

Horizontal Control

Finds from each grid square are collected separately in order to provide information on the horizontal patterning of material in the site. The size of the grid squares is a subjective choice based on a compromise between resolution of patterning and time expended. As a rough guide there should be at least 20 - 30 collection units if one is to be able to get any usable spatial information. This consideration alone means that 50 cm squares are to be recommended for most rockshelter excavations. Secondly, as it is not possible to resolve patterning at scales below about twice the size of the quadrats used (Kershaw 1957), metre squares, whilst suitable for largish open sites, are not generally suitable for the confined occupations of small to medium sized rockshelters. In special cases, where intact 'occupation floors' are suspected, it may be neccessary to reduce the collection unit size to 20 - 25 cm (Johnson in press, Ranson 1979) and employ systematic mapping of features and larger finds. Collection units below this scale are generally impracticable and in many cases will only serve to resolve 'noise' - either uninterpretable archaeological patterning or post-depositional disturbance. A discussion of the optimisation of collection unit size

is to be found in Johnson (in press).

A further important reason for the use of 50 cm grid squares for rockshelter sites is the difficulty of following the trend of an undifferentiated stratigraphy over an area as large as 1 square metre. This question will be dealt with in the following section, but I consider that the reduction of grid square size to 50 cm is even more important than the reduction of spit thickness proposed below.

The use of 50 cm grid squares restricts one dimension of the grid system to 12 metres (because of alphabetical constraints) unless a section letter or number is used (see above). However 12 metres is sufficient to cover the width of most rockshelter sites.

Vertical Control and Excavation Units

Vertical control means the removal of deposits in a series of spits or excavation units whose vertical position is recorded. In addition a proportion of the material excavated may be more accurately located by means of individual coordinates. Vertical control allows one to relate excavated material to observed or reconstructed stratigraphic boundaries.

Details of the procedure I am proposing are as follows. Each 50 cm grid square is excavated until a 10 litre bucket has been filled with the spoil or some change in colour, texture or artefact occurrence is noted. This corresponds with an average 2 - 4 cm of deposits removed and this volume is termed an EXCAVATION UNIT. The trend of the stratigraphy is followed as far as possible and information relative to each excavation unit is recorded on a sheet such as the one shown [1] in fig. 58. The spatial location of the unit is recorded by five spot heights before and after excavation (generally the four corners and the centre of the square). The spot heights are recorded on the two small plans provided on the form, together with the location of any rocks or features and the part of the square excavated. If a more detailed plan is required, this can be drawn on a separate sheet at a larger scale.

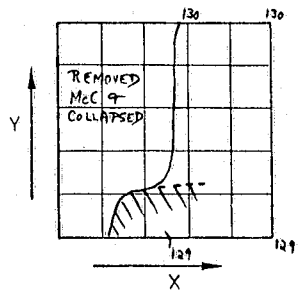
(1) All the recording sheets are illustrated at a reduced scale filled in with specimen data. They are reproduced blank and at full scale in appendix III.

SITE CP3 SQUARE Q14 EXCV'N UNIT 4

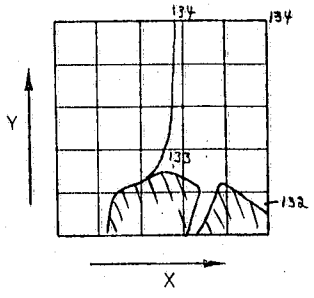
Excavators IT FEATURE STRAT' 2

Date 4/2/79

START LEVELS




END LEVELS




COMMENTS

Sediment wt 3·5 kg

Coarse sieve # -

Coarse sieve wt -·- kg

Medium sieve wt 0·27 kg

Fine sieve wt 0·19 kg

Previous excavation unit reached firm dark moist deposits, undoubtedly in situ. This unit removing loose deposits. Deposits V dark (7.5 YR 1.7/1), compact, firm moist structure. Rich in charcoal and some scattered mussel shell fragments. A lot of rootlets. Lightening of colour and increase in artefact at base of this unit

Soil rich in charcoal fragments 35-50, 25-50, 133-4 ~6 cm below in situ surface of strat 2.

| OBJ' | X | Y | Z | DESC' |
|---|---|---|---|---|
| 1 | 34 | 46 | 130 | fl |
| 2 | 40 | 16 | 129 | ch |
| 3 | 42 | 11 | 129 | ch |
| 4 | 34 | 27 | 131 | shell |
| 5 | 32 | 41 | 133 | " |
| 6 | 45 | 25 | 131 | ch |
| 7 | 34 | 23 | 132 | flake |
| 8 | 37 | 48 | 134 | fl |
| 9 | 42 | 37 | 134 | C14 |
| 10 | | | | |
| 11 | | | | |
| 12 | | | | |
| 13 | | | | |
| 14 | | | | |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | |
| 18 | | | | |
| 19 | | | | |
| 20 | | | | |

continue overleaf

Fig. 58 Example of field recording form

The use of a preprinted recording sheet of the kind illustrated helps to reduce errors and omissions and improve the general standard of note-taking in the field. The looseleaf file of sheets for each square provides a ready index to the progress of the excavation, organised in stratigraphic order. Extra plans, comment sheets or polaroid photographs can be inserted as required. I personally much prefer this system to the use of a site or square notebook in which information is recorded in an uncontrolled format and, in the former case, skipping from one part of the site to another. I disagree strongly with the idea (Bowdler, comment at Kioloa Conference, 1978) that only the director of the excavation should make notes; every person excavating should have a notebook or recording sheets to hand and be encouraged to make copious notes. This is the key to getting people to think about what they are doing, to become involved and to learn something. This need in no way hinder the director from making his/her own notes, either on the same sheets or in a separate site notebook or journal.

All finds exceeding a specified size, e.g. 3 cm length, observed in situ, are individually numbered and recorded with three dimensional coordinates to allow the preparation of point-distibution plans or backplots. The excavation units are numbered sequentially for each square and the sediments are processed a unit at a time so that all finds, both in situ and sieve finds, can be attributed to a particular excavation unit. The excavation unit is thus the minimal subdivision of material from the excavation.

## Stratigraphic Grouping of Excavation Units

When using a conventional spit methodology, the 'stratigraphic' attribution of finds is determined entirely by their spit number. In some cases (e.g. Gould's Puntutjarpa report, 1977:61) a table of equivalences is generated to allow for some obvious inconsistency in sedimentation rates across the site, but in most cases all spits with the same number are linked across the whole site. This is clearly a nonsense if, as is generally the case, the deposits have not accumulated uniformly across the whole site.

The essence of the recording technique which I am proposing in this chapter is to provide a more flexible means of following any observable stratigraphic or archaeological changes than one can achieve using a conventional spits methodology. This is accomplished partly by reducing both the areal and vertical extent of each excavation unit and also by excavating arbitrary amounts of sediment for each excavation unit rather than attempting to stick to, for example, a neatly defined 5 cm removal. The use of spits of standard thickness tends to discourage the following of minor changes in sediment or in artefact concentration which may prove useful in separating successive phases of occupation. Standard thickness spits also tend to encourage a 'hack it out as a block' attitude on the part of excavation helpers rather than careful trowelling which might lead to the observation of features and stratigraphic changes.

Excavation is followed up by a posteriori grouping of the excavation units into ANALYSIS UNITS, which are our best-guess at real stratigraphic units[1]. This grouping is based not only on the position of the excavation units with respect to one another and to observable stratigraphic changes noted in the field, but also on laboratory analysis of the nature and vertical distribution of the material excavated. In Australian sites the most important aspect of this laboratory analysis is probably vertical changes in artefact concentration as, in my experience, few sites have a uniform distribution of material from top to bottom. Concentrations of material are a valuable means of tying up the stratigraphy across a site which does not show geological differentiation.

Objections that have been raised to this sort of technique have been based on the supposed 'homogenisation' of deposits by treadage and scuffage. Though this may render backplots ineffective, we cannot say whether backplots will be useful in any particular case except through the empirical approach of recording the data neccessary and trying them out. Fortunately treadage is unlikely to give rise to misleading results, merely to inconclusive ones. My excavations at both Abercrombie and Capertee, both inside and outside the dripline and in sandy deposits, have revealed marked concentrations of material

(1) Fedele (1976:34) suggests the use of floating sequences of 'Elemental Sediment Units' and a posteriori grouping into stratigraphic units, see also Harris (1975) for a similar usage.

at particular levels which can be followed on backplots and used to show trends in the stratigraphy which could not be derived unambiguously from observation of the deposits.

A note of caution is in order here. It is very easy to imagine concentrations of material on backplots where none really exists, particularly if the plotted material is sparse (chance alignments or concentrations of points) or if excavation techniques have been poorly controlled so that a greater proportion of finds are recorded at particular levels.

It may also be possible to gain an insight on stratigraphic links through changes in typology, technology or raw materials, or through the use of conjoins. The latter are exceptionally valuable markers of contemporaneity when they are present in reasonable numbers, as well as providing information on the degree of vertical movement resulting from treadage and scuffage. Unfortunately they have not been widely used owing to the considerable time expenditure neccessary to identify them.

Finds Numbering System

A good finds numbering system is as essential to laboratory analysis as a good coordinate system is to field recording. To be sufficiently flexible, such a system must accommodate the following:

1. attribution of a common identifier (e.g. a letter/number combination) to all finds coming from the same horizontal provenance unit (grid square, trench, section etc.);

2. attribution of an additional identifier common to all finds from the same excavation unit within that grid square;

3. attribution of a unique number to any find whose 3D coordinates have been recorded and/or for which attributes have been measured (to permit checking and/or addition of attributes or use as a type specimen).

4. addition of finds to the individual numbering system in sequence with finds already numbered individually.

These considerations must lead us to reject a system where objects are

numbered sequentially for the whole site or for each square. The system I have adopted is to label all finds with site/square/ excavation unit and then to give an additional number (from 1 upwards for each excavation unit) to any finds which I wish to identify individually. The latter are termed INDIVIDUALISED FINDS, whilst those marked merely as coming from a particular excavation unit are termed UNINDIVIDUALISED FINDS.

Unindividualised Find: CP3 Q13 24

Individualised Find: CP3 Q13 24-1

I hesitated considerably before adopting this system as I was accustomed to sequential numbering for each square, a system which I used in combination with numbered excavation units for my excavation at Abercrombie Arch Shelter (Johnson 1977). The Abercrombie system proved very inconvenient at the analysis stage because one could not insert 'important' sieve finds into the numbering system in sequence. As a result one has to consult the excavation records to tell what excavation unit an individually numbered find belongs to. Having taken the plunge of the new numbering system I would now use no other.

## Sieving and Flotation

Too many excavators take the view that sieving procedures are merely a sort of safety net to check that one hasn't missed anything 'important'. For my part, I believe that a clear and explicit screening strategy is one of the most essential parts of any excavation. Crucial to such a strategy must be the specification of a minimum size above which collection of artefacts can be confidently stated as approaching 100%[1]. Apart from a few exceptional sites, this can only be assured by wet sieving and sorting verified by a competent person. Until such procedures are adopted it is impossible to satisfactorily compare the results of different excavations,

(1) People frequently talk of 'constant' errors in dry sieving (and other) procedures. This is a contradiction in terms as the very nature of an error is that it cannot be predicted. In particular, sieve recovery rates can vary markedly between sorters, between different stratigraphic levels or horizontal locations (depending notably on texture, dampness and organic content) and with the humour of the sorters.

particularly with respect to the composition of the fauna (small animals are selected against by imperfect sorting, see examples in chapter 4) or the presence or absence of stone knapping on the site.

Two arguments are commonly advanced against wet-sieving;

1. 'There's no water on my site'. This argument seems to spring from the misconception that one needs running water to be able to wet sieve. In most cases one can sieve quite satisfactorily with a few jerrycans of water topped up occasionally and freed of sediment by decantation or use of a settling tank. If the deposits are so clayey or rich in organic material that running water is essential, then dry sieving alone is quite inadequate and the dry sieved residues will have to be taken to water. This is not as arduous a task as one might imagine, since the bulk of the deposits can be reduced 5 - 10 times in most cases by initial dry sieving and discard of the larger fragments of parent rock.

2. 'If we wet sieved this stuff we would find so much small stuff that we couldn't keep up with sorting what we excavate'. If a larger mesh size and wet sieving is suggested, the usual reaction is that small things are going to be missed.....! There is a fundamental confusion here between sensitivity and accuracy - and it is the latter which generally gets scrapped in favour of the former. If sorting time is impracticably long owing to the quantity of small material recovered, there is only one sensible solution. This is not to ignore an unknown and arbitrarily selected proportion of the material by applying an inaccurate dry-sieving procedure, but to use a larger mesh size for the bulk of the deposits and carry out systematic sampling of the deposits for screening on a fine mesh with a view to detection of smaller remains. In this way we can make a reliable statement on the total population above the larger sieve mesh size and a probabalistic statement on the finer fraction, neither of which are possible if we have the sorts of biased samples commonly obtained by dry sieving.

At Capertee 3 I used a 1/4" (6 mm) and a 1/8" (3 mm) mesh sieve pair for dry sieving and transferred the residues retained in the sieves to very fine mesh household strainers for the quick rinse which

was all that was required for wet sieving. In order to minimise the effect of sorting efficiency on the composition of the sample analysed, the material collected was subsequently sieved on a 4 mm granulometric sieve and specimens which passed through this sieve were eliminated from the final analysis. I strongly recommend this procedure as a means of providing a 'buffer zone' between the vagaries of field collection and the sample analysed. I refer to this procedure as sample purification.

The use of a 1/8" sieve in the field proved to be a reasonable compromise between collection efficiency and sorting speed, with the added factor that this is about the smallest residue which can be sorted reliably under field conditions[1]. The detection of smaller material is best accomplished by taking systematic bulk samples of the deposits for laboratory processing on a finer mesh. A similar strategy should be employed if, for some reason, a larger sieve mesh size is used in the field.

Two supplementary sources of information are available at the sieving stage, sediment particle size and charcoal concentration.

Sediment particle size

By weighing the sediment from each excavation unit before sieving (essential as a means of standardising artefact counts) and by weighing the residues retained by two or more sieves, we can obtain a rough granulometry of the excavated sediments. This opens two possibilities:

1. The changes in particle size can help in the grouping of excavation units into analysis units if there is any significant change in sediment texture (see for example fig. 6 in the preliminary report on Freshwater Creek I, appendix I).
2. Vertical and horizontal changes in particle size distribution can give valuable clues to changes in site usage.

(1) It is advisable to split residues up into two or more fractions before sorting, as it is much easier and more effective to sort residues whose size-range is limited.

Fedele (1976:43) has noted the importance of looking at the gravel fractions of the sediment matrix and their vertical and horizontal distribution. The sieve residue weights provide a convenient and economical way of studying the distribution of the coarser sediment fractions without the need for extensive sediment sampling. Residue weights can help one look at the spatial layout of an occupation as, for example when one suspects clearing of debris from a part of the site or the collection of rock fragments to form a drier or cleaner surface for some activity. A third possible use for sieve residue weights may be as a means of standardisation of artefact counts etc., in cases where there is some reason for considering them preferable to overall sediment weight or volume. This approach may be particularly applicable when the finer sediment fractions have been differentially removed by erosion.

Collection of charcoal

The commonest approach to the collection and study of charcoal in an excavated site is to regard it purely as a dating medium. Where charcoal is present in large quantities as lenses or hearths it is treated as a feature or stratigraphic marker, if applicable, and these features are sampled (in a non-statistical sense) to provide datable material. Where concentrations of charcoal are absent, charcoal is collected from fairly extensive blocks of sediment (e.g. a 10 cm spit covering a 1 metre square), either by collecting specks seen during excavation or by picking them out of the sieves. This is referred to as 'scattered' charcoal, and it is the bête noire of anyone who has tried to pin down the dating of some feature of the archaeological sequence.

At Capertee 3 I was able to collect datable quantities of charcoal from a 5 cm thickness of a single 50 cm square at levels where no charcoal was visible, even after the deposits had been dry-sieved. The actual charcoal concentration was around 250 ppm at this level. This is because charcoal fragments could only be identified once the sieve residue was washed, as even in the dry sandy deposits of this site, sediment adheres to the rough surface of charcoal fragments. At Capertee 3 charcoal was collected during excavation or sorting. I later developed a much more efficient collection technique using a household strainer to scoop the charcoal

out of the submerged sieve. This method allows one to collect charcoal whether it floats or not (as is often the case for a proportion of the charcoal), by making use of the differential density of charcoal and gravel fragments using a sort of modified panning technique. A sophisticated version of this technique or the use of heavy liquid flotation on a systematic basis might, I feel, be put to good use in ensuring total recovery of faunal remains where these are present.

Apart from the ability to date charcoal-depleted deposits without the necessity to use samples with poor spatial control (i.e. collected over a large area or from more than one spit), the total recovery of charcoal (down to the size of the sieve used) can potentially be used as a means of quantifying the distribution of features. Though a bulk column sample taken in the field can give some indication of the vertical distribution of charcoal in a site, variations in horizontal distribution across the site are generally beyond our reach. The total collection of charcoal allows us to replace woolly statements about 'ashy areas' and 'large' hearths, with repeatable quantitative information which can be presented as site plans or sections. With this sort of information we can start discussing the relationship between artefact distributions and charcoal distributions, perhaps in terms of the spatial organisation of occupation of a site and its changes through time. It can also give us another line on:

1. Differential preservation in different parts of a rockshelter. For instance, the decline in charcoal with depth is much more abrupt at the front of Capertee Site 3 than at the rear owing to exposure to biochemical decay and leaching of decay products. This can be of relevance to the interpretation of faunal assemblages, particularly where there is horizontal patterning of faunal material.

2. Occupational disturbance. If peaks of charcoal and peaks in stone artefact concentrations are systematically offset from one another this may indicate differential vertical displacement and may have important consequences for the interpretation of C14 dates.

3. Comparison of charcoal concentrations between sites as a means of discussing site function. Note that suitable allowance would have to be made for depositional and preservation effects. Within and between site comparison of charcoal concentration present a means

of discussing fire regimes in the area.

The precise dating of charcoal-depleted deposits alone justifies the systematic recovery of as much charcoal as possible. A second overwhelming reason in favour of such an approach is the possiblity of examining the distribution of charcoal in a quantitative fashion, as part of a discussion of site function or spatial organisation. Total recovery, as opposed to recovery of most of the charcoal where it is scarce and a bit of the charcoal where it is common (as in hearths 'sampled' for dating), results in a considerable gain in information for little extra time expenditure. Sampling of charcoal simply where it is required for dating, as has often been the case, denies the essential feedback nature of excavation and analysis, as it requires an a priori decision as to where dates are required before the excavated material has been fully analysed; the decision is of course often strongly influenced by the distribution of easily collected charcoal.

Organisation and Safety Checks

However good the recording system used, mistakes will inevitably creep in. The more complicated the system the higher the chance of mistakes. To catch these mistakes before they become uncorrectable one must build in as many safety checks as possible. My experience has suggested the following safety measures - the list is by no means exhaustive.

1. The use of pre-printed recording forms encourages the efficient recording of data and eliminates to some extent mistakes such as omissions, numbering duplication and incorrect orientation of plans and coordinate measurements.

2. Processing (sieving and sorting) should be carried out, if at all possible, at the excavation rather than at a base-camp or in the laboratory after excavation is over. This allows continuous feedback and supervision by the director of the excavation in case of problems. Not processing on-site was one of the fatal errors that I made whilst excavating at Capertee, and caused me many headaches and much running back and forth between the camp and the site.

3. Processing should be supervised by one competent person who checks the material from each excavation unit as it is processed and boxed away. The same person should be responsible for checking sieve residues and excavation recording sheets. In this way inconsistencies, duplicate or omitted sheet or object numbers, can be detected whilst the mistake can still be rectified

4. Processing of the sediment removed should be carried out immediately and as far as possible by the person who excavated it. This avoids the accumulation of a backlog, with its attendant risk of error due to illegible or mislaid labels or duplicate numbering, and reduces excavator boredom which arises from the monotony of working on one job, particularly if the job is sorting.

5. As the processing of each excavation unit is completed the material should be packed away in storage boxes, one for each square excavated. In this way it is easy to check back through the excavated material if any problems arise.

6. Pre-labelling of recording sheets or of plastic bags, where possible, avoids duplication of excavation unit numbers or object numbers and, in the long run, is generally time-saving for the same reasons as any assembly-line process.

Excavation Rates

Nobody has, as far as I know, criticised the methodology I am proposing on the grounds of methodological inadequacy. One criticism that has, however, been levelled at it is slowness of excavation or, as it is more generally stated, 'do we really need this level of precision?'. This implies that something, presumably time, has been invested to obtain this 'undesirable' precision and that the critic considers this time would have been better spent digging more or elsewhere. The question of methodological inadequacies is dealt with elsewhere, so I wish to make a few comments here on relative speeds of 'shifting the dirt'.

There is no doubt that the methods I am proposing in this chapter shift less dirt per person per day than a coarser technique e.g. the use of 5 cm spits, metre squares and coarser sieve size and/or dry

| Site | Director and date | Nature of site | Person-days/cu.m. |
|---|---|---|---|
| Freshwater Creek I | Johnson 1979 | Open stratified | 10 |
| Abercrombie Arch Shelter | Johnson 1977 | Limestone shelter | 25 |
| Capertee Site 3 | Johnson 1978 | Sandstone shelter | 50 |
| Colless Creek I | Hughes & Aplin 1979 | Limestone shelter | 40 |
| Meg's Mit | Jones 1978 | Sandstone shelter | 30 |
| Sundown Point | Ranson 1979 | Open, midden | 20 |
| Rupo | Rhoads 1977 | Limestone shelter | 25 |
| Kulupuari | Rhoads 1977 | Open, village site | 15 |
| Rocky Cape S. | Jones 1967 | Quartzite shelter, midden | 20 |
| Rocky Cape N & S. | Jones 1964 | Quartzite shelter, midden | 12 |
| Skew Valley | Lorblanchet 1976 | Open, midden | 40 |

Table 19 Comparative excavation rates for selected sites

sieving. My excavation rate has varied from about 10 person days per cu.m. (FWCI), through 25 (Abercrombie) to about 50 (Capertee). These are overall rates and include a great deal of side-projects in the case of Capertee, e.g. sieving of the older spoil heaps, survey work, flotation experiments, emptying of McCarthy's trenches and minor excavations. On a reasonably efficient excavation without excessive side-projects, one could expect excavation rates of between 15-30 person days per cu.m., depending on the richness of the site, sediment character and working conditions. Typically a team of six would excavate between 1 and 2 cu.m. per week of fieldwork.

By way of comparison I have listed excavation rates for a number of sites (table 19). It will be seen that excavation rates for the system I am proposing compare favourably with those from other excavations. There is, in fact, a remarkably small spread in excavation rates with most lying in the range 20-30 person days per cu.m. The few sites for which excavation rates are much faster than this are short period excavations with an experienced team.

Some comments on publication

Satisfactory publication of both the findings and limitations of an excavation is probably as important as good excavation techniques. I think I can safely say that the vast majority of sites excavated in Australia never receive a satisfactory publication. Obviously thorough analyses such as Mulvaney's Kenniff Cave report (Mulvaney and Joyce 1966) or Lampert's Burrill Lake and Currarong reports (Lampert 1971a) are time consuming undertakings. But the addition of simple topographic information, details of provenance of C14 dates and artefact recovery techniques to a basic 'artefacts recovered' type report involves only the slightest extra investment of labour. If this sort of information is reported the site becomes an order of magnitude more useful to other workers.

The root of the problem is, I believe, that many excavators are not aware of, or do not ask themselves, what sort of questions other workers are likely to ask of their data. If dates are involved, other workers will want to be able to assess their validity. If the site is a rockshelter, the floor plan alone tells one little about the habitable area or the total volume of deposits. A section drawing of a trench

without a cross-section of the site showing the relationship of the trench section to the dripline, rear of the shelter, topography of the shelter floor and possible sediment sources above the shelter, will tell us little about the sedimentational history of the site, which is presumably why we drew the section of the trench in the first place. If details of the recovery techniques used, notably sieve mesh size and sorting technique, are omitted, it is impossible to compare artefact assemblages in any meaningful way. Put succinctly, the bulk of site-reports do not give us the information necessary to assess the depositional history, dating or assemblage composition reported. I believe that much of the necessary information is common to all sites and simple to report, and I have therefore attempted to set out a checklist of some essential information. It is undoubtedly a minimal list.

Plan and Cross-section

The cross-section of a site, whether open or shelter site, is undoubtedly as important as a plan when it comes to assessing the site. Often more than one section is required to show both the form of a rockshelter (headroom, degree of protection, relationship of excavation to dripline, topography of deposits and scalloping or jointing of the roof) and its relationship to the surrounding topography (possible sediment sources above shelter, distance from creek). Similarly a plan extending beyond the site itself may be required to pinpoint aspects of the local topography affecting sedimentation, access to the site or resources in the immediate vicinity of the site (e.g. a waterhole or raw material source).

C14 Dates

It is impossible to assess the validity of C14 dates unless they are reported in considerable detail:

Horizontal location: square/trench, area over which the sample was collected and location of this area within square/trench. Total area of feature if only partially sampled.

Vertical location: depth limits of collection unit (particularly in the case of scattered charcoal), relationship to visible stratigraphy (including vertical distance from stratigraphic boundaries above and

below and from ground surface and/or bedrock).

Nature of feature sampled: hearth, ash pile or lens, scattered charcoal. Extent of feature (area and thickness).

Method of collection: precautions taken to avoid contamination, proportion of available material collected; for scattered charcoal, whether collected during excavation or by sieving/flotation and the size range of fragments involved.

Identification of sample: nature of sample submitted - charred wood, 'ash', shell (species).

Other datable material: presence of other datable materials and whether collected or not. Was all organic material systematically collected (e.g. by wet sieving or flotation)?

Miscellaneous observations: 'sealing' layers or rocks, signs of disturbance, whether trend of stratigraphy could be followed across area sampled (i.e. whether the sample has stratigraphic integrity), whether a feature appears to have been dug into the contemporary surface.

## Assemblage collection technique

The most important and frequently omitted information about the way an assemblage has been collected is the sieve mesh size and procedure used, i.e. wet or dry sieved. Also important are notes as to whether the residue was cross checked, whether bones and lithic material stood out from the residue or were difficult to see due to dust, earthy sediments or concretions adhering to them, and whether there was any form of selection (i.e. discard of certain categories of artefactual material) at the sorting stage, as was the case for many older excavations. It should also be noted whether the residue was retained for later lab-sorting or whether solid samples were retained.

## Conclusion

In this chapter I have discussed the structuring of data recording in the field. I have intentionally avoided the term 'excavation technique' because this subsumes a number of aspects which are not amenable to standardisation, e.g. the shape and extent of the area excavated, the order in which grid squares are excavated and the sampling strategy for sediment, pollen or flotation samples. These

aspects can be considered as the strategy of excavation and it is at this level that an excavation director will express his/her intuition and competence in the perception of the structure (microstratigraphy and features) of the deposits. The strategy of excavation can be largely divorced from the recording of data, and the latter is best handled by a standardised mechanical technique which provides a stable framework for the material collected and observations made in the field. The standardisation of recording techniques in turn allows the setting up of standardised computer programs capable of generating a wide range of commonly used information. The following chapter is devoted to describing such a system.

# CHAPTER 8

## A computerised system for the recording and analysis of excavation data

Introduction

In the preceding chapter I have covered the in-field recording of excavation data. In the present chapter I shall look at the transfer of this data to coding forms and eventually to a computer storage medium (cards, tape or disc file), the addition of data derived from laboratory analysis and the processing of the resulting file which I shall refer to as the EXCAVATION DATA FILE.

I have not attempted to make a general survey of data storage and analysis techniques currently in use. This is because very little has been published on the subject in relation to hunter-gatherer archaeology, particularly in Australia. Moreover, what little has been published is of a problem-specific nature, most commonly involving the recording of attributes for a subset of excavated material (e.g. formal tools), with a view to carrying out a specific analysis. This sort of recording results in scattered files of data and incomplete recording of the material excavated.

I have therefore adopted a pragmatic rather than a synthetic approach to the question of data coding and analysis and set myself the task of evolving one specific system adapted to what I see as the current trends in Australian prehistoric research. I have not, for instance, attempted to integrate programs for generating cumulative typological diagrams, as might have been the case if this work was carried out in Europe. On the other hand, I have placed considerable stress on various measures of size and raw material classification which are basic components of most thorough Australian site reports. My discussion is largely oriented towards lithic artefacts since they are generally the most important component of Australian (and most other) assemblages. However, I have maintained sufficient flexibility so that other materials can be incorporated into the system as required.

It is perhaps in order here to point out the nature of the data we are dealing with. The data derived from the excavation of a hunter-gatherer site can be broadly divided into two categories. On the one hand, we have small numbers of observations with high individual information content, such as observations of different stratigraphic units or features. On the other hand, we have large numbers of observations with low individual information content

derived from the individual artefacts (flaked stone, faunal remains etc.) collected. The latter observations include some form of positional data, either in the form of 3D coordinates or by reference to a particular excavation unit, and attributes or classification data. Their numerical importance, low individual information content and repetitive nature make them an ideal candidate for computer storage and analysis.

Integration of data recording

I think it would be safe to say that data coding and analysis are virtually never conceived of as an integral part of excavation. Even on some well organised excavations that I have visited, material is collected and notes are made with no particular plan as to how they will be analysed. Once back at the laboratory the excavator sorts out the material and washes and labels it and only at this stage does he or she generally begin to decide what analysis to carry out.

This late and ongoing decision is often reflected in the fragmentation of data recording, i.e the recording of data relevant to different questions in a series of separate special-purpose files. Often the same artefacts contribute to several overlapping files which cannot be combined. For example, a file of length-class counts and a file of breadth-class counts cannot be combined to get length/breadth ratios. The result is that each time a new question is asked a new set of measurements has to be made. This limits the amount of information which is extracted from a collection. The solution is to record all the measurements and counts made on a reaccessible medium (i.e disk, tape or cards) in a systematic and structured fashion. If this is done we can specify new questions without the necessity of recording new data or carrying out lengthy hand-sorting and calculations.

The key to effective analysis is to have the totality of the data recorded in a systematic fashion in a single place. This is why I have aimed at a <u>single</u> excavation data file covering coordinate, attribute and classificatory data rather than the more common approach of separate files for 'tools', 'bones', 'waste' etc. However, the design of a particular file structure is only half the battle. If the file is to be an effective record of the data derived from excavation it is essential that new data can be added on easily as it becomes

available. This means that special programs are required and the provision of such programs has been a major part of the methodological section of my work. In writing the programs I have borne in mind Caelli's sixth commandment (Caelli 1979): 'Write programs that are themselves tools to let people access the data base as they want to'.

The computer programs and data structure adopted do not pretend to be sophisticated. Whilst this in part reflects the fact that I am a programming archaeologist rather than an archaeological programmer, it also reflects my desire to make the system I am proposing as simple as possible in order to make it attractive to non-programmers. Archaeologists are still very fond of punched cards and data organised in columns, so I have maintained a formatted file structure with well spaced columns for greater legibility. For similar reasons, I have used fixed column coding forms for initial input of data, although I have made use of freefield input for subsequent additions. The use of such a structure allows a 'cookbook' approach which I feel is more likely to be used than a more open structure requiring numerous decisions on the part of the user.

Final data analysis has been entrusted to the social scientist's best friend, SPSS (Statistical Package for the Social Sciences, Nie et.al. 1975), as this allows a very wide range of possible manipulations and statistical analyses beyond the scope of any specialised program that I could have written. I have concentrated my attention on providing an 'interface' between the excavation data file and the statistical analyses which the package can perform, leaving the user free to specify the analyses he/she requires (cf. Caelli op.cit.).

Individualised and unindividualised finds

A common fault in laboratory analysis of material is the duplication of measurement or classification which occurs because one cannot positively identify a specimen which has already been examined. At best this means that time is wasted in repetition and at worst that results are incorrect. I therefore work on the principle that all material which is to undergo individual measurement or identification must be individually numbered and I refer to this material as INDIVIDUALISED finds. The remainder of the material is known as

UNINDIVIDUALISED finds and will be analysed en masse by classification into size or raw material categories and counting and weighing of these categories.

The first stage of the laboratory analysis should therefore be to sort the material recovered in the sieves and to number any objects likely to undergo individual measurement or classification, e.g utilised and retouched artefacts, identifiable bones and all material exceeding some specified size. The choice of size above which all the finds are numbered will depend very much on the nature of the assemblage and may vary for different raw materials. The criterion(ia) used will generally be the same as those used to classify the remaining unindividualised material, as this will aid in the preparation of histograms of artefact size. For Capertee 3 I numbered all finds exceeding 2 gm weight and the unindividualised finds were classified by weight.

Broadly speaking, unindividualised finds are those which can be considered individually 'unimportant'. Individual coding of this material is not generally feasible because of its numerical importance. This fact has been recognised implicitly by most excavators who single out 'tools' and a sample of the larger 'waste flakes' for individual measurements and classification. The remainder of the material is generally counted and reported as 'waste flakes' (frequently a misnomer), 'debitage', 'bone fragments' and the like. Charcoal fragments are not generally quantified at all.

The relegation of this horde of small material to such blanket terms, and thence to obscurity, results in the loss of much information relative to site function and spatial organisation (Johnson in press). A close look at this material can tell us whether a site has served as a stone-knapping locus, where in the site stone-knapping has occurred and which raw materials were knapped as opposed to being brought in as finished flakes. This in turn can tell us about site usage and communication networks. Small bone and plant remains, including charcoal, can tell us about food processing and site usage. The great advantage of this small material is that, unlike the 'tools' upon which we are accustomed to rely for information, it is unlikely to be curated (ibid.).

One proviso on the use of unindividualised finds when discussing questions such as site function, is that sieve collection procedures must be well controlled. As a general rule, numerical importance increases rapidly with decreasing size (see chapter 5 for example), so differences in sieve size and technique can radically affect such 'classic' statistics as 'waste:tool' ratios or mean weight or mean length of flakes.

Structure of the excavation data file

The excavation data file must accommodate two different types of information:

1. information relating to each excavation unit as a whole, for example volume, weight of sediment, number and weight of unindividualised finds;

2. information relating to single (individualised) finds (coordinates and attributes including typological or species classifications).

In the system I am proposing, each excavation unit is represented by a block of consecutive records (lines of data). Information relating to the excavation unit as a whole is recorded on a fixed number of records for each excavation unit. These are followed by a variable number of records, one for each individualised object in that excavation unit, giving coordinate and attribute data for that object. The structure of the block of records for an excavation unit is illustrated in fig. 59.

The present system allows for four records of information relating to the excavation unit as a whole, but the programs can be easily altered to accommodate more or less records. The four record types at present available, identified by 1, 2, 3 or 4 in column 1, are:

Type 1: General information - sediment and residue weights and start and end levels for excavation unit.

Type 2: Raw material classification of the unindividualised finds. Up to 14 raw material types (number and weights) can be accommodated. In addition this record can contain the weights of lithic and organic finds eliminated during sample purification.

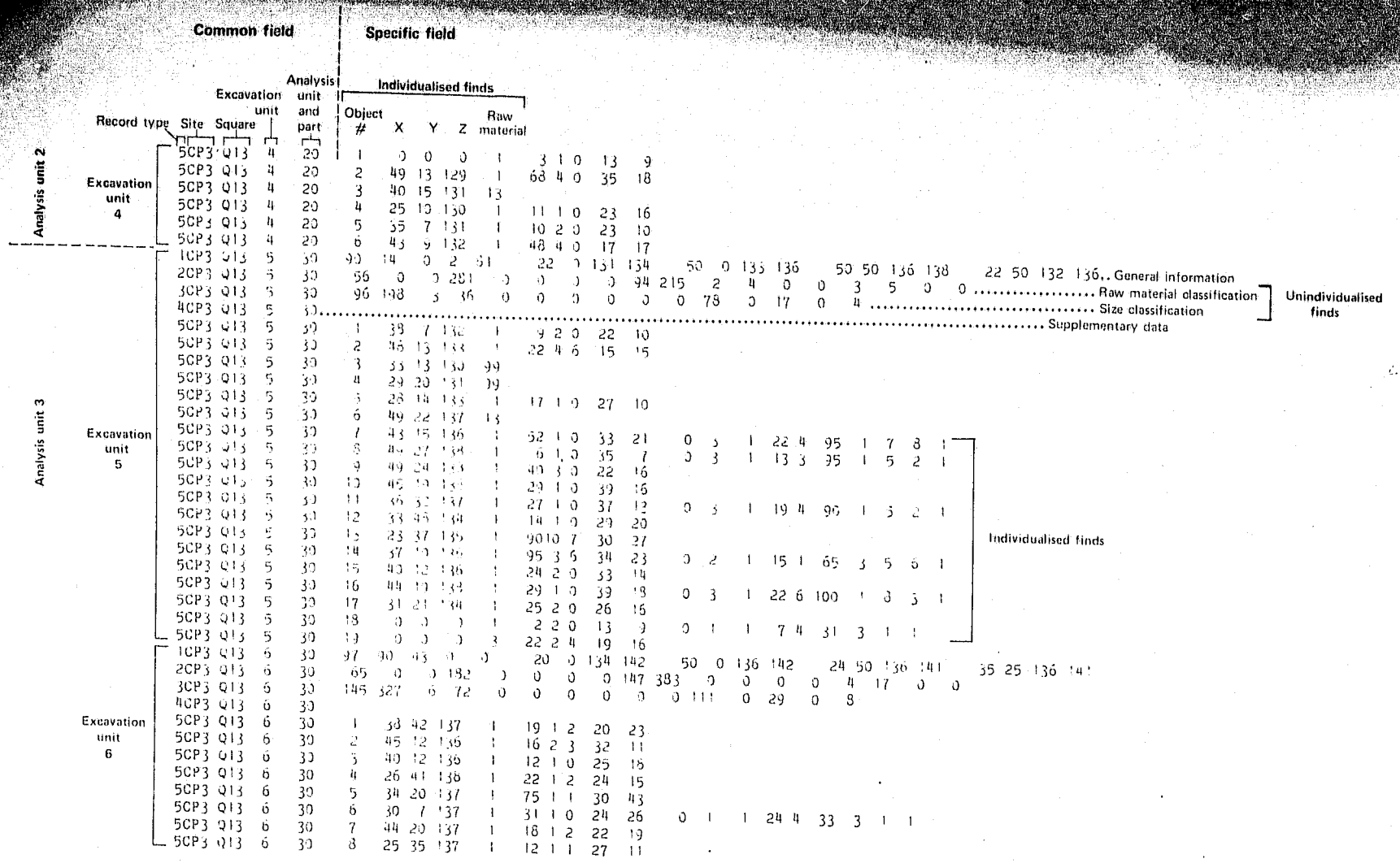



Fig. 59 Structure of the excavation data file

Type 3: Size classification of the unindividualised lithic finds. Up to four classes each (numbers and weights) can be accommodated for length, area and weight.

Type 4: Supplementary data - This record is available for any data not covered by the preceding records, for example weights of different shell species, sediment analyses.

Individualised finds records are identified by a 5 or a 6 in column 1. They must follow the corresponding records of excavation unit information, but need not be in any particular order (though it will generally be convenient to order them by artefact serial number).

Type 5: Forme attributes and artefact coordinates. If the find is a secondarily worked or utilised lithic find this record will also carry attributes for the first (or only) worked edge.

Type 6: Supplementary worked edge attributes. Attributes for second, third etc. retouched/utilised edges.

Each record of the excavation data file is divided into two parts, the COMMON FIELD and the SPECIFIC FIELD. The common field runs from columns 1-18 and contains the following information:

| Columns | |
|---|---|
| 1 | Record type (1-9) |
| 2-4 | Site identifier |
| 5 | Subdivision of site, if required |
| 6-8 | Excavation square identifier |
| 9-11 | Excavation unit number |
| 12-13 | Feature number, if required |
| 14-15 | Analysis unit number or stratigraphic level |
| 16 | Subdivision of above, if required |
| 17-18 | Subdivision of excavation square, if required |

The specific field contains different information according to the record type in question. The information coded and the columns used can be read off the field coding form (fig. 61) for record types 1-4. For record types 5 and 6 the attributes and format may be varied according to the specific requirements of the site being recorded; in appendix II I have listed the attributes and the columns in which they are recorded for my analysis of the Capertee 3 lithic material.

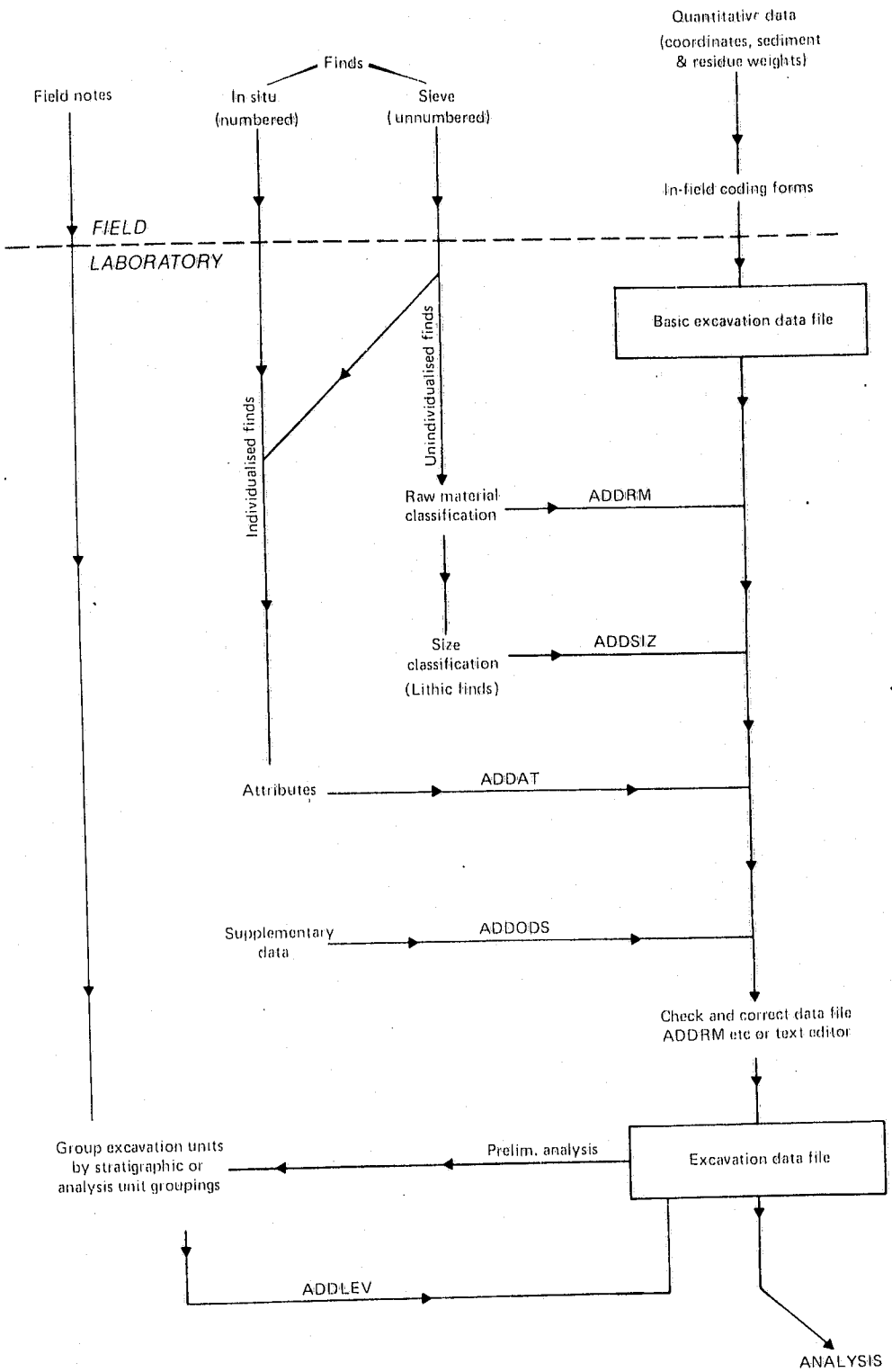


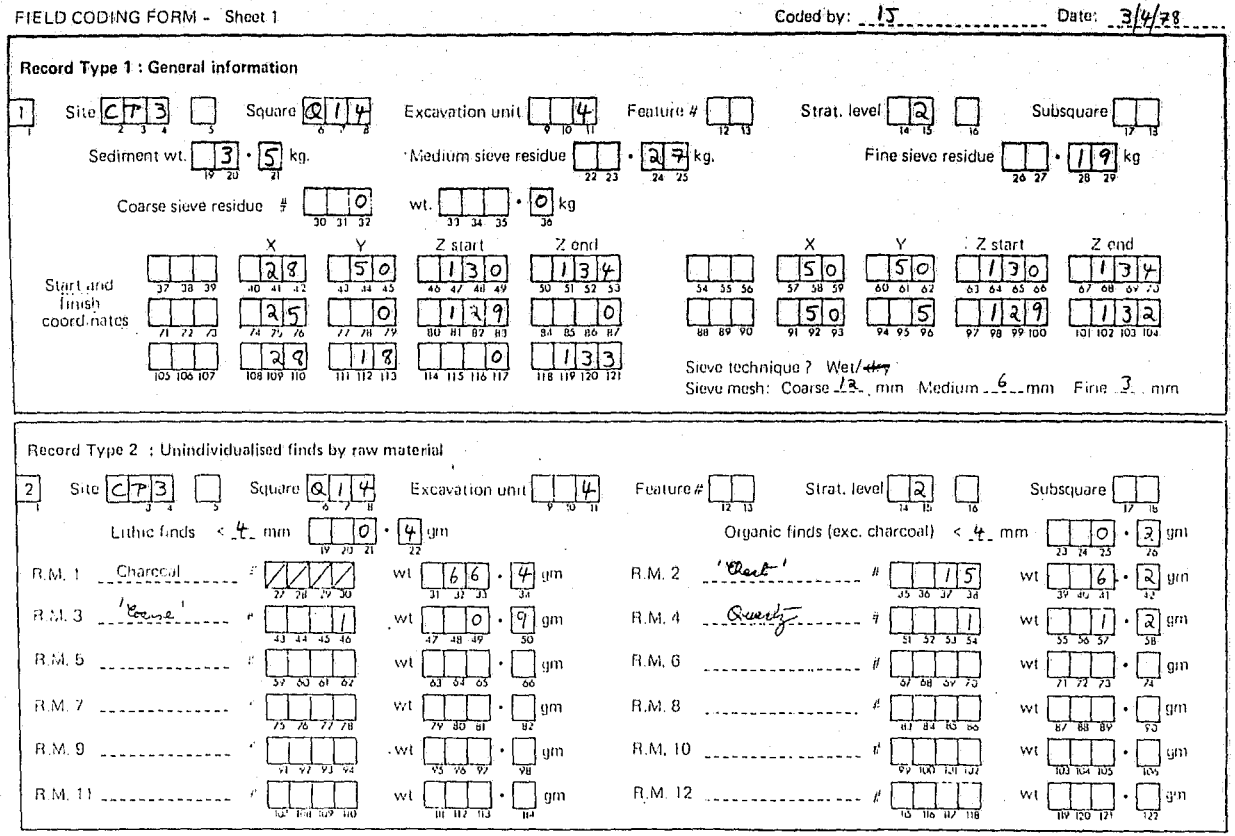

Fig. 60 Suggested flow-diagram of excavation data recording

There are several advantages in using a common field identifying the site, square and excavation unit to which each record of information belongs, rather than entering this information only on the first record for each excavation unit so that the remaining records are simply identified by their position. From the programming point of view life is made much easier by the fact that one does not have to cope with the possibility of numerical information and alphabetic characters occurring in the same position on successive records. From the manipulation point of view each record is uniquely identified and includes stratigraphic and spatial information, so that records can be extracted into special purpose files without loss of context.

Data storage

So far we have dealt with the sorts of information which will be generated by recording of the excavated material. The key to an effective data recording system is flexibility to accept new data a bit at a time and incorporate it into the data already recorded. This is particularly important as far as rapid publication of a preliminary report is concerned, since it should not be necessary to wait until a site has been fully analysed before the data can be stored and analysed using the computer. Equally preliminary analysis may suggest extra data to be recorded.

The programs I have written allow the creation of a basic excavation data file from data collected in the field (sediment and residue weights, start and end levels of excavation units, preliminary stratigraphic attributions) and subsequent addition of data collected during laboratory analysis. The basic excavation data file is created simply by keying in the information recorded on a set of field coding forms (fig. 51). Although these forms may also be used to record raw material and size classification data for the unindividualised finds, and forme attributes for individualised finds, these will more often be added after creation of the excavation data file and often after laboratory analysis away from the field situation. If no data is to be coded on record types 2-5 in the field, only the general information record (type 1) need be keyed in. DUPLIC will convert the file thus created to the standard format (see later). A suggested flow diagram for data recording is shown in fig. 50. Note that several runs of ADDAT may be required to add attributes for different classes of finds


FIELD CODING FORM - Sheet 1

Coded by: IS Date: 3/4/78

**Record Type 1 : General information**

1 Site C T 3 Square Q 1 4 Excavation unit 4 Feature # Strat. level 2 Subsquare

Sediment wt. 3 . 5 kg. Medium sieve residue . 2 7 kg. Fine sieve residue . 1 9 kg

Coarse sieve residue # 0 wt. . 0 kg

| Start and finish coordinates | X | Y | Z start | Z end | X | Y | Z start | Z end |
|---|---|---|---|---|---|---|---|---|
| | 28 | 50 | 130 | 134 | 50 | 50 | 130 | 134 |
| | 25 | 0 | 129 | 0 | 50 | 5 | 129 | 132 |
| | 29 | 18 | 0 | 133 | | | | |

Sieve technique ? Wet/~~dry~~

Sieve mesh: Coarse 12 mm Medium 6 mm Fine 3 mm

**Record Type 2 : Unindividualised finds by raw material**

2 Site C T 3 Square Q 1 4 Excavation unit 4 Feature # Strat. level 2 Subsquare

Lithic finds < 4 mm . 0 . 4 gm

Organic finds (exc. charcoal) < 4 mm . 0 . 3 gm

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| R.M. 1 | Charcoal | /// | wt | 66 . 4 gm | R.M. 2 | 'Chert' | 15 | wt . 6 . 2 gm |
| R.M. 3 | 'Coarse' | 1 | wt | . 0 . 9 gm | R.M. 4 | Quartz | 1 | wt . 1 . 2 gm |
| R.M. 5 | | | wt | . gm | R.M. 6 | | | wt . gm |
| R.M. 7 | | | wt | . gm | R.M. 8 | | | wt . gm |
| R.M. 9 | | | wt | . gm | R.M. 10 | | | wt . gm |
| R.M. 11 | | | wt | . gm | R.M. 12 | | | wt . gm |

Site C T 3 Square Q 1 4 Excavation unit 4

Fig. 61a Example of computer coding form (sheet 1)

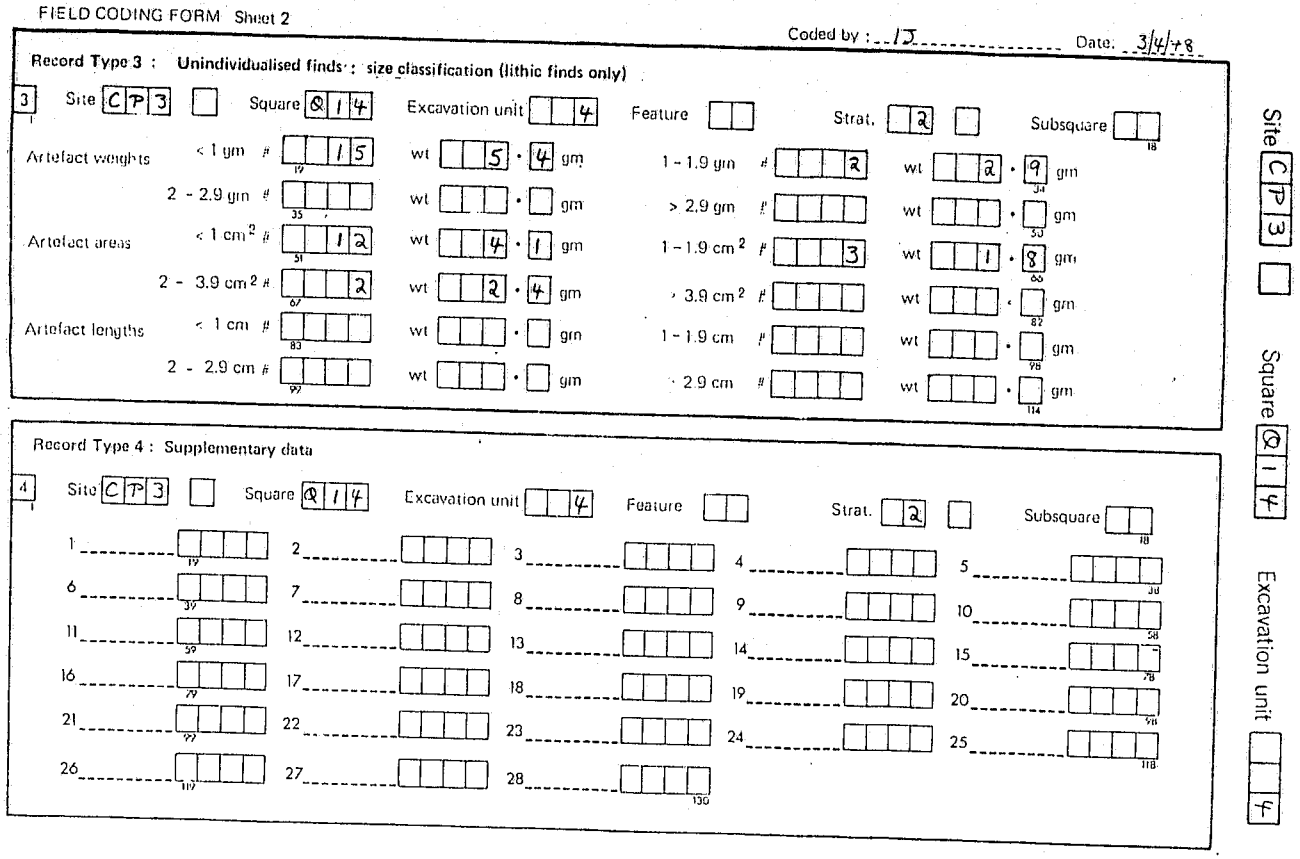



Fig 61b Example of computer coding form (sheet 2)

FIELD CODING FORM Sheet 3 — Coded by: IJ — Date: 3/4/78

**Record Type 5 : Individualised finds**

Optional variables - it is not necessary to code all these variables since they can be added later using ADDAT
Only lines with values for these variables will be keyed in

| | Site | Pt | Square | Ex unit | Featr | Strat | Pt | Sub sq | Obj # | X | Y | Z | RM | Wt (1/10g) | Sup | Ctx | Length mm | Breadth mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | CP3 | | Q 14 | 4 | | 2 | | | 1 | 34 | 46 | 130 | 1 | 15 | 1 | 0 | 19 | 12 |
| | | | | | | | | | 2 | 40 | 16 | 129 | 1 | 22 | 4 | 6 | 17 | 15 |
| | | | | | | | | | 3 | 42 | 11 | 129 | 2 | 107 | 4 | 7 | 35 | 28 |
| | | | | | | | | | 4 | 34 | 27 | 131 | 13 | 4 | | | 8 | 6 |
| | | | | | | | | | 5 | 32 | 41 | 133 | 13 | 7 | | | 12 | 8 |
| | | | | | | | | | 6 | 45 | 25 | 131 | 1 | 49 | 3 | 0 | 20 | 16 |
| | | | | | | | | | 7 | 34 | 23 | 132 | 1 | 12 | 1 | 1 | 13 | 4 |
| | | | | | | | | | 8 | 37 | 48 | 134 | 1 | 37 | 2 | 0 | 25 | 10 |
| | | | | | | | | | 9 | 42 | 37 | 134 | 11 | 15 | | | | |
| | | | | | | | | | 10 | | | | | | | | | |
| | | | | | | | | | 11 | | | | | | | | | |
| | | | | | | | | | 12 | | | | | | | | | |
| | | | | | | | | | 13 | | | | | | | | | |
| | | | | | | | | | 14 | | | | | | | | | |
| | | | | | | | | | 15 | | | | | | | | | |
| | | | | | | | | | 16 | | | | | | | | | |
| | | | | | | | | | 17 | | | | | | | | | |
| | | | | | | | | | 18 | | | | | | | | | |
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| | | | | | | | | | 31 | | | | | | | | | |
| | | | | | | | | | 32 | | | | | | | | | |
| | | | | | | | | | 33 | | | | | | | | | |
| | | | | | | | | | 34 | | | | | | | | | |
| | | | | | | | | | 35 | | | | | | | | | |

Please duplicate columns 1 – 18

NOTE This sheet should be used only if data is to be typed up by a data processing unit. Otherwise use laboratory coding forms and data addition programs.

Site CP3 Square Q 14 Excavation unit 4

Fig 61c Example of computer coding form (sheet 3)

(e.g. lithic finds, skeletal remains) if they are coded with different attribute sets.

The following programs are available for addition of data to the excavation data file:

ADDRM Adds raw material classification of the unindividualised finds (number and weight for up to 13 raw material classes, weight only for charcoal and for lithic and organic finds removed during sample purification).

ADDSIZ Adds size classifications (by weight, area or length) for the unindividualised lithic finds.

ADDAT Adds any chosen set of attributes for the individualised finds. To change the list of attributes and the format in which they are output minor program modifications are required which are fully explained in the program listing (appendix IV).

ADDODS Adds up to 28 variables to any specified record type. Present format is 28 four-column variables, but the number of variables and the format can be easily modified. This program can be used to add extra variables of the users choice, for example weights of different shell species, sediment colour codes, notebook or photograph cross-reference numbers.

Analysis units

It is a common feature of excavations that one may have second thoughts about the stratigraphic or analysis unit attribution of some excavation units during the course of analysis. In fact I have suggested in chapter 7 that final grouping into analysis units should not be carried out until a preliminary analysis of the material has been undertaken. I therefore consider it essential that reattribution of excavations units to different analysis units should be a straightforward process. I have written a program, ADDLEV, which allows one to modify selected attributions, the new attributions being entered from the terminal in response to prompts. The analysis unit attributions of both the general information/unindividualised finds records and of the individualised finds records are modified by this program; note that the basic philosophy of this procedure is that all individualised and unindividualised finds from an excavation unit

Fig. 62 Examples of 'conversations' with data addition programs

Explanatory note

All the data addition programs and the other programs described here are activated from a computer terminal, either a video (television type) or hard-copy (typewriter-like) terminal. To activate a program one types EXECUTE followed by the program name (if the program has already been translated into the machine's own language one can type EXECUTE or RUN, as in the 'conversations' illustrated). The computer will then type out information and questions on the terminal. Each answer is transmitted to the computer when the RETURN key is pressed (references to typing RETURN mean to press this key not to type the word 'RETURN').

A FILE on the computer is simply a magnetic equivalent of a roll of paper on which lines of information are written one after the other. Each line is called a RECORD. On the DEC10 computer, files are identified by names which are composed of two parts, a 'filename' and an 'extension' separated by a period (.) for example UPDAT1.CP3, CP3UN.RM. The filename can be up to six characters, the first of which must be a letter, and the extension up to three characters.

The period (.) preceding RUN at the top of each individual conversation and following EXIT at the end, is an indication that the computer is ready to run a new program. The line above EXIT tells one how much computer time (CPU time) has been used by the program.

```
.RUN ADDRM


EXCAVATION DATA PROCESSING
**************************

Ian Johnson, Prehistory, ANU,  July 1979
Version 3/8/79


**** ADDRM ****                    17-Aug-79

This program adds raw material classification data for
the unindividualised finds to the excavation data file
For documentation see top of program listing


Name of excavation data file? : UPDAT1.CP3


Name of raw material classification data file? : CP3UN.RM


What do you want to call your output file? : UPDAT2.CP3


What raw material classifications do you have?
Type in raw material code numbers in order of data
on a single line separated by spaces
If you have weights for lithic and organic finds under 4mm,
code these as 100 and 200 respectively

100  4  5  7

Do you have frequency data for the raw material categories? : Y

Do you have weights for the raw material categories? : Y


Program running


  667 records written on output file: UPDAT2.CP3
   87 Sets of raw material classifications read
   87 Sets of raw material classifications added to
      excavation data file


STOP

END OF EXECUTION
CPU TIME: 3.91   ELAPSED TIME: 1:11.20
EXIT
```

```
.RUN ADDSIZ


EXCAVATION DATA PROCESSING
**************************

Ian Johnson, Prehistory, ANU,  July 1979
Version 3/8/79


**** ADDSIZ ****                    17-Aug-79

This program adds size classifications for unindividualised finds
onto the excavation data file
For documentation see top of program listing


Name of excavation data file? : UPDAT2.CP3


Name of size classification data file? : CP3UN.SIZ


What do you want to call your output file? : UPDAT3.CP3


What size classifications do you have?
Type RETURN only for a list of attributes and code numbers
(Type 99 for list if you are using a video terminal)



Code numbers are as follows:
  1     Weight          <1gm            Number
  2     Weight          <1gm            Wt in 1/10gm
  3     Weight          1-1.9gm         Number
  4     Weight          1-1.9gm         Wt in 1/10gm
  5     Weight          2-2.9gm         Number
  6     Weight          2-2.9gm         Wt in 1/10gm
  7     Weight          3-3.9gm         Number
  8     Weight          3-3.9gm         Wt in 1/10gm
  9     Weight          >3.9gm          Number
 10     Weight          >3.9gm          Wt in 1/10gm
 11     Area            <1sq.cm.        Number
 12     Area            <1sq.cm.        Wt in 1/10gm
 13     Area            1-2sq.cm.       Number
 14     Area            1-2sq.cm.       Wt in 1/10gm
 15     Area            2-4sq.cm.       Number
 16     Area            2-4sq.cm.       Wt in 1/10gm
 17     Area            >4sq.cm.        Number
 18     Area            >4sq.cm.        Wt in 1/10gm
 19     Length          <1cm            Number
 20     Length          <1cm            Wt in 1/10gm
 21     Length          1-1.9cm         Number
 22     Length          1-1.9cm         Wt in 1/10gm
 23     Length          2-2.9cm         Number
 24     Length          2-2.9cm         Wt in 1/10gm
 25     Length          3-3.9cm         Number
 26     Length          3-3.9cm         Wt in 1/10gm
 27     Length          >3.9cm          Number
 28     Length          >3.9cm          Wt in 1/10gm

Type in code numbers in the order in which the data appears
on the classification data file
Separate codes by spaces and type on a single line

1  2  3  4  5  6    11  13  15


Program running


  667 records written on output file: UPDAT3.CP3
   46 Sets of size classifications read
   46 Sets of size classifications added to
      excavation data file



STOP

END OF EXECUTION
CPU TIME: 3.59  ELAPSED TIME: 1:46.16
EXIT
```

```
.RUN ADDAT


EXCAVATION DATA PROCESSING
**************************

Ian Johnson, Prehistory, ANU,  July 1979
Version 10/9/79


**** ADDAT ****                    9-Oct-79

This program adds attributes for individualised finds
to the excavation data file
For documentation see top of program listing


Name of excavation data file? : UPDAT6.CP3


Name of attribute data file? : CP3SUP.ATT


What do you want to call your output file? : UPDAT7.CP3


Output format of this version is as follows:
Common field:     (I1,A4,A3,I3,A1,I3,A1,2X,I3,
Attributes field: 2X,2I3,2I4,I5,2I2,2I4,I5,I3,2I4,I2,I4,9I3,10I4)

What attributes do you have?
Type RETURN only for a list of attributes and code numbers
(Type 99 for list if you are using a video terminal)


This version uses the attribute list for lithic finds
described in Johnson 1979, PhD, ANU

Code numbers are as follows:
 1      X coordinate
 2      Y coordinate
 3      Z coordinate
 4      Raw material
 5      Weight in 1/10 gm
 6      Nature of support piece (lithic finds)
 7      Amount of cortex                --
 8      Length in mm                    --
 9      Breadth in mm                   --
10      Thickness in mm.                --
11      Artefact type                   --
12      Edge number          (utilised/retouched lithics)
13      Length of working edge             --
14      Shape of edge                      --
15      Edge angle                         --
16      Disposition of retouch             --
17      Type of retouch, main surface      --
18      Extent of secondary retouch        --
19      Extent of tertiary retouch         --
20      Degree of polish                   --
21      Type of retouch, second surface    --
22      Extent of secondary retouch        --
23      Extent of tertiary retouch         --
24      Degree of polish                   --

Type in code numbers in the order in which  the attributes
appear on the attribute data file.
Separate codes by spaces and type on a single line

4  5  6  7  8  9  10


Program running


 3561 Records written on output file: UPDAT7.CP3
 1196 Sets of attribute data read
 1196 Sets of attributes matched with finds on the
      excavation data file


STOP

END OF EXECUTION
CPU TIME: 26.18 ELAPSED TIME: 5:17.16
EXIT
```

```
.RUN ADDLEV


EXCAVATION DATA PROCESSING
**************************

Ian Johnson, Prehistory, ANU,  July 1979
Version 3/8/79


**** ADDLEV ****                    17-Aug-79

This program adds stratigraphic level or analysis unit attributions
to the excavation data file
and duplicates existing or new attributions from the first record
for each excavation unit, onto subsequent records
For documentation see top of program listing


Name of excavation data file? : UPDAT4.CP3

What do you want to call your output file? : UPDAT5.CP3


At what excavation square do you want to start correcting or
adding level/analysis unit attributions?

Q13

At what excavation unit number? : 7


Scanning for starting point

Program will prompt with square identifier, excavation unit number,
and level attribution (level number and subdivision)
If level attribution is correct, simply press RETURN. Otherwise, type in
new level number followed by subdivision, separated by space(s)
If only one number is typed in the subdivision defaults to zero
If you want to terminate the current inputting session at any time
(without losing level attributions you have input), type control Z
in reply to prompt

Sqr Unit Lev/Sub New Value
Q13    7    3 0 :   3 1
Q13    8    4 0 :   3 1
Q13    9    4 0 :
Q13   10    4 0 :   4 1
Q13   11    5 0 :
Q13   12    5 0 :
Q13   13    6 0 :   5 0
Q13   14    6 0 :
Q13   15    7 0 :   ^Z

Copying over remainder of file

 1863 Records written on output file: UPDAT5.CP3

STOP

END OF EXECUTION
CPU TIME: 8.18  ELAPSED TIME: 2:51.64
EXIT
```

belong to the same analysis unit. This limitation was necessary if the program was to be easy to use and can be got around (messily) if absolutely necessary.

Fig. 62 shows a typical sequence of data additions, starting from a basic excavation data file produced by keying in the field coding forms (fig. 61). First a raw material classification of the unindividualised finds is added to the excavation data file using ADDRM and the updated excavation data file is output as UPDAT2.CP3. Then a weight classification is added using ADDSIZ. Thirdly forme attributes for the individualised finds are added using ADDAT. For these three programs the data to be added to the excavation data file is contained in the free-format files CP3UN.RM, CP3UN.SIZ and CP3SUP.ATT.

ADDAT is designed to be flexible so that different attribute systems can be accommodated according to research requirements or the types of artefact being recorded. The only modifications required to accommodate different sets of attributes are to two format statements in the program:

1. the format used for outputting the attribute values on the excavation data file;

2. the format which types out the attribute list on the terminal.

Instructions for carrying out these modifications are included in the program listing (appendix IV).

Note that attributes for different types of find, e.g. for lithic artefacts and faunal remains, need not be in the same columns (i.e. format), provided that some attribute by which they can be distinguished, e.g. raw material, does occur in a fixed position.

Fig. 62 skips further data additions and shows the correction of analysis unit attributions using ADDLEV. Finally SELEC is used to print out the updated data file (fig. 63). SELEC prints out records one type at a time so that they can be easily verified; by selecting one type at a time the values fall into columns so that errors can be spotted more easily (compare for example part of the excavation data file shown in fig. 59 with the output from SELEC shown in fig. 64).

```
.RUN SELEC


EXCAVATION DATA PROCESSING
**************************


Ian Johnson, Prehistory, ANU     July 1979
Version 3/8/79


**** SELEC ****          17-Aug-79

This program prints out or outputs a file of chosen record types
selected from the excavation data file
See top of program listing for documentation


Name of excavation data file? : UPDAT9.CP3


What do you want to call your output file?
If you want a printout not a permanent file, type RETURN only


Record types on excavation data file are as follows:
1  General excavation unit information (coordinates,sediment wt etc)
2  Unindividualised finds, raw material classifications
3  Unindividualised finds, size classifications
4  Supplementary variables
5  Individualised finds
6  Supplementary records for individualised finds (2nd,3rd.. utilised edges)

What record type do you want printed? (Control Z to terminate) : 1

   165 Records printed

What record type do you want printed? (Control Z to terminate) : 2

   165 Records printed

What record type do you want printed? (Control Z to terminate) : 3

   165 Records printed

What record type do you want printed? (Control Z to terminate) : 5

  2881 Records printed

What record type do you want printed? (Control Z to terminate) : ^Z

STOP

END OF EXECUTION
CPU TIME: 34.55 ELAPSED TIME: 2:5.64
EXIT
```

Fig. 63 Example 'conversation' with SELEC

Excavation Data File: UPDAT9.CP3 Date: 17-Aug-79 Record Type Selected: 1

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1CP3 | Q13 | 10 | 10 | 68 | 8 | 46 | 0 | 0 | 25 | 0 | 113 | 117 | 50 | 50 | 117 | 124 | 50 | 0 | 112 | 117 | 37 | 25 | 117 | 119 |
| 1CP3 | Q13 | 20 | 10 | 87 | 26 | 44 | 0 | 0 | 25 | 0 | 117 | 122 | 50 | 50 | 124 | 124 | 25 | 50 | 120 | 125 | 25 | 25 | 119 | 125 |
| 1CP3 | Q13 | 30 | 10 | 85 | 48 | 39 | 0 | 0 | 25 | 0 | 122 | 126 | 50 | 50 | 127 | 129 | 50 | 0 | 123 | 127 | 25 | 50 | 125 | 128 |
| 1CP3 | Q13 | 40 | 20 | 70 | 7 | 0 | 0 | 0 | 25 | 0 | 126 | 131 | 50 | 50 | 129 | 130 | 50 | 0 | 127 | 133 | 20 | 50 | 128 | 128 |
| 1CP3 | Q13 | 50 | 30 | 90 | 14 | 0 | 2 | 81 | 22 | 0 | 131 | 134 | 50 | 0 | 133 | 136 | 50 | 50 | 136 | 138 | 22 | 50 | 132 | 136 |
| 1CP3 | Q13 | 60 | 30 | 97 | 90 | 43 | 0 | 0 | 20 | 0 | 134 | 142 | 50 | 0 | 136 | 142 | 24 | 50 | 136 | 141 | 35 | 25 | 136 | 141 |
| 1CP3 | Q13 | 70 | 30 | 106 | 21 | 31 | 0 | 0 | 21 | 0 | 142 | 147 | 50 | 50 | 142 | 145 | 50 | 0 | 142 | 147 | 35 | 25 | 141 | 147 |
| 1CP3 | Q13 | 80 | 40 | 60 | 52 | 28 | 2 | 8 | 20 | 0 | 147 | 148 | 50 | 0 | 147 | 148 | 21 | 50 | 147 | 150 | 50 | 50 | 145 | 152 |
| 1CP3 | Q13 | 90 | 40 | 80 | 0 | 24 | 1 | 12 | 20 | 0 | 148 | 154 | 50 | 50 | 152 | 156 | 50 | 0 | 148 | 151 | 20 | 50 | 150 | 153 |
| 1CP3 | Q13 | 100 | 40 | 100 | 30 | 42 | 1 | 8 | 20 | 0 | 154 | 161 | 50 | 0 | 150 | 151 | 20 | 50 | 154 | 163 | 50 | 50 | 158 | 165 |
| 1CP3 | Q13 | 110 | 50 | 60 | 15 | 26 | 0 | 0 | 16 | 8 | 161 | 164 | 50 | 50 | 165 | 167 | 20 | 50 | 163 | 165 | 30 | 30 | 163 | 164 |
| 1CP3 | Q13 | 120 | 50 | 95 | 10 | 54 | 0 | 0 | 15 | 5 | 164 | 168 | 50 | 0 | 151 | 151 | 20 | 50 | 165 | 168 | 50 | 50 | 167 | 172 |
| 1CP3 | Q13 | 130 | 60 | 102 | 2 | 62 | 0 | 0 | 24 | 0 | 168 | 169 | 50 | 0 | 172 | 173 | 22 | 50 | 168 | 170 | 50 | 50 | 172 | 174 |
| 1CP3 | Q13 | 140 | 60 | 115 | 18 | 80 | 0 | 0 | 20 | 0 | 172 | 174 | 50 | 0 | 176 | 180 | 25 | 50 | 171 | 179 | 50 | 50 | 173 | 175 |
| 1CP3 | Q13 | 150 | 70 | 95 | 16 | 70 | 0 | 0 | 20 | 10 | 174 | 178 | 50 | 0 | 180 | 182 | 23 | 50 | 179 | 181 | 50 | 50 | 181 | 181 |
| 1CP3 | Q13 | 160 | 70 | 124 | 35 | 96 | 1 | 12 | 20 | 0 | 178 | 184 | 50 | 0 | 181 | 184 | 24 | 50 | 182 | 187 | 50 | 50 | 184 | 187 |
| 1CP3 | Q13 | 170 | 70 | 80 | 80 | 71 | 0 | 0 | 15 | 5 | 184 | 188 | 50 | 50 | 187 | 191 | 50 | 5 | 184 | 0 | 25 | 25 | 187 | 190 |
| 1CP3 | Q13 | 180 | 70 | 78 | 16 | 40 | 1 | 5 | 50 | 0 | 162 | 190 | 50 | 50 | 162 | 190 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1CP3 | Q13 | 190 | 70 | 125 | 68 | 120 | 0 | 0 | 15 | 4 | 188 | 193 | 50 | 0 | 188 | 193 | 20 | 50 | 191 | 193 | 50 | 50 | 191 | 194 |

Excavation Data File: UPDAT9.CP3 Date: 17-Aug-79 Record Type Selected: 2

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2CP3 | Q13 | 10 | 10 | 0 | 0 | 0 | 156 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2CP3 | Q13 | 20 | 10 | 70 | 0 | 0 | 177 | 0 | 0 | 0 | 0 | 156 | 343 | 0 | 0 | 0 | 0 | 5 | 14 | 0 | 0 |
| 2CP3 | Q13 | 30 | 10 | 60 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2CP3 | Q13 | 40 | 20 | 25 | 0 | 0 | 331 | 0 | 0 | 0 | 0 | 60 | 165 | 2 | 15 | 0 | 0 | 3 | 4 | 0 | 0 |
| 2CP3 | Q13 | 50 | 30 | 56 | 0 | 0 | 281 | 0 | 0 | 0 | 0 | 94 | 215 | 2 | 4 | 0 | 0 | 3 | 5 | 0 | 0 |
| 2CP3 | Q13 | 60 | 30 | 65 | 0 | 0 | 182 | 0 | 0 | 0 | 0 | 147 | 383 | 0 | 0 | 0 | 0 | 4 | 17 | 0 | 0 |
| 2CP3 | Q13 | 70 | 30 | 99 | 0 | 0 | 170 | 0 | 0 | 0 | 0 | 251 | 854 | 7 | 12 | 0 | 0 | 18 | 38 | 0 | 0 |
| 2CP3 | Q13 | 80 | 40 | 75 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 234 | 78 | 1 | 1 | 0 | 0 | 9 | 16 | 0 | 0 |
| 2CP3 | Q13 | 90 | 40 | 44 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 196 | 525 | 1 | 1 | 0 | 0 | 3 | 9 | 0 | 0 |
| 2CP3 | Q13 | 100 | 40 | 85 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 313 | 963 | 6 | 19 | 0 | 0 | 1 | 3 | 0 | 0 |
| 2CP3 | Q13 | 110 | 50 | 29 | 0 | 0 | 37 | 0 | 0 | 0 | 0 | 113 | 330 | 2 | 6 | 0 | 0 | 2 | 4 | 0 | 0 |
| 2CP3 | Q13 | 120 | 50 | 39 | 0 | 0 | 34 | 0 | 0 | 0 | 0 | 100 | 253 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 |
| 2CP3 | Q13 | 130 | 60 | 23 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 83 | 242 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 |
| 2CP3 | Q13 | 140 | 60 | 45 | 0 | 0 | 49 | 0 | 0 | 0 | 0 | 73 | 168 | 0 | 0 | 0 | 0 | 5 | 19 | 0 | 0 |
| 2CP3 | Q13 | 150 | 70 | 14 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 48 | 131 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2CP3 | Q13 | 160 | 70 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 184 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2CP3 | Q13 | 170 | 70 | 19 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 97 | 426 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2CP3 | Q13 | 180 | 70 | 18 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 67 | 217 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2CP3 | Q13 | 190 | 70 | 38 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 149 | 713 | 4 | 45 | 0 | 0 | 2 | 12 | 0 | 0 |
| 2CP3 | Q13 | 200 | 70 | 37 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 204 | 935 | 2 | 15 | 0 | 0 | 4 | 27 | 0 | 0 |

Fig. 64 Example output from SELEC

Correction of errors can be carried out by supplying new values and using ADDRM etc. New values overwrite values already existing on the excavation data file whilst values for which no new data is supplied remain unchanged. In practice, however, it may be more convenient and more economical in terms of computer time, to use a text editor to make minor corrections. I have developed a special-purpose editor which allows one to locate a specified artefact and modify any or all of the attributes for that artefact. I have not included this program in this thesis because it is expensive in terms of computer time and disc storage and I hope to improve its efficiency before publishing it.

Method of data addition

A number of considerations lead to my choice of method for adding data to the excavation data file. In the first place it is exceedingly slow and tedious to try and add data onto a file using a general purpose text-editor, so that special programs are essential for data additions. Two possibilities are therefore open to us. Either the new data is entered in reply to prompts from the program and added on in the appropriate places, or a file of data is created using a text editor (or keyed onto cards or tape) and the program combines this with the excavation data file. I chose the first strategy for ADDLEV since it is more convenient to use and a relatively small amount of data is likely to be input. For the other data addition programs one is likely to be dealing with far larger quantities of data, so I chose to read the new data from a file. This is a much faster way of adding data because, when creating the file, one is not obliged to wait for the computers response for each item of data added and data can be typed in very rapidly in free-format (values separated by spaces). It also allows one to have the data keyed in by a data preparation service if one is available.

In order to avoid the time consuming drudgery (for a non keypunch operator) of typing in data in fixed columns, the file of data to be added to the excavation data file is typed in in free format. This means that individual values are simply separated by space(s); the structure of these files is fully explained in the program listings in appendix V. I have written an additional program, CNTVAR, which checks that the correct number of values has been entered on each line of the

```
.RUN CNTVAR


EXCAVATION DATA PROCESSING
**************************

Ian Johnson, Prehistory, ANU,  July 1979
Version 3/8/79


**** CNTVAR ****                    1-Oct-79

This program counts the number of variables per record on a freefield
data file and lists those records which do not conform to an
expectation which you enter from the terminal.
Records containing alphabetic characters are ignored

Input file name? : BACKED.Q13


How many variables do you expect per record? : 8

LINE  41      # OF VARIABLES  7
LINE  58      # OF VARIABLES 16
LINE 108      # OF VARIABLES  6
STOP

END OF EXECUTION
CPU TIME: 2.21  ELAPSED TIME: 24.82
EXIT

.




Input file name? : REDIR.Q13


How many variables do you expect per record? : 11

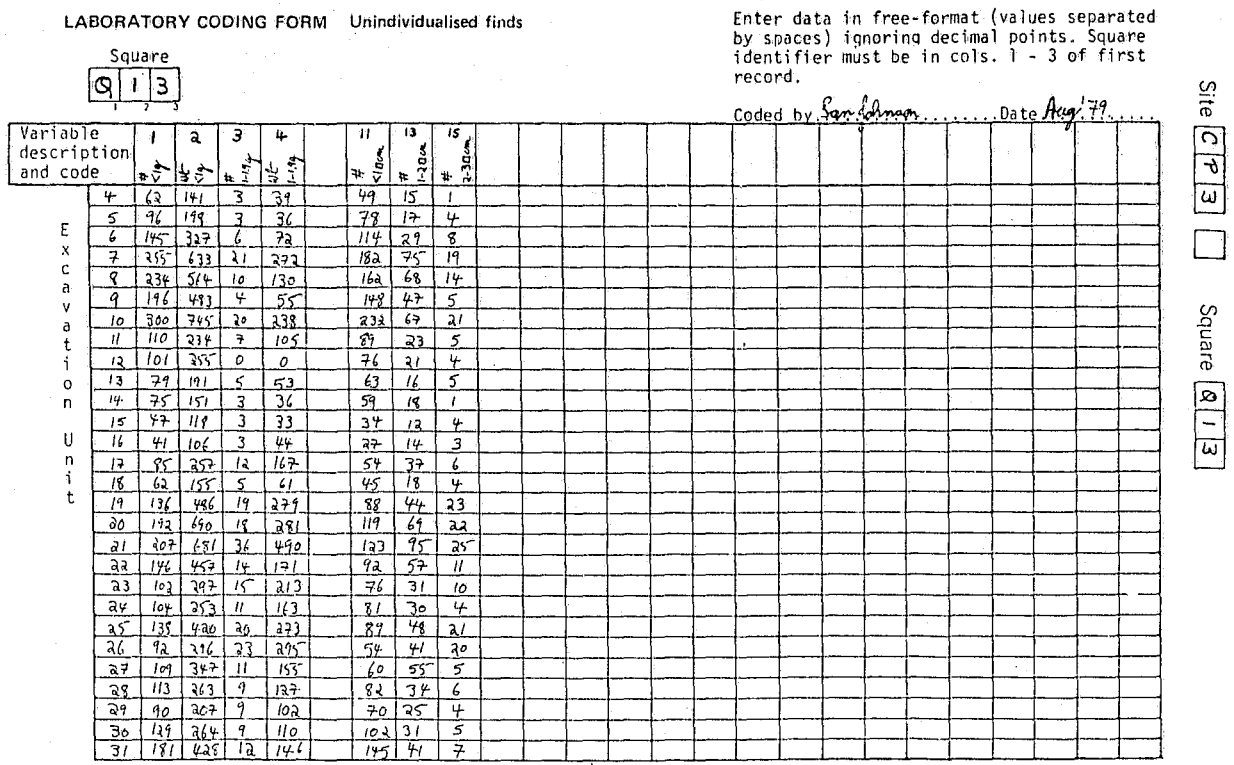

ALL RECORDS CONTAIN EXPECTED NUMBER OF VARIABLES


STOP

END OF EXECUTION
CPU TIME: 1.13  ELAPSED TIME: 40.94
EXIT

.
```

Fig. 65 Two example 'conversations' with CNTVAR



LABORATORY CODING FORM Unindividualised finds

Square: 9 | 1 | 3 (1 2 3)

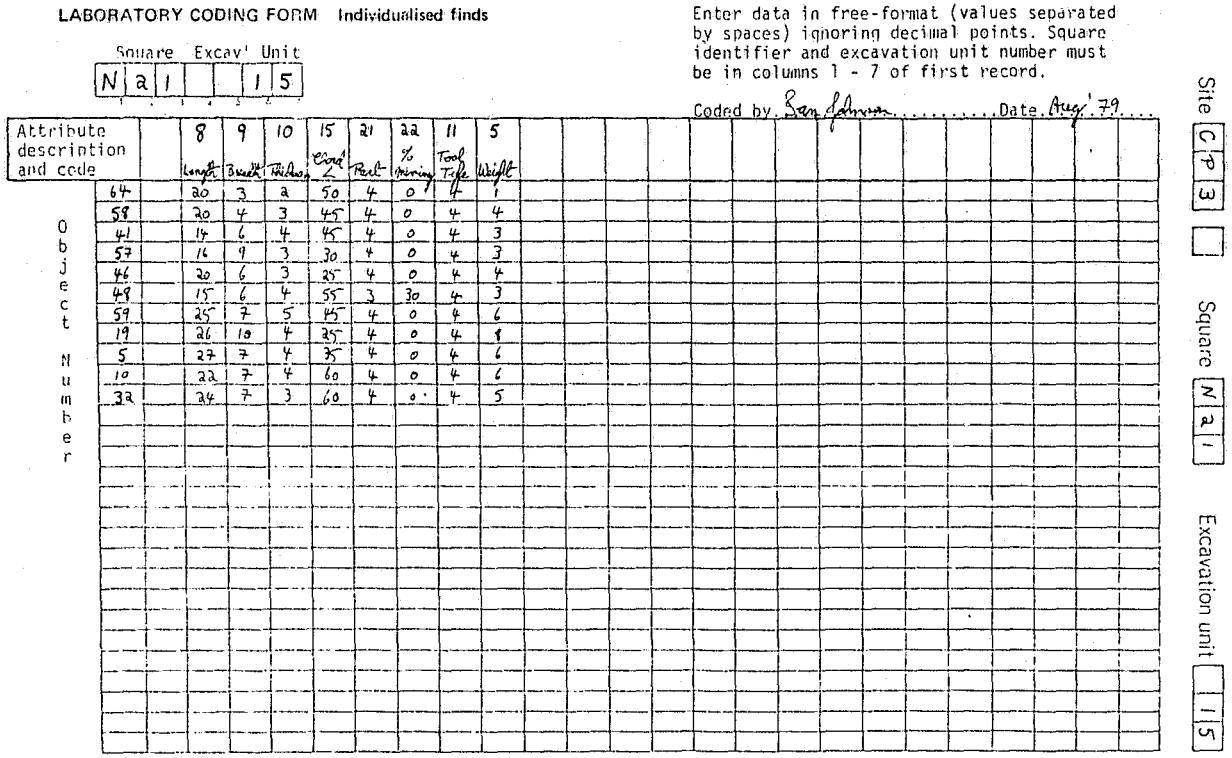
Enter data in free-format (values separated by spaces) ignoring decimal points. Square identifier must be in cols. 1 - 3 of first record.

Coded by Ian Edmon Date Aug '79

Site CP 3 Square 9 1 3

| Excavation Unit | 1 #<1cm | 2 wt <1cm | 3 # 1-2cm | 4 wt 1-2cm | 11 # <10cm | 13 # 1-20cm | 15 # 2-30cm |
|---|---|---|---|---|---|---|---|
| 4 | 62 | 141 | 3 | 39 | 49 | 15 | 1 |
| 5 | 96 | 199 | 3 | 36 | 78 | 17 | 4 |
| 6 | 145 | 327 | 6 | 72 | 114 | 29 | 8 |
| 7 | 355 | 633 | 21 | 272 | 182 | 75 | 19 |
| 8 | 234 | 514 | 10 | 130 | 162 | 68 | 14 |
| 9 | 196 | 483 | 4 | 55 | 148 | 47 | 5 |
| 10 | 300 | 745 | 20 | 238 | 232 | 67 | 21 |
| 11 | 110 | 234 | 7 | 105 | 89 | 23 | 5 |
| 12 | 101 | 355 | 0 | 0 | 76 | 21 | 4 |
| 13 | 79 | 191 | 5 | 53 | 63 | 16 | 5 |
| 14 | 75 | 151 | 3 | 36 | 59 | 18 | 1 |
| 15 | 47 | 119 | 3 | 33 | 34 | 13 | 4 |
| 16 | 41 | 106 | 3 | 44 | 27 | 14 | 3 |
| 17 | 85 | 252 | 12 | 167 | 54 | 37 | 6 |
| 18 | 62 | 155 | 5 | 61 | 45 | 18 | 4 |
| 19 | 136 | 486 | 19 | 279 | 88 | 44 | 23 |
| 20 | 192 | 690 | 18 | 381 | 119 | 69 | 22 |
| 21 | 307 | 681 | 36 | 490 | 123 | 95 | 25 |
| 22 | 146 | 457 | 14 | 171 | 92 | 57 | 11 |
| 23 | 103 | 297 | 15 | 213 | 76 | 31 | 10 |
| 24 | 104 | 353 | 11 | 163 | 81 | 30 | 4 |
| 25 | 135 | 430 | 20 | 273 | 89 | 48 | 21 |
| 26 | 92 | 316 | 23 | 295 | 54 | 41 | 30 |
| 27 | 109 | 347 | 11 | 155 | 60 | 55 | 5 |
| 28 | 113 | 263 | 9 | 127 | 82 | 34 | 6 |
| 29 | 90 | 307 | 9 | 102 | 70 | 25 | 4 |
| 30 | 129 | 364 | 9 | 110 | 102 | 31 | 5 |
| 31 | 181 | 428 | 12 | 146 | 145 | 41 | 7 |

Fig. 66 Example laboratory coding form for unindividualised finds



LABORATORY CODING FORM Individualised finds

Square Excav' Unit: N 2 1 | | | 1 5

Enter data in free-format (values separated by spaces) ignoring decimal points. Square identifier and excavation unit number must be in columns 1 - 7 of first record.

Coded by Ben Johnson ..... Date Aug' 79 ....

Site: C P 3 | | Square: N 2 1 | Excavation unit: 1 5

| Object Number | Attribute description and code | | 8 Length | 9 Breadth | 10 Thickness | 15 Coord' Z | 21 Part | 22 % mining | 11 Tool Type | 5 Weight |
|---|---|---|---|---|---|---|---|---|---|---|
| 64 | | | 20 | 3 | 2 | 50 | 4 | 0 | 4 | 1 |
| 58 | | | 20 | 4 | 3 | 45 | 4 | 0 | 4 | 4 |
| 41 | | | 14 | 6 | 4 | 45 | 4 | 0 | 4 | 3 |
| 57 | | | 16 | 9 | 3 | 30 | 4 | 0 | 4 | 3 |
| 46 | | | 20 | 6 | 3 | 25 | 4 | 0 | 4 | 4 |
| 49 | | | 15 | 6 | 4 | 55 | 3 | 30 | 4 | 3 |
| 59 | | | 25 | 7 | 5 | 45 | 4 | 0 | 4 | 6 |
| 19 | | | 26 | 10 | 4 | 35 | 4 | 0 | 4 | 8 |
| 5 | | | 27 | 7 | 4 | 35 | 4 | 0 | 4 | 6 |
| 10 | | | 22 | 7 | 4 | 60 | 4 | 0 | 4 | 6 |
| 32 | | | 24 | 7 | 3 | 60 | 4 | 0 | 4 | 5 |

Fig. 67 Example laboratory coding form for individualised finds

file, and types a list of any discrepancies (see fig. 65). In figs. 66 and 67 I have illustrated general purpose coding forms for recording data from laboratory analysis. In practice I fill in the headings on these forms before making copies for use in the laboratory, both to save writing the headings repeatedly and to avoid the risk of error through omission or transposition of variables.

All the data addition programs make a number of checks on the format and content of both the excavation data file and the file of new data to be added to the excavation data file. Warning messages are typed on the terminal if any inconsistencies are found and the program is aborted if necessary. The warning messages indicate where the error occurs in the excavation data file or file of data to be added so that the error can be located easily. A selection of typical warning messages are reproduced in fig. 68.

A shortcut for creating the excavation data file

I have provided a basic set of coding forms (fig. 61) which coincide with the format of the excavation data file in the present version. These forms allow one to carry out and record a range of basic analyses of the material before creating the basic excavation data file (see flow diagram in fig. 60). However, most of the information which can be entered on these forms can also be added on using the data addition programs, and this is probably the best way of going about it unless preliminary analysis is carried out in a field laboratory or within weeks of returning from the field. To cater for this strategy I have also designed a 'minimum information' form (fig. 69) which contains sufficient information to create a basic excavation data file. On this form, only the general information relating to each excavation unit (coordinates, sediment and residue weights) need be entered, and this is all information which is automatically obtained in the field. The data file keyed in from these coding forms consists exclusively of the type 1 record for each excavation unit. To generate an excavation data file in the correct format we use the program DUPLIC (see example of its use in fig. 70). Fig. 70 also shows the date file before and after running DUPLIC. DUPLIC generates type 2, 3 and 4 records following each type 1 record so that the data file can now be handled by the data addition programs.

```
**** ERROR **** Raw material classifications have been provided
for excavation units which do not exist on the excavation data file.
Encountered whilst reading raw material classification data for square: Q13 unit:  80
You should check your data - RUN ABORTED


**** ERROR ****
New excavation square (Q33) encountered on excavation data file
at record number: 1723, but column 1 contains a 2 not a 1
RUN ABORTED


**** ERROR ****
More than one set of classification data supplied for
square Q13, unit 22.  Encountered after reading   57 records
from size classification data file
RUN ABORTED


**** ERROR ****   Record number:  1347
A record which is not a type 5 record has been read
from the excavation data file whilst reading type 5 records
for square: Q13 unit:  36    RUN ABORTED


Warning: More than one set of attributes supplied for:
Square Q13, Unit 15, Object #  29
Square Q13, Unit 27, Object #   4
Square Q13, Unit 34, Object #   9
```

Fig. 68 Examples of warning messages from data addition programs

'MINIMAL' FIELD CODING FORM

Coded by: _____ Date: _____

**Record Type 1 : General information**

1 Site C P 3 Square Q 1 4 Excavation unit 4 Feature # Strat. level 2 Subsquare

Sediment wt 3 · 5 kg. Medium sieve residue · 2 7 kg. Fine sieve residue · 1 9 kg

Coarse sieve residue # 1 0 wt. · 0 kg

| | X | Y | Z start | Z end | X | Y | Z start | Z end |
|---|---|---|---|---|---|---|---|---|
| Start and finish coordinates | 2 8 | 5 0 | 1 3 0 | 1 3 4 | 5 0 | 5 0 | 1 3 0 | 1 3 4 |
| | 2 5 | 0 | 1 2 9 | 0 | 5 0 | 5 | 1 2 7 | 1 3 2 |
| | 2 8 | 1 8 | 0 | 1 3 3 | | | | |

Sieve technique ? Wet/~~dry~~

Sieve mesh: Coarse 12 mm Medium 6 mm Fine 3 mm

Site C P 3 Square Q 1 4 Excavation unit 4

The data file keyed in from these forms must be processed by DUPLIC to create an excavation data file in standard format. If these forms are used, they must be used on their own, i.e. no other field coding forms should be filled in. Any further data should be entered on laboratory coding forms and added to the excavation data file using ADDRM, ADDSIZ, ADDAT etc.

Fig. 69 Example of 'minimal' coding form

```
.TYPE PRELIM.CP3

1CP3 Q13  1   10   68   8  46  0   0     25  0 113 117    50 50 117 124    50  0 112 117    37 25 117 119
1CP3 Q13  2   10   87  26  44  0   0     25  0 117 122    50 50 124 124    25 50 120 125    25 25 119 125
1CP3 Q13  3   10   85  48  39  0   0     25  0 122 126    50 50 127 129    50  0 123 127    25 50 125 128
1CP3 Q13  4   20   70   7   0  0   0     25  0 126 131    50 50 129 130    50  0 127 133    20 50 128 128
1CP3 Q13  5   30   90  14   0  2  81     22  0 131 134    50  0 133 136    50 50 136 138    22 50 132 136
1CP3 Q13  6   30   97  90  43  0   0     20  0 134 142    50  0 136 142    24 50 136 141    35 25 136 141
1CP3 Q13  7   30  106  21  31  0   0     21  0 142 147    50 50 142 145    50  0 142 147    35 25 141 147
1CP3 Q13  8   40   60  52  28  2   8     20  0 147 148    50  0 147 148    21 50 147 150    50 50 145 152
1CP3 Q13  9   40   80   0  24  1  12     20  0 148 154    50 50 152 156    50  0 148 151    20 50 150 153

.RUN DUPLIC


EXCAVATION DATA PROCESSING
**************************

Ian Johnson, Prehistory, ANU,  July 1979
Version 28/8/79


**** DUPLIC ****                    1-Oct-79

This program duplicates records type 1 - 4 from a file containing
only type 1 records. This saves having to type in the common fields
of type 2, 3 and 4 records if no data is to be entered on them in the field


Name of data file containing type 1 records only? : PRELIM.CP3

What do you want to call your output file? : UPDAT1.CP3

  660 Records output on file: UPDAT1.CP3

STOP

END OF EXECUTION
CPU TIME:  1.43  ELAPSED TIME: 29.20
EXIT


.TYPE UPDAT1.CP3

1CP3 Q13  1   10   68   8  46  0   0     25  0 113 117    50 50 117 124    50  0 112 117    37 25 117 119
2CP3 Q13  1   10
3CP3 Q13  1   10
4CP3 Q13  1   10
1CP3 Q13  2   10   87  26  44  0   0     25  0 117 122    50 50 124 124    25 50 120 125    25 25 119 125
2CP3 Q13  2   10
3CP3 Q13  2   10
4CP3 Q13  2   10
1CP3 Q13  3   10   85  48  39  0   0     25  0 122 126    50 50 127 129    50  0 123 127    25 50 125 128
2CP3 Q13  3   10
3CP3 Q13  3   10
4CP3 Q13  3   10
1CP3 Q13  4   20   70   7   0  0   0     25  0 126 131    50 50 129 130    50  0 127 133    20 50 128 128
2CP3 Q13  4   20
3CP3 Q13  4   20
4CP3 Q13  4   20
1CP3 Q13  5   30   90  14   0  2  81     22  0 131 134    50  0 133 136    50 50 136 138    22 50 132 136
2CP3 Q13  5   30
3CP3 Q13  5   30
4CP3 Q13  5   30
```

Fig. 70 Example 'conversation' with DUPLIC and sections of the excavation data file before and after processing

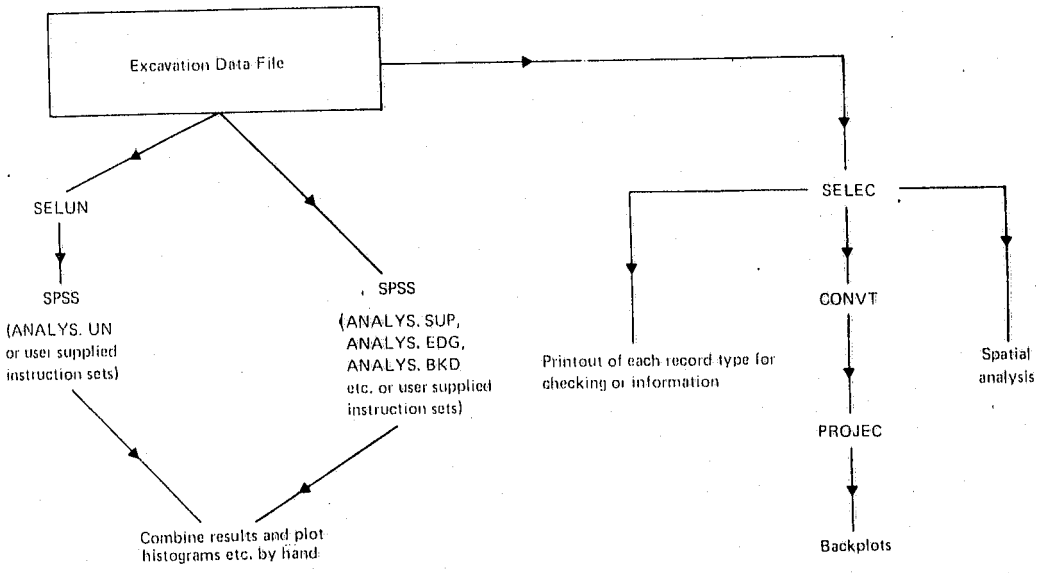
Analysing the excavation data file

Computer analysis of the excavation data file could easily develop into a black-box situation so that the excavator loses touch with the data. Equally a black-box analysis would necessarily be limited in scope and would tend to stultify searching for new ways to combine and present the data. On the other hand, a wide range of analyses are more or less standard fare, such as calculation of stone artefact concentrations, tool:debitage ratios and absolute numbers of lithic artefacts or bone fragments. What we need therefore is a system which will generate basic statistics and to which it is easy to add further more specialised analyses.

I have chosen to make use of SPSS for analysis because it allows a wide range of analyses to be specified with minimal instructions. The thorough documentation available for the package and simple structure of the commands means that even somebody with no computer experience can learn to use it in a very short time. This does away with the need for programming help if one wishes to add new analyses. Most of the analyses I have written to date fall within the scope of the SPSS Primer, a manual designed for the absolute beginner.

SPSS cannot work directly on the excavation data file because its case-by-case philosophy requires a fixed number of records (lines) of data for each case. Our cases are effectively the individual excavation units, which have a variable number of records from (at present) four upwards. SPSS <u>can</u> cope with this situation by aggregating the characteristics of the individualised finds for each excavation unit, but I have found it more convenient to carry out separate analyses of the individualised and unindividualised finds and combine the results by hand. This procedure also keeps one in closer contact with the data whilst not being particularly onerous in terms of manual manipulation.

The procedure for analysis of the excavation data file is illustrated by the flow diagram in fig. 71. For the analysis of the unindividualised finds and general excavation unit information, the data required is extracted from the excavation data file by SELUN (see fig. 72). For the individualised finds SPSS itself can select the record types required (types 5 and/or 6). In appendix V I have listed two sets of SPSS instructions which serve as interfaces. These tell




Upper case names are program names

Bracketed program names following 'SPSS' are names of SPSS instruction sets (see Appendix V11)

Fig. 71 Suggested flow-diagram for analysis of the excavation data file

```
.RUN SELUN


EXCAVATION DATA PROCESSING
**************************


Ian Johnson, Prehistory, ANU      July 1979
Version 3/3/79

**** SELUN ****          17-Aug-79

This program creates a file for input to SPSS
(using instruction set ANALYS.UN)
See top of program listing for documentation


Name of excavation data file? : UPDAT9.CP3


Program Running

File of  660 records output on file SELUN.OUT
ready for input to SPSS (using instruction set ANALYS.UN)
Note: SPSS should read  165 cases as it will read 4 records per case


STOP

END OF EXECUTION
CPU TIME: 8.21   ELAPSED TIME: 31.24
EXIT




.R SPSS

*LPT:=ANALYS.UN

[SP3EOF After reading    165 cases from subfile NONAME  ,
 end-of-file was encountered on INPUT MEDIUM]


*LPT:=ANALYS.SUP



[SP3EOF After reading   3548 cases from subfile NONAME  ,
 end-of-file was encountered on INPUT MEDIUM]

*^C
```

Fig. 72 Example of 'conversation' required to carry out a basic analysis of the excavation data file

SPSS the names of the files containing the data, the names of the variables on the files and in which columns they occur. It is then a simple matter to specify analyses of the data in terms of those variable names using standard SPSS notation which is fully described in the SPSS Primer (Klecka et al. 1975) or SPSS Manual (Nie et al. 1975). The first of the interfaces applies to unindividualised finds and general excavation unit information and the second to the individualised finds. Some modifications may be required to adapt these interfaces to particular attribute systems, particularly as far as the names of the different stone types are concerned, but these modifications are entirely straightforward.

I have listed three sets of analysis instructions in appendix V by way of illustration of the sorts of analysis which can be added onto the interface instruction sets. In writing these analysis instructions I have attempted to cover a range of basic statistics such as numbers of finds, sediment and residue weights, size classification and distribution of typological categories, so that these three sets of instructions will serve as a useful starting point for analysis. I have put a great deal of thought into coping with variables which have not been recorded so that one can run these analyses on a basic excavation data file before all the data has been added to it. This means that preliminary results can be generated before the material has been completely analysed. I have illustrated the sort of table generated by SPSS in chapter 5 (tables 16 and 17). The analysis instruction sets I have written have been documented in such a way that the output should be self-explanatory.

Backplots

Backplots are generated directly from the files of individualised finds output by SELEC, using the programs CONVT and PROJEC. CONVT converts the within-square coordinates of the finds to a true cartesian system, with the origin of the system located at the origin of any chosen square in the site. It creates a file for input to PROJEC, which prints backplots on a hardcopy terminal or line printer. The square at the origin of the coordinate system is transferred between the two programs so that one can specify the 'slice' of the site to be backplotted in terms of the original square letters and numbers system rather than the cartesian system generated by CONVT.

Backplots can be generated by horizontal projection, or by projection at a specified angle to the horizontal for better distinction of concentrations where the stratigraphy is sloping. Objects are plotted using the last digit of the excavation unit number so that one can see the relationship between the concentrations observed on the backplot and the excavation units used. I have not illustrated the use of these programs because improvements are still being made to them, although they are operative and will be archived with the other programs described.

## Horizontal Distribution Analysis

Horizontal distribution analysis or intra-site spatial analysis and generation of site-plans are best dealt with by using SELEC and/or SPSS to create a file in the correct format for the particular analysis and mapping programs available. I do not propose to go into the details of this sort of analysis, which are far beyond the scope of the present topic and which I have dealt with in considerable detail elsewhere (Johnson 1976, 1977a, in press). The coding forms I have designed allow the use of a cell-frequency approach (Johnson in press) as well as a coordinate approach to spatial analysis. The development of a full range of interface programs is one of my projects for the near future.

## Conclusion

In this chapter I have stressed the importance of flexibility, both to add new data to the excavation data file and to specify new analyses. On the other hand I recognise the utility of having self-explanatory fixed-format coding forms, particularly in a field-laboratory situation. I have therefore presented a system which starts from this sort of coding form but which allows the addition of new data to the excavation data file as processing proceeds. The programs I have written for these data additions incorporate a wide range of error traps and are designed as convenient interactive programs (i.e. question-and-answer programs run directly from a terminal).

I have not attempted to produce the last word in analysis programs because I do not believe in black-box analyses. Instead I have attempted to provide a framework onto which anyone with a

beginner's knowledge of SPSS (SPSS Primer level) can add new analyses. The final stage of analysis, combination and presentation of results, is carried out by hand and I personally have found this stage useful in forming conclusions about the results. In my analysis of Capertee 3 (chapter 5) I have demonstrated the range of information which can be generated using the general purpose analysis instruction sets listed in appendix V.

# CHAPTER 9

## Conclusion

## Future directions in the organisation of excavation data recording

Archaeologists the world over are faced with a common problem every time they put trowel to site. The problem is one of imbalance between excavation potential and analysis potential, described succinctly at a recent conference as the 'inch for a yard syndrome' (Rhys Jones, Australian Archaeological Association Conference, November 1979). This imbalance arises because it is easy to raise a team of field-helpers, either students or other interested people, who enjoy an interesting and economical holiday in the bush, but altogether more difficult to get people interested in the long grind of laboratory processing of the material. Some workers have been able to resolve the problem by some form of teamwork, either through incorporating laboratory work as part of course requirements or by hiving off parts of the project as thesis topics or to specialist colleagues. Neither of these solutions is widely applicable to Australia as we are still in a situation where there are too many masters and not enough slaves, i.e. new projects are being initiated from the B.A. Honours level upwards so that there is no pool of labour on which to draw for the completion of projects already undertaken. This is doubtless a situation which will gradually correct itself as the discipline develops, but the price we are paying is the existence of many uncompleted projects. The problem is also aggravated by the pace of Australian prehistory which rules out the sorts of large long-term projects on which teamwork can evolve.

Another solution which may be rather more applicable to the Australian situation is the shifting of as much as possible of the analysis of excavated materials into the field. In this way the onus of analysis rests less heavily on one or two people cloistered in a city laboratory The solution not only allows one to take advantage of the availability of relatively cheap and willing labour, but may also serve to introduce field-helpers to the idea that digging the stuff out is the easiest part of the process. This is an aspect of excavation which many quite experienced excavation helpers fail to encounter until the day that they are faced with the products of their own excavations, by which time it is generally too late.

If analysis in a field situation is to prove effective one requires a well structured recording system thought out right through to analysis and eventual storage of the material <u>before</u> fieldwork commences. Excavation and the recording of data from excavations are

technical operations requiring explicit formulation of methods based on wide-ranging experience. The design of an excavation recording system is not something to be put together in the last few days before fieldwork, or worse still once in the field. Many systems at present in use suffer from the fact that the designer has no special interest in excavation or data recording methods, nor any scientific training, and fails to formulate the system explicitly or take the planning as far as the analysis and storage stages. In addition, the duplication of effort arising from each excavator designing their own individualistic recording system involves the needless repetition of mistakes and slow spread of new ideas.

Two suggestions follow from the preceding discussion. First it is my contention that the design of excavation recording systems should be the realm of the specialist rather than the generalist, and it is in the former role that I have cast myself in the latter part of this thesis. Secondly, I believe there is far too little formal exchange of information on excavation and recording methods. The key to rapid progress and uniform standards is the explicit formulation and publication of a carefully designed system onto which other workers can build, and this is what I have attempted in in chapters 7 and 8. I would not pretend that this system is the last word in recording systems and I can already see a number of improvements which could be made within the general framework. However I hope that the system described is sufficiently flexible to provide a suitable starting point for future developments so that future work can build onto a common base rather than involving duplication of effort. By orienting my discussion towards a 'cookbook' approach, whilst maintaining flexibility so that individuals can add new data or new analyses, I hope that the system will appeal to those with little or no knowledge of computing who simply require a system that works. The 'cookbook' approach may also help to overcome the 'inch for a yard' syndrome by reducing the burden of analysis.

Given a well organised structure for data recording I believe that most of the routine, low level sorting and analysis of the excavated material can be carried out in the field, leaving the excavator of a site only the more interesting and higher level work such as faunal identification, classification of artefacts, study of use wear or detailed attribute analysis. Provided somebody reasonably

competent can supervise the field laboratory one should be able to carry out all the washing and labelling, basic artefact counts, raw material and size classifications and the recording of simple attributes such as weight, length or breadth. In some cases it may be possible to employ people who can carry out the identification of faunal material and classification of artefacts and this may be a much better strategy than attempting to get them interested in the project in a city laboratory situation. I cannot however overemphasise the importance of a well structured and highly organised recording system if field processing with semi-skilled or unskilled helpers is not to degenerate into chaos.

Already some of the larger excavation projects, notably in America, have adapted the on-site use of computers. I do not envisage the provision of major on-site computing potential as being important within the next few years of Australian prehistory because we are simply not dealing with large enough projects. On the other hand, there are considerable advantages in returning from the field with the bulk of one's data already recorded on a reaccessible medium (tape, disc or cards) and the advent of cheap microcomputers now makes this ar easily obtainable goal. I envisage the use of such computers, now available for under a thousand dollars, simply as data entry and storage devices with the potential to check data for inconsistencies as it is entered. With the provision of suitable programs no special knowledge would be required to operate them, so that any member of the excavation team would be able to enter new data. It would also be possible to generate a certain amount of feedback to aid in planning the excavation, although the present generation of microcomputers would not be capable of carrying out major analysis. This I see as no disadvantage since I believe that final analysis rightfully belongs outside the field situation. The use of microcomputers in the field on quite small projects such as those typical of Australia, implies the provision of self explanatory question and answer programs. The development of such programs is one of the major steps in the field of data recording which I believe should be tackled in the next few years.

There are over 200 excavated sites in Australia which have received some mention in the literature. Less than a dozen of these have received a full publication, by which I mean thorough analysis of

the artefacts collected together with geomorphological and other specialist studies. As a result we have a poor data base available for synthesis of the prehistory of the continent. This problem is aggravated by the fact that there is no established mechanism for the exchange of raw data and little consensus on the overall structure or detail of data recording, e.g. standardisation of numbering systems, attribute systems, typologies or the medium and format for data storage. This lack of structure in the whole process of data recording and exchange has its roots, I believe, in the individualistic approach to excavation and in some degree in the failure of many excavators to look beyond the limits of their own research project to the time when the materials they have excavated will have become store room fodder.

I believe that there is an urgent need for a systematic rethink of our attitude to the collection, recording and exchange of data from excavations. We are now in a situation of rapid expansion, not only in numbers of archaeologists but in the quantity of data being generated by individual excavations. Where thirty or forty years ago an average excavation yielded little more than a description and count of tool types and flakes for the removal of several tens of cubic metres of deposits, a couple of cubic metres may now generate information to fill a major report. Furthermore the large amount of data with individually low information content which is collected by modern excavations precludes its inclusion in published reports.

Unless the raw data is made available to other workers much of the potential of the site is wasted, reducing inter-site comparison to broad generalities. To take an example, Lorblanchet and Jones' interesting article on trends in artefact size through time (in press) was only possible because they had access to raw data for a number of sites. Had they had access to the raw data from <u>all</u> the sites excavated over the same period they might have been able to make a much firmer statement controlling for regional variation or variability in stone supply.

We are in a unique situation in Australia in that archaeology is still a young and expanding subject and it is still possible to have at least occasional personal contact with the whole of the archaeological community. So far people have relied on publications and personal contacts for the exchange of data, but this is rapidly becoming an inadequate means. As the archaeological community expands

and the inevitable backlog of unpublished and uncatalogued material grows inexorably, it becomes more and more difficult to get hold of the data relating to a particular topic. My experience in trying to look at the nature of the Small Tool Tradition is probably typical of the sort of problems that will be encountered by anyone wishing to look beyond either a restricted area or the very broad generalisations which can be made from published information. Fortunately it is not too late to move towards new dispositions for the exchange of data, a move which is facilitated by the level of availability of computing facilities in Australia and the relatively small and vigorous archaeological community. I feel that new methods of data exchange probably have more chance of gaining acceptance in Australia than in most other countries.

I see three steps as essential to the progress of data exchange in Australia. First, the establishment of a list of excavated sites and controlled surface collections giving some basic information on the collection and data relating to it, e.g. publications and unpublished reports, location of collection, field notes and data from the analysis and some information on the method and degree of detail in which the data has been recorded. Ideally this list would be maintained by some central body such as the Australian Institute of Aboriginal Studies and updated at regular intervals. One way of keeping this list up-to-date would be the system of regional research reports which has proved so valuable in promoting information flow in French prehistory. These reports are published at regular intervals in Gallia Prehistoire and are compiled by regional correspondants. A certain number of reports of this nature have appeared in Australian Archaeology, but I believe that the system should be formalised so that these reports appear regularly. My suggestion would be that the Australian Archaeological Association co-opt regional correspondants to prepare such reports on an annual or biennial basis.

The second step essential to more active exchange of data is the establishment of a central repository for raw data with the facilities to copy and distribute this data to workers who might wish to use it. Again this is a role that could be fulfilled by the Institute of Aboriginal Studies who are already involved in the use of computers for maintaining a national register of Aboriginal sites.

A third step implied by the second is that some form of standardisation of recording methods and recording medium should be carried out. At the present time magnetic tape is the obvious medium as it is economical, easy to transport and facilities for reading or writing it are widely available. Standardisation of recording methods is a more difficult problem and one towards which this thesis is in part oriented. However, although my discussion serves to establish a format for excavation data recording, it does not make more than tentative steps towards the classification of excavated material or the provision of a widely applicable attribute system for lithic or other sorts of artefact. Definition of general purpose attribute and classificatory systems is an urgent requirement for Australian prehistory if we are to progress towards comparability between data collected by different workers. Some people may argue that this will stultify the questing nature of archaeological research. I would argue that the provision of common units of measurement, i.e. attribute and classificatory systems, is the road along which archaeology can progress beyond the present stage of isolated regional prehistories linked by rather gross and often uninformative generalities. The rapid growth of the subject means that the development of common systems of measurement is a pressing matter. If the necessary steps are taken now we can look towards a considerable gain in information potential of the material collected over the next few years or decades.

# GLOSSARY

# GLOSSARY

ARTEFACT

I use this term in its very broadest sense to mean any object which has been modified by human agency. This may include faunal material or other organic remains such as charcoal or bedding material. In this thesis I use the term to refer to 'discrete' artefacts (Johnson 1976), meaning individual tangible objects, rather than to artefacts such as spatial distributions. Lithic artefact refers to any modified lithic object, irrespective of whether it is considered to have served as a tool or to be simply a waste product.

BACKPLOT

The projection of artefacts recorded with 3D coordinates onto a vertical plane, generally a drawn stratigraphic section of the site. For examples see White 1972, Flood 1973.

BLADE

A flake which is more than twice as long as it is wide. Length and width are defined in appendix II.

CONJOIN

A notional link between two parts of an object broken in antiquity. Typical examples are the linking of flakes with the core from which they were removed, burin spalls with the parent burin or the two halves of a broken tool. Refered to as artefact joins by White (1972).

DEC-10

One of the world's most expensive typewriters.

ELOUERA

This term is defined in a rather self-contradictory fashion by McCarthy, Brammell and Noone (1946:28) as '...a segment, triangular in transverse section, which bears scraper trimming on one or both edges of the thick margin, and either scraper trimming or evidence of cutting use on the thin margin... The latter edge is untrimmed and shows no signs of use on many specimens'. In my discussion of the Blue Mountains assemblages I have simply employed McCarthy's and

Stockton's own identifications. In my discussion of the Capertee 3 site I have used the term as defined above - the question of chord use did not arise since all my elouera had heavy chord use.

ENDSTRUCK FLAKE

A flake which is longer along the axis of the blow which detached it than along the axis at right angles to the blow.

EXCAVATION DATA FILE

A computer file containing data collected in the course of excavation or derived from analysis of the material collected. In the discussion of chaper 8 I am referring specifically to a file structured according to the discussion laid out in that chapter.

FABRICATOR

A bipolar scaled piece, i.e. any specimen which has been formed by bipolar working. White (1968) proposes the term scalar cores on the basis of ethnographic observation of their genesis in New Guinea, but I would prefer the more open term scaled piece. I have used the term fabricator in the present thesis as this is the term under which these specimens have been classified by both McCarthy and Stockton.

(COMPUTER) FILE

See heading to fig. 62 for explanation.

FORME

This term is used in the same sense as the French piece support, in other words the artefact blank after modification.

FREE-FORMAT DATA

Data which is entered as values separated by spaces rather than as values in specified columns of each record. The latter is known as fixed-format data.

Kyr

Kiloyear or thousand years, as in cm/Kyr meaning centimetres per thousand years.

NIBBLE OR NIBBLED RETOUCH

Fine regular edge modification extending no more than 1-2 mm from the margin.

SIDESTRUCK FLAKE

A flake which is shorter along the axis of the blow which detached it than along the axis at right-angles to the blow.

RECORD (in reference to computer files)

Each line of data in a file stored on a computer medium such as disk, magnetic tape or cards, is referred to as a record.

TEXT-EDITOR

A computer program which allows changes to be made to a computer file, generally from a remote terminal (a typewriter like device linked to the computer by a cable rather than being a part of the computer).

TOOL

I have restricted this term to lithic artefacts which are considered to have been manufactured for use for some specific purpose or which have served some specific purpose. By-products such as cores or flakes on which one cannot detect traces of use subsequent to manufacture are excluded from this class.

# APPENDIX I

## Published articles and unpublished reports

Reprinted from Breckwoldt, R. The Wolgan Valley : A study of land-use and conflicts with proposals for future management. The National Trust of Australia (N.S.W), 1977.

## 3.1 ABORIGINAL PREHISTORY

Mr. Ian Johnson, School of Pacific Studies, Australian National University, kindly prepared the following notes on Aboriginal prehistory.

*According to ethnographic records, the Wolgan Valley lay close to the boundary of the Wiradjuri tribe to the west and the Daruk tribe to the east. In view of its topographic situation, with access over fairly easy country to the west but restricted access to the east via the narrow gorges of the Colo River, it is probable that its ties are with the west rather than the east. Both in this respect, and in terms of the environment, relief, range of rockshelters and stone for tool-making, the Wolgan Valley is closely comparable with the neighbouring Capertee Valley. Aboriginal occupation of both valleys is attested by chipped stone flakes and tools found on the surface in almost all rockshelters of any size, particularly those near intermittent watercourses, swamps or the main river.*

*To date no excavations have taken place in the Wolgan Valley, and my own fieldwork is limited to a few days archaeological site survey. However, the Capertee Valley was the scene of an important series of excavations in 1958-61, and, in view of the similarity between the two valleys, a general statement may be made on the potential of the Wolgan, based on my limited observations coupled with the results of the Capertee excavations.*

*The sites in the Capertee Valley are among the oldest and richest sites excavated in South East Australia, dating back to 11,000 years or more ago. Unfortunately these sites were excavated with very limited means and using methods which became outdated soon afterwards, and as a result the collections made are less useful than those excavated more recently. In particular, they cannot answer certain questions that have come to the fore in recent years.*

*A large proportion of each major site was excavated, so there is little possibility of satisfactory re-excavation. These sites remain of considerable importance, however, both for their early dates and richness and because it was on the basis of these that F.D. McCarthy proposed two phases of Aboriginal prehistory in South East Australia (F.D. McCarthy, 1964 The Archaeology of the Capertee Valley, New South Wales. Rec. Aust. Museum. V26; 197-246). His division, though at present under review, seems to be the expression of an Australia-wide change in stone tools at about 6000 years ago, marked by the appearance of a number of smaller and more finely worked implement types.*

*The importance of the Wolgan Valley may take one of two forms. We observe that in the recent past, the Wolgan and Capertee Valleys seem to have witnessed similar levels of Aboriginal occupation under similar environmental and topographic conditions.*

1. *If this similarity stretches back into the past, the Wolgan offers the potential of locating sites of similar richness and antiquity to those of the Capertee, documenting the appearance of the more refined stone tools of the past 6000 years. Equally, the apparently undisturbed nature of the sites I have seen, holds out hope that a detailed study of the adaptation of the Aboriginal people to the resources*

provided by the valley, might eventually be possible if those sites are not disturbed.

2. On the other hand, it may be that in the past, the lesser accessibility of the Wolgan Valley resulted in more spasmodic occupation. If this were the case, a comparison of the two valleys could help document the process of expansion of the Aboriginal population into more remote areas as a result of population pressures, increasing mobility or increasing efficiency of the Aboriginal tool kit. A particular case of this might be the pressure caused by white settlement of adjoining areas.

Site recording

Preliminary archaeological reconnaissance has been carried out in the following areas:

1. The western side of the valley from just south of the Wolgan River/Rocky Creek junction (GR 510230), northwest for approximately 2½ kms.

2. The western side of the valley from Newnes south to the road junction at GR 398198.

(Grid references on Ben Bullen or Mount Morgan 1:25,000 topographic maps.)

The reconnaissance was restricted primarily to a search for rock-shelters, owing to their visibility and my aim to locate sites with some depth of archaeological deposits (Rockshelters act as a concentrating influence). As in the Capertee Valley, the sites are mostly overhangs formed by large boulders resting on the talus slope which forms the sides of the valley. They are most often located on flats or terraces. The cliffs in the area do not seem to form extensive rockshelters at their bases, though these may form from time to time to be later buried by the accumulating talus. There is, however, such a rockshelter approximately 1 km south of the Wolgan Gap, and this site has Aboriginal hand-stencils on the walls and some depth of archaeological deposits. It is probable that there are similar sites on the plateau region and around the base of the cliffs surrounding the Wolgan Valley, and others have been reported from neighbouring areas.

In all, 12 sites with chipped stone remains on the surface were located, together with a similar number of promising rockshelters (i.e. ones which appear to have some depth of deposits but where no Aboriginal relics were found on the surface).

In view of the small area examined and the number of sites found, the Wolgan Valley clearly has considerable archaeological potential. The preceding discussion will have made it clear that this potential is primarily a scientific one, extrapolated from results in the neighbouring Capertee Valley. Though no rock art has so far been found within the Wolgan itself, there are a number of art sites, on the surrounding plateau regions including the one at Wolgan Gap, and the excavated sites in the Capertee Valley also contain paintings. Equally, though I did not find any rockshelter sites as large as those excavated in the Capertee Valley, the potential for such sites exists. Positive protection of such sites is difficult - the best protection is generally remoteness. If any such sites with any depth of deposits, should be located, it will be clear from the preceding discussion that they are likely to be of considerable

*archaeological importance, and every effort should be made to preserve them from the depredations of specimen collectors or excessive use by campers, animals etc. It has been suggested that informative educational notices in archaeological sites help to protect them, but the best protection is probably the negative one of not making them visible, common knowledge or easily accessible.*

*The majority of the shelter sites I have found are at little risk from collectors, campers or other causes, owing to their small size. All that is needed for their conservation is an awareness that any protected area exceeding a couple of square metres and having a more or less level earthen or sandy floor, is a potential archaeological site, particularly if it is located near a source of water. It is the corpus of such sites rather than the individual sites themselves which is of archaeological importance.*

*A third type of site which is very vulnerable to changing land use, are sites in the open. It is known that the Aborigines lived primarily in the open, construcing shelters from bark etc. Though many of these sites will have been washed away and/or buried by soil movements on the steep slopes of the area, some are still visible on the surface or exposed in eroded areas. Location of such sites, however, requires an intensive ground survey, and their conservation would require consideration of the effect of changing land use on erosion and soil movement. Every effort should be made not to site paths or vehicle tracks on or near them, not only to avoid direct physical damage but also to avoid depredation by stone tool collectors. At the present time we do not have the ability to extract much information from these sites, but rapid advances are taking place elsewhere and these sites will probably become increasingly important in the future. If in situ conservation is not practicable, many of these sites can be effectively safeguarded for future study by a controlled total collection made by a competent archaeologist.*

*In conclusion, the Wolgan Valley appears to present a considerable scientific archaeological potential. Any changes in land-use should be accompanied by an archaeological reconnaissance of the area involved with a view to locating archaeological sites, determining the effect of such changes and suggesting effective conservation measures.*

# ABERCROMBIE ARCH SHELTER

## AN EXCAVATION NEAR BATHURST, NSW

Ian Johnson

Department of Prehistory
Research School of Pacific Studies
The Australian National University

Preliminary Faunal Report
by Ken Aplin

Reprinted from *Australian Archaeology* No. 6, 1977

# ABERCROMBIE ARCH SHELTER: AN EXCAVATION NEAR BATHURST, N.S.W.

Abercrombie Arch Shelter is situated 58 km south-south-west of Bathurst on the Abercrombie Caves Tourist Reserve (Bathurst 1/250,000 GR234809). It is at an altitude of 600 m in the foothills 40 km west of the main ridge of the Great Dividing Range.

## Environment

The site faces approximately 20° and thus provides shade from the afternoon sun. Mean annual temperature is ∿13.5°C with a seasonal range of ∿14.5°C.[1]

The ground slopes down from the shelter to a sink-hole about 35 m away and an erosion gully in front of the site drains into this. The sink-hole is generally blocked and contains water, clearing only under the increased pressure of water during prolonged heavy rains. Grove Creek (perennial) is a couple of minutes walk from the site in either direction (upstream or downstream) involving a descent of approximately 30 m. A semi-perennial tributary runs in a gully about 100 m away and 10 m below the level of the site. Thus the site is always within reasonably easy access of water. Mean annual rainfall is ∿700 mm with a slight winter maximum, potential evaporation being probably about twice precipitation.[1]

As a result of the differing exposure of adjacent hill slopes due to the high local relief (predominantly straight or convex hill slopes up to 50°)[1] coupled with the range of rock types in the area the vegetation is extremely varied.[2] Whereas the site itself is immediately surrounded by open woodland with grass understorey, nearby slopes range from open to closed woodland with a wide range of shrub species in the understorey. The vegetation is denser in well watered gullies and alongside Grove Creek where alluvial flats support dense grass, bushes and sedges where wetter. The present vegetation is, however, unlikely to be a direct descendant of pre-contact vegetation, as the area was densely populated by gold-miners during the 19th century. Scattered through the region in damper places are dense masses of bramble and stinging nettle.

## Description of Site

When the site was located in July 1976 a 2 m x 2 m hole had been dug at the back of the shelter (Figs. 1 and 2). This hole appeared to be fairly recent. A rescue excavation was therefore undertaken in August, and more prolonged work in November, a total of approximately 400 person-days.

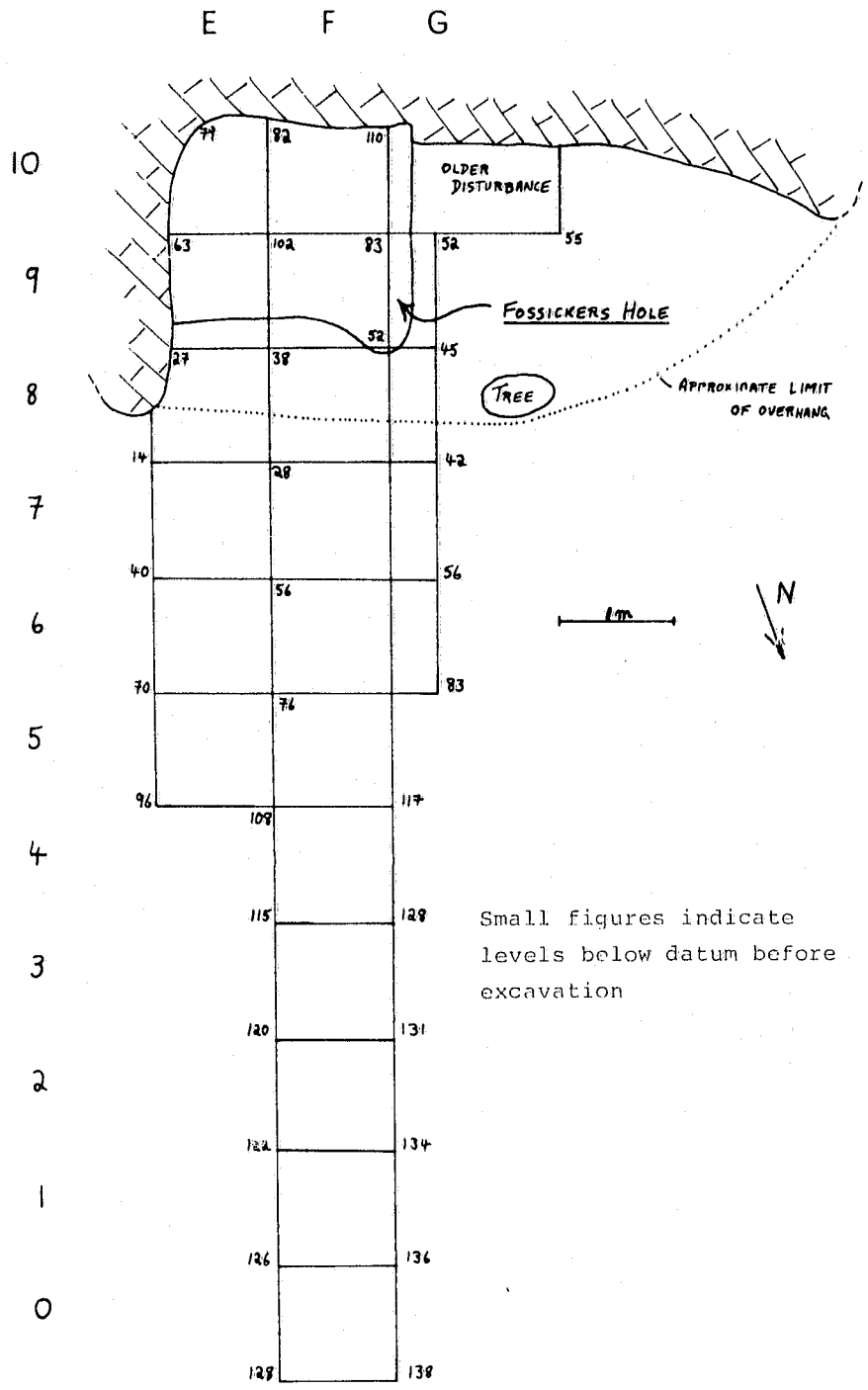
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1 Data from Frank (1972)

2 The dominant soil groups are red earths and red podzolics (Frank 1972 after Northcote 1966)

# ABERCROMBIE ARCH SHELTER

FIG 1




Small figures indicate levels below datum before excavation

The site is a small rockshelter at the base of a large outcrop of altered limestone, the 'Abercrombie Caves Marble'. It is situated in a saddle on top of the 'Grand Arch', a natural tunnel through which passes Grove Creek. The hillside slopes back from the top of the overhang to the main body of the outcrop, and the talus slope at the base of this is strewn with boulders. In the two months between our field seasons a number of new blocks had appeared on this slope. The limestone has been analysed as containing up to 10.5% angular to subround quartz, the remainder being 98% calcium carbonate (Carne and Jones 1912, *fide* Frank 1972). The shelter appears to have been formed by the action of Grove Creek when it ran as a surface stream prior to its passing through the Grand Arch from about 15,000 years ago onwards (Frank 1972). Since then it would appear to have developed by frost-weathering of the shelter walls, giving rise to rubbly sediments under the overhang. The roof of the overhang slopes sharply downwards towards the rear, where it joins the rear wall at about the level of the present surface of the sediments (see Fig. 2). The total overhang is approximately 2 m, but rain runs down the sloping roof and drips off ribbed concretions at various points within the shelter, resulting in areas of partly concreted sediments. The eastern end of the shelter is defined by a projection composed of limestone covered with stalagmitic flow. Towards the western end the shelter becomes lower and narrower, petering out after about 4 5 m.

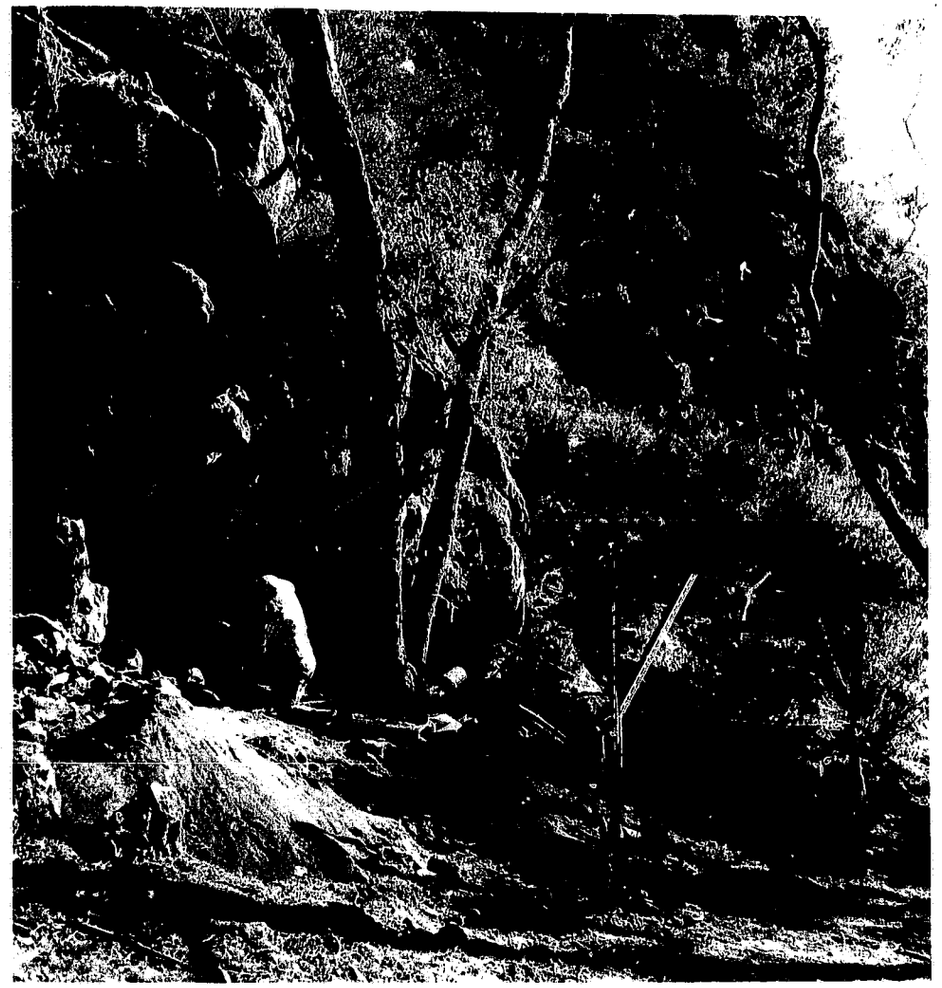
The deposits form a ridge approximately following the limit of the overhang, and slope down towards the rear of the shelter. In front of the shelter the deposits are contiguous with the talus slope to either side of the shelter, and slope down towards an erosion gully about 20 m away. Head room at the time of earliest occupation (level VI", see later) would have been considerable, giving standing room over the whole width of the overhang. On the other hand shelter from rain from the eastern, western or northern quarters would be reduced. This might have something to do with the lack of occupation below this level. It should be stressed however that bedrock had not been reached at over 2.5 metres below the surface in square E9. The ridge of deposits following the edge of the overhang would appear to represent sedimentation by material falling over the overhang, and this is confirmed by the nature of the deposits (angular limestone blocks similar to those on the talus slope and on the slope above the shelter).

## Stone Sources

Raw material for stone working is abundant in the area, the hillside to the east of the site being scattered with vein quartz of reasonable quality. Many of the hills in the region are capped with tertiary gravels containing quartz cobbles, and Grove Creek contains cobbles similar to those used as grinding and hammer stones and for pebble tools. It is probable that cherts are to be found somewhere in the complex sequence of sedimentary and metamorphosed rocks in the area, though no outcrop has been found in the immediate vicinity of the site. Silcrete occurs within

Plate I Abercrombie Arch Shelter : general view at start of excavation

Note the rocky talus deposits beyond the site, the mounding of deposits along the dripline and the framework, parallel wires and plumbobs used to materialise the horizontal grid system



a radius of about 30 km. Very poor quality quartz can also be found in the slope deposits above the shelter, apparently weathering from veins intrusive into the metamorphosed limestone, and this quartz finds its way into the deposits together with the flaked quartz which comprises the bulk of the lithic industry.

A small test-hole was excavated in the talus slope to the east of the shelter (located in A10 approx.) and revealed the same sort of sediments as in the ridge of deposits and talus slope of the site, including the poor quartz observed on the slope above the shelter.

## Co-ordinate System

The co-ordinate system used is a conventional three dimensional one with the axes divided up into sectors of one metre, each identified by a letter on the X axis and a number on the Y axis (see Fig. 1). The origin is located outside the shelter as shown. x and y co-ordinates are measured along the X and Y axes respectively within a given metre square, starting from the origin of that square. The Z axis is directed downwards, i.e. z co-ordinates are recorded as DEPTHS below datum. Sections are described by the terms "Frontal" (parallel to the shelter wall) and "Saggital" (at right-angles to this wall), and located by giving the sector number or letter through which they run, together with the y or x co-ordinate within that sector. (Diagonal sections can also be identified without reference to a section-line on a plan.)

## Excavation Method

The excavation of this site posed enormous problems. Over most of the site the deposits were composed almost entirely of limestone fragments, some of which were over a metre in diameter. The situation was further complicated by concretion which shrouded the archaeological material even after wet sieving, and which gradually increased to form an entirely concreted layer at the base of the excavation from sectors 8 to 4. As a result of the rockfall, particularly the largest fragments, it proved impossible to produce sections where they were required, and the stratigraphic connections between the different sedimentation zones described in the next section are therefore only tentative. The enormous variations in thickness of layers and the pronounced and variable slope of the layers which can be seen from Fig. 2 rendered the use of any sort of spits near impossible. The following technique was therefore adopted, designed to yield information suitable for the tracing of archaeological horizons based on an increased density of finds where geological layers may not be distinguishable. It is based on a technique widely used in Europe.

A notebook was used for every metre square, and all notes about the excavation were made in these rather than in a site notebook. A further notebook gives details of auger holes and test pits (in F0 and A10). The grid system is indicated by a

series of plumb-bobs hanging at the corners of each metre square. During the course of excavation all objects over approximately 2 cms (excepting limestone fragments and unknapped inferior quality quartz likely to have come from the slope above the shelter) were numbered and their co-ordinates recorded in the corresponding notebook. Each bucketful excavated was weighed and dry sieved on a 2 mm mesh. Limestone fragments between 5 and 10 cm were weighed separately and rejected, and fragments over 10 cms were rejected unweighed. The larger of these were mapped and contoured. The sieve residue was wet-sieved in Grove Creek on the same mesh and table-sorted; all imported stone, bone and shell was saved and bagged with the specimens whose 3D co-ordinates were recorded. Thus a reasonable measure of horizontal and vertical control is possible even for those items found in the sieves (one bucketful is approximately a 3 cm spit on a 50 x 50 cm square). The 3D co-ordinates recorded for the larger objects are used to relocate each bucketful in space, and also for constructing projection diagrams for the verification of the stratigraphy and possible subdivision of geological layers on archaeological criteria (the projection diagrams are produced by a computer program and can take the form of horizontal or sloping projections depending on the inclination of the ground surface and/or geological layers observed). Work on the projection diagrams has not been completed.

## Stratigraphy

The site can be divided up into three stratigraphic areas: (see Fig. 2).

A *The talus slope in sectors 7 to 4 (approximately)*

Here there are clearly marked layers :-

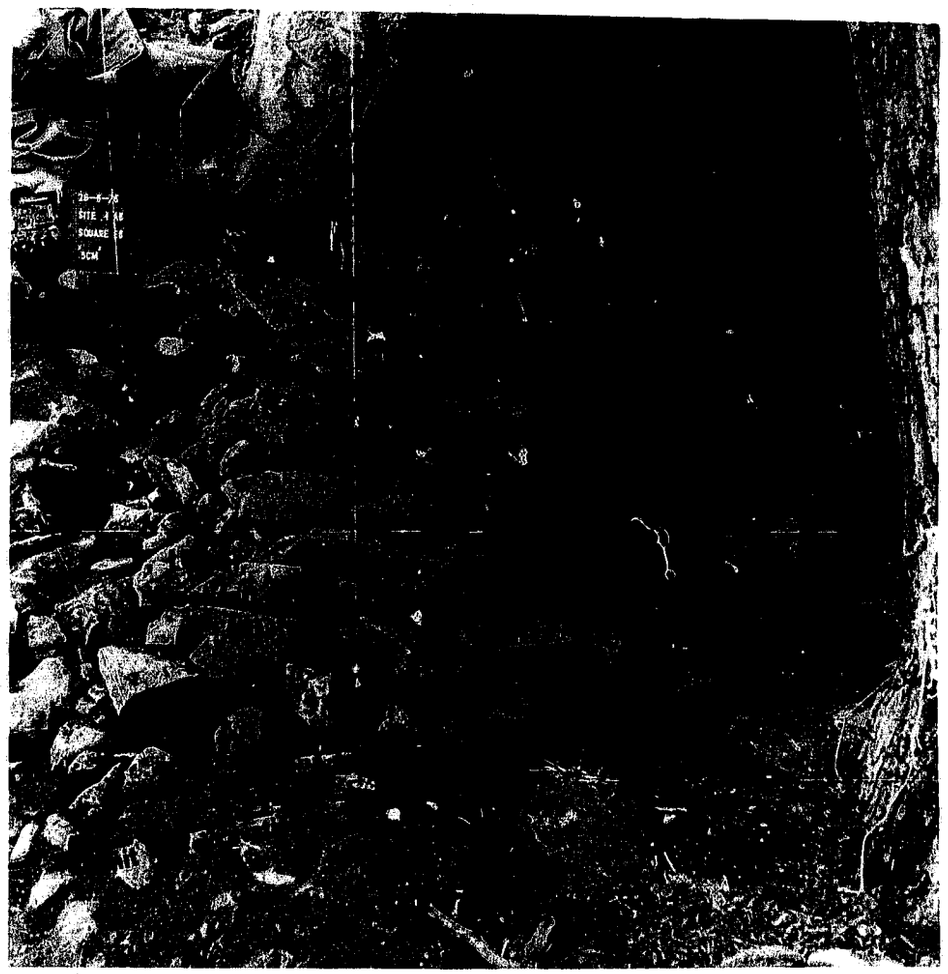
Layer I Black humic layer, absent in many places. Thickness 0-10 cm, increasing from sectors 7 to 4.

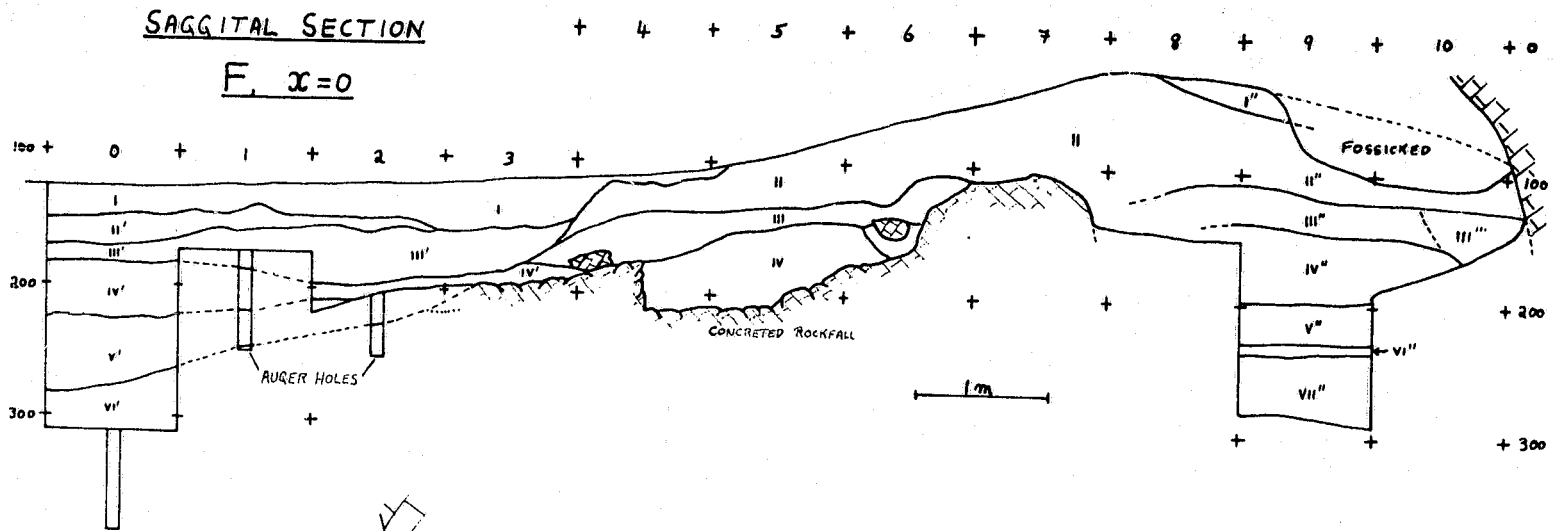
Layer II Rockfall, comprising at least 50% limestone fragments over 5 cms, and blocks up to 1 m diameter. This layer is from 20-70 cm thick and contains the richest archaeological material, which appears to be concentrated at particular levels. Its greatest thickness is around the dripline where deposition of fragments from the slope above the shelter has occurred. Dark reddish brown sediment (5YR2/2).

Layer III 15-30 cms of dark reddish-brown sediment (5YR3/4) with very few rocks and few archaeological remains.

Plate II Abercrombie Arch Shelter : view of the deposits at an early stage of excavation

Note the extremely rocky deposits of layer II overlain by a thin layer of rock-free, organic rich deposits (layer I) , the large area removed by fossickers and the plumbobs delimiting the horizontal grid system




SAGGITAL SECTION
F, x=0
+ 4 + 5 + 6 + 7 + 8 + 9 + 10 + 0
100 + 0 + 1 + 2 + 3 +
200
300
I
II'
III'
IV'
V'
VI'
I''
II''
III''
III'''
IV''
V''
VI''
VII''
FOSSICKED
+ 100
+ 200
+ 300
AUGER HOLES
CONCRETED ROCKFALL
1m

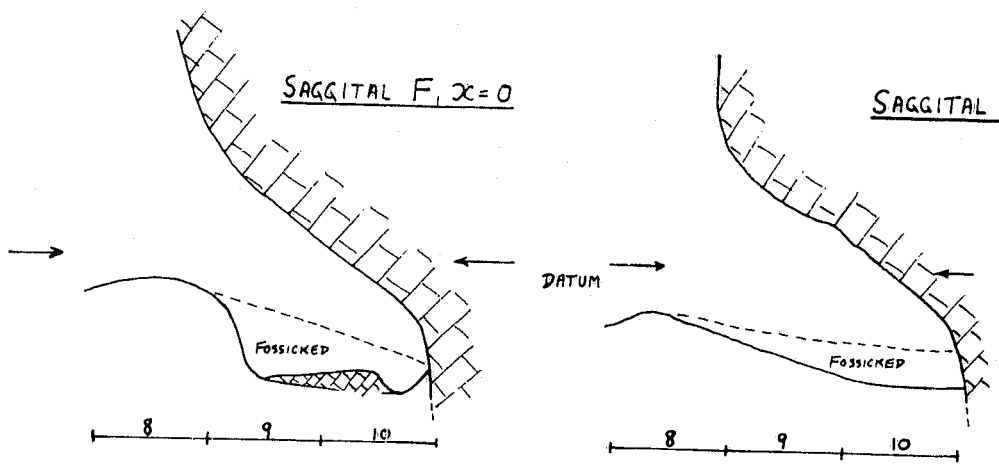

SAGGITAL F, x=0
SAGGITAL F, x=100
DATUM
FOSSICKED
FOSSICKED
8
9
10
8
9
10

FIG 2

Layer IV At the base of III objects became heavily concreted and layer IV consists of dark reddish brown sediments (7.5-5YR3/4) and rockfall, loosely cemented at the top and becoming increasingly cemented further down. Thickness excavated was approximately 50 cms in F5. There appear to be little occupation debris in this layer, but everything is heavily concreted.

B *The area underneath the overhang*

This section was stratigraphically confused owing to the presence of limestone blocks up to 0.5 cu metres, the fossickers hole and an area of older disturbance in square G9, G10 and H10. The build up of sediments in this area seems to have occurred by disintegration of the shelter roof as well as material derived from above the shelter, and may well have been further complicated by digging out of the deposits to increase the rather limited headroom during later occupations. Possible evidence of this was observed in the form of thick lenses of different sediments side by side at the same level. The whole deposit gave an impression of having been considerably disturbed down as far as level IV", but none of the disturbances were sufficiently clear to permit the distinction of definite pit outlines. One of the lenses described is visible in the section (Fig. 2) at the very back of the shelter - this appeared to be a bone dump, containing large quantities of bone with a wider representation of body parts and less fragmentation than elsewhere in the site.

The stratigraphy shown for this area in Fig. 2 is schematic and is based on field notes and sections. Some of the layers described are distinguished primarily on the basis of the archaeological material they contain rather than on geological grounds.

Layer I" Dark humic layer from 0-15 cm thick.

Layer II" Approximately 60 cm of rockfall, rich in artefacts at certain levels. The sediment is dark reddish brown (5YR3/4).

Layer III" Dark yellowish brown (10YR4/4) rock-free layer approximately 20 cms thick. This layer contains a considerable amount of bone.

Layer IV" Gravelly to rubbly textured dark brown layer (10YR4/4 to 3/3), between 60 and 70 cm thick, rich in bone at the top with decreasing finds towards the bottom, where it became more rubbly and concreted. This concretion continues into the layers below.

Layer V" Approximately 40 cm of loose gravelly textured dark brown sediment (5YR4/6 to 5/6). Less finds than in the layer above.

Layer VI" A clearly marked archaeological horizon visible in section as a narrow band approximately 5 cm thick of darker gravelly sediment (dark red 5YR3/4).

Layer VII" In sharp contrast with the preceding layer, this layer is pink in colour (7.5YR7/4) and is practically sterile archaeologically. Excavation was continued to a depth of approximately 280 cm below datum and a probe put down to over 3 metres below datum did not encounter bedrock.

All the layers from IV" to VII" have a pH of approximately 6.4 and fizz violently with concentrated hydrochloric acid, indicating that the sediment is probably composed of at least 20-30% limestone fragments. They would appear to be the result of *in situ* accumulation and breakdown of limestone roof disintegration products.

C *From sector 3 out to sector 0* the deposits consist of sandy clay/gravel interleaving with layers II to IV. The clearly distinguishable layers are identified by single primes from II' to VII'. Layer I continues over the surface of this section (see Fig. 2) Very little knapped stone and almost no bone was found in these layers which have pH of approximately 5.3 - 5.5. Hues range from 2.5 - 5YR, and value/chroma from 3/2 to 3/6, except for V' which is 5YR4/6-4/8. A Bondi point (Fig. 3, No. 3) was found in layer IV' in FO, associated with a large flat cobble (15 x 20 x 4 cm), one long edge of which was unifacially worked to form a large chopper-like implement. As mentioned earlier, these layers probably originate from slope wash carried down by the drainage system in front of the site.

## Stratigraphic Connections

One can tentatively propose the following stratigraphic connections between the areas described above:

1. The earliest deposits are layers VII" to IV" underneath the overhang. It is probably these layers which have been concreted from the dripline outwards to form layer IV in the talus slope area.

2. Layer III" underneath the overhang would appear to correspond with layer III in the talus slope area.

3. Layer II" under the overhang would appear to be an extension of the accumulation of limestone fragments from above the shelter which forms layer II on the talus slope. Unfortunately the stratigraphic connections at this level have been rendered particularly difficult by the presence of the fossickers hole. Support is lent to some degree by the richness in finds of both the fossickers spoil (which would mostly have come from layer II") and of layer II.

These connections are only very tentative because of the degree of stratigraphic confusion which occurs around the dripline as a result of the important accumulation of limestone fragments. The latter include several large boulders which made it impossible to draw any sections. Furthermore the fossicked area and an area of older disturbance confused the issue. It is hoped that the projection diagrams for this area will show up the concentration

of finds noticed at a particular level in layer II and enable it to be traced back under the overhang, thus verifying the tentative connection suggested.

4. Layers V' to II' in sectors 3 to 0 appear to overlie the concreted layer IV on the talus slope. Some concretion was noted in layer VI' which might suggest its contemporaneity with the concretion of layer IV. The sequence of interleaving of layers V' to II' and layers IV - II can be seen from the stratigraphic section (Fig. 2), but not too much faith should be put in this section as the junctions were not clearly marked and an error of a few centimetres could in some cases reverse the sequence of two layers. All one can be reasonably certain of is that the alluvial sediments in sectors 3 to 0 are broadly contemporaneous with layers III and II on the talus slope. This is really sufficient as there were very few finds in sectors 3 to 0.

## Lithic Materials

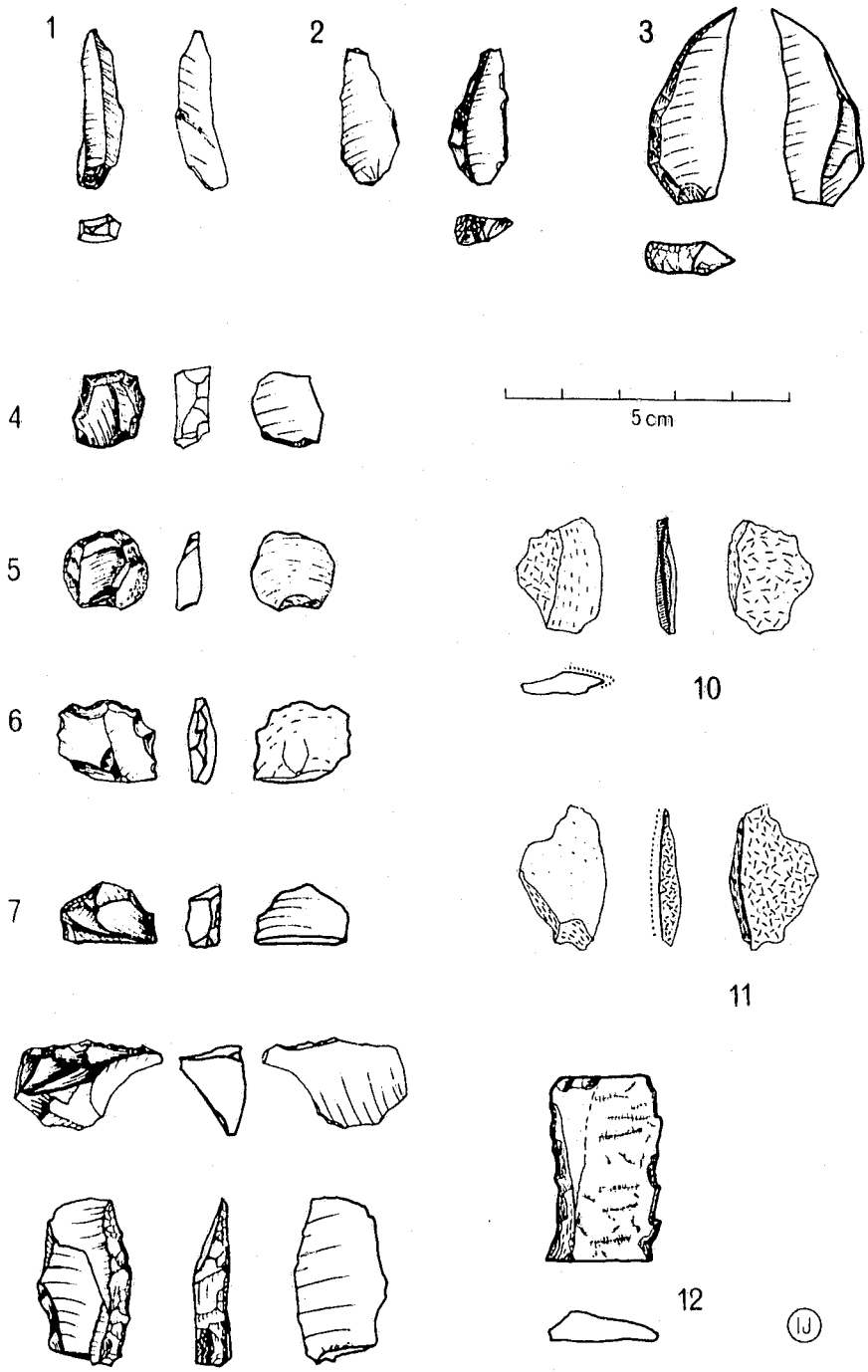
The excavation yielded a very large amount of lithic material - at least 20 to 30 kg and over 10,000 pieces excluding small chips. This, coupled with the concretion covering much of the material, has meant that it has not yet been possible to carry out even a provisional analysis of this material. The notes below are based on visual impressions obtained during excavation or during preliminary sorting.

At least 95% of the lithic material recovered was quartz, mostly in the form of irregular fragments. These fragments are what one might expect to find where attempts were made to knap the vein quartz in the locality. A proportion of the quartz is, however, of higher quality, either milky and lustrous or crystalline, and this material is often finely worked into flakes and small bladelets, many of them retouched. A cursory inspection of the quartz from sectors 0 to 6, only a small fraction of the total quartz recovered, revealed three backed bladelets, a burin, and over half-a-dozen each of notches, scrapers and scaled pieces (of which three were typical "fabricators"). These types are also present in the material from I" and II", so the total assemblage should be quite a large one. The material from the lower layers is too concreted to say whether similar types are present, though no obvious differences in stoneworking, size or raw materials is apparent. Even if these types are absent this could be a function of the sample size.

The rest of the lithic material includes fine-grained volcanics, cherts and silcrete and a number of broken or retouched pebbles. There is a great variety of different materials, and, apart from occasional groups of like material, within a limited area, there is an impression that no two pieces are the same. Most of the material is in the form of small to medium sized flakes (1-5 cm) and there is a marked absence of tiny chips or cores, suggesting that most of the pieces were brought in ready-made. At a guess approximately 20% of these pieces show signs of use and/or secondary retouch. Characteristic types include Bondi points (2 and 3)[1] a number of

[1] Numbers refer to object numbering in Fig. 3.

FIG 3



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thumbnail scrapers (4-7), finely worked small scrapers not falling directly into the discoidal thumbnail scraper category (8 and 9), burins and burin spalls (1). There is at least one elouera, numerous well-retouched smallish steep scrapers and a peculiar blade fragment with one margin backed and the other dentated (12). Evidence of grinding was found in the form of a small flake with one margin finely ground on both faces to form a convex sharp edge (10), a flake from a ground-edge tool (11), and a flat pebble ($9\frac{1}{2}$ x $6\frac{1}{2}$ x $2\frac{1}{2}$ cms) with a heavily used ground edge at one end. Quartz thumbnail and similar scrapers are also present, and one quartz backed bladelet has a possible gum stain on the backing.

The assemblage appears to fit broadly within the eastern variant of the Small Tool Tradition. The presence of fabricators and ground edge tools in layers I and II/II" might tempt one to assume a relatively late date for these layers. For the moment it is impossible to say anything very positive about the layers below these, though no obvious differences are apparent.

## Preliminary Faunal Reports (by K. Aplin)

Faunal remains were present in all parts of the site, with a maximum density and size range of fragments within the dripline of the shelter itself. The material is in general highly fragmented and a considerable proportion shows evidence of burning. A wide range of animals are represented, including a variety of marsupials, rodents, reptiles, birds and fish and land gastropods. Fragments of emu eggshell were also present in sectors 9 and 10. Faunal remains of any kind were almost completely absent in sectors 0 to 3.

Mammal dentaries present within each sample were separated for identification. The presence of both fish and reptile remains and of tortoise carapace were also recorded during this procedure. The concretion covering much of the material made identification practical to a family level only. The preliminary nature of this analysis is stressed and the results given are by no means considered as representative of the total assemblage but rather serve to give an indication of the range of species present in the deposit. Table 2 presents a provisional list of the genera represented by the dentaries. Table 1 shows the distribution of mammalian fauna in percentage form.

However, the initial picture gained from this analysis is one of the presence of a wide range of species, both in terms of size and favoured habitat. The presence of the marsupial carnivores Dasyurus spp. and Sarcophilus sp. raises the possibility of occasional use of the shelter by these animals.[1] The contribution of the remains of their prey to the faunal assemblage would produce a further complicating factor to be considered in any subsequent analysis.

A further analysis is planned taking into consideration such variables as anatomical location and specific identification of bone fragments where possible, the degree of fragmentation and burning, and the spatial and temporal variance of these.

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[1] Sarcophilus sp. - E9 £IV" left mandibular fragment. Adult?
- E10 £IV" right maxillary fragment. Juvenile?
both preliminary identification only.

TABLE 1 PERCENTAGE REPRESENTATION OF MAMMALIAN FAUNA

| Sector | Layer | Dasyuridae | Macropodidae | Muridae | Peramelidae | Petauridae | Phalangeridae | Vombatidae | Sample Size |
|---|---|---|---|---|---|---|---|---|---|
| Fossicker's Spoil | | 1 | 71 | 5 | 10 | 1 | 9 | 3 | 89 |
| 9 + 10 | I" | | 50 | | 25 | | 17 | 8 | 12 |
| 9 + 10 | II" | | 76 | | 3 | | 9 | 12 | 34 |
| 9 + 10 | III" | 2 | 82 | | | | 8 | 8 | 60 |
| 9 + 10 | IV" | 5 | 70 | | 9 | | 7 | 9 | 43 |
| 7 + 8 | I | | 74 | | 13 | | 13 | | 8 |
| | II | | 89 | | 4 | | 4 | 4 | 27 |
| | III | | 78 | | 11 | | 11 | | 18 |
| | IV | | 90 | | | | 10 | | 10 |
| 4 + 5 + 6 | I | | 25 | | | | | 75 | 4 |
| | II | | 79 | | 7 | | 14 | | 28 |
| | III | | 50 | | 50 | | | | 2 |
| 0 + 1 + 2 + 3 | I + II | | 100 | | | | | | 2 |

TABLE 2 PROVISIONAL LIST OF GENERA REPRESENTED

Dasyuridae - Dasyurus sp. (maculatus)
Dasyurus sp. (viverrinus)
Sarcophilus sp.

Macropodidae - Aepyprymnus sp.
Bettongia sp.
Macropus sp. (giganteus)
Macropus sp. (rufogiseus)
Petrogale sp.
Thylogale sp.

Muridae - Pseudomys sp.

Peramelidae - Isoodon sp.

Petauridae - Pseudocheirus sp.
Schoinobates sp.

Phalangeridae - Trichosurus sp.

Vombatidae - Phascalomys sp.

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## Appendix 1

*List of Participants*

Australian National University - K. Aplin, F. Baas-Becking, K. Barz, D. Bulbeck, E. Bunn, B. Cundy, D. Gaughwin, E. Hawke, P. Hiscock, M. Janssen, I. Johnson, M. Jones, D. Kaus, D. Llewellyn, M. Morwood, M. Nizette, F. Poldy, J. Robertson, O. Sananikone, V. Solo, H. Sullivan, L. Worrall, S. Wild

Sydney University - P. Gorecki, Université de Paris - A. Testart, Canada - J. Webber, Sydney - V. Middleton

Faunal Report :- Ken Aplin

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# OPEN SITE EXCAVATIONS AT FRESHWATER CREEK

# CAPERTEE VALLEY, NSW

Ian Johnson

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The Australian National University

Preliminary report to NSW National Parks and Wildlife Service

October 1979

May be consulted, but not quoted, without the permission of the author.

## SITE LOCATION

The Freshwater Creek site is situated at GR 513298 on New South Wales Government 1:25,000 sheet for Mount Morgan (332903 on Sydney 1:250,000 sheet). It is approximately 500 metres upstream (NW) of McCarthy's Capertee sites 1-3 (McCarthy 1964).

## EXCAVATIONS 1978 AND 1979

Following the discovery of flaked stone material during the excavation of a pit in the vicinity of our campsite, I decided to carry out test excavations in the area. Our camp was established on a flat spur some 20 metres above the Capertee River in the angle between the river and Freshwater Creek, the most reliable water source for several miles downstream from the junction of the Capertee River and Running Stream. The end of the spur gives a good vantage point over the river and the valley in general, whilst the flat area extends over a width of 40-50 metres and continues downstream for a couple of hundred metres. Two large boulders near the tip of the spur provide some shelter, though not as overhangs.

My first test, labelled FWC0, was situated between these two boulders in the middle of our camp (see fig. 1). Material was sparse and the metre square test was abandoned at a depth of approximately 50 cm reached in 9 spits. The other test labelled FWC1 was situated in an area of ti-tree scrub at the rear of the flat area (i.e. away from the river) and just overlooking Freshwater Creek, which is here only about 10 metres below the site. This excavation proved to be richer, perhaps because of its more sheltered position and greater proximity to water. A plan of the site is shown in fig. 2. Squares 1 and 2 (U5 and T5) were excavated in 4 arbitrary levels (spits) going down approximately 60 cm. No visible stratigraphy was observed.

Further excavations of square T6 in 1978 and square U6 in 1979 proceeded by 10 cm spits for the former and by buckets for the latter (see Johnson 1977:14 for details of this technique). The aim in excavating U6 in such detail was partly to collect well controlled charcoal samples and look for any changes in soil texture, and partly to try a small field application of the excavation techniques I have

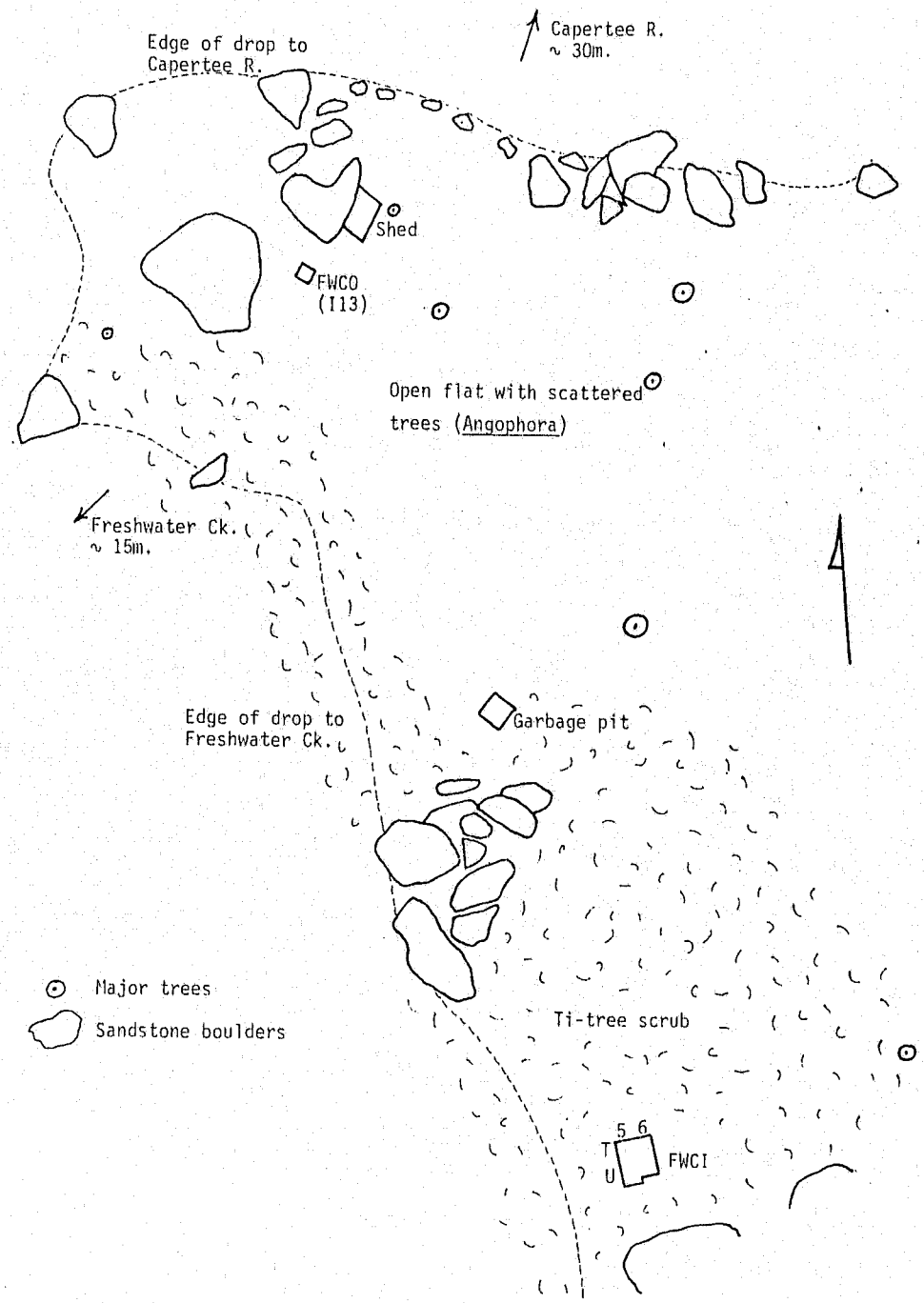



Fig. 1 Freshwater Creek, Capertee Valley : Locality plan

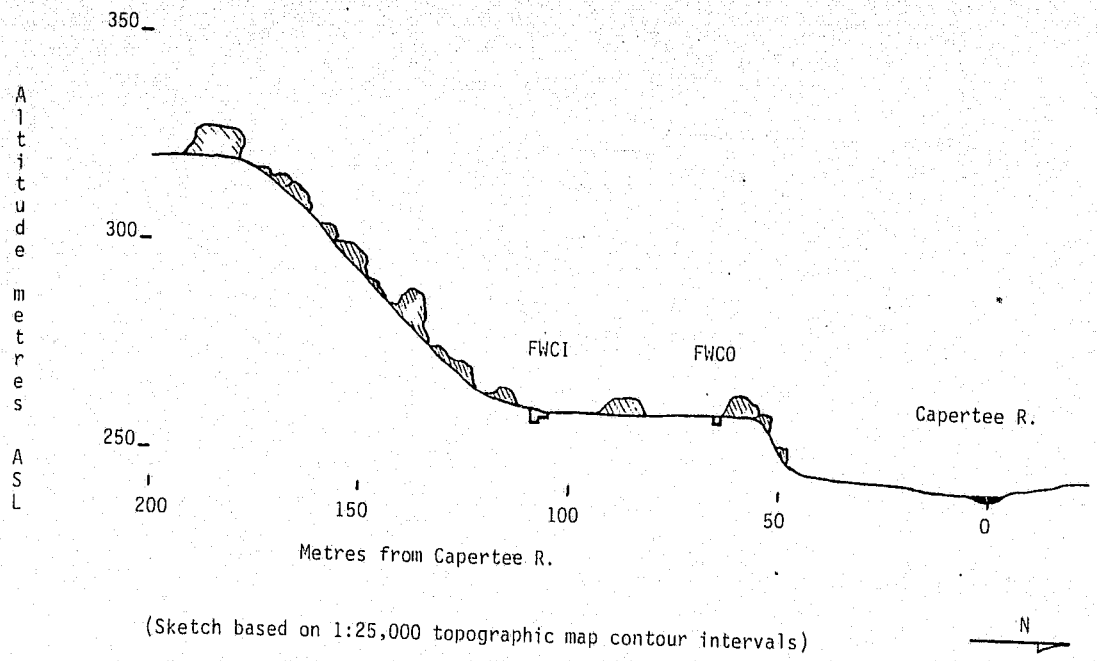
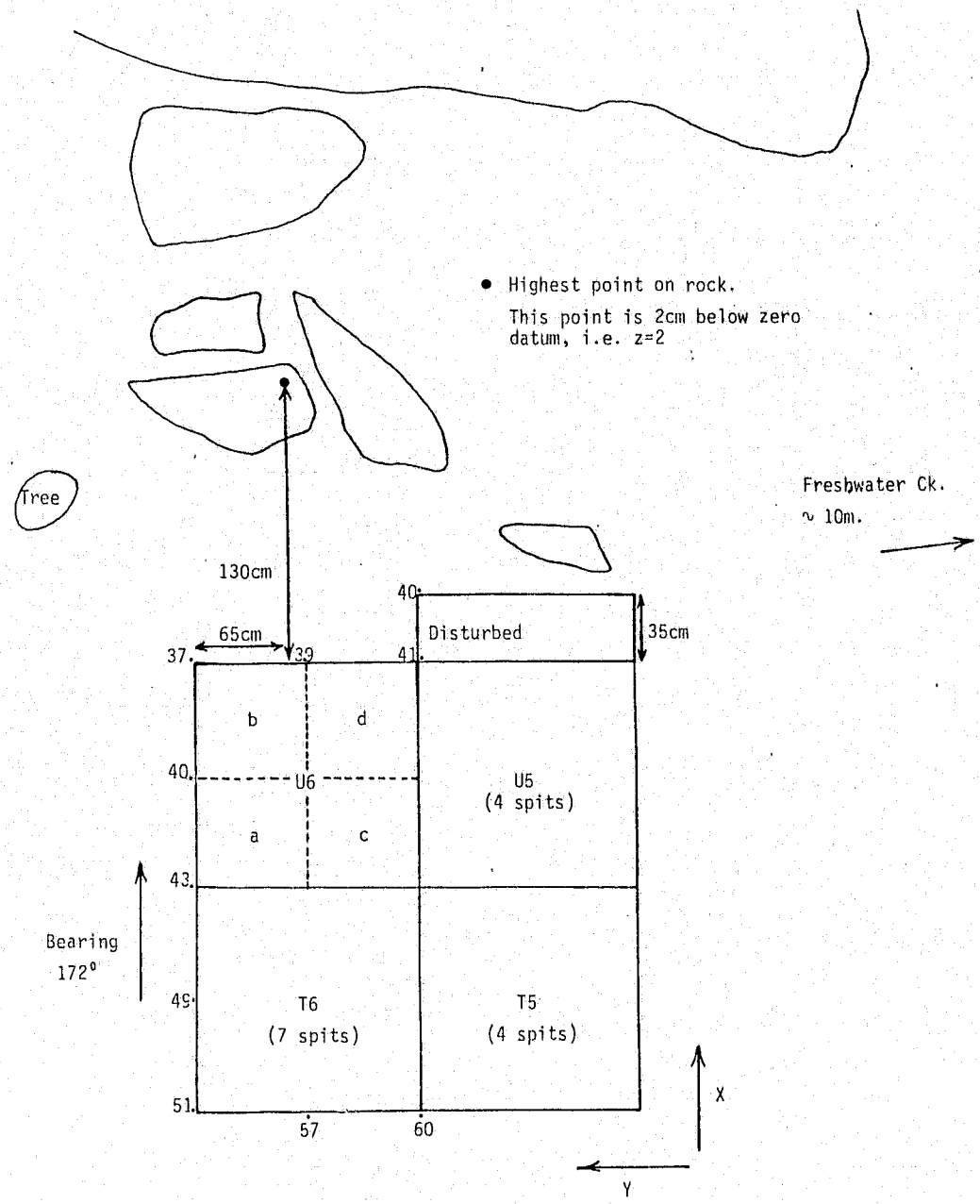



Fig. 2 Freshwater Creek locality : section through pediment and talus




Sketch plan - not to scale

47. Indicates spot height on surface of deposits relative to 1979 datum

Fig. 3 Freshwater Creek I : plan of excavation

proposed, updated with my experience from the 1978 field season at Capertee 3 and Noola. I do not think that under normal circumstances a site as diffuse as the Freshwater Creek sites warrants such careful excavation, though I think a proportion of squares excavated should be treated in this way to look at the vertical distribution of material and changes in the sediment as a control on the stratigraphy of surrounding squares (for example, each square in a lattice of squares has 8 contiguous neighbours, so 1 square in 9 might be excavated with close vertical control and its eight neighbours excavated using arbitrary levels determined with reference to this central square).

The material from T6 and U6 was wet sieved on a 3/16" (4.5 mm) mesh and 1/8" (3 mm) mesh, but only the material in the 3/16" (4.5 mm) mesh was sorted. For all except the lowest levels in U6 the 1/8" (3 mm) residue was brought back to Canberra rather than sorted in the field. Inspection of this residue suggests that there is <u>very</u> little in the way of flaked stone in it, and it is intended to discard it without sorting. An immediate conclusion is that little stone knapping was performed in the area covered by the excavation, a conclusion supported by the variety of raw materials and the high proportion of utilised pieces present, suggesting import of finished pieces. No bone is present in the site. Charcoal was recovered during sorting for T6 and by agitating and skimming the submerged sieves with a household strainer in the case of U6. This technique proved almost 100% effective in collecting charcoal despite the fact that much of it did not float. Charcoal is not concentrated at particular levels which suggests that we are not dealing here with the remains of Aboriginal hearths but rather with a more or less continuous supply of charcoal from natural fires smoothed by subsequent redeposition by wind and water and animal (or human) disturbance. On the other hand, at Capertee 3 the correlation between peaks of stone tool deposition and peaks (within the general trend) of charcoal, suggests that in that case human agency may have been more significant.

The cross section of the site on two walls of square U6 is shown in fig. 4, and the vertical distribution of excavation units on fig. 5. Buckets were filled to a constant level, corresponding with around 10 kg of deposits, rather than being weighed individually, and in the lower part of the site the excavation units were increased to 2 or 3 buckets, as indicated. By the time we reached about 80 cm below

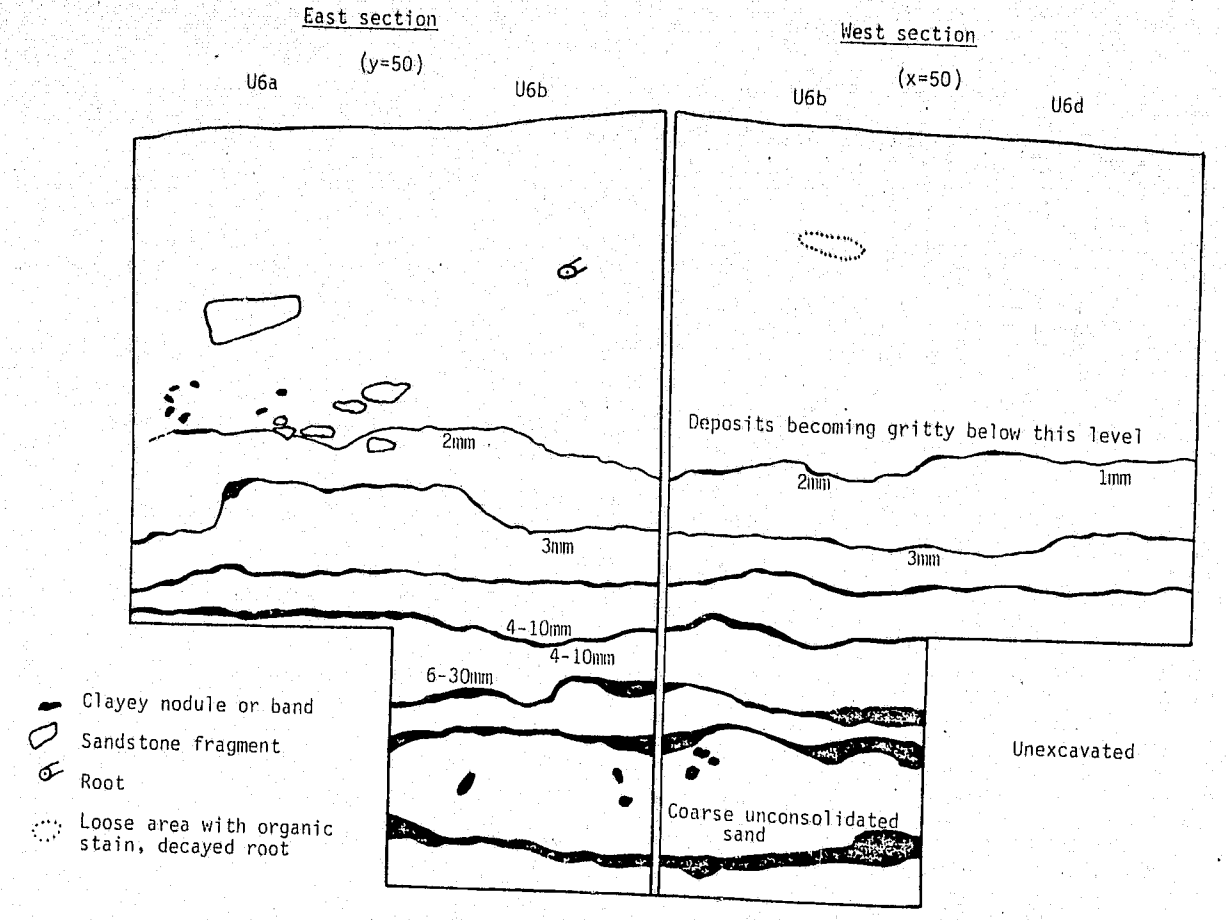



Fig. 4 Freshwater Creek I : stratigraphic section, square U6

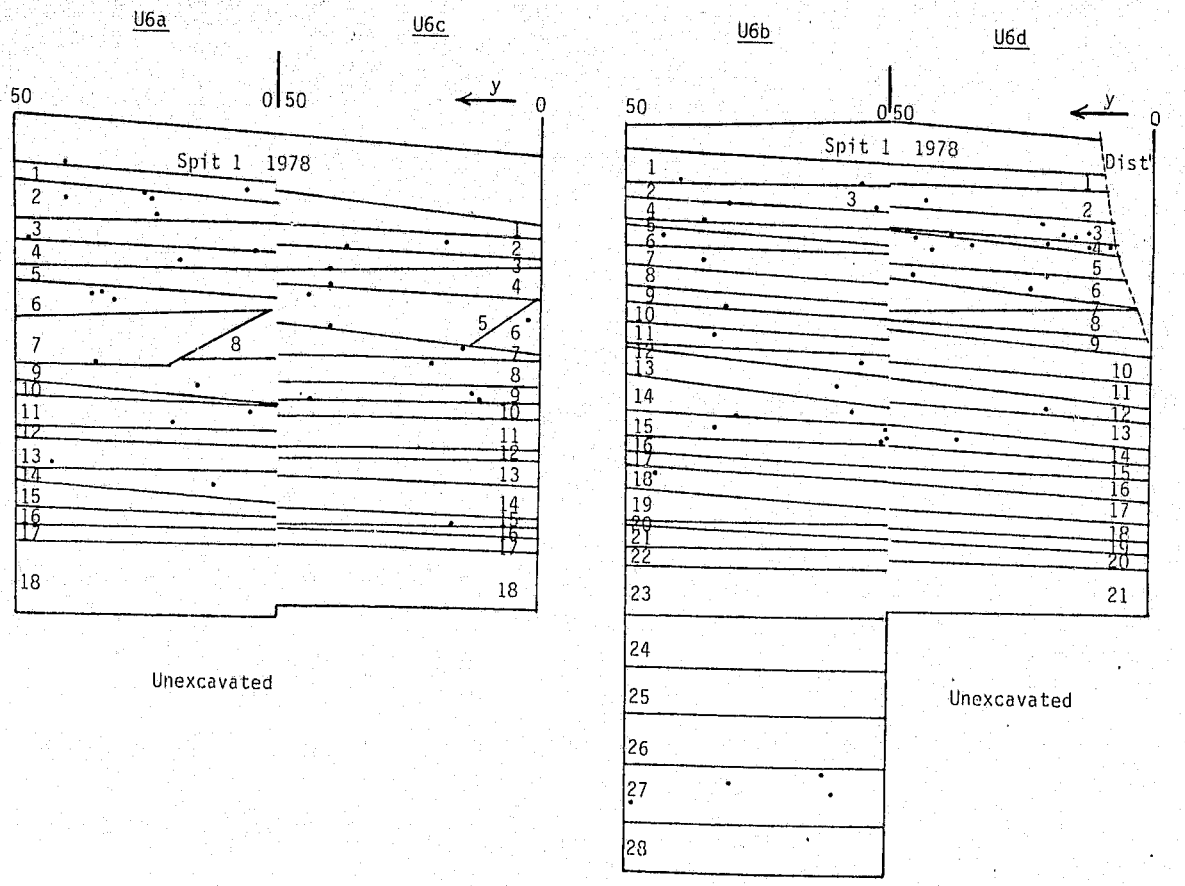
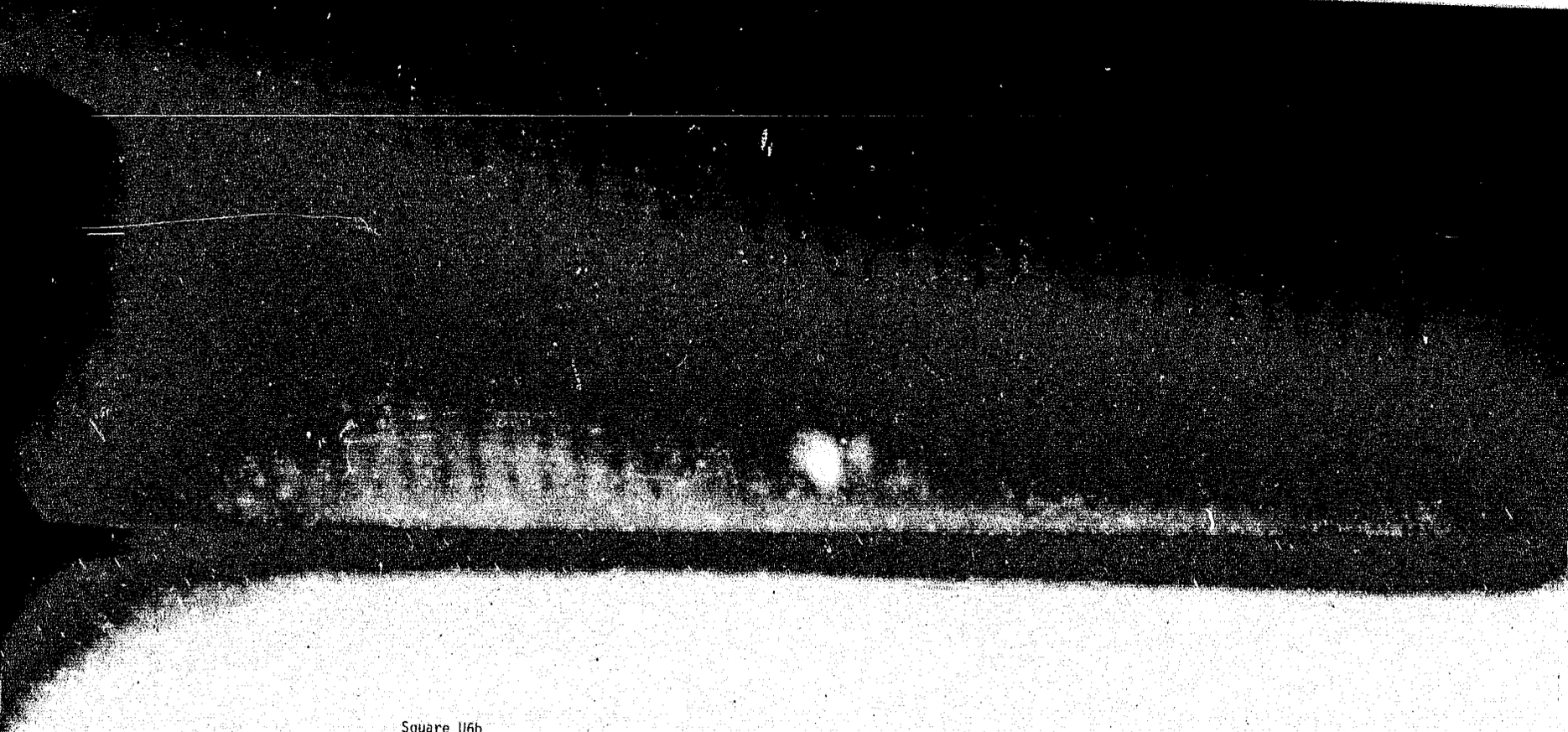
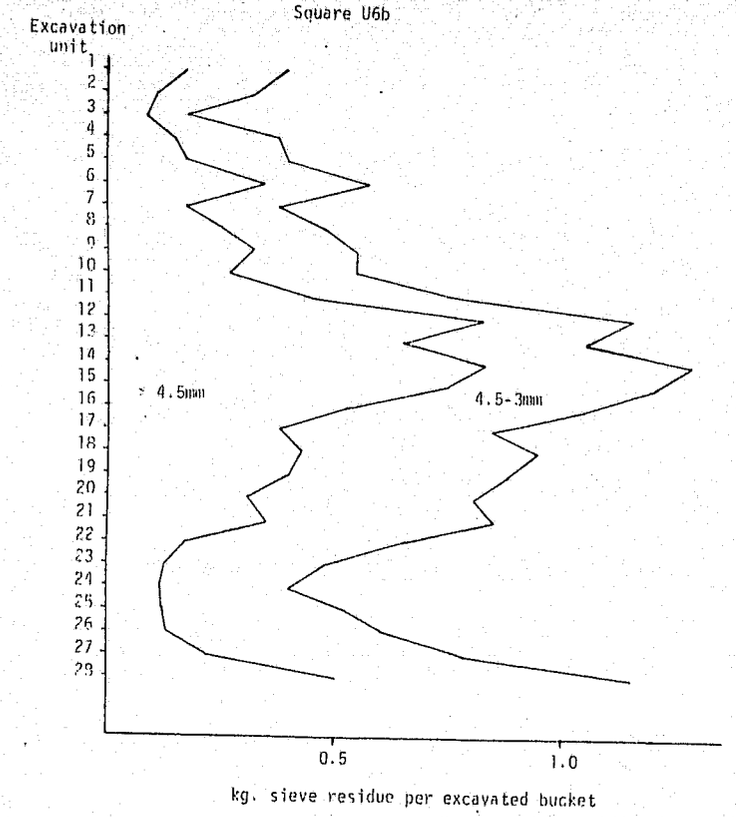



Fig. 5 Freshwater Creek I : projection of spit boundaries and 3D recorded finds, square U6

the surface, the deposits appeared to be nearly sterile, and hard clay bands similar to those at Capertee 3 were appearing (compare fig. 3 with fig. 28 in Johnson 1979). Excavation was halted in three of the four sectors of U6 at 136 cm below datum (~90 cm below ground surface) and the remaining sector, U6b was excavated down to ~145 cm below datum in units of 3 buckets at a time. Inevitably, the richest occurrence of lithic artefacts was found associated with a clay band in unit 27 and time did not permit us to expand the excavation at this level or continue to any greater depth. At this level the clay bands are hard and up to 6 cm thick and are separated by coarse friable sand. However there is a general decline in artefact concentration with depth, apparent in table 1 - note that spit 4 for T6 is not at an equivalent level to spit 4 for the other squares, which accounts for its higher artefact concentrations. Analysis of the material from the 1979 excavation has not yet been completed owing to thesis pressures, but U6 subsquares b and d yielded a total of 106 and 107 artefacts, representing concentrations of 300 and 500 artefacts per cu.m. Eight tools and two cores were found in U6b and four tools and one core in U6d (preliminary counts only). Mean weight of finds was 2.0 and 2.3 gm respectively.

The stratigraphy has much in common with that of the North excavation at Capertee 3. The grey surface layer is much thinner than at Capertee 3 and much more friable. This appears to be a function of vegetation cover which is much more profuse at Capertee 3, possibly due to nutrients provided by occupation debris in the site, as well as being the direct result of occupation debris incorporated in the deposits. Other factors such as drainage can also be cited as possible causes. Below the grey layer the deposits are in both cases compacted sands, with patches of clay beginning to appear about 60 cm below the surface. The clay bands gradually increase in thickness from the first, about 2 mm thick, to 2-6 cm thickness for the lowest ones, and in both cases the upper clay bands are associated with a noticeably grittier texture than the deposits above them. The main difference between the two stratigraphies is that the deposits at CP3 become progressively more and more rubbly, passing into a concreted and deeply weathered sterile zone at about 1.20 m below the surface, whereas those at FWCI remain stone-free with, however, a peak in sieve residues (material over 1/8" (3 mm)) corresponding with the appearance of the uppermost clay band (fig. 6). The deposits in fact become





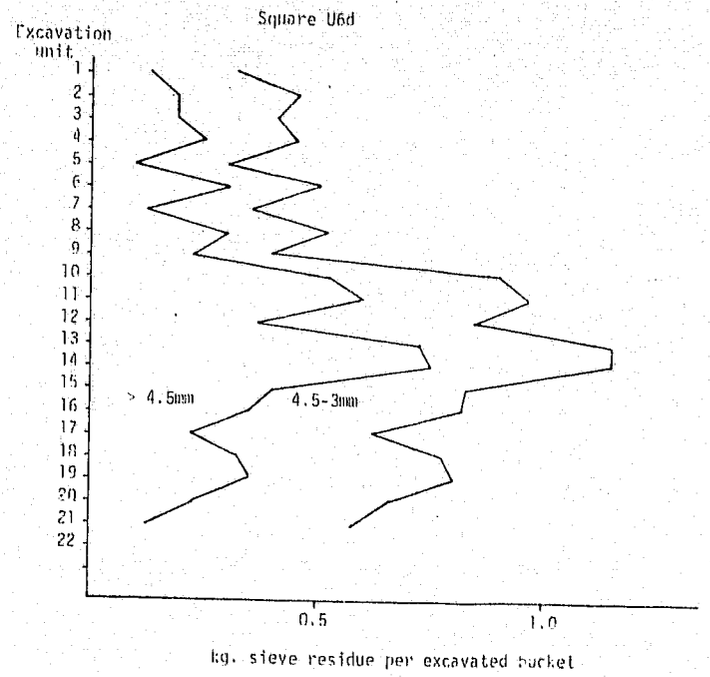




Fig. 6 Freshwater Creek I : in-field sediment analysis

| Square | Spit | Lithic artefacts | | Lithic artefact types | | | |
|---|---|---|---|---|---|---|---|
| | | No. | Wt (gm) | Backed impl' | Redir' spall | Utilised | Core frag' |
| U5 | 1 | 95 | 207 | 1 | 7 | 5 | 3 |
| T5 | 1 | 39 | 106 | - | 1 | 4 | 1 |
| U6 | 1 | 47 | 71 | - | 2 | 2 | - |
| T6 | 1 | 16 | 32 | - | - | 2 | - |
| U5 | 2 | 26 | 56 | - | - | 1 | - |
| T5 | 2 | 21 | 225 | - | - | 3 | 1 |
| U6 | 2 | - | - | | | | |
| T6 | 2 | 85 | 256 | 2 | 1 | 5 | 2 |
| U5 | 3 | 10 | 78 | - | - | - | - |
| T5 | 3 | 38 | 136 | - | 1 | 1 | 2 |
| U6 | 3 | - | - | | | | |
| T6 | 3 | 87 | 97 | 1 | 3 | 5 | - |
| U5 | 4 | 15 | 93 | | | | |
| T5 | 4 | 42 | 64 | | | | |
| U6 | 4 | - | - | | | | |
| T6 | 4 | 72 | 73 | | | | |
| U5 | 1-4 | 146 | 434 | | | | |
| T5 | 1-4 | 140 | 531 | | | | |
| U6 | 1 | 47 | 71 | | | | |
| T6 | 1-4 | | 458 | | | | |

| Square | Spit | Mean wt finds (gm) | Volume excav' ($m^3$) | Finds per $m^3$ |
|---|---|---|---|---|
| U5 | 1-4 | 3.0 | 0.6 | 250 |
| T5 | 1-4 | 3.8 | 0.6 | 230 |
| U6 | 1 | 1.5 | 0.1 | 470 |
| T6 | 1-4 | 1.8 | 0.4 | 650 |

Table 1 Freshwater Creek Site I : summary of lithic artefacts 1978

softer rather than harder at the bottom. No attempt was made to probe deeper than the level excavated, but the lie of the land gives us no means of predicting at what depth bedrock or the rubbly talus deposits underlying most of the area would be reached. This site could well have a considerable depth of stratigraphy, and the appearance of several artefacts in the penultimate excavation unit suggests an interesting archaeological potential. Furthermore, the presence of the clay bands could provide an invaluable stratigraphic marker for the opening up of area excavations.

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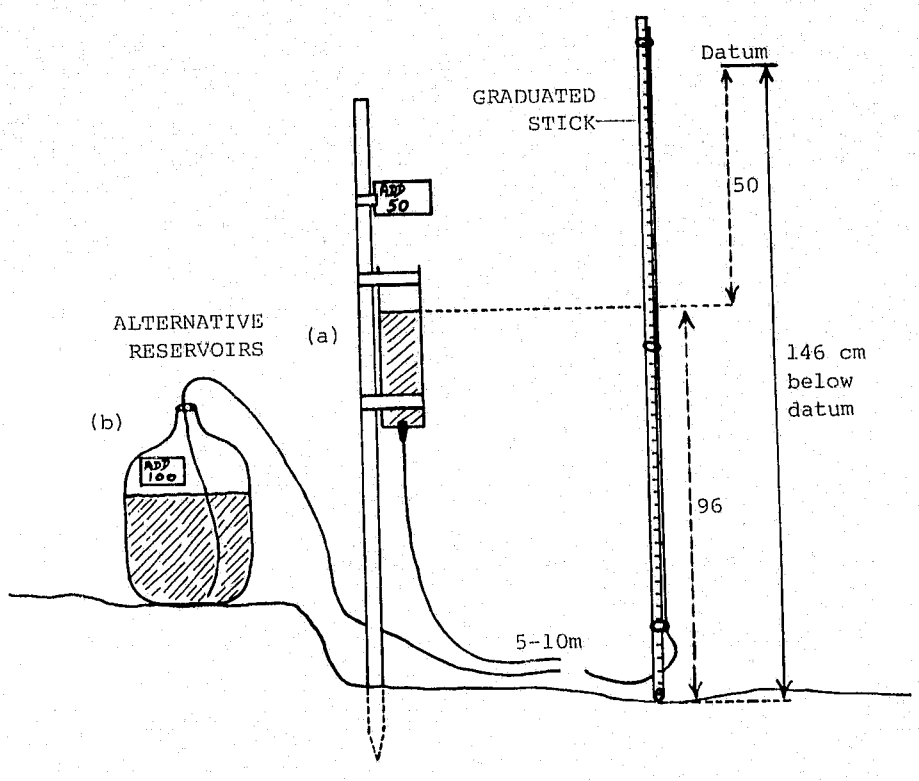
*Reprinted from AUSTRALIAN ARCHAEOLOGY No 8, Sept 1978 pp172-3.*

# WATER LEVELLING - A SUGGESTION

*Ian Johnson*

Water levelling is a simple, rapid and reliable way of levelling on archaeological sites, yet it seems to be somewhat under-used in favour of other methods such as dumpy or line levels. This is probably because water levels tend to be do-it-yourself contraptions, requiring some experimentation. This note is intended to provide details of an easily constructed water level which has proved both convenient and reliable in use.

The water at one end of the tube is maintained at a (more or less) constant level by a reservoir of much greater diameter than the levelling tube, leaving the person using the device with a free hand for taking notes. The tube may either be attached to the bottom of the reservoir (a) or work as a siphon (b). The reservoir is set up above the level of any finds or features to be recorded, and can be adjusted to a convenient datum level, either by pushing the supporting pole further into the ground, or by moving the reservoir to higher or lower ground, depending on the reservoir type. Levels below the site datum are simply calculated by adding the reservoir level to the reading on the graduated stick (graduated from 0 at the bottom upwards). Several tubes can be attached to a single reservoir provided it is of reasonable diameter (20 cm or more).



## Construction details

*Reservoir:* type (a) can be made from a plastic 'spaghetti container', attached to a support, such as a ranging pole, with masking tape. The pointed end of a biro tube is glued into a hole made in the bottom of the container (if the hole is made with a hot soldering iron the biro tube can be fused in position). The levelling tube can then be pushed onto the point. Type (b) can be made from a 5 litre orange juice container, a wine flagon, a bucket, or any larger container.

*Levelling tubes:* 5-10 m of 4 mm internal diameter clear polythene tubing. Longer lengths can be used but will progressively slow down the response, i.e. the speed with which the water level in the tube settles down.

*Liquid:* water with the addition of sufficient dye to make the level easily read. Dark colour clothing dyes are best. The addition of detergent or kerosene may speed the response of the device, but in practice the present arrangement was quite fast enough, and the addition of detergent tended to provoke the formation of air bubbles.

*Graduated stick:* up to 2 m of rectangular section wood or aluminium rod; 19 x 8 mm proved convenient in wood, but a thinner aluminium rod might be usable. The tube is attached to the rod with transparent tape, and the rod can be graduated directly with a fine point marker pen.

The open end of the tube must be kept above the level of the water in the reservoir. The graduated stick must therefore be stood upright, e.g. in a bucket, when not in use. A mark on the reservoir indicating the correct water level serves as a quick check that no significant amount of water has been lost (or gained).

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# PLANIMETRY: SCALE DRAWINGS FROM PHOTOGRAPHS

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Scale drawing of rock art surfaces or artefact scatters is a time-consuming business which bites heavily into limited fieldwork time, particularly in the case of archaeological survey work. This article sets out to show how scale drawings can be prepared from photographs taken with an ordinary camera, allowing the fieldworker to record artwork or artefact scatters rapidly in the field and prepare the diagrams after fieldwork is over.

Beaton (this volume) has discussed the technique of photogrammetry which allows one to make contoured scale drawings of surfaces from stereo photographs. However, photogrammetry is a demanding technique requiring expensive, bulky equipment and a considerable time expenditure, both in the field and in the preparation of the drawings. Most workers will be satisfied with moderately accurate scale drawings without contours which can be achieved rapidly and easily with an ordinary camera. The latter technique is known as planimetry.

The keys to accuracy in making scale drawings from photographs are, first, to take the photograph at right angles to the surface to be drawn, and second to take the photograph from as far away as possible. As a general rule the longer the focal length of the lens, the less the parallax distortion at the edges of the photograph (this is a geometrical effect and has little to do with the quality of the lens).

Shelter Walls and Cliff Faces

It is difficult to generalise about techniques for photographic coverage of near-vertical surfaces, as one may or may not be able to photograph them from a reasonable distance. In general, however, only surfaces which are very nearly flat should be photographed with a wide angle lens. Any surface which is curved or irregular should be photographed as a series of overlapping frames using a standard lens or moderate telephoto: each frame should be taken at right angles to the part of the surface being photographed and should include a graduated scale along the edge of the photograph so that successive frames can be printed to the same scale. In this way the series of frames can be assembled, using features of the surface as register marks, to provide a `straightened-out` picture of a curved surface, which is then traced (and if possible annotated on a subsequent visit to the site).

If a wide angle lens is used to photograph a complete surface which is not flat, whether in one or several frames, scale distortions will be caused:

1. where the surface is not directly facing the camera;

2. at the edges of each frame due to parallax effects

Near-Horizontal Surfaces

A special problem is posed by near-horizontal surfaces, such as open air rock engravings, axe groove sites and surface scatters of artefacts, because we cannot generally take photographs from any distance (other than oblique ones). What is required is some sort of

support to hold the camera two or three metres above the surface to be photographed.

I have seen a number of such devices, but all of them seem to suffer from one or more drawbacks, the most common being:

1. the time necessary to set up some form of tripod over the surface to be photographed, adjust the angle of view (often vertical), frame and focus;

2. the need for a step-ladder to carry out these operations;

3. lack of portability.

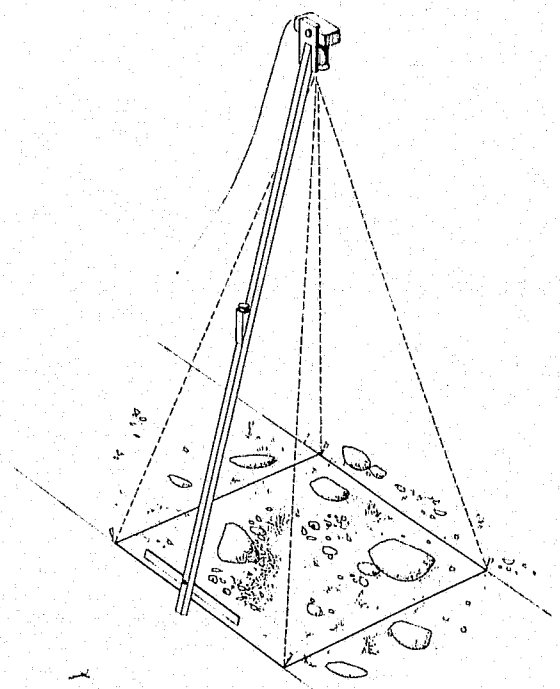
The remainder of this paper sets out to describe in detail a simple device which allows one to take either vertical or inclined photographs. By using a single supporting column to which the camera is rigidly attached, individual framing and focussing of each photograph is eliminated so that the camera can be supported considerably further from the surface to be photographed (as there is no need for the photographer to be able to reach the camera for these operations), thus reducing parallax distortion at the edge of each overlapping photograph. As there are no tripod legs to be adjusted, but simply a single column to be held in the right position at the moment of exposure, the time-consuming business of adjustment (and of finding somewhere to put the tripod feet without damaging something) is eliminated. As a result, once reference points (e.g. the corners of 1 metre squares) have been marked out on the surface to be photographed, photographs of successive areas can be taken at the rate of one a minute or faster: this compares more than favourably with the 10-20 minutes per photo rate which is about the fastest I have

observed for vertical photography with a three legged support. Finally, the device described can be made for around $25 at the time of going to press (excluding camera!). Its total weight is less than 3kg, which makes it ideal, for instance, for survey work involving the recording of rock engravings or surface scatters of artefacts in remote locations.

The basic camera support is an inclined column made of 1" (2.5cm) square section aluminium tubing. The camera is mounted on the end of this column in such a way that its field of view extends from the foot of the column outwards (Fig.1). Framing is carried out simply by placing the foot of the column alongside the area to be photographed and lining up the alignment bar (Fig.1 and Fig.2d) with the edge of this area.

Focussing is carried out when the camera is first attached to the support, and need not be subsequently modified, as the camera remains at a fixed distance from the surface being photographed (depth of field takes care of minor changes, see later). In order to maintain a constant orientation of the camera, the column is fitted with a bull`s-eye spirit level on a small perspex block (Fig.2b) cut in such a way that when the level is centred, the camera points vertically downwards. For photographs of sloping surfaces, the column is also fitted with a spirit level vial on an adjustable mount (Fig.2b) which can be set to the desired angle.

Prior to photography, it is best to mark out the surface to be photographed in squares or rectangles a little smaller (say 3/4 of the size) than the coverage of a single photograph, placing a small (1cm) white painted disc or flat headed nail at each corner. This marking out ensures complete photographic coverage without gaps, and the



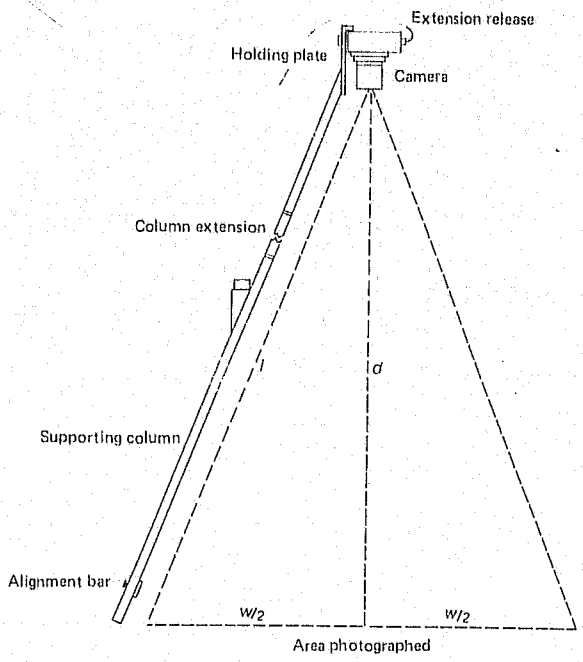

Extension release
Holding plate
Camera
Column extension
l
d
Supporting column
Alignment bar
w/2
w/2
Area photographed

Fig. 1

markers serve as guide points in the assembly of the individual photographs (1).

Successive photographs are taken by placing the foot of the column in the middle of, and just back from, the edge of each of the areas marked out, lining up the alignment bar with the edge and centering the level(s). The shutter is triggered with a long cable or pneumatic release. The device is shown in use in Plate I, and a sample of the results in Plate II - note that in this case the markers have not been retouched out.

I was initially worried by the possibility of camera shake with the set up described - I was not very keen on the idea of a camera waving around on the end of a 3 metre pole. In practice I found that one could get perfectly sharp results at 1/125th of a second exposure, or even lower speeds. I would be inclined, however, to use 1/250 or 1/500 for safety if you have a shaky hand or a high wind. For edge to edge sharpness and a good depth of field, an aperture of f4 or smaller is advisable, though acceptable results are produced at f2. As enlargements of this sort of photograph will not generally exceed about 12 magnifications, there is no point in using slow/medium black and white film, a fast, 400ASA film such as Tri X or HP5 (optionally developed in a speed enhancing developer such as Acufine to give 1000ASA or more) giving practically grain free results at this magnification and allowing the use of a fast shutter speed and small aperture and/or photography in poorer lighting conditions. Focussing is best performed by placing the foot of the column against a wall or tree, holding it so that the camera is aimed horizontally at the

(1) If the markers are considered to spoil the final assembly, they can easily be retouched out or removed just before each photograph is taken.

object in question, and focussing on it.

My thanks are due to Jim Neale who constructed a prototype for me and made several suggestions on the material realisation of the device, and to Win Mumford for turning my sketches into comprehensible diagrams.

Dimensions

To cover an area 1.4m x 2.1m on 35mm film, or 1.4m x 1.4m on 6 x 6 film.

Before mitreing the top end, the column length should be as follows:

35mm camera;

55mm lens - 335cm, 50mm lens - 305cm; 35mm lens - 220cm

6 x 6 camera; 80mm lens - 205cm

The metred end of the supporting column should be cut at the following angle to the column length ( on the diagrams):

35mm camera;

55mm lens - 12', 50mm lens - 13.5', 35mm lens - 19'

6 x 6 camera; 80mm lens - 20.5'

For other lenses or different areal coverage, the column length and mitre angle can be calculated easily from the equations given at the end of this paper.

Note 1: The shorter columns used with the 35mm lens or a 6 x 6 camera are obtained at the expense of greater parallax error at the edges and corners of the photograph. This will render the joining up of photographs difficult if the surface photographed is not entirely flat.

Note 2: One can use a shorter focal length lens than that for which

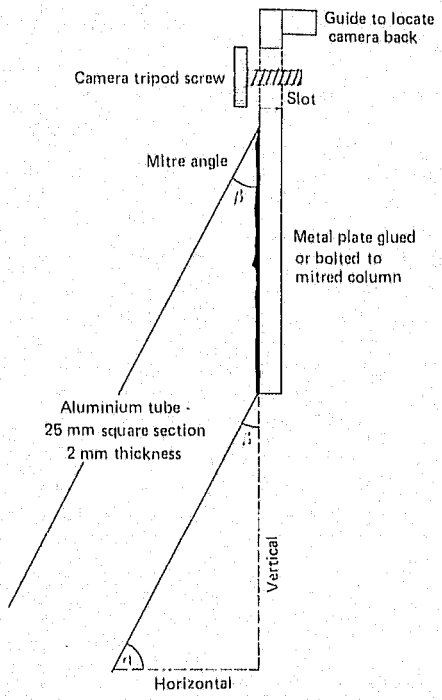
the support was designed, but the increased coverage will be lost along one edge by the inclusion of the base of the column.

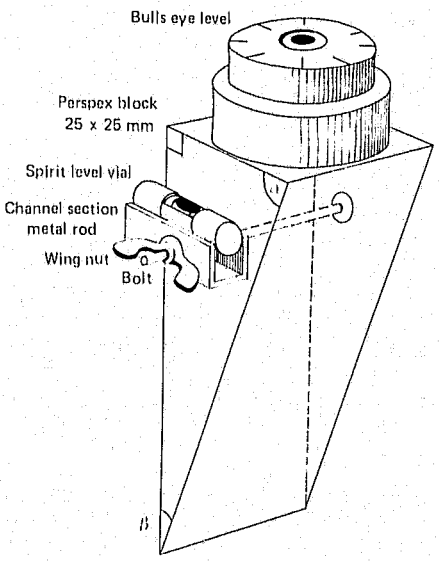
Note 3: In the examples above, coverage has been taken as 1.4m x 2.1m. This is more than ample coverage for photographing 1m squares, so that the dimensions given are not in the least critical. If an accurate construction and careful use can be assured, the coverage could well be reduced to, say 1.2 x 1.8m. This can be achieved after construction by cutting off the bottom of the column, as the column angle depends only on the focal length of the lens used, and it is the length of the column which determines areal coverage (for a given lens). Thus a support can be made with two or three detachable sections to give different scales of areal coverage.

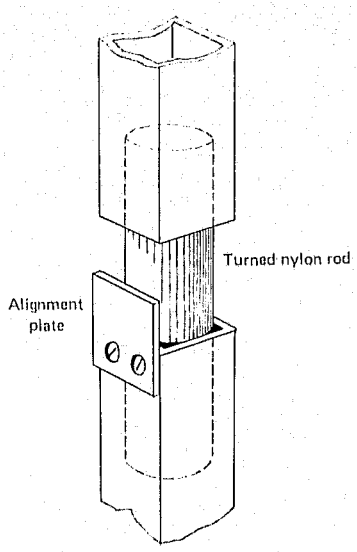
Note 4: The most critical part of the construction is cutting of the mitre, as a 1' error will shift the photographed area approximately 5cm relative to the base of the support. It is for this reason that I have chosen very generous areal coverage for a 1 metre square in the examples above, so that errors of one or two degrees can be accommodated.

Construction Details

The metal plate (Fig.2a) which supports the camera need only be as wide as the supporting column, and can be attached to the mitred end with epoxy glue and perhaps a bolt for safety. The camera tripod screw passes through a hole in this plate: this hole is best made as a slit by drilling two holes side by side and filing out the space between, so that the camera can be slid up against the guide at the top of the metal plate. This guide serves to maintain the camera in line with the column. The triangular perspex block (Fig.2b) holding


Guide to locate camera back
Camera tripod screw
Slot
Mitre angle
β
Metal plate glued or bolted to mitred column
Aluminium tube - 25 mm square section 2 mm thickness
α
Vertical
Horizontal


Bulls eye level
Perspex block 25 x 25 mm
Spirit level vial
Channel section metal rod
Wing nut
Bolt
β


Turned nylon rod
Alignment plate

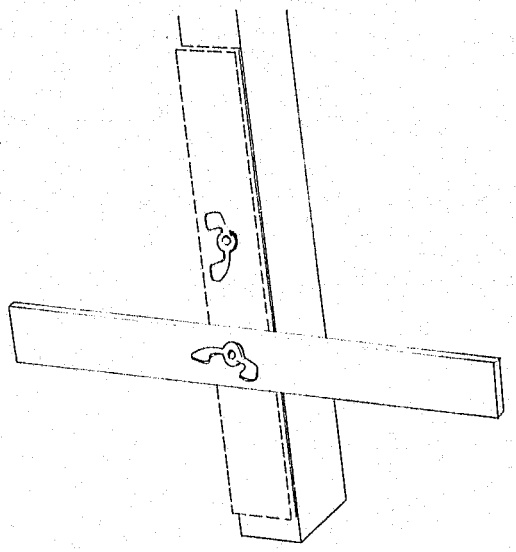


Fig 2

the bubble levels can be attached to the column with epoxy glue, and the levels can be glued onto the block. The (optional) joint(s) in the middle of the column are a more difficult problem, and are best entrusted to a workshop technician, as they must be rigid and maintain the two halves in line. On my prototype, a solid nylon rod was turned to fit tightly inside the two halves (Fig.2c), and this has proved very rigid and easy to assemble. The base of the column can profitably be fitted with a rubber foot (e.g. a rubber bung pushed into the end of the tube) to increase friction and protect the surface on which the foot is placed.

Design Calculations

$\ell$ = length of column to centre of mitre (cm). The addition of approximately 6 cm gives the total length of column required before the mitre is cut

f = focal length of lens (cm)

$\alpha$ = angle between column and horizontal (degrees)

$\beta$ = angle between column and vertical = 90 - $\alpha$ (degrees)

We assume that the optical centre of the camera lens is at the same level as the centre of the mitre, and offset 4 cm horizontally from it. This assumption is satisfactory for all 35 mm or 6 x 6 cameras.

For coverage of an area w x 1.5w on 35 mm film:

$\frac{\text{Image size}}{\text{Object size}} = \frac{2.4}{w} = \frac{f}{d-f}$ (from standard optical equations, d = distance from lens to surface photographed)

$d = (w/2.4)f$ .....(1)

$\ell = \sqrt{d^2 + (w/2)^2}$ .....(2) (by Pythagoras)

$\alpha$ = Arctan $(d/\frac{1}{2}w)$ = Arctan $(2d/w)$.....(3)

For coverage of an area w x w on 6 x 6 film, only equation 1 need be changed to:

$d = (w/6)f$.....(1a)

For coverage of an area 1.4 m x 2.1 m on 35 mm film (a suitable size for photographing 1 m squares with ample safety margin):

| | 55 mm lens | 50 mm lens | 35 mm lens |
|---|---|---|---|
| $d = (w/2.4)f$ | d = 325 cm | d = 295 cm | d = 207 cm |
| $\ell = \sqrt{d^2 + (w/2)^2}$ | $\ell$ = 328 cm | $\ell$ = 300 cm | $\ell$ = 216 cm |
| $\alpha$ = arctan(2d/w) | $\alpha = 78^0$ | $\alpha = 76.5^0$ | $\alpha = 71^0$ |

For coverage of an area 1.4 m x 1.4 m on 6 x 6 film with a standard 80 mm lens:

d = 187 cm $\quad \ell$ = 199 cm $\quad \alpha = 69.5^0$

# APPENDIX II

## Attribute and classificatory system used in the analysis of Capertee site 3

This appendix is intended as an example to illustrate the type of attribute and classificatory systems which can be used with the data recording system described in chapter 8. It also serves to define the attributes used in my analysis of the Capertee 3 material and to outline some of the reasons for the choices made. The attribute system goes beyond those attributes which I have actually discussed in chapter 5, as I have not made use of all the data recorded.

UNINDIVIDUALISED FINDS

The present structure of the excavation data file accommodates two sorts of classification for the unindividualised finds: raw material classification for all finds and size classification for lithic finds alone. Further classification, e.g. of bone fragments, could be added easily to the existing structure. The present structure should, however, prove adequate for most excavations. I have not made specific allowance for the extra information available from shell where it is an important component of the sediment matrix, but the addition of such information to the present data structure would present no problems.

Raw material classification will depend on the materials present and preserved on the site(s) in question. Therefore, with the exception of charcoal which I have defined as raw material 1, I have simply numbered the various raw material classes on my coding forms (fig. 66) so that they can be defined as required. The forms allow the recording of counts and weights (except for charcoal which will be recorded by weight alone since it suffers considerable post-depositional fragmentation).

The data from the raw material and size classifications of the unindividualised finds can be added onto the excavation data file using ADDRM and ADDSIZ (see appendix of computer programs - IV), or they can be entered on the in-field coding forms (fig. 61) prior to the creation of the excavation data file. Note that once this file has been created, further data additions must be made using the laboratory coding forms (fig. 66,67) and the appropriate programs - ADDRM, ADDSIZ, ADDAT, ADDODS.

Raw material classification

Because of the difficulty of identifying raw materials from small stone fragments, I restricted raw material classification to easily recognisable classes:

(1) Charcoal;
(2) Fine grained isotropic materials ('cherts');
(3) Granular or crystalline materials ('coarse');
(4) Quartz;
(5) Bone;
(6) Shell;

Size classification

Mulvaney and Joyce (1966:181) pioneered the size classification of 'waste' material in Australia by shaking it through a pair of sieves (0.5 and 0.75 inch mesh) and counting the number of flakes retained. More recent authors have used various length, area or weight classes (e.g. Pearce 1978, White 1972, Lampert 1971a,1979). Clearly we have a problem of comparability which must be resolved if we are to progress to making use of this information at an inter-site level.

I made use of weight as a size criterion in my analysis of the Blue Mountains and Capertee material for the following reasons:

1. Weight can be defined unambiguously and measured repeatably and extremely rapidly. One can quickly learn to pick out specimens over a given weight from a pile, without having to sort through the pile object by object;

2. Weight is more sensitive to change in size than a linear or area measurement as it varies as the cube of linear measurement;

3. Weight is sensitive to the 'chunkiness' of an object. I therefore considered it a better discriminator of the difference between the more regular <u>debitage</u> of the Bondaian and the irregular shattering of the Capertian at Capertee 3;

4. Unlike linear dimensions or areas, weights are cumulative, i.e. can be added together for a given stratigraphic level or size class.

In retrospect, although weight is probably the best discriminator of the Capertian and Bondaian, I think it is a poor measure of 'size' as we perceive it, since weight is strongly biassed towards the shape of an object. For example, a 1 cm cube shatter fragment typically weighs more than a 2 - 3 cm long flake or blade, although we perceive the latter as being 'larger'. This probably makes it a poor attribute for recording if we wish to use 'size' to investigate questions of site maintenance activities which have been found to be size-influenced in contemporary Aboriginal sites (O'Connell, pers. comm., Meehan and Jones, pers. comm.). A second problem with weight is the difference in specific gravity of different raw materials. In the case of Capertee 3 this was not a serious problem since the specific gravity of all lithic material lay within ± 5%. In other cases it could be allowed for by dividing weight by the average specific gravity for the raw material in question.

An additional reason for choosing a weight classification of the unindividualised material was that weight was one of the attributes measured on the individualised finds, and a weight classification would therefore allow the construction of a complete histogram for artefact weights. The classes chosen were as follows:

(1) Less than 1 gm;
(2) 1 - 1.9 gm;
(3) 2 - 2.9 gm;

Finds weighing 3 gm or over (2 gm for Q12-14) were transferred to the individualised finds category.

In terms of convenience and speed of classification, weight has much to recommend it as a classificatory attribute for unindividualised finds. On my coding forms I have detailled suggested class boundaries for length and area as well as for weight. Whilst area is a lot more troublesome to use as a classificatory attribute for the unindividualised lithic finds, I think it is probably a better measure of 'size' when it comes to examining the effects of site maintenance activities or vertical displacement of material through treadage and scuffage. I would suggest that, if possible, both a weight and area classification should be applied.

INDIVIDUALISED FINDS

The coding of individualised finds may in many ways present less problems than the coding of unindividualised finds. This is because the attributes of each find are recorded individually so that metric attributes can be grouped a posteriori into size classes, or combined into ratios or other secondary attributes, without one having to choose class boundaries or attribute combinations before analysis. Also, because individualised finds are likely to be less numerous than unindividualised ones, one can afford to spend much more time on each specimen and to record several different attributes rather than applying a single classificatory criterion. I shall describe below in detail the attribute system I used for the Capertee 3 lithic artefacts. An attribute system for bone would require further work by someone more competent in this line than myself and I did not require a bone attribute system for the analysis of Capertee 3. However, bone attributes can easily be inserted using the existing ADDAT program provided they are coded numerically. When it comes to analysis one can select 'bones' or 'lithic artefacts' simply by using the raw material variable. If 'tools' are required for analysis, one selects for lithic raw material and non-zero values for either the worked edge attributes or typological class.

Attributes for lithic finds

The design of an attribute system for stone artefacts is necessarily a series of compromises between complete description and ease of recording. Not only does a complex attribute system necessitate a great deal of time expenditure if one is to record a reasonable sample of artefacts, but the more complex the attribute set the larger must be the sample. A further problem is the difficulty of adequately defining a complex attribute system in such a way that the recording of attributes is repeatable.

This preamble is meant to underline the point that detailed attribute systems should be devised to answer specific problems and not as a general description of stone artefacts. On the other hand, a range of basic attributes such as length, breadth, weight, raw material, edge length, edge angle, retouch type and retouch extent, are common to many studies. I have combined these attributes into the

VARIABLE LIST RECTYPE,SITE,SECTION,SQUARE,EXCVUNIT,FEATURE,ANALUNIT,ANLUDIVN,
SUBSQ,OBJECT#,XCOORD,YCOORD,ZCOORD,
RAWMATER,MASS,SUPPORT,CORTEX,LENGTHMM,WIDTHMM,THICKMM,
TOOLTYPE,EDGENO,EDGELEN,CONTOUR,EDGEANGL,RETPOSN,
RETYPE1,HTA1,HTB1,POL1,RETYPE2,HTA2,HTB2,POL2

INPUT FORMAT FIXED(I1,A3,A1,A3,I3,2I2,A1,A2,
I3,2X,2I3,2I4,F5.1,2I2,2I4,I5,I3,2I4,I2,I4,10I3)

According to your INPUT FORMAT, variables are to be read as follows:

| Variable | Record | Columns | Print Format |
|---|---|---|---|
| RECTYPE | 1 | 1 - 1 | (0) |
| SITE | 1 | 2 - 4 | (A) |
| SECTION | 1 | 5 - 5 | (A) |
| SQUARE | 1 | 6 - 8 | (A) |
| EXCVUNIT | 1 | 9 - 11 | (0) |
| FEATURE | 1 | 12 - 13 | (0) |
| ANALUNIT | 1 | 14 - 15 | (0) |
| ANLUDIVN | 1 | 16 - 16 | (A) |
| SUBSQ | 1 | 17 - 18 | (A) |
| OBJECT# | 1 | 19 - 21 | (0) |
| XCOORD | 1 | 24 - 26 | (0) |
| YCOORD | 1 | 27 - 29 | (0) |
| ZCOORD | 1 | 30 - 33 | (0) |
| RAWMATER | 1 | 34 - 37 | (0) |
| MASS | 1 | 38 - 42 | (1) |
| SUPPORT | 1 | 43 - 44 | (0) |
| CORTEX | 1 | 45 - 46 | (0) |
| LENGTHMM | 1 | 47 - 50 | (0) |
| WIDTHMM | 1 | 51 - 54 | (0) |
| THICKMM | 1 | 55 - 59 | (0) |
| TOOLTYPE | 1 | 60 - 62 | (0) |
| EDGENO | 1 | 63 - 66 | (0) |
| EDGELEN | 1 | 67 - 70 | (0) |
| CONTOUR | 1 | 71 - 72 | (0) |
| EDGEANGL | 1 | 73 - 76 | (0) |
| RETPOSN | 1 | 77 - 79 | (0) |
| RETYPE1 | 1 | 80 - 82 | (0) |
| HTA1 | 1 | 83 - 85 | (0) |
| HTB1 | 1 | 86 - 88 | (0) |
| POL1 | 1 | 89 - 91 | (0) |
| RETYPE2 | 1 | 92 - 94 | (0) |
| HTA2 | 1 | 95 - 97 | (0) |
| HTB2 | 1 | 98 - 100 | (0) |
| POL2 | 1 | 101 - 103 | (0) |

| | |
|---|---|
| RECTYPE | RECORD TYPE/ |
| SITE | SITE NAME/ |
| SQUARE | SQUARE IDENTIFIER/ |
| SECTION | SUBDIVISION OF SITE/ |
| EXCVUNIT | EXCAVATION UNIT NUMBER/ |
| FEATURE | FEATURE NUMBER, IF APPLICABLE/ |
| ANALUNIT | ANALYSIS UNIT OR STRATIGRAPHIC LEVEL/ |
| ANLUDIVN | SUBDIVISION OF ANALYSIS UNIT/ |
| SUBSQ | SUBDIVISION OF EXCAVATION SQUARE/ |
| OBJECT# | OBJECT NUMBER/ |
| XCOORD | X COORDINATE/ |
| YCOORD | Y COORDINATE/ |
| ZCOORD | Z COORDINATE/ |
| RAWMATER | RAW MATERIAL/ |
| MASS | OBJECT WEIGHT IN GM./ |
| SUPPORT | SUPPORT PIECE TYPE/ |
| CORTEX | CORTEX RATING/ |
| LENGTHMM | OBJECT LENGTH IN MM/ |
| WIDTHMM | OBJECT WIDTH IN MM/ |
| THICKMM | THICKNESS OF OBJECT IN MM/ |
| TOOLTYPE | TYPOLOGICAL CLASSIFICATION FOR TOOLS AND CORES |
| EDGENO | RETOUCHED OR UTILISED EDGE NUMBER/ |
| EDGELEN | LENGTH OF WORKING EDGE IN MM/ |
| CONTOUR | SHAPE OF WORKING EDGE/ |
| EDGEANGL | EDGE-ANGLE AT MIDPOINT IN DEGREES/ |
| RETPOSN | DISPOSITION OF USE OR RETOUCH/ |
| RETYPE1 | RETOUCH TYPE FOR HEAVIER USE-RETOUCH ON EDGE/ |
| HTA1 | EXTENT OF SECONDARY RETOUCH/ |
| HTB1 | EXTENT OF TERTIARY RETOUCH/ |
| RETYPE2 | RETOUCH TYPE FOR LIGHTER USE-RETOUCH ON EDGE/ |
| HTA2 | EXTENT OF SECONDARY RETOUCH/ |
| HTB2 | EXTENT OF TERTIARY RETOUCH/ |

The INPUT FORMAT provides for 34 variables and 1 record(s) per case.

Table 1 Variables and format for individualised finds

system I used for Capertee 3. I have described this system below as an example of a general-purpose attribute system suitable for cataloguing and initial analysis. It would probably prove sufficient in cases where the excavator has no special interest in lithic morphometry, although it does require further development and refinement and better definition of some aspects.

Because there is no sharp dividing line between 'waste', utilised and retouched pieces at Capertee, and because individual assessments of these categories vary, I have avoided the common practice of separating out 'tools' from 'waste' and treating these categories separately. Thus the same basic attributes (length, width, weight, raw material, forme type and cortex rating) are recorded for all individualised lithic finds, whether they show traces of use/retouch or not. Though some of these attributes may be affected significantly where extensive modifications have been applied to produce the tool (e.g. in the case of backed implements), in most cases the basic attributes, which are in effect the forme attributes, can be considered independantly of the worked edge(s).

Attributes can be added to the excavation data file using ADDAT (appendix IV). Fig. 60 shows the flow diagram for data recording. The coding form on which the attributes are recorded before being keyed in is shown in fig. 67. When attributes are recorded for more individualised finds than appear on the excavation data file, the extra finds are added in at the end of the appropriate excavation unit and their coordinates field is left blank. The programs also check to see that the structure of the excavation data file is correct.

Raw material (attribute 4)

A variety of lithic raw materials occurred in the Capertee 3 assemblage, but they are difficult to distinguish consistently, for two main reasons:

1. The texture of the stone used is widely variable and grades from one sort into the next. In some cases, this even occurs within a single piece;

2. Colour is largely dependent on staining and patination, the grey surface levels containing grey-stained flakes and the other 'clean' levels yellow and deeply patinated umber flakes. When broken these colours turn out to be developed on a base material of neutral colour.

My division of raw materials gradually reduced as I realised that I could not consistently distinguish them. My final division is as follows:

Code 1: Cherts, jasperoid and fine-grained silicified mudstone. This group is by far the commonest at Capertee 3 and represents a range of fine-grained, isotropic siliceous material. True cherts are relatively uncommon, the bulk of the material falling into the jasperoid class (Watchman, pers.comm.). Some of this material occurs as tabular pieces which have a tendency to split along cleavage lines or to shatter irregularly, and this is particularly noticeable in the Capertian;

Code 2:Coarse granular materials, excluding sandstone, quartzites or volcanic material. This category of material appears to be a coarser facies of material type 1, and the two types are occasionally been observed together in the same specimen. Fracture may be roughly isotropic or more generally by cleavage or irregular breakage;

Code 3:Quartz. Quartz is fairly uncommon. Some large pieces occur in the Capertian. Occasional difficulties arose in distinguishing small chips from the shattered fragments of gravel derived from the sandstone roof of the shelter, so the distribution of unindividualised quartz can only be taken as approximate. The distinction between natural and flaked quartz was made on the basis of the colour ( the natural quartz was generally pink-stained whereas the flaked quartz was always white) and the presence/absence of rounded facets typical of the quartz gravel in the sandstone;

Code 4: Quartzite, silcrete and other crystalline material, including volcanic material. This category is uncommon and almost entirely restricted to the Capertian. Objects in these materials are most commonly pebbles or pebble decortication flakes. The different materials making up this category were initially distinguished, but their frequencies were so low and their occurence, both in terms of stratigraphic position and forme, were so similar that I have combined

them into a single category;

Code 9: Ferruginous sandstone. This material occurs as hard bands in the walls of the rockshelter and as fragments in the deposits. A few of these appear to have been flaked and have therefore been treated as artefacts; They occur only in the Capertian.

Code 11: Charcoal fragments;

Code 12: Faunal material;

Code 13: Shell;

Code 99: Finds which have gone missing between excavation and coding are given raw material code 99, so that if they are found later their 3D coordinates have not been lost from the excavation data file. (this procedure is preferable to simply deleting the corresponding record from the file).

Weight (attribute 5)

Weight is probably the most useful attribute after raw material, for a number of reasons stated earlier. Weights were measured to 1/10th gm on a digital balance. In the lower levels much of the material was heavily concreted, and where this was judged to amount to more than a couple of percent of the volume of the object itself the bulk of it was removed by carefully picking off with a metal point. The errors associated with the remaining concretion are, on the one hand, well within the limits of error on the other attributes, and on the other hand well below the level of differences likely to be of archaeological significance.

Forme (Lithic finds only, attribute 6)

Owing to the unstandardised nature of much of the lithic material, a simple forme classification was adopted to ensure consistency. The 'noise' introduced by inconsistent classification would, I believe, wipe out the benefits of any more detailed classification. The following categories were adopted:

Code 1 Whole flakes on which the position of the bulb of percussion and striking platform were evident. If there was any doubt about the

position of the bulb of percussion, the flakes were relegated to the flake fragment class;

Code 2: Flake fragments: Pieces which appear to have been detached from a larger 'nucleus' of material by isotropic fracture, identified by the presence of a positive flake scar (ventral surface). There is a difficult borderline between large, chunky flake fragments and core fragments, particularly where a core shatters. This category will also comprise a proportion of whole flakes where the characteristic features of the flake are not sufficiently well developed for positive identification of the flake as being whole;

Code 3: Cores: Pieces which have acted as a source of primary flakes, detached by isotropic fracture. Exceptionally large chunky flakes may have served as a core, and in this case the core classification will take precedence over the flake classification. Essentially, the shape of a core must be significantly modified by flake removals. A shatter fragment (code 4) may remove parts of the surface of a core without itself being classed as a core;

Code 4: Shatter fragment/chunk: Pieces resulting from non-isotropic fracture other than tabular cleavage (code 6), often occurring in an apparently isotropic material. Shatter fragments may have one or two flake removals (negative scars), but their shape is primarily determined by breakage along lines of weakness or through flexion and/or torsion breakage;

Code 6: Tabular fragment: These pieces are produced when tabular material splits along cleavage lines and may or may not be the direct result of man's intervention. They may be analogous to flakes when they have been split by a blow directed parallel to the cleavage plain, or to shatter fragments when the blow has shattered a slab of material. Where a shatter fragment has been produced from tabular material capable of isotropic fracture, the fragment is given code 4. The grouping of different forms of tabular piece, ranging from thin laminae to shattered chunks and unretouched fragments, into a single category is considered justified because the frequencies of the individual types is low and these intractable materials do not seem to have been retouched into any recognisable tools, or for that matter to show traces of utilisation. They may represent either an optimism on the part of the stone worker which was quickly shattered, or unmodified 'tools of fortune', on which use is not apparent due to the coarseness of the raw material. Stick fractures, giving rise to

elongated pieces with an oblong cross section through breakage along the edge of a slab of tabular material, were originally distinguihsed from other tabular pieces, but owing to their low frequency of occurrence (13 in the Capertian and none in the Bondaian) they have been combined with this category;

Code 10: Pebbles and pebble fragments. Shattered fragments of pebbles make up the bulk of this category. These may represent use as hammerstones or within hearths. As much of the material at Capertee appears to have been derived from the river bed, cores and flakes showing some pebble cortex have been included in their appropriate class rather than as pebble fragments.

Cortex rating (Lithic finds only, attribute 7)

The presence of cortex was rated on a nominal scale from 0-10 with the aim of giving a rough indication of the importance of primary stoneworking, as opposed to secondary retouching or flaking of roughed-out cores. The latter are likely to produce a lower proportion of flakes and cores with large amounts of cortex.

Code 0: No cortex;

Flake fragments and whole flakes (See fig. 1)

Code 1: Small patches, comprising up to 10% of the dorsal surface and/or the whole of the striking platform;

Code 2: Large patches of cortex, up to 50% of the dorsal surface;

Code 3: Cortex over the greater part of the dorsal surface (up to 90%);

Code 4: Almost the whole surface is covered by cortex (more than 90%);

Typical decortication flakes fall in categories 3 or 4.

Pebbles, cores, shatter fragments and tabular pieces

Code 5: Small patches of cortex, less than 10% of the surface area;

Code 6: Large patches of cortex, 10 to 30% of surface area;

Code 7: Roughly equal cortex and non cortex, 30-70%;

Code 8: Predominantly cortex, more than 70%;

Code 9: Unretouched, entirely cortex;

Code 10: Indeterminate: on many poor quality tabular fragments it is impossible to distinguish cortex from fracture surfaces.

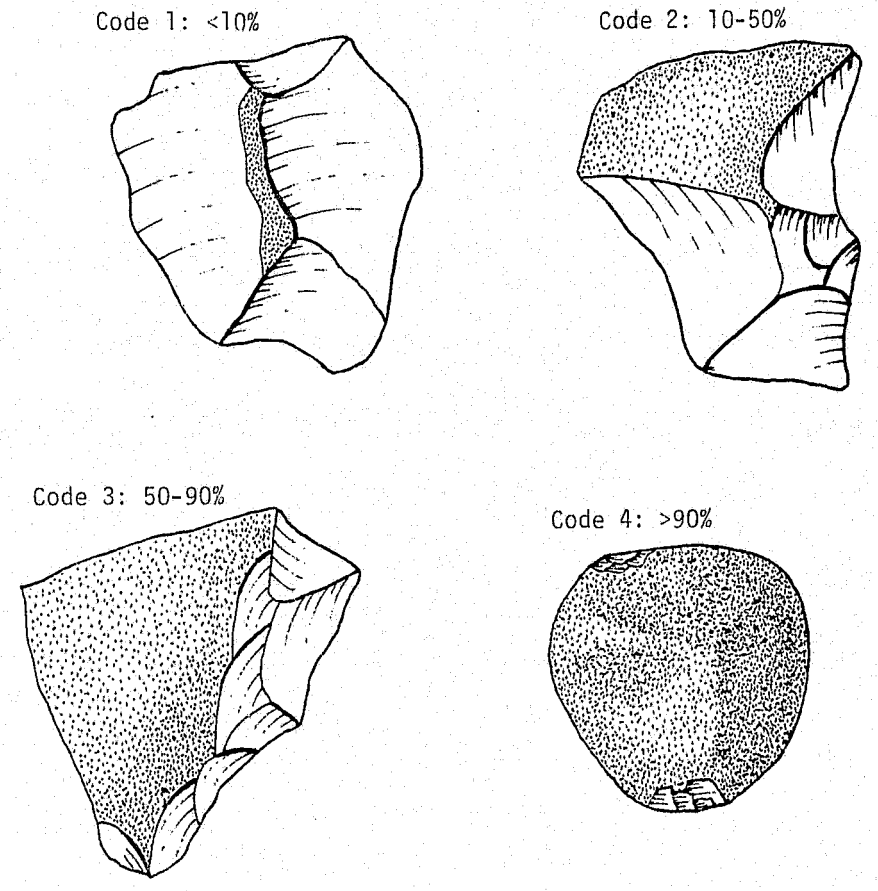



Fig. 1 Cortex rating codes for flakes

Length and breadth (attributes 8 and 9)

Lengths and breadths were measured to the nearest mm using graph paper. Length and breadth of flakes and tools are generally measured as 'the maximum dimension of the implement in the normal plane...(and) the maximum dimension in the normal plane at right angles to the direction of length' (Jones 1971:328-9, see also Lampert 1971:16 and White 1969) On the other hand, some workers measure the length of a flake in the axis of the blow which detached it. Both methods have their merits and demerits. On the one hand, I do not think that many workers would actually stick to the definition given by Jones (ibid. and pers. comm.) since the maximum dimension of, say, a sub-rectangular flake is the diagonal and not along the axis of symmetry as common sense dictates. On the other hand, the measurement of length in the axis of the blow is only applicable to flakes. I have therefore chosen the slightly less informative, but much more widely applicable use of length and breadth determined only by the shape of the artefact. Length and breadth of an artefact are taken as the length and breadth of the enclosing rectangle of minimum area in a plane at right angles to the minimum overall dimension. If the item is a whole flake and is sidestruck (i.e. shorter in the axis of the detaching blow than at right angles to it), the greater dimension of the rectangle is taken as the breadth and the shorter dimension as the length.

This procedure is obviously open to some criticism, but I believe brings out the essential differences in flake shape of the Capertian and the Bondaian, whilst at the same time allowing a compatible set of measurements for both whole flakes and other types of artefact.

Typological categories (attribute 11)

The following pages provide a brief list of the typological categories used in my classification of the Capertee 3 material. They are intuitively defined types which should be considered as provisional and subject to modification once attribute analysis of the material has been completed. For this reason I have provided only sketchy definitions or referred to definitions published elsewhere. My definitions should however be sufficient to allow the correlation of my types with major categories defined by other workers. I have

commented in my concluding chapter on the need for a well defined common typology in order to allow the comparison of material collected from different areas and I realise that my use of yet another typology does not aid this goal. However I did not feel that published typologies were satisfactory for the description of the Capertee material and, pending some sort of consensus, I doubt whether there is much advantage in sticking to an extant typology.

My typological categories are divided into a number of groups identified by the first digit of the type code. The second digit identifies the particular type within that group. The groups are as follows:

1) Backed implements;
2) Redirecting spalls;
3) Specialised knapping techniques;
4) Small adze flakes or scrapers;
5) Small scrapers;
6) Large scrapers;
7) Denticulate, notched and serrated pieces;
8) Simple cores and hammerstones or pebble fragments;
9) Miscellaneous.

It should be noted that these groups are groups of convenience rather than strictly grouping together similar artefacts. For example the simple cores of group 8 are closer to some of the more specialised cores of group 3 than they are to hammerstones or pebble fragments which are grouped with them. Entries of the form N21 17-21 refer to the catalogue numbers of artefacts illustrated in chapter 5 (figs. 39-43).

Group 1 : backed implements

Backed implements have been defined by numerous authors, e.g. McCarthy, Brammell and Noone(1946:40-43), McCarthy (1976:44-49), Glover (1969:36), Pearce (1974a:300), Mulvaney (1975, 1978). The terms used vary from microlith to backed blade, with special types such as the elouera falling outside these categories. I use the term backed implement to apply to all specimens with abrupt 'backing' retouch of one or more margins. I have commented in chapter 5 on the problem of distinguishing 'backing' and other sorts of retouch in borderline

cases. A number of specimens are illustrated in fig. 41.

10 : whole backed implement, unutilised chord;

11 : basal fragment or specimen with unfinished tip (these two types were combined because of the difficulty of reliably distinguishing them). N21 17-21;

12 : tip fragment. Q14 8-51, Q14 9-79, Q13 11-14, Q13 13-12, Q13 10-69, O20 9-20, N20 9-89, O20 9-23;

13 : other fragment;

14 : backed implement with slight chord damage, possibly due to natural causes;

15 : backed implement with nibbled edge damage or slight edge damage along the full length of the chord. N20 4-47;

16 : backed implement with well marked chord damage similar to that observed on eloueras (McCarthy, Brammell and Noone 1946, Kamminga 1977) but not of broad orange-segment or rectangular outline. O21 15-9;

17 : elouera corresponding with McCarthy's definition;

19 : truncated bladelets - bladelets on which one end has been obliquely or transversly truncated by retouch similar to that on the 'backs' of backed implements.

Group 2 : redirecting spalls

Redirecting spalls are elongated flakes or blades removed along the length of a ridge which has previously been retouched or utilised. Criteria for identifying them have been laid out in chapter 5.

i -5; 20 : 'Classic' redirecting spall - a triangular section blade. Often with a pronounced twist, and showing clear retouch or heavy edge damage on the dorsal ridge. Several specimens are illustrated in fig. 40;

21 : Normal small redirecting spall - a smaller blade, generally less than 3 cm in length, with minor retouch or use damage on the dorsal ridge. The dorsal ridge is approximately a median ridge and the section approaches an equilateral triangle;

22 : 'peeling' small redirecting spall - as 21 except that the spall has been removed primarily from the face of the ridge bearing retouch and therefore 'peels off' the retouched area;

23 : 'truncating' small redirecting spall - as 21 except that the

spall has been removed primarily from the face of the ridge without retouch and therefore truncates the ends of the flake scars on this ridge;

24 : outrepasse redirecting spalls - spalls which have started off as a narrow blade but have then broadened or thickened to remove a large chunk of the parent piece;

25 : tiny abruptly retouched convex-edged redirecting spalls - this category groups together several very characteristic spalls which have removed a tiny neatly trimmed steep convex edge (fig. 43: N20 6-33);

27 : large flake or chunk redirecting spall;

28 : small flake or chunk redirecting spall;

These two categories, arbitrarily separated, probably represent the accidental production of what is technically a redirecting spall since it bears retouch on a dorsal ridge. They are short broad flakes or shapeless chunky flakes, generally with only a little retouch on the dorsal ridge;

29 : small fortuitous redirecting spalls - these are tiny chips which have some traces of retouch or edge damage on the dorsal ridge. They can arise easily during core reduction or even by chance fracture when a piece of stone is dropped or stepped on. They are very unstandarised and I am confident that they are accidental products.

Group 3 : specialised techniques

31 : polygonal blade cores;

32 : outrepasse blade core fragments;

33 : core rejuvenation fragments (flakes removed across the striking platform of a core - fig. 43: Q13 39-10 and McCarthy 1967 fig. 6:7);

34 : flakes or blades with neatly facetted butts;

35 : bipolar scaled pieces;

36 : fragment of ground tool.

Group 4 : small scrapers or adze flakes

These are small flakes with a fairly regular rectangular outline characterised by fine regular retouch or heavy use-scaling on one or both elongated margins.

40 : thin bimarginal, bifacial edge modification (fig. 39: Q14 8-25);
41 : thick bimarginal, bifacial edge modification (fig. 39: 021 11-15);
42 : thin single margin unifacial edge modification (fig. 39:021 16-21);
43 : thick single margin unifacial edge modification (fig. 39: M21 9-9);
44 : thin single margin with utilisation traces similar to those observed on many elouera ;
45 : naturally backed flake with similar use traces opposite the back (fig. 39: L21 6-10);
46 : L shaped fractured tools (fig. 43: N21 17-12).

Group 5 : small scrapers

These are specimens with clearly defined fine regular retouch on one or more edges.

50 : end scraper - a blade or bladelet with one or both ends retouched into a small convex (fig. 43: N20 6-32);
51 : thumbnail scraper - a small thin flake, less than 2 cm across with one side retouched into a neat convex edge (fig. 43: N21 17-59);
52 : convex scraper edge on larger piece - a short length of well defined retouch forming a small convex edge or nose on a moderate sized flake, typically 3-5 cm long;
53 : steep edged scraper - several specimens are illustrated in fig. 42 (Q13 34-27, Q12 39-5) which also serves to illustrate how this type merges into small single-platform cores;
59 : small lengths of retouch on small to medium flakes. These may be slightly convex, straight or concave.

Group 6 : large scrapers

60 : large flake or chunk with length(s) of retouch on low to medium angled edges;

61 : large steep retouched scraper;

68 : heavy edge damage or sporadic retouch on moderate to low angled edge of large flake or chunk;

69 : chunk with traces of use or battering.

Group 7 : denticulate, notched and serrated pieces

70 : 'saw' as defined by McCarthy (1976:36), i.e. a finely serrated edge formed by regularly spaced removals of tiny flakes from a low to medium angled edge;

71 : denticulate piece - a flake with two or more adjacent notches formed either by a single blow or a series of flake removals (fig. 43: Q14 6-3);

73 : notched piece - specimens with a single notch formed by a single blow or more commonly a series of flake removals.

Group 8 : simple cores, hammerstones and pebble fragments

80 : single platform core (fig. 42: Q13 36-7, Q13 34-6, Q13 21-1);

81 : core with irregular or multiple platforms;

82 : core fragment;

83 : horsehoof core;

84 : pebble core;

85 : crystalline pebble fragment or hammerstone.

Group 9 : miscellaneous

90 : miscellaneous;

91 : possible traces of utilisation which may be attributable to natural causes rather than use.

WORKED EDGE CODING

The quantification of retouched and utilised edges was carried out using a slightly modified version of the attribute system originally proposed by Jones (1971:328-336) and since used by a number of other workers (e.g. Allen 1972, Flood 1973, Townley 1974). The present system is compatible, except in the detail of definition of retouch types, with that used by Jones, but I have added in the

ability to distinguish two different types of edge modification on the two surfaces forming each worked edge and, if applicable, whether the most severe modification is on the dorsal or ventral surface.

Edge number (attribute 12)

Edges are numbered from 1 upwards on each piece. An edge is defined as a length of perimeter showing a consistent retouch type and without a pronounced discontinuity in edge line.

Edge length (attribute 13)

This was measured along the perimeter of the retouched or utilised edge using a ruler if convex or straight or, if markedly concave, a piece of cotton. Measurements are im mm.

Edge shape (attribute 14)

Code 1 : Nosed Code 2 : Very convex Code 3 : Convex
Code 4 : Straight Code 5 : Wavy Code 6 : Concave
Code 7: Very concave or notched Code 8 : Denticulate
Code 9 : Indeterminate

These codings follow the definitions proposed by Jones (1971)
A denticulate edge is a series of closely spaced notches, not to be confused with the term dentate which has been proposed (Stockton 1978) for the serrated edge produced by closely spaced flake removals and which is characteristic of McCarthy's 'saw' (McCarthy 1964).

Edge angle (attribute 15)

Edge angle was measured at the midpoint of the worked edge using a contact goniometer and was recorded to the nearest five degrees. Higher precision of recording was not considered useful, on the one hand because of the uncertainty in making the measurement and on the other hand because the sort of differences in edge angle likely to represent fundamental functional differences are likely to be fairly gross (e.g. obtuse, steep, moderate and low angle). My purpose in examining edge angle being primarily to detect possible functional groupings, it might seem that the edge angle should be measured

immediately at the intersection of the two surfaces forming the edge. This measurement is probably, however, of little functional significance, as low-angle 'knife' edges may well have slight damage approaching 90 degrees on the very edge, whilst a robust edge suitable for working softwoods might have an angle of 60 degrees or less. Jones (ibid.:334) measured edge angle at a distance of 5 mm from the edge, thus effectively eliminating the influence of edge damage. Rather than defining an arbitrary distance such as 2 mm (5 mm would be too much for the Capertee assemblage, much of which is only a few mm thick) I have preferred to measure the angle between the two intersecting surfaces as close to the edge as possible but avoiding the zone of tertiary edge damage, which rarely extends more than 1 mm from the edge.

Disposition of retouch (attribute 16)

Retouch was classified as unifacial if the two surfaces forming the edge showed markedly different degrees of modification, e.g. if one was retouched and the other simply utilised. If the dorsal and ventral surfaces of the specimen could be distinguished, the retouch was classified as dorsal (normal) or ventral (inverse) according to the surface showing the greatest degree of modification. If both surfaces show similar degrees of modification the edge is classed as bifacial.

Code 1 : Unifacial Code 2 : Bifacial
Code 3 : Dorsal Code 4 : Ventral

Edge modification type (attributes 17 and 21)

The different types of edge modification distinguished are illustrated with their corresponding codes in fig. 2. Types 1 and 2 fall in the range of utilisation rather than intentional retouch - the cutoff point at which fine edge damage is considered as being due to post-depositional damage or tramping is arbitrary and difficult to determine, so type 1 must be considered as a rather impure sample of slight utilisation traces. If the edge modification is rated 1, no attempt is made to measure the extent of flake scars, as these will rarely if ever exceed 1 mm in length. Type 3 is typified by the invasive scaled removals seen on some elouera. Types 4 to 7 are

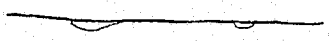
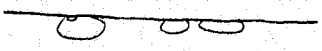
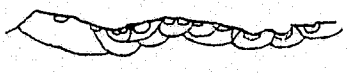
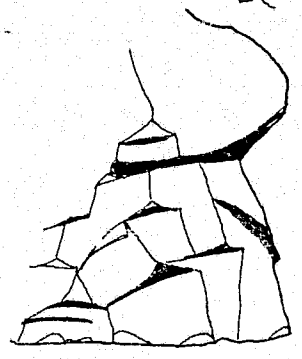
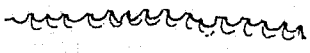
| | | |
|---|---|---|
| Sporadic edge modification | 1 |  |
| 'Nibbled' edge modification | 2 |  |
| Scattered flake removals | 3 |  |
| Retouch on low/medium angled edge, terminated flake scars | 4 |  |
| Invasive scalar retouch | 5 |  |
| Steep scalar retouch with crushing of edge | 6 |  |
| Steep step-fracture retouch | 7 |  |
| Heavily undercut retouch | 8 |  |
| Adze slug retouch | 9 |  |
| Serrated 'saw' retouch | 10 |  |

Fig. 2 Codes for edge modification types

broadly what one might consider as 'scraper' retouch, ranging from regular scalar flakes to steep step flaking and irregular denticulate edges. Type 8 is heavily undercut retouch such as that typical of horsehoof cores. Type 9 is the steep overlapping heavily stepped retouch characteristic of frequently resharpened hafted adze slugs. Type 10 is McCarthy's 'saw' retouch, consisting of regularly spaced single flake detachments, whose crescentic scars intersect to form a series of teeth.

Extent of edge modification (attributes 18,19,22,23)

Jones (ibid.:331) proposes the recording of two measurements of extent of modification (the distance flake scars extend up the surfaces forming the edge). 'Height A' is the distance secondary flake scars extend from the edge, whilst 'Height B' is the extent of tertiary retouch (utilisation). I initially adopted this system for Capertee and I have incorporated it into my coding system, but I have found that very few specimens have more than traces of utilisation extending 0.5-1 mm back from the edge. The few retouched edges have a similar extent of utilisation. In my final coding I therefore eliminated one of the extent attributes (the second) so that the first extent attribute would reflect the difference between edges with intentional modification (characterised by extent measurements of 3 mm and upwards) and those with utilisation traces only, characterised by extent measurements of 1-2 mm.

Note: Where both surfaces forming an edge show traces of utilisation or retouch, edge modification type and extent is recorded for each surface. In practice, edge modification is perhaps a misnomer and would be better termed surface modification, but this is contrary to common usage.

Polish or rounding (attributes 20 and 24)

If one of the surfaces forming an edge has visible areas of polish or if the flake scars on the surface have worn or smoothed marginal ridges, this is indicated by the polish/rounding attribute:
Code 1 : Polish Code 2 : Flake scars smoothed
Code 3 : Intersection of surfaces at edge severely rounded and flake scars smoothed.

# APPENDIX III

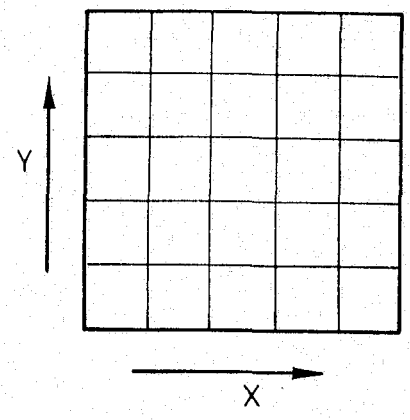
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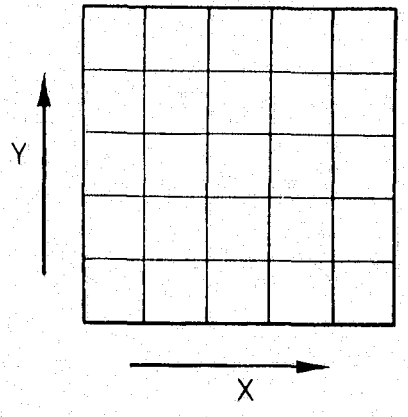
Excavators..... FEATURE ☐☐ STRAT' ☐☐☐ ☐

Date.....

START LEVELS




END LEVELS




COMMENTS

Sediment wt ☐☐.☐ kg

Coarse sieve # ☐☐☐

Coarse sieve wt ☐☐☐.☐ kg

Medium sieve wt ☐☐.☐☐ kg

Fine sieve wt ☐☐.☐☐ kg

| OBJ' | X | Y | Z | DESC' |
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continue overleaf

FIELD CODING FORM - Sheet 1 Coded by: _____ Date: _____

**Record Type 1 : General information**

1 (1) Site (2 3 4) (5) Square (6 7 8) Excavation unit (9 10 11) Feature # (12 13) Strat. level (14 15) (16) Subsquare (17 18)

Sediment wt. (19 20) • (21) kg. Medium sieve residue (22 23) • (24 25) kg. Fine sieve residue (26 27) • (28 29) kg

Coarse sieve residue # (30 31 32) wt. (33 34 35) • (36) kg

| | X | Y | Z start | Z end | X | Y | Z start | Z end |
|---|---|---|---|---|---|---|---|---|
| Start and finish coordinates | (37 38 39) | (40 41 42) | (43 44 45) | (46 47 48 49) | (50 51 52 53) | (54 55 56) | (57 58 59) | (60 61 62) | (63 64 65 66) | (67 68 69 70) |
| | (71 72 73) | (74 75 76) | (77 78 79) | (80 81 82 83) | (84 85 86 87) | (88 89 90) | (91 92 93) | (94 95 96) | (97 98 99 100) | (101 102 103 104) |
| | (105 106 107) | (108 109 110) | (111 112 113) | (114 115 116 117) | (118 119 120 121) | | | | | |

Sieve technique ? Wet/ dry

Sieve mesh: Coarse ____ mm Medium ____ mm Fine ____ mm

**Record Type 2 : Unindividualised finds by raw material**

2 (1) Site (3 4) (5) Square (6 7 8) Excavation unit (9 10 11) Feature # (12 13) Strat. level (14 15) (16) Subsquare (17 18)

Lithic finds < ___ mm (19 20 21) • (22) gm

Organic finds (exc. charcoal) < ___ mm (23 24 25) • (26) gm

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| R.M. 1 | Charcoal | (27 28 29 30) | wt | (31 32 33) • (34) gm | R.M. 2 | _____ | # (35 36 37 38) | wt | (39 40 41) • (42) gm |
| R.M. 3 | _____ | # (43 44 45 46) | wt | (47 48 49) • (50) gm | R.M. 4 | _____ | # (51 52 53 54) | wt | (55 56 57) • (58) gm |
| R.M. 5 | _____ | # (59 60 61 62) | wt | (63 64 65) • (66) gm | R.M. 6 | _____ | # (67 68 69 70) | wt | (71 72 73) • (74) gm |
| R.M. 7 | _____ | # (75 76 77 78) | wt | (79 80 81) • (82) gm | R.M. 8 | _____ | # (83 84 85 86) | wt | (87 88 89) • (90) gm |
| R.M. 9 | _____ | # (91 92 93 94) | wt | (95 96 97) • (98) gm | R.M. 10 | _____ | # (99 100 101 102) | wt | (103 104 105) • (106) gm |
| R.M. 11 | _____ | # (107 108 109 110) | wt | (111 112 113) • (114) gm | R.M. 12 | _____ | # (115 116 117 118) | wt | (119 120 121) • (122) gm |

Site ☐☐☐ Square ☐☐☐ Excavation unit ☐☐☐

FIELD CODING FORM Sheet 2

Coded by : _____ Date: _____

**Record Type 3 : Unindividualised finds : size classification (lithic finds only)**

3 (1) Site ☐☐☐ ☐ Square ☐☐☐ Excavation unit ☐☐☐ Feature ☐☐ Strat. ☐☐ ☐ Subsquare ☐☐ (18)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Artefact weights | < 1 gm # ☐☐☐☐ (19) | wt ☐☐☐.☐ gm | 1 - 1.9 gm # ☐☐☐☐ | wt ☐☐☐.☐ gm (34) |
| | 2 - 2.9 gm # ☐☐☐☐ (35) | wt ☐☐☐.☐ gm | > 2.9 gm # ☐☐☐☐ | wt ☐☐☐.☐ gm (50) |
| Artefact areas | < 1 cm² # ☐☐☐☐ (51) | wt ☐☐☐.☐ gm | 1 - 1.9 cm² # ☐☐☐☐ | wt ☐☐☐.☐ gm (66) |
| | 2 - 3.9 cm² # ☐☐☐☐ (67) | wt ☐☐☐.☐ gm | > 3.9 cm² # ☐☐☐☐ | wt ☐☐☐.☐ gm (82) |
| Artefact lengths | < 1 cm # ☐☐☐☐ (83) | wt ☐☐☐.☐ gm | 1 - 1.9 cm # ☐☐☐☐ | wt ☐☐☐.☐ gm (98) |
| | 2 - 2.9 cm # ☐☐☐☐ (99) | wt ☐☐☐.☐ gm | > 2.9 cm # ☐☐☐☐ | wt ☐☐☐.☐ gm (114) |

**Record Type 4 : Supplementary data**

4 (1) Site ☐☐☐ ☐ Square ☐☐☐ Excavation unit ☐☐☐ Feature ☐☐ Strat. ☐☐ ☐ Subsquare ☐☐ (18)

| | | | | |
|---|---|---|---|---|
| 1 _____ ☐☐☐☐ (19) | 2 _____ ☐☐☐☐ | 3 _____ ☐☐☐☐ | 4 _____ ☐☐☐☐ | 5 _____ ☐☐☐☐ (38) |
| 6 _____ ☐☐☐☐ (39) | 7 _____ ☐☐☐☐ | 8 _____ ☐☐☐☐ | 9 _____ ☐☐☐☐ | 10 _____ ☐☐☐☐ (58) |
| 11 _____ ☐☐☐☐ (59) | 12 _____ ☐☐☐☐ | 13 _____ ☐☐☐☐ | 14 _____ ☐☐☐☐ | 15 _____ ☐☐☐☐ (78) |
| 16 _____ ☐☐☐☐ (79) | 17 _____ ☐☐☐☐ | 18 _____ ☐☐☐☐ | 19 _____ ☐☐☐☐ | 20 _____ ☐☐☐☐ (98) |
| 21 _____ ☐☐☐☐ (99) | 22 _____ ☐☐☐☐ | 23 _____ ☐☐☐☐ | 24 _____ ☐☐☐☐ | 25 _____ ☐☐☐☐ (118) |
| 26 _____ ☐☐☐☐ (119) | 27 _____ ☐☐☐☐ | 28 _____ ☐☐☐☐ (130) | | |

Site ☐☐☐ ☐

Square ☐☐☐

Excavation unit ☐☐☐

FIELD CODING FORM Sheet 3

Coded by _____ Date _____

**Record Type 5 : Individualised finds**

Optional variables - it is not necessary to code all these variables since they can be added later using ADDAT
Only lines with values for these variables will be keyed in

| | Site | Pt | Square | Ex unit | Featr | Strat | Pt | Sub sq | Obj # | / | X | Y | Z | / | RM | Wt (1/10g) | Sup | Ctx | Length mm | Breadth mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | | | | | | | | | 1 | | | | | | | | | | | |
| | 1 2 3 4 | 5 | 6 7 8 | 9 10 | 11 12 | 13 14 | 15 | 16 17 18 | 2 | | | | | | | | | | | |
| | | | | | | | | | 3 | | | | | | | | | | | |
| | | | | | | | | | 4 | | | | | | | | | | | |
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| | | | | | | | | | 51 | | | | | | | | | | | |
| | | | | | | | | | 52 | | | | | | | | | | | |
| | | | | | | | | | 53 | | | | | | | | | | | |
| | | | | | | | | | 54 | | | | | | | | | | | |

Please duplicate columns 1 – 18

NOTE This sheet should be used only if data is to be typed up by a data processing unit. Otherwise use laboratory coding forms and data addition programs.

Site

Square

Excavation unit

'MINIMAL' FIELD CODING FORM

Coded by: _____ Date: _____

**Record Type 1 : General information**

1 (1)

Site (2 3 4) (5) Square (6 7 8) Excavation unit (9 10 11) Feature # (12 13) Strat. level (14 15) (16) Subsquare (17 18)

Sediment wt. (19 20) • (21) kg. Medium sieve residue (22 23) • (24 25) kg. Fine sieve residue (26 27) • (28 29) kg

Coarse sieve residue # (30 31 32) wt. (33 34 35) • (36) kg

Start and finish coordinates

| | X | Y | Z start | Z end |
|---|---|---|---|---|
| | (37 38 39) | (40 41 42) | (43 44 45) | (46 47 48 49) | (50 51 52 53) |
| | (71 72 73) | (74 75 76) | (77 78 79) | (80 81 82 83) | (84 85 86 87) |
| | (105 106 107) | (108 109 110) | (111 112 113) | (114 115 116 117) | (118 119 120 121) |
| | (54 55 56) | (57 58 59) | (60 61 62) | (63 64 65 66) | (67 68 69 70) |
| | (88 89 90) | (91 92 93) | (94 95 96) | (97 98 99 100) | (101 102 103 104) |

Sieve technique ? Wet/ dry

Sieve mesh: Coarse ____ mm Medium _____mm Fine _____ mm

Site ☐☐☐☐ Square ☐☐☐☐ Excavation unit ☐☐☐

The data file keyed in from these forms must be processed by DUPLIC to create an excavation data file in standard format. If these forms are used, they must be used on their own, i.e. no other field coding forms should be filled in. Any further data should be entered on laboratory coding forms and added to the excavation data file using ADDRM, ADDSIZ, ADDAT etc.



**LABORATORY CODING FORM** **Unindividualised finds**

Square

| 1 | 2 | 3 |
|---|---|---|
| | | |

Enter data in free-format (values separated by spaces) ignoring decimal points. Square identifier must be in cols. 1 - 3 of first record.

Coded by.....Date.....

Site

Square

| Excavation Unit | Variable description and code | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | 13 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 14 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 15 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 16 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 17 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 18 | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| | 21 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 23 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 24 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 25 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 26 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | |

**LABORATORY CODING FORM** **Individualised finds**

Square Excav' Unit

1 2 3 4 5 6 7

Enter data in free-format (values separated by spaces) ignoring decimal points. Square identifier and excavation unit number must be in columns 1 - 7 of first record.

Coded by.....Date.....

Site

Square

Excavation unit

| Object Number | Attribute description and code | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**LABORATORY CODING FORM** **Unindividualised finds**

Square

| 1 | 2 | 3 |
|---|---|---|
| | | |

Enter data in free-format (values separated by spaces) ignoring decimal points. Square identifier must be in cols. 1 - 3 of first record.

Coded by.....Date.....

Site

Square

| Variable description and code | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Excavation Unit | | | | | | | | | | | | | | | | | | | | | | | | |

**LABORATORY CODING FORM** **Individualised finds**

Square Excav' Unit

1 2 3 4 5 6 7

Enter data in free-format (values separated by spaces) ignoring decimal points. Square identifier and excavation unit number must be in columns 1 - 7 of first record.

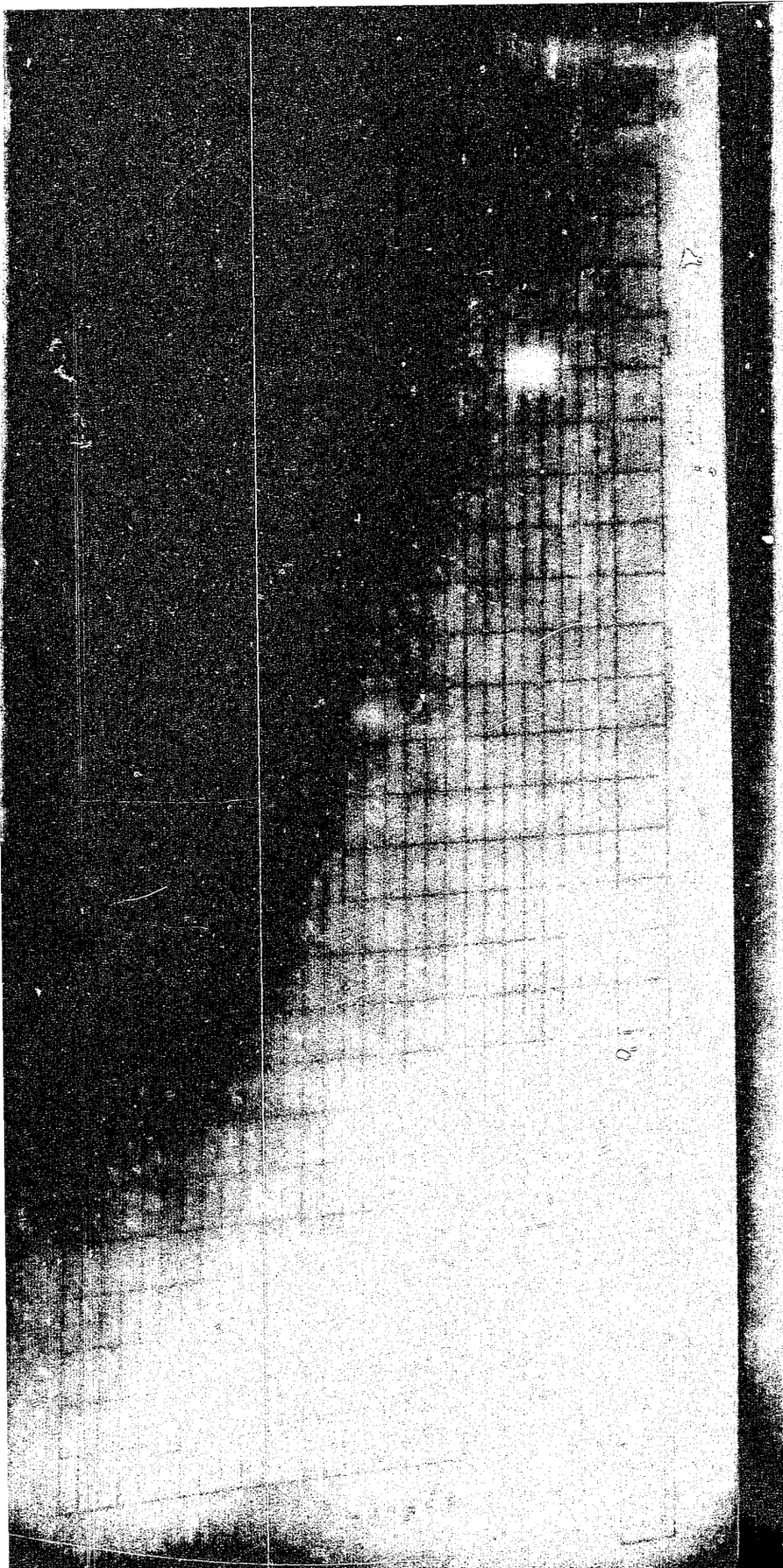
Coded by.....Date.....

Site

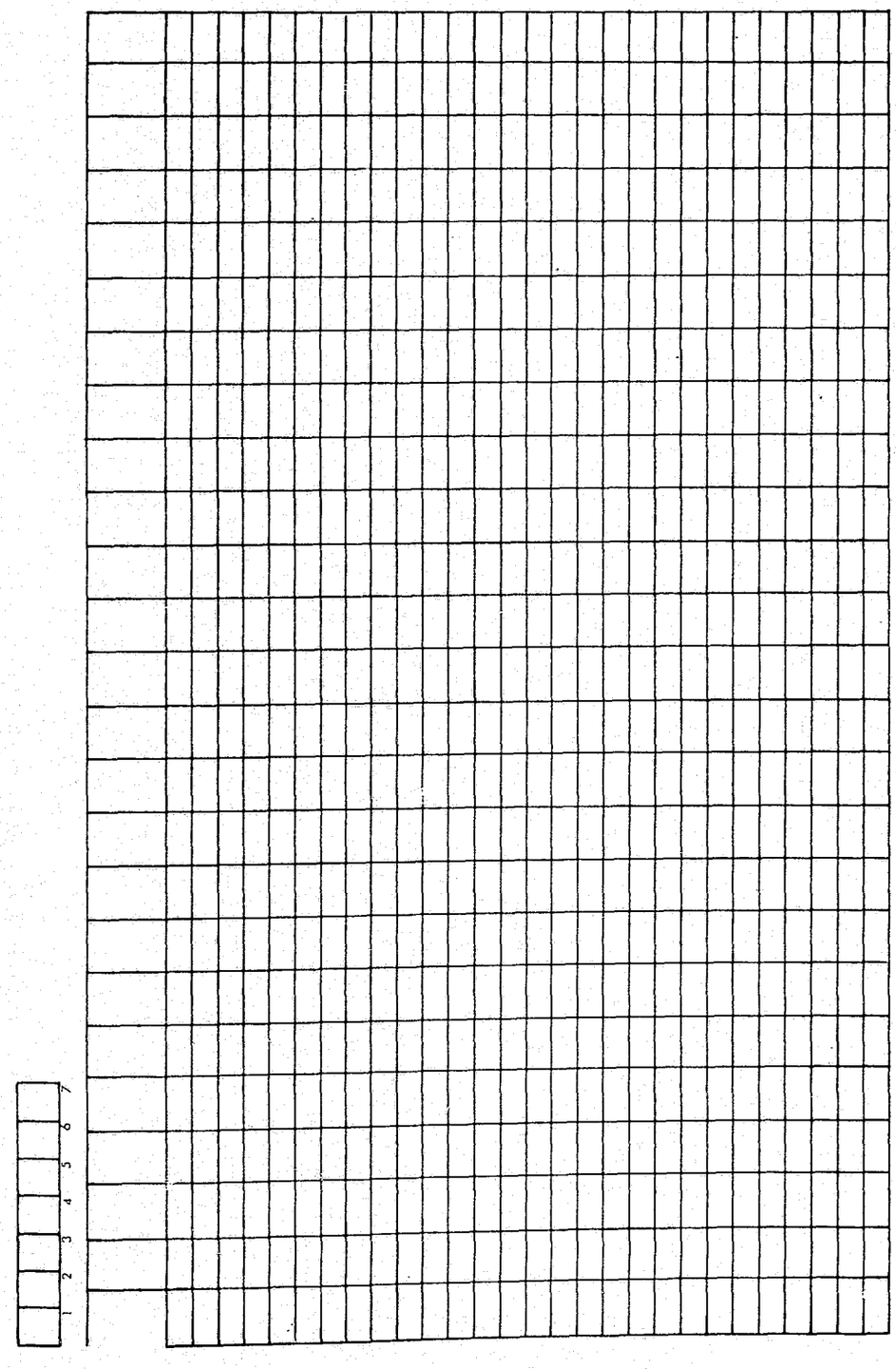
Square

Excavation unit

| Object Number | Attribute description and code | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | |
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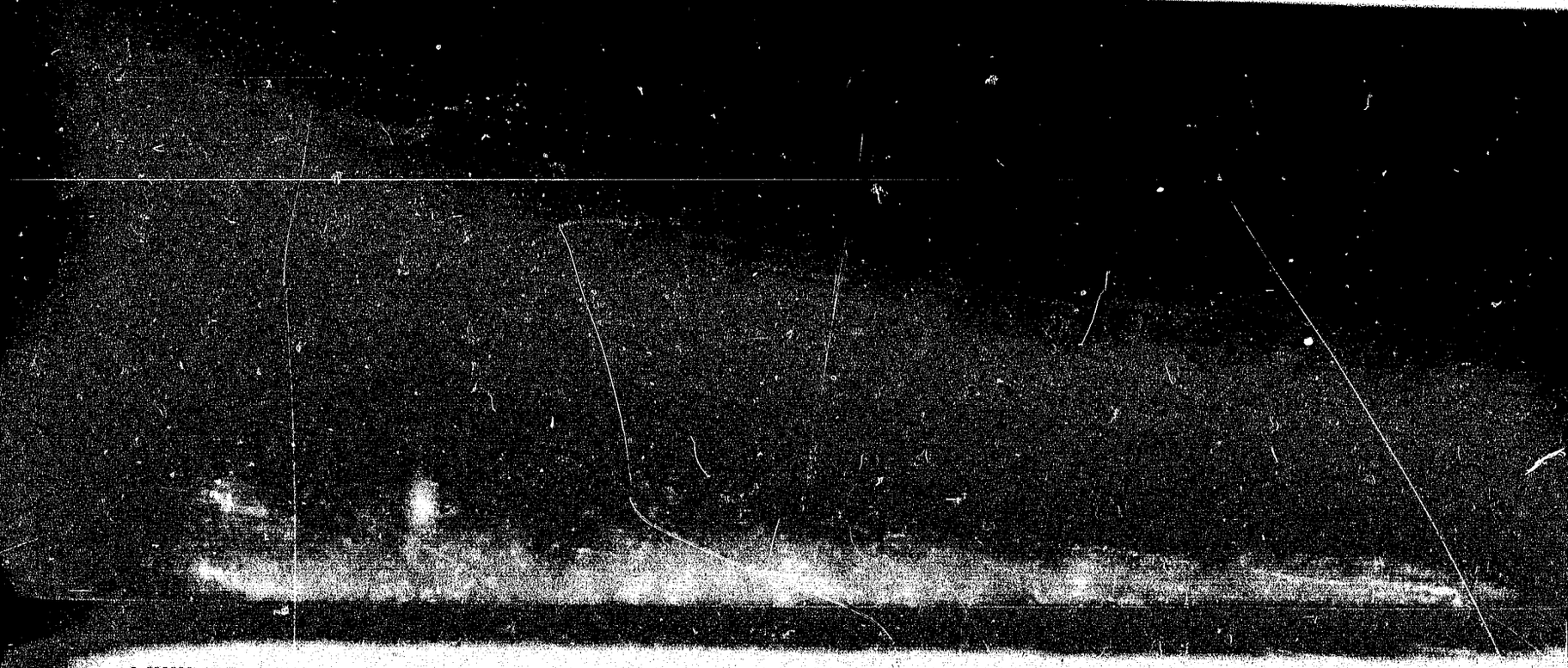
Site ☐☐☐ ☐ Square ☐☐☐ Excavation unit ☐☐☐



# APPENDIX IV

## Listing and documentation of computer programs

```
C-******* SELEC ******      IAN JOHNSON, PREHISTORY, ANU.    JANUARY 1979.
C VERSION  3/8/79/
C
C SELEC selects particular record types from the excavation data file,
C for output either to the line printer or as a file for input to other
C programs. This program is intended primarily as a means of preparing
C line printer listings of each type of record on the excavation data
C file to facilitate checking of the data. It may also be used to
C output particular record types for input to other programs, e.g. spatial
C analysis programs or plotting programs. Note that, for input to SPSS
C using the instruction set SPFILE.UN, it is more convenient to use SELUN
C for the selection of the appropriate data records. Input and (if applic-
C able) output filenames are specified from the terminal, together with
C the choice of record type(s) to be output. As of July 1979, record types
C are as follows:
C (1) General excavation unit information (sediment weights, coordinates etc.)
C (2) Unindividualised finds - raw material classification
C (3) Unindividualised finds - size classification
C (4) Supplementary variables at the users discretion
C (5) Individualised finds, coordinates and attributes
C (6) Supplementary records for individualised finds
C     (extra edge codings or supplementary attributes)
C
C-*************************************************************************
C
      DOUBLE PRECISION INP,DAT,OUTPT,BLANK
      DIMENSION TEXT(26),IRECS(20)
      DATA BLANK/10H          /
      CALL DATE(DAT)
C
      LEC=5
      ITERM=6
      NREC=0
C
      WRITE(ITERM,500) DAT
500   FORMAT(1HO,/,' EXCAVATION DATA PROCESSING',/,
     1 1X,26(1H*),///,' Ian Johnson, Prehistory, ANU',5X,
     2 'July 1979',/,' Version 3/8/79',///,
     3 ' **** SELEC ****',10X,A10,//,' This program prints out',
     4 ' or outputs a file of chosen record types'/' selected',
     5 ' from the excavation data file'/' See top of program',
     6 ' listing for documentation'//)
C
C
      WRITE(ITERM,400)
400   FORMAT(1HO,'Name of excavation data file? : '$)
      READ(LEC,401) INP
401   FORMAT(A10)
      CALL IFILE(10,INP)
731   WRITE(ITERM,410)
410   FORMAT(1HO,'What do you want to call your output file?'/
     1 ' If you want a printout not a permanent file, type',
     2 ' RETURN only')
      READ(LEC,401,END=668,ERR=668) OUTPT
      IF(OUTPT.EQ.BLANK) GO TO 732
      CALL OFILE(11,OUTPT)
990   FORMAT(1H1,'Excavation Data File: ',A10,10X,'Date:  ',A10,
     1 10X,'Record Type Selected:',I3,//)
732   WRITE(ITERM,299)
299   FORMAT(1H ,'Record types on excavation data file are',
     1 ' as follows:'/' 1  General excavation',
     2 ' unit information (coordinates,sediment wt etc)'/
     3 ' 2  Unindividualised finds, raw material classifications'/
     4 ' 3  Unindividualised finds, size classifications'/
     5 ' 4  Supplementary variables'/' 5  Individualised',
     6 ' finds'/' 6  Supplementary records for',
     7 ' individualised finds (2nd,3rd,. utilised edges)'/)
      IF(OUTPT.NE.BLANK) WRITE(ITERM,297)
297   FORMAT(1H ,'Specify, on a single line, the record type(s)',
     1 ' (code numbers) to be output:')
733   IF(OUTPT.EQ.BLANK) WRITE(ITERM,298)
298   FORMAT(1H ,'What record type do you want',
     1 ' printed? (Control Z to terminate) : '$)
C
C-READ IN RECORD TYPES REQUIRED. MAY OR MAY NOT BE SEPARATED BY
C SPACES, SO PACK INTO FIRST FOUR (OR LESS) ELEMENTS OF IRECS.
      NREC=0
      READ(LEC,301,END=668,ERR=668) IRECS
301   FORMAT(20I1)
      K=1
      DO 4 L=1,20
      IF(IRECS(L).EQ.0) GO TO 4
      IRECS(K)=IRECS(L)
      K=K+1
4     CONTINUE
      K=K-1
      IF(OUTPT.EQ.BLANK) PRINT 990,INP,DAT,IRECS(1)
C
C-READ IN DATA FILE AND OUTPUT RECORDS REQUIRED.
9     READ(10,200,END=555) LINE,TEXT
200   FORMAT(I1,26A5)
      DO 5 L=1,K
5     IF(LINE.EQ.IRECS(L)) GO TO 8
      GO TO 9
8     DO 6 L=1,26
      NOTBL=27-L
6     IF(TEXT(NOTBL).NE.BLANK) GO TO 3
3     IF(OUTPT.EQ.BLANK) GOTO 7
      WRITE(11,200) LINE,(TEXT(L),L=1,NOTBL)
      NREC=NREC+1
      GO TO 9
7     PRINT 201,LINE,TEXT
201   FORMAT(1H ,I1,26A5)
      NREC=NREC+1
      GO TO 9
C
555   IF(OUTPT.EQ.BLANK) GO TO 667
      WRITE(ITERM,987)NREC,OUTPT
987   FORMAT(1H ,'File of',I5,' selected records output on file: ',
     1 A10,//)
      GO TO 668
667   WRITE(ITERM,988) NREC
988   FORMAT(1H ,I5,' Records printed',/)
669   REWIND 10
      GO TO 733
668   STOP
      END
```

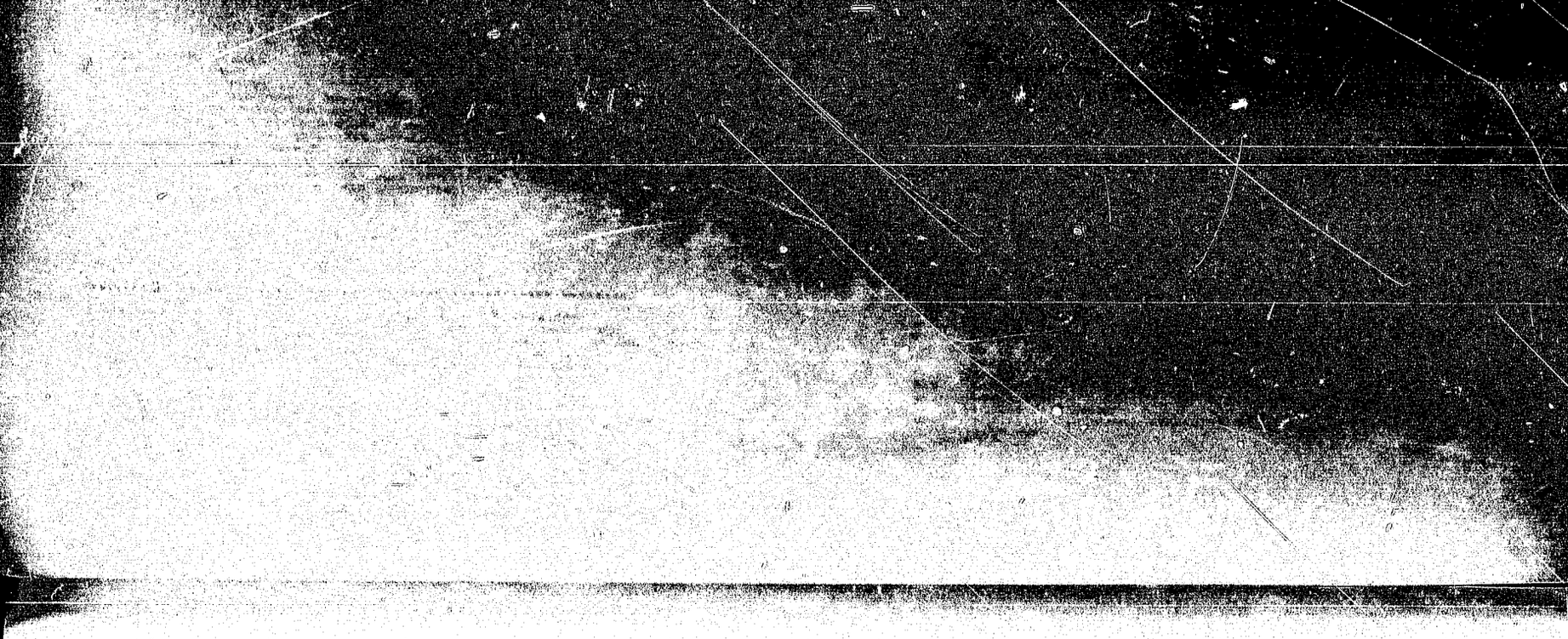


```
C-****** SELUN ******      IAN JOHNSON, PREHISTORY, ANU.    JANUARY 1979.
C VERSION  3/8/79/
C
C
C SELUN selects and outputs on a new file all the type 1,2,3 and 4
C records from an excavation data file. The names for the excavation
C data file and the output file are specified from the terminal, and
C the output file is in the correct format for input to SPSS using
C the instruction set SPFILE.UN, which creates an SPSS system file of
C the data from record types 1 - 4. The file thus created contains infor-
C mation relating to the excavation units rather than to individual
C finds. The information includes sediment and residue weights, numbers
C and weights of different raw material or size classifications of the
C unindividualised finds and up to 28 supplementary variables coded on
C record type 4 of the excavation data file which are available for
C the user to add on any extra data he/she may have. More supplementary
C variables records can be accommodated simply by modifying statement 5.
C
C-*************************************************************************
C
      DOUBLE PRECISION INP,DAT,OUTPT
      DIMENSION TEXT(26),IRECS(20),TITLE(20)
      DATA BLANK/5H     /
      CALL DATE(DAT)
C
      LEC=5
      ITERM=6
      NREC=0
C
      WRITE(ITERM,500) DAT
500   FORMAT(1HO,/,' EXCAVATION DATA PROCESSING',/,
     1 1X,26(1H*),///,' Ian Johnson, Prehistory, ANU',5X,
     2 'July 1979',/,' Version 3/8/79',///,
     3 ' **** SELUN ****',10X,A10,//,' This program creates',
     4 ' a file for input to SPSS'/' (using instruction',
     5 ' set ANALYS.UN)'/' See top of program listing for',
     6 ' documentation'//)
C
C
      WRITE(ITERM,400)
400   FORMAT(1HO,'Name of excavation data file? : '$)
      READ(LEC,401) INP
401   FORMAT(A10)
      CALL IFILE(10,INP)
      CALL OFILE(11,'SELUN.OUT')
C
      WRITE(ITERM,300)
300   FORMAT(1HO,'Program Running',/)
C
C-READ IN DATA FILE AND OUTPUT RECORDS REQUIRED.
9     READ(10,200,END=555) LINE,TEXT
200   FORMAT(I1,26A5)
5     IF(LINE.GT.4) GO TO 9
      DO 6 L=1,26
      NOTBL=27-L
6     IF(TEXT(NOTBL).NE.BLANK) GO TO 3
3     WRITE(11,200) LINE,(TEXT(L),L=1,NOTBL)
      NREC=NREC+1
      GO TO 9
555   KASES = NREC/4
      WRITE(ITERM,987) NREC,KASES
987   FORMAT(1HO,'File of',I5,' records output on file SELUN.OUT ',
     1 /,' ready for input to SPSS (using instruction',
     2 ' set ANALYS.UN)',/,' Note; SPSS should read',I5,' cases as',
     3 ' it will read 4 records per case',//)
      NREC=(4*(KASES))-NREC
      IF(NREC.NE.0) TYPE 988
988   FORMAT(1HO,'**** ERROR ****'/' Number of records output',
     1 ' is not divisible by 4'/' You should check your data',//)
667   STOP
      END
```

```
C-**** DUPLIC ****
C-Ian Johnson, Prehistory, ANU
C Version 28/7/79
C
C
C-This program duplicates record types 1 - 4 from a file containing
C only records of type 1. This saves having to type in the common
C fields of type 2, 3 and 4 records if no data is to be coded onto
C them in the field.
C
C
      DOUBLE PRECISION DAT,INP,OUT
      DIMENSION REC(28),LET(3)
      DATA LET/1H2,1H3,1H4/,ONE/1H1/
C
       TERM=6
      LEC=5
      NWRIT=0
      NREAD=0
      CALL DATE(DAT)
C
      WRITE(ITERM,5000) DAT
5000  FORMAT(1HO/' EXCAVATION DATA PROCESSING'/
     1 1X,26(1H*),//,' Ian Johnson, Prehistory, ANU,  July 1979'/
     2 ' Version 28/8/79',////,' **** DUPLIC ****',19X,A10,//,
     3 ' This program duplicates records type 1 - 4 from a file',
     4 ' containing',/,' only type 1 records. This saves having to',
     5 ' type in the common fields',/,' of type 2, 3 and 4 records',
     6 ' if no data is to be entered on them in the field',//)
C
      WRITE(ITERM,300)
300   FORMAT(1HO,'Name of data file containing',
     1 ' type 1 records only? : '$)
      READ(LEC,299) INP
299   FORMAT(A10)
      CALL IFILE(10,INP)
      WRITE(ITERM,302)
302   FORMAT(1HO,'What do you want to call your output file? : '$)
      READ(LEC,299) OUT
      CALL IFILE(10,INP)
      CALL OFILE(11,OUT)
C
C
C-Read in records from the input file and output record plus
C three following records each with the same common field except
C for column 1 (record type identifier)
1     READ(10,200,END=555) REC
200   FORMAT(2A1,4A4,22A5)
      NREAD=NREAD+1
C
      IF(REC(1).NE.ONE) GO TO 666
      WRITE(11,200) REC
      NWRIT=NWRIT+1
      DO 2 L=1,3
      NWRIT=NWRIT+1
2     WRITE(11,200) LET(L),(REC(LL),LL=2,6)
C
      GO TO 1

666   WRITE(ITERM,250) NREAD
250   FORMAT(1HO,'**** WARNING **** A number other than 1 has been',
     1 ' encountered',/,' in column one after reading',
     2 I5,' records from input file',//,' RUN ABORTED',/)
C
555   WRITE(ITERM,400) NWRIT,OUT
400   FORMAT(1HO,I5,' Records output on file: ',A10//)
      STOP
      END
```

```
C **** CNTVAR ****
C Ian Johnson, Prehistory, RSPacS, ANU   July 1979
C Version 3/8/79
C
C
C-This program counts the number of variables on each line of a
C freefield file, ignoring lines with alphabetics or special
C characters. The user enters the filename and the expected number
C of variables per line from the terminal, and those lines not
C conforming to this expectation are listed on the terminal.
C
C-****************************************************************
C
      DOUBLE PRECISION INP,DAT
      DIMENSION VARS(130)
      DATA BLANK/1H /
      CALL DATE(DAT)
C
      TYPE 499,DAT
499   FORMAT(1HO/' EXCAVATION DATA PROCESSING'/
     1 1X,26(1H*),//,' Ian Johnson, Prehistory, ANU,  July 1979'/
     2 ' Version 3/8/79',////,' **** CNTVAR ****',19X,A10,//,
     3 ' This program counts',
     4 ' the number of variables per record on a freefield'/' data',
     5 ' file and lists those records which do not conform to an',/
     6 ' expectation which you enter from the terminal.'/' Records',
     7 ' containing alphabetic characters are ignored',//,
     8 ' Input file name? ' '$)
      ACCEPT 553,INP
      CALL IFILE(10,INP)
      TYPE 498
498   FORMAT(1HO,'How many variables do you expect per record? : '$)
      ACCEPT 552,NEXPEC
553   FORMAT(A10)
552   FORMAT(G)
      N=0
      IERROR=0
      GO TO 1
2     READ(10,200)
1     N=N+1
      NVAR=0
      READ(10,200,END=555,ERR=2) VARS
200   FORMAT(150G)
      BACKSPACE 10
      READ(10,300) VARS
300   FORMAT(150A1)
      NVAR=0
      DO 4 K=1,130
      IF(VARS(K).EQ.BLANK) ISW=0
      IF(ISW.NE.0.OR.VARS(K).EQ.BLANK) GO TO 4
      NVAR=NVAR+1
      ISW=1
4     CONTINUE
      IF(NVAR.NE.NEXPEC) GO TO 10
400   FORMAT(1H ,'LINE',I4,'       OF VARIABLES'.I3)
      GO TO 1
10    TYPE 400,N,NVAR
      IERROR=1
      GO TO 1
555   IF(IERROR.NE.1) TYPE 500
500   FORMAT(1HO,'ALL RECORDS CONTAIN EXPECTED NUMBER OF',
     1 ' VARIABLES',//)
      STOP
      END
```



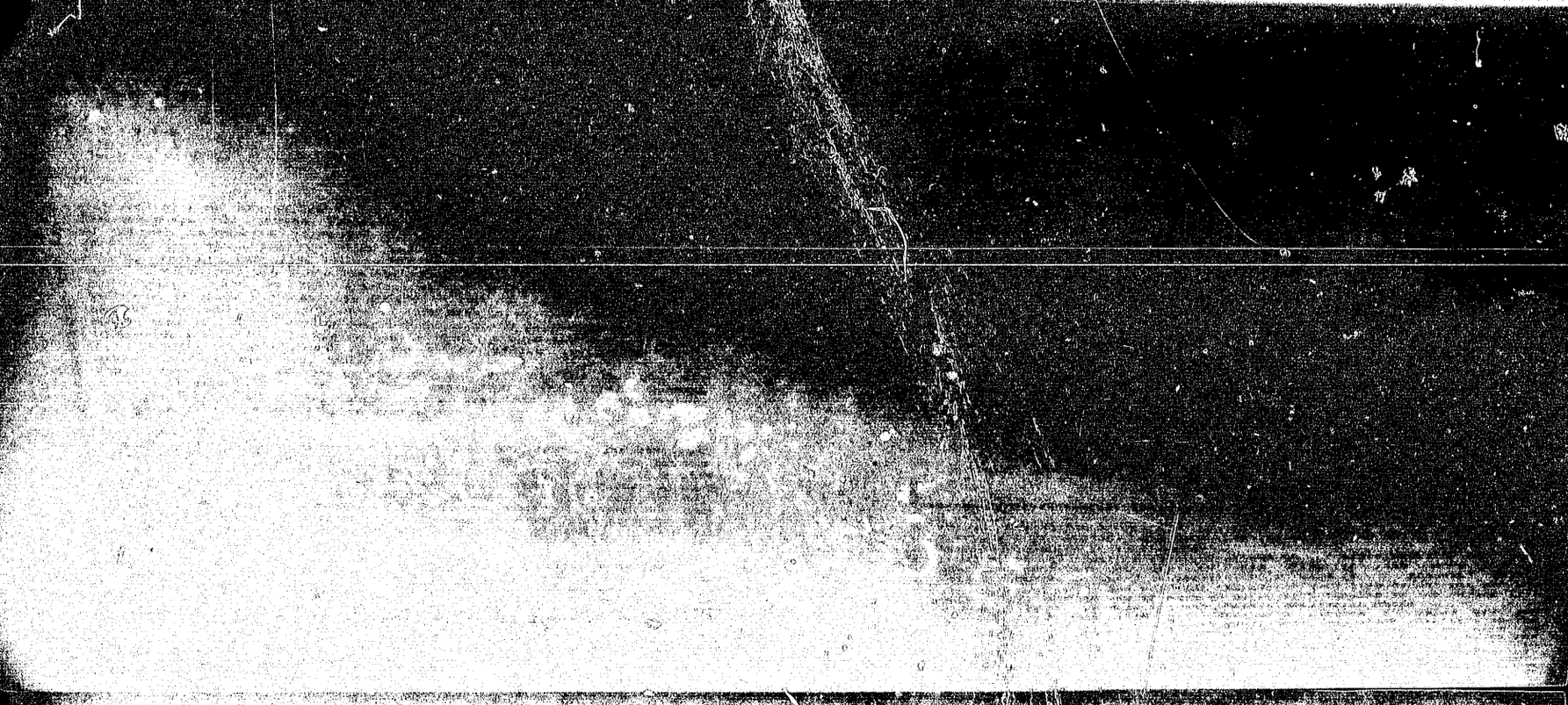
```
C-**** ADDRM ****
C
C-Ian Johnson, Prehistory, ANU    July 1979
C VERSION 10/9/79
C For a full explanation of the use of this program, see
C Johnson 1979, "Digging for Data", PhD, ANU.
C
C
C  This program adds raw material classifications for the unindividualised
C  finds (number and/or weight for up to 13 raw material categories plus
C  weight only for charcoal (=RM 1), lithic finds <4mm and organic finds
C  <4mm) onto the excavation data file. The classification data is read
C  from one file (the classification data file) and added onto the
C  appropriate records (type 2 records) of the excavation data file. An
C  updated version of the excavation data file is output, leaving the
C  source files unchanged.
C
C  Running the program
C  When the program is run (by typing EX ADDRM or RUN ADDRM) it asks for
C  the names of the excavation data file and the classification data file
C  and for the name you wish to give to the updated excavation data file
C  which is output from the program. It then asks you to list the raw
C  material classes which occur on the classification data file in the
C  order in which they occur.
C
C  Structure of the classification data file
C  (1) Excavation squares must appear in the same order on the
C  classification data file as on the excavation data file. However
C  classification data need not be supplied for all squares or for all
C  excavation units within a square.
C  (2) The block of records for each excavation square is headed by a
C  record containing the excavation square identifier in columns 1-3.
C  (3) Subsequent records for that square may occur in any order and should
C  contain the excavation unit number followed by frequencies and/or
C  weights for artefact occurrence in each raw material category. The
C  values are separated by space(s) (freefield format). They may be
C  entered in any (consistent) order as the raw materials which are present
C  and the order in which they are input are specified from the terminal
C  when the program is run. Note, however, that if both frequencies and
C  weights are present then the weight must immediately follow the
C  frequency for the corresponding raw material. It is not possible to
C  input a mixture of weights for some raw material categories and
C  frequencies for others, though this can be done using the program
C  ADDODS. Raw material 1 (charcoal) (if present on classification data
C  file) is assumed to be represented by weight alone, as are lithic and
C  organic finds which pass through a 4mm granulometric sieve (or fall
C  below some other specified size criterion).
C  Note that zero or missing values in the classification data must be
C  represented by a zero, not a blank (since blanks are used to delimit
C  successive values). If there are less values on a record than the
C  number of classes specified from the terminal, the extra variables will
C  be read as zeros.
C  Example:
C  Q12
C  1 34 54 76 54 37 89
C  2 3 6 4 0 4 7
C  3 0 0 4 6 2 8
C  Q13
C  2 96 98 57 83 27 44
C  3 4 6 1 0 4 7
C  22 5 2 0 3 7 1
C  15 4 6 12 9 0 3
C  Q15
C  48 3 0 0 0 4 2
C
C  A number of error traps are built into the program. These will pick up
C  various coding errors in the common field (columns 1-18) of the
C  excavation data file, raw material codes outside the range 1-14,
C  excavation units with numbers greater than 110 and classification data
C  supplied for excavation units which do not exist on the excavation data
C  file. In addition, if the excavation squares are incorrectly ordered on
C  the classification data file, the unmatched classification data will be
C  output on a new file. One or two additional runs using this file as the
C  classification data file will generally suffice to match all the
C  classification data onto the appropriate excavation units.
C  Note: this program can be used as an editing program as the output file
C  is identical with the original excavation data file except for any new
C  values supplied on the raw material classification data file. However,
C  values must be supplied for all the raw material classifications chosen
C  from the terminal at run time, as trailing blanks on the classification
C  data file will be converted to zero values.
C  Limit on this version: not more than 100 excavation units may occur for
C  any one excavation square.
C
C*****************************************************************************
C
      DOUBLE PRECISION INEXC,INRM,DAT.OUTPT,UNMAT
      DIMENSION KLASS(33),INTER(30),IDATA(100,30),TEXT(30),
     1 NUDAT(100),TEXTO(26),NUMER(10)
      DATA BLANK/1H /,Y/1HY/,SMY/1Hy/,IBLANK/1H /,
     1 NUMER/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/
C
      ITERM=6
      LEC=5
C-MAXU is maximum permissible number of excavation units in a single
C excavation square - if it is changed, dimensions of arrays and
C vectors above will have to be changed.
      MAXU=100
      CALL DATE(DAT)
C-NOMOR is a flag for the end of the classification data file.
      NOMOR=0
C-MATCH is a counter for the number of records output onto which
C classification data has been added.
      MATCH=0
C-NUVAL is a counter for the number of records of classification
C data read in from unit 11.
      NUVAL=0
```

```
C-NREAD is a counter for the number of records read from the
C excavation data file.
      NREAD=0
C-NWRIT is a counter for the number of records written on the output file
      NWRIT=0
299   FORMAT(A10)
      WRITE(ITERM,5000) DAT
5000  FORMAT(1HO/' EXCAVATION DATA PROCESSING'/
     1 1X,26(1H*),//,' Ian Johnson, Prehistory, ANU,  July 1979'/
     2 ' Version 10/9/79',////,' **** ADDRM ****',19X,A10,//,
     3 ' This program adds raw material classification data for'/
     4 ' the unindividualised finds to the excavation data file'/
     3 ' For documentation see top of program listing',//)
      WRITE(ITERM,300)
300   FORMAT(1HO,'Name of excavation data file? : '$)
      READ(LEC,299) INEXC
      CALL IFILE(10,INEXC)
      WRITE(ITERM,301)
301   FORMAT(1HO,'Name of raw material classification data file? : '$)
      READ(LEC,299) INRM
      CALL IFILE(11,INRM)
      WRITE(ITERM,302)
302   FORMAT(1HO,'What do you want to call your output file? : '$)
      READ(LEC,299) OUTPT
      CALL OFILE(12,OUTPT)
C
10    WRITE(ITERM,303)
303   FORMAT(1HO,'What raw material classifications do you have?'/
     1 ' Type in raw material code numbers in order of data'/' on a',
     2 ' single line separated by spaces'/
     3 ' If you have weights for lithic and organic finds under',
     4 ' 4mm,'/' code these as 100 and 200 respectively',/)
      READ(LEC,330) (KLASS(L),L=1,33,2)
330   FORMAT(50G)
C
C-Expand series to allow for two values for each raw material (number
C and weight) and for weights of lithic and organic finds under a
C specified size (e.g. 4mm) which appear as variables 1 and 2 on output.
      DO 20 L=1,33
      IF(KLASS(L).EQ.100.OR.KLASS(L).EQ.200.OR.KLASS(L).EQ.0)
     1 GO TO 19
      IF(KLASS(L).LT.1.OR.KLASS(L).GT.14) GO TO 750
      KLASS(L)=((KLASS(L))*2)+1
      GO TO 20
19    KLASS(L)=KLASS(L)/100
20    CONTINUE
C
21    DO 18 L=1,33
18    IF(KLASS(L).EQ.3) WRITE(ITERM,344)
344   FORMAT(1H ,'(It is assumed that only weight is present',
     1 ' for charcoal (RM 1)')
      WRITE(ITERM,342)
342   FORMAT(' Do you have frequency data for the',
     1 ' raw material categories? : '$)
      READ(LEC,298) QUER
298   FORMAT(A1)
      IF(QUER.EQ.BLANK) GO TO 21
      IF(QUER.EQ.Y.OR.QUER.EQ.SMY) GO TO 23
C
C-Weights only for each RM class.
      DO 22 L=1,33
      IF(KLASS(L).LE.2) GO TO 22
      KLASS(L)=KLASS(L)+1
22    CONTINUE
      GO TO 25
C-Frequency data are present, are weights?
23    WRITE(ITERM,333)
333   FORMAT(' Do you have weights for the raw material',
     1 ' categories? : '$)
      READ(LEC,298) QUER
      IF(QUER.EQ.BLANK) GO TO 23
      IF(QUER.NE.Y.AND.QUER.NE.SMY) GO TO 25
C
C-Both numbers and weights are present for raw material
C classes - fill up KLASS accordingly
      DO 24 L=1,33,2
      IF(KLASS(L).EQ.1.OR.KLASS(L).EQ.2) GO TO 24
      IF(KLASS(L).EQ.0) GO TO 25
      KLASS(L+1)=KLASS(L)+1
C-Frequency data presumed absent for charcoal (RM 1)
      IF(KLASS(L).EQ.3) KLASS(L)=0
24    CONTINUE
C
C-Pack code numbers for size classification variables into
c beginning of KLASS
25    WRITE(ITERM,331)
331   FORMAT(1HO,'Program running',/)
C
      NOCLS=0
      DO 40 L=1,33
      IF(KLASS(L).EQ.0) GO TO 40
      IF(KLASS(L).EQ.3) KLASS(L)=4
      NOCLS=NOCLS+1
      KLASS(NOCLS)=KLASS(L)
40    CONTINUE
C-*************************************************************
C-First of new square, read in data for this square from
C file of size classification data, unit 11.
135   READ(11,305) SQUAR,CHECK
305   FORMAT(A3,A10)
      IF(CHECK.NE.BLANK) GO TO 751
C
140   DO 150 K=1,MAXU
      NUDAT(K)=0
      DO 150 L=1,30
150   IDATA(K,L)=0
C
160   READ(11,330,END=170,ERR=165) KUNIT,INTER
      NUVAL=NUVAL+1
C-Maximum number of excavation units per square for this version =MAXU
      IF(KUNIT.GT.MAXU) GO TO 700
```

```
C-Unpack size classification data read into IDATA in the standard order
C for the excavation data file.
180     IF(NUDAT(KUNIT).EQ.1) GO TO 590
        DO 190 L=1,NOCLS
190     IDATA(KUNIT,KLASS(L))=INTER(L)
        NUDAT(KUNIT)=1
        GO TO 160
C
C-Check to see if square header is merely a repetition
165     READ(11,305) NUSQ
        IF(NUSQ.EQ.SQUAR) GO TO 160
        BACKSPACE 11
        GO TO 200
C
C-End of classification data file, set flag
170     NOMOR=1
C
C
C-*************************************************************
C
C-Read first record of new square from excavation data file, check to
C see whether the square now being read corresponds with the classification
C data held in IDATA, whose square identifier is held in SQUAR.
C If squares don't correspond, copy over records until correct
C square is reached
200     READ(10,306,END=600) INTEG,SITE,SQ,TEXT
        NREAD=NREAD+1
        IF(SQ.EQ.SQUAR.AND.INTEG.EQ.2) GO TO 210
        DO 201 L=1,30
        NOTBL=31-L
201     IF(TEXT(NOTBL).NE.BLANK) GO TO 202
202     WRITE(12,306) INTEG,SITE,SQ,(TEXT(L),L=1,NOTBL)
        NWRIT=NWRIT+1
        GO TO 200
C
C-This record is a RM classification record (record type 2).
C Transfer RM classification data held in IDATA to INTER ready for output.
210     BACKSPACE 10
        READ(10,307,END=600) INTEG,SITE,SQ,KUNIT,PRT,LEVEL,DIVN,INTER
        IF(KUNIT.GT.100) GO TO 700
307     FORMAT(I1,A4,A3,I3,A1,I3,A1,2X,30I4)
        IF(NUDAT(KUNIT).EQ.0) GO TO 221
        DO 220 L=1,NOCLS
220     INTER(KLASS(L))=IDATA(KUNIT,KLASS(L))
        MATCH=MATCH+1
        NUDAT(KUNIT)=0
        DO 222 L=1,30
        NOTBL=31-L
222     IF(INTER(NOTBL).NE.0) GO TO 221
221     WRITE(12,307) INTEG,SITE,SQ,KUNIT,PRT,LEVEL,DIVN,
     1  (INTER(L),L=1,NOTBL)
        NWRIT=NWRIT+1
C
C-Read in and write records from excavation data file, unit 10.
205     READ(10,306,END=600) INTEG,SITE,SQ,TEXT
306     FORMAT(I1,A4,A3,30A4)
        NREAD=NREAD+1
        IF(SQUAR.NE.SQ) GO TO 208
        IF(INTEG.EQ.2) GO TO 210
        DO 223 L=1,30
        NOTBL=31-L
223     IF(TEXT(NOTBL).NE.BLANK) GO TO 224
224     WRITE(12,306) INTEG,SITE,SQ,(TEXT(L),L=1,NOTBL)
        NWRIT=NWRIT+1
        GO TO 205
C
C-New square just read on excavation data file, check to see whether
C classification data file has been exhausted.
208     IF(INTEG.NE.1) GO TO 580
        DO 225 L=1,100
225     IF(NUDAT(L).EQ.1) GO TO 226
        BACKSPACE 10
227     IF(NOMOR.EQ.1) GO TO 200
        GO TO 135
C
C
C-*************************************************************
C       ERROR MESSAGES
C-*************************************************************
C
750     WRITE(ITERM,315) KLASS(L)
315     FORMAT(1HO,'**** WARNING ****    Raw material code: ',I4/
     1  ' This version cannot accommodate more than 14 raw material',
     2  ' categories'/' (codes 1 - 14)',///)
        GO TO 10
C
C
751     WRITE(ITERM,363) NUVAL
363     FORMAT(1HO,'**** WARNING ****'/
     1  ' Square identifier extends into column 4 on raw material',
     2  ' classification data file'/' encountered after reading',I5,
     3  ' records'/' RUN ABORTED',//)
        GO TO 800
C
C
C
C-Not all the classification data read in for this square has been
C matched. Type out error message.
226     WRITE(ITERM,343) SQUAR,L
343     FORMAT(1HO,'**** ERROR **** Raw material classifications have',
     1  ' been provided'/' for excavation units which do not exist',
     2  ' on the excavation data file.'/' Encountered',
     3  ' whilst reading raw material classification data for',
     4  ' square: ',A3,' unit: ',I3/
     3  ' You should check your data',
     3  ' - RUN ABORTED',///)
        GO TO 800
```

```
C-Type out warning that program version capacity exceeded.
700     WRITE(ITERM,308) SQ,KUNIT,NREAD,NUVAL
308     FORMAT(1HO,'**** WARNING ****     Square: ',A3/
     1 ' This version cannot accommodate more than',
     2 ' 100 excavation units'/' in each excavation square.'/
     3 ' Value of',I4,' encountered after reading',I5,' records'/
     4 ' from excavation data file and',I5,' records from'/
     5 ' raw material classification file'/
     6 ' You will need to modify the DIMENSION statement at',
     7 ' the top'/' of the program and this error trap',//,
     8 ' RUN ABORTED',///)
       GO TO 800
C
C
580     WRITE(ITERM,341) SQ,NREAD,INTEG
341     FORMAT(1HO,'**** ERROR ****'/' New excavation square (',
     1 A3,') encountered on excavation data file'/
     2 ' at record number:',I5,', but column 1 contains a ',I1,
     3 ' not a 1'/' RUN ABORTED',///)
       GO TO 800
C
C
590     WRITE(ITERM,332) SQUAR,KUNIT,NUVAL
332     FORMAT(1HO,'**** ERROR ****'/' More than one set of',
     1 ' classification data supplied for'/' square ',A3,
     2 ', unit',I3,'.  Encountered after reading',I5,' records'/
     3 ' from raw material classification data file'/
     4 ' RUN ABORTED',///)
       GO TO 800
C
C
600     WRITE(ITERM,309) NWRIT,OUTPT,NUVAL,MATCH
309     FORMAT(1HO,I5,' records written on output file: ',
     1 A10/1X,I5,' Sets of raw material classifications read'/
     2 1x,I5,' Sets of raw material classifications added to',/,
     3 '      excavation data file',///)
       IF(NUVAL.EQ.MATCH.AND.NOMOR.EQ.1) GO TO 800
C
       WRITE(ITERM,310)
310     FORMAT(1HO,'**** WARNING ****'/' Some of the excavation',
     1 ' squares in the raw material classification file'/
     1 ' have not been matched with',
     2 ' excavation squares on the excavation data file.'/
     3 ' This may be due to incorrect ordering of excavation squares',
     4 ' on the'/' raw material classification file.'/' Unmatched',
     5 ' classification data will be output on a new file.',//,
     6 ' What do you want to call this file? : '$)
       READ(LEC,299) UNMAT
       NWRIT=0
       CALL OPILE(13,UNMAT)
       WRITE(13,334) SQUAR
334     FORMAT(A3)
       NWRIT=NWRIT+1
       DO 605 L=1,100
       IF(NUDAT(L).EQ.0) GO TO 605
       WRITE(13,314) L,((IDATA(L,KLASS(M))),M=1,NOCLS)
314     FORMAT(50(I5,1X))
       NWRIT=NWRIT+1
605     CONTINUE
608     IF(NOMOR.EQ.1) GO TO 620
610     READ(11,311,END=620) SQ,TEXT
311     FORMAT(A3,10A5,20A4)
       IF(SQ.EQ.SQUAR) GO TO 615
C-Change of excavation square, output square identifier heading
       SQUAR=SQ
       WRITE(13,312) SQUAR
312     FORMAT(A3)
       NWRIT=NWRIT+1
615     WRITE(13,313) TEXT
313     FORMAT(10A5,20A4)
       NWRIT=NWRIT+1
       GO TO 610
620     WRITE(ITERM,630) NWRIT,UNMAT
630     FORMAT(1HO,I4,' unmatched data records copied over',
     1 ' to file: ',A10,///)
C
C
800     STOP
       END
```

```
C-**** ADDSIZ ****
C
C-Ian Johnson, Prehistory, ANU    July 1979
C VERSION 10/9/79
C For a full explanation of the use of this program, see
C Johnson 1979, "Digging for Data", PhD, ANU.
C
C
C This program adds size classifications for unindividualised lithic finds
C  (number and/or weight for up to 24 size categories ) onto the excavation
C  data file.  The classification data is read from one file (the
C  classification data file) and added onto the appropriate records (type 3
C  records) of the excavation data file.  An updated version of the
C  excavation data file is output, leaving the source files unchanged.
C
C  Running the program
C  When the program is run (by typing EX ADDSIZ or RUN ADDSIZ) it asks for
C  the names of the excavation data file and the size classification data
C  file and for the name you wish to give to the updated excavation data
C  file which is output from the program.  It then asks you to type in code
C  numbers for the size classes which occur on the size classification data
C  file in the order in which they occur.  If requested a list of size
C  classes and code numbers will be typed out on the terminal.  The present
C  version of the program lists the size classes for lithic finds described
C  in Johnson 1979.
C
C  Structure of the classification data file
C  (1) Excavation squares must appear in the same order on the classi-
C  fication data file as on the excavation data file.  However
C  classification data need not be supplied for all squares or for all
C  excavation units within a square.
C  (2) The block of records for each excavation square is headed by a
C  record containing the excavation square identifier in columns 1-3.
C  should contain the excavation unit number followed by frequencies and/or
C  weights for artefact occurrence in each size category.  The values are
C  separated by space(s) (freefield format).  They may be entered in any
C  (consistent) order as the classifications which are present and the
C  order in which they are input are specified from the terminal when the
C  program is run.  Note that zero or missing values in the classification
C  data must be represented by a zero, not a blank (since blanks are used
C  to delimit successive values).  If there are less values on a record
C  than the number of classes specified from the terminal, the extra
C  variables will be read as zeros.
C
C  Example:
C  Q12
C  1 34 54 76 54 37 89
C  2 3 6 4 0 4 7
C  3 0 0 4 6 2 8
C  Q13
C  1 4 6 8 9 3 5
C  2 96 98 57 83 27 44
C  3 4 6 1 0 4 7
C  22 5 2 0 3 7 1
C  15 4 6 12 9 0 3
C  Q15
C  48 3 0 0 0 4 2
C  A number of error traps are built into the program.  Those will pick up
C  various coding errors in the common field (columns 1-18) of the
C  excavation data file, size codes outside the range 1-24, excavation
C  units with numbers greater than 110 and classification data supplied for
C  excavation units which do not exist on the excavation data file.  In
C  addition, if the excavation squares are incorrectly ordered on the
C  classification data file, the unmatched classification data will be
C  output on a new file.  One or two additional runs using this file as the
C  classification data file will generally suffice to match all the
C  classification data onto the appropriate excavation units.
C  Note:  this program can be used as an editing program as the output file
C  is identical with the original excavation data file except for any new
C  values supplied on the size classification data file.  However, values
C  must be supplied for all the size classifications chosen from the
C  terminal at run time, as trailing blanks on the classification data file
C  will be converted to zero values.
C  Limit on this version:  not more than 110 excavation units may occur for
C  any one excavation square.
C
C*************************************************************************
C
C
      DOUBLE PRECISION INEXC,INSIZ,DAT,OUTPT,UNMAT
      DIMENSION KLASS(33),INTER(30),IDATA(100,30),TEXT(30),
     1 NUDAT(100),TEXTO(26),NUMER(10)
      DATA Y/1HY/,SMY/1Hy/,IBLANK/1H /,BLANK/1H /,
     1 NUMER/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/
C
      ITERM=6
      LEC=5
      MAXU=100
C-MAXU is the maximum number of excavation units permissible in
C one excavation square.
      CALL DATE(DAT)
C-NOMOR is a flag for the end of the classification data file
      NOMOR=0
C-MATCH is a counter for the number of records onto which
C classification data has been added
      MATCH=0
C-NUVAL is a counter for the number of records of classification
C data read in from unit 11
      NUVAL=0
C-NREAD is a counter for the number of records read from the
C excavation data file.
      NREAD=0
C-NWRIT is a counter for the number of records written on the output file
      NWRIT=0
C
298   FORMAT(A1)
299   FORMAT(A10)
C
      WRITE(ITERM,5000) DAT
5000  FORMAT(1HO/' EXCAVATION DATA PROCESSING'/
     1 1X,26(1H*),//,' Ian Johnson, Prehistory, ANU,  July 1979'/
     2 ' Version 10/9/79',////,' **** ADDSIZ ****',18X,A10,//,
     3 ' This program adds size classifications for unind',
     4 'ividualised lithic finds'/' onto the excavation',
     5 ' data file'/
     6 ' For documentation see top of program listing',//)
```



```
      WRITE(ITERM,300)
300   FORMAT(1HO,'Name of excavation data file? : '$)
      READ(LEC,299) INEXC
      CALL IFILE(10,INEXC)
      WRITE(ITERM,301)
301   FORMAT(1HO,'Name of size classification data file? : '$)
      READ(LEC,299) INSIZ
      CALL IFILE(11,INSIZ)
      WRITE(ITERM,302)
302   FORMAT(1HO,'What do you want to call your output file? : '$)
      READ(LEC,299) OUTPT
      CALL OFILE(12,OUTPT)
C
C
      WRITE(ITERM,303)
303   FORMAT(1HO,'What size classifications do you have?'/
     2 ' Type RETURN only for a list of size classes and code',
     3 ' numbers'/' (Type 99 for list if you are using a',
     5 ' video terminal)',/)
      GO TO 31
42    WRITE(ITERM,327)
327   FORMAT(1HO,'Code numbers are as follows:'/
     1 '   1 Weight  <1gm  Number',/
     2 '   2 Weight  <1gm  Wt in 1/10gm'/
     3 '   3 Weight  1-1.9gm  Number'/
     4 '   4 Weight  1-1.9gm  Wt in 1/10gm'/
     5 '   5 Weight  2-2.9gm  Number'/
     6 '   6 Weight  2-2.9gm  Wt in 1/10gm'/
     7 '   7 Weight  3-3.9gm  Number'/
     8 '   8 Weight  3-3.9gm  Wt in 1/10gm'/
     9 '   9 Weight  >3.9gm  Number'/
     1 '  10 Weight  >3.9gm  Wt in 1/10gm'/
     1 '  11 Area  <1sq.cm. Number'/
     2 '  12 Area  <1sq.cm. Wt in 1/10gm'/
     3 '  13 Area  1-2sq.cm. Number'/
     4 '  14 Area  1-2sq.cm. Wt in 1/10gm'/
     5 '  15 Area  2-4sq.cm. Number'/
     6 '  16 Area  2-4sq.cm. Wt in 1/10gm')
      IF(KLASS(1).EQ.0) GO TO 10
      WRITE(ITERM,304)
304   FORMAT(1HO,'Note codes needed before they disapear off',
     1 ' screen.  Press RETURN to continue')
      READ(LEC,299)
10    WRITE(ITERM,344)
344   FORMAT(
     7 '  17 Area  >4sq.cm. Number'/
     8 '  18 Area  >4sq.cm. Wt in 1/10gm'/
     9 '  19 Length  <1cm  Number'/
     1 '  20 Length  <1cm  Wt in 1/10gm'/
     1 '  21 Length  1-1.9cm  Number'/
     2 '  22 Length  1-1.9cm  Wt in 1/10gm'/
     3 '  23 Length  2-2.9cm  Number'/
     4 '  24 Length  2-2.9cm  Wt in 1/10gm'/
     5 '  25 Length  3-3.9cm  Number'/
     6 '  26 Length  3-3.9cm  Wt in 1/10gm'/
     7 '  27 Length  >3.9cm  Number'/
     8 '  28 Length  >3.9cm  Wt in 1/10gm',/)
44    WRITE(ITERM,315)
315   FORMAT(1H ,'Type in code numbers in the order in which',
     1 ' the data appears'/' on the classification data file'/
     2 ' Separate codes by spaces and type on a single line'/)
31    READ(LEC,330) KLASS
330   FORMAT(50G)
41    IF(KLASS(1).EQ.0.OR.KLASS(1).EQ.99) GO TO 42
43    WRITE(ITERM,331)
331   FORMAT(1HO,'Program running',/)
C
C-Determine number of variables to be input.
      DO 40 L=1,30
      IF(KLASS(L).GT.29) GO TO 750
40    IF(KLASS(L).EQ.0) GO TO 45
45    NOCLS=L-1
C
C
C-************************************************************
C-First of new square, read in data for this square from
C file of size classification data, unit 11.
135   READ(11,305) SQUAR,CHECK
305   FORMAT(A3,A10)
      IF(CHECK.NE.BLANK) GO TO 751
C
140   DO 150 K=1,MAXU
      NUDAT(K)=0
      DO 150 L=1,30
150   IDATA(K,L)=0
C
160   READ(11,330,END=170,ERR=165) KUNIT,INTER
      NUVAL=NUVAL+1
C-Maximum number of excavation units per square for this version =MAXU
      IF(KUNIT.GT.MAXU) GO TO 700
C-Unpack size classification data read into IDATA in the standard order
C for the excavation data file.
180   IF(NUDAT(KUNIT).EQ.1) GO TO 590
      DO 190 L=1,NOCLS
190   IDATA(KUNIT,KLASS(L))=INTER(L)
      NUDAT(KUNIT)=1
      GO TO 160
C
C-Check to see if square header is merely a repetition
165   READ(11,305) NUSQ
      IF(NUSQ.EQ.SQUAR) GO TO 160
      BACKSPACE 11
      GO TO 200
C
C-End of classification data file, set flag
170   NOMOR=1
```

thumbnail scrapers (4-7), finely worked small scrapers not falling directly into the discoidal thumbnail scraper category (8 and 9), burins and burin spalls (1). There is at least one elouera, numerous well-retouched smallish steep scrapers and a peculiar blade fragment with one margin backed and the other dentated (12). Evidence of grinding was found in the form of a small flake with one margin finely ground on both faces to form a convex sharp edge (10), a flake from a ground-edge tool (11), and a flat pebble (9½ x 6½ x 2½ cms) with a heavily used ground edge at one end. Quartz thumbnail and similar scrapers are also present, and one quartz backed bladelet has a possible gum stain on the backing.

The assemblage appears to fit broadly within the eastern variant of the Small Tool Tradition. The presence of fabricators and ground edge tools in layers I and II/II" might tempt one to assume a relatively late date for these layers. For the moment it is impossible to say anything very positive about the layers below these, though no obvious differences are apparent.

## Preliminary Faunal Reports (by K. Aplin)

Faunal remains were present in all parts of the site, with a maximum density and size range of fragments within the dripline of the shelter itself. The material is in general highly fragmented and a considerable proportion shows evidence of burning. A wide range of animals are represented, including a variety of marsupials, rodents, reptiles, birds and fish and land gastropods. Fragments of emu eggshell were also present in sectors 9 and 10. Faunal remains of any kind were almost completely absent in sectors 0 to 3.

Mammal dentaries present within each sample were separated for identification. The presence of both fish and reptile remains and of tortoise carapace were also recorded during this procedure. The concretion covering much of the material made identification practical to a family level only. The preliminary nature of this analysis is stressed and the results given are by no means considered as representative of the total assemblage but rather serve to give an indication of the range of species present in the deposit. Table 2 presents a provisional list of the genera represented by the dentaries. Table 1 shows the distribution of mammalian fauna in percentage form.

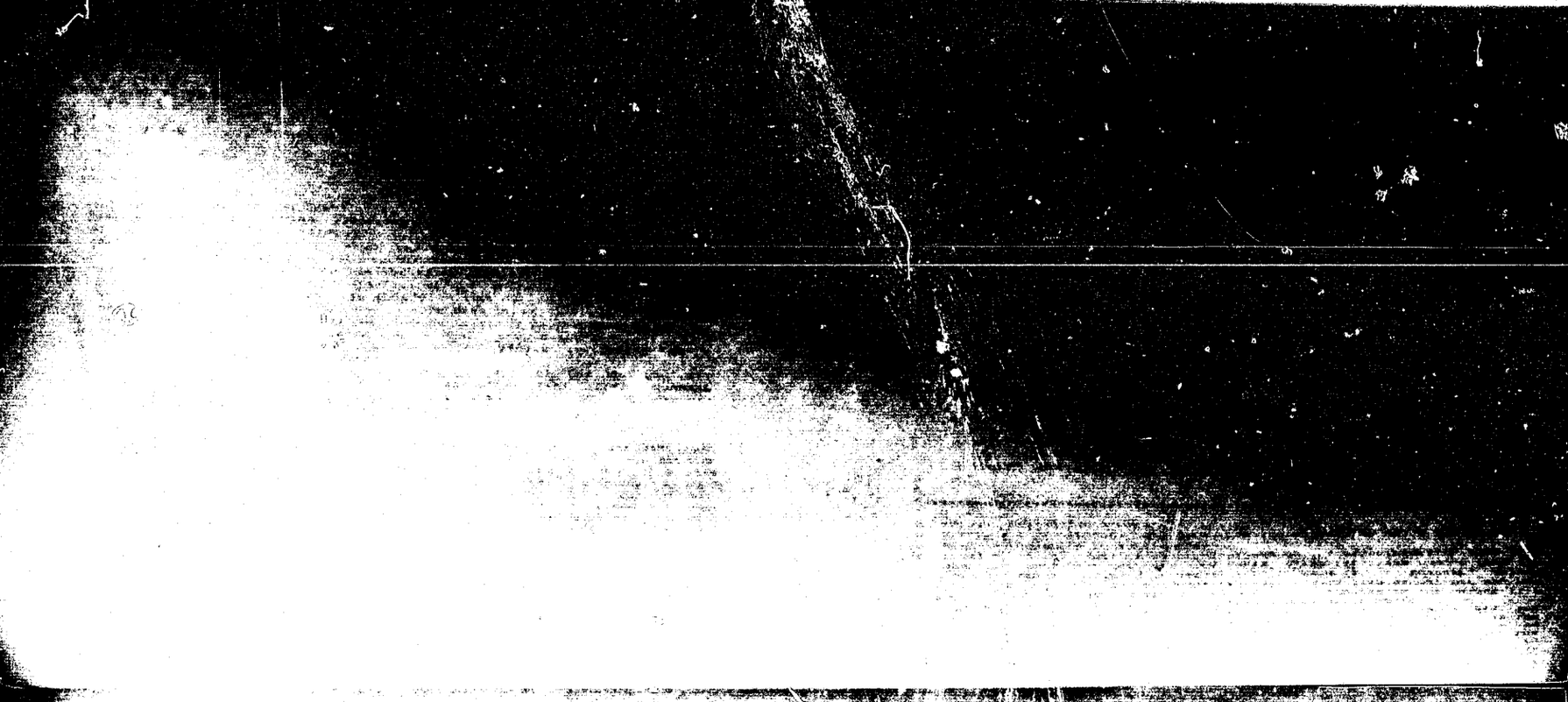
However, the initial picture gained from this analysis is one of the presence of a wide range of species, both in terms of size and favoured habitat. The presence of the marsupial carnivores Dasyurus spp. and Sarcophilus sp. raises the possibility of occasional use of the shelter by these animals.[1] The contribution of the remains of their prey to the faunal assemblage would produce a further complicating factor to be considered in any subsequent analysis.

A further analysis is planned taking into consideration such variables as anatomical location and specific identification of bone fragments where possible, the degree of fragmentation and burning, and the spatial and temporal variance of these.

---

[1] Sarcophilus sp. - E9 &IV" left mandibular fragment. Adult?
- E10 &IV" right maxillary fragment. Juvenile?
both preliminary identification only.

```
C **** CNTVAR ****
C Ian Johnson, Prehistory, RSPacS, ANU   July 1979
C Version 3/8/79
C
C
C-This program counts the number of variables on each line of a
C freefield file, ignoring lines with alphabetics or special
C characters. The user enters the filename and the expected number
C of variables per line from the terminal, and those lines not
C conforming to this expectation are listed on the terminal.
C
C-****************************************************************
C
      DOUBLE PRECISION INP,DAT
      DIMENSION VARS(130)
      DATA BLANK/1H /
      CALL DATE(DAT)
C
      TYPE 499,DAT
499   FORMAT(1H0/' EXCAVATION DATA PROCESSING'/
     1 1X,26(1H*),//,' Ian Johnson, Prehistory, ANU,  July 1979'/
     2 ' Version 3/8/79',////,' **** CNTVAR ****',19X,A10,//,
     3 ' This program counts',
     4 ' the number of variables per record on a freefield'/' data',
     5 ' file and lists those records which do not conform to an',/
     6 ' expectation which you enter from the terminal.'/' Records',
     7 ' containing alphabetic characters are ignored',//,
     8 ' Input file name? - '$)
      ACCEPT 553,INP
      CALL IFILE(10,INP)
      TYPE 498
498   FORMAT(1H0,'How many variables do you expect per record? : '$)
      ACCEPT 552,NEXPEC
553   FORMAT(A10)
552   FORMAT(G)
      N=0
      IERROR=0
      GO TO 1
2     READ(10,200)
1     N=N+1
      NVAR=0
      READ(10,200,END=555,ERR=2) VARS
200   FORMAT(150G)
      BACKSPACE 10
      READ(10,300) VARS
300   FORMAT(150A1)
      NVAR=0
      DO 4 K=1,130
      IF(VARS(K).EQ.BLANK) ISW=0
      IF(ISW.NE.0.OR.VARS(K).EQ.BLANK) GO TO 4
      NVAR=NVAR+1
      ISW=1
4     CONTINUE
      IF(NVAR.NE.NEXPEC) GO TO 10
400   FORMAT(1H ,'LINE',I4,'       OF VARIABLES',I3)
      GO TO 1
10    TYPE 400,N,NVAR
      IERROR=1
      GO TO 1
555   IF(IERROR.NE.1) TYPE 500
500   FORMAT(1H0,'ALL RECORDS CONTAIN EXPECTED NUMBER OF',
     1 ' VARIABLES',//)
      STOP
      END
```

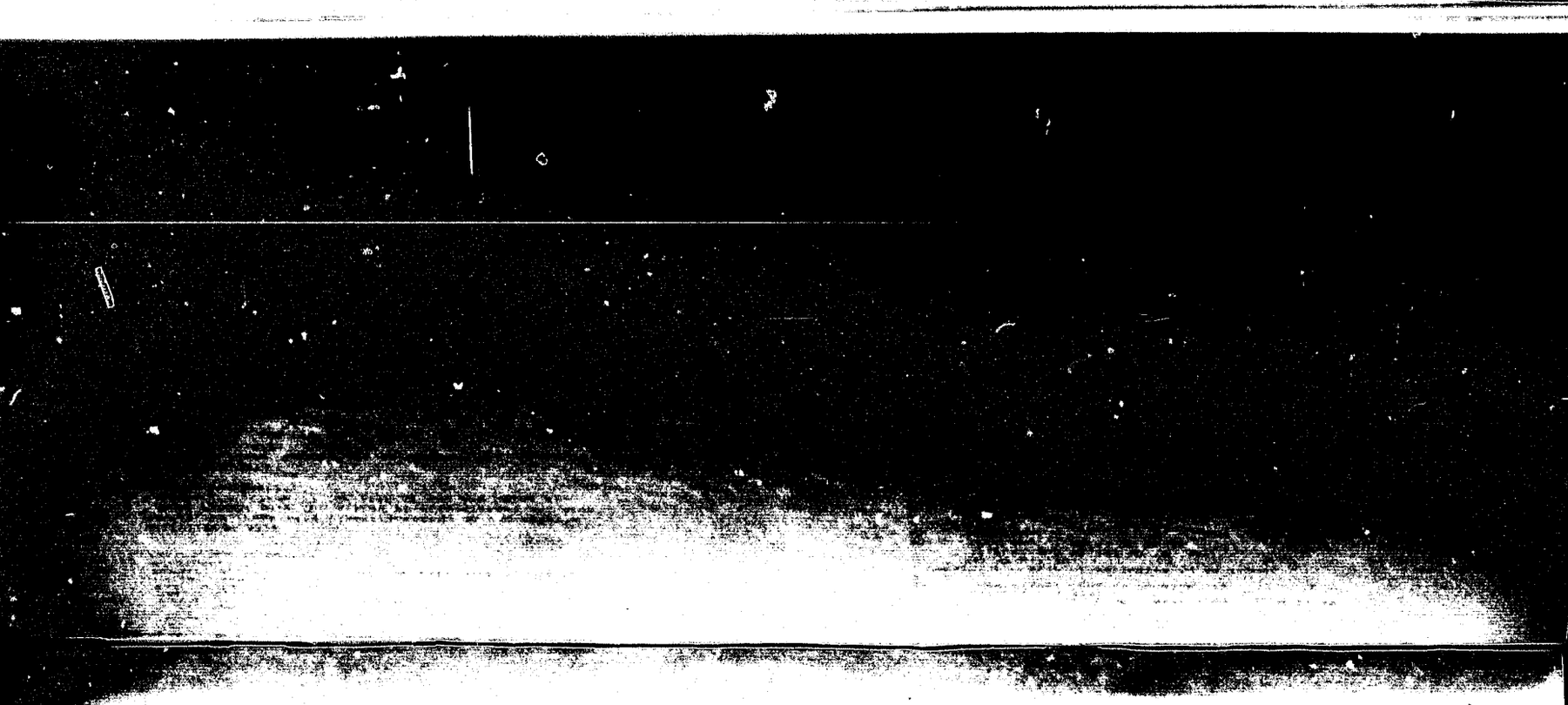


```
      WRITE(ITERM,300)
300   FORMAT(1HO,'Name of excavation data file? : '$)
      READ(LEC,299) INEXC
      CALL IFILE(10,INEXC)
      WRITE(ITERM,301)
301   FORMAT(1HO,'Name of size classification data file? : '$)
      READ(LEC,299) INSIZ
      CALL IFILE(11,INSIZ)
      WRITE(ITERM,302)
302   FORMAT(1HO,'What do you want to call your output file? : '$)
      READ(LEC,299) OUTPT
      CALL OFILE(12,OUTPT)
C
C
      WRITE(ITERM,303)
303   FORMAT(1HO,'What size classifications do you have?'/
     2 ' Type RETURN only for a list of size classes and code',
     3 ' numbers'/' (Type 99 for list if you are using a',
     5 ' video terminal)',/)
      GO TO 31
42    WRITE(ITERM,327)
327   FORMAT(1HO,'Code numbers are as follows:'/
     1 '   1 Weight  <1gm  Number',/
     2 '   2 Weight  <1gm  Wt in 1/10gm'/
     3 '   3 Weight  1-1.9gm  Number'/
     4 '   4 Weight  1-1.9gm  Wt in 1/10gm'/
     5 '   5 Weight  2-2.9gm  Number'/
     6 '   6 Weight  2-2.9gm  Wt in 1/10gm'/
     7 '   7 Weight  3-3.9gm  Number'/
     8 '   8 Weight  3-3.9gm  Wt in 1/10gm'/
     9 '   9 Weight  >3.9gm  Number'/
     1 '  10 Weight  >3.9gm  Wt in 1/10gm'/
     1 '  11 Area  <1sq.cm. Number'/
     2 '  12 Area  <1sq.cm. Wt in 1/10gm'/
     3 '  13 Area  1-2sq.cm. Number'/
     4 '  14 Area  1-2sq.cm. Wt in 1/10gm'/
     5 '  15 Area  2-4sq.cm. Number'/
     6 '  16 Area  2-4sq.cm. Wt in 1/10gm')
      IF(KLASS(1).EQ.0) GO TO 10
      WRITE(ITERM,304)
304   FORMAT(1HO,'Note codes needed before they disapear off',
     1 ' screen.  Press RETURN to continue')
      READ(LEC,298)
10    WRITE(ITERM,344)
344   FORMAT(
     7 '  17 Area  >4sq.cm. Number'/
     8 '  18 Area  >4sq.cm. Wt in 1/10gm'/
     9 '  19 Length  <1cm  Number'/
     1 '  20 Length  <1cm  Wt in 1/10gm'/
     1 '  21 Length  1-1.9cm  Number'/
     2 '  22 Length  1-1.9cm  Wt in 1/10gm'/
     3 '  23 Length  2-2.9cm  Number'/
     4 '  24 Length  2-2.9cm  Wt in 1/10gm'/
     5 '  25 Length  3-3.9cm  Number'/
     6 '  26 Length  3-3.9cm  Wt in 1/10gm'/
     7 '  27 Length  >3.9cm  Number'/
     8 '  28 Length  >3.9cm  Wt in 1/10gm',/)
44    WRITE(ITERM,315)
315   FORMAT(1H ,'Type in code numbers in the order in which',
     1 ' the data appears'/' on the classification data file'/
     2 ' Separate codes by spaces and type on a single line'/)
31    READ(LEC,330) KLASS
330   FORMAT(50G)
41    IF(KLASS(1).EQ.0.OR.KLASS(1).EQ.99) GO TO 42
43    WRITE(ITERM,331)
331   FORMAT(1HO,'Program running',/)
C
C-Determine number of variables to be input.
      DO 40 L=1,30
      IF(KLASS(L).GT.29) GO TO 750
40    IF(KLASS(L).EQ.0) GO TO 45
45    NOCLS=L-1
C
C
C-************************************************************
C-First of new square, read in data for this square from
C file of size classification data, unit 11.
135   READ(11,305) SQUAR,CHECK
305   FORMAT(A3,A10)
      IF(CHECK NE.BLANK) GO TO 751
C
140   DO 150 K=1,MAXU
      NUDAT(K)=0
      DO 150 L=1,30
150   IDATA(K,L)=0
C
160   READ(11,330,END=170,ERR=165) KUNIT,INTER
      NUVAL=NUVAL+1
C-Maximum number of excavation units per square for this version =MAXU
      IF(KUNIT.GT.MAXU) GO TO 700
C-Unpack size classification data read into IDATA in the standard order
C for the excavation data file.
180   IF(NUDAT(KUNIT).EQ.1) GO TO 590
      DO 190 L=1,NOCLS
190   IDATA(KUNIT,KLASS(L))=INTER(L)
      NUDAT(KUNIT)=1
      GO TO 160
C
C-Check to see if square header is merely a repetition
165   READ(11,305) NUSQ
      IF(NUSQ.EQ.SQUAR) GO TO 160
      BACKSPACE 11
      GO TO 200
C
C-End of classification data file, set flag
170   NUMOR=1
```

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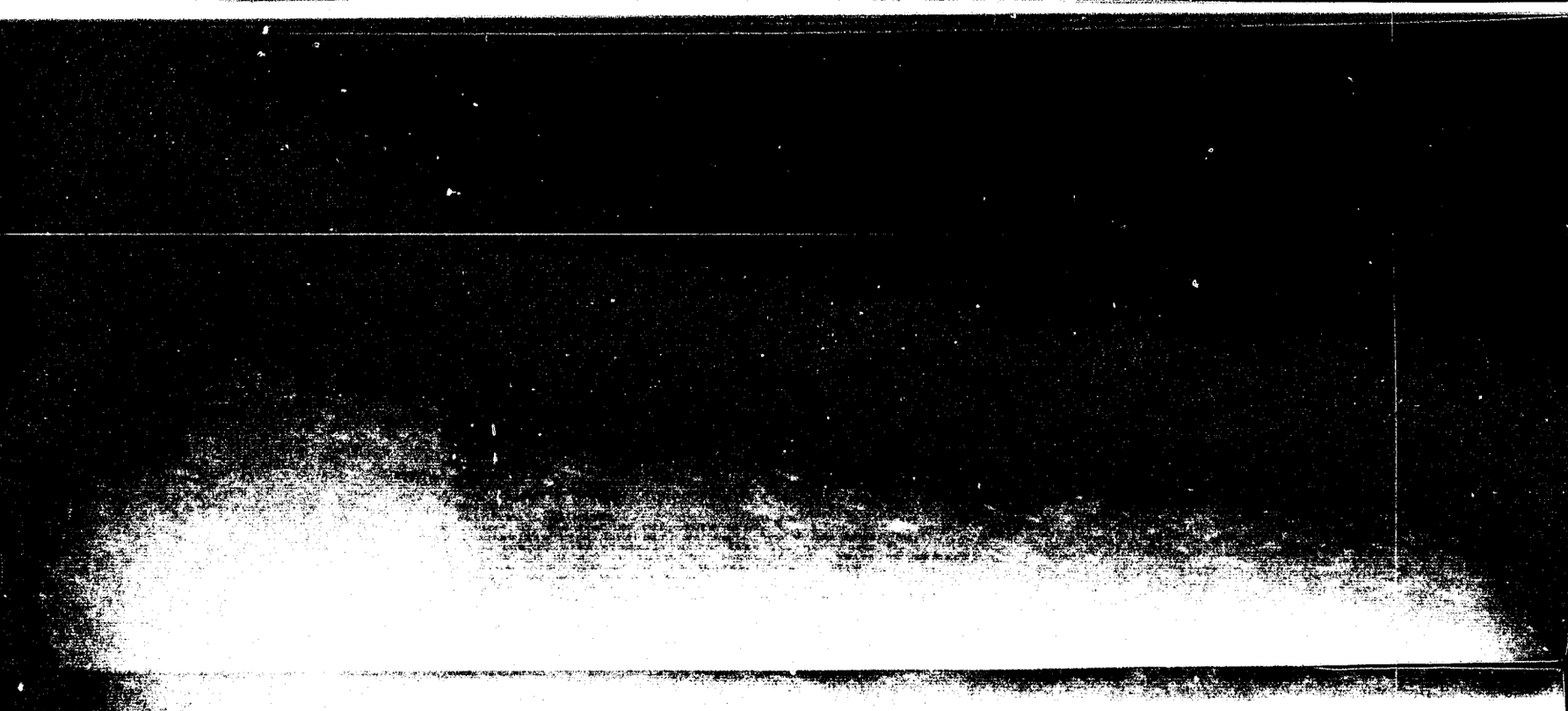
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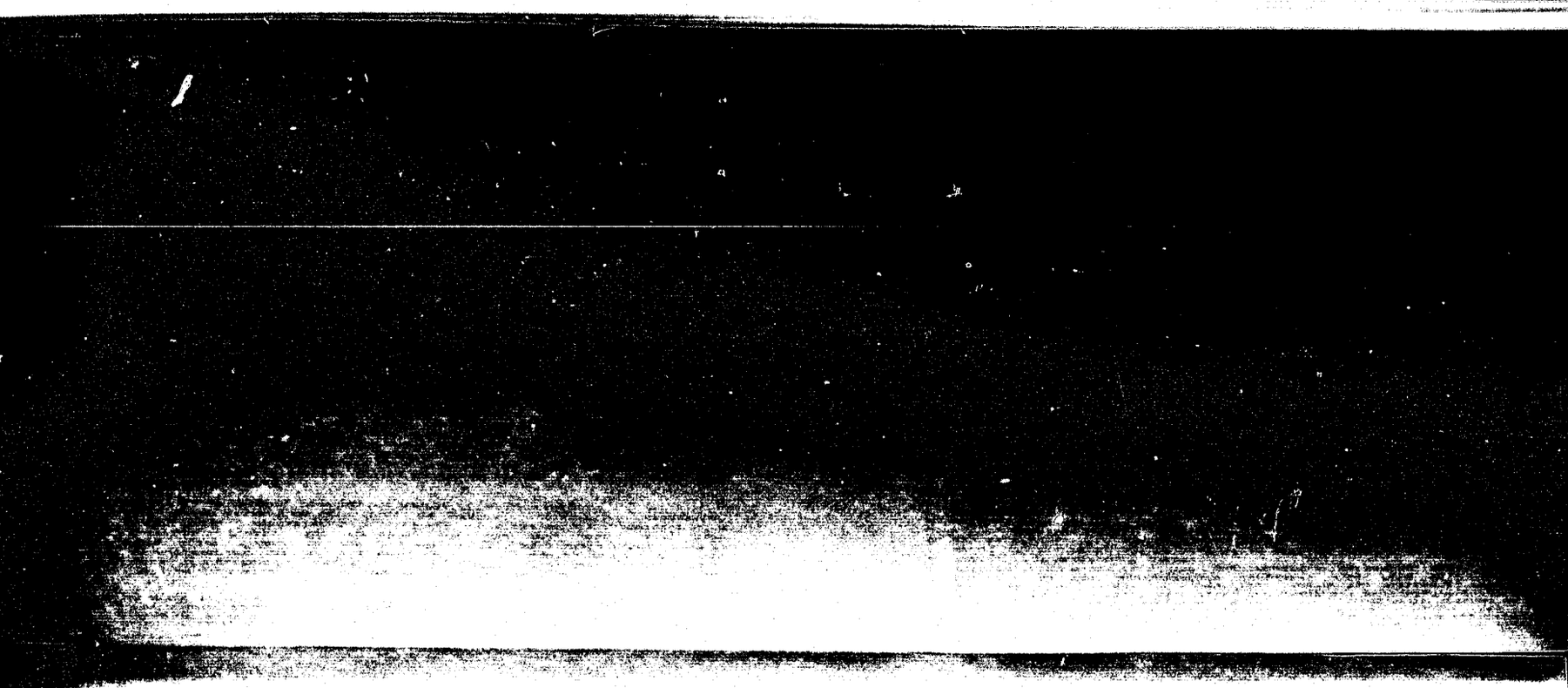


```
C-************************************************************
C
C-Read first record of new square from excavation data file, check to
C see whether the square now being read corresponds with the classification
C data held in IDATA, whose square identifier is held in SQUAR.
C If squares don't correspond, copy over records until correct
C square is reached
200     READ(10,306,END=600) INTEG,SITE,SQ,TEXT
        NREAD=NREAD+1
        IF(SQ.EQ.SQUAR.AND.INTEG.EQ.3) GO TO 210
        DO 201 L=1,30
        NOTBL=31-L
201     IF(TEXT(NOTBL).NE.BLANK) GO TO 202
202     WRITE(12,306) INTEG,SITE,SQ,(TEXT(L),L=1,NOTBL)
        NWRIT=NWRIT+1
        GO TO 200
C
C-This record is a size classification record (record type 3).
C Transfer size classification data held in IDATA to INTER ready for output.
210     BACKSPACE 10
        READ(10,307,END=600) INTEG,SITE,SQ,KUNIT,PRT,LEVEL,DIVN,INTER
        IF(KUNIT.GT.100) GO TO 700
307     FORMAT(I1,A4,A3,I3,A1,I3,A1,2X,50I4)
        IF(NUDAT(KUNIT).EQ.0) GO TO 221
        DO 220 L=1,NOCLS
220     INTER(KLASS(L))=IDATA(KUNIT,KLASS(L))
        MATCH=MATCH+1
        NUDAT(KUNIT)=0
        DO 218 L=1,30
        NOTBL=31-L
218     IF(INTER(NOTBL).NE.0) GO TO 221
221     WRITE(12,307) INTEG,SITE,SQ,KUNIT,PRT,LEVEL,DIVN,
     1 (INTER(L),L=1,NOTBL)
        NWRIT=NWRIT+1
C
C-Read in and write records from excavation data file, unit 10.
205     READ(10,306,END=600) INTEG,SITE,SQ,TEXT
306     FORMAT(I1,A4,A3,50A4)
        NREAD=NREAD+1
        IF(SQUAR.NE.SQ) GO TO 208
        IF(INTEG.EQ.3) GO TO 210
        DO 223 L=1,30
        NOTBL=31-L
223     IF(TEXT(NOTBL).NE.BLANK) GO TO 224
224     WRITE(12,306) INTEG,SITE,SQ,(TEXT(L),L=1,NOTBL)
        NWRIT=NWRIT+1
        GO TO 205
C
C-New square just read on excavation data file, check to see whether
C classification data file has been exhausted.
208     IF(INTEG.NE.1) GO TO 580
        DO 225 L=1,100
225     IF(NUDAT(L).EQ.1) GO TO 226
        BACKSPACE 10
227     IF(NOMOR.EQ.1) GO TO 200
        GO TO 135
C-************************************************************
C       ERROR MESSAGES
C-************************************************************
C
750     WRITE(ITERM,316) KLASS(L)
316     FORMAT(1HO,'**** WARNING ****   Size class code: ',I4/
     1 ' This version cannot accommodate more than 28 size classes'/
     2 ' (codes 1 - 28)',/)
        GO TO 44
C
751     WRITE(ITERM,363) NUVAL
363     FORMAT(1HO,'**** WARNING ****'/
     1 ' Square identifier extends into column 4 on size',
     2 ' classification data file'/' encountered after reading',I5,
     3 ' records'/' RUN ABORTED',//)
        GO TO 800
C
C
C-Not all the classification data read in for '  s square has been
C matched. Type out error message.
226     WRITE(ITERM,343) SQUAR,L
343     FORMAT(1HO,'**** ERROR **** Size classifications have',
     1 ' been provided'/' for excavation units which do not exist',
     2 ' on the excavation data file.'/' Encountered',
     3 ' whilst reading size classification data for',
     4 ' square: ',A3,' unit: ',I3/
     3 ' You should check your data',
     3 ' - RUN ABORTED',///)
        GO TO 800
C
C
C-Type out warning that program version capacity exceeded.
700     WRITE(ITERM,308) SQ,KUNIT,NREAD,NUVAL
308     FORMAT(1HO,'**** WARNING ****     Square: ',A3/
     1 ' This version cannot accommodate more than',
     2 ' 100 excavation units'/' in each excavation square.'/
     3 ' Value of',I4,' encountered after reading',I5,' records'/
     4 ' from excavation data file and',I5,' records from'/
     5 ' size classification file'/
     6 ' You will need to modify the DIMENSION statement at',
     7 ' the top'/' of the program and this error trap',//,
     8 ' RUN ABORTED',///)
        GO TO 800
C
C
580     WRITE(ITERM,341) SQ,NREAD,INTEG
341     FORMAT(1HO,'**** ERROR ****'/' New excavation square (',
     1 A3,') encountered on excavation data file'/
     2 ' at record number:',I5,', but column 1 contains a ',I1,
     3 ' not a 1'/' RUN ABORTED',///)
        GO TO 800
C
C
590     WRITE(ITERM,332) SQUAR,KUNIT,NUVAL
332     FORMAT(1HO,'**** ERROR ****'/' More than one set of',
     1 ' classification data supplied for'/' square ',A3,
     2 ', unit',I3,'.  Encountered after reading',I5,' records'/
     3 ' from size classification data file'/
     4 ' RUN ABORTED',///)
        GO TO 800
```

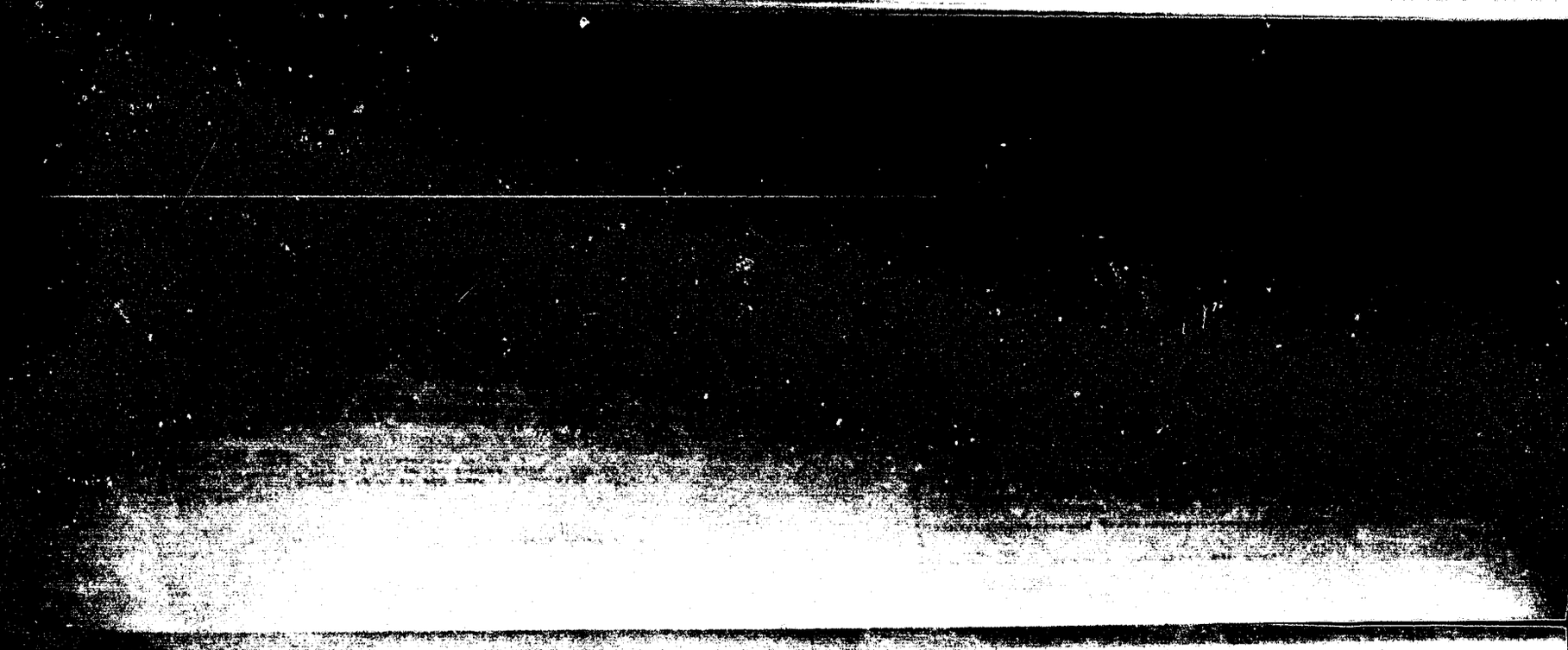
```
600     WRITE(ITERM,309) NWRIT,OUTPT,NUVAL,MATCH
309     FORMAT(1HO,I5,' records written on output file: ',
     1 A10/1X,I5,' Sets of size classifications read'/
     2 1x,I5,' Sets of size classifications added to'/
     3 '      excavation data file',///)
        IF(NUVAL.EQ.MATCH.AND.NOMOR.EQ.1) GO TO 800
C
        WRITE(ITERM,310)
310     FORMAT(1HO,'**** WARNING ****'/' Some of the excavation',
     1 ' squares in the size classification file'/
     1 ' have not been matched with',
     2 ' excavation squares on the excavation data file.'/
     3 ' This may be due to incorrect ordering of excavation squares',
     4 ' on the'/' size classification file.'/' Unmatched',
     5 ' classification data will be output on a new file.',//,
     6 ' What do you want to call this file? : '$)
        READ(LEC,299) UNMAT
        NWRIT=0
        CALL OPFILE(13,UNMAT)
        WRITE(13,334) SQUAR
334     FORMAT(A3)
        NWRIT=NWRIT+1
        DO 605 L=1,100
        IF(NUDAT(L).EQ.0) GO TO 605
        WRITE(13,314) L,((IDATA(L,KLASS(M))),M=1,NOCLS)
314     FORMAT(50(I5,1X))
        NWRIT=NWRIT+1
605     CONTINUE
608     IF(NOMOR.EQ.1) GO TO 620
610     READ(11,311,END=620) SQ,TEXT
311     FORMAT(A3,10A5,20A4)
        IF(SQ.EQ.SQUAR) GO TO 615
C-Change of excavation square, output square identifier heading
        SQUAR=SQ
        WRITE(13,312) SQUAR
312     FORMAT(A3)
        NWRIT=NWRIT+1
615     WRITE(13,313) TEXT
313     FORMAT(10A5,20A4)
        NWRIT=NWRIT+1
        GO TO 610
620     WRITE(ITERM,630) NWRIT,UNMAT
630     FORMAT(1HO,I4,' unmatched data records copied over',
     1 ' to file: ',A10,///)
C
C
800     STOP
        END
```



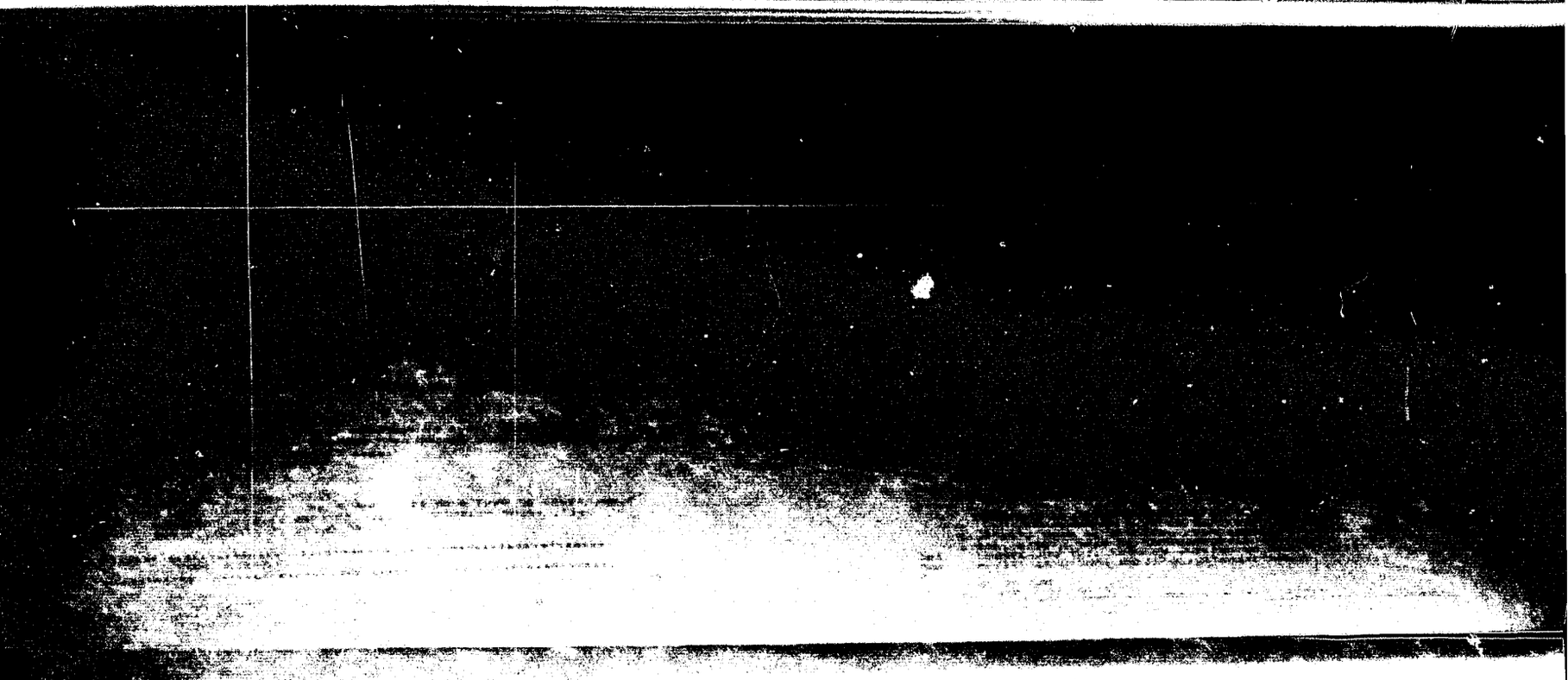
```
C-**** ADDODS ****
C
C-Ian Johnson, Prehistory, ANU    July 1979
C VERSION 10/9/79
C For a full explanation of the use of this program, see
C Johnson 1979, "Digging for Data", PhD, ANU.
C
C
C  This program adds up to 28 supplementary variables per excavation unit
C  onto the excavation data file.  These variables may include such things
C  as sedimentological analysis data, typological counts, pH or any other
C  data which refers to the excavation unit as a whole rather than to
C  individual finds.  The variables are read from one file (the
C  supplementary variables data file) and are added onto any chosen record
C  type on the excavation data file.  An updated version of the excavation
C  data file is output, leaving the source files unchanged.
C
C  Running the program
C  When the program is run (by typing EX ADDODS or RUN ADDODS) it asks for
C  the names of the excavation data file and the supplementary variables
C  data file and for the name you wish to give to the updated excavation
C  data file which is output from the program.  It then asks you to list
C  the code numbers for the variables which occur on the supplementary
C  variables data file in the order in which they occur, and the record
C  type to which you want these variables added.
C
C  Structure of the supplementary variables data file
C  (1) Excavation squares must appear in the same order on the
C  supplementary data file as on the excavation data file.  However
C  supplementary variables data need not be supplied for all squares or for
C  all excavation units within a square.
C  (2) The block of records for each excavation square is headed by a
C  record containing the excavation square identifier in columns 1-3.
C  (3) Subsequent records for that square may occur in any order and should
C  contain the excavation unit number followed by values for each of the
C  supplementary variables you wish to add on to the file.  The values are
C  separated by space(s) (freefield format).  They may be entered in any
C  (consistent) order as the variables which are present and the order in
C  which they are input are specified from the terminal when the program is
C  run.  Note that zero or missing values in the supplementary variables
C  data must be represented by a zero, not a blank (since blanks are used
C  to delimit successive values).  If there are less values on a record
C  than the number of variables specified from the terminal, the extra
C  variables will be read as zeros.
C
C  Example:
C  Q12
C  1 34 54 76 54 37 89
C  2 3 6 4 0 4 7
C  3 0 0 4 6 2 8
C  Q13
C  1 4 6 8 9 3 5
C  2 96 98 57 33 27 44
C  3 4 6 1 0 4 7
C  22 5 2 0 3 7 1
C  15 4 6 12 9 0 3
C  Q15
C  48 3 0 0 0 4 2
C  A number of error traps are built into the program.  These will pick up
C  various coding errors in the common field (columns 1-18) of the
C  excavation data file, variable codes outside the range 1-28, excavation
C  units with numbers greater than 110 and supplementary data supplied for
C  excavation units which do not exist on the excavation data file.  In
C  addition, if the excavation squares are incorrectly ordered on the
C  supplementary variables data file, the unmatched supplementary variables
C  data will be output on a new file.  One or two additional runs using
C  this file as the supplementary variables data file will generally
C  suffice to match all the supplementary variables data onto the
C  appropriate excavation units.
C  Note:  this program can be used as an editing program as the output file
C  is identical with the original excavation data file except for any new
C  values supplied on the supplementary variables data file.  However,
C  values must be supplied for all the supplementary variables chosen from
C  the terminal at run time, as trailing blanks on the supplementary
C  variables data file will be converted to zero values.
C  Limit on this version:  not more than 110 excavation units may occur for
C  any one excavation square.
C
C*************************************************************************
C
C
      DOUBLE PRECISION INEXC,INRM,DAT,OUTPT,UNMAT
      DIMENSION KLASS(33),INTER(30),IDATA(100,30),TEXT(30),
     1 NUDAT(100),TEXTO(26),NUMER(10)
      DATA BLANK/1H /,Y/1HY/,SMY/1Hy/,IBLANK/1H /,
     1 NUMER/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/
C
      ITERM=6
      LEC=5
C-MAXU is the maximum permissible number of excavation units in any one
C excavation square. If it is changed, the DIMENSION statement above
C will also have to be changed.
      MAXU=100
      CALL DATE(DAT)
C-NOMOR is a flag for the end of the classification data file.
      NOMOR=0
C-MATCH is a counter for the number of records output onto which
C classification data has been added.
      MATCH=0
C-NUVAL is a counter for the number of records of classification
C data read in from unit 11.
      NUVAL=0
C-NREAD is a counter for the number of records read from the
C excavation data file.
      NREAD=0
C-NWRIT is a counter for the number of records written on the output file
      NWRIT=0
C
299   FORMAT(A10)
      WRITE(ITERM,5000) DAT
5000  FORMAT(1HO/' EXCAVATION DATA PROCESSING'/
     1 1X,26(1H*),//,' Ian Johnson, Prehistory, ANU,  July 1979'/
     2 ' Version 10/9/79',///,' **** ADDODS ****',19X,A10,//,
     3 ' This program adds up to 28 variables to any specified',
     4 ' record type'/' on the excavation data file'/
     5 ' For documentation see top of program listing',//)
```



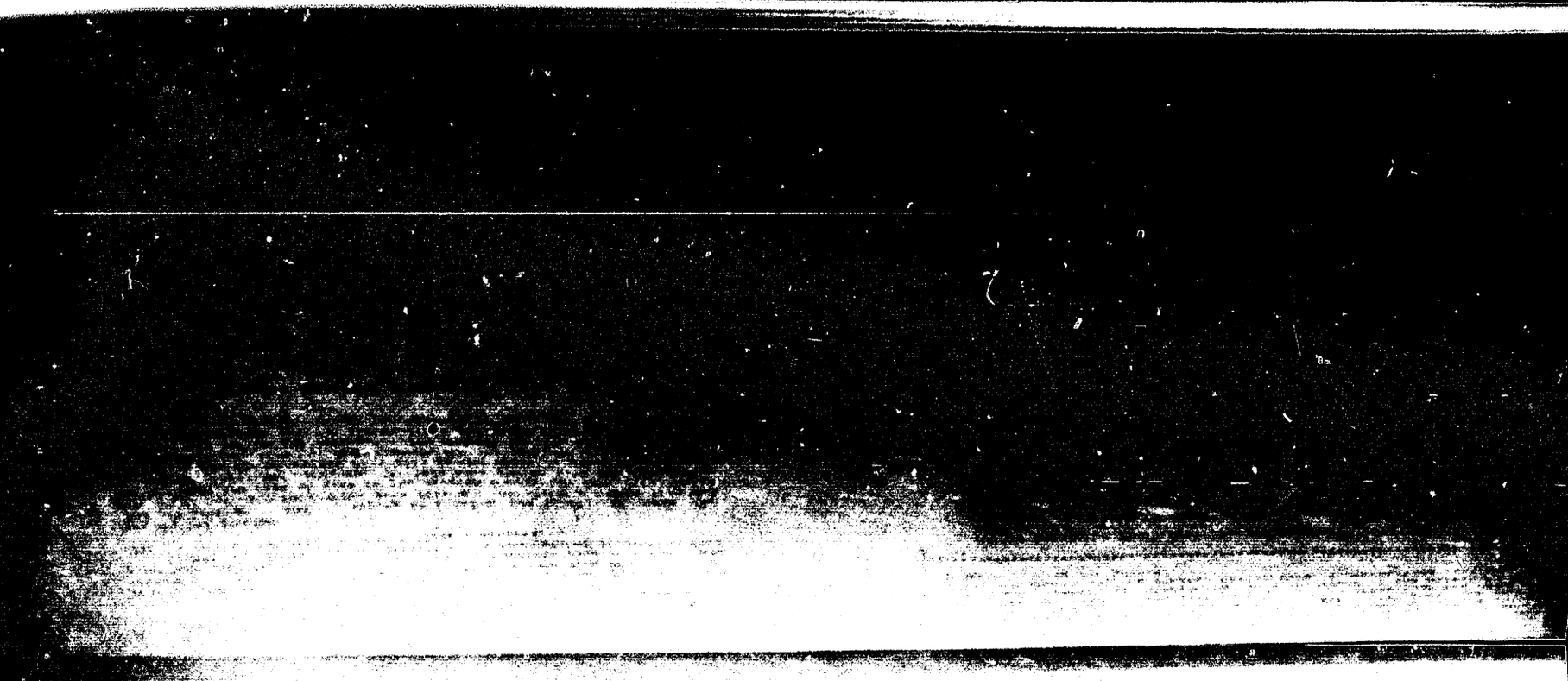
```
      WRITE(ITERM,300)
300   FORMAT(1HO,'Name of excavation data file? : '$)
      READ(LEC,299) INEXC
      CALL IFILE(10,INEXC)
      WRITE(ITERM,301)
301   FORMAT(1HO,'Name of supplementary variables data file? : '$)
      READ(LEC,299) INRM
      CALL IFILE(11,INRM)
      WRITE(ITERM,302)
302   FORMAT(1HO,'What do you want to call your output file? : '$)
      READ(LEC,299) OUTPT
      CALL OFILE(12,OUTPT)
C
C
5     WRITE(ITERM,280)
280   FORMAT(1HO,'Which record type do you want to add data to?',/
     1 ' Specify integer number 4,7,8 or 9. Record type 4 should',/
     2 ' be used initially for supplementary values')
      READ(LEC,330) NREC
C
10    WRITE(ITERM,303)
303   FORMAT(1HO,'What supplementary variables do you have?'/
     1 ' Type in code numbers of variables in order of data'/' on a',
     2 ' single line separated by spaces'/)
      READ(LEC,330) (KLASS(L),L=1,28)
330   FORMAT(50G)
C
25    WRITE(ITERM,331)
331   FORMAT(1HO,'Program running',/)
C
      NOCLS=0
      DO 40 L=1,33
      IF(KLASS(L).EQ.0) GO TO 40
      NOCLS=NOCLS+1
      KLASS(NOCLS)=KLASS(L)
40    CONTINUE
C
C-************************************************************
C-First of new square, read in data for this square from
C file of size classification data, unit 11.
135   READ(11,305) SQUAR,CHECK
305   FORMAT(A3,A10)
      IF(CHECK.NE.BLANK) GO TO 751
C
140   DO 150 K=1,MAXU
      NUDAT(K)=0
      DO 150 L=1,30
150   IDATA(K,L)=0
C
160   READ(11,330,END=170,ERR=165) KUNIT,INTER
      NUVAL=NUVAL+1
C-Maximum number of excavation units per square for this version =MAXU
      IF(KUNIT.GT.MAXU) GO TO 700
C-Unpack size classification data read into IDATA in the standard order
C for the excavation data file.
180   IF(NUDAT(KUNIT).EQ.1) GO TO 590
      DO 190 L=1,NOCLS
190   IDATA(KUNIT,KLASS(L))=INTER(L)
      NUDAT(KUNIT)=1
      GO TO 160
C-Check to see if square header is merely a repetition
165   READ(11,305) NUSQ
      IF(NUSQ.EQ.SQUAR) GO TO 160
      BACKSPACE 11
      GO TO 200
C
C-End of classification data file, set flag
170   NOMOR=1
C
C
C-************************************************************
C
C-Read first record of new square from excavation data file, check to
C see whether the square now being read corresponds with the classification
C data held in IDATA, whose square identifier is held in SQUAR.
C If squares don't correspond, copy over records until correct
C square is reached
200   READ(10,306,END=600) INTEG,SITE,SQ,TEXT
      NREAD=NREAD+1
      IF(SQ.EQ.SQUAR.AND.INTEG.EQ.NREC) GO TO 210
      DO 201 L=1,30
      NOTBL=31-L
201   IF(TEXT(NOTBL).NE.BLANK) GO TO 202
202   WRITE(12,306) INTEG,SITE,SQ,(TEXT(L),L=1,NOTBL)
      NWRIT=NWRIT+1
      GO TO 200
C
C-This record is a supplementary variables record (record type NREC).
C Transfer variables held in IDATA to INTER ready for output.
210   BACKSPACE 10
      READ(10,307,END=600) INTEG,SITE,SQ,KUNIT,PRT,LEVEL,DIVN,INTER
      IF(KUNIT.GT.100) GO TO 700
307   FORMAT(I1,A4,A3,I3,A1,I3,A1,2X,30I4)
      IF(NUDAT(KUNIT).EQ.0) GO TO 221
      DO 220 L=1,NOCLS
220   INTER(KLASS(L))=IDATA(KUNIT,KLASS(L))
      MATCH=MATCH+1
      NUDAT(KUNIT)=0
      DO 222 L=1,30
      NOTBL=31-L
222   IF(INTER(NOTBL).NE.0) GO TO 221
221   WRITE(12,307) INTEG,SITE,SQ,KUNIT,PRT,LEVEL,DIVN,
     1 (INTER(L),L=1,NOTBL)
      NWRIT=NWRIT+1
C
C-Read in and write records from excavation data file, unit 10.
205   READ(10,306,END=600) INTEG,SITE,SQ,TEXT
306   FORMAT(I1,A4,A3,30A4)
      NREAD=NREAD+1
      IF(SQUAR.NE.SQ) GO TO 208
      IF(INTEG.EQ.NREC) GO TO 210
      DO 223 L=1,30
      NOTBL=31-L
223   IF(TEXT(NOTBL).NE.BLANK) GO TO 224
224   WRITE(12,306) INTEG,SITE,SQ,(TEXT(L),L=1,NOTBL)
      NWRIT=NWRIT+1
      GO TO 205
```



```
C-New square just read on excavation data file, check to see whether
C classification data file has been exhausted.
208     IF(INTEG.NE.1) GO TO 580
        DO 225 L=1,100
225     IF(NUDAT(L).EQ.1) GO TO 226
        BACKSPACE 10
227     IF(NOMOR.EQ.1) GO TO 200
        GO TO 135
C
C-************************************************************
C       ERROR MESSAGES
C-************************************************************
C
750     WRITE(ITERM,315) KLASS(L)
315     FORMAT(1HO,'**** WARNING ****    Variable code: ',I4/
     1 ' This version cannot accommodate more than 28 variables',
     2 ' (codes 1 - 28)',///)
        GO TO 10
C
751     WRITE(ITERM,363) NUVAL
363     FORMAT(1HO,'**** WARNING ****'/
     1 ' Square identifier extends into column 4 on supplementary',
     2 ' variables data file'/' encountered after reading',I5,
     3 ' records'/' RUN ABORTED',//)
        GO TO 800
C
C-Not all the classification data read in for this square has been
C matched. Type out error message.
226     WRITE(ITERM,343) SQUAR,L
343     FORMAT(1HO,'**** ERROR **** supplementary variables have',
     1 ' been provided'/' for excavation units which do not exist',
     2 ' on the excavation data file.'/' Encountered',
     3 ' whilst reading supplementary variables data for',
     4 ' square: ',A3,' unit: ',I3/
     3 ' You should check your data',
     3 ' - RUN ABORTED',///)
        GO TO 800
C
C-Type out warning that program version capacity exceeded.
700     WRITE(ITERM,308) SQ,KUNIT,NREAD,NUVAL
308     FORMAT(1HO,'**** WARNING ****     Square: ',A3/
     1 ' This version cannot accommodate more than',
     2 ' 100 excavation units'/' in each excavation square.'/
     3 ' Value of',I4,' encountered after reading',I5,' records'/
     4 ' from excavation data file and',I5,' records from'/
     5 ' supplementary variables file'/
     6 ' You will need to modify the DIMENSION statement at',
     7 ' the top'/' of the program and this error trap',//,
     8 ' RUN ABORTED',///)
        GO TO 800
580     WRITE(ITERM,341) SQ,NREAD,INTEG
341     FORMAT(1HO,'**** ERROR ****'/' New excavation square (',
     1 A3,') encountered on excavation data file'/
     2 ' at record number:',I5,', but column 1 contains a ',I1,
     3 ' not a 1'/' RUN ABORTED',///)
        GO TO 800
590     WRITE(ITERM,332) SQUAR,KUNIT,NUVAL
332     FORMAT(1HO,'**** ERROR ****'/' More than one set of',
     1 ' variable values supplied for'/' square ',A3,
     2 ', unit',I3,'.  Encountered after reading',I5,' records'/
     3 ' from supplementary variables data file'/
     4 ' RUN ABORTED',///)
        GO TO 800
C
600     WRITE(ITERM,309) NWRIT,OUTPT,NUVAL,MATCH
309     FORMAT(1HO,I5,' records written on output file: ',
     1 A10/1X,I5,' Sets of supplementary variables read'/
     2 1x,I5,' Sets of supplementary variables added to',/,
     3 '       excavation data file',///)
        IF(NUVAL.EQ.MATCH.AND.NOMOR.EQ.1) GO TO 800
C
        WRITE(ITERM,310)
310     FORMAT(1HO,'**** WARNING ****'/' Some of the excavation',
     1 ' squares in the supplementary variables file'/
     1 ' have not been matched with',
     2 ' excavation squares on the excavation data file.'/
     3 ' This may be due to incorrect ordering of excavation squares',
     4 ' on the'/' supplementary variables file.'/' Unmatched',
     5 ' variable values will be output on a new file.',//,
     6 ' What do you want to call this file? : '$)
        READ(LEC,299) UNMAT
        NWRIT=0
        CALL OFILE(13,UNMAT)
        WRITE(13,334) SQUAR
334     FORMAT(A3)
        NWRIT=NWRIT+1
        DO 605 L=1,100
        IF(NUDAT(L).EQ.0) GO TO 605
        WRITE(13,314) L,((IDATA(L,KLASS(N))),N=1,NOCLS)
314     FORMAT(50(I5,1X))
        NWRIT=NWRIT+1
605     CONTINUE
608     IF(NOMOR.EQ.1) GO TO 620
610     READ(11,311,END=620) SQ,TEXT
311     FORMAT(A3,10A5,20A4)
        IF(SQ.EQ.SQUAR) GO TO 615
C-Change of excavation square, output square identifier heading
        SQUAR=SQ
        WRITE(13,312) SQUAR
312     FORMAT(A3)
        NWRIT=NWRIT+1
615     WRITE(13,313) TEXT
313     FORMAT(10A5,20A4)
        NWRIT=NWRIT+1
        GO TO 610
620     WRITE(ITERM,630) NWRIT,UNMAT
630     FORMAT(1HO,I4,' unmatched data records copied over',
     1 ' to file: ',A10,///)
800     STOP
        END
```



```
C-**** ADDAT ****
C
C-Ian Johnson, Prehistory, ANU    July 1979
C VERSION 10/9/79
C For a full explanation of the use of this program, see
C Johnson 1979, "Digging for Data", PhD, ANU.
C
C
C  This program adds attribute data for individualised finds onto the  main
C  excavation  data  file.  The attribute data is read from one file ("the
C  attribute data file") and added onto the appropriate records (type 5 and
C  6  records)  of the excavation data file.  A new updated excavation data
C  file is output, leaving the source files unaltered.
C
C  Running the program
C  When the program is run (by typing EX ADDAT or RUN ADDAT)  it  asks  for
C  the  names  of  the excavation data file and the attribute data file and
C  for the name you wish to give to the updated excavation data file  which
C  is  output  from  the  program.  It then asks you to list the attributes
C  which occur on the attribute data file in the order in which they occur.
C  If  requested  a  list  of code numbers and the corresponding attributes
C  will be typed out on the terminal.  The present version of  the  program
C  lists  the attribute set for lithic finds described in Johnson 1979, but
C  this list can be easily changed (or ignored) without affecting the  rest
C  of the program.
C
C  Changing the attributes and output format
C  See statement numbers  312  and  314  in  program  for  a  list  of  the
C  attributes  available  with  the  present  version  of the program.  The
C  program can quite easily accommodate different sets of attributes to the
C  one chosen in the present version, only minor changes being required for
C  up to 50 attributes per object.  These changes are detailed  below.  In
C  addition  the  list  of  attributes  in  statements  312  and 314 can be
C  modified if required.
C
C  Format of the attribute data file
C  (1)Records for finds from a particular excavation unit must  be  grouped
C  together  and  headed  by  a  record  specifying  the  excavation square
C  identifier in columns 1-3 followed by the excavation unit number.
C  (2) The excavation units must appear in the same order on the  attribute
C  data  file  as  on the excavation data file.  Excavation units for which
C  there is no data can be omitted from the attribute data file.
C  (3) Records for each find should specify  the  find-number  followed  by
C  values for one or more attributes.  The attribute values can be arranged
C  in any (consistent) order.  Values are separated  by  spaces  (freefield
C  format).  Finds can occur in any order within each excavation unit, and
C  more finds may be specified than exist on the excavation data file.  In
C  this  case records are output for the new finds with zero values for all
C  attributes not specified.
C  If more than one set of attributes is specified for a  particular  find,
C  the  extra  sets  will  be output on type 6 (supplementary working edge)
C  records on the excavation data file.
C  If no record occurs on the  attribute  data  file  for  a  find  on  the
C  excavation  data  file,  the  record  for  that find will be transferred
C  unchanged to the updated excavation data file output from  the  program.
C  For  those  finds  which  do  occur on the attribute data file, only the
C  attributes appearing on this file are modified, the remaining attributes
C  being  transferred  unchanged  to  the  output  file.  The program can
C  therefore be used to edit a data file because only the attribute  values
C  supplied on the attribute data file are modified.
C  From 1 to 24 attributes may be specified  from  the  terminal  when  the
C  program  is run, but if there are less attributes on a particular record
C  than the number you have specified the missing attributes will be output
C  with  zero  values.  If  there  are  more  attributes  than  the number
C  specified, the extra values will be ignored.  To check that you have got
C  the  right  number  of  attributes  on each record of the attribute data
C  file, you should use the program CNTVAR (see  documentation  at  top  of
C  program listing for CNTVAR).
C
C*************************************************************************
C
      DOUBLE PRECISION INEXC,INATT,DAT,OUTPT,UNMAT
      INTEGER EXUNT
      DIMENSION KLASS(50),INTER(26),IDATA(110,26),TEXT(26),
     1 TXT(3),NUDAT(110),NUMER(10),MREDG(20,26),INDEX(20),FORM(30)
      COMMON INTER,NATTS,NOTBL
      DATA Y/1HY/,SMY/1Hy/,BLANK/1H /,IBLANK/1H /,
     1 NUMER/1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1H0/,
     2 FORM/'(I1,A', '4,A3,', 'I3,A1', ',I3,A', '1,2X,', 'I3,',
     3 '2X,2I', '3,2I4', ',I5,2', 'I2,2I', '4,I5,', 'I3,2I',
     4 '4,I2,', 'I4,9I', '3,10I', '4)'/
C-The preceding format is that used for outputting the attribute data
C The first line of the format refers to the "common field" and
C should not be changed, the second line is the attributes field
C which may be changed freely
C
C
C
C-The number of attributes and format in which they are output can
C be changed by changing the following records. Up to 50 attributes
C can be accommodated without other changes. For more than 50
C attributes some of the format statements will have to be changed.
C NATTS is the number of attributes and MAXOB is the maximum permissible
C number of objects in a single excavation unit. MXSUP is the maximum
C permissible number of supplementary attribute records (2nd,3rd etc
C utilised/retouched edges) per excavation unit
      NATTS=26
      MAXOB=110
      MXSUP=20
C-In addition it will be neccessary to change the DIMENSION statement
C above, as follows:
C       INTER should have dimension NATTS
C       NUDAT should have dimension MAXOB
C      INDEX should have dimension MXSUP
C       IDATA should have dimensions MAXOB,NATTS
C      MREDG should have dimensions MXSUP,NATTS
C
C-ITERM is the FORTRAN unit number for terminal output and LEC for
C terminal input
      ITERM=6
      LEC=5
      CALL DATE(DAT)
C-FLEOF is a flag for the end of the excavation data file
C-NOMOR is a flag for the end of the attribute data file
C-MATCH is a counter for the number of attribute sets which have been
C successfully added onto records on the excavation data file
```

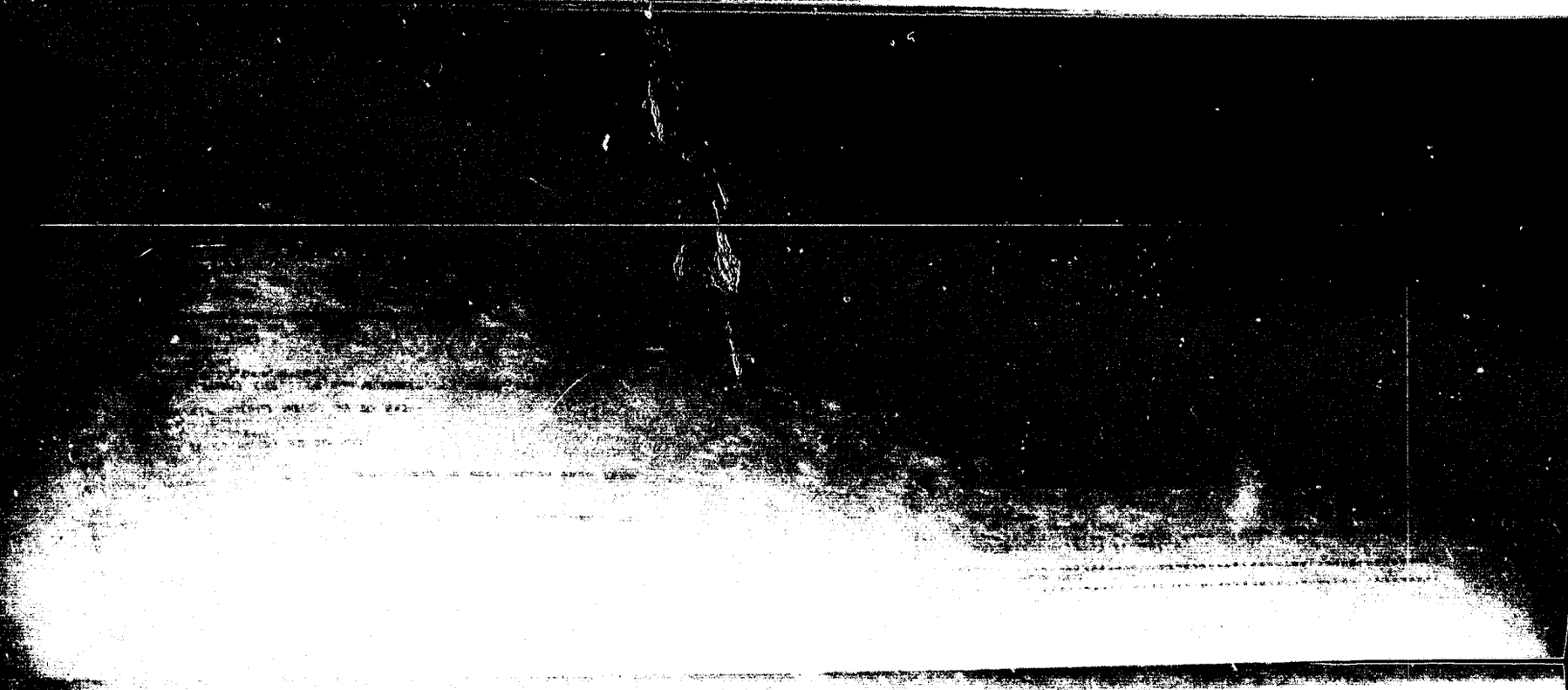


```
C-NWRIT is counter for number of records output on unit 12
C NREAD is counter for number of records read from excavation data file
C NUVAL is a counter for number of records read from attribute data file
C MLTAT is a flag for the presence of one or more objects for which
C more than one set of attributes has been supplied
      FLEOF=0
      NOMOR=0
      MATCH=0
      NWRIT=0
      NREAD=0
      NUVAL=0
      MLTAT=0
C
298   FORMAT(A1)
299   FORMAT(A10)
C
      WRITE(ITERM,5000) DAT
5000  FORMAT(1HO/' EXCAVATION DATA PROCESSING'/
     1 1X,26(1H*),//,' Ian Johnson, Prehistory, ANU,  July 1979'/
     2 ' Version 10/9/79',////,' **** ADDAT ****',19X,A10,//,
     3 ' This program adds attributes for individualised',
     4 ' finds'/' to the excavation data file'/
     3 ' For documentation see top of program listing',//)
C
      WRITE(ITERM,300)
300   FORMAT(1HO,'Name of excavation data file? : '$)
      READ(LEC,299) INEXC
      CALL IFILE(10,INEXC)
      WRITE(ITERM,301)
301   FORMAT(1HO,'Name of attribute data file? : '$)
      READ(LEC,299) INATT
      CALL IFILE(11,INATT)
      WRITE(ITERM,302)
302   FORMAT(1HO,'What do you want to call your output file? : '$)
      READ(LEC,299) OUTPT
      CALL OFILE(12,OUTPT)
C
C
      WRITE(ITERM,303) FORM
303   FORMAT(1HO,'Output format of this version is as follows:',/,
     1 ' Common field:     ',6A5,/,' Attributes field: ',24A5,//,
     2 ' What attributes do you have?'/' Type RETURN',
     3 ' only for a list of attributes and code numbers'/
     4 ' (Type 99 for list if you are using a video terminal)',/)
      GO TO 31
10    WRITE(ITERM,312)
312   FORMAT(1H ,'This version uses the attribute list for lithic finds',
     1 /,' described in Johnson 1979, PhD, ANU',//,
     2 ' Code numbers are as follows:'/
     1 '  1 X coordinate'/
     2 '  2 Y coordinate'/
     3 '  3 Z coordinate'/
     2 '  4 Raw material'/
     3 '  5 Weight in 1/10 gm'/
     4 '  6 Nature of support piece (lithic finds)'/
     5 '  7 Amount of cortex                --'/
     6 '  8 Length in mm                    --'/
     7 '  9 Breadth in mm                   --'/
     8 ' 10 Thickness in mm.                --'/
     9 ' 11 Artefact type                   --'/
     9 ' 12 Edge number              (utilised/retouched lithics)'/
     1 ' 13 Length of working edge          --'/
     2 ' 14 Shape of edge                   --'/
     3 ' 15 Edge angle                      --'/
     4 ' 16 Disposition of retouch          --')
      IF(KLASS(1).EQ.0) GO TO 20
      WRITE(ITERM,304)
304   FORMAT(1HO,'Note codes needed before they disappear off',
     1 ' screen. Press RETURN to continue',/)
      READ(LEC,298)
20    WRITE(ITERM,314)
314   FORMAT(
     1 ' 17 Type of retouch, main surface   --'/
     2 ' 18 Extent of secondary retouch     --'/
     3 ' 19 Extent of tertiary retouch      --'/
     4 ' 20 Degree of polish                --'/
     5 ' 21 Type of retouch, second surface --'/
     6 ' 22 Extent of secondary retouch     --'/
     7 ' 23 Extent of tertiary retouch      --'/
     8 ' 24 Degree of polish                --',/)
30    WRITE(ITERM,315)
315   FORMAT(1H ,'Type in code numbers in the order in which ',
     1 ' the attributes'/' appear',
     1 ' on the attribute data file.'/' Separate codes by spaces',
     2 ' and type on a single line'/)
31    READ(LEC,330) KLASS
      IF(KLASS(1).EQ.0.OR.KLASS(1).EQ.99) GO TO 10
330   FORMAT(50G)
      WRITE(ITERM,331)
331   FORMAT(1HO,'Program running',/)
C
C-Determine number of variables to be input.
      DO 40 L=1,50
      IF(KLASS(L).GT.NATTS) GO TO 210
40    IF(KLASS(L).EQ.0) GO TO 45
45    NOCLS=L-1
C
C
C-*************************************************************
C
C-Read in first record of attribute data for next excavation unit
50    READ(11,310) SQUAR,ICHEK,KUNIT
310   FORMAT(A3,I1,50G)
      IF(ICHEK.NE.0) GO TO 751
      DO 60 K=1,MAXOB
      NUDAT(K)=0
      DO 60 L=1,NATTS
60    IDATA(K,L)=0
      NEDGE=0
      DO 65 K=1,MXSUP
      DO 65 L=1,NATTS
65    MREDG(K,L)=0
C
C-Continue reading attribute data until new excavation unit is found
70    READ(11,333,END=80,ERR=75) NOBJ,INTER
333   FORMAT(100G)
      NUVAL=NUVAL+1
      GO TO 90
```



```
C-If square header record is just a repetition, continue reading
C attribute data file
75      READ(11,310) NUSQ,ICHEK,NUUNT
        IF(NUSQ.EQ.SQUAR.AND.NUUNT.EQ.KUNIT) GO TO 70
        BACKSPACE 11
        GO TO 120
C
C-End of attribute data file
80      NOMOR=1
        GO TO 120
C
C-Add attribute data onto IDATA, unpacking INTER
90      IF(NUDAT(NOBJ).GT.0) GO TO 180
        IF(NOBJ.GT.MAXOB) GO TO 190
        DO 100 L=1,NOCLS
100     IDATA(NOBJ,KLASS(L))=INTER(L)
        NUDAT(NOBJ)=NUDAT(NOBJ)+1
        GO TO 70
C-Supplementary attributes record just read,pack data in MREDG
110     NEDGE=NEDGE+1
        IF(NEDGE.GT.MXSUP) GO TO 195
        INDEX(NEDGE)=NOBJ
        DO 115 L=1,NOCLS
115     MREDG(NEDGE,KLASS(L))=INTER(L)
        NUDAT(NOBJ)=NUDAT(NOBJ)+1
        GO TO 70
C
C
C-*****************************************************************
C
c-Read in first record for next excavation unit from excavation
C data file (unit 10).
120     READ(10,320,END=500) INT,SITE,SQ,NUNT,PT,LEV,DIV,INTER
320     FORMAT(I1,A4,A3,I3,A1,I3,A1,50A4)
        NREAD=NREAD+1
C-Safeguard stratigraphic level information for output of finds not
C already on excavation data file if new excavation square or
C excavation unit is encountered on excavation data file.
        IF(INT.NE.1) GO TO 160
        PRT=PT
        LEVEL=LEV
        DIVN=DIV
        SQR=SQ
        EXUNT=NUNT
C
C-Copy over data till type 4 record for correct square and unit is found
160     DO 161 L=1,NATTS
        NOTBL=NATTS+1-L
161     IF(INTER(NOTBL).NE.BLANK) GO TO 162
162     WRITE(12,320) INT,SITE,SQR,EXUNT,PRT,LEVEL,DIVN,
     1 (INTER(L),L=1,NOTBL)
        NWRIT=NWRIT+1
        IF(SQ.EQ.SQUAR.AND.NUNT.EQ.KUNIT.AND.INT.EQ.4) GO TO 140
        GO TO 120
C-Read in a type 5 or 6 (individualised find) record, check still in same
C excavation unit, extract attribute data from INTER, and output
140     READ(10,FORM,END=500) INT,SITE,SQ,NUNT,PT,LEV,DIV,NOB,INTER
        NOBJ=NOB
        NREAD=NREAD+1
        IF(SQ.NE.SQUAR.OR.NUNT.NE.KUNIT) GO TO 510
        IF(NOBJ.GT.MAXOB) GO TO 190
        IF(INT.NE.6) GO TO 169
C-Type 6(supplementary working edge attributes) record
        IFL=0
192     DO 165 LL=1,NEDGE
        IF(INDEX(LL).NE.NOBJ) GO TO 165
        IFL=1
        DO 166 M=1,NOCLS
        K=KLASS(M)
166     INTER(K)=MREDG(LL,K)
C-Avoid outputting trailing blanks
        CALL PACK(INTER,NATTS,NOTBL)
168     WRITE(12,FORM) INT,SITE,SQUAR,KUNIT,PRT,LEVEL,DIVN,NOBJ,
     1 (INTER(L),L=1,NOTBL)
        NWRIT=NWRIT+1
        MATCH=MATCH+1
        INDEX(LL)=0
        NUDAT(NOBJ)=NUDAT(NOBJ)-1
        GO TO 191
165     CONTINUE
        IF(IFL.EQ.1) GO TO 140
C-No new data to add onto the type 6 record read, output unchanged
        CALL PACK(INTER,NATTS,NOTBL)
        WRITE(12,FORM) INT,SITE,SQUAR,KUNIT,PRT,LEVEL,DIVN,NOB,
     1 (INTER(L),L=1,NOTBL)
        GO TO 140
C
C-This should be a type 5 record for square/unit for which
C data is held in IDATA. Check this.
169     IF(INT.NE.5) GO TO 221
        IF(NUDAT(NOBJ).EQ.0) GO TO 173
        DO 170 K=1,NOCLS
        L=KLASS(K)
170     INTER(L)=IDATA(NOBJ,L)
        NUDAT(NOBJ)=NUDAT(NOBJ)-1
        MATCH=MATCH+1
173     CALL PACK(INTER,NATTS,NOTBL)
175     WRITE(12,FORM) INT,SITE,SQUAR,KUNIT,PRT,LEVEL,DIVN,NOBJ,
     1 (INTER(L),L=1,NOTBL)
        NWRIT=NWRIT+1
176     IF(NUDAT(NOBJ).EQ.0) GO TO 140
C
C
C-Read type 6 record if present
191     READ(10,FORM,END=500) INT,SITE,SQ,NUNT,PT,LEV,DIV,NOB,
     1 INTER
        NREAD=NREAD+1
        IF(SQ.NE.SQUAR.OR.NUNT.NE.KUNIT) GO TO 510
        IF(INT.EQ.6) GO TO 192
C-Type 5 record read
        BACKSPACE 10
        NREAD=NREAD-1
```

```
C-Supplementary working edges to be added
193     DO 178 LL=1,NEDGE
        IF(INDEX(LL).NE.NOBJ) GO TO 178
        INT=6
        DO 151 L=1,NATTS
        NOTBL=NATTS+1-L
151     IF(MREDG(LL,NOTBL).NE.0) GO TO 152
152     WRITE(12,FORM) INT,SITE,SQUAR,KUNIT,PRT,LEVEL,DIVN,NOBJ,
     1 ((MREDG(LL,M)),M=1,NOTBL)
        MATCH=MATCH+1
        NWRIT=NWRIT+1
        NUDAT(NOBJ)=NUDAT(NOBJ)-1
178     CONTINUE
        GO TO 140
C
C-End of excavation unit reached on excavation data file (unit 10)
C-FLEOF is a flag for the end of this file
500     FLEOF=1
        GO TO 515
C-Output objects which were not previously on excavation data file
510     IF(INT.NE.1) GO TO 220
515     DO 520 K=1,MAXOB
        IF(NUDAT(K).EQ.0) GO TO 520
        DO 516 L=1,NATTS
        NOTBL=NATTS+1-L
516     IF(IDATA(K,NOTBL).NE.0) GO TO 517
517     INT=5
        WRITE(12,FORM) INT,SITE,SQUAR,KUNIT,PRT,LEVEL,DIVN,
     1 K,(IDATA(K,L),L=1,NOTBL)
        NWRIT=NWRIT+1
        MATCH=MATCH+1
518     NUDAT(K)=NUDAT(K)-1
        IF(NUDAT(K).EQ.0) GO TO 520
C-Output supplementary attribute records (type 6)
        INT=6
        DO 519 LL=1,NEDGE
        IF(INDEX(LL).NE.K) GO TO 519
        DO 521 L=1,NATTS
        NOTBL=NATTS+1-L
521     IF(MREDG(LL,NOTBL).NE.0) GO TO 522
522     WRITE(12,FORM) INT,SITE,SQUAR,KUNIT,PRT,LEVEL,DIVN,K,
     1 (MREDG(LL,L),L=1,NOTBL)
        NWRIT=NWRIT+1
        MATCH=MATCH+1
        NUDAT(K)=NUDAT(K)-1
519     CONTINUE
520     CONTINUE
        IF(FLEOF.EQ.1) GO TO 230
        BACKSPACE 10
        NREAD=NREAD-1
        IF(NOMOR.NE.1) GO TO 50
C
C-No more attributes - copy across remainder of excavation data file
150     READ(10,360,END=230) TEXT
360     FORMAT(50A5)
        NREAD=NREAD+1
        DO 366 L=1,26
        NOTBL=27-L
366     IF(TEXT(NOTBL).NE.BLANK) GO TO 367
367     WRITE(12,360) (TEXT(L),L=1,NOTBL)
        NWRIT=NWRIT+1
        GO TO 150
C
C
C-************************************************************
C     ERROR MESSAGES
C-************************************************************
C
210     WRITE(ITERM,375) KLASS(L)
375     FORMAT(1HO,'**** WARNING ****   Code number given (',I4,') is',
     1 ' out of range.')
        GO TO 20
C
C
751     WRITE(ITERM,383) NUVAL
383     FORMAT(1HO,'**** WARNING ****'/
     1 ' Square identifier extends into column 4 on attribute',
     2 ' data file'/' encountered after reading',I5,
     3 ' records'/' RUN ABORTED',//)
        GO TO 290
C
C
180     IF(MLTAT.NE.1) WRITE(ITERM,363)
363     FORMAT(1HO,'Warning: More than one set of attributes',
     1 ' supplied for:')
        MLTAT=1
        WRITE(ITERM,364) SQUAR,KUNIT,NOBJ
364     FORMAT(1H ,'Square ',A3,', Unit',I3,', Object  ',I4)
        GO TO 110
C
C
190     WRITE(ITERM,365) NOBJ,SQUAR,KUNIT,NREAD,NUVAL,MAXOB
365     FORMAT(1HO,'**** WARNING ****   Object number:',I5,
     1 '  square ',A3,' unit',I4,/
     1 ' Encountered after reading',I5,' records from',
     2 ' excavation data file'/
     3 ' and',I5,' records from attribute data file'/
     1 ' This version cannot accommodate more than',I4,' finds in a',
     2 ' single'/' excavation unit. You will need to modify the',
     3 ' DIMENSION statement'/' at the top of the program'/
     4 ' RUN ABORTED',///)
        GO TO 290
C
C
195     WRITE(ITERM,368) MXSUP,SQUAR,KUNIT,NUVAL
368     FORMAT(1HO,'**** WARNING ****'/' Over',I4,' sets of',
     1 ' supplementary attributes (2nd,3rd etc. working edges)'/
     2 ' supplied for square ',A3,' unit',I4,'.  Encountered',
     3 ' after reading'/,I5,' records from attribute data file'/
     4 ' You will need to modify the DIMENSION statement at the',
     5 ' top of this program'/' and this error trap    RUN ABORTED'//)
        GO TO 290
```



```
220     WRITE(ITERM,376) NREAD
376     FORMAT(1HO,'**** ERROR ****  Record number:',I5/
     1 ' Change of square or',
     1 ' excavation unit'/' has occurred on excavation data',
     2 ' file, but record just read'/' is not a type 1 record.',
     3 '    RUN ABORTED',///)
       GO TO 290
C
C
221     WRITE(ITERM,379) NREAD,SQUAR,KUNIT
379     FORMAT(1HO,'**** WARNING ****   Record number: ',I5/
     1 ' A record which is not a type 5 record has been read'/
     2 ' from the excavation data file',
     2 ' whilst reading type 5 records'/' for square: ',A3,' unit: ',
     3 I3,'    RUN ABORTED ',///)
       GO TO 290
C
230     IF(NOMOR.EQ.1) GO TO 235
        WRITE(ITERM,377)
377     FORMAT(1HO,'**** ERROR ****   Some of the attribute data',
     1 ' supplied'/' has not been matched with excavation units on',
     2 ' the excavation'/' data file. This may be due to',
     3 ' incorrect ordering of the'/' excavation squares or units',
     4 ' on the attribute data file'/' or incorrect square or',
     5 ' excavation unit identifiers on either file',/
     5 ' Unmatched attribute data will be output on a new file.'/
     6 ' What do you want to call this file? : '$)
        READ(LEC,299) UNMAT
        CALL OFILE(13,UNMAT)
        WRITE(13,334) SQUAR,KUNIT
334     FORMAT(A3,1X,I5)
        M=1
        DO 605 L=1,MAXOB
        IF(NUDAT(L).EQ.0) GO TO 605
        WRITE(13,316) L,((IDATA(L,KLASS(LL))),LL=1,NOCLS)
316     FORMAT(50(I5,1X))
        M=M+1
605     CONTINUE
        IF(NOMOR.EQ.1) GO TO 204
201     READ(11,362,END=204) SQ,NUNT,TEXT
        NUVAL=NUVAL+1
362     FORMAT(A3,G,50A5)
        IF(SQ.EQ.SQUAR.AND.NUNT.EQ.KUNIT) GO TO 202
C-New excavation unit or square reached
        SQUAR=SQ
        KUNIT=NUNT
        WRITE(13,334) SQUAR,KUNIT
        M=M+1
202     WRITE(13,360) TEXT
        M=M+1
        GO TO 201
204     WRITE(ITERM,378) M,UNMAT
378     FORMAT(1HO,I5,' unmatched attribute records written on',
     1 ' file: ',A10)
235     WRITE(ITERM,380) NWRIT,OUTPT,NUVAL,MATCH
380     FORMAT(1HO,I5,' Records written on output file: ',A10,/
     1 1X,I5,' Sets of attribute data read'/
     2 1x,I5,' Sets of attributes matched with finds on the'/
     3 '       excavation data file',///)
C
290     STOP
        END
C
C
C
C-This subroutine scans INTER to find out how much of it is blank
        SUBROUTINE PACK(INTER,NATTS,NOTBL)
        DIMENSION INTER(NATTS)
        DO 1 L=1,NATTS
        NOTBL=NATTS+1-L
1       IF(INTER(NOTBL).NE.0) GO TO 2
2       RETURN
        END
```

```
C-**** ADDLEV ****
C
C- Ian Johnson, Prehistory, RSPacS, ANU.  July 1979
C Version 19/10/79
C
C
C-This program adds on stratigraphic level/analysis unit attributions
C to the excavation data file. An updated excavation data file is output
C leving the source file unmodified
C The attributions are supplied from the terminal in reply to prompts;
C the program prompts with the excavation square, excavation unit and
C current level attribution given on the excavation data file. A blank
C reply (i.e. pressing RETURN without typing anything) is taken as
C indicating that the existing attribution is correct. Correction or
C addition of level attributions can be started and ended at chosen points
C in the file.
C
C-*****************************************************************
C
      INTEGER PART,PT
      DOUBLE PRECISION INEXC,OUTPT,DAT
      DIMENSION TEXT(23),TEXTO(26)
      DATA Y/1HY/,SMY/1Hy/,BLANK/1H /
      NWRIT=0
      CALL DATE(DAT)
      ITERM=6
      LEC=5
      NORM=0
C
      WRITE(ITERM,5000) DAT
5000  FORMAT(1HO/' EXCAVATION DATA PROCESSING'/
     1       1X,26(1H*),//,' Ian Johnson, Prehistory, ANU,  July 1979'/
     2       ' Version 19/10/79',////,' **** ADDLEV ****',18X,A10,//,
     3       ' This program adds stratigraphic level or analysis unit',
     4       ' attributions'/' to the excavation data file'/
     5       ' and duplicates existing or new attributions from',
     6       ' the first record'/' for each excavation unit, onto',
     7       ' subsequent records'/
     8       ' For documentation see top of program listing',//)
      WRITE(ITERM,300)
300   FORMAT(1HO,'Name of excavation data file? : '$)
      READ(LEC,301) INEXC
301   FORMAT(A10)
      CALL IFILE(10,INEXC)
      WRITE(ITERM,302)
302   FORMAT(1HO,'What do you want to call your output file? : '$)
      READ(LEC,301) OUTPT
      CALL OFILE(12,OUTPT)
C
5     WRITE(ITERM,303)
303   FORMAT(1HO,'At what excavation square do you want to start',
     1       ' correcting or'/' adding level/analysis unit attributions?')
      READ(LEC,304) SQ
304   FORMAT(A3)
6     WRITE(ITERM,305)
305   FORMAT(1HO,'At what excavation unit number? : '$)
      READ(LEC,310) NUNT
      IF(NUNT.EQ.0) GO TO 6
      WRITE(ITERM,306)
306   FORMAT(1HO,'Scanning for starting point')
C-Search for requested excavation unit or copy over remainder of file
7     READ(10,308,END=14) INT,SITE,SQUAR,KUNIT,IPT,LEV,PT,TEXT
      IF(SQUAR.EQ.SQ.AND.KUNIT.EQ.NUNT) GO TO 8
      IF(INT.EQ.1) LEVEL=LEV
      IF(INT.EQ.1) PART=PT
      DO 70 L=1,23
      NOTBL=24-L
70    IF(TEXT(NOTBL).NE.BLANK) GO TO 71
71    WRITE(12,308) INT,SITE,SQUAR,KUNIT,IPT,LEVEL,PART,
     1       (TEXT(L),L=1,NOTBL)
      NWRIT=NWRIT+1
      GO TO 7
C
C-Correct excavation unit reached
8     BACKSPACE 10
      WRITE(ITERM,307)
307   FORMAT(1HO,'Program will prompt with square identifier,',
     1       ' excavation unit number,'/' and level attribution',
     2       ' (level number and subdivision)'/' If level attribution',
     3       ' is correct, simply press RETURN. Otherwise, type in'/,
     4       ' new level number followed by subdivision, separated by',
     5       ' space(s)'/' If only one number is typed in the',
     6       ' subdivision defaults to zero'/' If you want to terminate',
     7       ' the current inputting session at any time'/' (without',
     8       ' losing level attributions you have input), type',
     9       ' control Z'/' in reply to prompt'//
     1       ' Sqr Unit Lev/Sub New Value')
C
C
10    READ(10,308,END=15) INT,SITE,SQUAR,KUNIT,IPT,LEV,PT,TEXT
308   FORMAT(I1,A4,A3,I3,I1,I3,I1,30A5)
      IF(INT.NE.1) GO TO 17
      WRITE(ITERM,309) SQUAR,KUNIT,LEV,PT
309   FORMAT(1H ,A3,2I5,I2,' :   '$)
      READ(LEC,310,END=12) LEVEL,PART
310   FORMAT(2G)
      IF(LEVEL.NE.0) GO TO 11
      LEVEL=LEV
      PART=PT
17    DO 16 L=1,23
      NOTBL=24-L
16    IF(TEXT(NOTBL).NE.BLANK) GO TO 11
11    WRITE(12,308) INT,SITE,SQUAR,KUNIT,IPT,LEVEL,PART,
     1       (TEXT(L),L=1,NOTBL)
      NWRIT=NWRIT+1
      GO TO 10
C
C
12    BACKSPACE 10
      WRITE(ITERM,311)
311   FORMAT(1HO,'Copying over remainder of file'/)
      NORM=1
      GO TO 7
```

```
C
14   IF(NORM.EQ.1) GO TO 15
     WRITE(ITERM,313)
313  FORMAT(1H0,'Specified square/excavation unit combination',
     1       ' does not occur on file'/)
     REWIND 10
     REWIND 12
     GO TO 5
C
C
15   WRITE(ITERM,314) NWRIT,OUTPT
314  FORMAT(1H0,I5,' Records written on output file: ',A10,//)
     STOP
     END
```

# APPENDIX V

Listing of SPSS instruction sets for carrying out basic analyses of the excavation data file

This appendix lists SPSS instructions for analysing the excavation data file created by the methods described in chapters VII and VIII. The complete SPSS instruction set required to carry out an analysis is created by combining one of the excavation data file interface instruction sets (which tell SPSS about the names of the variables read and the format in which they are recorded on the excavation data file) with one of the analysis instruction sets (which tell SPSS what analyses to carry out). There are two types of interface instructions:

Type 1: Interface for general excavation unit information and data on unindividualised finds. This interface reads data from the file output by the program SELUN.

Type 2: Interface for data on the individualised finds. This interface reads data directly from the excavation data file.

Three analysis instruction sets have been listed to demonstrate the sorts of analyses which can be undertaken:

1. ANALYS.UN: Basic analysis of general information (sediment and residue weights, coordinates of excavation units) and unindividualised finds data (distribution by squares, analysis unit and raw material or size classes). Uses interface type 1.

2. ANALYS.IND: Basic analysis of individualised finds. Generates tables of distribution of each raw material type and distribution of typological categories by excavation square and analysis unit. Uses interface type 2.

3. ANALYS.SUP: More detailed analysis of individualised lithic finds, including basic distribution data and tables of artefact size, length/breadth ratio etc. Uses interface type 2.

Most of the SPSS instructions used are to be found in the beginners guide to SPSS ('SPSS Primer') and modifications or additions should present no problem to any SPSS user. Some modifications will of course be necessary if the user has recorded a different set of attributes to those listed in appendix II.

```
**********************************************************
*                                                        *
*                EXCAVATION DATA FILE INTERFACE          *
*                                                        *
*  Version 1: General excavation unit information and data *
*  24/10/79   for unindividualised finds                 *
**********************************************************
```

VARIABLE LIST

```
RECTYPE,SITE,SECTION,SQUARE,EXCVUNIT,FEATURE,ANALUNIT,ANLUDIVN,
SUBSQ,SEDIMWT,MEDRES,SMALLRES,LGERES ,LGERESWT,
COORD1 TO COORD20,LITH<4MM,ORG<4MM,RM1NO,RM1WT,
RM2NO,RM2WT,RM3NO,RM3WT,RM4NO,RM4WT,RM5NO,RM5WT,
RM6NO,RM6WT,RM7NO,RM7WT,RM8NO,RM8WT,
RM9NO,RM9WT,RM10NO,RM10WT,RM11NO,RM11WT,
RM12NO,RM12WT,NOLT1GM,WTLT1GM,NO1TO2GM,WT1TO2GM,
NO2TO3GM,WT2TO3GM,NOGE3GM,WTGE3GM,
NOLT1SQ,WTLT1SQ,NO1TO2SQ,WT1TO2SQ,NO2TO4SQ,WT2TO4SQ,
NOGE4SQ,WTGE4SQ,NOLT1CM,WTLT1CM,NO1TO2CM,WT1TO2CM,
NO2TO3CM,WT2TO3CM,NOGE3CM,WTGE3CM,VAR1 TO VAR28
```

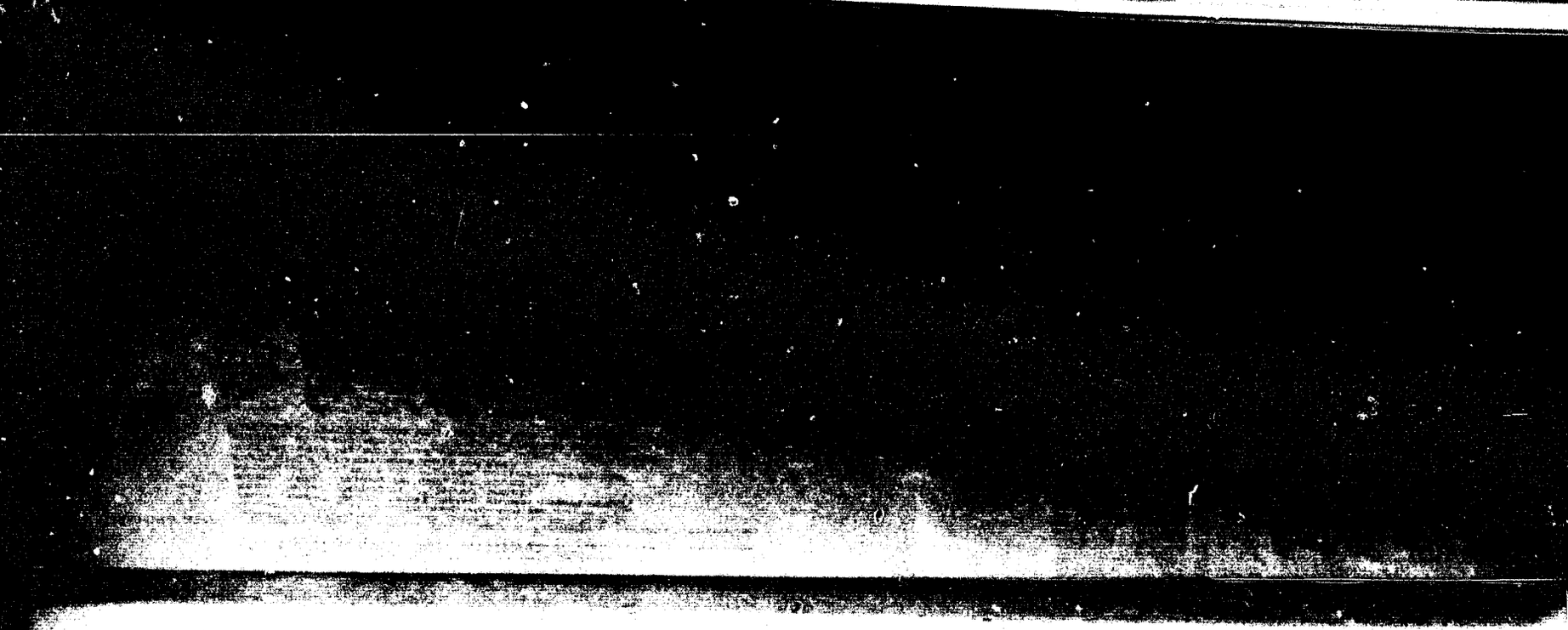
VAR LABELS

```
RECTYPE   RECORD TYPE OF FIRST RECORD/
SITE      SITE MNEMONIC NAME/
SQUARE    SQUARE IDENTIFIER/
EXCVUNIT  EXCAVATION UNIT NUMBER/
FEATURE   FEATURE NUMBER IF APPLICABLE/
ANALUNIT  STRATIGRAPHIC LEVEL OR ANALYSIS UNIT/
ANLUDIVN  SUBDIVISION OF ANALYSIS UNIT/
SUBSQ     SUBDIVISION OF EXCAVATION SQUARE/
SEDIMWT   NET WEIGHT OF SEDIMENTS IN KG/
MEDRES    MEDIUM SIEVE RESIDUE WEIGHT IN KG/
SMALLRES  FINE SIEVE RESIDUE IN KG/
LGERES    NUMBER OF FRAGMENTS RETAINED IN LARGEST SIEVE/
LGERESWT  WEIGHT OF FRAGMENTS RETAINED IN LARGEST SIEVE/
LITH<4MM  LITHIC FINDS PASSING THROUGH 4MM SIEVE, IN GM./
ORG<4MM   ORGANIC FINDS XCPT CHARCOAL PASSING THROUGH 4MM SIEVE/
RM1NO     NUMBER OF RAW MATERIAL TYPE 1 = CHARCOAL/
RM1WT     WEIGHT OF RAW MATERIAL TYPE 1 = CHARCOAL/
RM2NO     NUMBER OF RAW MATERIAL TYPE 2/
RM2WT     WEIGHT OF RAW MATERIAL TYPE 2 IN GM./
RM3NO     NUMBER OF RAW MATERIAL TYPE 3/
RM3WT     WEIGHT OF RAW MATERIAL TYPE 3 IN GM./
RM4NO     NUMBER OF RAW MATERIAL TYPE 4/
RM4WT     WEIGHT OF RAW MATERIAL TYPE 4 IN GM./
RM5NO     NUMBER OF RAW MATERIAL TYPE 5/
RM5WT     WEIGHT OF RAW MATERIAL TYPE 5 IN GM./
RM6NO     NUMBER OF RAW MATERIAL TYPE 6/
RM6WT     WEIGHT OF RAW MATERIAL TYPE 6 IN GM./
RM7NO     NUMBER OF RAW MATERIAL TYPE 7/
RM7WT     WEIGHT OF RAW MATERIAL TYPE 7 IN GM./
RM8NO     NUMBER OF RAW MATERIAL TYPE 8/
RM8WT     WEIGHT OF RAW MATERIAL TYPE 8 IN GM./
RM9NO     NUMBER OF RAW MATERIAL TYPE 9/
RM9WT     WEIGHT OF RAW MATERIAL TYPE 9 IN GM./
RM10NO    NUMBER OF RAW MATERIAL TYPE 10/
RM10WT    WEIGHT OF RAW MATERIAL TYPE 10 IN GM./
RM11NO    NUMBER OF RAW MATERIAL TYPE 11/
RM11WT    WEIGHT OF RAW MATERIAL TYPE 11 IN GM./
RM12NO    NUMBER OF RAW MATERIAL TYPE 12/
RM12WT    WEIGHT OF RAW MATERIAL TYPE 12 IN GM./
NOLT1GM   NUMBER OF FINDS <1GM   WEIGHT/
WTLT1GM   WEIGHT OF FINDS <1GM IN GM./
NO1TO2GM  NUMBER OF FINDS 1 - 1.9GM/
WT1TO2GM  WEIGHT OF FINDS 1 - 1.9GM IN GM./
NO2TO3GM  NUMBER OF FIND.2 - 2.9GM/
WT2TO3GM  WEIGHT OF FINDS 2 - 2.9GM   IN TENTHS/
NOGE3GM   NUMBER OF FINDS 3GM   OR OVER/
WTGE3GM   WEIGHT OF FINDS 3GM   OR OVER IN GM./
NOLT1SQ   NUMBER OF FINDS UNDER 1 SQUARE CM/
WTLT1SQ   WEIGHT OF FINDS UNDER 1 SQUARE CM/
NO1TO2SQ  NUMBER OF FINDS 1 - 2 SQUARE CM/
WT1TO2SQ  WEIGHT OF FINDS 1 - 2 SQUARE CM/
NO2TO4SQ  NUMBER OF FINDS 2 - 4 SQUARE CM/
WT2TO4SQ  WEIGHT OF FINDS 2 - 4 SQUARE CM/
NOGE4SQ   NUMBER OF FINDS OVER 4 SQUARE CM/
WTGE4SQ   WEIGHT OF FINDS OVER 4 SQUARE CM/
NOLT1CM   NUMBER OF FINDS UNDER 1CM IN LENGTH/
WTLT1CM   WEIGHT OF FINDS UNDER 1CM IN LENGTH/
NO1TO2CM  NUMBER OF FINDS 1 - 2 CM IN LENGTH/
WT1TO2CM  WEIGHT OF FINDS 1 - 2 CM IN LENGTH/
NO2TO3CM  NUMBER OF FINDS 2 - 3 CM IN LENGTH/
WT2TO3CM  WEIGHT OF FINDS 2 - 3 CM IN LENGTH/
NOGE3CM   NUMBER OF FINDS OVER 3CM IN LENGTH/
WTGE3CM   WEIGHT OF FINDS OVER 3CM IN LENGTH/
```

```
COMMENT        INDUST defines a group of analysis units, e.g. analysis
               units belonging to a particular lithic industry. The
               statements which follow define INDUST according to the
               analysis unit number for each excavation unit, and will
               need to be changed for each different situation
COMPUTE        INDUST = 0
IF             (ANALUNIT LE 5 AND ANALUNIT GE 2) INDUST = 1
IF             (ANALUNIT GT 6) INDUST = 2
VALUE LABELS   INDUST    (1) BONDAIAN
                         (2) CAPERTIAN/

INPUT MEDIUM   SELUN.OUT
INPUT FORMAT   FIXED(I1,A3,A1,A3,F3.0,2F2.0,A1,A2,F3.1,2F4.2,F3.0,F4.1,
               5(3X,2F3.0,2F4.0),/18X,2F4.1,12(F4.0,F4.1),/
               18X,12(F4.0,F4.1),/,18X,28F4.0)
N OF CASES     UNKNOWN
MISSING VALUES SEDIMWT,MEDRES,SMALLRES,COORD3,COORD4,COORD7,COORD8,
               COORD11,COORD12,COORD15,COORD16,COORD19,COORD20(0)

TASK NAME      Calculate mean start and end levels
COMMENT        **********************************
COUNT          NZ=COORD3,COORD7,COORD11,COORD15,COORD19(1 THRU HIGHEST)
IF             (NZ NE 0) STRTZ = (COORD3+COORD7+COORD11+COORD15+COORD19)/NZ
COUNT          NNZ=COORD4,COORD8,COORD12,COORD16,COORD20(1 THRU HIGHEST)
IF             (NNZ NE 0) ENDZ = (COORD4+COORD8+COORD12+COORD16+COORD20)/NNZ
```



```
TASK NAME       Calculate weight and number of unindividualised lithic finds
COMMENT         **********************************************************

                It is assumed that lithic raw materials are coded as raw
                materials 4 - 9 for the unindividualised finds. The following
                group of statements will require modification if this is not
                the case.
                The total number and weight of unindividualised lithic finds is
                calculated in two different ways, based on the raw material
                classification of the unindividualised finds and the size
                classification of the unindividualised lithic finds. The
                totals should be the same within the limits of experimental
                error, and if this is not the case an error has occurred.
                Note: Lithic finds are assumed to be coded as raw material
                types 4 - 9 ; modify the following statements if neccessary
COMPUTE         LITHNORM=RM4NO+RM5NO+RM6NO+RM7NO+RM8NO+RM9NO
COMPUTE         LITHWTRM=RM4WT+RM5WT+RM6WT+RM7WT+RM8WT+RM9WT
COMPUTE         LITHNOSZ=NOLT1GM+NO1TO2GM+NO2TO3GM+NOGE3GM
COMPUTE         LITHWTSZ=WTLT1GM+WT1TO2GM+WT2TO3GM+WTGE3GM
VAR LABELS      LITHNORM Number of unindivid' lithic finds, RM classif'/
                LITHWTRM Weight of unindivid' lithic finds, RM classif'/
                LITHNOSZ Number of unindivid' lithic finds, size classif'/
                LITHWTSZ Weight of unindivid' lithic finds, size classif'/

READ INPUT DATA


COMMENT         Add on SPSS instructions to perform analyses required
                **********************************************************
```

```
*****************************************************************
*                                                               *
*                  EXCAVATION DATA FILE INTERFACE               *
*                                                               *
*  Version 2: Data for individualised finds. This version       *
*  24/10/79   uses the attribute coding described in Johnson    *
*             1979, PhD thesis, ANU                             *
*****************************************************************

VARIABLE LIST   RECTYPE,SITE,SECTION,SQUARE,EXCVUNIT,FEATURE,ANALUNIT,ANLUDIVN,
                SUBSQ,OBJECT ,XCOORD,YCOORD,ZCOORD,
                RAWMATER,MASS,SUPPORT,CORTEX,LENGTHMM,WIDTHMM,THICKMM,
                TOOLTYPE,EDGENO,EDGELEN,CONTOUR,EDGEANGL,RETPOSN,
                RETYPE1,HTA1,HTB1,POL1,RETYPE2,HTA2,HTB2,POL2
INPUT FORMAT    FIXED(I1,A3,A1,A3,I3,2I2,A1,A2,
                I3,2X,2I3,2I4,F5.1,2I2,2I4,I5,I3,2I4,I2,I4,10I3)
N OF CASES      UNKNOWN
COMMENT

                This instruction should be modified by specifying
                the name of the excavation data file to be analysed.
INPUT MEDIUM    UPDT16.CP3
COMMENT         **********

                The variable labels will require modification if a different
                attribute system has been used (as also will the format
                statement above)
VAR LABELS      RECTYPE   RECORD TYPE/
                SITE      SITE NAME/
                SQUARE    SQUARE IDENTIFIER/
                SECTION   SUBDIVISION OF SITE/
                EXCVUNIT  EXCAVATION UNIT NUMBER/
                FEATURE   FEATURE NUMBER, IF APPLICABLE/
                ANALUNIT  ANALYSIS UNIT OR STRATIGRAPHIC LEVEL/
                ANLUDIVN  SUBDIVISION OF ANALYSIS UNIT/
                SUBSQ     SUBDIVISION OF EXCAVATION SQUARE/
                OBJECT    OBJECT NUMBER/
                XCOORD    X COORDINATE/
                YCOORD    Y COORDINATE/
                ZCOORD    Z COORDINATE/
                RAWMATER  RAW MATERIAL/
                MASS      OBJECT WEIGHT IN GM./
                SUPPORT   SUPPORT PIECE TYPE/
                CORTEX    CORTEX RATING/
                LENGTHMM  OBJECT LENGTH IN MM/
                WIDTHMM   OBJECT WIDTH IN MM/
                THICKMM   THICKNESS OF OBJECT IN MM/
                TOOLTYPE  TYPOLOGICAL CLASSIFICATION FOR TOOLS AND CORES/
                EDGENO    RETOUCHED OR UTILISED EDGE NUMBER/
                EDGELEN   LENGTH OF WORKING EDGE IN MM/
                CONTOUR   SHAPE OF WORKING EDGE/
                EDGEANGL  EDGE-ANGLE AT MIDPOINT IN DEGREES/
                RETPOSN   DISPOSITION OF USE OR RETOUCH/
                RETYPE1   RETOUCH TYPE FOR HEAVIER USE-RETOUCH ON EDGE/
                HTA1      EXTENT OF SECONDARY RETOUCH/
                HTB1      EXTENT OF TERTIARY RETOUCH/
                RETYPE2   RETOUCH TYPE FOR LIGHTER USE-RETOUCH ON EDGE/
                HTA2      EXTENT OF SECONDARY RETOUCH/
                HTB2      EXTENT OF TERTIARY RETOUCH/
```



```
COMMENT         The value labels will require modification for each specific
                project, depending on the raw materials present etc.
VALUE LABELS    RECTYPE   (5)  SUPPORT PIECE AND FIRST RETOUCHED EDGE
                          (6)  SUPPLEMENTARY WORKED EDGES/
                RAWMATER  (1)  CHERTS AND JASPEROID
                          (2)  COARSE GRAINED CHERTS AND MUDSTONE
                          (3)  QUARTZ
                          (4)  QUARTZITE SILCRETE AND VOLCANIC
                          (9)  FERRUGINOUS SANDSTONE
                         (11)  CHARCOAL
                         (12)  BONE
                         (13)  SHELL
                         (99)  OBJECT MISSING/
                SUPPORT   (1)  WHOLE FLAKE  (2)  FLAKE FRAGMENT
                          (3)  CORE     (4)  CHUNK OR SHATTER FRAGMENT
                          (5)  TABULAR FRAGMENT OR LAMINA
                         (10)  PEBBLE FRAGMENTS AND WHOLE PEBBLES/
                CORTEX    (0)  NO CORTEX  (1)  LT 10% DORSAL SURFACE
                          (2)  10-50% DORSAL     (3)  50-90% DORSAL
                          (4)  OVER 90% DORSAL SURFACE CORTEX
                          (5)  NON-FLAKES LT 10% SURFACE AREA
                          (6)  NON-FLAKES 10-30% SURFACE AREA
                          (7)  NON-FLAKES 30-70% SURFACE AREA
                          (8)  NON-FLAKES GT 70% SURFACE AREA
                          (9)  UNRETOUCHED
                         (10)  INDETERMINABLE CORTEX/
                CONTOUR   (1)  VERY CONVEX OR NOSED
                          (2)  CONVEX - DEFINITIONS AFTER JONES PHD
                          (3)  STRAIGHT
                          (4)  WAVY
                          (5)  CONCAVE
                          (6)  VERY CONCAVE OR NOTCH
                          (7)  DENTICULATE
                         (10)  INDETERMINATE - TOO SHORT TO ASSESS/
                RETPOSN   (1)  UNIFACIAL - CANNOT DETERMINE DORSAL OR VENTRAL
                          (2)  BIFACIAL - RETOUCH ON BOTH FACES SIMILAR DEGREE
                          (3)  DORSAL
                          (4)  VENTRAL/
                RETYPE1,RETYPE2
                          (1)  SLIGHT UTILISATION TRACES
                          (2)  REGULAR NIBBLING OR UTILISATION TRACES
                          (3)  INVASIVE SCALED UTILISATION SCARS
                          (4)  INVASIVE SCALED RETOUCH - 'FISH SCALES'
                          (5)  STEEP CRUSHED SCRAPER RETOUCH
                          (6)  SCRAPER RETOUCH WITH CONTIGUOUS NOTCHES
                          (7)  STEEP STEPPED RETOUCH
                          (8)  HEAVILY UNDERCUT STEP RETOUCH
                          (9)  ADZE SLUG TYPE RETOUCH AS ON TULAS
                         (10)  DENTATED OR 'SAW' EDGE/
                POL1,POL2 (0)  NO VISIBLE POLISH OR ROUNDING
                          (1)  EDGE POLISHED BUT NOT ROUNDED
                          (2)  FLAKE SCARS ON EDGE HAVE SMOOTHED OUT RIDGES/
```

```
COMMENT         INDUST defines a group of analysis units, e.g. analysis
                units belonging to a particular lithic industry. The
                statements which follow define INDUST according to the
                analysis unit number for each excavation unit, and will
                need to be changed for each different situation
COMPUTE         INDUST = 0
IF              (ANALUNIT LE 5 AND ANALUNIT GE 2) INDUST = 1
IF              (ANALUNIT GT 6) INDUST = 2
VALUE LABELS    INDUST    (1) BONDAIAN
                          (2) CAPERTIAN/


COMPUTE         MASSGM=TRUNC(MASS)
RECODE          MASSGM (41 THRU HIGHEST = 41)
COMPUTE         LENGTHCM=TRUNC(LENGTHMM/10)
COMPUTE         WIDTHCM=TRUNC(WIDTHMM/10)
COMPUTE         AREASQMM = (LENGTHMM*WIDTHMM)
COMPUTE         AREASQCM = TRUNC (AREASQMM/100)
COMPUTE         ANGLE10 = TRUNC(EDGEANGL/10)
RECODE          AREASQCM (26 THRU HIGHEST = 26)

VAR LABELS      MASSGM    Weight in gms - truncated value/
                LENGTHCM  Length in cm - truncated value/
                WIDTHCM   Width  in cm - truncated value/
                AREASQMM  Length x width in square mm/
                AREASQCM  Length x width truncated to sq.cm./
                ANGLE10   Working edge angle truncated in units of 10deg./
                INDUST    Lithic industry/
VALUE LABELS    MASSGM   (41) 41 GMS OR OVER/
                AREASQCM (26) 26 SQ. CMS. OR OVER/


MISSING VALUES  OBJECT  TO SUPPORT, LENGTHMM, WIDTHMM,RAWMATER,INDUST,
                AREASQMM,THICKMM TO HTB2(0)

COMMENT         Note: If you only wish to analyse lithic artefacts or some
                other subset of the total range of individualised finds,
                you will have to modify the following SELECT IF statement
                appropriately. Equally, if second, third etc. worked edges
                are to be included in the analysis, the SELECT IF must be
                modified to  (RECTYPE EQ 5 OR RECTYPE EQ 6)
SELECT IF       (RECTYPE EQ 5)

READ INPUT DATA


COMMENT         Add on SPSS instructions to perform analyses required
                ************************************************************
```

```
RUN NAME        ANALYS.UN :  Analysis of unindividualised finds and gen' info'
COMMENT         ************************************************************
                VERSION 24/10/79


                Insert excavation data file interface instruction set here
                (Version 1 for general excavation unit information and
                data on unindividualised finds).


                ************************************************************
                *                                                          *
                *                          ANALYSIS                        *
                *                                                          *
                *  ANALYS.UN : Analysis instruction set to generate basic  *
                *              statistics for general excavation unit      *
                *              information and unindividualised finds.     *
                ************************************************************


                These SPSS instructions serve to output statistics for
                each analysis unit and excavation square. Statistics
                output include sediment and residue weights, unindivid-
                ualised finds (number and weight by raw material and
                size classes), mean weight of unindividualised finds
                below 1gm, 1sq.cm. or 1cm, weight of charcoal and
                start, end and mean z (depth) coordinates for each
                excavation unit.
                As SPSS works on a case-by-case basis, ratios cannot be worked
                out for each analysis unit - any ratios for analysis units
                will have to be calculated by hand from the sum of the two
                variables for each analysis unit. More advanced users can make
                use of the AGGREGATE subprogram to get round this difficulty.

TASK NAME       All lithic finds exceeding 4mm
COMMENT         **************************
*WEIGHT         LITHNORM
                CROSSTABS procedure outputs number of lithic finds
                estimated from the raw material classification,
                by excavation square in each analysis unit
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = LITHWTRM*10
*WEIGHT         PLOT
                CROSSTABS procedure outputs weight of lithic finds
                estimated from the raw material classification, in each
                excavation square by analysis unit
                (in 1/10ths gm).
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         LITHNOSZ
                CROSSTABS procedure outputs number of lithic finds
                estimated from the artefact size classification,
                by excavation square in each analysis unit
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = LITHWTSZ*10
*WEIGHT         PLOT
                CROSSTABS procedure outputs weight of lithic finds
                estimated from the artefact size classification, in each
                excavation square by analysis unit
                (in 1/10ths gm).
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

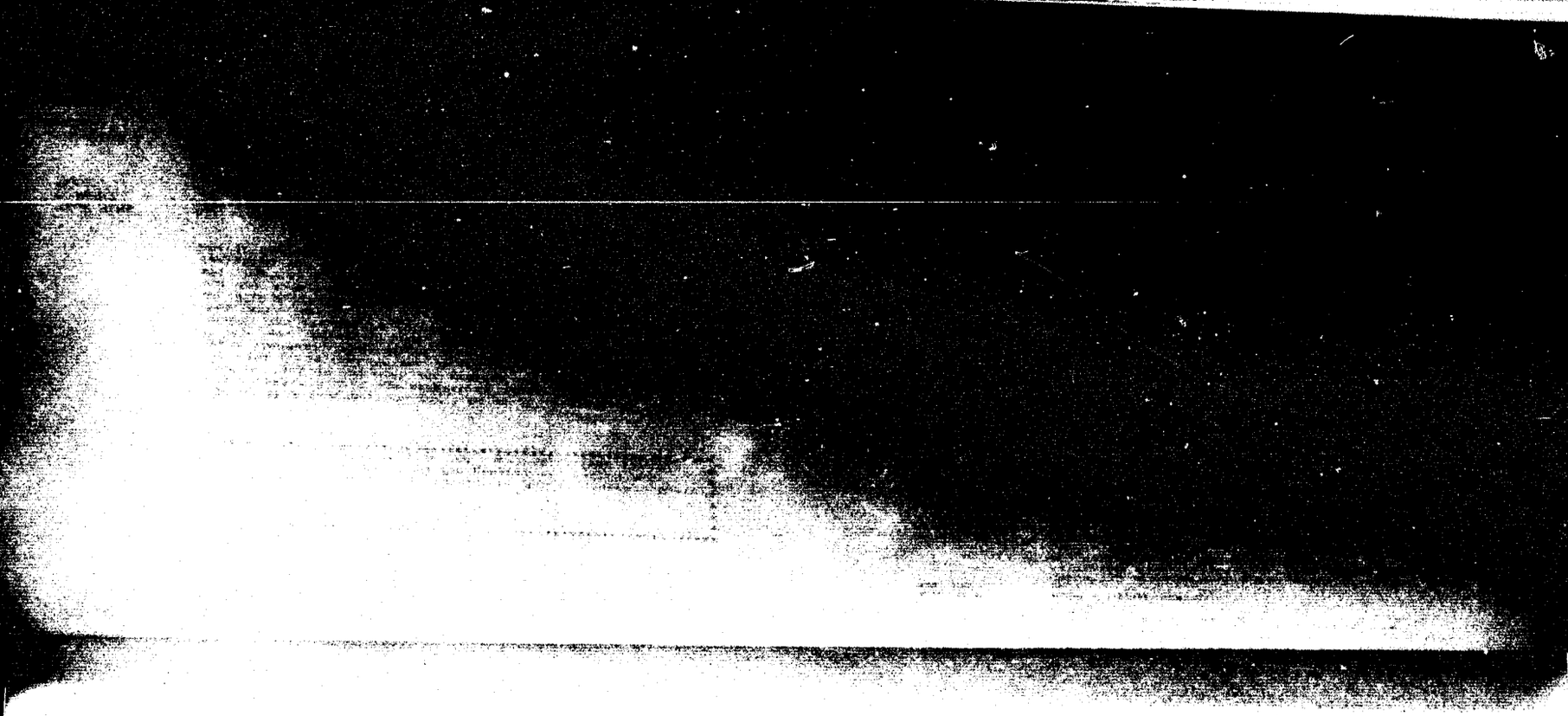
TASK NAME       Sediment and residue weights
COMMENT         ***************************
*COMPUTE        PLOT = SEDIMWT*10
*WEIGHT         PLOT
                CROSSTABS procedure outputs sediment weights by excavation
                square for each analysis unit  (in 1/10kg).
                Note that sediment weight excludes weight of large
                sieve residue (if any).
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = MEDRES*100
*WEIGHT         PLOT
                CROSSTABS procedure generates distribution of medium sieve
                residue weights by excavation square for each analysis
                unit, (in 1/100ths kg).
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = SMALLRES*100
*WEIGHT         PLOT
                CROSSTABS procedure generates distributions of fine sieve
                residue weights by excavation square for each analysis
                unit(in 1/100ths kg).
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = LGERESWT*10
*WEIGHT         PLOT
COMMENT         CROSSTABS procedure generates distribution of large
                sieve residue by square for each analysis unit
                (in 1/10ths kg).
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         LGERES
COMMENT         CROSSTABS procedure generates distribution of numbers
                of fragments in the large sieve residue by square
                for each analysis unit.
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5
```



```
TASK NAME       Start and end levels of excavation units
COMMENT         ****************************************
*WEIGHT         STRTZ
COMMENT         Mean starting z values for excavation units
CROSSTABS       TABLES = EXCVUNIT BY SQUARE
OPTIONS         3,4,5
*WEIGHT         ENDZ
COMMENT         Mean end z values for excavation units
CROSSTABS       TABLES = EXCVUNIT BY SQUARE
OPTIONS         3,4,5
*COMPUTE        MEANZ = (STRTZ+ENDZ)/2
*WEIGHT         MEANZ
COMMENT         Mean z value for excavation units
CROSSTABS       TABLES = EXCVUNIT BY SQUARE
OPTIONS         3,4,5

TASK NAME       Mean weight of finds below 1gm, 1sq.cm. or 1cm
COMMENT         **********************************************
*SELECT IF      (NOLT1GM NE 0)
*COMPUTE        MEANWT = (WTLT1GM/NOLT1GM)*10
*WEIGHT         MEANWT
CROSSTABS       TABLES = EXCVUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (NOLT1SQ NE 0)
*COMPUTE        MEANWT = (WTLT1SQ/NOLT1SQ)*10
*WEIGHT         MEANWT
CROSSTABS       TABLES = EXCVUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (NOLT1CM NE 0)
*COMPUTE        MEANWT = (WTLT1CM/NOLT1CM)*10
*WEIGHT         MEANWT
CROSSTABS       TABLES = EXCVUNIT BY SQUARE
OPTIONS         3,4,5

TASK NAME       Finds less than 4mm
COMMENT         *******************
*COMPUTE        PLOT = LITH<4MM*10
*WEIGHT         PLOT
                CROSSTABS procedure outputs weight of lithic finds under 4mm
                (in 1/10ths gm).
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (ORG<4MM GT 0)
*COMPUTE        PLOT = ORG<4MM*10
*WEIGHT         PLOT
                CROSSTABS procedure outputs weight of organic finds under 4mm
                (in 1/10ths gm).
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

TASK NAME       Distribution of Charcoal
COMMENT         ************************
*COMPUTE        PLOT = RM1WT*10
*WEIGHT         PLOT
COMMENT         CROSSTABS procedure outputs distribution of charcoal
                (weight in 1/10ths gm) by square for each analysis unit.
CROSSTABS       TABLES = ANALUNIT BY SQUARE
```

```
TASK NAME       Distribution of raw materials, unindividualised finds
COMMENT         ****************************************************
*SELECT IF      (RM2NO NE 0)
*WEIGHT         RM2NO
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM2WT NE 0)
*COMPUTE        PLOT = RM2WT*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM3NO NE 0)
*WEIGHT         RM3NO
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM3WT NE 0)
*COMPUTE        PLOT = RM3WT*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM4NO NE 0)
*WEIGHT         RM4NO
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

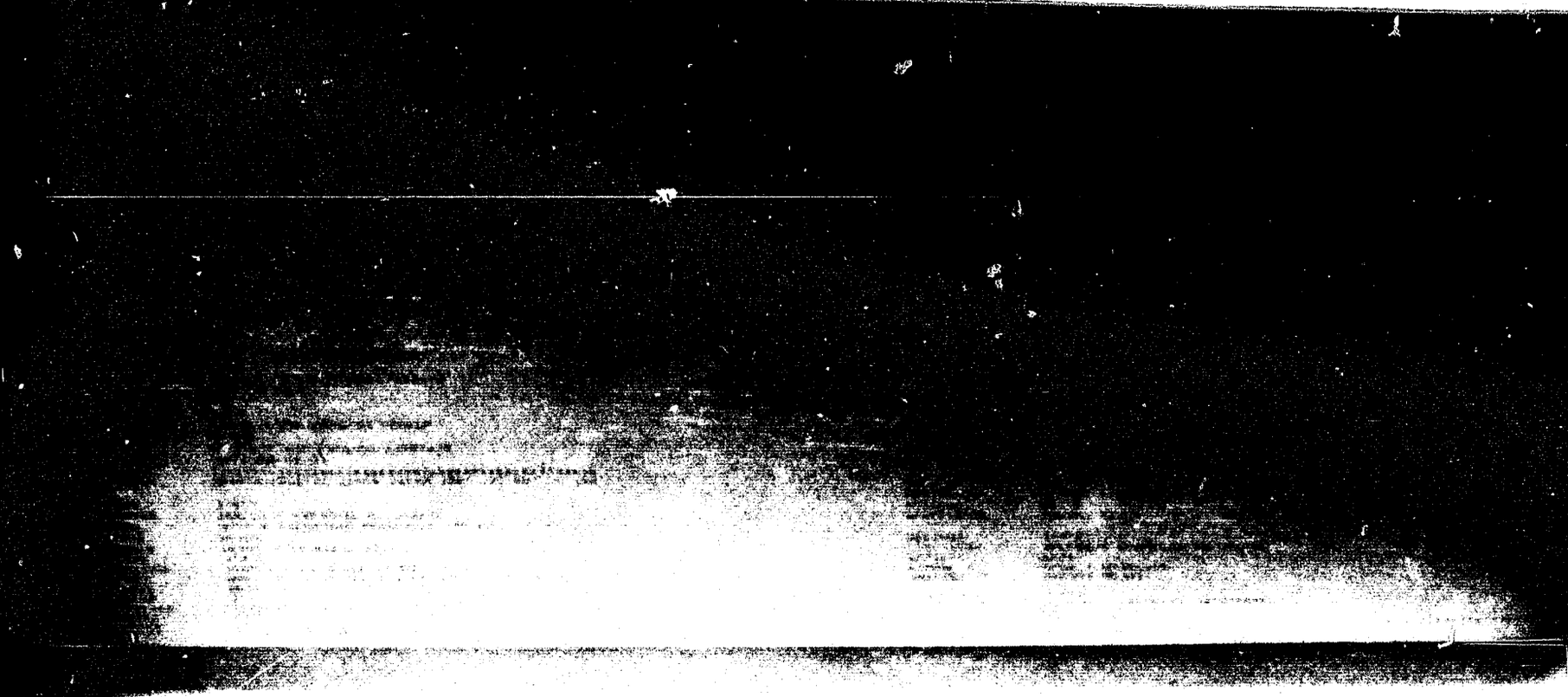
*SELECT IF      (RM4WT NE 0)
*COMPUTE        PLOT = RM4WT*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM5NO NE 0)
*WEIGHT         RM5NO
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM5WT NE 0)
*COMPUTE        PLOT = RM5WT*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM6NO NE 0)
*WEIGHT         RM6NO
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM6WT NE 0)
*COMPUTE        PLOT = RM6WT*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5
```



```
*SELECT IF      (RM7NO NE 0)
*WEIGHT         RM7NO
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM7WT NE 0)
*COMPUTE        PLOT = RM7WT*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM8NO NE 0)
*WEIGHT         RM8NO
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM8WT NE 0)
*COMPUTE        PLOT = RM8WT*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM9NO NE 0)
*WEIGHT         RM9NO
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*SELECT IF      (RM9WT NE 0)
*COMPUTE        PLOT = RM9WT*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

COMMENT         This version allows for up to 9 different raw material
                classes in the unindividualised finds. The coding forms
                illustrated in Johnson 1979, PhD thesis, ANU allow for
                up to 12 classes. Extra analyses should be added here if
                more than 9 raw material classes have been defined

TASK NAME       Size classes for unindividualised finds.
COMMENT         ****************************************
MISSING VALUES  NOLT1GM TO WTGE3CM(0)

*WEIGHT         NOLT1GM
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WTLT1GM*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NO1TO2GM
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WT1TO2GM*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NO2TO3GM
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WT2TO3GM*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NOGE3GM
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WTGE3GM*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NOLT1SQ
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WTLT1SQ*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NO1TO2SQ
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

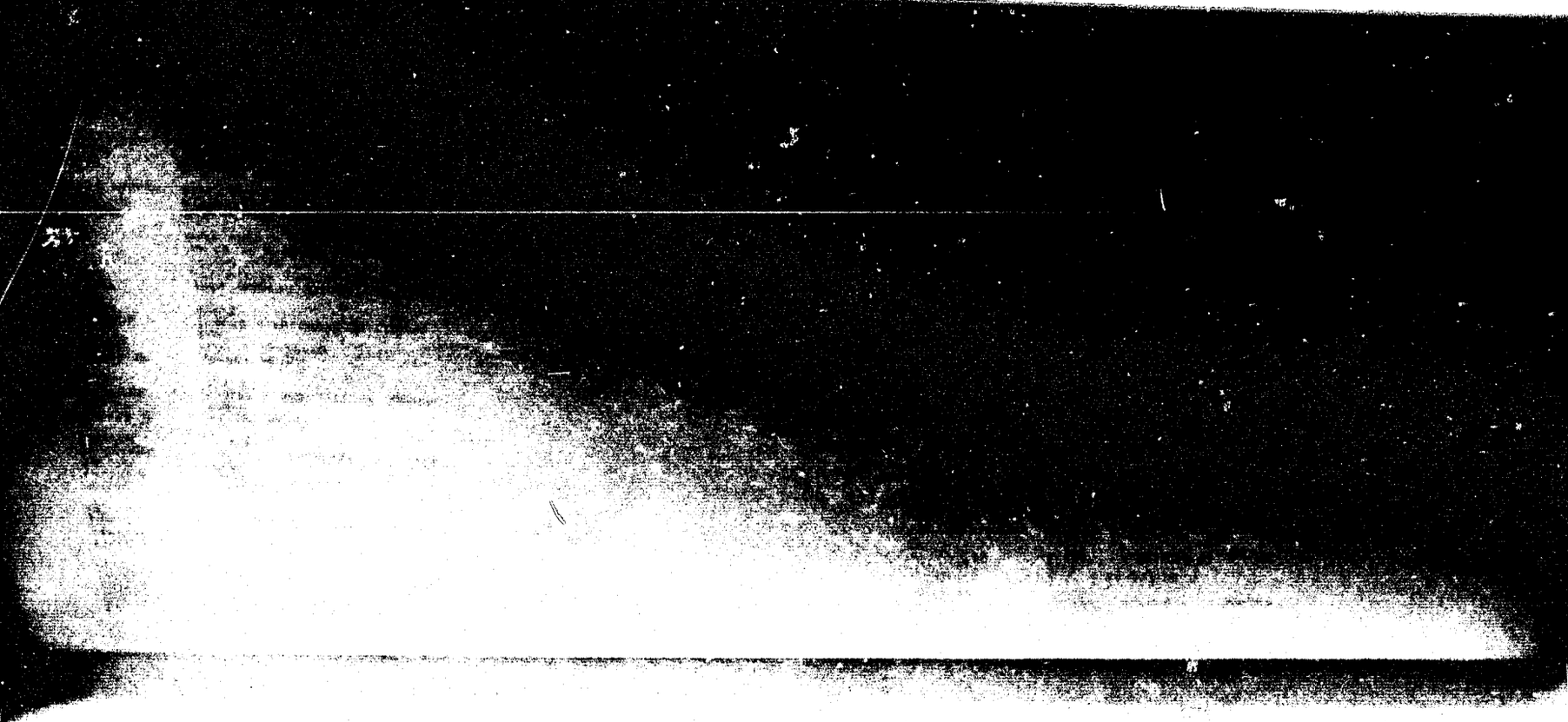
*COMPUTE        PLOT = WT1TO2SQ*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NO2TO4SQ
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WT2TO4SQ*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NOGE4SQ
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WTGE4SQ*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5
```



```
*WEIGHT         NOLT1CM
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WTLT1CM*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NO1TO2CM
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WT1TO2CM*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NO2TO3CM
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WT2TO3CM*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*WEIGHT         NOGE3CM
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

*COMPUTE        PLOT = WTGE3CM*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5

FINISH
```

```
RUN NAME        ANALYS.IND : Basic analysis of individualised finds
COMMENT         **********************************************************
                Version 24/10/79

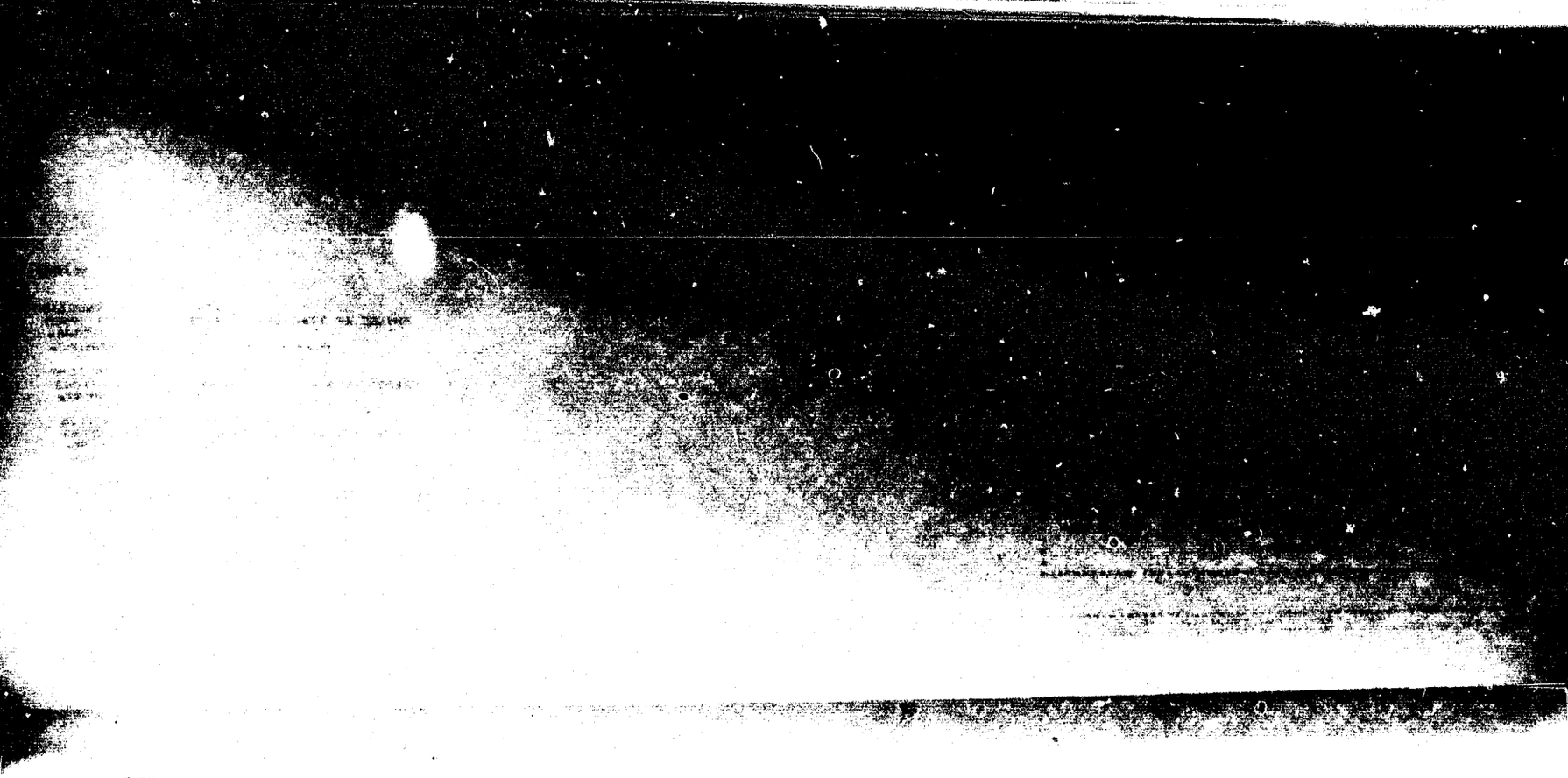

                Insert excavation data file interface instruction set here
                (Version 2 for individualised finds data)
                **********************************************************


                **********************************************************
                *                                                        *
                *                        ANALYSIS                        *
                *                                                        *
                *  ANALYS.IND: Analysis instruction set to generate basic *
                *  24/10/79    statistics for individualised finds        *
                **********************************************************


TASK NAME       Distribution by raw materials (numbers)
COMMENT         ***************************************
*RECODE         RAWMATER (1 THRU 10 = 1)
CROSSTABS       TABLES = ANALUNIT BY SQUARE BY RAWMATER
OPTIONS         3,4,5

TASK NAME       Distribution by raw materials (weights)
COMMENT         ***************************************
*RECODE         RAWMATER (1 THRU 10 = 1)
*COMPUTE        PLOT = MASS*10
*WEIGHT         PLOT
CROSSTABS       TABLES = ANALUNIT BY SQUARE BY RAWMATER
OPTIONS         3,4,5

TASK NAME       Size (weight) distribution for each raw material
COMMENT         ************************************************
*RECODE         RAWMATER (1 THRU 10 = 1)
CROSSTABS       TABLES = MASSGM BY ANALUNIT BY RAWMATER
OPTIONS         3,4,5
COMMENT         Size distribution by weight in 1gm intervals
```



```
TASK NAME      Distribution of all individualised lithic finds
COMMENT        **********************************************
*SELECT IF     (RAWMATER LE 10)
CROSSTABS      TABLES = ANALUNIT BY SQUARE
OPTIONS        3,4,5
COMMENT        Distribution of lithic finds by square for each
               analysis unit.

*SELECT IF     (RAWMATER LE 10)
*COMPUTE       PLOT = MASS*10
*WEIGHT        PLOT
CROSSTABS      TABLES = ANALUNIT BY SQUARE
OPTIONS        3,4,5
COMMENT        Distribution of total weight of lithic finds for each
               excavation square by analysis unit (in 1/10ths gm)

*SELECT IF     (RAWMATER LT 10)
CROSSTABS      TABLES = MASSGM BY SQUARE BY INDUST
OPTIONS        3,4,5
COMMENT        Distribution of lithic artefact sizes (weights) by
               excavation square and industry


TASK NAME      Distribution of typological categories
COMMENT        *************************************
*SELECT IF     (RAWMATER LE 10 AND TOOLTYPE NE 0)
CROSSTABS      TABLES = TOOLTYPE BY SQUARE BY INDUST
OPTIONS        3,4,5

*SELECT IF     (RAWMATER LE 10 AND TOOLTYPE NE 0)
CROSSTABS      TABLES = TOOLTYPE BY ANALUNIT
OPTIONS        3,4,5

FINISH
```

```
RUN NAME       ANALYS.SUP :    Analysis of individualised finds
COMMENT        **********************************************
               VERSION 23/10/79


               Insert excavation data file interface here
               (Version 2 for data on individualised finds)
               **********************************************

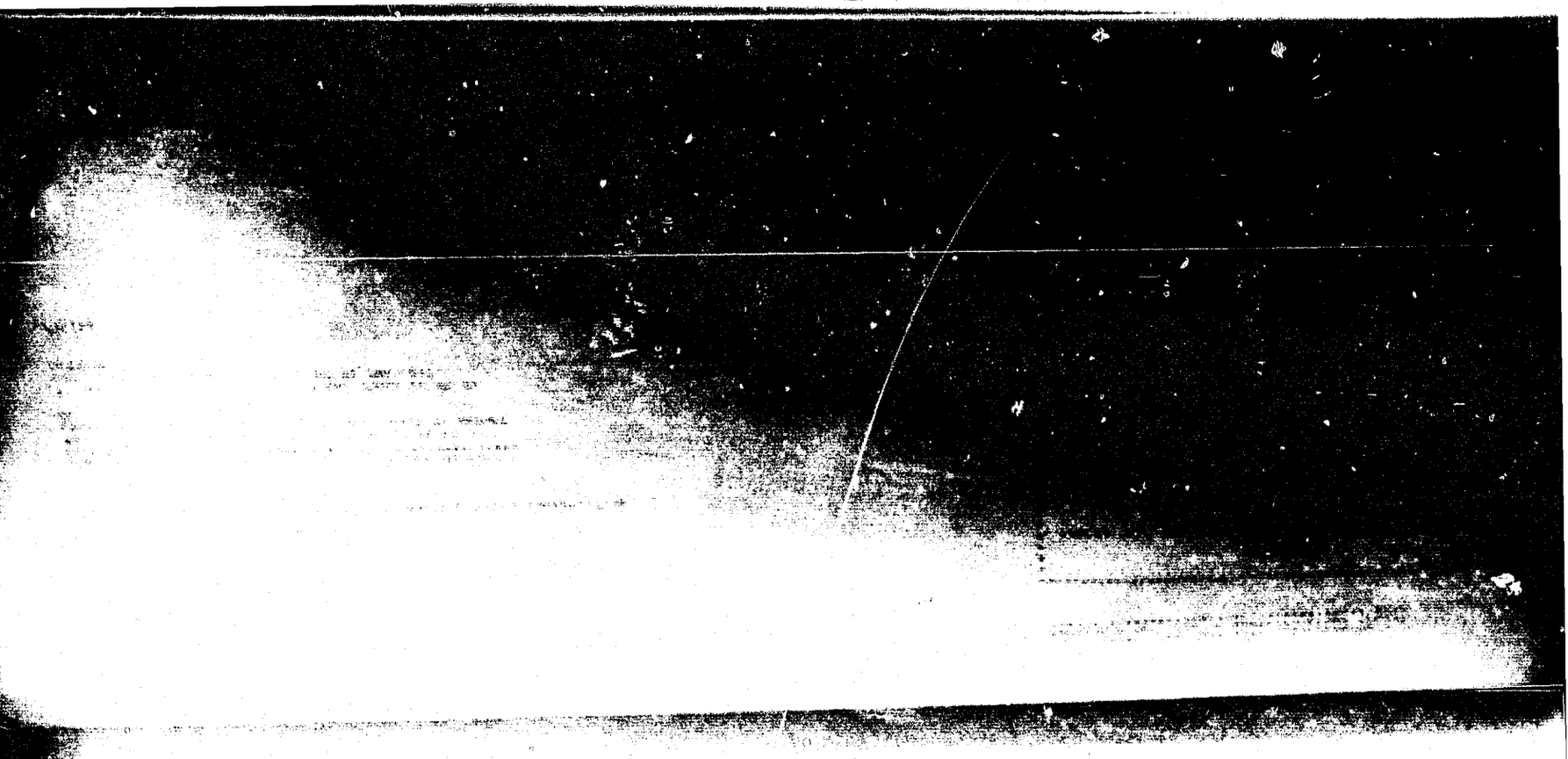

               ************************************************************
               *                                                          *
               *                        ANALYSIS                          *
               *                                                          *
               *  ANALYS.SUP: Analysis instruction set to generate basic  *
               *              statistics for the support piece attributes *
               *              of the individualised lithic finds          *
               ************************************************************


               The SPSS instructions which follow serve to output basic
               statistics for the support-pieces of individualised lithic
               finds. These include distributions by length, area and
               weight classes for each excavation square and analysis unit,
               length/breadth ratios and scattergrams for whole flakes,
               crosstabulations for nominal level attributes and class
               intervals for continuous attributes.
               ************************************************************


TASK NAME      Distribution of all individualised lithic finds
COMMENT        **********************************************
CROSSTABS      TABLES = ANALUNIT BY SQUARE/EXCVUNIT BY SQUARE
OPTIONS        3,4,5
COMMENT        Distribution of lithic finds by square for each
               analysis and excavation unit.

*WEIGHT        MASS
CROSSTABS      TABLES = ANALUNIT BY SQUARE/EXCVUNIT BY SQUARE
OPTIONS        3,4,5
COMMENT        Distribution of total weight of lithic finds for each
               excavation square by analysis and excavation unit
               (in 1/10ths gm)

TASK NAME      Distribution of typological categories
COMMENT        *************************************
CROSSTABS      TABLES = TOOLTYPE BY SQUARE BY INDUST/
               TOOLTYPE BY ANALUNIT
OPTIONS        3,4,5
```



```
TASK NAME       All individualised lithic finds, distribution and characteristics
COMMENT         ****************************************************************
CROSSTABS       TABLES = ANALUNIT BY LENGTHCM BY INDUST
OPTIONS         4,5
COMMENT         Length classification of all individ' lithic finds (class size 1cm

CROSSTABS       TABLES = ANALUNIT BY WIDTHCM BY INDUST
OPTIONS         4,5
COMMENT         Breadth classification of all individ' lithic finds (class size 1c

CROSSTABS       TABLES = MASSGM BY ANALUNIT BY INDUST
OPTIONS         3,5
COMMENT         Weight classification of all individ' lithic finds (class size 1gm

CROSSTABS       TABLES = AREASQCM BY ANALUNIT BY INDUST
OPTIONS         3,5
COMMENT         Distribution of areas of enclosing rectangle for all
                individualised finds, by analysis unit


TASK NAME       Whole flakes, distribution and characteristics
COMMENT         **********************************************
*SELECT IF      (SUPPORT EQ 1)
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5
COMMENT         Distribution of whole flakes by analysis unit and square

*SELECT IF      (SUPPORT EQ 1)
*COMPUTE        LBRATIO = TRUNC((LENGTHMM/WIDTHMM)*10)
*RECODE         LBRATIO (41 THRU HIGHEST = 41)
CROSSTABS       TABLES = LBRATIO BY ANALUNIT BY INDUST
OPTIONS         3,5
COMMENT         Length/breadth ratios of whole flakes (to one decimal place)

*SELECT IF      (SUPPORT EQ 1)
CROSSTABS       TABLES = ANALUNIT BY LENGTHCM BY INDUST
OPTIONS         4,5
COMMENT         Length classification of whole flakes (class size 1cm)

*SELECT IF      (SUPPORT EQ 1)
CROSSTABS       TABLES = ANALUNIT BY WIDTHCM BY INDUST
OPTIONS         4,5
COMMENT         Breadth classification of whole flakes (class size 1cm)

*SELECT IF      (SUPPORT EQ 1)
CROSSTABS       TABLES = MASSGM BY ANALUNIT BY INDUST
OPTIONS         3,5
COMMENT         Weight classification of whole flakes (class size 1gm)


TASK NAME       Distribution and characteristics of individualised sieve finds
COMMENT         **************************************************************
*SELECT IF      (ZCOORD EQ 0)
CROSSTABS       TABLES = ANALUNIT BY SQUARE
OPTIONS         3,4,5
COMMENT         Distribution of individualised sieve finds by analysis
                unit and excavation square

*SELECT IF      (ZCOORD EQ 0)
CROSSTABS       TABLES = ANALUNIT BY MASSGM
OPTIONS         3,4,5
COMMENT         Distribution of individualised sieve finds,
                by analysis unit and weight class


TASK NAME       Crosstabulation of nominal level attributes
COMMENT         *******************************************
*SELECT IF      (MASS GE 2.0)
CROSSTABS       TABLES = RAWMATER BY SUPPORT BY INDUST/
                CORTEX BY SUPPORT BY INDUST/
                RAWMATER BY CORTEX BY INDUST
OPTIONS         5

TASK NAME       Distribution of nominal level attributes by analysis unit
COMMENT         *********************************************************
*SELECT IF      (MASS GE 2.0)
CROSSTABS       TABLES = ANALUNIT BY SUPPORT/ANALUNIT BY CORTEX/
                ANALUNIT BY RAWMATER/
OPTIONS         4,5

TASK NAME       Crosstabulation of mass by support piece and cortex
COMMENT         ***************************************************
*SELECT IF      (MASS GE 2.0)
CROSSTABS       TABLES = MASSGM BY SUPPORT BY INDUST
OPTIONS         5
COMMENT         Crosstabulation of mass in gms by support piece
                type, for each industry

CROSSTABS       TABLES = MASSGM BY CORTEX BY INDUST
OPTIONS         5
COMMENT         Crosstabulation of mass in gm by cortex rating,
                for each industry


TASK NAME       Length/breadth scattergram for whole flakes over 2gm
COMMENT         ****************************************************
*SELECT IF      (SUPPORT EQ 1 AND INDUST EQ 1 AND MASS GE 2.0)
SCATTERGRAM     WIDTHMM(0,50) WITH LENGTHMM(0,100)
OPTIONS         4
STATISTICS      ALL
COMMENT         Scattergram for Bondaian industry
*SELECT IF      (SUPPORT EQ 1 AND INDUST EQ 2 AND MASS GE 2.0)
SCATTERGRAM     WIDTHMM(0,50) WITH LENGTHMM(0,100)
OPTIONS         4
STATISTICS      ALL
COMMENT         Scattergram for Capertian industry

FINISH
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# BIBLIOGRAPHY

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Abbreviations

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|---|---|
| AA | Australian Archaeology |
| AIAS | Australian Insitute of Aboriginal Studies |
| Amer.Antiq. | American Antiquity |
| ANU | Australian National University |
| APAO | Archaeology and Physical Anthropology in Oceania |
| Aus. | Australian |
| BSPF | Bulletin de la Societe Prehistorique Francaise |
| CNRS | Centre Nationale de la recherche Scientifique |
| CUP | Cambridge University Press |
| J. | Journal |
| JRSWA | Journal of the Royal Society of Western Australia |
| Mem. | Memoire(s) |
| Mus. | Museum |
| PPS | Proceedings of the Prehistoric Society |
| Proc. | Proceedings |
| Rec. | Records |
| Roy. | Royal |
| SA | South Australian |
| SAAB | South African Archaeological Bulletin |
| Soc. | Society |
| UNE | University of New England |
| WA | Western Australian |

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