EXCAVATION AT BUANG MERABAK, CENTRAL NEW IRELAND

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ABSTRACT

This paper reports on the excavation of the cave of Buang Merabak in New Ireland. The site was occupied before 30,000 years ago and has produced evidence for very early shellfishing and movement of obsidian. Buang Merabak is an important member of a network of excavated sites with evidence for late Pleistocene human occupation in western Melanesia.

INTRODUCTION

The excavation at the cave of Buang Merabak was undertaken in the context of the Lapita Homeland project (Allen 1986; Allen and Gosden 1988). The project was designed primarily to explore the thesis (Allen 1984) that it was in this general region that the complex of archaeological traits generally recognised as Lapita took on its characteristic forms prior to its spread throughout the Pacific. The project resulted in a number of excavations in several northern Melanesian islands which together have considerably extended the range of archaeological data available for the region. The implications of the results of the project now extend well beyond the question of the beginnings of the Lapita complex. Indeed some of the excavations, notably those at Buang Merabak, have turned out to have only peripheral relevance to the question of the Lapita homeland, since the period crucial to the development of Lapita is poorly represented at this site.

Buang Merabak was one of five sites selected for excavation on New Ireland. The cave lies about 1 km inland, between 150 and 200 m up a steep slope from the village of Kanangusngus on the Boluminski Highway, 185 km south of Kavieng and just south of the turnoff of the present road onto the Lelet Plateau.

The cave is under the custodianship of Telexas Ephraim[1], the *masa* of the village, an elder of the *Lamawan* clan who is also the rainmaker for the village. Buang Merabak contains the rainmaking shrines which we were permitted to see, but not to interfere with in any way. This aspect of the cave's use and the associated handstencils and inscriptions will not be discussed any further here. This paper is intended merely as a brief presentation of the excavation and of the radiocarbon dates obtained.

The cave (Figures 1 and 2) is a large and long tunnel (30 m long and from 10 to 14 m wide) which opens out on a steep slope formed by the erosion of a former cave shaft. The tunnel leads to a chamber, now the base of an open doline in which the rainmaking shrines are situated. Beyond this a smaller passage has been blocked off with boulders, and remains closed to visitors. During World War 2 people used the cave to escape the attention of the Japanese. Bamboo platforms and stone retaining walls were built at the entrance and about halfway inside the tunnel, causing some disturbance to the deposits in the process.

EXCAVATION PROCEDURE

The excavations were limited initially to two squares of 1 x 1 m, near the entrance, only one of which, square 2B, was taken to bedrock. Light conditions, even close to the entrance, were poor. The yellow light (and heat) of a kerosene pressure lamp only partly improved conditions, making it difficult to evaluate changing deposit colour. The erection of a reflector, and increasing the size of the excavation pit by 50 cm (square 2A) improved visibility, but it remained poor below 1 m in depth.

The excavation proceeded in quarter squares of 50 x 50 cm and arbitrary spits of 5 cm, which in practice were

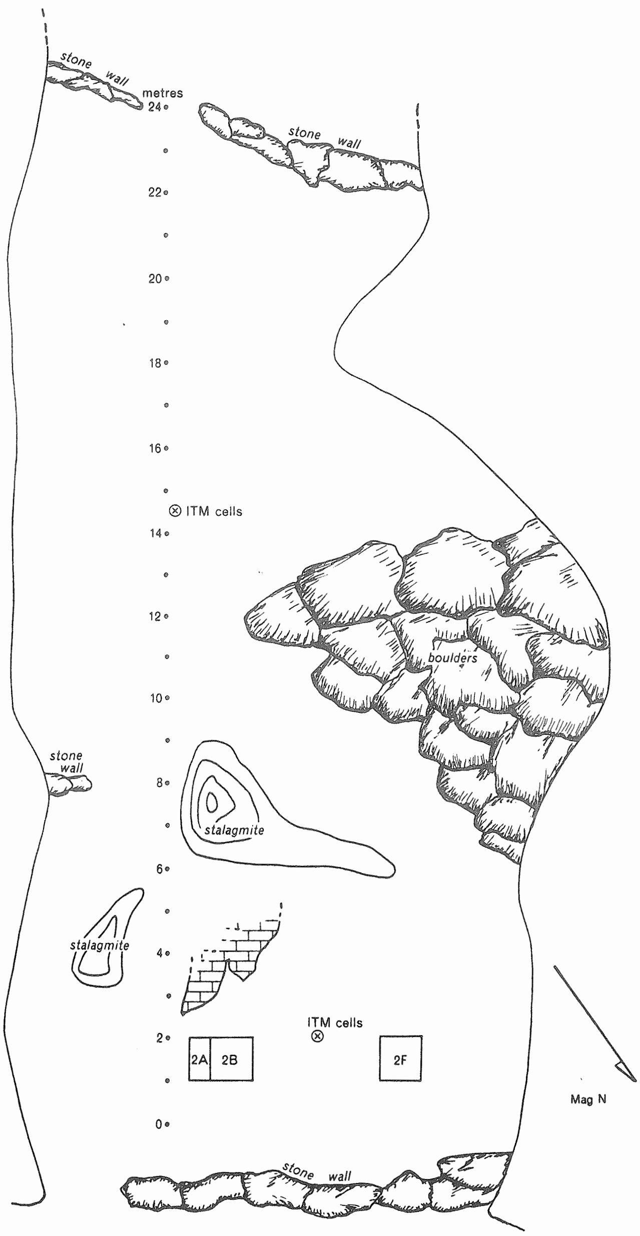

Figure 1: Plan of Buang Merabak, showing the location of the excavation squares.

of uneven thickness (see Figure 3). This was due, in part, to irregular access to a dumpy level. All excavated deposit was weighed in buckets with hand-held spring balances. Calculations of artefact, bone and shell densities are therefore based on weights rather than volume. The deposit was dry sieved through 5 mm sieves (smaller-mesh sieves were not available) and the stone residue on the sieve was also weighed. Sorting for cultural and faunal material was carried out on the sieves. As the clayey deposit became more humid with depth, and in some levels also calcreted, identification of such material became difficult, particularly for very small specimens. Occasional checks, however, showed that the three men and one schoolgirl from the village who were employed for this task were extremely adept at identifying the relevant material.

The excavation yielded a depth of deposit of 165 cms, consisting mainly of clay, limestone rubble and shell midden material with small numbers of stone artefacts, little obsidian, some organic material, principally animal bone and seeds of *Celtis* sp., and three very small undistinguished sherds of pottery.

THE DEPOSIT

The upper 10-15 cm of deposit are unconsolidated, loose and dusty, with considerable movement of material and disturbance from very recent use of the cave. Below this the deposit throughout consists of a clay and limestone breccia of varying consistency, with small pockets of either less stony or of very stony deposit. However, between 40 cm (spit 10) and 55 cm (spit 14) the deposit was more silty to the feel. Although the percentage of residue >5 mm remains relatively even, between 25% and 30% (Table 1), there were fewer large stones in this zone[2].

The colour of the deposit varied gradually from a blackish brown at the surface through brown and reddish brown to a bright ochre colour at the base. These colour changes are gradual and do not correlate with zones identified on textural criteria (described above). In view of the gradualness of these colour changes, it is inferred that this most likely reflects decreasing amounts of organic residue with depth of deposit. The increased intensity of orange-red colour may also be due to increased amounts of corroded limestone in the lower levels. From 90 cm (spit 22) to the base (spit 31) many limestone fragments are corroded to small pieces of friable orange rock (which superficially resembles pottery). This corrosion increases with depth and is probably a result of post-depositional subsurface runoff. The bedrock (or huge boulder?) reached at the base of the excavation has a deeply pocketed surface, with a layer of orange gritty deposit which grades into corroded limestone. The lowest spit recorded, spit 32, consists merely of scraping of this material, and is therefore very irregular and virtually sterile.

Between 60 cm from the surface (spit 16) and 90cm (spit 22), post-depositional calcrete has cemented the deposit and its cultural material into irregular lumps. The

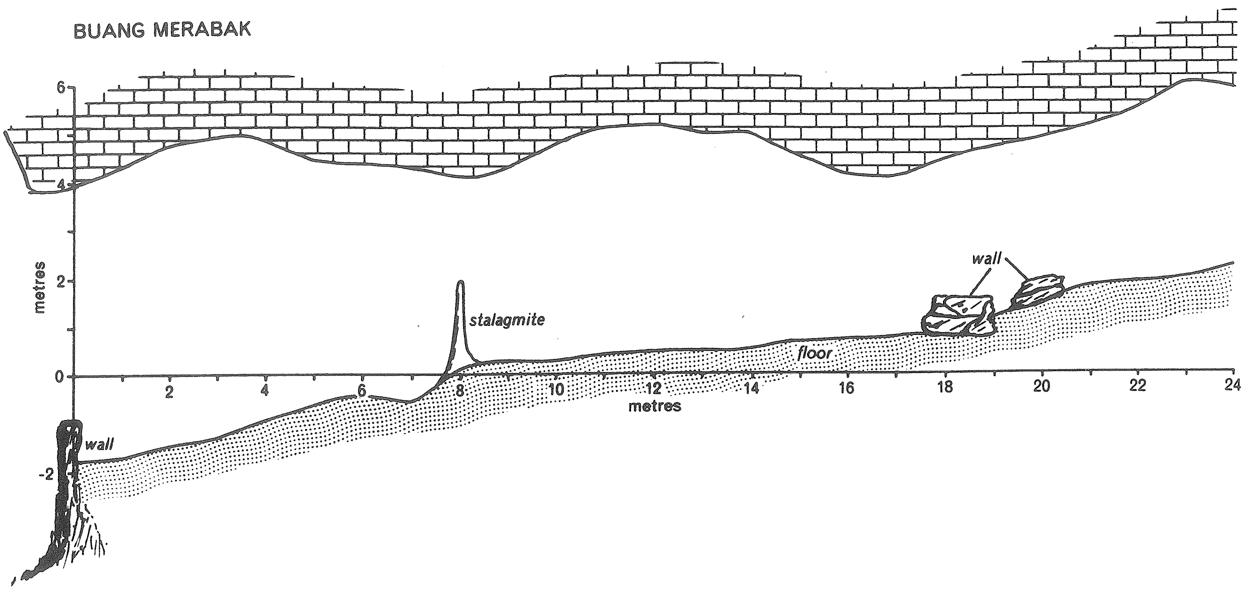

Figure 2: Longitudinal section through the shelter.

intensity of calcreting is variable and diminishes markedly below 90 cm (spit 22). The increase in residue >5mm between spits 17 and 25 (Table 1) corresponds to the zone of heaviest calcreting.

CHRONOLOGY

The three sherds of pottery were found over a depth of some 15 cms in spits 9 and 11, between 30 and 45 cms below the surface. By analogy with much more significant pottery finds elsewhere in New Ireland, notably at Lossu (White 1972, White and Downie 1983), Pinikindu (Clay 1974) and Lasigi (Golson 1991), it was estimated that this level probably dated to c. 2000-2500 BP. Initial age-depth extrapolations, prior to submission of radiocarbon dates, suggested that the total depth of deposit in the site thus covered some 6000 to 8000 years. With such a short apparent time span represented through a significant depth of deposit, compared to other caves in the region, Buang Merabak seemed particularly suitable to provide a closer focus on the Holocene period and particularly on the recent archaeology of immediate pre- and post-Lapita developments, though the virtual absence of pottery was disappointing. Good discrimination of the recent past suited my own interests in recent prehistory and in the interface between archaeology and ethnography.

Given such a reliable chronological indicator as pottery in New Ireland (Allen, Gosden and White 1989: 554), it was decided to delay the submission of shell for radiocarbon dating until the analysis of the shells could be undertaken. When this was completed (Balean 1989), three shell samples were selected to establish a preliminary determination of the depth/age relationships of the deposits.

These first three radiocarbon dates (Table 1) showed a sequence of deposits from c. 3000 to 30,000 BP. Given the situation outlined above, these results were initially viewed with dismay. The recent past cannot be clearly discriminated at all in this site. Further samples have confirmed the timescale for the Buang Merabak deposits, but some anomalies remain.

The series of 10 radiocarbon dates obtained includes at least three and possibly four anomalous results: i.e. a 30% or 40% failure rate. The source of error for these anomalies remains unknown. At the very least, these results highlight the problems inherent in the interpretation of chronologies of this and similar sites on the basis of few radiocarbon determinations. Determinations ANU 7506 and ANU 6961 are clearly incompatible with the general pattern of age determinations. In addition, ANU 6612 is incompatible with both ANU 6959 and ANU 7505. On the evidence available it is not possible to determine which of these two latter sets of dates is the more reliable, and the chronology of the last four millennia of

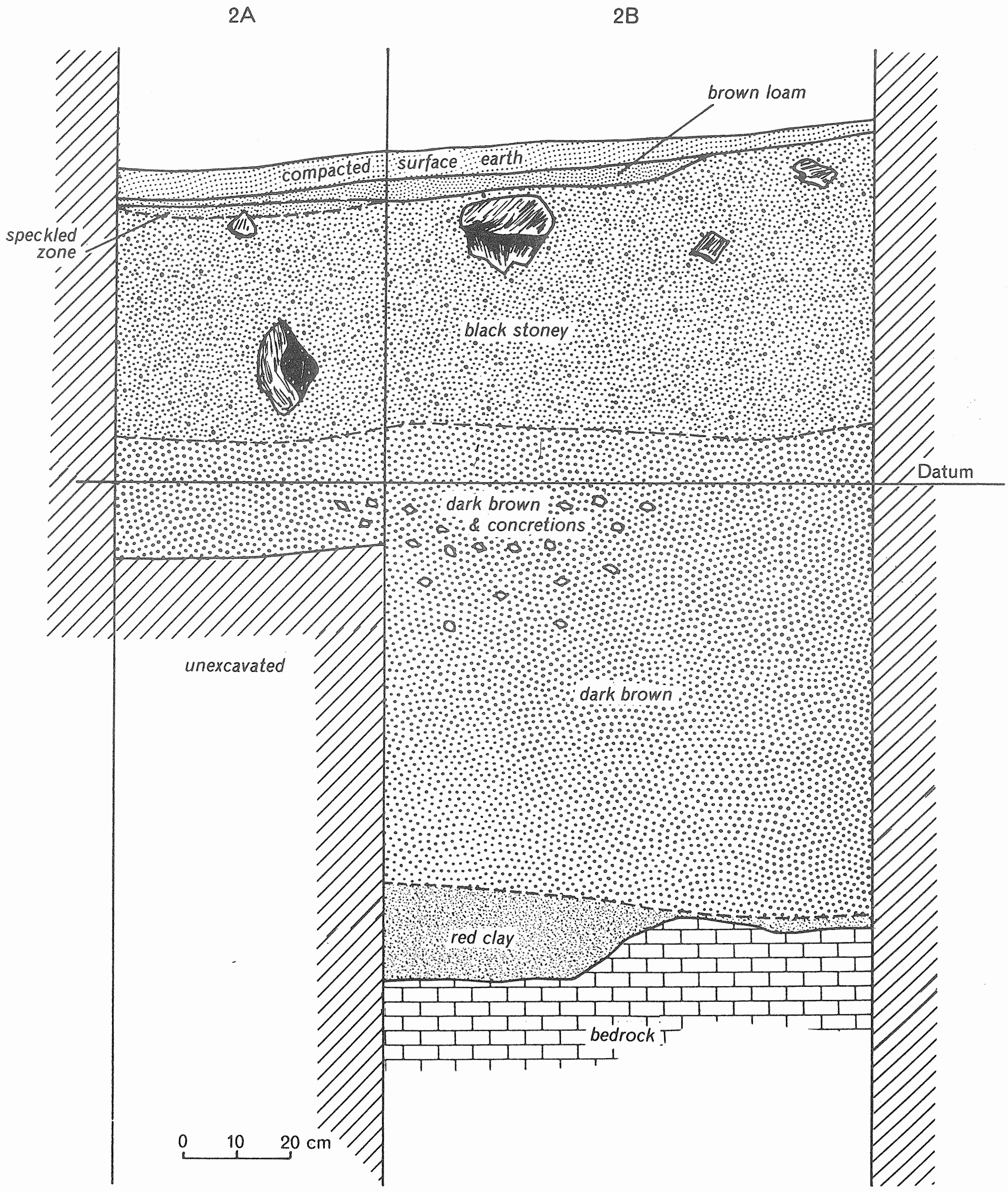

Figure 3: Section through the deposits in squares 2B and 2A, Buang Merabak.

history at the site remains problematical. In view of the unknown source of error for 30-40% of the determinations and the probabilistic errors inherent in radiometric dating, any assertion that the base of the deposit definitely dates to 32,000 BP requires the faith of a punter.

However, the general pattern of results obtained confirms that the bulk of the sequence from Buang Merabak

Table 1: Buang Merabak, Square 2B. Summary analysis of the excavation, by spits. Percentages are by weight of total deposit.

Spits	Deposit	Deposit	Shell		Bone		*Celtis*	Stone		Chert	Obsidian
	gms	%>5mm	gms	%	gms	%		gms	no.	gms	presence
1+2	20.75	-	-		-		4	-		-	-
3	49.00	-	254	0.52	32	0.07	-	6.7	1	-	-
4	32.00	31.25	482	1.51	17	0.05	-	18.1	4	-	-
5	20.50	24.39	374	1.82	10	0.05	2	2.8	2	-	+
6	65.00	28.85	2888	4.44	59	0.09	2	5.1	6	-	+
7	35.50	33.10	1546	4.35	44	0.12	1	22.2	10	-	+
8	38.00	25.66	1484	3.90	100	0.26	22	179.6	22	2.8	+
9	36.00	29.17	746	2.07	162	0.45	>50	41.2	21	4.5	+
10	35.75	24.11	922	2.62	192	0.54	48	37.5	28	4.8	+
11	39.00	28.85	1786	4.58	290	0.74	>50	46.2	28		+
12	40.00	21.88	1806	4.52	590	1.48	>50	49.2	9	-	-
13	37.00	22.30	1468	3.97	428	1.16	>50	19.3	5	-	-
14	32.00	17.19	838	2.62	300	0.94	>50	21.9	12	-	+
15	45.50	24.18	1420	3.12	268	0.59	>50	144.7	16	1.4	+
16	46.00	29.35	1918	4.16	84	0.18	30	5.1	9	3.3	+
17	13.00	48.08	298	2.29	32	0.25	8	0.4	2	-	+
18	38.50	53.25	1868	4.85	22	0.06	-	81.7	342	-	-
19	39.50	40.51	1626	4.12	34	0.09	-	105.2	46	0.5	-
20	43.75	39.43	1404	3.20	34	0.08	1	34.6	30	16.8	-
21	42.00	43.35	994	2.37	50	0.12	-	14.8	14	5.5	-
22	36.25	39.31	1646	4.54	58	0.16		35.2	6	-	-
23	43.00	41.99	1252	2.91	64	0.15		23.2	15	3.7	-
24	41.75	42.51	572	1.37	26	0.06		2.2	2	4.2	-
25	37.00	29.05	530	1.43	20	0.05		1.5	3	10.4	-
26	41.25	32.12	655	1.59	40	0.10		0.6	1	3.2	+
27	37.00	31.08	1259	3.40	46	0.12		10.4	6	35.1	-
28	33.50	28.36	1298	3.87	45	0.13		4.4	1	9.8	
29	43.00	19.77	2005	4.66	85	0.19		31.2	3	14.7	
30	31.00	27.42	878	2.83	42	0.11		135.4	8	17.8	
31	30.00	23.33	303	1.01	24	0.08		-		23.7	
32	8 .25	36.36	34	0.41	6	0.07		-		-	

Table 2: Radiocarbon dates from Buang Merabak.

BM2B	3	ANU 6959	4270 ± 60	shell	C13 measured
BM2A	3	ANU 7505	4040 ± 60	shell	check for ANU 6959
BM2A	3b	ANU 7506	440 ± 90	charcoal	check for ANU 6959: anomalous ?
BM2B	4	ANU 6612	2490 ± 80	shell	anomalous ?
BM2B	7	ANU 6960	5810 ± 110	shel!	C13 measured
BM2B	10	ANU 6613	10800 ± 110	shell	
BM2B	16	ANU 6961	2340 ± 70	shell	C13 measured, anomalous.
BM2B	16b	ANU 7507	20890 ± 270	shell	check for ANU 6961
BM2B	25	ANU 6962	20350 ± 290	shell	C13 measured
BM2B	30	ANU 6614	31990 ± 830	shell	

dates to the later Pleistocene and early middle Holocene. For the sake of internal consistency in this report, the chronology indicated by radiocarbon dates will be used in the discussion of material, on the understanding that the dates are considered to reflect merely an approximate order of magnitude.

Finally, the sequence of dates obtained, if plotted against depth of deposit, would indicate very variable rates of deposition. As an example one may compare the virtually identical dates obtained for spits 16 and 25, separated by 50 cm, with the high gradient represented by the markedly different dates between spits 10 and 4, also 50 cms apart. It is plausible that the relatively finer deposit of spits 10-14 reflects a slower rate of sedimentation than the stony breccia below and above it. Non-linear sedimentation sequences are also reported for other sites in New Ireland, where they are interpreted as reflecting periodic abandonment of the sites (Allen, Gosden and White 1989:551). Periods of site abandonment, revealed by sterile levels or stratigraphic breaks, were not evident during excavation at Buang Merabak. Subsequent analyses of the cultural materials (see below) do not enable a resolution of this problem. All of this means that any reliance on extrapolations from a depth/age curve are unwarranted for this site.

The apparent time-scale involved, however, demands a total re-orientation of my initial concepts about the cave, the relevance of the material within it, and its significance in relation to other sites in New Ireland. The time-scale covered makes it comparable with the caves of Matenkupkum and Matenbek excavated by Gosden in southern New Ireland, these having basal dates of c. 33,000 and 20,000 BP respectively, and with excavations at Balof cave and Panakiwuk in the north of the island, with basal dates of c. 14 000 and 15 000 BP (Allen, Gosden, Jones and White 1988; Allen, Gosden and White 1989).

POTTERY

A first problem relates to the occurrence of the only three sherds of pottery found in the cave, at levels dated to around 10,000 years BP. The sherds are very small; 1.3, 0.5 and 1.6 gms respectively. They are of a thin red fired paste with fairly fine grained shell grit. The sherds are very worn and abraded, and show no trace of decorative markings. They are also much too small to hint at pottery shapes. Clearly, three small and undistinguished sherds of pottery do not constitute a ceramic tradition at 10 000 BP. In the absence of any pottery at higher levels, it is difficult to explain their occurrence at about the same anomalous level in the deposit. Their fragility and very worn appearance, however, is entirely compatible with considerable movement through the deposits. Evidence for disturbance of the deposits was not visible during the excavation (except in the uppermost 10-15 cms of loose dusty material), but at present considerable post-depositional movement must be taken as the more likely explanation for the occurrence of pottery sherds at this early level.

If pottery has moved considerably through the deposits, the integrity of the stratigraphic distribution of other material in the site must also be interpreted with caution, particularly in the case of small isolated items such as the flaked piece of obsidian in spit 26 (Table 3).

SHELL

Shell occurs throughout the deposit, for the most part intensely fractured; considerably more so than was observed on a few occasions in small, incidental middens left by recent meals on the beach. This fracturing cannot be explained as resulting solely from the processes of cooking and extracting the meat. Intense treadage may be one causative factor, and this in turn would tend to promote relatively deep vertical movement of small objects through unconsolidated deposit.

With a timespan of up to 32,000 years, the location of the cave with respect to the shore line is likely to have fluctuated with changing Pleistocene sea levels. Bathymetric contours indicate a steep coast line, and sea level fluctuations may not have affected horizontal distance from the coast very substantially. Furthermore, the effects of sea level fluctuations were in part compensated by the tectonic uplift of the shore during episodes of rising sea level, though this would tend to increase the effect of a receding sea. The rates and total amount of uplift for this region are unknown, and the changing geography of the shoreline cannot be estimated. It must be assumed, however, that even if the cave was close to the coast at the relatively elevated sea levels of c. 30,000 years ago, it must have been farther removed during the late Pleistocene sea level minimum of 20,000 BP, probably corresponding to excavation levels within the range of spits 25 to 16 and above (Table 2).

The total weight of shell recovered from each spit is variable (Table 1) ranging from 1.4% to 4.8% by weight of deposit, an average of 3.3% (excluding the disturbed surface and the basal spit which consisted of corroded limestone surface with small amounts of presumed intrusive material). In the uppermost spits shell decreases significantly (0.5-1.5%). The three spits 24-26 also show

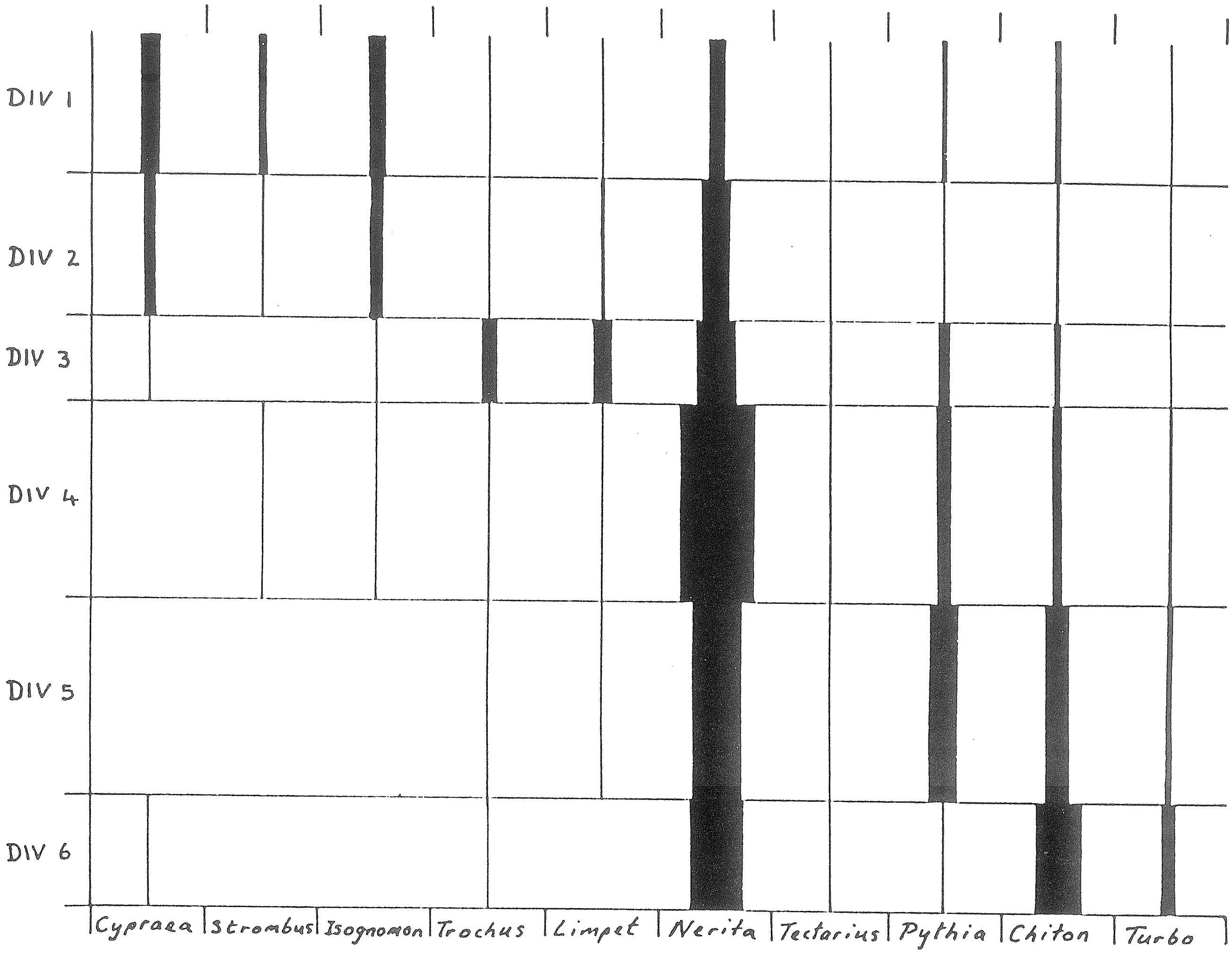

Figure 4: Diagram showing the major trends in shellfish distribution through the deposits, after Balean 1989, fig 5g.

low amounts of shell (1.4-1.6%) which may reflect lower intensities of shellfish collecting corresponding to a low sea level of c. 20,000 BP. Slight shifts in the discard location of shell, as evidenced in Matenkupkum (Robertson 1986) where larger areas were excavated, may also account for this brief reduction in shell frequency. The data imply that even with fluctuating conditions, the cave remained within easy reach of the shore.

The identification of the shell from Buang Merabak was undertaken by Caroline Balean as a BA Honours project at the ANU, and a full report is available in her unpublished thesis (Balean 1989). The essence of her results are summarised here and compared with the analyses of shell from the site of Matenkupkum (a BA Honours project at La Trobe University, Robertson 1986). Comparisons must remain general, as both researchers chose very different analytical criteria for their studies. The general trends are very similar. Both sites yielded highly fragmented material, but in each case with a decrease in shell sizes, increase in species range and corresponding increase in fragmentation in the more recent deposits, after approximately 10,000 BP.

Balean and Robertson each point out that, with possible basal dates of c. 32,000 BP, Buang Merabak and Matenkupkum are among the very few sites known with evidence for shellfish exploitation at such an early date. Evidence for Pleistocene shellfish exploitation in Melanesia is now also documented from Matenbek (Allen, Gosden and White 1989).

Balean's analysis of the shell (Figure 4) shows clear trends in the occurrence of shellfish species and of shell sizes over time. She finds that the lower levels, below spit 10, show an almost exclusive reliance on gastropod species, principally species of *Turbo* and *Nerita*, ranging between 90% and 100% by weight[3] of identifiable shell. Bivalves are virtually absent. Within this time period there is a gradual decrease of *Turbo* and corresponding increase in *Nerita*. Chiton also occurs mainly in the lower levels, and particularly in spits 25-31, i.e. apparently preceding the sea level low of c. 20,000 BP. Although Robertson has not closely identified the shell from Matenkupkum, she also states that gastropods, and especially *Turbo,* are the dominant shells in the Pleistocene levels of that site, though there chiton appears to occur throughout in small quantities (Robertson 1986: Fig. 4.6).

With rising seas, after c. 10,000 BP (spit 10) there is a marked increase in the number of shell species collected, and in particular an increase in the proportion of bivalve species which reach 25% by weight of identifiable shell in spit 5. Species of *Nerita* continue to be common, but *Turbo* become proportionately uncommon. Important new species are barnacles, *Cyprea*, *Trochus* and *Anadara*. In particular, shellfish species of sandy and littoral environments, which are virtually absent from the Pleistocene levels, occur in the early to mid Holocene. This may reflect localised changes in the coastal environment. However, similar changes seem to occur at Matenkupkum, and the sites may therefore reflect significant cognitive changes in relation to shellfish collecting and consumption rather than merely a response to local changing coastal morphology. Recent work with women in Kanangusngus village showed that although many species are known, named and collected (not all are considered edible), there is a clear consensus as to their respective desirability and women will take some trouble to collect selectively.

Another feature of the shellfish assemblage, also observed at Matenkupkum, is the gradual diminution in the size of shellfish collected. Both Robertson and Balean posit overpredation as one of several contributory factors, but Balean points to the absence of these features in the shell assemblage from the nearby recent mound site of Lasigi (Golson 1991) to suggest that other factors have operated in the formation of the Buang Merabak shellfish assemblage. By analogy with ethnographic evidence, she considers that through the Holocene, the site may have functioned primarily as a refuge, and that the apparent low level of selectivity in shellfish collecting may reflect conditions of social stress and uncertainty rather than optimum collecting strategies of an impoverished resource. The location of the cave, some way inland and up slope from the coast would make it a suitable refuge, but if temporary refuge was the primary function of the site, more permanent sites must have existed in its general vicinity. These have not, as yet, been found.

VERTEBRATE FAUNA

The quantitative distribution of bone through the deposits is uneven and shows no clear trends. Gross weights of bone as a percentage of weight of deposit show a variation from 0.05-0.07% in the uppermost levels, reaching 1.48 and 1.16% in spits 12 and 13 (terminal Pleistocene), then rapidly decreasing to a range of 0.2-0.05% in the lower levels (Table 1). The high density of bone in the middle spits occurred primarily as diffuse pockets of bone-rich deposit, unevenly distributed over the area excavated (1.5 x 1.5 metres at this level). The high level of breakage observed in the bone may, in part, be due to intense treadage. Species identification of the bone has not been completed, but it includes mainly very small animals, the largest being *Phalanger* sp.[4]

The general stratigraphic trends shown by the faunal remains, as well as the systematic trends identified from the shellfish remains, suggest some stratigraphic integrity in the vertical and horizontal distribution of the bulk of the material in the deposits. The discussion of stone and plant remains will therefore focus on general trends, while isolated deviations from these are taken as most cautiously interpreted in terms of post depositional movement.

STONE ARTEFACTS

Although stone artefacts occur in very small quantities, the vertical distribution of raw materials is not random. Stone sources used include a variety of cherts[5] which appear to have been gradually replaced by obsidian during the final Pleistocene. Other stones used are mainly basalt and a range of unidentified rocks, probably fine grained volcanics and indurated siltstones. Stone artefacts occur as small flakes, chips, flaked pieces and shattered fragments. There are no identifiable patterns of flake manufacture nor retouched pieces. Stone working technology at this site appears to have been opportunistic and infrequent. The paucity of stone artefacts suggests that other materials, for instance bamboo, may have been a preferred raw material. Shells were examined for evidence of flaking and/or use. But only one whole shell in spit 13, of *Anadara* sp., is abraded at the distal end, most probably as a result of use as a scraper. Two fragments of shell with cut marks have been identified, possibly segments of armband (in spits 9 and 11).

TABLE 3: Analysis of obsidian from Buang Merabak, square 2B. (Density and source from information provided by W. Ambrose, per. comm).

Spits	Ref No.	Description	Size: mm	Colour	Density	Source
1-4	(nil)					
5 NW	3443	blade flake	16.5 x 8.1	grey translucent	2.3495	Talasea
6 SW	3444	hinged flake	8.4 x 8.5	grey translucent	2.3523	Talasea
6 NE	3445	hinged flake	11.7 x 10.4	dark grey translucent	2.3575	Talasea
6 SE	3446	flake, pointed	11.1 x 8.6	grey translucent	2.4480	Admiralty
7 NE	3447	triangular flake	15.8 x 7.0	grey translucent	2.3533	Talasea
8 NE	3449	flake	11.7 x.10.6	dark opaque, cortex	2.3545	Talasea
9 SE	3450	flake, 2 long scars	9.5 x 5.0	grey translucent	2.3456	Mopir
10 NW	3451	flaked piece	21.4 x 11.6	dark grey, opaque	2.3416	Talasea
11 NE	3452	hinged flake	8.6 x 6.5	grey translucent	2.3464	Mopir
12-13	(nil)					
14 SE	3453	hinged flake	15.0 x 16.9	grey translucent	2.3453	Voganakai
15 NW	3454	flake	10.0 x 8.5	grey translucent	2.3499	Talasea
16 SW	3455	flaked piece	17.5 x 9.1	black opaque	2.3472	Voganakai
17 NW	3456	thin flake	10.2 x 10.7	grey translucent	2.3334	Voganakai
17 NW	3457	flaked piece	16.1 x 14.8	black opaque	2.3474	Voganakai
18-25	(nil)					
26 SW	3458	thin flaked piece	21.2 x 10.8	grey opaque	2.3472	Talasea
27-32	(nil)					

Obsidian

Obsidian occurs only in the upper section of the deposits, between spits 5 and 17, possibly as early as 20,000 years BP. One fragment occurred much lower in the sequence, in spit 26, but the possibility of post-depositional movement through the deposits cannot be excluded for this isolated occurrence. Throughout, obsidian occurs in very small quantities as very small chips or flaked pieces (Table 3). Since stone is generally discarded in very small quantities in the site, this is not sufficient to demonstrate poor access to this imported material, but obsidian fragments are small compared even to cherts and in this respect may reflect somewhat higher levels of curation.

Fifteen pieces of obsidian were submitted to W. Ambrose for inclusion in his project on the sourcing of obsidians throughout Western Melanesia (Ambrose 1978; Bird *et al.* 1981). The results, based on density measurements and on selected element analyses (see Duerden *et al.* 1987), indicate that all except one specimen are compatible with sources on New Britain (Ambrose, pers. comm). The results further suggest that, over time, obsidian may have been obtained from three separate localities in New Britain. Obsidian from the lower levels, possibly dating to c. 20,000 BP, is comparable with obsidian sources at Voganakai on the Willaumez peninsula. In spits corresponding to c. 10,000 BP two specimens compare with obsidian from Mopir, to the west of the Willaumez peninsula. Most of the obsidian, however, derives from Talasea, also on the Willaumez peninsula. Finally, one small flake in spit 6 has a distinctly higher density, probably deriving from the Admiralty Islands. In view of the very small sample represented by the Buang Merabak material, these results cannot be taken as demonstrating a sequential chronology of extraction at these localities, but they are suggestive of changing patterns of obsidian exploitation and distribution in the later Pleistocene and early to mid Holocene.

Chert

The distribution of chert is more or less complementary to that of obsidian, being absent above spit 8. White chert and some grey and black chert occur in spits 8-10, but chert only occurs regularly from about spits 15 or 16 and below (Table 1). Although the amount of chert recovered from each spit is variable, it tends to decrease in frequency and in size of fragments through time. The chert occurs mainly as flake fragments, chips and some flaked pieces as well as shattered pieces. Few pieces exceed 30 mm in maximum dimension and most are smaller.

White chert is by far the most common. It is homogeneous and with generally good flaking properties, though some pieces show columnar or irregular fracture. Red chert occurs sporadically throughout the lower levels and cherts of other shades — pink, green and yellow — are very rare. A number of fragments and flakes retain pebble cortex.

Other rock

A range of other rocks, mainly basalt and a fine grained greenish volcanic rock occur throughout the sequence. Sources appear to have been mainly (or exclusively?) pebbles or cobbles.

With the exception of two flakes and three chips, basalt is the only rock utilised through the upper range of spits 3-11. Below this, the dominance of basalt gradually gives way to more heterogeneous assemblages of raw materials. Although the bulk of the material is relatively small (<3 cm), the size range is much more variable than for obsidian and chert, probably reflecting the sizes of available pebbles.

In conclusion, the lithic assemblage from the Buang Merabak sequence reflects a casual stone working technology. However, there is a clear change in the preferential selection of raw materials around spits 11-9, roughly 10,000 BP. In the lower levels, a wider range of rocks was used, including various cherts. In the upper section, after the introduction of obsidian, chert was virtually abandoned, and heavier flaked material was consistently made on basalt. In view of the poor stratigraphic integrity of the site, it is difficult to assess the significance of the co-occurence of obsidian and chert between spits 17 and 9, though this may indicate that obsidian did not immediately replace the locally-available chert material.

PLANT REMAINS

In view of the calcareous and poorly consolidated nature of the deposit, few macroscopic plant remains are preserved. However, seeds and a few other fragments were recovered from the 5 mm sieves. It is thus possible that flotation recovery techniques might reveal further botanic information. All plant remains were identified by Doug Yen, whose identifications are used here.

Most are seeds of *Celtis* spp. Although a very few seeds were recovered from the upper spits, seeds of *Celtis* only occur regularly in spits 8 to 16, where quantities range from c. 20 to c. 100 seeds or seed fragments, with only 8 specimens in spit 17. Yen (pers. comm.) further comments that the range of seed sizes, 5 mm to 11 mm[6], appears too great to result solely from intertree variability. He concludes that more than a single species is probably indicated.

The human origin of *Celtis* seeds at the site is, however, far from certain. Most occur as fragments which may result from animal consumption of the seed kernel. Ethnographically, humans are known to relish the flesh of some species of *Celtis* fruit, but there is no recorded data on the use of the seeds. The virtual absence of *Celtis* below spit 16, and in the recent past, may reflect the nature of the local tree canopy and/or microfaunal activity at the site rather than past human diet.

Other plant remains are a few seed cases of *Canarium* in spits 3, 6 and possibly one in spit 9; four fragments of the shell of the candlenut, *Aleurites moluccana* in spits 2 and 9, and from the upper spits only, small slivers of bamboo, fragments probably of unidentified bark and unidentified charred wood.

Although these remains are few, there appears to be a clear difference in the plant remains from the upper spits, above spit 8, and below this. Below spits 16/17 no plant remains have been identified.

DISCUSSION

Despite the very poor stratigraphic and chronological resolution possible from the Buang Merabak deposits, certain general trends emerge. Throughout the period from the late Pleistocene to mid Holocene (and up to the present) the site appears to have remained within foraging range of the coast despite significant changes in global sea level. Changes in shellfish collecting practices beginning apparently around the period of rapid sea level rise c. 10,000 BP seem to reflect a more diversified coastal environment, but also a less selective and optimised use of shellfish. There is a marked diversification in the range of species collected, but also the inclusion of a significant amount of very small specimens. Today, women in the village consider such small specimens not worth collecting, though most of the species represented in the midden assemblage are considered edible with varying degrees of palatability. A few species of *Conus* represented in the midden are poisonous but are used today as decorative items.

The same general period may also reflect changes in the local tree canopy as indicated by the disappearance of *Celtis* above spit 8. The presence of *Celtis* in the vegetation during the final Pleistocene also brackets a period of lesser rock fragmentation as indicated by the slight diminution of material >5mm, and especially of larger stones, in spits 12-14.

Trends can be identified in the selection of raw material for stone artefacts. A diversity of stones were utilised throughout the Pleistocene levels, with obsidian from New Britain being introduced perhaps as early as c. 20,000 BP. During Holocene times, a much closer selectivity operated on the choice of stone for artefact manufacture. Basalt became the only stone used for larger tools, while chert appears to have given way entirely to obsidian. The presence of obsidian and the absence of shell tools, however, contrast with present practice and knowledge about the recent past.

While at present people are aware of the value of a "black rock from the bush" (?basalt) for making stone tools, obsidian (*kelibet)* is said to result where lightning strikes the ground and it is considered totally unsuitable for anything. The idea that it might have been used for tools was dismissed out of hand. Shell scrapers, however, are still often used by women to clean hard baked taro and occasionally by men for whittling wood. The woman's shell taro knife is virtually a universal household item and denticulated shell scrapers are still occasionally made and used. It is clear that the material in the more recent levels at Buang Merabak still differs from the recent past and that further changes have occurred that are not identifiable in the archaeological record at this site. In particular, it would seem that access to obsidian was lost and that a shell tool technology developed, possibly to replace the obsidian.

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NOTES

1 The letter 'x' is used to denote a sound as in the Dutch 'g'. This is the spelling adopted by the Summer Institute of Linguistics in consultation with local people for their translation of the bible into Madak.

2 Soil samples taken during excavation were lost in the process of transporting all material from Lasigi to Canberra.

3 Balean's analysis relies on a species list of 50 (including three categories of landsnail), and includes quantification by weight and by minimum numbers. Minor differences revealed from these different perspectives do not alter the general pattern described here, but for a fuller discussion see Balean 1989.

4 The faunal collection has been sent to La Trobe University for detailed analysis.

5 All rock identifications are based on handspecimen identification at low magnification only, and so are subject to verification. Chert is used as a general term to denote the range of microcrystalline and chalcedonic siliceous stones.

6 Note that the smaller end of the size range corresponds to the mesh of sieves available during excavation.

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