NEW ZEALAND ARCHAEOLOGICAL ASSOCIATION

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CONCENTRATED SHELL MIDDENS

by J.M. Davidson

Ambrose (1963) has called our attention to the necessity to study structure in attempts to sample shell midden refuse deposits. Among others, Lockerbie has often called attention to the work of returning to old sites to solve additional problems. In the last year I have concerned myself (Davidson 1964) with the overall problem of adequate techniques for obtaining reliable samples suitable for midden analysis. In this contribution I offer some results that may help illuminate problems raised by Ambrose as well as further enriching our knowledge of already published materials by additional work on known sites with different techniques and aims. Certain conclusions about sampling shell middens containing *Amphidesma* and *Chione* are offered and a suggestion made for future research.

When site N 44/2, at Tairua, was excavated in 1958-9 (Smart and Green 1962) the shell midden of layer 6 was of only secondary interest, the focus of the excavation being the lower layer 2, which contained a quite different range of shellfish and quantities of bone. This lower layer was the only one of its kind seen on this dune area, whereas numerous other concentrated shell middens, also containing *Amphidesma* and *Chione*, are scattered about on the dunes and eroding into deflation basins in the immediate vicinity of the excavated site. Such middens could be matched by many others on the Coromandel beaches, in Northland, and in other parts of the country.

With the assistance of Mr. R.G.W. Jolly, a return visit was paid to Tairua in June 1963, to collect new samples from the upper layer. The site was located without difficulty, the upper layer having eroded further since the excavation, but probably not very much. No pegs or landmarks remained, so that it was not possible to relate the new samples exactly to the old. However test excavation revealed undisturbed material of the lower layer, confirming the identification of the site, and showing that we were now working inland of the earlier excavation.

As time was short and the weather unfavourable, little systematic work could be done beyond collection of samples. A straight face cut across the edge of the midden, where it spilled down the slope, revealed two layers of shell midden. Samples were taken from each. A small area behind the face, measuring approximately 3 feet by 3 feet, was trowelled. This proved to consist of loose shell, almost devoid of stone or other material. Even in this small area, however, the midden was not homogeneous. The two main lenses visible in the face overlapped and petered out one above the other. A small ashy lens, finely divided from the other two by clean sand, lay between, being not more than 18 inches in diameter and 2 inches deep. Yet another lens appeared in the rear corner above the others. From this brief investigation it was apparent that the midden was structurally far more complex than had been realised, and evidently consisted of separate deposits of varying size and composition, laid down on an unstable dune surface. The entire structure could result from a very short occupation, because no depth of sand had accumulated between lenses, and under present conditions sand movement is quite sufficient to cover a small heap of trash very quickly if a dune is unstable. As sand was as easily disturbed by man in the past as today, such deposition would be expected if occupation was discontinuous over a period of time.

Eight samples were taken, five from the upper lens and three from the lower lens. This sampling was not random. Because of the obvious variation it was thought preferable to take samples from each apparent lens within the shell midden in order to obtain an idea of the between lens variation. The original intention had been to take samples at regular intervals across the midden, but the presence of such variety and number of lenses caused the change in approach. In addition to the eight samples from the site, one sample was taken from each of the two other middens within less than 50 yards of the first site. The upper layer of site N 44/2 appeared at first glance to consist of almost equal amounts of Amphidesma and Chione, while of the other two middens one, N 44/41, appeared to be composed almost entirely of Amphidesma and the other N 44/42 almost entirely of Chione. Time did not permit the taking of more than one sample from each of these or the sampling of other middens in the vicinity, although as I shall show later it is hardly likely that such single samples are representative. The size of the Tairua samples ranged between 1500 and 2500 gms. each.

While the Tairua middens are the only sandy beach middens sampled in detail, I have inspected similar middens at Whangamata, Hahei, and Cooks Beach on the Coromandel Peninsula, and at various Northland beaches, and studied the extensive sandy beach middens northwest of Wellington. The one at Tairua appeared typical. It was fairly thin, less than one foot deep, with only one edge exposed and eroding, and the rest capped by sterile sand and grass. It was unusual in that two lenses were exposed, but only one had been visible at the time of the excavation. A casual glance would have suggested that this site was typical of many other small dumps of food refuse along the coast.

Ambrose (1963:156) has pointed out that there has been as yet little or no effort made to investigate middens as structures. Certainly the few excavations which have taken place in the shell middens to date have not done so. Sampling projects have been carried out without regard to the internal structure, although the manner of overall composition may be estimated, as outlined by Ambrose, and should be tested. Previously the need had not arisen, and most people had concluded that the middens were probably homogeneous and contained few or no artifacts. This may not apply to sites where a shell midden is stated to compose an upper layer or layers (e.g. Moa-bone Point Cave, Shag River, Papatowai, Pounawea), but as nothing has been published on the composition or structure of these layers, they shed no light on the probable structure of shell middens elsewhere in the country. They may be similar to such large North Island sites as Paremata (N160/50), and would therefore not respond to the analysis outlined below.

While I have not been able to put this into practice, I think that it would be worthwhile, informative, and not too difficult, to excavate completely one of these small middens to discover its structure. Tairua demonstrated that such middens may not be homogeneous. By clearing the surface sand, and gridding the midden into small squares, to control the small lenses, and excavating and recording lens by lens as one would any other series of strata, a clear picture of the total composition of the midden could be obtained. From the shape of each lens, and its relation to the slope of the dune, much could be learned about its deposition. Side by side with the excavation of the shell layers as lenses systematic samples of shell as faunal material would need to be taken, for information on content. Controlled sampling would be necessary, as the concentration of shell in the site would be too great for field sorting of all material during excavation. Small lenses of shell can be quickly and efficiently excavated by hand trowel, and, if the Tairua midden is as typical as it appears, there would be few or no portable artifacts or other material to slow down the work or necessitate screening, only shell and yet more shell. The reasons for selecting a small midden are obvious. Equally obviously it should be both as little disturbed as possible, and not too deeply buried by overlying sand.

It might be that the midden selected would prove to contain no lenses or other irregularities. In such a case, an arbitrary system of levels and squares would have to be imposed, in order to gauge the variation with more precision than has been done so far. At Tairua, however, any system of arbitrary levels would have been entirely inadequate, owing to the very local nature of the variation. Such tests on several middens with lenses might reveal that arbitrary levels do give a good picture of the total range and composition of the faunal material in the deposit but fail to reveal its content according to its structure. Similarly in the midden at Kauri Point Pa (N53-54/5), while methods used to tackle a deep shell midden such as this were inadequate it also appeared that if arbitrary horizontal levels were used, some tortuous and regorous procedure for equating arbitrary and actual strata such as that employed by Willey and McGimsey (1954: 39-41) would become necessary because the section of the mound was quite clearly stratified, with various shell layers slanting at quite a considerable angle to the horizontal plane.

The percentages of the two main shell species at Tairua as percentages of total shell number and total shell weight, and the percentage by weight of each constituent of the midden are given in Tables IA and IB, together with means. The processing of these samples had been discussed elsewhere (Davidson 1964: 146-168). It is apparent that one layer is more homogeneous than the next and that neither resembles the figures obtained by Smart and Green, suggesting that there was considerable further variation in that small area of the site which has eroded away since 1959. This evidence suggests that while one sample may confirm a visual impression as is the case with the samples from N 44/41 and N 44/42, further controlled sampling is necessary to gain reliable estimates of the true structure and composition of one small midden. It may also be noted that while the samples were taken from the entire visible section of the midden, further midden layers reappeared not more than ten feet to the south on the same plane, and seemed as if they might link with those sampled. Visually these layers conveyed an impression of much higher Amphidesma content, closer to that of Tairua N 44/41 which was on the other side of the peak of this same dune.

Enough has been said here to indicate that at least one sandy beach midden outwardly typical of many others, proved after some slight investigation to be neither simple in structure nor homogeneous in internal composition.

Shell middens in earth: Because dry land shell middens often do not show up as clearly as do eroding beach middens, they are not always easily located, and are seldom recorded. Many are grassed over, although farmers are usually aware of their existence, and crop marks may be good indicators at certain seasons. The number of middens located in one small area near Kauri Point, shows how numerous these sites may be.

In the original survey of the Kauri Point middens one or two samples were taken from each midden, although only one from each was used, except for one site, sectioned by a road cutting, in which two strata were clearly visible, from each of which a sample was taken. The results of a minimum analysis of 500 gms. from each midden is available (Green 1963b: facing page 149).

The original samples were kept. Six of them were subjected to further analysis. These six were selected arbitrarily. They were processed in various ways, to obtain information on the most satisfactory and expedient methods of processing. At the same time various ways of manipulating and expressing the data were tried. Both these aspects are discussed elsewhere (Davidson 1964:146-168), the concern here being the initial problem of sampling and internal composition.

However great the amount of data on processing, and size of individual small samples may be, it is of little value unless we have a reasonable sample of the range of variation in the individual deposit. We have already seen that the Tairua midden exhibited greater structural complexity than might have been expected. In order to test the variety of the individual dry land shell middens a further visit to Kauri Point was made by the author and Mr. Green to collect more samples from certain middens. From those six middens samples subjected to further processing, several sites were selected for further field investigation although it was planned to sample only two in detail. Almost all these sites had been laid down on quite steep slopes, in several cases probably below undefended pit sites. Many were trampled by stock and slumped, and only in a few was any definite face exposed. Two of those selected proved to be very small and scanty. Two were of reasonable size and seemed suitable for further investigation. These were N53-54/19 and N53-54/21.

N53-54/19 measured approximately 30 feet in diameter, but an eroded face was present for only 12 feet across it. This face was cleaned down carefully, and it was found that three distinct layers were present, an upper dark layer from which the first sample had been taken, a middle layer with fine clay matrix and considerable midden material, and a lower dark layer resembling the first but appearing to have a somewhat higher Chione content. Four column samples were taken at three foot intervals, comprising altogether eleven samples, for the middle layer was absent at one point.

N53-54/32 was quite different in composition. It measured approximately 30 feet in diameter although the edges of it were not clear. The central portion was all eroding and in places disturbed. The deposit was thin except for one point where there appeared to be a pit partly filled with midden material. Eleven samples were taken at two foot intervals across the midden, except for one column sample, in the area with the pit, which involved two samples.

The samples from these two middens were processed according to techniques already tested, and accorded the minimum processing. Each sample was dried and a sample of from 500 to 750 gms. selected. This was then passed through a $\frac{1}{4}$ inch sieve, and all the material retained sorted. The residue was set aside. All constituents were expressed as percentages of the total weight, and in addition the proportion of each species as a percentage of the total shell by weight and by number was calculated. For certain constituents, the mean of the twelve samples and the standard deviation and S.E. of the mean were calculated. It was apparent that the range of variation within N53-54/32 was very high. The figures are presented in Table II A & B. For purposes of comparison, the sixteen original samples each from a single midden, were treated as samples of one population and the same means and standard deviations computed. The figures in Table III show that the range in shell concentration, and in proportions of <u>Amphidesma</u>, <u>Chione</u>, and minor shell constituents, is only slightly smaller within a single medium sized midden, than it is between single samples of all the middens together.

For site N53-54/19, the means and standard deviations by weight for each level, and for the entire site, of residue and the percentage of total shell weight of <u>Amphidesma</u> and <u>Chione</u> were calculated, as percentage by weight had proved slightly more consistent than percentage by number (see Table IV). This midden proved less varied than the other although the range was still great enough to include at least eight of the single samples from other middens within it. More importantly it demonstrates that the range is almost as great within layers as between them, although the samples are too few to be entirely satisfactory for this purpose.

This information is sufficient to indicate that these middens were not sufficiently homogeneous in shell content to allow an ordering based on single small samples from each midden to have any significance. More importantly, it cast doubts on the validity of attempts to view the variations between the two major shell species (<u>Amphidesma</u> and <u>Chione</u>) in this locality as a result of chronological change. It will be interesting to learn whether the results from the midden at the Kauri Point pa support this conclusion. If they do, the dating of these middens may only be solved by associating them with more diagnostic types of site, or by non-archaeological dating techniques.

These two projects have shown, that while these middens are not large, they are not internally homogeneous, and that numbers of samples must be taken to gain an adequate indication of the actual content. Given the experience of Tairua and Kauri Point, it would be wise before embarking on any further sampling projects in middens of these kinds, to run an extensive pilot study on two or three typical examples to discover the range of variation they present, and the number of samples likely to be necessary to specify this precisely.

Concerning the structure of earth middens less can be said, as those which have been recorded are more disturbed than most beach middens, and no excavation has been carried out beyond that necessary for the collection of samples. However it may be noted that while their siting is different from that of a beach midden, in that the material appeared to have been cast down from above on to a slope in most cases, the two investigated in more detail both revealed clear structural features. In one, distinct layers were clearly visible, and in the other an architectural feature of some kind, not relating to the midden structure itself, was present. Walking over the disturbed area, one could still see clusters of shells, as for example an area with a great concentration of Struthiolaria papulosa where a number of them seemed to have been dumped at once.

These two areas are the only two to my knowledge where a systematic attempt to gauge the complexity of a midden has been attempted and the results published. They are representative only of concentrated shell middens, where bone, stone, and artifactual material is scanty or absent, but as a class they are extremely common. They present a challenge, and now that we are somewhat more aware of their nature, we must seek more sophisticated methods of gaining information from them.

It should be emphasized that these middens are those containing Amphidesma and Chione and what has been said applied only to these until such time as further tests are carried out on, for example, the Waikanae middens. If one views the combination of A. australe and Chione as one constituent, the deposit becomes internally far more homogeneous, yet even so, many samples are needed to obtain data on the smaller shell constituents, or on the amount of residue, and there seems to be no aim which could demand quantitative sampling and yet be satisfied with one or two samples.

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Table I

Small samples from N 44/2, and other Tairua middens

Part A: Analysis by total weight and shell weight

Sample No.	% total weight					% shell weight		
	Residue	Stone	Chione	Amphidesma	Other	Chione	Amphidesma	Other
1 (bed 6)	56.1%	.1%	21.6%	20.7%	1.0%	49.8%	46.8%	2.4%
2 "	71.4	.8	15.6	12.0	.2	56.0	43.2	.7
3 "	65.7	.1	21.8	11.8	.6	63.8	34.5	1.7
8 "	79.7	.1	10.6	9.2	.1	52.7	45.6	1.7
9 "	78.3	.3	13.5	7.6	.3	63.3	35.6	1.1
mean for upper lens	70.3	.3	16.6	12.4	.4	57.1	41.3	1.5
10 (bed 6)	78.4	.1	14.1	7.0	.4	65.7	32.5	1.7
4 "	58.3	1.1	25.7	13.9	1.0	63.2	34.2	2.5
6 "	55.0	15.3	18.5	10.6	.6	62.2	35.7	2.0
mean for lower lens	63.9	5.5	19.4	10.5	.7	63.7	34.1	2.1
Total mean bed 6	67.9	2.2	17.7	11.6	.6	59.6	38.6	1.7
Tairua N44/41	51.6	.5	4.4	43.1	.4	9.0	90.1	.9
Tairua N44/42	34.4	.2	52.5	10.4	2.5	80.2	15.9	3.9

Part B: % by number, average weight of shells and % unbroken shell

Sample No.	% by number			av. wt. in gms.		% whole
	Chione	Amphidesma	Other	Chione	Amphidesma	Chione
1 (bed 6)	42.4%	53.9%	3.6%	1.2gms	1.0gm	48.2%
2 "	46.1	51.2	2.7	1.35	.97	61.0
3 "	54.9	42.3	2.8	1.4	.96	68.6
8 "	43.6	52.7	3.6	1.5	1.1	72.5
9 "	50.0	41.3	8.7	1.3	1.1	53.3
mean for upper lens	47.4	48.3	4.3	1.34	1.04	60.7
10 (bed 6)	58.6	36.8	4.6	1.4	1.5	46.2
4 "	64.6	32.4	3.0	1.3	1.3	65.1
6 "	54.9	41.1	3.9	1.3	1.2	62.3
mean for lower lens	59.4	36.8	3.8	1.33	1.33	57.9
total mean for bed 6	51.9	44.0	4.1	1.35	1.15	59.65
Smart & Green	37.8	60.6	1.6	-	-	-
Tairua N44/41	18.3	75.7	6.0	1.2	1.8	41.6
Tairua N44/42	72.2	24.5	3.3	1.5	.95	71.0

Table II

Analysis of small samples from N 53-54/32

Part A

Sample No.	% shell by wt.			% shell by number		
	Amphidesma	Chione	Other	Amphidesma	Chione	Other
1	72.3%	26.1%	1.6%	47.5%	45.0%	7.5%
2	66.3	32.9	.7	39.0	53.8	6.2
3	80.4	12.0	7.6	56.6	35.8	7.6
4	86.4	12.2	1.4	55.2	33.3	11.5
5	46.3	52.0	1.7	12.1	85.5	2.4
6	49.9	49.4	.7	18.9	78.7	2.4
7	47.3	51.3	1.3	12.8	82.4	4.8
8	40.6	54.1	5.3	9.9	85.9	3.2
9	57.4	36.9	5.7	29.5	64.4	6.1
10	67.7	26.0	6.3	32.3	53.8	13.9
11	56.2	42.6	1.2	23.2	69.5	7.3
12	41.6	58.1	.3	19.0	79.4	1.6
mean	58.96	37.8	2.8	29.7	64.0	6.2
standard deviation	14.6	15.4	2.5	15.95	18.2	3.6
S.E. of mean	4.2	4.4	.72	4.6	5.2	1.04

Part B

Sample No.	% total weight			av. wt. in gms.	
	Residue	Amphidesma	Chione	Amphidesma	Chione
1	59.0%	29.6%	10.7%	3.4gm	.5gm
2	47.3	34.9	17.4	3.1	.97
3	51.2	39.3	5.9	4.2	.87
4	35.0	56.2	7.9	3.8	.91
5	29.4	32.7	36.7	4.4	.72
6	34.0	32.8	32.5	2.8	.84
7	31.9	21.9	34.5	3.9	.72
8	16.8	34.3	45.0	4.6	.71
9	19.5	36.2	29.7	4.6	.93
10	49.5	34.1	13.1	4.9	1.2
11	42.5	32.3	24.5	4.4	.91
12	32.3	27.1	37.8	3.5	.92
mean	37.4	35.1	24.6	4.0	.93
standard deviation	12.28	8.1	12.7	.63	.20
S.E. of mean	3.5	2.3	3.6	.18	.06

Table III

Other Kauri Point middens results for comparison with Tables II and IV

Site No.	% shell by weight Amphidesma a.	% shell by weight Chione st.	% shell by number Amphidesma a.	% shell by number Chione st.	% total weight residue	average weight Amphidesma a.	average weight Chione st.
N53-54/27	66.4%	9.3%	44.8%	31.6%	11.4%	5.9gm.	1.2gm.
N53-54/22	96.3	3.7	84.6	15.4	6.8	6.7	1.5
N53-54/29	66.7	18.2	46.5	44.7	16.2	4.3	1.1
N53-54/32	36.4	52.2	9.6	85.6	3.5	5.6	.9
N53-54/31	51.8	34.2	34.7	55.4	3.0	3.0	1.2
N53-54/20	92.8	.7	66.7	4.2	10.4	13.4	3.0
N53-54/19	78.6	18.3	44.4	37.0	64.8	4.1	1.2
N53-54/24	87.9	4.7	81.6	8.2	34.6	3.5	1.9
N53-54/23	95.8	4.2	77.8	22.2	8.5	7.9	1.3
N53-54/25	93.0	6.5	73.1	21.2	20.1	4.9	.7
N53-54/21	94.9	.3	92.1	2.6	22.9	5.3	1.0
N53-54/30	67.1	29.0	37.5	53.4	34.1	3.3	1.0
N53-54/28	85.7	13.8	69.5	28.0	15.3	3.1	1.3
N53-54/26	85.5	8.1	74.5	21.3	3.3	3.0	1.0
N53-54/6	98.2	.9	91.3	4.3	-	9.6	2.3
N53-54/7	66.1	32.8	45.5	51.9	9.0	4.1	1.8
mean	79.0	14.8	60.9	30.5	17.6	5.5	1.4
stand. deviation	17.3	14.6	22.9	22.14	15.9	2.7	.57
S.E. of mean	4.3	3.7	5.6	5.5	4.0	.7	.14

Table IV

Small samples from N53-54/19, partial analysis

Sample No.	% shell weight Amphidesma	% shell weight Chione	% shell weight Other	% total weight Amphidesma	% total weight Chione	% total weight Residue
1	85.2%	13.2%	1.6%	46.8%	7.3%	45.1%
4	73.5	24.0	2.5	38.1	12.5	47.2
7	56.7	40.0	3.3	34.4	24.3	39.1
9	59.2	39.0	3.8	13.0	8.9	63.2
mean	68.7	29.1	2.8	33.1	13.3	48.7
stand. deviation	11.2	11.13	.85	12.36	5.9	8.6
2	49.6	43.0	7.4	17.0	14.6	61.6
5	71.9	26.0	2.2	21.4	7.7	70.2
10	60.0	35.0	5.0	5.7	3.3	90.4
mean	60.5	34.6	4.9	14.7	8.5	74.7
stand. deviation	9.1	6.9	2.03	6.6	4.7	7.2
3	73.6	23.3	3.1	50.7	16.0	31.0
6	41.2	54.7	4.1	25.6	34.0	35.7
8	55.1	39.9	5.0	31.5	22.8	43.7
11	69.1	26.8	4.1	37.9	14.7	45.2
mean	59.8	36.2	4.1	36.4	21.9	38.9
stand. deviation	12.5	12.35	.5	9.4	7.5	5.8
total mean	63.2	33.2	3.8	29.3	15.1	52.0
stand. deviation	12.05	11.12	1.59	13.4	8.38	16.8
S.E. of mean	3.6	3.3	.48	4.0	2.5	5.0