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SHELL ARTEFACTS FROM ARCHAEOLOGICAL SITES IN SOUTHERN NEW ZEALAND

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Examination of excavated mollusca from several archaeological sites in Southern New Zealand revealed that many had been damaged deliberately. Two major activities were identified; firstly food getting, that is, shells were broken in order to extract the animals; and secondly manufacturing; that is, the shells were cut, broken or sawn to make something. The purpose of this paper is to describe the results of these studies.

Materials and Methods

All excavated mollusca were sorted into species and then into whole shells and fragments. The fragments were then studied more closely for regularities in break patterns, and for evidence that some kind of cutting or breaking implement had been used. Some of the excavated mollusca particularly those from sites BSS/1 and C1/1, were so badly fragmented (presumably by trampage) that studies of this sort were not possible. Results are summarised in table 1.

The shells of Perna canaliculus, Cookia sulcata (figure 2), Haliotis iris and Haliotis australis were utilised for artefact manufacture. The most frequently worked species is Haliotis iris (paua) and there were abundant remains of cut shells at a number of sites. An analysis of the utilised paua fragments was carried out with the object of determining whether or not the shell working industries were linked with wood working, localised areas within the sites, paua shells with special properties, the manufacture of specific shapes and areas or selective methods of cutting the shells (see Phillips 1935).

The question of localised working areas and industrial relationships were investigated by considering the overlaid spatial distributions of wood chips, cut shells and unworked shells (Coutts 1972, figures 3.5, 3.8, 3.10). An attempt was made to look at the problem of selection by comparing average measurements of cut or utilised shells with those from 200 undamaged paua randomly selected from the total collection of excavated specimens (table 2). The positions selected for thickness measurements are shown in figure 1.

For purpose of analysis the cut paua were divided into two groups: fragments (sections of shell cut from paua) and bodies (paua from which pieces of shell have been cut). Select parameters were measured wherever possible and the shapes (fig. 1), general areas from which pieces of shell were cut (see fig. 1), whether or not the shells were cut along the line of naturally occurring holes and the occurrence of cut holes in the centre of the shells were noted. Finally, the areas of the cut pieces were measured. The mean values of the continuous parameters and the frequencies of occurrence of discrete data were calculated (tables 2-4). Examples of utilised paua shell are shown in figures 3-6.

Results

Many of the Gastropoda (e.g. Lunella smaragda, Modelia granosa, Cookia sulcata and Amphibola crenata) from most layers at most sites have been broken deliberately, presumably to extract animals (c.f. Beattie MHL

Another way of examining this problem is to examine the ratio of whole Lunella (W) to total estimated numbers of Lunella (E), calculated by dividing the total weight of Lunella by the average weight of a single shell of Lunella in each archaeological layer. When this is done it has been shown elsewhere (Coutts 1972, table 3.15) that the W/E ratios tend to fall in the range 0.5 to 0.7; that is half to a quarter of the shells in each archaeological layer are broken. Now when the estimated numbers of deliberately broken Lunella are added to the total numbers of whole shells, and the W/E ratios are recalculated it was shown that the values tended to approach unity. These results then, strongly suggest that most of the fragmented Gastropoda have been broken deliberately.

The method of fracturing the shells varied from breaking their lower halves off, to smashing or cutting a small hole in the exterior wall of back passage, about half to one centimeters behind the operculum. Presumably the latter could then be pushed out by inserting an appropriate implement into the hole.

A small percentage of all excavated paua shells have been worked, and the industries at the Southport sites appear to have been conducted in the living areas of each site. It was found that the percentage numbers of paua shells in the living areas are higher than in midden areas, presumably because many were retained there for artefact manufacture. However, both worked and unworked paua shells were found together in conjuncting midden and living areas at these sites.

The results of the analysis of the worked paua shell from SP/1 (tables 2-4) indicated that there is considerable uniformity in the dimensions of the cut pieces of shell and the shells from which pieces were cut. In general adult shells of circa average size and thickness were utilised.

This contrasts with the results from SP/10 and SP/11 where there was a tendency to select large shells. The mean thickness of the cut fragments from all sites except SP/11 tend to be greater than the mean thickness of the shells and the estimated mean thicknesses of the sections cut from the shells. Hence, it may be assumed that the pieces of shell removed from the sites were of average or less than average thickness. Again, there are considerable differences between the estimated average areas of shell cut from the paua and the average areas of the fragments. For those layers which have sufficient samples of utilised shells, where the average areas of shell are less than the average areas of the cut fragments it seems likely that the shells were the utilised objects and these would have been taken from the site.

The presence of cut shells and pieces cut from shells in the various archaeological layers can be explained in two ways. Firstly, the remnants of a shell from which a piece(s) has been but may have been discarded after this operation, in which case the piece cut from the shell would represent the final or first stage of the artefact(s) that was being manufactured. Secondly, the piece(s) of cut shell may represent the artefact(s) being manufactured or phases thereof, and which has been discarded for some reason.

At this stage it is difficult to choose between these alternatives and it is possible that both explanations are valid. Nor is it possible to deduce the forms of the finished objects on the basis of present evidence (see below). It may be surmised that the finished products would have been taken from the site unless they were broken during manufacture.

Some clues are available from ethnographic data; paua shell was used to inlay wood and stone carvings (Best 1912 : 80) and since there was considerable evidence of wood working at the various Southport sites it is held that the paua shell and woodworking industries were linked.

The percentage numbers of shells with holes was relatively high at SP/9 and SP/10 (see fig. 5). Some of these were bored out, others cut with a sharp implement. The purpose of these holes is not clear; in the post-European/ Maori contact period they were used frequently to seat wooden pegs on canoes and other artefacts (Phillips 1935). The holes also may have been made prepatory to further work.

In general, pieces of shell were cut from area 2, and, to a lesser extent, from area 1. Moreover, the shells were frequently cut along the line of naturally occurring holes. Two techniques were used to cut the shells. The more usual method utilised a sharp cutting instrument and the second employed a narrow abrasive implement.

It may be significant that most of the cut fragments have no particular shape and have not been ground, suggesting that they are the rejects or by-products of secondary working. The percentage number of shells from which recognisable shapes have been cut is much higher, and if they are not the final shapes, they may represent standard starting shapes.

However, there is no certainty that the cut shell fragments or the shapes cut from the shells were the intended final shapes. Three small, ground, circular discs were excavated (two in SP/5 layer 1A and one in SP/11 layer 6), and clearly, other discs have been cut from some of the shells. There is also some evidence that more complex shapes were made.

At G1/1 4% of the shells were Cookia sulcata. This is a much higher percentage than for any of the other archaeological layers at Southport and it is significant that 86% were broken deliberately and 55% utilised. Clearly, they were collected for artefact manufacture. Similarly high percentages were obtained for Cookia from SHP/3. Cookia sulcata is particularly robust. At both sites they were cut with sharp implements. In general, the upper spirals were removed and discarded, and only the lower spirals of the shells were utilised.

The bases of the lower spirals were cut away to leave fragments similar in form to a car tyre. The finished objects, possibly one piece fish hooks were made from these sections. No finished/semi-finished artefacts were found and to date there are no relevant ethnographic data.

There is convincing evidence that Perna shells were utilised at BSS/1 and CI/1. There, shell fish hooks were made, presumably, in response to the unavailability of more suitable raw materials. Fragments of shells have been cut and ground.

Summary and Conclusions

The analysis has yielded a variety of evidence which can be used to compliment better known data categories. In the culinary sphere, the evidence suggests that some Gastrapoda were deliberately broken to extract the animals, that shells were sometimes broken or cut and that an auxillary implement may have been used to aid extraction. These results compliment findings in Australia where such methods were used to open Gastrapoda by Aborigines (Coutts 1970, Jones Per Comm).

It has also been established that some species were utilised for making artefacts and selective characteristics of the waste materials have been defined. However, the evidence to date does not permit us to describe the range of end products of this industry, though it is known that shell fish hooks were made from Perna and pieces of paua were used to inlay wooden artefacts. Technological traits such as cutting, grinding and sawing were linked with the production of such artefacts.

A comparison of characteristics of late prehistoric and post-European/Maori contact shell industries in Fiordland showed that they were similar. These data then, may be used also as a basis for comparing shell industries elsewhere in New Zealand, since the characteristics, artificial though some of them may be, have the status of cultural parameters.

Finally a reminder that the analysis of mollusc data from coastal New Zealand sites is often tedious and time consuming so that every effort must be made to extract the maximum possible information to reward the effort outlaid. A number of possibilities are described here which have hitherto been overlooked; there is little doubt that others remain to be discovered.

Acknowledgements

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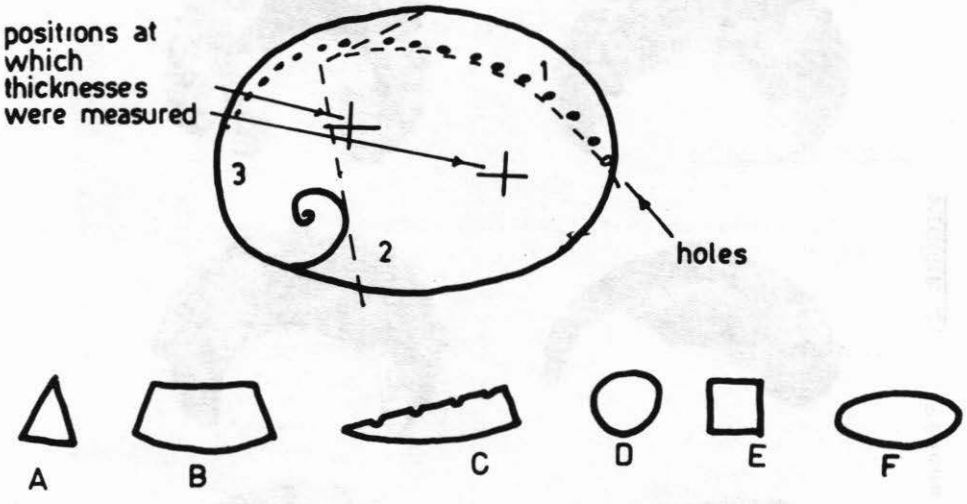

FIGURE 1: Analysis of paua shell. Shown here are three major regions of the shell, the points at which thickness measurements were taken and a variety of shapes cut from the shells.

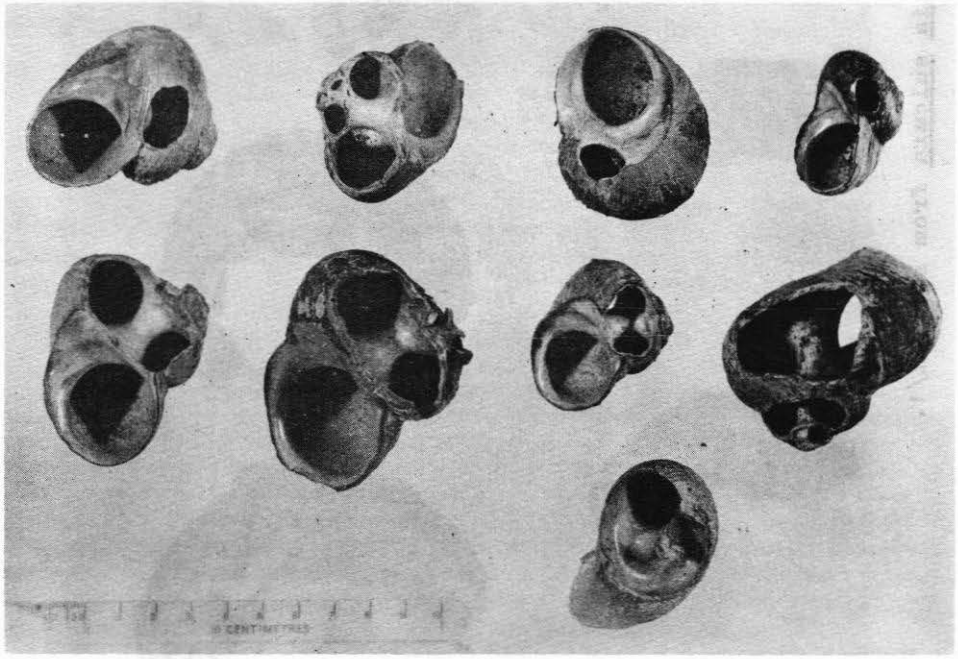

FIGURE 7: Examples of Lunella smaragda deliberately broken.

FIGURE 2: Pieces of cut Cookia sulcata from site GI/1.

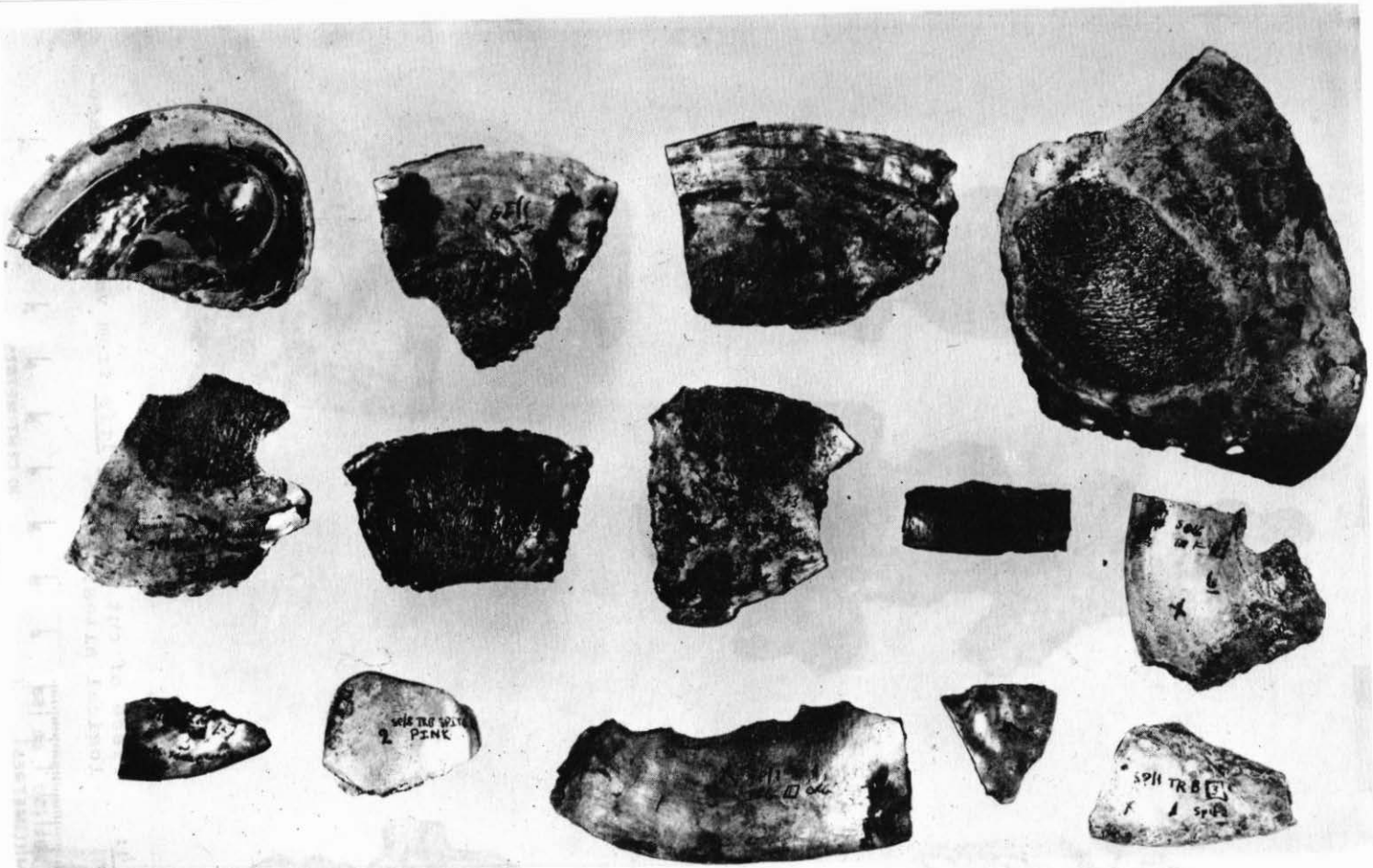

FIGURE 3: Piece of cut *Haliotis iris* from various archaeological sites.

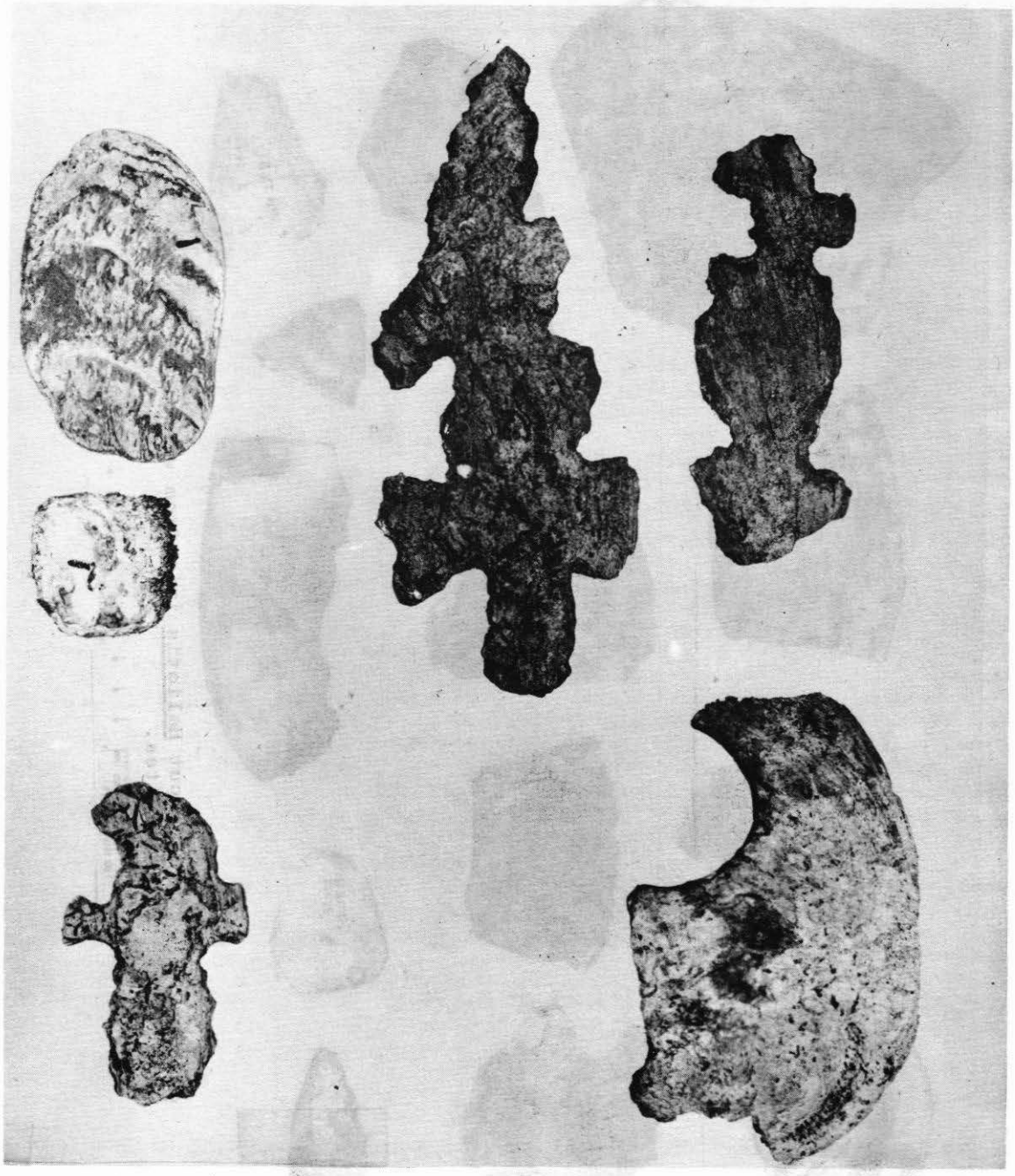

FIGURE 4: Piece of cut Haliotis iris from various archaeological sites.

FIGURE 5: Haliotis iris shells showing areas from which pieces have been cut.

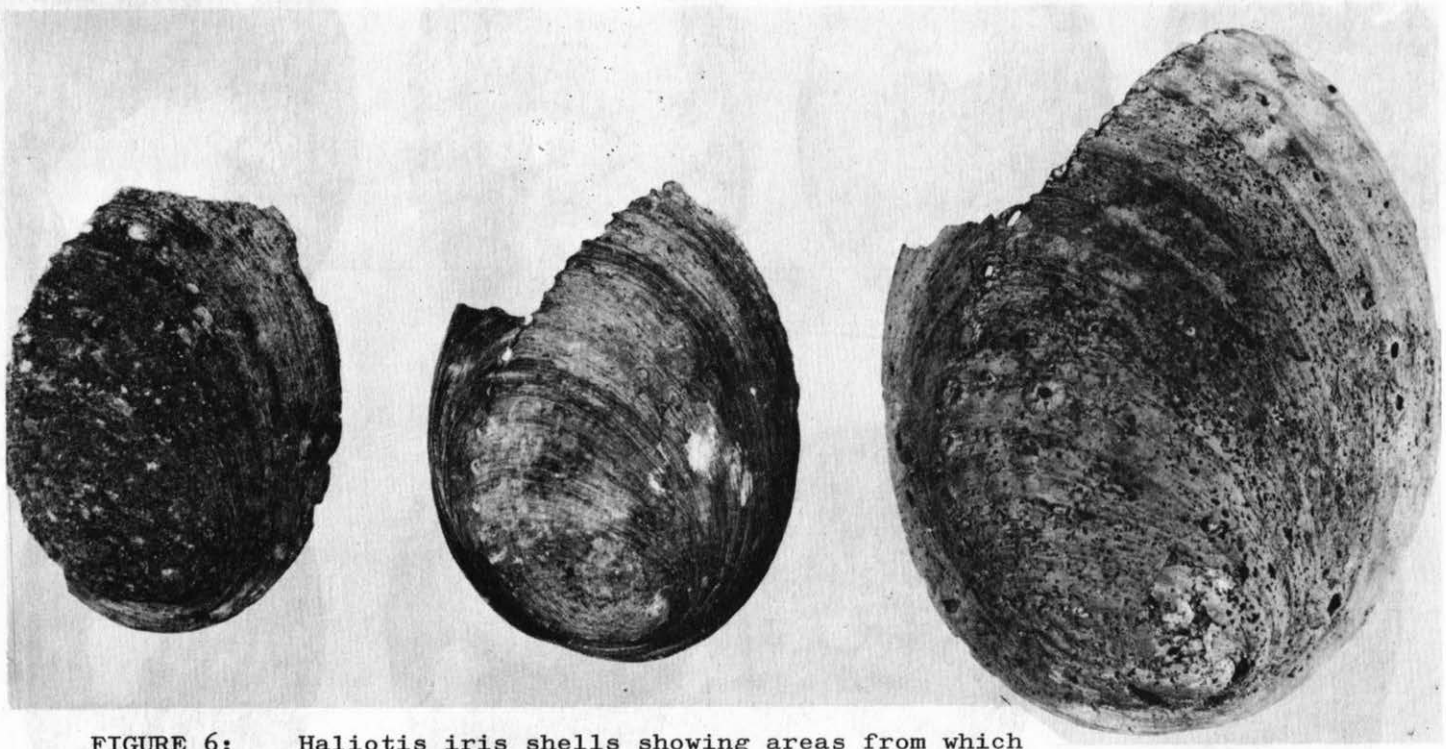

FIGURE 6: Haliotis iris shells showing areas from which pieces have been cut.

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SPECIES: LUNELLA SMARAGDA

SITE	LAYER	% No. Deliberately broken.	Estimated No. of Shells	Description of Layer	No. as a % of the tot Estimated of Shell
SP/1	2	0.5	64	Living Area	4.1
	3	15.5	95	Refuse Area	2.6
	4B	30.4	33	" "	3.9
	5	21.0	315	" "	2.3
	5Bb	45.5	22	" "	2.3
	6A & 6B	36.1	80	" "	9.7
	7A	30.5	95	" "	20.1
SP/4	3-	6.0	138	" "	14.8
	6-	15.5	45	" "	6.3
	2	25.3	382	" "	3.5
SP/5	2-	26.0	395	" "	3.8
	2	28.0	104	Living Area	8.6
	4	31.0	99	" "	15.4
SP/9	2	24.2	546	Refuse Area	4.7
SP/10	2	25.4	63	Living Area	10.0
	3	39.0	26	Refuse Area	6.2
	4	33.4	415	" "	4.4
	5	60.2	12	" "	4.5

TABLE 1 (Continued.....)

SITE	LAYER	% No. Deliberately broken.	Estimated No. of Shells	Description of Layer	No. as a % of the total Estimated No. of Shells.
GI/1	2	8.6	303	Refuse Area	33.6
CH/I	2A	24.8	1780	" "	33.9
	2B	33.4	104	Living Area	37.2
LI/1	2	43.0	17	Refuse Area	1.1
PC/1	2	7.2	515	" "	38.7
	3	5.6	586	" "	36.0
SHP/1	2	35.0	635	" "	79.7
	3	0.6	651	" "	80.1
SHP/3	2A	3.5	85	" "	9.3
SHP/4	2	7.5	5462	" "	85.8

TABLE 1 (Continued...)

COOKIA SULCATA

SITE	LAYER	% No. Deliberately broken.	Estimated No. Shells	Layer Description	No. as % of Estimated No.of Shells	% No. utilised in same way.
GI/1	2	?	36	Refuse Area	4.0	55
SHP/3	1A	35.0	329	Living Area	68.7	61
	2A	34.8	135	" "	14.7	52
	2B	38.1	625	Refuse Area	20.6	49

PERNA CANALICULUS

		% No. utilised in same way.			
BSS/1	2	28.0	6	" "	0.8
	8	25.0	4	" "	1.1
LI/1	2	x		" "	NEG.
	3	x	201	" "	5.4
CI/1	3	x		" "	NEG.
CC/1	2	x	18	" "	3.1

NEG = Negligible No.

x = present, but difficult to estimate numbers.

TABLE 1 continued.....

SPECIES: LUNELLA SMARAGDA

SITE	LAYER	% No. with hole.	% No. utilised in some way.	Estimated No. of shells.	Layer Description.	No. as % of Estimate No. of shells.
SP/1	2		6.6	226	Living Area	14.4
	3		15.5	242	Refuse Area	6.6
	5		21.0	754	" "	5.5
	5B6		45.5	11	" "	1.3
	6A & 6B		36.1	82	" "	9.3
	7A		30.5	19	" "	4.0
SP/4	3-	1.6	-	238	" "	25.0
	6-		1.3	78	" "	10.8
	2		11.9	87	" "	0.8
SP/5	2-	2.0	4.6	882	" "	7.9
	2		8.0	187	Living Area	15.4
	4		16.6	144	" "	22.5
SP/9	2-		5.9	59	" "	14.6
	2	1.9	2.2	1582	Refuse Area	13.6
SP/10	2	1.3	22.2	157	Living Area	25.0
	3		15.2	59	Refuse Area	14.2
	4	2.4	7.0	1058	" "	11.2
	5	4.1	6.8	74	" "	25.8
SP/12	2	0.4	16.3	856	" "	65.5
GI/1	2		38.0	461	" "	51.2
CH/1	2A	3.2	6.3	866	" "	16.5
	2B		12.3	57	Living Area	20.2
PC/1	2		34.4	32	Refuse Area	2.4
	3		37.5	8	" "	0.5
SHP/4	2		3.1	432	" "	6.8

TABLE 1. HALIOTIS IRIS

SITE	SP/1				SP/4	SP/5			SP/9	SP/10	SP/11	SP/12	GI/1	CH/1
BODY OF SHELL LAYER	2	3	5	6A&6C	2	2	2	4	2	4	6	2	2	2A
Mean Lengths(cm) shell	8.5	8.9	8.6		11.1	10.3	8.4	7.7	9.8	12.7	12.3	10.2	9.9	10.0
Mean thickness(mm)	1.7	1.7	1.9		2.4	2.3	2.3	1.7	2.4	2.9	2.0	2.1	2.2	2.1
Mean area(sq.cm) cut from shell	5.3	1.7	11.2		20.7	5.7	27.2	19.5	9.9	7.6	42.5	35.4	8.0	7.9
Estimated mean thickness(cm) of section cut from shell	1.7	1.7	2.0		2.3	2.2	2.1	1.5	2.1	2.5	2.3	2.3	2.4	2.3
Sample number	4	14	12	0	11	35	6	15	33	54	4	20	60	30

FRAGMENTS CUT FROM SHELLS

	SP/1				SP/4	SP/5			SP/9	SP/10		SP/11	SP/12	GI/1	CH/1
LAYER	2	3	5	6A&6C	2	2	2	4	2	2	4	6	2	2	2
Mean thickness(mm)	2.5	2.4	2.3	2.4	2.9	2.2	3.1	2.4	2.3	2.5	2.1	2.8	2.2	2.0	1.8
Area of shell fragment(sq.cm)	27.9	25.3	31.1	32.3	21.2	14.6	19.6	14.5	18.5	20.1	20.1	14.7	31.1	23.5	21.0
Sample number	15	4	9	4	16	14	8	11	77	19	23	14	4	25	9

MEAN VALUES OF 200 PAUA SHELLS SELECTED AT RANDOM FROM VARIOUS SIZES :

Lengths (cm) 9.7 variance 2.8
Thickness(mm) 2.1 " 1.7

TABLE 2: STUDY OF CUT PAUA SHELL FROM THE SOUTHPORT SITES.

BODY OF SHELL	EXCAV LAYER	SP/1 2	3	5	6A&6C	SP/4 2	SP/5 2	2	4	SP/9 2	SP/10 2	4	SP/11 6	SP/12 2	GI/1 2	CH/1 2A
% no. cut along line of holes		12.5	28.3	16.7		27.0	25.7	50.0	6.7	27.3		14.8		35.0	30.0	23.4
% no. with holes cut in centre				8.3			22.9			27.3		31.5		5.0	3.4	13.4
FRAGMENTS OF SHELL																
% no. cut along the line of holes		20.0	25.0	44.5	25.0	18.0	28.7	25.0	18.2	31.0	21.0	47.9		100.0	64.0	22.3
% no. with holes cut in centre										6.5	5.3	4.4				44.6
PREDOMINANT POSITION OF CUTS %'s (refer to figure 1)*																
BODY OF SHELL	1	50.0	21.4	25.0		36.4	28.5		13.3	24.2		31.5		40.0	30.0	15.8
	2	37.5	64.2			54.4	37.1	83.4	80.0	57.7		59.3		50.0	35.0	69.5
	3		7.1						6.7			3.7		5.0	6.7	
FRAGMENTS OF SHELL																
	1	20.0	25.0	22.2	25.0	18.7	21.5		9.1	26.0	10.5	13.1	7.1		36.0	44.6
	2	66.0	75.0	44.4	50.0	75.0	71.6	100.0	72.7	58.5	89.5	74.0	78.6		36.0	55.4
	3	6.7					7.2		18.2				7.1	25.0	4.0	

TABLE 3: STUDY OF CUT PAUA SHELL FROM THE SOUTHPORT SITES

* REMAINING PERCENTAGES ARE CASES WHERE SHELLS HAVE BEEN CUT IN TWO OR MORE OF THE THREE MAJOR AREAS.

SHAPE OF CUT PIECES - (refer figures 1) PERCENTAGES

BODY OF SHELL	SITE / LAYER	SP/1 2	SP/1 3	SP/1 5	6A&6C	SP/4 2-	SP/5 2-	SP/5 2	SP/5 4	SP/9 2	SP/10 2	SP/10 4	SP/11 6	SP/12 2	GL/1 2	CH/1 2A
Triangular	A	37.5	38.7	25.0		12.5	22.9	6.7		21.2		5.6		10.0	13.3	23.4
	B		14.3	8.3		12.5	5.7			18.2		3.7		20.0	13.3	23.4
	C	12.5		25.0			14.3			9.1		3.7		10.0	16.6	3.3
No particular shape		12.5	14.3			45.5	17.2	60.0	83.3	30.4		51.8		25.0	30.0	40.0
Can't tell shape		25.0	28.6	25.0		9.1		33.4		9.1		11.1		50.0	16.7	3.3
	F														5.0	
Circular	D						22.9			9.1		1.9				
Rectangular	E	12.5	7.1	16.7		9.1	14.3		16.7	3.0		18.5			1.7	6.6
FRAGMENTS OF SHELL																
	A		25.0				28.7		18.2	6.5		13.1	7.1			
	B	6.7							18.2	6.5		17.4	14.3			
	C			11.1		6.3				5.2		4.4		25.0		
No particular shape		80.0	75.0	88.0	50.0	87.5	35.9	87.5	36.4	63.7	84.2	13.5	71.4	75.0	76.0	100.0
Can't tell shape		6.7			50.0		7.2		9.1	3.9		13.1			24.0	
	E	6.7				6.3	28.7	12.5	18.2	14.3	15.8	4.4	7.1			

TABLE 4: STUDY OF CUT PAUA SHELLS FROM THE SOUTHPORT SITES