

# THE ETHNOARCHAEOLOGY OF SOUTHEAST ASIAN COASTAL SITES: A MODEL FOR THE DEPOSITION AND RECOVERY OF ARCHAEOLOGICAL MATERIAL

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## *Abstract*

This paper discusses ethnoarchaeological research done in Phuket, southwestern Thailand, among the nomadic sea peoples, the Chaw Lay. Discussion focuses on the way in which materials and tools utilized in their maritime adapted activities are discarded, curated or otherwise become part of the archaeological record. Specifically, we look at stone artifacts, altered surfaces of activity areas, depositions and structural evidence in the form of postholes and driplines. A group of existing Chaw Lay settlements are described in terms of these variables, and the model of Chaw Lay site formation and use which evolved is outlined. This model was tested in the field by a series of excavations of abandoned Chaw Lay archaeological sites. The usefulness of the model for interpreting maritime adapted sites is then discussed, with remarks concerning the implications for archaeology of similar sites.

## **Introduction to the Phuket Project**

The goal of this paper is to show and share some of the methodologies by which we have tried to understand the intricate ecological relationship with the sea which certain groups of people in Southeast Asia have developed in post-Pleistocene times. Tantalizingly early evidence from throughout the archipelago convinces us that this process has been one of long evolution and that unique cultures have resulted from this process. But we have also been struck, since we first started working in this area 20 years ago, by how limited is the data for this ecological specialization and how problematic is its extraction from the archaeological record, given the difficulties of retrieval in sandy or mangrove covered, coastal and monsoonal environments. This has led, we are convinced, to a limited interpretation of the data from many sites and a preoccupation with imported culture due to

the high visibility of exotic imported items found.

Because of this, we launched in 1978 a loosely organized, multi-disciplinary study of the problem of cultural adaptation to the maritime econiche in Southeast Asia. Gratifyingly, we are finding that as we work on more sites throughout the region, approached from a variety of different scientific perspectives, the evidence is converging. This is particularly true for what we might call the epistemology of archaeology of maritime Southeast Asia; that is, how do we archaeologists know what we know?

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We have always been convinced that ethnoarchaeology, despite the serious drawback of the limited time over which observations for making analogies are usually made, is an exercise which can illuminate the concerns of archaeological research. Not wanting to get into a discussion of the advantages and or shortcomings of ethnoarchaeology, we will present a rough outline of our data and analyze the directions this points in for archaeological research in general in coastal areas of tropical Southeast Asia.

Our research is based on the ethnoarchaeological portion of work done on a series of 15 sites in south Thailand over a three year period from 1978 to 1981, followed by visits in 1986 and April–May 1996. We now have plans to return at the 10 year interval to further test and verify our conclusions before final publication.

The aim of our ethnoarchaeological work is to test, in the specific environment of coastal tropical Southeast Asia, how effectively archaeological recovery techniques can identify and interpret remains of subsistence strategies that created them. Specifically, the focus is on those activities associated with maritime-based subsistence strategies that have been posited to characterize the socio-economic development of the area throughout at least the past 7–10,000 years.

We asked ourselves: how direct a line can be traced from the activity to archaeological deposit, after redeposition, post-depositional and taphonomic factors have all been taken into consideration?

### **Background to the study area**

For our study, we chose an area centred on the island of Phuket in the Andaman Sea off the west coast of southern Thailand (Figure 1) Twenty years ago this area was not the tourist paradise it is today, but it was slated to become one. That is one of the reasons we chose to study the many archaeological sites known to exist on Phuket and the smaller islands: they were to be, and now mostly are, lost to archaeological research.

The other reason for choosing the Phuket area, is that the island of Phuket itself has for at least the past four centuries been known as the

common meeting point of two major groups of sea nomads travelling the Andaman Sea coast between Burma and the Riau Lingga archipelago south of Singapore.

### **The Chaw Lay**

The Chaw Lay, the focus of this study, are an indigenous population of the west coast of Thailand (Sopher 1977). Traditionally, they live a nomadic existence travelling by boat over an area extending from Burma to Singapore. They are reported to be of proto-Malay racial stock, but no genetic mapping has been done, as far as we are aware, to confirm this. The Chaw Lay speak Malayo-Polynesian dialects related to Malay (Hogan 1972). Their language has three subgroups reflecting regional variation: Moken, spoken from southern Burma southwards to Phuket; Moklen, from Phangnga southward to Phuket; and Urok Lawoi, spoken from Phuket southward along the coast of Malaysia, to the Riau Lingga Islands south of Singapore. Phuket, at the meeting point of all these dialects, has speakers of all three.

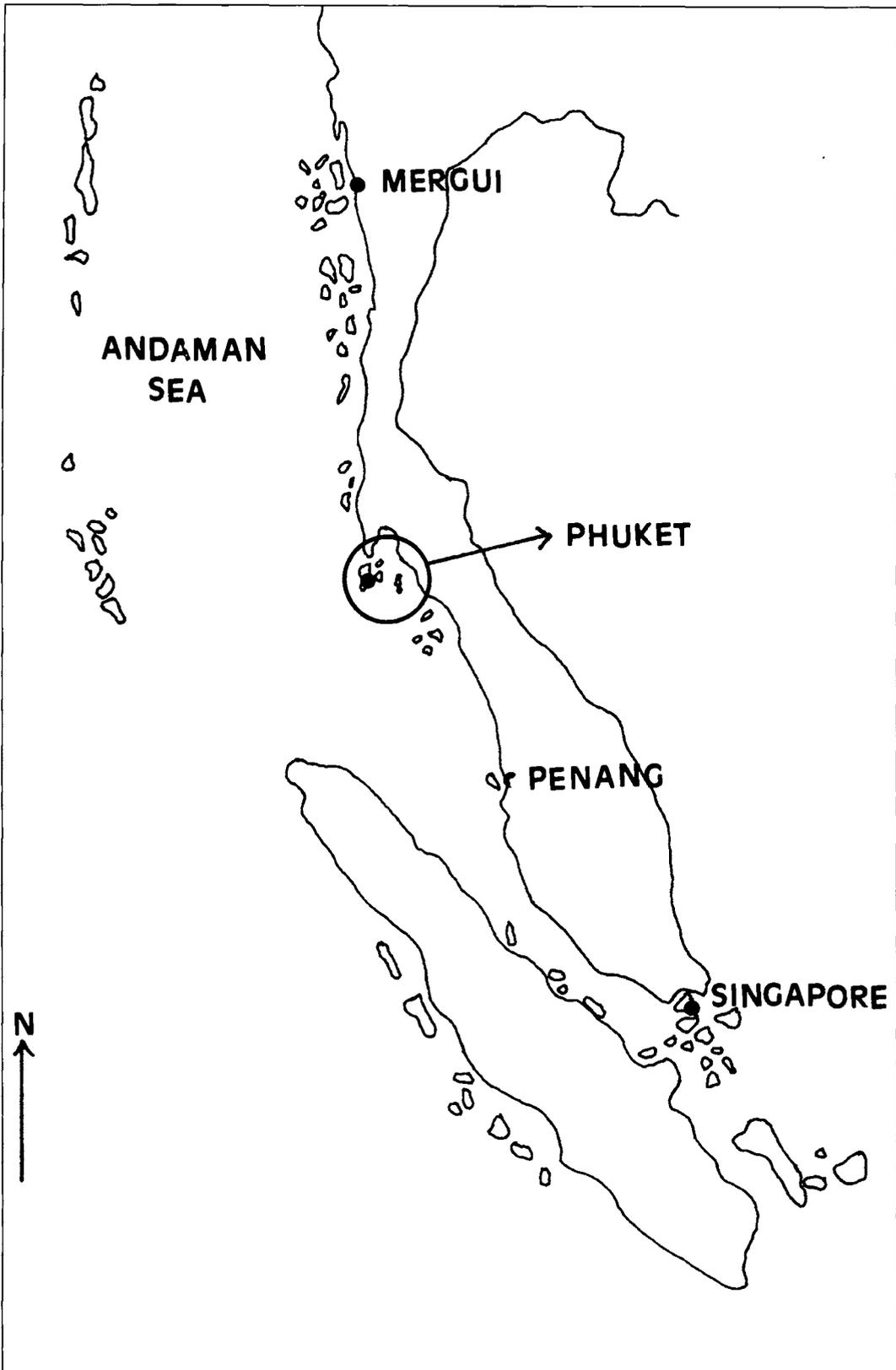
The groups in question all have names for themselves, but refer to themselves as a group in the southern Thai vernacular as 'Chaw Lay'. Although unscientific, use of this term breaks the dangerous misconception that these people are nomads in the true sense of the word, a misconception that the term 'sea nomads' perpetuates.

In 1981, in the areas we studied, there were approximately 4500 Chaw Lay living in more than 40 groups of settlements ranging in size from two to more than 800 peoples (Figure 2). Of these about 1600 lived on Phuket Island itself and the nearby islands; mostly in the five main settlements of Rawai, Tukay, Sapam, Laem La and Laem Tong on Ko Phi Phi.

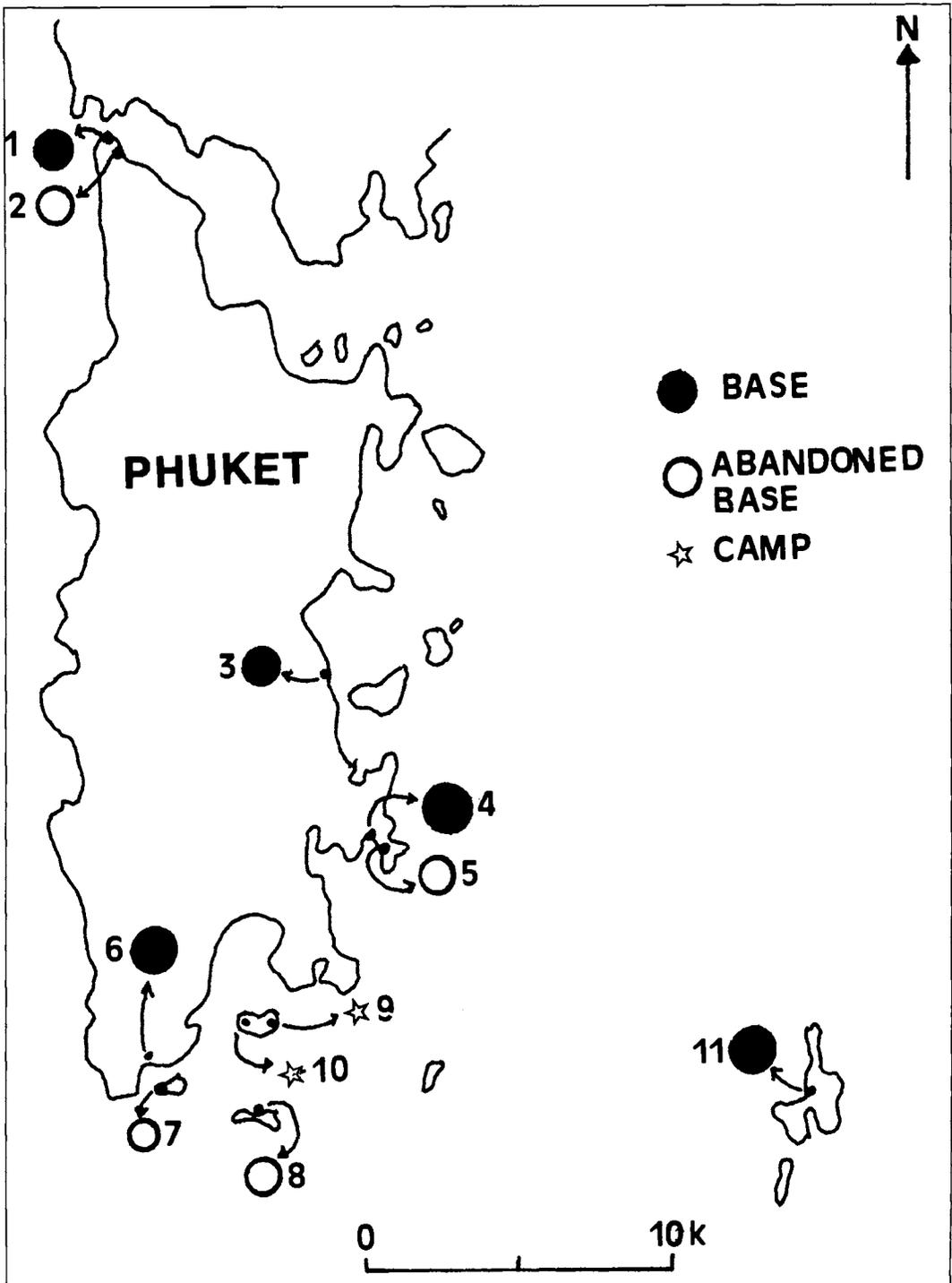
They travelled to and from these base settlements and a wide range of fishing camps by small boat. Voyaging by sight and rarely staying out on the sea after dark they are very dependent on their shore camps.

### **The environment**

A consideration of the environmental niche which the Chaw Lay have chosen to occupy is



**Figure 1** Map of southern Thailand showing the Phuket Project study area.



**Figure 2** Map of Phuket showing the sites mentioned in the text: 1. Laem La , 2. Ta That Chai, 3. Sapam, 4. Tukay, 5. Phap Pha, 6. Rawaii, 7. Haad Yao, 8. La Eo, 9. Haad Hin Khaw, 10. Ao Wai Daeng, 11. Laem Thong. ( Circle size represents relative settlement size).

crucial to an understanding of their adaptive strategy. The entire coast from the Bay of Bengal to the Riaou Linnga archipelago, and beyond into the main Indonesian Islands, is characterized by long stretches of sandy beach broken by estuarine areas of mangrove and mud-flat, rocky outcrops and off-shore island groups, closely enough spaced as to be easily visible one from another all along the chain.

The sea is shallow over the narrow continental shelf, with warm temperatures and low salinity resulting in plentiful marine fauna and a great diversity of species. The shelf was created by the flooding in the Pleistocene of the Sunda Shelf. The resulting Southeast Asian landscape is unique in its high ratio of sea to land.

The climate is warm at all times, with a monsoon pattern of a mild, sunny period during the northwest winter monsoon and a period of strong winds and rains during the summer monsoon from the southwest. During this summer monsoon the seas are not safely navigable by small craft.

This entire stretch of coast is a vast and homogenous environment in which fish, the main resource, are sparsely but widely distributed and mobile. The Chaw Lay of the area have adopted a subsistence strategy wholly devoted to the exploitation of these resources and those of the shoreline of their selected terrestrial habitats.

The specific study area of the Phuket Project extends from Takuapa, in Pangnga Province, south to Ko Phi Phi in the province of Krabi (Figure 1). It contains habitats characteristic of the entire Chaw Lay range, which are described below:

**Sandy Beaches**—these range from tiny pockets backed by forested hillslopes, to long expanses usually backed by low, marshy lagoons colonized by mangrove species. The beach forest is open woodland with few species, constant over the area. This niche is an important source of gathered fruits and vegetables, wood and forest materials. Of even greater importance is the associated intertidal area as a source of bivalves in the shallows such as burrowing clams and cockles, shrimp and crabs.

**Rock and Cliff Shorelines** – often project into the sea enclosing small beach areas. The

rocks provide a habitat for oysters, gastropods, seaweed and crabs. The hillslopes above are the homes of utilized tree species.

**Coral Reefs**—these provide environments for extremely varied and abundant sea life: fish, shellfish, cuttlefish and squid, sea urchins and slugs, turtles and sharks.

**Estuarine Mud Flats**—are often large expanses at the mouths of rivers and between islands and the coast of the mainland. This habitat is characterized by large areas of a few species of mangrove trees thriving in the poorly aerated and salty mud. The networks of channels meandering through the stands of mangrove can be used for access to the trees for timber, fuel, the rich biota and for concealment.

This benign environment provides a year-round supply of fish, shellfish, fruit and vegetables. Unlike man in temperate continental areas, faced with an environment with limited resources concentrated in space and time, the inhabitants of Southeast Asian coastal areas had to develop ways to access the many small but rich pockets of resources scattered throughout the seas of the region.

Within the general environment described above, the Chaw Lay typically select land habitats with a wide variety of congruent ecological zones: deep sea through reef, mudflat and tidal wash to raised beach, mangrove and lagoon, to hillslope. These preferred raised beach sites are most typically found at the mouths of large streams; these sites provide shelter in rough weather, fresh surface water and cool breezes to rid the site of insects and disease. They also afford access to a wide range of ecozones that provide all the important subsistence and material resources required by the Chaw Lay's maritime form of adaptation. The catchment area of each Chaw Lay group therefore encompasses a much larger area than just their habitation site. It is the existence and spacing of these catchment areas that plays a large role in determining the spacing of Chaw Lay groups throughout their environment.

### **Socio-Economic adaptation**

Throughout the millennia the challenge for those who have chosen to exploit the maritime econiche has been to develop ways to access

the many small, rich but limited pockets of resources scattered along the coasts (Engelhardt 1989; Yesner 1980). The archaeological record shows that individual communities have had greater or lesser success in maintaining equilibrium with their environment.

The Chaw Lay economic adaptation is based on two complimentary elements: the 'primary' economic base is fish. Its capture from the deep sea and coral reef provides the inspiration for the bulk of the culture's technology and for its social organization. Because fish are a mobile resource, the Chaw Lay concentration on fishing requires that they maintain a mobile way of life. They exploit the full range of available species, using hook and line. Spears are used for larger prey such as octopus, squid and turtle, while crabs and reef species are trapped. No specific species are preferred over others, and expeditions are not organized to predate any specific species.

On the other hand, the 'fundamental' economic activity on which Chaw Lay subsistence is based is the collection and processing of shellfish. It forms the bottomline of their economy. Oysters in particular are the subsistence item a Chaw Lay group must never find itself without. Oysters and other species of shellfish are stationary and live close to shore. They can therefore be gathered by anyone. They require no specific tool or technology to collect and can be eaten raw or with minimal processing. Therefore, in times of sickness, death or absence of the fishermen/women, at times when the catch fails or during the periodic monsoon storms when it is not possible to go out in boats to fish, oysters and other shellfish can be relied upon to supply the food needs of the group.

During our research we inventoried Chaw Lay material culture. This showed us that the tools utilized by them to exploit their environment were few in number and easily movable, as suits a lifestyle where numerous possessions would be a burden. Items are multi-purpose, light and easy to transport, with an emphasis on wood, coconut, bamboo, stone and other material easily available from the local environment. The larger the item, the more likely there will be only one shared by a group. The only specialized technology common to all the groups we studied were boats, to provide

mobility, and fishing gear, to facilitate the capture of mobile sea resources.

An important feature of Chaw Lay subsistence is the role of re-used materials and tools. All objects are re-used until they disappear or are consumed or broken into tiny fragments too small to be manipulated. This is less a condition of poverty than that a large number of material possessions are a liability in a mobile society. The richness of the environment and the effectiveness of their adaptation frees them from the need to stockpile against environmental uncertainty.

### **The study methodology**

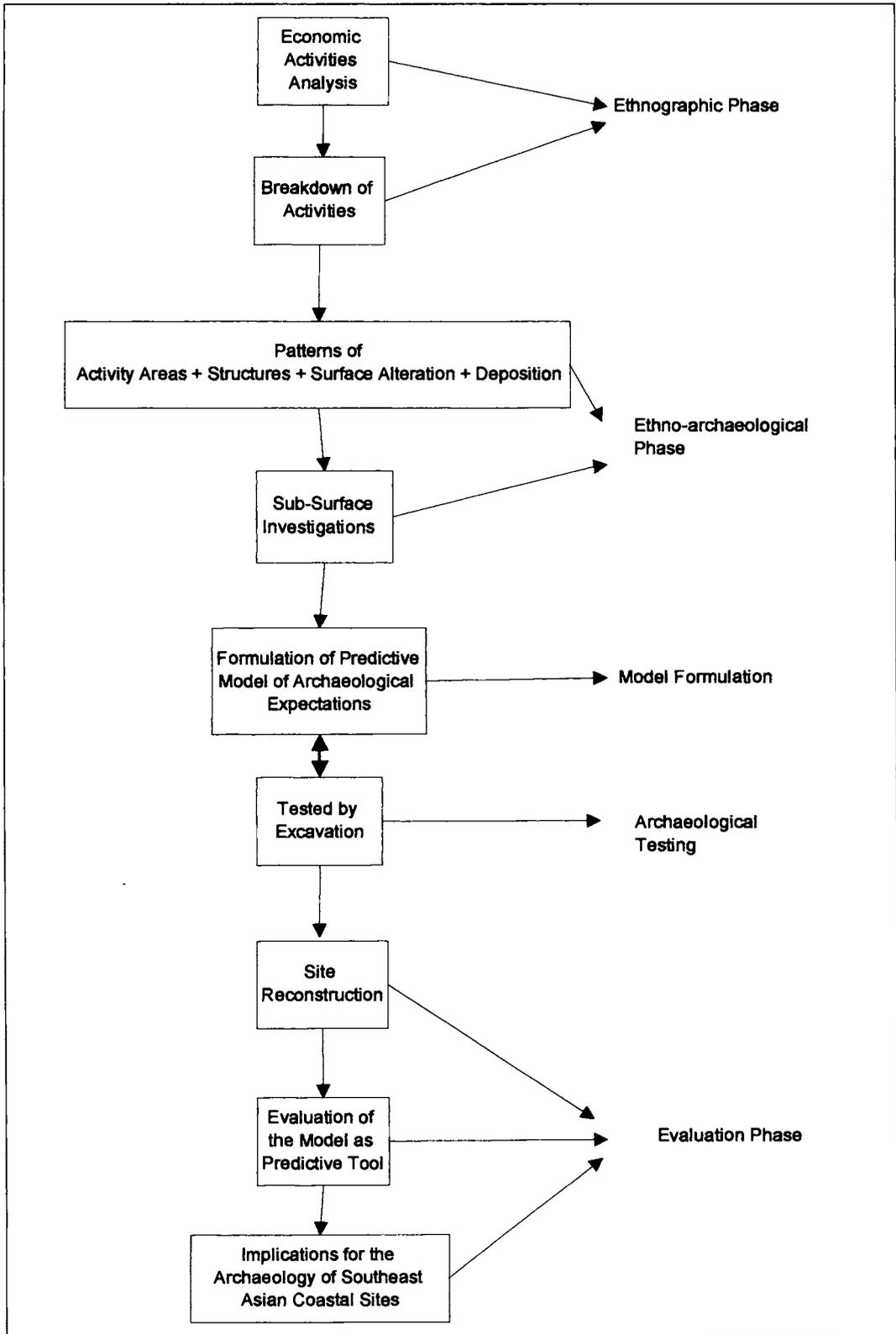
This then, in brief, is the socio-economic adaptation, the evolution of which we have attempted to identify and trace in the archaeological record. Represented here in schema (Figure 3) is the methodology used to analyze this unique maritime socio-economic adaptation.

All Chaw Lay daily, seasonal and specialized activities were analyzed and broken down into their component parts. Particular emphasis was put on mapping the spatial distribution of these activities and quantifying them. Associated discard and the resulting impact on the activity areas in question were also quantified and recorded over time. The effect these activities had on the soil was recorded photographically, mapped and physically collected for chemical and microscopic analysis.

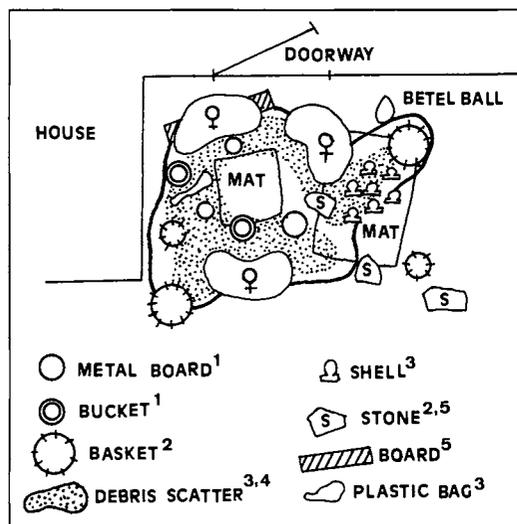
For purposes of testing at archaeological sites, the resulting ethnographically derived patterns were abstracted into a conceptual type site and a predictive model of archaeological expectation was developed. This model was tested by survey and excavation of a number of abandoned Chaw Lay sites which were then compared to the normative type site. After evaluating the accuracy of fit, we returned to the ethnographic situations in an attempt to identify the archaeological findings unexplained by the model. Throughout, we worked with native informants to help us to interpret the data.

### **Activities and activity areas**

The Chaw Lay subsistence strategy results in a range of activities for extraction, processing and



**Figure 3** Schema illustrating the study method used to analyze the deposition and recovery of archaeological material.



**Figure 4** A diagramme illustrating the tools and materials used in shellfish processing and the deposition of these and the byproducts of the activity. Key: 1. Removed from activity area; 2. Stored nearby for future use; 3. Cleaned up and put in a midden; 4. Bits left in situ; 5. Left in the area for future use.

consumption of resources from their environment. Those activities which occur on-site and therefore have potential impact on the archaeological record have been analyzed in detail. The aim of this analysis is to follow each activity from the event to the final product, charting the tools and materials used, associated discard, deposition and impact on the activity locus. As an example, Figure 4 illustrates the tools and materials used in shellfish processing with their ultimate deposition indicated and impacts on the area marked.

After studying the corpus of Chaw Lay activities, we were able to hypothesize, with some degree of certainty, that the remains of individual activities would not be directly retrievable where they took place. This is a result of post-depositional factors, overlap of activities and repeated mixing of the resulting byproducts of the activities (Brooks and Yellen 1987). However, certain areas of a Chaw Lay settlement are the loci of certain types of repeated activities, creating a pattern of archaeological impact and retrievable site modification. These distributions of activities create a pattern of activity areas; examples of each of the following types of areas were excavated for subsurface evidence of alteration.

### House complexes

Houses act as the centres of activity areas representing almost the entire spectrum of Chaw Lay activity. Under the house area a pattern can be identified of debris which clearly were the by-products and therefore diagnostic of the activities taking place in the house above (Figure 5). Under the kitchen area of the house is found evidence of packaging, stove remains and their contents, food and some small evidence of the utensils used to prepare and cook it. Under the entrance/sitting areas of a house we can expect to find a low proportion of food consumption remains, but no remains of food preparation. There is a preponderance of packaging remains compared to under the kitchen, and no stove remains at all. Food remains will be found in association with evidence of socializing, such as betel, cigarettes and playing cards. Under the areas of the house used for storage and sleeping are found some food remains, packaging and artefacts associated with sleep and relaxation, such as cloth, combs, sandals and batteries, but with the additional context of objects in storage. There is a very strong association between storage and sleeping areas of a house: the former above, and storage areas below. Under this part of the house we never find the organic remains associated with other under-house areas.

The other areas that cluster around the houses include outdoor kitchen space, areas for water collection and use, sitting platforms and generalized activity loci. Not all houses have these associated areas, some have more than one and some are used communally. The impact left in these areas will be an accumulation related to the activities carried out there; no discrete evidence reflecting specific activities but rather a mish-mash of evidence reflecting the multi-purpose nature of the area.

### Trees

Trees are the focus for processing, manufacturing and storage, as well as eating and socializing. A sitting platform or board is often associated with these activities and located at the foot of the tree. The debris that remains from these activities forms a dense, concentrated ring around the base of the tree.



**Figure 5** View of the area under a Chaw Lay house with variations in debris distribution.



**Figure 6** A flattened shell mound with shellfish processing taking place on top of it.

### **Open areas**

These large open areas typically in the centre of a site, support a wide range of communal activities requiring open space. Activity debris tends to be dispersed and scattered over the area and the areas are typically swept after use.

### **Flattened shell mounds**

These flat-topped deposits are the focus of processing activities in particular (Figure 6). They continue to function as growing shell mounds but are kept spatially restrained, in so far as possible. The debris associated with these activities is dropped on the mound and not altered.

### **Well or water areas**

The activities taking place at a well or fresh-water location, include water collection, bathing and washing and socializing. The debris from these activities cannot be swept up because of the wetness of the surface. Often it is picked up and tossed into debris baskets nearby for later redeposition. A certain amount of material is trampled into the mud and or wet sand.

### **Peripheral areas**

These areas form a ring of activity around the outside of a settlement, along the beach front and rear lagoon edge. They are the focus of secondary midden deposition and processing of organic material with quantities of waste by-products.

### **Intertidal**

The intertidal area is used widely, in an overall and uniformly dispersed fashion, for shellfish gathering, beachcombing, boat anchorage and as a toilet.

### **Post-depositional forces on activity areas**

The activity areas discussed above are all subject to post-depositional alteration and natural taphonomic rather than taphonic processes which effect the likelihood of evidence entering the archaeological record (Schiffer 1987). The following post-depositional forces were recorded as having significant effects on the depositional remains resulting from activities undertaken by Chaw Lay at their campsites.

### **Human forces**

Sweeping and redeposition in secondary middens: resulting in the removal of all but the tiniest bits from the activity area, and in the redeposition of the material, often after burning, into the midden.

- Picking up and tossing objects: individual objects or pieces of debris tossed out of context.
- Dismantling and moving of structures: activity areas associated with structures are disassociated when the structure is moved and the surface area intentionally re-surfaced.
- Recycling and re-use of objects for varied activities: multi-purpose artefacts are removed from one area to another for a series of different activities.
- Trampling of waste material into the surface of the activity area: all but large or sharp materials, such as some shell types, are trampled before sweeping and in areas that are not swept. Loose sand, wet and clayish surfaces are particularly affected.

### **Animal forces**

- Scavenging of organic material: chickens in particular consume organic material and in the process loosen and sieve the sediment.
- Chickens and dogs dig depressions in the sand where they sit and pit the surface.

### **Natural forces**

- Tidal action: redistribution and removal of material
- Rain action: exerting downward wash and redistribution during heavy rains.
- Decomposition: the rotting of all organic material into the sediment.

In the course of our research we focussed on a range of diagnostic activity-created surfaces, and on their survival in the archaeological record. Individual activities were studied through the act, through the impact on the ground and on to the impact below the surface. Emphasis was placed on the kinds of cleaning and maintenance activities that regularly took place after the event. From our study it is clear that most debris associated with activity areas is removed as part of the area's routine maintenance; areas are swept,

debris is collected and either dumped elsewhere or burnt on the activity area. This constant sweeping and burning cycle effects the surface and makes it identifiable with careful excavation.

1. Maintained open area surfaces (Figure 7a)

The large, flat activity surface at Tukay has been in use for many years. The entire surface is hard-packed with a crisp, brittle top layer. The surface is dark and filled with charcoal bits. At the time of the study five debris-burning fires were in process on it. Portions of the surface are green tinged from algae; this seems to have the effect of increasing the hardness. This area is known to have been used repeatedly for shellfish processing, trap construction, sleep and play during the period of the study and yet no specific evidence of any of these activities remained.

2. Fire-effected surfaces (Figure 7b)

If fire is a basic element of an activity, it has very notable effects on the activity area sediment. A closer look at the five debris-burning fires mentioned above clarified the process by which fires become deposits. An attempt was made to put the five fires in temporal sequence based on the assumptions that :

- Ash deposits on the surface of a fire will in time be blown and/or washed away.
- Stratigraphy of a fire will lose distinction with the passage of time, the effects of trampling and sweeping.
- The items in a fire will lose their segregation over time.

On the basis of these assumptions the five fires were seriated and this was verified by the villager who had built them. When the ash is gone from a fire, a packed and mottled deposit in the colour region of 10 YR 3/3 seems to be diagnostic of the presence of fire. If the fire was associated with fish smoking or cooking the mottled deposit has a sticky consistency. Another diagnostic

feature of fires in sand is a red-orange oxidized layer (7.5 YR 4/6-7/2).

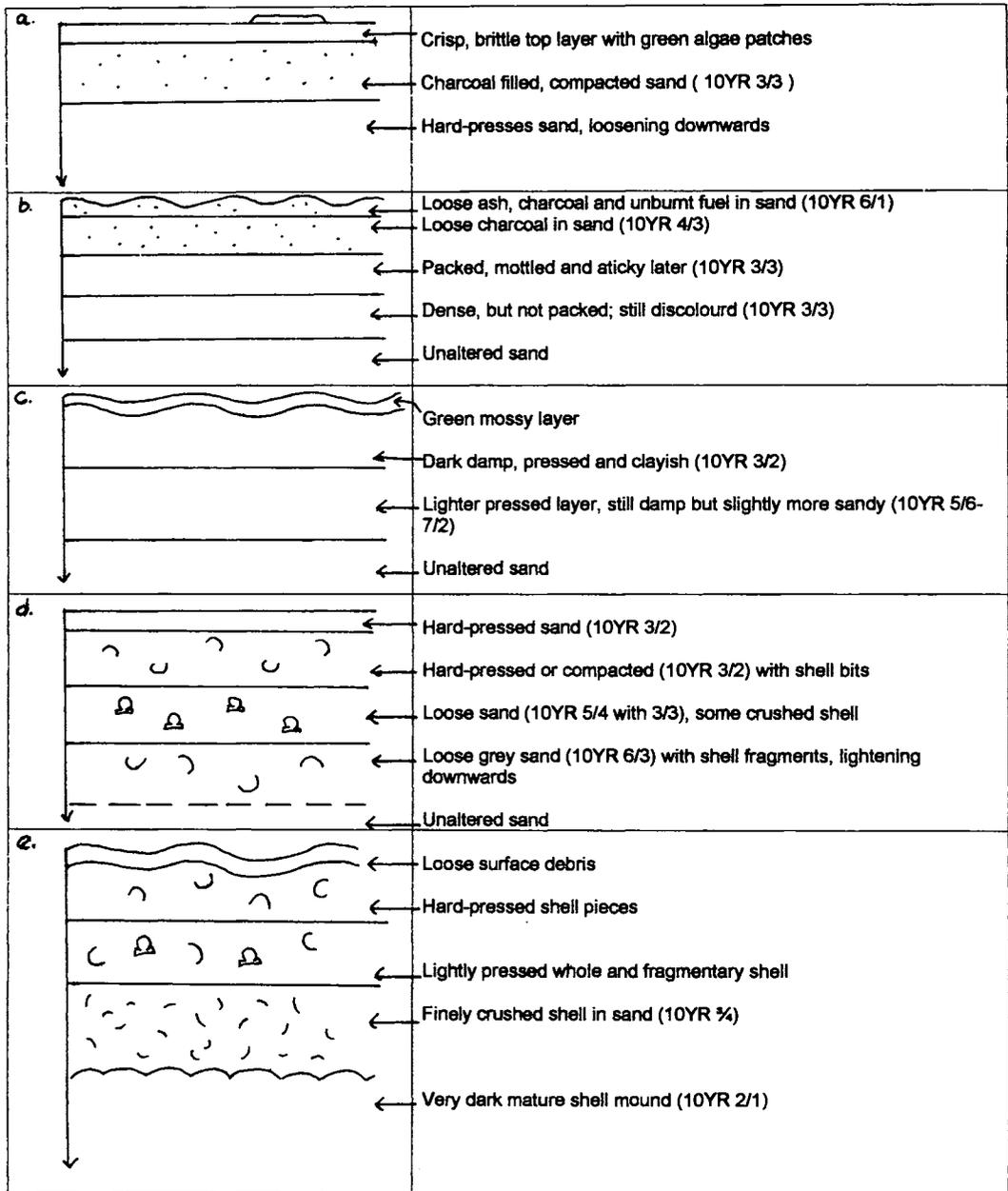
3. Water-affected surfaces (Figure 7c)

Likewise, repeated saturation from water-related activities such as bathing and water collection at the side of a house, has predictable impact on the sediments of a site. For example, a water jar was recorded resting on a board behind the kitchen area of a house. The uppermost surface of the sand below was green and mottled and hard compacted. Below this a damp and clayish layer of pressed and leached sediment was found .

4. Trampled surfaces (Figure 7d)

The effects of continuous trampling result in changes in sediment and deposits and the moving of material within the deposit. In a matrix of shell, or shell mixed with sand, a characteristic pattern of breakage occurs. Paths at Sapam are pressed into a shellmound deposit (Figure 5e); at Rawai into a matrix of sand with quantities of shell Figure 5d). Below the deposits of loose surface debris, a layer of shells is pressed firmly into the top of the midden, generally concave-side down. Below is a deposit of more lightly pressed whole shells. From a depth of approximately 8 to 18 cm is a zone of finely crushed shell; even heavy oyster shells are crushed in this level, and mixed with sand. Below this lies the dark mound proper.

In other words, the breakage from continuous trampling occurs not on the top surface, in direct contact with traffic, but at a sub-surface level. Rates of breakage are determined by the species of the shells: oysters, which constitute the bulk of mounds, have a low rate while mussels crush easily. There is insufficient data to give estimates for the depths of downward and horizontal displacement of artefacts caused by trampling. A general trend was noted for smaller objects to be more mobile than larger, and for objects in general to move downwards not upwards.



**Figure 7** The stratigraphy of activity areas within a Chaw Lay settlement: a. Maintained open area, b. Fire, c. Water-affected area, d. Trampled surface at Rawai, e. Trampled surface at Sapam.

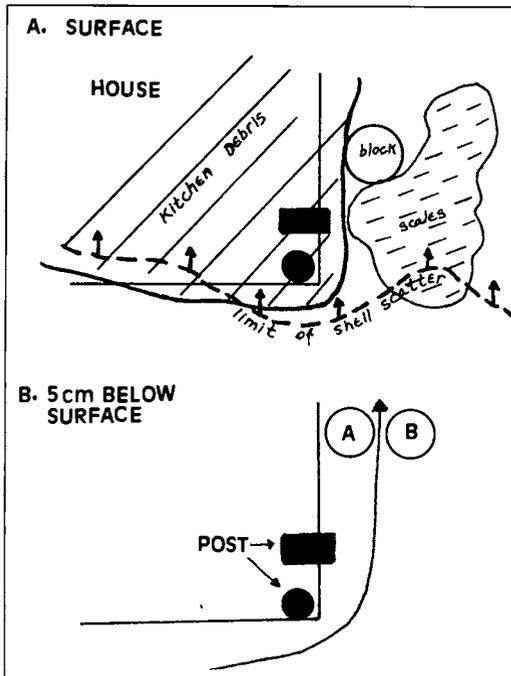


Figure 8 Remains of fish scaling at the corner of a house, before and after cleaning up: A = an area of loose and dark, damp organic sand ( 10 YR 2/1 ) to a depth of 10 cm; above loose unaltered sand ( 10 YR 5/3 ). B= firm, pressed sand ( 10 YR 5/3).

5. Under-house surfaces (Figure 8)

Some areas of a Chaw Lay site are altered by the addition of large quantities of organic material dropped from the kitchens of houses. The deposit is sometimes cleaned by sweeping and all but tiny pieces and slop removed. Sometimes fresh sand is poured over the soiled area. Often however, the daily scavenging by animals is enough to dispose of any garbage. In the process these scavengers loosen and churn the deposit further. The result is a loose, wet sand, very dark in colour and containing small fragments of organic material.

One example of this process can be seen under the kitchen of a house at Rawai. On the surface, under the kitchen, was a deposit of fruit pips, rice, vegetable peel, charcoal, coconut husk, paper and eggshell. Overlapping the drop area was recorded a fish-scaling activity with associated

scattered scales and a wooden chopping block. When this area was excavated at a later date the kitchen debris had been swept away and the wooden block removed. The sediment in the area was loose and dark, still damp and containing only as few scales, charcoal fragments and a small fish bone.

Artefact survival

If we look at the list of diagnostic subsistence activities and their by-products and consider the influence of post-depositional forces, it is possible to see that the artefactual evidence left in activity areas will be minimal. It is clear that these forces will bias the nature and quantity of primary evidence that might enter the archaeological record. All the above forces were recorded working upon the activity area evidence as it was being deposited on the site.

Given that the preservation of shell, coral, bone, fish and organic remains is subject to local soil chemistry, and that the Chaw Lay are not ceramic producers, it is clear that stone artefacts are the most potentially retrievable artefact types within the traditional Chaw Lay material culture and are therefore deserving of some comment. Stones are the basic Chaw Lay tool, used primarily in their natural state or with minimum modification. They are not technically artefacts, but rather 'utilized stones'. Often a stone will be casually picked up from the beach, selected for some inherent quality, used and then tossed away. Frequently, however, they are curated for generations. Material is collected during outings for other purposes to various islands, often from specific beaches or stream beds.

Utilized stones have the following recorded uses:

1. As cracking platforms on which to break open shells or nuts.
2. As hammerstones for cracking open shells or nuts.
3. As whetstones for sharpening metal, stone or bamboo blades.
4. As firestones for supporting cooking vessels.
5. As pounding stones for processing food and betel.

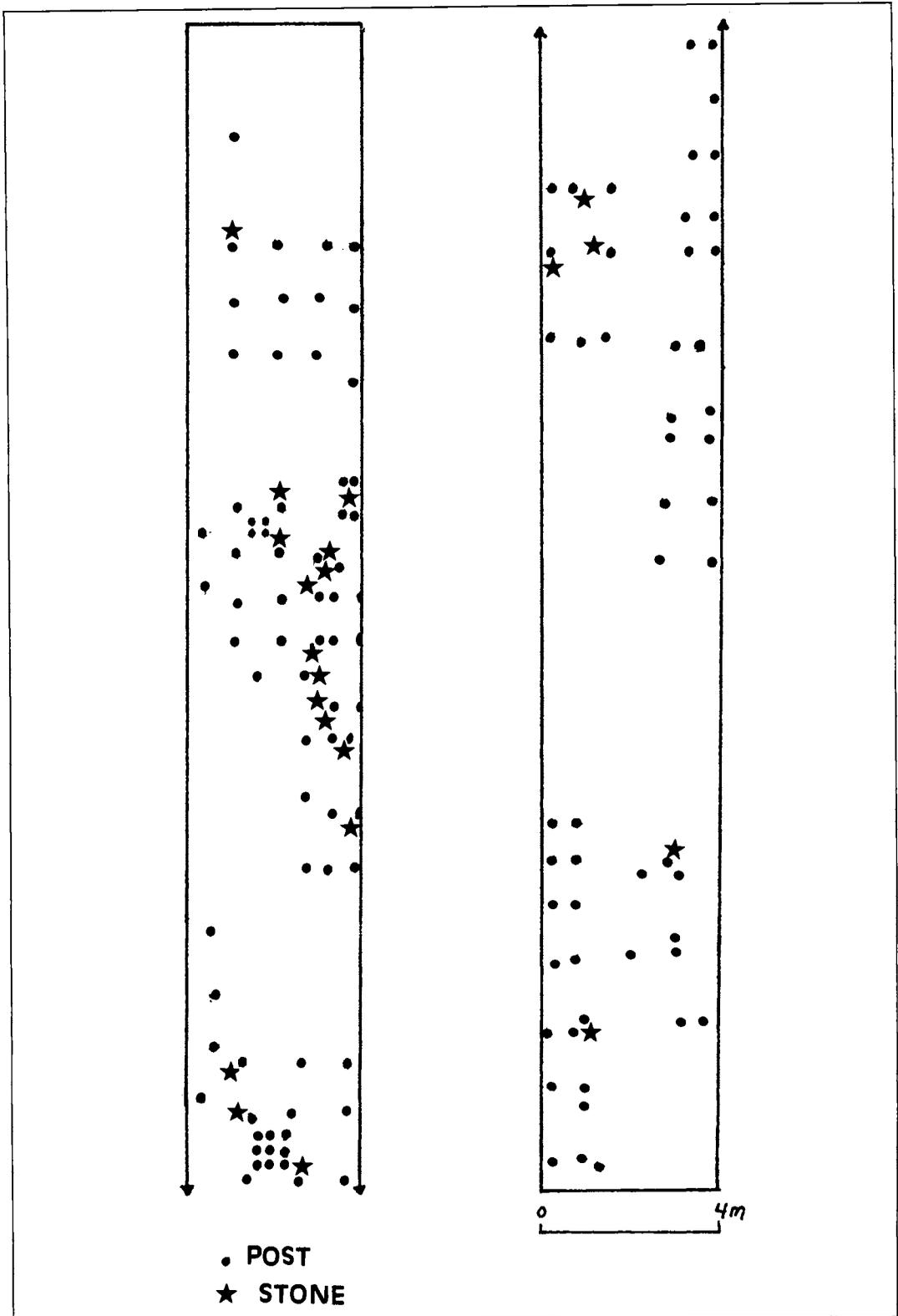


Figure 9 Plan illustrating the spatial distribution of stones and house posts; data from a transect through the settlement of Tukay.



**Figure 10** View of stones in storage around the post of a house structure.

6. As supports for posts, piles or vessels.
7. As bathing or scrubbing stones.

When the various Chaw Lay sites were mapped and recorded, counts of stones were made and their spatial distribution noted. A number of generalizations can be made from this study concerning stone behaviour in this context. Firstly, stones of all types are most commonly found in association with structures; in particular they exhibit a strong spatial affinity for house posts (Figure 9 and 10).

The second strongest association is between stones and fires, because of their use as vessel supports. When found in association with activity areas, including shell mounds, stones in the ethnographic context are either in use or

temporarily in storage for future use. Finally, when associated with secondary midden deposits, stones are either around the edge of the midden where they function as retainers or discarded in the midden as broken debris.

Fires are another part of the minimalist Chaw Lay material culture, the remains of which occur all over Chaw Lay sites and persist into the archaeological record. Like more conventional artefacts they can be grouped and typed and form diagnostic features of Chaw Lay life. Like stones and boats they can be made portable. Types of fires recorded are set out in Table 2.

Certain generalizations were observed concerning fire behaviour in the Chaw Lay context:

**Table 1** presents the statistical relationship between stone and house post occurrence at settlements

Number found within 0.5m of a post		
Tukay	233 out of a total of 338 =	69%
Rawai	317 out of a total of 433 =	73%
Sapam	32 out of a total of 40 =	80%
Laem La	17 out of a total of 23 =	74%

**Table 2** Fires found in Chaw Lay contexts and their archaeologically retrievable components

FIRE TYPE	ASSOCIATED ITEMS	ARCHAEOLOGICAL VISIBILITY
Cooking Fires	3 or 4 stones in diagnostic arrangements fuel, grills, vessels, food	likely to be left for re-use because dirty to remove and store. Stones tossed out when cracked
Fires to ward off mosquitoes	no stones, metal sheets or branches. fuel	moveable, put under sleeping areas or sitting platforms
Fires for drying and smoking	no stones, fuel, food	associated posts of rack
Fires for burning rubbish	no stones, little or no fuel	remains removed to a midden
Scrub clearance fires	no stones, additional fuel	burnt organic material remains
Fire to heat boat caulk	no stones, boat, tools, materials	glassy melted caulk on the ground stone boat supports

- Fire based activities and those not involving fire are never spatially associated.
- If fire remains are found under a house they are either the remains of a mosquito fire, or the inverted contents of a stove dumped from the house above.
- Fire at the edge of a midden will likely be for burning debris or clearing brush.
- A fire very close to a house is most likely a cooking fire.
- Fires in open shared areas are for debris burning.
- Fires in middens are often associated with smoking racks.

**Patterns of discard**

As we have seen, deposits swept and collected from under houses and other activity areas on the site make their way into secondary deposits on middens and mounds. These contain shell, debris removed from the site, debris dropped from activity on the deposition, tidal deposit and materials stored on the midden in various proportions. Some deposits are almost 100 percent shell of a single species; others can be a homogenous mix of all categories. The econiche of the site and the economic activities

carried out there play a decisive role in determining contents. These secondary deposits occur along the periphery of the site (Figure 11), especially at:

- The tide line or beach front.
- The lagoon edge or back of the site.
- Scrub areas at the edges of a site.
- The edges of streams or waterways.
- At areas of what we call the ‘floating periphery’, such as mounds around trees in the main area of the site; areas where several houses back onto each other creating a space for deposition buildup and islands of dead space created by the splitting and joining of paths.

The exact pattern of these depositions and their content is determined by site-specific factors. Following are brief descriptions of the patterns of deposition at the main Chaw Lay sites studied.

**Tukay (Figure 12)**

The settlement of Tukay is a strand site with mangrove lagoon behind it and paths. The deposit is three to four metres wide and up to one and a half metres deep. It has scrub covered hills at both ends. The primary



Figure 11 Area of secondary deposition along the back of the site at Tukay

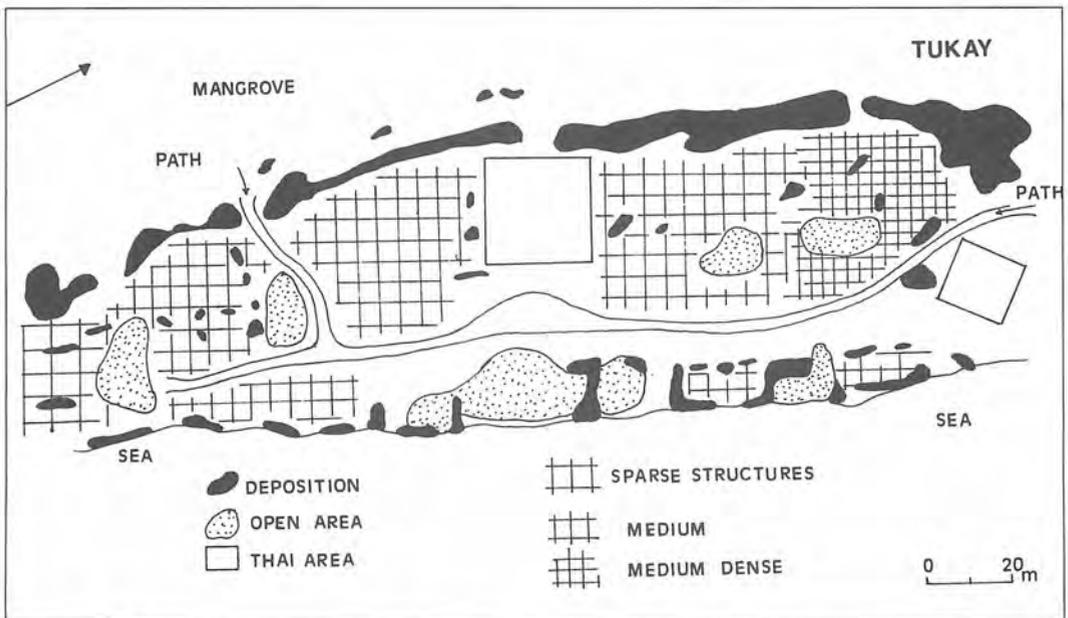


Figure 12 Schematic map of Tukay, illustrating the spatial patterning of structures, depositions, open activity areas and paths.

economic activities are fishing and shellfish collection.

There are almost continuous shell mounds and some debris along the beach front, broken only for access. This deposit contains 99 percent shell plus mixed debris that has been tidally deposited, and some items placed on the mounds for storage and drying. Tidal action is eating away and eroding the mound face on one side while the other side is regularly swept to contain it.

An almost continuous shell mound and some debris run along the rear of the site, extending into the mangrove area. The deposit is maximum 8 m wide and 1.4 m deep and contains 85 percent shell plus mixed debris. The debris tends to be tipped over on to the mangrove side and then redeposited by tidal seepage. Tidal action here does not eat away at the midden, as mangrove

tides seep rather than wash. Discrete dumps are identifiable until time mixes them together. Also in the midden is debris from activities taking place on or beside it, such as drying, smoking, coops and toilets and items in storage on the midden.

Large amounts of shells are found around and between trees. They are composed of 100 percent shell and are usually of only one species (Figure 5). They measure up to 9m in diameter and over 2m in depth. They are restrained from spreading into other areas and also serve as storage areas for wood, baskets and mats.

**Sapam** (Figure 13)

Sapam is situated on both sides of a river leading from estuarine mudflats into a tidal lagoon. The primary economic activity is shellfish gathering.

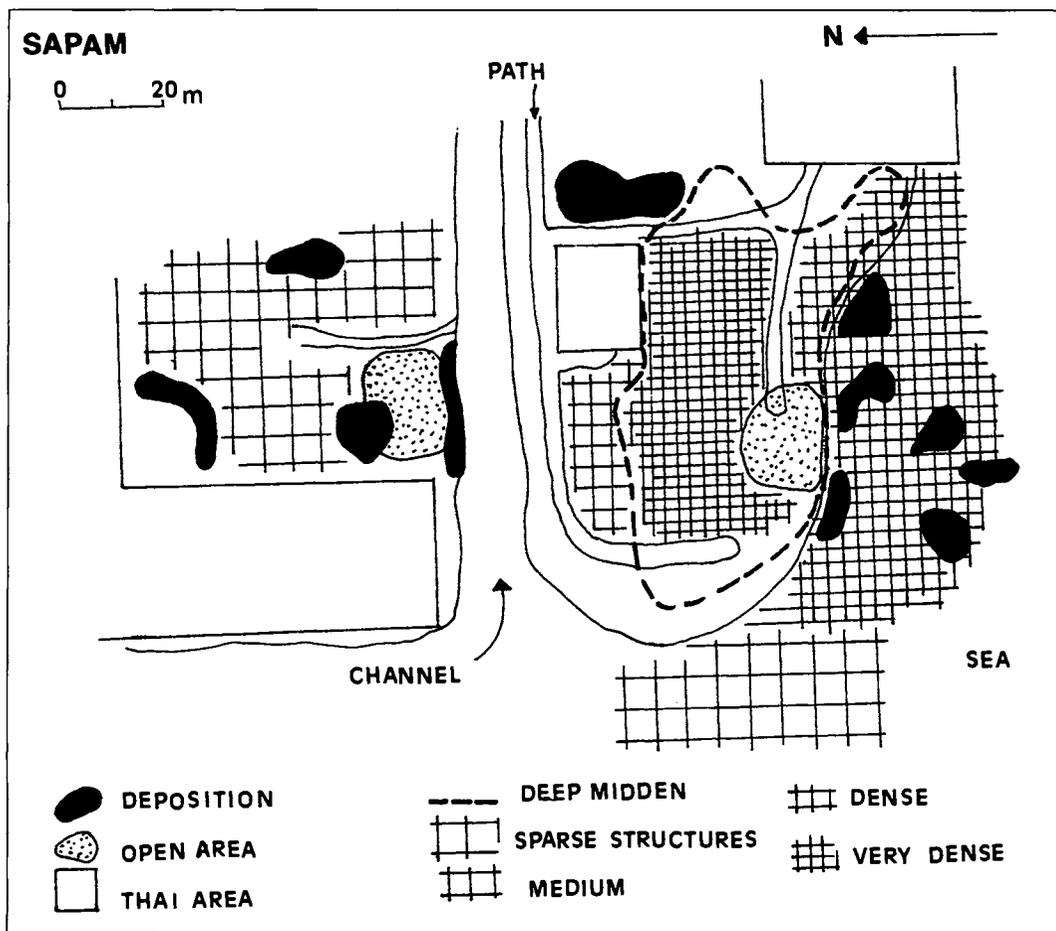


Figure 13 Schematic map of Sapam, illustrating the spatial patterning of structures, depositions, open activity areas and paths.

The entire site of Sapam is a shell mound with a pattern of household and activity area deposition on top. The mound cannot be swept, therefore debris is buried by yet more shell. Non-organic house debris gets washed about by the tides and augmented by further droppings from the stilted houses in the intertidal.

At Sapam there are no clear spatial distinctions between deposits and no distinctions on the basis of content. The example of Sapam is of a community at the end of the evolutionary cycle. It shows that when a site is limited in size, the shell mounds will in time grow to occupy all available space. Discrete mounds, middens, peripheral and tidal deposits all combine in a single process and primary and secondary distinctions are blurred. A site in this condition can be said to have reached a state of environmental overload, its carrying capacity exceeded and population out-migration to other suitable sites is the next inevitable step in the cycle. In fact, as we studied Sapam, the population was in the process of moving to a new site across the river, referred to as Sapam South.

#### **Rawai (Figure 14)**

Rawai is a beach site with lagoon behind; a sand spur extends back across the lagoon to another beach. The edges of the village are scrub, with a road to the west. The primary economic activity is fishing.

At Rawai the pattern of deposition along the front of the site is atypical because the land is owned by non-Chaw Lay and access is limited. However, at the rear of the site a large but not continuous deposit runs along the edge of the low area. The midden is approximately 10m long and 7.5m wide and 2.5m deep. The contents are mixed: shell, wood and food debris, vegetable matter, fabric, plastic, metal fragments, paper, baskets and glass. The material is caught in the vegetation bordering the edge of the mangrove. 90 percent of the material is a homogenous mix of tossed material, the remaining 10 percent being segregated dumps of material such as baskets of coconut husks, log piles and piles of shell.

Five large mixed middens are found towards the front of the site, on the village side of the road, and up against non-Chaw Lay structures.

The contents are the same as the rear middens. It appears that the edge of the non-Chaw Lay areas is seen as equivalent to the periphery of the site in terms of the activities that take place there. Small mixed depositions are found around some trees. There are no shell mounds found at Rawai.

#### **Laem La (Figure 15)**

Laem La is a beach site facing on to the mudflats to the east and the open Phuket Channel to the north. The primary subsistence activity is fishing, with limited shellfish exploitation.

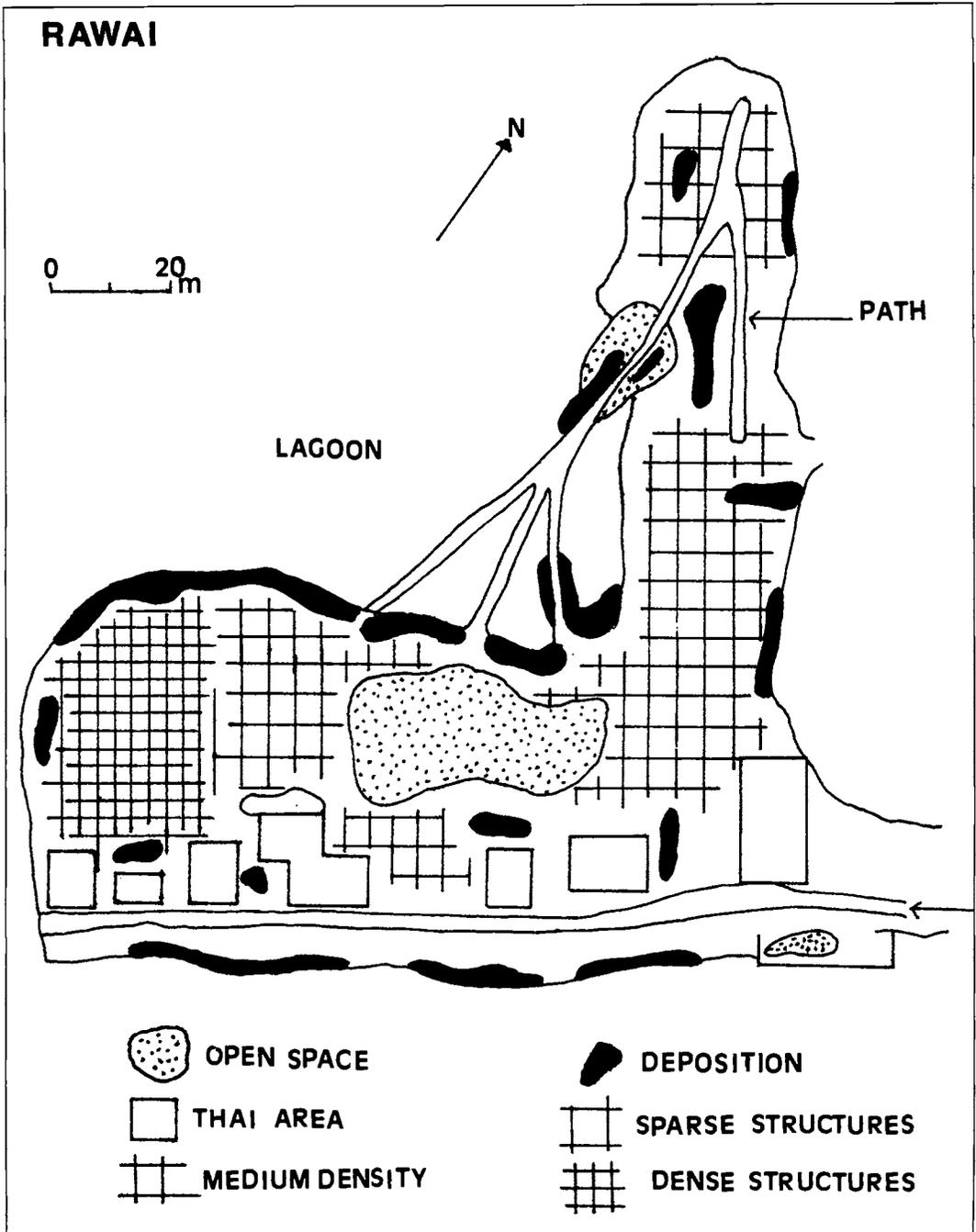
There is a single large midden at the rear of the site, backing on to the wall of a non-Chaw Lay structure. The midden measures 9m x 7m and is 1.5m deep. It is composed of 30 percent shell, 20 percent debris from sweeping, 20 percent coconut husks and mixed deposition. The midden is contained by the fence, paths and sweeping action.

Small shell mounds are found around many trees; there are numerous small shell deposits rather than a few larger ones. Because of the lack of peripheral space available for use as activity areas, 'floating periphery' is created by the flattening of and then sweeping over of old shell deposits, and thus creating new surfaces.

#### **Post-depositional modifications**

Middens and mounds are subject to a variety of forces that result in modification and alterations of the deposits and effect greatly the archaeological survival of their contents. In a Chaw Lay context these forces include:

- Activities taking place on the midden or mound surface which create additional debris, such as smoking fires, toilets, drying racks, storage and fish processing.
- Animal scavenging and burrowing resulting in the sorting and rearranging of material.
- Traffic along the edges of deposits which wears down the edges and crushes material.
- The re-cycling of objects with re-use potential that are stored on the midden, such as boards, poles, baskets and stones.
- The addition of material by walk-by tosses.
- The repeated burning of collected debris and activity area sweepings on the midden surface.



**Figure 14** Schematic map of Rawai, illustrating the spatial patterning of structures, depositions, open activity areas and paths.

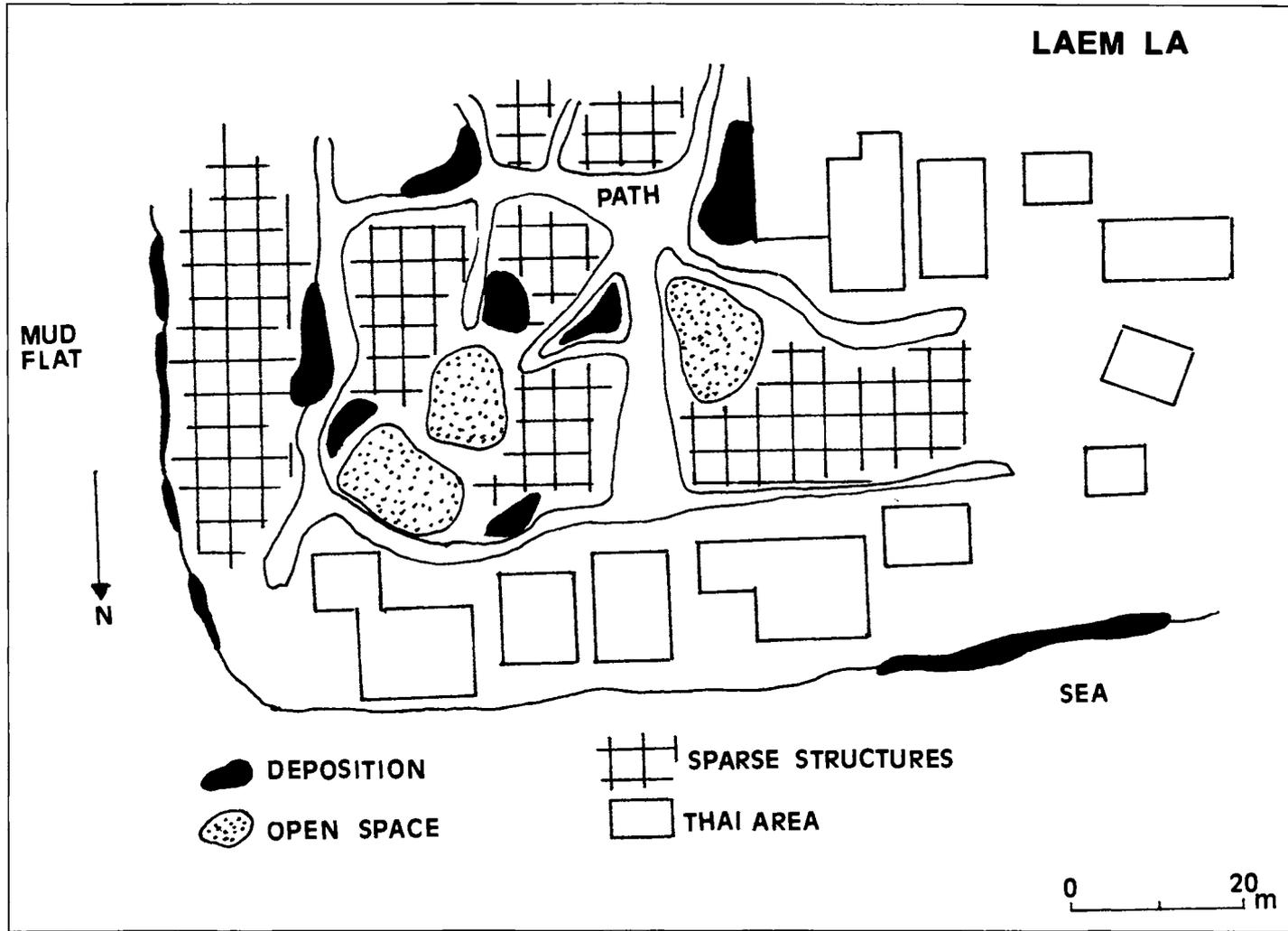


Figure 15 Schematic map of Laem La, illustrating the spatial patterning of structures, depositions, open activity areas and paths.

- Edge maintenance to control the spread of the deposit, using boards, large stones, sweeping etc.
- Tidal wash and mangrove ooze displacing and rearranging material
- Cumulative natural forces of rain, wind, weight of the contents and decomposition.

What remains in Chaw Lay garbage is in fact only a partial sample of the material consumed by the community, and the sample that enters the archaeological record will be smaller still. Recycling is the most significant factor that effects object survival rates, and is the most difficult to interpret correctly. Virtually every item which passes through the hands of the Chaw Lay is used, re-used, re-cycled for another purpose and then another until it is literally used up or broken into fragments too tiny to be manipulated.

### Patterns of construction

The third pattern-forming activity in Chaw Lay sites is construction. The basic unit of the Chaw Lay built environment is the rack, a table-like structure of bamboo slats on supports. This rack unit develops by the addition of roof, walls, openings and partitions to adapt to a range of uses. The primary functions are storage of tools, materials and people, protection from the elements and as a raised activity surface. Most activities, however, such as food preparation, mat and basket manufacture and fish processing, take place outside of structures, or as in the case of sleeping, cooking and sex, as often outside as inside.

The main feature of all Chaw Lay structures is their pre-fabrication and re-usable construction. Entire structures or parts of them,

can be easily dismantled and moved within the site or by boat to another site. Components such as mangrove logs, split bamboo and thatch are easily bundled and transported, well suited to a mobile lifestyle.

The mobile and degradable nature of all Chaw Lay construction materials means that evidence on site is limited to a pattern of postholes and driplines.

### Postholes

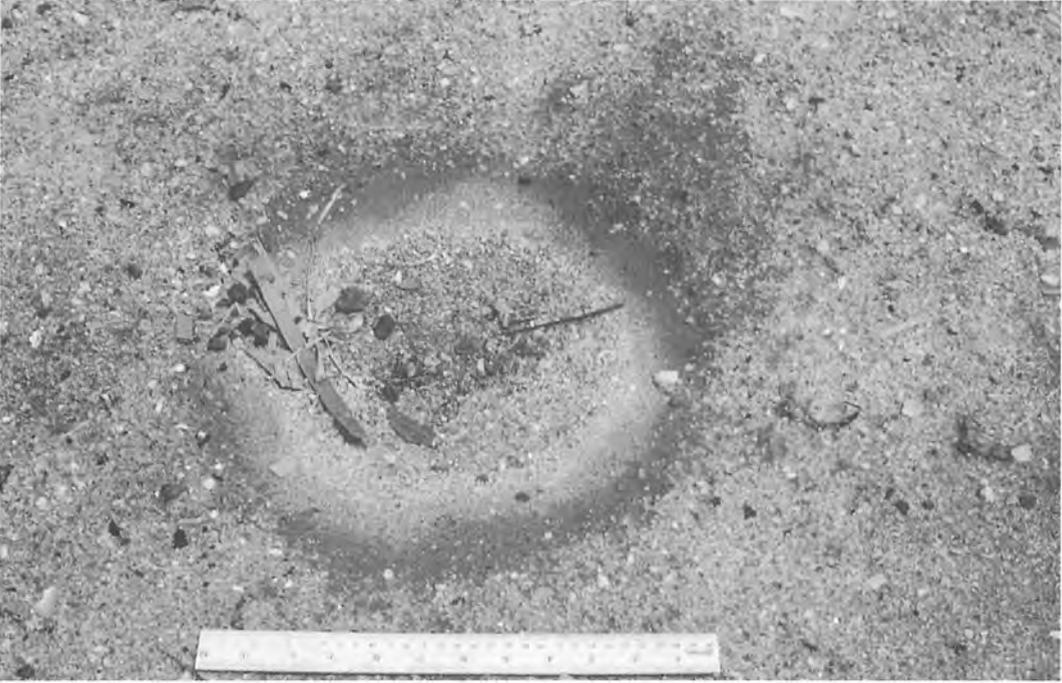
The number of posts at each Chaw Lay settlement were recorded and mapped. The distribution of postholes shows some spatial patterning, as shown in Table 3

Analysis of this data shows that the centres of sites are notably free of posts and that the rear of sites are more densely built up than the front of sites. The site which least fulfils these expectations is Sapam North. The very high density of posts in the centre of the site represents site saturation and is an indicator of imminent site collapse.

All postholes found in the ethnographic context, resulting from the dismantling and removal of structures or individual posts were recorded. There were no documented examples of the use of footings or packings, nor of posts burnt or rotten in situ. The form of the archaeological remains is very much effected by the way in which the post was removed from the ground. As the post is moved to and fro to loosen it, the edges of the hole are compacted on one side and broken down on the other. Often the Chaw Lay dig around the post slightly when removing it; the sediment removed is piled up at the edge of the hole forming a patch of reverse stratigraphy. Both actions lead to a hole

**Table 3 The density of postholes in different sections of a Chaw Lay settlement is shown as an indicator of site saturation**

	TUKAY	RAWAI	LAEM LA	SAPAM N.	SAPAM S.
No. of posts	4609	2580	1144	851	380
Posts per 10 m sq.	0.7	0.7	0.5	111.1	6.0
Rear density	125	69	18	10	7
Middle density	205	75	44	86	65
Front density	98	27	56	64	18
Central 10 m sq.	0.0	1	0.0	66	22



**Figure 16** View of a posthole after removal with sand and debris fill.



**Figure 17** Closeup of the debris fragments collected in a dripline.

much bigger at the upper levels than the post itself. The real dimensions appear only at the lowest levels.

After removal of the post the area of the dismantled structure is thoroughly swept. This neutralizes the site, leaving little evidence of the structure's form or use. All that remains of the postholes is a generalized fill of sand, pebbles, shell fragments, organic material and possibly charcoal (Figure 16).

### **Driplines**

When tropical rains repeatedly run off the roofs of the irregularly thatched Chaw Lay structures, they etch lines in the sandy matrix below. These depressions fill with tiny bits of debris left behind when the area is swept. The lines show the limit of the structure and its under-house activity area and also show the orientation of the structure.

When carefully excavated driplines appear as a series of irregular shaped spots and softer areas in a light, thin and brittle surface crust (Figure 17). Analysis of these micro-deposits can help to identify the surface debris at the times the rain occurred, even though the parent debris has long been swept off the adjacent surfaces.

### **The predictive model**

The observations made above are some of the many made during the study. Translated into behavioural predictions, they form the basis of a model of Chaw Lay site formation and use. This can be abstracted into a conceptual or archetypal site, suggesting what will be found in the archaeological record, in what frequencies and in what spatial patterning. The interplay of activity areas, secondary depositions and post holes, driplines and circumstantial artefactual evidence should allow us to identify and reconstruct a Chaw Lay archaeological site.

### **The test programme**

To test this hypothesis we designed a programme of investigations at five abandoned, archaeological Chaw Lay sites (Figure 2):

- Phap Pha, on the Phuket mainland
- La Eo, on the island of Ko He
- Haad Yao, on the island of Ko Bon
- Haad Hin Khaw, on the island of Ko Lon

- Ao Wai Daeng, on the island of Ko Lon
- Space allows the presentation of only two of these sites: one of which we interpret as having been a major base habitation; the other a casually visited fishing camp.

### **Phap Pha (Figure 18)**

Phap Pha is a shady raised beach between two headlands; it is separated from the mainland of Phuket by a mangrove swamp and bordered on both sides by the sea. The site was occupied for more than ninety years, and was abandoned in the early 1960s, twenty years before our study. We know from our informants that the primary factor leading to its abandonment was overcrowding leading to over exploitation of the shellfish resources and environmental degradation to the point where the site could no longer supply the baseline emergency needs of its inhabitants.

Our study methodology at Phap Pha included:

- One hundred percent surface mapping
- Detailed mapping of three transects through the site
- Excavation of specific areas within the transects
- Study of the intertidal area
- Catchment area mapping and identification of biota

The site at Phap Pha has large quantities of shell, which lie in a complex arrangement of overlapping mounds, lengthwise across the site. The mounds at Phap Pha are more than 90 percent shell, frequently deposited in discrete lenses by species. Although post-depositional forces have scattered and spread the deposit, it is of note that the species segregation was still clearly discernable when the layer of surface disturbance was removed.

Secondary middens were found in concentrations along the back of the site where the contour of the raised beach dips at the base of the hill slope. Many of these deposits were charred by debris-burning fires. The artefactual material surviving in secondary depositions included chunks of coral, metal fragments, rope and net pieces, plastic, glass and pottery fragments.

The other form of midden at this site is built up at the base of trees. These are characterized by minimal shell content and frequent artefacts

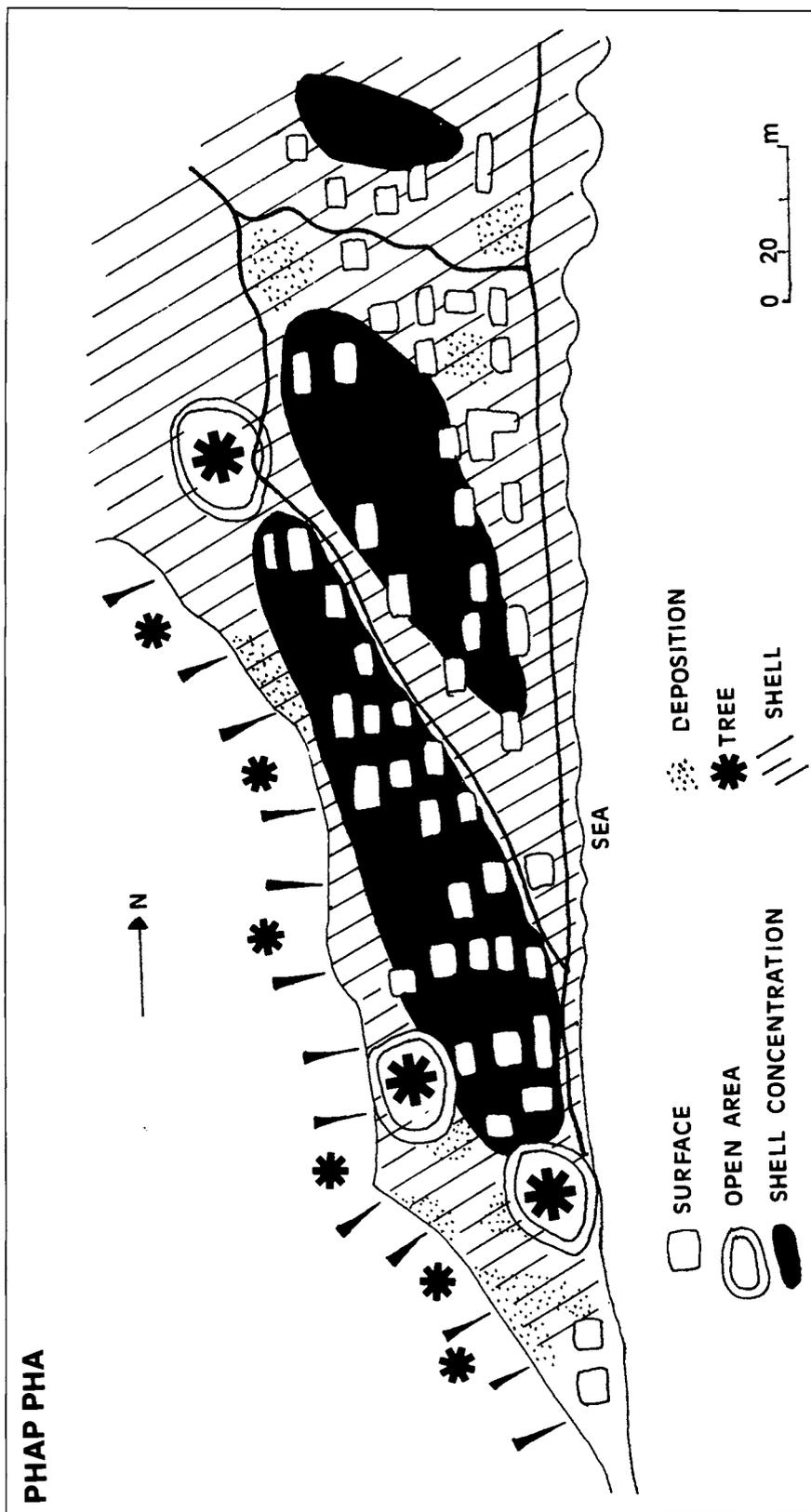


Figure 18 Schematic map of the archaeological site of Phap Pha.

in storage, in particular whetstones and cracking platforms.

The archaeological map of Phap Pha shows the large number of activity areas. Sixty-two flat, compressed surfaces occupy the site area, pressed into sand, sediment and shell mound. The majority were the slightly raised and compacted areas of the type associated ethnographically with under-house activity areas. Several soft, under-kitchen deposits were identified in associated with them, forming house complexes.

Open activity areas occur at several places along the front of the site and under large tamarind trees at the rear of the site. The surfaces of these areas are hard, dark with charcoal bits and shell fragments pressed into them. A number of activity areas were recorded with associated fires, shell fragments and stones in temporary storage.

Peripheral activity areas were also identified at the far west end of the site; a butchering area in the brush at the edge of the site, and an ancestral spirit-house area on the hill nearby.

#### Haad Hin Khaw, Ko Lon (Figure 19)

Ko Lon is a large island off the southwest of Phuket Island, but reachable from the Phuket Island sites by rowing or sailing within a few hours. The site of Haad Hin Khaw itself is a small raised beach, 70m long, on the southeast corner of the island, near the path of passing schools of fish (Figure 19). Foothills rise at either end, while behind the raised beach a mangrove lagoon area extends some distance back. From our ethnographic informants we know that Haad Hin Khaw has a long history of intermittent use as a seasonal fishing camp.

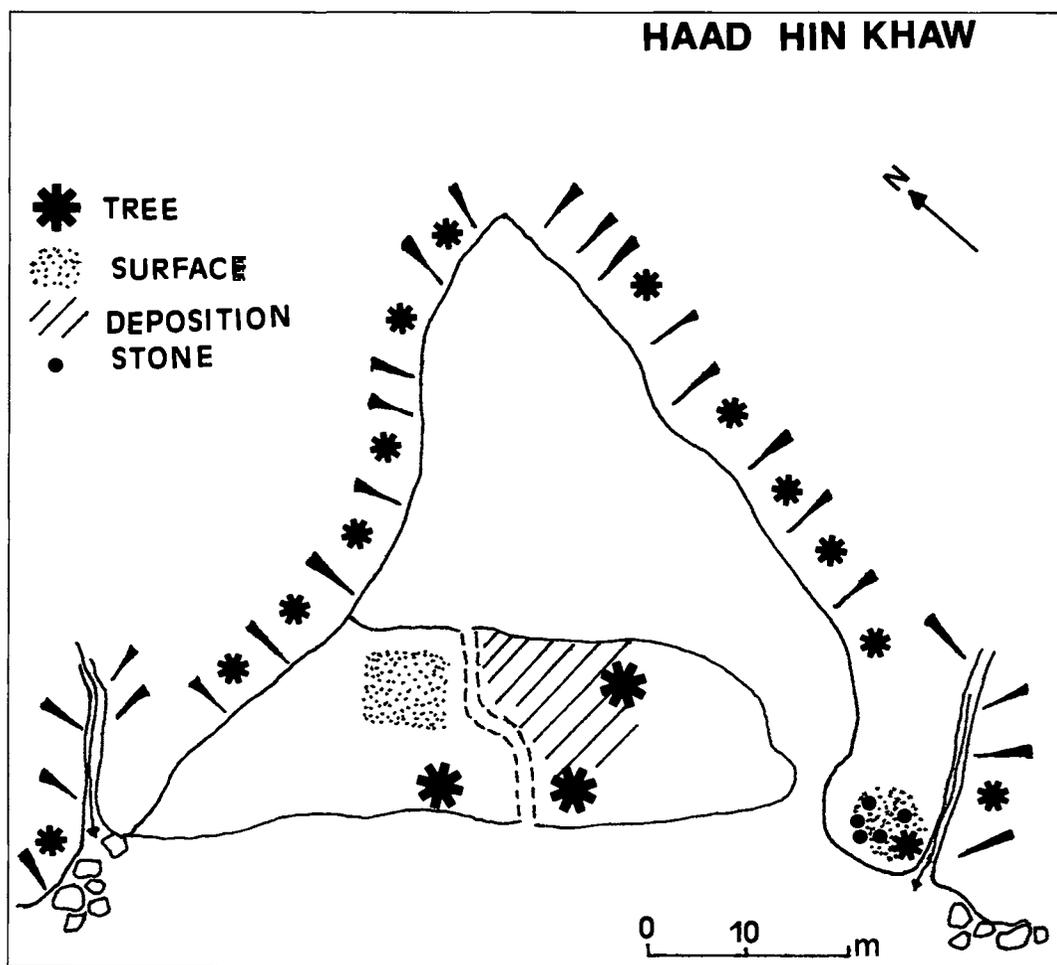


Figure 19 Schematic map of the archaeological site of Haad Hin Khaw, Ko Lon.

Because of its small size, we were able to map and investigate archaeologically 100 percent of the site. We found it comprised a single hard pressed area near the centre of the raised beach, which by analogy confirmed by our informants, was the central communal area of a small campsite. Beside it, a gully or dry stream bed ran from the low lagoon behind to the sea. On the other side of this gully, behind the pressed surface area were remains of a secondary midden deposit. At the far eastern end of the site, there is a small headland some metres above sea level. On it was a flat and compacted activity area surface at the foot of a tree. Associated with it were five fire-charred stones, shell fragments and a midden deposit to the rear. This association of debris in such a location indicated a multi-purpose activity area associated with fish processing.

### **Findings and implications**

Although these data from the test programme have been presented in abbreviated form, it is possible to make some specific points concerning the findings and the implications for archaeology of similar sites.

### **Alteration to soil and sediments**

A pattern of environmental impact reflected by transformations of soil and depositional sediments covers the entire surface of a Chaw Lay site. In situations where artefact recovery can be expected to be low, circumstantial and consisting largely of utilized stones, the soil transformations form the primary archaeological record. For this reason, considerably more concentration on discovery and classification of these soil variations is required, in particular in relation to sand and intertidal mud matrices.

The colour readings collected over all the sites lead us to believe that the range is in fact very narrow. The variations from this narrow field are the red sediments and those that are extremely dark and mottled sediments. Further analysis of colour variations may show ways in which they may prove more informative, in particular in conjunction with other sediment variables (Schiffer 1987: 288).

It was found in the course of excavation that vertical stratigraphy supplied an incomplete

record of depositional variations visible in horizontal plan. In a sandy matrix stratigraphy proves a less specific tool for the interpretation of a site than in other environments. For this reason, more emphasis should be placed on recording in plan to complement stratigraphic data.

In general, evidence for the presence of fire is very shallow, no more than 6–9cm deep, and consists of colour variation, sometimes in conjunction with a sticky consistency, in the case of fish-smoking fires, or stones in the case of cooking fires. Ash and charcoal are not features of fires in the archaeological record; instead the charcoal and ash are found in secondary refuse deposits. As a result, recording of fires depends on the recognition of thin lenses of colour variation as opposed to substantial deposits of charred material.

The post-depositional activities of the Chaw Lay, such as trampling, sweeping, debris burning and the action of animals and children, are instrumental in the formation of soil variation recoverable archaeologically. Therefore, it is important that more attention focus on the range and nature of these activities and their exact impact on the archaeological environment.

### **Identification of activity areas**

The model was found effective in predicting the spatial distribution and identity of the range of activity areas. Test excavation supported the model's contention that it is rarely possible to identify specific activities within communal activity areas. It illustrated that unless there is direct evidence to the contrary, debris found should be assumed to be in secondary deposition and therefore not to reflect a direct spatial relationship with the activity of which it is a by-product. We suggest therefore that attention should be paid initially to the identification of communal activity areas.

In a situation where artefactual and other types of evidence are primarily found in secondary depositions, it is clear that all aspects of discard require detailed study to avoid errors of mistaken interpretation and false association.

### **Subsistence and the environment**

Regarding evidence of Chaw Lay economic emphasis, the question to ask is, how clearly

does the recorded data of an occupation site reflect the Chaw Lay's over-riding dependence on the two off-site activities of fishing and shellfish gathering? Shellfish collection and processing leave behind in the archaeological record large quantities of shell remains and occasionally discarded tools. Evidence of fishing and fish processing, however, is more difficult to recover. The tools of the trade are more often lost at sea and the recovery of organic remains depends entirely on local soil chemistry. Even if fish remains survive, excavation requires concentration on methods capable of retrieving this sort of microscale evidence. Sites suspected of reflecting a maritime economic base particularly require systematic use of sieving and flotation.

### Material culture

In a mobile adaptation, the tool-kit is streamlined, multi-purpose and designed to be carried away. Combined with the Chaw Lay emphasis on curation, sharing and recycling, it means that few objects from their way of life enter the archaeological record. A possible exception to this caveat is the large range of stone artefacts found on Chaw Lay sites. Because of their weight and size they are often left behind in temporary storage for return use. Their frequency, durability and wide, often multi-purpose usage makes them deserving of special study. As has been pointed out previously, Chaw Lay stone artefacts are utilized stones with little or no working, but with compound use wear. Particular attention should be paid to the relationship between stones and posts. It was found that in the Chaw Lay context stones are strongly correlated with house posts. If it could be statistically verified, this could provide a useful tool for the detection of postholes in the archaeological context.

A certain number of re-usable objects are left as 'site furniture' (Binford 1979: 264) for use when the group and/or other groups return to the site. There is no evidence for buried caches; instead material is stored temporarily on secondary refuse deposits or under or around houses.

Virtually all artefactual evidence at Phap Pha and Ko He was found in the form of deposition. Artefacts rarely if ever reflected

directly their systemic context. In addition, the range of artefact types was a very small fraction of the number of types known to be functioning in a Chaw Lay community. Comparison of the items involved in activities with those found in the archaeological context shows this clearly. This point served to remind us of the futility of an artefact-centred approach to site analysis.

### Final comments

In the course of this paper we have attempted to track the ethnographic evidence of subsistence activities of maritime-based communities as far back as possible in the archaeological record. In addition to the detailed ethnographic study of material culture, the methodology included surface investigation, analysis of a range of post-depositional forces and excavation. On the basis of this research, a model of maritime-adapted site formation under tropical Southeast Asian conditions has been formulated. Survey and test excavation of the test sites have shown that the model is a serviceable tool, albeit needing refinement in some points. It is hoped that this model will help to predict some of the cultural and environmental transforms affecting Southeast Asian coastal sites and to aid with their 'readability' in the archaeological record.

### Note

This paper was presented at the ICANAS Conference, in Hong Kong, August 1993, and has been revised. Since first writing of the paper, the authors have presented a number of other papers (Engelhardt & Rogers 1995, 1997 and 1998) which are listed in the References.

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**KEYWORDS—ETHNOARCHAEOLOGY, MARITIME-ADAPTATION, MARITIME HUNTER-GATHERERS, MIDDENS, THAILAND, SEA NOMADS, FISHING, MOLLUSCS, CHAW LAY**

