PETROGRAPHIC FEATURES OF ANDAMANESE POTTERY

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The ceramic tradition of the Andaman Islanders is of particular interest, not only in view of the fact that their economy is based on foraging, but also in the light of a reported absence of the knowledge of making fire (Man 1883:150; Radcliffe-Brown 1922:472).

Hitherto, attempts to reconstruct the culture history of the Andamanese have been very few. This situation has been remedied to a certain extent as a result of archaeological surveys undertaken in the Andamans during the last few years (see Cooper 1985). One goal of these surveys has been to elucidate the role of pottery in Andamanese society. The first step towards this goal requires delineation of the morphological characteristics of the pottery from various islands. This paper presents the results of a preliminary analysis of potsherds from a shell midden in South Andaman.

The midden, which is located near the village of Chauldari (see Figure 1), is 4.45m high and lies within 300m of Flat Bay. A 1.5m wide trench was excavated down the eastern flank of the mound, exposing the dyke of intrusive serpentinite on which it rests. The cutting yielded 97 potsherds, besides numerous shell remains, bones of *Sus scrofa*, and artifacts of stone, shell and bone (Cooper 1985:32-35).

DESCRIPTION OF THE CHAULDARI POTSHERDS

Interestingly enough, potsherds were present only below a depth of 1m in the midden, which may be due to the disturbance of the upper layers as a result of recent human and animal activity, or to a genuine decrease in pottery usage in recent times. The site stands at the edge of a field and a cattle shed has been built on top of it; children from the neighbouring school often come to play there and shells are periodically removed from the western and southern sides of the mound for the purpose of extracting lime. The potsherds described herein were collected from a depth of about 1.5m down to the basal level, which represents a section approximately 3m thick.

The maximum dimensions of these potsherds range from 1.6 to 10.6cm (average 5.3cm), with a mean thickness of 0.7cm. The colours vary from brown to reddish yellow.

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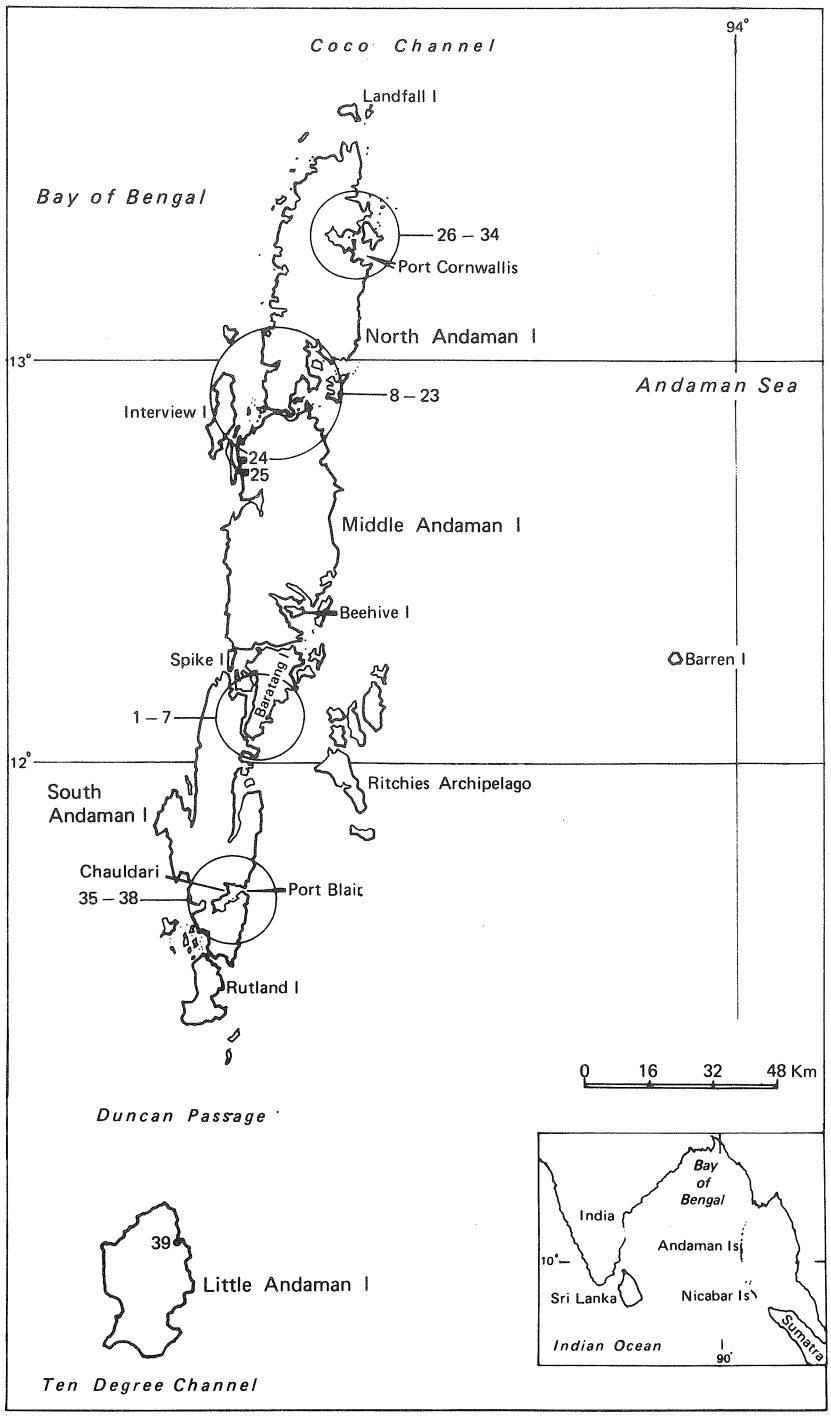

FIGURE 1: MAP OF THE ANDAMAN ISLANDS SHOWING THE LOCATIONS OF THE CHAULDARI AND BEEHIVE HILL MIDDENS

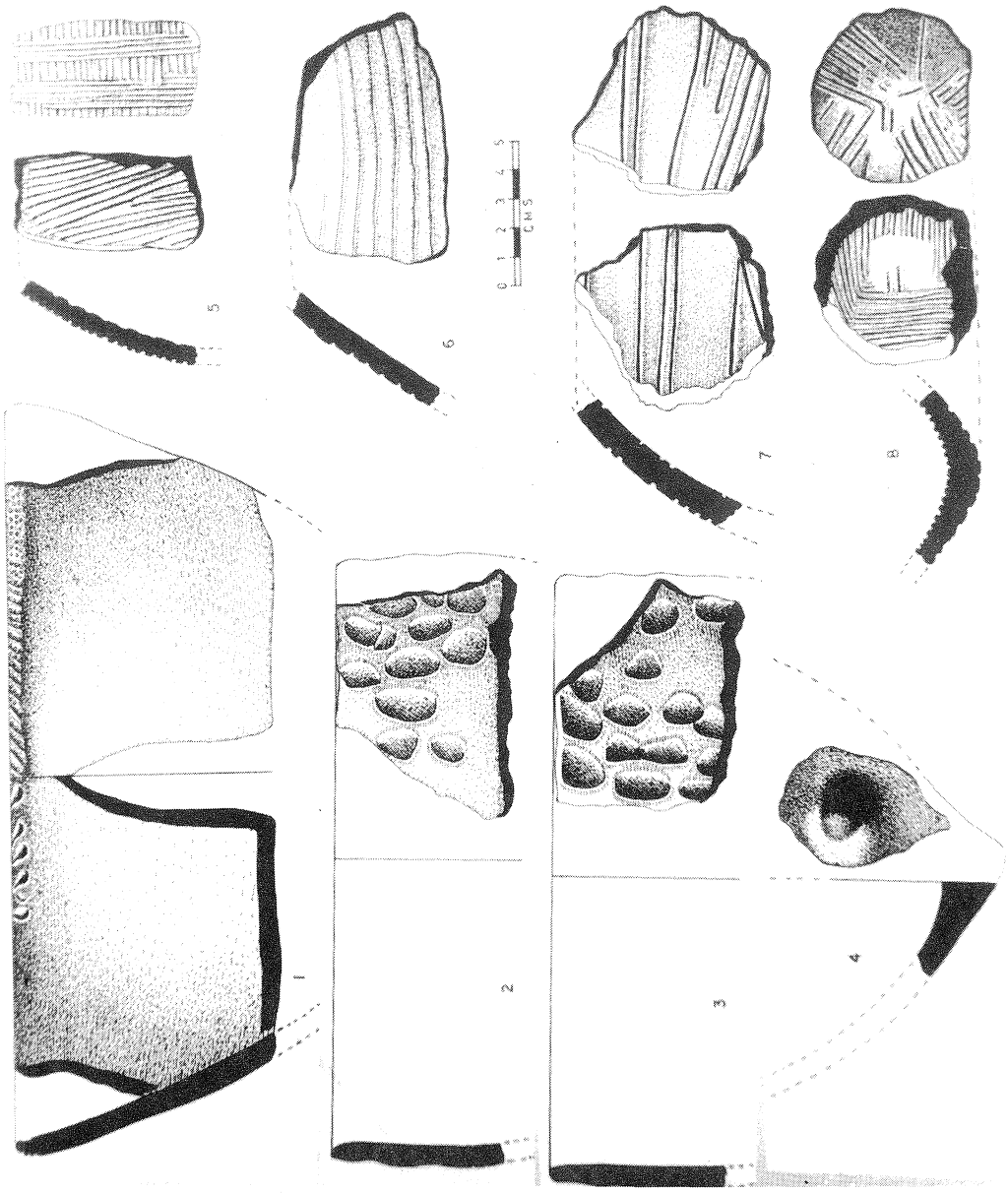

FIGURE 2: POTTERY FROM THE CHAULDARI MIDDEN. FOR DESCRIPTION SEE TEXT

Six of the pieces are from the pointed bases of pots which were apparently shaped in this manner so that they could be made to stand upright in sandy ground (Figure 2, nos.4 and 8). It may be noted, however, that this feature does not accord well with Radcliffe-Brown's (1922:473) observation that such forms are common in North Andaman, while the pots from South Andaman are thicker and have rounded bases.

The percentage of incised out of all sherds from Chauldari is 20.61 per cent, the designs consisting mostly of sets of parallel lines executed with the edges of shells or with sharp sticks (Figure 2, nos.5, 6, 7). As suggested by Fox (1878:444), such ornamentation bears a close resemblance to the basket-work casing in which pots were generally carried. With the exception of one sherd, all are incised only on their outer surfaces. Two pieces exhibit patterns of thumb impressions (Figure 2, nos.2 and 3), while three others comprise the rims of pots which have been delicately notched or stamped (Figure 2, no.1).

Ethnographic reports suggest that these pots generally served as cooking vessels, although some smaller ones were used as containers for boiling a mixture of bees' wax, resin and red ochre which was smeared over the binding of arrowheads (Man 1883:375; Radcliffe-Brown 1922:474).

Pots were generally made by the technique of coil construction (for details see Man 1883:374-375; Radcliffe-Brown 1922:473). It is noteworthy that this method of manufacture appears to be a cruder version of a similar process practised on the island of Chowra in the Nicobars (Man 1894; Reddy 1981), so it may perhaps be assumed that the art of making pottery was introduced to the Andamans from these islands. The adoption of this innovation apparently took place at a fairly early stage, as suggested by the occurrence of potsherds in the basal layers of the Chauldari midden, for which a radiocarbon date on marine shell of 2280±90 uncal. BP (BS 599) has been obtained. Thus, Cipriani's (1966:74-75) suggestion, based on the absence of pottery in the lower levels of the midden at Beehive Hill, Middle Andaman, that ceramics were a fairly late introduction to the Andamans, is no longer valid. This is particularly so in view of the fact that the age of the Beehive Hill site is no more than 1400±100 uncal. BP (PRL 1237) (Cooper 1987:175).

A rather puzzling feature that is characteristic of pottery from the Andamans is that it appears to degenerate in quality in the upper layers of the midden sites. This trend from finer to coarser ware was noted by Man (1883:373), as well as by Cipriani (1966:74) with reference to pottery from the midden near Beehive Hill. The pottery from Chauldari also shares this trait, contrary to what was stated earlier on the basis of an incomplete examination of the material (Cooper 1985:34). Representative potsherds from Chauldari have been subjected to petrological analysis in order to define precisely the seeming decline in quality.

PETROLOGICAL ANALYSIS OF CHAULDARI POTTERY

Thin sections were made from thirteen potsherds representative of the main stratigraphical units of the exposed eastern flank of the shell mound. Small pieces, measuring approximately 2 x 2cm, were cut from each sherd and subjected to a test in order to determine porosity. This was done by weighing each sherd and then saturating it in water for two hours, after which the

sherds were re-weighed and the volume determined by displacement. The calculation of porosity is based on the formula given by Shepard (1957:127).

The thin sections were examined under a Carl-Zeiss Jenapol petrological microscope. Table 1 presents the major petrographic characteristics and porosity percentages for the potsherds from Chauldari, together with three sherds from a midden at Wrafters Creek on Baratang Island and two from sites in North Andaman. These last five are surface finds and have been included here in order to permit a general comparison to be made between regions. However, at this stage of research it is not possible to discern significant regional variations in textural or mineral compositions.

Notwithstanding the preliminary nature of the results, they present several noteworthy features which are summarised here, with particular reference to the Chauldari midden.

1. Two sub-populations of quartz grains have been found to occur. In the lower layers of the site, i.e., from 3-4m, the pottery is predominantly fine-grained, the sizes of the grains ranging from 40-110μm. Coarse-grained ware dominates in the upper levels; grain sizes vary from 120-200μm and some grains are larger than 200μm. The grain-size frequency is, therefore, bimodal.

2. In general, the grains tend to be sub-angular to sub-rounded, though the coarser material is well-rounded. Some of the fine quartz grains are frosted and stained by iron.

3. Two types of matrix can be identified. One of these is composed of limonite, the other of an iron oxide which may be a mixture of hematite and goethite. Minerals of the iron oxide group in fine-grained clay form pseudo-grains which are sub-angular to very well-rounded. The ratio of clay matrix to the coarse and fine temper fraction varies from 7:3 to 3:7. In places the matrix exhibits micro-fracture and flow structure, and traces of cellular structures represent vegetal materials which have burned out during firing.

4. Orthoclase feldspars and muscovite are present, and vary from about 2 per cent (by number of grains) in the upper layers to 5 per cent in the lower. Some of the muscovite flakes are slightly altered. The percentages of these minerals were determined by comparator charts following Bullock *et al.* (1985).

5. Quartz grains comprise nearly 5-6 per cent of the rock fragments. They are shattered in places and the cracks are infilled with iron.

6. Pieces of volcanic glass occur in the pottery in the lower layers. Some appear to be devitrified, probably due to weathering.

7. The occurrence of charcoal in pottery fabric in the lower half of the site accords well with the predominance of charred shells in these horizons. The pottery, however, does not contain any shell.

8. The percentage of porosity does not vary markedly, though the samples from 2.7m to 4m appear to be slightly less porous than those from 1.5m to 2.7m. This is in keeping with the structure of the clay.

Sample number	Depth in m.	Clay matrix	Coarse to fine fraction ratio of quartz	Coarse and fine fraction to matrix ratio	Porosity (percentage of volume)
Chauldari Site:					
1	1.5	Iron oxide	8:2	7:3	.06
2	1.5	Goethite	9:1	7:3	.03
3	1.5	Iron oxide + Limonite	5:5	7:3	.11
		CEMENTED CALCIFIED LAYER			
4	2.1	Goethite	4:6	6:4	.03
5	2.1	Goethite	4:6	6:4	.05
6	2.7	Hematite + Goethite	4:6	5:5-6:4	.09
7	2.7	Hematite + Limonite	7:3	6:4	.09
8	2.7	Hematite + Goethite	6:4	7:3	.09
9	3.0	Hematite	3:7	4:6	.12
10	3.0	Hematite + Limonite	7:3	6:4	.04
11	3.0	Hematite	3:7	4:6	.07
12	4.0	Goethite + Hematite	3:7	3:7	.09
13	4.0	Limonite	2:8-3:7	4:6	.07
Midden at Wrafters Creek, Baratang Island:					
14	1	Hematite	6:4	4:6	
15	3	Hematite	6:4	4:6	
16	4	Hematite	7:3	4:6	
North Andaman:					
17		Hematite	3:7	4:6	
18		Hematite	6:4	6:4	

TABLE 1: MICROMORPHOLOGICAL ANALYSIS OF ANDAMANESE POTSHERDS

X-RAY DIFFRACTION ANALYSIS

The petrological studies were supplemented by X-ray diffraction analysis in order to confirm the identification of the clay minerals and to examine the effect of heat on these minerals. Untreated but powdered samples of the potsherds were analysed by a Phillips X-ray diffractometer, using Cu K alpha radiation. The diffraction characteristics were recorded and the spectra identified according to Robert (1975).

The most commonly occurring minerals identified through XRD are quartz, goethite, muscovite/illite and hematite. Orthoclase feldspars are present throughout, but in traces. In samples belonging to the basal layers from 4 to 4.5m there is a predominance of quartz and dehydrated mica. The XRD spectra of the five samples from the sites north of Chauldari reveal an abundance of quartz, hematite, goethite, calcite and orthoclase.

FIRING TEMPERATURES

The process of firing pots in the Andamans simply involved the placing of burning wood in and around the vessel. The analysis carried out so far renders it possible to determine that the firing temperatures were fairly low.

1. In the first place, it is known that the crystalline structure of kaolin is destroyed at about 600°C (Rye 1981:30, 106). The absence of the kaolinite group of minerals in the potsherds examined so far indicates that firing temperatures could have reached this level.
2. Diffused peaks of illite (micaceous clay minerals) occurring at low values have been identified in all the XRD patterns. The stability of these peaks suggests that the temperatures at which firing took place may not have been less than 500°C.
3. The crystalline form of quartz undergoes a change at 573°C (Rye 1981:34). The fact that the quartz grains in the samples described above are unaltered makes it clear that, on the whole, maximum temperatures could not have exceeded 600°C.
4. As pointed out earlier, traces of orthoclase feldspars occur throughout the sequence. Although two types of feldspars have inversion points of 900°C the effects of this alteration have not been detected in the pottery (Shepard 1957:28).

In view of the above it is possible to generalize that the firing temperatures arising from the baking technique followed by the potters of the Andamans may have ranged between 500 and 600°C. This is in keeping with temperatures associated elsewhere with open-firing (Rye 1981:25).

SOURCES OF THE CLAYS

The principal sources of the clays used most probably lie in the local blue-grey micaceous sandstones, which are sometimes non-micaceous and calcareous. Conglomerates of white quartz pebbles in a sandy matrix also occur. Chert, opal and chalcedony, as seen in the thin sections, have probably been derived from these conglomerates.

Soils in the vicinity of the Chauldari site were also examined in order to determine their mineral composition. Samples were collected from the foot of the site, the stream bed about 400m to the north, as also from the Flat Bay area, 300m away from the site. Twenty grams of soil from each sample were treated with 10 per cent HCl acid, washed with deionised water, and then allowed to dry, after which the soil was studied under a petrological microscope.

In these soils, the predominant minerals are quartz and plagioclase feldspars. Other minerals include zircon, garnet and tourmaline, together with pale yellow to pale grey magnetitic and ferruginous semi-rounded nodules. The glass sherds found in the thin sections are probably of volcanic origin, which is not surprising as the volcanoes of Narkondam and Barren Islands lie to the east of the Andamans. In fact, the Barren Island volcano is known to have erupted as recently as 1789 (Pascoe 1964:1871).

DISCUSSION OF THE DIFFERENCES IN TEXTURAL COMPOSITION IN POTTERY

It has not yet been possible to arrive at a definite reason for the deterioration in the quality of the pottery from fine to coarse-grained in the course of time. However, with regard to the midden at Chauldari, this problem may be more clearly defined by taking into consideration the evidence of a distinct break in the sequence at 2.1m. This signifies a phase when the site was in all likelihood abandoned for a considerable period of time, as suggested by the fact that the shells at this depth are cemented. In addition, the XRD analysis of shells indicates the predominance of aragonite in all the layers, though calcite is present at 2.1m, which may be the result of exposure and pedogenic change. Moreover, the chemical analysis of soils from the site shows that the percentage of $CaCO_3$ increases from 2.1m downwards, while there is a decrease in organic carbon in the cemented layer as well as a sharp drop in phosphate content below 2.1m.

Three radiocarbon dates obtained on charred as well as uncharred marine shells have yielded the following uncalibrated age results:

Depth	Age
1.1 m	1350±100 BP (BS-617)
2.2 m	2070±100 BP (BS-600)
4.45m	2280±90 BP (BS-599)

It is thus possible that the midden reached its present height in about one thousand years, which indicates a fairly rapid rate of deposition, particularly with regard to the lower half of the mound from 2.2 to 4.45m. However, there seems to be a much longer period of over 700 years between the time when occupation on the site may have ceased (represented by the calcified layer at 2.1m from the surface) to the time when the final metre of debris was piled on top of the midden. Even if it is assumed that for some reason the rate of accumulation was

much slower after the site was reoccupied, it is apparent that the period of abandonment may have spanned several centuries, if not half a millenium.

It is not within the scope of this paper to explore the factors responsible for this break in habitation, though it is necessary to consider its implications in terms of the textural changes observed in the pottery. Table 1 indicates that the break in occupation does not coincide with the appearance of coarse-grained potsherds, which start occurring at a depth of 2.7m. Moreover, the abundance of suitable clays in South Andaman eliminates the factors of availability and accessibility as accountable for the difference in question. Nor does there seem to be a fundamental change in the technique of coil building during the period with which we are concerned. In fact, the most significant feature in the mineral composition of the ceramics appears to be a certain indifference with regard to the selection of clay and its preparation prior to its use.

Obviously, the quality of the clay was not essential for the efficacious rendering of traditional incised designs, and clay vessels in general served only a basic utilitarian purpose, in addition to being easily expendable. However, pots were valued as objects of barter (Man 1883:374), perhaps more so in earlier times, which might partially explain the greater care with which they were made. On the other hand, there is reason to believe that large specimens of *Turbo marmoratus* and valves of *Tridacna gigas* could have served also as containers for boiling food (Stoliczka 1870:16).

In view of these facts, two possibilities seem to be worth considering. First, the earlier pottery may have been brought in as a trade item from the Nicobar Islands, where the quality of manufacture is far superior to that in the Andamans. Today, all the pottery sold within the Nicobars is made on Chowra Island and the potters use only the fine clay from the neighbouring island of Teressa. In several respects the geological strata of the Nicobars are similar to those of the Andamans (Tipper 1911:12-14; Gee 1927:227-30), so that the material used in the manufacture of pottery in the earlier phase of occupation represented in the Andaman middens may appear to have been derived from local sources, whereas it might well have had its source in the Nicobars. However, judging by the rather hostile relationship that prevailed in the past between the two races (Man 1885:266) and in the light of records of the Andamanese being exploited as slaves by Malaysians, Chinese, Burmese and even Europeans (Cooper in press), it seems unlikely that any regular and long-term system of trade ever existed between the Andamans and Nicobars.

This leaves the second possibility, that the Andamanese, in spite of the enmity with the Nicobarese and other communities, managed to acquire the knowledge of pottery making themselves from the start. In time, the Andamanese perhaps realized that the coil building process offered the advantage of permitting the utilization of less plastic clay than is required when a vessel has to be fashioned out of a single lump of material (Shepard 1957:59). This meant not having to expend energy in procuring fine clay or having to pay much attention to the quality of the temper, which probably accounts for the increasing coarseness of the ware with the progress of time. This is, however, only a hypothetical point of view which needs to be substantiated with further research on the subject.

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