

**Probelms and Hypotheses on the Prehistoric Lal-lo,  
Northern Luzon, Philippines**  
**- Archaeological Study on the Prehistoric interdependence between  
Hunter-Gatherers and Farmers in the Tropical Rain Forest -**

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**要約** フィリピン、北部ルソン島カガヤン河下流域に分布するラロ貝塚群の調査は、先史時代における狩猟採集民と農耕民との相互関係の歴史過程を解明する目的をもって開始された。その準備段階として、貝塚遺跡群の発掘調査による当該地域の編年体系の精緻化、自然遺物資料の収集と分析による生業復元、民族考古学調査による相互関係モデル構築をめざしてきた。現在までに発掘調査した遺跡は7遺跡11地点である。これらの遺跡はそのほとんどが貝塚遺跡であるが、その他にも貝塚を形成した人々の墓地群、貝層下シルト層中の文化層、そして洞穴に分類できる。また遺跡立地は河岸石灰岩台地上、河岸段丘上、沖積平野、石灰岩丘陵上にわたる。これらの遺跡の出土遺物から遺跡の年代は相対的に6期に分けることができる。すなわち赤色有文土器群→赤色無文土器群→黒色土器群Ⅰ類→黒色土器群Ⅱ類→貿易陶磁Ⅰ(14~15世紀)→貿易陶磁Ⅱ(16世紀以降)である。現在までに得られている絶対年代では、BP3,000年以降に相当する。これらの調査結果を総合して、先史時代の狩猟採集民と農耕民との相互関係の実態解明のために、以下の作業仮説を立て、その検証のために今後の調査の方向性を模索した。1.遺跡編年と河川環境の変化をもとにして、遺跡分布に一定のパターンが見いだされた。すなわち赤色有文土器群→赤色無文土器群→黒色土器群Ⅰ類→黒色土器群Ⅱ類の変化の過程で、上流から下流にかけて遺跡分布域が縮小と拡大を繰り返すのである。この変化はさらに沼沢から流水への河川環境の変化、それに伴う貝採集の開始という生業変化へと連動している。2.河岸段丘上と洞穴の両遺跡から出土した剥片石器群は共伴する赤色無文土器から同時期の所産と考えられ、直線で10km隔てた両遺跡居住者間で資源の交換が行われていた可能性を示唆している。

**Keywords:** Lal-lo Shell Middens, Chronology, Subsistence, Interdependence between Hunter-Gatherer and Farmer

### **Introduction**

Shell midden sites containing archaeological materials are located on the river bank of lower Cagayan River, extending from the mouth of the river on the northern coast of Luzon Island for a distance of 40 kilometers upriver. Site locations varies basically in four categories, like river bank, limestone hill, inland and coastal sand dunes (Fig. 1). Extended areas of the shell middens are also varying differently, from the small shell midden having 50 meters diameter to the big one extending 500 meters long, 100 meters wide and two meters deep. But shell species formed those middens are limited, except coastal middens, shell middens are predominantly composed by locally called Kabibi, fresh water bivalve shell. Carbon 14 dating of the shell middens are from 3,000BP to 1,000BP (1).

Standing on those shell middens, many questions come out; why this kind of big size

of shell middens were formed? How was the formation process? How was the subsistence of the prehistoric people formed those shell middens? Was the shell gathering activities subsidiary to their farming? Or, shell gathering was specialized as their main subsistence activities? How their subsistence activities like hunting, gathering, fishing, farming were conducted, beside shell gathering? How the micro-environments surrounding the sites like the river bank, inland plain, limestone hill and coastal shore were utilized for those activities? How was the economic, social and political relationships with other prehistoric groups around the shell gathering people, occupying the particular place for shell as a subsistence resource?

Having those questions, we started the research on these shell middens. Research area is covered from the Cagayan River bank to its eastern inland hilly area. In the following chapters, we will explain at first the research rationales, and the general settings of the research area, natural and geological settings, history of the area including the settings of each archaeological shell midden sites from the mouth of the river to upstream. And then the results of research will be shown with the contexts of chronology of artifacts and the prehistoric environment. The economic and social relationships between the sites located on the river bank sites and cave in the hilly area inferred by the artifacts make us possible to present the hypothesis on the prehistoric interdependence between hunter-gatherers and farmers in the area.

## **I. Research Rationales**

### **1. Brief history of the research conducted in Lal-lo Shell Middens.**

The first research of the shell middens in Lal-lo was conducted in 1971 at the Magapit sites by Israel Cabanilla and Yoji Aoyagi, the researchers of National Museum of the Philippines. These sites were discovered by chance, during the excavations of the Cabalwanian sites at the west bank of the Cagayan River. The vehicles of the research team were supplied gasoline by the Shell Oil Company at their oil tanks in Appari, Cagayan. On the way to Appari, they found the shell deposit and pottery sherds beside the national highway No.5 at Magapit, because the highway was under construction for the widening of road, and cutting down the limestone cliff beside the highway.

Excavation of the shell midden in Magapit was conducted in 1971 (Cabanilla 1972), and four excavation areas of 2x2m square were set (site number: II-71-LL1 to 4) on the limestone hill of 10 to 20m above mean sea level (M.S.L.). The location of 1971 excavation is corresponding to the location 1 of Magapit Shell middens explored in 1986 by the national museum team including the author (Ogawa and Aguilera 1992). Red-

slipped potteries of different shapes with decoration like dot punctuation and incision, stone adzes, bones and bivalve shells were collected by the excavation (Cabanilla 1972). Clay pendant or earring like water buffalo horn revealed during this excavation was designed to the symbol of the Cagayan Provincial Museum.

Through the 1970's, Israel Cabanilla, Yoji Aoyagi and Roberto Santiago, the researchers of National Museum, have continued the exploration in Lal-lo shell middens, and discovered Bangag site, in front of Magapit site, other side of Cagayan River, and Lal-lo Centro site (Aoyagi 1977). During their explorations, these researchers recognized already that those shell middens produced two types of potteries, Red-slipped and Black pottery, and that these potteries were never found together from the same site. They noticed that it could be the difference of pottery tradition in chronology (Aoyagi 1973:89, 1974:47, 1976, 1979, 1981, Aoyagi and Tanaka 1985). Magapit site was excavated in 1978 by Barbara Thiel, after the research of Arku and Musang Cave in Penablanca, 80 km south of Lal-lo (Thiel 1989). Rich archaeological materials were revealed, red-slipped potteries of different shapes, coarsely made potteries without red-slip, clay ornaments and stone adzes.

In the early 1980's, Aoyagi had continued the explorations in Cagayan, not only Lal-lo shell middens, but also culturally and chronologically related sites upriver along the Cagayan River, like Carig site, Tuguegarao and Lanna site in Solana (Aoyagi 1983). Richard Shutler, Jr. and the research team of Simon Frazer University also explored the Magaoit site during their study of pottery traditions of the northern Luzon Island (Snow and Shutler 1985). Archaeologists working in the Southeast Asia, Pacific and India visited the sites during the conference of Indo Pacific Prehistory Association held at Penablanca, Cagayan in 1985. At 1986, National Museum team and the author started the explorations on the Lower Cagayan River area, including Lal-lo, from the mouth of the river to municipality of Gattaran, about 40 km upriver. The purpose of this explorations was basically same as the present research in Lal-lo. First aim was for the establishment of local chronology in the area. Data of the characteristics of shell middens such as size, depth, location, artifacts and ecofacts derived from each site by the surface finding, could be useful for the establishment of relative chronology in this area. Second aim of the research was to approach to the one of the biggest problems in Southeast Asian Archaeology, contemporaneous existence of the groups having the different technological background. In the research area, Negrito people, hunter-gatherers in Northern Luzon, are living in the hinterland of Cagayan River alluvial plain, and established the economic and social relationships with lowland farmers. How long had continued hunter-gatherers and farmer relationships from the prehistoric

time to the recent? Resolving this problem, at the first stage of this purpose, we conducted the site exploration from the alluvial plain to the hinterland in Lal-lo.

Twenty one shell middens containing the archaeological materials are recognized along the Lower Cagayan River and coastal sand dune by the exploration (Aoyagi, Aguilera, Ogawa and Tanaka 1986, Ogawa and Aguilera 1992). Beside this lowland exploration, the hinterland exploration did not carry out until 1996 because of the political situation of the area. Artifacts collected from the surface of these sites indicate the several cultural phases among those shell midden sites. Shell middens which produce red-slipped pottery (Fig. 4, 5) don't produce black pottery (Fig. 11) at the same time. Magapit shell middens produce red-slipped pottery, but the other river bank shell middens like Bangag, Santa Maria, Catayauan site, produce black pottery. No shell middens produce both types of pottery together. Stone adzes are almost collected at Magapit and Bangag site, and only one or two fragments of stone adzes from Santa Maria and Catayauan site. Almost the Chinese ceramics collected are blue and white from Santa Maria, Catayauan, Lal-lo Centro, Camalaniugan sites. These shell middens are possibly classified into the different groups of cultural phases or chronological order. Such as, Magapit→Bangag→Santa Maria, Catayauan, Lal-lo Centro, Camalaniugan. To resolve this chronological problem and collect the ecological data for the reconstruction of prehistoric subsistence, the excavations of shell middens started from 1987 in Magapit, Catayauan and San Lorenzo (western bank of the river, in front of Catayauan site).

The excavations of Lal-lo shell middens started from Catayauan site. Catayauan shell midden is thickly formed, site area extends widely, and shell gathering still continuously performs by village people. The excavation was conducted to reconstruct the depositional process of shell midden formation, revealing shell deposit, layer by layer. Shell layers revealed were processed by water separation and floatation to collect the ecofacts like animal bones and plant remains. Different species of shells were counted by each piece and percentage of materials revealed from each layer was calculated. Beside these ecofacts, artifacts were revealed only black pottery in small fragments. Catayauan excavation delineated the characteristics of shell midden formation and its possible depositional process by the disposal of food stuffs and utensils of prehistoric people (Aoyagi, Aguilera, Ogawa and Tanaka 1988). But new question came out from the results of the excavation; Did the prehistoric people utilize those huge amount of shell only for their food stuffs? Ethnoarchaeological research of the present shell gathering in Catayauan had conducted after the excavation (Ogawa 1997).

Magapit shell midden excavations are also conducted in 1987. Excavation spots were selected at the highest location in Magapit sites. Hill Top site is located at 50 meters above

M.S.L., four meters square was set for excavation. 5.5 meters deep shell deposit was excavated. Cliff site at 25 meters above M.S.L., also excavated 2 x 2 meters square. Big amount of artifacts and ecofacts were collected from both excavation spots, such as different types of red-slipped pottery, jar, bowl with dot punctuation and incision, coarse type of bowl without red-slip, stove, clay, stone and bone ornaments, stone adzes (Fig. 4 ~11, Aoyagi, Aguilera, Ogawa and Tanaka 1988, 1991, 1993, Tanaka 1993, 1996, Aoyagi, Ogawa, Tanaka 1996).

Datings of these shell middens are available; Catayauan site about 1,000BP and Magapit Hill Top site about 2,800BP.

San Lorenzo shell midden is located on the west bank of Cagayan River, about ten meters above M.S.L.. The site was recognized during the exploration in 1988. San Lorenzo village people, Ibanag and Ilocano, also perform the shell gathering at the present day. Three shell layers and two silty clay layers were revealed in 4 x 2 meters square. The deepest shell layer reached to 2.5 meters and produced the Chinese blue and white ceramic sherd belonging to 16th Century. Depositional order of shell and silty clay layers, arranged alternatively, indicates that the flood brought silt to the site, but shell gathering was continued even after the inundation. Artifacts revealed from the deepest portion of the shell midden showed that the deposition of shell and silt layers was quickly performed, during about four hundred years (Aoyagi, Aguilera, Ogawa and Tanaka 1991, Tanaka 1993, 1996).

In the perspectives of cultural relationships with other areas in South China Sea like Taiwan, South China and Vietnam, Stone and Clay pendants from Magapit site shows its similarities in typology and dating. Unexpectedly some inquiries were made about the red-slipped pottery from Magapit site by Oceanic archaeologists in the relationship with Lapita pottery. For the study of cultural relationships with adjacent area, further research and more data are needed, but the significance of our results are recognized even at the first stage of our study.

Shell Middens in Southeast Asia and South China had been the special issue of study for archaeologists belonged to the Japan Society for Southeast Asian Archaeology since 1992 to 1993, and they recognized its importance. Especially, Lal-lo Shell Middens are noticed as one of the biggest shell middens in Southeast Asia and South China.

After three years of research on the shell middens in the Lower Cagayan River, analyses of findings had continued until the middle of 1990's. New project has conducted from 1995 to 1997 in the same research area for the further study and resolution of old and new questions on the prehistory of this area.

## **2. The problems and purposes of the research**

Our researches in 1980's are limited to the river bank shell midden exploration and excavation. Twenty one shell middens were explored and three of them were excavated. Further research must be conducted, not only the sites located on the river bank, but also in the hinterland, limestone hilly area. Then, new research term started from 1995 for three years. The problem and purposes of the research is in a same perspective to the previous project.

**Problems:**When we planed to conduct the Lal-lo Project from 1986, we had the question why the hunter-gatherers still exist until the present day in this area? It must be possible to suppose that the different groups having the different technological background, hunter-gatherers and farmers exist contemporaneously in one area. In the research area, Negritos, Agta or Ita people are living in the hinterland of Cagayan River alluvial plain, and established the economic and social relationships with lowland farmers. Same situation of hunter-gatherer / farmer exchange of food stuffs and labor was reported in the Sierra Madre Mountain, in Cagayan and Isaberra Province (Peterson 1978, Peterson and Peterson 1977, Hutterer 1982, Headland 1986). How had the economic and social mechanism of this hunter-gatherers/farmer relationships elaborated and continued from the prehistoric time to the recent? It must be one of the biggest problems in Southeast Asian archaeology.

This problem has been discussed for long years. Isolate model for this problem was presented by Heine Gelderun(1932). The reason why hunter-gatherers continuously exist until present day was explained by the isolation from the influence of outsiders who have more developed technology. Hutterer appreciates Heine Gelderun's endeavor to explain the present situation of the contemporaneous existence of hunter-gatherer and farmer. But he denied the isolate model, because intersocial relationships or economic exchange was observed in many cases of the Philippine Negritos(Huterer 1976). Peterson and Peterson brought the inter-social relationships observed between hunter-gatherers and farmers into the prehistoric situation and presented "exchange adaptation" model(1977). Headland and Bailey individually presented the question of scarcity of carbohydrate food in tropical rain forest(Hutterer 1982, 1983, 1986, Headland 1987), and advocate that if hunter-gatherers had no relationships with farmers, they could not find their way to rain forest. They proposed the "interdependence model" of tropical rain forest hunter-gatherers with farmers(Headland and Bailey 1991). Archaeologists and ethnologists working in the Philippines have delineated the prehistoric relationships between hunter-gatherers and farmers in the perspective of interdependence or

mutualism for last two decades. But this model or hypotheses have never tested by the archaeological materials. Our project in Lal-lo area is conducted to collect data and approach to this problem for the testing of these hypotheses.

**Purposes of the research:** Resolving and discussing our problem by the archaeological method, the purposes of the project must be conducted as follows;

1. to clarify the process of cultural evolution in this research area, from the beginning of agriculture to the present.

2. and to reconstruct the each archaeological phases in the course of local cultural evolution.

3. to specify the factors and conditions to promote the system of hunter-gatherer/farmer relationships.

**Archaeological Method:** Archaeological method to satisfy these purposes is projected as follows;

1. to conduct the archaeological explorations and controlled excavations at a surveyed undisturbed parcel of land located at the Lower Cagayan River and its hinterland to elucidate the dating of sites.

2. to generate the data which could aid in establishing the subsistence strategy and palaeoenvironmental data of the area, conducting the multi-disciplinary research in cooperating with archaeo-scientists.

3. to delineate the settlement system at the area based on the function of each sites.

4. to determine the chronological sequence at the area based on relative and absolute dating.

5. to perform the ethnoarchaeological study on the inter-social relationships between hunter- gatherers and lowlanders, and also on the shell gathering system.

6. to refer the historical documents of missionaries and colonial officers on the mutual activities between hunter-gatherers and lowlanders.

7. to build up the most possible models to infer the systems existed in the prehistoric time, using the data collected by the above mentioned archaeological methods.

## **II. Lower Cagayan River; natural settings, history and shell middens.**

### **1. Characteristics of Shell Middens**

Cagayan Valley is surrounded by the three mountain ridges, Sierra Madre, Caraballo, and Cordillera. Cagayan River flows from Nueva Viscaya and acrosses Isabel, Cagayan Province, and empties into the Babuyan Channel. Shell middens are located along the

Cagayan River, from the mouth to 40 km upriver. So far more than 20 shell middens and one cave are recognized as archaeological sites.

These shell middens are categorized into five groups by its geological location; 1) on the limestone hill beside the river, 50 meters above M.S.L. (Magapit, Bangag II), 2) river bank shell middens, five to eight meters above M.S.L. (Dummon, Gattaran Centro Sur, Aggunetan, Aguguican, Bangag, San Lorenzo, Alaguia, Catugan, Santa Maria, Catayauan, Tocalana, Lal-lo Centro, Dugo, Camalaniugan Centro), 3) inland shell middens, one to two kilometers east from river bank, seven to eight meters above M.S.L. (Bagumbayan, Dalaya, Catayauan II), 4) limestone hill cave, four kilometers away from river bank, 40 meters above M.S.L. (Mabangog), 5) sea shore sand dune shell middens, 0 to five meters above M.S.L. (Aparri).

The limestone hill shell midden (Magapit site) and river bank shell middens (Catayauan site) are mentioned already at the brief history of the research. Inland shell middens are so far recognized three sites. Although the excavation of the sites are not yet performed, pottery sherds and polished stone adzes were not collected during the site reconnaissance survey. There is the possibility that these shell middens had formed before the appearance of pottery in the area.

## **2. Scenery of shell middens**

The explanation of natural settings and history of research area start from the mouth of Cagayan River. River delta is developed on the east bank from the mouth of river to 10 km upriver. Limestone formation stops at the boundary of delta. It is supposed that the boundary of delta and limestone had been the sea shore before the delta developed (Ooi 1996: personal communication). The width of river is 1.5 km at the mouth and 1.25 km at the boundary.

The town of Camalaniugan was built at the boundary of delta and limestone formation. The bell of Camalaniugan Church has the date of 1597 (National Historical Institute 1993). Juan de Salcedo and Don. Juan Ronquillo's expedition in the northern Luzon had performed since 1572. After the suppress of two times of rebellions raised in the Lower Cagayan River, Dominicans had engaged in missionary work from 1596. The tower to keep watch the raiders or pirates making attack from the mouth of river has been built situated on the river bank, in Camalaniugan Centro, 200 meters north of the church. The ruin of the Watch Tower remained as a historical marker of Spanish time. Shell deposit extends about 500 meters long, 50 meters wide, in the town of Camalanugan Centro. Chinese blue and white porcelain sherds were collected from the surface ground. Shell gathering has been performed by Ibanag people of this town.



Dugo shell midden is situated on the former river bank, one kilometers south of Camalaniugan Centro, along the west side of National Highway No. 5. Present river bank is formed about 500 meters east of the site. Cortez site, one of the location to be excavated by National Museum. The excavation indicates that the shell deposit showed more than one meter deep (Orogo 1980).

Water level of Cagayan River is affected by the raise and fall of sea tide. Water control of the Coast and Geodetic Survey measures the difference of low and high tide water level as 155 cm every six hours 42 minutes (Bureau of Coast and Geodetic Survey 1971, 1982).

Lal-lo Centro is located seven kilometers south upriver. The river width here becomes narrower, but it measures about 800 meters. Alluvial plain of Lal-lo extends two or three kilometers on the east bank, and the limestone formation continuing from Camalaniugan to southward retreats here and comes out at Magapit on the river bank. On the alluvial plain, paddy field extends now a day. Shell deposit extending area is recognized as 500 meters long, 100 meters wide and two meters deep. Stratigraphy of shell deposit is observed on the wall of well drilled in the town.

Town of Lal-lo had been called as Nueva Segovia, and capital of Cagayan province until 1839. Nueva Segovia was originally built by Juan Pablo Carion in 1582 during the first era of Spanish expedition (Morga 1966 : 52, 302-3, Keesing 1962:168-181). Defeating the Chinese and Japanese pirates at the mouth of river, Carion secured the first Spanish settlement on the lower Cagayan River. Nueva Segovia became a administration, military, economy and religious center of present three provinces, Cagayan, Isaberra and Nueva Viscaya. But in 1755, diocese was transferred to Vigan, Ilocos Sur, and the capital of Cagayan also transferred to Tuguegarao, present capital of Cagayan, in 1839 (National Historical Institute 1993:81, 124). The economic and political importance of Nueva Segovia had lost gradually, now it is called by its Ibanag name, Lal-lo.

Historic documents indicate that the first settlement of Nueva Segovia built by Carion was located at eight miles from the river mouth. Eight miles is equivalent to 13 km (Morga 1966, Keesing 1962). But at present, it measures 17 km from the river mouth to Lal-lo. If the historic records are correct, why does generated the four kilometers difference for 400 years. After 400 years, if the delta had developed for four kilometers, the rate of delta development must be one kilometer for one hundred years.

According to the research of palinology and geology group, before the delta was formed, limestone hill had been washed by sea tide at Camalaniugan. At the same period, Lal-lo area of the lower Cagayan River had been swampy, and the river had flowed slowly (Ooi 1996; personal communication, Aguilera 1996). The beginning of the formation of delta must be caused by the faster flow of the river, and washed away the

muddy soil of swamp deposited at Lal-lo area to the sea. The cause of the faster river flow possibly to be derived by the sea level change.

Ecological and geological settings of the Cagayan River affect the conditions of shell habitat, also the formation of shell middens along the river. Shell middens of research area are formed predominantly by one species of freshwater bivalve shell, locally called Kabibi (possibly *Batissa childreni*, Toizumi 1996; personal communication). The habitat of this species of shell is sandy river bed, not muddy swamp bed. Then, when the ecological settings of the area had been swampy, Kabibi shell could not inhabit there, therefore, shell middens also could not be formed. This assumption must be tested by the further collection of data on geology and palinology.

Catayauan shell midden is located four kilometers upriver from Lal-lo Centro. Shell midden extends 500 meters long, 100 meters wide and two meters deep. Catayauan village is now populated by about 500 families, 2,500 population and 100 families are Ibanag shell gatherers. Ground surface is covered by shells, and houses are built on the white shell ground. Shells have been collected and discarded for long years and huge shell midden are formed. In San Lorenzo and Catugan village in front of Catayauan also have huge shell middens on the river bank.

Santa Maria shell midden is situated two kilometers upriver from Catayauan. In Santa Maria, the formation of shell midden is different from the one of Catayauan. Shell middens here have ten meters diameter, two meters deep and extends on the river bank, every 30 to 50 meters intermittently in a area of one kilometer long. The different type of the formation of shell middens in Santa Maria and Catayauan could be caused by the difference of shell gatherer's social organization, population density or utilization of shells. But the actual condition must be continuously studied.

At Magapit, the width of river becomes suddenly narrower, about 400 meters, at three kilometers upriver from Santa Maria. This is because at Magapit, the limestone formation across the river and extends to westward, and the river cut through the limestone formation. Magapit shell middens are situated on the east bank of the river, in the different locations on limestone hill. Five locations of shell middens are recognized in 800 meters of distance along the National Highway. Hill Top site above mentioned produced big amount of artifacts and ecofacts including red-slipped pottery sherds. The datings of Hill Top site shows about two thousand years older than Catayauan shell midden which produces the black pottery.

Bangag shell midden is located on the alluvial plain on the west bank of the river, in front of Magapit sites. Site area extends 100 meters diameter and deepest deposit measured 2.8 meters. The location of Bangag site is alluvial plain deposited on the

limestone bedrock, one hundred meters away from the river shore. Bangag shell midden formed mound one or two meters higher than the level of surrounding ground surface. Black pottery produced here has decoration of incision, hum-like handle, but black pottery from Catayauan, Santa Maria and San Lorenzo usually has no incision. The limited evidence of black pottery from Catugan site is similar to the decoration of black pottery from Bangag site. Even though among black potteries exist the different characteristics, both of them might belong to the Metal Age pottery, comparing with other Metal Age potteries in the Philippines.

Other shell middens are recognized on the west bank of Cagayan River; San Lorenzo, Catugan and Alaguia. San Lorenzo and Catugan are located on the river bank, and face to Catayauan and Santa Maria on the other side of river. Stratigraphy of shell layers are exposed on the wall of river bank. Alaguia shell midden is located on the tributary of Cagayan River, and exposes more than two meters of shell deposit on the riverside. Black pottery is collected from those three sites. San Lorenzo and Catugan sites are already excavated and revealed two shell layers on the river bank wall face to the Cagayan River. After having excavated the second lower level of shell layer, red-slipped pottery sherds were revealed in the silty clay layer from those two sites. Red-slipped pottery sherds revealed under the shell layer are also recognized in Santa Maria and Bangag site. The characteristic difference of red-slipped pottery between Magapit and these sites is on the decoration; the former has dot punctuation and incision, but the latter has no decoration except perforation on ring-foot. But some pottery form is similar, such as Footed bowl type and Jar type pottery. Chronological order of these two types of red-slipped pottery is still unknown at this stage of research. But it is interesting that before shell middens were formed on the both side of river bank, red-slipped pottery had been used by the people living on the both side of the river. At this period, the ecological setting of the river was not good for the habitat of shells. There had been the swampy ecological conditions as mentioned above. With the collaboration of geological and palinological studies, chronology and subsistence study of the red-slipped pottery phases will be examined and studied.

### **3. Climate and ecological settings.**

On the climate of the lower Cagayan River, the atmospheric temperature is 29.1 degrees at highest (in May) and 23.2 degrees at lowest (in January), and the annual average temperature is 26.7 degrees. Total amount of annual precipitation is 2,178.4 mm, it reaches at the highest peak in November, and the lowest in April (Fig. 2, National astronomical observatory of Japan 1995:136-7,180-1). The width of the river at the each

shell middens mentioned above should be summarized here; Appari, 1.5 km, Camalaniugan, 1.25 km, Lal-lo Centro and Catayauan and Santa Maria, 800 meters, Magapit, 400 meters and Dummon, the shell midden site of south end, 1 km. The sand bars are formed along the lower river, and at the other side of Lal-lo Centro big sand bar island is developed. The river activities to bring sand, stone and silt downriver rapidly form the sand bars along the river bank. Especially after typhoon, sand bars are developed and emerge different shape. During more than one decade of our research, sand bars have changed its shape little by little. Even though thus strong river activity to bring and deposit soil, the depth of the river keeps five to seven meters at the deepest point.

It is supposed that the natural conditions of shell gathering ground change annually or daily. Topography of river bed directly affect to the habitat of shells and fishes. Every year, from August until November, typhoon changes the topography of the river bed, and new fishing ground is formed. The sea tide changes twice a day, sea water comes into the river up to Magapit. The water level difference of low and high tide is 155 cm at Camalaniugan. The daily tidal change affects the salinity and temperature of river water, and these changing conditions affect also the shell and fish habitat. Shell gatherers in the research area read everyday the changes of those natural conditions and select the gathering point.

Shell gatherers say that the tide comes into Magapit, 26 kilometers upriver from the mouth. It must be caused by the gentle inclination of the river at this area, ten meters of level difference for 40 kilometers distance. Our measurement of salinity of the river at Catayauan village shows less than one percent, even though shell gatherers say the salinity of river water affect to the habitat of shells. So far, we don't have precise data of salinity of the river, but it could be possible to estimate the habitat area of each shell species by the information of shell gatherers. It indicates that the habitat of three major species of shells Kabibi, Asisi and ginookan (Ibanag term), is different as showed in Figure 4. The habitat of Ginookan is smallest, and Asisi can live widely in freshwater, Kabibi can be gathered from Camalaniugan to Gattaran. Comparing the population in 1846 and 1948, total population of Cagayan became seven times (Keesing 1962:216-7). Although eighty percent of population in 1948 was Ilocano, Ibanag population didn't augment so much. Ibanag population growth rate during 100 years is very low comparing with the high growth rate in all region of lowland Philippines. This event was derived from the Ilocano migration to Cagayan and they pushed Ibanag people to the southern region of Cagayan (Keesing 1962:218-9).

Shell gathering village population also has been augmented gradually by Ilocano

migration. At present, the population of Ilocano is bigger than Ibanag. But the shell gathering is performed by Ibanag people. Ilocano usually doesn't perform the shell gathering except some Ilocanos in San Lorenzo village. Although Ilocano migration pushed Ibanag people to southern Cagayan, now population is mixed in the villages of the lower river, even Ilocanos are majority. There must be existed the regulation mechanism to avoid the conflict in this situation of mixed population.

#### **4. Shells for gathering and midden formation.**

Shell middens in shell gathering village is situated on the Cagayan River bank, and formed predominantly by one freshwater bivalve shell. Other shell species from middens are two freshwater bivalve, three freshwater conical shell and land snails. Characteristics of three freshwater bivalves are as follows;

**Kabibi**(possibly, *Batisa childreni*): size of Kabibi gathered varies from six centimeters wide, five centimeters long and three centimeters high to 2.5 centimeters width, two centimeters long and one centimeter high. Wet weight of big one with shell measures 55 grams. Shell middens explored in the lower Cagayan River formed predominantly by Kabibi. Kabibi's habitat extends from Camalaniugan to Gattaran (40 kilometers from the mouth of river, Fig. 3), and Kabibi is annually gathered, even there is the fluctuation of monthly catch amount. Annual catch amount also shows the fluctuation, such as in 1986 to 87 the amount became few, but in early 90's it became a lot. The factors affect the rise and fall of biomass and the catch amount of shells are still unknown. Kabibi gathering is a main subsistence ways of shell gatherers in the area, and they sell most of their catch to brokers living in the village. Shell brokers are usually women. They bring those shells bought everyday to the towns in the lower river and sell in the markets. Shell gatherers today usually don't eat shells, therefore they don't discard shells to form shell middens.

**Asisi**: Average size of Asisi measures 1.5 centimeters wide, 1.5 centimeters long and one centimeter high. This shell species distributes in freshwater all over the Philippines. In Tgalog, it is called tulya. Asisi can be collected big amount in one time gathering, but in rainy season, the catch amount falls down. Shell gatherers tell that they began to gather Asisi recently, before few decades. And the reason why they began to gather Asisi is the shortage of Kabibi catch amount. Asisi became the substitute of Kabibi. Excavation data of shell deposit shows that Asisi is revealed mainly from the surface ground, but the deeper in layers, the fewer the frequency (Table 1). Asisi is also gathered for cash. The amount to be consumed by shell gatherers is also few, but shell of Asisi is discarded in the village. It is not because that the Asisi consumption by shell gatherers, but because that shells are removed for selling at higher price. Watching the surface ground of shell

gathering village, new shells of Asisi can be observed.

**Ginookan:** Average size of Ginookan measures 2.5 centimeters wide, 1.5 centimeters long and 0.8 centimeters high. Its shell is thin. According to the shell gatherers, its habitat ranges from Lal-lo Centro to Santa Maria(Fig. 3). The habitat area Ginookan can be gathered is smaller than the one of Kabbi. Therefore its catch amount is also limited. Quantitative data of Ginookan gathering and transaction are not yet fully collected. But it is said that Ginookan has short life, not so strong like Kabibi, and can not last for two days after having been gathered. So, Ginookan is not appropriate to sell in Markets far from this area. And sometimes it is served for self-consumption in a household. It is sometimes processed to remove its shell by boiling, and sold its meat. The meat processed to "alamang", a local seasoning. Shells removed and consumed are discarded in the village.

Other three species of freshwater conical shells (Agurong, Liddak, Biruko) and land snails are found from shell middens. But its amount is limited.

### **III. Results of archaeological research.**

Before to start the discussion, it must be needed to summarize the results of archaeological data obtained from the research of the sites.

1. The research area extended from the north of the Cagayan River to the northern coast of Luzon for a distance of 45 kilometers upriver. The sites, so far, revealed by the archaeological research can be grouped into seven basic categories by its location and characteristics(Aoyagi et al. 1989:105, Ogawa and Aguilera 1992).

(a) Shell middens along the Cagayan River bank (five to seven meters above M.S.L.). Big size shell middens (extended more than 100 meters, more than two meters deep of shell deposit); Santa Maria, San Lorenzo, Catayauan, Catugan, Lal-lo Centro, Cortez, Camalaniugan Centro Sur.

Small size shell middens (about 50 meters diameter, one to two meters deep of shell deposit); Dummon sites, Aggunetan, Gattaran Centro Sure, Aguiguican, Tocalana.

Shell mound site: (Shell midden extending in a area of 100 meters of diameter, situated on the river bank sediment but not along the river side, forming shell mound of two meters high); Bangag.

(b) Limestone hill slope shell middens ( 10 to 50 meters above M.S.L.); Magapit sites, Bangag II.

(c) Limestone hill burial site (50 meters above M.S.L.); Malanao.

(d) Inland shell middens (located on the alluvial plain, 7-8 meters above M.S.L., 1-1.5

- kilometers from the Cagayan River bank);Catayauan II, Dalaya, Bagumbayan
- (e) Shell midden on the river bank of tributary of the Cagayan River(seven meters above M.S.L.);Alaguaia.
  - (f) Cave site(40 meters above M.S.L., shell midden is formed in the cultural layer);Mabangog.
  - (g) Coastal sand dune shell middens(one to three meters above M.S.L.);Appari.

The excavated sites are eleven localities of seven sites; Magapit(Hill Top and Cliff site;Aoyagi et al. 1988, 1989, 1991, 1992, Tanaka 1993a, Aoyagi, Ogawa and Tanaka 1997), Bangag(Tanaka 1997b, Bautista 1996a, 1997), Santa Maria(Irigayen site;Orogo 1995, de la Torre 1995, 1996, 1997, Bautista 1996c), San Lorenzo(Magundayao site;Aoyagi et al. 1989, Siriban site),Catayauan(Catayauan site;Aoyagi et al. 1988, Ogawa 1997, Sison site;Garong 1996a, Conciso site:Garong 1996b), Catugan (Dombrique site;Tanaka 1997a, 1998, Bautista 1996b) and Mabangog Cave.

2. The shell middens are predominantly composed of one species of fresh water bivalve shell, possibly *Batissa childreni*, locally called *Kabibi*, except at the Appari sites where the shells are predominantly marine. Local people living on the Cagayan River bank, like village of Catayauan, San Lorenzo, mostly Ibanag people, are performing the shell gathering of *Kabibi* and other two species of fresh water bivalve shells, locally called *Asisi* and *Ginookan*. The supply for the shell midden formation by the disposal of shells is mostly stopped at this moment in these villages, because of commercial transaction of shells in the market places out of village(Ogawa 1997).

The percentages of shell and soil ratio of shell middens were measured by the weight in each layers. The results show that the percentages of most shell layers are ranging from 70% to 95% except the surface of shell midden. High percentage of shell ratio of midden layers might indicate that the discard of shells to midden were performed big amount at once.

3. At the river bank sites excavated(Bangag, Santa Maria, San Lorenzo, Catugan and Catayauan), two cultural layers are recognized; the upper one is shell midden and the lower one is silty clay layer. And the shell middens produce the black pottery, and the silty clay layers produce the red-slipped pottery without decorations. The difference of these cultural layers is distinctive, so that the typological changes of pottery or other kind of artifacts, and the changes of ecological settings and subsistence strategy must be existed between these layers.

4. Results of site excavations and explorations; As mentioned above, the archaeological sites like shell middens and other sites, so far, excavated are eleven localities of seven sites. The materials revealed from these sites are categorized into many categories, but there are particular relationships between sites and materials as follows;

(a)Red-slipped pottery with decorations: Magapit sites produce the red-slipped pottery with decoration of dot punctuation, carbonate inlay and fine incision on the lip, rim, shoulder and carinate part of jar type, and lip and inside/outside of ring foot of footed vessels. This type of potteries are, so far, found only in Magapit sites.

(b)Red-slipped pottery without decorations: The river bank sites (Bangag, Santa Maria, San Lorenzo, Catugan and Catayauan) have two cultural layers, the upper one is shell midden and the lower one is silty clay layer. The upper layer produces the black pottery and the lower one produces the red-slipped pottery without decorations. Red-slipped pottery without decoration shares some vessel form with the one of Magapit sites, such as jars and footed bowls. But the most of vessels from the silty clay layers have plain surface, and this is the distinctive difference of vessels between Magapit and river bank sites. So far, only the round perforation of bowl type ring foot can be seen both in Magapit and river bank sites.

(c)Black pottery with decorations: Shell midden of Bangag site produces the black colored pottery with incision on the shoulder of jar type pottery. The black pottery has the thick vessel-wall, and its color must be derived from the smudging of carbon. After the firing, pots are immediately put into the organic matters like rice husks, and the carbon oozes out on the surface of pottery. Catugan site also produce the incised black pottery.

(d)Black pottery without decorations: Shell middens of river bank sites, such as Santa Maria, San Lorenzo, Catugan and Catayauan produce the black pottery of thick vessel-wall. But these black potteries have the plain surface, without design of incision, and this is different from the black pottery of Bangag. Otherwise some vessel forms of black pottery such as the footed bowl and jar can be seen both in Bangag and these river bank sites. In the shell midden of Catugan site, the sequence of typological change of potteries can be traced; the lowest, red-slipped pottery without decoration, the middle, black pottery with decoration and the upper, black pottery without decoration.



(e)Stone flakes: Chert, andesite, obsidian and limestone flakes are found in these sites. But the stone flakes are rarely revealed from the shell middens. Some chert and obsidian flakes are revealed from the silty clay layer of Santa Maria site. Only Mabangog cave produces a flake assemblage of chert, andesite and limestone flakes (80 pieces /1 m<sup>2</sup>) as shown in the Table 2. For the estimation and recognition of these flakes as a flake tool assemblage, it is needed that further analyses of these flakes on flaking technology and functions as tools. These flakes have the amorphous shape and made by the direct percussion technique. The stone materials of these flakes are popular in the research area, the geological setting of limestone formation.

In the inland shell middens, the artifacts are rarely found, but in Dalaya site, one chert core and flake were found by surface.

(f)Clay earring and pendant: Clay earring from Magapit sites are noticed by its water buffalo (locally called “Tamaraw”) horn shape from the first excavation of the sites, and it became a symbol of the Cagayan Provincial Museum. The cut of earring is positioned at the upper-most, and the lower half has the heart shape (Fig. 8). Also Magapit has the oval shape clay pendants which have a small perforation at the upper portion. Santa Maria site (Irigayen Property) of the silty clay layer produce the clay earring of the different type of Magapit sites. The differences between those earrings from Magapit and Santa Maria are the shape and the position of cut. The shape of earring from Santa Maria is oval and sideways long, not like water buffalo horn, and its cut is positioned at the side. The section of profile is also different; Magapit earrings have the relatively flat profile, but Santa Maria ones have round one.

(g)Stone ornament: A broken part of a small rectangular stone tablet from which a segment has been cut (like “slit”), was excavated from Magapit Hill Top site (Fig. 10). In Santa Maria (Irigayen site), a stone ornament which has the same shape but smaller and the different material (possibly jade) used is found from the silty clay layer. This kind of stone ornament or earring are distributed in the northern coast area of South China Sea, from northern Vietnam, Taiwan until the Philippines Islands. Sa Huynh Culture in the Middle Vietnam has the particular types of earring, and these are distributed in many sites of Southeast Asian islands at ca. 2,000 years BP. Arku Cave in Penablanca Caves produces one of the Sa Huynh type of earrings (Thiel 1989, 1990). But the rectangular shape earrings from Magapit and Santa Maria sites are found in the Bronze Age sites in the northern Vietnam and the Pinam burial site in the southeastern part of Taiwan (Sung 1987, 1989).

(h) Burials and Human bones: As mentioned above, Santa Maria site was, at first, chosen to reveal the primary burial features for the study of composition and sets of the black potteries. At the last field season of the excavation of Irigayen site, the burial pit, primary, extended adult human bones and the associated potteries were revealed without disturbance. On the other side of the Cagayan River, a primary burial pit was also found in Siriban site of San Lorenzo. This burial has the human bones of child and black potteries. And both of these burials were revealed from the silty clay layer. Shell middens in research area also produce the human bones, but mostly these are fragmental, so that the burial features were not recognized yet. The disturbed burials were found in Catayauan(Sison) and Catugan(Dombrique) sites of shell middens, and the grass beads were collected as the associated materials.

Jar burial is also revealed from the shell midden(upper cultural layer) of San Lorenzo(Siriban) site. Some fragmental human bones were contained in the burial jar. The size of this jar is big, but it can not estimate whether this jar burial is secondary or primary burial practice.

Two different funeral practices were revealed in San Lorenzo site, from the different cultural layers; the primary burials from the silty clay layer(lower cultural layer) and the jar burial from shell midden(upper cultural layer). The primary burials with the trade ceramics are also existed in San Lorenzo site, in the same funeral area. These trade ceramics are celadons, blue and white porcelains and brown glazed jars, and belong from 14th to 18th Century. These data on the primary burials with trade ceramics are acquired from the disturbance of pot hunters to the burials. Malanao site is also the primary burial site and the associated materials of trade ceramics, celadon, blue and white and brown glazed jars, belonging to 14th to 17th Century are collected from the surface ground. Tocalana site is the primary burial site and the blue and white porcelains are associated. The human bones are also observed in the soil deposit under the basement of the ruin of the Tocalana Church which was built by the Dominicans missioned from the late 16th Century in Lal-lo, formally called Nueva Segovia. No excavation is so far conducted to these burials, but once start the excavations, the chronological order or the changing process of these different funeral practices will be made clear.

(i) Iron slags: Iron slags are found in Bangag and San Lorenzo(Siriban Property) sites from shell layers. These iron slags indicate the presence of the black smithing in these sites. The result of components analyses of these iron slags suggests that these are remnants of iron smelting, its temperature is ranging from 1,200 to 1,300 centimeters

degrees and the raw material is not the iron sand(Uchida personal communication 1997). If not the iron sand, the raw material is possibly the iron ore. It is informed that the iron ore had been mined at Alacapan, about 10 kilometers northwest of San Lorenzo. Further research and study on the iron tools manufacturing features will clarify the prehistory of local iron technology, and the process of local political/economical development by the accessibility or monopoly of its resource and high technology.

(j) Stone adze: Stone adze can be found generally in the sites, both in shell middens and in silty clay layers, except in the inland shell middens. All adzes collected and excavated are broken pieces, but it shows same characteristics of quadrangular section of profile. Some chisels were rejuvenated from the broken piece of adze. Also many stone adze rejuvenation flakes which have the polished part on the dorsal surface of flake were found in the sites. By the excavation of Mabangog Cave, only one rejuvenation flake was also revealed from the backfill soil of disturbed area of cave.

(k) Ecofacts: By the 7mm dry mesh strainer and water floatation of sample spots(20 x 20 x thickness of layers cm), organic matters like faunal and floral remains were collected. The identification of data will present many environmental information like its habitat, and these information will indicate the human activities for their subsistence, such as that the particular micro-environments provide the unique resources to the social groups, then the accessibility to these resources will affect to the economic, social and political relationships among these social groups. The one of the reason of the research on shell middens is the preservation of organic matters in better condition than soil matrix. The shell middens produce many ecofacts but the soil layers a little.

The data is huge amount, and so far, the identification of animal bones is ongoing. The problem is the lack of references for the identification, such as plant seeds and fish bones. For these references, the sample collection must be conducted. The ethnoarchaeological research on the local hunter-gatherer, shell gatherer and farmer includes this kind of ecological research.

(l) Trade ceramics: Trade ceramics are collected from the most of river bank sites. These ceramics can be separated into two groups. The ones belong to 14th to 15th Century, the others belong to 16th to 17th Century. Most of these are made in China, and the former group of ceramics are the Longquan kiln type celadons, the latter group of ceramics are the Fujian or Guangdong kilns made blue and white porcelains. Among the former group, there exist the celadon bowls made in Go Sanh kiln, Binh Dinh Province,

middle Vietnam, so-called "Champa Ware" (Aoyagi and Ogawa 1992, Aoyagi et al. 1992, 1995, Yamamoto et al. 1993), which are recently found, more than 7,000 pieces, in the Pandanan shipwreck site of Southeastern Palawan Island.

Between two ceramic groups, there is the lack of one group of ceramics which were commonly excavated in the Calatagan primary burials, so-called "Calatagan Type" ceramics belong to the late 15th to early 16th Century, Jingdezhen kiln type blue and white porcelains (Fox 1959, 1967, Aoyagi 1991, 1992, Tanaka 1993b). Both two groups of ceramics are crudely manufactured for the daily utensils.

4. Features: The features in the Lalo-lo archaeological sites are revealed in Santa Maria (hearth and primary burial) and San Lorenzo (primary and jar burial) sites. In Santa Maria (Irigayen site), a hearth, pits filled by shells, a pit discarded wasted pottery and burial pit are revealed. A hearth and shell pits were found on the same horizon at the bottom of shell layers and the top of the silty clay layer. The hearth was made on the horizon of the top of silty clay layer. The hearth has a structure of shallow pit and a burnt clay structure at the edge of pit. The hearth pit was filled with ash, charcoal and burnt soil. The feature of hearth continues from the top horizon of silty clay layer into the shell layer. The section of profile shows that the pit of hearth has the width of 70 centimeters at the top of the pit. The plan of hearth in the shell layer could not be recognized during the excavation, but on the section, the profile of hearth pit in the shell layer could be distinguished and the hearth pit was recognized its continuation from the upper part of silty clay layer to the shell layer. In the shell layer, the section of hearth pit profile shows that it was filled by the burnt shell fragments and both side of the hearth pit profile, the burnt clay layers were observed. This evidence might indicate that the hearth was dug in the shell layer and the wall was fortified by clay.

On the top horizon of silty clay layer, the hearth was surrounded by the mixture of ash, charcoal and shell fragments. The small pits of 10 centimeters of diameter surrounding the hearth were also observed. These pits were filled with shells, so that it was easy to recognize even the small pit plans in the silty clay layer. The evidence of small pits around the hearth indicates the hut was built over the hearth.

The pit of primary burials are needed the big effort to recognize the plan, because it is not filled with shells. The difference of soil color and contents between inside and outside of feature could not be easily distinguished in the silty clay layer. There must be existed the more features in the silty clay layers, because the artifacts like red-slipped pottery sherds, stone adzes were buried abundantly and continuously from the top horizon of silty clay layer until one meter deep. But in the silty clay layer, it is difficult to distinguish

the plan of feature as long as by the eye sight using the criteria of soil color and contents.

5. Cavesite; Apart from the river bank sites, the hinterland or hilly area are also explored and excavated to intend to find the archaeological sites which have the different characteristics of the artifacts, features and settlements in the different ecological settings. Mabangog cave, located on the limestone hill area, about 40 meters above M.S.L., was explored in 1996, then, the presence of pottery and shell were recognized, and in 1997 , two squares(1 x 2 meters) were excavated.

The thickness of soil stratigraphy was thin, 20 to 40 centimeters until the bedrock. The lower layer contained the shell species same as found at the river bank shell middens. The artifacts such as stone flakes, pottery sherds, animal bones were revealed from the shell layers. The stone flakes revealed are chert, andesit limestone flakes and have the amorphous shape and the size is less than five centimeters. Total of 80 pieces of stone flakes were revealed from two squares. The estimation of flakes as stone tool, especially limestone, is needed the technological studies of flaking and the functional studies on size, position/angle/use-wear of edges.

The red-slipped pottery sherds were found from this cave. These pottery sherds have not the decoration of punctuation and incision. This characteristic is similar to the pottery from the river bank sites, not similar to the one from the Magapit shell middens. These pottery sherds, stone flakes and fresh water shells(*Kabibi* ) were revealed from the same cultural layer in the Mabangog Cave. This kind of artifacts composition is the first evidence in the Lal-lo Shell Middens. And this composition of artifacts arises the questions in the context of chronology of artifacts and the ecological settings, of Mabangog Cave.

6. Ethnoarchaeological research on the shell gathering people; The ethnoarchaeological research have been conducted in the shell gathering village of Catayauan, focusing on their technique of shell gathering and fishing, and their knowledge on the natural environment for the model building of the prehistoric subsistence strategy of shell gatherers. The researchers conducted the interview to each household of shell gatherers. One hundred households of sixty eight families have performed the shell gathering activities, and they have four kind of gathering methods. These gathering methods varies from the using of complex gears to the simple hand catching. By the difference of age and sex, economic condition of households, daily changing condition of environment, people choose the adequate methods. The gatherers sell the shells to the vendors who are mostly the housewives of shell gatherers. The domestic consumption of shells gathered is

very limited, so that the disposal of shells to shell middens is also limited. The vendors go to the markets outside of village. The shell gathering is performed for the commercial transaction or cash income, not for subsistence(Ogawa 1997).

The prehistoric catch amount making the shell middens can be inferred from the daily amount of shell catch of Catayauan shell gatherers. It is supposed by even the rough estimation of prehistoric catch amount and demography that the huge volume of shell midden of Catayauan could not be made for 1,000 years. This huge amount of shell midden could not be made by the consumption of shell gatherers only for their subsistence. There must be existed the some kind of processing and exchange or trade of shells, such as the dried shell meat trade to the other social groups. Comparing with the evidences of the prehistoric exchange or trade of shells as a specific resource occupied by the Cagayan River bank people, the models of present gathering activities and commercial transaction of shells must be elaborated. The ethnoarchaeological research is still ongoing to gather more information on the subsistence and commercial activities of shell gatherers for the finer model building of shell gathering and local exchange network .

7. Shellfish growth line studies: The growth lines on the section of Kabibi have been studied by Toizumi. This is the common technique and method in Jomon study of Japan to reconstruct the shell midden formation process and to reveal the seasonal variation of human subsistence activities in annual schedule(Koike 1980, 1986). The result of this study contributes also to the process of shell midden formation. Once the growth line analyses of shell samples from one layer could be clarify the season when the shells were discarded and formed one layer, the depositional history can be reconstructed by the comparison of seasons of the other shell layers in sequence of stratigraphy. It has been difficult to count each growth line because the lines of Kabibi are not clear. But when he abandoned to count the each growth line and pay attention to the recurrent patterns of dense and coarse concentrations of lines, the three different patterns of line concentrations could be extracted. The reason of these different patterns of growth lines supposed to be caused by the different conditions of natural environment such as the salinity of water, temperature and feeds. The experimental excavations for the reconstructive study of the shell midden formation process have been conducted in Catayauan site(Sison and Conciso sites). The excavation and data processing have been performed by Toizumi and Garong in the field(Garong 1996a, b). If the results of analyses on the faunal and floral data extracted from shell layers will correlate to the seasonal change of shell layers in sequence, more detail of subsistence activities might be

clarify.

8. Geological and palinological studies; The research and study on the palaeo-environmental settings have been needed for the subsistence basis of prehistoric people lived in the research area. The change of natural settings like river system, alluvial plains, sea level and vegetation must affect directly to the subsistence activities and strategies of prehistoric people. The Prehistoric human exploitation also had changed the natural settings, such as the retreat of tropical rain forest by the prehistoric farming. If the information of prehistoric natural conditions can be synthesized with the archaeological data, we could reconstruct more affluently and finely the prehistory of this area.

The boring samples were collected from the different geological setting or micro-environments for this study. The analyses of boring samples are still conducting, but the important information on the river bank sediment formation process is presented during the field work. As already mentioned above, the river bank shell middens are situated on the silty clay sediment, and this layer has no shell deposit. There is the distinctive difference between the shell midden and silty clay layer. The silty clay sediment contains red-slipped pottery, so that this is also the cultural layer like shell midden. But the reason why the silty clay layer doesn't contain the shell deposit should be that the shells had not lived when the silty clay layer had been formed. It is supposed that the area had been swampy environment when the silty clay sediment had deposited. When the swampy environment of the area had changed to fluvial by some reason (e.g. sea level progression), the new environmental conditions was accepted by shells as their habitat. The environmental change from swampy to fluvial must affect to the change of subsistence strategy of prehistoric people engaged in the site formations of this area. And the biggest resource must have been the shell for them.

#### **IV. Discussion and further perspectives.**

Synthesizing the results of excavation acquired from each site, we will extract and discuss here the problems on the chronology of artifacts and sites, and subsistence activities or strategies of prehistoric people engaged in the sites formation. Although the analyses of excavated data are not yet fully finished at this moment, extracting the problems or questions from the archaeological data, the perspectives of further studies can be indicated.

##### **1. On the chronology of artifacts and sites.**

In each site, considering the prehistoric ecological setting, the specific problems of chronology of artifacts can be discussed differently. The questions, problems and topics of each site concerning with chronology must be synthesized here, for the further studies of this archaeological project (Table 3).

**(a) Chronological sequence of potteries.**

Before the project was started, the existence of the red-slipped pottery from Magapit and black pottery from Bangag were already recognized. By the excavation of the sites, it becomes clear that these potteries can be divided into four types at least. In Catugan site, the sequence of different pottery types in this research area could be as follows;

1. Red-slipped pottery with decorations (Red I): Magapit sites, from shell middens
2. Red-slipped pottery without decorations (Red II): from silty clay layer of river bank sites
3. Black pottery with decoration (Black I): Bangag and Catugan site, from shell middens
4. Black pottery without decorations (Black II): from shell middens of river bank sites

Except Magapit and Catugan sites, the river bank sites excavated have two cultural layers of Red and Black pottery; Magapit (Red I), Bangag (Red II and Black I), Santa Maria (Red II and Black II), San Lorenzo (Red II and Black II), Catayauan (Red II and Black II), Catugan (Red II, Black I and II). Magapit has only one cultural layer, but Catugan has three, and other sites have two layers. The evidences of potteries and its layers of each site can correlate to one sequence. The evidences from Magapit, Bangag and Catugan can be linked sequentially and this sequential model can be applied to the evidences of other sites. Arranging these potteries in the order of sequence, the hypothetical chronology can be presented as above (Table 4).

The C14 datings of Red. I from Magapit Hill Top site is ca. 3,000BP and the Black II from Catayauan site is ca. 1,000BP. The sequence of these potteries could be ranging from 2,000 years (1). When the datings of other sites and layers will be acquired, the details of typological changes in the chronological sequence can be examined more finely.

**(b) On the Red-slipped pottery from Mabangog Cave.**



Aside from the river bank sites, Mabangog Cave is located on the limestone hill area about 40 meters above M.S.L.. The red-slipped pottery without decoration (Red II) were revealed from the soil sediment on the bedrock of cave. The soil layers contained the Kabibi shells together with Red II sherds. The Red II can be revealed in the silty clay layer of river bank sites. But any kind of black pottery was not revealed. The Red II sherds from Mabangog Cave are similar to the ones from the river bank sites. The problem is arisen here that the chronological contradiction of artifacts associations; at the river bank sites, the silty clay layer produces the Red II sherds, and the shell midden produces the Black I and/or II sherds. But the shell layer of Mabangog Cave produces the Red II sherds. As mentioned at the Mabangog Cave, the questions are arisen in terms of the chronological sequence of artifacts and natural settings.

Q1. How could be the shell midden formed in Mabangog Cave while the shell middens had not been formed at the river bank sites ?

Q2. Where did the Mabangog Cave people had gathered shells while the river bank people could not gather the shells at the Cagayan River because of the swampy ecological and geological settings at the lower river area where the shells could not inhabit at that time ?

Here the chronological problem of artifacts becomes linked with the problems of natural environment and human subsistence activities. If it is confirmed that the Red II sherds from Mabangog Cave are made or imported from the river bank sites and used contemporaneously with the ones from the silty clay layer of river bank sites, the contradiction of chronology and environmental conditions will arise between the archaeological data from Mabangog Cave and river bank sites. When Kabibi could not be gathered in the Cagayan River, where the Mabangog Cave people had gathered Kabibi ? At present, the Kabibi does not inhabit in the tributaries of the Cagayan River. But it can not answer at this stage of research whether the Kabibi had inhabited in the tributaries at the prehistoric time or not.

Another problem is derived from the association of stone flakes and Red II sherds of Mabangog Cave. The Red II sherds are associated with the stone flakes in the shell layer. The evidences of stone flakes from other sites are very limited, and the biggest evidence of flakes is revealed from the silty clay layer of Santa Maria. These are six chert and two

obsidian flakes. Mabangog Cave produces 80 pieces of stone flakes and 60 % of those are chert flakes. For one decade of excavations in Lal-lo, the assemblage of stone flakes have not been found in the Magapit and river bank sites. The biggest number of flakes in one site is found, even six pieces, in Santa Maria, until the excavation of Mabangog Cave. It was supposed that at the beginning of the project, the stone tool assemblage would be associated with the pottery. This kind of situation is inferred by the present circumstances of the contemporaneous existence of the human groups with the different technological background, like farmers and hunter-gatherers in the research area. But the models of interdependence or symbiotic relationships between farmers and hunter-gatherers (Headland and Bailey 1991, Hutterer 1976, Peterson and Peterson 1977, Spielmann 1986) is not easily corroborated by the archaeological data.

The chronological contradictions of artifacts (Red II and Stone flakes) and ecofact (shell) between Mabangog Cave and the river bank sites can derive the questions on the archaeological contexts. The true aspects of long term process of the cultural evolution in this area must be more complicated. But for the next step of the study, the working hypotheses must be presented in terms of the subsistence activities of prehistoric people both in the river bank sites and the hilly area.

1. The different human groups with the different technological background and different way of environmental exploitation existed contemporaneously and utilized exclusively the environment around the site.

2. And these two groups had the economic, social and political relationships through the exchange.

3. One human group had used these two ecological settings properly, then these two sites have the different site functions for the exploitation.

These hypotheses can not be tested or confirmed by the archaeological data at this moment, but in a near future, must be tested through the analyses of artifacts, ecofacts and datings.

**(c) Problem of Black II potteries from the burial pit of Irigayen site, Santa Maria.**

Archaeological problems concerning to the burial of Santa Maria site have two issues; the living horizon of prehistoric people to be buried and the subsistence basis of these

people. The first issue is the archaeological data concerning with the plan of burial pit. To find the plan of features was the most difficult matter of the excavation of this site. Because the differences of soil color between inside and outside of the burial pit in the silty clay layer of this site was difficult to distinguish. The difference of soil was distinguished by the criteria of its color, contents and hardness. After the long examination and comparison of the soil, the oval shape of plan of burial pit was found. The horizon where the plan was found was 30 centimeters below the top of the silty clay layer, and 60 centimeters below the surface ground. During our endeavor to find the plan of burial pit, 30 centimeters of depth of soil was removed for the examination and the comparison of the soil, inside and outside of the pit. Is it really the actual horizon where the people started to dig the burial pit? Examining this problem, the associated materials with burial pit must be discussed here.

The soil filled burial pit did not contained the shells or shell fragments. Only one piece of small fragment of shell was found under the right shin bone. And the Black II potteries were associated with human bones in burial pit. The Black II is revealed from the shell layers above the silty clay layer, and silty clay layer produces the Red II. Both inside and outside of the burial pit contained the Red II sherds. These Red II sheds must not belong to the time of buried person. So that these Red II sherds must be dug and filled by the people who buried the skeletal remains. And these people had used the Black II. Examining these facts and considerations, it is supposed that the burial pit was dug before the site area was not used as the disposal area of shells and other garbage for these people. The people should have lived on the horizon on where they started to dig the burial pit.

The second issue on the subsistence basis of these people is concerned with their living horizon. As mentioned above, when the burial pit was dug, shells were not scattered around the pit. Only one piece of small fragment of shell was found in the pit. But the Black II potteries were associated with the human bones, and again, the Black II usually collected from the shell layers above the silty clay layer. These fact suggest that the people dug the pit had used the Black II, but the site area had not been used for the shell midden or the garbage disposal area for these people. It can not be said that these people didn't practice the shell gathering and form the shell middens at this time. Even only one piece of the small fragment, shell was found in situ from the burial pit. On the process of our excavation of this site, we supposed that the technological back ground of people used

black pottery must be different from the one of people used red-slipped pottery, because the Red II is not associated with the shell layers. The distinction is very clear and abrupt between silty clay layer and shell layer. So that we didn't have supposed the possibility of the transitional period when the site had not been used for the shell midden. But there must be existed the period that people had used this site as the burial site, not for the shell midden site during the Black II had been used. There is not enough data to answer if the shell gathering had already carried the part of their subsistence basis or not.

Same burials associated with Black II potteries were revealed in the Siriban site of San Lorenzo. These burials also performed in the silty clay layer, and the primary extended human body. The burials from these two sites located both side of the river might exist together in the Black II phase. The burials in the shell layer is not yet excavated clearly as a feature at this stage of research. But after the Black II phase, the primary burials associated with trade ceramics are reported in San Lorenzo, Malanao and Tocalana.

By the excavation of burials in Santa Maria and San Lorenzo, the different utilization or function of locality by the same people is inferred. It can not be discussed at this moment where the settlement of these people had been performed.

## **2. On the subsistence of the sites.**

### **(a) Typological change of potteries and the change of river environment.**

In the assumed chronological sequence of the sites, the typological changes of potteries correlate with the site location and environmental and geological changes; limestone hill slope site (Magapit, Red I) to the river bank (Red II), and the silty clay layer (Red II) to shell midden (Black I or Black II). The latter change is supposed by the results of geology group that the river environmental setting were changed from swamp to fluvial. The habitat of fresh water shells like Kabibi is sandy sediment of riverbed. This type of habitat was caused by the result of river environment change from swampy to fluvial. The typological change of potteries from Red II to Black I or II could correlate with the change of river environment. The shells began to inhabit in the sandy sediment of riverbed, the prehistoric people started to explore the shells as a special resource in the area.

But when the typological change from Black I to Black II were caused, people had already explored Kabibi in the river. The changing sequence of Black I to Black II in the

stratigraphy was observed only in Catugan(Dombrique property) site. Both type of potteries were revealed from the shell midden. It is difficult to tell the reason of change between these two black potteries. In the other river bank sites, the Black I is lacked in the sequence and the Red II are revealed from the silty clay layer and the Black II are found from the shell midden. The distribution of Black I is limited in Bangag and Catugan site. But the Black II is found in the most river bank sites except Bangag. Even the subsistence activity of shell exploitation was not changed from Black I to Black II, the demographic change can be inferred by the increase of the number of site.

**(b) Magapit and Bangag, original places of pottery type and its subsistence.**

Two different types of pottery originates at the same locality, on the both side of the Cagayan River. But the location of these sites are different, Magapit is situated on the 50 meters above M.S.L. limestone hill and slope, and Bangag is located on the river bank but not facing to the river and about one hundred meters away from the river side and forming the two meters high shell mound of 200 meters of diameter. Two sites are facing each other on the both side of river. The Red I originate at Magapit and the Black pottery originate at Bangag in the research area. The Red I is found only at Magapit, but Red II is distributed in the most of river bank sites. This pattern of expansion or increase of pottery distribution is same to the increase pattern of the Black pottery. Both types of pottery have the original place and expanded downriver. When the change had come from the Red to Black potteries, it is seemed that the expanded area of Red II had contracted to Bangag of original place of Black pottery. From the inference of expansion and contraction of the distribution patterns of these two types of potteries, the change of demography and subsistence strategy could not be discussed at this moment of beginning of data analyses. But it can be assumed that the typological change of pottery and its distribution should correlate with the environmental change of river, from swampy to fluvial.

Another question is posed on the exploitation of shells at Magapit and Bangag. In the Red I phase, Magapit people had explored Kabibi but Bangag people didn't form the shell midden at the phase of Red II. The localities of these sites are same, only the site location is different. During Magapit people had explored the shells, the downriver from Magapit could not been inhabited as long as it is inferred by the present data. After

Magapit phase, the Red II had expanded to the downriver, the swampy area at that phase. Bangag site has also the Red II in the silty clay layer and Red II is not associated with shell midden. Why the shell became not to inhabit in the river of Magapit-Bangag area when the archaeological phase had changed from Red I to Red II? When the environmental setting of the river was changed from fluvial to swampy, and the habitat of shell also changed from sandy to muddy riverbed, did the Magapit people of Red I phase stop the shell gathering? These archaeological and geological facts suggest that when the Red II cultural layer had been formed in the silty clay layer at Bangag, the river environment of the area could have been swampy. In the process of typological change of pottery from Red I to Red II, the river environment could have changed. Then the Kabibi could not inhabit in the river of Magapit-Bangag area, and the subsistence strategy of people should be changed. And then another question arises; what was the subsistence basis of the people who made the Red II pottery. But there is not enough data to discuss on the question at this moment of data analyses.

**(c) Relationship between Mabangog Cave and the river bank sites.**

We discussed already on the questions or problems of contradictions of the archaeological data from Mabangog Cave and the river bank sites. The Mabangog Cave Red II sherds are associated with shells, but the Santa Maria Red II are not. As long as the Mabangog Red II belongs to the same typological category of the Santa Maria Red II, it can be supposed that Mabangog people had performed shell gathering in the tributary of Cagayan River, near the cave, otherwise they went to the upriver of Cagayan River where kept the fluvial condition and inhabited the shells. But at present, the tributary is not inhabited by Kabibi. It is more possible that the shells of Mabangog Cave had been gathered at the upriver of Cagayan river or the Kabibi had been exchanged with the upriver people. If the model of coexistence of the groups who have the different technological background, like farmers and hunter-gatherers, could be applied to this archaeological context, the exchange relationships of food and goods might be assumed between the river bank people and Mabangog. This kind of exchange relationships can be observed at present between lowland farmers and Ita hunter-gatherers in Lal-lo area. The models must be elaborated by both the archaeological and ethnological data.

Then again, the subsistence base of Santa Maria people becomes questionable. They

didn't or could not explore the shells. But aside from the shell middens, the silty clay layer hardly produces the ecofacts. The subsistence activities of river bank people in the Red II phase must be corroborated by the archaeological contexts, like economic and social network among these sites.

### **III. Conclusion.**

The archaeological data have discussed on the topics of the chronology and subsistence change in the Lal-lo area. The analyses of the collected data are not fully finished. With these limitations, the problems and working hypotheses are presented for the further research. The discussion can be summarized as follows;

1. The chronological sequence of sites is represented by the potteries from each site as Red I→Red II→Black I→Black II. The change of typology of pottery from Red I to Red II is not yet certified by the stratigraphy. But The change from Red II→Black I→Black II is recognized in the stratigraphy of the Dombrique site of Catugan. The Red I, Black I and II are revealed from the shell layer, but the Red II is found from the silty clay layer.

The distributions of sites along the Cagayan River in each phase of potteries show the particular pattern. The pattern of site distribution can be called the 'expansion and contraction'. In the Red I phase, the site, only Magapit is known, but in the Red II phase, the sites are expanded to the downriver on the river bank from Magapit. The contraction is appeared in the Black I phase. The sites of this phase are limited in Bangag and Catugan. And again the expansion of the Black II sites in the downriver. This changing pattern of settlements on the river bank, expansion and contraction, could be related to the demographic and subsistence change.

2. The artifacts are associated with ecofacts in each site; Magapit Red I is revealed with thick shell layer on the limestone hill top ca. 50 meters above M.S.L.. The Red II in the river bank sites are not associated with shell layer, but the silty clay layer. Typologically, these two types of potteries are similar in the form and manufacturing technique. But the difference of subsistence bases of prehistoric people between these sites are abruptly occurred. There must be the environmental change in the habitat of shells in the Lower Cagayan River. The change from Red II to Black I also correlates with the change of shell

habitat of river. The correlation of changes in environment and typology of potteries must derive the change in subsistence strategy of these prehistoric people.

3. The Red II sherds from Mabangog Cave showed the contradiction with the above mentioned correlation between the river environment and the typology of potteries. In Mabangog Cave, the Red II sherds are revealed from shell layer, not from silty clay layer like in the river bank sites. Then the question is posed where the shells(Kabibi) of Red II phase were collected. In the Red II phase, the river environment of Lal-lo area is supposed to be swampy, and it is not adequate for the shell habitat. The Kabibi revealed in Mabangog Cave might be brought from the fluvial river environment, sandy river bed area, upriver from Magapit at that phase. Then the another question is how the Mabangog people have gotten Kabibi away from the Cave. The subsistence bases and social relationships between hilly area and river bank area people must be considered. The Red II sherds and stone flakes from Mabangog Cave and Santa Maria site also must be considered in the same focus of social relationships. The models on the prehistoric interdependence or symbiotic relationships between social groups with different technological background have been built by the studies on the hunter-gatherers and farmers relationships in Palanan, Isabella(Peterson and Peterson 1977), Casiguran, Aurora(Headland and Reid 1989, 1991). The models must be tested by the archaeological data from Lal-lo area.

4. The primary extended burials are found in the silty clay layer in Santa Maria and San Lorenzo. These burials are associated with Black II potteries. The Black II is revealed from the shell layers above the silty clay layer, and silty clay layer produces the Red II. Examining these facts, it is supposed that the burial pit was dug before the site area was not used as the disposal area of shells and other garbage for these people. The people should have lived on the horizon on where they started to dig the burial pit. There must be existed the period that people had used this site as the burial site, not for the shell midden site during the Black II had been used. It must be possibly inferred that the shell gathering had already carried the part of subsistence basis of these people, but the disposal area of shells had been separated from the burial area by these people. Same burials associated with Black II potteries were revealed in the Siriban site of San Lorenzo. By the excavation



of burials in Santa Maria and San Lorenzo, the different utilization or function of locality by the same people is inferred. It can not be discussed at this moment where the settlement of these people had been performed.

The models and hypotheses presented here will be fortified and tested by the results of data analyses and the further studies. Based on the results of this research, the further research will be conducted as follows;

1. The further site explorations in the hilly area; The context of findings from Mabangog Cave is very different from the one of river bank sites. Sharing the same kind of artifacts like Red II sherds and stone flakes between these sites, the economic and social interaction between them can be inferred. For the model building of the prehistoric interaction among social groups, the data from the hilly area away from the river bank is necessary for the further study.

2. The further excavations of river bank sites; The chronology among the different types of artifacts and the subsistence bases of river bank sites is crucial for the bases of this study. The sequential change from Red I to Red II is not certified by the stratigraphic data. The subsistence strategic change from Red I to Red II and Red II to Black I is also corroborated in terms of shell gathering by the further research.

3. The geological research; The reconstruction of environmental history of Lal-lo area will help to consider the chronology and the subsistence change of each site. The change of river environment, swampy to fluvial, could be correspondent to the subsistence change and site formation. In the Red II phase, the river bank sites has no evidence of shell gathering, but the shell middens have been formed after Black I phase until recent. The geological change of river settings will provide the basic information to consider the archaeological context. The iron mine and obsidian resource should be researched by geologist for the economic and social network.

4. The ecological and palinological studies; This research also provide the crucial information on the faunal and floral settings of the researcher and make us possible to

infer the prehistoric natural conditions to be explored by the people formed the archaeological sites. The basic information on the shells and fishes, terrestrial animals and plants in the research area help for the identification of faunal and floral remains from the archaeological sites. The pollen analysis from boring core samples is now ongoing for the reconstruction of changing process of floral conditions in the area.

5. The ethnoarchaeological studies; The models of interdependent relationship between hunter-gatherers and farmers must be elaborated in this research area. So far, the ethnoarchaeological research on this topic have not been conducted. It can be inferred that the result of the ethnoarchaeological studies on the shell gathering people indicates the commercial transaction of shells as food stuff have been performed with other societies. The shell gathering in the villages in Lal-lo area have not been performed self-sufficiently. The social groups had been settled in the different natural setting, such as the river bank, lowland basin, limestone hilly area, sea shore, etc... But each place has not sufficient diversity of resources to satisfy the needs of their members throughout the year. The social network must be existed with outside of their settlement. The interdependence or symbiotic relationship between hunter-gatherers and farmers is one of the significant variations of social exchange of resources. The model built by this study can be expected to apply to the prehistoric context of this area for the explanation of long term co-existence of hunter-gatherers and farmers.

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#### Notes.

1: Two C14 dating are available in Magapit Hill Top Site:  $2,800 \pm 140\text{BP}$  (N-5396, half life: 5,730 年) ,  $2,760 \pm 125\text{BP}$  (N-5397, half life: 5,730 年) , one in Catayauan:  $1,060 \pm 290\text{BP}$  (N-5398, half life: 5,730 年).

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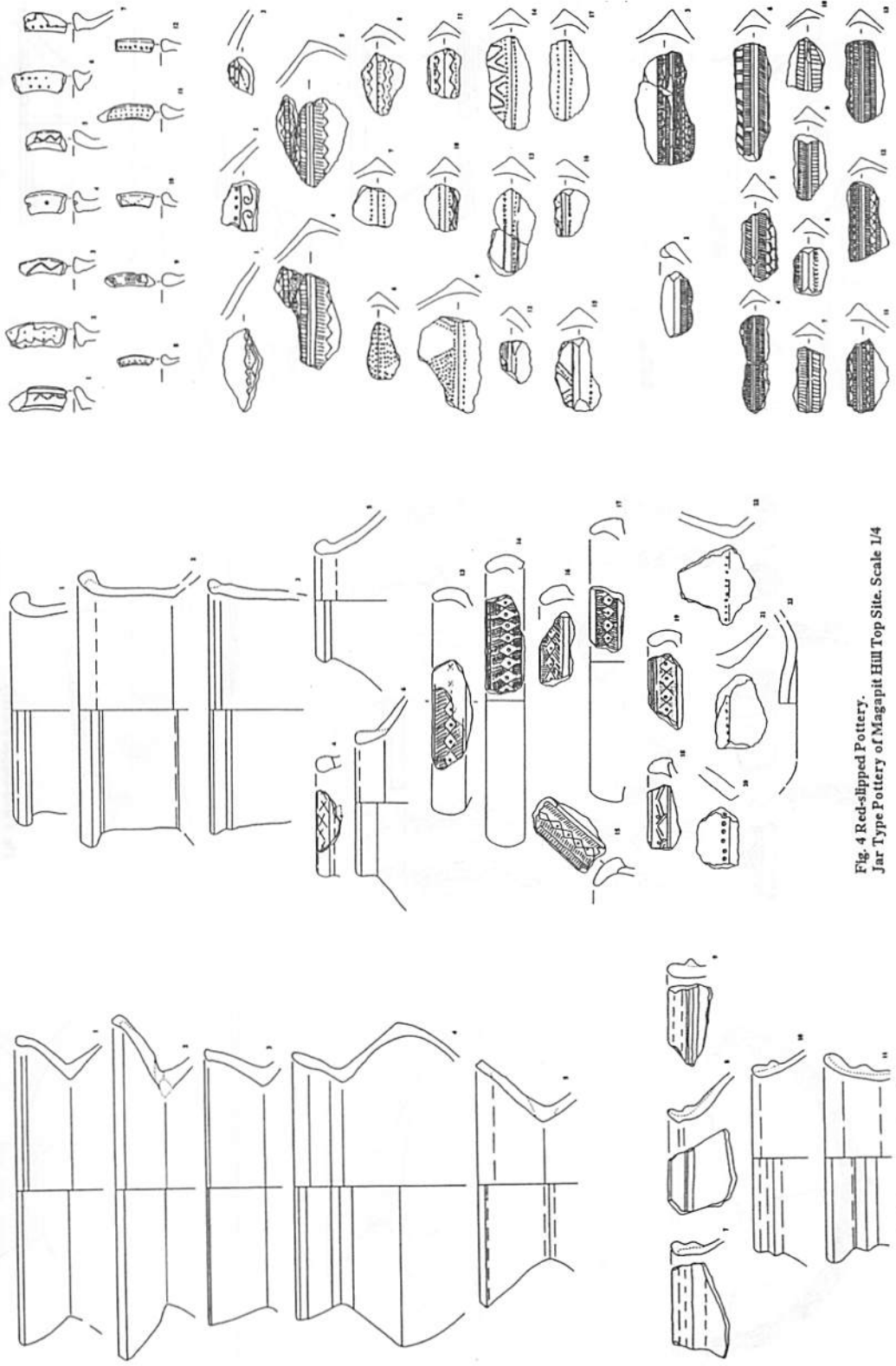


Fig. 4 Red-slipped Pottery.  
Jar Type Pottery of Magapit Hill Top Site. Scale 1/4

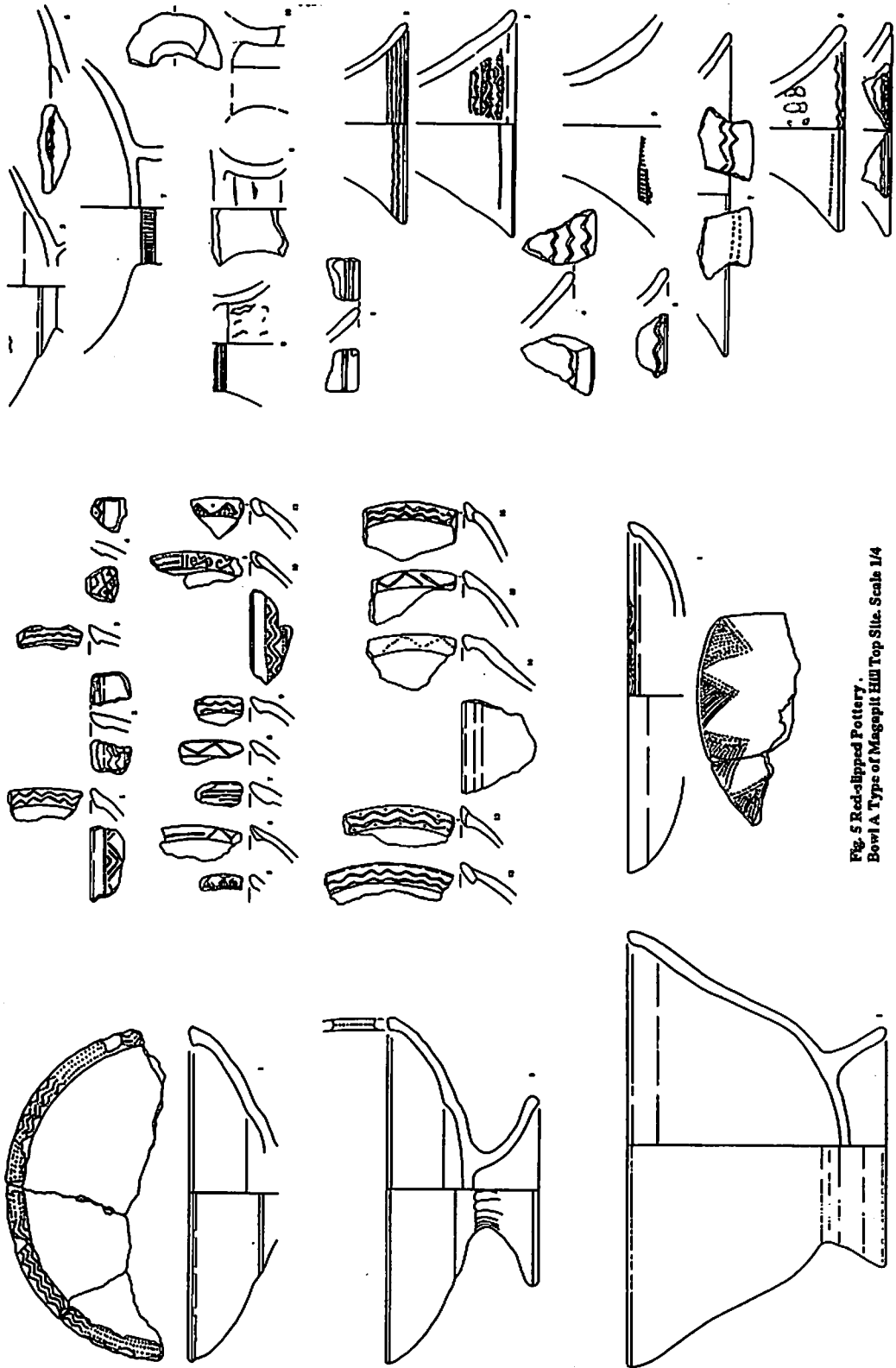


Fig. 5 Red-slipped Pottery.  
Bowl A. Type of Magapit Hill Top Site. Scale 1/4



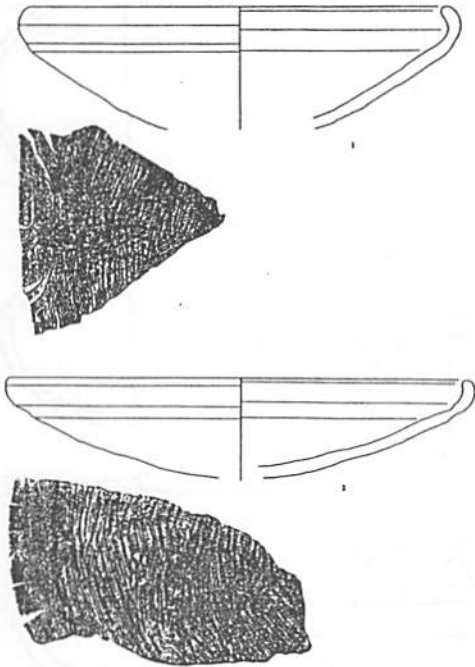


Fig. 6 Bowl B Type of Magapit Hill Top Site. Scale 1/4



Fig. 7 Reconstructed Set of Potteries of Magapit Hill Top Site

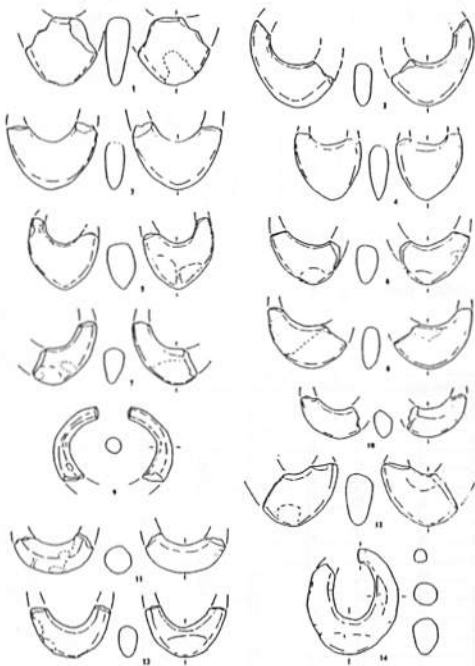


Fig. 8 Clay Earring of Magapit Hill Top Site. Scale 1/4



Fig. 9 Stone Adze of Magapit Hill Top Site. Scale 1/4



Fig. 10 Stone ornament, possibly a part of earring with cut. Scale 1/2

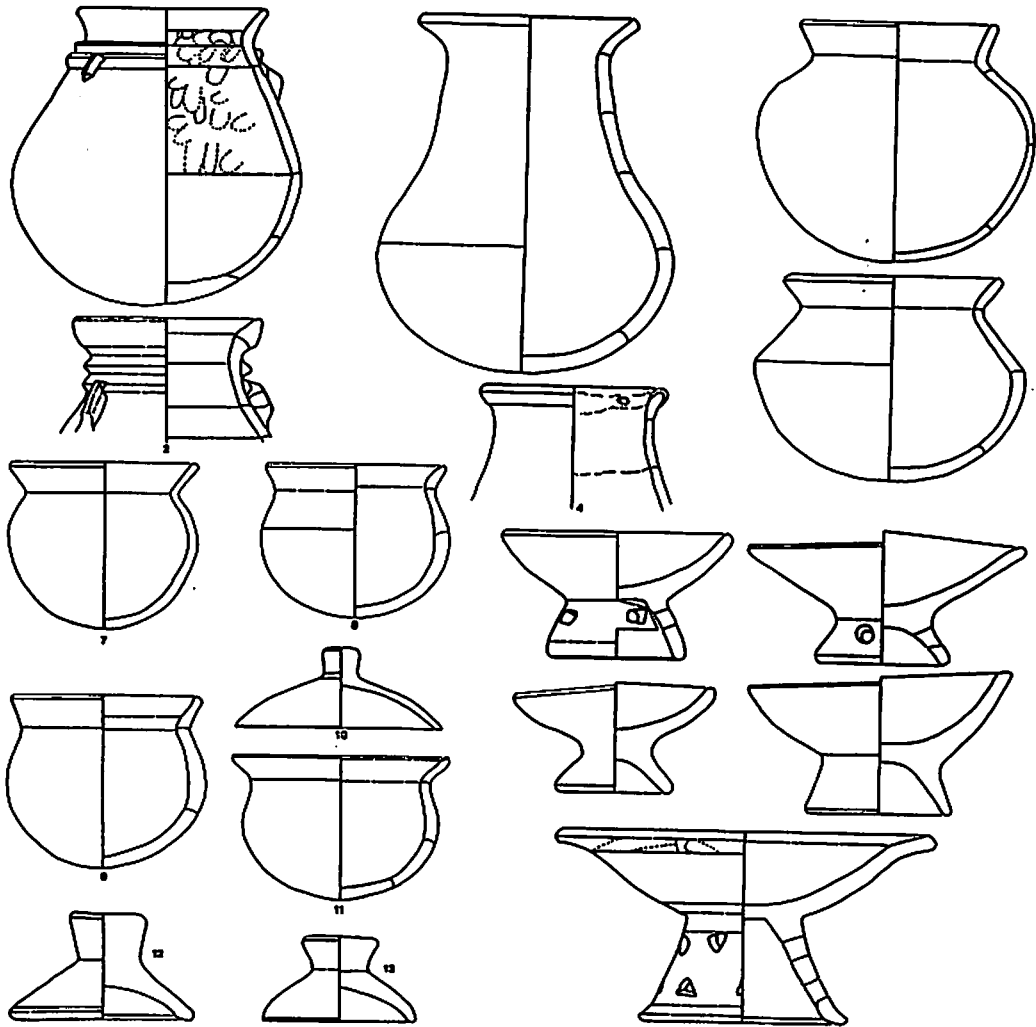


Fig. 11 Black Pottery of Santa Maria. Surface End. Scale 1/4

Table 1. Calapaya Shell Frequency

Layer	Kabibi	Kabibi No.	Asici	Asici No.	Gincohan	Gincohan No.	Agroong	Agroong No.	Binskol	Binskol No.	Lidabak	Lidabak No.	Binskol	Binskol No.
1	24,718	11,650	420	2,260	101	1,820	38	76	72	16	4	10	7	21
2	63,128	23,921	18	44	10	34	21	62	2	1	0	0	10	12
3	24,620	9,254	4	11	14	32	10	24	0	0	0	0	0	0
4	149,718	44,092	10	31	79	275	20	97	1	1	1	1	1	1
A	70,325	21,891	8	10	62	210	38	79	1	1	1	1	5	6
B	25,278	26,920	9	20	110	507	31	63	0	1	1	1	11	4
C	24,978	6,426	0	0	12	107	1	1	0	0	0	0	1	1
D	79,518	23,981	0	0	62	225	12	3	0	0	0	0	0	0
E	21,620	13,251	1	1	21	126	2	6	0	0	0	0	6	0
F	3,800	1,126	0	0	1	2	1	1	0	0	0	0	0	0
G	10,900	3,450	2	4	10	68	1	1	0	0	0	0	0	0
H	44,000	10,220	2	3	12	117	6	0	0	0	0	0	0	0
7	20,100	8,881	1	1	9	64	2	4	0	0	0	0	0	0
8	1,800	240	0	0	1	1	0	0	0	0	0	0	0	0
9	105,820	50,420	2	4	21	104	9	0	0	0	0	0	0	0
10	1,272	518	0	0	0	0	0	0	0	0	0	0	0	0
11	12,320	6,502	0	0	20	205	0	0	0	0	0	0	0	0
12	5,278	2,613	1	1	3	17	1	1	0	0	0	0	0	0
13	13,800	5,056	2	3	13	404	2	2	0	0	0	0	0	0
Ph b	15,182	5,094	2	6	9	51	0	13	0	0	0	0	2	0
Ph v	0,800	2,200	0	0	2	23	2	2	0	0	0	0	0	0
Total	811,420	274,808	64	2,269	600	4,521	210	263	27	12	7	13	40	61
Percentage														
						1,722		263		12		13		61

Kabibi, Asici, Gincohan: freshwater bivalve shells  
 Agroong, Binskol, Lidabak: freshwater conical shells  
 Binskol: shell

**Table 2 Distribution of Artifacts from Mabangog Cave.**

		SQ8				SQ17				SQ10				Dis.	Total
		Sur.	LI.	LII.	Dis.	Sur.	LI,Sp1	LI,Sp2	LII.	Sur.	LI,Sp1	LI,Sp2	LII		
Stones	Chert Flakes	2	5	11	1			8	12			3	5		47
	Chert Nodule								1						1
	Andesite Flake						1								1
	Andesite Nodule														0
	Basalt Flake			1											1
	Limestone Flakes		3	17	3				5						28
	Limestone Chunk								1						1
	Dacite Flake							1							1
	Earthenware	Rim								1					6
neck									5					4	9
Body				1		200		41			25		507	774	
Ringfoot														1	1
Ecofacts	Bones		4	1				5	2					1	13
	Teeth								4				5		9
	Charcoal		3	11											14

Sur.:Surface, LI.:Layer I, LII.:Layer II, Dis.:Disturbed  
 LI,Sp1:Layer I, Spit 1 LI,Sp2:Layer I, Spit 2

Table 3 Distribution of artifacts.

	Pottery				Stone	Clay	Stone	Primary	Jar	Iron	Stone	Trade	
	Red I	Red II	Bla. I	Bla. II	Flakes	earring	ornament	Burial	burial	Slag	Adze	ceramics	
Dumnon		○										●	Dumnon
Gattaran		○											Gattaran
Agnetan		○											Agnetan
Agulglean		○											Agulglean
Magpiti	●					●	●				●		Magpiti
Bangag L.		●											Bangag L.
Bangag U.			●							●	●		Bangag U.
Bangag II.				●									Bangag II. U.
Santa Maria L.		●			●	●	●	●			●		Santa Maria L.
Santa Maria U.				●							●	●	Santa Maria U.
San Lorenzo L.		●						●	●	●			San Lorenzo L.
San Lorenzo U.				●								●	San Lorenzo U.
Catayuan L.		●											Catayuan L.
Catayuan U.				●								●	Catayuan U.
Alapia				●								●	Alapia
Catagan L.		●											Catagan L.
Catagan U.			●	●									Catagan U.
Malanao								●				●	Malanao
Tucalana								●				●	Tucalana
Lal-fo				●								●	Lal-fo
Cortez				●								●	Cortez
Camalanagan				●								●	Camalanagan
Catayuan II													Catayuan II
Dalaya					●								Dalaya
Bagumbayan													Bagumbayan
Mabangog Cave		●			●						○		Mabangog Cave
Appari												●	Appari

●:present, ○:possibly present, Red:Red-slipped pottery, Bla.:Black pottery  
L: Lower layer:silty clay layer, U: Upper layer:shell layer

Table 4 Correlation of artifacts distribution and ecological settings.

	Red.I	Red.II	Flakes	Bla.I	Bla.II
Magpiti	●				
Bangag L.		●			
Catagan L.		●			
Santa Maria L.		●	●		
San Lorenzo L.		●			
Catayuan L.		●			
Mabangog		●	●		
Bangag U.				●	
Catagan U.				●	●
Bangag II. U.					●
Santa Maria U.					●
San Lorenzo U.					●
Catayuan U.					●
River ecology	Swampy → → Flowing				

● : present

Red:Red-slipped Pottery, Bla.:Black Pottery

L:Lower, shell layers, U:Upper, Silty clay layers

Magpiti C14 dating:2,800 ± 140BP, 2,760 ± 125BP

Catayuan C14 dating:1,060 ± 290BP