

**Prehistoric Trade and Culture Contact  
Between Bukit Tengkorak and Other Sites  
in Southeast Asia and the Pacific Region**

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## **INTRODUCTION**

This paper describes the initial results of my research project entitled "Prehistoric trade and culture contact between Bukit Tengkorak and other sites in Southeast Asia and the Pacific region". It presents the research activities and findings during the first year of the project from 2002-2003 and a brief overview of the background of the research project, the research aims and methodology as well as plans for future research.

## **RESEARCH BACKGROUND**

Briefly, the archaeological research at Bukit Tengkorak in Sabah, Malaysia began as my PhD research in 1994-1995, which was completed successfully in 1997. The research produced new and important findings on the prehistory Bukit Tengkorak in Southeast Asia, in particular new insights and theories on prehistoric movements of people as well as long-distance sea trading and exchange in island Southeast Asia and the Pacific region. The research also revealed a major ancient pottery-making site at Bukit Tengkorak and the longest sea-traded obsidian in the world, over a distance of 3,500 km, at around 3,000-5,000 years ago (Chia 2003, Chia 2003a, Chia, 2001, Vandiver & Chia 1997, Tykot & Chia 1997).

The previous research at Bukit Tengkorak, however, had raised several important issues and questions on the archaeology of Southeast Asia and the Pacific that need to be resolved (Service 1996). Some of the main issues and questions include the dating of obsidian artefacts excavated from Bukit Tengkorak, the type of people who inhabited Bukit Tengkorak and other sites in the southeastern coastal region of Sabah, the origins of the Bukit Tengkorak obsidian artefacts and pottery sherds that have yet to be traced to any sources or origins in Southeast Asia and the Pacific region as well as the factors leading to the movement of people, trade or exchange between Bukit Tengkorak and island Southeast Asia and the Pacific region during the prehistoric times.

## **RESEARCH AIMS**

Bukit Tengkorak and the Semporna region in Sabah is regarded as an important archaeological area in Southeast Asia because it has great potential to generate new data in order to answer the numerous issues and problems related to the prehistory of Southeast Asia and the Pacific region. The present research project hopes to be able to resolve these issues and questions and to provide significant contributions towards the understanding of the prehistory of Bukit Tengkorak in island Southeast Asia and the Pacific region. The main aims of the present research project, therefore, will include the following:

- (i) To identify and to locate prehistoric settlements in Bukit Tengkorak, the Semporna region and other areas along the southeastern coastal region of Sabah, Malaysia.
- (ii) To determine and to map the ancient sources, trade or exchange routes of archaeological materials, in particular obsidian artefacts and pottery between Bukit Tengkorak and other contemporaneous archaeological sites in island Southeast Asia and the Pacific region.
- (iii) To find answers to the questions of the origins and factors leading to the development of interregional contact, movement or migration of prehistoric people, and prehistoric trade or exchange routes between Bukit Tengkorak, the southeastern coastal region of Sabah and other sites in Southeast Asia and the Pacific region.

## RESEARCH METHODOLOGY

The research project uses a multi-disciplinary approach on a regional basis that involves not only archaeologists but also scientists such as geologist, geographer, geochemist, archaeochemist, palaeo-anthropologist, and zoologist from Malaysia, Indonesia and the Philippines. Such multi-disciplinary and collaborative approach on a regional scale will not only be able to provide more data but also a more holistic and complete picture of the prehistory of Bukit Tengkorak in the southeastern coastal region of Sabah as well as its relationships with other sites in island Southeast Asia and the Pacific region.

The research project will be carried out in several phases over a period of three years. The various phases of the research methodology include:

- (i) Archaeological surveys at Bukit Tengkorak and the southeastern coastal region of Sabah in order to identify and to locate prehistoric sites and settlements as well as to locate sources of raw materials such stones and clays used to make the numerous stone tools and pottery.
- (ii) Archaeological excavations at Bukit Tengkorak and potential sites identified during the surveys to obtain primary data such as *in-situ* association of artefacts, radiocarbon dating and soil samples in order to provide answers to questions related to site interpretation, dating, and trade or exchange.
- (iii) Morphological and scientific analyses of the excavated artefacts and non-artefacts such as radiocarbon dating, identification of animal and plant species, and chemical analyses of pottery and obsidian artefacts.
- (iv) Travel to archaeological sites, museums and research institutions in island Southeast Asia (Indonesia, the Philippines and Melanesia) to conduct comparative studies with similar artefacts found at other contemporaneous

sites in island Southeast Asia and the Pacific region. The travel also hopes to be able to obtain obsidian samples from different archaeological sites or source areas, particularly in Indonesia, the Philippines and Melanesia, for chemical analyses in order to fingerprint their origins and the trading or exchange routes in Southeast Asia and the Pacific region.

## **RESEARCH ACTIVITIES AND RESULTS**

The research activities covered during the first year of the project from 2002-2003 included archaeological fieldwork in Semporna, Sabah and the analysis of the artefacts and data recovered from the surveys and excavations at the sites of Bukit Tengkorak, Melanta Tutup, and the Semporna region of Sabah, Malaysia.

### **Archaeological Fieldwork**

Two seasons of archaeological fieldwork were carried out in 2002-2003 at Bukit Tengkorak and the Semporna region in Sabah, Malaysia. The fieldwork comprised archaeological and geological surveys in Semporna as well as excavations at Bukit Tengkorak and Melanta Tutup - a new archaeological site discovered during the first season of survey (Figure 1). The archaeological fieldwork was conducted by a team of researchers, headed by the author, from the Centre For Archaeological Research Malaysia at the University of Science Malaysia, Penang in cooperation with technical staff from the Sabah Museum Department and geologists from the Mineral and Geoscience Department of Malaysia in Kota Kinabalu, Sabah as well as local villagers from Semporna, Sabah. Dr. Truman Simantunjak, our co-researcher and the head of the Prehistory Department of the National Research Centre of Archaeology in Jakarta, Indonesia joined us briefly during the first season of our archaeological survey and excavations at Bukit Tengkorak in Semporna, Sabah.

### **Archaeological Surveys**

The two seasons of archaeological surveys were conducted simultaneously with the archaeological excavations in 2002 and 2003. The first survey was a preliminary survey done over a period of about two weeks from the end of September to early October 2002 while the second survey was carried out over a period of about three weeks in May 2003.

**First season survey:** The first season of archaeological survey was done in order to search and to locate archaeological sites in the Semporna region. Surveys were done in and around Bukit Tengkorak and other areas in the Semporna region in order to identify potential sites for test excavations. Reconnaissance surveys were done in the Semporna region to search for

surface finds of archaeological artefacts that might indicate areas or sites used for prehistoric human habitation, camp or burial.

The first season of archaeological survey had been able to discover a few areas in Bukit Tengkorak and the Semporna region with signs of use by prehistoric human. Some of these archaeologically potentially sites were discovered at the slopes of Bukit Tengkorak as well as in the nearby hills of the Tagasan Bay area. Many pottery sherds and food remains as well as stone tools were found during the survey at these sites. The most significant findings was the discovery of a new site known as Melanta Tutup in the Tagasan Bay. Our archaeological survey at this rockshelter site uncovered surface finds, which included an ancient log coffin with a carved buffalo head and considerable amount of pottery sherds, animal bones, shells, and some stone tools.

**Second season survey:** The second season of survey was conducted with the aim of locating the sources of raw materials, in particular sources of rock materials that were used to make the stone tools at Bukit Tengkorak and Melanta Tutup. The survey was carried out with the help of a geological team from the Mineral and Geoscience Department of Malaysia in Kota Kinabalu, Sabah. The survey covered mostly the hills and lowlands of the Semporna region, especially areas located near the sites of Bukit Tengkorak and Melanta Tutup.

The results of the geological survey provided useful information on the likely sources of rock materials (agate and chert) used for making the stone tools at Bukit Tengkorak and Melanta Tutup. Several *in-situ* agate and chert sources were found at the foothills and other hills located near the site of Melanta Tutup. A number of stone tools were also found at the agate and chert sources during the survey. However, no obsidian source was found during the survey - some of the obsidian artefacts at Bukit Tengkorak had thus far been traced chemically to sources in Melanesia (Tykot & Chia 1997). Nevertheless, a local obsidian source is still a possibility because some of the obsidian artefacts excavated from Bukit Tengkorak have yet to be traced to any known obsidian sources in Southeast Asia and the Pacific region.

### **Archaeological Excavations**

Two seasons of archaeological excavations were carried out in Semporna, Sabah from 2002-2003. The first season of excavations was done at Bukit Tengkorak for a period of more than two weeks between the end of September and early October 2002. The second season of excavations was carried out for a period of more than 3 weeks in May 2003 at Bukit Tengkorak and the newly discovered site of Melanta Tutup in Semporna. The following discusses the archaeological excavations and the artefacts found at the sites of Bukit Tengkorak and Melanta Tutup.

**Excavations at Bukit Tengkorak:** Archaeological excavations at Bukit Tengkorak were carried out over two field seasons based on the results of our first surveys. During the first season, a test excavation was done at one of the archaeologically potential areas situated at the edge of the summit of Bukit Tengkorak. This potential area was cleared of thick undergrowth and the floor was cleaned – there were many scrub, twines with nasty thorns and an overburden of rubbish and dried foliage covering the floor. After clearing and cleaning, the area was mapped, including two 2 x 2 meters trenches, A & B, located at the bottom of a huge volcanic boulder. The test excavation was done in order to assess further the potential of the area and to determine if the area is disturbed or not for further excavations. The two test trenches were excavated using only trowels, brushes, and ice picks in arbitrary levels or spits of 10 cm. The excavated soil were sieved using 0.2 cm and 0.5 cm wire meshes in order to retrieve small pieces of artefacts that were not recovered during the excavations. The *in-situ* position and the association of the artefacts were recorded using the standard established methods. The excavations were carried out until the sterile layers or base rocks at a maximum depth of about 120 cm. Samples of charcoal or shells were collected whenever possible at different levels during the excavations for radiocarbon dating purposes. Soil samples were also collected from the different soil layers and were subjected to flotation in the base camp to check for botanical remains. The soil profiles of the excavated trenches were recorded and the trenches were then covered with plastic sheets and backfilled with the sieved soil in order to protect the site.

The results of the excavations revealed the presence of many artefacts such as pottery sherds, stone tools and shells at the top levels. The surface of the floor is covered by an overburden of dried foliage and the top 10-15 cm level of the soil appeared to be disturbed as it contained modern waste materials. Further excavations revealed that from the depth of 20 cm onwards, there was no deposit of modern materials or no significant signs of disturbances to the cultural deposits. Small roots from the scrubs undergrowth were encountered during the excavations at the top layers and many volcanic boulders were found at the lower layers. Each of the soil layers contained many archaeological materials such as pottery sherds, stone tools and faunal remains. As for the stone tools, the excavations revealed that the top layers contained mostly polished adzes as well as cores and microliths. The close association of the cores, flake tools and waste flakes suggested stone tool making at the site. The excavated artefacts – pottery, stone artefacts and faunal remains - were cleaned with water and air-dried at the base station in Semporna. The pottery sherds were preliminary sorted into body, rim, base as well as decorated and plain sherds. Prior to washing, pottery sherds and stone tools that have signs of residue or use wear were separated (not washed) so that they can be used for future analysis such as residue analysis. The faunal remains were preliminary sorted into three main groups: animal bones, fish bones and shells.

**Excavations at Melanta Tutup:** The volcanic rock shelter site of Melanta Tutup was discovered during the first season of archaeological survey. The site was located about 600 feet above sea level and surface finds at the site included an ancient log coffin and many pottery sherds and food remains (animal and fish bones as well as marine shells). Treasure hunters have disturbed a small part of the floor of the rock shelter site but a large part of it is still intact for archaeological excavations.

The ancient log coffin at Melanta Tutup is believed to be that of an important person, perhaps an aristocrat or leader of a community. The lid of the log coffin was carved in the shape of buffalo head at one end and its tail at the other end. The coffin was disturbed as no human skeletal remains or artefacts were found inside. Some of the human remains and burial items - mostly teeth, some beads and metal objects - were found scattered on the floor near the coffin. The floor of this site is covered with dried foliage in very dry and powdery soil. The floor was cleaned and was mapped for test excavation.

A test excavation was done using a 2 x 1 meter trench located near the wall of the rock shelter. This trench was further divided into two equal trenches (1 x 1 meter each), namely A4 and B4, in order to have better control of the test excavations. The test excavation was carried out to determine the types of archaeological artefacts and depth of the cultural layers at the site. Such information is needed to help in future planning of cost, time and strategy for further excavations at the site. The test trench was excavated using only trowels and brushes in arbitrary levels or spits of 10 cm. The excavated soil was sieved using 0.3 cm and 0.5 cm wire meshes in order to retrieve small pieces of artefacts such as beads and seeds. All the sieved soil was also collected and subjected to flotation in order to collect botanical samples. The *in-situ* position and the association of the artefacts were recorded using the standard established methods. Dating samples such as charcoal, charred materials or shells were collected whenever possible at different levels during the excavations for radiocarbon dating purposes. The excavation was carried out until the sterile layer at 150 cm and the soil profile of the excavations was recorded.

The results of the excavations revealed the presence of many artefacts such as pottery sherds, stone tools, shells, seeds, beads, metal objects and stoneware. Further excavations revealed that from the depth of 15 cm onwards, there were less foliage and the soil colour changes to a bit grayish. The top 10-30 cm of the soil layers contained human teeth and bones, stoneware, metal objects, seeds, beads, as well as pottery sherds, stone tools and faunal remains. There were a few pieces of stone artefacts from 90 cm to 100 cm and the soil layer was sterile of archaeological remains from 110 cm to 150 cm. The test excavation was stopped at 150 cm. It is hoped that the next season of fieldwork would be able to continue the excavations further in order to check the deeper soil layers as we have yet to reach the base rock at the site.

## **Analysis of the Excavated Artefacts**

All the archaeological artefacts as well as dating and soil samples recovered during the two seasons of archaeological surveys and excavations were properly packed and transported back by air to the Centre For Archaeological Research Malaysia in University of Science Malaysia, Penang for further analysis. Some of the excavated artefacts, in particular pottery sherds, were washed and preliminary sorted during the fieldwork at the base station in Semporna and the archaeology section of Sabah Museum in Kota Kinabalu, Sabah.

Detailed morphological and scientific analyses were conducted at the laboratory of the Centre For Archaeological Research Malaysia in Penang. Morphological analyses of the excavated artefacts carried out included examining the physical and macroscopic features as well as the quantitative analysis of the excavated pottery, stone artefacts, and faunal remains. Scientific analyses of the excavated artifacts is currently being carried out and they include compositional studies of the Bukit Tengkorak pottery using the X-ray fluorescence analysis and thin section petrographic analysis. Some of the excavated obsidian artefacts are also currently being analyzed using the electron microprobe at the Geology Department in Malaya University, Kuala Lumpur, Malaysia. The faunal remains is being re-identified in order to determine prehistoric diet based on the various species and quantities of mammals, fish and shells recovered during the excavations at Bukit Tengkorak and Melanta Tutup.

The following provides the results of the morphological analyses of the excavated artifacts from Bukit Tengkorak and Melanta Tutup, Sabah.

**Artefacts from Bukit Tengkorak:** The artefacts recovered during excavations at Bukit Tengkorak were mostly pottery sherds, stone tools and faunal remains such as animal and fish bones as well as shells.

Pottery: A total of about 256,464 pieces of pottery sherds, weighing approximately 183 kilograms were recovered during the excavations. Preliminary analysis of the pottery sherds revealed that the sherds belonged mostly to the body and some were broken parts of bases, handles, flanges, knobs, lids and fragments of pottery stove. A majority the pottery is plain while the remaining of the sherds were decorated with impressed, incised, red-slipped, and perforated designs.

Stone Tools: A total of approximately 3,664 stone artefacts were found during the excavations. Preliminary analyses of the stone artefacts suggested that there were nine main classes of stone types: core, hammerstone, borer, adze, utilised flake, flake, waste flake and chunk. The stone artefacts were made from a variety of raw materials such as chert, agate, obsidian, andesite, sandstone, and slate.

Faunal Remains: The faunal remains comprised animal and fish bones as well as shells. Animal and fish bones recovered during the excavations weighed about 10.3 kilograms. The animal and fish bones were fragmentary but a considerable number of these faunal remains can still be identifiable as to their species. Preliminary analyses suggested mostly marine fish bones and animal bones belonging to various types of mammals such as pigs, monkeys and small mammals. The shell remains recovered from the excavations weighed approximately 6.3 kilograms. Our preliminary analysis of the shell remains suggested that they are mostly edible marine species.

**Artefacts from Melanta Tutup:** The artefacts recovered during test excavations at Melanta Tutup comprised human remains, pottery sherds, animal and fish bones, shells, stone artifacts, stoneware, seeds and a few metal objects. Apart from these materials, an ancient log coffin was also found at the site of Melanta Tutup (Chia and Koon 2003).

Human Remains: The human remains found during the test excavations were badly deteriorated and fragmentary, consisted of mostly teeth and some fingers and foot bones. About 81 pieces of human teeth has thus far been identified as belonging to perhaps several individuals and about 42 pieces of bones were identified as finger and foot bones.

Pottery and Stoneware: A total of 4,036 pieces of pottery sherds, weighing approximately 16.5 kilograms were recovered during the excavations. Preliminary analysis of the pottery sherds identified that these sherds mostly as parts of the body as well as some parts of the pottery rim, base, handle, flange, knob and fragments of pottery stove. A majority the pottery is plain while the remaining sherds were decorated with impressed, incised, red-slipped and perforated designs. There were also about 27 pieces of stoneware, weighing about 113 grams, found mostly at the top layers of the site.

Stone Tools: A small number of about 32 stone artifacts were found during the excavations. Preliminary analyses of the stone artifacts suggested that these microliths were of five main types: core, utilised flake, scraper, borer, and waste flake. The stone artifacts were made from a variety of raw materials such as chert, agate, obsidian, andesite and sandstone.

Faunal Remains: The faunal remains comprised animal and fish bones as well as shells. Animal and fish bones recovered during the excavations weighed about 2.6 kilograms. The animal and fish bones were in small pieces and fragmentary with only a small number of the teeth that can still be identified as to their species. The shell remains recovered from the excavations weighed approximately 6.5 kilograms. Preliminary analysis of the shell remains suggested that they are mostly edible marine species.

Metal objects: A total of about 10 pieces of metal objects, weighing about 102 grams, were found at the top layers in rather badly corroded conditions. As such, it was difficult to determine the shape and function of these artefacts, except for two pieces of metal bells. These bells and metals objects appeared to be associated with the log coffin as burial items.

Beads: A total of about 6 beads were recovered at the top layers during the test excavations. The beads were small in sizes and of various colours such as yellow, red and white. These beads are also believed to be part of the burial items associated with the coffin that were scattered by looters at the site.

### **Radiocarbon Dating of the Sites**

A total of about 20 organic samples of charcoal and shells were collected carefully during the excavations at Bukit Tengkorak and Melanta Tutup for radiocarbon dating purposes. Of the samples collected, 3 samples were selected from Bukit Tengkorak and 6 samples were selected from Melanta Tutup for submission to the Beta Analytical Radiocarbon Laboratory in Florida, United States of America for radiocarbon dating services. Results of the radiocarbon dating of 3 samples had been obtained and we are still awaiting the results of the other samples from the dating laboratory. The results of the radiocarbon dates are presented in the Table 1.

Table 1 Radiocarbon dates from Bukit Tengkorak, Sabah

| Sample           | Material | Lab#        | Conventional Age (BP) | Calibrated Age (Cal BC)* |
|------------------|----------|-------------|-----------------------|--------------------------|
| BT02<br>B2 30cm  | Charcoal | Beta-172047 | 3190 +/-70            | 1620 to 1310             |
| BT02<br>B2 40 cm | Charcoal | Beta-172048 | 3080+/-60             | 1450 to 1190             |
| BT03<br>A2 45 cm | Shells   | Beta-179680 | 2790+/-50             | 1200 to 910              |

\* Cal BC dates (2 sigma, 95% probability)

## CONCLUSIONS

The archaeological research at Bukit Tengkorak and the Semporna region in Sabah, Malaysia had thus far yielded promising results with the potential to provide the necessary data for resolving the issues and problems of this research project. The two seasons of archaeological fieldwork in Semporna, Sabah had uncovered many *in-situ* artefacts, including obsidian artefacts and dating materials needed for the research. The excavated artefacts at Bukit Tengkorak have been radiocarbon dated to around 3,000 years ago. The archaeological survey in Semporna had uncovered several new sources of agate and chert rock materials used to make the stone tools discovered at Bukit Tengkorak. The archaeological survey had also been able to identify new archaeological sites in the Semporna region that can provide new data needed for this research project. Among the most significant results of the survey is the discovery of a new site – Melanta Tutup, which contained rich archaeological evidence as well as an ancient log coffin with a carved buffalo head. Test excavations carried out at this site during the first year of the project produced new evidence on the presence of human habitation with the findings of archaeological materials such as human remains, stoneware, beads, metal artefacts, potsherds, stone tools, fish and animal bones, food shells and botanical remains. The test excavations suggested that the cultural layers at Melanta Tutup is buried up to more than 100 cm deep. Such information is very helpful in future planning of cost, time and strategy for further detail excavations at the site. The discovery of the ancient log coffin at the site provides a rare opportunity to date, to compare and to trace the origin of such unique and ancient burial tradition in Sabah and Southeast Asia. In addition, the presence of obsidian artefacts found at Melanta Tutup will be very useful for chemical tracing of its origins and hence the movements of prehistoric people, trade or exchange routes between the Semporna area in Sabah and other sites in Southeast Asia and the Pacific region. The Melanta Tutup site is largely undisturbed and therefore has great potential to provide more clues - including new archaeological evidence and dates on ancient human habitation in the Semporna region and its relationships or origins in Southeast Asia and the Pacific region.

During the first year of the research project, discussions with our co-researcher, Dr. Truman Simantunjak, from Indonesia while in the field at Bukit Tengkorak provided very useful information for comparative studies on a regional basis - several old and new sites in Indonesia as well as those the Philippines and Melanesia (contemporaneous and similar to that of Bukit Tengkorak in Sabah) have been identified for travel and comparative studies in the second and third year of the research project. At present, the research project is continuing the morphological and scientific analyses of archaeological artefacts that were discovered during the surveys and excavations at Bukit Tengkorak and Melanta Tutup in Semporna, Sabah.

## FUTURE RESEARCH

The second year of the project will include a detail and full-scale archaeological excavation and survey at the newly discovered site of Melanta Tutup in Semporna, Sabah. Preliminary survey and test excavations at this site during the first year provided new and important clues on the existence of ancient human remains and habitation in Semporna and the southeastern region of Sabah. The discovery of the human remains could provide important clues to the type of people who inhabited Melanta Tutup, Bukit Tengkorak and the Semporna region. The discovery also raised many new questions such as the dating of this site and the archaeological artefacts, in particular the obsidian tools and the log coffin, the type of people who inhabited Melanta Tutup and their relationships with those in Bukit Tengkorak, Southeast Asia and the Pacific region. Proper radiocarbon dating is needed to date the site and artefacts. Comparative study of the ancient log coffin with other similar log coffins found in Sabah, Indonesia and elsewhere is important to know the origins or cultural connections of the people practicing such ancient burial tradition in Southeast Asia. A detail excavation of Melanta Tutup is therefore very important to search for the missing pieces of evidence to answer such questions and to generate new knowledge about the people and archaeology of Bukit Tengkorak, Semporna, and its relationships in Southeast Asia and the Pacific region.

The second and third year of the research project will also include travel to relevant archaeological sites, museums and research institutions in island Southeast Asia (Indonesia and the Philippines) and the Pacific region (Melanesia) in order to do comparative studies and to collect data as well as obsidian samples from archaeological sites and obsidian sources for chemical analyses to help trace their sources and their cultural connections. Among the archaeological sites and obsidian source areas thus far identified in Indonesia include Dago and Bukit Karcamanik in Bandung, Nagrek in Garut and Gua Pawon in Padalarang (West Java), Tapak Harimau and Pondok Silabe Cave in Baturaja, and Kunduran in Lahat (South Sumatra), Kalumpang, Minangka Sipako, Leang Burung, Ulu Leang, and the Talaud islands (Sulawesi), Tjekik and Gilimanuk (Bali), Lake Kerinchi and Djambi (Sumatra), and Paso in Minahasa. In the Philippines, the archaeological sites identified include those in the Novaliches-Marilao district, Lake district and Central district of Rizal province, Tagaytay and Indang areas in Cavite province, Pugad-Baboy and Maysan areas in Bulacan Province, Balite Barrio, Calatagan, Lian, Sitio Dayap, Barangay Tanagan, in Batangas Province, Mt. Makiling in Laguna Province as well as Kibawe in Bukidnon Province, Bungiao rockshelter in Zamboanga and Huluga open site in Cagayan de Oro City. In Melanesia, archaeological sites and obsidian source areas that have been identified for visit include Talasea, Lalma Cave, Kandrian, and Bonduna in New Britain, Ambitle island, Arawe islands, Sasi, Pisik, and Emsin in Lou island, Rakival in Watom island, Mopir island, Admiralty island, Dori and Lasigi in New Ireland, Eloaua and Emananus in Mussau island, Buka and Nissan in the north of the Solomons islands.

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DENTAL CHARACTERISTICS OF PREHISTORIC  
HUMAN TEETH FROM MELANTA TUTUP, SEMPORNA, SABAH

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## Introduction

Archaeological fieldwork was carried out in 2002-2003 at Melanta Tutup in Semporna, Sabah by the Centre For Archaeological Research Malaysia at Universiti Sains Malaysia, Penang with technical cooperation from staff of the Sabah Museum Department in Kota Kinabalu as well as the Mineral and Geoscience Department Malaysia in Kota Kinabalu, Sabah. The archaeological fieldwork comprising surveys and excavations at the site of Melanta Tutup revealed clues and evidence of prehistoric human presence at Melanta Tutup from the early historical period to the late Palaeolithic period. Amongst the archaeological materials recovered from the surveys and excavations at Melanta Tutup included an ancient log coffin, prehistoric human remains as well as pottery sherds, stone tools, metal artefacts, stonewares, beads and food remains consisting of mostly marine shells, fish bones and animal bones. This paper discusses the dental characteristics of the prehistoric human teeth, dated 2500 BP to 3330 BP, from Melanta Tutup and its possible affinities with other ancient populations in Southeast Asia, China, Japan, Melanesia and Australia.

## The Excavations at Melanta Tutup

Melanta Tutup is a volcanic rockshelter site located about 600 feet above sea level near the Tagasan Bay in Semporna, Sabah (Map 1). The site of Melanta Tutup was discovered during an archaeological survey in 2002 (Plate 1). Surface finds at the site included an ancient wooden coffin (Chia & Koon 2003) as well as many pottery sherds and food remains comprising animal and fish bones as well as marine shells. The archaeological excavations at Melanta Tutup in 2002-2003 was carried out using a 2 x 1 metre trench in arbitrary levels or spits of 10 cm. The excavations have thus far revealed cultural deposits from the tops levels up until 150 cm in depth. Numerous archaeological materials such as human remains, pottery sherds, stone artefacts, metal objects, stonewares, beads, seeds, ornaments and food remains were recovered from various levels during the excavations. These materials represent cultural artefacts from the early historical period to perhaps the late Paleolithic period. The human remains from Melanta Tutup were recovered from spits 1-10 (0-100 cm) during the excavations

and were found in rather deteriorated and fragmentary state, consisting of mostly teeth and some fingers and foot bones. A total of about 98 pieces of human teeth have thus far been identified as belonging to perhaps several individuals.

## **Materials and Methodology**

The materials used in this study consist of prehistoric human teeth excavated from Melanta Tutup, Sabah. These prehistoric human teeth were excavated from spits 3 to 10, radiocarbon dated between 2500 BP to 3330 BP. A total of 54 teeth specimens comprising the upper and lower incisors, canines, premolars and molars were used in this study (see Table 1).

The dental characteristics of the human teeth were described using both metric and non-metric measurements. The Wood's method (1991) was used to measure the bucco-lingual (BL) and mesio-distal (MD) sizes of the teeth. For the non-metric measurement, the scoring procedure for key morphological traits of the permanent dentition according to Turner *et.al* (1991) was used in this study.

Biological affinities between the Melanta Tutup and other populations were assessed by metric and nonmetric dental traits. The sex should be identified for the analysis using metric dental data. Although the sexes of the Melanta Tutup specimens are unknown, we attempt to calculate the biological distances using male comparative samples. On the other hand, we need sufficient sample size in order to analyze frequency data of nonmetric dental traits, but we have only several specimens from Melanta Tutup. Despite small sample size, we dare to carry out statistical analysis in order to interpret rough tendency of population affinity.

## **Results and Discussions**

The results of the metric and non-metric measurements of the teeth specimens, with remarks on the key morphological traits of the permanent dentition are presented in Tables 2, 3 and 4.

The teeth in general showed primitive trait such as shovel-shaped and lingual tubercle of the upper incisors (UI1), the presence of hypocone on UM1 and hypoconulid on LM1, and the deflecting wrinkle of LM1. The upper incisors (UI1) showed high to low degrees of shoveling and the absence of double shovel (only one specimen has weak double shoveling) as well as the occurrences of tuberculum dentale (lingual tubercle).

Based on the metric data of upper and lower molar, the size of first molars is bigger than that of the second molars. This phenomenon is usually found in recent or modern human population teeth rather than older human population.

According to Larsen (2000) some of the most dramatic reduction of teeth has taken place just in the last ten thousand years. In some settings, this reduction has been extra ordinarily fast and has tended to occur in populations that made the transition from foraging to farming. Generally, foragers having recently made the shift to agriculture have larger teeth than population with a longer history of agricultural use and associated food preparation techniques.

The examination of non-metric trait of teeth revealed that the prevalence of sundadont dental trait is dominant on teeth from Melanta-Tutup. Some of the sundadont traits are the absence of double shoveling (75%) on the upper first incisor (UI1) and the existence of two-rooted of upper third premolar (UP3)-100%.

In the present time, the sundadont dental pattern exist in some of Southeast Asian aboriginal populations such as Negritos (T.Hanihara called as Proto Malay) and in modern Australian aborigine populations although the latter have some exception like the high frequencies of weak shoveling of upper first incisor (UI1), hypocone of upper second molar (UM2), and sixth cusp and deflecting wrinkle of lower first molar (LM1) (T.Hanihara, 1992).

The data of comparative population samples were cited from Matsumura and Hudson (2004). Figure 1 depicts Penrose shape distances from Melanta Tutup to the comparative samples. From the Melanta Tutup samples, many modern Southeast Asians tend to be close, while Hoabinhian Malay series such as those from Gua Cha and Guar Kepah are far distant. Figure 2 shows Smith's mean measure of divergence (MMDs) calculated using frequencies of 17 nonmetric dental traits (shovelling UI1, shoveling UI2, double shoveling UI1, double shovelling UI2, dental tuberculum UI1, dental tuberculum UI2, interruption groove UI2, De Terra's tuberculum UP1, double rooted UP1, double rooted UP2, Carabelli's trait UM1, hypocone reduction UM2, sixth cusp LM1, seventh cusp LM1, protostylid LM1, deflecting wrinkle LM1, groove pattern Y LM1). The closest samples from the Melanta Tutup are Neolithic Southern Chinese, followed by Yayoi in Japan and next is Indochinese. Early Flores and Malay consisting of Hoabinhian and early Holocene specimens are far from the Melanta Tutup.

The population affinities with the Melanta Tutup are different between the metric and nonmetric traits. Therefore, in order to take both metric and nonmetric traits into consideration of population affinities, the Penrose shape distances based on metric traits and the Smith's distances using nonmetric data are schematized simultaneously as show in Figure 3. Some population samples are not coincide with the samples for metric data comparisons, because the population with small sample size are pooled. As a substitute, for example the Smith's distance by nonmetric traits of Gua Cha and Guar Kepah samples are adopted the Early Flores and Malay data. As a result, the Neolithic Southern Chinese, Thailanders,

Vietnamese and Yayoi Japanese are closest to the Melanta Tutup, while the Gua Cha and Guar Kepah are far distant from it. Since the Thailanders and Vietnamese and Yayoi are considered to originate from Southern China, the Melanta Tutup people were probably genetically influenced by immigrants from Southern China, and are different from Gua Cha and Guar Kepah people.

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Table 1: The Human Teeth Specimens from Melanta Tutup, Sabah

| <b>Tooth Types</b>          | <b>Number Of Teeth</b> |
|-----------------------------|------------------------|
| Upper first incisor (UI1)   | 4                      |
| Upper second incisor (UI2)  | 2                      |
| Upper canine (UC)           | 10                     |
| Upper third premolar (UP3)  | 3                      |
| Upper fourth premolar (UP4) | 5                      |
| Upper first molar (UM1)     | 7                      |
| Upper second molar (UM2)    | 1                      |
| Lower first incisor (LI1)   | 2                      |
| Lower second incisor (LI2)  | 4                      |
| Lower third premolar (LP3)  | 5                      |
| Lower fourth premolar (LP4) | 5                      |
| Lower first molar (LM1)     | 6                      |
| Total                       | 54                     |

Table 2: Average Sizes of Teeth

| <b>Upper tooth</b>          | <b>N</b> | <b>MD (mm)</b> | <b>BL (mm)</b> |
|-----------------------------|----------|----------------|----------------|
| Upper first incisor (UI1)   | 4        | 8.8            | 7.6            |
| Upper second incisor (UI2)  | 2        | 6.6            | 5.8            |
| Upper canine (UC)           | 10       | 8.0            | 8.0            |
| Upper third premolar (UP3)  | 3        | 7.8            | 9.6            |
| Upper fourth premolar (UP4) | 5        | 7.1            | 9.3            |
| Upper first molar (UM1)     | 7        | 11.2           | 11.2           |
| Upper second molar (UM2)    | 1        | 10.5           | 9.3            |

| <b>Lower tooth</b>          | <b>N</b> | <b>MD (mm)</b> | <b>BL (mm)</b> |
|-----------------------------|----------|----------------|----------------|
| Lower first incisor (LI1)   | 4        | 6.0            | 6.0            |
| Lower second incisor (LI2)  | 2        | 6.3            | 6.5            |
| Lower third premolar (LP3)  | 5        | 7.7            | 7.9            |
| Lower fourth premolar (LP4) | 5        | 7.4            | 7.6            |
| Lower first molar (LM1)     | 6        | 11.5           | 10.3           |

Note: some of the traits could not be determined because the tooth are either broken or heavily worn off and these sort of tooth are not counted into the N

Table 3: Characteristics of the Upper Teeth

| Trait                                    | Tooth | N  | Freq (%) | Remarks   |
|--|-------|----|----------|---|
| <i>Shovel</i>                            | UI1   | 4  | 100      | The lingual surface is shovel-shaped (degree: faint to clear shoveling) |
| Labial convex                            | UI1   | 4  | 75       | The labial surface is mostly flat                                       |
| Double-shoveling                         | UI1   | 4  | 75       | Double-shoveling is mostly absent                                       |
| Interruption groove                      | UI1   | 4  | 50       | Grove can be either present or absent                                   |
| Tuberculum dentale                       | UI1   | 4  | 50       | Tuberculum dentale can be either present or absent                      |
| <i>Shovel</i>                            | UI2   | 2  | 100      | The lingual surface is shovel-shaped                                    |
| Labial convex                            | UI2   | 2  | 100      | The labial surface is slightly convex                                   |
| Double-shoveling                         | UI2   | 2  | 100      | Double-shoveling is absent  |
| Interruption groove                      | UI2   | 2  | 100      | The labial surface is not smooth (any groove are present)               |
| Tuberculum dentale                       | UI2   | 2  | 100      | Tuberculum dentale is absent  |
| Shovel                                   | UC    | 10 | 100      | The lingual surface is shovel-shaped                                    |
| Double-shoveling                         | UC    | 10 | 80       | Double-shoveling is mostly present                                      |
| Tuberculum dentale                       | UC    | 10 | 100      | Tuberculum dentale is present   |
| Canine mesial ridge                      | UC    | 9  | 56       | Mesial is bigger than distal lingual ridges                             |
| Canine distal accessory ridge            | UC    | 5  | 80       | Distal accessory ridge is mostly absent                                 |
| Double-shoveling                         | UP3   | 3  | 100      | Double-shoveling is absent  |
| Distosagittal ridge                      | UP3   | 3  | ?        | Could not be determined   |
| Premolar mesial & distal accessory cusps | UP3   | 3  | 100      | No accessory cups occur   |
| Tricusped premolars                      | UP3   | 3  | 100      | Extra distal cusp is absent   |
| Premolars root                           | UP3   | 2  | 100      | One root  |
| Premolar mesial & distal accessory cusps | UP4   | 3  | 67       | No accessory cups occur   |
| Tricusped premolars                      | UP4   | 5  | 100      | Extra distal cusp is absent   |
| Premolars root number                    | UP4   | 4  | 100      | One root  |
| Metacone (cusp 3)                        | UM1   | 5  | 100      | Metacone is present   |
| Hypocone (cusp 4)                        | UM1   | 6  | 100      | Hypocone is present & large   |
| Cusp 5 (metaconule)                      | UM1   | 4  | 50       | Cusp 5 is either absent or present                                      |
| Carabelli                                | UM1   | 5  | 100      | Carabelli trait is present  |
| Parastyle                                | UM1   | 4  | 75       | Parastyle is mostly absent  |
| UM root number                           | UM1   | 3  | 100      | Three roots   |
| Metacone (cusp 3)                        | UM2   | 1  | 100      | Metacone is present   |
| Hypocone (cusp 4)                        | UM2   | 1  | 100      | Hypocone is present & large   |
| Cusp 5 (metaconule)                      | UM2   | 1  | 100      | Cusp 5 is absent  |
| Carabelli                                | UM2   | 1  | 100      | Carabelli trait is present  |
| Parastyle                                | UM2   | 1  | 100      | Parastyle is absent   |
| UM root number                           | UM2   | 1  | 100      | Two roots cannot be determined  |

Table 4: Characteristics of the Lower Teeth

| Trait  | Tooth | N | Freq (%) | Remarks  |
|--|-------|---|----------|--|
| <i>Shovel</i>                                  | LI1   | 4 | 100      | The lingual surface is shovel-shaped           |
| Double-shoveling                               | LI1   | 4 | 100      | Double-shoveling is absent                     |
| <i>Shovel</i>                                  | LI2   | 2 | 100      | The lingual surface is shovel-shaped           |
| Double-shoveling                               | LI2   | 2 | 100      | Double-shoveling is absent                     |
| Premolar lingual cusps variation               | LP3   | 5 | 80       | Lingual cusp is mostly present                 |
| Tomes's root                                   | LP3   | 2 | 50       | Groove is either present or absent             |
| Premolar lingual cusps variation               | LP4   | 5 | 100      | Lingual cusp is present                        |
| Anterior fovea                                 | LM1   | 4 | 50       | Anterior fovea is either present or absent     |
| Groove pattern                                 | LM1   | 6 | 100      | Y pattern                                      |
| Deflecting wrinkle                             | LM1   | 4 | 50       | Deflecting wrinkle is either present or absent |
| Distal trigonid crest                          | LM1   | 4 | 100      | Distal trigonid crest is absent                |
| Protostylid                                    | LM1   | 6 | 100      | Protostylid is absent                          |
| Cusp 5 (hypoconulid)                           | LM1   | 6 | 100      | Cusp 5 is present & large                      |
| Cusp 6 (entoconulid or tuberculum sextum)      | LM1   | 5 | 40       | Cusp 6 is present                              |
| Cusp 7 (metaconulid or tuberculum intermedium) | LM1   | 6 | 100      | Cusp 7 is absent                               |
| Lower molar root number                        | LM1   | 5 | 100      | Two roots                                      |

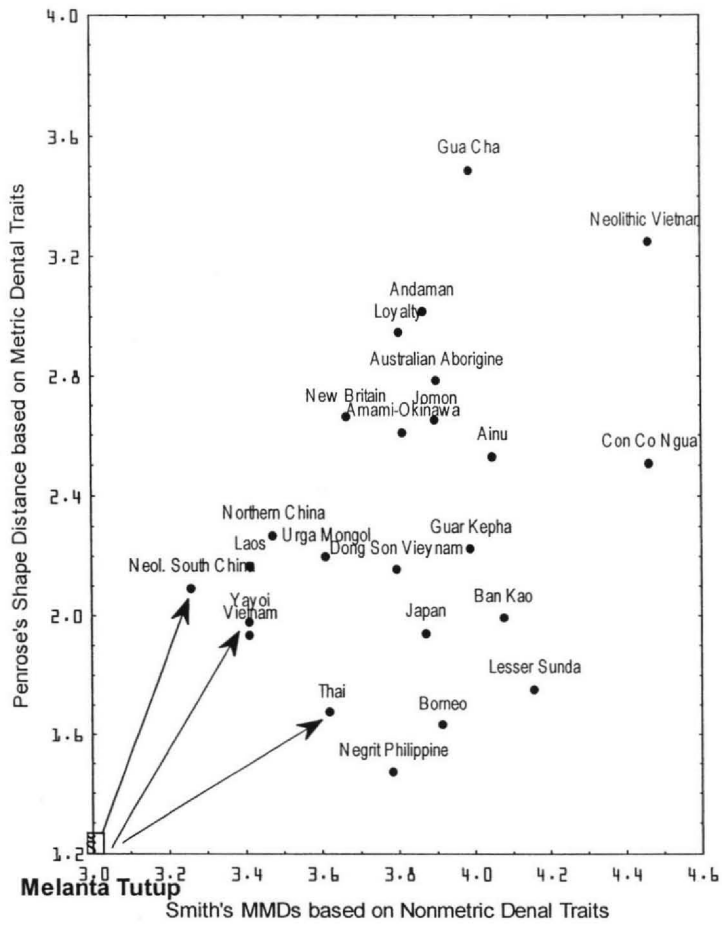


Fig.3 Penrose's shape distances by metric dental data and Smith's distances by nonmetric der