PALAEOANTHROPOLOGICAL STUDY OF LATE PREHISTORIC HUMAN SKELETAL REMAINS IN SEMPORNA, SABAH

by

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ABSTRAK

Penyelidikan arkeologi di Semporna, Sabah dari tahun 2002 hingga 2007 telah menemui dua tapak pengkebumian Zaman Akhir Prasejarah di Melanta Tutup dan Bukit Kamiri. Kedua-dua tapak pengkebumian tersebut ditemui semasa ekskavasi yang dijalankan oleh sekumpulan penyelidik dari Pusat Penyelidikan Arkeologi Malaysia, Universiti Sains Malaysia, Pulau Pinang dengan kerjasama Jabatan Muzium Sabah, Kota Kinabalu, Sabah. Kedua-dua pengkebumian tersebut mendedahkan rangka manusia yang ditemui dalam posisi terlunjur, berorientasi timur-barat dengan kepala mereka mengadap ke timur. Pentarikhan radiokarbon yang dijalankan telah memberikan tarikh di antara 890 dan 1,170 AD untuk pengkebumian di Melanta Tutup serta tarikh di antara 3,330 dan 2,830 BP untuk pengkebumian di Bukit Kamiri.

Kajian ini menggunakan data metrik dental untuk menguji hipotesis imigrasi "Dua Lapisan" di mana populasi asal Australo-Melanesian di Asia Tenggara mengalami proses pergabungan genetic dengan orang Mongoloid dari utara pada zaman Neolitik. Hasil analisis paleoantropologi menunjukkan bahawa pengkebumian di Melanta Tutup mengandungi empat dewasa (satu perempuan, tiga lelaki), dua kanak-kanak dan dua bayi. Kesemua individu tersebut didapati dalam keadaan normal dari segi osteologi. Analisis tersebut juga menunjukkan bahawa kesemua rangka manusia daripada Melanta Tutup tidak mempunyai sebarang penyakit patologi dan mengamalkan makanan yang seimbang serta kehidupan yang sihat. Rangka lelaki

berketinggian minima 168 cm manakala rangka wanita 157 cm. Analisis kluster metrik dental menunjukkan bahawa spesimen Melanta Tutup mempunyai hubungan populasi yang rapat dengan spesimen-spesimen dari Borneo, Negrito Filipina, *Lesser Sunda*, Man Bac, Melayu, Laos, Thai dan Sumatera.

Hasil analisis paleoanthropologi turut menunjukkan bahawa pengkebumian di Bukit Kamiri terdiri daripada dua rangka lelaki dewasa yang normal dengan ketinggian minima 161 cm. Analisa kluster metrik dental pula menunjukkan bahawa spesimen Bukit Kamiri mempunyai perhubungan ras yang rapat dengan spesimen-spesimen dari Neolitik China Selatan, Ban Na Di, Urga Mongolia, *Lesser Sunda*, Dong Son, Man Bac, Melayu, Filipina, Negrito Filipina and Sumatera. Rangka-rangka manusia dari Melanta Tutup dan Bukit Kamiri juga didapati terletak jauh daripada kumpulan Australo-Melanesia dari segi perhubungan ras berdasarkan dendogram. Walaupun keputusan didapati menyokong hipotesis imigrasi, namun demikian lebih banyak sampel Prasejarah Akhir diperlukan untuk mengukuhkan lagi penemuan ini.

PALAEOANTHROPOLOGICAL STUDY OF LATE PREHISTORIC HUMAN SKELETAL REMAINS IN SEMPORNA, SABAH

ABSTRACT

Archaeological research in Semporna, Sabah in 2002 to 2007 uncovered two burial sites in Melanta Tutup and Bukit Kamiri dated to the Late Prehistoric period. These two burial sites were discovered during archaeological excavations conducted by a research team from the Centre for Archaeological Research Malaysia, Universiti Sains Malaysia, Penang, with the cooperation of the Sabah Museum Department, Kota Kinabalu, Sabah. Both the burial sites contained human skeletons placed in extended and supine positions, and orientated in an east-west axis with their heads pointed east. Radiocarbon dating analysis placed the Melanta Tutup burials between 890 and 1,170 AD, and the Bukit Kamiri burials between 3,330 and 2,830 BP.

This research uses metric dental data to test the "two-layer" or immigration hypothesis whereby Southeast Asia was originally occupied by "Australo-Melanesian" population that later underwent substantial genetic admixture with "Mongoloid" peoples from the north during the Neolithic period. Results of the palaeoanthropological analysis suggested that the Melanta Tutup burials contained four adults (one female, three males), two children and two infants. The analysis of the skeletal remains also revealed that they were normal, with no signs of pathology, and that they maintained a well-balanced diet and a healthy lifestyle. The males have an average height of 168 cm while the females have an average height of 157 cm. Dental metric cluster analysis revealed that the Melanta Tutup specimens possessed

close population affinities with specimens Borneo, Negrito Philippine, Lesser Sunda, Man Bac, Malay, Laos, Thai and Sumatra.

The palaeoanthropological analysis also suggested that the burial at Bukit Kamiri consisted of two normal adult males with an average height of about 161 cm. The analysis indicated that these two males did not suffer from any form of pathological diseases, and maintained a balanced diet and a healthy lifestyle. Dental metric cluster analysis showed that the Bukit Kamiri specimens have close affinities with specimens from Neolithic South China, Ban Na Di, Urga Mongol, Lesser Sunda, Dong Son, Man Bac, Malay, Philippine, Negrito Philippine and Sumatra. Both the Melanta Tutup and Bukit Kamiri specimens were found to be phenetically distant from the Australo-Melanesian stock. Although it is found that the results are consistent with the immigration hypothesis, more Late Prehistoric samples are needed to consolidate the finding.

CHAPTER 1

INTRODUCTION

Palaeoanthropology is the study of ancient humans that provides the most direct evidence for investigating the biology of past human populations (Larsen, 1997, 2002). It adopts a diverse multidisciplinary approach in seeking to understand human origins, evolution, dispersal and relationships by reconstructing information concerning the dating, morphology, behaviour, and ecology of our ancestors.

In Southeast Asia, palaeoanthropological study of prehistoric human skeletal remains began perhaps as early as 1920-30s as suggested by works carried out by Evans (1918, 1928), Callenfels (1939) and Colani (1935). In recent years, palaeoanthropological studies have been gaining momentum in Southeast Asia, and the study of ancient skeletal remains has helped in providing a better understanding of the biological relationships and evolution of human populations in the Southeast Asian region and beyond. Recent studies, for example by Howells (1973, 1989), Matsumura (1994, 1995, 2000, 2006), Pietrusewsky (1999a, 1999b, 2008) and Turner (1983, 1987, 1989, 1990), using data collected from cranial and dental morphologies have proven to be valuable sources of information for examining biological relatedness between and within populations (Buikstra *et al.*, 1990). The cranial variation is generally viewed as reflecting genetic similarity. On the other hand, teeth being the hardest tissue after life oftentimes contain valuable information about living conditions, palaeodiet, subsistence activity and illnesses. Hence, these features become the basis for biodistance studies in palaeoanthropology (Buikstra *et*

al., 1990; Konigsberg and Ousley, 1995) in establishing a prehistoric human populations' affiliation.

In Southeast Asia, prehistoric human skeletal remains are often examined quantitatively and qualitatively to answer questions regarding the health and diet, physical activity, palaeodemography, violence and trauma in ancient populations. The study of prehistoric human skeletal remains in Southeast Asia is often used to answer basic questions such as: What are the sexes of these people? How old are they? Did they suffer from any developmental stresses or pathological diseases? How are they related to other prehistoric human skeletal remains from the region? Are they an indigenous group or a mixed group due to the influx of immigrants? If they were an immigrant group, where did they originate from? Who were their ancestors? These are amongst some of the major issues and questions a palaeoanthropologist seeks to resolve and answer.

PREVIOUS STUDIES OF PREHISTORIC HUMAN SKELETAL REMAINS IN MALAYSIA

Many archaeological sites with prehistoric human remains have been found in Malaysia as a result of archaeological investigations and research carried out since the 1950s. Some of these sites include Gua Gunung Runtuh, Gua Teluk Kelawar and Gua Harimau in Perak, Gua Cha and Gua Peraling in Kelantan, Gua Niah in Sarawak and Gua Balambangan in Sabah. The earliest human remains found in Malaysia dates back 40,000 BP during the Palaeolithic Period in Gua Niah, Sarawak. The human remains, in the form of a skull, were found in the West Mouth, Gua Niah in 1958 (Harrisson, 1967; Harrisson, 1958, 1959, 1972). The site of Gua Niah also presented

a rather complete chronological and cultural sequence of human occupation from the Palaeolithic to the Late Prehistoric period (Brothwell, 1960; Harrisson, 1967; Brooks and Brooks, 1968; Brooks *et al.*, 1979; Bulbeck, 1981, 1982; Bellwood, 1993, 2007; Barker *et al.*, 2002; Barker, *et al.*, 2003; Krigbaum and Manser, 2005; Zuraina and Pfister, 2005; Zuraina *et al*., 2005a). Palaeoanthropological study was first applied to the prehistoric human skeletal remains found in Niah in order to better understand ancient human populations in Malaysia and Southeast Asia. The study concerned mostly with the Australo-Melanesian population, which is believed to have been replaced by the East Asian immigrants during the mid-Holocene period (Callenfels, 1936; Mijsberg, 1940; Barth, 1952; von Koenigswald, 1952; Coon, 1962; Thoma, 1964; Jacob, 1967, 1975; Brace, 1976; Howells, 1976; Brace *et al.*, 1991). The following section will present the previous palaeoanthropological studies of prehistoric human skeletal remains carried out by researchers in Malaysia. The section will also review the various methodologies used and results obtained from these studies.

GUA NIAH, SARAWAK

In the 1950s, Tom and Barbara Harrisson made a series of important discoveries of human remains in Gua Niah, Sarawak (Harrisson, 1957, 1958, 1959, 1972). Gua Niah is situated in the Subis Limestone Complex of the Miocene Tangap Formation (Wall, 1967). The main cave, also known as the West Mouth, contained the largest limestone massif and a cavernous space of about 20 acres in extent. Archaeological excavation at West Mouth by Harrissons and his colleagues have uncovered more than 200 human burials in various stages of preservation. The burial series represent the largest diachronic collection of late/terminal Pleistocene and Holocene human

remains from a single locality in Island Southeast Asia (Harrisson, 1957, 1958, 1959, 1972; Zuraina, 1982; Barker *et al.*, 2002; Barker, *et al.*, 2003; Krigbaum and Manser, 2005; Bellwood, 2007;). The burials have been studied and classified by Barbara Harrisson (1967). Her work has thus far been the main source of reference on the human burials excavated from Gua Niah. The pre-Neolithic or Palaeolithic burials contained primary flexed, seated and secondary mutilation burials while the Neolithic burials comprised mostly primary extended and less frequent secondary burnt and cremation burials. Sheilagh and Richard Brooks (Brooks and Brooks, 1968) have also produced several important works on the burial series despite the fragmentary nature of the collection. Their works include the identification and differentiation of arm positions by sex in a series of burials and the palaeoserology and radiocarbon dating of the burials (Brooks and Brooks, 1968; Brooks *et al.*, 1979). A preliminary report on the palaeoserology of the Niah Cave was published by Brooks and Heglar (1972). Their analyses involve a comparative analysis of soil samples removed from within and around the burial prior to an analysis of a vertebral bone from the skeleton. The purpose of the analysis is to determine if the bone had absorbed Group A or B antigen factors from the surrounding soil. The results showed that the bone was giving a clear serology of Group O (H specificity), and was not taking up Group A or B factors from the soil. The results also indicated that the bones from the other burials were free from this contamination.

The most important discovery at Gua Niah is a 40,000-year-old human cranium, known as the “Deep Skull”, which was found at a depth of 2.5 m in the West Mouth in 1958, together with some fragments of postcranial bones, faunal remains and flaked stone artefacts (Solheim, 1958; Harrisson, 1959; Harrisson, 1967). Brothwell

(1960) has conducted the osteological analysis of the age and sex, morphological examination and cast reconstruction. The age estimated from the development of the third molars suggests that the cranium belonged to a 15-17 year-old adolescent, of unknown sex because of the young age. Brothwell (1960) also noted a few observations such as the heavy wear on the right first molar and the "almost completely fused" basilar suture, which could be indications of an adult. In terms of population affinity, the prominent parietal bossing, a smooth occiput, slight brow ridge development and moderately steep forehead indicated a Tasmanian-like appearance, similar in many aspects to the more robust adolescent cranium from Talgai in Queensland, Australia (Brothwell, 1960). In 1979, Kenneth Kennedy (1979) evaluated the significance of the Deep Skull in human evolutionary studies from the perspective of radiology, without new interpretation on the age and sex of the Deep Skull. Birdsell (1979:419) also reassessed the age and sex based on the above mentioned features, and estimated an age of between 20 and 30 years old, and concluded that the sex was female. He also affiliated the skull to the Tasmanians, with a heightened Negritoid component. The different approach to sex of the skull was suggested because the advanced stage of wear on the first molar is inconsistent with a sub-adult age. Birdsell (1979:419) reported that more weight should be placed on the basilar suture fusion and less on the inconsistent timing of the third molar development and eruption as age estimation. There were certainly mixed interpretations regarding the Deep Skull's antiquity, biological age, sex, and population affiliation. Ongoing studies were active in using 3-D morphometric analysis and CT-scans to obtain new metrics, but a new reconstruction cannot be drawn (Krigbaum and Datan, 1999). Nonetheless, the Deep Skull from the Niah

Cave remains an important specimen for understanding the evolution of modern humans in Southeast Asia.

Zuraina and Pfister (2005) attempted stature estimation by using long bones that were selected from a total of 122 skeletons from the Holocene Niah skeletal collection, which were kept at the University of Nevada, Las Vegas, USA. Radiocarbon dating analyses done on 32 of these skeletons yielded a date of between 12,000 and around 1,800 BP (Brooks *et al.*, 1979). They decided to measure 21 complete long bones belonging to eight individuals, and estimated their statures by the regression formulae developed for Javanese males and females (Bergman and The, 1955) and Australian aboriginal males (Rao, 1966). The limb proportions as expressed by the brachial index (humerus/radius x 100) from two individuals, and the crural index (femur/tibia x 100) from an individual were also studied (Zuraina and Pfister, 2005). The results of stature for males was 158.5 ± 4.0 cm, and for females 148.5 ± 5.4 cm. When categorised according to pre-Neolithic and Neolithic burials, there was an average of 7 cm increase in female stature (145 to 152 cm) and a 5.5 cm increase in male stature (154.4 to 159.9 cm). These results were entirely in contrast to Bulbeck's (1996) findings, where he suggested a decrease in stature from the Hoabinhians to the Neolithic in Peninsular Malaysia, and interpreted it as the result of rainforest foraging adaptation. Zuraina and Pfister (2005) advocated that this conflict could be due to the small sample size of their studies. The high indices from the brachial and crural indices showed that the results were positively consistent with their adaptation to the tropical environment in which they lived as revealed by Holliday (1999).

Recently, Krigbaum and Manser (2005) reviewed some of the work done on the West Mouth burial series. They attempted palaeodiet analysis using stable isotopes of carbon derived from human tooth enamel, as well as face shape in pre-Neolithic and Neolithic burials. Tooth enamel is formed during childhood and does not remodel over time like bone. Hence, it is possible to reconstruct the palaeodiet profile by analysing the stable isotopes of carbon from tooth enamel. However, the fragmentary condition and the poorly preserved remains did not allow good collagen isolation for dating by RIKEN or palaeodietary analysis (Krigbaum, 2001). The results of the isotope analysis showed statistically significant differences for $\delta^{13}C$ values by burial type at Gua Niah, and demonstrate a clear order of magnitude in diet between the two pooled samples (Krigbaum and Manser, 2005:181). The trend shows that the Neolithic individuals were 'broad spectrum' foragers and were incorporating plant foods grown in open settings more regularly than the Pre-Neolithic individuals. In the second part of their studies, geometric morphometric methods were applied to gauge the evidence for the replacement of an Australo-Melanesian population by a Southern Mongoloid population during the mid-Holocene at the West Mouth site, and to explore face shape differences between the West Mouth pre-Neolithic and Neolithic materials (Hooijer, 1950, 1952; von Koenigswald, 1952; Jacob, 1967; Bulbeck, 1981, 1982; Turner, 1990; Ballinger *et al.*, 1992; Bellwood, 1993, 2007; Blust, 1999). Facial landmark data was selected because East Asian, Southeast Asian, Melanesian, Polynesian and Australian samples have been shown to differ in facial shape and dimensions (e.g. Howells, 1973, 1976, 1989; Pietrusewsky, 1979, 1984a, 1990; Bulbeck, 1981; Lahr, 1996). Homologous landmark data in three dimensions were collected from the West Mouth series and from other recent comparative samples in East Asia, Southeast Asia,

Island South Asia, greater Australia, Melanesia, and Polynesia with a portable 3-D digitising device (Microscribe 3DX) and InScribe software (Krigbaum and Manser, 2005:183). Each set of data was then computed into a common coordinate system using the generalised least-squares Procrustes superimposition method (GLS) in GRF-ND software (Slice, 1999), which was then modified and scaled to unit centroid size (Rohlf and Slice, 1990). The standard multivariate methods (Mahalanobis' distances, multidimensional scaling analysis, and principal components analysis) were applied (Rohlf, 1999). The results of the geometric morphometric methods showed that the upper and mid-face data sets did not show significant statistical differences between the pre-Neolithic and Neolithic face shapes, thus failing to support the replacement model for the West Mouth series.

In 2004-2005, Zuraina *et al.* (2005a) studied a skeleton named "Niah 1977" excavated by Zuraina in the West Mouth in 1977. The skeleton was one of two skeletons in Malaysia that had a congenital deformity. The other one was the Perak Man (Matsumura and Zuraina, 2005:51). The Niah 1977 skeleton was found without radiuses on both arms. According to Zuraina *et al.* (2005a:208), several attempts to radiocarbon date this skeleton was unsuccessful. The only radiocarbon date obtained (14,040 ± 40 BP) came from a bone sample, but this date was rejected because the skeleton was clearly associated with pottery vessels. The ulnas were short and curved at both sides. Reconstruction of the bones was unsuccessful because the bones were too fragmentary. The rest of the bones were examined and appeared normal. The sex was determined to be male judging from the features retained on the skull, sacrum and some long bones. This male individual was estimated to be 18-19 years old based on the almost fused epiphysis in the left upper tibia. Stature was calculated,

using formulae provided by Trotter and Gleser (1951), at 146-153 cm. The non-metric dental traits and cranial morphology revealed that the Niah 1977 skeleton has close affinities to the Sunda type or Southern Mongoloid race. The Niah 1977 skeleton most likely suffered from Thrombocytopenia Absent Radius Syndrome (TAR) or Holt-Oram Syndrome (HOS) (Zuraina *et al.*, 2005a:216).

GUA BALAMBANGAN, SABAH

Three human teeth were found at a depth of 120 cm in Gua Balambangan. The cave is located on a cliff along the western coast of Balambangan Island, off the northern tip of Kudat, Sabah. The teeth were radiocarbon dated 15,520 ± 190 BP (Jeffrey, 2005:229). Further excavation is needed because there may be more human remains present in the vicinity. These three permanent teeth came from the upper jaw, comprising a second right molar, a first right premolar and a right canine. The teeth were individually assessed in aspects of non-metric traits, Smith's tooth wear index (1984), and dental metric measurement of buccolingual and mesiodistal dimensions. The teeth were compared with the data of Australoid dentition by Wolpoff (1971) and showed that the size of Balambangan teeth was larger than the average Australoid and fell within the range of maximum size of Australoid. The teeth suggest close population affinities to other fossil records of skeletal remains with the same Australoids characteristics such as those found in Tabon Cave, Wadjak, Niah, Vietnam and Peninsular Malaysia (Matsumura and Zuraina, 1995). The teeth samples from Gua Balambangan were taken as contemporaneous to the remains from Tabon Cave in Palawan Island, Philippine, which was dated to 15,000 years ago (Jeffrey, 2005:233).

GUA GUNUNG RUNTUH, PERAK

Gua Gunung Runtuh in Perak yielded a 10,000 to 11,000 years old adult human found in a foetal position and associated with stone tools and food remains (Zuraina, 1994, 2005). The site is located in a cave in the Bukit Kepala Gajah limestone massif in the Lenggong Valley, Perak. The skeleton has been morphologically described by Jacob and Soepriyo (1994, 2005), Loh (1994, 2005), and Jamaludin (1994, 2005). Sex was determined as male and the skeleton was named the Perak Man after the state of Perak, in Malaysia. The Perak Man is one of the earliest most complete early Holocene skeletal remains found in Southeast Asia. He suffered from a congenital deformity known as brachymesophalangia Type A2. The cranial and postcranial measurements have been taken following the standard measurements by Martin and Saller (1957). The dentition of the Perak Man was measured by Matsumura and Zuraina (1999) according to the method established by Fujita (1949). However, only the buccolingual diameters were recorded because the mesiodistal dimensions were severely affected by attrition.

The statistical comparison of the biological distances, based on the dental and limb metric traits, suggested that the Perak Man is morphologically linked to the Australo-Melanesian, and his ancestry can be traced back to the people of the Australo-Melanesian stock who occupied this region during the late Pleistocene period (Matsumura and Zuraina, 1995, 1999, 2005:60). Matsumura and Zuraina (2005:61) explained that it could be due to "local evolution or genetically long separation under different environments". The Perak Man was palaeopathologically diagnosed with a congenital deformation called brachymesophalangia Type A2, where the shafts of his left ulna and radius were shorter, abnormally thin and curved anteriorly. There are

only four similar cases reported in the present world population (Matsumura and Zuraina, 2005). In addition, the vertebral column was laterally curved indicating idiopathic scoliosis syndrome. The deformity observed in the left upper limb was probably due to cerebral palsy during his childhood (Matsumura and Zuraina, 2005:61), but further investigation is needed.

GUA CHA, KELANTAN

Gua Cha is a spacious rock shelter measuring about 100 meters along the base of a limestone massif, which overlook a tributary of the Sungai Nenggiri in Kelantan (Bulbeck, 2005a). The Gua Cha was first excavated by Gale Sieveking in 1954 and it served as a habitation and burial area during the so-called Hoabinhian phase (the Middle Holocene period), and was also used as a cemetery during the Neolithic phase (Sieveking, 1954, 1954-5, 1987). Sieveking (1954) found that the human skeletal remains comprised Middle Holocene specimens belonging to the Hoabinhian, and some from the subsequent Neolithic period (ca. 3000 BP). In 1979, Bellwood and Adi (1985) found no evidence to support Sieveking's claim for a sterile horizon separating the Hoabinhian and the Neolithic layers. However, Bulbeck (2000) examined the remains again and was able to assign the burials to two distinctive periods, i.e. the Neolithic burials are extended in supine positions and usually accompanied by Neolithic grave goods whereas the Hoabinhian burials are interred in other manner, and lacked grave goods. "In other manner" here may have suggested a flexed, foetal position. It is reported that Gua Cha has so far yielded the largest sample of Pre-Neolithic and Neolithic burials in Peninsular Malaysia. At most other Southeast Asian sites with burials, there may be a large assemblage but very rarely a mixture of both (Oxenham *et al.*, 2002; Bulbeck *et al.*, 2003). Bulbeck

(2005a:300) concluded based on skeleton Gua Cha 1 that there is a reduction in body size in Peninsular Malaysia during the Holocene. He observed a reduced cranial robustness, among other traits, without any evidence of transition towards a Mongoloid pattern. However, it is reported that this human population is somehow related to the Orang Asli ancestry (Bulbeck, 2005a:301).

GUA TELUK KELAWAR, PERAK

Gua Teluk Kelawar is a rock shelter site situated in the Bukit Kepala Gajah limestone massif of Lenggong, Perak. A fragmentary skeleton, known as skeleton GTK1 was found in a flexed position at 100 – 110 cm deep and radiocarbon dated 8,400 ± 40 BP (Zuraina *et al.*, 2005b). Burial items found with the skeleton were stone tools like oval unifacial pebble tools, shells (*Brotia costula*), animal bones such as primate (*Macaca*), monitor lizard (*Varanus*), reptile and rat, and 10.8% of charred remains. The skeleton was assessed for sex, race, age and height. The sex was identified as female based on the sexual dimorphism features on the skull and some long bones. The non-metric dental analysis suggested that GTK1 was an Australoid (Sundadont). The dental wear of the lower molar indicated an age of between 45 and 50 years old based on comparative data from Miles (1963), Brothwell (1981), Smith (1984) and Lovejoy (1985). The estimated stature for this female skeleton, based on the left fibula, was 143-151 cm using the Mongoloid and Negroid range (Trotter and Gleser, 1951).

GUA PERALING, KELANTAN

Gua Peraling is a spacious rock shelter located near the village of Tohoi in Ulu Kelantan. Human remains belonging to four young to middle aged adults were

identified but their sex could not be determined because not enough specimens were preserved (Bulbeck and Adi, 2005). Burial Gua Peraling 1 was found at the top of stratigraphic layer 3. It was an extended Neolithic inhumation buried with three black cord-marked vessels dated to the last few thousand years. The burial was 20 cm beneath the surface, and was disturbed. The bones found were limb shaft fragments and foot bones. Burials Gua Peraling 3A and 3B were uncovered at layer 5, radiocarbon dated by charcoal between 6,000 and 8,000 years ago (Bulbeck and Adi, 2005:311). They were represented merely by teeth and jaw fragments. The two burials were found commingled together and coated with haematite, suggesting a secondary burial. Gua Peraling 4 was represented by a semi-complete skull, a right clavicle shaft, a scapula and numerous rib and vertebral fragments, the upper sacrum and fragment of the left pelvis, much of the left humerus, and a partial femur shaft (Bulbeck and Adi, 2005). Apparently, Gua Peraling 4 was better preserved than the others and its stature was estimated at 160 cm. This skeleton was from the early to the middle Holocene period. A series of analyses including craniometry and mandibular metrical analyses have drawn some affinities with the Orang Asli, recent Melanesians (Solomon Islands and Vanuatu), Easter Islanders, and New Guinean with a close phenotype resemblance to the Australian Aboriginal females, and Indo-Malaysia group intermediate between Southwest Pacific and mainland East Asia populations (Bulbeck and Adi, 2005:332). The authors also deduced that there is "a tendency to a more 'Australoid' phenotype compared with the more gracile morphology and East Asian metrical features of the Orang Asli."

GUAR KEPAH, PENANG

Prehistoric human skeletal remains from Guar Kepah were excavated by Callenfels (1936) and his colleagues from a shell midden site in Seberang Prai, Penang. The precise stratigraphy is unclear according to Bellwood (2007:164-168), but since potsherds were recorded at all levels in the three mounds (Matthews, 1961), Bulbeck (2005b:383) proposed "a middle Holocene dating of around 4,000 to 5,000 years ago based on consideration of the most recent, high stand of the seas along the Malay Peninsula". There were three mounds labelled as A, B and C. A total of 31 individuals were identified by Jacob (1967) whilst Callenfels (1936) indicated 88 burials. Bulbeck (2005b:385) re-assessed the human skeletal remains and found a single burial from mound A, 31 individuals from mound B, and nine individuals from mound C. There were some other minor discrepancies in the findings by Jacob (1967) and Bulbeck (2005b) in terms of sex and age, but both of them found that the Guar Kepah mounds served as burial sites for a mixed sex of predominantly adults. There was no evidence of cannibalism observed by Jacob (1967), and he opined that the red coloration on the mandible and teeth was the result of haematite coating. Bulbeck (2005b) noted that the red zones were concentrated along the cervico-enamel junction, reaching up the crown. It clearly reflects that the stains were acquired during life from betel-nut chewing. Haematite coating, indicating secondary burials, was found in 20 % of the burials. The same practice was seen on jaws unearthed from Gua Peraling c. 5,000 to 6,000 years ago (Bulbeck, 2005b:389). Mijsberg (1940) noted a tendency for the teeth to fragment during his initial study of the remains. He suggested that it could be due to the use of teeth to puncture hard substances, although post-depositional deterioration may have contributed to it too. Bulbeck (2005b) compared the Guar Kepah human's oral health with those of Gua

Cha (the so-called Hoabinhian and Neolithic series) and found that the pattern of deteriorating oral health with greater tooth wear in Guar Kepah matches the Gua Cha's Hoabinhian series, but not the Gua Cha's Neolithic series. The proportional incidence of caries at Guar Kepah also resembles those of the Gua Cha's Hoabinhian series. Bulbeck concluded that the Guar Kepah remains fall within the recent Melanesian range of variation, including dental morphology, tooth size and shape, and cranial anatomy, as advocated by Mijsberg (1940) and Jacob (1967). These observations most likely matched the ancestor-descendant relationship between Guar Kepah and the Orang Asli (Non-Semang), even though the Orang Asli crania anatomy is more gracile than the Guar Kepah crania, which appear similar and consistent with Storm's (1995) model for the paedomorphic changes that is associated with body-size reduction between the Wajak skulls and recent Javanese (Bulbeck, 1981, 2005b).

GUA KAJANG AND GUA KERBAU, PERAK

Gua Kajang is a cave located four kilometres away from Gua Gunung Runtuh in Lenggong, Perak. At the west of this cave, Evans (1918) found a fragment of a human jaw with some teeth, and fragments of other parts of the human skeleton. Duckworth (1934) reported that they probably belonged to a female in her twenties, with an affinity to the Australian aborigines based on the dental features. In 2007, an excavation at the east of the cave found two skeletal remains (Goh, 2008). Skeleton GK1 was the remains of an incomplete female adult unearthed from the depth of 150 cm, with an estimated height of between 155 and 160 cm. The flexed burial was orientated in a north-south axis, with her head pointed to north. The burial was radiocarbon dated to about 10,820 BP. Skeleton GK2 was found at the depth between

60 and 80 cm, and was represented by the remains of two feet. The burial was radiocarbon dated to 7,890 BP. Due to its extremely fragmentary condition, the age, sex and burial orientation were unable to be determined (Goh, 2008). About 40 kilometres from Gua Gunung Runtuh at Gua Kerbau in Gunong Pondok, Evans (1928) and Callenfels (1936) excavated several fragments of human bones. Examination of these specimens by Duckworth (1934) suggested population affinities to the Australo-Melanesians. Unfortunately, further description on the inhumations and radiocarbon datings of the skeletal remains were not available.

GUA HARIMAU, PERAK

Gua Harimau is a limestone hill in Bukit Gua Harimau, Lenggong, Perak. Williams-Hunt (1952) unearthed a juvenile skeleton with an estimated age of between 10 and 12 years old, and found a stone adze and pottery, radiocarbon dated to 3,450 ± 150 BP. In 1987-88, another seven human burials were uncovered and dated 4,900 – 1,700 BP by Zuraina (1988) and Zolkurnian (1989). They found various types of burial items such as earthenware vessels, stone tools, a stone adze, a bark-cloth beater, shell and stone ornaments, food remains, bronze axes and bronze moulds. Another excavation by Zolkurnian (1998) unearthed four more human burials, radiocarbon dated 3,170 ± 60 BP. The surveys and excavations revealed that Gua Harimau was used as a cemetery site. The human skeletal remains were in fragmentary condition due to the location of the cemetery, which was situated at the cave mouth, exposed to weather and human disturbances. Sex and stature estimation could not be determined due to the fragmentary condition of the skeletons. The teeth showed shovel-shaped incisors, which led Chia and Zolkurnian (2005) to conclude that the Gua Harimau human remains were closest to the Gua Cha remains, with

some Mongoloid traits and close affinities with the Neolithic populations of Gua Cha and Ban Kao.

GUA SIREH, SARAWAK

Gua Sireh is located in Gunung Nambi, which is one of several isolated limestone outcrops in the Serian District of the Samarahan Division in west Sarawak (Datan, 1993). The site was first excavated by Tom Harrisson and Wilhelm G. Solheim II in 1959 (Solheim *et al.*, 1959, 1961; Solheim, 1983; Harrisson, 1960:81). Unfortunately, no full report published and the excavations notes were nowhere to be traced. The human remains in Gua Sireh were badly fragmented and disintegrated to the extent that reconstruction and identification cannot be carried out. The remains include skeletons of adults and children. Dowling (1993) studied the human remains and found that most of the teeth belonged to adults and a few have been identified as deciduous teeth. There were 16 individuals identified based on the dental remains. The number of individuals was reached by dividing the total number of molars with 12 (the normal number of molars in human dentition). Radiocarbon dating of the cultural materials like beads and metal objects associated with the human bones gave a date of 3,500 BP, which was too early and reflects stratigraphic disturbance (Datan, 1993:20). Chia (2007:114) suggests that the iron objects could have come from the upper layer, which was dated about 800 AD. The presence of postholes in the trenches also suggested the used of wooden coffins or grave items, which had rotted away. There were traces of bark cloth, like those in Lubang Angin (Datan, 1993:98). St. John (1863) mentioned in his work that the Bidayuh treated the dead by wrapping them in sleeping mat (made of bark cloth or sometimes pandanus leaves) and carried by the village *Peninu* (priest) to the place of burial or cremation. A retrospective

examination of this piece of ethnographic information by Datan revealed that the Bidayuh stock is most probably the descendant of the Gua Sireh's prehistoric population. The teeth were assessed for incidence of caries, enamel hypoplasia, shovel-shaped incisors and Carabelli's trait. 6.8% of the 370 teeth were observed with caries attacks, which were equated by Dowling (1993:179) to those of the Neolithic Europe (Brothwell, 1981). Two incisors and four canines were noted to exhibit single and multiple hypoplasia lines. Based on these lines, the estimated age of stresses range between six months and four and a half years, which according to Dowling, was not uncommon for prehistoric populations (Goodman *et al.*, 1980; El-Najjar *et al.*, 1978). 91.6% of Gua Sireh teeth showed the presence of shovelling on the central incisor. The study by Brothwell (1981) was used to interpret the results, where the highest frequencies of shovelling were found in American Indians, Eskimos and East Asian population, and is much lower in Europeans (about 15%). The conclusion of this examination was that the frequencies of shovelling shown here are not unusual for Southeast Asia. Carabelli's trait was observed on one of the maxillary first molar. Dowling noted that the European and African have the highest frequency of Carabelli's trait ranging from 70 to 90%, and Asian have a low frequency of between 25% and 60% (Scott, 1980). Conclusion on the population affinities was not reported in this study.

LUBANG ANGIN, SARAWAK

Lubang Angin is a limestone cave in the Gunung Mulu National Park, Sarawak. It is located in the south-western part of the Gunung Api range on the left bank of the Melinau River (Datan, 1993:23). There were at least seven individual burials excavated in 1989. The teeth excavated in Lubang Angin were also studied by Datan

(1993) and Dowling (1993), and were compared with those from Gua Sireh. Radiocarbon dating of a marine bivalve shell associated with burial 2 gave a date of about 3,020 BP but this date appears a little early for the assemblage, especially when it was associated with metal and glass beads (Datan, 1993:31). He suggested that a commencement date in the first millennium BC for these burials in the cave was not impossible judging by the dates of 2,000 – 2,500 BP for extended burials in the West Mouth (Harrisson, 1967; Datan, 1993:31). However, Chia (2007:114) opined that the date should be corrected to less than 1,500 years ago instead of 2,000 years ago because the date was derived from a marine bivalve shell.

All the burials, except for Burial 7, were extended with their heads placed towards the cave interior, i.e. east, similar to the extended burials found in Gua Niah (Harrisson, 1967:148; Harrisson, 1962:7-8). Treatment of the burials with haematite is widespread in the Neolithic and Early Metal Phase burials in Sarawak (Datan, 1993:103). The haematite appeared to be associated with life (blood) and was said to give the departed souls strength for their journey to the afterlife (Kosasih, 1985:107). The grave goods appeared similar to those found in Gua Niah, though not as rich. Datan (1993:103) mentioned that the similar traditions in burial practice as well as pottery making were once shared among the communities at Lubang Angin and Niah. The higher frequency of caries at 15.8% here is noted to be similar to Medieval Europe when refined carbohydrates made up more proportion of the daily diet during the Late Prehistoric period (Dowling, 1993). Three hypoplasia lines were observed on a single central incisor. Dowling measured the distance of the lines from the C-E (cervico-enamel) junction and found that it was common in prehistoric population to have incidences of growth disruption during ages from one to two and a half years

(El-Najjar *et al.*, 1978; Goodman *et al.*, 1980; Dowling, 1993). In this case, Dowling noted this child overcame each of the growth stresses and survived into adulthood. 77.7% of the maxillary central incisors showed shovelling trait, which is common among the Southeast Asian specimens. Carabelli's trait was not mentioned by Dowling in this Lubang Angin series, and the population affinity was not addressed by Datan.

MELANTA TUTUP, SABAH

In 2002 to 2003, archaeological fieldwork at Melanta Tutup in Semporna, Sabah revealed evidence of prehistoric human occupation from the late Palaeolithic period to the early historical period. Melanta Tutup is a volcanic rock shelter site located about 183 metres above sea level near the Tagasan Bay in Semporna, Sabah. A total of 54 prehistoric human teeth were excavated from the Neolithic levels, radiocarbon dated around 2,930 to 3,330 BP (Chia *et al.*, 2005). The teeth comprised the upper and lower incisors, canines, premolars and molars. The dental metric measurements were recorded using Wood's method (1991), while the non-metric morphological traits were scored according to procedures outlined by Turner *et al.* (1991). The results showed that the teeth have primitive traits such as shovel-shaped and lingual tubercle of the upper incisors, the presence of hypocone on the upper first molars and hypoconulid on the lower first molars, and deflecting wrinkle of the lower first molars. According to findings by Chia *et al.* (2005), there was a dominant presence of the sundadont dental trait, such as the absence of double shovelling on the upper first incisor and the existence of two-rooted upper third premolar. The size of the first molar is bigger than the second molar, which is usually found in recent and modern human population that has undergone the transition from foraging to farming (Chia

et al., 2005). Penrose's size distance between the comparative population samples were calculated using the crown diameter (Penrose, 1954). Smith's mean measure of divergence (MMDs) was computed with frequencies of 17 non-metric dental traits (shovelling UI1, shovelling UI2, double shovelling 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 Penrose's shape distance showed that the Melanta Tutup samples are closest to the modern Southeast Asian sample, and farthest from the so-called Hoabinhian Malay series like those from Gua Cha and Guar Kepah. Smith's MMDs, on the other hand, showed that the Melanta Tutup samples are closest to Neolithic Southern Chinese, followed by Yayoi in Japan and the Indochinese, but are far from the Flores and Malay (consisting of the so-called Hoabinhian and early Holocene specimens). This conflict is solved when both distances were schematised. The results revealed that the Melanta Tutup is closest to the Neolithic Southern Chinese, Thailanders, Vietnamese and Yayoi Japanese, while the Gua Cha and Guar Kepah are far from it. Chia *et al.* (2005) concluded that the Melanta Tutup people were probably genetically linked to early population from Southern China.

All these palaeoanthropological findings showed that there was clear evidence of an Australo-Melanesian presence from the Palaeolithic until the early Neolithic periods as suggested by the specimens, for example those from the West Mouth in Gua Niah, Gua Balambangan, Gua Gunung Runtuh, Gua Teluk Kelawar, Gua Peraling, Gua

Kajang and Gua Kerbau. Human remains from Gua Cha and Guar Kepah, according to some scholars, belonged to the Hoabinhian and Early Neolithic period.

DISCUSSION OF PREVIOUS STUDIES

The survey of previous studies on prehistoric human remains carried out in Malaysia has revealed different approaches in the examination of the past populations. Specimens from the West Mouth in Gua Niah showed the advantage of having a big sample size that enabled a more accurate categorisation of the pre-Neolithic and Neolithic burials by Barbara Harrisson (1967). Next, a series of osteoscopy examination carried out on the 40,000 year-old Deep Skull by Brothwell (1960) and Birdsell (1979) have revealed its age, sex and possible population affiliation. Brothwell (1960) assessed the age by using the development of the third molar, and his estimation was a 15-17 year-old adolescent. Birdsell (1979), however, thought more weight should be placed on the basilar suture fusion, and he gave an estimation of between 20 and 30 years old. The population affiliation is done based on the skull morphology first by Brothwell, and later by Birdsell. They both reported that the Deep Skull has a Tasmanian-like appearance, and Birdsell added that there is a heightened Negritoid component. Apparently, there are mixed interpretations of the Deep Skull regarding its age, sex and population affiliation. They may have studied the same specimen, but there were some minor differences in opinions.

Apart from the use of skeletal morphological traits to estimate the sex, age, stature and pathology, the statistical methods were also used in studying the human remains, namely metrical and non metrical measurements. Depending on the condition and availability of the skeletal remains, metric and non-metric traits obtained from the

cranial, postcranial bones and teeth can be used for population affiliation. Jacob and Soepriyo (2005), for instance, applied metric and non-metric measurements in analysing the Perak Man from Gua Gunung Runtuh. The non-metric cranial and postcranial traits of this skeleton suggested an Australo-Melanesoid affinity. Further palaeoanthropological analysis was done on the same skeleton by Matsumura and Zuraina (2005) using biological distances based on dental and limb bone measurements. The results also suggested that the skeleton is morphologically linked to the Australo-Melanesian stock, who once occupied Southeast Asia during the late Pleistocene period. It is noted that a number of earlier studies were concluded based on a rather limited non-metric morphological features/traits data that are inevitably subjected to inter- and intra-observer errors. These limited data alone may not be substantial or statistically comprehensive enough to provide solid and sound interpretations.

Geometric morphometric methods, on the other hand, have several advantages over the traditional linear distance data, including the ability to capture shape more accurately and its applicability to fragmentary skeletal remains (Bookstein *et al.*, 1999; Delson *et al.*, 2001; Hennessy and Stringer, 2002; Harvati, 2003). Recently, a study by Krigbaum and Manser (2005) selected a few of the West Mouth burials (N=4-7) that were suitable to be examined by the geometric morphometric methods. However, the small number of specimens may contribute to the failure to find real differences between the pre-Neolithic and Neolithic face shapes. Consequently, they suggested several possibilities; (i) a migrating group did reach northwest Borneo but its genetic contribution was not enough to alter the phenotype of the original population, (ii) its phenotype was similar to the phenotype of the original population

and thus remains undetected in the Neolithic sample, (iii) the replacement occurred earlier in time and was not sampled by the burial groups studied here (Krigbaum and Manser, 2005:185-186). In fact, incomplete and small sample size is the main issue constantly encountered in these recent studies.

Both the metric and non-metric traits are extensively used in efforts to find population affinities amongst human populations and in mapping their similarities using statistical tools as shown by recent works in Malaysia by Matsumura and Zuraina (1995, 1999, 2005), Krigbaum and Manser (2005), Zuraina and Pfister (2005), Chia *et al.* (2005), and Bulbeck (2005a, 2005b). Multivariate analysis employing the Q-mode correlation coefficients and multidimensional scaling (MDS) methods has allowed a systematic, effective and descriptive examination on the human skeletal remains. Also, it is applicable to small sample size. Eventually, the relationship and similarities amongst past human populations can be visualised graphically. Clearly, it is only when data are made comparable to other series of specimens by means of statistical analysis that we could study their relationships.

In order to overcome the weaknesses of previous studies, the present study will employ metric and non-metric traits of cranial, postcranial bones and teeth in studying the Late Prehistoric human remains from Semporna, Sabah. Chia (2003:135, 141) reported that Bukit Tengkorak is a pottery-making centre dated to the Neolithic period (4,300 BC to 50 BC). The site is presumably also located in an area of cultural and genetic mixing as suggested by the movements of people, trade or exchange between Bukit Tengkorak and other islands in Southeast Asia and the Pacific. However, Chia (2003:135) mentioned that the site was probably abandoned