DENTAL METRIC ON THE LATE HOLOCENE TO CURRENT ERA POPULATION FROM THE LOWLAND PART OF INDONESIAN-PAPUA

Marlin Tolla[1], Hirofumi Matsumura[2], Dominik Bonatz[3],

Kathrin Nägele[4], Cosimo Posth[4, 5]

[1]Research Centre for Archaeometry, National Research and Innovation Agency, Indonesia
[2]Department of Anatomy, Sapporo Medical University, Japan
[3]Freie Universität Berlin, Germany
[4]Department of Archaeogenetics from the Max Planck Institute for the Science of Human History, Jena-Germany
[5]Archaeo- and Palaeogenetics Institute for Archaeological Sciences Eberhard Karls University Tubingen-Germany
marl011@brin.go.id

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Abstract. *In an attempt to understand human history in this world, the researchers have applied several methods to identify the group of populations based on the teeth trait characteristic. However, the lack of knowledge about human diversity from several regions in this world derived from the osteological study from archaeological context has limited the understanding of human history in many societies including the populations that occupied the lowland part of Indonesian-Papua. For this, the aim of this study is to reconstruct the population history by employing the dental metric measurement on the 304 samples from the archaeological sites in the lowland parts of Indonesian- Papua which are classified into two different groups, Late Holocene and Current Era. The multivariate statistics analysis was applied to compare the results from the Lowland Indonesian- Papua samples with 17 groups of the population included in this study. The results from the statistics measurement were further used to reconstruct and visualize the phylogenic tree by employing The Neighbor-Joining method and UPGMA algorithm. The result from this clustering group presents the data about East Asian affinities for the Late Holocene and Australo Melanesian for the Current Era group.*

Keywords: *Dental, Metric, Papua, Late-Holocene, Current-Era*

Abstrak. Dalam upaya untuk memahami sejarah asal usul manusia di dunia ini, beberapa metode telah diterapkan oleh peneliti selama ini untuk mengidentifikasi kelompok populasi termasuk analisis ciri-ciri gigi manusia. Terbatasnya data tentang keanekaragaman manusia yang didasarkan pada studi osteologi dalam konteks arkeologi dari beberapa belahan dunia termasuk populasi yang mendiami dataran rendah Papua-Indonesia telah membatasi pengetahuan tentang sejarah asal usul serta penyebaran manusia. Berdasarkan hal tersebut, adapun tujuan dari penelitian ini adalah untuk merekonstruksi sejarah populasi dengan menggunakan 304 metrik gigi manusia yang ditemukan di situs arkeologi di dataran rendah Papua. Berdasarkan kronologinya, situs arkeologi tersebut diklasifikasikan menjadi dua bagian yaitu masa Holosen akhir dan Era Saat ini. Penggunaan analisis statistik diterapkan untuk membandingkan hasil penghitungan sample dataran rendah Papua dengan 17 kelompok populasi yang termasuk dalam penelitian ini. Hasil dari pengukuran statistik ini selanjutnya digunakan untuk merekonstruksi dan memvisualisasikan pohon filogenik dengan menggunakan Neihbor-Joining dan algoritma UPGMA. Hasil dari pengelompokan ini menyajikan data tentang kedekatan Asia Timur untuk kelompok Holosen Akhir dan Australo Melanesian untuk kelompok populasi Era Saat ini.
Kata kunci: Gigi, metrik, Papua, Holosen akhir, Era Saat ini

1. Introduction

The human history related to migration events into the island of New Guinea in prehistorical time have been extensively discussed by researchers related to population, time, and pathways into this area. During the last glacial period until ~12,000 years ago, a greater mass of land known as Sahulland connected New Guinea, Australia, Tasmania, and a low-lying shelf Arafura Sea. At the maximum of the glacial period, the sea level dropped to 120 m below the present position (Inger and Voris 2001). The early migration into the Sahulland was confirmed through the results from two sites from Australia occurred between 50,000 and 66,000 BP that was later re-dated to 40,000 BP related to the dating result of the fossils from the Huon Peninsula site (Groube et al. 1986; Thorne et al. 1999; Roberts et al. 1990). After that, it was revised to 47,000 to 61,000 years ago based on the uranium-thorium dating analysis (Roberts 1997).The genetic split between the Aborigines-Australian and the Highlanders of Papua New Guinea implied multiple migrations events into the Sahulland. This was confirmed by multidimensional-scaling mtDNA variations and phylogenetic analysis (Redd & Stoneking 1999:824). Regarding migration events into the Sahulland, the concept of voyager's routes was explained by Birdsell (1977) where she stated that this event involved the continental shelf fringing Asia known as Sundaland that was united the present area of Sumatra, Borneo, and Java in Pleistocene time. The climate character in the middle of Pleistocene time marked by alternating cold and warm lasted from 2,588,000 to 11,700 years ago. Furthermore, the climate conditions allow Archaic modern humans like H. erectus to enter the Sundaland supported by the fossil specimens found in Java (Lansing & Cox 2019: 26). A zone was located in the middle between Sunda and Sahulland known as Wallacea, used as a stepping zone into the Sahulland in in this period.

In terms of physical characteristics and biological makeup, modern humans are varied and unique in many ways. The biological variability among the human groups results from the natural forces and human behavior for a lifetime (Molnar 2002). According to a genetic study from the populations of the New Guinea island, the result shows several demographical events, including the initial colonization that occurred at different times and ways, performed by the modern humans and Denisovans that were interbreeding in the past (Stoneking 2016; Pugach and Stoneking 2015). The genetic and morphological study has confirmed the admixture events and gene flow on New Guinea island.

To better comprehend the history of modern humans, researchers have progressively examined the human skeleton within and between geographic regions over the last few decades, focusing on subjects such as genetic and morphological variations, including crown and root tooth characteristics (Hrdlicka 1911; Lewontin 1972; Cann et al. 1987; Nei and Roychoudhury 1982; Cavalli-Sforza et al. 1988; Hillson 1986; Stoneking et al. 1997; Scott and Turner 1997 etc). These studies were focused on several topics, such as genetic and morphological variation, e.g., crown and root teeth traits (Dahlberg 1963b, 1971a; Scott and Turner 1997).

In the term of teeth traits, the results underline the fact that the human teeth are divergence from one another (Scott and Turner 1997). The human dental metric traits displayed a relationship to population ancestry (Pilloud et al. 2014; Hrdlckâ 1920, 1921; Dahlberg 1971a). Therefore, the tooth crown size diameters as a central topic in dental metric studies are part of complex environmental and genetic, inherited from generation to generation (Potter & Nance 1976; Goose & Lee 1971; Townsend & Brown 1980 1981b; Townsend et al. 1992). When one population is considered independently, the crown diameters display a consistently positive or significant inter- correlations pattern. In this way, the diameters of various permanent teeth are correlated (Harris & Rathbun 1991). Genes significantly affect the size and form of human teeth on the chromosomes in many loci; it is a multifactorial inheritance. These multiple loci may converge with the varying environment in which has created a continuous variance in size, where a measurement can identify any value within a range (Hillson 2005). The more independently confirmed these features are, the more likely it inherited the phenotypic differences. There would be no probability of an individual inheriting discordant characteristics if everyone in a population carried the same genetic material (Proffit 2013: 131).

The lack of knowledge about human diversity derived from physical characters and osteological study from archaeological contexts has limited the understanding of human history in this world. For this, this study is performed to provide data for the populations where limited information is available in terms of human dental morphology. Also, this research aims to provide the teeth databases of Late Holocene and Current Era groups from the lowland parts of Indonesian- Papua, which is can be used as complementary data to identify the pattern with established data between the group of populations in other regions in this world.

2. Materials and Method

2.1 Materials

IIn this study, the human dental materials represent the lowland-coastal populations from the Papua-Indonesia region were found in the five different excavated archaeological sites: Mamorikotey in Nabire regency, Karas and Namatota in Kaimana regency, Srobu and Yomokho sites in Jayapura regency, which are grouped into the Late Holocene related to the dating and Beta analysis of the charcoal finding results from these sites. While two sites, Kayu Batu and Biak- Sowek teeth, were unearthed from the four caves in the northern coastal area. The Biak-Sowek and Kayu Batu sites have never been through a dating process before; however, based on grave goods such as glass beads, jewelry made from shells, and animals-teeth, these two sites are grouped to represent the Current Era (Table 1). This assumption is based on the glass beads, and ceramic distributions were introduced and used as a trade-goods by Chinese traders in the coastland Papua in the early Current Era for the Massohi tree and other goods from Papua (d'Urville 1853; Reisenfeld 1951). The glass-beads jewellery, porcelain, incised dog-like teeth, shells, jewelry, etc., are the number of goods that have played a significant value in the Papuan community in the past. In addition, it revealed the level of social stratification in the indigenous Papuan in the lowland area.

The human teeth encountered from the five sites are grouping into the Late Holocene groups were consisting of sixty-one (61) teeth, whereas two hundred forty-nine (249) teeth from the group Current-Era (Biak-Sowek and Kayu Batu). The teeth data in this study has never been studied before. Teeth from the group Late Holocene have been written in the preliminary research report in Balai Arkeologi Papua, but have never been analysed and published in a scientific journal. At the same time, the teeth from the group of Biak-Sowek & Kayu Batu which represented the Current Era group, were done in this study project and have never been reported before.

The radiocarbon and AMS dating for Late Holocene in the three sites (Srobu, Karas, and Yomokho) have been done within the field project of Balai Arkeologi Papua (Regional research for archaeology in Papua/Ministry of Education and Culture Republic of Indonesia). Whereas two samples: Namatota and Mamorikotey, were done in this study project was performed using OxCal v4.3.2 Bronk Ramsey (2017); r:5; IntCal 13 atmospheric curve (Reimer et al. 2013). The descriptions of the teeth from the seven sites will be explained in the following paragraph.

Table 1. Dating sites in this study derived from the Charcoal sample analysis

Sites	Dating	Sample	Sources
Karas	3400 BP	Charcoal	Suroto, 2012 & Mas'ud 2013
Mamorikotey	2520 ± 50 BP	Charcoal	IHME-3995/ Current Study
Srobu	1720 BP	Charcoal	Djami, 2020
Namatota	110 ± 40 BP	Charcoal	IHME-3994/ Current Study

Source: Tolla, 2023

The Archaeological Site

2.1.1 Mamorikotey

Mamorikotey is an open site, it is located in the regency of Nabire, Papua Province. It is positioned in the Mamorikotey hills-bed, places at 3º.073667 South and Longitude: 135º.590278 East; it is located about ± 20 to 30m from the shorelines and with a height of 75m asl. The mamorikotey is placed in the Kapotar Island, which is administratively is a part of the Moraa Islands District, in the Nabire regency, on the northern coast in Teluk Cenderawasih/Cenderawasih Bay. Several small to large islands distributed in the Cenderawasih bay included the Kapotar island where the mamorikotey site is placed. In the MMK/Ktk01, four human teeth (MMK/405/LP, MMK/78/UI1, MMK/49/LC, and MMK/79/UI2 (figure 1) were found ninety cm from the string level. The archaeological assemblage includes a wide range of archaeological materials such as marsupial teeth, pottery fragments, sea- shells from various family groups, fragmentary of animal bones, nuts, the molar teeth of sus- species, and stone tools. Three human teeth, including lower Molar (MMK/419/LM2, upper molar (MMK/638/UM1), lower premolar(MMK/640/LP) was found sixty-two centi meter from the string level of box two (MMK/ktk02) associated humans long-bones, ecofacts, shells, potteries fragments, and stone tools. The tooth MMK/42/UP1, lower premolars (MMK/333/LP), lower premolar (MMK/ 405/LP) were found in the box excavation Ktk03 associated pottery fragments, shells, fauna bones, and stone tools.

2.1.2 Yomokho

The Yomokho site is an open-dwelling site situated in Lake Sentani's bay in the Jayapura Regency, astronomically located at 2º.590125 South and 140º.610278 East. This site lies on Yomokho hills' beds, about 200meters from the main street of the *Kampung* Harapan-Asei village, Sentani-Jayapura. The fragments of human cranium were discovered inside the broken jars associated with shells, and the fragment of animal bones identified from monotremes species. A series of radiocarbon sample test confirm that the occupations occurred at 2590 ±120 BP (Suroto 2016:1). Two human mandible jaws were found in the Yomokho site. The lower left jaw was discovered on the Yomokho site's cliffs; half of the jaw was partially buried in the hills-walls (Figure 7). Two teeth left in this jaw, including the LP2 and the left lower (LM1). The second premolar presents only the root part while the crown is lost. Whereas in the first molar, the crown part is still present but severed from wear signified by the loss of the crown, dentine, and pulp area. From the morphology characters, this jaw is derived from the male adult person related to the third molar's socket in this jaw and by the sexes recognized from the chin with the square shape. In the figure, seven caries-lesions are almost eliminated through dental wear in molars and pulp chamber exposure due to severe wear in the lower second premolar. The lower left jaw was found in the bed of Yomokho hills-bed about 22m from the box excavation; it was incidentally found during a survey in this site. Two teeth still present in this left of the jaw, the second molar at the front of the third molar. The second individual was encountered in this site is the lower mandibula.

2.1.3 Karas

Karas is a cave-dwelling site, located in Arguni district in the Kaimana Regency, Province of Papua Barat. It was first discovered by the Lengguru-Kaimana expedition team that carried out Interscience research in 2010 involved archaeological researchers from Balai Arkeologi Papua in expeditions (http://lengguru.org). Karas site is positioned in the 3º.306583 South and East at 133º.750556. It settled on a hill about ±45m asl in the Arguni bay area.

Five human teeth collected from this site were recognized from the two individuals identified through the long bones associations and their positions in the layer soils. The five teeth were unearthed in the two different layers of soil. Two teeth, including Krs/41/LLC; 1 and the Krs/638/UM2; 5 were discovered from the Spit 6 associated charcoal, one fishbone, two turtle bones, twelve marsupial bones, one human bone fragment from the tibia. The Krs/649/UC; 2, the Krs/334/LP1, 3), and Krs/649/UP1; 4) were discovered 120cm from the string level associated with human skeletal, lied vertically in the direction of northeast-southwest.

2.1.4 Srobu

Srobu is an open-site settled about 85m asl in youtefa bays; administratively, it is placed in Abe Pantai's village, Abepura district, Jayapura regency, Papua Province. By astronomical aspect, it is located at 2º.616417 South and 140º.708611 East. The Srobu site covered the youtefa bay's area ± 20,059 M2. This bay formed from the coral limestone stretches over the shoreline in this area. The archaeological project on this site has done by Balai Arkeologi Papua's team through the extensive survey and excavations from 2014 to 2019 (Mene 2014; Djami 2015, 2016, 2017, 2018, 2019). The six individuals were found linked with skulls including: first, Srb/20 with three teeth: two lower first premolar (LP1) and one tooth from lower second premolar (LP2), second, Srb/413 with five teeth including right lower (LM1), right lower (LM2), left lower (LM1), left lower (LM2), left lower (LM3). Third, Srb/ 489 with two teeth: left upper (LM1) and left upper (LM2), four, SRB/ 624 present two teeth: lower premolar (LP) and lower second incisor (LI2), five, Srb/633 consisting of two teeth: right upper (URM1) and upper first molar (UM1), six, Srb/636 consisting of two teeth: lower first molar (LM1) and lower second molar (LM2). The teeth were found with the fragile jaw in several layer of excavation including: Srb/4/UP, Srb/21/UC, Srb/22/UC, Srb/23/UC, Srb/24/UC, Srb/25/UC, Srb/27/LC, Srb/28/UC, Srb/29/UC, Srb/30/LC, Srb/31/UC, Srb/32/LC, Srb/33/LC, Srb/34/LC, Srb/35/UP1, Srb/64/UI1, Srb/65/UI1, Srb/66/LI2, Srb/67/LI2, Srb/86/UI2, Srb/90/UI2, Srb/403/LP1, Srb/622/LP, Srb/623/LP, Srb/25/LP, Srb/626/LP, Srb/627/LP, Srb/629/LC, Srb/630/UM2, Srb/ABC/UM1 (figure 1).

2.1.5 Namatota

The Namatota site is an open-dwelling site located in the Kaimana regency, Papua Barat Province, southern coast of Papua. By astronomical positions, this site is placed at 3.779007º South and 133.885388º East. Two individuals were recovered from this site, first, individuals (NMT/1) present the left lower jaw and the second individuals (NMT/2) have four teeth, namely first premolars, second premolars, first molars, and second molars (Figure 19). The lower jaw from these individuals was found together with ecofacts and potteries fragment at 20cm from the string-levels. Based on the morphological characteristics, the dental teeth was found in the left jaw, present four posterior teeth lined up one another from the front with the first premolars (LP1) in the first place following by fisrt molar.

2.1.6 Kayu batu

Kayu Batu is a rock-shelter burial sites located in the *kampung* Kayu Batu, in Jayapura district, Papua. By astronomical positions, it places at 2º.534491 South and 140º.738056 East. The Kayu Batu shelter faces into the north, to the direction of Yos Sudarso bay, while the south part, is a border with rocky hills in this area. One-hundred sixty teeth were applied for metric study from this site, consisting of fifteen lower first molar (LM1), sixteen lower second molar (LM2), fourteen upper first molar (UM1), twenty upper second molar (UM2), eighteen upper first incisors (UI1), fourteen upper second incisors (UI2), four lower first incisors, three lower second incisors, six upper canines (UC), two lower canines (LC), seven upper first premolars (UP1), twelve upper second premolars.

Figure 1. Above to below: human teeth in this study. Above left, middle to right: teeth from Srobu site; Middle column from left middle: Namatota; middle right: teeth from Karas site. Below left: Mamorikotey site, below middle: Kayu Batu, below right: Kayu Batu
(Source: Tolla, 2023)

2.1.7 Biak-Sowek

The Biak-Sowek burial cave is located in the Biak Supriori regency on the northern coast of Papua. The burial cave is located on a small island standing over the water's body surfaces, about 500m from the shorelines, with the 0º.827306 South and 135º.491389 East. The cave entrances face the northwest direction; it is about 12m above sea level. Eighty-five human teeth (posterior and anterior teeth) were applied for metric study from the burial cave in Biak-Sowek. This including twenty tooth of the LM1, twenty-three tooth of the LM2, six tooth of the UM1, four tooth of UC, six tooth of UP1, three tooth of the UP2.

2.2 Methods

2.2.1 Metric Traits Measurements

The procedures for this study involved measuring the size of the teeth following Buikstra and Ubelaker (1994), making calculations, and using the multivariate statistical method to estimate the distance values. The results were then outlined in the phylogenetic tree employed both, the Neighbor-Joining and UPGMA method. Metric traits are measured on a continuous scale, e.g., breadth and length (at least theoretically, any value between 0 and ∞) or traits that can be empirically measured (DiGangi & Hefner 2013; Sutton 2021: 31). Human teeth were examined in this study were consist of permanent adult teeth which by terminology follows Hillson (1996) with the abbreviated notations used as follow: I, Incisor, consist of two, I1 and I2; one canine, C; two Premolar (P), P1 and P2; three Molar (M), M1, M2, M3. By positions, L, left; R, right; BL, buccolingual; MD, mesiodistal; superscripts are upper teeth; superscripts are the Lower teeth.

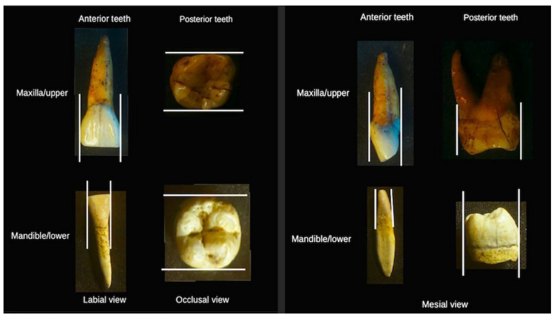


Figure 2. Tooth measurements. Left: Mesiodistal (MD) crown length (diameter); right: Buccolingual (BL) crown breadth (diameter)
(Source: Tolla, 2023)

The mesiodistal length and buccolingual breath of the teeth, were measured to assess the overall proportions and shape of human teeth by using the vernical caliper Mitutoyo 0.02mm. The mesiodistal and buccolingual crown measurements were recorded as a maximum diameters (Fujita systems 1949). Third molars were not examined because their large size and shape variation in human dentition (Matsumura & Hudson, 2005). The human teeth involved in the measurement are between the left or right side, or one of these parts is used depends on their availability. Mesiodistal measurement (length) is the maximum diameter of the crown in the mesiodistal direction; it is parallel to the buccolabial surface. Buccolingual measurements constitute the maximum crown diameter in the buccolingual direction parallel to the mesiodistal surface. The mesiodistal and buccolingual measurement is marked as the most significant distance between contact points on the tooth's long axis. To establish consistency of recorded measurements, intra-observer measurements were applied for each tooth category with intervals a few weeks after the first measurement was done. The differences resulted from the measurements required a new set of measurements. The results of intra-observer measurement were calculated by the use of Q-mode distance matrix, using software Split Tree to assess the correlation between the scores measurement.

2.2.2 Statistical Analysis

The multivariate statistical procedures were undertaken using the dental metrics, comprised 28 crown diameters (14 mesiodistal and 14 buccolingual) examined using metric dental traits.

The mean, standard deviation (SD), and coefficient of variation (CV) were computed for the two populations. The hypothesis developed in this study is that the human teeth from the lowland archaeological sites are not related or have unequal variances to the seventeenth groups of populations involved in this study . Australian-Aborigines, Negritos, Early-Holocene Laotians, Andaman Islanders, Loyalty-Islanders, Lesser-Sunda, and Java Islanders, Sumatra Islanders, Dayak, Malay, Philippines, Vietnamese, Laotians, Amami-Okinawa Islanders, Gua Kepah, Gua Cha, Ban Kao, and Non-Nok Tha were adapted from Matsumura & Hudson (2005) by using multivariate statistical procedures. Unpaired or independent t-test (Gosset 1908) with the significant probability was set at 5% is used to compared the two different populations by applying the formula:

$$t=\frac{\mu_A-\mu_B}{\frac{\sigma_A^2}{n_A}+\frac{\sigma_B^2}{n_B}}$$

t: t-Value
μ_A: Average for population A
σ_A: Standard deviation for population
A n_A: Number of values for population A

The statistic results furthermore was used to reconstruct and visualize the phylogenetic trees by the Neighbor-Joining and UPGMA algorithm method (Saitou and Nei 1987). The phylogenetic trees reconstruction was used in order to find which group of populations were clustered with the Lowland Papua samples; to conclude which populations Lowland populations are affiliated.

3. Result and Discussion

3.1 Result

Multivariate statistical procedures were undertaken to testing the level of variation of the average tooth size and to measure the distance between the group in this study, while the data sets of dental metrics from 17 populations were added to explore the population affinities of the Lowland Papuan.

The table 3 shows the t-test results and probability values for all teeth diameters. A p-value below 0.05 is seen as significant difference, a value p-value above 0.05 as insignificant. Most mesiodistal diameters were not found to be significant different, or the related sample size in the Late-Holocene group was very low. Exceptions are the LP2 and

LM2 mesiodistal diameters, which were found significantly smaller in the Late-Holocene group, with 5 samples each. Most buccolingual diameters however show a significant difference. Especially the UP1 diameter in the Late-Holocene group was found to be significantly smaller, while their UM1 and UM2 diameters were found to be significantly larger, but again with a small sample size. In general, the results show a tendency for larger teeth diameters among the Current Era group.

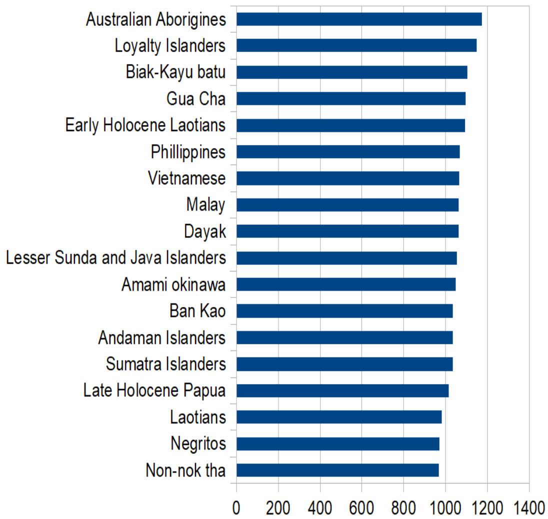
Table 4 shows the triangular distance matrix result for all populations in this study based on the raw data of mesiodistal, buccolingual measurements, the distance value shown by the bold- marked in the table representing the close relationship of population groups. The Andaman Islanders and Loyalty Islanders are the most closed relationship in this study. The two groups from Indonesian-Papua present a relationship with each other; in any case, it does not excessively intimate kinships between one another.

The results obtained from the distance matrix data set analysis scheme used for the Tree diagram of Neighbor Joining and UPGMA Cluster method that was measured excluding three groups of populations including, Amami Okinawa, Viernamese, and Negritos to simplify the cluster, demonstrates that the samples from Papua (Late Holocene and Current Era group) are clustered together with Gua Kepah indicating their close affinities (Figure 3 and 4). Nine populations shared the same branch including, Early Holocene Laotians, Ban Kao, Lesser Sunda and Java Islanders, Laotioans, Non-Nok Tha, Malay, Sumatra Islanders, Dayak and Philippines. In addition, the Gua Cha group, Loyalty Islanders, Andaman Islanders, and Australian Aborigines are joined together in the same branch. The study of non-metric traits is also needed to apply for both samples, Late Holocene and Current Era group in the future to provide comprehensive data to see the variability derived results.

3.2 Discussion

Since the human teeth dimensions are established early in life, the tooth size and morphology are under strong heredity control and environmental factors (Scott & Turner 1997:131). However, since this study aimed to investigate the Lowland population affinities, the environmental factors may not be used to interpret the metric traits in this study, given the assumption that phenotypic similarity reflects primarily genetic similarity (Scott & Turner 1997:145).

Table 2. The total dental crown size (Mesiodistal x Buccolingual) for all teeth in this research



Source: Tolla, 2023

Among the diameters of teeth measurements from two group of population in this study, the results would tentatively support the hypothesis that these groups were genetically distinct. This result appeared to confirm that independent inheritance of tooth size characteristics could be a significant result of breeding between different group lineage. If both groups carried the same genetic, the tooth size between them should be present the similarity.

In this study, the question about the population affinities of the Late Holocene and Current Era groups were examined through the metric dental traits applied the statistical method in the analysis process. The comparison between the tooth variable of the two groups shows several differences shown in the average size of mesiodistal and buccolingual between the tooth variables. The mesiodistal and buccolingual size in the lower first incisors (LI1) and the lower second incisors (LI2) more significant in the Current Era group than in the Late Holocene group. In the upper canines (UC), the average size mesiodistally in the Late Holocene samples was found greater than the Current Era group, while the buccolingual size was found more prominent in the Current Era group compared to the Late Holocene. In the lower premolar two (LP2), the average size of the Current Era groups was found greater mesiodistally and buccolingually compared to the Late Holocene group. The average tooth size distances in a few tooth variables from these two groups of Lowland populations suggest that they may have been carried a different genetic material. This evidence supported by the genetic pattern was studied by several researchers in the past presents the evidence about the different ancestry expansion into the region of Near and Remote Oceania, including Papua (Skoglund et al. 2016). The ancestral modern human population contributed to the Indigenous people of Aborigines Australian, Papuans, and Melanesians, known as Australo-Melanesians as a result of the first out of Africa that arrived in the island of Southeast Asia more than 40,000 years before present (BP) (Coon 1966; Bellwood 1997; Matsumura et al. 2022). This expansion was also supported by the evidence of Mungo Man remains was found in Australia, dated at 40 kya (Davidson 2010), and the evidence of artifacts associated with human colonization at the Huon Peninsula of Papuan New Guinea (Robert 1997). The second ancestral population arrived in Papua around 3,000 BP, which is more closely related to mainland East Asians (Wollstein et al. 2010). These people spread into Near and Remote Oceania and introduced new domesticated plants and animals.

The tooth size of the current Era group (Kayu Batu and Biak) is the third largest teeth after Australian Aborigines and Loyalti Islanders (Table 2), followed by other populations used as a comparison in this study. Based on this evidence, it can be assumed that the Current Era group implies a close genetic relationship with Australian Aborigines and Loyalti Islanders, which by genetically inherited Australo-Melanesian affinities. Populations that possessed Australo-Melanesian traits exhibited larger crown dimensions, such as the Goroka and Lufa from the Eastern Highlands of PNG (Doran and Freedman 1974) and the Wabak Highlanders in PNG (Kanazawa et al. 2000; Igarashi et al. 2001), which by their tooth size referred to as megadont (Harris 1987). While the Late Holocene group crown size is placed between the Sumatra Islanders and Laotians which are close genetic relationships to the East Asian population, in this term Austronesian speakers.

The dental crown measurement results of the Current Era group categorized as Australo Melanesian population contradict the Austronesian languages spoken by this population presently. This can be assumed that the member of the Current Era group or Australo Melanesian in this study have adopted the Austronesian languages from Austronesian speakers to be their languages until today. At present, the living tribes of Kayu Batu speak the Austronesian language Central Eastern Malayo Polynesia (Blust 1993); similarly, the tribe of the Biak-Sowek who occupied the Biak- Supriori Island live in the Bay of various small islands speaks the South Halmahera-West New Guinea (Van den Heuvel, 2006), this language is a branch of Eastern Malayo-Polynesian.

The language distribution in the north coast of Papua and some of Near Oceania's areas were classified into the Western Oceanic linkage based on the geographical areas, the linguistic factors, and socio-cultural aspects

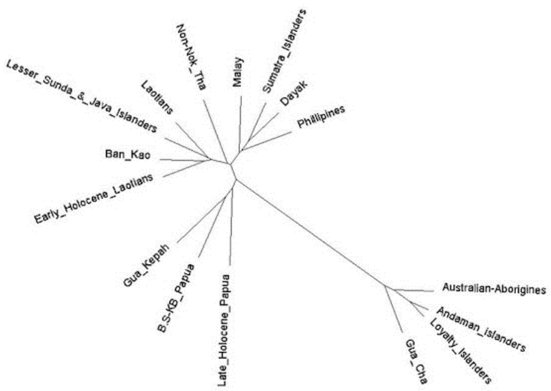


Figure 3. UPGM Cluster analysis from the 16 group of population based on Q-mode distance matrix
Source: Tolla, 2023

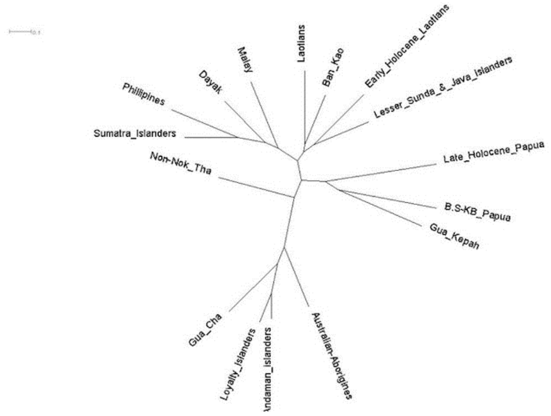


Figure 4. Tree diagram of Neighbor Joining Method results from the 16 population
Source: Tolla, 2023

(Lynch et al. 2011: 92-95). Thus, the western oceanic language may have been formed locally related to the geographical areas of its distribution; as an impact of innovations descended from a dialect network and then linkages to these people in the past (Ross 1988; Lynch 2011: 96).

The results from the triangular distance matrix analysis by the use of the Tree diagram of Neighbor-Joining and UPGMA Cluster method support the assumptions that both groups, Late Holocene and Current Era group show a relationship with each other, but it does not have intimate kindships (Fig 3 and 4). This is shown through the main branch where the Late Holocene and the Current Era are derived, however, later branching off from one another. The Late Holocene owned the branch alone, while the Current Era group joining with Guar Kepah group. This result strengthens the assumption that the Current Era is Australo Melanesian derived, related to the joined group of Guar Kepah in the Current Era branches. Based on the archaeology and genetic studies from the Guar Kepah populations, this group was a hunter-gatherer who occupied Peninsular Malaysia and practiced the Hoabinhian culture. The Guar Kepah remains interpreted as having Australo Melanesian features (Mijsberg 1940), which by this hint further supports the Current Era group affiliations, in this case, the Australo Melanesian affinity. The results of the dental metric analysis in this research are consistent with the 'Two Layer model" (Matsumura et al. 2019) of human dispersal into the area of Southeast Asia including the present region of Indonesian Papua. This process was performed by Australo Melanesian in the 'first layer' of dispersal (O'Connell et al. 2018) who arrived in Pleistocene time, and in the 'second layer' performed by the Austronesian group (Bellwood 2005) from the mainland of East Asia arrived in the region of Near Oceania including the Lowland Papua in mid-Holocene.

4. Conclusion

TThe absolute conclusions concerning the affinities of these two different populations, whether they are East Asian-derived or Australo Melanesian, are difficult to present here, due to the small sample size of the Late Holocene group. Nevertheless, the metric analysis results in this study are useful in determining which populations are more closely related genetically with them. The results show the mainland of East Asians for the Late Holocene group, and the Australo Melanesians affinities for the Current Era group. The metric dental analysis from these two populations in this study can be used as complementary data to shed some light on understanding the human affinities of this region. Future fieldwork should researcher provides a large sample for a better understanding of the population affinities occupied by the region of Indonesian-Papua.

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Table 3. Descriptive statistics coefficient matrix t-test, df and p-value of crown measurements from 19 populations in this study (continued)

	Late-Holocene Papua			Kayu batu & Biak Papua						Australian Aborigines						Loyalty Islanders					
	n	Mean	SD	n	Mean	Std	t	df	p	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p
UI1_MD	3	9.57	0.38	18	9.05	0.53	2.06	19	0.026682	19	9.06	0.53	2.03	20	0.027935	11	8.96	0.72	1.98	12	0.035552
UI2_MD	3	7.28	0.35	14	7.78	0.80	-1.70	15	**0.054883**	23	7.26	0.50	0.09	24	**0.464517**	14	7.3	0.51	-0.08	15	**0.468647**
UC_MD	11	7.58	0.79	10	7.02	0.95	1.47	19	**0.078964**	34	8.29	0.52	-2.79	43	0.003913	17	8.44	0.41	-3.33	26	0.001303
UP1_MD	4	7.18	0.77	13	7.12	0.78	0.14	15	**0.445261**	37	7.53	0.47	-0.90	39	**0.186822**	22	7.58	0.54	-1.00	24	**0.163643**
UP2_MD	2	6.14	0.06	15	7.38	0.38	-11.70	15	1E-05	41	7.02	0.49	-10.19	41	1E-05	22	7.28	0.47	-10.57	22	1E-05
UM1_MD	2	10.38	0.40	20	10.84	0.55	-1.49	20	**0.075913**	45	11.19	0.62	-2.72	45	0.004622	27	11.11	0.60	-2.39	27	0.012046
UM2_MD	2	10.70	0.59	20	10.35	0.83	0.76	20	**0.22806**	47	10.48	0.68	0.51	47	**0.306219**	26	10.48	0.63	0.50	26	**0.31064**
LI1_MD	3	5.73	0.33	4	6.37	0.05	-3.32	5	0.010504	12	5.64	0.37	0.39	13	**0.351426**	8	5.24	0.42	2.00	9	0.038276
LI2_MD	2	6.20	0.71	3	6.31	0.21	-0.21	3	**0.423561**	13	6.41	0.72	-0.39	13	**0.351426**	12	5.86	0.35	0.67	12	**0.257772**
LC_MD	7	6.93	0.86	8	7.02	0.41	-0.26	13	**0.399468**	20	7.22	0.45	-0.85	25	**0.201696**	14	7.25	0.30	-0.95	19	**0.17702**
LP1_MD	8	7.10	0.83	30	7.57	0.42	-1.58	36	**0.061427**	29	7.41	0.66	-0.99	35	**0.164485**	18	7.46	0.39	-1.19	24	**0.122843**
LP2_MD	5	7.07	0.62	20	7.63	0.45	-1.89	23	0.035713	27	7.5	0.51	-1.45	30	**0.078717**	16	7.72	0.42	-2.17	19	0.021446
LM1_MD	2	10.38	0.37	35	12.36	0.59	-7.11	35	1E-05	28	12.33	0.66	-6.76	28	1E-05	21	12.2	0.50	-6.45	21	1E-05
LM2_MD	5	10.52	0.70	39	11.66	0.74	-3.42	42	0.000703	36	12.12	0.91	-4.62	39	2.1E-05	21	11.84	0.65	-3.86	24	0.000375
UI1_BL	3	7.98	0.24	18	7.65	0.14	2.32	19	0.015814	18	7.93	0.49	0.28	19	**0.391252**	12	7.82	0.34	0.94	13	**0.182178**
UI2_BL	3	6.60	0.41	14	7.39	0.73	-2.58	15	0.010457	25	6.80	0.51	-0.78	26	**0.221217**	17	6.81	0.44	-0.81	18	**0.21426**
UC_BL	11	7.91	0.64	10	8.40	0.45	-2.06	19	0.026682	39	8.97	0.68	-4.81	48	0.00`001	17	8.73	0.62	-3.37	26	0.001178
UP1_BL	4	7.18	0.77	13	9.88	0.51	-6.61	15	1E-05	34	10.02	0.72	-7.05	36	1E-05	21	10.24	0.69	-7.43	23	1E-05
UP2_BL	2	9.31	0.95	15	9.48	0.65	-0.25	15	**0.402989**	41	10.08	0.64	-1.14	41	**0.130451**	21	10.26	0.65	-1.39	21	**0.089544**
UM1_BL	2	12.84	0.20	20	11.76	0.49	6.04	20	1E-05	47	12.76	0.70	0.46	47	**0.323819**	29	12.57	0.64	1.46	29	**0.07752**
UM2_BL	2	12.90	0.25	20	11.54	0.68	5.77	20	1E-05	48	13.02	0.87	-0.55	48	**0.292435**	26	12.83	0.71	0.31	26	**0.379516**
LI1_BL	3	6.19	0.54	4	6.55	0.30	-1.06	5	**0.168821**	17	6.26	0.51	-0.22	18	**0.414173**	8	6.13	0.44	0.16	9	**0.438207**
LI2_BL	2	6.07	0.24	3	6.85	0.45	-2.51	3	0.043469	23	6.47	0.43	-2.08	23	0.024428	13	6.52	0.5	-2.05	13	0.030548
LC_BL	7	7.18	0.45	8	8.13	0.46	-4.04	13	0.000701	25	8.24	0.67	-4.90	30	1.5E-05	15	8.19	0.54	-4.59	20	8.9E-05
LP1_BL	8	8.13	0.87	30	8.22	0.50	-0.30	36	**0.382951**	29	8.73	0.67	-1.83	35	0.037889	17	8.69	0.48	-1.72	23	0.049431
LP2_BL	5	7.87	0.57	20	8.33	0.53	-1.64	23	0.057306	27	8.95	0.63	-3.84	30	0.000296	16	8.93	0.73	-3.39	19	0.001537
LM1_BL	2	10.71	0.01	35	11.02	0.63	-2.90	35	0.003204	36	11.75	0.60	-10.35	36	1E-05	21	11.2	0.59	-3.79	21	0.000536
LM2_BL	5	9.88	0.49	39	10.58	0.63	-2.90	42	0.002957	36	11.40	0.68	-6.16	39	1E-05	21	10.93	0.77	-3.80	24	0.000436

Table 3. (continued)

	Early Holocene Laotians						Negritos						Andaman Islanders						Lesser Sunda and Java Islanders					
	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p
UI1_MD	6	8.85	0.45	2.52	7	0.019905	21	8.37	0.67	4.55	22	7.9E-05	8	8.34	0.4	4.71	9	0.000552	6	8.75	0.54	2.64	7	0.016712
UI2_MD	4	7.5	0.48	-0.7	5	**0.257574**	21	6.95	0.75	1.27	22	**0.108677**	13	6.81	0.48	1.94	14	0.036398	6	7.21	0.55	0.23	7	**0.412334**
UC_MD	7	8.02	0.67	-1.26	16	**0.112869**	21	7.74	0.4	-0.62	30	**0.26997**	15	7.84	0.35	-1.01	24	**0.161285**	8	8.1	0.29	-2	17	0.030869
UP1_MD	6	7.68	0.78	-1	8	**0.173297**	23	7.16	0.39	0.05	25	**0.48026**	19	7.3	0.41	-0.3	21	**0.383563**	9	7.59	0.4	-1.01	11	**0.167098**
UP2_MD	7	6.94	0.4	-5.12	7	0.000684	20	6.85	0.47	-6.31	20	1E-05	18	6.69	0.33	-6.29	18	1E-05	8	7	0.4	-5.85	8	0.000191
UM1_MD	8	10.81	0.74	-1.12	8	**0.147605**	20	10.51	0.42	-0.44	20	**0.332328**	25	10.59	0.43	-0.71	25	**0.242137**	10	10.71	0.45	-1.04	10	**0.161416**
UM2_MD	7	9.97	9.97	0.19	7	**0.427351**	18	9.34	0.56	3.09	18	0.003158	25	9.55	0.94	2.5	25	0.009672	10	9.62	0.54	2.38	10	0.019306
LI1_MD	7	5.53	5.53	0.09	8	**0.46525**	20	5.27	0.52	2.03	21	0.027608	6	5.03	0.29	3.09	7	0.008783	5	5.61	0.35	0.47	6	**0.327476**
LI2_MD	6	6.4	0.48	-0.37	6	**0.362046**	22	5.94	0.49	0.51	22	**0.307565**	9	5.34	0.73	1.55	9	**0.077776**	5	6.48	0.28	-0.54	5	**0.306185**
LC_MD	6	7.28	0.84	-0.74	11	**0.237399**	21	6.76	0.49	0.49	26	**0.314122**	11	7.02	0.42	-0.26	16	**0.39909**	5	7.32	0.53	-0.97	10	**0.177461**
LP1_MD	6	7.26	0.61	-0.43	12	**0.337408**	24	6.92	0.44	0.57	30	**0.286461**	14	7.2	0.47	-0.33	20	**0.372416**	5	7.31	0.56	-0.56	11	**0.293351**
LP2_MD	7	7.56	0.66	-1.3	10	**0.111383**	25	7.05	0.56	0.07	28	**0.472346**	17	7.29	0.38	-0.74	20	**0.233949**	5	7.2	0.21	-0.44	8	**0.335791**
LM1_MD	8	12.11	0.5	-5.5	8	0.000287	19	11.34	0.5	-3.38	19	0.001572	18	11.6	0.54	-4.21	18	0.000263	6	11.78	0.47	-4.33	6	0.002464
LM2_MD	6	11	0.86	-1.02	9	**0.167181**	17	10.31	0.67	0.6	20	**0.277622**	17	11.05	0.54	-1.57	20	**0.066051**	5	10.58	0.44	-0.16	8	**0.438424**
UI1_BL	6	7.42	0.45	2.43	7	0.02271	9	7.47	0.59	2.12	10	0.030012	8	7.27	0.36	3.77	9	0.002208	6	7.47	0.46	2.19	7	0.032339
UI2_BL	4	6.8	0.48	-0.59	5	**0.290422**	9	6.26	0.6	1.1	10	**0.148553**	13	6.48	0.58	0.42	14	**0.34043**	7	6.72	0.61	-0.36	8	**0.364083**
UC_BL	7	8.62	0.67	-2.24	16	0.01982	13	7.83	0.57	0.31	22	**0.379739**	15	8.32	0.49	-1.79	24	0.04304	8	8	0.8	-0.27	17	**0.395205**
UP1_BL	6	9.83	0.78	-5.32	8	0.000356	24	9.24	0.51	-5.19	26	1E-05	19	9.85	0.67	-6.47	21	1E-05	9	9.49	0.76	-5.03	11	0.000192
UP2_BL	7	9.8	0.4	-4.22	7	0.001968	20	8.99	0.45	0.47	20	**0.32172**	18	9.58	0.35	-0.4	18	**0.346932**	8	9.51	0.51	-0.29	8	**0.389595**
UM1_BL	8	12.21	0.74	1.78	8	**0.056475**	20	11.38	0.48	8.22	20	1E-05	25	12.13	0.51	4.07	25	0.000207	10	12.16	0.41	3.54	10	0.002678
UM2_BL	7	12.31	0.38	29.96	7	1E-05	18	10.96	0.55	8.75	18	1E-05	24	11.95	0.84	3.82	24	0.000415	10	11.93	0.61	3.68	10	0.002123
LI1_BL	7	6	0.56	-1.05	8	**0.1622**	13	6.05	0.46	0.41	14	**0.344005**	8	5.92	0.52	0.74	9	**0.239079**	4	5.97	0.47	0.56	5	**0.29982**
LI2_BL	6	6.58	0.48	-7.02	6	0.000208	15	6.54	0.39	-2.38	15	0.015506	9	6.25	0.36	-0.87	9	**0.203453**	4	6.44	0.56	-1.13	4	**0.160823**
LC_BL	6	7.89	0.84	-2.93	11	0.006845	9	7.74	0.51	-2.34	14	0.017308	11	7.64	0.53	-1.98	16	0.032585	4	8.16	0.33	-4.14	9	0.001261
LP1_BL	6	8.3	0.61	-1.13	12	**0.140279**	22	7.86	0.45	0.82	28	**0.209571**	14	8.21	0.39	-0.26	20	**0.398761**	5	8.15	0.31	-0.07	11	**0.472725**
LP2_BL	7	8.57	0.5	-10.45	10	1E-05	23	8.09	0.42	-0.83	26	**0.207048**	17	8.72	0.42	-3.11	20	0.002759	5	8.41	0.49	-1.61	8	**0.073032**
LM1_BL	8	11.18	0.5	0.56	8	**0.295405**	19	10.45	0.41	2.75	19	0.006367	17	11.11	0.6	-2.74	17	0.006979	6	10.78	0.58	-0.3	6	**0.38715**
LM2_BL	6	10.61	0.86	-1.76	9	**0.056131**	19	9.84	0.58	0.16	22	**0.437171**	18	10.51	0.68	-2.32	21	0.015248	5	10.23	0.47	-1.15	8	**0.141679**

Table 3. (continued)

	Sumatra Islanders						Dayak						Malay						Philippines					
	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p
UI1_MD	5	8.61	0.16	4.16004	6	0.002972	5	8.89	0.67	1.83107	6	0.058494	3	9.19	0.57	0.96077	4	0.19571	2	8.94	0.13	2.64848	3	0.038497
UI2_MD	9	7.09	0.51	0.71762	10	**0.244006**	6	7.2	0.58	0.25651	7	**0.401173**	4	6.81	0.43	1.58957	5	0.086353	3	7.05	0.21	0.9728	4	**0.193487**
UC_MD	17	7.96	0.46	-1.43907	26	**0.0809**	14	8.05	0.49	-1.7238	23	**0.049431**	10	8.3	0.4	-2.66516	19	**0.007568**	5	8.34	0.66	-1.99983	14	0.032644
UP1_MD	19	7.52	0.29	-0.87412	21	**0.197068**	23	7.46	0.43	-0.7114	25	**0.242137**	22	7.47	0.34	-0.74354	24	**0.233239**	10	7.62	0.31	-1.11232	12	**0.144374**
UP2_MD	21	7.01	0.49	-7.62064	21	1E-05	26	6.91	0.54	-6.8018	26	1E-05	27	6.91	0.34	-10.0403	27	1E-05	6	7.05	0.45	-4.84001	6	0.00144
UM1_MD	23	10.43	0.49	-0.16626	23	**0.433248**	36	10.58	0.65	-0.6603	36	**0.256727**	46	10.6	0.42	-0.75982	46	**0.225566**	17	10.59	0.38	-0.70593	17	**0.243665**
UM2_MD	20	9.47	0.55	2.81056	20	**0.005408**	35	9.67	0.89	2.30875	35	0.013453	44	9.5	0.56	2.80112	44	0.003781	17	9.62	0.67	2.39819	17	0.014063
LI1_MD	11	5.48	0.22	1.21263	12	**0.124788**	6	5.85	0.42	-0.4787	7	0.322932	5	5.86	0.32	-0.55624	6	0.297876	2	5.51	0.4	0.63349	3	**0.286705**
LI2_MD	13	6.11	0.25	0.17829	13	**0.429964**	7	6.32	0.41	-0.2292	7	**0.412334**	4	6.22	0.3	-0.03831	4	**0.485005**	2	6.29	0.23	-0.17117	2	**0.440326**
LC_MD	12	7	0.39	-0.20659	17	**0.418082**	12	7.12	0.35	-0.5595	17	**0.291392**	6	7.21	0.54	-0.71374	11	**0.246241**	1	6.79		0.42388	6	**0.344555**
LP1_MD	18	7.35	0.42	-0.82728	24	**0.207359**	15	7.35	0.58	-0.7772	21	**0.222047**	6	7.47	0.38	-1.1344	12	**0.140279**	5	7.46	0.48	-1.00734	11	**0.167098**
LP2_MD	18	7.22	0.41	-0.50153	21	**0.311137**	15	7.22	0.67	-0.451	18	**0.329041**	6	7.37	0.57	-0.82055	9	**0.216698**	4	7.08	0.77	-0.01683	7	**0.492301**
LM1_MD	18	11.53	0.42	-4.13359	18	0.000314	22	11.74	0.55	-4.7683	22	4.6E-05	6	11.84	0.45	-4.58607	6	0.001866	8	12.06	0.5	-5.34344	8	0.000347
LM2_MD	20	10.81	0.52	-0.87232	23	**0.196645**	20	11.03	0.82	-1.4111	23	**0.08596**	6	10.92	0.73	-0.92794	9	**0.188321**	7	11.07	0.75	-1.30599	10	**0.109744**
UI1_BL	7	7.25	0.42	3.46443	8	0.004284	5	7.46	0.36	2.44804	6	0.024895	5	7.44	0.76	1.47122	6	0.09598	2	7.56	0.9	0.64486	3	0.283849
UI2_BL	12	6.77	0.36	-0.65973	13	**0.260388**	9	6.88	0.24	-1.1245	10	**0.144446**	4	6.41	0.69	0.45467	5	**0.335775**	4	6.77	0.51	-0.48947	5	**0.322438**
UC_BL	18	8.36	0.52	-1.98564	27	0.028403	13	8.59	0.6	-2.685	22	**0.006688**	10	8.54	0.52	-2.50104	19	0.01087	5	8.81	0.61	-2.70489	14	**0.008628**
UP1_BL	18	9.67	0.47	-6.24182	20	1E-05	24	9.78	0.65	-6.411	26	1E-05	23	9.73	0.56	-6.36503	25	1E-05	10	9.92	0.38	-6.8222	12	1E-05
UP2_BL	21	9.49	0.56	-0.2643	21	0.398698	25	9.59	0.69	-0.4093	25	**0.342649**	26	9.37	0.6	-0.0882	26	**0.464488**	6	9.63	0.32	-0.46878	6	**0.327476**
UM1_BL	23	11.9	0.59	5.01486	23	**2.3E-05**	36	11.89	0.7	5.18182	36	1E-05	46	11.97	0.58	5.26422	46	1E-05	17	12.06	0.53	4.08139	17	0.00039
UM2_BL	20	11.74	0.63	5.075	20	2.9E-05	35	11.85	0.88	4.49665	35	3.6E-05	44	11.78	0.78	5.20917	44	1E-05	18	11.82	0.54	4.89898	18	5.8E-05
LI1_BL	12	5.81	0.33	1.16176	13	**0.133455**	8	6.16	0.36	0.0796	9	**0.468994**	5	5.87	0.49	0.8343	6	**0.219154**	2	5.59	0.58	1.16072	3	**0.16499**
LI2_BL	14	6.29	0.5	-1.01742	14	0.162516	7	6.36	0.71	-0.9129	7	0.196539	4	6.46	0.49	-1.30783	4	**0.130181**	2	6.53	0.14	-2.33831	2	**0.07208**
LC_BL	13	7.81	0.52	-2.83107	18	0.005549	13	7.85	0.58	-2.8678	18	0.005092	6	8.04	0.56	-3.02363	11	0.005828	1	7.9		-4.23237	6	0.00275
LP1_BL	18	8.16	0.54	-0.10535	24	**0.456662**	15	8.16	0.73	-0.0972	21	**0.460646**	6	8.31	0.65	-0.45601	12	**0.198209**	5	8.57	0.42	-1.23684	11	**0.120388**
LP2_BL	19	8.5	0.46	-2.29559	22	0.015654	15	8.38	0.59	-1.7273	18	**0.05037**	6	8.68	0.89	-1.83097	9	0.050248	4	8.18	1.05	-0.53485	7	**0.306251**
LM1_BL	20	10.75	0.6	-0.29732	20	**0.383637**	22	10.94	0.56	-1.9197	22	0.033958	6	11.05	0.66	-1.26099	6	0.127229	9	10.89	0.46	-1.17142	9	**0.136025**
LM2_BL	20	10.29	0.44	-1.70685	23	**0.050362**	21	10.47	0.72	-2.1881	24	**0.019239**	6	10.38	0.62	-1.49346	9	0.085205	7	10.49	0.73	-1.73125	10	**0.057157**

Table 3. (continued)

	Vietnamese						Laotians						Amami-Okinawa Islanders						Gua Kepah					
	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p	n	Mean	SD	t	df	p
UI1_MD	4	8.87	0.37	2.43918	5	0.029327	2	8.27	0.07	5.78016	3	0.005149	36	8.51	0.45	4.57176	37	2.6E-05	7	9.33	0.34	0.94392	8	0.187364
UI2_MD	3	7.23	0.83	0.09608	4	**0.462578**	5	6.75	0.73	1.37869	6	**0.108402**	36	7.08	0.52	0.90618	37	0.184356	6	7.71	0.45	-1.57066	7	**0.080203**
UC_MD	9	8.09	0.41	-1.85202	18	**0.0404**	8	7.67	0.37	-0.3248	17	**0.376434**	40	7.82	0.45	-0.95906	49	**0.170884**	6	8.26	0.54	-2.09078	15	0.027031
UP1_MD	17	7.41	0.62	-0.55869	19	**0.291011**	16	7.26	0.51	-0.1981	18	**0.421861**	49	7.32	0.45	-0.36028	51	**0.360167**	6	7.89	0.26	-1.78545	8	**0.05562**
UP2_MD	16	7.12	0.99	-3.90888	16	0.000624	21	6.7	0.37	-6.2149	21	1E-05	46	6.84	0.42	-9.49526	46	1E-05	5	7.2	0.52	-4.49217	5	0.003229
UM1_MD	33	10.52	0.49	-0.47389	33	**0.320723**	29	10.36	0.41	0.06828	29	**0.472337**	58	10.42	0.56	-0.13687	58	**0.444573**	4	11.24	0.15	-2.93899	4	**0.021195**
UM2_MD	30	9.5	0.53	2.78421	30	**0.004648**	27	8.99	0.63	3.9117	27	0.000281	44	9.62	0.46	2.53708	44	0.007346	4	10.43	0.34	0.59589	4	0.290421
LI1_MD	5	5.47	0.54	0.83143	6	**0.219154**	2	5.29	0.51	1.06845	3	0.181529	40	5.36	0.34	1.83637	41	0.036508	4	5.87	0.25	-0.62495	5	**0.281209**
LI2_MD	9	6.02	0.51	0.34084	9	**0.370829**	2	6.18	0.01	0.04	2	**0.485864**	41	5.89	0.36	0.61612	41	**0.269344**	5	6.86	0.13	-1.31117	5	**0.123575**
LC_MD	12	7.05	0.36	-0.35398	17	**0.365319**	10	7.13	0.3	-0.5917	15	**0.281987**	43	6.89	0.64	0.11306	48	**0.456434**	6	7.34	0.34	-1.15842	11	**0.135304**
LP1_MD	12	7.34	0.62	-0.71552	18	**0.240385**	15	6.92	0.45	0.557	21	**0.290702**	54	7.12	0.53	-0.08314	60	**0.468252**	8	7.85	0.43	-2.29396	14	**0.019032**
LP2_MD	10	7.75	0.49	-2.12546	13	**0.026425**	12	7.04	0.35	0.1079	15	**0.456934**	52	7.14	0.51	-0.23639	55	**0.405611**	6	7.89	0.78	-1.93265	9	**0.042836**
LM1_MD	17	11.63	0.54	-4.29371	17	0.000248	18	11.48	0.52	-3.8269	18	0.000613	60	11.65	0.45	-4.76706	60	1E-05	5	12.56	0.18	-8.00951	5	0.000245
LM2_MD	20	11.04	0.9	-1.40234	23	**0.087429**	21	10.4	0.63	0.35248	24	**0.364696**	52	10.87	0.63	-1.08202	55	**0.142428**	6	12.19	0.35	-4.87362	9	**0.000442**
UI1_BL	4	8.02	0.42	-0.15899	5	0.439572	2	7.26	0.42	2.197	3	0.057586	2	7.75	0.2	1.16168	3	0.16499	7	8.09	0.25	-0.65587	8	0.263897
UI2_BL	3	6.94	0.41	-1.01761	4	**0.1827**	5	6.15	0.72	1.12754	6	**0.150808**	3	7.13	0.34	-1.72744	4	**0.079341**	6	7.35	0.54	-2.32342	7	**0.026697**
UC_BL	10	8.52	0.6	-2.2684	19	0.017518	8	7.95	0.17	-0.2121	17	**0.418082**	6	8.55	0.89	-1.56355	15	0.069803	6	9.02	0.5	-3.96824	15	**0.000616**
UP1_BL	17	9.65	0.62	-5.99984	19	1E-05	16	9.31	0.51	-5.2738	18	2.6E-05	14	9.77	0.66	-6.13922	16	1E-05	6	10.44	0.31	-8.07754	8	2E-05
UP2_BL	16	9.39	0.65	-0.11604	16	0.452989	21	9.22	0.54	0.1323	21	**0.448902**	11	9.67	0.54	-0.52212	11	**0.306684**	5	9.86	0.76	-0.73208	5	**0.249071**
UM1_BL	34	11.73	0.59	6.38329	34	**1E-05**	29	11.62	0.53	7.0808	29	1E-05	24	11.86	0.54	5.46557	24	1E-05	4	12.77	0.36	0.3058	4	0.38602
UM2_BL	29	11.65	0.69	5.65748	29	1E-05	27	11.6	0.73	5.69338	27	1E-05	19	12.1	0.64	3.44399	19	0.001372	4	12.93	0.56	-0.09013	4	0.466307
LI1_BL	5	6.16	0.46	0.07169	6	**0.473234**	2	6.22	0.1	-0.1049	3	**0.463326**	7	5.83	0.15	1.13208	8	**0.145608**	4	6.82	0.39	-1.72969	5	**0.072096**
LI2_BL	9	6.37	0.43	-1.34916	9	0.104993	4	5.96	0.23	0.53595	4	0.308928	7	6.49	0.25	-2.15943	7	**0.033804**	5	7.32	0.4	-5.06526	5	**0.001934**
LC_BL	12	8.35	0.44	-5.51036	17	1.9E-05	10	7.37	0.48	-0.844	15	0.207049	9	7.79	0.58	-2.3757	14	0.016037	6	8.75	0.76	-4.44096	11	0.000498
LP1_BL	12	8.38	0.56	-0.7352	18	**0.234421**	15	7.98	0.51	0.43423	21	**0.335788**	19	8.22	0.23	-0.3051	25	**0.379565**	8	9.09	0.43	-2.81783	14	**0.006816**
LP2_BL	10	8.68	0.53	-2.66625	13	0.009632	12	8.29	0.47	-1.4642	15	**0.082458**	19	8.57	0.46	-2.54985	22	0.009127	5	9.25	0.71	-3.39732	8	**0.00468**
LM1_BL	19	10.91	0.56	-1.55206	19	**0.068819**	20	10.77	0.56	-0.4776	20	0.318218	32	11.12	0.55	-4.1948	32	0.000102	5	11.76	0.49	-4.78659	5	**0.002463**
LM2_BL	20	10.38	0.73	-1.82983	23	**0.040121**	21	10.02	0.63	-0.5412	24	**0.297086**	28	10.52	0.58	-2.61204	31	0.00691	6	11.18	0.31	-5.13723	9	**0.000306**

Table 4. The distances (1-r) between the 19 population, derived from the comparing the crown distance matrix (continued)

	LH- Papua	B.S-KB Papua	Aus-Abo	Negritos	EH-Laotians	Andaman Isl	Loyalty Isl	L.Sunda Java Isl	Sumatra Isl
B.S-KB Papua	**0.972**								
Aus-Abo	**0.926**	1.400							
Negritos	1.128	**0.952**	1.462						
EH-Laotians	1.080	1.155	1.055	1.224					
Andaman Isl	1.350	1.351	**0.532**	1.083	1.083				
Loyalty Isl	1.163	1.436	**0.506**	1.165	**0.977**	**0.259**			
L.Sunda Java Isl	**0.959**	1.094	1.443	**0.748**	**0.590**	1.474	1.267		
Sumatra Isl	1.353	1.053	1.532	**0.971**	**0.777**	1.124	1.112	**0.631**	
Dayak	**0.963**	**0.732**	1.444	**0.881**	**0.865**	1.545	1.615	**0.692**	**0.543**
Malay	1.155	1.238	1.164	**0.884**	1.070	1.123	1.216	0.718	**0.741**
Phillipines	1.197	1.235	1.081	**0.862**	1.045	1.231	1.028	1.062	**0.570**
Vietnamese	1.165	**0.805**	1.414	**0.663**	1.377	1.127	1.048	1.041	**0.875**
Laotians	1.092	1.133	1.047	**0.898**	**0.806**	1.087	1.203	**0.621**	1.027
Amami Okinawa Isl	1.155	**0.972**	**0.925**	1.141	1.204	**0.757**	**0.912**	1.482	**0.983**
Gua Kepah	1.045	**0.865**	**0.999**	1.081	1.023	1.075	1.271	1.041	1.246
Gua Cha	1.275	1.008	**0.798**	1.290	1.238	**0.502**	**0.650**	1.545	1.090
Ban Kao	1.211	1.265	**0.722**	1.287	**0.577**	**0.770**	**0.966**	**0.683**	1.001
Non-Nok Tha	1.319	1.214	**0.731**	1.062	**0.816**	**0.981**	1.199	1.035	1.143

Table 4. (continued)

	Dayak	Malay	Phillipines	Vietnamese	Laotians	Amami Okinawa Isl	Gua Kepah	Gua Cha	Ban Kao
Malay	**0.689**								
Phillipines	**0.808**	**0.777**							
Vietnamese	1.015	**0.919**	1.037						
Laotians	**0.729**	**0.833**	1.413	1.095					
Amami Okinawa Isl	1.113	1.442	**0.833**	**0.807**	1.387				
Gua Kepah	1.316	1.127	1.127	**0.965**	1.082	1.096			
Gua Cha	1.441	1.388	1.121	1.045	1.195	**0.660**	**0.898**		
Ban Kao	**0.872**	**0.578**	1.166	1.401	**0.577**	1.491	1.085	1.317	
Non-Nok Tha	1.060	**0.926**	**0.853**	1.320	**0.997**	**0.877**	**0.890**	1.096	**0.681**