Brief Summary (Preliminary Report) of Research Findings: Study into Malay Peninsula Aborigines' Dental Differentiation; and the Orang Asli Project 1999

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1. Introduction

This report summarizes our joint field work undertaken in August 1999 to survey the dental status of the Orang Asli. Bulbeck's project "Study into Malay Peninsula Aborigines' Dental Differentiation" (Research Pass No. 0689) is co-ordinated in conjuction with Adi Haji Taha, Director of the Malaysian Division of Museums, Department of Museums and Antiquities. Three staff members from the Division, Muhamad Mahfuz Nordin, Matasuki bin Sadkin, and Ludin bin Hassan, have been assigned to the project to select suitable Orang Asli settlements in liaision with the Jabatan Hal Ehwal Orang Asli, collect information on the villagers' customs and residential patterns, and assist in the logistics and general administration. Rahimah Abdul Kadir heads the "Orang Asli Project 1999" which is the initiative of the University of Malaya Faculty of Dentistry. Other Faculty staff members screening the Orang Asli and collecting their dental casts are Daw Mohammad Swessi and Zamri bin Radzi from the Department of Children's Dentistry and Orthodontics, and Paula Nuti Pontes from the Department of Prosthetics Dentistry. The periods spent in the field are August 6th-7th, 13th-14th, 19th-22nd, and 27th-29th.

According to the Aboriginal Peoples (Amendment) Act, an Orang Asli or West Malaysian aborigine is a person who speaks an Orang Asli language, habitually follows an Orang Asli way of life (including customs and beliefs), and is a member of an Orang Asli community either by patrilineal membership, adoption as an infant, or maternal descent (Abdul Kadir R. 1992:1). The recognized Orang Asli language groups fall in three major divisions, from north to south: Kensiu, Kintaq, Jahai, Lanoh, Mendriq, Bateq; Temiar, Semai, Jahut, Che Wong (and the Mah Meri isolate to the south); Semelai, Temuan, Temoq, Jakun, Orang Kanaq, Orang Laut, Orang Selatar (Abdul Kadir R. 1992:2-4). These three divisions correspond to the Semang or Negritos, who usually speak North Aslian languages, the Senoi who usually speak Central Aslian languages, and the Proto-Malays (or Aboriginal Malays) who speak

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Southern Aslian and Austronesian languages (Benjamin 1986). Demographic data on display in the Muzeum Orang Asli, near Kuala Lumpur, attest to 2992 Semang (244 Kensiu, 235 Kintaq, 1049 Jahai, 359 Lanoh, 145 Mendriq, 960 Bateq), 46,952 Senoi (15,122 Temiar, 26,049 Semai, 3193 Jahut, 403 Che Wong, 2185 Mah Meri), and 42,605 Proto-Malays (4103 Semelai, 16,020 Temuan, 2488 Temoq, 16,637 Jakun, 64 Orang Kanaq, 2492 Orang Laut, 801 Orang Selatar).

The Aslian languages belong to the Austroasiatic or Mon-Khmer language family, and the Orang Asli Austronesian languages also differ to varying degrees from Melayu Malay (Benjamin 1986). Physically the Semang have dark skin, woolly hair, and short stature which averages at around 154 cm for males; the Senoi are slightly taller, especialy those living at higher alitudes, and have a high frequency of wavy hair; while the Proto-Malays exhibit only subtle physical differences from the mainstream Malay community (Bulbeck 1996). Traditionally the Semang foraged in bands of 10 to 60 people in the lowland rainforests; most of the Senoi lived in the hills in settlements of 50 to 200 people residing in a long house (plus accessory dwellings), with an economy based on slash and burn horticulture; while the Proto-Malays tend to be farmers and fishers of the coast and interior lowland, with more of an emphasis on individual family plots rather than communally owned land (Abdul Kadir R. 1992:2-4). There is a government-sponsored trend for many Orang Asli to settle into villages with one acre per household, which these Orang Asli are achieving with varying degrees of success, generally depending on the degree of fit between their traditional lifestyle and the new settlement pattern.

Scholarly awareness of the three Orang Asli groups had developed by the late 19th century, leading to the theory of three separate waves of migration in the order Semang, Senoi, Proto-Malays (see Martin 1905). Bellwood (1993, 1997) modifies this view by arguing that the Semang are direct descendants of the original hunter-gatherers of the peninsula, whereas the Senoi and, to a lesser degree, the Aboriginal Malays are largely descended from immigrant farmers who introduced pottery and Aslian languages from central Thailand about 4000 years ago. Rambo (1984), on the other hand, has argued that the external physical differences between the three groups are the result of in situ biological adaptation to the contrasting lifestyles of rainforest foraging, swidden gardening in the forested uplands, and farming in the lowlands. Some Malay scholars, e.g. Nik Hassan Shuhaimi, view the difference between Malays and the Orang Asli as the result of a long-term historical relationship between coastal and predominantly hinterland communities. Other Malay scholars, e.g. Adi Haji Taha, place more stress on West Malaysia's prehistory as the record of the cultural heritage of the Orang Asli, especially the Semang who once would have occupied a much larger area of the Malay Peninsula hinterland. This brief survey shows there is a wide range of scholarly opinions to account for the evident physical and linguistic differences between the Orang Asli groups, and between them and the Malays.

Our joint project surveys two hinterland groups from each of the three Orang Asli groups to investigate hypotheses on their past and to examine their adjustments in the present. Dental morphology (incisor shovelling, etc.) and tooth size are the means to examine the various scholarly opinions expressed on the biological origins and evolution of the Orang Asli. Inspection of their dental health is the selected indicator of the degree to which the community members are enjoying a healthy lifestyle today. Dental casts are routinely made to allow the determination of dental morphology, the measurement of the teeth, and to permanently record the occurrences of major carious events, tooth loss through periodontal disease, and impaction of the teeth. These studies must be carried out on living individuals, rather than skulls, because only 30 Orang Asli skulls appear to have ever found their way into museum collections, none of them had their teeth studied (Martin 1905; Schebesta and Lebzelter 1926), and virtually none of them can now be relocated. However, some idea of historical trends in oral health can be gauged by comparing the present results with those of Mummery (1948) on the Che Wong, Polunin (1953) on the Lanoh Semang and Semai Senoi, Kinzie *et alia* (1966) on the Jahai and the Temuan, Chan *et alia* (1974) on the Temiar, Khor (1985) on the Semia, and Abdul Kadir R. (1992, 1993) on the Temuan Proto-Malays.

Our project focuses on the Orang Asli and makes no attempt to sample a comparative Melayu Malay population, for various reasons. First, Malays are so variable in their lifestyle, from city to plantation to farming kampong to fishing village, that a very large number of samples would be required to begin to cover the range. Second, there has been a historical process whereby members of other communities adopt Islam and Malay dress, and speak Malay, so that Malays as a group can be expected to have a diverse ancestry. Further, the Malays themselves recognize historical immigrations of different ethnic groups from Sumatra such as the Minangkabau, as well as long-term residents (arguably dating back to the Srivijaya empire, 7th to 13th centuries A.D.), not to mention the infiltration of non-Malay groups such as the Bugis of South Sulawesi. Any comparable integration of outsiders into the Orang Asli communities should have occurred at a lower level, and should be fairly clear in a preliminary interview. Third, the status of the Orang Asli arguably deserves special attention given their lesser preparedness for the rapid social and economic changes placed upon them during the internationalization of Malaysia's economic system.

Dental morphology is selected as the key indicator of inter-population realtionships for various good reasons (see Hillson 1996). Dental morphology is evidently under polygenic control, with no convincing evidence that environmental factors can influence the development of dental traits, and no evidence that any dental variant represents an adaptation to identifiable environmental pressures. That is, the degree of similarity between two populations in their dental morphology should be correlated with their degree of genetic relatedness by some combination of common ancestry and long-term interbreeding. The polygenic nature of the

inheritance of dental traits should make their transmission relatively conservative, that is, they should be less susceptible to genetic drift, the founder effect, point mutations and other processes that can rapidly differentiate small, isolated populations on their blood groups and other "genetic markers". Under the scenario of three separate migratory waves, the Semang, Senoi and Proto-Malay samples should show three contrasting dental morphological profiles. Under Bellwood's theory of an immigration of Aslian-speaking farmers, the Semang samples should be readily distinct from the Senoi and Aboriginal Malay samples. Under Rambo's hypothesis of in situ biological adaptation, any distinction between Semang, Senoi and Proto-Malay profiles should be subtle to the point of vacuity.

Tooth size data should be interpreted in consideration of the evidence that the three Orang Asli divisions may or may not stem from different origins. However, what is clear is that teeth have generally become smaller across the world during the Holocene period spanning the last ten thousand years. Two main theories have been proposed for this change. One theory focuses on smaller body size as documented among the pre-industrial inhabitants in every continent of the world; as people became smaller, with the onset of climatic amelioration following the Ice Age, so their teeth became smaller. According to this theory, the Semang (who have the shortest stature) should have the smallest teeth, the lightly built Senoi should have the next smallest teeth, and the Proto-Malays should have relatively large teeth. A second theory holds that the economic consequences of the Neolithic, especially the consumption of agricultural produce and the use of pots to cook foodstuffs to a soft consistency, reduced the requirements for a large tooth mass. Hence selection pressures reduced tooth size during the Neolithic and subsequent phases, both to minimize the somatic costs of producing unnecessarily large teeth, and to reduce the risk of these large teeth becoming impacted in insufficiently sized jaws. Under this theory, the traditional hunter-gatherers, the Semang, should have the largest teeth, the Senoi should have intermediate-sized teeth, and the Proto-Malays should have the smallest teeth.

As regards the adjustment to modern settled living, it may be hypothesized that the Semang have entered into the major transformation of their traditional lifestyle, the Senoi have had to restrict their peregrinations to an intermediate degree, and the Proto-Malays have made only a slight transition. The sharpness of the transition should be evident from the degree to which elders in the community exhbit different rates of dental attrition and periodontal disease from younger members who would be more able to embrace the secular socio-economic changes. Hence the Semang should show the sharpest differences in oral health as a function of age, the Senoi should be intermediate in this regard, whereas the Proto-Malays should not show great differences between the age classes in terms of oral health.

One interesting point regarding the Proto-Malays is that, traditionally, in some groups, the women's teeth were ground flat for reasons of beautification. Among the Semelai, this occurred as a rite of passage when a girl was considered to

enter womanhood. Among the Temuan (as among traditional Malays), the teeth were ground flat for the woman's presentation at her wedding. The crown could be ground down to the point where bleeding occurred.

2. Methods

The aim of the field work is to obtain 30 male and 30 female subjects from each of the following groups: Jahai, Bateq (Semang); Temiar, Semai (Senoi); Temuan, Semelai (Proto-Malays). The operational definition for representing one of these groups is that both parents belong to that group. Ideally, the 60 subjects would all live in the same village, to make the samples discrete, and would be aged between approximately 15 and 50 years old, so that most of the permanent dentition would be present. The practicalities on the ground enforced various concessions to this ideal design. These concessions included the acceptance of sample sizes less than 30 of each sex, the inclusion of individuals from more than one village within the samples, and the assaying of subjects younger than 15 or older than 50. The full process followed for a subject consisted of a brief interview, oral health screening, photography, and dental casting.

In the interview, subjects were asked to supply their name, sex, age, and ethnic status of both parents. The subject's village, state, and serial number (from #1 to #261) were also recorded. One point of the interview was to determine whether both parents of the subject belonged to the Orang Asli group under consideration or, at least, could otherwise be fitted into the study (e.g. a Semai Senoi in a Semelai village could fit into the project design as a Semai but not as a Semelai). Dental casts were rarely taken on subjects of unsuitable extraction.

Oral health screening covered the aspects of mucosal lesions, caries status, and periodontal status (see attached form). This form is a refinement of a previous form designed by Rahimah Abdul Kadir (1992:Appendix A). All subjects who were screened were also photographed so that the screening and photographic records kept in tally. Subjects were photographed twice with a Polaroid 600 Instant Camera. One photograph was pasted into a log book along with the subject's identity details. The second photograph was given to the subject. The subjects also received a key ring with the University of Malaya logo as their momento for participating in the project, along with a small package of food. The Semang participants also received their choice in second-hand clothing. As a result of the screening, some subjects were excluded from dental casting, owing to problems with their oral health such as bleeding abscesses, or too severe loss of teeth.

To produce the dental casts, negative impressions were first taken with mint-flavoured alginoplast. The subject was then asked to bite into dental modelling wax to record the subject's occlusion, and the relationship between the upper and lower dental arcades. As soon as possible, a Bayer moldano mixture was poured into the negative impressions to produce the positive impression. The positive impression

and the subject's bite impression were labelled with the subject's serial number. Later, plaster of Paris bases were added to both the upper and the lower dental arcades. The process was repeated at the University of Malaya to produce a second positive impression from the original positive, with one series of impressions remaining at the University of Malaya, and the second series being transported to the Australian National University for tooth measurement and scoring of the dental morphology. Plans are in train for a third set to be manufactured for the National Museum.

Teeth are measured on their maximum mesio-distal lengths and bucco-lingual breadths using a Mitutoyu electonic calliper accurate to 0.01 mm. Lengths and breadths at the cemento-enamel junction are not taken because, first, this location is sometimes difficult to determine on casts and, second, occlusal attrition had rarely proceeded below the level of the maximum tooth diameters. Dental morphology is scored with reference to the standard plaques produced by the Arizona State University system, plus other traits (e.g. the *Dryopithecus* fissure pattern on the lower molars) documented in the literature (see Hillson 1996). Variants in the number of roots are not handled in this project as only crown traits are recorded from dental casts. This still leaves a large number (approximately 20) of dental morphological variants which are considered as potential discriminants between the world's major population complexes. Owing to time constraints, the measurement of the teeth and the recording of their crown morphology will take place at the Australian National University.

3. Sampled Populations

Kampung Sungei Sampo, Jempol District, Negeri Sembilan

Kampung Sungei Sampo (Map 1) was studied on August 6th-7th 1999. The population was given as 510 people distributed among 108 families, with an area inside the kampung of approximately 70 acres. The wider area inside this Orang Asli reserve amounts to approximately 2800 acres, including two small, government-sponsored oil palm projects. The village hardly differs in external appearance from Malay villages of a similar size. It includes a grassed playing field, a small open-air eating house, and an asphalt road which runs a circuit around the village. The field site is easily accessed by good asphalt roads after a travel time of approximately 50 minutes from Bahau, the major town in Jempol District. Owing to the ease of transport, many of the residents work in the surrounding oil palm and rubber plantations. Formerly, long-distance travel was primarily by dugout canoe along Sungei Sampo downstream to Sungei Serting, then to Tasik Bera and finally Sungei Pahang. The Sungei Sampo Semelai community may have originated from the Sungei Pahang lowlands, before being attracted upstream by economic opportunities such as labouring in the colonial period sugar plantations.

Rice is now the major staple, much of it purchased from shops, along with a large proportion of the other foodstuffs. Dry rice, fruits and vegetables are also grown in semi-permanent gardens away from the main road. Many of the inhabitants chew betel-nut (along with lime and gambier) as a stimulant, leading to obviously stained teeth, espcially on the more elderly subjects. Freshwater gastropods are still collected from Sungei Sampo and boiled with chili peppers for consumption.

The population belongs predominantly to the Semelai Orang Asli, which is a Southern Aslian speaking group. Most inhabitants would also seem to be fully conversant in Bahasa Melayu. Individuals from several other ethnic groups have also married into the community. It would appear that most of the population has converted to Islam, and Islamic names dominated our sample. Reportedly, the term Semelai means "same as Malay", a name given to them by early British researchers. They are recorded to have practised circumcision even before the widespread conversion to Islam.

Dental casts and oral health records were collected on 22 males and 22 females who claimed that both their parents were Semelai. A further three men, both of whose parents were Semelai, were screened for their oral health, but dental casts were not taken owing to a bleeding abscess or poor state of the dentition. One nine-year old girl and one ten-year old boy were also screened but no casts were taken as their dentition was primarily deciduous. Among these people, 11 of the males had slightly wavy (or lank) hair and 15 had straight hair, whereas seven of the females had slightly wavy (lank) hair and the other 16 had straight hair. Two females of mixed Temuan-Semelai parentage, aged 17 and 18 years old, and a 19-year old male of the same extraction, were also recorded in full as valid Proto-Malay representatives. We also fully recorded a Semai Senoi woman, aged 50, married to a local Semelai man. Other residents screened for their oral health include a 23-year old man of combined Chinese-Semelai background, a Bajo man aged 30, and a Chinese female aged 20.

The demographic details of the fully Semelai subjects are tabulated below. The average age of all recorded Semelai females was 27.0 years (standard deviation 9.0 years, range 9-38 years old). The average age of the males who provided a dental impression was 31.2 years (standard deviation 13.7 years, range 13-64 years old), and for those Semelai males who were screened, 32.0 years (standard deviation 15.7 years, range 9-65 years old). For some reason, women giving their age as greater than 40 years old were not included in the sample.

	9-10	11-20	21-30	31-40	41-50	51-60	61-70
Females (full record)	1	3	7	11	0	0	0
Males (dental cast)	0	6	5	7	2	1	1
Males (oral health)	1	7	5	7	2	2	2

Kuala Pilah District, Negeri Sembilan

We were drawn to Kuala Pilah (Map 1) to study the Temuan, a Proto-Malay group whose members speak a dialect of Malay. In the villages we studied, the Temuan have adopted the social system of the Minangkabau Malays who are culturally dominant in Negeri Sembilan. Land ownership is passed through the women, although men may still exercise rights of access and, indeed, control through their sibling relationships. Because of the establishment of a recognizably Malay form of land tenure, the traditional form of land ownership continues to prevail in the villages we surveyed, without any transition towards a one household-one acre form of land classification. Subsistence follows a typically Malay pattern, based on rice (purchased from the shops) as the major staple, supplemented by other fruits and vegetables, along with poultry, goats, water-buffalo and cattle, and occasional hunted animals. Despite the many Malay-like features of the economy, there has been little conversion to Islam among the Temuan.

One particular aspect of the Temuan economy is the persistent practice of forays into the forested hills, surrounding the villages, in order to collect forest produce. The *patai* pod can be either grown in gardens or harvested in the forest. Durians, whose trade is more important, are however harvested from garden orchards. In the Senibai area, the Temuan used to grow wet rice and dryland rice, but not any more. Coconut palms are abundant in Langkap, and coconut is commonly used in cooking (similar to Malay cuisine). Freshwater gastropods are still collected, and cooked with a sour fruit similar to turmeric (*asam grugu*). Chewing the betel-nut remains a common practice.

Three villages were sampled within the Senibai area, about 15 kilometres from Kuala Pilah, on 13th August. The villages are Kampung Air Lerek (where the dental observations were made), Kampung Air Palasan, and Kampung Air Runtuh. These villages were reportedly founded approximately six generations ago. Originally they were discrete settlements, but they have now grown together along the asphalt road to resemble a single strung-out village. 12 subjects were sampled from Air Lerek, 13 from Air Runtuh, and four from Air Palasan, 29 in all. On 14th August, 25 subjects were sampled from Kampung Langkap, which lies about 25 kilometres from Kuala Pilah along a different asphalt road from the route to Senibai. The name Langkap would appear to come from the *langkap* tree whose leaves are used in making roof thatch.

The Temuan in the study sites often professed a mixed ancestry. Five males and five females from the Senibai area were the result of Semelai-Temuan marriages. Two women (from Senibai and Langkap) mentioned a Malay grandfather among otherwise Temuan ancestry. One Langkap woman owned to a Temuan father and a Malay mother, and another Langkap woman owned to a Jahut Senoi father and a Temuan mother. One boy from Senibai had a Temuan father and an Indian mother, and three Langkap females were the offspring of Temuan-Chinese unions. In the 16

cases of mixed marriages, the father was Temuan in five instances and the mother was Temuan in the other eleven. Finally, one Senibai man was a Jakun Proto-Malay. Only 16 of the subjects from the Senibai area, and 19 of the Langkap subjects, were fully Temuan, 65% of the total sample.

Among these 35 fully Temuan subjects, there were nine males and eight females from the Senibai area, then nine males and nine females from Langkap. Eleven of the males had straight hair and seven had slightly wavy to very wavy hair, whereas 15 of the females had straight hair and only two had wavy hair. Dental casts were taken on 30 of these subjects, 17 from Senibai and 13 from Langkap. One ten-year old girl was excluded because her dentition was primarily deciduous, another 14-year old girl did not want to have her dental impression taken, while one 50-year old woman and two 70 to 75 year old men had too few teeth left, and those in poor condition, to warrant taking their cast. Demographic details of the fully Temuan subjects who provided casts are tabulated below.

	11-20	21-30	31-40	41-50	51-60
Males	6	7	0	1	2
Females	8	5	0	1	0

The average age of the males recorded in full is 28.3 $\pm$ 15.2 years old, with a range of 11-60. Including the two elderly subjects with poor teeth, the average age is 33.8 $\pm$ 20.4 years old, with a range of 11-75. The females recorded in full had the average of 20.0 years old with a standard deviation of 10.0 years and a range between 12 and 48 years old. The females screened for their dental health were on average 20.8 $\pm$ 11.9 years old (range 10 to 50).

Aboriginal Malays (Proto-Malays)

The "Proto-Malay" classification can include the 13 subjects of mixed Semelai and Temuan marriages, as well as the 49 fully Semelai and 35 fully Temuan participants. The Jakun man from Kampung Air Lerek could also be included in the grand total of 98. The 51 males included 31 with straight hair and 20 with slightly wavy to very wavy hair. The 47 females included 37 with straight hair and 10 with wavy hair. Men showed a greater tendency to wavy hair in each of the three groups of Semelai, Temuan, and Semelai-cross-Temuan. Unless there is a sex-linked genetic basis to hair form among the Aboriginal Malays, the apparent difference would reflect cultural practices, for instance a greater emphasis among the women on combing their hair straight and pulling it out tight with hair pins and hair clips. It is also worth remarking that mixed Semelai-Temuan marriages were in more frequent evidence than unions involving either the Semelai or the Temuan and a partner from a third ethnic group.

As tabulated below, the age distributions for all Aboriginal Malay subjects show a regular pattern for both sexes. The far more irregular patterns documented for either the Semelai or the Temuan subjects alone are the result of their small sample sizes. The modal age group in both sexes is the 11-20 year old bracket. The 21-30 and 31-40 age brackets were also strongly represented, approximately equally in both sexes. The number of subjects in the older age groups dropped off sharply, especially in the females. The small number of subjects younger than 11 years old reflects our sampling strategy. The available sample is therefore commensurate with a growing population with a large proportion of sub-adults and younger adults. Life expectancy after reaching a middle age may not be especially favourable, although one male reported his age as 75. The slightly greater representation of females over males in the youngest age brackets could be attributed to the tendency for girls' physical development, including eruption of the permanent teeth, to occur slightly ahead of the boys'. There may be cultural reasons for why no women older than 50 came forward to participate in the study, although it is also possible that elderly Aboriginal Malay women have a reduced life expectancy compared to the elderly men. A higher proportion of elderly men compared to elderly women has been reported for the Jahai Semang and the Semai Senoi (Baer 1999:18, 110).

	9-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80
Males (oral health)	1	15	12	11	4	4	3	1
Females (oral health)	4	16	13	12	2	0	0	0
Males (dental cast)	0	14	12	11	4	3	1	0
Females (dental cast)	2	15	13	12	1	0	0	0

The average age of all Proto-Malays male subjects is 32.5 $\pm$ 16.7 years old (range 9 to 75). For the 45 males who provided dental casts, read 30.3 $\pm$ 13.6 years old (range 11 to 64). The mean age of all Proto-Malay female subjects is 23.7 $\pm$ 10.0 years old (range 9 to 50). These figures change to 24.0 $\pm$ 8.9 (range 10 to 48) for the 43 female subjects who provided dental impressions.

Sungei Betis Reserve (Temiar Senoi)

The Sungei Betis area, Gua Musang District, Ulu Kelantan, is a single Orang Asli reserve which includes 17 Temiar villages (Map 1). The villages are connected to the main population locus and administrative centre, Sungei Betis, by logging roads. Sungei Betis lies at the junction of the Betis and Nenggiri rivers, and the villages we surveyed lie near the banks of either the Betis or the Nenggiri. The Orang Asli who build their houses within the reserve are granted two acres of land surrounding the household, and a further two hectares of land per household for their gardens. Locally grown crops include tapioca, dryland rice, coconuts, bananas,

green-leaf vegetables and durians. The main form of income is wages from labouring in the surrounding plantations, especially as rubber tappers. The diet is supplemented by the purchase of tapioca, rice and other foodstuffs from the shops in Sungei Betis. Fish caught in the rivers and small numbers of freshwater shellfish are also consumed. Relatively undisturbed forest abounds within the Reserve, and the inhabitants hunt all sorts of game with their guns and blowpipes. Finally, the houses in the villages appear to be built mainly of traditional materials, although the traditional Temiar long house has given way to nuclear family units.

Our team worked in the Sungei Betis Reserve on 19th and 21st August. On the 19th we operated within the primary school building at kampong Lambok, and studied 28 subjects (15 males and 13 females). On the morning of the 21st we set ourselves up at the open air meeting hall at kampong Jias. Here we studied 11 subjects from Jias (four males, seven females), seven subjects from Goleng (four males, three females), and nine subjects from Sawut (six males, three females). In the afternoon of the 21st, we shifted our operations to the primary school building at Sungei Betis. Here we studied 19 subjects (nine males, ten females) from Bawik, a few kilometres away. In summary, 38 males and 36 females were sampled from the Lambok, Jias, Goleng, Sawut and Bawik villages.

Two girls and one boy had a Chinese father and a Temiar mother, but all other 71 subjects were of Temiar descent via both parents. Hair form was highly variable among the 70 Temiar who could be recorded on this attribute. Among the males, 15 had straight hair, 18 had slightly to strongly wavy hair, and 3 had hair that could be classified as woolly. Among the females, two had straight hair, 29 had slightly to very wavy hair, and three had woolly hair. The higher frequency of straight hair among the males, compared to the females, is the opposite tendency to that noted among the Proto-Malays. The males often had their hair cropped very short, which may have tended to prevent the natural wave from manifesting itself.

The average age of the male Temiar subjects was 21.2 $\pm$ 13.7 years old, with a range between 10 and 67. The Temiar females' average age was signficantly less, 15.1 $\pm$ 2.7 years old (range 11 to 22). It may be supposed that the female teenagers were drawn to the possibility of obtaining a photograph of themselves, whereas older women were pre-occupied with domestic duties or were reluctant to participate. (The three recorded individuals with a Chinese father were all aged between 11 and 13.) Demographic details are tabulated below.

	9-10	11-20	21-30	31-40	41-50	51-60	61-70
Males	1	26	2	4	3	0	1
Females	0	33	1	0	0	0	0

64 subjects, 32 males and 32 females, provided dental impressions. The two oldest men, aged 50 and 67, had few remaining teeth and so were excluded. Five of

the youngest children, aged between 10 and 12, had few of their permanent teeth and so were also omitted from the casting operation. The ages of those whose dental casts were taken are: males, 19.8 ± 10.7 years old, range 11-49; females, 15.3 ± 2.6 years old, range 11-22.

Sungei Aring 5, and Pasir Linggi (Bateq Semang)

We visited Sungei Aring 5 on 20th August and Pasir Linggi on the morning of the 22nd of August (Map 1). Only nine subjects, all male Bateq, chose to participate in the study in Sungei Aring 5. 13 subjects (five Bateq males, seven Bateq females, one Mendriq woman) participated in the study in Pasir Linggi, and more would probably have been suitably disposed, except that the majority of the community was still at Kuala Koh, having attended a ceremony there on 21st August in which the crown prince of Kelantan officiated over the welcoming of new Orang Asli converts to Islam.

The term Negritos, with its implication of diminutive body size, would seem to be inappropriate for the Bateq at these two villages, based on the small sample of Bateq who participated in the study. The older adults do tend to have the reduced stature associated with the term "Negrito" (< 154 cm for males, < 144 cm for females). But the young adults would seem to be approximately as tall, on average, as the other Kelantan populations. As further tabulated below, the teenagers would seem to be on a growth trajectory that would bring them close to the average height of the young adults. It may be suggested that improvements to the diet, and/or the greater availability of health care, have enabled Bateq stature within these two villages to increase substantially over the last few decades. The term "Semang" is appropriate because almost all of the subjects have the woolly hair reputedly associated with this group. Only two of the 15 males had a hair morphology better described as strongly wavy. Two of the girls did not want to remove their veil to reveal their hair morphology, so the recorded occurrence of woolly hair among these Bateq is 18/20, i.e. 90% (or 19/21, including the Mendriq woman).

Average stature	Teenagers (13-14)	Young adults (20-39)	Old adults (40+)
Males	151.5 cm	162.5 cm	153.8 cm
Females	145.5 cm	146.8 cm	130.0 cm

Sungei Aring 5 was established by the government as a Bateq settlement approximately 15 years ago. It lies about 35 kilometres from Kuala Koh, and about three km from Pasir Aring 5, a predominantly Malay village (with school, shops, and a small eating house) where the local plantation workers reside. Most of the land on the approach road to Sungei Aring 5 is given over to oil palm plantations. The local Bateq formerly utilized the rainforest that used to grow here, but there is still a vast

expanse of rainforest available to them. 17 small, almost cubic houses can be counted along the main track through the settlement, which serves as the centre for a population of around 160 individuals. A grassed playing field area is being established at the bottom of the settlement, along with the construction of a *suara* prayer house, which is where we examined the subjects.

Pasir Linggi is a more dispersed settlement. The central complex, which consists of a grassed soccer field surrounded by the health clinic, primary school and other buildings, lies eight kilometres from the main highway between Gua Musang and Kota Bahru, about 106 kilometres short of Kota Bahru. Rainforest appears fairly continuously along the road between the highway and the health clinic. About 50 families live in the vicinity, or about 250 people based on the estimate of 5 people per household. All 12 subjects gave Muslim names and would therefore appear to have converted to Islam. There were reportedly only 20 Muslim adults in the Pasir Linggi area, and the high incidence of Muslims in our sample was attributed to the trip by many of the non-Muslims to the ceremony at Kuala Koh. (21 Muslim adults at Sungei Aring 5 were also reported.)

The lifestyle and economy in the two settlements would seem to be highly comparable. Collection of rainforest produce, especially gharu (eaglewood) and rattan, is the main source of income. During the months when honeycomb is available in prodigious quantities, honeycomb will also be collected for sale. Family groups trek into the forest for days at a time, hunting with their blowpipes, scaling the trees for fruit and honeycomb, digging up the wild tubers, fishing in the rivers, and camping in shelters of palm thatch which require about an hour to construct. (The Bateq pattern of activities in the rainforest is described in several publications and theses by the anthropologists Karen Endicott and Kirk Endicott.) The proceeds from the collected rainforest produce are used, in part, to purchase rice and other foods from the shops (but hardly ever sugar). Certain crops are grown in the villages. In Sungei Aring 5 we observed tapioca, bananas and sundry fruit trees. In Pasir Linggi we observed tapioca, bananas, coconut palms and breadfruit trees growing near the health clinic. Fish are also available in the local streams, and wild tubers can also be readily found.

The 14 male subjects had an average age of 29.6 ± 12.1 years old (range 13 to 50). Of these, one man aged 47 did not have enough teeth left to warrant taking his dental cast. The seven Bateq female subjects averaged 24.4 ± 10.6 years old (range 14-47). However, no cast was taken of the 47-year old woman as she had few teeth left. The Mendriq woman, whose dental impression was taken, was 30 years old.

Banun RPS, Perak and Sungai Rual, Kelantan (Jahai Semang)

Our last stint of field work was dedicated to obtaining an adequate Jahai Semang sample. 28 Jahai males were inspected, of whom 21 provided dental casts. Only 21 Jahai females participated and of these, 17 were suitable for dental

impressions. The Banun RPS Orang Asli Reserve in Gerik, Perak (Map 1) was visited on the 27th and 29th of August, and the work took place within the Banun Health Clinic operated by Mr Uda Goyung. The operations at the Sungai Rual Orang Asli Reserve, Jeli, Kelantan (Map 1) occurred on 28th August at the local *sural* prayer house.

The Banun RPS Reserve was initially established about 20 years ago. One of the reasons for its establishment was to accommodate the Jahai who were relocated on account of the flooding of the upper reaches of the Perak River to create the Tasuk Banding lake, associated with the Hydro Temengor electricity scheme. Three villages are recognized within the reserve: Kampung Sungai Banun (52 inhabitants), Kampung Sungai Raba (132 residents), and Kampung Desa Ramai (52 residents); or approximately 236 inhabitants in all. Most of the residents are Jahai but there is also a significant component of Temiar in Sungai Banun. As with the other Orang Asli communities we studied, Bahasa Melayu would appear to be widely understood. Originally, the school was an upstairs room in an ordinary house, and the inhabitants had to rely on a mobile health clinic, or travel to Gerik in emergency cases. The present primary school building was built in 1996, and the health clinic in 1997.

The inhabitants continue to venture into the forest for days at a time, often as family groups. Some gharu wood, rattan and *patai* can be collected for sale, as well as a surplus of honeycomb in the main honey seasons during June-July and in the new year. Various fruit trees such as bananas and durians also occur here and there as groves in the forest, owned by the individual families. Five types of wild taro can be grubbed up and cooked, freshwater shellfish are also occasionally collected and cooked with salt, while hunting and fishing also contribute to the diet. Increasingly, attention is turning to cultivated crops, despite the problem of crop damage from marauding pigs and elephants. For instance, the crops cultivated in Kampung Sungei Banun include cassava, peanuts, bananas, maize, coconut palms, and miscellaneous fruit trees. Nonetheless, life here seems to be a constant struggle, and the inhabitants complained about the difficulties in collecting or growing enough of their own food, or earning sufficient income from forest produce to purchase their dietary requirements.

The Sungai Rual Orang Asli reserve extends across 100 acres and includes 91 households. Three settlements are officially recognized: Pos Sungai Rual, with 128 inhabitants (63 males, 65 females); Kampung Kalok, with 93 inhabitants (50 males, 43 females); and Kampung Manok, with 121 inhabitants (64 males, 57 females). However, there are seven *penghulu* or headmen, representing extended family groups before the Jahai were concentrated into the reserve. The Sungai Rual centre includes a community school with classes up to Grade 4, a health clinic which is open on Saturdays, the *sural* prayer house, and an asphalt ball court. There are 89 Muslim adults in the community, so, including the converts' children, over half of the *circa* 320 inhabitants would be Muslim. Subsistence activities are essentially the same as at RPS Banun. Collection of rattan and gharu wood provides the main source of

income, along with occasional labouring in the nearby oil palm plantations. Crops which we saw growing around the Sungai Rual centre include coconut palms, banana palms and maize.

One point of interest for analysis of the dental condition is that only a small number of the inhabitants chew the betel-nut. This would seem to be the general pattern among both the Jahai and and the Bateq.

20 subjects from Sungai Banun—11 Jahai males, five Jahai females, and four Temiar males—participated in the study. The nine subjects from Sungai Raba comprised three males and six females, while a single male from Desa Ramai also participated. Overall, the 30 RPS Banun participants included 21 males and nine females. At Sungai Rual, the 25 participants were made up of 13 Jahai males, two males of mixed Bateq-Jahai parentage, and ten Jahai females. There is the possibility of some Temiar admixture among the RPS Banun Jahai. At the same time, the Temiar there seem to show significant Jahai admixture, as indicated by a relatively high frequency of woolly hair, short stature, and darker skin pigmentation than was the case among the Kuala Betis Temiar. Hence, any Temiar admixture among the RPS Banun Jahai would be ameliorated by the Jahai admixture among those same Temiar.

The 34 male subjects from RPS Banun and Sungai Rual had an average age of 35.1±16.0 years old (range 12 to 70). In the case of the 28 male Jahai participants, the average age was 34.2±16.7 years old (range 12 to 70). Seven of the oldest Jahai men had very poor oral health, pre-empting the collection of their dental impression, so the 21 Jahai males who did provide dental casts produced a significantly younger sample (average age 28.3±13.7 years old, range 12 to 54). All 21 female participants in the study claimed Jahai parentage on both sides, and their average age was 21.8±8.7 years old (range 12 to 45). The condition of the teeth of the oldest Jahai women, but also some young women no more than 20 and 22 years old, was unsuitable for their dental impressions to be taken. The average age of the 17 female Jahai who provided dental casts was 19.5±5.8 years old (range 12 to 32). As with the other Orang Asli communities in the study, there was a distinct reluctance among middle-aged and elderly women to volunteer their participation. One possible reason could be advanced oral disease (and a lack of teeth in place) among the older women, who might thus see no point in participating in a study on teeth. The demographic breakup of the samples is tabulated below.

	11-20	21-30	31-40	41-50	51-60	61-70
All male participants	11	3	9	4	6	1
Jahai males, oral health screening	10	3	6	3	5	1
Jahai males, dental casts taken	10	3	5	1	2	0
Jahai females, oral health	12	6	2	1	0	0
Jahai females, dental casts taken	11	5	1	0	0	0

Finally, a 57 year old Jahai man from Desa Ramai agreed to have his stature recorded, but did not want a dental inspection. If we include this man, then 26 Jahai males had woolly hair and three had strongly wavy hair. 16 of the Jahai females had woolly hair whereas five had moderately to strongly wavy hair. The recorded incidence of woolly hair among the Jahai is thus 42/50 (84%). Average stature among the Jahai men 19 years of age or above was 155.2 centimetres, without any sign that the older men were shorter than the younger men. Average stature among the Jahai women in the same age bracket was 148.8 cm, again without any indication of decreasing stature with age. However, the Jahai adolescents, who included individuals as young as 12 years old in both sexes, were on average slightly taller than the adults. This might suggest that the younger Jahai in RPS Banun and Sungai Rual are showing a secular trend towards stature increase, as a result of improved diet and/or medical facilities, even though the adults generally have the small stature associated with the Malay Peninsula "Negritos" in the classical literature.

Average stature	Adolescents (12-18)	Young adults (19-39)	Old adults (40+)
Males	156.4 (142-160.5)	155.05 (148-159)	155.4 (149-161)
Females	150.5 (139-169)	148.2 (132-153)	152.0 (142, 162)

The Semang

A sufficient number of Bateq and Jahai males were sampled to test for signficant differences in tooth size, dental morphology or oral health between these two Negrito groups. However, in the case of the females, the Bateq and Jahai need to be pooled to produce a decent statistical sample. The pooled Semang samples can also include the two males of mixed Bateq-Jahai parentage, and the Mendriq woman from Pasir Linggi.

	11-20	21-30	31-40	41-50	51-60	61-70
Semang males, oral health	14	8	10	5	6	1
Semang males, dental casts	14	8	9	2	3	0
Semang females, oral health	15	10	2	2	0	0
Semang females, dental casts	14	9	1	0	0	0

44 Semang males were inspected for their oral health, with an average age of 33.3±15.5 years old (range 12 to 70). Of these, 36 provided dental casts (average age 29.3±13.4 years old, range 12 to 54). The 29 Semang females inspected for their oral health had an average age of 22.7±9.2 years old (range 12-47). The 24 who provided casts were aged 20.2±6.0 years old, with a range between 12 and 32. The demographic breakup of the Semang samples is tabulated below. The distribution is very similar to that recorded above for the Aboriginal Malays, and so might be

indicative of a healthily growing population. On the other hand, exponential population growth from a small population base (about 2000 Bateq and Jahai in all) leads to a much smaller increase in numbers compared to exponential growth from a large population base (as with the surrounding Malays and Temiars), so there is still a real danger of the Semang being demographically swamped by their neighbours.

With the expanded sample sizes, it is possible to investigate variation in stature per decade of life, as tabulated below. Generally speaking the women are approximately 10 cm shorter, on average, than males of the same age bracket. The exception is the adolescent group (12-18 years old) where on average the girls are only about 6 cm shorter than the boys and, indeed, are taller than the women. This result is in line with the earlier physical development of females compared to males. The stature of the younger adults sits at around 159 cm on average for the males, and 148 cm on average for the females, values which are no less than those recorded for traditional, rural Southeast Asian populations elsewhere. In the age bracket above 40, average male stature drops to around 156 cm and average female stature to 145 cm. Despite the small sample sizes, these data suggest that the Semang are gradually experiencing a secular increase in height. Hence the term "Negrito", with its implication of unusually small body size, may well become outmoded in the future as the Semang begin to approach their full potential body size.

Stature (cm)	Male Semang	Female Semang
12-18 years old	(9) 155.3±7.0	(10) 149.5±8.2
19-29 years old	(11) 158.9±7.2	(12) 148.3±3.9
30-39 years old	(9) 159.2±5.4	(4) 147.75±10.8
40-49 years old	(7) 155.3±3.7	(3) 144.7±16.2
50+ years old	(9) 157.2±8.3	—

These data appear to be in conflict with the claims in the literature of a reduction in welfare among resettled Orang Asli groups compared to those following a traditional residential pattern. For instance, Leng (1995:55) summarizes a medical study which found that the protein levels of Orang Asli living in the forest were superior to those of Malay, Chinese and Indian military personnel, even though the Orang Asli were shorter and weighed less. Leng (1955:59) contrasts this with another study which found that over 50% of resettled Semai children were underweight and stunted, and 5-7% even showed wasting, even though there were no clinical manifestations of protein calorie deficiency. Actually, however, these studies seem to have produced comparable results—good protein levels, but small body size—so Leng's basis for drawing a contrast would appear to be his decision on which aspect to emphasize. Elsewhere, Leng (1955:57-58) summarizes estimates which suggest that child mortality rates among the Orang Asli have remained high and relatively constant, between *circa* 250 and 600 per 1000, between 1939 and 1971.

Note also that Bulbeck's (1996) evidence for an evolutionary trend towards reduced stature among the indigenous inhabitants of West Malaysia, over the last 10,000 years, is not necessarily discredited by the evidence for a recent secular increase in stature among the Semang. The environmental factors which prevented individuals' realization of their full growth potential may have been as pronounced among the Peninsula's ancient prehistoric inhabitants as among the traditional Orang Asli and their immediate ancestors.

4. Discussion and Conclusions

261 subjects (140 males, 121 females) were screened for their oral health during the field work and, of these, 216 (113 males, 103 females) had their dental impression taken. The available sample sizes are fairly evenly distributed between the three groups, the Aboriginal Malays, Senoi and Semang, with between 73 and 98 subjects inspected, and between 60 and 88 recorded for their dental impressions.

Subjects inspected for oral health	Males	Females	Total
Semelai	26	22	48
Temuan	18	17	35
ABORIGINAL MALAYS	51	47	98
Sungai Betis Temiar	37	34	71
SENOI	41	35	76
Bateq	14	7	21
Jahai	28	21	49
SEMANG	44	29	73
MISCELLANEOUS	4	10	14
TOTAL	**140**	**121**	**261**

Note. "Miscellaneous" includes Semai-Temuan, Malay-Temuan, Chinese-Temiar, Chinese-Temuan, Chinese-Semelai, Indian-Temuan, Chinese and Bajo individuals.

Subjects with dental casts taken	Males	Females	Total
Semelai	22	22	44
Temuan	16	14	30
ABORIGINAL MALAYS	45	43	88
Sungai Betis Temiar	32	32	64
SENOI	32	33	65
Bateq	13	6	19
Jahai	21	17	38
SEMANG	36	24	60
MISCELLANEOUS	0	3	3
TOTAL	**113**	**103**	**216**

The ideal sample size of 30 males and 30 females from the same Orang Asli community was achieved only once, in the case of the Sungai Betis Temiar. However, as regards the Senoi, the original intention to sample the Semai had to be shelved owing to time limitations. In general, time restrictions, and the difficulties in finding subjects willing to participate in the survey, had the practical effect of virtually halving the number of subjects whose dental impressions could be taken, compared to the original research design. Instead of having two Aboriginal Malay, Senoi and Semang samples of 30 males and 30 females each, we have something more like one of each. Nonetheless, these are good solid samples which should allow the scientific investigation of any differences in tooth size and dental morphology between these three Orang Asli groups, and the rigorous testing of the hypotheses mentioned in the Introduction to this report.

Hair form, as recorded throughout the survey, shows a marked transition from predominantly straight (and never woolly) among the Aboriginal Malays, to predominantly wavy (and highly variable) among the Senoi, to predominantly woolly (and never straight) among the Semang subjects. This transition is in line with the expectations from the classical physical anthropological literature. It confirms our confidence that the studied samples are truly representative of these three groups as they are understood in the literature. Of course, it would be possible to identify groups whose physical appearance lies in between these extreme expressions, such as the Che Wong (reportedly intermediate between the "Proto-Malays" and the Senoi, and the Semaq Beri (reportedly intermediate between the Senoi and the Semang). Hence, the general pattern is one of clining, albeit with a tendency to stepped clining, rather than hard-and-fast typological differences. From our impressionistic observations, the same remarks would apply to skin pigmentation and stature as well.

Hair morphology	Straight	Wavy	Woolly
Aboriginal Malay males	31 (60.8%)	20 (39.2%)	0 (0%)
Aboriginal Malay females	37 (78.7%)	10 (21.3%)	0 (0%)
ABORIGINAL MALAYS	68 (69.4%)	30 (30.6%)	0 (0%)
Senoi males	15 (37.5%)	20 (50.0%)	5 (12.5%)
Senoi females	2 (5.7%)	30 (85.7%)	3 (8.6%)
SENOI	17 (22.7%)	50 (66.7%)	8 (10.7%)
Semang males	0 (0%)	5 (10.9%)	41 (89.1%)
Semang females	0 (0%)	5 (18.5%)	22 (81.5%)
SEMANG	0 (0%)	10 (13.7%)	63 (86.3%)

A comparable transition applies in the domain of foodways and economic activities. In all three studied goups, there is some collection of forest produce for

subsistence and sale, some farming, some wage labouring, and some purchase or rice and other foodstuffs. However, the pendulum swings from labouring and heavy involvement in the cash economy among the Aboriginal Malays, with a dietary focus on commercially processed rice, to broad-spectrum horticulture (supplement by hunting and foraging in the rainforest, and purchased tapioca and rice) among the Senoi, to a specialization in living off forest resources among the Semang. As an example of this last specialization, only the Semang groups in this study regularly collected honeycomb, or mentioned the collection of wild taro roots. These major differences in dietary focus, as well as accessory differences such as the popularity of chewing betel-nut among the Aboriginal Malay groups, should be of importance to the interpretation of the data on caries, periodontal disease and tooth impaction.

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ORAL HEALTH SCREENING FORM
ORANG ASLI PROJECT 1999

ID ☐☐☐☐☐

A. SOCIO-DEMOGRAPHIC PARTICULARS

Name .....

Village..... State .....

Sex ☐ M ☐ F Ethnicity . .....

Age(yrs) ☐☐

B. CLINICAL EXAMINATION

B1. MUCOSAL LESION :

	No	Yes →	Specify site
White lesion/patches	☐	☐	.....
Ulcers	☐	☐	.....
Growth	☐	☐	.....

B2. CARIES STATUS

	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
S																
T																

	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
S																
T																

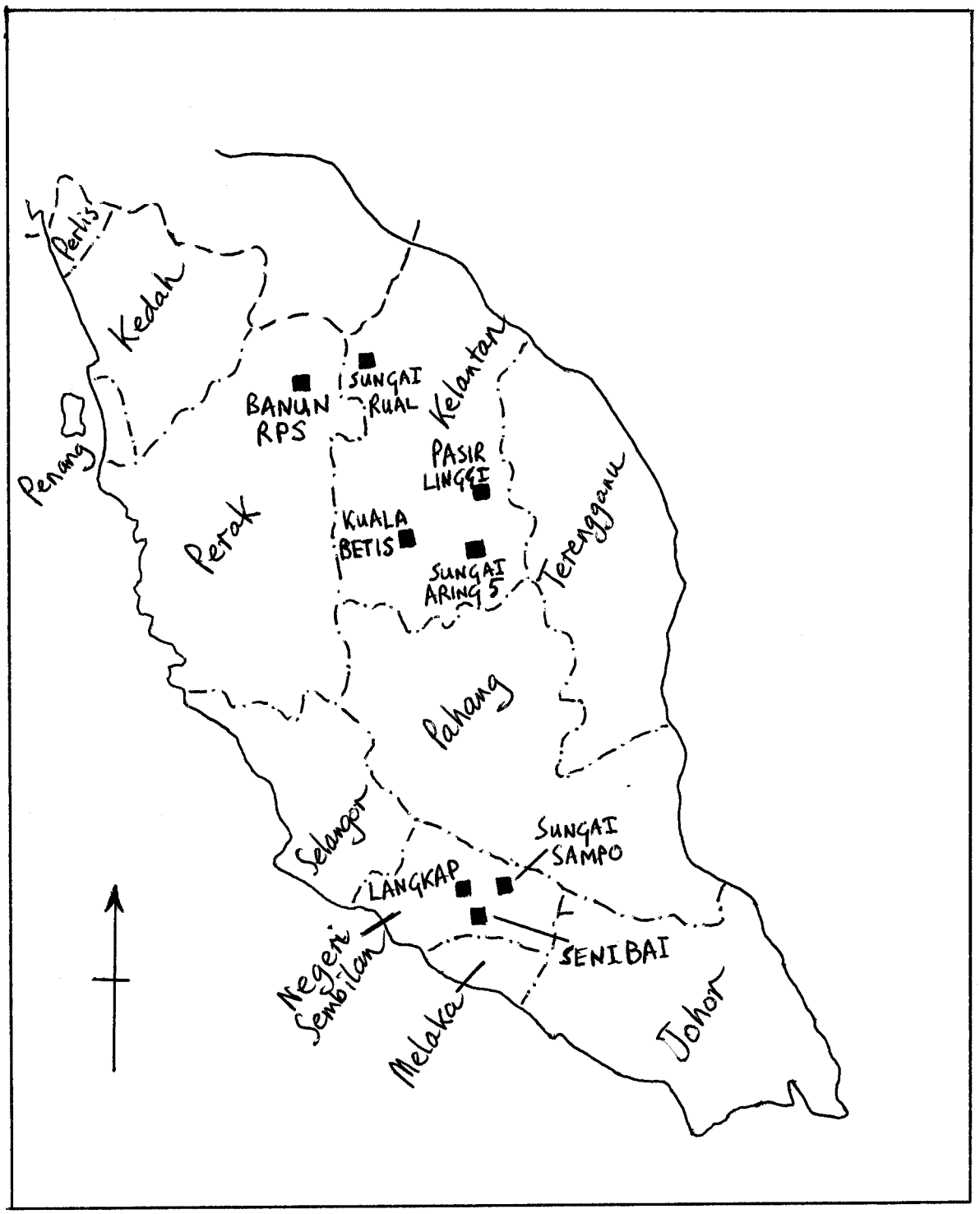
STATUS (S)				TREATMENT (T)
0	= Sound	5	= missing other reasons	0 = None
1	= decayed	6	= retained root	1 = preventive
2	= filled and decayed	7	= bridge etc	2 = restorative
3	= filled and no decay	8	= unerupted	3 = extraction
4	= missing due to caries	x	= indicated for extraction	

B3. PERIODONTAL STATUS (CPI)

17/16	11	26/27
46/47	**31**	**36/37**

0 = Healthy
1 = Bleeding after probing
2 = Sub/supra gingival calculus present without bleeding
3 = Sub/supragingival calculus with bleeding
4 = Pocketing 4 –5 mm
5 = Pocketing 6mm or more
8 = Sextant excluded

HScore ☐



MAP 1. LOCATION OF THE ORANG ASLI STUDY SITES.