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Biological Relationship between the Jomon-Ainu and Pacific Population Groups

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Biological relationships between the Jomon-Ainu and Pacific population groups were investigated through statistical analyses of the following 5 cranial indices: length-breadth, length-height, upper facial (after Kollmann), orbital and nasal indices. Data sets analyzed were consisted of 25 representative populations from Japan, Polynesia, Micronesia, Melanesia, and East Asia. The results supported a diffusion model supposed by many anthropologists as well as Turner's local evolution model, but were inconsistent with a Jomon-Pacific cluster model proposed by Brace and colleagues and Katayama's similar hypothesis. The former 2 models stress the migration of both Pacific and Jomon-Ainu groups from somewhere in Southeast Asia, while the latter emphasizes a direct lineage from the Jomonese to the Pacific group. It was also confirmed that Java may have been part of a diffusion center from where the migration to the Pacific and Pacific-rim areas had taken place.

Keywords: JOMONESE, AINU, RYUKYUS, JAPANESE, PACIFIC, SOUTHEAST ASIA, BIOLOGICAL RELATIONSHIP

INTRODUCTION

During the last two decades studies on the affinities and origins of the Pacific populations have progressed remarkably through detailed investigations carried out by a number of anthropologists and related scientists. Today, a majority of anthropologists suggest the Southeast Asian origin of the Polynesians and Micronesians. The aboriginal Southeast Asians are supposed to have been distributed in mainland and island Southeast Asia and probably in the Sunda Shelf that was above water in the late Pleistocene times. However, a few other anthropologists emphasize a direct lineage from the Jomonese, Japan's prehistoric population, to Southeast Asians and further to the Pacific populations.

On the other hand, the present authors studied the population history of the Japanese including Ainu and Ryukyus, the people of Okinawa, finding close similarities between the Jomonese-Ainu-Ryukyu and Southeast Asian population groups. In particular, the phyletic relationships between Jomonese and Southeast Asians are suggested by several other authors from the aspects of anthropology, human genetics, archaeology, ethnology, linguistics, etc.

One of fundamental issues is, therefore, to estimate the probable course of migration that took place in the late Pleistocene and early Holocene times through diachronic as well as synchronic comparisons of the Pacific and East Asian populations including Jomonese. To achieve this purpose, some cranial indices are compared among populations from different times and areas to analyze their affinities.

The reason for using cranial indices is that a number of analyses have been reported on the basis of individual cranial measurements but few on indices. At the same time, characteristics in cranial shape can be assessed directly through indices, so that morphological differences or similarities among populations can be expressed in a more concrete way than in the case of individual measurements.

MATERIALS AND METHODS

All the materials used in the present study were male crania selected from Jomonese, Ainu, Japanese of Southwestern Islands, Polynesians, Micronesians, Melanesians, and Southeast Asians including Javanese and Taiwan aborigines (Table 1).

One of the Jomonese skeletal populations was excavated at the Tsukumo site in Okayama Prefecture, western Japan, being derived from the late Jomon age, ca. 3,500-3,000 years B.P.; the other at the Yoshiko site in Aichi Prefecture, central Japan, from the latest Jomon age, ca. 3,000-2,300 years B.P.

Japanese from Southwestern Islands, the islands of Okinawa and Tokunoshima, are included in the data set because they carry several characteristics resembling Jomonese and Ainu (K. Hanihara *et al.*, 1973, 1984; Ikeda, 1974; Tagaya and Ikeda, 1976).

Negritos, or Aeta, from the Philippines and Dayaks from Landak, Borneo, are selected because they are supposed to be possible representatives of the aboriginal population of Southeast Asia (Coon, 1962; Brues, 1977; Glinka, 1981; Omoto, 1984; Bellwood, 1985; T. Hanihara, 1992a,b,c,d).

All the Polynesian skulls, particularly those from the Mokapu site, Oahu, were examined carefully for cranial deformation, selecting those without such a sign. As a result, 23 (40.4%) out of 57 Mokapu samples were judged to be affected. The percentage of the affected samples is close to that of the male Mokapu crania (approximately 44%) reported by Snow (1974). The judgment of cranial deformation in the present study is, therefore, likely reasonable.

Samples from the Hane Dune site, Uahuka, Marquesas Islands, are likely part of the earliest Polynesian skeletal populations derived probably from the 1st cen-

tury (Pietrusewsky, 1977). All other Polynesian populations are believed to date back to the pre-contact age, though none of their absolute chronology has been reported.

Table 1. Materials used (male crania).

Population	Group	Author (Measurer)
Jomon-1 (Tsukumo)	Western Japan	Kiyono and Miyamoto, 1926
Jomon-2 (Yoshiko)	Central Japan	Kintaka, 1928
Ainu-1 (Yakumo)	Hokkaido	Watanabe, 1938
Ainu-2 (Hidaka)	Hokkaido	Oba, 1973
Mokapu	Polynesia	Present study (Koizumi)
Marquesas	Polynesia	Present study (K. Hanihara)
Society	Polynesia	Present study (T. Hanihara)
Molokai	Polynesia	Present study (T. Hanihara)
Kona (Hawaii Is)	Polynesia	Present study (T. Hanihara)
Kauai	Polynesia	Present study (T. Hanihara)
Maui	Polynesia	Present study (T. Hanihara)
Guam	Micronesia	Present study (Koizumi)
Tinian	Micronesia	Present study (Koizumi)
Truk	Micronesia	Present study (T. Hanihara)
Fiji	Melanesia	Present study (T. Hanihara)
New Guinea	Melanesia	Present study (T. Hanihara)
New Hebrides	Melanesia	Present study (T. Hanihara)
Eastern Java	Java	von Bonin, 1931
Central Java	Java	von Bonin, 1931
Western Java	Java	von Bonin, 1931
Negrito (Aeta)	Philippines	von Bonin, 1931
Dayak	Borneo	Yokoo, 1931
Taiwan Abor.	Taiwan	Xu, 1947*
Okinawa	SW Japanese	Present study (T. Hanihara)
Tokunoshima	SW Japanese	Tagaya and Ikeda, 1976

*Cited by Liu *et al.*, 1991.

Micronesian samples from the Tumon Bay site, Guam, and Tinian are the representatives of early Chamorros in Northern Marianas; and those from Truk in Eastern Carolines represent the Micronesian people who are generally called Kanakas.

Three Melanesian populations are from New Guinea, New Hebrides and Fiji, representing Western, Central and Eastern Melanesia, respectively, though very small in sample numbers. In addition, 3 Javanese populations are included in the data set according to their geographical distribution. A representative population of the Taiwan aborigines (Atayals) is also included for comparison.

Data used in the present study are only cranial indices which represent the shape of the cranial vault and face for the reason described in the previous chapter. The data are consisted of the following cranial indices: (1) length-breadth index, (2) length-height index, (3) upper facial index after Kollmann, (4) orbital index, and (5) nasal index. The former two indices are concerned with the shape of the cranial vault and the latter three with that of the face.

The methods of statistical procedures will be described in the corresponding sections.

RESULTS

(1) *Univariate analysis.*

To start with, a few representative populations were selected to obtain a general view of population affinities. Populations used were selected from the groups of Polynesians, Micronesians, Jomonese, Ainu and those supposed to be the ancestral form of Southeast Asians.

Pentagons shown in Figure 1 were drawn on the basis of the deviations of 5 cranial indices using Negritos as a reference population (Tables 2 and 3). The circles represent the loci of mean values for the reference population, or those of SD=0, and the radii correspond to 2 standard deviations. Therefore, values smaller or larger than the reference population means are plotted inside or outside the circles in proportion to a 2 standard deviation unit. Each angle represents, from the top clockwise, length-breadth, length-height, upper facial, orbital and nasal indices.

Table 2. Cranial indices (males).

Population	L-B		L-H		Upp Fac		Orbital		Nasal	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
Jomon-1	16	77.7	13	71.6	6	48.3	12	76.5	12	54.5
Jomon-2	38	79.1	11	75.0	4	45.8	14	76.8	14	55.4
Ainu-1	41	75.9	45	73.4	24	51.5	31	81.7	31	53.5
Ainu-2	22	75.0	21	72.6	16	49.7	20	76.6	18	52.3
Mokapu	34	77.6	33	77.5	29	49.4	34	81.6	32	48.9
Marquesas	4	74.5	2	74.4	4	52.2	4	82.9	3	45.4
Society	8	75.7	8	75.9	8	52.2	8	82.6	8	47.5
Molokai	14	80.3	11	78.0	13	50.6	14	78.5	13	47.9
Kona	15	78.2	15	77.6	15	49.7	15	77.4	15	47.3
Kauai	21	77.7	20	77.5	18	49.1	20	77.7	18	50.0
Maui	13	79.4	13	79.1	11	51.0	13	78.4	10	47.7
Guam	53	77.1	40	78.1	27	48.8	41	81.0	42	49.0
Tinian	10	75.9	7	78.0	7	48.3	7	82.6	6	49.1
Truk	3	72.5	3	76.7	3	53.1	4	76.6	4	50.6
Fiji	8	71.3	6	72.9	8	50.9	9	80.6	8	50.9
New Guinea	2	71.8	2	75.3	2	52.5	2	80.0	2	59.6
New Hebrides	3	80.4	3	73.3	3	48.5	3	78.8	3	57.4
East Java	6	80.1	6	77.5	6	55.8	6	80.0	6	51.3
Cent Java	30	82.4	30	78.3	30	52.4	30	81.2	30	53.1
West Java	22	83.3	22	79.2	20	53.3	22	80.4	21	53.6
Negrito	33	84.0	29	79.4	26	52.5	32	79.0	31	54.1
Dayak	11	77.9	10	78.3	8	49.9	12	83.6	10	55.3
Taiwan*	-	78.3	-	75.7	-	54.1	-	84.4	-	52.8
Okinawa	21	77.9	20	75.2	16	50.2	21	77.2	21	52.0
Tokunoshima	23	78.0	22	75.8	15	50.1	24	79.2	23	50.4

*No sample numbers available.

Table 3. Deviations from the means of Negritos.

Population	L-B	L-H	Upp. Fac.	Orbital	Nasal
Negrito	0.00	0.00	0.00	0.00	0.00
Jomon-1	-1.78	-2.07	-1.17	-0.69	0.11
Ainu-1	-2.29	-1.59	-0.28	0.64	-0.17
Mokapu	-1.81	-0.50	-0.87	0.61	-1.49
Marquesas	-2.69	-1.33	-0.08	0.94	-2.50
Guam	-1.95	-0.34	-1.03	0.46	-1.47
Dayak	-1.73	-0.29	-0.73	1.17	0.34
West Java	-0.20	-0.05	0.22	0.36	-0.14
Taiwan	-1.61	-0.98	0.45	1.38	-0.37
Tokunoshima	-1.70	-0.95	-0.67	0.05	-1.06
Pooled SD	3.53	3.76	3.59	3.62	3.64

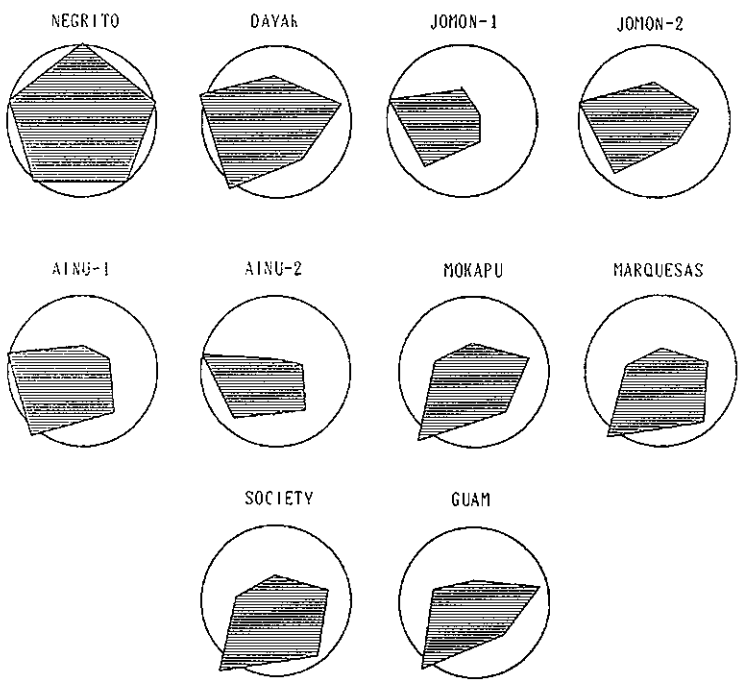

Figure 1. Deviation Pentagons.
From the top clockwise: L-B, L-H, Upp. Fac., Orbital and Nasal indices. Reference population = Negrito; Radius = 2 SD.

The total morphological pattern as expressed by indices can be judged by comparing the shape of pentagons.

Generally, Polynesians and Micronesians (Pacific group) are characterized by smaller length-breadth index and larger orbital index; and Jomonese and Ainu (Jomon-Ainu group) by larger nasal index and smaller length-height and upper fa-

cial indices. Differences between the Pacific and Jomon-Ainu groups are, therefore, particularly evident in upper facial and nasal indices. Dayaks are, on the other hand, closest to Negritos in length-height, orbital and nasal indices but smaller than the latter in length-breadth and upper facial indices. Dayaks and Negritos are, however, resemble each other in the total shape of pentagons.

(2) *Analysis based on similarity coefficients.*

In the second place, multivariate statistical methods were applied on the 5 cranial indices to analyze affinities among populations. A cluster analysis and Torgerson's multidimensional scaling method (Torgerson, 1952) were performed on the matrix of Q-mode correlation coefficients which represent between-population similarities based on multi-variables. Figure 2 is a dendrogram by means of a group-average method, and Figure 3 is a two-dimensional scattergram drawn after Torgerson's method.

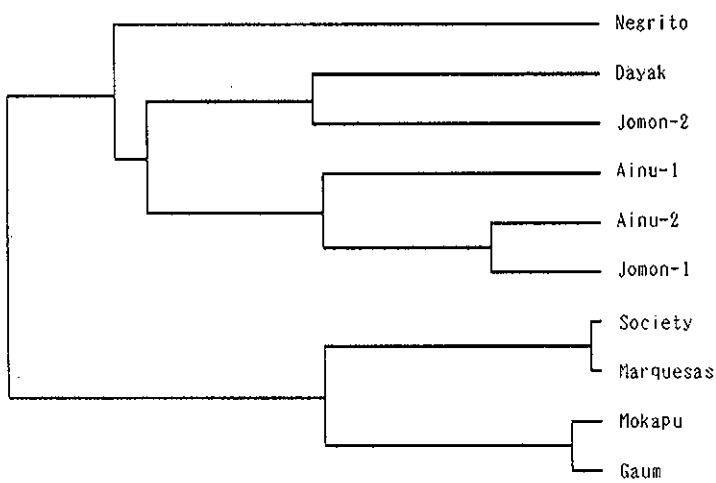

Figure 2. Dendrogram based on the Q-mode correlation matrix of 10 representative populations.

It is evident in Figure 2 that all the Pacific populations are classified into a single cluster and the Jomon-Ainu group into another cluster together with Negritos and Dayaks. Affinities among populations are more obvious in Figure 3. The populations belonging to the Pacific group are located on the right side of Dayaks and Negritos, and those belonging to the Jomon-Ainu group on the left side. It is of interest to note that Negritos and Dayaks are located roughly intermediate between the two population groups. It is worthy of notice that Dayaks occupy nearly the central position of the scattergram. Both figures are, therefore, likely to suggest that Negritos and Dayaks represent basic cranial morphology common to the Pacific and Jomon-Ainu groups.

To analyze the affinities of the Pacific and Jomon-Ainu groups in a wider view, 15 additional populations were selected from the Pacific and Pacific-rim areas and analyzed together with the 10 populations used in the previous analyses. They rep-

resent the Polynesians, Micronesians, Melanesians, Javanese, Southeast Asians and Japanese of southwestern islands.

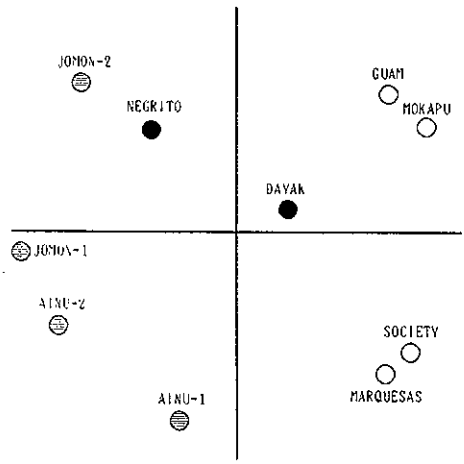

Figure 3. Scattergram based on the Q-mode correlation matrix of 10 representative populations. Torgerson's multi-dimensional scaling.

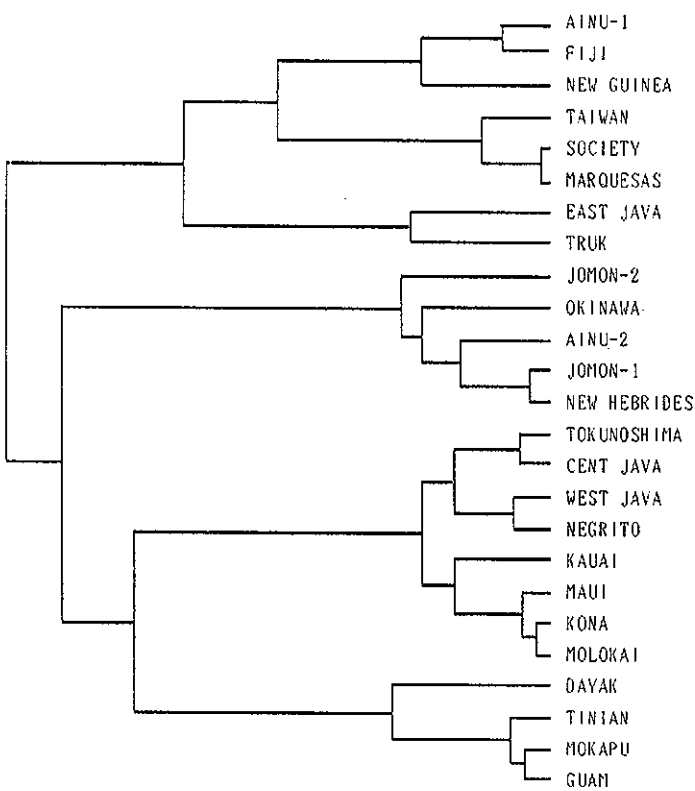

Figure 4. Dendrogram based on the Q-mode correlation matrix of 25 populations.

Figure 4 is a dendrogram drawn on the basis of group average method of clustering which was performed on a Q-mode correlation matrix. In this dendrogram the populations involved are classified into 2 large clusters, one of which is separated further into 3 sub-clusters. It is of special interest to note that the 3 sub-clusters are represented by Jomon-Ainu, Polynesian-Javanese-Negrito, and Micronesian-Dayak groups. The structure of another large cluster is complicated. The small sample numbers in some populations may be responsible for accidental fluctuations, but, on the other hand, complicated relationships among the Pacific and Southeast Asian populations seem to be reflected in the dendrogram.

As a whole, it may be safely stated that the Jomon-Ainu group is morphologically different from the Pacific group, the latter showing closer affinities to Negritos and Dayaks than to the former.

(3) *Factor analysis.*

Among-population differences in terms of cranial indices were analyzed by means of the method of factor analysis. The first 3 factors extracted explain 80.7% of total variance. As shown in Table 4, factor loadings after varimax rotation suggest that the 1st factor is concerned with the length-breadth and length-height indices, the 2nd with the upper facial and orbital indices, and the 3rd with the nasal index.

Table 4. Factor loadings after varimax rotation.

	Factor 1	Factor 2	Factor 3	Communality
L-B	0.8045	-0.0454	0.1486	0.6714
L-H	0.7457	0.2797	-0.4268	0.8165
Upp. Fac.	0.1057	0.5792	-0.0148	0.3468
Orbital	-0.0283	0.5957	-0.1148	0.3688
Nasal	0.0020	-0.0676	0.6224	0.3920
Proportion	0.3485	0.2542	0.2040	
Cumm. Prop.	0.3485	0.6027	0.8067	

In Figure 5, which was drawn using the 1st and 2nd factor scores (Table 5), the Pacific group tends to represent higher face and orbits in comparison to the Jomon-Ainu group. Differences between the 2 groups are more evident in Figure 6 that was drawn using the 1st and 3rd factor scores. The Jomon-Ainu group shows wider nose than the Pacific group, the Southeast Asian group (Negritos, Dayaks and Javanese) being in between. Almost the same scattering pattern is shown in Figure 7 based on the 2nd and 3rd factor scores.

In sum, differences between the Pacific and Jomon-Ainu groups are more remarkable in the shape of the face and nose than in that of the brain case. Here again, the Southeast Asian group tends to show an intermediate morphology.

Table 5. Factor scores.

Population	FC 1	FC 2	FC 3
Jomon-1	-0.8630	-1.3870	1.3177
Jomon-2	0.1764	-1.5349	0.6708
Ainu-1	-0.9648	0.3331	0.7680
Ainu-2	-1.1395	-0.9373	0.5404
Mokapu	0.1567	0.1228	-0.6957
Marquesas	-1.2145	0.6624	-0.6275
Society	-0.6070	0.7271	-0.5786
Molokai	0.7794	-0.3022	-0.6099
Kona	0.4589	-0.6507	-0.8359
Kauai	0.3173	-0.5929	-0.5925
Maui	0.8698	-0.1176	-1.0252
Guam	0.2419	-0.0138	-0.9194
Tinian	-0.0071	0.2299	-1.0410
Truk	-0.6845	0.0991	-0.7696
Fiji	-1.8379	0.1431	-0.0405
New Guinea	-0.9818	0.6860	0.6533
New Hebrides	-0.0377	-0.8613	1.6573
West Java	1.5882	0.5989	0.3557
East Java	0.6159	0.9310	0.1844
Cent Java	1.1980	0.5189	0.3637
Negrito	1.8131	0.2019	0.4002
Dayak	0.4836	0.7508	0.0219
Taiwan	-0.1803	1.3578	0.5753
Okinawa	-0.1212	-0.6541	0.2745
Tokunoshima	-0.0597	-0.3107	-0.0474

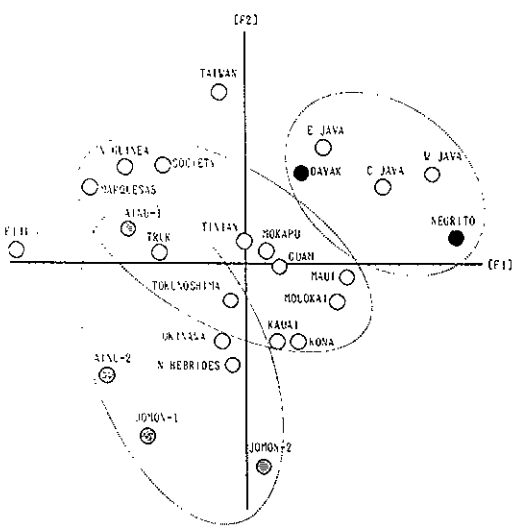

Figure 5. Scattergram based on the 1st and 2nd factor scores.

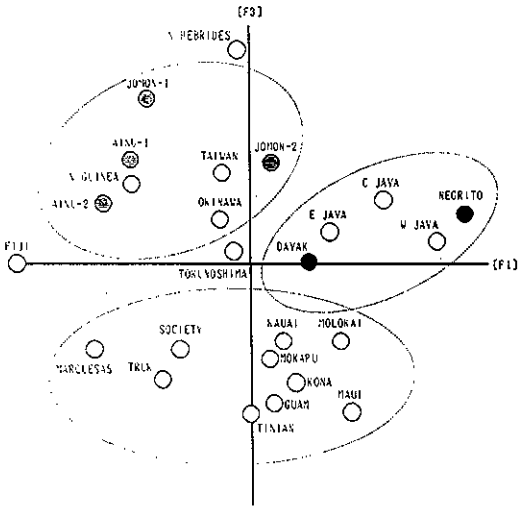

Figure 6. Scattergram based on the 1st and 3rd factor scores.

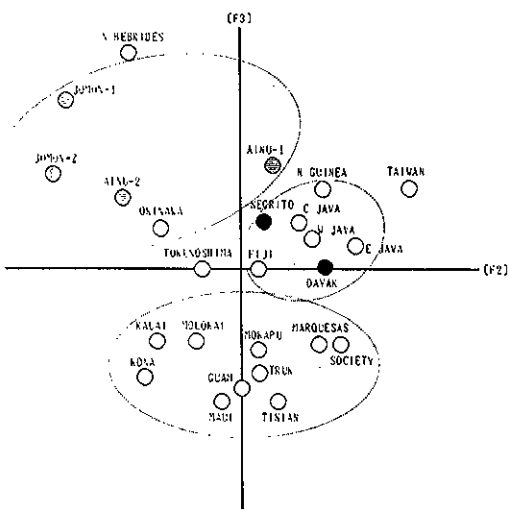

Figure 7. Scattergram based on the 2nd and 3rd factor scores.

(4) *Biplot graphical display.*

Gabriel (1971) proposed the method of biplot graphical display of matrices. This method is a type of principal component analysis, locating samples and variables in the same space. Relationship between samples and principal components is, therefore, expressed on a single two-dimensional graph.

In the present study, Gabriel's method was applied on the 5 cranial indices for 25 populations. In Figure 8, vectors representing variables are expressed by 5 dotted lines, and samples are located according to their principal component scores.

Judging from the lines representing variables, samples with larger nasal index

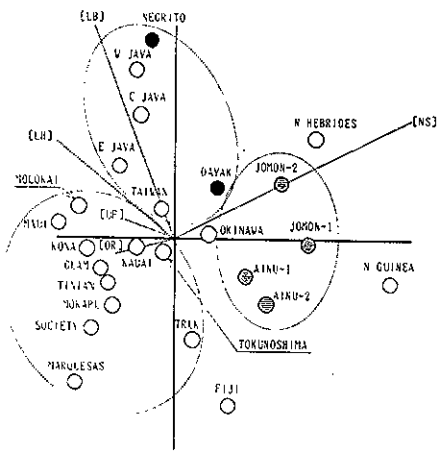

Figure 8. Scattergram by means of Gabriel's biplot method. Dotted lines represent variables. [LB] length-breadth, [LH] length-height, [UF] upper facial, [OR] orbital, [NS] nasal indices.

are located on the right half area of the graph, those with larger length-breadth and length-height indices on the upper half area, and those with larger upper facial and orbital indices on the left half area.

In the present case, the Pacific group tends to occupy the left half area, the Jomon-Ainu group is located on the opposite side, and the Southeast Asian group in between. Therefore, as in the case of factor analysis, the Pacific group is characterized by higher face and orbits as well as narrower nose, and the reverse is the case in the Jomon-Ainu group. It is just the same as in the previous analyses that the Southeast Asian group occupies roughly an intermediate position, though it shows higher length-breadth index than the other populations.

(5) *Discriminant analysis.*

Another way to assess population affinities is to apply the method of discriminant analysis. In the present study, samples providing all the indices except for the upper facial index were selected from Jomonese (Tsukumo site), Polynesians (Mokapu site of Oahu), Micronesians (Tumon Bay site of Guam) and Dayaks to make data sets for discriminant analysis. The upper facial index was excluded from the analysis because it was unavailable in a large number of samples.

Coefficients of linear discriminant functions were computed between Jomonese and Dayaks, obtaining the following simple equation.

$$Y = -0.0716X_1 + 0.3367X_2 + 0.2622X_3 + 0.1201X_4 - 46.9830,$$

where $X_1 - X_4$ stand for the length-breadth index, length-height index, orbital index and nasal index, respectively. In this equation, if $Y > 0$, then the corresponding samples are judged to be closer to Dayaks than to Jomonese in cranial morphology, and *vice versa*.

Using this equation, 22 (71.0%) out of 31 Polynesian samples and 32 (78.0%) out of 41 Micronesian samples show $Y > 0$. It is likely, therefore, that a majority

of Polynesians and Micronesians are closer to Dayaks than to Jomonese in cranial indices.

Altogether, the statistical analyses performed on the 5 cranial indices proved that the Pacific group does not show the closest affinity to the Jomon-Ainu group but to the Southeast Asian group, particularly to Negritos and Dayaks. Closer affinities between the Pacific group and Javanese also attract out attention in view of their population history.

DISCUSSION AND CONCLUSION

In 1981 Howells and Schwidetzky reviewed the population history of Oceania, concluding as follows:

> "The data do not lead us to suggestions of ultimate origins for the Polynesians, that is to say, beyond their highly probable ancestry in the Lapita people of western Melanesia"; "Cranial studies would have to be broader and more sophisticated to have promise."

Since then, the search for the probable ancestral stock of Polynesians and Micronesians has progressed rapidly through extensive studies by many anthropologists. Today, it is generally accepted that Polynesians and Micronesians share ancestral ties with Southeast Asians, Chinese and Malays (Howells, 1989, 1990; Turner, 1987, 1989, 1990a,b, 1992; Pietrusewsky, 1990a,b, 1992; T. Hanihara, 1992a,b,c,d). At the same time, it has become highly probable that the mainland and island Southeast Asians as well as the Pacific populations had radiated from Sundaland that had been a Pleistocene landmass connecting mainland Southeast Asia with Greater and Lesser Sunda Islands, Borneo, the Phillipines, etc. (Riesenfeld, 1956; Simmons, 1956, 1962; Bowler, 1976; Chappell, 1976; Howells, 1976; Turner, 1976, 1979, 1987, 1990a; Birdsell, 1977; Brace and Hinton, 1981; Omoto, 1984, 1992; Bellwood, 1985; T. Hanihara, 1989a,b,c, 1990a,b, 1992a,b,c,d).

On the other hand, close similarities between the group of the Upper Pleistocene Minatogawa Man from Okinawa and Jomonese-Ainu-Ryukyus and that of the Pacific and Southeast Asian populations are suggested by several authors (Omoto, 1972, 1992; Turner, 1976, 1987, 1989, 1990; Turner and K. Hanihara, 1979; Suzuki, 1982; K. Hanihara, 1984, 1985, 1991, 1992; Kozintsev, 1990; T. Hanihara, 1990, 1991, 1992a,b,c,d; Pietrusewsky, 1992; Wu Xinzhi, 1992).

Recently, Brace and colleagues (1989, 1990) proposed a "Jomon-Pacific cluster" hypothesis that stresses a direct lineage from Jomonese to Polynesians and Micronesians. They wrote that:

> "Jomon form is closely allied to that visible in Polynesia and Micronesia, constituting an important part of and perhaps a point of origin for what can be called the Jomon-Pacific cluster" (1989); and ". . . it is just possible that

the archipelago that includes Japan and the Ryukyus was the original source for the people who brought Austronesian languages out to where they are spoken today" (1990).

A similar hypothesis was proposed by Katayama (1990), supposing that the bearers of the ancient Lapita culture were linked closely with Jomonese so that the latter represented a probable ancestral stock of the Oceanic populations. In this hypothesis, he emphasizes remarkable similarities between the Pacific populations and Jomonese in skeletal morphology. Differences in skeletal features are, however, also evident between the two population groups particularly in robustness, thickness and overall size of skeleton. Katayama's hypothesis seems, therefore, to be hardly acceptable as in the case of the Jomon-Pacific cluster model.

It is likely that they overlooked the significance of populations who retain the characteristics of early Southeast Asians. It is highly probable, as pointed out by many authors, that Negritos and Dayaks are part of the representatives of aboriginal Southeast Asians. Data analyses without these populations may lead investigators to an inappropriate conclusion. In addition, there is no evidence at all that shows a high navigation technique in the Jomon culture, except for simply constructed canoes that allow transportation along rivers and the coast.

As stated previously, the purpose of the present study is to confirm the relationship between the Pacific populations, especially Polynesians and Micronesians, and Jomonese on the basis of cranial indices that have so far been dealt with by few authors.

In general, the Pacific group, Polynesians and Micronesians, are characterized by higher upper face and orbits and narrower nasal aperture in comparison with the Jomon-Ainu group. The Southeast Asian group such as represented by Negritos, Dayaks and Javanese shows intermediate characteristics. At the same time, it should be noted that the Pacific and Jomon-Ainu groups are similar to each other in the shape of the cranial vault, which is longer and lower than in the Southeast Asian group.

Regarding affinities among populations, the Pacific group does not show the closest ties with the Jomon-Ainu group but with the Southeast Asian group. This finding is inconsistent with the hypotheses proposed by Brace *et al.* and Katayama but favors a diffusion model that supposes the migration of the Pacific populations from mainland and island Southeast Asia or now disappeared Sundaland (Omoto, 1984, 1992; Turner, 1987, 1989, 1990a,b, 1992; Howells, 1990; Pietrusewsky, 1990a,b, 1992; T. Hanihara, 1992a,b,c,d). A local evolution model proposed by Turner (1987, 1990a,b) is the same as the latter in its basic idea.

It is worthy noting that the Javanese populations are close to Negritos and Dayaks in cranial morphology, forming a distinct population group together with the latter 2 populations. It is possible, therefore, that Java is part of the original place for the people who expanded to the Pacific.

In conclusion, comparisons of cranial indices and other cranial, dental and genetic evidence strongly support the idea that the Pacific and Jomon-Ainu groups

share the ancestral ties with aboriginal Southeast Asians, from whom several migratory waves have taken place to different directions in different times.

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縄文・アイヌ集団と太平洋諸集団の系統関係

埴原和郎・埴原恒彦・小泉清隆

縄文人と太平洋諸集団との系統関係については、現在二つの対立する考え方がある。第1は「拡散モデル（diffusion model)」またはTurnerの「多地域進化モデル（local evolution model)」といわれるもので、東南アジアの古アジア人が2万年以上前に日本列島に移動して縄文人の祖先となり、また別に数千年前に太平洋諸島に進出した群が現在の太平洋集団を形成したという考えである。このモデルは多くの人類学者や関連領域の研究者に支持されている。

一方、Braceらは「縄文・太平洋集団（Jomon-Pacific cluster)」の存在を想定し、異なる考え方を提出した。それは縄文人、またはその系統に属する集団が南下して東南アジアに達し、さらに大洋洲に進出して太平洋諸集団を形成したという考えである。片山も同様の考え方を表明している。

これらの対立する二つの仮説についてはすでに多くの研究が行なわれ、論争の的になっている。本研究の目的は、従来あまり使われていない頭骨示数に基づいて二つの仮説の信頼性をさらに確かめるとともに、縄文人と近隣諸集団との系統関係についても分析を進めようとするものである。

データとして使った示数は頭骨長幅示数、頭骨長高示数、上顔面示数（Kollmann)、眼窩示数および鼻示数の5種である。また比較した集団は縄文人、アイヌ、南西諸島の日本人、ポリネシア人、ミクロネシア人、メラネシア人、東南アジア人を代表する25集団である（Table 1)。

統計学的分析の結果、縄文・アイヌ集団に最も類似するのは太平洋諸集団ではなく、古代東南アジア人を代表すると思われるフィリピンのネグリト族およびボルネオのダヤーク族であることが明らかとなった。また全体として東南アジア人（ジャワ人を含む）は縄文・アイヌ集団と太平洋諸集団との中間的特徴をもつ。更新世以後の東アジアにおける小進化の過程

を考慮に入れると、この結果は他の多くの研究とともに拡散モデルを支持するものであるが、Brace らや片山が提出した仮説とは矛盾する。

考古学や民族学などの証拠からみても、縄文人が南下して東南アジア人や太平洋諸民族の祖先になったということは考え難い。たとえば縄文文化に高度な航海術があったことを示唆する遺物は発見されておらず、また日本の説話や生活習慣も、むしろ東南アジアに起源をもつと思われる例が多い。

一般に人間集団の系統を論ずる場合には、通時性・地域性を考慮して比較する集団を慎重に選ぶとともに、身体・文化の両面を含め、自他の多くのデータを総合的に考慮する必要がある。