

Current Trends in Physical Anthropology in Japan

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The trends in physical anthropology in Japan have largely changed through the introduction of new methodologies such as molecular genetics and multivariate statistics in the 1960s. The development of ecology and primatology brought another new wave into the field of physical anthropology. This paper reviews briefly general trends in research in physical anthropology now on-going in Japan. Microevolutionary studies of the Japanese and neighboring populations which have a long history in Japan will be reviewed in more detail.

Keywords: JAPANESE, CURRENT TRENDS, PHYSICAL ANTHROPOLOGY, EVOLUTION.

GENERAL TRENDS OF RESEARCH

Since Japan has yielded few fossil remains of Palaeolithic man, most research has been focused on the prehistoric Jomon and later populations, and on 'indirect' evidence of human evolution. The following are the recent trends in human evolutionary research in Japan.

1. Studies on the Palaeolithic and earlier fossils

Among few Upper Palaeolithic human skeletal remains, the Minatogawa man found at Minatogawa, Okinawa Prefecture, is the only fossil material preserved in good condition. The research group at the University of Tokyo came to the conclusion that the Minatogawa man showed close affinity to the contemporary Liujiang man of south China and gave rise to the Jomon man, the people of Japan's prehistoric hunting, fishing and gathering stage (H. Suzuki, K. Hanihara, etc.). None of the other fossils allow detailed studies because of their fragmentary condition.

As regards Palaeolithic fossil materials in other countries, studies on the chronology of the Java man (N. Watanabe, S. Matsu'ura) and on the morphology of the Plio-Pleistocene hominoid fossils from Kenya are now on-going (H. Ishida *et al.*). Excavation and evolutionary studies of the Tertiary primates in South America are

also in progress (S. Kondo, T. Setoguchi, etc.). The excavation of the Middle Palaeolithic sites in Western Asia, particularly in Syria, has been continued as part of the Tokyo University Scientific Expedition to Western Asia, which was started by H. Suzuki at the Amud Cave in Israel. The present party, headed by T. Akazawa, is hoping to find Middle Palaeolithic human skeletal remains.

2. Morphological Studies on the Jomon and later populations

Since more than a century ago thousands of skeletal remains from the prehistoric Jomon and later ages have been unearthed in areas all over Japan. They have provided a good basis for microevolutionary studies of the Japanese populations from early to modern ages. As a result, several different views on the origins of Japanese have been proposed, the issue still being the subject of controversy. Recently, the use of analytical methods of numerical taxonomy has opened a new horizon to Japanese anthropologists, allowing data analysis in a more sophisticated way. Details of microevolutionary studies will be described in the next chapter.

3. Studies on the Pacific populations

Although K. Hasebe carried out somatological studies of the Micronesians as early as in the 1930s, no researcher continued his work before the War. Morphological studies on the Pacific populations, mainly Polynesians and Micronesians, re-started in the 1960s. Studies on the dermatoglyphics of the Polynesians were undertaken mainly on the Tonga-Samoa islanders (G. Shima, Y. Terakado, etc.). Morphological as well as palaeopathological data from skeletons and dentition have been accumulated to analyze the origins and affinities of the Pacific people, who are supposed to be part of the diversified branches of the early Asiatic populations. Analysis of this data is still in progress (K. Hanihara *et al.*, T. Suzuki, K. Katayama, etc.).

4. Studies on biomechanics

Biomechanical studies on human bones have developed in Japan during the last three decades. After the first stage of study, which was concerned with mechanical analysis of human bones, a large number of investigations have concentrated on the analysis of the human locomotion system (B. Endo, T. Kimura, N. Yamazaki, etc.).

5. Studies on genetic anthropology

Human genetic studies at the molecular level started in the early 1960s. Before that time large scale genetic surveys were carried out to find the geographic variations of modern Japanese on the basis of different blood group types, as well as finger and palm print patterns. Important studies after 1960 have been concerned with the analysis of blood genetic markers. Frequencies of several marker genes provide one of the bases for analyzing geographic variation and the affinities of modern Japanese. Related fields are studies on the origins of Ainu in Hokkaido, Negritos in the Philippines and minority tribes on Hainan Island, China (K. Omoto, M. Hirai, etc.). Variants in DNA sequence and their frequencies in different populations are another important subject which is rapidly progressed in this field (K. Tokunaga, T. Juji, N.

Saitou, S. Harihara, etc.).

Amplification of mitochondrial DNA from a skeleton dating to some 6,000 years B. P. was achieved recently. This technique allows direct analysis of DNA sequence in the Jomon population and contributes to the search for the population affinities of early people (S. Horai *et al.*).

Taxonomic studies of the relationship between man and apes constitute another topic in this field. Based on the sequence analysis of pseudogene, one of the immunoglobulin genes, it was proved that the chimpanzee was genetically closest to man, the gorilla came next and the orangutan was farthest (S. Ueda, etc.).

6. *Studies on human ecology in Africa and Papua New Guinea*

Field surveys in Africa have been undertaken since 1961, mainly by researchers at Kyoto University. The studies are focused on tracing back the evolutionary history of hunter-gatherer social structures. During the last three decades a large amount of data on livelihood was collected from Uganda, Kenya, Tanzania, Zaire, Congo and Botswana, and provides a strong basis for constructing theories of social evolution (K. Imanishi, J. Itani, etc.).

The relationship between demography and adaptability to food resources in Australo-Melanesian populations was studied. Biochemically their metabolism, which is largely different from that of other populations, plays an important role in maintaining population density (T. Suzuki, R. Otsuka, etc.).

7. *Primatological Studies*

Japan has long history of primate study. It started with research on Japanese monkeys in the early 1950s and grew into the ecological study of African apes and monkeys (M. Kawai *et al.*). In particular, ecological and ethological studies of chimpanzees in Tanzania and pygmy chimpanzees in Zaire provided several new findings which were of special importance in reconstructing early states of human evolution (T. Nishida, R. Kano, etc.).

Morphological studies on primates, particularly on Japanese monkeys, are another unique field in Japan. Extensive morphological data from multiple troops of wild Japanese monkeys has been accumulated. Studies on physical growth and muscular differentiation related to locomotion in Japanese monkeys have been part of a long-term project in primatology since the 1960s (M. Iwamoto, S. Hayama, K. Moriyama, M. Hasegawa, etc.).

Studies on the New World monkeys such as *Ateles*, *Saguinus* and *Cebus* suggest that the adaptive radiation of primates may have taken place in both the Old and New Worlds (H. Izawa *et al.*).

8. *Others*

Among other subjects in related fields, physiological studies of man and non-human primates, palaeopathology of human bones, human growth studies and forensic anthropology are representative of the variety of research currently in progress in Japan.

MICROEVOLUTIONARY STUDIES ON THE JAPANESE POPULATION

As pointed out in the previous section, Palaeolithic human fossil remains are quite few in Japan. In the following section, therefore, microevolutionary studies on the Japanese population, which are endowed with a considerably long history and rich data, will be introduced.

The first scientific excavation of a Jomon site was carried out by E. S. Morse in 1877. Morse was a professor of zoology at the University of Tokyo, and the site excavated was named the Omori Shell Mound; it was located in what was then Oi Village, in present-day Ota-ku, Tokyo. Morse and his assistants, mainly students at the University of Tokyo, found an extensive number of pottery pots, potsherds and human bone fragments which were derived from the Jomon age, about 3,000 to 4,000 years B. P. The name 'Jomon' came from the characteristic cord marked pattern of pottery of the period.

Since then, a large number of Japanese students have been interested in the study of prehistoric man and culture. As they were appointed to university professorships, they started academic activities in anthropology, anatomy, archaeology, folklore, geography, and other fields. S. Tsuboi, the first professor of anthropology in Japan, established the Anthropological Society of Tokyo, the predecessor of the present Anthropological Society of Nippon, in 1884.

The first hot debate in anthropology took place in connection with Ainu in Hokkaido who are now recognized as part of the Japanese population. In the early 20th century, Y. Koganei, professor of anatomy, studied Ainu and Jomon skeletal remains, emphasizing that the recent Ainu was similar to the Jomon man in morphology. In contrast to this, Tsuboi stressed, on the basis of archaeological and ethnological evidence, that the Jomon man was entirely different from Ainu. For instance, Tsuboi attached special importance to the absence of pottery in Ainu culture. However R. Torii, a research assistant of Tsuboi's, found that the Ainu in the Kurile Islands used pottery pots until recent times, and opposed Tsuboi's theory. On the other hand, since Koganei used objective data from the skeletal remains and scientific methodology, his theory was accepted by a majority of researchers.

Since the late 19th century, as the number of archaeologists increased, archaeological excavations have also increased. At the same time, many anatomists were interested in anthropology and excavated prehistoric sites to obtain early skeletal samples. They also studied soft tissues and several different characteristics of living man. In particular, somatological studies on Japanese and neighboring populations were carried out mainly by anatomists.

In the early 1920s, K. Kiyono of Kyoto University applied statistics to the metric data on human bones and compared prehistoric, historic and modern populations with each other. As a result, he came to the conclusion that the modern Japanese population was formed by the mixing of descendants of the prehistoric Jomon and the neighboring populations. He emphasized that the modern mainland Japanese

were an admixture of Jomon and Southeast Asian populations, and the modern Hokkaido Ainu were an admixture of the former and Northeast Asian populations.

Later, his theory was criticized but the introduction of statistics into anthropological studies stimulated researchers in related sciences. At the same time, Kiyono collected more than a thousand skeletal remains which were derived from the Jomon and succeeding ages. This collection, housed at Kyoto University, is still highly useful for the microevolutionary studies of Japanese.

After World War II, H. Suzuki of the University of Tokyo collected a number of skeletal remains from both prehistoric and historic ages. Suzuki's collection includes not only remains from the prehistoric and proto-historic ages but also those from the 14th through 19th centuries, amounting up to nearly six thousand individuals. At the same time, anatomists collected skeletal specimens of modern Japanese local populations at more than a dozen anatomy departments, the number amounted to more than 3,000 altogether.

Suzuki compared data from these skeletal collections and came to the conclusion that the Jomon population gradually changed to the modern Japanese through microevolutionary processes and never mixed with any other populations. Since he used skeletal remains which had been collected systematically from different ages, his theory seemed to be quite persuasive. However, Suzuki based his theory only on skeletal remains collected from eastern Japan. Later, it was pointed out that the geographic variation in Japanese physical characteristics, particularly those between eastern and western Japan, were much larger than so far supposed, and Suzuki's theory had to be revised.

In the 1960s, a kind of revolution occurred in anthropological method. One was the introduction of computers and the other was the development of molecular biology. The former gave strong support to statistical analysis and made comparative studies through multivariate analysis methods possible; the latter allowed direct analysis and comparison of genes.

These new methods were first applied in Japan by K. Omoto and K. Hanihara in the late 1960s and by B. Yamaguchi in the early 1970s to the study of Ainu. In their joint study, Omoto used molecular genetics and Hanihara carried out multivariate analyses of cranial and dental data from Ainu, non-Ainu Japanese and other populations. The results from both genetic and morphological studies showed surprisingly high correlations with each other and revealed that Ainu were not derived from Caucasians, as had been suggested by a number of anthropologists, but from the Asian prototype. The results of the analyses further suggested that the ancestors of Ainu was probably the Jomon population who inhabited all of Japan during the period from ca. 10,000 to 2,300 years B. P.; non-Ainu Japanese were also derived from the Jomon population but their microevolutionary processes were likely different from those of Ainu.

Since then, the usefulness of the new approaches and techniques has been recognized by anthropologists and related scientists, particularly by those of younger generations. At the same time, the establishment of the Cultural Properties Protection Act and an increase in land development and construction work after World War II

accelerated the accumulation of a large amount of new archaeological evidence and human skeletal remains as well. In particular, the latter provided an extensive amount of data which allowed reasonable application of multivariate statistics.

An additional method for microevolutionary studies is the morphological investigation of human teeth. The so-called dental anthropology was established by A. A. Dahlberg of the University of Chicago and his colleagues, and investigations in this field have been rapidly developed. In Japan, Hanihara started anthropological studies on human dentition in 1951, comparing dental traits of Japanese and other populations including non-Japanese Mongoloids, Caucasoids, Africans, Pacific populations, Australian Aborigines, etc. On the basis of comparative studies of dentition, Hanihara proposed the concept of a 'Mongoloid dental complex.' The complex includes shovel-shaping in incisors, 6th cusp, 7th cusp, protostylid and deflecting wrinkle in mandibular molars, all of which show higher frequencies in the Mongoloid populations than in any other population groups. In other words, the traits included in the Mongoloid dental complex are, in a sense, similar to marker genes which appear in some specific populations.

Later, researchers in dental anthropology proposed the terms 'Caucasoid dental complex' and 'Negroid dental complex,' etc. These complexes, or groups of dental traits, have been proved to be useful for studies of human microevolution and affinities among different populations.

T. Sakai of Aichi Gakuin Dental School is another researcher in dental anthropology in Japan. One of his important works was a morphological study of the enamel-dentin border. Applying the method developed by C. A. W. Korenhof, he studied the morphogenesis of dental traits which were included in the Mongoloid dental complex, proving that these traits had evolutionary significance.

As described above, microevolutionary studies in Japan are now making progress mainly in the fields of skeletal morphology, dental anthropology and molecular genetics, all of which are aided by several methods of multivariate statistical analysis as well as numerical taxonomy. Studies in archaeology, ethnology, linguistics, natural environment, and other fields, however, are also important to analyze the microevolutionary processes of human populations.

In this regard, K. Hanihara organized a joint research project in 1987 at the International Research Center for Japanese Studies in Kyoto under the title "The Fundamental Structure and Natural Backgrounds of Japanese Culture." The research group consists of 19 specialists whose fields are anthropology, genetics, medicine, archaeology, ethnology, history, linguistics, and the environmental sciences; the purpose of the project is to analyze the basic structure as well as formation processes of the Japanese population and culture.

The uniqueness of the joint study lies in its approach method: every member attacks a hypothesis proposed by the organizer, and other members support or criticize the attacker's opinion. Through this process, both weak and reliable points in the proposed hypothesis are revealed.

The hypothesis to be attacked is the 'dual structure model' for the population history of the Japanese, which was proposed by K. Hanihara. He obtained this idea

on the basis of statistical analysis of skeletal and dental data covering the periods from the Palaeolithic to modern ages and the areas of East Asia and the Pacific. The essential point of the idea was described in Hanihara's paper in the *Japan Review*, No. 2, 1991.

The highlight of the project was the international symposium, "Japanese as a Member of the Asian and Pacific Populations," which was held in September, 1990 in Kyoto. Participants were specialists in physical anthropology, human and animal genetics and prehistoric archaeology in the Asian and Pacific areas who came together from Canada, China, the United States and Japan. The conclusion reached through discussions was that there existed diachronic biocultural evidence for (1) a Southeast Asian origin of the Jomon population; (2) a late Asian mainland origin of the migrants after the Yayoi age, or some 2,300 years ago; and (3) locally different degrees of admixture of both elements in modern Japanese. Thus, the 'dual structure model' for the population history of the Japanese was supported by specialists in different scientific fields.

In sum, the trends in microevolutionary studies in Japan, particularly those after World War II, are as follows:

First, the Cultural Properties Protection Act in Japan and a rapid increase in land development and construction work promote archaeological excavation, and are responsible for the rapid accumulation of cultural evidence as well as of human skeletal remains.

Secondly, the use of multivariate statistical methods and large computer systems allowed objective and advanced analysis of several kinds of anthropological data. In particular, affinities among different populations cannot be analyzed without such powerful devices.

Thirdly, findings in different research fields provide human microevolutionary studies with important and useful information. Integration of different data may give us new perspectives.

Finally, it should be emphasized that the introduction of a research system which integrates different disciplines is of special importance. One of the ways to operate this system is to present a target which must be attacked by every researcher involved. The dual structure model of the Japanese population is thus but one of the targets of our current research.

REFERENCES

Recent studies in physical anthropology carried out in Japan are reviewed in the following book. Almost complete references up to 1983 are listed in each chapter.

Recent Progress of Natural Sciences in Japan, Vol. 8 (Anthropology), published by the Science Council of Japan, Tokyo, 1983.

Chapters:

- I. Origin and evolution of Japanese physical characteristics
- II. Growth and development
- III. Physiological anthropology

IV. Primatology

V. Ecology and population studies

VI. Overseas field works, 1956-1981

VII. Applied anthropology

The following references are representatives of works published after 1983, particularly concerning with the microevolution of Japanese.

- Hanihara, K. (1985a): Origins and affinities of Japanese as viewed from cranial measurements. In, R. Kirk and E. Szathmary (eds.), *Out of Asia: Peopling the Americas and the Pacific*, Canberra, pp.105-112.
- Hanihara, K. (1985b): Geographic variation of modern Japanese crania and its relationship to the origin of Japanese. *Homo*, **36**: 1-10.
- Hanihara, K. (1987): Estimation of the number of early migrants to Japan: A simulative study. *J. Anthropol. Soc. Nippon*, **95**: 391-403.
- Hanihara, K. (1991): Dual structure model for the population history of the Japanese. *Japan Review*, **2**: 1-33.
- Hanihara, K. (ed.) (1991): Proceedings of the 1990 IRCJS International Symposium, (In press).
- Hinuma, Y. (1985): Natural history of the retrovirus associated with a human leukemia. *BioEssays*, **3**: 205-209.
- Hinuma, Y. (1986): The origin of Japanese HTLV-I. *Nature*, **322** (6079): 504.
- Horai, S. et al. (1989): DNA amplification from ancient human skeletal remains and their sequence analysis. *Proc. Japan Acad.*, **65** (Ser. B): 229-233.
- Moriwaki, K. (1989): The mice in Japan (Hatsuka-nezumi). *Kagaku Asahi*, September Issue (1989), pp.26-29. (In Japanese.) 森脇和郎(1989): ハツカネズミ. 科学朝日 1989年9月号, pp.26-29.
- Omoto, K. (1984): The Negritos: Genetic origins and microevolution. *Acta Anthropogenetica*, **8**: 137-147.
- Saitou, N., K. Tokunaga and K. Omoto (in press), Genetic affinities of human populations. In, D. F. Roberts, N. Fujiki and K. Torizuka (eds.), *Isolation, Migration and Health*, Cambridge University Press.
- Tanabe, Y. et al. (1985): Phylogenetic relationships of Asian dog breeds. *Proc. 3rd AAAP Animal Sci. Congr. (Seoul)*, **1**: 290-292.
- Tanabe, Y. (1990): Genetic relationships among dog breeds with special reference to Asian dog breeds studied by biochemical polymorphisms of blood proteins. In Z. Ogita and C. L. Markert (eds.), *Isozymes: Structure, Function and Use in Biology and Medicine*. Alan R. Liss Inc., New York, pp.619-637.
- Tokunaga, K. and T. Juji (in press): The migration and dispersal of East Asian populations as viewed from HLA genes and haplotypes. In, T. Akazawa, K. Aoki and T. Kimura (eds.), *The Evolution and Dispersal of Modern Humans in Asia*, University of Tokyo Press.
- Yonekawa, H. et al. (1988): Hybrid origin of Japanese mice "*Mus musculus molossinus*": Evidence from restriction analysis of mitochondrial DNA. *Mol. Biol. Evol.*, **5**: 63-78.

日本における自然人類学研究の現状

埴原和郎

要旨：人類学は「集団としてのヒトおよびその生産物と行動に関する科学」(A. L. Kroeber)と定義される。その一部である自然人類学は人類集団の進化(大進化と小進化)を解明することを最終目的とするが、人類進化にかかわる要因はきわめて複雑であるとともに、文化ならびに人間社会の成立に深く関与している。したがって自然人類学は他の人類学諸分野とともに人類そのもの、人類が作り出した有形、無形の文化、ならびに人類の生存と密接不離の関係にある環境を理解するための基本的知識を提供する科学であるといえる。

日本において自然人類学を専攻する研究者の数はきわめて少ないが、その活動は広範囲におよび、研究のレベルも国際的に高く評価されている。本総説ではこの分野の現状をごく簡単に紹介したが、とくにわが国の伝統ともいえるべき日本人の小進化に関する研究をやや詳しく述べた。これらの研究は単に日本人集団の起源や形成過程を明らかにするばかりでなく、人種の分岐や形成、あるいは環境への適応に関わる普遍的問題の解明にも貢献するもので、人類生存の展望に不可欠の基礎的知識を提供する。

この総説は人類学専攻の研究者というより、他分野の研究者への情報提供を目的としているので、詳しい研究内容にはふれていない。また研究項目についてもごく一部を紹介したに過ぎないが、日本における自然人類学研究の現状と傾向の大筋を理解して頂ければ幸いである。

終わりに、それぞれの分野に関する研究動向をご教示下さった方々に深くお礼を申し上げます。

この総説は1989年9月に、Liblice (Czechoslovakia) で開催された国際シンポジウム“Foundations of Different Approaches to the Study of Human Evolution” (Organizers: B. A. Sigmon and V. Leonovicova)で発表した“Japan and Human Evolutionary Research”の内容を書き改めたものである。