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# Historical overview and challenges in the development of bioarchaeology in Japan

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Archaeological human skeletons provide direct evidence of the physical features, lifestyle, diseases, mortality, and health of our ancestors. Bioarchaeology explores population-based trends that vary according to subsistence, social stratification, urbanization, and industrial development. The first systematic bioarchaeological studies in Japan were those on medieval human skeletons in Kamakura City, Japan, in 2003. However, most anthropological studies have focused on the origin and population history of the Japanese since the end of 19th century. Moreover, the number of bioarchaeological studies in Japan is far lower than that in North America, Europe, and Latin America. This paper reviews the history of bioarchaeological research in Japan and discusses the problems associated with its development.

## KEYWORDS

bioarchaeology, osteoarchaeology, research history, human skeletons, Japan

## 1 Introduction

Archaeological human skeletons provide direct evidence of the physical features, lifestyle, diseases, mortality, and health of our ancestors. The research field of archaeological human skeletons is categorized into osteoarchaeology and bioarchaeology, which are part of physical anthropology. The lifestyle, mortality, diseases, and health of human remains have been explored by many physical anthropologists (such as [Koganei, 1894](#); [Sakura, 1964](#); [Kobayashi, 1967](#); [Suzuki, 1984](#)) until the 1990s. Most physical anthropologists in Japan have actively examined the origin and population history of the Japanese since the end of the 19th century ([Koganei, 1894](#)), though some have travelled overseas to explore the population history of the Asian peoples ([Matsumura et al., 2019](#)).

## 2 Origins of osteoarchaeology in Japan

Kazumichi Katayama of Kyoto University wrote the book, *Ancient bones talk: Beginning of Osteoarchaeology* (1990) which introduced osteoarchaeology to Japan. In this book, Katayama defines osteoarchaeology as a study that explores lifestyles (such as, subsistence, societies, and habitual postures) from archaeological human remains using the methods of physical anthropology. He related archaeological human skeletons to the lives of ancient humans: the skeletal data could thus be related to and reveal information about the habitual postures, lifestyle, diets, diseases, mortality, and health of an ancient population. Though prior paleopathological and paleodemographic studies have explored ancient lives and diseases to yield significant results ([Kobayashi, 1967](#); [Suzuki, 1998](#)), [Katayama \(1990\)](#)

proposed a new research area and tried to integrate these studies. Since then, osteoarchaeology has developed as a branch of physical anthropology in Japan. The Osteoarchaeology subcommittee of the Anthropological Society of Nippon was established in 1997, and the Japanese Society of Paleopathology was established in 2016. The spread of osteoarchaeology in Japan never lagged behind that in the United States and Europe. This can be understood from the fact that the *International Journal of Osteoarchaeology* started publication in 1991. Osteoarchaeology combines osteology and archaeology and targets both human and animal bones. However, the current study only concerns human bones, based on to [Katayama \(1990\)](#), who related osteoarchaeology to ancient human skeletons. In the 1990s, osteoarchaeological studies of human remains in Japan emphasized the diagnoses and interpretations of skeletal disorders ([Inoue et al., 1999](#)). Most of these studies were just case reports. The findings from these case reports are important; however, I wonder whether an accumulation of such studies could lead to a breakthrough in physical anthropology. To compensate for the lack of a grand theory, researchers in Japan prefer to use a message, “Bones talk.” In the 1990s, when *Ancient bones talk: Beginning of osteoarchaeology* was first published, this message was novel and thus attracted young researchers. However, this message has been used repeatedly, in both research and outreach programs, and has thus lost its attractiveness and novelty over the past 30 years. The message “Bones talk.” reflects a passive attitude, but researchers should be actively extracting data.

### 3 Transition to bioarchaeology in Japan

In the 2000s and later, research activity in osteoarchaeology in Japan decreased because the existing researchers were aging and there were very few young researchers. Since the end of the 20th century, the research area relating human skeletal remains to human lives has changed from osteoarchaeology to bioarchaeology in North America. Clark Spenser Larsen of Ohio State University published the book, *Bioarchaeology: Interpreting behavior from the human skeleton* (1997) and bioarchaeology spread worldwide. Bioarchaeology explores population-based trends that vary according to subsistence, social stratification, urbanization, industrial development, and climate change. It overcomes the limitations of osteoarchaeology which primarily focused on case reports and diagnoses of skeletal disorders. The accumulation of skeletons and the employment of new methods, such as stable isotope ecology and molecular biology, have contributed to the development of bioarchaeology.

Both osteoarchaeology and bioarchaeology target skeletal remains. However, bioarchaeology is different from osteoarchaeology in that it includes broad perspectives of regions and time periods to obtain population-based trends. The difference between osteoarchaeology and bioarchaeology is not just the difference in names, but also in the sets of concepts that determine a scientific discipline or “paradigm” as defined by [Kuhn \(1970\)](#).

The bioarchaeological study in Japan was first organized as a Grant-in-Aid for Scientific Research for a team with members from St. Marianna University School of Medicine (Kawasaki, Japan) and the University of Ryukyus (Nishihara, Japan). This research project

examined dental diseases, degenerative diseases of joints ([Shimoda et al., 2012](#)) and trauma ([Nagaoka et al., 2009](#)) of medieval human skeletons in Japan, but these bioarchaeological studies overlapped with osteoarchaeology and paleopathology. Most achievements that have influenced bioarchaeology in Japan have been made by foreign researchers. For example, Daniel Temple of Ohio State University examined linear enamel hypoplasia and dental caries in the Jomon and Yayoi people and showed detailed regional and temporal variations that Japanese anthropologists have not dealt with ([Temple, 2007](#); [Temple et al., 2008](#)). His studies utilized [Larsen's \(1997\)](#) concept of bioarchaeology which includes broad perspectives of regions and time periods to obtain population-based trends.

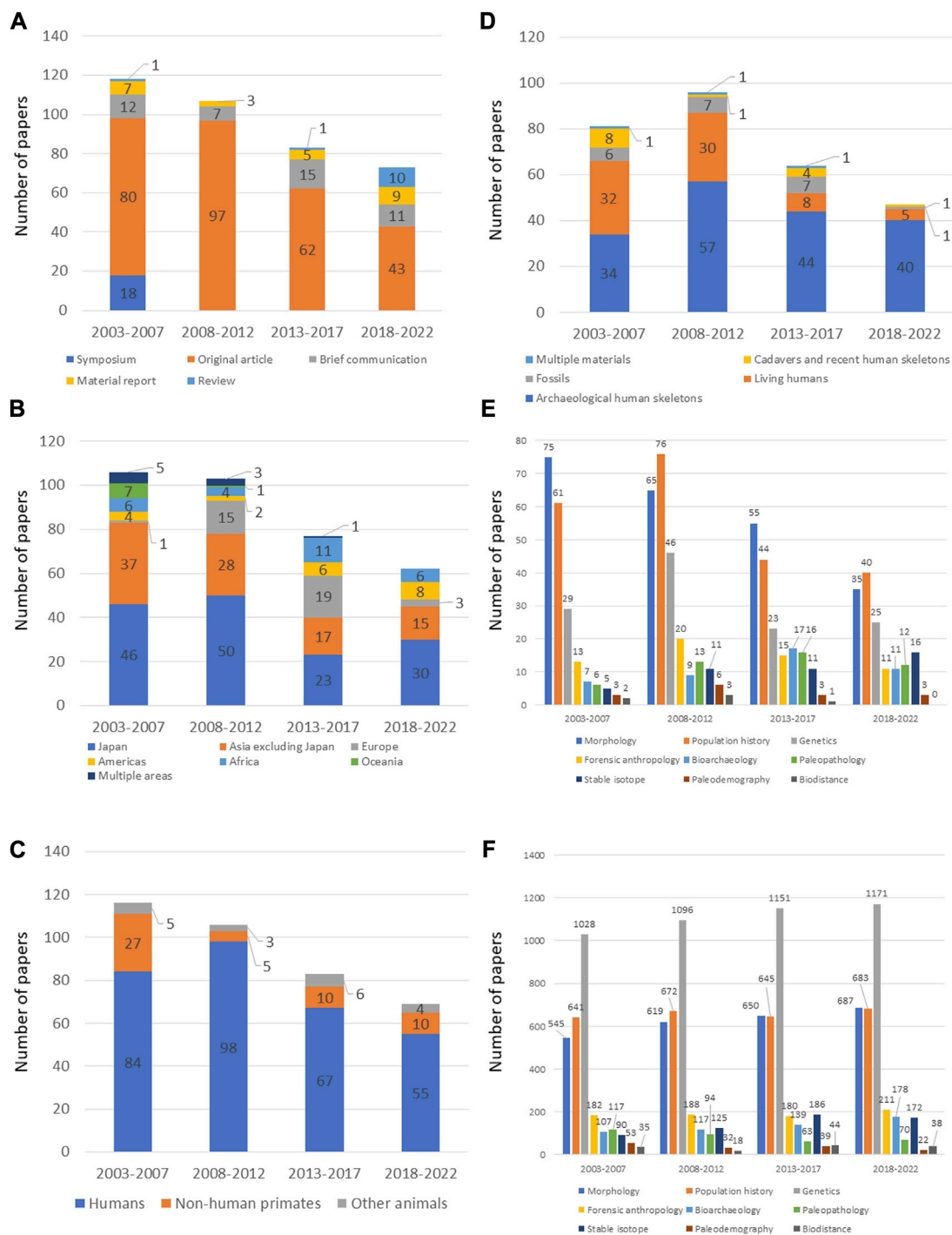
However, there are far fewer bioarchaeological studies in Japan than in North America, Europe, or Latin America. Since [Suzuki \(1969\)](#), the majority of the anthropological studies in Japan have focused on the origin and population history of the Japanese, and most of these studies lack a global perspective on the common causes that influence living conditions worldwide.

Fortunately, thousands of human remains are housed in physical anthropology laboratories in Japan. These materials are from various time periods and from various regions within the Japanese archipelagos and are thus ideal for elucidating whether epochal events such as subsistence changes, social stratification, climate change, and industrial revolution have affected health status. These materials can contribute to the development of bioarchaeology if more physical anthropologists become involved in this research field. Some skeletons that have been repeatedly observed by researchers over the past 100 years could still provide new insights. For example, the oldest recorded shark attack in the fisher-hunter-gatherer Jomon period was detected in such a housed skeleton in 2021 ([White et al., 2021](#)). The application of new methods to these materials has revealed the weaning age of the Jomon people ([Tsutaya et al., 2014](#)). The quality and quantity of information extracted from human remains depend on the researchers' knowledge and analytical techniques used, although all physical anthropologists are confident in their appraisals.

### 4 Materials and methods

This study examined papers published in [Anthropological Science, \(2023\)](#), the official journal of the Anthropological Society of Nippon, to identify the trends in paper types, regions of research, materials, and methods and to understand the contribution of anthropology in Japan to the development of bioarchaeology. A total of 381 papers were published during 2003–2022 in *Anthropological Science*. These were categorized into four time periods: 2003–2007, 2008–2012, 2013–2017, and 2018–2022.

This study searched for certain terms in the full texts of papers using websites of [Anthropological Science, \(2023\)](#), counted the number of papers that contained these terms, and compared them with the data from the *American Journal of Biological Anthropology*, [\(2023\)](#) to understand the prevalence of bioarchaeology in human osteology and physical anthropology in Japan. [Larsen \(1997\)](#) edited a textbook on bioarchaeology that had chapters on stress and deprivation, infectious diseases, injuries and violence, activity patterns, masticatory and non-masticatory functions, isotopic analyses, biological distance, and



**FIGURE 1**

Temporal trends in the number of papers submitted to *Anthropological Science* from 2003 to 2022 (A–D) and comparison in the number of papers that contain the terms “morphology, population history, genetics, forensic anthropology, bioarchaeology, paleopathology, stable isotope, paleodemography, and biodistance” between *Anthropological Science* and the *American Journal of Biological Anthropology* (E–F). (A) paper types (symposiums, original articles, brief communications, material reports, and review articles); (B) regions of the research (Japan, Asia, Europe, America, Africa, Oceania, and multiple regions); (C) materials (humans, non-human primates, and other animals); (D) classification of human materials (archaeological human skeletons, living humans, fossils, cadavers and recent human remains, and multiple materials); (E–F) Number of papers that contain the terms “morphology, population history, genetics, forensic anthropology, bioarchaeology, paleopathology, stable isotope, paleodemography, and biodistance” in full texts from *Anthropological Science* (E) and the *American Journal of Biological Anthropology* (F).

paleodemography. White et al. (2011) edited a textbook on human osteology and its application to physical anthropology, whose chapters encompassed anatomy; assessment of age, sex, stature,

ancestry, and identity of the individual; osteological and dental pathology; postmortem skeletal modification; the biology of skeletal populations; and case studies in molecular osteology,

forensics, bioarchaeological, and paleontology. Referring to these textbooks, this study selected several terms that represent the relevant research fields: morphology, population history, genetics, forensic anthropology, bioarchaeology, paleopathology, stable isotope, paleodemography, and biodistance. Even though some bioarchaeological studies overlaps with the research in other fields, such as paleopathology, this study counted the number of papers separately for each shortlisted term.

## 5 Results and discussion

Several important findings were obtained in this study. The number of papers with the relevant terms published in *Anthropological Science* decreased over time (from 118 in 2003–2007 to 73 in 2018–2022) (Figure 1A; Supplementary Appendix S1). The proportion of original research articles decreased from 90.7% in 2008–2012 to 58.9% in 2018–2022 (Figure 1A; Supplementary Appendix S1). In these articles, the primary research region in all time periods was Japan (Figure 1B; Supplementary Appendix S1). The proportion of papers on non-human primates accounted for 23.3% in 2003–2007, while it decreased in the subsequent time periods (Figure 1C; Supplementary Appendix S1). The proportion of papers on ancient human skeletons among papers on all human materials increased monotonously from 42.0% in 2003–2007 to 85.1% in 2018–2022, while the proportion of papers on living humans decreased from 39.5% to 10.6% (Figure 1D; Supplementary Appendix S1).

Morphology was the most commonly used term in *Anthropological Science*, but its proportion has decreased radically from 66.3% in 2013–2022 to 47.9% in 2018–2022 (Figure 1E; Supplementary Appendix S1). However, the proportions of papers with various research terms such as paleopathology, stable isotope, and bioarchaeology has increased over time: the proportion of papers with the term “bioarchaeology” increased from 5.9% in 2003–2007 to 15.1% in 2018–2022 (Figure 1E; Supplementary Appendix S1). In contrast, the proportion of papers with the term “genetics” accounted for almost 100% in the total number of papers and the proportion of the term “bioarchaeology” was present in 10.4%, 10.7%, 12.0%, and 15.2% of the papers in the four time periods in the *American Journal of Biological Anthropology*. Comparison between the two journals shows that in the beginning of bioarchaeology, Japan lagged behind, but the proportion of papers with the term “bioarchaeology” was almost the same between the two journals in 2018–2022.

In summary, the momentum of research in physical anthropology in Japan has reduced over the past 20 years as seen by the decrease in the number of papers. Some anthropologists in Japan have moved overseas, but most have focused on population history. The number of papers on population history was 61, 76, 44, and 40 in 2003–2007, 2008–2012, 2013–2017, and 2018–2022, respectively, which was far more than those on bioarchaeology. Larsen published his textbook on bioarchaeology in 1997, but since then, there are only a small number of anthropologists in Japan who have learned the new discipline.

## 6 How to learn bioarchaeology in Japan

Archaeologists in Japan are worried when human remains are excavated from the site. In Japan, most students learn archaeology in

the Faculty of Letters and physical anthropology in the Faculty of Science. Students cannot learn both archaeology and anthropology. There are only three physical anthropology laboratories at the University of Tokyo, Kyoto University, and Osaka University and only a few researchers to teach bioarchaeology.

When archaeologists or students study osteology and physical anthropology from books, they often accept the idea “Bones talk” without question, and this creates a misunderstanding that bones are almighty in this field. Students must also learn about the limitations of these methods. In the estimation of sex from skeletons, the accuracy of sex classification is almost 90% based on the os coxae; however, these osteological methods cannot be applied to non-adults (White et al., 2011). Bone injuries are not always human-induced cutmarks, and are often confused by taphonomic factors (White et al., 2011). If we do not lend an ear to the skeleton, the bones will not talk. It is difficult for archaeologists or students to learn bioarchaeology only from books. Today, students have opportunities to also learn from the osteological seminars held by physical anthropologists at Nihon University (2009–2012), Nippon Dental University (2013), and Niigata University of Health and Welfare (2014 to present). It is ideal that students can learn about bioarchaeology in archaeology courses, in future.

Another important issue for researchers in bioarchaeology is finding a job. Owing to the division between archaeology and physical anthropology in Japan, researchers are caught in a dilemma between the two research fields. Archaeologists rejected these researchers stating that bioarchaeology is a science, whereas physical anthropologists reject them stating that bioarchaeology belongs to archaeology. Most physical anthropologists in Japan cannot judge bioarchaeological studies unless the origin and population history are the target of the study. Because it is almost impossible for students to learn bioarchaeology, obtain jobs, and be evaluated in academic jobs, there are only a few bioarchaeology researchers in Japan. To increase job opportunities, students should acquire interdisciplinary knowledge in a wide range of research areas, such as anatomy, forensic anthropology, genetics, archaeology, and ethnology.

However, bioarchaeology is advantageous for exploring the living conditions of ancient people using direct evidence. Bioarchaeology provides a global perspective that correlates human life with epochal events (such as climate change and social stratification). The gate of bioarchaeology in Japan is narrow; however, if students understand the situation, the opportunities beyond the gate are still open.

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The author confirms being the sole contributor of this work and has approved it for publication.

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## Conflict of interest

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## Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feart.2023.1137696/full#supplementary-material>

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