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Arrival of Austronesian Immigrants in the Java Sea Region, Central Java, Indonesia: A New Dating Interpretation

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Abstract. The research analyzes the chronology of the arrival of Austronesian speakers in the Java Sea Region, Indonesia, through absolute and relative dating analysis. Radiocarbon dating analysis of findings of human skeletons from research at the Leran and Plawangan Sites, Central Java Province, and the East Tamberu Site, East Java Province, shows significant dating, namely, far past historical times. Relative dating analysis is based on textual and artifactual data found contextually on Bawean Island in the Java Sea Region. The discovery of absolute and relative dating results can fill in the gaps in the chronology of the arrival of the Austronesian speakers in the Java Sea Region, the North Coast of Java, and the Madura Islands. Bawean Island is thought to be a transit area for Austronesian speakers, so absolute dating samples were taken from the closest and farthest sites from Bawean Island, namely Leran and Tamberu Timur sites. Meanwhile, 2 Long Grave Units were found on Bawean Island as relative dating samples. Both will provide information on the chronology of the arrival of Austronesian speakers in the Java Sea area.

Keywords: *Absolute Dating, Austronesian Migration, Chronology, Java Sea Region, Relative Dating.*

A. INTRODUCTION

The general view of Austronesian speakers' migration refers to the out-of-Taiwan hypothesis (Bellwood, 1984; Blust, 1984). In another study, Bellwood et al. (2006) stated that Austronesian immigrants left Taiwan around 3500 BC and occupied the Java Sea Region around 500 BC (Figure 1). Regarding the out-of-Taiwan theory, some scholars such as W.G. Solheim II proposed the concept of the Nusantara Maritime Trade and Communication Network (NMTCN), which is the concept of how Austronesian languages spread in the Asia-Pacific Region. This theory is an alternative to the Out of Taiwan theory, which is generally accepted by Bellwood (Solheim II, 1996). Agreeing with Solheim, Neri states that migration is more challenging than imagined. This statement is based on the results of obsidian distribution studies in three areas: Mindanao Island, the Philippines; the Sabah region, Malaysia; and the Talaud Islands, Indonesia. The results found that obsidian, a Neolithic artifact, was sourced from the islands of Sulawesi. It was further concluded that since the Neolithic period in the three regions above, there had been a complex and massive "exchange network" by Neri. This maritime network was raised as a hypothesis of the "Celebes Seafaring People" (Neri, 2019).

However, Out of Taiwan is a highly influential multi-regional archaeological theory in Southeast Asia and the Pacific Region. Other research supports the Out of Taiwan theory, including the study of Chang et al. (2015), which concludes that the holistic picture of Austronesian expansion and migrations revealed by the phylogeography of Pacific paper mulberry is in close agreement with archaeological, linguistic, and human genetic data. Similarly, research on the relationship between DNA variation in Taiwan and its distribution in Southeast Asia shows a similar scenario of pre-neolithic expansion from China to all of Southeast Asia (Trejaut et al., 2014). The research results of the National Archaeological

Research Center at the Plawangan Site in 1980-1993 concluded that the Plawangan Site was occupied by Australomelanesid humans and the Mongoloid race from prehistoric times to the historical period (Prasetyo, 1985). The period between 3500 and 500 BC is very long, as is the time between prehistory and history because history will continue throughout the ages. Therefore, research on this dating analysis will answer the dating of the presence of Austronesian speakers in the Java Sea Region, the North Coast of Java, and the Madura Islands.

So far, there has been much research on the migration of Austronesian speakers on the North Coast of Java. However, most research has yet to be equipped with absolute dating analysis, except for research at the Binangun and Leran sites in 2012. A research team surveyed the coast of Leran Village and found that charcoal in the soil layer was affected by seawater abrasion. The charcoal findings were in the same cultural layer as the findings of human bones. They were immediately sent to the Bandung Geological Survey Center Laboratory to conduct the carbon dating analysis. The results show that charcoal is in the age of 2640 +/- 160 or equal to–850-530 BC (Gunadi et al., 2012).

The results of collaborative research between the Faculty of Fisheries and Marine Sciences, Diponegoro University, Semarang, Indonesia, and L'Institut de Recherche Dupuy de Lome, Universite de Bretagne-Sud, FRE CNRS 3744, Lorient, France, revealed several types of Bryozoa, including Candidae, Policellaridae, Onychocelidae, Lepralicellidae, Phideloporidae, and new species Smittinidae in the Java Sea Region. Biogeographically, these types of marine biota are distributed in the Western Indo-Pacific tropical region, including the Java Sea Region. This type of marine life is the preferred food for fish (Asagabaldan et al., 2019). Thus, many bryozoan colonies were found, including fish and shell populations. To date, the waters of the Java Sea, especially the Bawean Island area and its surroundings, have been known as the largest producers of fish. Almost every day, fresh or pindang fish containers are transported to Java, Kalimantan, and other islands, some even to Malaysia and Singapore. Pindang fish from Bawean are known for their extraordinary quality ingredients and processing (Soedrijanto et al., 2020).

In addition, there are several findings of human skeletons based on research on Austronesian language speakers, such as the skeleton found at the Leran Site (Figure 2) identified as the Mongoloid race (Noerwidi, 2015; (Noerwidi 2017)), the Plawangan human skeleton (Figure 3), Rusyad Adi Suriyanto identified as the Mongoloid race (Gunadi, 2016), and the East Tamberu human skeleton (Figure 4) by Toetik Koes Bardiati, also identified as the Mongoloid race (Gunadi, 2021). While the Mongoloid race spread across the Asia-Pacific region are identified as Austronesian speakers, they are immigrants from Taiwan who occupy more than half of the world, as mentioned by the Head of the Indonesian Institute of Sciences in his book Pengantar Buku: Polemik tentang Masyarakat Austronesia Fakta atau Fiksi (Masinambow et al., 2004).

One of the most important data types in archaeology is absolute and relative dating. In this case, the unknown dating data of the Leran, Plawangan, and East Tamberu sites are a problem related to the arrival of Austronesian-language speakers in the Java Sea Region (Bawean Island) and the North Coast of Java and Madura (Leran Site; Plawangan and East Tamberu). The results of absolute dating research are based on the results of radiocarbon dating analysis. In contrast, relative dating is based on the results of contextual analysis between historical, archaeological, ethnographic, and textual data. Thus, the problem in this research can be formulated as to how the results of absolute and relative analysis can provide a new interpretation of the Austronesian immigration occupation on the north coast of Java.

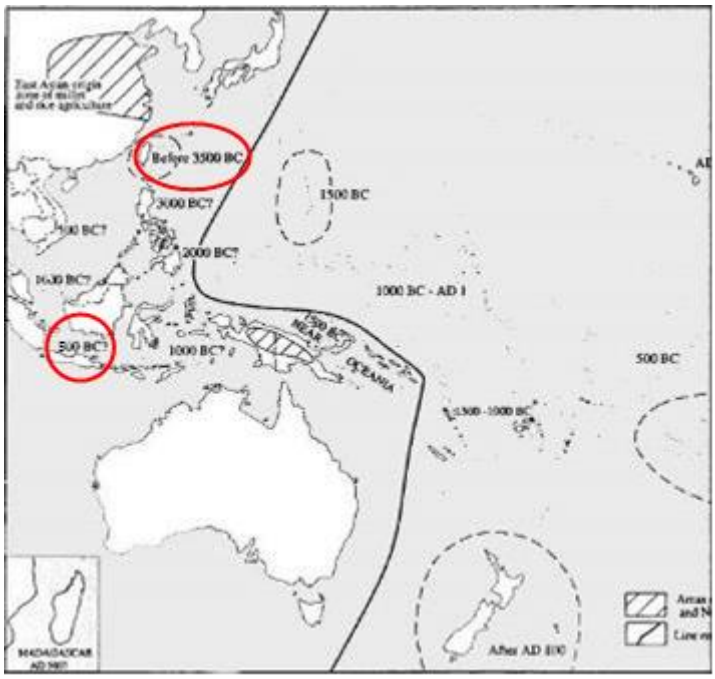

Figure 1. Migration routes and territories of Austronesian Speakers
Source: Bellwood et al. (2006)

Based on the discovery of a bronze kettle drum as a burial container, previous researchers believed that the Plawangan Site was a Paleometallic period site. In my opinion, this statement needs to be corrected, because the use of burial containers is not necessarily contemporary with burial traditions. Therefore, it is necessary to carry out radiocarbon dating analysis for the Plawangan, Leran and Tamberu Timur sites.

B. METHOD

The primary materials or data set for radiocarbon dating analysis were taken from the three representative sites, namely the Leran, Plawangan, and East Tamberu Sites. Two data sets, including the findings from the Leran and East Tamberu sites, were stored in the laboratory room of the former Yogyakarta Archaeology Center. In contrast, the findings from the Plawangan site were stored in the museum. The samples from the three sites were bone, teeth, and sediment.

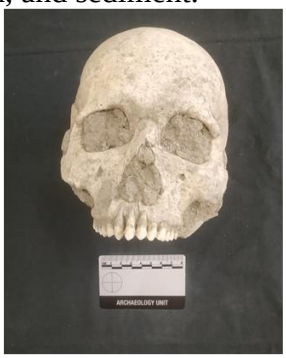

Figure 2. Human Skeleton in Leran Site

Figure 3. Human Skeleton in Plawangan Site

Figure 4. Human Skeleton in East Tamberu Site

(Source: Gunadi Collections, August 2023)

There are two types of samples from each site as a backup in case one fails the analysis process. Both bone or tooth and sediment samples (Figures 5-7) will be analyzed by the

absolute dating method. The procedures and steps of the radiocarbon dating analysis related to this research are as follows:

1. Determine the type of material and the sampling sites based on the results of consultation with the laboratory-obtained information about the size and number of samples and the cost of radiocarbon dating analysis. Furthermore, two types of samples were obtained from each site where human skeletal remains were found that were thought to be Austronesian speakers.
2. The two types of samples were organic human bones from the Leran Site, human teeth from the Plawangan and East Tamberu Sites, and inorganic samples in the form of sediments taken from the three sites.

Figure 5. Bone & Sediment Sample (Leran Site)

Figure 6. Tooth & Sediment (Plawangan Site)

Figure 7. Tooth & Sediment (East Tamberu Site)

(Source: Priyatno Hadi Collections, August 2023)

Radiocarbon dating analysis is the most widely used dating technique in quaternary research, as the half-life of the 14C isotope can extend back hundreds of years. In addition to human bones and teeth, sediment samples from the local environment can also be used. However, sediment samples sometimes do not contain sufficient material for 14C dating analysis; therefore, sediment samples can be used as a last resort (Buró et al., 2022). Following coordination with the BETA Analytic Laboratory, the researchers sent one bone sample from the Leran Site, one tooth sample from the Plawangan Site, and one tooth sample from the East Tamberu Site. From the three sites mentioned above, one sediment sample was taken for carbon dating analysis as a backup and anticipation in the case of failure.

Relative dating analysis related to the research case on Bawean Island, to determine when approximately the Java Sea Region was inhabited by Austronesian language speakers, while there were no excavation findings on Bawean Island. Archaeological data in the form of two units of Kubur Panjang (Long Grave); one unit was found in the public cemetery complex of Tanjung Anyar Beach, Lebak Village, Sangkapura, Bawean (Figure 8-left), and one unit was restored by the people of Lebak Village (Figure 8-right). Briefly, Long Graves are similar to graves from the prehistoric period (megalithic tradition). Long Graves in Budi Village, Mukim Lesong, Pendang, Kedah, Malaysia, are believed by the local community to be the grave of two brothers from Pattani, Thailand, who migrated to Malaysia (Jamil, 2022). The historical-archaeological data of The Bawean Long Grave and Kedah Long Grave in Malaysia contextually represent the migration journey of some people from one place to another. Both have similar shapes and sizes and the same legendary background story.

The Legend of Aji Saka and Bawean Long Grave is explicitly described in the Babad Prambanan manuscript (Figure 9), so what happened at the time is textually documented, including when an event occurred. The Bawean people believe that the two units of Long Graves found in Bawean are the graves of Aji Saka's bodyguards, Sembada and Dora.

Figure 8. Sembada's Grave (left) and Dora's Grave (right)

Figure 9. Babad Prambanan Manuscript

Figure 10. Pottery Craftsmen in Bawean

Figure 11. *Pendhil*, pottery from Bawean

Source: Gunadi Collections, August 2023

As stated in the Babad Prambanan manuscript, the death of Sembada and Dora was due to miscommunication, so both quarreled and fought physically. Because both had the same martial arts knowledge, no one won, and no one lost, and finally, they died together. At that time, Aji Saka, who succeeded in becoming king in Java, heard the news of the death of his two bodyguards. That incident was used as a source of inspiration in compiling the Javanese alphabet by Aji Saka. Explicitly, Babad Prambanan states that the Javanese alphabet was compiled in 1026 AD (Sugiarti & Adi, 1981).

Data from the survey results 2022 are ethnographic data on pottery craftsmen in Dissalam, Patar Selamat, Sangkapura, Bawean. The pottery craftsmen (Figure 10) produce only one pottery type, *pendhil* (Figure 11), which is a particular container for cooking pindang fish. The technology of making Bawean pottery is done without the help of a rotary wheel; it is entirely handmade, and they have not added a red slip. The presence of pottery-making technology in Bawean Island is one of the pieces of evidence of the presence of Austronesian speakers in the Java Sea Region.

C. RESULT AND DISCUSSION

In Indonesia, researchers classify archaeological sites with finds of bronze artifacts, especially Nekara and Moko, as Paleometallic sites. Nitiprodjo, 1994: 119-130; Atmosudiro, 1994: 131-138). Movable bronze objects such as the Nekara found at the Plawangan Site do not mean that the Plawangan Grave Site originates from the Paleometallic period.

Information from the BETA Analytic Laboratory shows that of the 6 (six) samples sent, one bone sample from the Leran Site could not be analyzed because the collagen content in the sample did not meet the requirements. Analysis of inorganic samples (sediment) from the three sites. The Leran and East Tamberu Sites date from the Hindu Mataram period (AD X century) to the Islamic Mataram period (AD XV century). While the results of the analysis of sediment samples from the Plawangan Site found a remarkably risen dating. Two samples of human teeth from the Plawangan and East Tamberu Sites were dated to XIV-XVII AD. This radiocarbon dating analysis revealed significant technical obstacles, namely analysis failures

due to samples that did not meet the technical requirements. Some of these failures include failing to analyze human long bone fragments from the Leran Site because chemicals contaminated the bone collagen while conserving the bone samples. In addition, the analysis of sediment samples from the Plawangan Site failed because it was thought that the samples collected were soil collapsed from the surface when the skeleton was lifted from the excavation pit to the storage museum. The results of the radiocarbon absolute dating analysis by the BETA Analytic Laboratory are shown in Table 1.

Table 1. Result of Radiocarbon Dating Analysis

Lab. Number	Sample Code*	Material	CAL. AD	CAL. BP
Beta 664659	LER/2013/TP1/B1	Sediment	958 – 1030	1100 +/- 30
Beta 664657	PLW/2016/TP1	Tooth	1401 – 1451	540 +/- 30
Beta 664660	PLW/2016/TP1/I	Sediment	Post AD 1950	100.75+/- 0.38pMC
Beta 664658	BDR/2021/S1T1	Tooth	1497 - 1653	340 +/- 30
Beta 664661	BDR/2021/S1T1	Sediment	1390 - 1442	580 +/- 30

*Notes: Sample Code - LER = Leran; PLW = Plawangan; BDR = East Tamberu

Source: Beta Analytic Testing Laboratory, Report of Radiocarbon dating analysis

In addition to absolute dating analysis, relative dating analysis was conducted based on artifactual, textual, and other intangible data that supported the research objectives. The relationship between the two units of Long Grave and the story of Aji Saka in Babad Prambanan informs us that Aji Saka's journey with his two bodyguards before arriving on Java Island stopped at Majeti Island (Bawean Island). Historical and archaeological data (Figures 8 and 9) show that Bawean Island was a transit location for Austronesian immigrants before they continued to Java, Madura, and other islands in the Java Sea region. Other important information is the dating data that the two Long Graves (Figure 8) explicitly relate to the compilation of the Javanese alphabet by Aji Saka in 1026 AD (Sugiarti & Adi, 1981). The discovery of pottery craftsmen in Disalam, Patar Selamat, Sangkapura also provides evidence of the presence of Austronesian speakers on Bawean Island.

Carbon dating analysis of sediment samples from the Leran Site revealed an absolute dating of 1030 AD. Based on the contextual analysis of historical and archaeological data of both long graves in Bawean and the story of Aji Saka in Babad Prambanan, relative dating analysis found the year 1026 AD. Thus, the results of both absolute dating and relative dating analysis show that the migration of Austronesian speakers in the XI century AD occupied Bawean Island in the Java Sea area and Leran in the North Coast of Rembang Regency. This migration was followed by the next wave that occurred in the early to mid-XV century AD, based on the results of radiocarbon dating analysis of human teeth and sediment samples from the Plawangan Site, Rembang Regency, which found absolute dating between 1390-1442 AD. The results of radiocarbon dating analysis of human teeth and sediment samples from the East Tamberu Site, Sampang Regency, found absolute dating between 1401 and 1451 AD.

Data on the facing direction of graves at the Plawangan Site (N to E - Northeast) and the East Tamberu Site (N to W - Northwest), if an imaginary straight line is drawn from both points, the two lines will meet at one point. Although they had different facing directions, they had the same orientation. In this case, the meeting point between the two directions was Bawean Island. Furthermore, the results of linguistic studies in the three research areas provided data on the kinship relationship between Sukaoneng Bawean, Madurese Sampang, and Javanese Plawangan (Endardi et al., 2023). Thus, the results of collaborative research between archaeology and linguistics in 2022 support and complement each other with this

nonfield research. The connectivity between the three regions above (Figure 12) is related to the chronology of the arrival of Austronesian speakers, estimated to have occurred since 500 BC (Bellwood et al., 2006). This is consistent with the results of carbon dating analysis of charcoal samples found at the Leran Site, the result of research in 2012 (Gunadi, 2012).

Figure 12. Sailing Route Triangle (Bawean-Rembang-Bawean-Sampang)
Source: Google Map modification

One of the dataset analysis results shows the date and number of 1026 AD, which implicitly and contextually refers to the historical-archaeological data found on Bawean Island (Sugiarti & Adi, 1981).

Based on Table 1, it can be explained that at a certain time, the chronology of the arrival of Austronesian speakers on Bawean Island is approximately 1026 AD, almost at the same time as those who occupied the Leran Site in the North Coast Area of Rembang Regency, between 958 - 1030 AD. Furthermore, between 1390 and 1442 AD, Austronesian speakers occupied the Plawangan Site, Rembang Regency. Between 1401 and 1451 AD, they occupied the East Tamberu Site, Sampang Regency. The chronology illustrates that Austronesian speakers inhabited Bawean Island before they reached the Plawangan and Tamberu Timur sites.

The connectivity between Bawean, Plawangan, and Tamberu Timur, based on data on the facing direction and orientation of Mongoloid race graves, places Bawean on the axis of Austronesian speakers' migration route. This connection is supported by the findings of pottery fragments from the excavation of the Plawangan Site (Figure 13) and the East Tamberu Site (Figure 14), which are types of pottery made without the help of a rotary wheel and have not used a red slip. This type of pottery is similar to that produced by the Dissalam community in Bawean today. In addition, linguistic data show a close linguistic kinship between Sukaoneng Bawean Madurese, Plawangan Javanese, and East Tamberu (Sampang) Madurese. The results of the linguistic analysis between the three languages above show that Austronesian speakers first occupied Bawean Island, and then, from Bawean, they headed to Plawangan. Furthermore, it also extends from Bawean to East Tamberu (Endardi et al., 2023). All the data are the carrying capacity that elevates Bawean Island as the axis of the Austronesian speakers' migration path in the archipelago.

Figure 13. Pottery Fragment from Plawangan Site's Excavation

Figure 14. Pottery Fragment from Tamberu Timur Site's Excavation

(Source: Gunadi Collections, 2022)

D. CONCLUSION

Based on the absolute and relative dating analysis results, the chronology and connectivity between Bawean Island, Leran, and Plawangan-East Tamberu were found. In the early 11th century (1026 AD and 1030 AD), Aji Saka and two of his guards occupied Bawean Island. At the Leran Site at that time, a Mongoloid race had arrived and lived there, which was identical to Austronesian-language speakers. There are similarities in the absolute dating results and relative dating analysis of the occupation of Bawean Island and the Leran Site. The following chronology of the arrival of the Mongoloid race at the Plawangan Site was in the early to mid-XV century (1401-1451 AD).

Furthermore, the Mongoloid race occupied the East Tamberu Site from the end of the XV century to the XVII century (1497-1653 AD). The absolute and relative dating analysis results have not fully answered the chronology of Austronesian-language speaker migration in the Java Sea region. From 500 BC, the beginning of Austronesian migration in the Java Sea region, the next period is known in the X-XI century AD, namely the presence of the Mongoloid race at the Leran Site and on Bawean Island. The next period includes the Plawangan people, and the last includes the East Tamberu people. This nonfield research still leaves the problem of the chronology of the migration of Austronesian speakers in the Java Sea region. Therefore, it is hoped that other researchers will be interested in continuing it in the future.

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