The role of radiocarbon analysis in determining the chronology of Erong culture in Tana Toraja

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Abstract. Research on the beginning of the growth of Toraja culture needs to track when this unique culture began to develop. The Toraja cultural remains are generally made of stone such as menhirs and stone, and wood graves such as erong grave containers and various daily living equipment. Erong cemetery made of wood is noted as a cultural heritage that is quite old, and generally stored safely in caves, so it is very representative to know its age through the radiocarbon method (C14). A research through selectively taking samples of 22 erong burial sites in Tana Toraja and North Toraja Regency can be a media of tracking the range of the development period of the culture, which is noted around 780 - 1960 AD. Thus the date of the erong burial culture in Tana Toraja can provide a perspective on the initial period and development of the culture.

1. Introduction

Archaeological research about Tana Toraja area has been carried out by many experts, they are still in general and descriptively like Crystal [1], Harun [2], Soegondo et al [3], Duli [4-15], Duli & Hasanuddin [14], Bernadeta [15,16,17] and Somba [19,19,20]. The results of these studies have provided an illustration that the area of Tana Toraja is potentially for archaeological studies to be examined more deeply, especially those related to the megalithic cultural traditions that still exist in the lives of local people. Various aspects of the megalithic culture, such as the use of simbuang (menhirs), liang (burial forms), erong (wooden grave containers), and belief systems about worship of ancestral spirits. One of the fundamental questions about Toraja culture is that megalithic and the uniqueness. The critical question is when the culture began to develop in the area.

One of Toraja cultural heritages that can be investigated to answer the above question is the remains of a wooden grave container called erong. Since 2010, some in-depth researches have done by Duli [21-26] to explain the chronological and ideological aspects of the erong grave culture in Toraja ethnic region. In terms of its chronological aspects, a radiocarbon C14 analysis of several erong samples was obtained from several erong burial sites in Tana Toraja area, in order to determine the age of the erong sample. The aim of the study was to explain the beginning of the development and process of erong culture change in the cultural practice by Toraja ethnic in that area.
2. Radiocarbon Method in Archeological Research in Tana Toraja

The use of laboratory analysis methods for archaeological studies is very important such as XRD and XRF analysis to find out the material. One method used to determine the age of erong burial culture in the study area is radiocarbon dating. Fagan explains that radiocarbon dating is the most useful dating method for archaeologists.

This method above was introduced by Libby and Arnold in 1949, during the age of organic samples from its radiocarbon content. The basis for radiocarbon dating depends on determining the relative density of radioactive isotopes of carbon-14 (14C) and carbon-isotope 12 (12C). The 14C isotope is unstable and shrinks to produce nitrogen -14 by releasing beta particles. The period taken for half of the 14C shrinks in a sample is 5730 years (also known as half-life). But this isotope is produced sustainably by the circulation of nitrogen in the earth's atmosphere with cosmic emission from space. Until now, the ratio of 14C to 12C is constant at 1.30 x 10-12.

In this theory, all living plants absorb carbon dioxide from the air to form organic matter through photosynthesis. Radiocarbon levels which exist are estimated to be the same as in the atmosphere. When organism dies, 14C is no longer replaced. Therefore, the ratio of 14C to 12C in dead organisms will decrease due to the shrinkage of 14C. Measurement of 14C levels allows us to determine the age of death of these organisms. Measurement of 14C levels is now controlled by Jisim Spectrometry. Early research usually used beta rays to measure 14C levels.

Taking erong burial samples for radiocarbon dating is used to find out the initial date and development of erong burial culture in the Tana Toraja area. There are several criteria that are used as the basis for taking samples, namely: (1) information about the local community about the erong grave which is found on a site that is older. (2) Erong graves are generally located on sites that are still safe from human disturbances and naturally. (3) Erong graves that are not exposed to sunlight and rain, and (4) All samples were taken from erong graves which physically showed old age and had weathered.

Figure 1. Erong Boat-shaped with various decorative motifs at Ke’te ’Kesu’.

The sampling process sometimes faces a number of problems, such as the finding of a grave erroneous on one site are very much that makes difficult to choose samples, limited sampling at each site, obstruction by the local community due to their belief in not disturbing what is in the grave including erong graves that are still intact and should not be sampled, because they are considered to be damaged by the local community, a very extensive research location, and financing for very expensive radiocarbon dating. The sample from the erong grave was sent to the Beta Analytic Inc. Laboratory, 4985 S.W. 74 Court Miami, Florida, USA.
One of Toraja cultural heritages that can be investigated to answer the above question is the remains of a wooden grave container called *erong*. Since 2010, some in-depth researches have done by Duli\textsuperscript{[21-26]} to explain the chronological and ideological aspects of the *erong* grave culture in Toraja ethnic region. In terms of its chronological aspects, a radiocarbon C14 analysis of several *erong* samples was obtained from several *erong* burial sites in Tana Toraja area, in order to determine the age of the *erong* sample. The aim of the study was to explain the beginning of the development and process of *erong* culture change in the cultural practice by Toraja ethnic in that area.

### 3. Results of Radiocarbon Analysis of *Erong* Grave Samples in Tana Toraja

The *Erong* grave samples analysed are generally taken from sites that have historically been the center of development of Toraja culture since ancient times, such as sites found in Sesean, Rantepao, Sanggalang’, Sangngalla’, and Mengkendek. The results of the field research conducted in the Tana Toraja region can be described in the table as follows:

| No | Makmal No | Sampel No | Sites                | Dating          | Form                        |
|----|-----------|-----------|----------------------|-----------------|-----------------------------|
| 1  | Beta-274723 | TOR 01    | Marante Tondon       | 112.87±0.54 pMC | The high boat- covered     |
|    |           |           |                      | 800±50BP        | The low boat- covered       |
| 2  | Beta-274726 | TOR 05    | Ke’te’ Kesu’        | 400±50BP        | The high boat- covered     |
| 3  | Beta-287186 | TOR 17    | Marimbunna Tikala   | 390±50BP        | The high boat- covered     |
|    |           |           |                      | 1130±50BP       | Simple buffalo              |
| 4  | Beta-294689 | TOR 25    | Pangi Mengke’pek    | 350±60BP        | The unintact boat           |

The results of radiocarbon dating show the chronology of the *erong* burial culture in the Tana Toraja area between 1130 ± 50BP until the 1960s or Cal CE 780 AD until 50 years ago. Although the sample for *erong* grave dating in the study area is still far from the comparison of the number of *erong* grave populations at each site, the existing dating samples can provide an initial picture of the early period and development of the *erong* burial culture in the Tana Toraja area.

Thus, based on the results of the date, there is a tendency for the early development of the *erong* grave in the northern part of Tana Toraja in the period around the year 780M, then being developed to the South.
From the results of the date, it can be seen that technological developments and erong tomb typologies that developed in Tana Toraja, namely between the years 780 AD and 1200 AD developed an erong grave shape of a simple boat with a low cover shape, a simple buffalo head shape without legs and a simple carvings like geometric lines. The second development around 1200 AD to 1600 AD developed a type of erong tomb boat with high horizontal cover and slightly curved upward, a form of
buffalo without legs, round shape with simple decorations such as geometric stripes, snakes, straddle human and masks. The third development is around the end of 1600 AD to 1900 AD, developed grave *erong* type of boat with a high cover, at both ends curved and towering resembling the *tongkonan* roof, growing *erong* type of perfect and legged buffalo, and rich with various motifs of carving ornaments [21,22,26].

Figure 5. *Erong* graves are placed at the bottom of the niche.

4. The Origin of the Culture of the *Erong* Grave Toraja
The culture of burial using wood as a container for graves and placed in caves or rock cliffs has similarities in South China, Thailand, Vietnam, the Philippines, Borneo, Kalimantan, Sulawesi, and Irian. The equation is clear in terms of form, layout in caves, niches, rock cliffs, and natural environments that are almost the same as located in the hinterland and high photography (mountains) and contain symbolic meanings of beliefs in ancestors and social status symbols.

Figure 6a. Wood graves on the Yangtze River, Hubei.( source: http://www.hiyangtze.com).

Figure 6b. Wood graves on and Wuyi, Fujian. (source: http://www.thesupernaturalworld.com)

The culture of burial of wooden containers in South China is between 3000 BP and 400 BP, in Thailand [34],[35],[36],[37],[38],[39], in Vietnam between 2100 BP to 1200 BP [40], in the Philippines between 2000 BP to 500 BP [41], in the Borneo region (Sarawak, Sabah) between 1170 BP to 840 BP [42],[43],[44] and the area of Tana Toraja, Sulawesi (Indonesia) between 1130 BP to 50 BP [21 – 26]. If this date is used as a basis for structuring the spread of culture in the past, then of course we will not hesitate to conclude that the wood grave culture in the Southeast Asian region originates from the South China region, then spread to Thailand, Vietnam and the Philippines at almost the same time. From the area of the Philippines then spread to Borneo, Sulawesi, and Irian in almost the same period. Of course the
deployment pathway needs to be studied in more depth by examining the physical equations of human support and other cultural elements.

Figure 7a. A buffalo Erong grave in Toraja.  

Figure 7b. A belted wooden tomb decorated with a Kinabatangan buffalo head in Sabah.

5. Conclusion

The radiocarbon dating analysis method is very important in determining the age or developmental period of a culture in the past. Therefore, archeology in determining the age of artifacts (cultural heritage of the past) is in dire need of the help of radiocarbon analysis of artifacts or organics that are present in these cultural layers. The culture of erong grave in Tana Toraja which is made of wood (organic) is very appropriate to be analyzed using the radiocarbon method.

The results of the analysis of several erong grave samples in Tana Toraja, can be known the development period, which is around 780 AD until the 1960s. Likewise, based on the results of the date, it can be seen technological developments and cultural typologies of erong graves in Toraja, and can be compared with the same culture about the developmental period and the possibilities of the culture or human migration in Southeast Asia and South China.

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