

Underwater Archaeological Remains in Matano Lake, South of Sulawesi, Indonesia: Evidence of Iron Age Civilization

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ABSTRACT

Matano Lake is a natural freshwater lake located in South Sulawesi, Indonesia that has a depth of roughly 590 m, making this lake the deepest lake in Southeast Asia. The existence of cultural heritage in land surrounding Matano Lake was revealed in 1998, based on research conducted by OXIS projects, which found a quantity of artifacts dated approximately between the 6th and 16th. From 2016 to 2022 The National Research Centre of Archaeology Indonesia (now the Badan Riset dan Inovasi Nasional) conducted research in underwater and terrestrial observation relating to submerged landscapes in the Matano Lake environment. This research reveals the civilization of the iron age that has been developed since during much of the second millennium CE regarding mass iron production and iron smelting in Matano Lake. The agency utilized several approaches such as geography and geology as well as the method to collect primary archaeological data in terrestrial excavation and geology survey and also underwater observation using SCUBA (Self Contained Underwater Breathing Apparatus) to directly identify archaeological remains on the bottom of the lake.

Based on the survey, literature study, and spatial analysis utilizing ArcGIS, there are five sites consisting of Sebengkuro, Pulau Ampat, Pontada, Sukoiyo, and Onetengka with various of human cultural remains such as iron tools, iron slag, pottery, tuyere, wooden poles, ore, charcoal, and fragments of an animal tooth which were laying on the bottom of the lake in 4 to 20 m. The result of the archaeological remains and geological analysis reveals that each site has a different type, contour, and period. Furthermore, based on a literature study, the existence of mass iron production was mentioned in Nagarakrtagama (a Javanese poem in the 14th century) proving iron production in Matano has been exported from Sulawesi Island to Java Island.

Keywords: Matano Lake, Underwater Archaeology, Submerged Landscapes, Iron age, Indonesia

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INTRODUCTION

The topic of this abstract fits best within this Session 18 (The Archaeology of Submerged Landscapes and Inland Waters) because of the current existence of underwater archaeological sites in Matano Lake that sank due to natural disasters. Underwater archaeological research on the lake has not been conducted in Indonesia before. Matano Lake is located in Malili Region, South Sulawesi Province, Indonesia and has a depth of approximately 590 m and 382 m above sea level with an area of 16,408 ha. This became Matano Lake, the eighth deepest lake in the world and the deepest lake in South East Asia (Herder 2006). Based on a geology survey and map, Matano Lake is considered to be 1-4 million years old and lies on the Matano Fault Zone which is still active with tectonic movement of roughly 2 cm per year (Tamuntuan et al. 2010).

Previous archaeological research in Matano Lake was conducted in 1998 by the OXIS project which involved Indonesian and foreign researchers. The research revealed that mass iron production and iron smelting was developed on the northern shore during much of the second millennium CE and the western shore of the lake dating from 1500 to 1900 (Bulbeck and Caldwell 2000). From that, the National Research Center for Archaeology (Now Badan Riset dan Inovasi Nasional) carried out research on the lake in terrestrial and underwater to collect various archaeological data. Beginning in 2016 to 2021, the research demonstrated that there are five underwater archaeological sites with cultural remains. This research attempted to elaborate on the causes of the sunken sites and the age of iron tools discovered underwater.

CASE STUDIES

The research project explores five underwater archaeological sites which are distributed in Matano Lake namely Sebengkuro, Pulau Ampat, Pontada, Sukoiyo, and Onetengka (Figure 1). Each site has different characteristics and forms of archaeological data which is still in situ within the context. Sebengkuro, Pulau Ampat, and Pontada are located on the southern shore of the lake. However, all these sites have a variety of types and shapes. For instance, in Sebengkuro, underwater archaeologists found cultural material at a depth of about 5 to 7 meters consisting of pottery fragments, clamshells, and a stone beater fragment. In Pulau Ampat and Pontada, the archaeological remains are more complex in a depth of 4 to 8 meters including fragments of pottery, accumulated iron slag, dispersed charcoal, tuyeres from a smelting furnace, iron tools, wooden poles, animal teeth, and bone, as well as stone flakes (Triwurjani et al. 2018-2021).

Sites on the north shore of the lake including, Sukoiyo and Onetengka did not reveal as much cultural material as the southern shore sites. However, in these sites, there is evidence of tectonic activity in the past; geologists called the evidence graben (Subsidence areas) (Triwurjani et al. 2019). It is proven that the location of Matano Lake in the main Matano Fault which is still active today makes the environment around the lake become more dynamic.

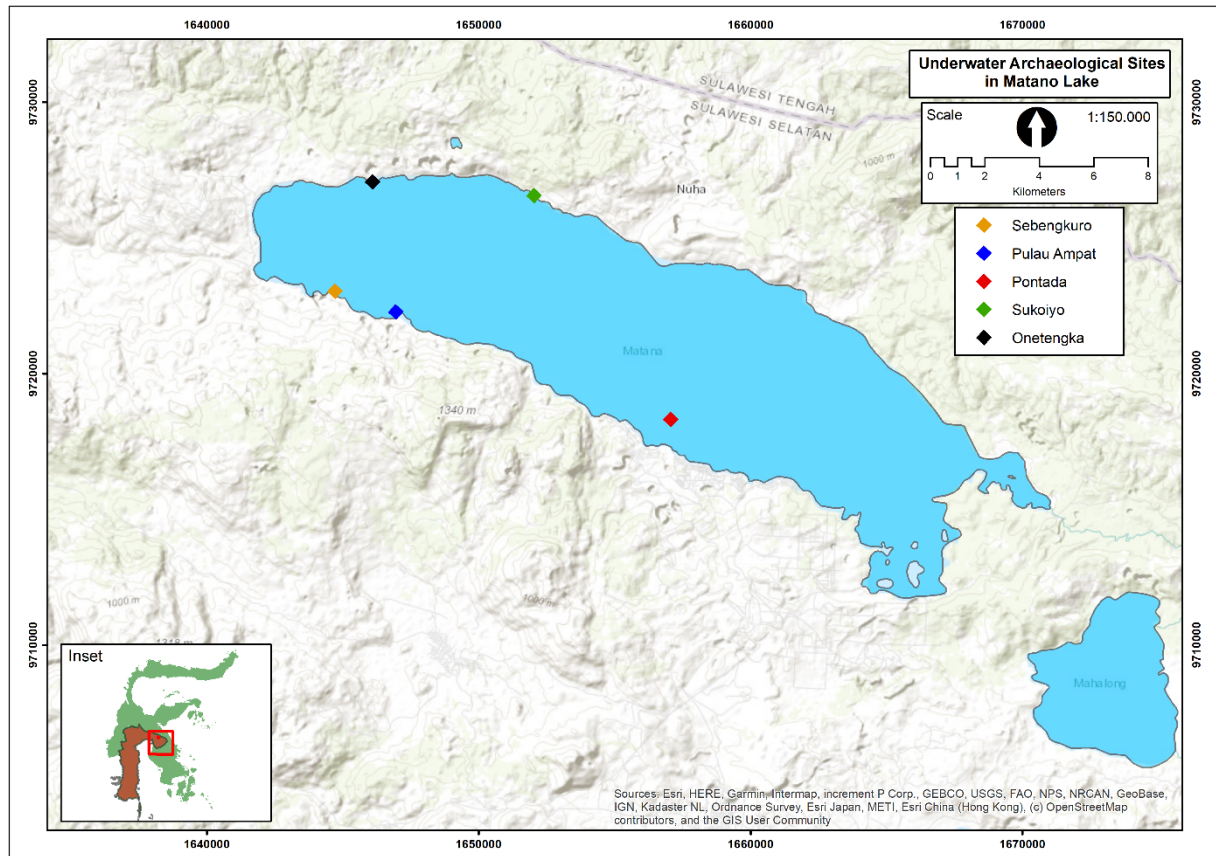


Figure 1. Maps of the distribution of underwater archaeological site in Matano Lake (Muslim Dimas KD).

RESOURCES

This research has been carried out from 2016 to 2022. During the research project, team members conducted surveys and excavations in terrestrial and underwater for collecting the archaeological data. After collecting, the team also did database recording and documentation of the samples for further analysis. The archaeological data consist of fragments of pottery, iron tools, animal teeth and bone, charcoal, flakes of stone, tuyeres, and a stone beater fragment which are kept in storage at Pusat Penelitian Arkeologi Nasional (now Badan Riset dan Inovasi Nasional).

Moreover, for spatial analysis, the team utilized ArcGIS to show the distribution of underwater archaeology sites and the existence of the site in a geology map. In addition, we also studied literature related to mass iron production in Matano in the ancient text of *Negarakertagama*, a Javanese poem in the 14th century. Within the text it was written that the Majapahit Empire had imported the iron tools from the Matano Lake region (Mulyana 2006; Robson 1995).

FRAMEWORK

This project exerts underwater archaeology and submerged landscape studies to understand the cause of the sinking of the archaeological site in Matano Lake. Furthermore, this research uses inductive reasoning which in archaeology means taking material culture as the primary evidence (Tanudirjo 1995). Explorative and comparative-descriptive approaches were conducted focusing on primary archaeological data with the context of the remains in terrestrial and underwater environments. The observation was conducted by diving, using SCUBA (Self Contained Underwater Breathing

Apparatus) equipment for underwater objects and an underwater camera for documenting archaeological objects and landscapes. The team also recorded and measured using underwater archaeological techniques such as the baseline and quadrant methods (Bowens 2009). Moreover, database recording was also done to achieve complete archaeological data collection of the findings at Matano Lake. The team also employed ArcGIS for spatial analysis, to demonstrate the distribution of archaeological remains and sites in Matano Lake and three dimensional photogrammetry recording and analysis on objects and sites located at the bottom of the lake.

RESULTS

Description of each site

- *Sebengkuro*

This site is located on the southern shore of the lake. The underwater team conducted surveys in 2019 and 2022 for collecting archaeological remains and observation of the environment on the bottom of the lake with a depth of approximately five to eight meters. From the survey, the team succeeded in finding several kinds of remains such as pottery fragments, clamshells, iron slag, and a stone beater fragment (Figure 2). In addition, regarding the environment, the contour is quite declivous with sand material covered by grass on the bottom of the lake.

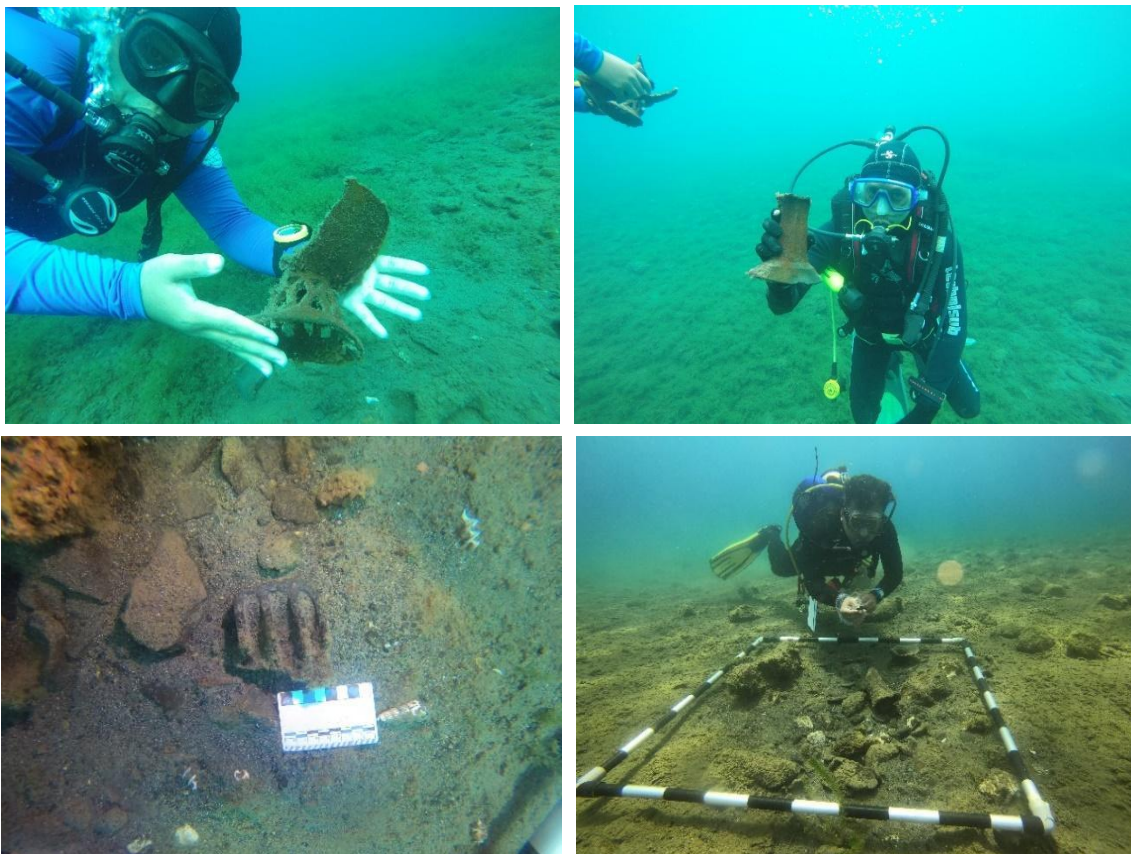


Figure 2. The divers take archaeological remains for analysis sample (Triwurjani et al. 2019 and 2022).

- *Pulau Ampat*

Pulau Ampat is 2 kilometers to the east of the Sebengkuro site. This site has an area of about 4,6 ha with plenty of archaeological remains on the bottom. Based on observation by the team, the remains consist of fragments of pottery, accumulated iron slag, dispersed charcoal, tuyeres from a smelting furnace, iron tools, animal teeth and bone, and flakes of stone lying in a depth roughly 3 to 10 meters (Figure 3). Thus, the underwater team made a 10 by 10-m baseline and quadrant crossing the concentration of finds and recorded it by taking 3D photogrammetry for analysis (Adhityatama et al. 2022). In this site, it was interesting to observe the stone flakes that are spread on the bottom in context within iron slag and metal artifacts. Based on research analysis, the stone flakes were used by the Matano indigenous iron smelters for strike-a-lights and in particular for the combustion of fuel for iron smelting (Suryatman et al. 2021). Regarding the environment, the material is sand with rock boulders on steep slopes. In order to know the age of the site, the sample of charcoal was sent to the Bandung PSG laboratory for processing by the C14 calendar. The calibrated results show that samples date from between mid-7th and mid-8th centuries (Adhityatama et al. 2022)



Figure 3. Variations of cultural remains in Pulau Ampat site (Triwurjani et al 2018).

- *Pontada*

Located about 12 kilometres to the east of the Pulau Ampat site, the 14th century Pontada site has evidence of people and iron production (Adhityatama et al. 2023). Compared to the two sites before, Pontada Site is a more complex related form of material culture in a depth of about 2 to 8 meters with material sand covered by grass. Due to the density of archaeological remains, the underwater team made a grid baseline for recording and taking samples. Based on the observation, the remains were still intact within the context; for instance, a machete was found with fragments of pottery, charcoal, and tuyere. Additionally, there are wooden poles which had not been discovered on the previous investigations (Figure 4).

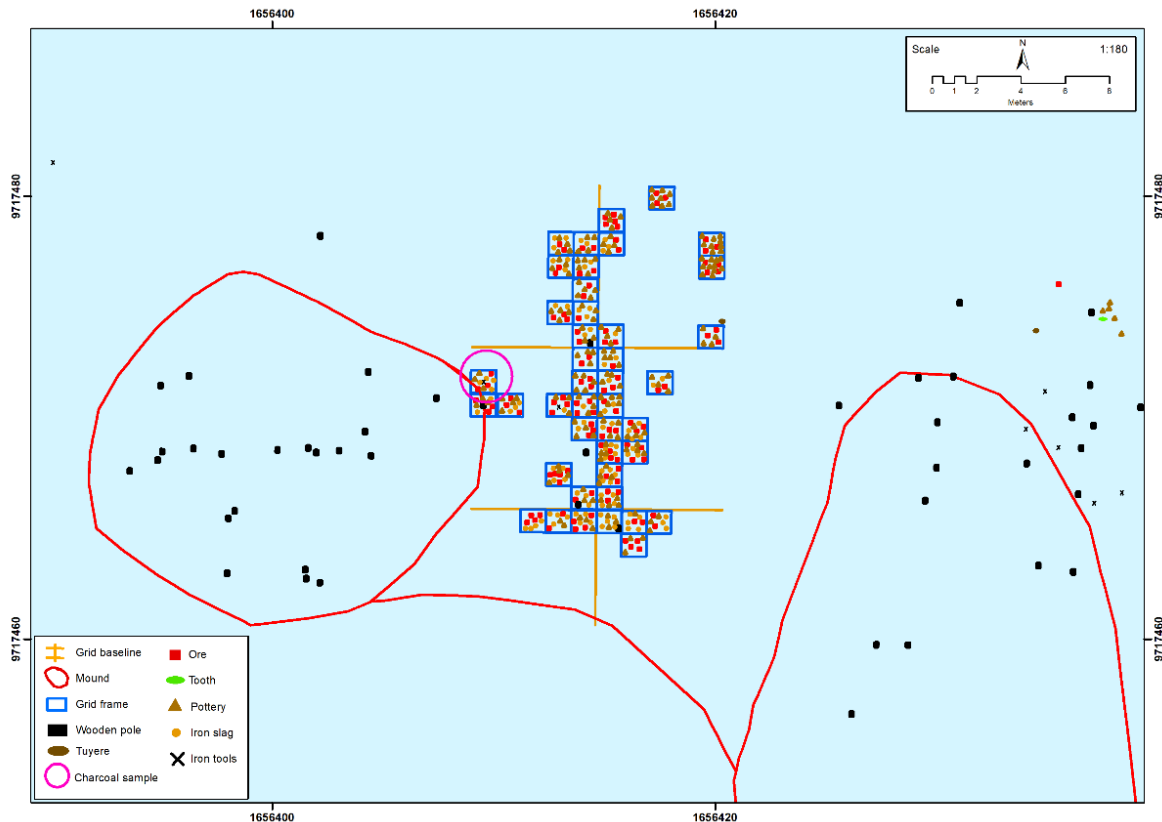


Figure 4. Maps of grid baseline and spread of wooden poles in Pontada Site (Adhityatama et al 2023).

- *Sukoiyo*

This site is located on the northern shore of the lake. Regarding archaeological data, this site is not as abundant as the sites on the southern shore of the lake. Based on the survey, the team found several pottery fragments exposed on the slopes of the rocks in depths of 15 to 20 meters.

- *Onetengka*

During this research project, this site was visited twice for documenting and taking samples for geology analysis. It is located five kilometres to the west of the Sukoiyo Site. Based on observation, there is no cultural material on this site. However, at a depth roughly from 20 to 30 meters there is evidence of tectonic activity which geologists called graben (Subsidence areas).

Geological interpretation

According to geologists' interpretations, Matano Lake was formed due to the pull-apart mechanism, where two opposite segments move apart. Thus, the mechanism will affect the middle to form a basin or graben. Then this graben will fill with water and form a lake (Triwujani et al. 2018). Lake Matano is estimated to be one to four million years old and is a crypto depression lake, that is, a lake whose bottom is deeper than the seabed nearby (Tamuntuan et al. 2010). Concerning underwater archaeological sites, the availability of sites that sank on the shore of the lake is due to the location being in the Matano fault zone (Tamuntuan et al. 2010). The fault which is active with tectonic movement and is prone to major earthquakes in the past and present.

CONCLUSION

The archaeological research project in Matano Lake is significantly important to identify the chronology and development of the iron age civilization in Indonesia. By showing the cultural material as evidence of mass iron production activity and the result of the radiocarbon dating, people in Matano Lake had been conducting iron smelting since the early first millennium. In Addition, the chronology of the Matano Lake formation has a long dynamic process that lies on the Matano Fault Zone. Therefore, the underwater archaeological sites that are located on the shore of the lake were prone to destruction and sinking which is caused by tectonic movement and earthquakes.

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