CINEST

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November 30 - December 1, 2023

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Kyushu University, Fukuoka, Japan

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International Symposium on Earth Science and Technology 2023

Greetings from Cooperative International Network for Earth Science and Technology (CINEST)

We are facing with global environmental problems with problems on resources depletion at behind. In particular, the rapid increases in mineral resources and energy consumptions have cast a shadow over the sustainability of human activities. The CINEST was founded in 2008 to enhance cooperative studies and activities by young researchers and engineers, because their boldly tackles must be keys and absolute foundation to solve problems found on the earth, especially in Asia and Africa. I would like to emphasize to young researchers that performing research “by hand” rather than “by manual” may develop their potential to find new solutions.

This international symposium started from 2008 cooperating with The JSPS International Training Program during 2008 to 2012, supported by Mitsui-Matsushima Co., Ltd. from 2013 to 2020, and supported by Leading an Enhanced Notable Geothermal Optimization (LENGO) Project of Science and Technology Research Partnership for Sustainable Development (SATREPS) from 2021. The important objective of the symposium is strong networking of young researchers to enhance international collaboration to solve both of global and domestic problems on mineral resource and environment.

Finally, I would like to sincerely thank all of the organizations and participants, and believe the symposium will provide fruitful successes for all.

Welcome to “International Symposium on Earth Science and Engineering 2023.”

Y. Fujimitsu

Yasuhiro Fujimitsu
CINEST Chair

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Nov. 30, 2023

9:00~ 9:05	Opening Session
9:05~ 9:40	Plenary Lecture I: Education Programs and Research Activities in the Graduate School of International Resource Sciences, Akita University Hikari Fujii (Akita University, Japan)
9:40~ 10:15	Plenary Lecture II: Sustainable Processing of Precious and Critical Minerals Richmond K. Asamoah (University of South Australia, Australia)
10:15~ 10:40	Coffee Break
10:40~ 12:00	Technical Sessions
12:00~ 13:00	Lunch
13:00~ 14:40	Technical Sessions
14:40~ 15:00	Coffee Break
15:00~ 16:20	Technical Sessions
16:20~ 17:40	Poster Session
18:00~ 19:30	Banquet

Dec. 1, 2023

9:00~ 10:00	Technical Sessions
10:00~ 10:20	Coffee Break
10:20~ 11:50	Technical Sessions
11:50~ 13:00	Lunch
13:00~ 14:30	Technical Sessions
14:30~ 14:50	Coffee Break
14:50~ 16:20	Technical Sessions
16:30~ 17:00	Awards Ceremony* & Closing Session

* Best Papers, Best Presentations and Best Posters will be announced at the Awards Ceremony.

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Plenary Lecture I:
Education Programs and Research Activities in the Graduate School of International Resource Sciences, Akita University

Hikari Fujii

Graduate School of International Resource Sciences, Akita University, 1-1 Tegatagakuen-machi, Akita, 010-8502, Japan

Prof. Hikari Fujii is the vice president and the dean of Graduate School of International Resource Sciences, Akita University, Japan with over twenty-three years' research and education experiences in energy resource engineering. He also has a working experience as a field engineer in off-shore oil fields in Saudi Arabia for over six years. Fujii holds bachelor and doctoral degrees from University of Tokyo and MSc from Stanford University all in Petroleum Engineering. His current research interests are in petroleum engineering and shallow and deep geothermal development.

Plenary Lecture II:
Sustainable Processing of Precious and Critical Minerals

Richmond K. Asamoah

University of South Australia, UniSA STEM, Future Industries Institute, Mawson Lakes, Adelaide, SA 5095, Australia

Dr Richmond K. Asamoah is a Postdoctoral Research Fellow at the Future Industries Institute (University of South Australia) with over twelve years in-depth knowledge of and hands-on experience in mineral processing and extractive metallurgy in tandem with surface, interfacial and data science. Richmond holds BSc (Hons) Minerals Engineering and PhD Engineering (Minerals and Resources), obtained from the University of Mines and Technology and University of South Australia, respectively. His research interests are in physical separation and beneficiation of complex mineral ores (low grades and wastes), hydrometallurgy (including bio-), and machine learning and data analytics, having links with environmental sustainability.

Geology and Coal Reserves Calculation with the Cross Section and Block Method in Pit Z of Mangkalapi Area, Kusan Hulu District, Tanah Bumbu Regency, South Kalimantan Province

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Universitas Pembangunan Nasional "Veteran" Yogyakarta, Indonesia
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ABSTRACT

The research area is located in Mangkalapi, Kusan Hulu District, Tanah Bumbu Regency, South Kalimantan and based on its physiography, this area is included in Asem-Asem Basin. The research area is known to be prospect of coal in which coal-bearing formation in this area is Warukin Formation that consist of claystone, shale carbon, sandstone, and coal itself that aged Early Miocene to Late Miocene. This study focuses on Pit Z which nowadays is being developed and ecomonic to be mined. Therefore, the goal of this research is to know about the geological condition of the area such as its geomorphology, stratigraphy, geological structure, and also coal reserves that is economic to be mined. The used method in this research is descriptive and analytical method that integrate between field data and laboratory test.

Geomorphology of this area is made up of two origin landform in which denudasional landform consist of undulating landform and peneplain, and antropogenic landform consist of mined pit, disposal area, sump, and coal storage area. The stratigraphy, from the oldest to youngest, are Warukin Claystone Unit that aged Early Miocene to Middle Miocene and Warukin Sandstone Unit that aged Middle Miocene to Late Miocene. Both units shows that their depositional environment is Transitional Lower Delta Plain. Method that used to calculate coal reserves on Pit Z is Cross Section method and Block Method. The result of the calculation from cross section method is 2,695,770.58 mT with stripping ratio 3,72, while calculation result of coal reserves using block method is 2,678,897.74 mT with a stripping ratio of 3.47.

Keywords: Coal, Block, Reserve, Cross Section, Geology

INTRODUCTION

The research area is located in Mangkalapi, Kusan Hulu District, Tanah Bumbu Regency, South Kalimantan [**Figure 1.**]. The coal bearing formation in the research area is the Warukin Formation, which is aged from Early to Late Miocene. There are four seams of coal in the research area, namely seam G1, seam G2, seam H1, and seam H2.

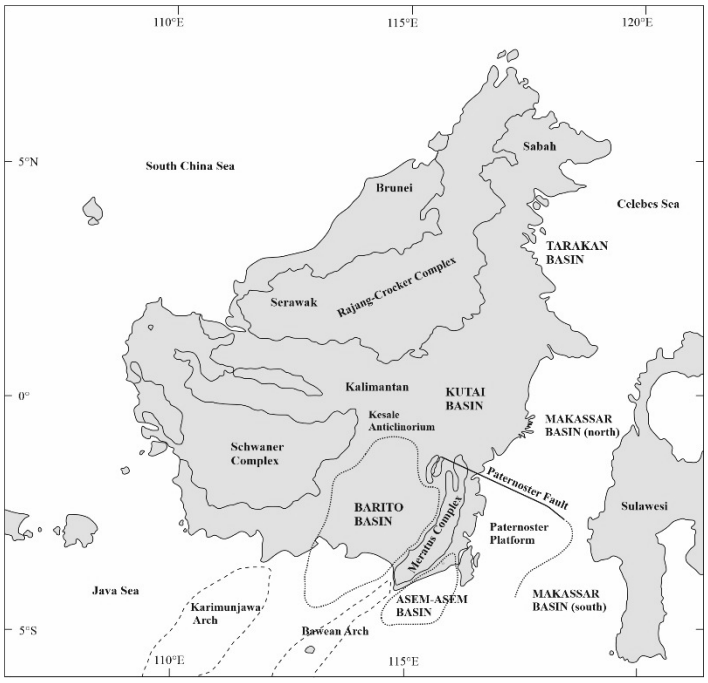

Figure 1. Simplified map of Borneo showing the main geological features in Witts et. al. (2012). The red square shows the study area.

The coal distribution pattern in the research area looks continuous and shows a relative southeast – southwest direction. There are several factors that affect the calculation of reserves, including thickness, coal rank, and depth of coal seam. This study focuses on Pit Z which nowadays is being developed and ecomonic to be mined.

The Asem-Asem Basin has several formations from the oldest to the youngest are basement, Tanjung Formation, Berai Formation, Warukin Formation, and Dahor Formation (Witts et al., 2011). The reasearch area is included in the Warukin Formation which is characterized by claystone, claystone intercalated sandstone, and coal (Witts et al., 2011).

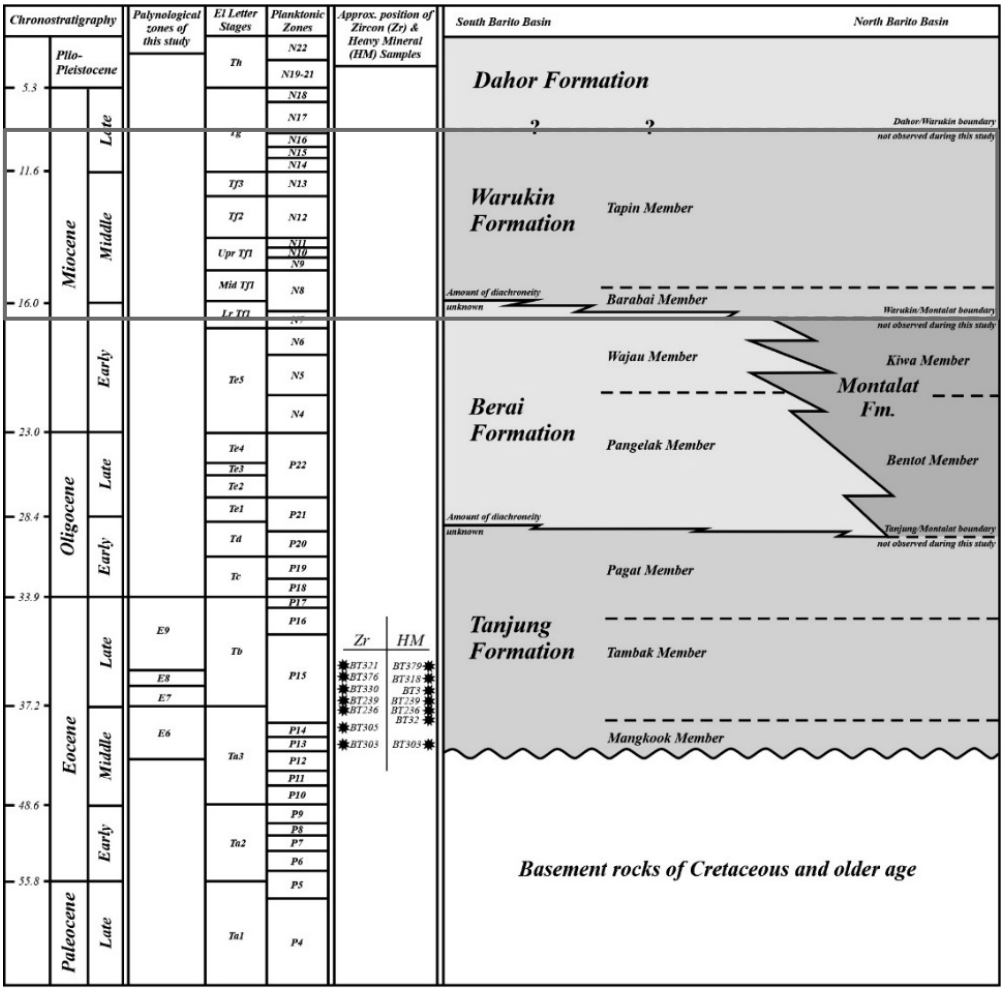

Figure 2. Stratigraphy of the Asem–Asem Basin, modified from Witts et. al. (2011) in Witts et. al. (2012). The red square shows the study area, redrawn by the Author (Dita, 2023).

In the research area is divided into two lithology units [**Figure 3.**], namely the Warukin claystone unit which composed of claystone, claystone intercalated coal, carbonaceous shale, interbedded of claystone with coal, coal, and sandstone. The average dip direction of this unit is relatively to the southwest and the strike direction is to the southeast – northwest. This unit is aged from Early to Middle Miocene. Besides that, the Warukin sandstone unit is characterized by sandstone, sandstone intercalated claystone, and claystone that have the same relative dip and strike direction as the Warukin claystone unit. This unit is aged from Middle to Late Miocene and both were deposited in transitional lower delta plain.

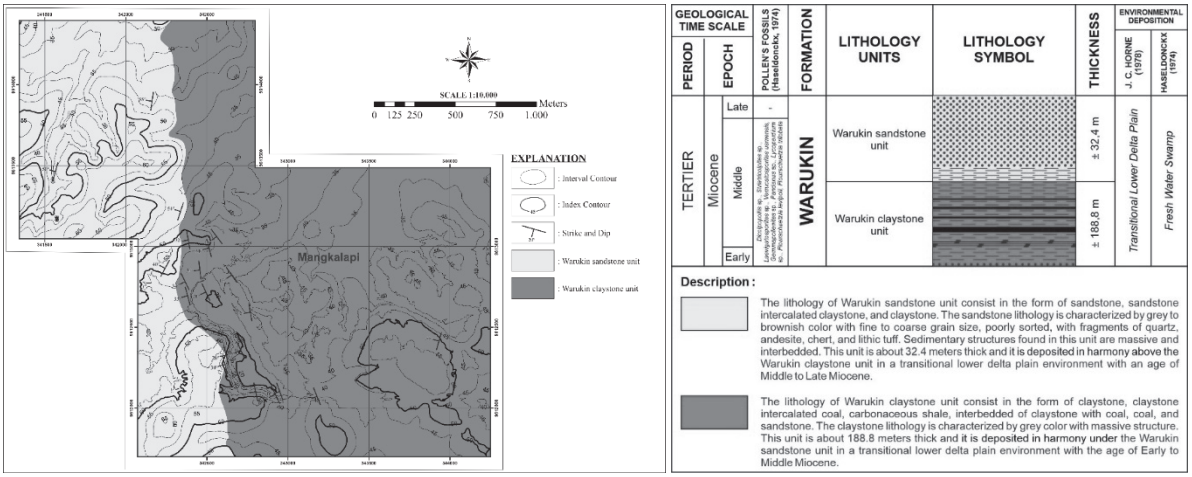

Figure 3. [Left] Geology map of the study area, [Right] Stratigraphy of the study area

METHOD OF RESEARCH

The methods that used in this research are descriptive methods, such as actual observation and measurement methods in the field and analytical methods such as data processing to provide an actual condition in the field by integrating field data and laboratory tests.

The primary data include lithological samples, measurement of the rock layers position and geological structures, also constructing measuring sections or profiles that are supported by secondary data in the form of model data and borehole data. Then, followed by the primary and secondary data analysis such as thin section analysis and paleontological analysis that will be presented by several maps including geological maps and coal reserve calculations.

RESULTS AND DISCUSSION

The geometry of coal seams that are proper to be mined consider by several aspects, such as thickness, slope, position or distribution pattern, and the continuity of the coal seam (Jeremic, 1985 in Hibatullah et al., 2022). Based on facts on the field, a coal seam can be found in an irregular distribution, not continuous, thickened and thinned, and separated with various geometries (Kuncoro, 2000).

Based on the model data, the average thickness of the target seam is obtained, seam G is 7.20 meters, seam G1 is 5.23 meters, seam G2 is 0.64 meters, seam H1 is 1.34 meters, and seam H2 is 0.41 meters. To calculate coal reserves, a boundary is required. Boundary is a limited area where coal reserves will be calculated. The mining boundary is determined based on two main aspects, which is the slope safety factor and pit design that based on the safety factor and the continuity of the coal seam. Both aspects will affect the exploitation or mining activities.

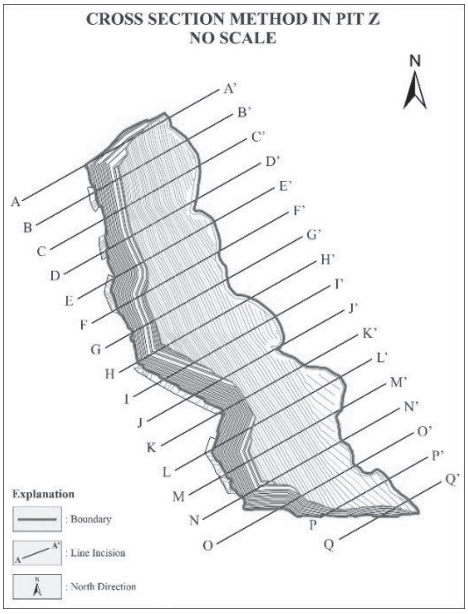

Figure 4. The appearance of incision lines with the cross-section method

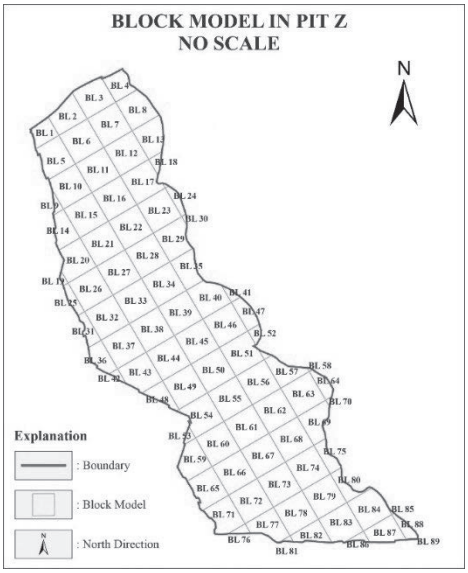

Figure 5. The appearance of block model

Cross Section Method

Volume and Tonnage of Coal Calculation

Based on the calculation of coal reserves from section with a distance of 100 meters, the volume and tonnage in each seam are seam G 124.396 m^3 and 157.982,92 mT, seam G1 1.643.388 m^3 and 2.087.102,76 mT, seam G2 168.460,5 m^3 and 213.944,84 mT, seam H1 162.565,5 m^3 and 206.458,19 mT, and seam H2 23.844 m^3 and 30.281,88 mT with a total of 2.695.770,58 mT.

Overburden (OB) Calculation

Based on the calculation of total overburden from the results that obtained from crop line section with a distance of 100 meters, the total volume obtained in each seam is seam G 757.414 BCM, seam G1 1.103.629,5 BCM, seam G2 6.560.893 BCM, seam H1 696.116 BCM, and seam H2 898.656,5 BCM for a total of 10.016.709 BCM.

Stripping Ratio (SR) Calculation

Based on the calculation of the results that obtained from the section, the total stripping ratio value is 3,72.

Block Method

Volume and Tonnage of Coal Calculation

Based on the calculation of coal reserves using the block method, the volume and tonnage in each seam are seam G 164.871,52 mT, seam G1 2.169.013,3 mT, seam G2 137.248,83 mT, seam H1 182.760,6 mT, and seam H2 25.003,5 mT with a total of 2.678.897,74 mT.

Overburden (OB) Calculation

Based on the results of the total overburden calculation using the block method, the total volume obtained in each seam is seam G 593.511,03 BCM, seam G1 2.831.947,47 BCM, seam G2 4.328.535,1 BCM, seam H1 1.072.925,56 BCM, and seam H2 467.724,07 BCM with a total of 9.294.643,24 BCM.

Stripping Ratio (SR) Calculation

Based on calculations from MineScape 5.7 software, the total stripping ratio value is 3,47.

CONCLUSION

1. The average thickness of each coal seam is seam G 7.20 meters, seam G1 5.23 meters, seam G2 0.64 meters, seam H1 1.34 meters, and seam H2 0.41 meters.
2. The results of the calculation of coal reserves using the cross section method in Pit Z obtained from incisions with an interval distance of 100 meters are seam G 157.982,92 mT, seam G1 2.087.102,76 mT, seam G2 213.944,84 mT, seam H1 206.458,19 mT, and seam H2 30.281,88 mT with a total of 2.695.770,58 mT.
3. The results of coal reserve calculation using the block method obtained seam G 164.871,52 mT, seam G1 2.169.013,3 mT, seam G2 137.248,83 mT, seam H1 182.760,6 mT, and seam H2 25.003,5 mT with a total of 2.678.897,74 mT.
4. The results of the stripping ratio calculation using the cross section method were found to be 3.72, while the block method was found to be 3.47.

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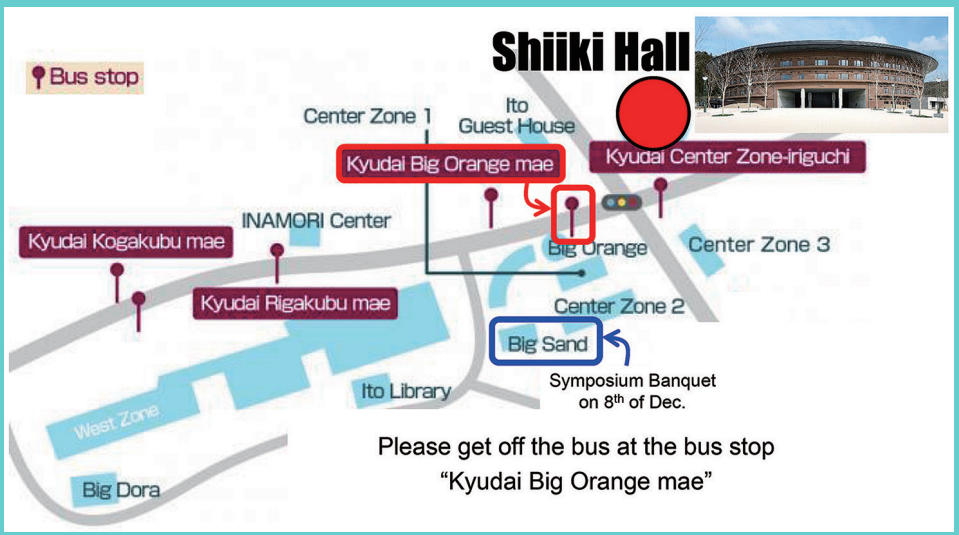

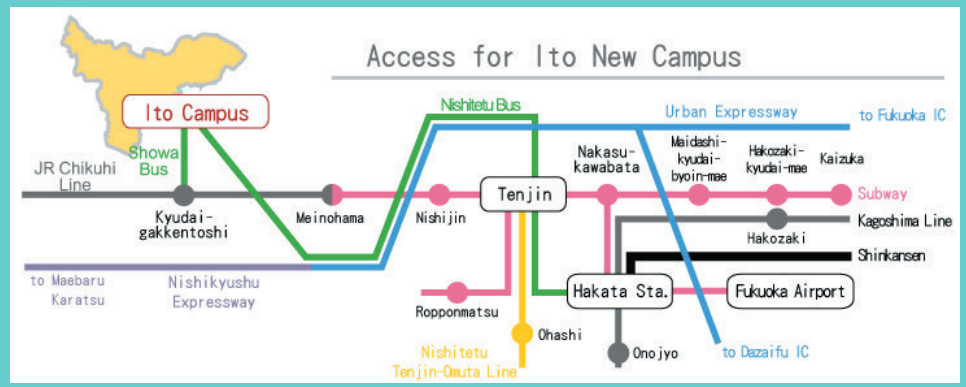

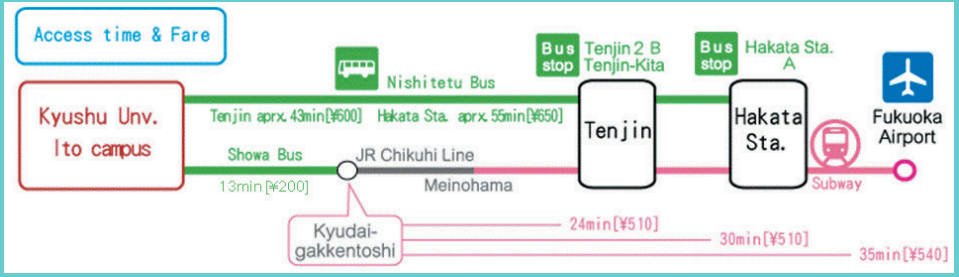

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