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Kyushu University, Fukuoka, Japan

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Cooperative International Network for Earth Science and Technology (CINEST)

Sponsored by

Leading Enhanced Notable Geothermal Optimization (LENGO)
Science and Technology Research Partnership for Sustainable Development (SATREPS)
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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 Estimation of Coal Resources Using the Cross Section Method in the Muaraenim Formation, Site Bangko PIT-E, Lawang Kidul, Muara Enim, South Sumatera, Indonesia

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ABSTRACT

Administratively the study area is located in Tegalrejo Village, Lawang Kidul District, Muara Enim Regency, South Sumatra Province, with coordinates X1: 374251 Stratigraphically the study area is in the South Sumatra Basin, the Muara Enim Formation which has a lithology dominated by claystone, and scattered several lithologies such as glauconite sandstones with a flarer structure, siltstone and coal. It is interpreted that this area is experiencing a process of sedimentation in the lower delta plain environment (Allen & Chambers, 1998). This study aims to determine the geological conditions in detail in the study area in the form of drainage patterns, geomorphology, stratigraphy, geological structure, and depositional environment as well as knowing the estimated coal resources. This research method is conducting field observations to obtain geological data on the surface as well as secondary data processing in the form of actual contours and contours of the coal structure. The geomorphology of the study area consists of undulating hilly, mine openings, and water sump. The stratigraphy of the study area was composed by the Muaraenim Claystone Formation which was deposited during the Late Miocene (Ginger & Fielding, 2005). In the research area there are geological structures, namely the Left Slip Fault Normal Fault (Rickard, 1972) and Left Thrust Slip Fault (Rickard, 1972). Estimation of coal resources using the cross section method yielded 4,213,118 tonnes of D seam and 6,476,089 tonnes of E1 seam coal, for a total of 10,689,207.17 tonnes. Overburden calculation results obtained a result of 184,106,371.5 m3.

Keywords: Coal, Cross Section, Muaraenim, Resource

INTRODUCTION

The research location, which is located in Tegal rejo, Lawang kidul, Muara Enim, South Sumatera. below which are coal deposits including the Muaraenim Formation of Late Miocene age in the South Sumatra Basin (Gafoer et al. ., 1994). The Muaraenim Formation is composed of mudstone, siltstone, glauconite sandstone and coal (Ginger & Fielding, 2005) and is located in a shallow marine to land depositional environment (Bishop, 2011). The research area has two coal seams as target seams, namely seam "D" and seam "E1". In the northeastern part of the study area there are areas that have not been exploited, so it is necessary to calculate coal resource estimates. Coal resource estimation has an important role in determining the sustainability of mining activities.

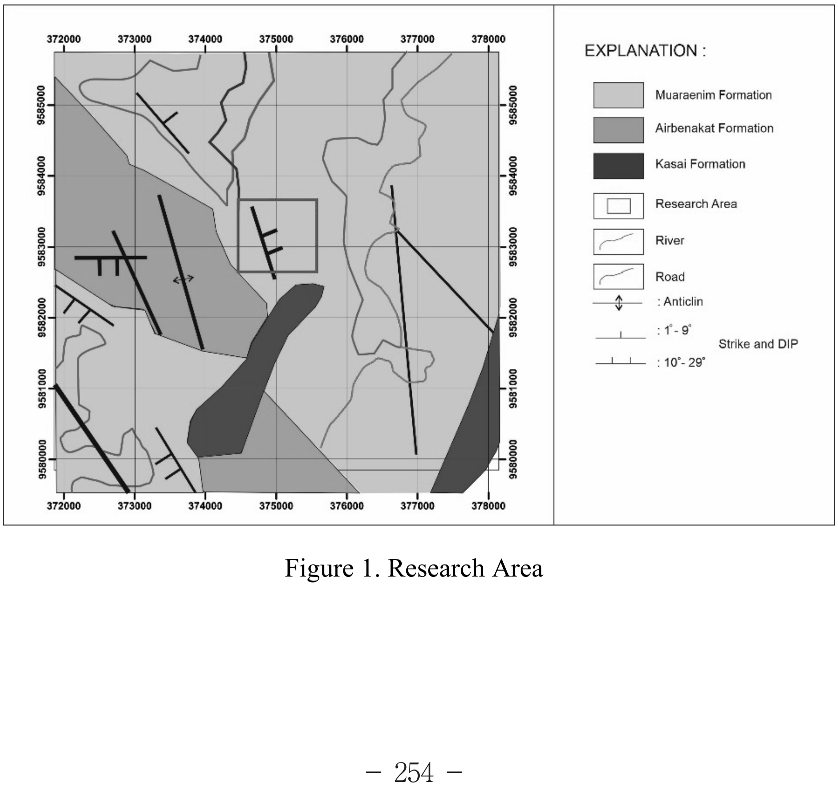

Figure 1. Research Area

METHOD OF RESEARCH

The research method uses primary and secondary data collection. The primary data obtained is lithology data, geological structure, microfossils, and observations of coal outcrops. The secondary data obtained is the actual contour and stratmodel of two coal layers. The primary data that has been obtained is subjected to petrographic analysis to determine rock names, stereographic analysis to determine geological structure, and micropaleontological analysis to determine fossils, age and depth. From the data obtained, both primary and secondary, a coal resource estimation analysis was carried out using the cross section method in the Minescape and AutoCad applications by making representative coal cross-sections, so that the calculation would calculate the area of each cross-section.

The final stage is the stage of presenting the resulting data, namely trajectory maps, geological maps, geomorphological maps, coal distribution maps, coal cross-sectional models, and the results of coal resource calculations.

RESULTS AND DISCUSSION

Geology of the Research Area

Based on the lithology developed in the research area, there is a dominant Muaraenim mudstone unit (Figure 2) showing variations in lithology, namely mudstone, siltstone, glauconite sandstone, and coal. Determination of the unit is based on the sand shale ratio in the unit in the results of measuring sections carried out in the field. From the results of the thickness comparison between sandstone and mudstone, it was found that the thickness ratio of mudstone was greater than that of sandstone.

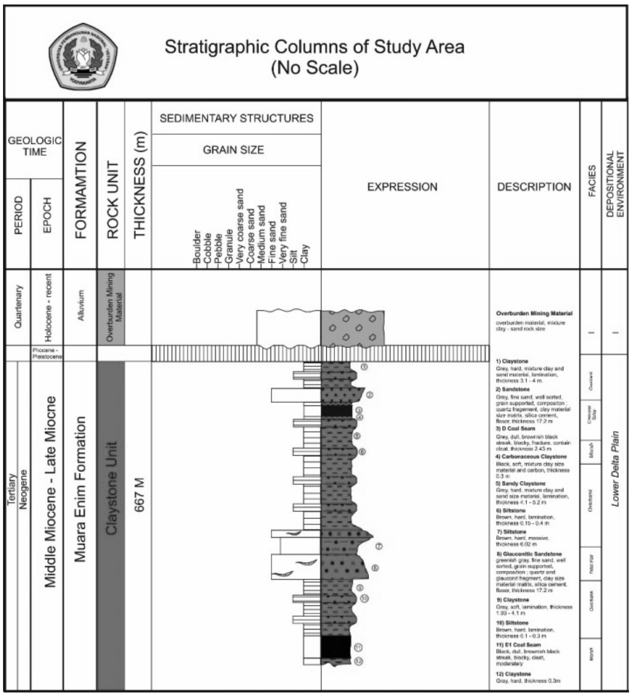

Figure 2. Geological map of muaraenim claystone formation

Coal Geology

In determining coal resources, the continuity or coal cropline of each layer must first be known. Where coal resource calculations can be done using several methods, one of which is the cross section method. This method is suitable for use in calculating coal resources in this research area because it has the same average thickness in each layer and has the same average coal seam dip.The cross section method has the advantage of being able to calculate resources in a predetermined area by making representative cross-sections. The following are the steps in calculating coal resources using the cross section method. the cropline will help in limiting the calculation of coal resources that will be calculated. Determining

1. Determine the area that will be calculated for coal resources.
2. Make a parallel incision in the area specified in the Minescape application.
3. In this research, the subsurface data used is the calculated structural contour of the coal seam.
4. From the incision made, a cross-sectional model of the coal below the surface will be formed.
5. The cross-sectional model in the Minescape

6. application is exported in DWG form to be transferred to the AutoCAD application.
7. In the AutoCAD application, create the area of each cross-sectional model to determine the area.
8. After obtaining the area area for each coal deposition model, proceed with manual calculations using the formula:

   Volume (m^3) : $\frac{A+B}{2}$ X distance between sections

   Tonnage : Volume (m^3) X Density of coal

   Explanation : A and B Section Area of each coal (m^2)
9. The overburden volume calculation is also done in the same.

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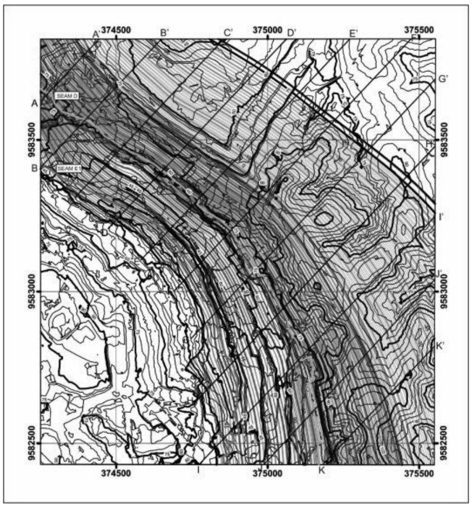

Figure 3. Subsurface data of coal and section

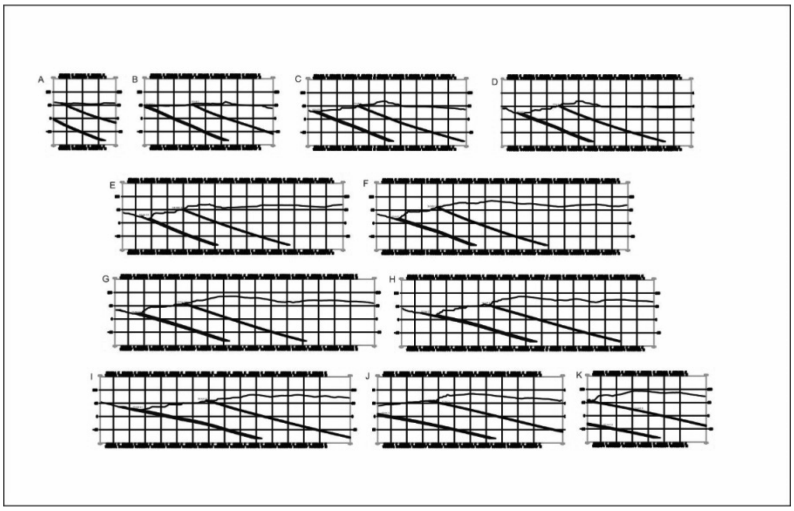

Figure 4. Section of coal subsurface

From the data that has been processed in the Minescape and AutoCAD applications, the values for the area of each cross-section, coal volume and coal tonnage are obtained. So the results of calculating resources and overburden volume using the cross section method are as follows:

Table 1. Calculation of coal resource

Section	Distance	Area		Volume		Tonnage (Tons)	
		Seam D	Seam E1	Seam D	Seam E1	Seam D	Seam E1
A-A'	150.00	888.54	1,487.80	0.00	0.00	0.00	0.00
B-B'	150.00	1,466.82	2,902.71	176,652.00	329,288.40	229,647.60	428,074.92
C-C'	150.00	1,960.91	2,995.22	257,079.75	442,344.90	334,203.68	575,048.37
D-D'	150.00	1,860.80	2,803.29	286,628.25	434,888.25	372,616.73	565,354.73
E-E'	150.00	1,882.86	2,637.28	280,774.50	408,042.75	365,006.85	530,455.58
F-F'	150.00	2,230.65	3,051.63	308,513.25	426,668.25	401,067.23	554,668.73
G-G'	150.00	2,596.26	3,686.07	362,018.25	505,327.50	470,623.73	656,925.75
H-H'	150.00	2,766.55	4,321.66	402,210.75	600,579.75	522,873.98	780,753.68
I-I'	150.00	2,834.52	5,107.99	420,080.25	707,223.75	546,104.33	919,390.88
J-J'	150.00	2,488.41	3,910.37	399,219.75	676,377.00	518,985.68	879,290.10
K-K'	150.00	2,147.37	2,101.18	347,683.50	450,866.25	451,988.55	586,126.13
Total Tonnage per *Seam*						4,213,118.33	6,476,088.84
Total Tonnage						10,689,207.17	

Table 2. Calculation of volume of overburden

Section	Distance	Area		Total Area OB per Section	Volume of Overburden
		OB D	OB E1		
A-A'	150.00	25,033.70	11,142.90	36,176.60	0.00
B-B'	150.00	40,863.14	24,955.74	65,818.88	7,649,661.00
C-C'	150.00	43,638.99	42,749.91	86,388.90	11,415,583.50
D-D'	150.00	43,463.70	62,502.67	105,966.37	14,426,645.25
E-E'	150.00	45,598.85	94,958.06	140,556.91	18,489,246.00
F-F'	150.00	48,141.96	126,819.06	174,961.02	23,663,844.75
G-G'	150.00	54,237.44	120,499.44	174,736.88	26,227,342.50
H-H'	150.00	59,905.48	94,879.31	154,784.79	24,714,125.25
I-I'	150.00	67,326.42	68,521.33	135,847.75	21,797,440.50
J-J'	150.00	70,717.34	51,047.88	121,765.22	19,320,972.75
K-K'	150.00	52,200.00	44,721.58	96,921.58	16,401,510.00
Total					184,106,371.50

The estimated results for coal resources in seam D are 4,213,118 tons, seam E1 is 6,476,089 tons with a total of 10,689,207 tons. Meanwhile, when calculating the overburden, the volume was found to be 184,106,371 m3. Determining the striping ratio (SR) is comparing the coal seam tonnage with the overburden volume to determine the sustainability of mining which will later be continued to calculate coal reserves. So the stripping ratio (SR) in the research area is 1:17.

CONCLUSION

1. The research area is composed of the Muaraenim mudstone unit with lithologies consisting of mudstone, siltstone, glauconite sandstone and coal.
2. The geological structures found are normal left slip faults and left thrust slip faults
3. The results of coal resources in seam D are 4,213,118 tons and seam E1 are 6,476,089 tons with a total of 10,689,207 tons. The overburden volume is 184,106,371 m3
4. The result of stripping ratio (SR) is 1:17

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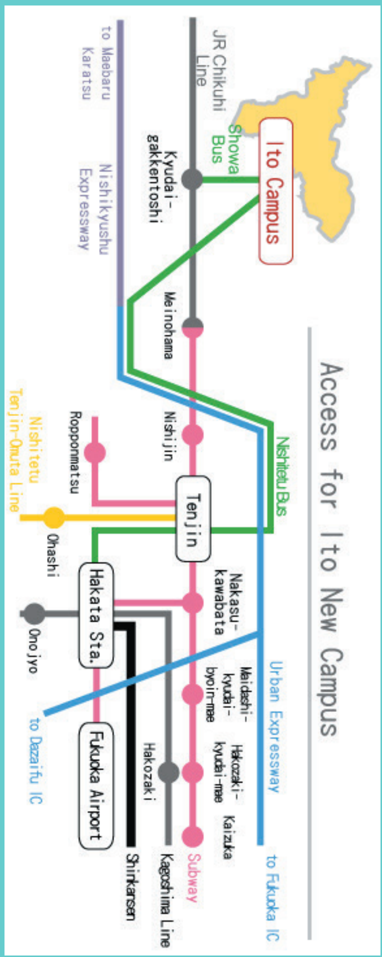

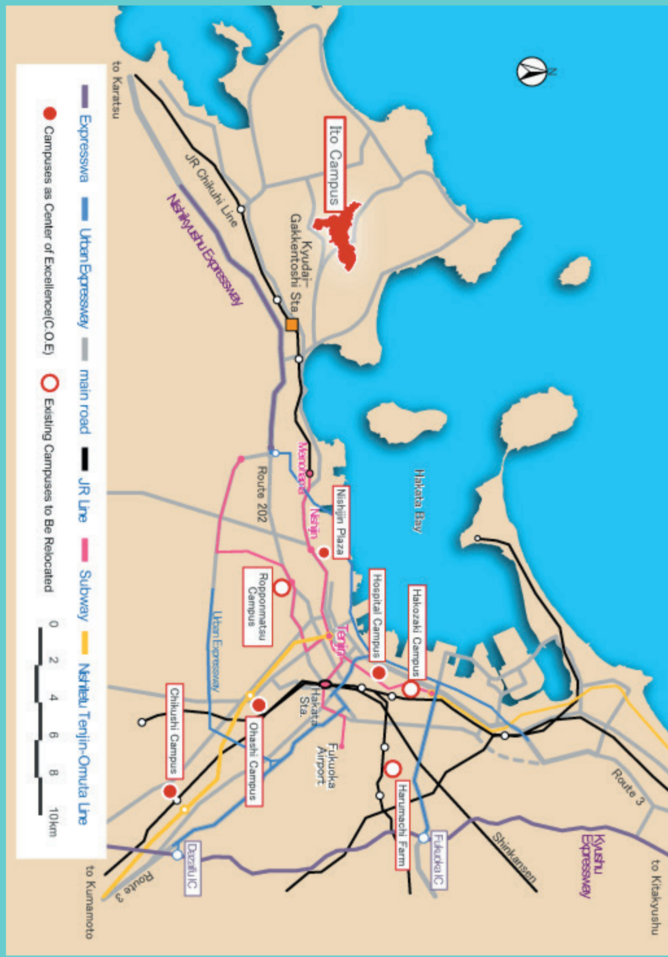

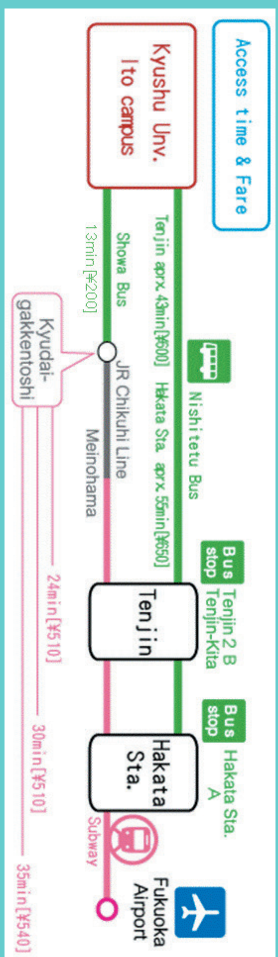

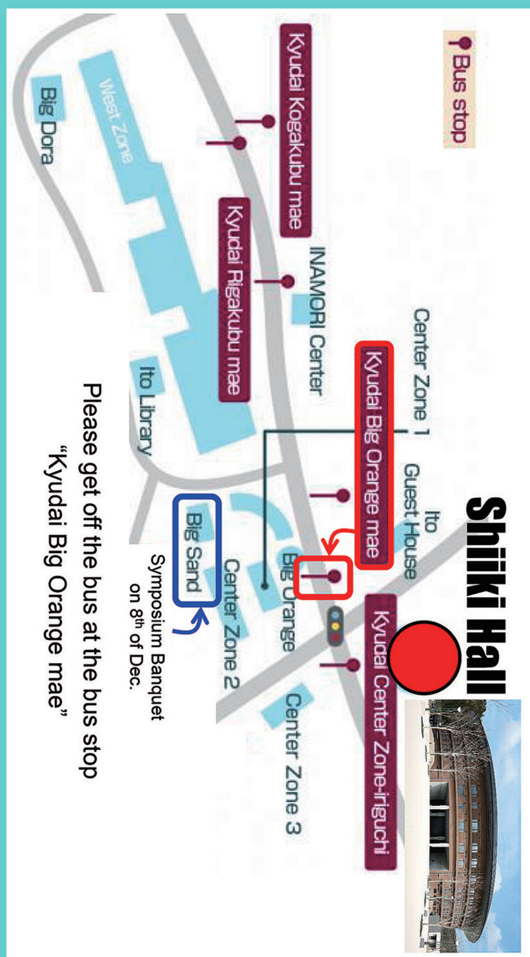

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