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Stratigraphy Drilling And Infill Drilling At Block LM For Updating Subsurface Geological Condition

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Abstract
Block LM is located in Central Kalimantan, this block is one of block in the company (Suprabari Mapanindo Mineral, PT). This block regionally has located in Barito Basin and has a coal bearing formation namely Tanjung Formation. Last drilling Block LM was 2014 and the purpose drilling in Block LM was completed geological data. The data were thickness, seam, logging data, Subsurface and geological updated by detailing drilling in this area. There are 2 (two) types of drilling namely stratigraphy and infill drilling. Target of the drilling was bottom seam of pit. There was a seam that will be the bottom pit, the seam is seam 4L, but others seam is deeper than seam 4L or bottom pit will be drilled by geologist instructions for modelling data. Main seams in this block are seam 8, seam 7, seam 6, seam 51, seam 52, seam 4U1, seam 4U2, Seam 4 Series (41, 42, 43), seam 4L, seam 31 and seam 32.
Keywords: *Subsurface, Geological, Infill, Drilling, Stratigraphy, Seam*

INTRODUCTION

Geological modelling is the process of creating a geological model carried out manually or using software by entering data relating to topography, structure, quantity and quality of coal and overburden rock which is depicted visually and also geological model is a mathematical depiction that reflects the geological interpretation of the deposit. A good understanding of the geology should be established before constructing the model, as this will guide selection of the most appropriate modelling technique for the deposit[1].Coal is a dense, flammable, fossil sedimentary rock formed from land plants (Embryophyta) that thrived in ancient wetlands[2]. Types of coal are divided into lignite, sub-bituminous, bituminous, anthracite, boghead coal, cannel coal, liptobialite, and saline coal[2]. Coalification is a geological process of the material formationwith increasing content of the element carbon from organic material[13]. Coal is classified into 2 type based on utilization, namely Thermal Coal & Coking Coal [14]. Metallurgical coal comprises coking coal of various qualities (hard, semi-hard and semi-soft) and coal for Pulverised Coal Injection (PCI). Coke is the solid product obtained by hightemperature heating of coking coal in the absence of oxygen (coking process) in coke ovens. Coke is used mainly in the iron & steel industry acting as energy source, and chemical agent (carbon source) in blast furnaces (BF) [15]. Thermal coal is used by the various markets in two applications—power generation and cement manufacturing. Coal is used either in a pulverized or sized form as feeder fuel in burners and stokers. Stokers and burners have different specifications and usually the product can be adapted in terms of size for optimal utilization [19].
Previous geological condition of the area, there are 16 seams based on old logging data. Stratigraphy drilling is designed for acquisition data for further steps and validation old data in research area. Stratigraphy drilling is one of drilling in exploration area that aim to be knowing subsurface geology such as lithology, structure, and etc. old schema in this research was following old drilling data that uncomplete cover all area block LM, see following figure 1.

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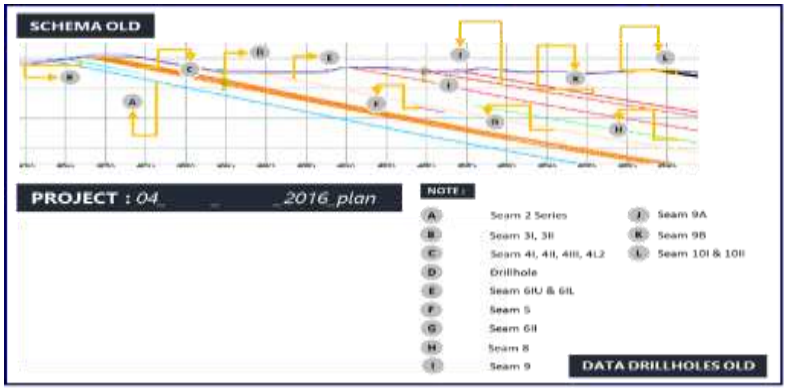

Figure 1. Previous Model Research area

Geophysical logging is the only acquisition technique in subsurface based geophysical tools. Log is a depth graphics from a set curve that show measured parameters in well continuously[3]. Geophysical tools used in this research are Gamma Ray (GR), Caliper & Density.Gamma Ray Log is a drill hole logging method by utilizing the natural radioactive nature of the rock[4]. Gamma Ray log tools measured emissions natural in the subsurface[5]. Log gamma ray can be used on open hole and cased hole[5]. Caliper Log is one of mechanical log that measured borehole condition/environment and it determines washout zone, breakout, etc[5]. Density Log is one of nuclear log that measured bulk density of formation, the log used to determine lithology and type of mineral qualitatively[5]. The density logging device is a contact tool which consists of medium-energy gamma ray source that emits gamma rays into a formation[12]. Minerals Radioactive that record using GR (Gamma Ray) tools are (K) Potassium, (Th) Thorium, dan (U) Uranium [6]. Structural Geology determines folds, fault, & other deformations in earth's crust (lithospher)[7]. Stratigraphy is discipline of science about rocks strata[8]. Terminology of geomorphology is used for description morphology on earth's surface in 1870 & 1880 [9]. The influence of geomorphology are energy, rocks material, erosion phase, & time [10].

METHOD

Flow Chart

Flow chart of this research devided into 11 steps, see following figure 2. Surface mapping was mapping activies in research area to determine outcrop lineament and etc, especially in surface condition. Outcrop sampling was picking lithology in surface for quality analysis, lab analysis was analyze general paramaters namely (Ash, TS, IM, VM, CV, FC) and others paramaters (CSN & MF). Create Geological map was interpretation and determination all geological aspect (geomorphology, stratigraphy & etc). Drilling stratigraphy & infill was advanced steps of mapping to determine & interpretation subsurface condition. Quality analysis from drilling process must to analyze to be knowing coal quality. Geological model was last step of this process to create geological model from new data drilling & mapping, see following figure 2.

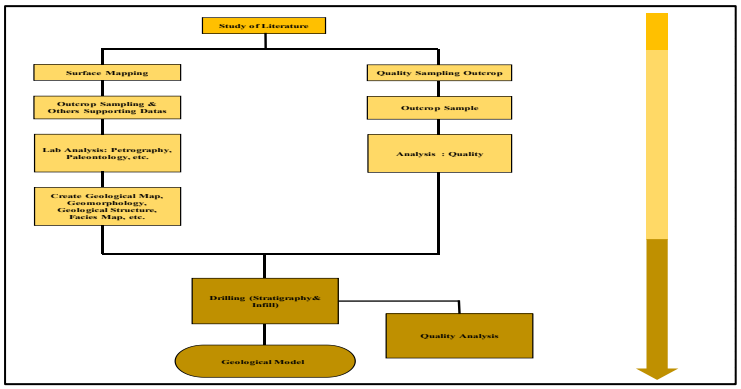

Figure 2. Flow Chart Research

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Sofware was used in this research is Minescape. Flow model update in this software were aquistion data, inventory data, logging data, reconcile data, input data, trend, fault modelling, build schema, running schema & geological model, see following figure 3. Acquisition data was drilling process in all area research to record all geological data especially in subsurface, inventory data was collect and checklist all data that has been recorded. Logging data was geophysical data that acquisition by logging tools (gamma ray, density, caliper). Reconcile data was checking activities by geologist to validation lithology type & picking logging. Input data was inputing all data reconcile to software namely, depth, lithology type, number drillholes, lithology codes & data was used for creating trend geology, fault modelling & build schema, see following figure 3

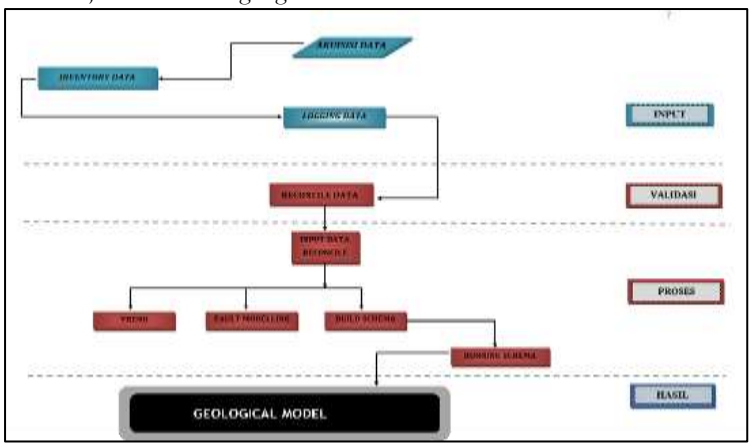

Figure 3. Software Flow Chart

Data geological that used in this research were mapping , drilling, quality analysis and update model, see following figure 4.

Figure 4. Data Geological Model Update

Collecting Datas

The data collection technique was carried out qualitatively and quantitatively, namely observation and documentation to obtain detailed and valid data at the end of the conclusion of this research. This stage also carried out literature studies to support the initial research stage.

Reconnaise

The research stages are divided into 5 major parts, namely the preliminary stage, field research stage, laboratory research stage, analysis stage and draft report preparation stage.

Research Datas & Area

This field research was carried out to complete field data including surface mapping, including searching for coal and non-coal outcrops, collecting geological structure data, collecting geomorphological data, collecting stratigraphic data in the research area, searching for lithological boundaries, and making geological maps. This stage is also completed by carrying out grab sampling in several areas to support laboratory tests at Block LM. The second stage is drilling in the new development area, both stratigraphy drilling and infill drilling. The research area is located in Central Kalimantan, Indonesia. The Company is Suprabari Mapanindo Mineral, PT, see following figure 5.

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Figure 5. Location Research Area

Data Analysis

This stage is carried out based on primary data that has been obtained from the field. This stage is carried out to determine the quality of coal (consisting of proximate and ultimate analysis) in the research area and the data analyzed is in the form of cores from coring drilling, this stage is carried out by the laboratory appointed by the company.

RESULT AND DISCUSSION

Geological data in 2014 or previous year of the company has not completed yet and the amount of drilling data is a few. Seams in the area is not similar to another block existing. The geological model existing in Block LM is old schema mining. For further model updated needs some datas (subsurface and surface), subsurface data such as geophysical logging, cutting, core etc. surface data such as outcrop, evidence structure geology, seam linement, etc.

a. Stratigraphy

Based on result of mapping area in Block LM stratigraphy in this area dived into 4 unit stratigraphy, namely Schist Micca Unit, Sandstone Quartz Unit, Limestone Unit & Alluvial Deposits[11].

b. Geomorphology

Based on result of mapping area in BLOCK LM geomorphology area devided into 2 relief, namely Undulating geomorphological with gently undulating sub-unit (0° – 4°) and Undulating geomorphological with sloping undulating sub-unit (4° – 8°)[11].

c. Structure Geology

Lineament structure geology of the area, namely set-1 direction NNE – SSE with main bearing N190^{0}E, set-2 direction WNW-ESE with bearing N290^{0}E, set-3 direction WSW-ENE with bearing N330^{0}E, and set-4 direction NW-SE with bearing N330^{0}E[11].

Figure 6. Geological Map Research Area

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Drilling Data

Surface mapping was used for drilling plan in the area. Drill holes covered all seam to determine variative seam in development area, see following figure 7.

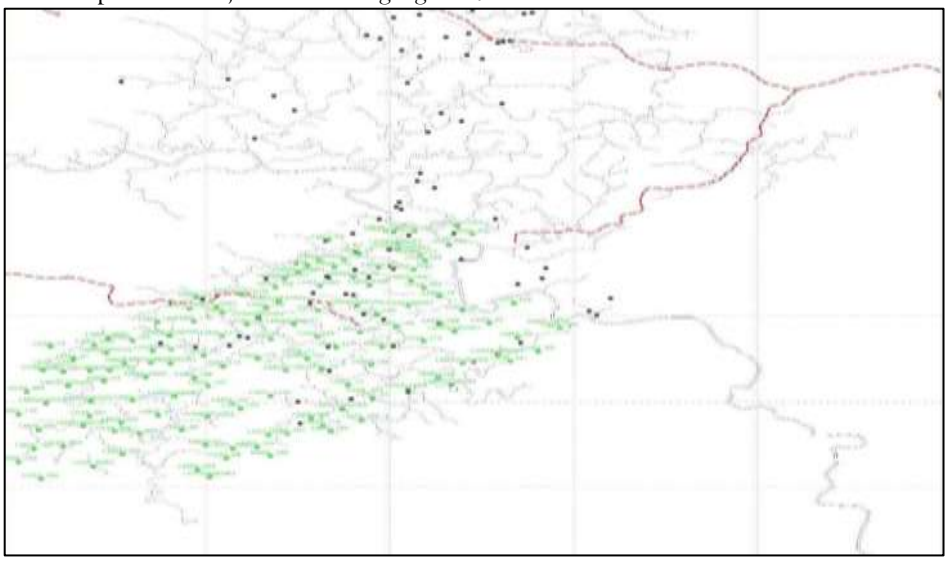

Figure 7. Drillholes update in research area

Drilling data above is drillholes updated in stratigraphy & infill drilling. Data drilling has been covered all area in Block LM. Drilling data that aquisiton and used in the exploration steps are collar, lithology data, quality etc[16]. Infill drilling is a crucial steps for mine development of a deposit that is roughly delineated by a sparse drilling program[17]. Core sampling from drilling would be analyzed by third party and the parameters are Proximate, Ultimate, Petrography etc. Proximate analysis (total moisture, ash, sulfur, calorific value, volatiles, fixed carbon) [18]. Coal petrography is used to determine a coal's rank (degree of coalification) and type (amount and type of macerals) [18]. Ultimate analysis (total moisture, ash, carbon, hydrogen, nitrogen, sulfur, oxygen by difference) [18].The drilling data will be used next step to modelling geology in the area for updating and added geological data that used for interpretation. The data also used in resources estimation, there are 3, classification measured, indicated & inferred[20]. Define seam and geological subsurface update in this area followed by new data logging and the result of this interpretation is below, see following figure 8.

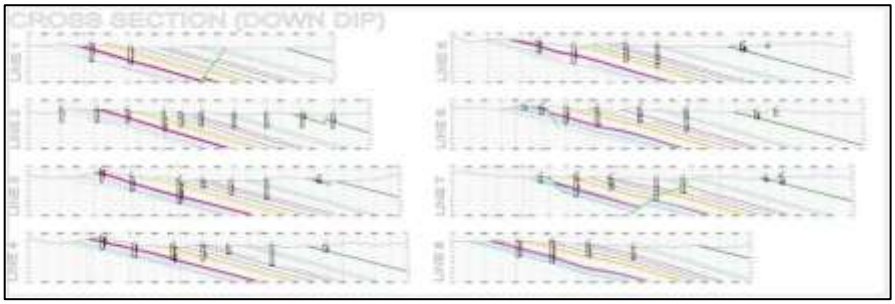

Figure 8. Model update Research area

CONCLUSION

This research aim to be knowing measured area radius of research area and also estimation resources of seam 8 in target area. BLOCK LM has 25 (twenty five) coal seam based on new determine method, namely, seam 81U, 81L, 81L, 82, 7, 6A, 6, 51, 52, 4U1, 4U2, 4A, 4B, 41, 42, 43, 4LR1, 4LR2, 4L, 31A, 31, 32A, 32, 2U, and 2L. Main seam commonly has splitting seam, except seam 82, 41, 42, 43, 4L, 31 dan 32.

Based on lineament structure Block LM devided into 4 namely Set-1 with direction NNE–SSE, Set-2 with direction WNW–ESE, Set-3 with direction WSW–ENE, Set-4 with direction NW–SE. Based on fracture density Block LM devided into 4 zonation, the highest density fracture, from north to south namely Fracture Zone Sungai Mamput-Kecil, Fracture Zone Sungai Balakangkeng, Fracture Zone Sungai Penoon–Tang dan Fracture Zone Sungai Selirang. Based on result of analysis quality from grab sampling and result of the analysis quality from borehole, product of coal in this area divided into 2 type, namely coking coal (metallurgical coal) and Thermal.

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