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CALCULATION AND ANALYSIS RADIUS DRAINAGE FOR DEVELOPMENT OF BETUNG FIELD WELLS JAMBI SUB-BASIN-SOUTH SUMATERA

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ABSTRACT

The Betung Field consists of 4 reservoir layers, namely L-2, L-3, L-4 and L-5 with the production target of the Air Benakat Formation. Based on the calculation of reserves in 2017, L-5 has Original Oil In Place of 16,531.05 MSTB. In this layer the average production is 667.65 BOPD. This paper will discuss the analysis of the radius of the drain radius based on the calculation of reserves from reservoir data and production data where this analysis is one of the strategic factors in adding wells for the development of the Betung field.

This study uses a data processing methodology using Oil Field Manager (OFM) software. The output of data processing is the drain radius which is one of the strategies to determine the development of the next wells.

The AI-209 well has a drain radius of 155.11 meters and a cumulative production of 37184 barrels; The AI-210 has a drain radius of 209.94 meters and a cumulative production of 48233 barrels; The AI-211 has a drain radius of 310.83 meters and a cumulative production of 66488 barrels; The AI-213 has a drain radius of 181.33 meters and a cumulative production of 29499 barrels and the AI-214 has a drain radius of 255.93 meters with a cumulative production of 12500 barrels. The reference wells are located in the Southeast-South and South-Southwest directions which have a large enough drain radius (bubble map), indicating that this areas are good enough for the development of potential wells.

Keywords: Radius drainase, Comulative production, Reservoir data, Production data, Oil field Manager (OFM)

INTRODUCTION

Indonesia has a large potential for hydrocarbon basins, one of which is the South Sumatra basin (AQ Rabbani et al, 2018). It is estimated that there are 4.3 billion barrels of hydrocarbon reserves in this basin (Klett, 2000), which are still in the exploration and production stage (AA Prawoto et al, 2015). One of the production fields in the South Sumatra basin that is the focus of this research is the Betung Field. This field consists of 4 reservoir layers, namely L-2, L-3, L-4 and L-5 with the production target of the Air Benakat Formation. Based on the calculation of reserves in 2017, layer five (L-5) has Original Oil In Place of 16,531.05 MSTB (AI Irmaya et al, 2022). In this layer the average production is 667.65 BOPD. Based on the data above, this field is still very likely to be developed with the addition of further wells. The addition of a well requires in-depth analysis of integrated data including subsurface geology, reservoir and production characteristics. This paper will discuss the analysis of the radius of the drain radius based on the calculation of reserves from reservoir data and production data where this analysis is one of the factors in adding wells to the development of the Betung field.

Reserve is part of resources where the definition of resources is part of the total amount of oil and gas and associated substances from a reservoir that is estimated at a certain time and can be produced and added to future estimated reserves (Dadang R et al, 2011).

Calculation of reserves has several methods including volumetric method, monte carlo, material balance and decline curve. In this study, the calculation of reserves is carried out using the volumetric method whichincludes the calculation of the amount of oil and gas in place with a combination of volumetric maps, petrophysical analysis and reservoir engineering.

Volumetric method formula:

$$Ni = 7758\ x\ Vb\ x\ \emptyset\ \frac{1-Swi}{Boi} \qquad (1)$$

Where:

Ni	: Initial volume of oil in place, STB
Vb	: Volume of reservoir rock, acre-ft
Ø	: Average porosity, fraction
Swi	: Average initial water saturation, fraction
Boi	: Initial formation volume factor, bbl/STB

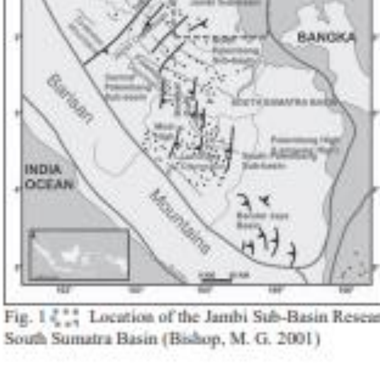

Fig. 1 Location of the Jambi Sub-Basin Research Area-South Sumatra Basin (Bishop, M. G. 2001)

METHODOLOGY

This study uses a data processing methodology using Oil Field Manager (OFM) software. The processed data is in the form of reservoir data, namely porosity, fluid saturation, formation volume factor and also production data. The output of data processing is the drain radius which is one of the strategies to determine the development of the next wells.

RESULTS AND DISCUSSION

The wells located in L-5 and which are the focus of research: AI-209, AI-210, AI-211, AI-213, AI-214, AI-217, AI-219, AI-220, AI- 221, AI-222. The position of these wells can be seen in Figure 2.

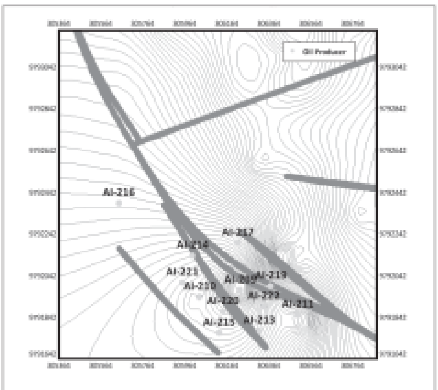

Fig 2. Location of L-5 wells

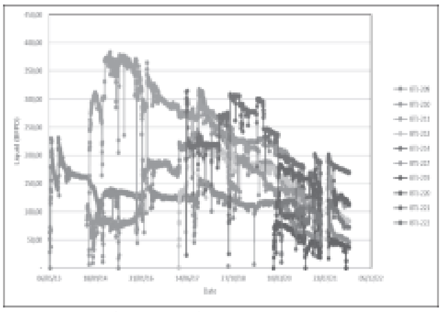

Fig 3. L-5 Production Performance

Table 1. Reservoir Data and Cumulative Production Data L-5

Wells	Np	h	ø	Swi	Boi
	Bbl	m	Friksi	Friksi	Friksi
AI-209	37184	27.81	0.2322	0.5161	0.12
AI-210	48233	25.36	0.2564	0.6573	0.12
AI-211	66488	17.62	0.2493	0.6794	0.12
AI-213	29499	21.76	0.1906	0.5622	0.12
AI-214	12500	27.64	0.2024	0.9357	0.12
AI-217	1076	27.44	0.1876	0.9629	0.12
AI-219	4032	22.70	0.2535	0.3408	0.12
AI-220	10723	23.77	0.3023	0.3812	0.12
AI-221	346	14.13	0.1117	0.8225	0.12
AI-222	3513	30.75	0.3103	0.2813	0.12

Based on the data above, the calculation of the drain radius is carried out using the assumption reservoir formula in the form of a tank model. Calculation of the drain radius for Well AI-209:

$$Ni = 7758 \times Vb \times \emptyset \frac{1-Swi}{Boi}$$

$$Vb = A \times h$$

$$A = \frac{Ni \times Boi}{7758 \times h \times \emptyset\ (1-Swi)}$$

$$A = \frac{371840.8 \times 1.22}{7758 \times 27.81 \times 0.23\ (1-0.51)}$$

$$A = \frac{453644.8}{24315.022}$$

$$A = 18.6569 \text{ acre}$$

$$A = 18.6569 \times 43560 \text{ ft}^2$$

$$A = 812697.906 \text{ ft}^2$$

$$A = \pi r^2$$

$$r^2 = \frac{A}{\pi}$$

$$r^2 = \frac{812697.906}{3.14}$$

$$r^2 = 258820.98$$

$$r = \sqrt{258820.98} \text{ ft}$$

$$r = \frac{508.744}{3.281}$$

$$r = 155.11 \text{ m}$$

The following are the results of the calculation of the drain radius for the L-5 wells (Table 2.)

Table 2. Calculation of the L-5 Wells Drain Radius Calculation Results

Wells	Np	r
	Bbl	m
AI-209	37184	155.11
AI-210	48233	209.94
AI-211	66488	310.83
AI-213	29499	181.33
AI-214	12500	255.93
AI-217	1076	105.11
AI-219	4032	46.72
AI-220	10723	70.23
AI-221	346	50.07
AI-222	3513	45.58

The distribution of the calculation of the drain radius (bubble map) based on data processing using Oil Field Manager (OFM) software can be seen in Figure 4.

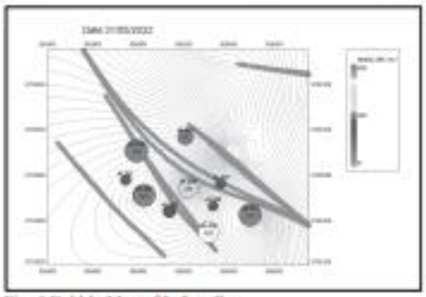

Fig. 4 Bubble Map of L-5 wells

The size of the Bubble map is influenced, among others, by the length of production time (Figure 3) and the quality of the reservoir. Based on the distribution of the bubble map in Figure 4, it shows that wells in the Southeast-South direction have a large enough drain radius so that these wells can be used as reference wells, namely AI-211 (r = 310.83 meters) and well AI-213 (r = 181.33 meters). This indicates that the reservoir in the Southeast-South area is quite good for the development of potential wells in the future in terms of the drain radius.
Likewise, the South-Southwest area, where reference wells AI-209 (r = 155.11) and AI-210 (r = 209.94 m) have large drain radius, so that the South-Southwest area also has a large reservoir potential. good for the development of potential wells in the future.
The distance or location of development wells needs to consider the drain radius (bubble Map) to find out how far the area has been taken/drained from the well radius of 250 m (if there is no Drill Stem Test) and also to find out whether the bubble map is a the wells in the same layer are in contact with the adjacent wells, because if they are in contact, there is an indication that the production of the two wells affects each other.
Based on the guidelines from SKK Migas in the technical aspect subsurface – POD, where the P1 limit (proven reserve) based on the radius of the well is 1.5 x Investigation Radius from the DST results calculated using the Darcy formula and if there is no DST using a well radius of 250 m (Figure 5).

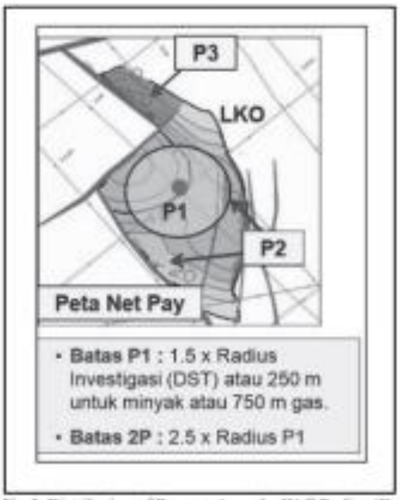

Fig 5. Distribution of Reserve Areas by Well Radius (Dadang Rukmana, Technical Aspect Subsurface, 2014)

The case study in the Betung L-5 field shows that several existing reference wells have a drain radius of more than 250 meters. This shows that the P2 well reserve has been proven so that it becomes P1.
The following are some scenarios for the coordinates of potential area development directions for further wells based on one of the field development strategies using drain radius:
Well 1 (X: 306471.398325, Y: 9791720.748063)
Well 2 (X: 306072.637820, Y: 9791842.369060)
Well 3 (X: 305885.445402, Y: 9792094.687247)

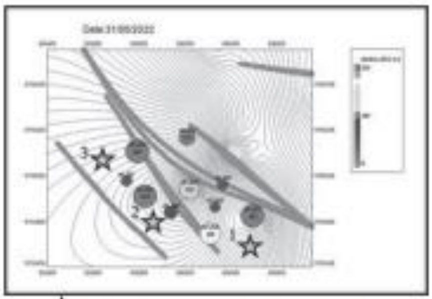

Fig.6 ☆ Scenario of the location of the next development wells

CONCLUSION

Based on the results of calculations and analysis of the drain radius of the L-5 wells in Betung Field, it can be concluded:

1. The L-5 wells in Betung Field which are used as references based on the calculation of the drain radius are AI-209 well; AI-210; AI-211; AI-213 and AI-214.
2. The AI-209 well has a drain radius of 155.11 meters and a cumulative production of 37184 barrels; The AI-210 has a drain radius of 209.94 meters and a cumulative production of 48233 barrels; The AI-211 has a drain radius of 310.83 meters and a cumulative production of 66488 barrels; The AI-213 has a drain radius of 181.33 meters and a cumulative production of 29499 barrels and the AI-214 has a drain radius of 255.93 meters with a cumulative production of 12500 barrels.
3. Based on the calculation of the drain radius, the wells located in the Southeast-South and South-Southwest directions have a large enough drain radius, indicating that the reservoir in the Southeast-South and South-Southwest area is good enough for the development of future potential wells.
4. Scenario the location of potential wells is at the coordinates:
   Well 1 (X: 306471.398325, Y: 9791720.748063);
   Well 2 (X: 306072.637820, Y: 9791842.369060);
   Well 3 (X: 305885.445402, Y: 9792094.687247)

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