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# Estimation of gas volume based on four wells in the G field, East Sengkang Basin, South Sulawesi Indonesia

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Research in Sulawesi is still very limited due to the complex tectonic conditions. Due to the lack of drilling, subsurface formation data is very limited, so further research is needed. Against this background, this study attempts to estimate the gas volume in the G field, based on four oil and gas wells in the East Sengkang Basin, South Sulawesi. Fortunately, the wells are located close together, allowing for accurate volume estimation. The four wells are GI-1, GI-2, GI-3, and GI-4. The objectives of this study are: first, to determine the depth of the gas reservoir zone (qualitative-quantitative); second, to determine the total gas volume in the reservoir zone. Gas volume estimation uses well logging methods to obtain subsurface data, specifically hydrocarbon potential. Bulk reservoir volume is a representation of the volume of a 3D model that is influenced by reservoir thickness. Determining the bulk reservoir volume is used to estimate the volume of gas hydrocarbons. 3D modeling is an important method in the oil and gas industry to understand subsurface characteristics. Therefore, the findings are expected to provide important insights for energy resource development and serve as a reference for the oil and gas industry in evaluating gas hydrocarbon potential. The results showed a water saturation below 30 % with a resistivity above 60 Ohm·m, indicating the presence of gas. Furthermore, the total gas volume was $4.46 \cdot 10^8$ m$^3$, indicating significant potential in the prospective reservoir zone. The gas potential in the entire Sengkang Basin field block reached $226.5 \cdot 10^8$ m$^3$, while the calculated gas volume in the study area resulted in $4.46 \cdot 10^8$ m$^3$. Based on these calculations, the gas volume in the study area is quite realistic.

**Key words**: gas reservoir, well logging, qualitative and quantitative interpretation, Archie equation, 3D modeling of reservoir, total hydrocarbon volume.

**Introduction.** Natural gas is a widely available energy resource in Indonesia and continues to play a dominant role in the national primary energy mix [Wang et al., 2023]. Sulawesi has been recognized as a region with substantial hydrocarbon potential, supported by considerable proven gas reserves [Statistik minyak dan Gas Bumi, 2022]. Oil and gas drilling in the Sulawesi region remains limited, primarily due to the complex tectonic framework of Eastern Indonesia [Grainge, Davis, 1985; Kusnama, Mangga, 2007; Adhitiya et al., 2010; Suyono, Kusnama, 2010; Satyana et al., 2011; Setyanta, Subagio, 2013; Liu, 2021]. As a result of the lack of drilling in the area, there is limited subsurface formation data, so it is necessary to conduct further research in the area, namely in the East Sengkang Basin, South Sulawesi Province. In addition, there are still several wells and areas that have not been included in the calculation of the total gas volume value in all fields in the Sengkang Basin block.

Based on these considerations, this study

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aims to estimate gas volume in the G field using data from four oil and gas wells located in the East Sengkang Basin, South Sulawesi. The relatively close spacing between the wells allows for a reliable volumetric estimation. The four wells are GI-1, GI-2, GI-3 and GI-4. The objectives of this study are to identify the depth of gas reservoir zones through qualitative and quantitative analyses in wells GI-1, GI-2, GI-3, and GI-4, and to estimate the total gas volume of the G field. Reservoirs in the study area are known as potential reservoirs of oil and gas systems in the East Sengkang Basin, South Sulawesi [Adhitiya et al., 2010].

This study employs well logging as a subsurface investigation approach, in which measurement tools are deployed within the wellbore to assess formation properties and characterize underlying rock units [Dewanto et al., 2023, 2024; Mulyatno et al., 2024]. Relative to alternative exploration techniques, well logging delivers superior data quality, which accounts for its continued preference in exploration activities despite the high operational costs [Widarsono, 2012; Yan, 2014]. The research collected primary data in the form of well log data and secondary data in the form of mud logs. The determination of gas volume used the seismic method, namely Petrel, without using seismic data, thus saving data processing costs. This is supported by the four wells studied being close together.

Setyanta, B. & Subagio, D. [2013] and Van Den Berg et al. [2016] modeled the configuration and geometry of subsurface structures in the Sengkang Basin, South Sulawesi Province. Their results indicate hydrocarbon potential in the eastern arm of the South Sulawesi Basin, which is separated by the Walanae Fault. This potential is associated with sedimentary rocks and fold structures in the area [Abraham, Alile, 2019]. Therefore, further exploration is necessary to optimize hydrocarbon resources.

Determination of the reservoir target area is done by looking at gamma ray logs with small values (sandstone or carbonate lithology). At small gamma ray values, there is a crossover point between the porosity log (NPHI) and the density log (RHOB). If the resistivity log (LLD) value is high, it can be stated as a reservoir target area (qualitative interpretation). Quantitative analysis is then performed by calculating water saturation ($S_w$) and subsequently determining the target reservoir area [Ordas et al., 2023]. Furthermore, $S_w$, fluid type, clay influence, and resistivity in the target reservoir area can be analyzed [Kamel, Mabrouk, 2003; Jafarinezhad et al., 2015].

Water saturation is a critical petrophysical parameter in oil and gas exploration because it directly influences hydrocarbon reserve estimation within reservoir systems [Widarsono, 2011; Zhang et al., 2014]. It can also be used to support fluid identification across reservoir intervals in oil and gas wells [Adim, 1993; Irawan, Utama, 2009; Ganat, 2020]. In practice, $S_w$ can be inferred from resistivity measurements because water-bearing reservoir intervals typically exhibit lower resistivity than hydrocarbon-bearing zones as a result of the higher electrical conductivity of formation water [Camyra et al., 2022]. Consequently, higher resistivity generally corresponds to lower $S_w$ values, whereas lower resistivity indicates higher $S_w$ values. According to Irawan and Utama [2009], $S_w$<25 % indicates gas, 25 %≤$S_w$<75 % indicates oil, and $S_w$>75 % indicates water.

Water saturation cannot be measured directly from conventional logs, but it can be estimated using established petrophysical models such as the Simandoux, Archie, and Indonesian methods [Sam-Marcus et al., 2018]. In this study, $S_w$ was estimated using the Archie method [Archie, 1942; Ordas et al., 2023]. The Archie equation is an empirical formulation developed for clean formations with nonconductive matrices and is generally applicable to clean clastic sandstone and carbonate reservoir systems; therefore, its application to heterogeneous reservoirs should be treated carefully because Archie parameters depend strongly on rock properties [Widarsono, 2008]. According to Mohamad and Hamada [2017], the Archie parameters commonly used for sandstone are $a$=0.81 (tortuosity), $m$=1.7 (cementation exponent), and $n$=2.0 (saturation exponent). For carbonates, the parameters are $a$=1.0 and $m$=$n$=2.0. In addition to these parameters, formation-water resistivity ($R_w$), true formation resistivity ($R_t$), and porosity (φ) are also required to determine $S_w$. Once $S_w$ has been obtained, the fluid type may be interpreted using the criteria proposed by Adim [1993], Irawan & Utama [2009], and Porras & Campos [2001].

According to Mohamad & Hamada [2017], the Archie equation (this equation is explained in equation (6) parameters for sandstone are $a$=0.81 (tortuosity), $m$=1.7 (cementation exponent), and $n$=2.0 (saturation exponent). For carbonates, the parameters are $a$=1.0 and $m$=$n$=2.0. Apart from that, important parameters in determining water saturation values are formation $S_w$, actual resistivity ($R_t$) and porosity (φ). For further research, if $S_w$ has been obtained, the type of fluid can be identified according to research by Adim [1993], Irawan & Utama [2009], Porras & Campos [2001].

This research used four well data to conduct qualitative and quantitative petrophysical analysis to determine the presence of gas in each well [Saadu, Nwankwo, 2018]. This study utilizes gamma-ray, LLD, NPHI, and RHOB logs. The accuracy of well log interpretation can be significantly improved when integrated with core data [Worthington, 2011; Mennan, 2017; Ashraf et al., 2024].

There is also 3D modeling done to determine the reservoir bulk volume. Reservoir bulk volume is a description of the volume or contents of a 3D model that is affected by the thickness of a reservoir. Determination of reservoir bulk volume is used in estimating gas volume. 3D modeling is an important method in the oil and gas industry to understand subsurface characteristics [AlBahadily, 2017; Liu, 2021; Yang, 2022; Complexity, 2024], so the results of this study are expected to provide important insights for the development of energy resources in this region and become a reference for the oil and gas industry in evaluating gas potential in Indonesia. This research aims to provide information on gas volume based on four wells located in the reservoir zone of field G, East Sengkang Basin, South Sulawesi.

**Research Methods.** This research was conducted at the Geological Disaster Mitigation Laboratory, Department of Geophysical Engineering, University of Lampung. The study was carried out from October 2024 to March 2025. The dataset consists of well logging data from wells GI-1, GI-2, GI-3, and GI-4 in LAS (Log ASCII Standard) format and there is supporting data in the form of well final report data.

***Data Processing.*** The data processing workflow begins with qualitative and quantitative analyses of well log data, followed by 2D and 3D modeling and bulk volume calculations. The following are the stages of data processing carried out in several stages.

*Data Input and Data Loading*. The initial stage of the research begins with data processing, namely inputting and loading data by entering data into Interactive Petrophysics. The initial data loading process is carried out by creating a new database header which aims to facilitate checking the completeness of the data and carrying out the processing process. When creating a new database header, it is necessary to input start, stop, and step data on LAS data, then enter the well data in LAS format and load data.

*Qualitative Analysis*. Each well in this study is characterized by gamma ray, resistivity, neutron, and density log data. These logs were combined into a triple-combo display using Interactive Petrophysics and qualitatively interpreted to identify gas reservoir target zones based on low gamma-ray values, high resistivity responses, and crossover characteristics between density and neutron logs. Zones that satisfy these criteria are interpreted as prospective gas reservoir intervals.

Qualitative fluid identification can be performed based on the log responses illustrated in Fig. 1. In identifying reservoir targets, the first step involves examining the gamma-ray log for low values, which indicate sandstone or carbonate lithologies. Subsequently, resistivity responses are evaluated, followed by an assessment of separation between neutron porosity and density log curves. The degree of separation between neutron and density logs varies depending on the fluid content. High to very high resistivity values are generally associated with a pronounced separation between neutron and density log responses. Such conditions indicate the presence of gas when the separation is large, whereas narrower separations may correspond to oil-bearing zones. Minimal separation between the curves typically reflects brine or water-filled intervals.

*Quantitative Analysis***.** Quantitative analysis was conducted to determine petrophysical parameters, including shale volume, which are required to calculate effective porosity within each identified reservoir prospect zone. Based on the effective porosity value, water saturation calculations are then carried out to obtain the type of fluid contained in the reservoir zone in each well. Calculation of water saturation requires water resistivity values using the pickett plot method on the water-bearing layer, then computing the water saturation value based on log data calculations using the Archie method, and obtaining the water saturation value and type of fluid in the reservoir.

Gamma ray logs often use some empirical equations, such as linear equations. Meanwhile, non-linear equations are based on the formation and geographical conditions, so all non-linear equations tend to be more optimistic in estimating shale content. Therefore, linear equations need to be adapted to non-linear equations. Non-linear equations based on formation and geographical conditions will be more accurate because the results correspond to real conditions [Asquith et al., 2004]. Linear response equation:

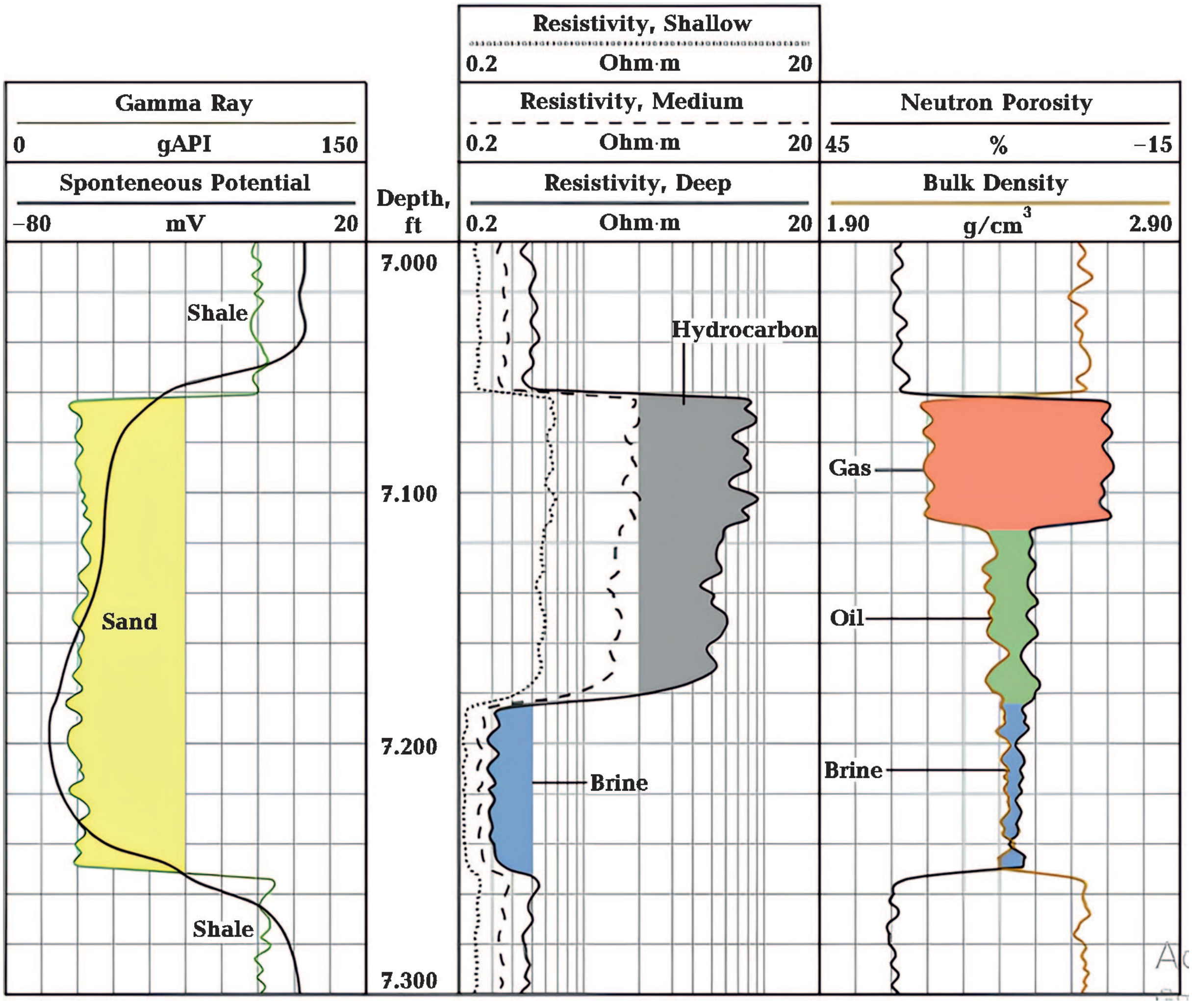


Fig. 1. Qualitative interpretation of reservoir zones [Varhaug, 2016].

$$V_{sh} = I_{GR} = \frac{GR_{log} - GR_{min}}{GR_{max} - GR_{min}}. \quad (1)$$

The equation used in this study is equation 3.

Meanwhile, the non-linear equation can be written as follows.

Steiber [1970], shale volumes for the Miocene and Pliocene of South Louisiana:

$$V_{sh} = \frac{I_{GR}}{3 - 2I_{GR}}. \quad (2)$$

In 1969, shale volumes for tertiary age formations was determined:

$$V_{sh} = 0.083\left(2^{3.7 I_{GR}} - 1.0\right). \quad (3)$$

Clavier [1971], shale volumes for secondary-aged formations:

$$V_{sh} = 1.7 - \sqrt{3.38\left(I_{GR} + 0.7\right)^2}, \quad (4)$$

for older rocks:

$$V_{sh} = 0.33\left(2^{2 I_{GR}} - 1.0\right), \quad (5)$$

with the following information: $I_{GR}$ — shale gamma ray index, $V_{sh}$ — shale volume, $GR_{log}$ — gamma ray log response value (API), $GR_{min}$ — minimum value of gamma ray (API), $GR_{max}$ — maximum value of gamma ray log (API).

Kamel & Mabrouk [2003] grouped rock types based on shale content into three categories, namely clean sand (shale volume below 10 %), shaly sand (10—33 %), and shale (over 33 %).

After obtaining all the physical parameters of the reservoir area, the next step is to calculate the $S_w$ using the Archie equation. Finding water saturation using equation 6 according to [Archie, 1942]:

$$S_{w^n} = \frac{aR_w}{\varphi^m R_t}, \quad (6)$$

where $S_w$ — water saturation (%), $R_w$ — formation water resistivity (Ω·m), $R_t$ — resistivity of the rock filled with water < 10 % (Ω·m) (true resistivity), $a$ — tortuosity factor, φ — rock porosity, $m$ — cementation factor, $n$ — varying saturation exponent (generally 2.0).

Water saturation (water saturation level) is a comparison between the volumes of a fluid and the pores of the rock where it is located. Generally, there are two methods for determining water saturation, namely through laboratory analysis using core samples taken from drilling results or using log data by carrying out petrophysical calculations. Water saturation has an important role in determining the zone containing hydrocarbons in a reservoir. The zone in the reservoir is not completely filled with hydrocarbons. Therefore, calculations are still carried out to determine water saturation in the formation [Asquith et al., 2004]. The smaller the water saturation value, the larger the capacity to hold hydrocarbon fluids, such as oil and gas. A value $S_w$ of 1 indicates that the pore space is fully occupied by water, whereas the presence of hydrocarbons within the pores results in lower $S_w$ values. The sum of water saturation, oil saturation ($S_o$), and gas saturation ($S_g$) under conditions of saturation pressure is equal to one: $S_w$+$S_o$+$S_g$=1.

*Data Loading and Well Data Correlation***.** This process inputs log data that produces a display of drilled well points based on the coordinates of each well. These well points will then be correlated based on the location of adjacent wells and produce a sequential well data path from the closest one.

*Prospect Zone Correlation*. The process of reservoir prospect data correlation is a stage of analyzing the existence of hydrocarbon reservoir zones by analyzing well data. Reservoir zone correlation is a correlation based on reservoir prospect data by conducting correlation based on the similarity of reservoir prospect zones from each well data by creating a certain horizon.

*2D and 3D Modeling and Bulk Volume Estimation*. 2D modeling is done by looking at the distribution of hydrocarbon reservoir prospect zones. The results of this modeling are in the form of maps of the upper and lower depths and reservoir thickness, while 3D modeling is done to show the sand body in the area suspected of being a reservoir prospect. From the results of 3D modeling, the bulk volume can be calculated to obtain an estimate of the hydrocarbon volume in the research area. Gas volume estimation is based on petrophysical parameters derived from the analysis, including porosity and $S_w$. The formula for calculating gas volume is shown in equation 7 [Schon, 1995]:

$$V_{gas} = \frac{V_{bulk}\varphi(1-S_w)}{B_g}, \qquad (7)$$

where $V_{bulk}$ — rock bulk volume (m$^3$), φ — effective porosity, $S_w$ — water saturation, $B_g$ — formation gas volume factor.

The well pressures and temperatures in the study area are very high. Pressures in wells GI-1 to GI-4 ranged from $1.5858 \cdot 10^7$ to $1.8961 \cdot 10^7$ Pa, while temperatures ranged from 318.15 to 334.817 K.

**Results and Discussion.** This research was conducted in the East Sengkang Basin, South Sulawesi Province using well data from four well points, namely wells GI-1, GI-2, GI-3, and GI-4. The location of the research area is shown in Fig. 2. This research processed data from the four wells to obtain an estimate of the volume of hydrocarbon gas in the G field, East Sengkang Basin, South Sulawesi.

***Qualitative and Quantitative Analysis.*** Qualitative and quantitative analysis aims to determine the reservoir target area, lithology type, and reservoir filling fluid in the wells of the study area. In addition, qualitative analysis is used to identify the characteristics of log curves to distinguish permeable and non-permeable rock layers. The log curves used are gamma ray log, resistivity log, density log, and neutron log. According to Adim [1993], water saturation values below 50 % can be identified as gas fluids. Apart from the water saturation value, fluid type can be inferred from resistivity measurements, where high resistivity responses are characteristic of gas-bearing reservoir intervals, whereas low resistivity values generally indicate water-saturated zones. The greater the resistivity, the smaller the water saturation, and vice versa. The results of the qualitative and quantitative

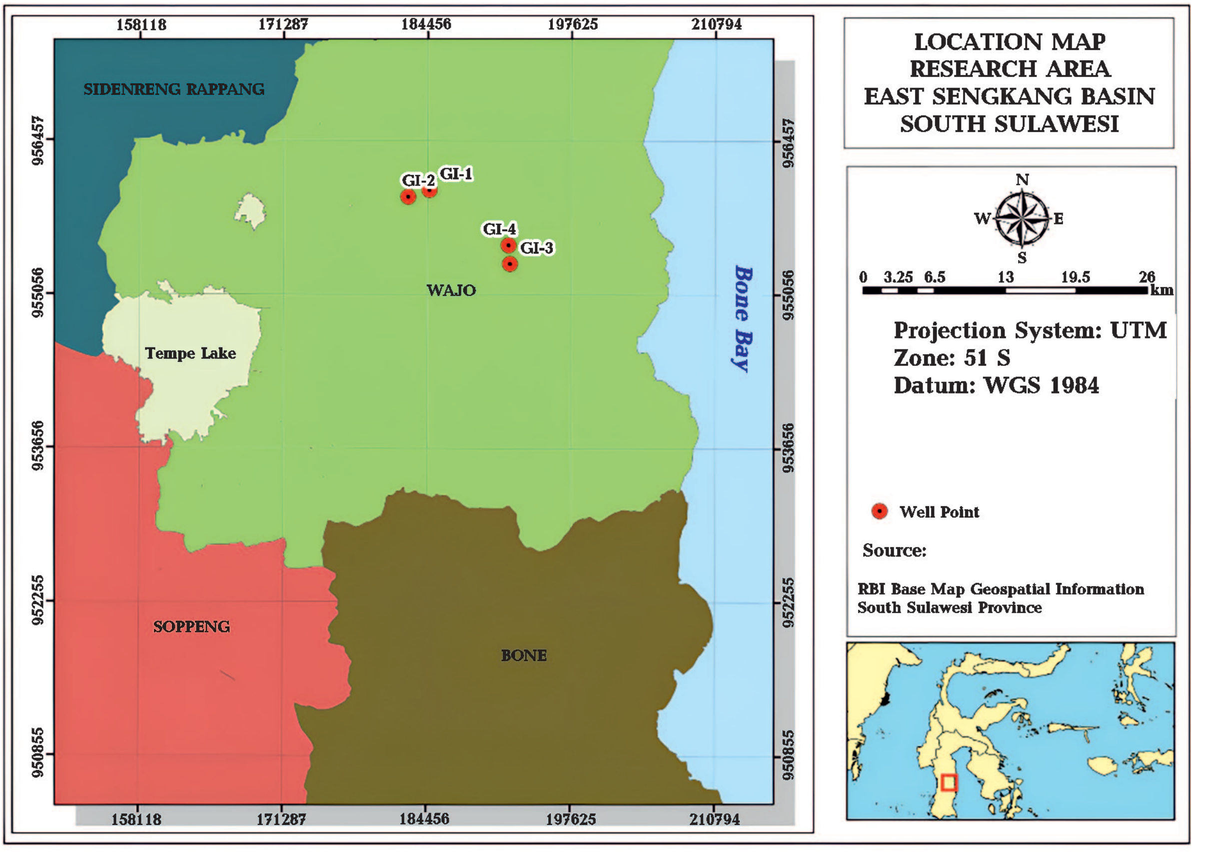


Fig. 2. Location of the research area.

analysis of the GI-1 well are shown in Fig. 3.

Based on qualitative analysis, the GI-1 well has a cross-over in the log RHOB and log NPHI response at a depth of 835.30—864.41 m which has a thickness of 29.11 m. The area has a low gamma ray value between 27—47 API, as well as a high resistivity log value ranging from 60 to 400 Ohm·m, which is interpreted as a gas reservoir. This is supported by the quantitative analysis of the GI-1 well which has $S_w$ values ranging from 9 to 36 %, and from the interpretation results the area is a potential gas reservoir.

As for the GI-2 well, the reservoir target area is located at a depth of 704.39—854.66 m. The qualitative analysis results show that the gamma ray log value is low between 17—44 API, with a cross-over in the density log RHOB and log NPHI, as well as a high resistivity log value ranging from 62 to 2000 Ohm·m, which is interpreted as a gas reservoir. This is supported by the quantitative analysis results of the GI-2 well. It has $S_w$ ranging from 5.7 to 26 %, so that the interpretation of the area is a gas reservoir. The results of the qualitative and quantitative analysis of the GI-2 well are shown in Fig. 4.

In well GI-3, the reservoir target area is located at a depth of 719.63—827.33 m. The qualitative analysis results show that the gamma ray log value is low between 13 and 32 API, with a cross-over in the density log RHOB and log NPHI, as well as high resistivity log values ranging from 60 to 2000 Ohm·m, which is interpreted as a gas reservoir. This is supported by the quantitative analysis results of the GI-3 well target area: $S_w$ is between 8.3 and 24.6 %, so the area has potential as a gas reservoir. The qualitative and quantitative analysis results of the GI-3 well are shown in Fig. 5.

Furthermore, for the GI-4 well, the reservoir target area is located at a depth of 709.45—809.86 m with a thickness of 100.28 m. The qualitative analysis results show that the gamma ray log value is low, 16—32 API, with a cross-over in the density log RHOB and log NPHI, as well as a high resistivity log value ranging from 64 to 2000 Ohm·m, which is in-

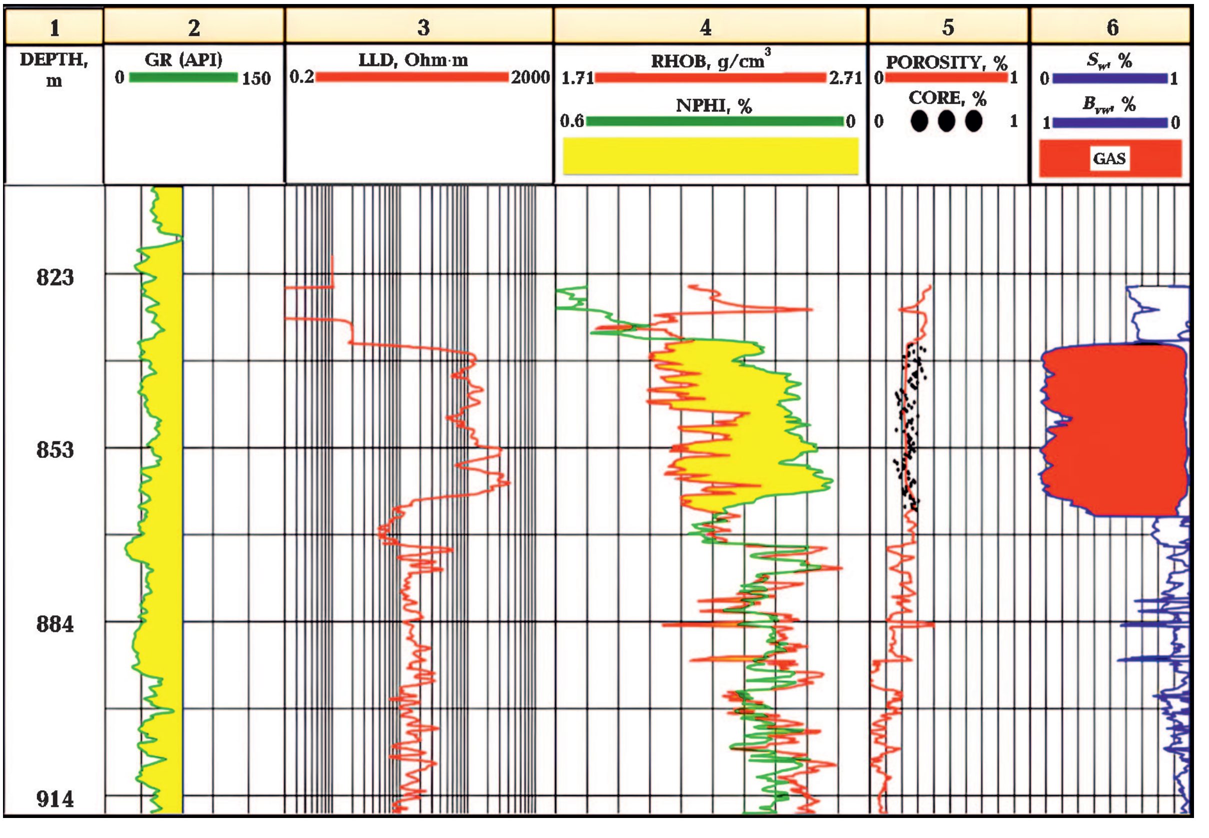


Fig. 3. Qualitative and quantitative analyses of the prospect zone of the GI-1 reservoir.

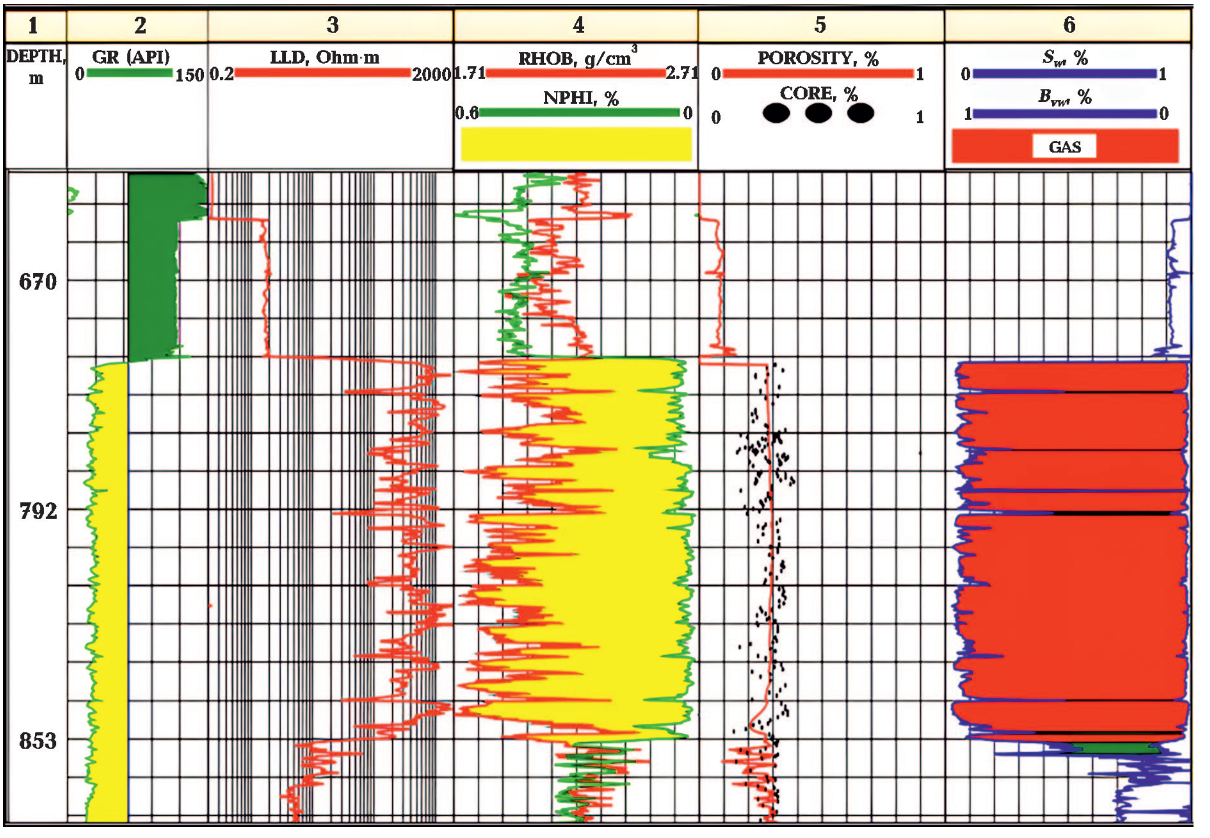


Fig. 4. Qualitative and quantitative analyses of the GI-2 reservoir prospect zone.

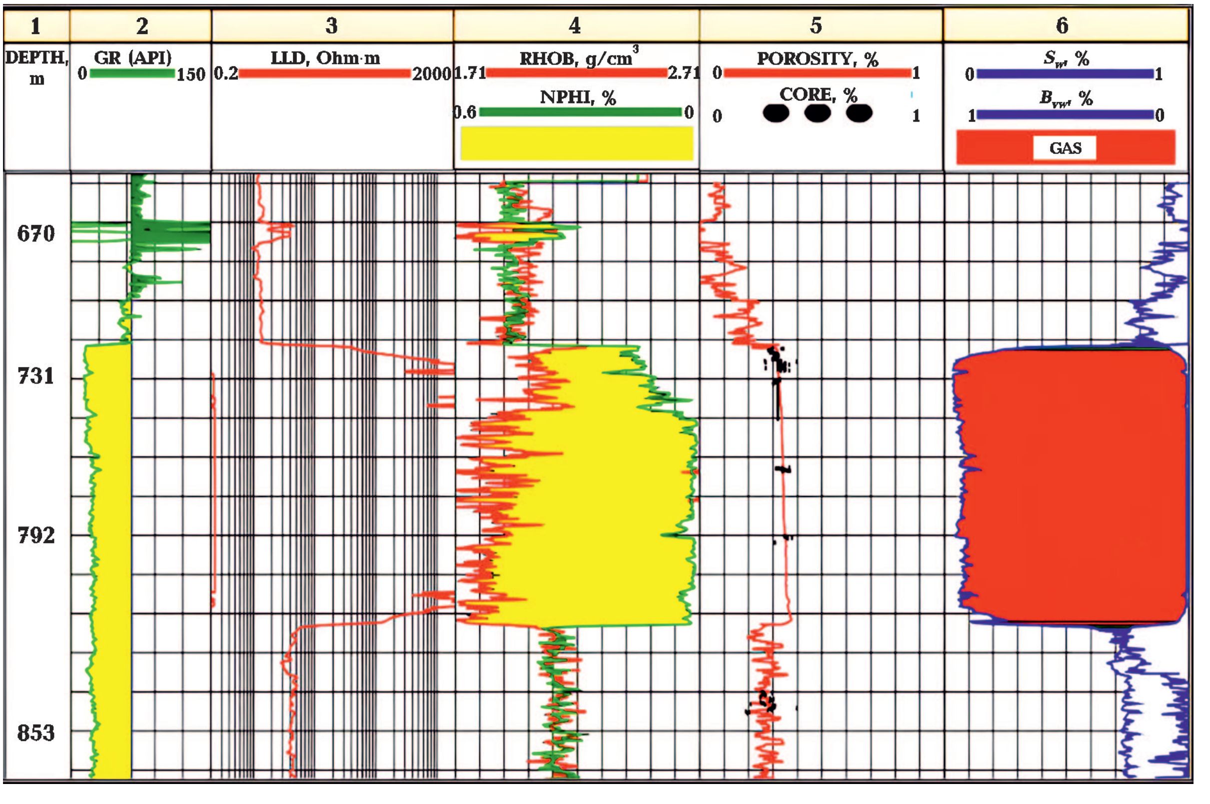


Fig. 5. Qualitative and quantitative analyses of the GI-3 reservoir prospect zone.

terpreted as a gas reservoir. This is supported by the results of the quantitative analysis of the target area of well GI-4 which has $S_w$ values ranging from 10.7 to 30.15 %, marking it a gas reservoir prospect. The results of the qualitative and quantitative analyses of the GI-4 well are shown in Fig. 6.

***Reservoir Zone Correlation.*** Reservoir zone correlation is a correlation between one well and another well based on the reservoir target zone. Before conducting correlation between wells, it is necessary to conduct a well section of the four research wells first. Well section aims to get the correlation results of the four research wells based on the closest coordinate point between each well to each other, so that the distance between the wells can be known. Based on the results of this well section process, it will produce the sequence of the location of the closest well points starting with the GI-2, GI-1, GI-4, and GI-3 well points, which are shown in Fig. 7.

The research area is 15.34 km$^2$, and there are research well points that intersect with the polygon line. The next step is to correlate the reservoir prospect zone with the well top data from each well. Well top data is reservoir prospect data from each well resulting from qualitative analysis. The reservoir prospect zone correlation process will produce horizons in the form of lower horizons and upper horizons in each well that produce reservoir layers that are correlated with each other. Based on the results of the prospect zone correlation of the four research wells, the reservoir prospect areas are correlated with each other. The correlation results are shown in Fig. 8.

***3D Modeling and Bulk Volume of Gas Reservoir Zone.*** 3D modeling in this study is a modeling of the layer indicated as a gas reservoir layer. 3D modeling is used to display the body sand or the body of the hydrocarbon reservoir so that the bulk volume of the reservoir can be calculated and the thickness

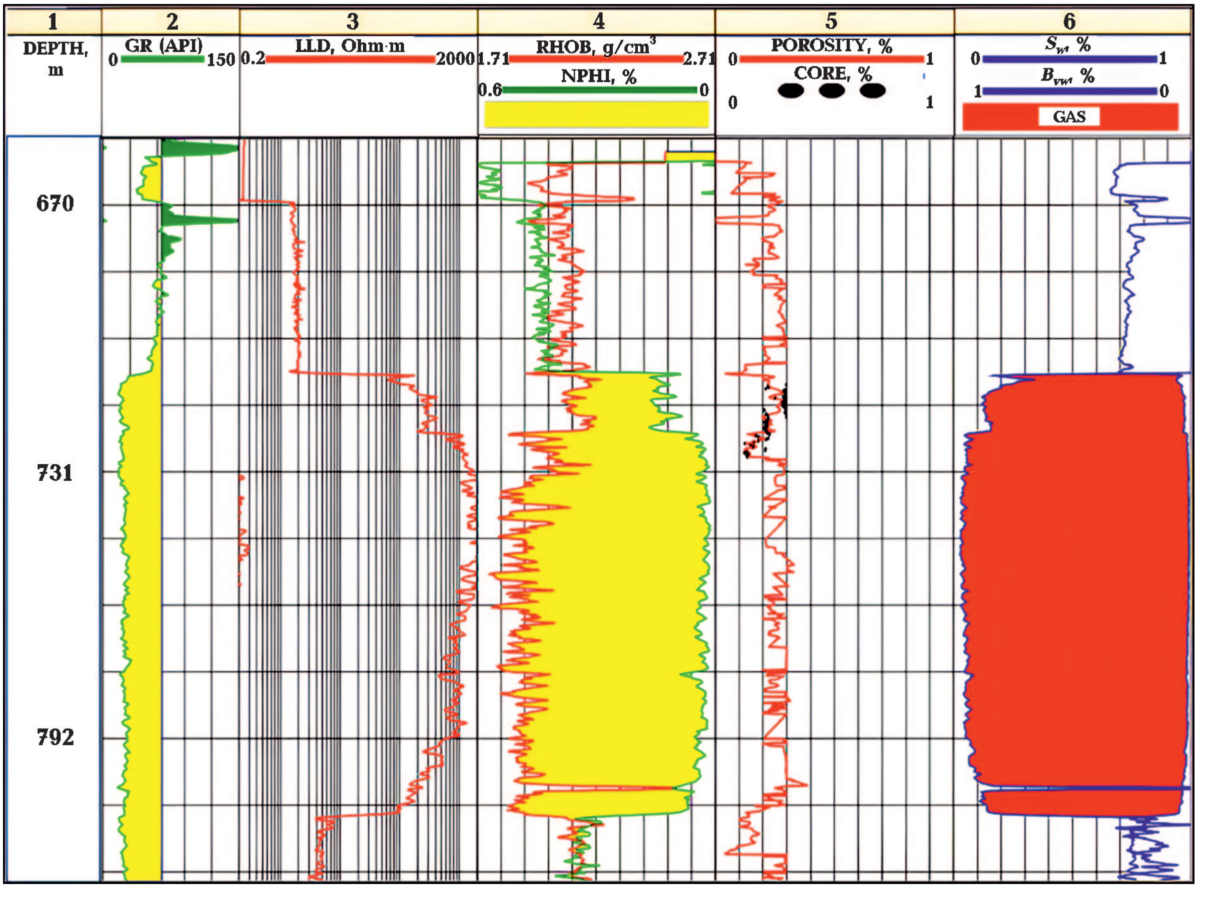


Fig. 6. Qualitative and quantitative analyses of GI-4 reservoir prospect zone.

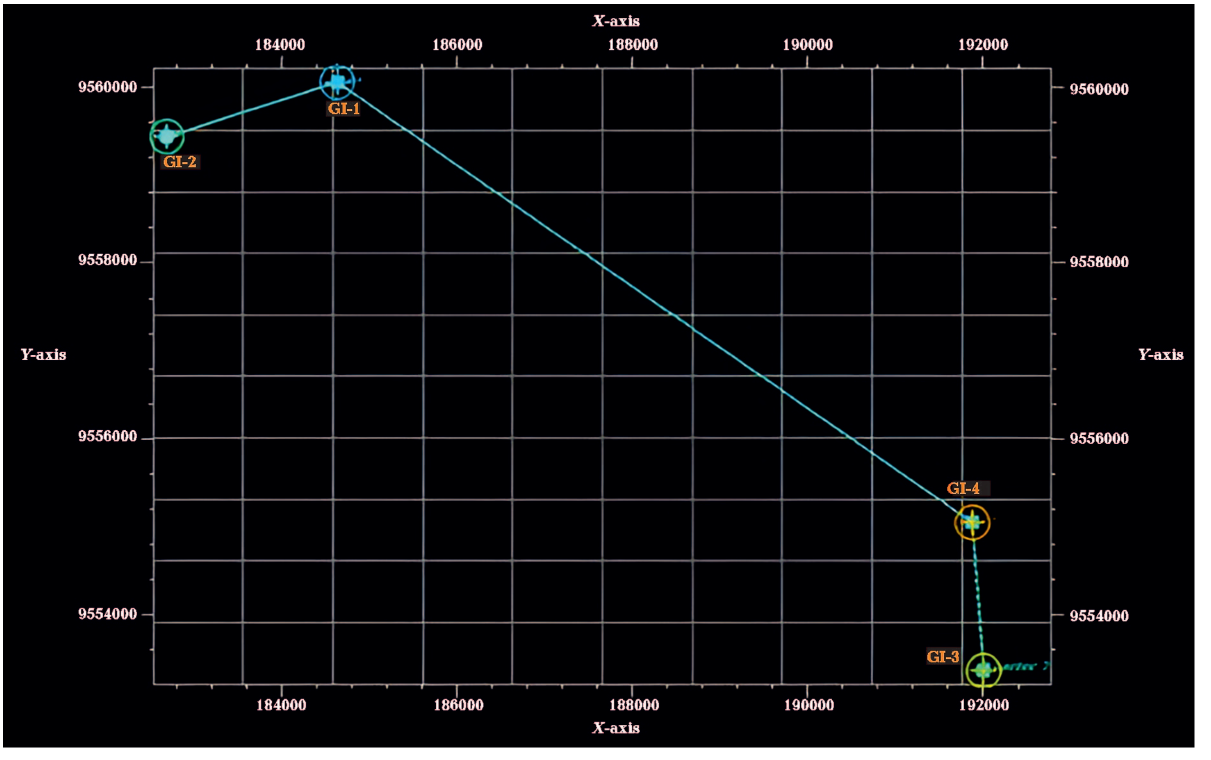


Fig. 7. The sequence of the nearest well point locations starts with well points GI-2, GI-1, GI-4, and GI-3.

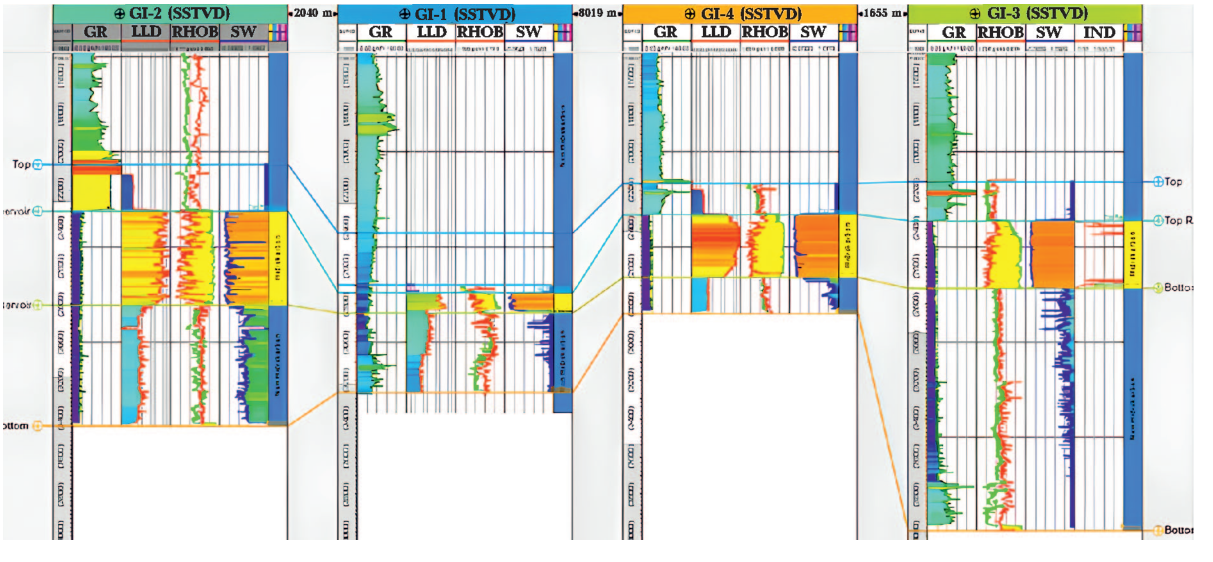


Fig. 8. Correlation of prospect zones of wells GI-1, GI-2, GI-3 and GI-4.

of the reservoir can be determined. Reservoir bulk volume is a description of the volume or container in which a reservoir is located.

Analysis of the bulk volume of the hydrocarbon-bearing sand body focuses on evaluating the physical properties required for hydrocarbon reserve calculations. From this 3D modeling, the bulk volume value of a reservoir can be generated. The 3D modeling of the gas reservoir layer can be shown in Fig. 9.

The thickness of the reservoir layer is a factor that affects the bulk volume of hydrocarbon reservoirs, so from the 3D modeling it can be seen that the GI-2 well has the largest thickness compared to other wells. From the 3D modeling, the bulk volume value of the gas

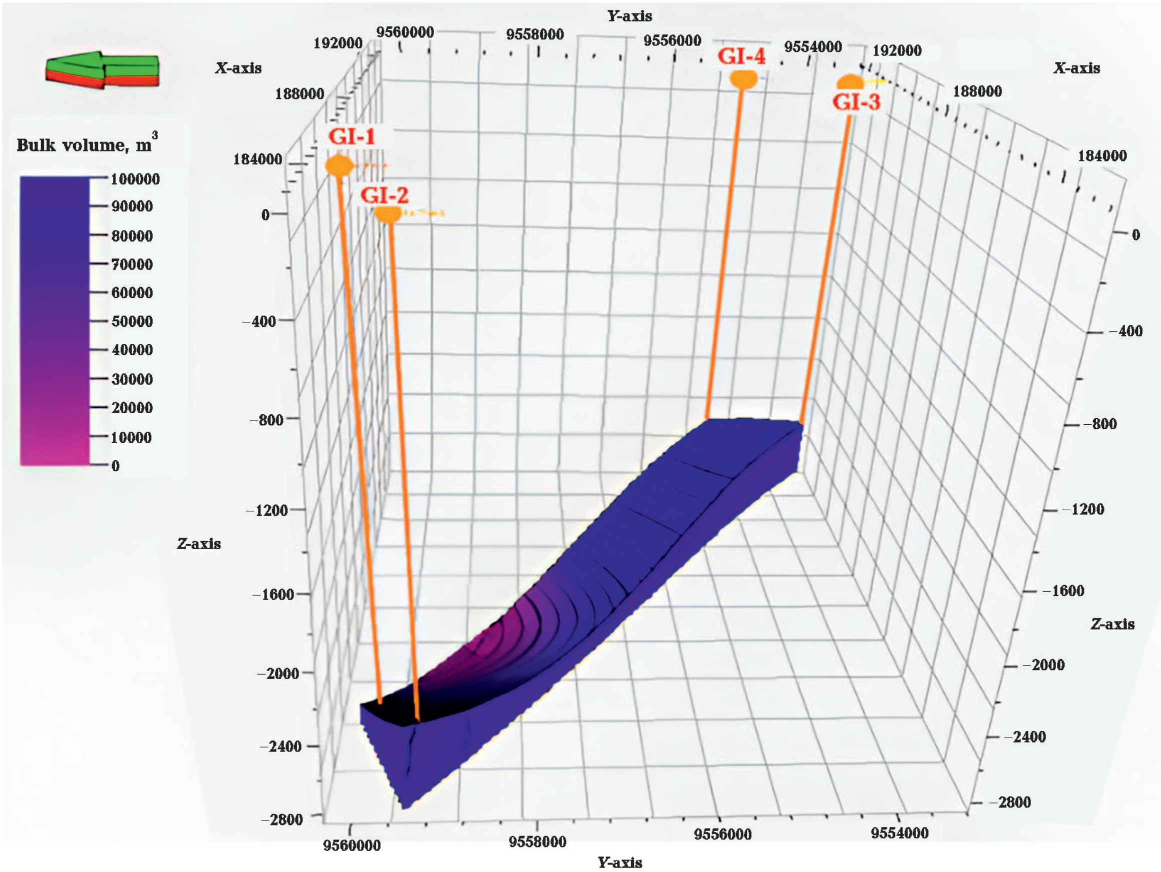


Fig. 9. 3D modeling of the reservoir, from the west.

reservoir prospect zone is 2,679,641,120 m$^3$. Based on the rock physical parameters, it can be seen that the reservoir prospect zone has an average porosity of around 19 % which is classified as good porosity [Koesoemadinata, 1978]. There is a value $S_w$ in the reservoir prospect zone, which is around 21 %, which is identified as containing gas type fluids [Adim, 1993; Irawan, Utama 2009].

Following 3D modeling and the determination of bulk volume, the total hydrocarbon volume within the gas reservoir zone of the study area was estimated. This estimation incorporates petrophysical parameters obtained from the analysis, including porosity and water saturation. The equation for calculating gas volume is shown in equation 7 [Schon, 1995].

Formation gas volume factor is the ratio of gas volume under reservoir conditions (high pressure and temperature) to the volume of gas under standard conditions. The well pressures and temperatures in the study area are very high. Pressures in wells GI-1 to GI-4 ranged from $1.5858\cdot10^7$ to $1.8961\cdot10^7$ Pa, while temperatures ranged from 318.15 to 334.817 K.

Thus, the gas volume calculation is as follows.

Known $V_{\text{bulk reservoir}}$ — 2, 679, 641, 120 m$^3$, $\varphi$ — 0.19, $S_w$=0.21. Solution: $V_{gas}$=$4.46\cdot10^8$ m$^3$.

From this calculation, the total gas volume in the reservoir layer of the G field in the East Sengkang Basin, South Sulawesi, is approximately $4.46\cdot10^8$ m$^3$. The gas volume in all fields within the Sengkang Basin block reaches approximately $226.5\cdot10^8$ m$^3$ [ESDM, 2018]. Based on these results, the estimated gas volume in the study area can be considered realistic.

This research was conducted because there are several wells and areas that have not been included in the calculation of the total gas volume value in all fields in the Sengkang Basin block. There are four wells that are close together, so the total gas volume value in the area can be determined using the seismic method without having to use seismic data. This study offers several advantages, including the ability to estimate total gas volume in a cost-effective manner and to provide gas volume information derived from four wells situated within the reservoir zone of the G field, East Sengkang Basin, South Sulawesi; third, it provides important insights into the development of energy resources in this region, and becomes a reference for the oil and gas industry in evaluating gas potential in Indonesia.

**Conclusion.** The petrophysical analysis of the G field in the East Sengkang Basin, South Sulawesi, reveals that the investigated reservoir intervals exhibit favorable reservoir characteristics. The analyzed wells generally show low shale volume, moderate to good porosity, and relatively low water saturation values, indicating the presence of gas-bearing formations. The integration of well log interpretation successfully delineates potential gas reservoir zones and confirms the hydrocarbon prospectivity of the study area. Based on the volumetric estimation, the total gas resource in the G field is approximately $4.46{\cdot}10^8$ m$^3$. These findings highlight the importance of petrophysical evaluation in identifying reservoir quality and estimating hydrocarbon resources, providing a valuable basis for future exploration and development activities in the East Sengkang Basin.

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**Conflicts of interest.** The authors declare no conflict of interest; the work should be regarded as (food for thought) to be driven further by anyone who may find it useful.

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# Оцінювання об'єму газу на основі чотирьох свердловин у родовищі «G», басейн Східний Сенгканг, південь о. Сулавесі, Індонезія

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Дослідження на о. Сулавесі все ще дуже обмежені через складні тектонічні умови. Через відсутність буріння дані про підземні пласти недостатні, тому потрібні подальші дослідження. З огляду на це, у цій роботі автори намагалися оцінити об'єм газу в родовищі «G» на основі даних з чотирьох нафтогазових свердловин у басейні Східний Сенгканг, південь о. Сулавесі. Всі свердловини (GI-1, GI-2, GI-3 та GI-4) розташовані близько одна до одної, що дало змогу точно оцінити об'єм. Мета дослідження: по-перше, визначити глибину зони газового пласта (якісно-кількісний аналіз); по-друге, визначити загальний об'єм газу в зоні пласта. Оцінювання об'єму газу використовує методи каротажу свердловин для отримання даних про підземні пласти, зокрема вуглеводневого потенціалу. Загальний обсяг пласта-колектора є обсягом його 3D моделі, який залежить від потужності колектора. Визначення об'єму пласта використовується для оцінювання об'єму газових вуглеводнів. 3D моделювання є важливим методом у нафтогазовій промисловості для розуміння характеристик підземних пластів. Очікується, що результати цього дослідження нададуть важливе розуміння розробки енергетичних ресурсів і слугуватимуть орієнтиром для нафтогазової промисловості при оцінюванні потенціалу газових вуглеводнів. Результати дослідження показали значення водонасичення нижче 30 % та питомий опір вище 60 Ом·м, що вказує на наявність газу. Крім того, загальний об'єм газу становив $4{,}46\cdot10^8$ м$^3$, що вказує на значний потенціал у перспективній зоні пласта. Газовий потенціал у всьому блоці родовища басейну Сенгканг досяг $226{,}5\cdot10^8$ м$^3$, тоді як розрахований об'єм газу в досліджуваній зоні становив $4{,}46\cdot10^8$ м$^3$. З огляду на розрахунки, об'єми газу в досліджуваній зоні є цілком реалістичними.

**Ключові слова:** газовий пласт, каротаж, якісна та кількісна інтерпретація, рівняння Арчі, 3D моделювання пласта, загальний об'єм вуглеводнів.