Integrated of Sequences Seismic Stratigraphy, Accoustic Impedance Invertion, and Petrophysical for Resources Exploration in Offshore Southern Arjuna Northwest Java Basin, Indonesia

M S Indah1,2*, Abdul Haris2 and M Natsir1
1Staff Geologist of PT.Pertamina Persero,
2Magister Geophysic Reservoir of UI

*Corresponding author: mill.indah@pertamina.com

Abstract. This thesis discusses the uses of the integration of the Stratigraphic Seismic Sequence method, AI Inversion, Petrophysical Evaluation for Exploration Resource Analysis in more detail and more accurately which will produce information on contingent structures ranging from Play concepts, petroleum systems, and properties from reservoir characteristics, to prospect mapping, and evaluation of the risk of exploration findings. Understanding of seismic internal characteristics helps draw stratigraphic sequential seismic markers in seismic cross sections. The Seismic AI invasion will help in the determination of the spread of lithofasies, porosity, fluid in seismic sections. Distribution Map of AI Inversion of Structure Overlays The depth of the interval TST 2 provides trap area parameters for Sand DST 4 located on the Tidal System. Petrophysics will help provide porosity properties, netpay thickness, formation water saturation. The use of this integration method will prove if the evaluation of subsurface data is assessed by Integration of Seismic and Geophysical Methods (Seismic Inversion, Seismic Attribute Analysis, Seismic Stratigraphy Analysis) and Wells Data (DST test data, Fossil Index Catalog, and mud log well) very helpful for evaluating the Half Graben Exploration Resources in an integrated manner.

1. Introduction

The Arjuna Basin is one of the mature backarc hydrocarbon basins [1]. The Arjuna Basin is still able to produce and still has oil and gas resources that cannot be mapped properly [2]. In terms of regional geological evaluation, the existence of reservoirs in many cases of mature fields that are still "new play hidden potential" [3]. Play structural are in the inner zone and are high risk and generally hydrocarbon fluid types based on the geochemical analysis of oil window modeling and gas window basins [4]. Fluida testing of possible like PVT or DST test results more to the type of gas fluid in the form of wet gas, dry gas, or condensate [5]. This has made it difficult to develop the structure of exploration findings in the mature basin offshore [6]. Production pipeline facility being issue economically and commercially are in large amounts of investment to produce exploration resources in deep target exploration zones if they are not found in large quantities [7].
2. Subsurface Data and Methods

The purpose and objectives of this study were compiled as one of the requirements to attend a Thesis session at the Master of Geophysics Reservoir Program at the University of Indonesia. The objectives of this study are: Knowing the Reservoir Deposition Sequence in the research area. Interpreting the prospect sequence intervals using analysis results from DST, AI Distribution, and Petrophysics. Determination of Oil and Gas Resource Prospect area based on overlaying AI Inversion Distribution Map with Depth Structure Map, then validated with Porosity Distribution Map using reference well data.

2.1. Subsurface Data

In this research, available subsurface data includes: 1) a total of 2 well data include GR Log, Resistivity Log, Neutron Log, Density Log, Sonic Log, Mud Log, Well Report, 2) A total of 3 Interval Section Data Cores, 3) 3D Seismic Post Stack Data, 4) Report Data Fossil Catalog Regional Marker Index, 5) DST Test Reports, SWC & Core Plug Test Reports, 6) Check Shoot data for 2 wells, 7) Application of Petrel, HRS, MMRA, Techlog, Jason

2.2. Methods

Case of the problems in this study are as follows: What is the Integration of the Stratigraphic Seismic Sequence Method, AI Inversion, Petrophysical Evaluation can help the Analysis of Exploration Resources in Half Graben. What is the condition of the element elements of the petroleum system in this X Sub Basin in the Exploration Risk Analysis. Which Sequence interval can still be developed well as the discovery of the target reservoir on Wells X and Y. The stratigraphic sequence correlation in the X-Y well shows that the SB 1 marker is onlapping on the base so it does not reach the Y well. The target reservoir is very far from the seismic resolution range of 32 meters because the gross thickness of the body reservoir is in the range of 8-10 meters because it is a product of the tidal system. The research focus is in the third sequence limited by the boundary sequence SB 2 SB 3. The sequential system used shows. Transgressions and regression conditions so as to produce 4 cycles of sequences here. How is the Lateral Distribution of AI and Reservoir Porosity target at the sequence interval. How much exploration resources can be obtained at the Sequence interval (Figure 1).

Figure 1. Block Diagram of Research Stages
3. Result and Discussion

By using the seismic cosine of phase attribute we can see the upper and lower limits and the internal character of the seismic cross section. Using the ABC formula we will easily find regional boundary sequential markers. Suppose zero Boundary is a regional marker where the response of reflector seismic shows the condition towards the base of the bedrock the upper limit of the toplap and the lower limit of onlap and internal seismic character in the form of humoky. The section towards basinward shows the concordan upper border then under the downlap with the Humocky internal character (Figure 1).

Figure 1. Upper, Lower Boundary, and Internal Character in evaluating seismic sequence facies

Seismic has limited vertical resolution, which is a seismic ability to be able to separate two objects. By using the average velocity of the well data at an interval of 1800 ms as a marker of SB3 to 2200 ms as a marker SB0, it can be calculated how much a quarter wavelength of lamda if using a seismic frequency as high as 18 hz the result is 32 meters. Integration Seismic data and well data in the form of log data and catalog of fossil indices show good results so that these regional markers can be used throughout this half graben because they have undergone an integrase process very good data. From the AI and PHI distribution section, the results are the same so that it can be used well in the evaluation of
graben in the southern arjuna with a very good distribution of low sand AI. Fault separates the potential of the facies distribution by varying lithology, fluid, porosity (Figure 2).

The distribution map of AI and Map of PHI has been overlapped with Depth Maps Structure which is the result of the distribution of the AI low sand sand reservoir prospect areas in which the exploration strata are combined so that the findings of this stratigraphic trapping find it easier to develop the field with the addition of a second exploration well located within the probability prospect of 10, 50, 90 (Figure 3).

![Figure 3. Overlay Map of AI-PHIE with Map of Depth Structure](image)

**Figure 3. Overlay Map of AI-PHIE with Map of Depth Structure**

![Figure 4. Calculation of exploration reserves](image)

**Figure 4. Calculation of exploration reserves**

Calculation of proven oil DST 4 sand resources is calculated as a contingent exploration structure where using the MMRA application shows the calculation results of 10 percent probability of 6.44
MMBO. The lateral distribution of the body of the tidal sandstone reservoir system. It can be seen well along the cross section of the AI (Figure 4).

Lithology can be separated using crossplots between AI curves vs. PHIE vs. RHOB. Objective Reservoir Well X produces AI 9500–10000 m/s * g/cc with a PHIE value of 0.08–0.2 v/v from the evaluation of Crossplot AI vs. PHIE vs GR at the TST interval. 2. Evaluation of Crossplot AI vs. RHOB at the interval TST 2 will produce condition of lithology picture as objective Reservoir Well X shows AI 8000–10000 m/s * g/cc, RHOB Sand 2.35–2.65 g/cc, RHOB Coal 1.45–2.35 g/cc can be seen in figure 11. From the assessment of the system's petroleum elements, POS / Pg will be calculated by multiplying all the values of the system's petroleum element. By using the MMRA application, it is known that the risk is at a moderate level and the uncertainty is in the form of closure and migration (Figure 5).

**Figure 5.** Analysis of risk and uncertainty

4. Conclusion
Sequencing method of seismic stratigraphy, AI Inversion, Petrophysical Evaluation, is very appropriate in mapping the thin layer reservoir under vertical seismic tuning. Exploration resources were found but had medium risks and uncertainties in closure and migration.

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