CHAPTER V

DISCUSSION AND CONCLUSIONS

The previous chapter illustrates the application of for reconstruction of the lithofacies from geophysical log data. The procedure of the application is verified using two data sets, including well with known lithofacies and well with unknown lithofacies. The results of hypothesis testing show that this application are adequate to detect lithofacies using geophysical logs. Four steps are eventually established for routine work Gamma ray log shapes have to be firstly recognized to decide boundaries of individual sequences. Then, gamma ray log values are employed in subdividing all the lithofacies into 3 groups, including sandstone lithofacies (<90 API), claystone (>100 API) and other lithofacies (90-100 API). The last group is characterized by combination of sandstone and claystone lithofacies or shell coquina lithofacies. Next step, key bed is selected based on absolute geophysical log values as summarized in Table 4.2. Finally, vertical relationship is subsequently constructed in comparison with lithofacies diagrams (Figures 4.8 and 4.9).

Relationships between core geophysical log and lithofacies of the Lan Krabu Formation is mostly satisfactory. However, it is critical to note that the bed thickness and organic materials affect the lithofacies interpretation. Regarding the hypothesis testing, the majority of lithofacies, namely S1, S2, CS, C1, C2 and C3 present the clear relationship between each lithofacies and geophysical logs. On the other hand, the minority of lithofacies notably S3, S4, SC and P cannot be recognized from geophysical log. These minor lithofacies have thickness between 0.20 to 1.00 meters which clearly reveals that thin-beded lithofacies cannot be predicted using geophysical log characteristics. The limitation would be due to detail of geophysical log record. Normally, geophysical log is recorded every 15 centimeters interval which is not always detected at the center of each bed. Consequently, the geophysical log values of thin bed may be interfered by the neighboring lithofacies beds. Furthermore, the well LKU-E17 with known lithofacies, illustrates conclusively that organic materials critically affect the geophysical log record. This effect is pronounced particularly in thin sandstone bed which has average bed with thickness of about 30 centimeters. Gamma ray log values of thin-beded sandstone bearing organic material are higher than those of ordinary sandstone. Therefore, it may be concluded at this stage that the procedure constructed in this study is suitable for quick prediction of the lithofacies by using geophysical log, however missing of thin lithofacies and misleading of organic sandstone would be taken into account.

Coll et al.(1999) studied integration of core and log information to improve the representation of small- and medium-scale heterogeneity. They investigated core and log information and consequently created a facies and electrofacies database. Small-scale geological facies are calibrated with logs and used to generate electrofacies using statistical analysis. Data were computerized and then eletrofacies modeling was constructed. This methodology is, however, cannot assist in the determination of standard facies modeling with complex combinations of small-scale sedimentary structures within small depth interval. However, high-resolution log is recommended for calibration before detecting those small-scale heterogeneities. Although, Coll et. al. (1999) produced such good tool for interpreting eletrofacies, they still insisted that this methodology cannot substitute core lithofaices. In this study, normal resolution of log was employed which cannot resolve the similar problem.

Currently, advanced computer models are available for description and interpretation of complex reservoir, such as Artificial Neural Network (ANN). ANN is a well known technique used for lithofacies interpretation as well as many disciplines. The computing scheme is designed as models of the brain processing information as the result of excitation of simple neurons, which are richly interconnected on a massive scale. White et al. (1995) applied ANN for zone identification in a complex reservoir; Granny Creek Field. The objective of their study is to investigate the feasibility of using ANN a tool for zone recognition and identification in a heterogenous reservoir utilizing geophysical logs. Several artificial neural networks were successfully designed and developed for the study. They finally concluded that it is feasible to utilize ANN for zone identification in heterogeneous reservoirs. The developed networks can also predict depositional environment, lithofacies and stratigraphy. Although ANN is sufficient tool to predict accurate detail with high resolution of complex reservoir, experience and high investment for ANN must be concerned for utilizing the methodology.

This thesis research provides a simple methodology with low operation cost to identify lithofacies using common geophysical log data. It is a satisfactory tool; however, some details, particularly thin-beded lithofacies, may be invisible during the process. According to above previous works, higher resolution of log record as well as high-performance computing system would be engaged to improve the methodology proposed in this study. However higher investment and complex procedure have to be taken into consideration as compared with additional information obtained.

Finally it can be concluded that

(1) Relationship between core lithofacies and geophysical logs in the Lan Krabu Formation provides good calibration to predict lithofacies in uncored wells.

(2) A simple methodology for quick predicting the lithofacies by using geophysical log consists of four significant steps: gamma ray log shape recognition.; geophysical log values consideration; key bed identification; vertical relationship investigation.

(3) Gamma ray is the most powerful to classify major groups of lithofacies.

(4) Density log, neutron log and sonic log are additional data to clarify key beds from constraint of gamma ray log.

(5) In addition, sonic log is a common tool to detect especially fluvialo-lacustrine claystone. Consequently, this log type provides good indicator to distinguish between floodplain claystone (lithofacies C1) and lacustrine claystone (lithofacies C3) in the Lan Krabu Formation.

(6) Thin bed layers, during process of identification including lithofacies S3, S4, SC and P, may be accidentally absent.

(7) The high-resolution log or high-performance computing system is recommended to identify and describe small-scale detail such as thin bed layers.