

# **Petroleum Elements Play Modeling Using Spatial Analysis**

By

Abdullah Sofiy Bin Mansor

Dissertation submitted in partial fulfillment of  
the requirements for the  
Bachelor of Engineering (Hons)  
(Civil Engineering)

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**CERTIFICATION OF APPROVAL**

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A project dissertation submitted to the  
Civil Engineering Programme  
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in partial fulfillment of the requirement for the  
BACHELOR OF ENGINEERING (Hons)  
(CIVIL ENGINEERING)

Approved by,

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(AP. Dr. Abdul Nasir Bin Matori)

UNIVERSITI TEKNOLOGI PETRONAS  
TRONOH, PERAK

September 2012

## **CERTIFICATION OF ORIGINALITY**

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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ABDULLAH SOFIY BIN MANSOR

## **ABSTRACT**

The objective of this project is to optimize the use of spatial analysis through GIS technology in oil and gas basin modeling. By using GIS technique, play analysis that involve petroleum elements such as source rock, reservoir rock, migration route, trap and seal can be done. The analysis resulted in the possible location that contains oil or gas. Currently, oil and gas companies are using specialized software to conduct basin modeling. This method eventhough efficient is very costly since the software users need to undergo specialized training in order to master the complicated software. The license of the software itself is expensive. On the other hand manual analysis is really tedious and time consuming. Therefore by maximizing the potential of GIS in oil and gas exploration, we may reduce the time and cost for play analysis without compromising the quality of the end result. The scope of this project covered the application of GIS technology in petroleum exploration for Malay basin. The project methodology involves the use of spatial analysis involving source rock, reservoir rock, migration route, maturation and seal to obtain the potential play of oil or gas.

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## **ABBREVIATIONS**

GIS: Geographic Information System  
ESRI: Environmental System Research Institute  
CAD: Computer Aided Design  
RDMS: Relational Database Management System  
DEM: Digital Elevated Model  
COS: Chance Of Success  
DSU: Drill Spacing Units  
PUG: Petroleum User Group  
PETRONAS: Petroleum Nasional Berhad  
DTM: Digital Terrain Model  
SRAK: South Rub al-Khali Company Limited  
STOM: Seismic Tapes and Optical Media  
STHCOIP: Standard Hydrocarbon Originally In Place  
NPV: Net Present Value  
IPR: Investment Profit Ratio  
FYP: Final Year Project



## **NOMENCLATURES**

Cartography: study and making maps.

Raster: graphical technique using arrays of pixel values.

Isopach: contour.

Lithology: physical characteristics of rock such as color, size, distribution and texture.

Paleoriver: inactive river or stream channel that has been either filled or buried by younger sediment.

Geomorphic: branch of geology that studies the characteristics and configuration and evolution of rocks and land forms.

Neogene: range time from 24 million years ago up to present time.

Thematic map: geographical map with specific theme.

## **CHAPTER 1: INTRODUCTION**

### **1.1 BACKGROUND OF STUDY**

#### **1.1.1 Petroleum System**

Petroleum word is a combination of two Latin's words which are petro means rock and oleum means oil. In term of chemical composition, petroleum contains mainly hydrogen and carbon with minor composition of nitrogen, oxygen and sulphur. Sulphur content is one of the ways to measure oil quality. The term "sweet" oil refer to a good quality oil with sulphur content less than 1% by weight, on the other hand "sour" oil is a less quality oil with sulphur content more than 1% by weight. Malaysian basin produced mainly sweet oil. Petroleum products have various forms which are oil, gas, condensate, heavy oil, tar sand and shale oil.

Petroleum system is a unifying system that consists of elements and processes that allowed a producing well to exist. The main elements are source rock, overburden rock, reservoir rock and seal rock. Source rock is the rock that produces petroleum and it's originated from algae, marine plankton, bacteria, fungi or terrestrial plant million years ago that are buried deep under the earth crust. As time goes, the depths of sediments on top of the source rock increase and its applied pressure to the source rock. When pressure increase, the temperature also increase. These sediments are called overburden rock. It allows the source rock to be matured and produce petroleum or hydrocarbon. Petroleum is expelled from the source rock into the reservoir rock. This fluid movement is called primary migration. Reservoir rock is a porous and permeable type of rock which petroleum can flow into it and migrate to a trap where the petroleum is accumulated. This migration from source rock area to the trap is called secondary migration. For a trap to exist, seal rock layer must be present in a continuous form on top of trap in order to confine the accumulated petroleum. Figure 1 below shows a simple shape of petroleum system. In the real world, the petroleum systems are much complicated due to many geologic factors like rift, fault and fold due to plate tectonic movement.

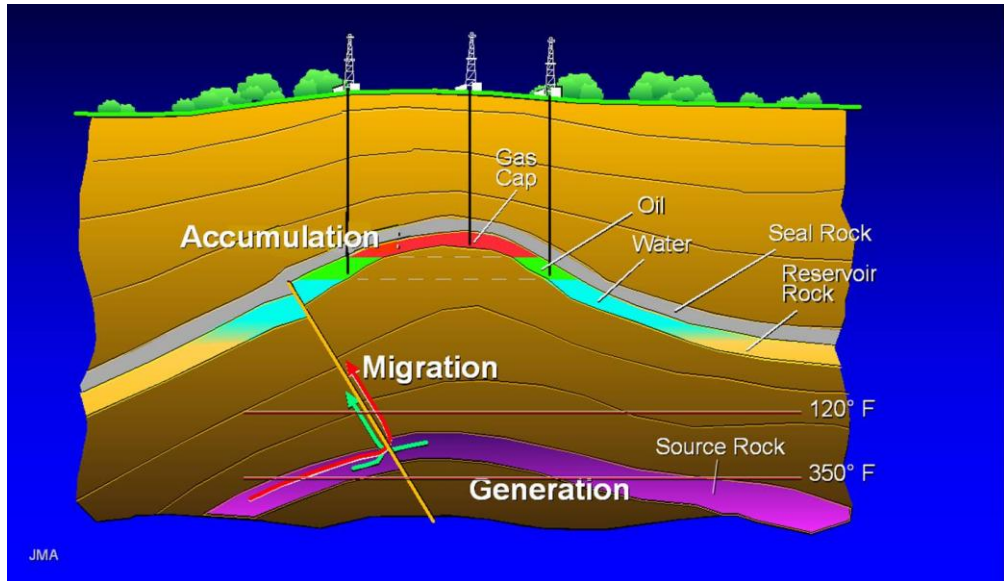


Figure 1: Petroleum system (from <http://petroleumsupport.com/reservoir-system-to-accumulate-hydrocarbon/petroleum-system/>)

### 1.1.2 Geographic Information System(GIS)

According to Environmental System Research Institute(ESRI) official website, GIS is a system that combine three basic elements in order to operate which are hardware, software and data. This elements when integrate together can allow user to capture, manage, analyze and display various form of geographically reference information. It allowed user to see the relationships, patterns and trends of the information in form of maps, globes, reports or chart. As a whole, GIS provide a range of functionality comprising computer aided design(CAD), cartography(study and making maps), relational database management system(RDMS) and image processing.

The term “spatial analysis” is really synonym with GIS. According to Wikipedia, spatial analysis or spatial statistics include any of the formal techniques which study entities using their topological, geometric or geographic properties. Topology basically concern about the preserved characteristic of the continuously deformed object. Geometry mainly concern about shape and size of an object. On the other hand geography concern about the land and earth’s phenomena. Spatial analysis involves network analysis, geometric analysis, raster(graphical technique using arrays of pixel values) analysis, interface modeling, cartographic output and visualization.

### 1.1.3 GIS Contribution to Oil and Gas Exploration

According to Exprodat, exploration process can be divided into 4 stages as follow:

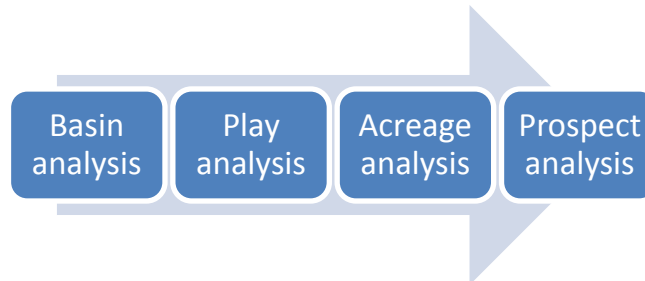


Figure 2: Stages of exploration process.

In basin analysis, GIS is basically used as a screening tool before more specialized software is deployed. Basin or sedimentary basin is where sediments are deposited under the earth crust. This analysis using data such as regional, structure, faults, gross depositional environment, hydrocarbon seeps, gravity and magnetic. The result can be in form of various exploration statistics such as creaming curves(Figure 3), field size distributions and yet-to-find analysis. Using the tool originally design for hydrological mapping, GIS also can be use to map the sub surface secondary migration. This map applied raster analysis to identify the drainage networks and basins using digital elevated model(DEM).

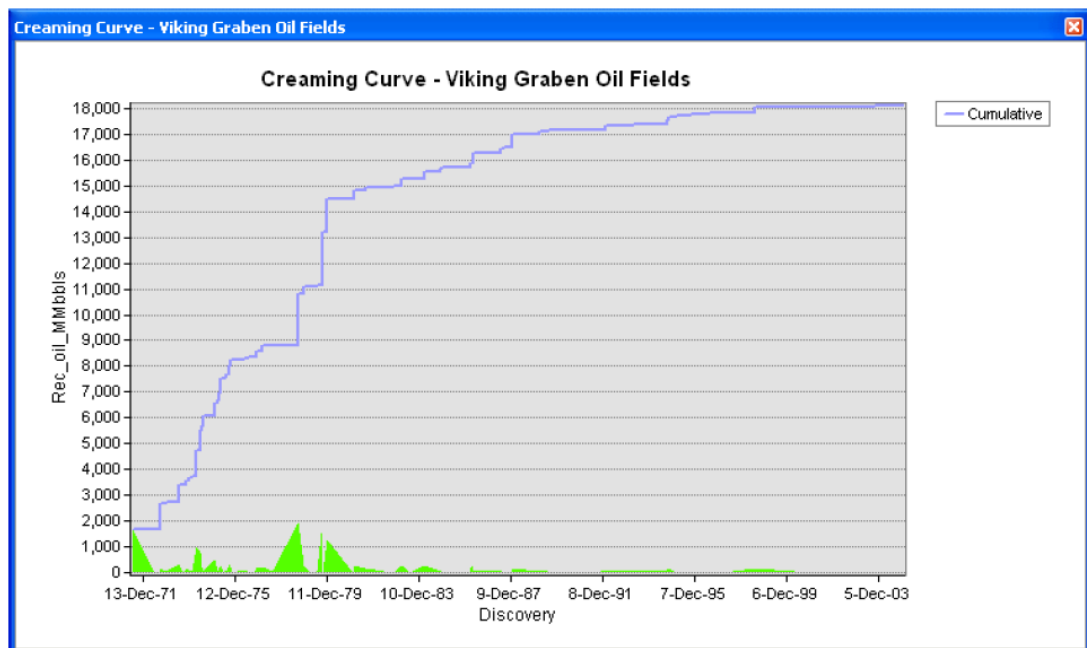


Figure 3: Creaming curve-Viking Graben oil fields(from Why use GIS in Petroleum, by Exprodat, ebook version 1.0(May2012)page 18)

The second stage of petroleum exploration is play analysis. Play involves elements of petroleum system like source rock, reservoir rock, migration route, trap and seal rock. GIS allow the user to map his or her area of interest and combine it with specific attribute like well location, well depth and the presence of petroleum system's elements. Once this is achieved, geologist can assign chance of success(COS) to each petroleum system's element and perform the required mathematical calculation. Figure 4 below shows an example of risk segment analysis. Green color indicate that the area have high COS, amber color is use to show that one or more petroleum system's elements are risky or uncertain. Red color represent the absent of this elements.

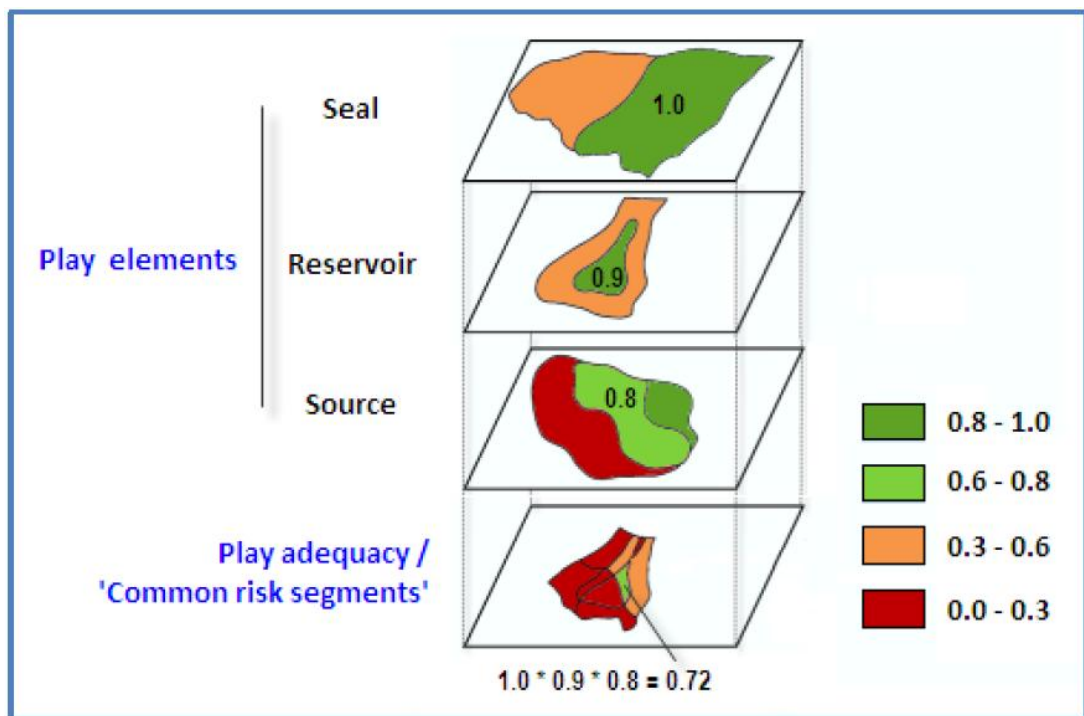


Figure 4: Risk segment analysis(from Why use GIS in Petroleum, by Exprodat, ebook version 1.0(May2012)page 20)

The next stage of petroleum exploration after basin analysis is acreage analysis. Acreage deals with area management of petroleum field. Different field have different potential. Using GIS the acreage owner can quantitatively rank the opportunities and evaluate it in term of license of lease blocks. Multi disciplinary asset data like geology, environment, economy and infrastructure can be integrated in one map and specific weighting can be done. The results allow the field owner to prioritize the opportunities. Figure 5 shows an example of acreage analysis using GIS.

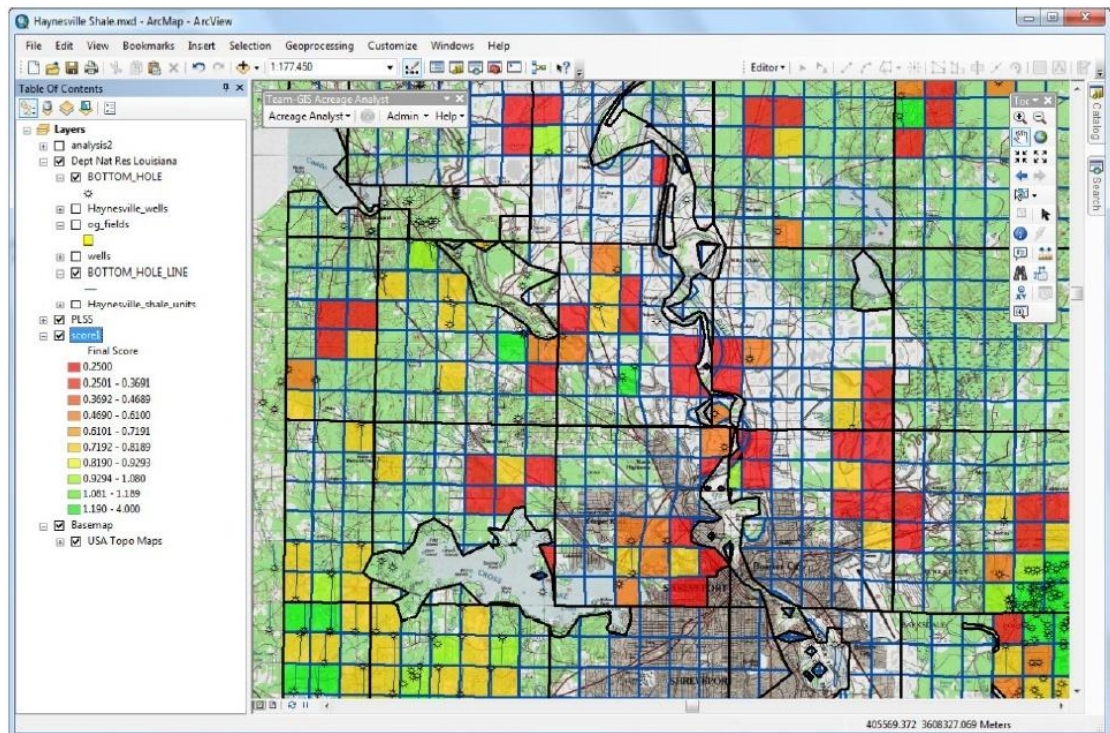


Figure 5: Acreage analysis using GIS(from Why use GIS in Petroleum, by Exprodat, ebook version 1.0(May2012)page 21)

The final stage in petroleum exploration is prospect analysis. Prospect is a play that had been confirm the presence of hydrocarbon. This time, the objective is to know the amount of reserve hydrocarbon inside the trap. Does the amount of hydrocarbon is economical or not to proceed with the production stage? This technique can be applied to both conventional and unconventional hydrocarbon plays. In conventional hydrocarbon plays where petroleum reservoirs can be identified and mapped, GIS enable the user to applied raster-based analysis to calculate the volume between two gridded surfaces or between single gridded surfaces with different depth level. The resulting volume can be multiplied by other volumetric factors such as recovery efficiency, net to gross, porosity or oil



saturation. For unconventional hydrocarbon plays such as shale gas, shale oil or coal bed methane it is possible to use GIS to estimate the reserved based on preliminary drilling result using the common drill spacing unit(DSU) grid based reserve classification technique as shown in Figure 6 below.

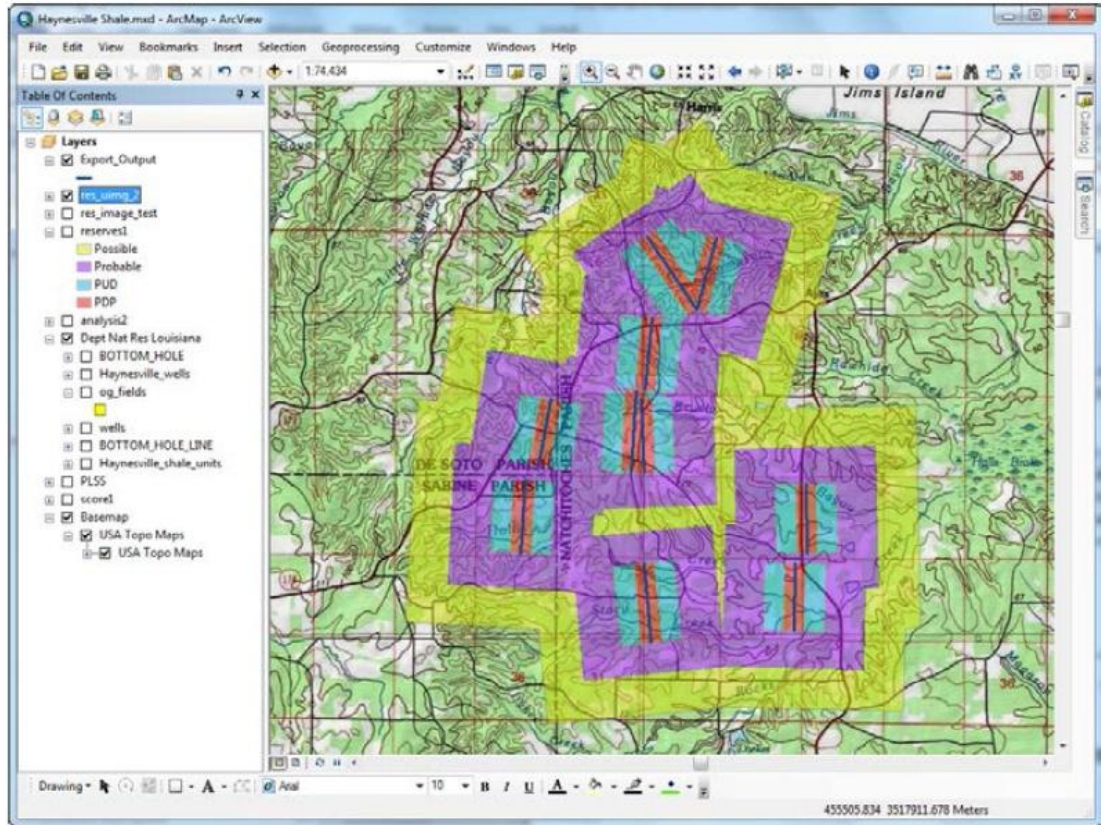


Figure 6: Common drill spacing unit(DSU) grid based reserve classification technique(from Why use GIS in Petroleum, by Exprodat, ebook version 1.0(May2012)page 23)

## 1.2 PROBLEM STATEMENT

**Problem identification:** Petroleum companies are using specialized software to conduct play analysis. It is too complicated, time consuming and required significance amount of training in order to use the software efficiently. Besides, the software itself is quite expensive. Manual method of analysis is tedious and also time consuming.

**Significance of the project:** To maximize the utilization of GIS capability in petroleum exploration in order to obtain the potential play that contain oil or gas and at the same time reduce cost and time without compromising the quality and liability of the result's gained.

### 1.3 OBJECTIVES

- To enhance petroleum play modeling using spatial analysis through GIS.
- Identify the area of possibility containing oil and gas using GIS software.

### 1.4 SCOPE OF STUDY

This study covered the application of GIS in petroleum exploration of Malay basin at second stage of oil and gas exploration which is play analysis.



## CHAPTER 2: LITERATURE REVIEW AND THEORY

According to Jepps(2012), GIS was developed from the rise of computer mapping technology in the 1960s. By 1990s, the use of GIS in petroleum industry had rise and many large multinationals company with CAD-based systems migrate to GIS. The first Esri Petroleum User Group(PUG) led by oil companies such as Exxon and Shell met in the early 1990s. By late 1990s, oil and gas service companies such as Landmark and Schlumberger begin to include GIS technology in their business.

Since that, GIS had brought many contributions to the petroleum industry especially in exploration stage. Ghazi(2008) in his presentation mention about using GIS in several basins in offshore Peru. He also says that GIS has the capability to construct play maps from conventional structure and isopach or contour map. Then it was use to estimate ranges in the number and size of potential petroleum accumulation in these plays.

Abdul Latif and Kahar(2008) mention that Petroleum Nasional Berhad(PETRONAS) had utilized GIS in planning stage for its oil and gas exploration project in Ethiopia. Integrated geological maps had been developed using various data types such as topographical map, digital elevation model(DEM), lithology, strike and dips, folds and faults and satellite images to identify best prospect to find hydrocarbon. Then GIS was use to get the best seismic lines layout for seismic survey purposes. This method manages to save cost and time for the company.

In Eastern Sahara, geologist manage to combine remote sensing with GIS analysis which allows them to map the Kufrah Paleoriver of Libya and give some ideas on its geomorphic evolution during the Neogene(Ghoneim, Benedetti and El-Baz, 2011). The Kufrah system is now largely buried beneath the sands of the Eastern Sahara which drained an area of about 236,000km<sup>2</sup> in central and southern Libya. In this case, GIS is use to model the past lake levels and paleoclimates, then locating groundwater sources and exploring for reservoirs of oil and gas in that region.

In Yemen, GIS is used to evaluate the exploration potential in the remaining traps area of two matured basins which are Sabatayn and Sayun-Masilah. According to Mohammad, Palanivel, Kumanan and Ramasamy(2010), there are mainly four steps in the study process. The first step involve generating digital GIS database on different thematic map which are surface lineaments, drainages and subsurface lineaments using data from satellite, subsurface basement, gravity and magnetic. The next remaining three steps involve the use of GIS to integrate several lineaments together, conduct orientation analysis and finally bring out the relation of surface lineaments to potential hydrocarbon existence.

At the Northeast China where Songliao basin is located, GIS-based modeling algorithm were successfully applied in the modeling of the secondary migration pathways. The modeled results matched well with the drilling data, proving the GIS reliability in oil and gas modeling. The algorithms are constructed on a raster digital elevation model(DEM) of the top boundary of a carrier bed, in which the secondary migration normally occurred. Based on a journal written by Liu, Zhong, Yin, He and Li(2007), they use 3x3 pixel sized window for searching on the DEM. The center of the search window is initially assumed at a point on the boundary of a hydrocarbon source area. Center of search is a pixel and surround it is eight pixels in eight different directions which are north, east, south, west, north-east, south-east, south-west and north-west. Each of the altitude value for all the nine pixels is compared. The highest altitude among all is the value chosen as the next center pixel. This algorithm agreed with the petroleum system that hydrocarbon flow from low altitude to high altitude due to decrease in pressure.

Another location in Northeast China, which is Shuer basin of the Shuguang Oil Field also implement the use of GIS in their petroleum exploration. This is where they simulate the oil and gas migration path from the Dalinghe reservoir. Besides the pixel or matrix technique as mention above, they also maximize the use of digital terrain model(DTM) in the GIS function. In this case, they use fault transporting factor which influence by the opening and closing factors of the faults, porosity and permeability of the transporting rock. Various DTM maps are produced by using

Kriging difference value or distance weight interpolation. Vector data consist of point and line, and also surface generate raster data can be made.

The next example of using GIS in petroleum exploration is in Oman. Petroleum Development Oman which is one of the leading exploration and production company in that country using GIS to do geological mapping that involve play fairway mapping, and mapping and analysis of trapping configuration. Play fairway is the area within a basin where the specific geological attributes are necessary for the existence of a hydrocarbon accumulation to exist (Kjemperud,2012). By mapping the subcrop formations below an unconformity and subsequently overlaying the mapped supercrop or seal formation, it was possible to enhance the interpretation of potential play fairways (McLay, Muggli & Mazrui, 2003). For trap analysis, a raster gravity map was created and contoured. From this, sweet spots of low gravity oil could be detected and their relationship to the trap as identified.

In Saudi Arabia, an incorporated joint venture company called South Rub al-Khali Company Limited(SRAK) which named after the basin's name where the project in conducted, had managed to integrate an exploration Seismic Tapes and Optical Media(STOM) system into GIS technology (Al-Ali & Kent, 2007). The idea is to allow user to accurately and efficiently view, track and query the exploration data in a spatial environment. STOM is an in-house system developed by Geomatics and Data Management section within SRAK to keep track of all the tapes and optical media related to SRAK geotechnical data. This technique improves the decision quality in term of identifying and extracting the correct data for a proposed copying, processing and reprocessing projects. Hence, reduce a lot of money and time for the analysis stage.

The last example is from Beijing, China. Yu, Wu, Wang, Luo, Li & Zhang(2012) had manage to use GIS to conduct prospect screening and evaluation process using both technical and economic aspects. This had contributed in the petroleum upstream investment decision making. The method used involves several modules which are data management module, volume calculation module, geological risking module and economic analysis module. The data management module is

designed to manage the map data and other database. The volume calculation module is designed to calculate the gross bulk volume and Standard Hydrocarbon Originally in Place(STHCOIP). The geological risking module is used to characterize the risk for the structure, trap, reservoir and charge. Economic analysis modules on the other hand is used to do economic cutoff calculation, Net Present Value(NPV) calculation, Investment Profit Ratio(IPR) and the sensitivity analysis.

## CHAPTER 3: METHODOLOGY AND PROJECT WORK

### 3.1 RESEARCH METHODOLOGY

Since the latest data about petroleum system elements for Malay basin are hard to get and expensive to buy, the map used for the analysis using ArcGIS are from the Esso-PETRONAS Integrated Collaborative (EPIC) Study from March 1995. The coordinate for the map also not stated during the analysis since the data is not available inside the report. For Malay basin petroleum system, according to the report, there are ten petroleum system exist and already identified. These petroleum systems are called petroleum system E, F, H, I lower, I middle, I upper, J, K L and M. Using arcGIS software, the individual elements for each petroleum system can be overlay on top of each other. Each petroleum systems consist of:

- Source map
- Reservoir map
- Migration map
- Maturation map

Due to the limited source of data, only petroleum system K, J, I lower, I middle and I upper have the seal. For the trap element, it is not included in the analysis since the report does not mention any data for the trap.

Detail steps for spatial analysis are further described below:

1. Import raw data into ArcCatalog: The report of the EPIC Study which in PDF form is opened using Adobe Reader. The position of the play map is adjusted to be at the center of the computer screen, the play maps for source rock, reservoir rock, migration route and maturation from each ten petroleum systems from the EPIC report are print screen. Then paste inside the Paint where cropping can be done to remove unnecessary region of the map like its border. Then, the maps are saved in form PNG. Then reopen the image using Microsoft Office Picture Manager and crop the white region of the picture.

It is important to make sure that the play maps size are as equal in size as possible to each other because in the later stage we want to arrange it on top of another. Open ArcCatalog then drag the image into the Content box on the

right side. ArcCatalog is use to manage the data that involve in spatial analysis. The type of data for the image is Raster Dataset. Now that we have the raw data, next stage is to create a new data file for layers.

2. Creating new data files inside ArcCatalog: The purpose of these new data files is to allow us to draw back the polygon shape of each petroleum elements from the pictures that we obtain from the previous step. On the Content side of the ArcCatalog, right click and choose option New then choose Shapefile. Then, pop-up box with the title “Create New Shapefile” will appear. Specify the Name for the new data. For Feature Type, choose Polygon since in our analysis involve enclosed area.

Additional image like “ACREAGE” and shapefile named “acreage line” are made to assist us in the later stage when we need to identify the location of our interest area respective to the field name. Now that we had prepared the raw data and the new data on the ArcCatalog, next stage is to import the data to the ArcMap because then we can begin to do the editing.

3. Data importing from ArcCatalog to ArcMap: Open the ArcMap then choose creating new project. Put the name as “FYP project”. Now that we open the ArcCatalog and ArcMap window side to side, simply select all the data from the Content tab of ArcCatalog, then drag it into the white screen of the ArcMap. The layer names and details are shows on the left side of the ArcMap window. We can simply on or off the layer by clicking on the square box right before the layer name.

The layer arrangement following the logic way which is the top most layer located at the top most layer of the white screen while bottom most layer located at the bottom most layer of the white screen. In our analysis, we want the play map layers grouped together respective to their petroleum system. Acreage and acreage line are located at the bottom most layer in order to provide a framework or reference for our analysis.

Now that we have imported the layers required, we may proceed to the next step which is to create the polygon.

4. Creating the polygon for source rock, reservoir rock, migration and maturation maps: We begin editing the M play map by turning on the layer for source rock picture and also the source rock polygon that we created from the previous step. Then, click on the square colored box for the polygon layer in order to change the color to blue. Make sure to use consistently the same green color for the reservoir rock, migration and maturation. Once done with the color selection, click “OK” button.

Now we want to change the transparency so that the color will not be solid. If the color is solid, we can't see the difference once we open number of layers later on. Select the layer's name until it highlighted, right click and then choose “Properties”. Pop-up box named Layer Properties will appear and choose the tab “Display”. For the Transparency, instead of 0% which means very solid color, change it to 70% which we wanted it to be more transparency in order to give the darker effect for the overlapped layers. The darker the better the area, which means a better potential and higher confidence to found oil and gas.

To begin making polygon, click “Editor” button on top task bar then click “Start Editing”. At the same line to the right of the “Editor” button, make sure the Task is to “Create New Feature” and the Target is “M source polygon”. Then click on the pencil symbol button named “Sketch Tool”. The cursor now is on the sketching mode. Before that, to use snapping ability, click on “Editor”, then “Snapping” then check all three boxes representing “vertex”, “edge” and “end”.

To draw, simply click on the line that made up the area and double click to allow it to complete the polygon. We also use the Tools that consist of zoom in, zoom out, pan, full extent, go back to previous extent and select element. The Tools allow the sketching to be more accurate and easy. After we confirm with our sketch and satisfied with the polygon produced, click on the

“Editor” and then “Stop Editing”. Make sure to save the editing work. Repeat the same step for reservoir rock, migration and maturation maps.

Images below show the results at the end of this step:

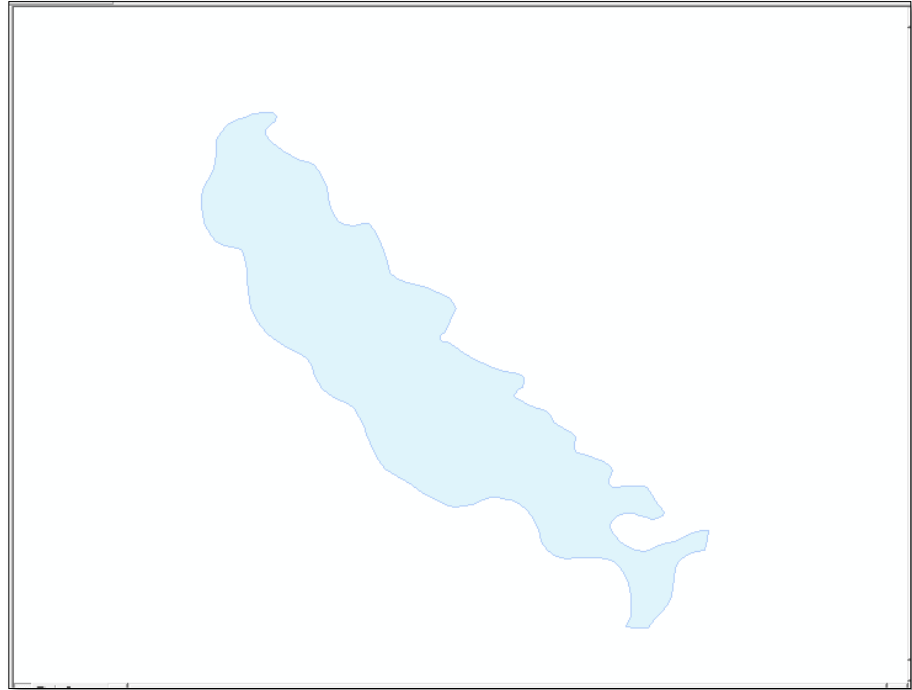


Figure 7: M source polygon

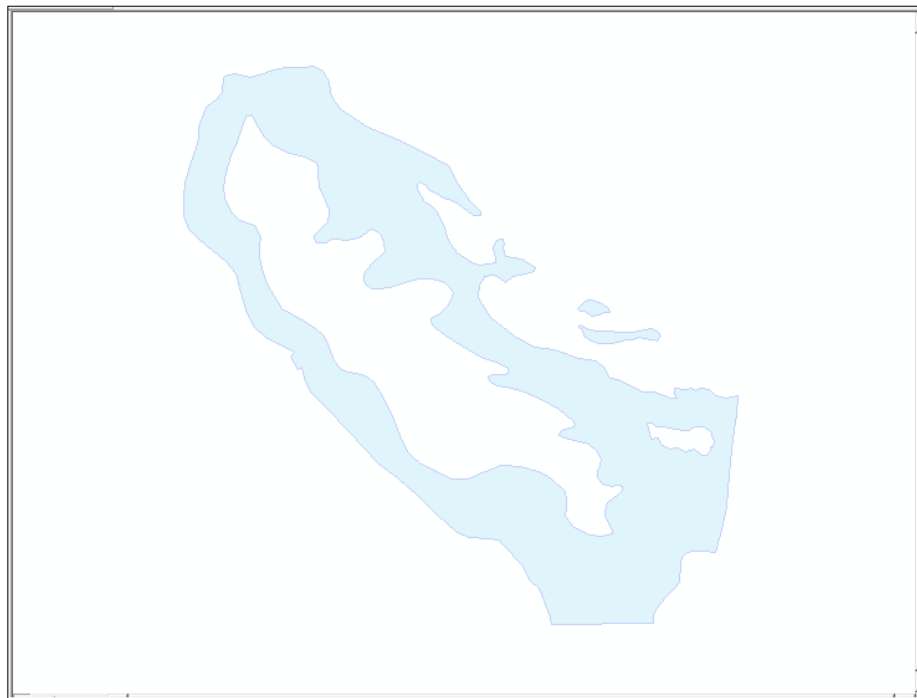


Figure 8: M reservoir polygon





Figure 9: M migration polygon

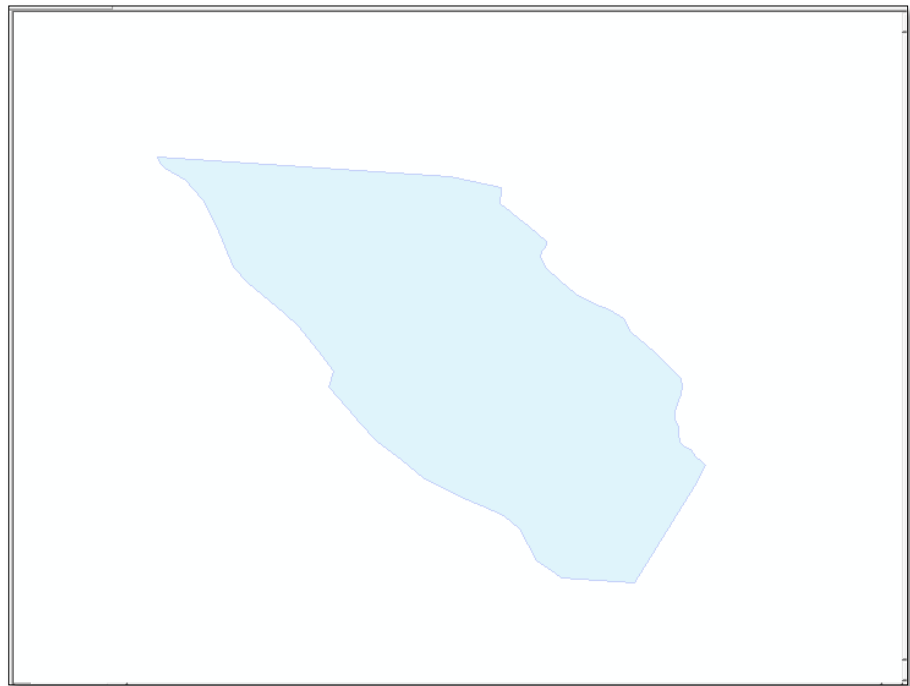


Figure 10: M maturation polygon

5. Analyzing the overlapping area: Open all four layers that represent M petroleum system. The image should appear in the ArcMap as shown below:

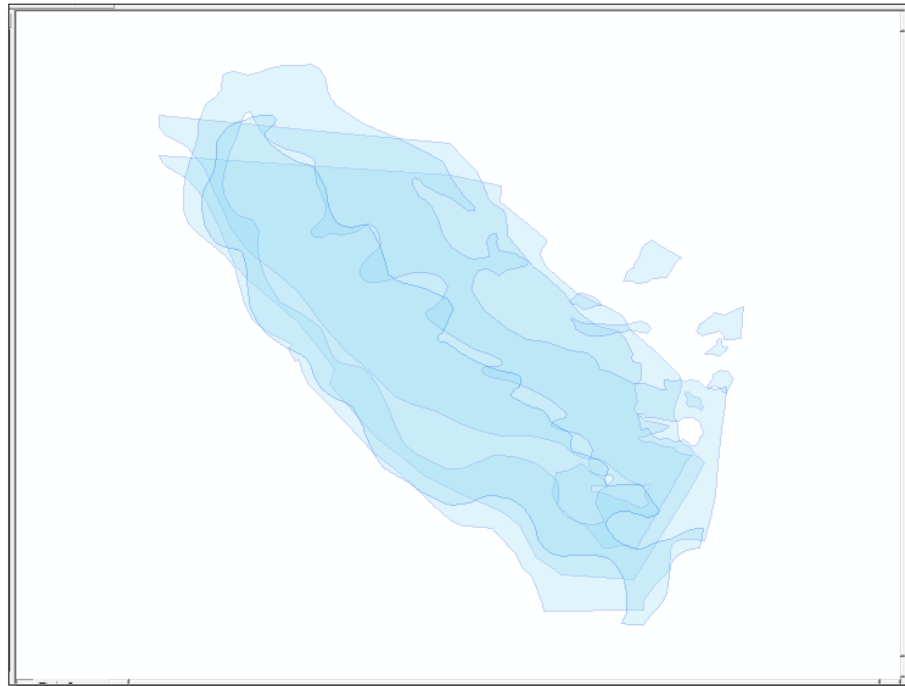


Figure 11: M petroleum system

At this stage of analysis, we realize that we manage to create a range of blue color from light blue to dark blue resulted from the overlapping of source, reservoir, migration and maturation maps. Now we want to analyze further by focusing on the most overlapping layers. This area is the one with the highest potential to contain hydrocarbon.

To create another layer to represent the most overlapping layer, we use function “Intersect”. Click on the “ArcToolbox Window” button. A small window with many red buttons will appear in between the map and the layers name. Expend the button “Analysis Tool” and then further expend the “Overlay” button. Double clicks on the “Intersect” button appeared. A small window named “Intersect” will pop-up. For the “Input Features” column, insert all four petroleum system’s elements. Then click “Ok”.

The result will be like below:

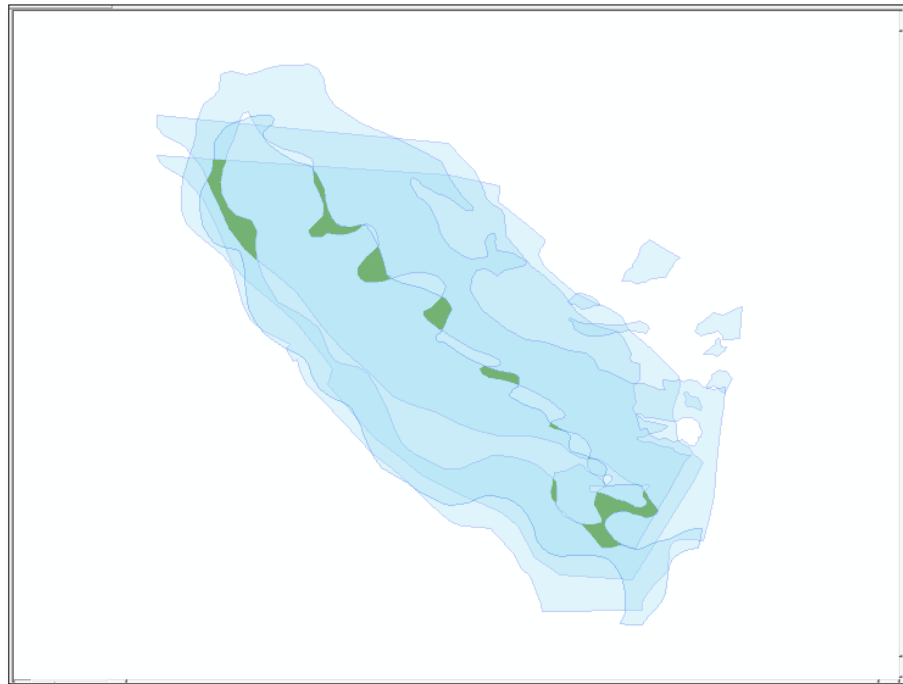


Figure 12: M petroleum system with the most overlapped area

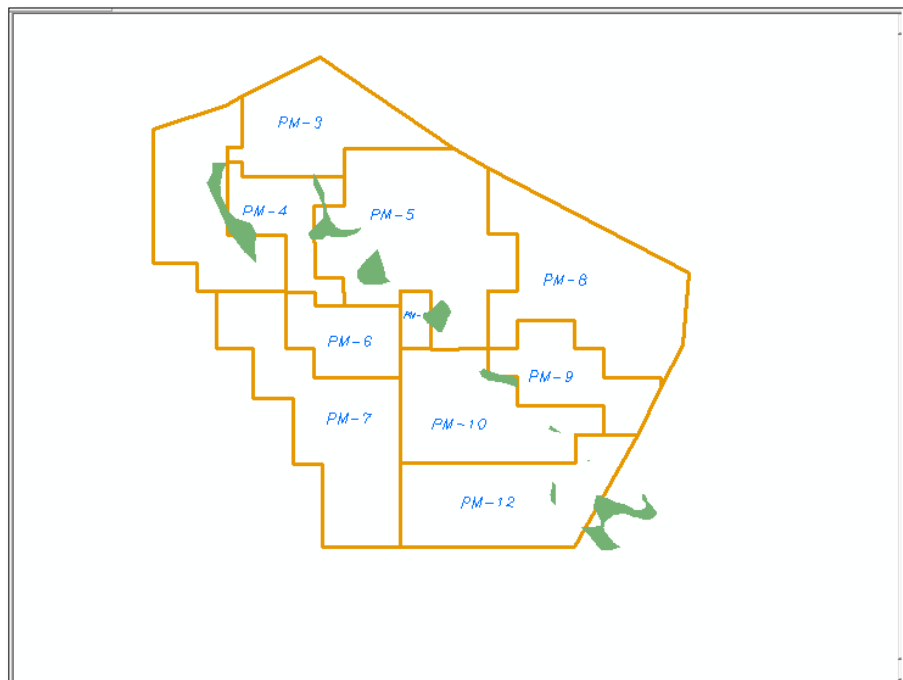


Figure 13: M petroleum system with highest chance of success

6. Repeat the above steps for another nine petroleum systems. Then combine the result for all ten petroleum system using the function union.

### 3.2 PROJECT ACTIVITIES

- Read and understand research papers, journals, conference papers, e-books, articles and reports related to GIS, spatial analysis, petroleum system, oil and gas basin modeling, and petroleum exploration.
- Get familiar with GIS software which is ArcGIS version 9.3 and use it to conduct play analysis.

### 3.3 KEY MILESTONE AND GANTT CHART

The Gantt chart and key milestone for FYP 1 is provided in the Table 1 below:

Table 1: Gantt chart and key milestone for FYP 1

No.	Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Selection of Project Topic	■	■												
2	Preliminary Research Work		■	■	■	■									
3	Submission of Extended Proposal Defense						√								
4	Proposal Defense								■	■					
5	Project Work Continues										■	■	■		
6	Submission of Interim Draft Report													√	
7	Submission of Interim Report														√

√ Key Milestone

■ Process

The Gantt chart and key milestone for the FYP 2 is provided in the Table 2 below:

Table 2: Gantt chart and key milestone for FYP 2

No.	Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Project Work Continues	■	■	■	■	■	■	■								
2	Submission of Progress Report								√							
3	Project Work Continues									■	■	■	■			
4	Pre-EDX											√				
5	Submission of Draft Report												√			
6	Submission of Dissertation (soft bound)													√		
7	Submission of Technical Paper													√		
8	Oral Presentation														√	
9	Submission of Project Dissertation (Hard Bound)															√

√ Key Milestone

■ Process

### 3.4 INSTRUMENTATION

- ArcGIS 9.3 Software
- Play analysis stage required data related to petroleum system's elements like source rock, reservoir rock, migration route, trap and seal of Malay basin.

## CHAPTER 4: RESULT AND DISCUSSION

### 4.1 DATA GATHERING AND ANALYSIS

Below is the result for the intersection of source rock, reservoir rock, migration route, maturation and some of it contain seal for each petroleum system. Noted that there is no intersection area for H petroleum system since the area for migration and maturation is not intersected.

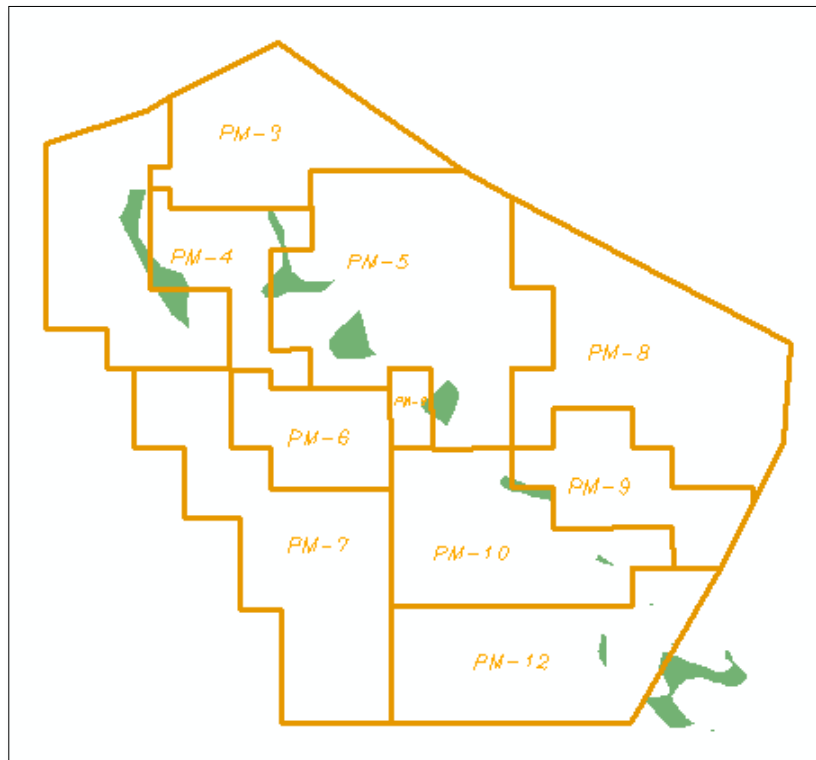


Figure 14: Intersection area for M petroleum system

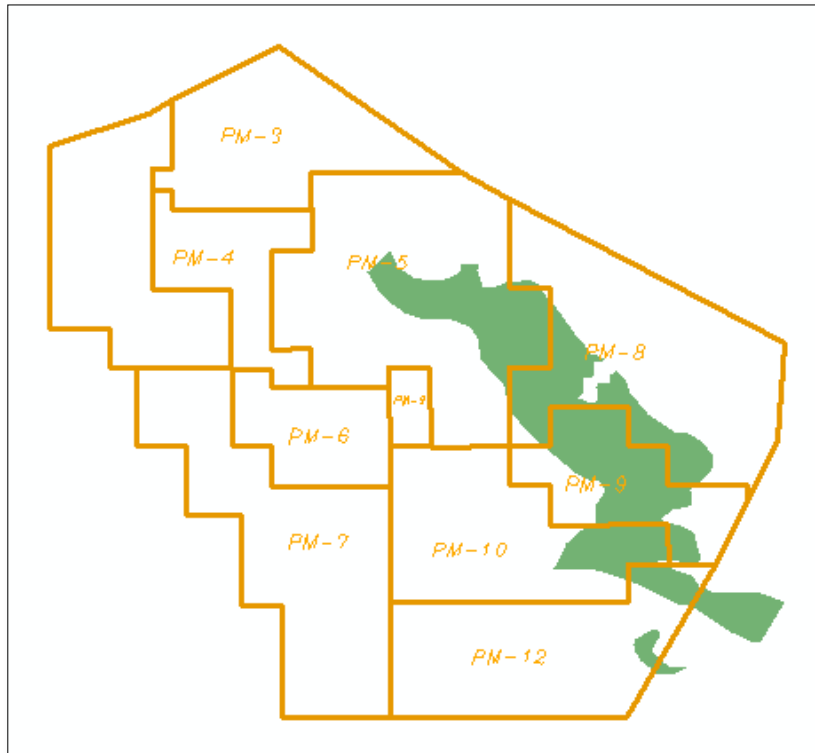


Figure 15: Intersection area for L petroleum system

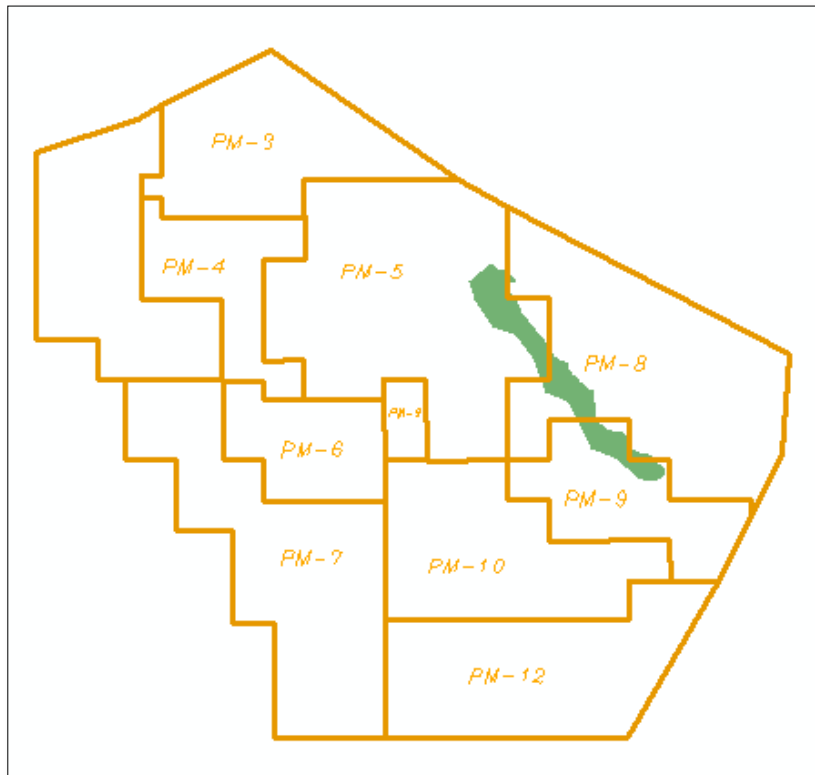


Figure 16: Intersection area for K petroleum system

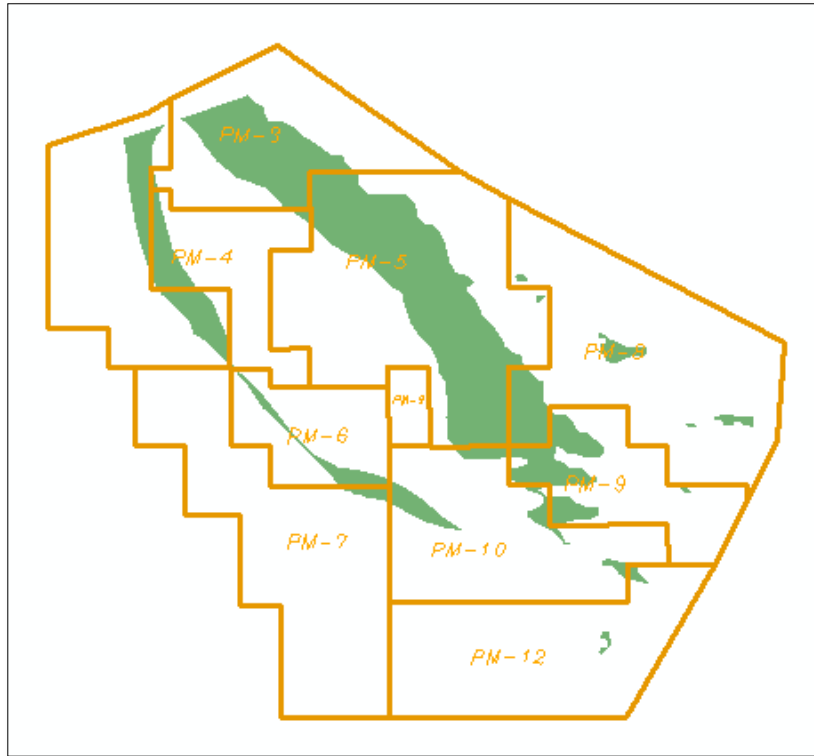


Figure 17: Intersection area for J petroleum system

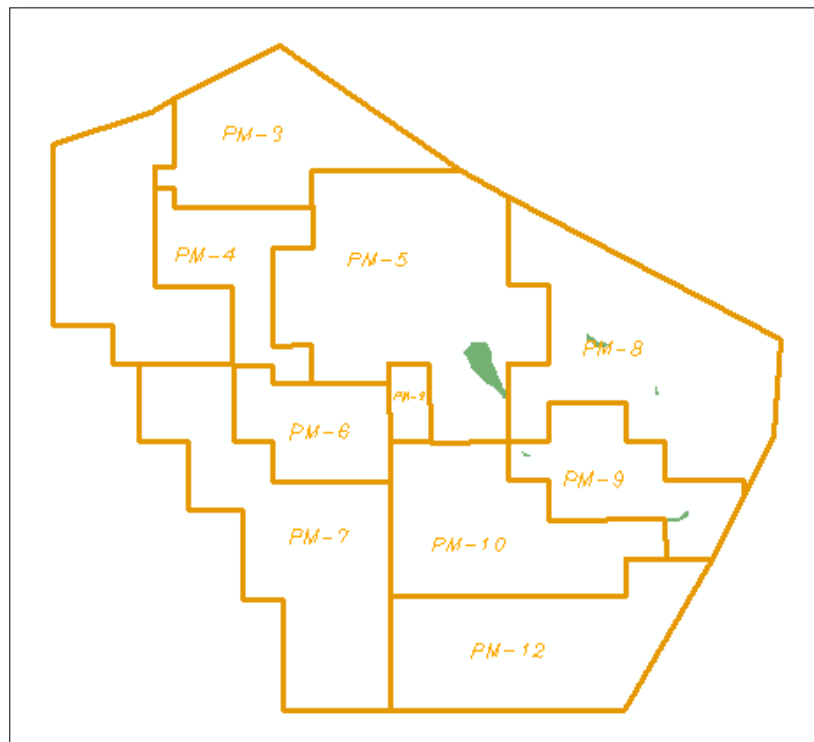


Figure 18: Intersection area for I lower petroleum system

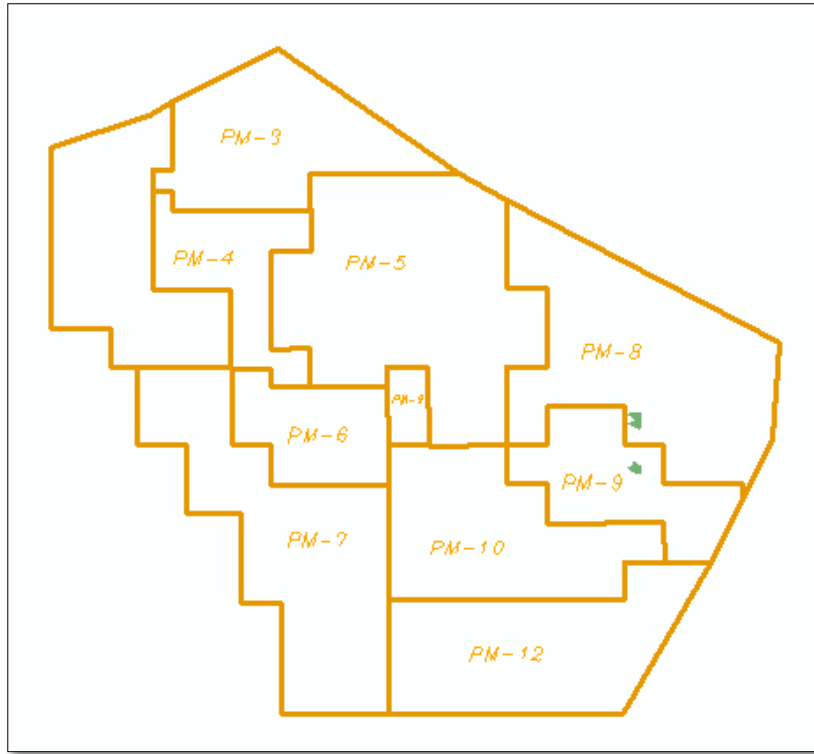


Figure 19: Intersection area for I middle petroleum system

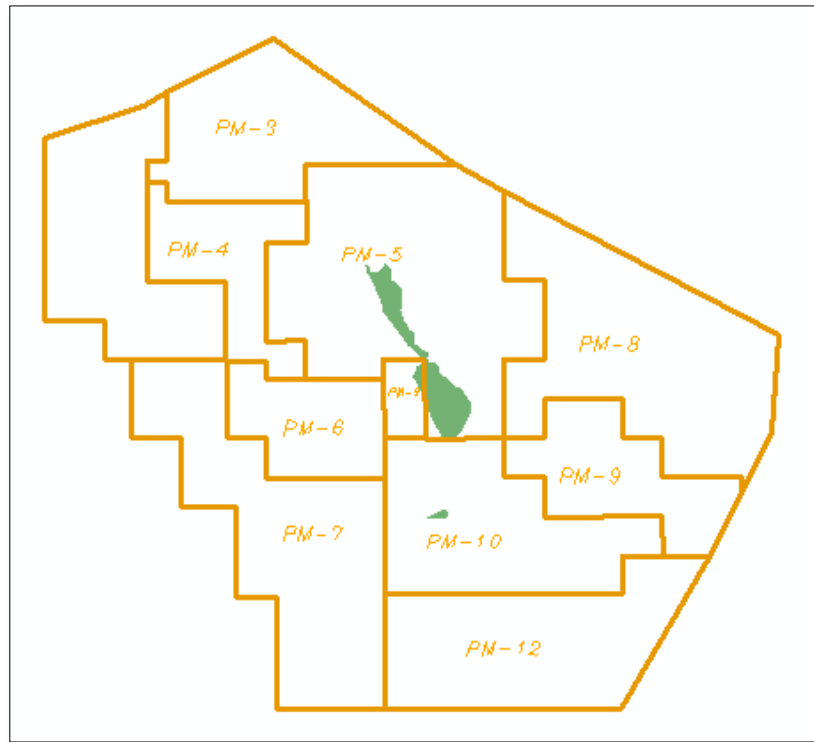


Figure 20: Intersection area for I upper petroleum system



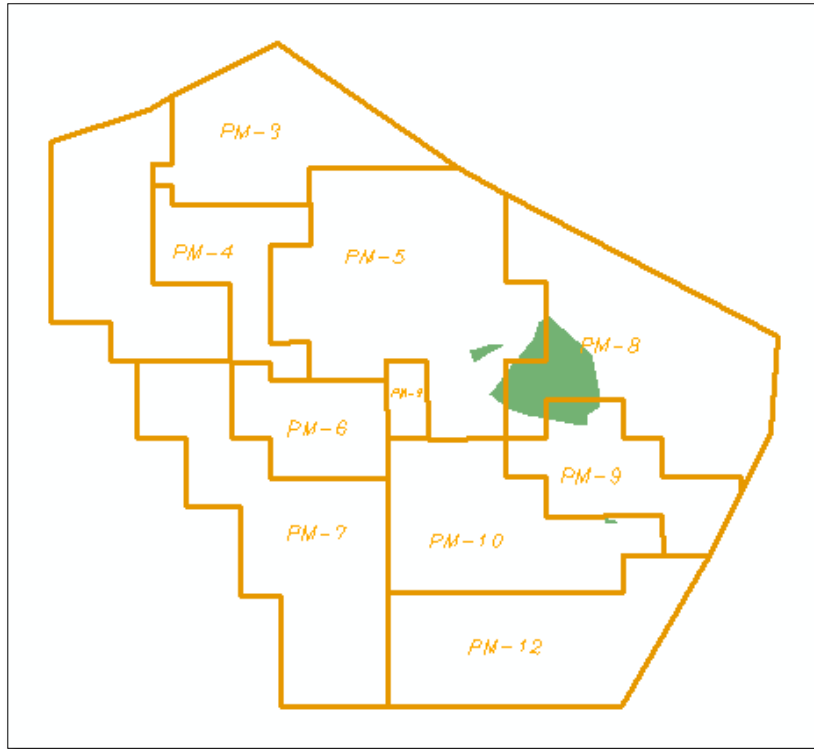


Figure 21: Intersection area for F petroleum system

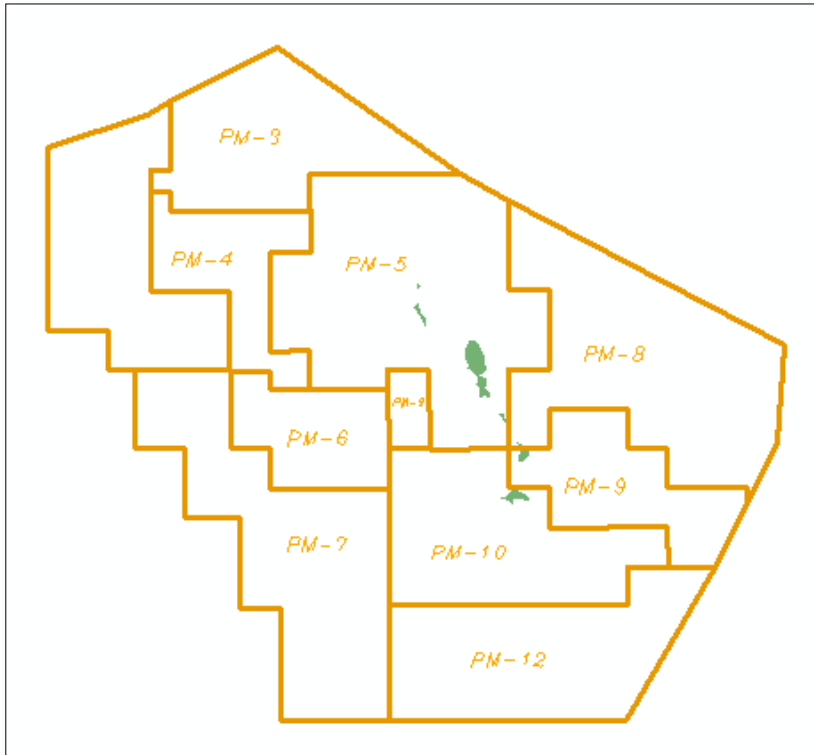


Figure 22: Intersection area for E petroleum system

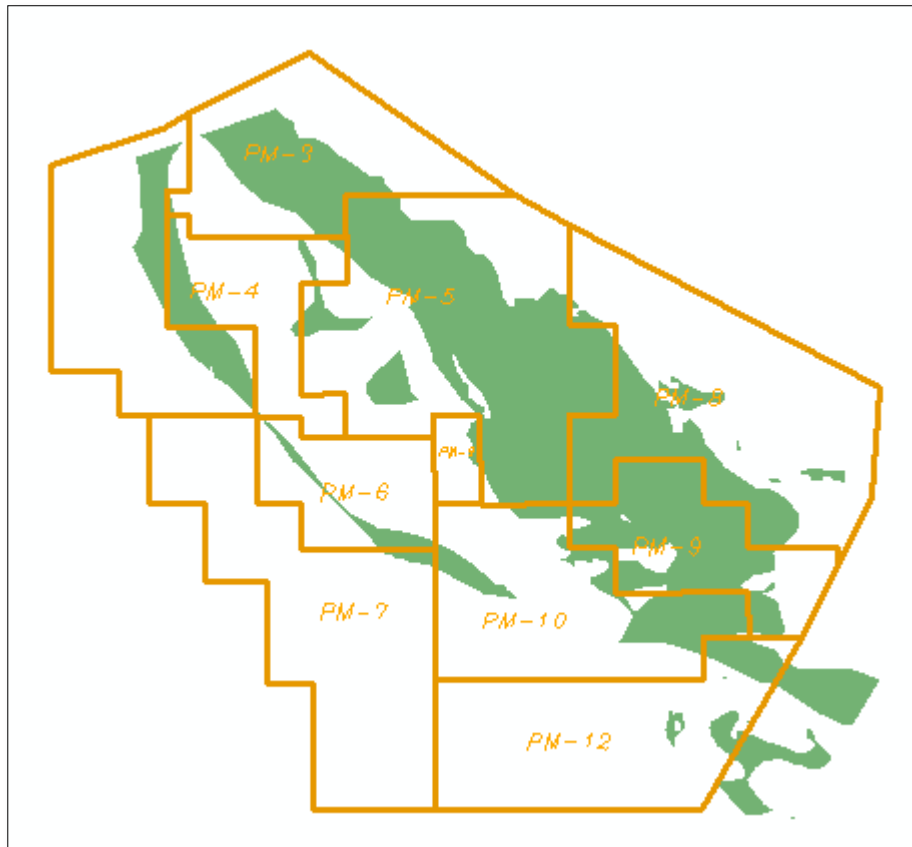


Figure 23: Combine area of intersection for all petroleum systems in Malay basin

#### 4.2 FINDINGS

Based on the intersection area for all ten petroleum systems, it shows that field PM-3, PM-5, PM-8 and PM-9 provide a good potential to contain oil or gas.

## CHAPTER 5: CONCLUSION AND RECOMMENDATION

Based on the result obtain, it is possible to implement GIS technology to assist in petroleum play analysis. ArcGIS allowed the possibility of obtaining potential play that contain oil or gas. Now we know exactly which field to be given priority for exploration just by using GIS technology. The project objective is achieved.

For recommendation, firstly I would suggest that more and more reliable data about the petroleum system must be obtain since the accuracy of result depend totally on the data. It is an advantage to obtain petroleum element data with its coordinate and elevation. This level of accuracy allowed us to estimate the potential volume of oil or gas in specific region. Secondly, we can compare the result obtain from final analysis with the result produced by other people using different method. By doing this, we can really know whether our result is on the right track or not. Thirdly, since we have numerous amounts of data, we can divide it into several set of data and use it separately during our analysis. This is because, more data does not mean more accurate result can be produced. Usually, excessive amount of data causing the result to be hard to analyze and at the end, no conclusion can be made. By doing this step, we can conclude what range of data is optimum for our analysis.

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