

Innovative Techniques for Geochemistry Core Location Mapping Using Model Builder

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ABSTRACT

Starting in late 2006 for approximately 18 months Black Gold Energy LLC underwrote a large marine survey across Indonesia, which included collecting seafloor sediments from over 1,300 locations. Geochemistry analytical results consisting of 130 field columns were recorded on several spreadsheets consisting of more than 3,000 records. The data continues to be updated by geologists and geochemists as new results from the lab are available making it very difficult and time consuming to manually update the database and update maps. Using Model Builder, data is spatially displayed in the latest state. Other benefits of using this method are the standardization of the data structures and the entire process can be done automatically. This technique allowed the scientists to interactively review results in a geographic framework in addition to review of the raw data spreadsheets. Understanding the relationship between the results and their spatial distribution was critical for project success

1. INTRODUCTION

Basically, mapping core and geochem location along with their supporting information is not so hard to do, but if it is a continuously job and the scale is big too, it needs some attention. Dissynchronization data and information structure might leads to many problems if one day we use it for the bigger and more advanced needs.

By using ArcGIS, especially using Model Builder, seafloor sediment location mapping is easier to do. The Model Builder utility allows geoprocessing models to be created quickly using the built in tools in ArcGIS. There is also the capability of creating new tools using

Python or VB script. Before this tool available using, many problems occur when we have so many data, number of information is increase and needs to be update periodically, information from analysis results are always changing depend on the methods, and new addition variables for the analysis is very time consuming, and also hard to spatially update the seafloor sediments location. Every new plotting results, have to be reviewed by the Geoscientist for data accuracy and analysis, so it is possible to change the information. Process to create updated database and information is required, and it is not just for one study area, but also for the

entire study area to review the dissemination pattern for the result. The main thing from this whole process is that we need to pay attention to the basic tools (software) that were used by the scientist, where they were using common, familiar, and easy spreadsheets, and abandoning the complex database application. It has been understandable that using spreadsheet for gathering and

processing data, in the limited database context, for example; the limited data that can be recorded. On the other hand for the scientist, is easy to use, and the availability for the formula generating facilities, so the scientist can do experiment with the various methods. Those limitations cannot constrain, but we can scheme it when we design the workflow process in the model builder.

2. BASIC CONCEPT

The basic concept for this workflow is Geochem location plotting by merging several worksheets that have so many information attributes. All of the information will be integrated into the Geodatabase for then it will results in feature classes/shapefiles according to a certain theme. These feature classes/shapefiles is the output that were resulted from the series of processes, which are; Core and Geochem Locations, then we do a querying according to the themes that were showed by certain symbols representing for each cores.

Resulted themes are;

- DC1-C5 Hydrocarbon distribution, such as; Pentane, Butane, Propane, Ethane and Methane

- Oil and Gas Seeps
- Oil Criteria, such as; Thermogenic Oil, Unresolved Complex Mixture, Ratio T/D and Total Scanning Fluorescence
- Gas Criteria, such as; Thermogenic gas, Sum Alkane Gas C2a/C2e
- Sum Alkane Gas
- Ethane/Ethene
- Core Ranking

Needs to be known that, designated model builder for this workflow does not gives values for the themes above, but only mapping locations of Geochem, where the values itself were gained from the previous lab analysis and also from Geoscientist analysis that working using the spreadsheets.

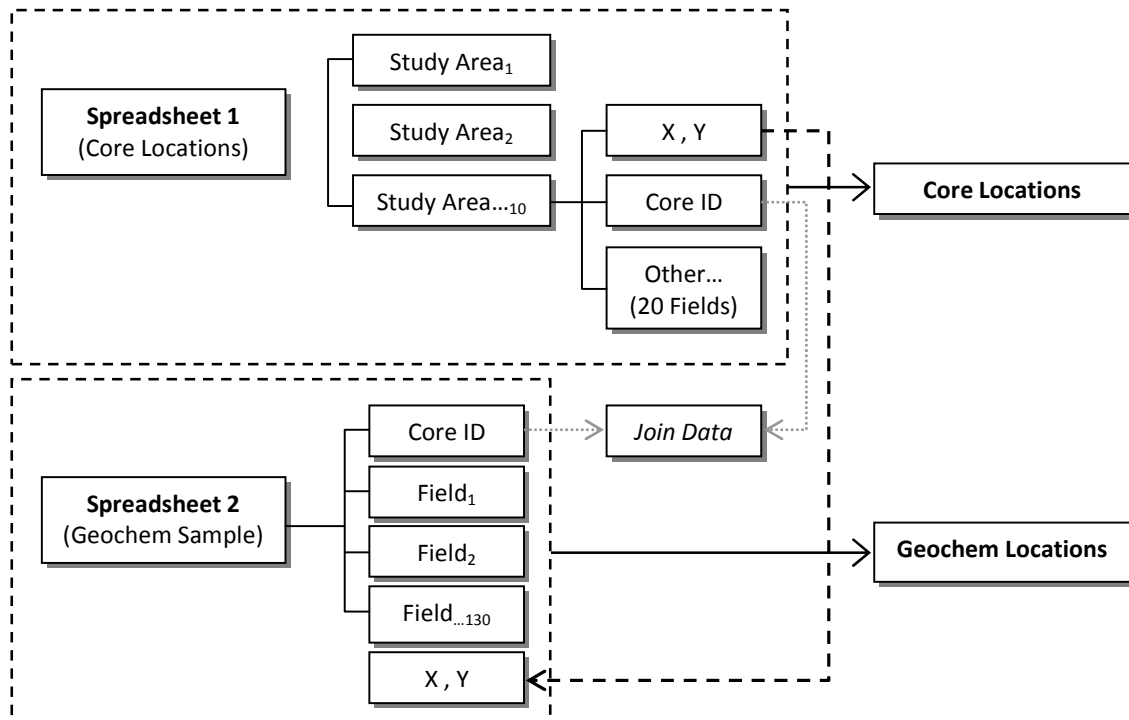


Figure 1: Diagram of Main Model Components

Beside the above themes, in the workflow model builder also implemented several tools that have extracting function for the supporting

data such as; high-resolution bathymetry and backscatter to that Geochem location point.

3. MODEL BUILDER IMPLEMENTATION

Model Builder is an application that is functioning on generating, editing and manipulating workflow on a model. This application is really open the gate for the GIS user generally and ArcGIS user especially, to do various innovation for automation work, test scenario alternative, and documenting workflow.

Besides that, there is another consideration on using Model Builder; Models can be modified with custom script and Models can be executed from the customized graphical user interface using ArcMap. Generally, the design from this model builder that is going to be implemented is shown in this figure.

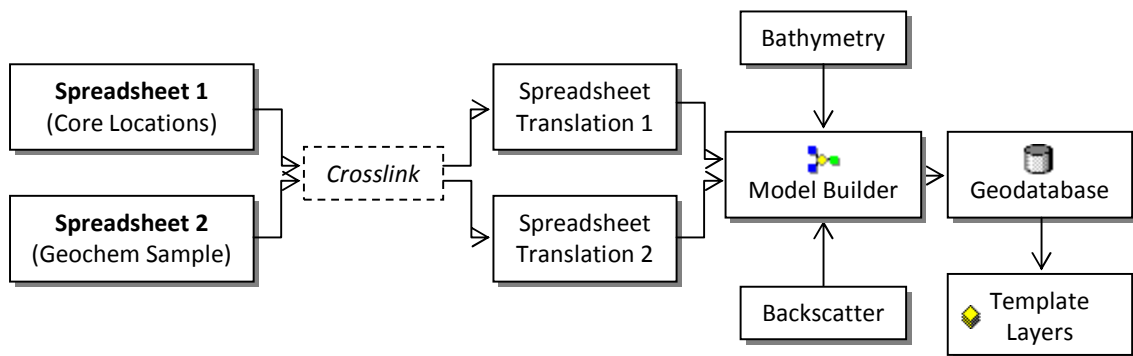


Figure 2: Model Approach Storing to Geodatabase and Layers

In several implementation cases, the data format dissynchronization in *master spreadsheet* that were used by the Geoscientists will be the problem itself, so we need another spreadsheet that we use as a template to translate the format from the *master spreadsheet* into database format that generally used, for example; field name width is no more than 10 characters, text format can only contain 255 characters, etc. Not all of the variables in the master spreadsheets are used, but we need to select the variables (fields) and records that will be used in the model builder. For that, we need the *spreadsheet translation* as the interface. To get all of the data in master spreadsheet, we use the straight crosslink from the spreadsheet translation, so that everytime the master spreadsheet data is updated, then automatically update the spreadsheet translation if the file is opened, and this file is used as the data input in the model builder.

In the designing, there were 3 (three) Toolset that were designed, which are; 1) Models that effective for each study area, 2) Models that effective for every study area and 3) Utility models that functioned to do different things than both models mention before, such as; backing up all of existed data before running model to generate new data. Those toolset will be *.tbx file, so it is very possible to be used by other user in different machine. It is conceivable that, before this tool available, it takes time consuming to create a new data manually with their own problems and the data structure results could be different from one study area to another study area. From the Data Management side, this will be a problem, considering the data will be used for the advanced analysis for different purposes. The customized Toolbox from that application is shown in this Figure 3.

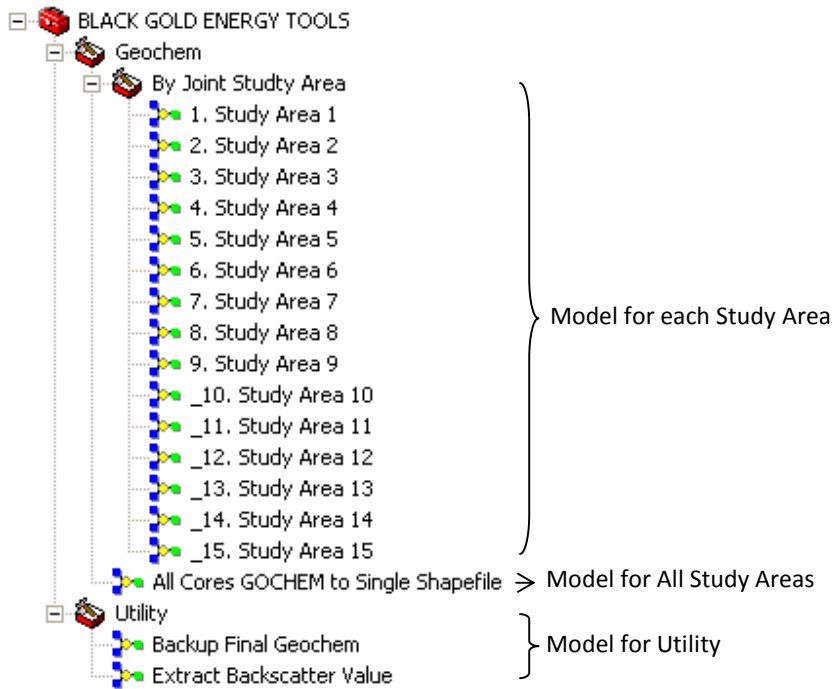


Figure 3: Customized Toolbox in ArcCatalog

In that model, variable that is used as Model Parameter consists of; Core location spreadsheet and Geochem spreadsheet as data input, Spatial Reference (coordinate and projection

system) and Output Feature Class. Model from one toolset **Geochem > By Joint Study Area** is showing the workflow on this Figure 4.



Figure 4: Model Diagram for Each Study Area

For the easiest way is shown in this dialog box in Figure 5, where user only

define 4 (four) from the existing parameters.

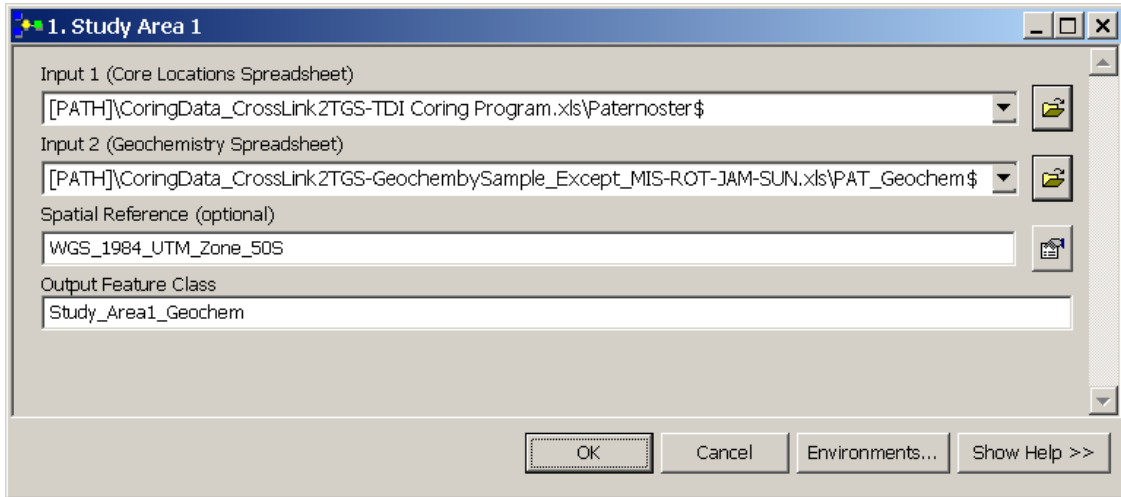


Figure 5: Dialog Box of Model for Each Study Area

On the hand, workflow model for “All Cores GEOCHEM to Shapefile” is shown in the next Figure 6. It needs 3 (three) variables that can be used as, which are;

1) Geochem spreadsheet, 2) Spatial Reference; Coordinate & Projection system and 3) Output Feature Class.

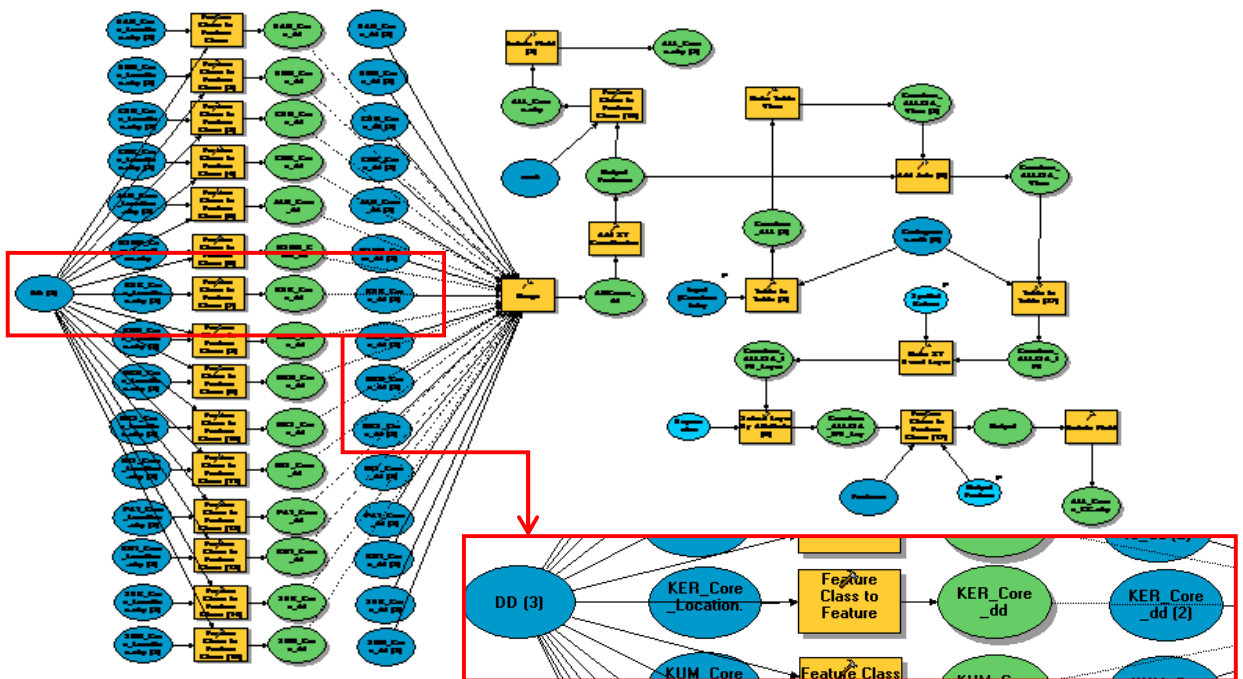


Figure 6: Model Diagram of All Cores Geochem to Geodatabase

For the dialog box as seen in the Figure 7, where parameters that important to be defined; 1) Geochem spreadsheet as a Data Input, 2) Spatial Reference

(Coordinate & Projection system) and 3) Output feature class.

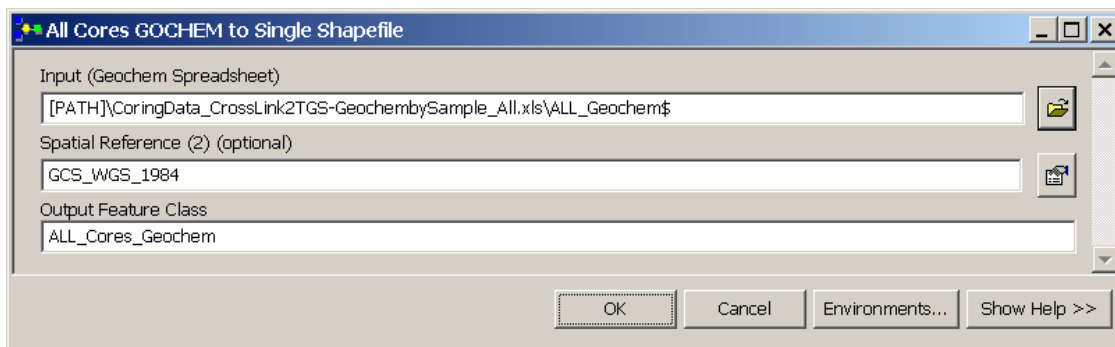


Figure 7: Dialog Box of Model for All Cores Geochem to Geodatabase

After we get the final data, to add another information that come from other spatial data, it also needs a model workflow that extract values from grid

data into point locations. In this case, it is necessary to have a model that can answer those kind of solution because of the data amount

4. CUSTOMIZED TOOLBOX AND LAYERS IN ARCMAP

To make it easier to use the Toolbox, we need customized GUI (Graphical User Interface) in ArcMap, so user can directly use that model through ArcMap interface, and operating it is becoming easier. This is to avoid speculation that said, those kind of diagram model is so complicated that creates doubts on

operating those models. Customized menu is created by using VB script to open the dialog box from model in the Toolbox.

The interface from the Customized GUI is shown in this Figure 8.

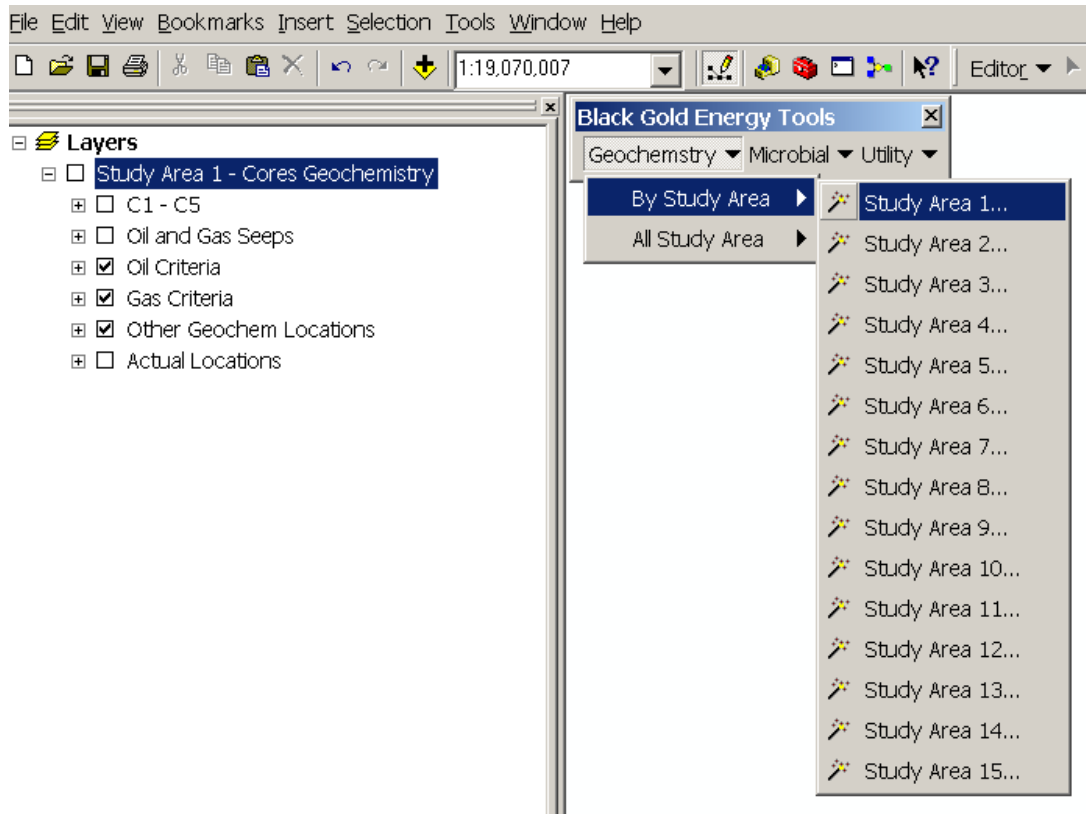


Figure 8: Customized GUI

To show those data, we need template layers (*.lyr) which specifically made to translate geochem points into certain symbols, it's aim is so that geochem points can appear based on their values. Those symbols can be shown based on

unique values, graduated symbol, unique values-many fields and single symbol. This template layer can be used for all of the study area. Examples for these symbols are shown in the next figure.

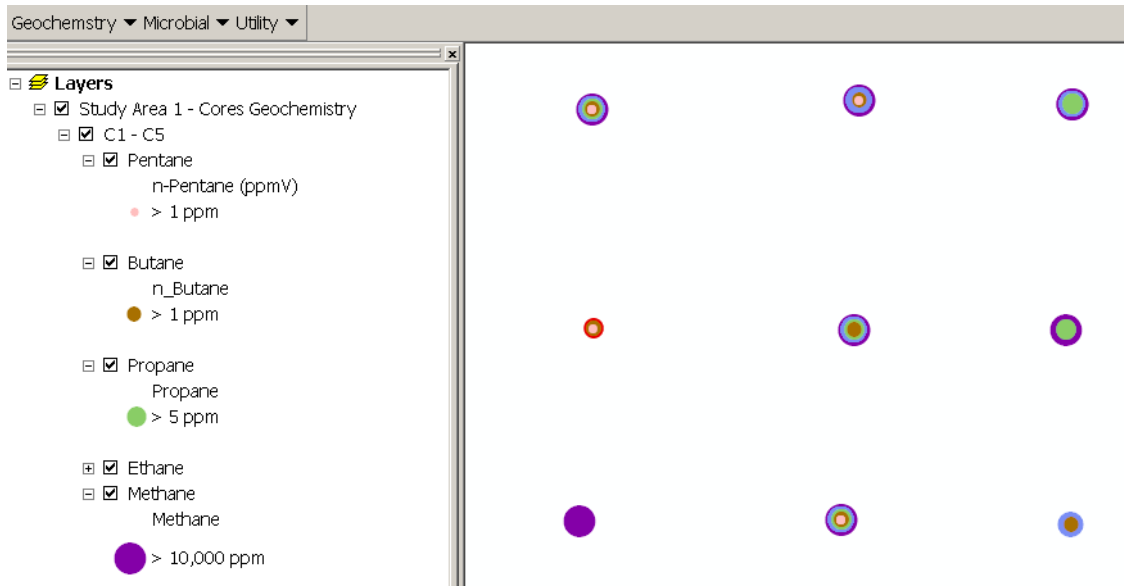


Figure 9: Layers for C1-C5 Hydrocarbon Based on Graduated Symbols

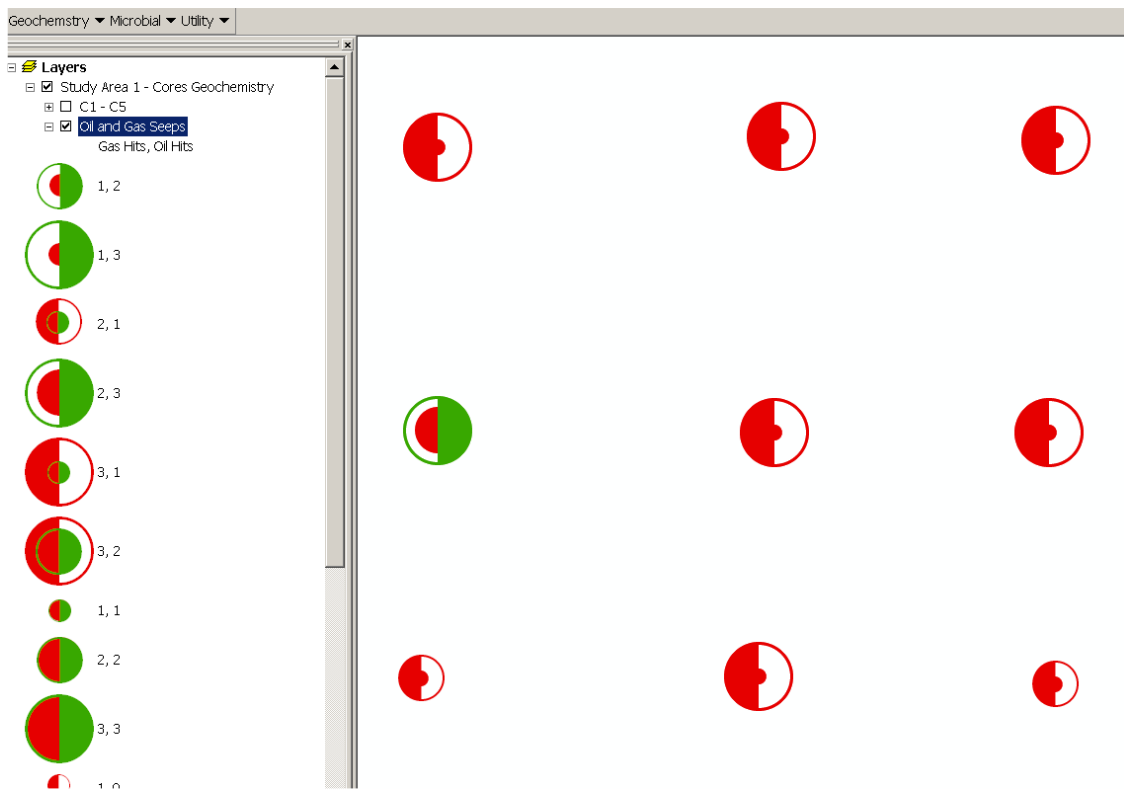


Figure 10: Layers for Oil and Gas Seeps Based on Unique Values-Many Fields

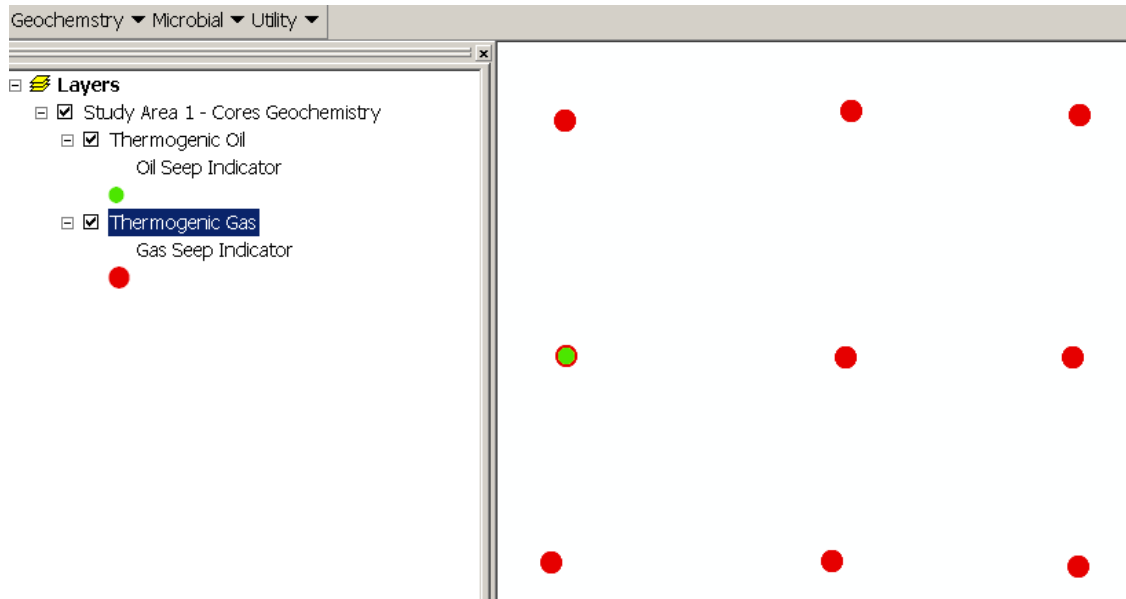


Figure 11: Layers for Thermogenic Oil and Gas Based on Unique Values

5. SUMMARY AND CONCLUSION

By using ArcGIS as a model interface will be easier to illustrate, analysis and data process. Model Builder itself is a tool that very useful where possibilities for making alternative scenario to data and used methods is widely open.

Advantages that we can get from this techniques application are:

- We can get the standard database,
- Time consuming to generate data and information is getting faster,
- Can be done by several users at one time,
- The analysis result can be reviewed as soon as possible, so if there's a mistake, can be corrected immediately,
- The Geoscientist can still get the free work with the spreadsheet, just as they like,
- It is open for the development possibilities, for more advanced necessities.