CHAPTER 8
SUMMARY & CONCLUSION

In this chapter we apply the other data to our AOI apart from well logging methods, like proximate analysis result, desorption Isotherm test data to evaluate gas in Place. We calculate the Gas-in place for prominent seams individually and then summing it out and finally evaluate the resource potential of the surrounding area. Cross-section of the major wells have been already done to show the lateral continuity of the coal seams.

We finally obtain the standard workflow for modeling of CBM resource estimation. This chapter contains major findings and significant contributions of the research to the industry. The thesis finally ends with the limitations of the study and future scope for further research in the same area.

8.1 INTRODUCTION

Well logs are important information source for identifying coal layers and infer their characteristics. It provides several critical parameters such as net pay thickness, density, porosity and other parameters for forecasting the resource potential of the area of study.(our present AOI).Well logs are useful in all stages of CBM project management-venture exploration, evaluation and exploitation.

8.2 DETERMINATION OF GAS IN PLACE

In the previous section, we have completed entire well log analysis for all seven wells(4 wells and 3 core-holes). Lithology of the area has been ascertained from log analysis and shown as part of log analysis representation.

The Gas-in place can be calculated by the standard CBM Gas-in-place formula is,

GIP=(A)(h)(RhoB)(Gc)+(A)(h)(Por)(1-Sw)(Bg) Where:

- GIP=Gas In Place
- A= Area of reservoir for which volumetrics are being calculated.
- h=Thickness of organic reservoir.
- RhoB= Average density of the reservoir interval being calculated.
- Gc= Average Gas content of reservoir interval being taken from lab data.
- Por=Average porosity produced by cleats or fractures in reservoir interval.
- Sw=Average water saturation in reservoir cleats and fracture.
- Bg= Gas Compressibility factor, driven by reservoir pressure for free gas in fractures.

The above formula consists of two parts. The First part(left of the + sign)pertains to gas stored within the coals by adsorption to the coal's molecular structure. The second part is for free gas stored in the cleat system(natural fractures) of the coals. Because the fraction of free gas in coal cleat or fracture systems is very often insignificant to the overall reserves picture (less than 2%),we'll drop this part of the equation out of our process.

We calculate the Gas-in place for prominent seams individually and then summing it out and finally evaluate the resource potential of the surrounding area.

TABLE 8.1: Gas-in-place Calculation from well-log for well 1

	Well 1			
	Coal 1	Coal 2	Coal 3	Coal 4
Area (A) (sq m)	18	18	18	18
Thickness (h) (m)	8.00	10.00	2.00	2.00
Density (Rhob) (gm/cc)	1.35	1.43	1.50	1.50
Gc (%)	14.8	15.1	15.2	14.5

TABLE 8.2: Gas-in-place Calculation from well-log for well 2

	Well 2			
	Coal 1	Coal 2	Coal 3	Coal 4
Area (A) (sq m)	18	18	18	18
Thickness (h) (m)	9.00	8.00	5.00	5.00
Density (Rhob) (gm/cc)	1.30	1.35	1.41	1.33
Gc (%)	14.5	13.5	10.2	14.2

TABLE 8.3: Gas-in-place Calculation from well-log for well 3

	Well 3				
	Coal misc	Coal 1	Coal 2	Coal 3	Coal 4
Area (A) (sq m)	18	18	18	18	18
Thickness (h) (m)	4.00	2.00	5.00	6.00	2
Density (Rhob) (gm/cc)	1.03	1.04	1.34	1.25	1.28
Gc (%)	14.5	13.5	10.2	14.2	14.5

TABLE 8.4: Gas-in-place Calculation from well-log for well 4

		Well 4			
	Coal Misc	Coal 1	Coal 2	Coal 3	Coal 4
Area (A) (sq m)	18	18	18	18	18
Thickness (h) (m)	10	8.00	6.00	7.00	5.00
Density (Rhob) (gm/cc)	1.4	1.35	1.40	1.36	1.37
Gc (%)	14.5	13.00	13.5	13.5	17.2

TABLE 8.5: Gas-in-place Calculation from well-log considering all wells

Coal Layers	Coal 1	Coal 2	Coal 3	Coal 4	Coal Misc
Cu m	21356055000	23546767500	16487550000	13032810000	22198050000

TABLE 8.6: Gas-in-place Calculation from well-log considering all wells

In-Place at Reservoir Condition	
96621232500	Cu m
i,e equivalent to 0 .9 TCM	

8.3 PROCESS OVERVIEW FLOWCHART

Then finally we are in a process to create a lay-out of standard workflow for overall CBM play. The workflow will use mapping, log-analysis, and cross-section building to assess gas-in-place, and a few other important reservoir factors on CBM properties.

In previous Chapter ,while describing methodology, the activities of entire research has been depicted as one Process Flow Diagram which should be a part of designing the final lay-out of Standard Workflow for CBM Prospect Evaluation.

This will give a visual overview of the workflow: (**Present and Future Scenario**)

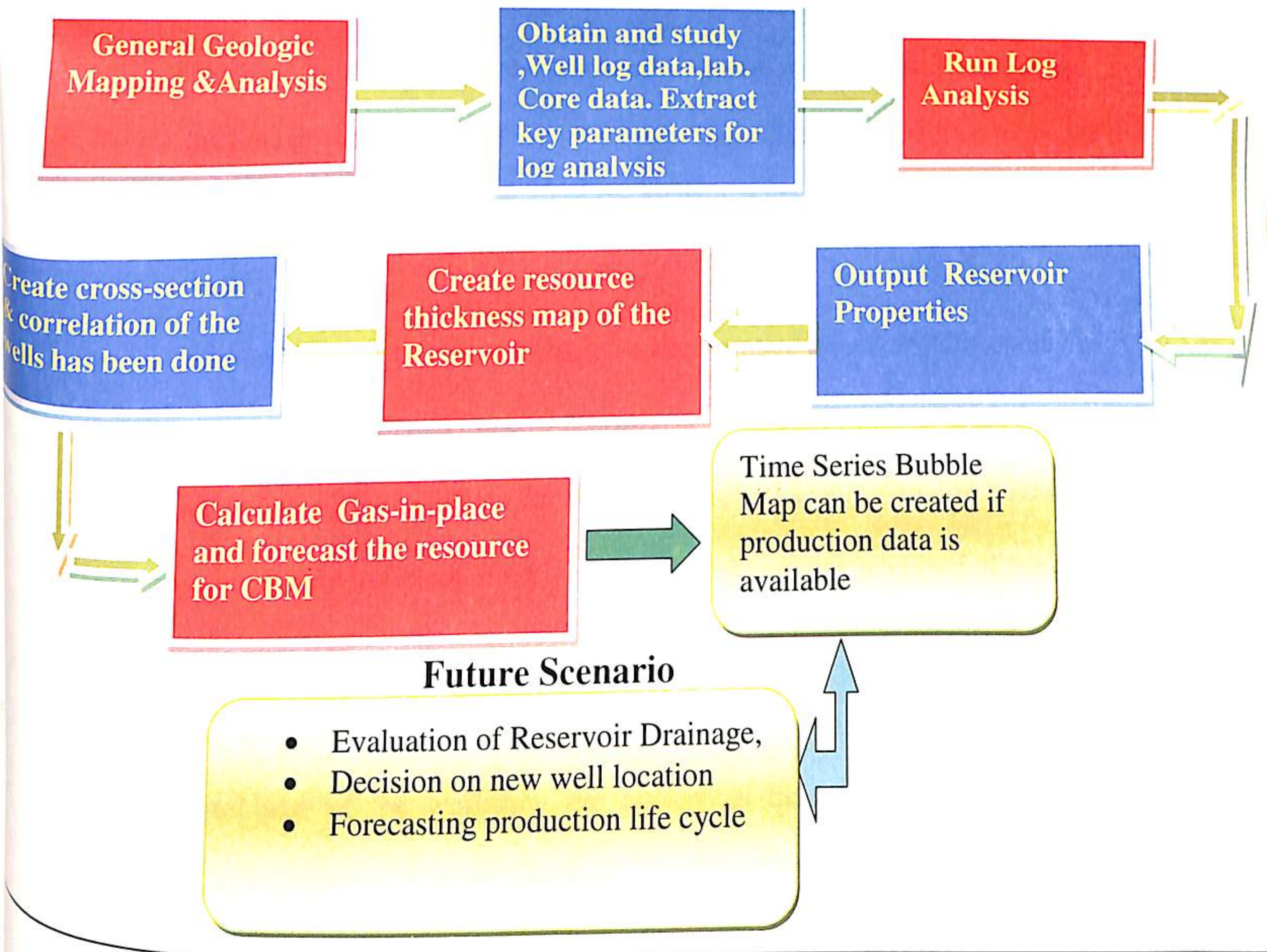

FIGURE 8.1: VISUAL DISPLAY FOR PROCESS FLOW-CHART

8.4 CONCLUSIONS FROM THE STUDY

The following are some of the important outcomes of this research work:-

1. Analysis of the various Well logs are important information source for identifying coal layers and infer their characteristics. It provides several important parameters such as net pay thickness and host of inputs for map preparation necessary for reserve estimation and forecasts spatial extent, gas potential. Well logs have been found useful in all stages of CBM project management from exploration to exploitation.
2. Interpretation of the Well-logs and determination many important reservoir properties like thickness, density and other parameters for CBM reservoir.
3. Creation of the detailed lithology of the Area of Interest (AOI) which will be ultimately helpful for the detailed Geological analysis of the mentioned area of interest.
4. Cross-sections of the major wells have been created which will ultimately prove the lateral continuity of the coal seams.
5. Calculation of Gas-in-Place for prominent seams as the Area of Interest has a multi-seam environment. Finally evaluation of resource potential of the area has been completed.
6. The final creation a lay-out of standard workflow for overall CBM play. The integral part of the workflow are geological mapping, log analysis, cross-section building to assess gas-in-place and finally forecasting the resource potential of CBM for that particular area.

8.4 LIMITATION OF THE RESEARCH

Probably one of the most critical factors to the success of any CBM play is the number of control points. For this research, real time data has been gathered from Jharia Coalfield (Specifically from AOI) and sample data points are scanty. There are less numbers of wells that have digital log data (especially density data) and also other lab data. So, it is often a bit difficult to characterize for a CBM Play.

Apart from this, as production has not started yet in Jharia Coalfield, so production data is not available. For calculation of Drainage areas and radius of currently producing wells is not possible.

8.5 FUTURE SCOPE OF THE STUDY

To have a complete knowledge of CBM play and to generate more realistic basin modeling in CBM, we must require Production data (both water & gas). Bubble-map can be created with the magnitude of both gas and water production from the reservoir zone. If per well cumulative production over different time periods can be obtained, it will find be helpful to create time-series bubble maps of the production magnitude as a way to evaluate the progression of reservoir drainage.

If production data is available, workflow created so far can be extended for determining the drainage areas .Combination of the recoverable resource maps with the probable drainage maps will evaluate the new location for drilling. The basin modeling in that way will be more accurate.

In addition to uses for gas drainage, this modeling technique can also be used for water production in the de-watering phases of reservoir. This will accomplish a better job of planning drilling patterns for optimum reservoir de-pressurization.