

## **An Alternative Method for Estimating Gas In Place Values for CBM Wells**

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### **Summary**

Extensive shallow gas drilling has occurred over the past 50 years with considerable infrastructure and overhead costs to delineate, estimate and capture this resource. A significant portion of the developed sections in Southern Alberta have been drilled to ultimate well density and have reached their economic potential for shallow gas. With a renewed focus on Coal Bed Methane (CBM) in Southern Alberta, the resource can be easily developed through existing wellbores and infrastructure. As short term gas prices face downward pressure, Schlumberger and Cenovus have devised an alternative method for estimating gas in place values for CBM wells using currently available wireline log, laboratory core and testing data in combination with derived algorithms relating relationships between proximate components and gas content for the Taber and McKay zones of the Belly River coals in Southeastern Alberta.

### **Introduction**

Shallow gas recovery rates are in decline with peak production reached in 2005-2006. The average shallow gas well is currently producing less than 25 mcf/d with many wells reaching or producing below their economic abandonment rate. The current method to obtain desorption control well status requires a significant outlay of capital to acquire core or cuttings for testing. An initial minimum cost estimate for survey and acquisition, drilling and abandonment, surface abandonment and laboratory analysis of the core or cuttings is \$120,000 CAD. As the cost associated with the current method is prohibitive to expanding the resource an economic low tier solution is required.

One goal of this study was to provide an economical method to estimate the resource using currently available data with a view to minimizing the drilling and, in turn, environmental impact of quantifying the available resource.

## Theory and/or Method

The interpretation method as depicted in the simplified workflow in Figure 1 uses currently available well logs, desorption data specific to the area, high pressure adsorption tests for coal isotherms and derived algorithms that relate well log values back to the laboratory data.

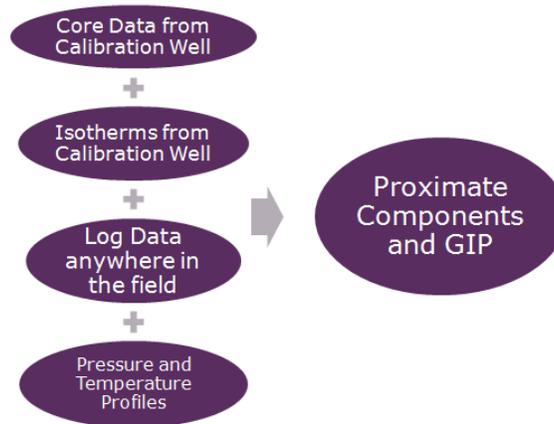


Figure 1: Simplified Workflow

Coal proximate analysis is a laboratory method used to determine components of coal through sample pyrolysis or heating under specific conditions. The key proximate components are: moisture content, volatile matter, fixed carbon and ash. From the figure below, a general relationship between the fixed carbon, volatile matter and moisture as related to ash can be established.

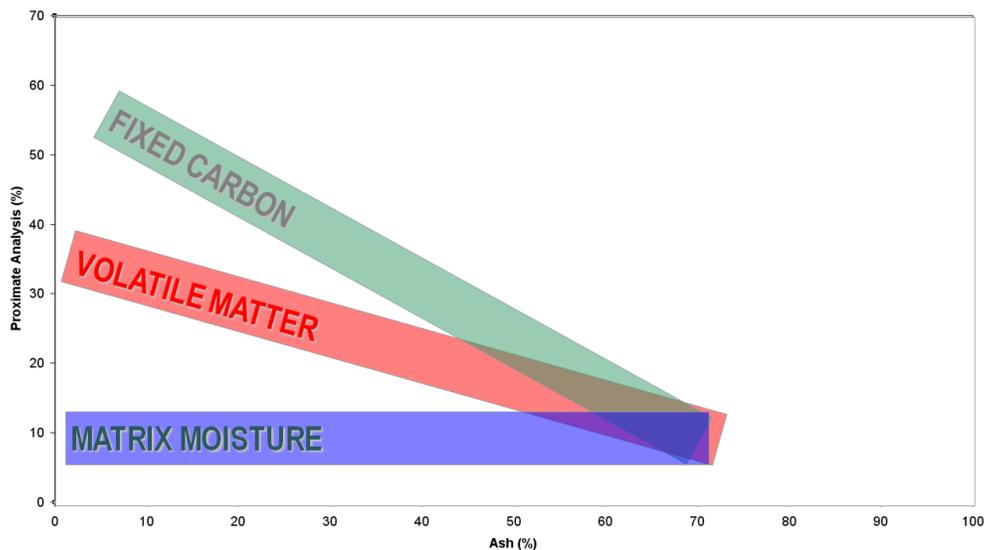


Figure 2: General distribution of proximate components

Two traditional methods of determining ash from log measurements are based on gamma ray or density readings. In the gamma ray method, sample radioactivity is related to ash content and specific local relationships valid over a wide area are developed. With the density approach, provided that the specific density of the coal fraction and ash fraction can be determined, a calibrated density log can lead to reasonable ash indications.

The availability of consistent data across the field is the main consideration for proximate component determination. As density data is not readily available and cannot be satisfactorily acquired after the well has been cased, the Schlumberger approach uses a proprietary technique built on the more prevalent Cased Hole Neutron-Sonic-Gamma Ray suite to determine ash. Schlumberger has developed an algorithm combining gamma ray and neutron measurements that can be used in cased hole environments to estimate proximate components. Once the log derived proximate components are calibrated with core proximate components, gas in place can be determined using the log derived outputs in combination with Langmuir isotherm relationships.

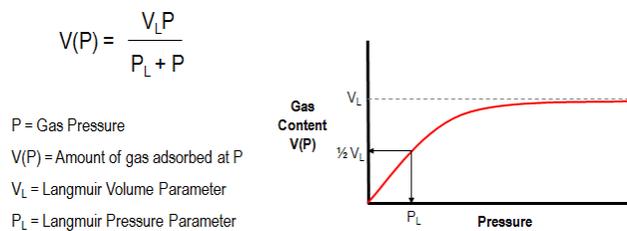


Figure 3: Langmuir Isotherm

## Examples

The log plot below is a composite display showing input well log data in tracks 1 and 2 with log derived proximate components plotted with core derived proximate in tracks 3 to 5. Track 6 shows good agreement between the log and core derived gas in place values.

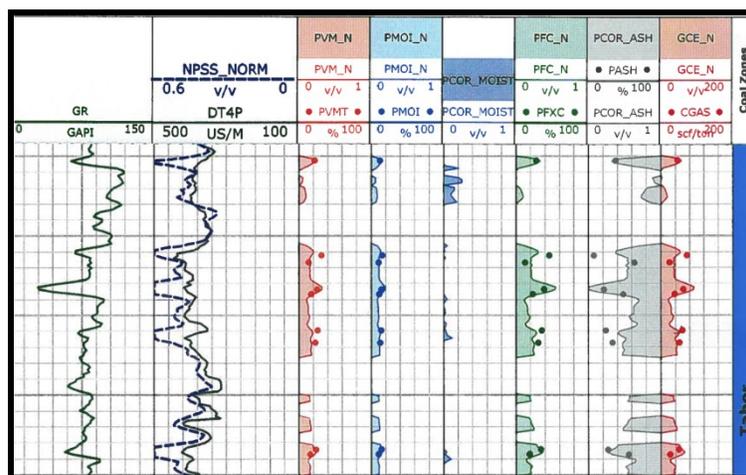


Figure 4: Log derived proximate components on a cored well

## **Conclusions**

Proximate and gas content values were successfully derived using field correlations and existing well logs. Measurement resolution may lead to subtle differences between core derived ash and log derived ash. As core measurements are made on a sample representing approximately one inch of rock whereas log measurements typically resolve up to two feet of rock, the log technique averages the sample. Unlike coring, as the log measurements cover the full range of the logged interval, the log technique offers a more complete picture of the reservoir as all potential zones are analyzed.

Log derived proximate components were calculated using the ash content calibrated to core derived proximate component relationships on the control well. After calculating the proximate components, rank and ash for each seam were determined and Langmuir isotherms used to derive GIP. Other inputs to this process were temperature and pressure gradients.

This technical analogue is a method to leverage currently available wireline log, laboratory core and testing data in combination with derived algorithms relating proximate components to gas in place. This approach benefits industry as a more cost effective way to determine the increased resource delineation and capture while minimizing additional environmental impacts related to drilling additional wells.

## **Acknowledgements**

The authors wish to acknowledge Cenovus and Schlumberger for their commitment to this project.

## **References**

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