AAPG Datapages/Search and Discovery Article #90234 © 2015 AAPG Asia Pacific Region, Geoscience Technology Workshop, Opportunities and Advancements in Coal Bed Methane in the Asia Pacific, February 12-13, 2015, Brisbane Australia

Predicting Coal Connectivity in an Extremely Heterogeneous Sedimentary System; A Case Study of the Jurassic Walloon Coal Measures, Surat Basin, Australia

Zana Williams[1], Leon Erriah[1], Kat Norman[1], and Colin Zimmer[1]

[1]QGC, Brisbane, QLD, 4000, Australia

Abstract

Successful CSG development relies on dewatering of coal seams before desorption and production of commercial volumes of gas. Critical to success is ensuring that the development well pattern and spacing accesses as much of the coal as possible in order to maximise gas production. Understanding coal connectivity is a critical step in planning an appropriate well spacing but there is confusion around what is meant by coal connectivity and the best way to describe it in extremely heterogeneous systems such as in the Surat basin.

Description of the three dimensional coal seam distribution of the Jurassic Walloon Coal Measures, Surat Basin, is particularly challenging. Significant lateral and vertical heterogeneity of the coal seams across the Surat basin exists with short-range variability observed between 750m spaced wells. Coal seam thickness is generally below seismic resolution (average 20cm) and while there is confidence of well-to-well correlation of larger coal seam packages, smaller coal seams, which can contribute a significant percentage of the well productivity, are much harder to correlate. Modern analogues provide some insight but key differences in climate, regional volcanic activity and, critically, basin size, limit the relevance of these analogues. Intracratonic basins across the globe appear to be much smaller than the Surat basin during deposition of the Walloon Coal Measures. Figure 1 highlights an example of a detailed well to well correlation, note that the correlation is further complicated by the splitting and coalescing nature of the coal seams.

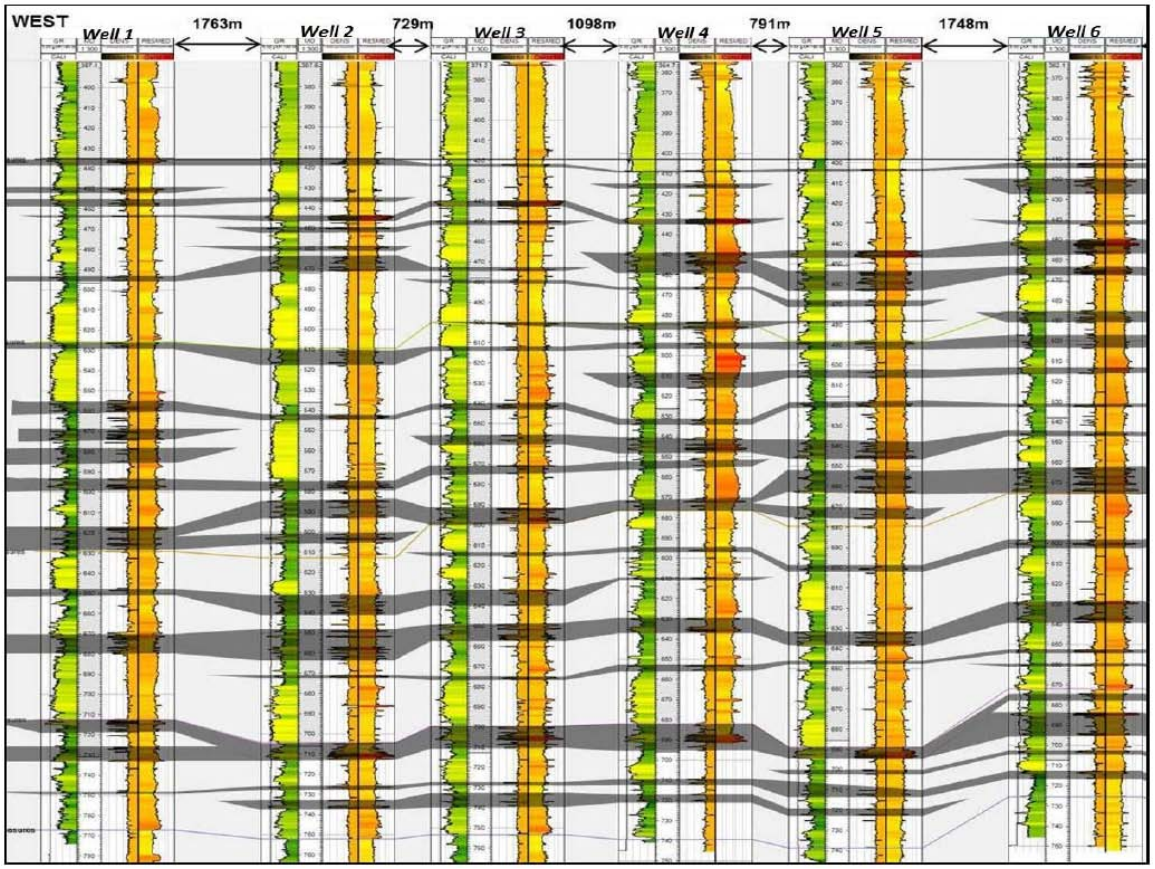

Figure 1. An example of fine-scale well correlation across approximately 6km of the Surat basin.

Three-dimensional reservoir models provide one way to estimate how much coal will be connected to the development well stock and provide a relatively efficient way to test different subsurface descriptions with different field development scenarios. Critical to this understanding is the geological description of the lithofacies in the 3D facies model. Therefore, detailed understanding of coal body geometry and dimensions are critical to generating realistic coal connectivity estimates. A detailed study of the coal body geometry of the Walloon Coal Measures has been completed using sedimentological characterisation from core, fine-scale well correlation as well as modern and ancient analogue studies. This has been used as a fundamental basis to inform a range of 3D reservoir modelling techniques, which have been employed to understand the uncertainty in regional coal connectivity. Figure 2 highlights one of example of a coal distribution concept used to inform the facies modelling algorithm of a 3D reservoir model.

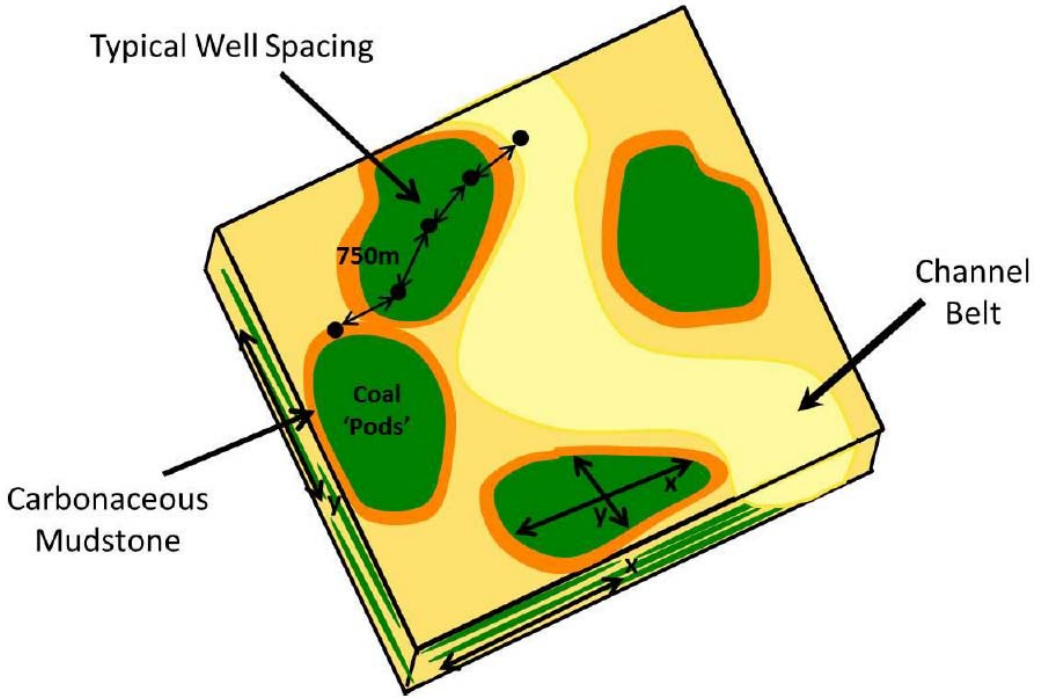

Figure 2. A conceptual diagram of the distribution of coals within the Surat basin.

A number of key reservoir model parameters have been varied and results analysed in order to understand connected regional coal connectivity to a range of different development scenarios. These range from basic I, J and K grid dimensions and well log upscaling parameters through to different facies modelling algorithms and associated inputs e.g. variogram length. In order to assess regional connectivity via 3D reservoir models a careful balance between detailed reservoir description and software and CPU processing limits must be achieved with a clear understanding of the impact that any compromises will have on the uncertainty in connectivity.

Establishing coal connectivity is a fundamental step in understanding both field EUR and timing of ramp up and plateau of gas production and, therefore, commercial viability. It is therefore critical that 3D reservoir models used to establish connectivity are representative of the subsurface description and that associated uncertainties are well understood.