Can Decompauction Increase the Predicting Accuracy for Depositional Facies in Geological Modelling?

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INTRODUCTION

Well correlation and/or seismic interpretation based stratigraphic framework is basic for geological modelling. However, peat/coal compaction may change the sedimentary structure (Fig. 1). Also, there is big debate about the peat/coal compaction ratio as shown in Fig. 2. A local area, about 6 × 8 sq. km with 47 wells' wireline logs is selected for this study. The well spacing ranges from 0.8-1.5 km. Among those wells, 19 wells were used in modelling and 28 wells were used as monitors for prediction accuracy assessment. Two sets of models were generated, one with un-decompacted wireline logs and the other with de-compacted wireline logs. Fig. 3 shows the compaction ratio for different lithologies. A workflow was generated and used to optimise the variogram geometry.

![Fig. 1. Peat/coal compaction changes thickness hence structure (after Titheridge, 2016?)](image1.png)

![Fig. 2. Variations of peat:coal compaction ratio in the literature (after Widera, 2015). (a) Wierzbicki (1996); b) Bird et al. (2004); c) Widera (2015a); d) Kurisch (1989); e) Smith and Gyesy (1986); f) Whitney (1982); g) Wierzbicki (1996). Values by Bird et al. (2004) ) were corrected by Bird and Langer (1986) and Ethol (1985).)](image2.png)

![Fig. 3. Variation of compaction ratio of thickness for different facies with burial depth (after Buchanan, 2015).](image3.png)

DATA AND METHODOLOGY

![Fig. 4. Locations of the study area (a) wells (b).](image4.png)

RESULTS

![Fig. 5. An example showing depositional facies comparison between log and model predicted depositional facies at one borehole. A workflow in Petrel was used to automatically calculate the prediction accuracy by using different variogram ranges, major direction, and vertical range. Major range varies from 0 to 5 km; major-range/ minor-range ratio varies from 1 to 2; vertical range varies from 1 to 5; major range direction varies from 0 to 180°. Each case includes 200 realisations.](image5.png)

![Fig. 6. Correlation based on un-decompacted (a) and decompacted (b) wire logs and depositional facies.](image6.png)

![Fig. 7. Histogram of facies.](image7.png)

![Fig. 8. Predicting accuracy against (a) major range of variogram; (b) major range direction; (c) vertical range of variogram for coal with un-decompacted wireline logs. Major range at about 2 km yields highest predicting accuracy of about 23%. Major range direction and vertical range have less impact on predicting accuracy for coal.](image8.png)

![Fig. 9. Predicting accuracy against major range of variogram with decompacted wireline logs. Major range at about 3 km yields highest predicting accuracy of about 35%. Note that the different decompauction ratios will offset the grid numbers for different facies.](image9.png)

CONCLUSIONS

- A workflow has been generated in Petrel to compare the predicting accuracy for depositional facies with different variogram geometry.
- Major range has a strong relationship with predicting accuracy compared with variogram direction and vertical variogram range.
- The incremental predicting accuracy is about 8% with decompauction logs.
- More decompauction ratios will be assessed in future.

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