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Assessment of phosphorus estimation uncertainty in the South Walker Creek Rangal Coal Measures, Bowen Basin, Central Queensland

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Phosphorus is a deleterious coal component that can significantly impact the marketability and utilisation of coals. It can form slag deposits in certain types of boilers, degrade the quality of steel by-products, and cause long term environmental problems through the leaching of coal waste. Understanding the uncertainty in the estimation of the distribution of phosphorus in the Rangal Coals of South Walker Creek is the subject of interest in this paper.

The nature of phosphorus distribution in this deposit is such that the element is only abundant in a few plies/sections, but not in others. Considering that the sampling regime has already been restructured to respond to fluctuations in phosphorus content, this has given rise to questions regarding the suitability of the modelling algorithm currently being used for estimation. Currently, the Inverse-Distance-weighting (IDW) and Ordinary Kriging (OK) methods are used for phosphorus estimation. Considering the IDW method, the major drawback is that the weights are not assigned to the samples based on the spatial continuity (variogram), sample clustering will introduce a bias on the estimates and there is no quantitative mechanism that one can use to assess the reliability of the estimate. As for the OK algorithm, it aims at minimising the error variance (in the least square sense) of the estimates by smoothing out the actual geological structure resulting in a variability of estimates that is generally less than that of the true values [1,2]. When assessing the grade fluctuations of the trace elements, this approach fails to yield realistic results by providing a smoothed, averaged out value for the horizon.

Conditional simulation (CS), the method being considered for this study, is a Monte Carlo simulation-based technique that produces numerical models of possible distribution of the simulated phenomenon in space [3]. CS, also called stochastic imaging, can be used to generate equi-probable realisations each of which ensures global accuracy (variogram reproduction) by preserving the actual geological structure. The global uncertainty resulting from the simulations can be assessed through the fluctuation from one realisation to another. In this case study, the uncertainty associated with phosphorus estimation will be assessed through the sequential Gaussian simulation (sGs) algorithm. The nominal areas corresponding to different mining periods will be evaluated in terms of the product specifications defined for the deposit.

Keywords: Conditional Simulation, Phosphorus, Coal Thickness, Deleterious Component

References:

[1] Srivastava, RM (2013) International Journal of Coal Geology 112: 2-13
[2] Olea, RA et al. (2011) International Journal of Coal Geology 85: 78-90.
[3] Karacan, CO et al. (2012) International Journal of Coal Geology 90-91: 50-71.