Combining Geostatistical Hierarchical Clustering (GHC) and potential field method for fast and flexible domaining with updating capabilities: a case study with grade shell modelling in iron ore.

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The domaining process in the mining industry aims at partitioning the ore deposits into 3D volumes ensuring local grade stationarity for robust resource estimation. Domaining is often reduced to the 3D modeling step but it is actually preceded by a crucial data clustering step which consists in understanding the various domain characteristics and assigning each drillhole sample to a given domain. The development of implicit modeling approaches has drastically reduced the time dedicated to the modeling step over the last decade with a semi-automatic approach. The classification step however, still relies in most cases on a subjective time consuming manual interpretation. Geovariances has introduced an innovative workflow to overcome this limitation by combining Geostatistical Hierarchical Clustering (GHC) and the potential field method. This proposed approach extends the implicit modeling advantages to the whole domaining process, therefore ensuring reproducibility, conversion of subjective parameters into objective ones, auxiliary variables integration and easy update. The GHC (Romary et al., 2011) is a multivariate unsupervised machine learning algorithm which provides a clustering method that actually takes into account the key spatial dependency between the samples. The use of the potential field method (Renard et al., 2013) was motivated by its implicit nature, its capability to integrate directional data and to assess uncertainties related to the domains’ envelopes through simulations.

This paper first summarises the key points of the underlying methodology and then describes the implementation of this new workflow on the iron ore OB31 deposit operated by BHP Billiton. The samples have been classified into waste, low grade and high grade domains using GHC on the mineral grades and several spectral analysis variables. Then high and low grade shells were modeled thanks to the potential field method and the uncertainty over the domain boundaries were characterized using potential field simulation. Finally new drillholes were efficiently integrated to update the classification and the 3D envelopes.