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Development of an empirical geo-metallurgical model that unlocks value of the mineral resources at Yandi Mine

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ABSTRACT

The Yandi channel iron deposit is the only non-bedrock asset within BHP's Western Australian Iron Ore operations. The Yandi orebody is a fluvial sedimentary deposit that consists of a meandering paleo channel, and several tributaries that form six main stratigraphic units containing varying levels of clay, moisture and ochreous goethite. The depositional environment creates a somewhat unique set of circumstances that cause a high amount of materials handling delays when attempting to process the ore. The Yandi operation Incurs between 4-5 million tonnes of lost feed opportunity per annum due do materials handing delays across all ore handling plant systems.

Yandi mine life is entering its last 5 years of operation, creating additional pressure on the processing plants and mine plan optimisations to handle problematic ore. The historical approach to identify problematic ore within mine planning has been to segregate material thought to be problematic using chemistry as a proxy for clay. This approach is now seen to be over simplistic and not representative of problematic ore from a holistic perspective.

In late 2017 Yandi implemented hyperspectral sensing on blasthole samples, exploiting synergies in the blasthole XRF value chain that was already imbedded at Yandi for chemistry. This spectral analysis has been developed into a handle-ability index using an empirical algorithm derived from mineralogy and moisture inputs. The handle-ability index has been coded into the Yandi grade control model which enables mine planning engineers to optimise mine plans on geo-metallurgical properties in the short term planning horizon. This optimisation has included blending of problematic ore with non-problematic ore within the pre crusher stockpiles. End state we plan on using the handle-ability index in the mining fleet management system to control the sequence of trucks tipping at the primary crushers to reduce materials handling delays in the plant and throughout the supply chain.

The next stage of development was to code the handle-ability index into geological models for use in long term planning, which could potentially convert mineral resources into ore reserves by the reclassification of problematic ore. Future state we will develop a quantitative trained model to replace the empirical model, linking correlations between spectra from the on belt hyperspectral unit, and delays on the ore handling plant to better characterise problematic material.
This report will detail the Yandi journey in expanding the hyperspectral and geo-metallurgical value chain, unlocking resource knowledge along the way. As part of this work a simple model has been developed that describes problematic ore that could be used in other assets and commodities.