Challenge

Plotlogic was engaged to work with an iron ore operation, who, after more than 25 years of mining, was struggling to maintain the consistency of high ore grade.

In iron ore, the negative step in value once ore grade decreases below 62% iron by weight can equate to a 30% drop in saleable price. Producing a consistently high-grade ore is therefore critical for the mine's viability, particularly during periods of lower commodity prices.

The iron ore operation, located in the Pilbara region of Western Australia, has a geological profile similar to that of other channel iron deposits (CID) in the region. Iron is predominately held in goethite and hematite, either present in the nuclei of ferruginous pelletoids or as the mineral cortex accreted around it. In summary, ore have varied compositions with cores and rims ranging from maghemite (Fe2O3) to hematite (Fe2O3) to goethite, (FeO·OH) and rarely in turgite (Fe2O3·nH2O).

The challenge for mining operators is to identify type and grade of ore, and waste materials on the mine wall to improve the processing of ore and scheduling of the removal of ore and waste.

Solution

Plotlogic’s OreSense® system, uses hyperspectral sensors, LiDAR, and cloud-based computation to map key mineralogies with high precision thereby providing means to accurately and precisely define ore and waste. Accurate definition of these boundaries combined with rapid integration of this data into modelling workflows provides means to improve the feed grade. Such improvements subsequently increase mill feed grade and mill efficiency.

The OreSense® system was developed to meet the needs of the industry and is capable of acquiring, processing, and classifying hyperspectral data in the field in real time, mapped to terrain and geo-referenced for integration with mine maps, allowing for precise grade control. In addition to this the other significant advantage in is that it makes mining safer and healthier, as it reduces exposure of personnel to the active mine areas and can detect the presence of hazardous fibrous materials.

The distribution of rocks representing high- and low-grade ore, and waste materials (e.g. clay) can be highly variable spatially. Independent detection and mapping of different minerals and rock types indicative of high- and low-grade ore and waste is critical for efficient extraction of materials from the mine wall and to predict the relative abundance of each so that removal of ore and waste materials can be appropriately scheduled.

Figure 1: Plotlogic’s OreSense® scanning the mine face to identify ore grade quality
Results

The OreSense system was deployed to the site for a 4-week period with the core objective to delineate and quantify the minerals of interest, hematite, goethite, limonite and clays from the hyperspectral data acquired from mine faces, stockpiles and samples. Measures of the hematite/goethite ratio, which contribute to the assessment of the quality of the iron ore, were also completed.

Figure 2 below illustrate 3 images of the same face. The top image is a colour image of the mine face similar to what would be observed by a human being. The middle image a classified map derived from OreSense© hyperspectral data, highlighting the boundaries between different grades of ore and waste materials (clay). The bottom image maps the absolute abundance (wt%) of Aluminum Oxide (Al2O3) on the mine wall.

Summary

The ability of iron ore producers to maintain a consistently high ore grade and consistent functioning of their ore processing facilities is critical in maintaining their competitive edge. Plotlogic’s OreSense system was able to accurately and with high precision map the ore and waste boundaries along with ore grade to inform both mine operators and planners to achieve this goal.

Figure 2: Plotlogic’s OreSense© outputs to identify ore boundaries and ore grade