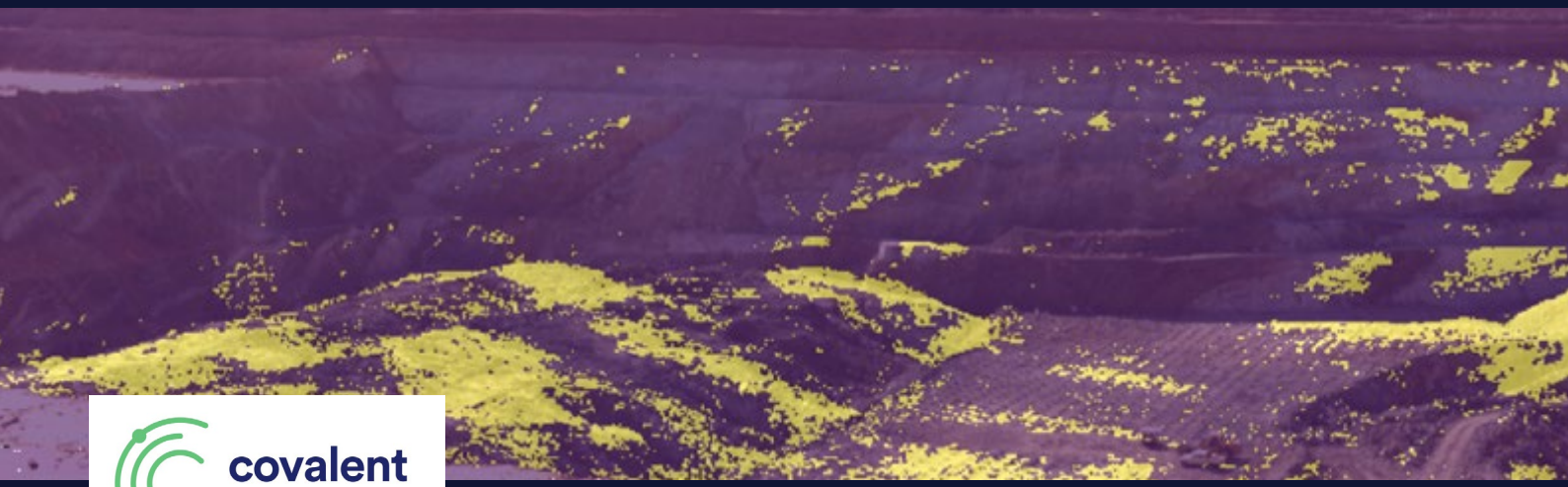
PLOTLOGIC

CASE STUDY



covalent LITHIUM

RAPID ORE/WASTE DISCRIMINATION AND OPERATIONAL OPTIMISATION AT MT HOLLAND WITH ORESENSE®

EXECUTIVE SUMMARY

Covalent Lithium's Mt Holland operation partnered with Plotlogic to deploy OreSense®, an ore classification system designed to bring speed, accuracy, and consistency to ore/waste discrimination in the production environment. By integrating next-generation technology into its daily operations, Covalent Lithium is setting a new benchmark for innovation and performance in the global lithium sector.

Over two project phases, OreSense® proved its capability to deliver rapid, quantitative results directly in the mining environment. The system integrates seamlessly into daily operations, providing geology and production teams with timely and objective information. This not only improved classification accuracy but also gives the mine site a new level of visibility into operational patterns, revealing areas for optimisation in both destination compliance and ore spotter performance.

By enabling fast, consistent decision-making and offering actionable insights, OreSense® positioned itself as both a technical solution for ore/waste delineation and a strategic tool for ongoing operational improvement.

KEY BUSINESS OUTCOMES FOR PHASES 1 AND 2

1. **Technical Performance & Speed**
   - Time from scan start to result available to geologist consistently under 20 minutes
   - Maintained 100% system availability throughout operational periods
   - Delivered consistent and accurate pegmatite/basalt discrimination across a wide range of environmental and geological conditions
2. **Workforce & Workflow Impact**
   - Demonstrated that use of OreSense® outputs reduced the standard deviation of ore spotter variance in 0-10% waste estimates from 11.6 to 4.3
   - Provided easy to digest visual heat maps of ore/waste classification suitable for use by ore spotters and geologists
   - Integrated smoothly into geology daily inspections without disrupting production cycles
   - Offered an objective benchmark for ore spotter performance, enabling targeted training and feedback
3. **Operational Optimisation & Insights**
   - Provided rapid, quantitative waste dilution data for monitoring and improving destination compliance and selective mining practices
   - Supported proactive quality control by identifying potential plant feed contamination early
   - Enabled resource optimisation by allowing geologists to identify incorrectly placed loads for correction
   - Created a permanent digital record of contaminated ore stockpile material classification for future analysis and planning

BACKGROUND

At Mt Holland, the ability to feed clean pegmatite ore to the processing plant is critical for maintaining product quality and plant efficiency. Visual discrimination between ore and waste - predominantly basalt - is an industry wide focus for continuous improvement initiatives. The two materials can appear remarkably similar, and environmental factors such as dust, lighting variability, and complex geology make the task even more difficult. Ore that contains between 3% and 50% basalt is commonly stockpiled as 'contaminated ore' for future processing using alternate methods.

For ore spotters, this means that opportunities exist to support decision making, particularly when dealing with material containing low to moderate dilution. Continuous improvement in this space provides opportunity for positive implications on plant feed quality, ore control, stockpile management, and overall mine and resource efficiency.

THE ORESENSE® SOLUTION

Plotlogic's OreSense® technology uses imaging spectrometry and advanced machine learning to scan active mining faces and stockpiles, producing detailed heat maps that identify the spatial distribution of ore and waste. This information is delivered to operational teams in less than 20 minutes, with data capture completed in less than five minutes.

By combining speed with accuracy, OreSense® offers a reliable feedback loop that can be embedded directly into the site's ore control system. The technology not only offers immediate continuous improvement opportunities in ore classification but also generates a permanent, quantitative record of material characteristics that can be analysed for trends and operational insights.

DEPLOYMENT AND INTEGRATION

Following laboratory validation in Phase 1, where distinct spectral signatures for pegmatite and basalt were confirmed under varied material conditions, Phase 2 focused on full-scale deployment in the field. OreSense® was used to scan mine faces, ROM, Contaminated Ore, and Waste stockpiles, integrating into the daily work routines of both ore spotters and geologists. An example is shown in Figure 1.

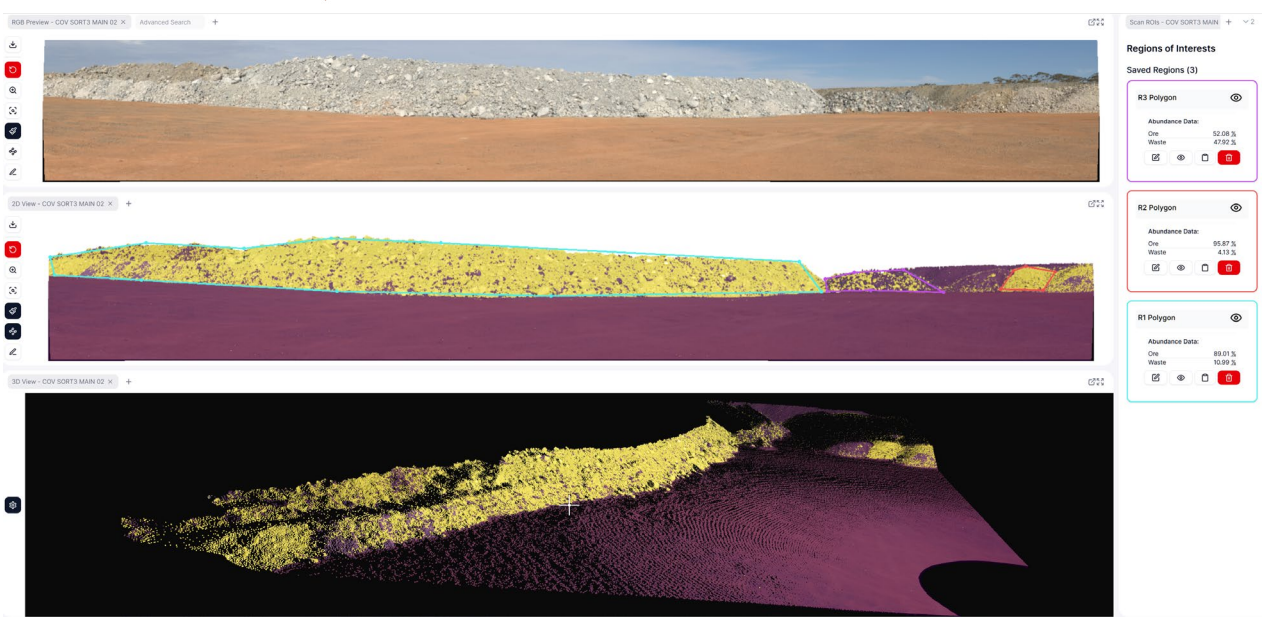


Figure 1 Example contaminated ore stockpile scan

The deployment confirmed that OreSense® can operate without disrupting production schedules, providing consistent coverage of active mining areas. The web-based platform allowed multiple team members to review scan data, making it possible to compare performance between shifts and ensure alignment in classification decisions.

PERFORMANCE VALIDATION

Calibration and validation of the classifiers used an iterative approach, responding rapidly to site specific conditions in the early stages of deployment. As calibration progressed and accuracy was validated, frequency of updates decreased to a sustainable pace, inline with continuous improvement of the base technology. Continued confidence in outcomes for the ongoing operation of OreSense® is maintained through rapid investigation and resolution of any calibration issues identified by the site team.

During Phases 1 and 2, performance was assessed throughout validation and operational deployment stages. Some specific validation examples included:

- Comparative assessment of classification accuracy in the test/train stage of model development. Representative samples were obtained with input from the site geology team and spanned key variables in addition to the primary parameter of lithology. Drill samples provided the opportunity to inspect the relationship between categorical variables (e.g. lithology as logged by geologists) and continuous variables (e.g. chemistry from laboratory analysis). Detailed outputs of this process are available in the appendix

- Field checks of faces and stockpiles were completed by the site team to allow direct comparison of in person results to OreSense® heat maps. This included validating of ore markups as well as simple identification of waste rocks in stockpiles

- A simple test was conducted where a control scan of an ore block tip was compared to the same scan with nine 150x150mm basalt rocks placed on the load. The same scan was then repeated with the basalt rocks marked with pink survey paint to enable visual identification of their location. Test setup is shown in Figures 2, 3 and 4

Figure 2 Accuracy validation test setup

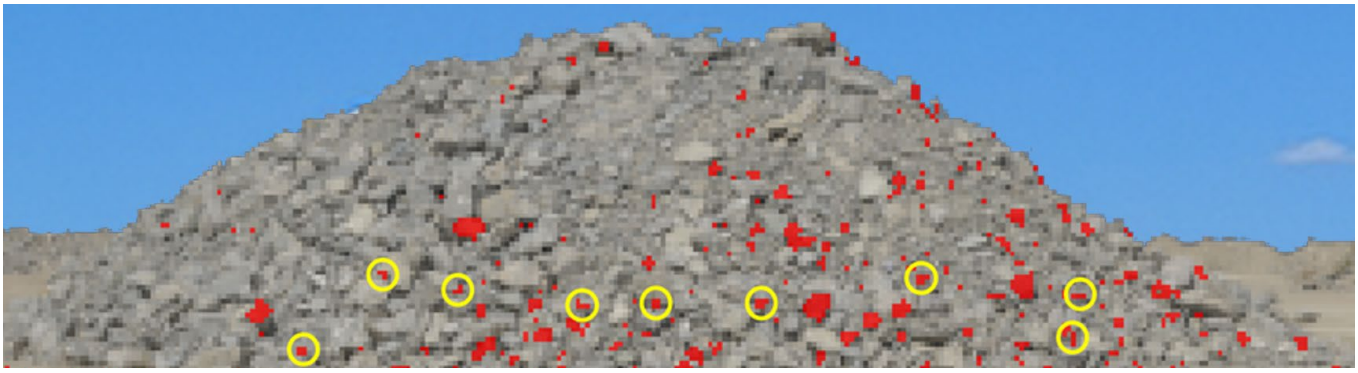


Figure 3 OreSense® scan from 65m (prior to pink markup of basalt rocks)

Figure 4 Close up of block tip shown basalt rocks marked with pink paint for easy visual identification

IMPACT AND INSIGHTS

To categorically demonstrate the impact of OreSense® heat maps on ore spotters a test was designed, referred to as the 'ore spotting challenge'. Participants were tasked with estimating the %basalt content of 12 block tips and 12 excavator bench sections.
The challenge was designed to compare the difference in waste calls between current practice and with the added benefit of visual heat maps provided by OreSense®.

The test required participants to complete the same challenge twice:

- First – using visual and resource model-based aids
- Second – using visual, resource and OreSense® decision support aids

Distribution plots for each test comparing ore spotter variance as compared to %waste value measured by OreSense® are shown in Figure 5. Only challenge loads containing <10% waste are included in the plots. The full data set is available in Appendix A5 and A6.

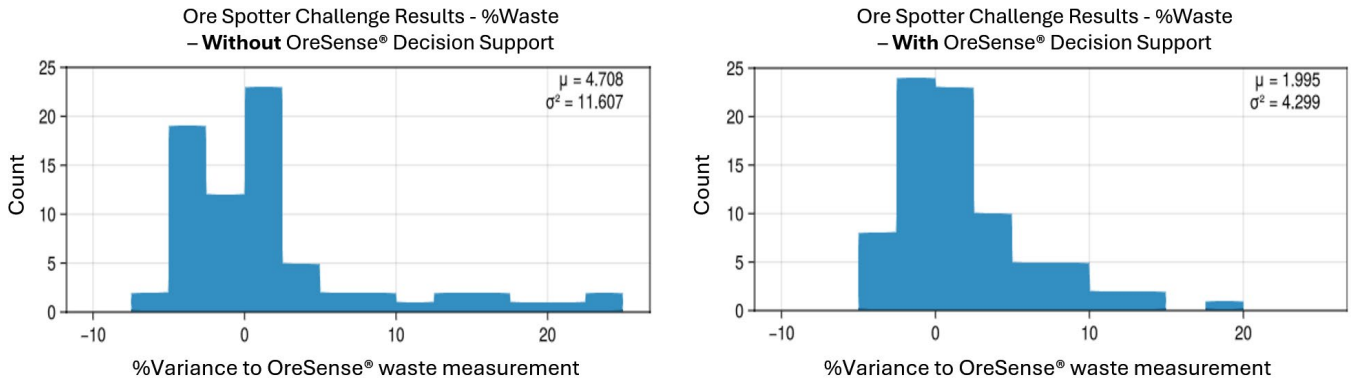


Figure 5 Ore Spotter Challenge Results (excluding challenge loads >10% waste)

The use of OreSense® demonstrated a significant continuous improvement opportunity for improvements in classification consistency. The availability of clear, data-backed visuals provided an additional information source to support ore spotter decision making, especially in cases where material characteristics were marginal or difficult to interpret visually. As an example, basalt abundance was presented as a simple ore/waste classification, removing the need for visual interpretation. This is shown in Figure 6.

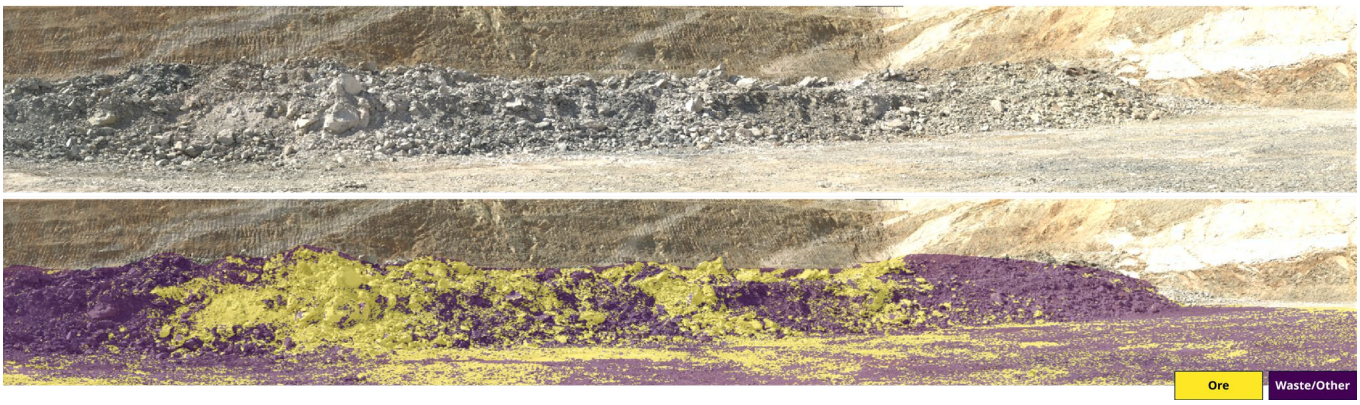


Figure 6 OreSense® scan of production bench

Beyond its immediate role in ore/waste discrimination, OreSense® has become an important tool for identifying opportunities to improve operational efficiency. Continuous data capture enables the site to monitor destination compliance - ensuring that ore and waste consistently reach their correct stockpiles - and to assess ore spotter performance against an objective benchmark. These insights enable targeted discussions on refining workflows and improving adherence to operational standards.

The system also supports proactive quality control at the plant, with data enhancing early detection of potential contamination risks to help maintain the homogeneity of ROM feed.

LOOKING FORWARD

OreSense® remains integrated into daily geology workflows at Mt Holland, focused on operational optimisation. Covalent Lithium and Plotlogic continue to explore potential additional applications including excavator mounted and other geological and geotechnical tasks such as clay classification, lithium mineral differentiation, blast heave and highwall mapping. An example of highwall mapping conducted is shown in Figure 7.

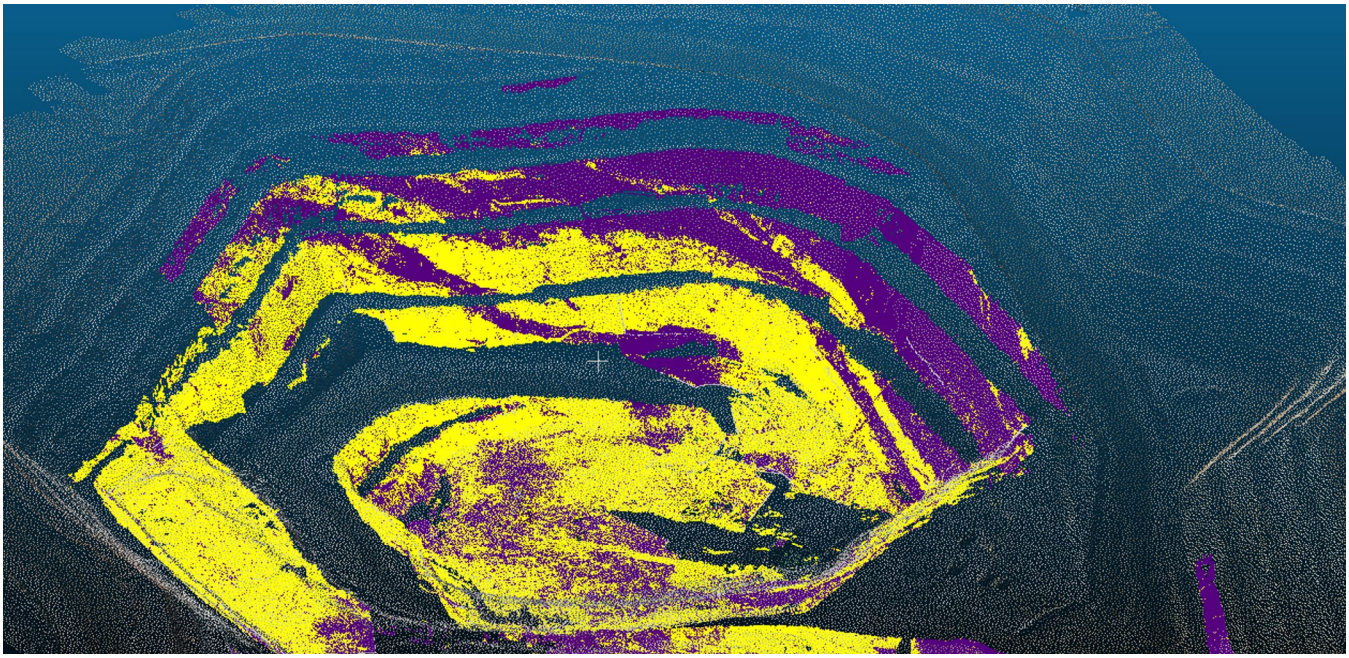


Figure 7 Combined OreSense® scans of pit highwalls

CONCLUSION

Covalent Lithium isn't just keeping pace with industry change - it's driving it by embedding advanced technologies like OreSense® into the heart of its operations.

OreSense® has demonstrated that fast, reliable ore/waste discrimination in a live mining environment is not only achievable but can act as a catalyst for broader operational optimisation. At Mt Holland, the system's rapid data delivery enhances classification consistency, strengthens quality control, and gives the site additional insight to identify and address performance gaps and continuous improvement opportunities.

CLIENT TESTIMONIAL

"In my 40 years in WA mining, I've seen plenty of technologies promise big things in ore control but fall short in the production environment. OreSense® is different. It not only works in the field – it works quickly, consistently, and without disrupting operations.

At Mt Holland, it has proven to be more than just a technical solution for ore/waste discrimination. It's become a strategic tool for continuous improvement, helping us tighten compliance, manage dilution, and plan more effectively. This is exactly the type of innovation our industry needs."

Marcel Kamperman – Geology Manager
Covalent Lithium, Mt Holland Mine

"Plotlogic's OreSense® system measurably impacts one of Covalent's core mining risks – ore loss and dilution. As a decision support tool for spotters, it provides precise, timely insights that improve the accuracy of ore versus waste identification. The result is reduced dilution, increased ore recovery and improved plant performance. The business case is clear."

Ben Jaggard, Director, Mining Consulting
Intifica

APPENDIX

Detailed appendices are included to provide interested parties additional information and high resolution images from the activities discussed in this case study.

A1 – OreSense Predictions vs Logging & ICP Laboratory Chemistry

A 20 m interval of RC chip was reviewed to compare in detail the results of OreSense® prediction relative to original Covalent logging and ICP laboratory chemistry. The interval chosen covers the two dominant lithologies, namely pegmatite and basalt. It includes several boundaries and narrow intervals which allows for investigation of more challenging mixed or "contaminated" intervals. Results of this comparison are shown in Figure 8.

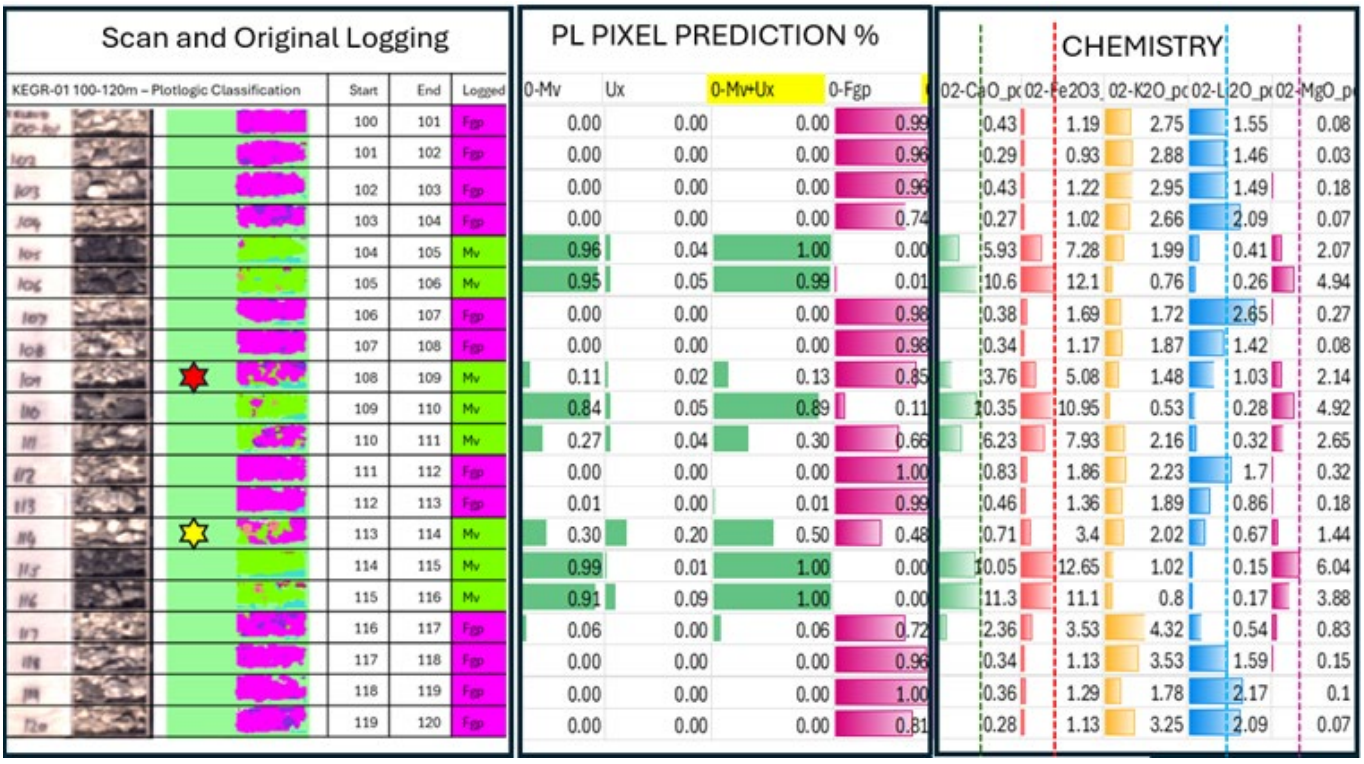


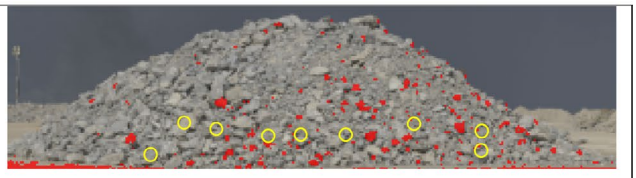
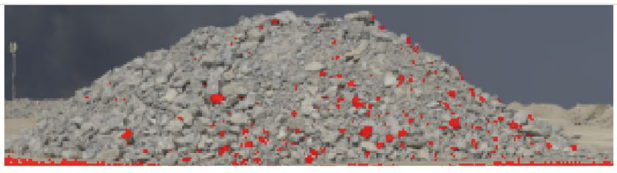
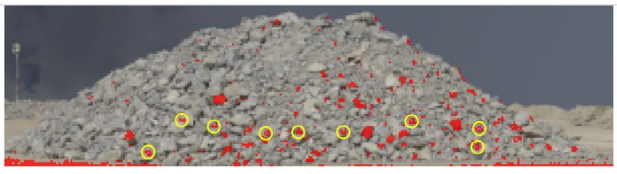
Figure 8 OreSense® Prediction (M L Lithology Model) vs Logging/ICP

Based on Figure 8, the following comments are made:

- Predictions match logging and chemistry well
- Spectral results are consistent with labelled data
- Mixed zones are quantified
- Red star – "original manual logging is potentially incorrect" – picked up by OreSense® scan
- Yellow star – mixed interval – quantitative information allows precise allocation Waste vs Contaminated Ore

A2 – Control Scan Field Validation Results

Table 1 Accuracy Validation Test Setup (Extended)

Control		
Basalt Added		
Basalt Added		
Basalt Painted		
Basalt Painted		

A3 – Ore Spotter Challenge – 12 Block Tip Loads Requiring %Waste Estimate

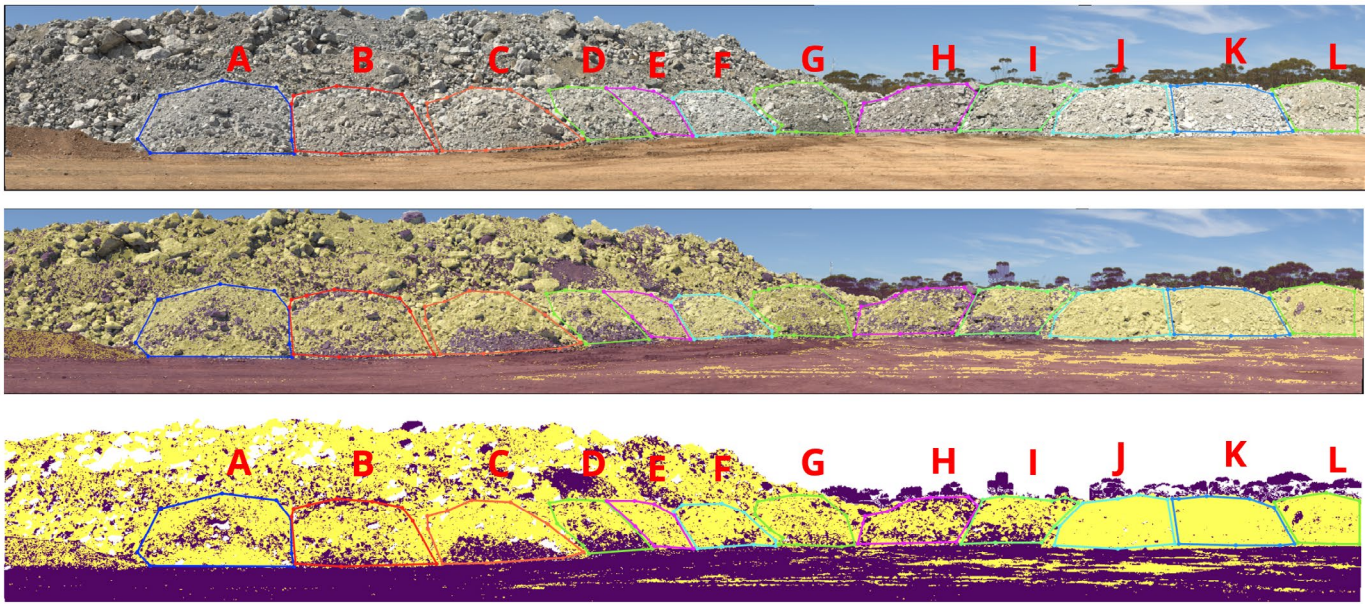


Figure 9 Ore Spotter Challenge – OreSense® Decision Support – Block Tips

A4 – Ore Spotting Challenge – 12 Excavator Bench Sections Requiring %Waste Estimates

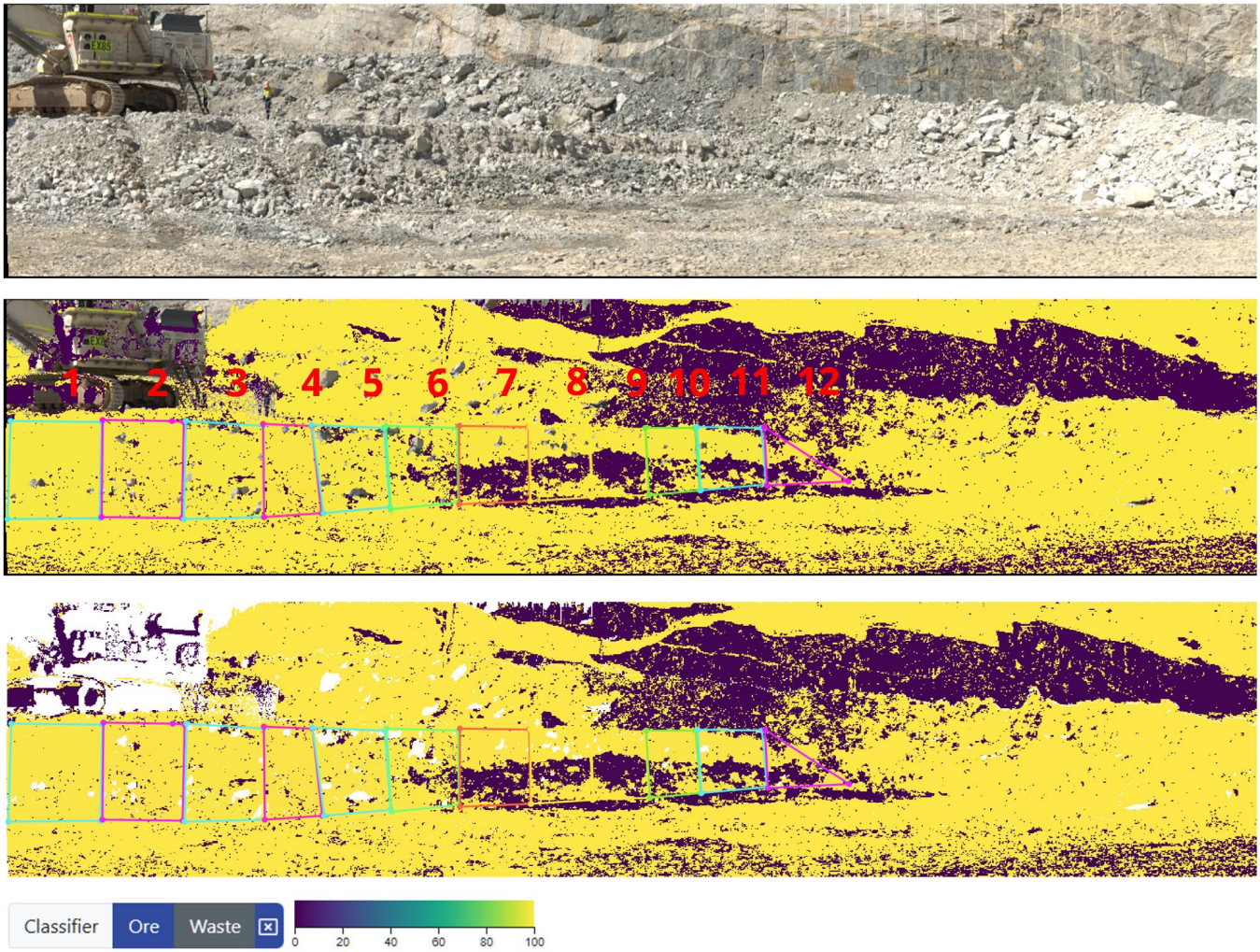


Figure 10 Ore Spotter Challenge – OreSense® Decision Support – Production Bench

A5 – Ore Spotting Challenge Results (All Loads)

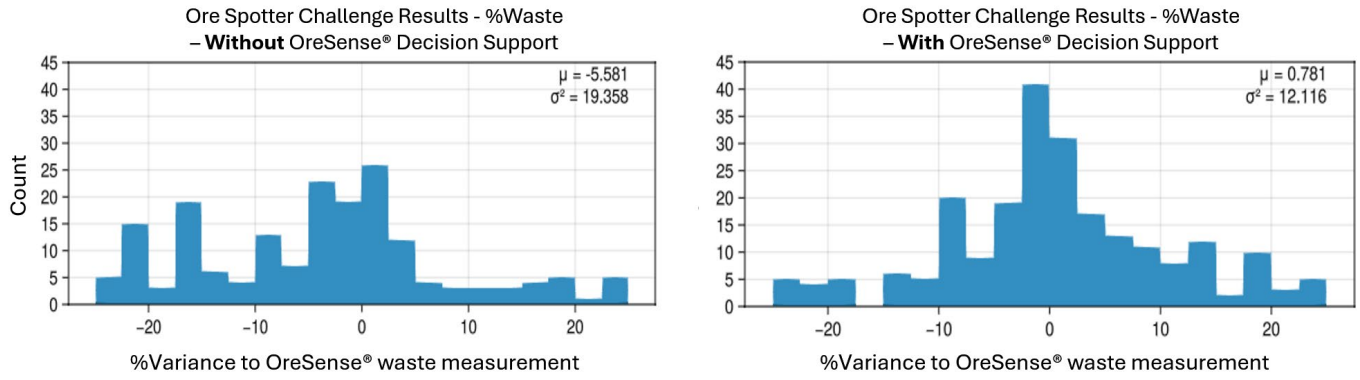


Figure 11 Ore Spotter Challenge Results (All Loads)

A6 – Ore Spotting Challenge Results – Load by Load Results

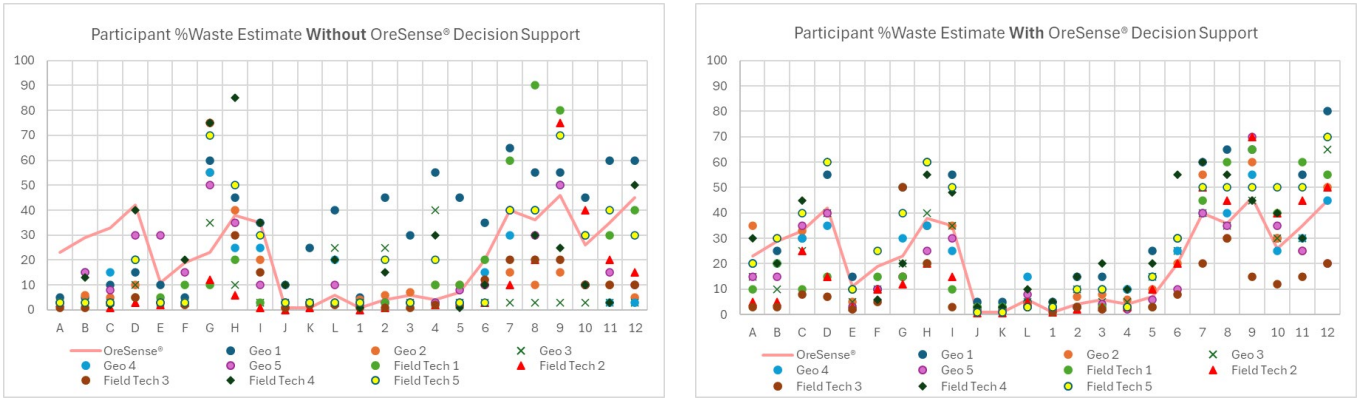


Figure 12 Ore Spotter Challenge Loads by Loads Results

Central 1 – A1, 605 Zilmere QLD 4034 Australia

info@plotlogic.com plotlogic.com