AI-Driven Core Logging and Drill Optimization Using High-Resolution Core Scanning: Enhancing Geological Models and Reducing Exploration Risk

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The successful shift to clean energy and sustainable development hinges on timely access to large quantities of critical minerals. Yet, mineral discovery rates are falling, costs are rising, and the path from discovery to production is slower and riskier than ever. Many mines underperform in their early years, delaying returns and deepening the global supply gap. A key factor behind these challenges is inadequate geoscience data collection and analysis, which leads to poor deposit characterization resulting in unclear risk assessment, suboptimal mine design, and weakened decision-making.

Drill core data remains the most critical and costly component in evaluating a mineral deposit—yet it is rarely collected and utilized optimally. High-resolution core scanning is transforming how the exploration and mining industry acquires drill core data and generates core logs. Traditional logging is slow, subjective, and inconsistent. In contrast, dense multi-sensor datasets from core scanning, when integrated with geological knowledge and spatial context, enable auto-logging and auto-domaining through advanced machine learning algorithms. The resultant digital logs are consistent, spatially coherent, timely, and cost-effective. They provide a firm foundation for geological modelling, downstream risk quantification, and decision making. Digital logs feed directly into a centralized “digital core table” enabling remote access and more collaborative interpretation supported by AI-generated insights that improve efficiency, consistency, and data quality. Crucially, real-time scanning data can now inform drill hole optimization during active drilling campaigns, allowing for adaptive decision-making focused on zones of high geological uncertainty. This maximizes the value of each meter drilled while guiding drill hole spacing strategies that align with resource classification targets and budget constraints.

This presentation will feature real-world case studies that demonstrate the application of these integrated workflows, highlighting their impact on cost reduction, accelerated decision timelines, and improved engineering precision.