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## Geoscience Sample Management and Discovery through Best Practices and Digital Solutions –CSIRO Mineral Resources (Discovery) Case Study

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Physical samples are essential research assets. Systematic curation ensures their accessibility and reusability for future scientific studies. CSIRO Mineral Resources (CMR) scientists collect diverse physical samples—including rock, regolith, water, and vegetation—for research and mineral exploration projects. These samples are costly to obtain, irreplaceable, and critical for generating and validating downstream research data. In mineral exploration, sample analyses allow geologists to compare newly discovered deposits with previously studied ones, helping identify similarities and new exploration targets. However, the lack of standardised curation practices and digital solutions has resulted in fragmented, ad-hoc sample management. Metadata is often recorded manually and inconsistently, increasing the risk of data loss, inefficiencies, and missed opportunities for future analysis. This disorganisation also poses safety hazards, including trip risks, dust accumulation, and storing unidentified or mislabelled samples. Over time, labels on archived samples have faded or detached, and pallet cardboard boxes in storage facilities have deteriorated, making it difficult for researchers to locate and access samples beyond their immediate projects. As a result, researchers frequently rely on project leads or laboratory technicians for assistance, adding to operational inefficiencies. To address these challenges, it is essential to enhance sample accessibility while reducing costs and staffing efforts associated with their management and tracking.

This presentation outlines best practices developed and implemented within CMR Discovery to enhance the physical and digital curation of samples. These practices include standardised procedures for sample identification, labelling, and packaging, as well as the deployment of a comprehensive sample management system to ensure integrity, traceability, and efficient curation. Built on Specify, an open-source biological collections management platform, this system streamlines the recording and discovery of research samples that were previously challenging to track. We highlight the system's key functionalities, including an adapted data model tailored for geological samples and its integration with FAIR-enabling services to enhance sample discoverability and reuse in future mineral exploration projects. Finally, we share key lessons from implementing these practices and insights gained from system adoption, demonstrating an effective integration of technical and non-technical components.

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