

# Minnesota DNR Corescan Project

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# Minnesota DNR Corescan Project Seminar

1. Project Overview
2. Mobile, Automated Hyperspectral Core Logging
3. Hyperspectral Core Imaging for Institutional Core Repositories
4. Procedure and Deliverables
5. Results from Five Focus Areas
6. Data Visualization and Interpretation Using the Coreshed Virtual Core Library





# Minnesota DNR Corescan Project – An Introduction

Don Elsenheimer, Ph.D. | Senior Geologist, Minnesota DNR















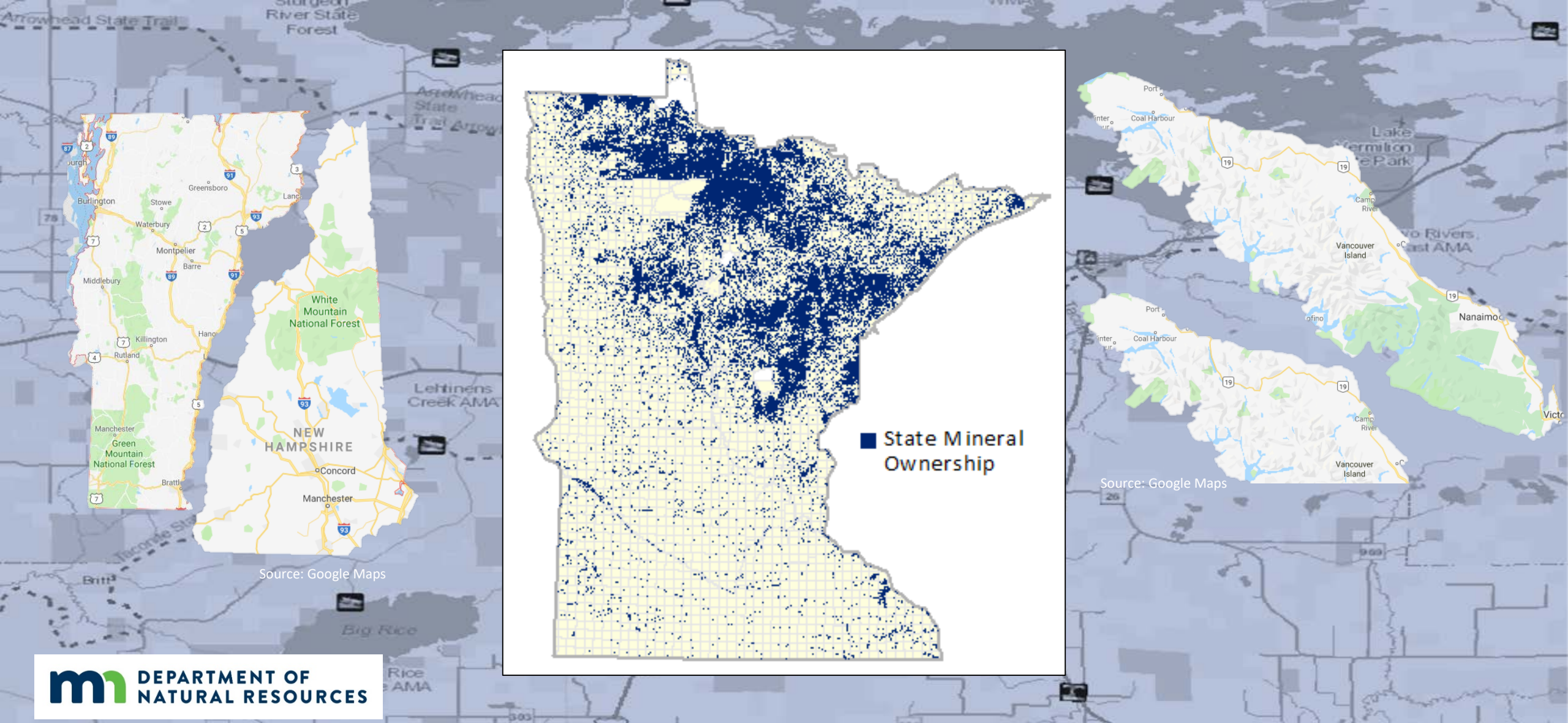




# DNR Division of Lands and Minerals

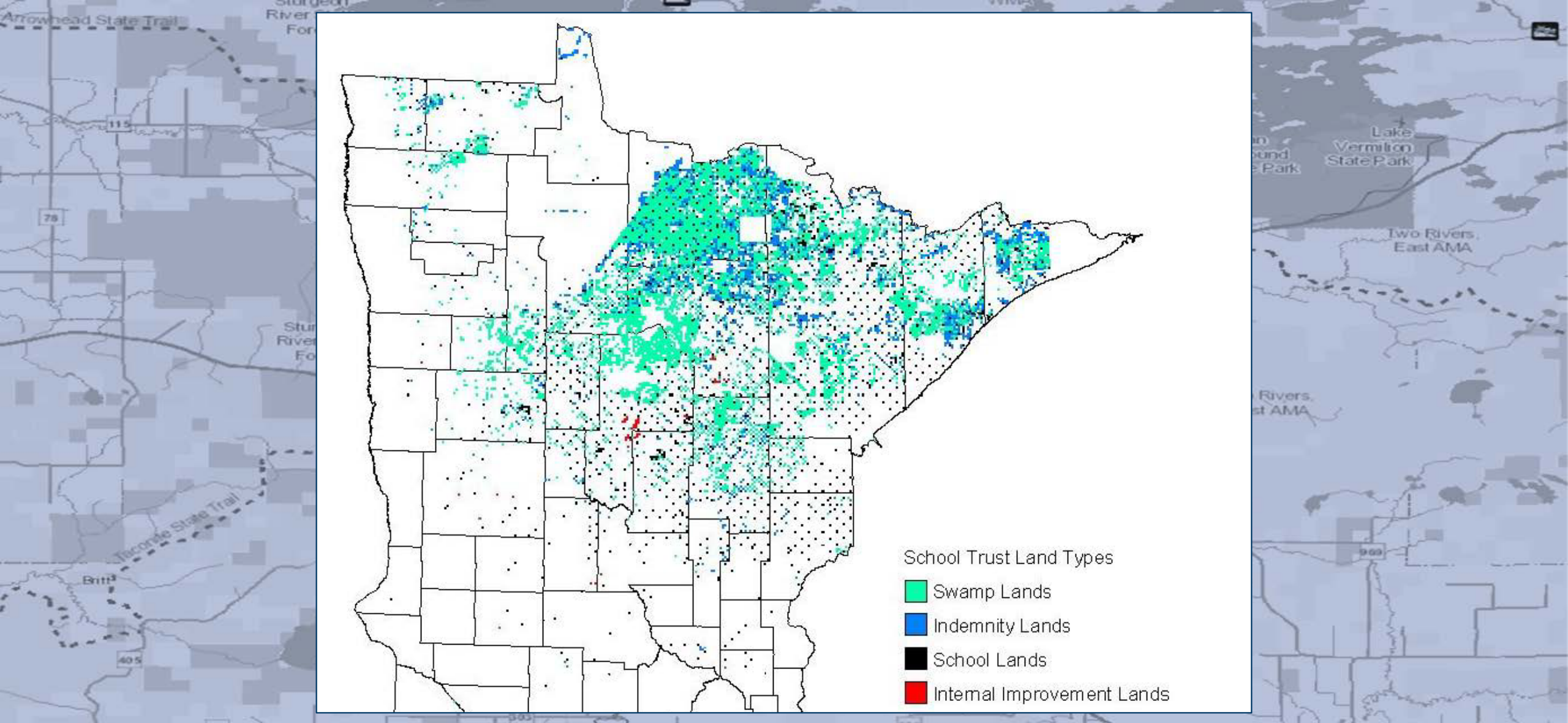






# State-managed Mineral Rights





# School Trust Lands

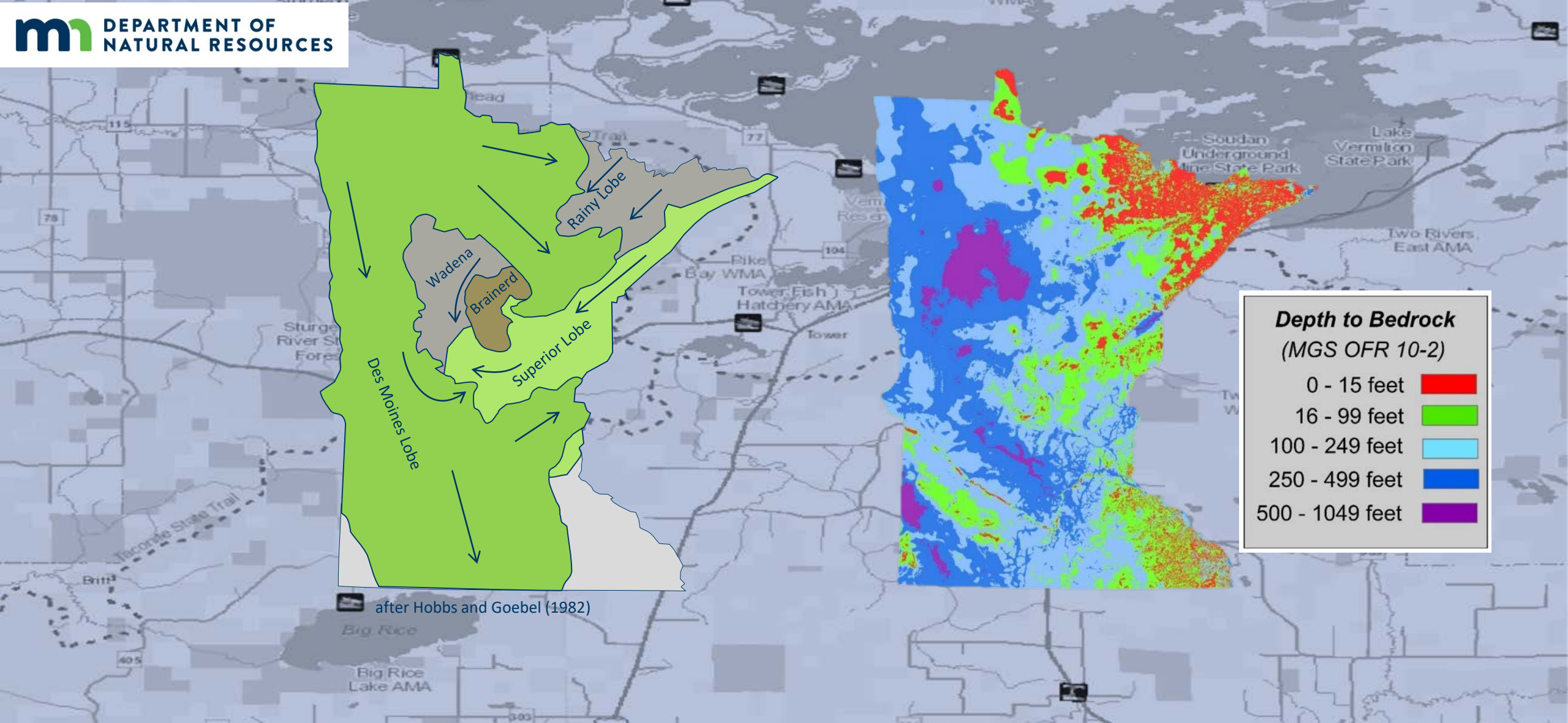




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NATURAL RESOURCES

# Minnesota – a Mining Jurisdiction





## Under Cover Mineral Resources





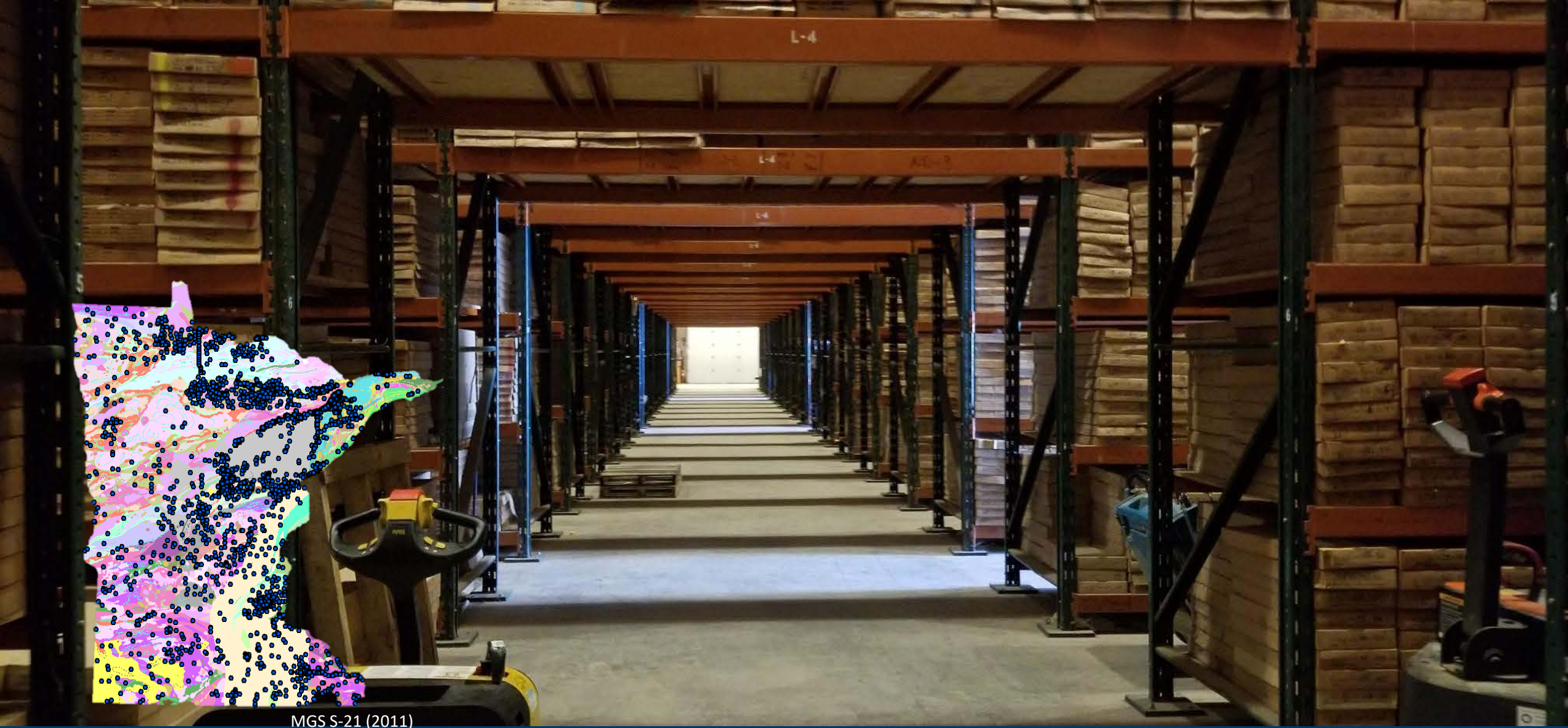
# Exploratory Borehole Law





DNR Drill Core Library





# DNR Drill Core Library





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NATURAL RESOURCES

An Important Public Resource





<b>Amount of archived core</b>	<b>3.3 million feet (1 million meters)</b>
<b>Core replacement cost</b>	<b>\$330 million (at \$100/foot)</b>
<b>Mineral exploration investment linked to archived core</b>	<b>\$600 million</b>



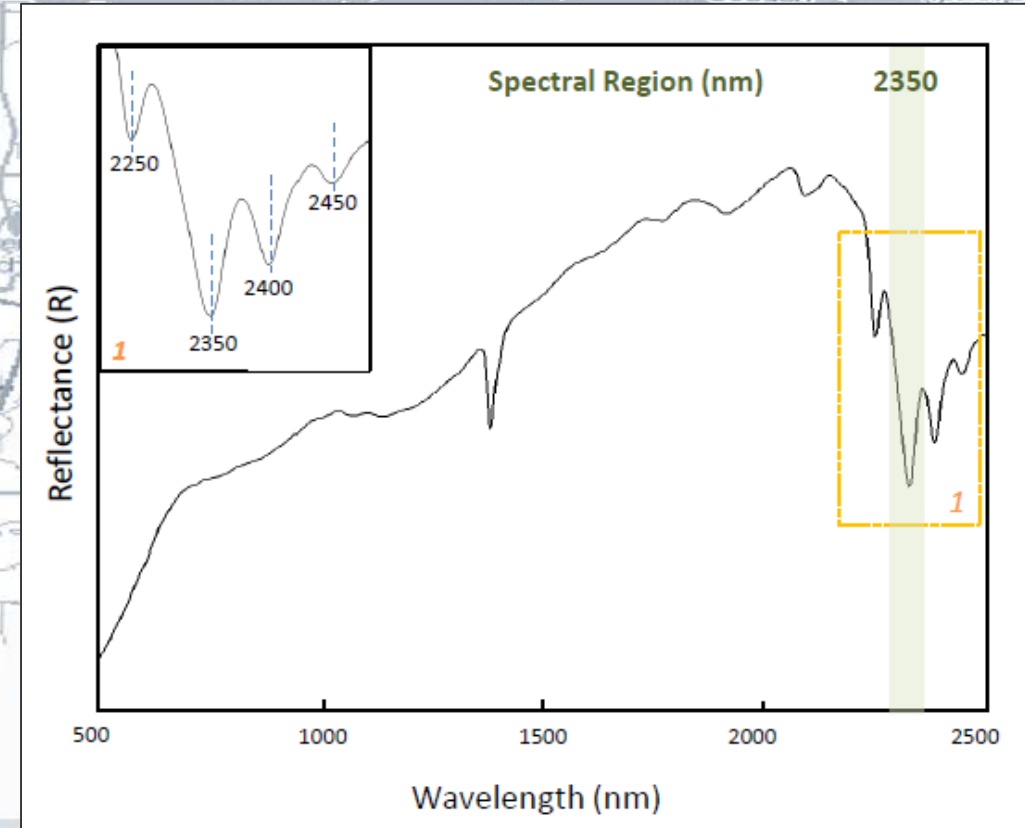
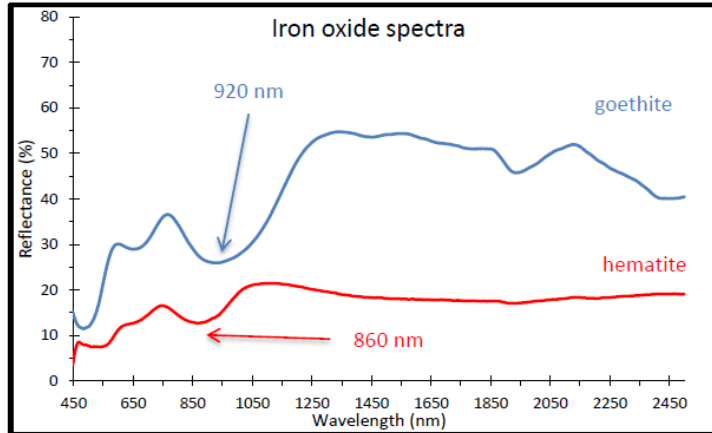


Photo Credit: Corescan

# Drill Core Library Discoveries





IRON OXIDES COMPOSITION ~860nm feature

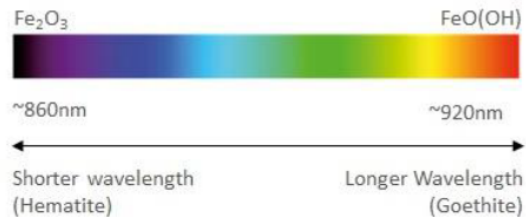


Photo Credit: Corescan

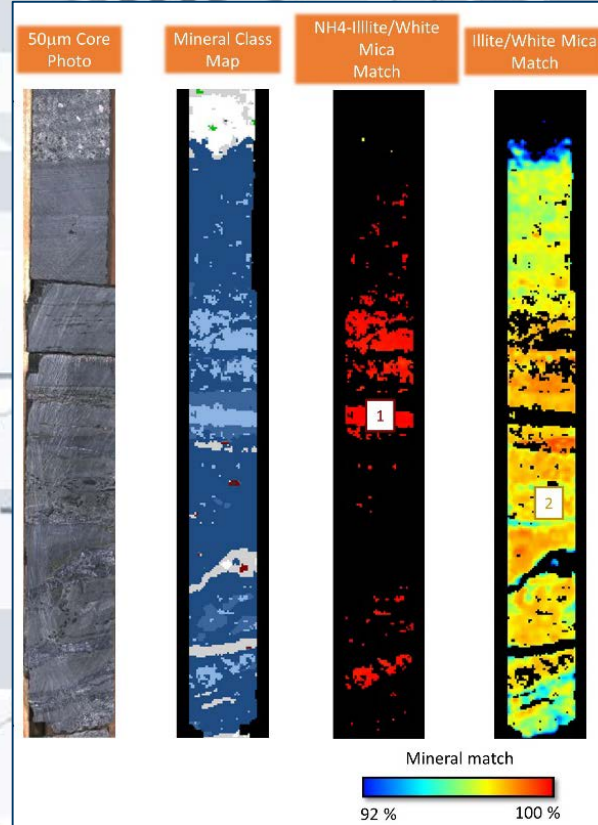
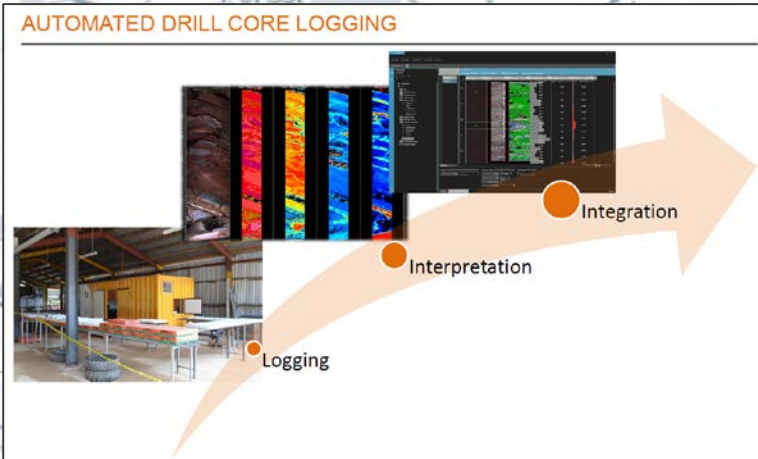


Photo Credit: Corescan

## Hyperspectral Core Imaging

- Non-destructive
- Mineral maps and textures
- Mineral compositions





## Corescan

- Australian company founded in 2003
- Commercial hyperspectral imagery since 2013
- Mobile labs





## Corescan

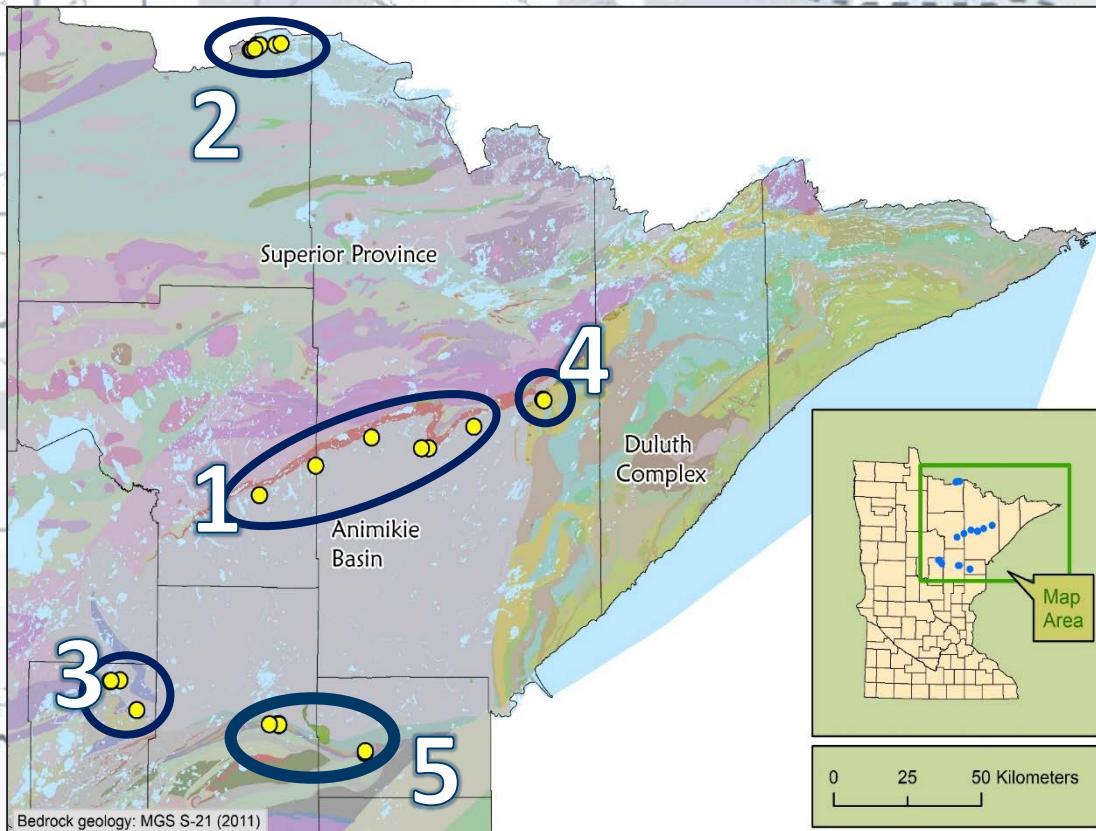
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- 5000 meters (16,000 feet) of hyperspectral core imaging
- 32 scanned cores from 5 regional Focus Areas
- Public access to results on Coreshed on-line platform

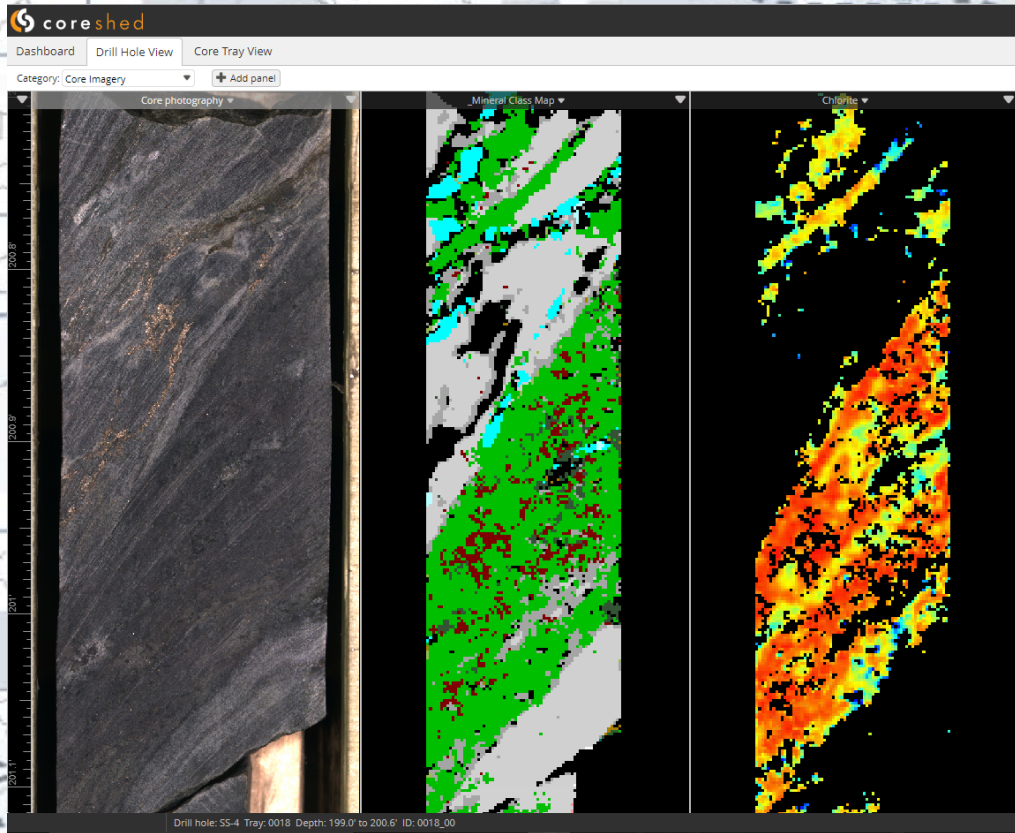




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## DNR Corescan Project





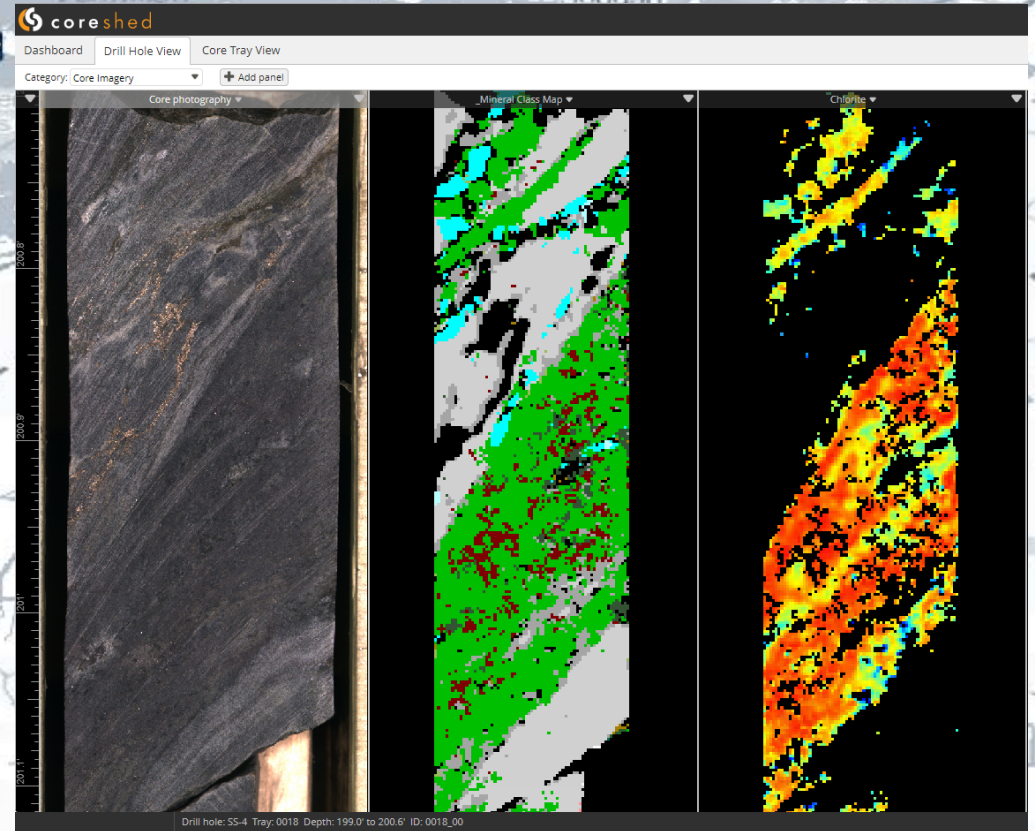
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## DNR Corescan Project



## Project Goals

- Value Add
- Land Management Decisions
- Geological Research

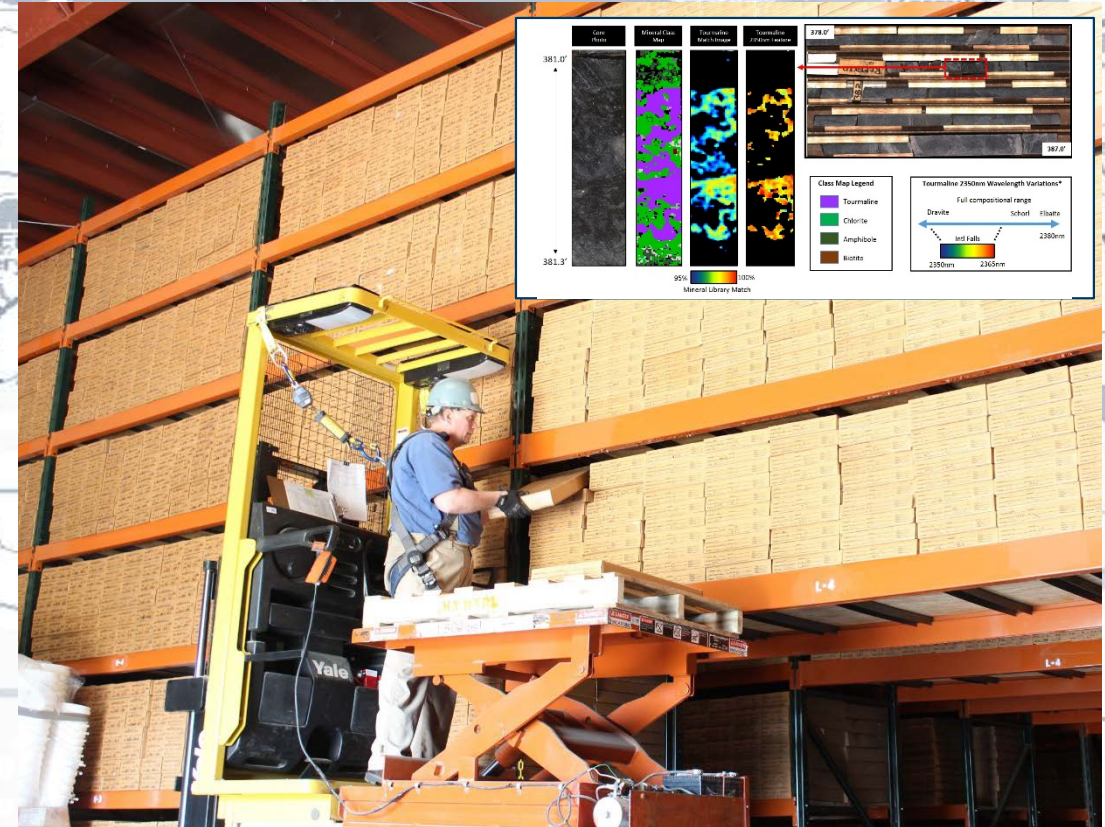


# Project Goals



## Value Add

- Drill Core Library operations
- Minnesota's mineral estate
- Minnesota's mining industry

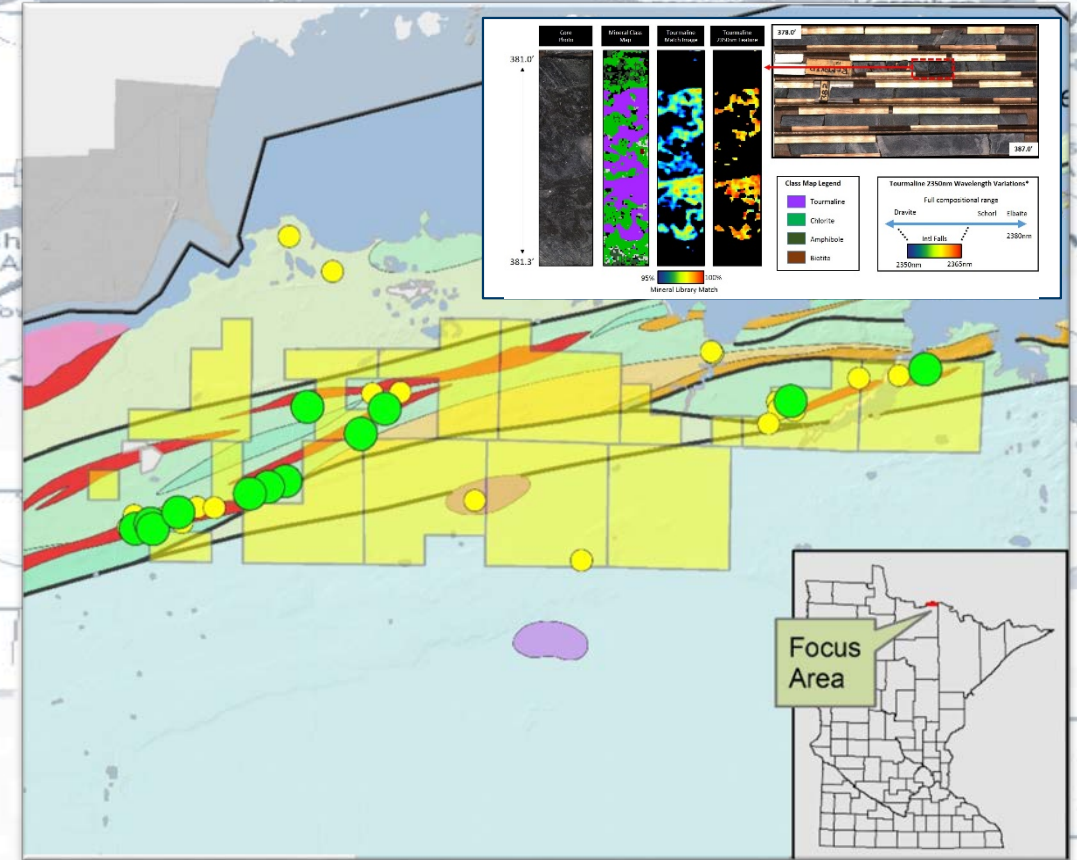


## DNR Corescan Project Goals



## Land management decisions

- Multiple land use
- Mineral exploration leases



## DNR Corescan Project Goals



# Geological Research

- Local, regional, and international importance

## Hyperspectral Imaging of Bedrock Core from the Minnesota DNR Drill Core Library: A New Tool for Archival Preservation and Mineral Exploration

ELSENHEIMER, Don<sup>1</sup>, DEYELL-WURST, Carl<sup>1</sup>, and FONTENEAU, Lionel C.<sup>2</sup>

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<sup>2</sup>Corescan Pty Ltd, 22033 Boul Gouin Ouest, Montreal, QC, CANADA

<sup>3</sup>Corescan Pty Ltd, 1/127 Grandstand Road, Ascot WA 6104, AUSTRALIA

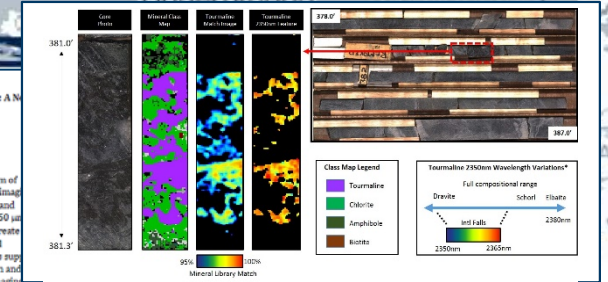
The Minnesota Department of Natural Resources (DNR) hired Corescan Inc. to scan 4900m of bedrock core from the DNR Drill Core Library (DCL) using Corescan's hyperspectral core imaging system (Martini et al. 2017). The technique integrates both Visible Near InfraRed (VNIR) and Shortwave Infrared (SWIR) reflectance spectroscopy with high-resolution photography (50 µm and 3-4 laser profiling (200 µm) to identify minerals, estimate mineral abundances and create textural maps at 500 µm resolution. Hyperspectral imaging is a non-destructive analytical technique that supports the archival preservation of limited core material. Project results support DNR land management decisions on state mineral rights and promote mineral exploration and development. This project for the first time will provide public access to hyperspectral images archived within the Corescan Virtual Core Library. DNR anticipates public release of project data and public access to Corescan by summer, 2019.

The DNR selected project core from thirty-two (32) drill holes located in five areas in Northern and Central Minnesota with distinct mineral deposits and/or high mineral potential. Initial project results are from an Archean Wabigoon Subprovince greenstone terrane near International Falls (Selse Group) and Bivabik Iron Formation core from the Mesabi Range.

The Selse Group of greenschist-facies metasediments between the Wabigoon and Quetico Subprovinces (e.g. 2014). Gold exploration in the region included an active (2012) re-logged and re-sampled several of the DCL-a alteration patterns and features favorable for gold mineralization. Hyperspectral imaging of the area extends Frey's tourmaline observations to drill core available at the time of his study. There is a positive correlation between hyperspectral identification of under-recognized feature position (Bierwirth, 2008) suggest tourmaline (Figure 1).

Complete or near complete transects of the Bivabik Mesabi Range drill cores (LWD99-1, LWD99-2, MDOP core from LWD99-2) is able to differentiate microplaty bands. Two chlorite types are also recognized within the an Mg-Fe intermediate composition that occurs in the underlying Upper Slaty Unit, and a more iron-rich contact with the underlying Pokigama Quartzite.

Average albedo in the visible spectral range (440-740 nm) sampled contact between the BIF and overlying Virginites identified an ~25 to ~50cm thick ejecta layer associated



## Hyperspectral Imaging of Sedimentary Iron Ores – Beyond borders

Lionel C. Fonteneau<sup>1</sup>, Don Elsenheimer<sup>2</sup> and Brigitte Martini<sup>3</sup>

<sup>1</sup> Corescan Pty Ltd, Perth, Australia

<sup>2</sup> Minnesota Department of Natural Resources, Minnesota, USA

<sup>3</sup> Corescan, Vancouver, Canada

Crown Perth, 5<sup>th</sup> September 2019  
Perth (WA), Australia



# DNR Corescan Project Goals

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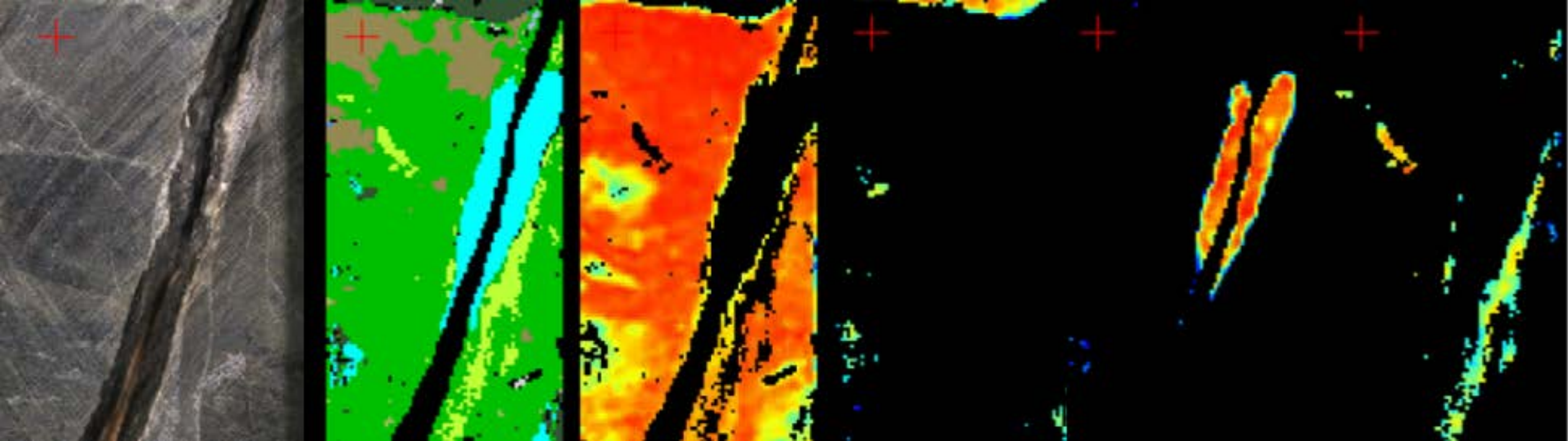
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# Acknowledgements



# For More Information

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