



2022
Geologic Repositories
Rock Sample Digitization
Webinar Series
Alaska Geologic Materials
Center

March 09, 2022

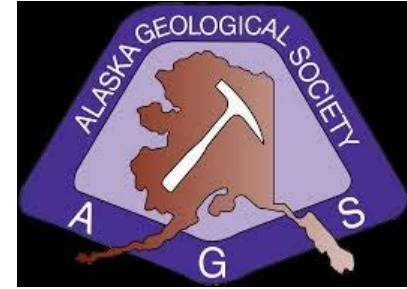
Institutions of Support



State of Alaska



**Department of Natural
Resources**



Alaska Geological Society

Other Support

National Geological and Geophysical Data Preservation Program

Harvey Thorleifson, Minnesota Geological Survey

Alaska Oil and Gas Association

Alaska Miners Association

What's That?

Digitization vs digitalization

- Digitization means to convert something into a digital format.
- Digitalization means to convert business processes over to use digital technologies.
- In a nutshell, digitization refers to information, while digitalization refers to processes.

<https://nextservicesoftware.com/news/digitize-vs-digitalize-know-the-difference/>

Talk Series Goals

Asking Questions

- What are current digitization technologies
- How are demands on repositories shifting
- What changes to the geologic support infrastructure are researchers needing
- How is digitalization changing the research process

Presentations Overview

Timetable

- Weekly from February 23 to June 1
- Each Wednesday between Noon and 1PM, Alaska time
- Some time flexibility (Australia/Europe)
- Scope of 30 to 45 minutes (leaving time for questions)
- Invitations emailed the Sunday before each talk

Webinar Online Archive

Webpage

- Mostly constructed
- Brief series overview
- Talk schedule
- Video download link for each presentation

URL: <https://dggs.alaska.gov/gmc/webinar-series.html>

February Schedule

23rd - Jacob Proctor, Ingrain – A Halliburton Service
*Addressing Reservoir Challenges in the North Slope and
Non-destructive Dual Energy CT*

Resource sector focus

- Energy – black text
- Mineral – blue text
- Both – brown text

March Schedule

9th - Kurt Johnson, Alaska Geol. Materials Center

Promise and Challenge of Digital Rocks

16th - Katrina Cox, Core Laboratories

RAPIDZoom™ Core and Thin Sections

23rd - Matthew Andrew, Zeiss Microscopy

Bringing petrography into the digital age: automating acquisition, analysis & quantification of thin sections using the Axioscan 7, advanced algorithms and machine learning

30th - Dale Blue, Halliburton

Look at a national data repository for exploration and production – examples from Norway

- Energy
- Mineral
- Both

April Schedule

6th – Rainer Bärs, Spectral Imaging Ltd.

Introducing SisuROCK hyperspectral scanner

- Energy
- Mineral
- Both

13th – Georgina Gordon, Geo. Survey S. Australia

Australia state level core facility and the NVCL

19th - Marie-Christine Ferland, Photon Etc

Modular Multi-Sensor Core Scanning Platform for Geological Applications

26th – Phillip Lypaczewski, College of North Atlantic

Hyperspectral Imaging as a Public Geoscience Tool - Early results of a drill core digitization program in Newfoundland and Labrador, Canada

May Schedule

04th – Gary Thompson, College of North Atlantic
The Mining Innovation Commercialization Accelerator (MICA)
and the role of Canadian Colleges in advancing geosciences

- Energy
- Mineral
- Both

11th – Jacob Proctor, Ingrain – A Halliburton Service
Pore scale simulations and upscaling to core

18th – To be announced

25th – Jacob Proctor, Ingrain – A Halliburton Service
Dynamic property simulations and EOR sensitivity analysis results

June Schedule

1st - AJ Kumar, Core Laboratories

Title to be announced

- Energy
- Mineral
- Both

Stay tuned

Several presentations may be hybrid live and webinar events broadcast from the GMC.

The GMC Experience

Promise and Challenge of Digital Rocks

Kurt Johnson, Curator
Alaska Geologic Materials
Center
kurt.johnson@alaska.gov



USB 2.0 Rock

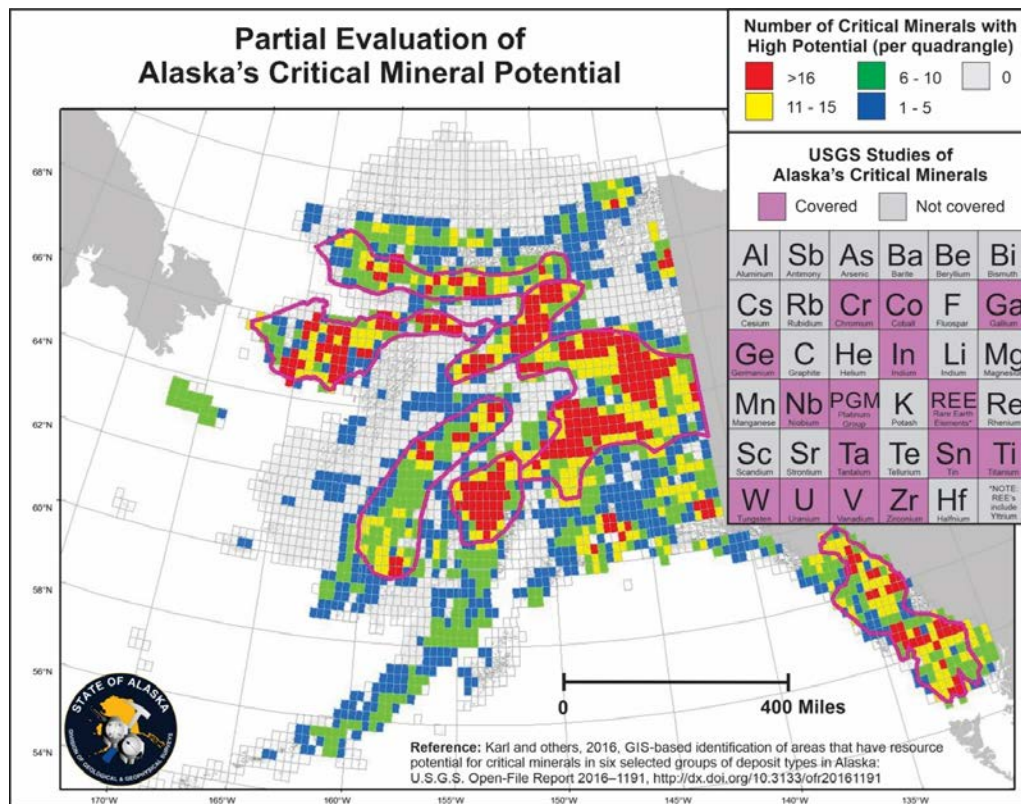
State Geologist Messaging

Alaska's Carbon Ore, Rare Earth and Critical Minerals

Stakeholders Meeting:
January 18, 2022

Steve Masterman, Alaska
State Geologist - Project
Overview and Critical
Minerals in Alaska

<https://dggs.alaska.gov/energy/core-cm.html>



Congressional Messaging



“Despite the fact that minerals are the front end of the supply chain, necessary for everything whether it's clean energy, defense technologies - we remain heavily dependent on others for what we have right here at home. It has real world consequences importing minerals from others ... it weakens our economy and our national security, it makes us more vulnerable to supply disruptions, as well as geopolitical threats.”, Senator Lisa Murkowski, Jan. 2022

<https://dggg.alaska.gov/energy/download/core-cm/01-intro-congressional-delegation.zip>

Media Messaging

New York Times “cobalt” Search

Ten articles since
Nov. 21, 2021

The New York Times search results for 'cobalt' show ten articles. The first article is 'Chinese Company Removed as Operator of Cobalt Mine in Congo' (Feb. 28, 2022), followed by 'The U.S. is planning to boost supply of minerals needed for electric vehicles' (Feb. 23, 2022), 'In Congo, Bolivia and Beyond, Where the Green Future Begins' (Dec. 26, 2021), 'Why a Chinese Company Dominates Electric Car Batteries' (Dec. 22, 2021), and 'Who Are Congo's Cobalt Entrepreneurs?' (Dec. 7, 2021). Each article includes a date, category, title, a short summary, and a small image.

A search results page for 'cobalt' showing ten articles. The first article is 'On the Banks of the Furious Congo River, a 5-Star Emporium of Ambition' (Dec. 7, 2021), followed by 'Congo Ousts Mining Leader in a Cloud of Corruption Claims' (Dec. 5, 2021), 'What to Know About Mining in Congo' (Nov. 26, 2021), 'Hunt for the 'Blood Diamond of Batteries' Impedes Green Energy Push' (Nov. 26, 2021), and 'How the U.S. Lost Ground to China in the Contest for Clean Energy' (Nov. 21, 2021). Each article includes a date, category, title, a short summary, and a small image. At the bottom of the page, there is a search feedback prompt: 'Have search feedback? Let us know what you think.' and a 'SHOW MORE' button.

Bipartisan Infrastructure Act

TITLE II--SUPPLY CHAINS FOR CLEAN ENERGY TECHNOLOGIES National Geological and Geophysical Data Preservation Program.

(4) to provide for preservation of samples to track geochemical signatures from critical mineral ... ore bodies for use in provenance tracking frameworks.

(B) provide for analysis of samples, including samples within the National Geological and Geophysical Data Preservation Program ... for the occurrence of critical minerals.

SEC. 41003. MINERAL SECURITY PROJECTS.

There are authorized to be appropriated to the Secretary of the Interior to carry out activities under section 351 of the Energy Policy Act of 2005 (42 U.S.C. 15908)–

(1) \$8,668,000 for fiscal year 2022; and

(2) \$5,000,000 for each of fiscal years 2023 through 2025.

The GMC Digital Experience

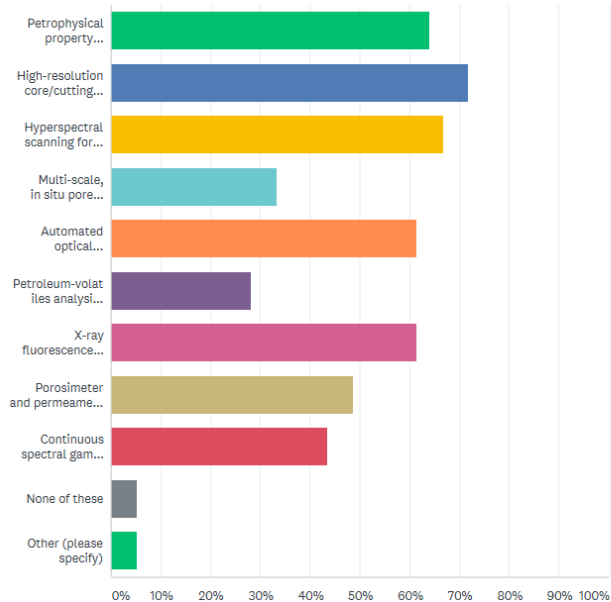
A Brief History

- May 2019, AOGA Technical Breakout Session
 - Stakeholder survey
 - Establish equipment purchase priorities
- 2020 – 2022, Hurry up and wait
 - Seek Grants and CIP funding
 - Endure COVID
 - FY2022 Phase I CIP funding from State of Alaska

Non-destructive Scanning Equipment

Which of the following technologies would you use, if available at the Geologic Material Center in Anchorage?

Answered: 39 Skipped: 0



2019 scanning equipment survey

Equipment purchase status

Non-destructive scanning equipment	Community interest	In purchase	In grant	Deferred
High resolution photography	72%		X	
Hyperspectral scanning	67%		X	
Petrophysical property scanning	64%			X
Automated optical petrology and thin section point counting	62%			X
X-ray fluorescence	62%	X		

XRF Handheld



Screening for New Data

- SciAps X-555 HH-XRF
 - 55 kV X-ray tube
 - Specifically developed for REE
 - Calibrated for Y, La, Ce, Pr, Nd, Sm, Eu and Gd
 - Excellent detection limits measured on whole rock hand samples (down to lower tens of ppm)
- Obtain rapid, qualitative elemental data
- Android interface

Hyperspectral Scanner

Research Platform



<https://www.specim.fi/products/sisurock/>

Mobile Platform



College of North Atlantic

Hyperspectral Scanner

Features

- RGB camera
- VNIR, SWIR, MIR, LWIR cameras
- Laser 3D profiling

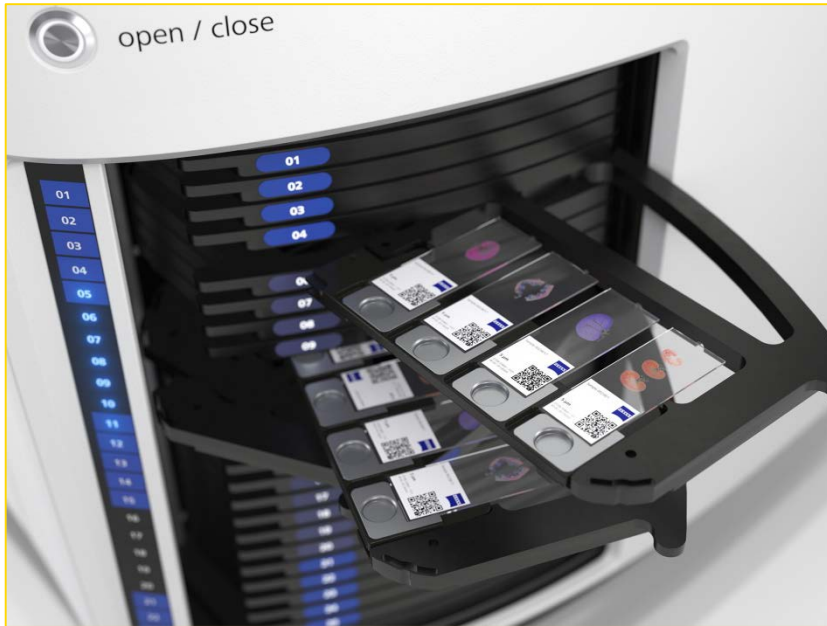
Intention

- Digital core preservation
- Rapid mineral and alteration maps



<https://www.corescan.com.au>

Petrographic Scanner



<https://www.zeiss.com>

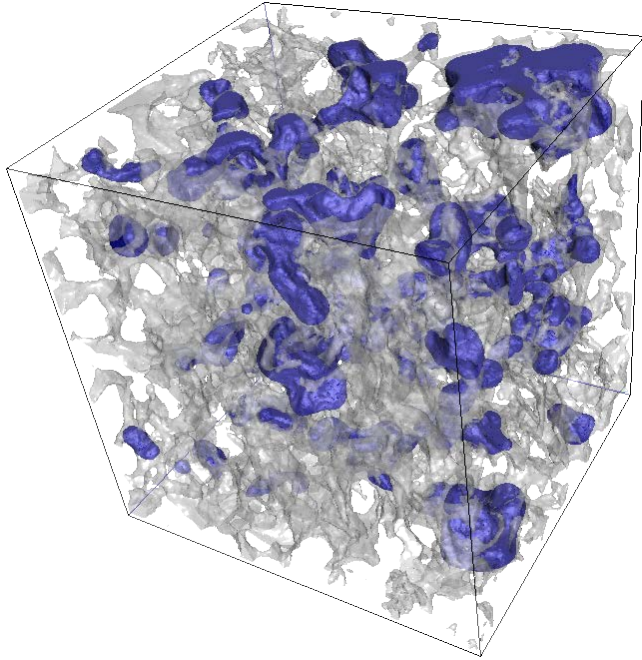
GMC slide collections

- 35,000+ thin sections
- 150,000+ palynology slides

Zeiss Axioscan 7 Geo

- Batch scans up to 100 slides
- High power LED increases scanning speeds
- Plane or Crossed Pol
- Z-stacking

The Digitization Promise



Advantages

- Preservation of rock properties
- Conserve sparse rock materials
- Help prune core samples
- Extend digital rocks to researchers
 - Pre-screening aid to project
 - Cost effective sample access
- Leverage collections with new ideas

<https://www.digitalrockportal.org/>

Leverage Collections

Vetted collections

Rapid reconnaissance scanning

- Critical metals
- Regional analysis libraries
 - Mineral deposit types
 - Alteration relationships
- Basin-wide analysis for energy

Support regional projects

- ASTAR – infrastructure S&G
- CORE-CM – Carbon Ore REE



Where's that mineral?

Digitalization Perils

Sketched out

- Significant IT infrastructure requirements to host and serve very large data objects
- Increased staffing for scanning logistics
- Long-term fiscal project support
- Greater operational complexity



Complex Folding

IT Infrastructure

Hardware

- GMC onsite server room
- About 2 petabytes of storage
- 3-2-1 backup capacity
- RAID redundancy
- Air conditioned room
- UPS racks

**Very large digital scans
require more storage arrays**



GMC Server Stacks

IT Architecture

Existing GMC services

- Web application: Java
- Backend database: PostgreSQL/PostGIS
- Search indexing: Solr (Elastic)

Digitization upgrades

- Serve all data objects out of an S3-compatible data store like MinIO
- Networking upgrades for moving large data files

These services run on three different virtual machines, one for the database (PostgreSQL), one for the search (Solr), and one for the web server (Tomcat.) The entire stack runs on a cluster of Proxmox machines providing failover.

Inventory Interface

User Enhancements

- Intuitive usability
 - Sector views
 - Dataset filters
 - Boolean search
- Dataset selections
- Checkout services
 - Web download
 - Hard drive

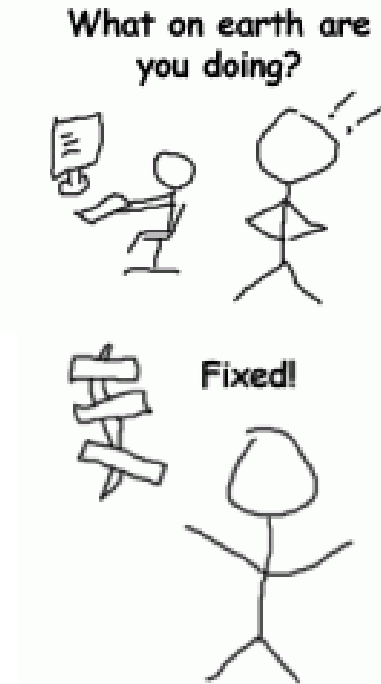
ID	Related	Sample / Site	Box / Set	Core No / Diameter	Top / Bottom	Keywords	Collection
27791	WAB_80263 TEST - 1 APT_50023300130000		1:1	60 3 in	3177.0 3364.0	raw, core, whole, teaching	USGS
27791	WAB_80263 TEST - 1 APT_50023300130000		1:1	45 3 in	2668.0 3171.0	raw, core, whole, teaching	USGS
27790	WAB_80263 TEST - 1 APT_50023300130000		1:1	39 3 in	3147.0 3158.0	raw, core, whole, teaching	USGS
27783	WAB_80263 TEST - 1 APT_50023300130000		1:1	45 3 in	2668.0 2719.0	raw, core, whole, teaching	USGS
27814	WAB_80263 TEST - 1 APT_50023300130000		1:1	50 3 in	2286.0 2291.0	raw, core, whole, teaching	USGS
18349	WAB_18349 27 - 1 APT_50279200230000		DIST 1		1830.0 1922.0	raw, crude oil	USGS
18348	WAB_18349 27 - 1 APT_50279200230000		DIST 2		1830.0 1922.0	raw, crude oil	USGS
18348	WAB_18349 27 - 1 APT_50279200230000		DIST 1		1830.0 1922.0	raw, crude oil	USGS
18492	WAB_18492 00263 CORE TEST - 27 APT_50279200230000		collection 01			raw, crude oil	BLM
18191	WAB_18191 07 - 17 APT_50023300130000		2:5		1512.0 1711.0	raw, crude oil	USGS
18193	WAB_18191 07 - 17 APT_50023300130000		3:3		1512.0 1711.0	raw, crude oil	USGS
18194	WAB_18191 07 - 17 APT_50023300130000		4:3		1512.0 1711.0	raw, crude oil	USGS
18195	WAB_18191 07 - 17 APT_50023300130000		4:5		1512.0 1711.0	raw, crude oil	USGS
18193	WAB_18191 07 - 17 APT_50023300130000		3:5		1512.0 1711.0	raw, crude oil	USGS
18191	WAB_18191 07 - 17 APT_50023300130000		5:5		2260.0 2417.0	raw, crude oil	USGS

GMC Web Inventory Interface

Programing Punch List

Scope of changes

- Database modifications
 - Update schema
 - Setup S3 compatible container
- Interface with scanning equipment
 - Serve metadata
 - Capture signal
- Inventory interface upgrade
- Signal deconvolution
- Graphical analysis presentation



Digital Platform Tensions

Repository mission

- Preserve analogue and digital datasets in perpetuity

Geologic digital platforms

- Energy
- Hyperspectral
- Petrographic

Federated database?

- Mapping multiple autonomous databases



More streaming can decrease access.

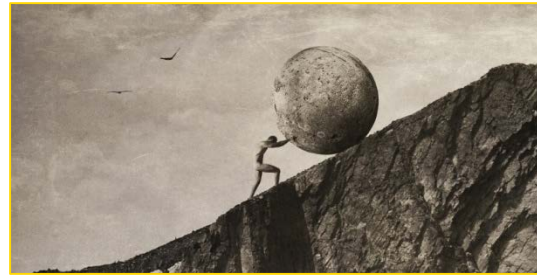
Increased Staffing



50+ Pound Core Boxes

Inventory logistics

- “Tons” of inventory
- Significant time
- Pace staff



Rinse, repeat per scanner



40% Palletized Core

Fiscal Concerns

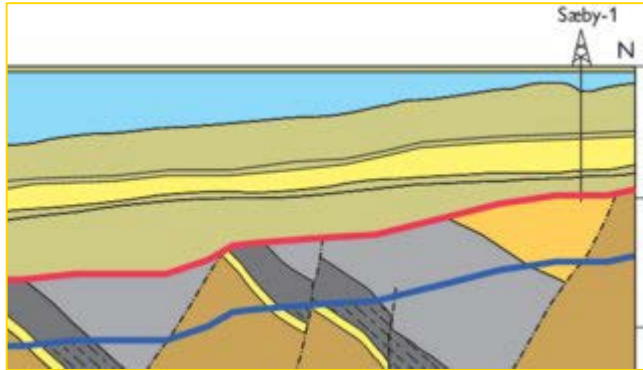
Overview

- High equipment purchase costs
- Building modification costs
 - Room
 - Utilities
 - Inventory handling
- Extra staff+ for each scanner
- Long-term projects (3 to 10 years)



Moving Forward

**Increasing complexity
verses
capability and adaptability**



The Sweet Spot

Support resources

- Industry
- Stakeholders
- Associated institutions
- Advisory boards

Community Investment

Private firms

- Rock donations
- Metadata support
- Communicate needs
- Provide financial support to targeted projects

Public institutions

- NGGDPP (NIBI, networking)
- USGS (IT & libraries)
- International (opportunities)
- Academia (innovation)
- GMC GitHub code base
 - Java web interface
 - Android warehouse scanner

Advisory Board

Identify local concerns

- Build regional digitalized collections
- Prioritize non-destructive scanning
- Big data analysis opportunities

Find private support

- Bring third-party services to State
- Financial buy-in for equipment

Provide industry partnership oversight

- Data campaign
- Review industry opportunities



Partners can be helpful.

Next Presentation

16-March, Noon to 1PM
Katrina Cox, Senior Geologist
Core Laboratories

**RAPIDZoom™ Core and Thin
Sections**

Questions or Feedback



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