An Overview of the Uinta Basin DOE CORE-CM Project Interim Findings for Rare Earth, Carbon, and Critical Materials Opportunities and Related Support

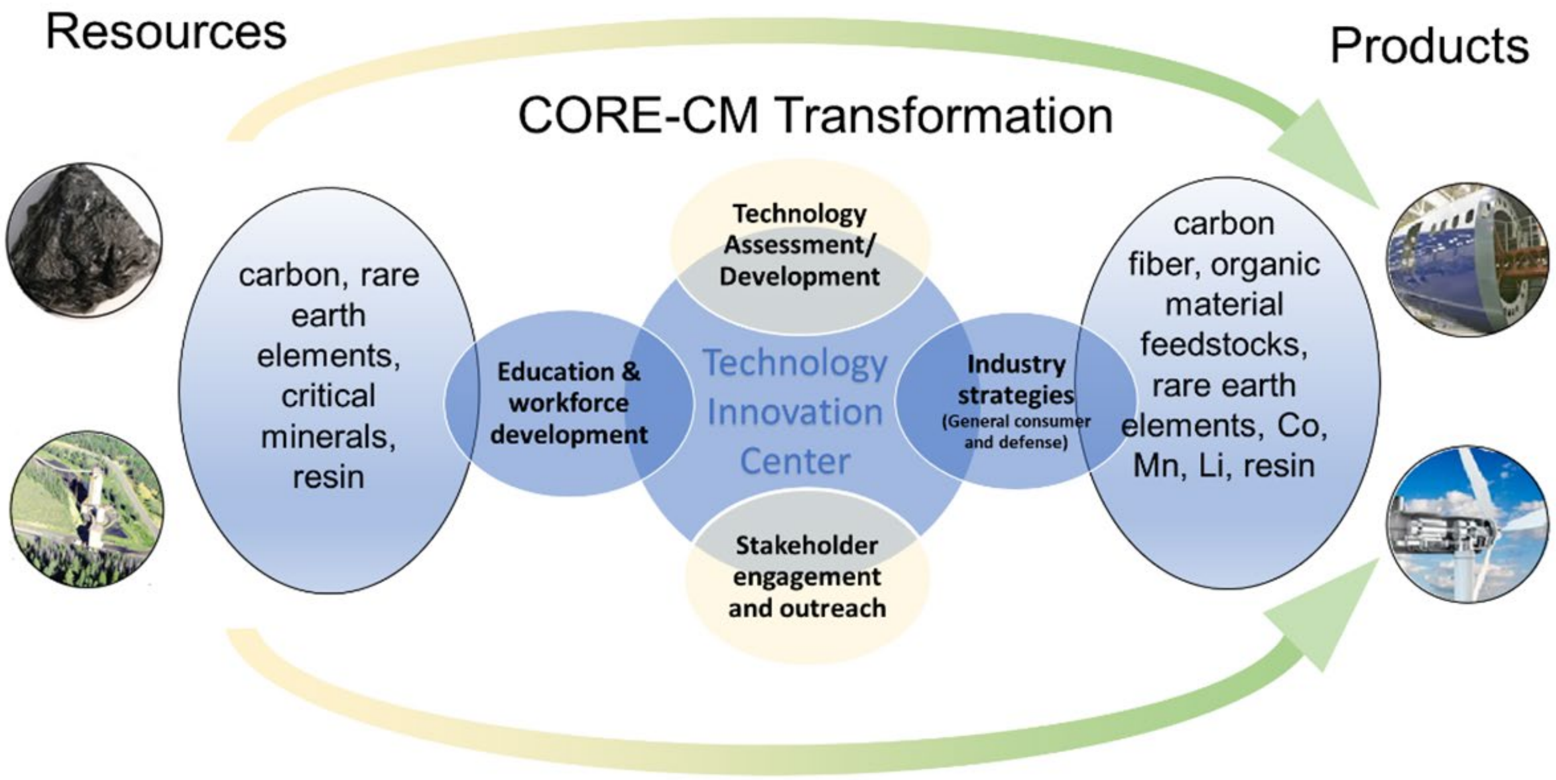
Michael L. Free, project leader

• Acknowledgements

Financial support provided by DOE NETL (DE-FE0032046) is gratefully acknowledged.

Our DOE CORE-CM Project Vision

The Objective: Transform Uinta Basin Resources Into Advanced Products



DOE CORE-CM Uinta Basin Initial Team

- University of Utah
- UAMMI
- IACMI
- Colorado School of Mines
- Los Alamos National Lab
- Wolverine Fuels
- Utah State University
- Energy and Geoscience Institute
- Utah Geological Survey
- Colorado Geological Survey
- JWP Consulting LLC
- Arcadia Minerals Inc.
- Black Mountain Resources
- Carbon County
- Ekomatter, LLC
- Emery County
- Energy Fuels
- FGX
- K. Marc LeVier and Associates, LLC
- Monsanto
- Iperion X
- North American Coal Corp
- RAMACO
- Red Leaf Resources Inc.
- Seven County Infrastructure Coalition
- The Graphene Council
- University of Alaska
- UT Gov. Off. Economic Development
- UT Gov. Off. Energy Development
- Vermeer
- Utah Mining Association

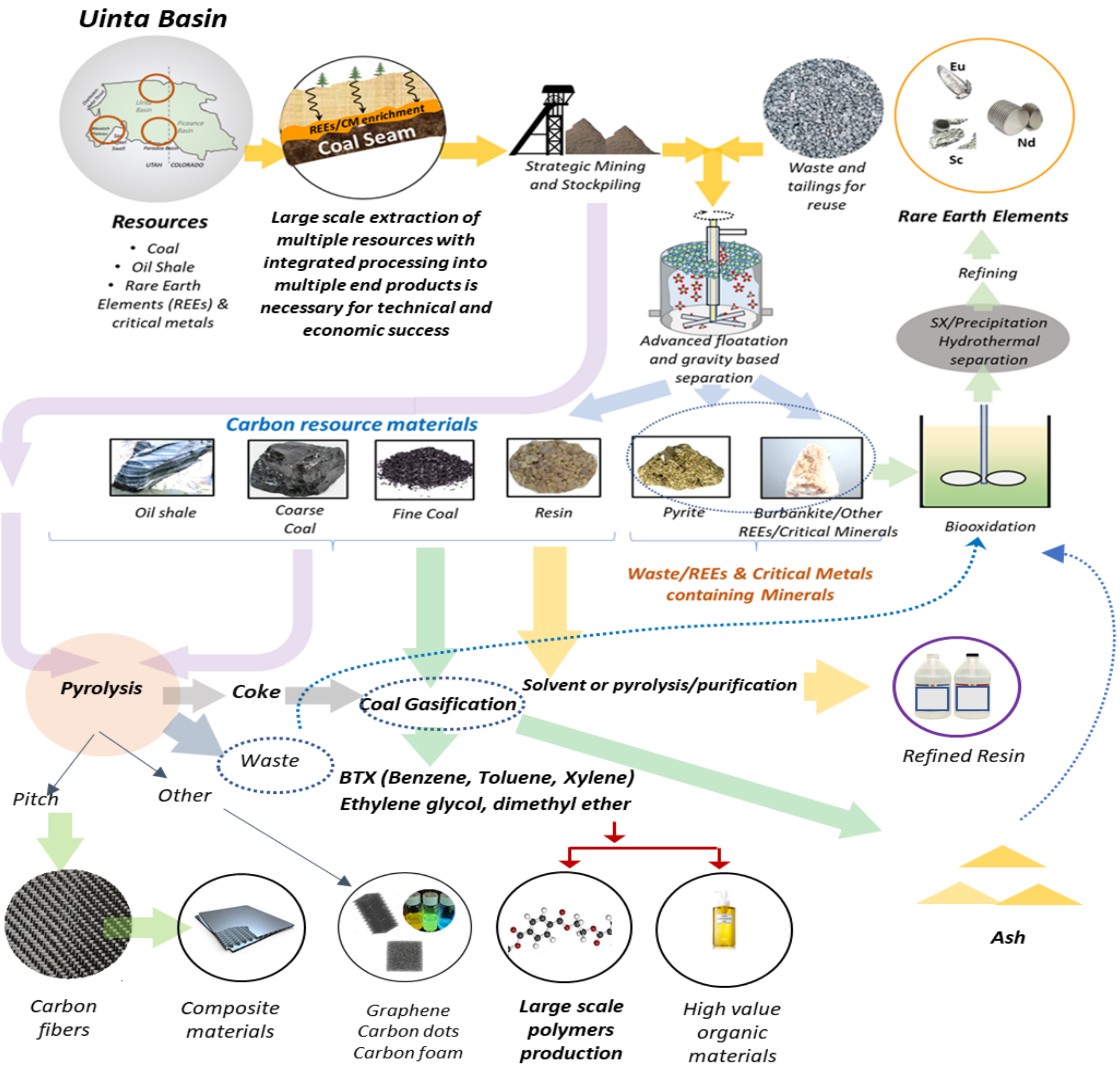
Main researchers: Lauren Birgenheier, Eric Eddings, Michael Free, Ryan Gall, Rajive Ganguli, Andrew Giebel, Tulinda Larsen, Jaeheon Lee, Jan Miller, Swomitra Mohanty, Michael Nigra, Jim Patten, Pratt Rogers, Prashant Sarswat, Patrick Taylor, Michael Vanden Berg, Xuming Wang, Jessica Wempen

THE UNIVERSITY OF UTAH

Conceptual Processing Plan

The Uinta Basin's rich resources of carbon and critical minerals can be converted through innovative local processing (see figure) to nonfuel products such as:

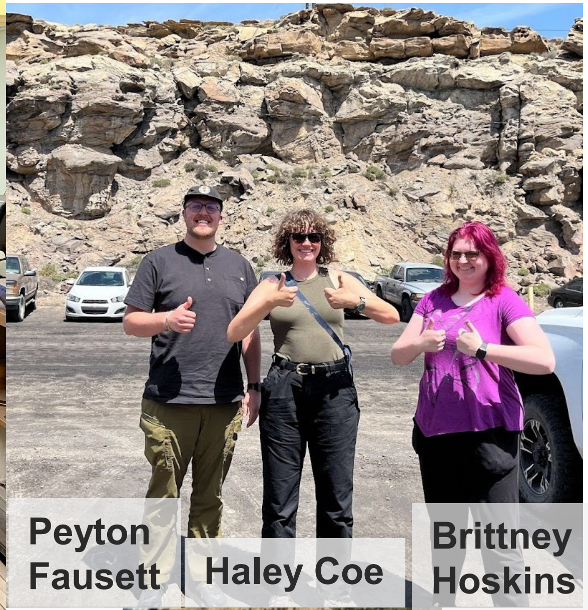
- Carbon fiber
- Polymers
- Graphene
- Resin
- Rare Earth Element Metals
- Critical Materials



CORE-CM Uinta Region GEO team members

Dr. Lauren Birgenheier

Ryan Gall



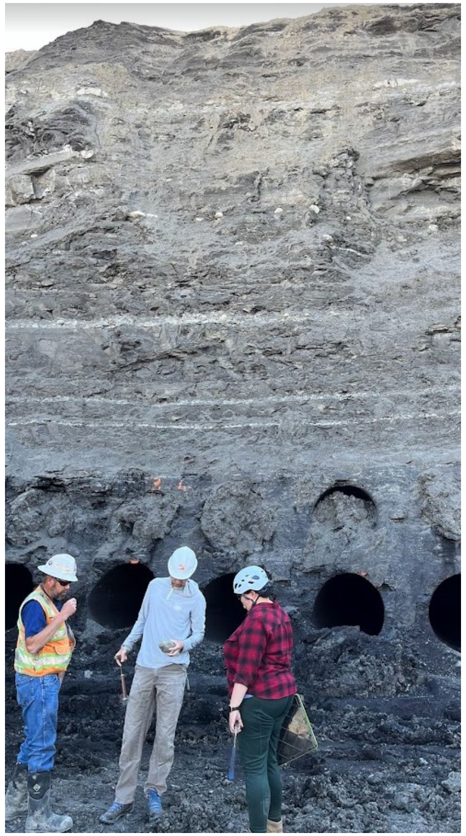
Peyton Fausett

Haley Coe

Brittney Hoskins

Michael Vanden Berg

Andrew Giebel



Erin Lofgran

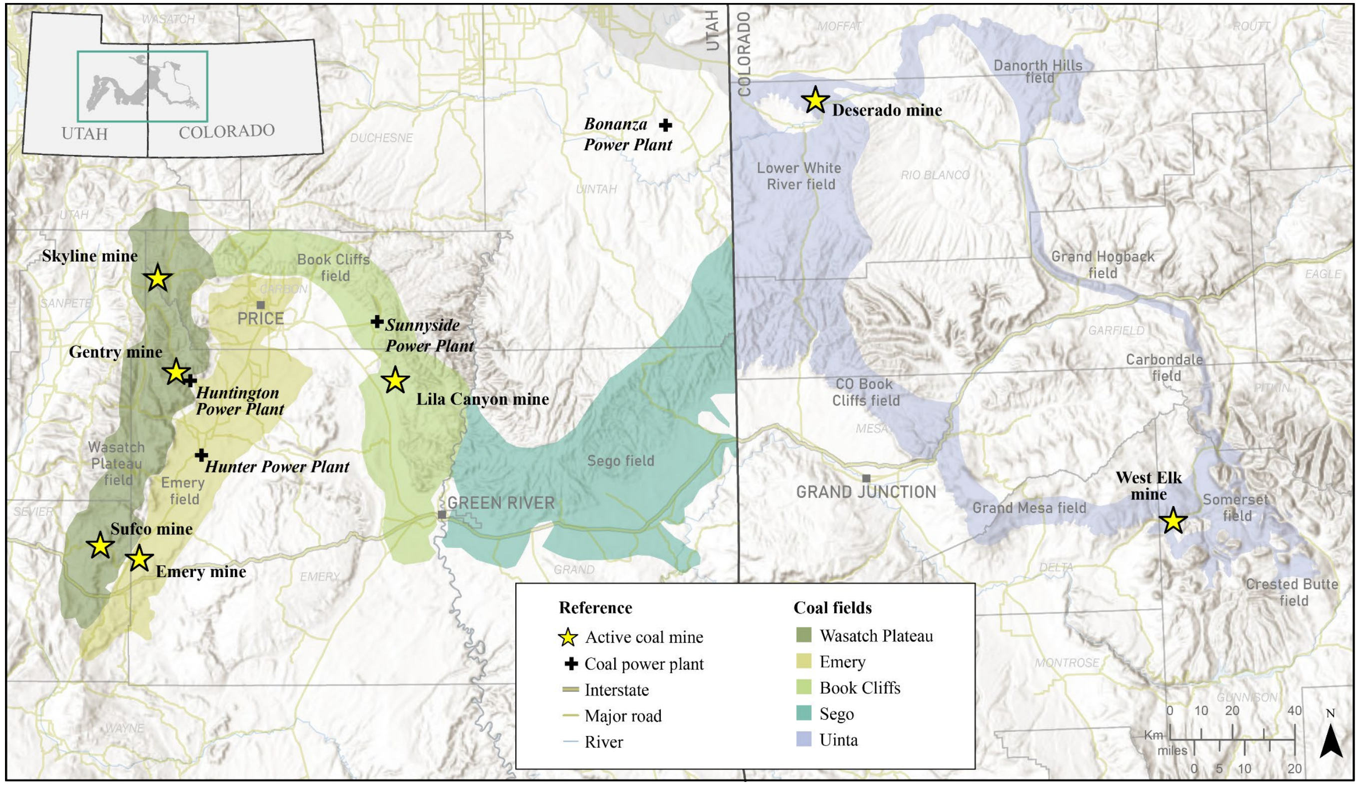
Amin Hamidat

Dr. Diego Fernandez

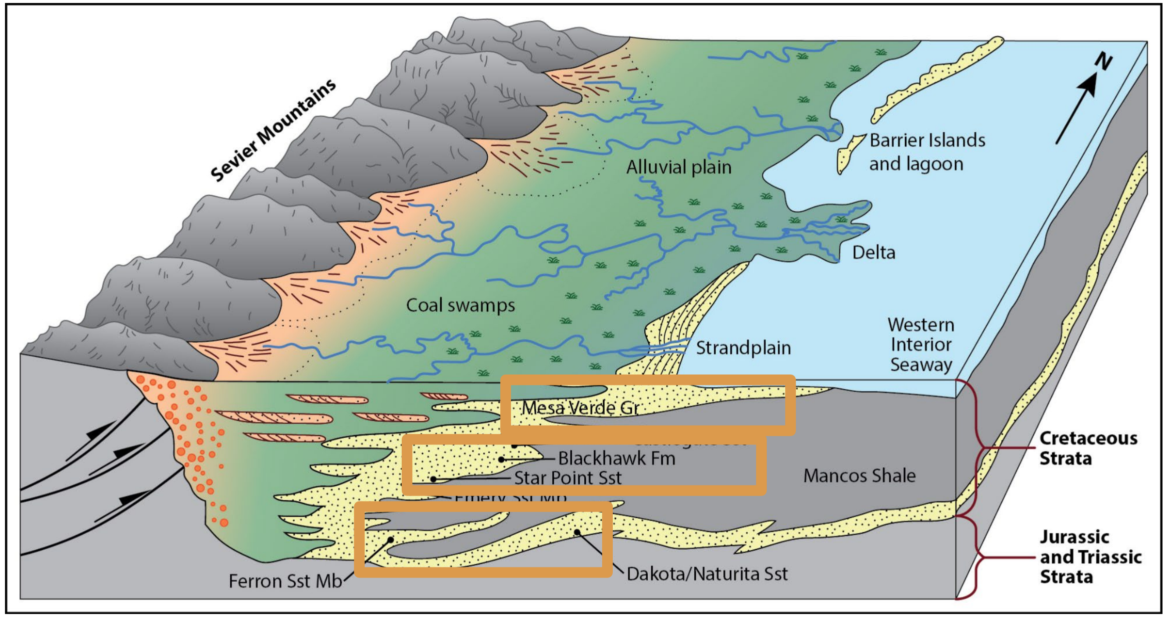
Dr. Emma Morris

Add’t’n’l thanks to: Katie Cummings, Skadi Kobe, Tom Dempster, Utah Geo Survey

Uinta Region – geologic setting



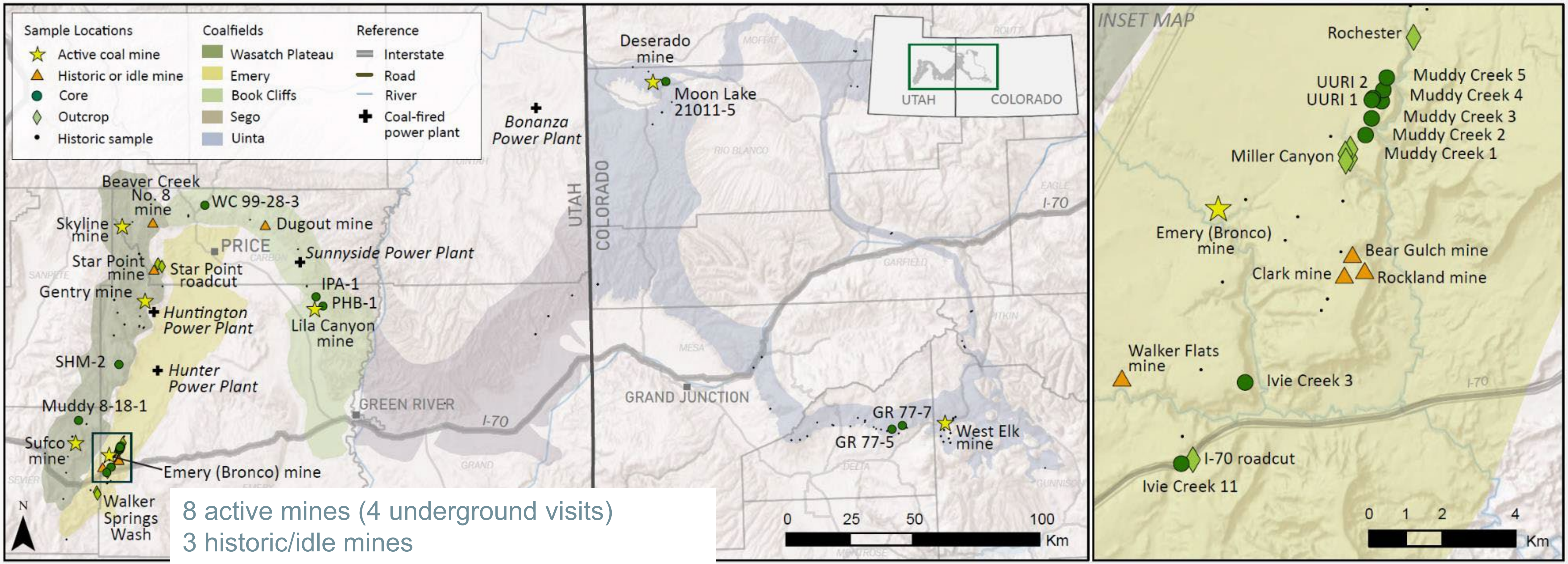
8 active mines UT & CO



Several coal-bearing stratigraphic interv

1) Mesaverde Grp (CO)
2) Blackhawk Fm (UT)
3) Ferron Sst (UT)
4) Naturita (Dakota) Sst (UT)

Uinta Region – dataset highlights



8 active mines (4 underground visits)
3 historic/idle mines
4 waste piles
8 Blackhawk or Mesaverde cores
9 Ferron cores
7 Ferron outcrop/ shallow mine locations
2 power plant ash piles

>7,778 pXRF analyses
217 ICP-MS analyses

Methodology highlights

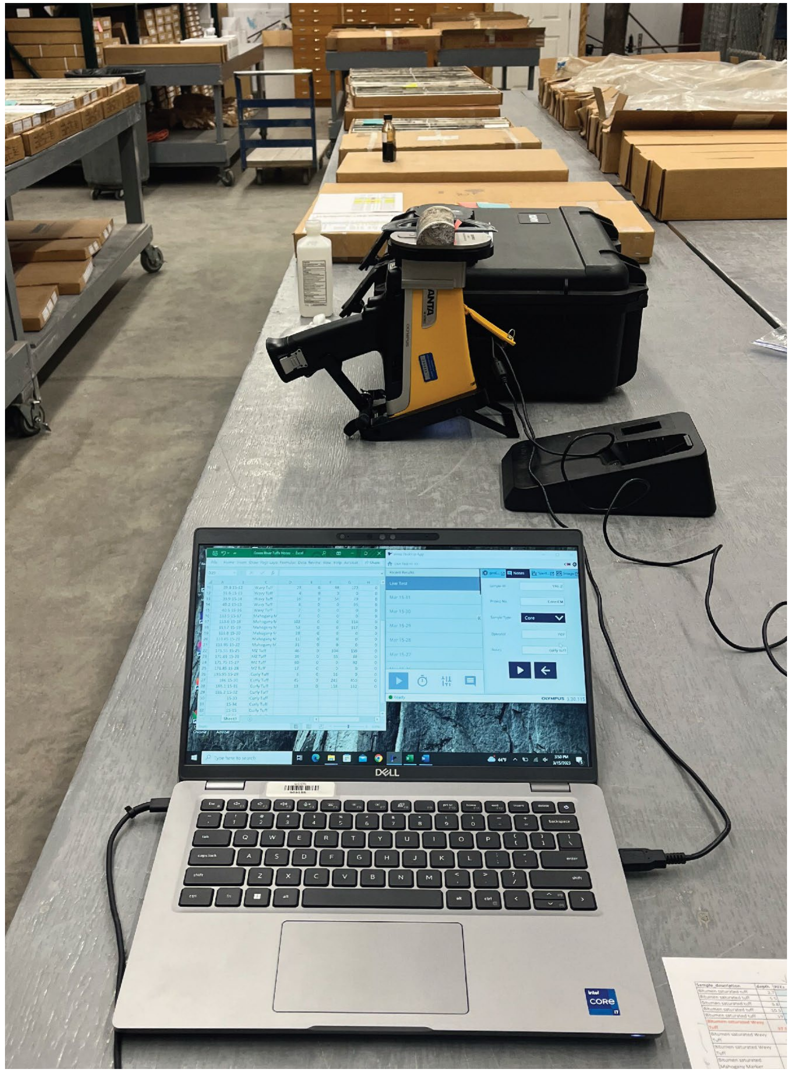
Field sampling – mines, waste piles

Core description & sampling

Methodology

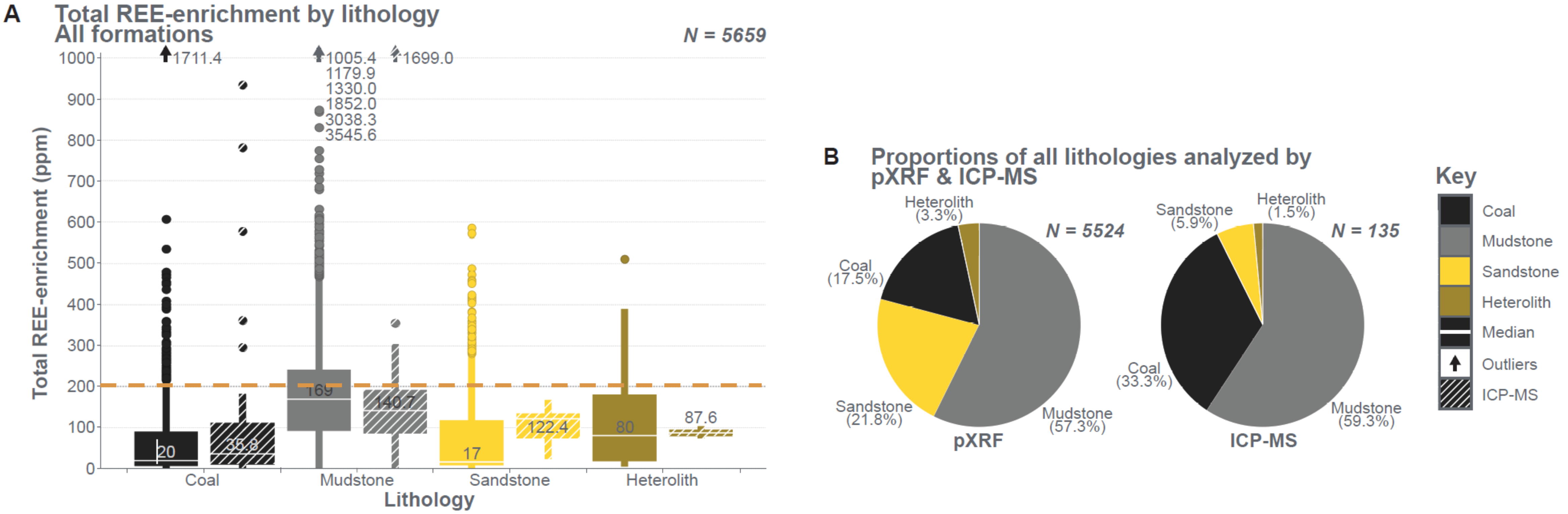
- Olympus Vanta M series portable X-Ray Fluorescence (pXRF)
  - Short Range REE detection – La, Sc, Ce, Pr, Y and Nd
  - **Enrichment = these six elements combined >200 ppm.**
- Blackhawk Fm & Mesaverde Grp scanned at 0.5 ft intervals, with several high resolution 0.1 ft intervals.
- Ferron scanned at 0.1 ft intervals with focus through coal zones.

← ALL of summer 2022



Results by lithology,
All Formations – Blackhawk Fm, Mesaverde Grp, Ferron Sst

Core, mine, outcrop data only

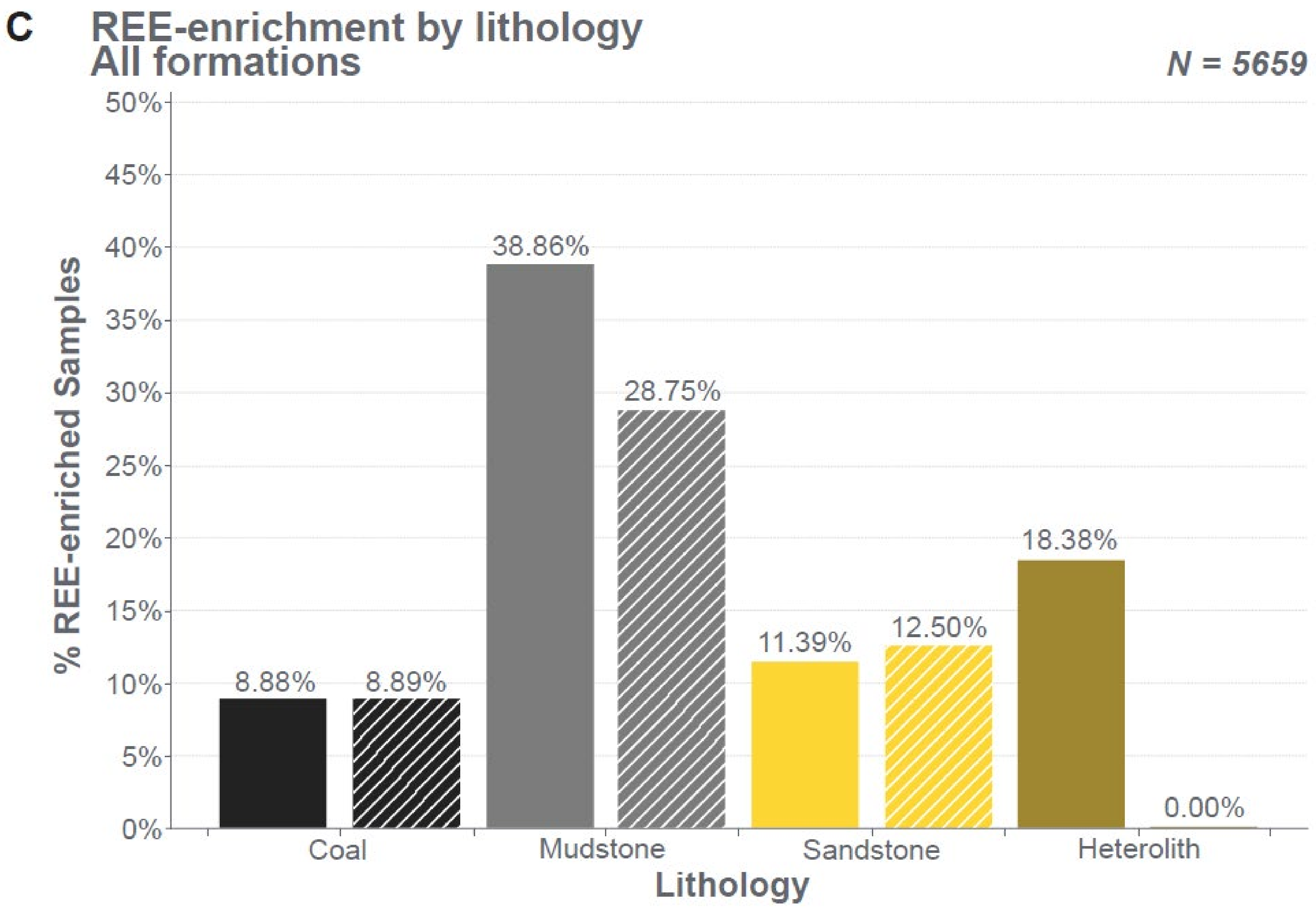


Lithologic trends, All Formations

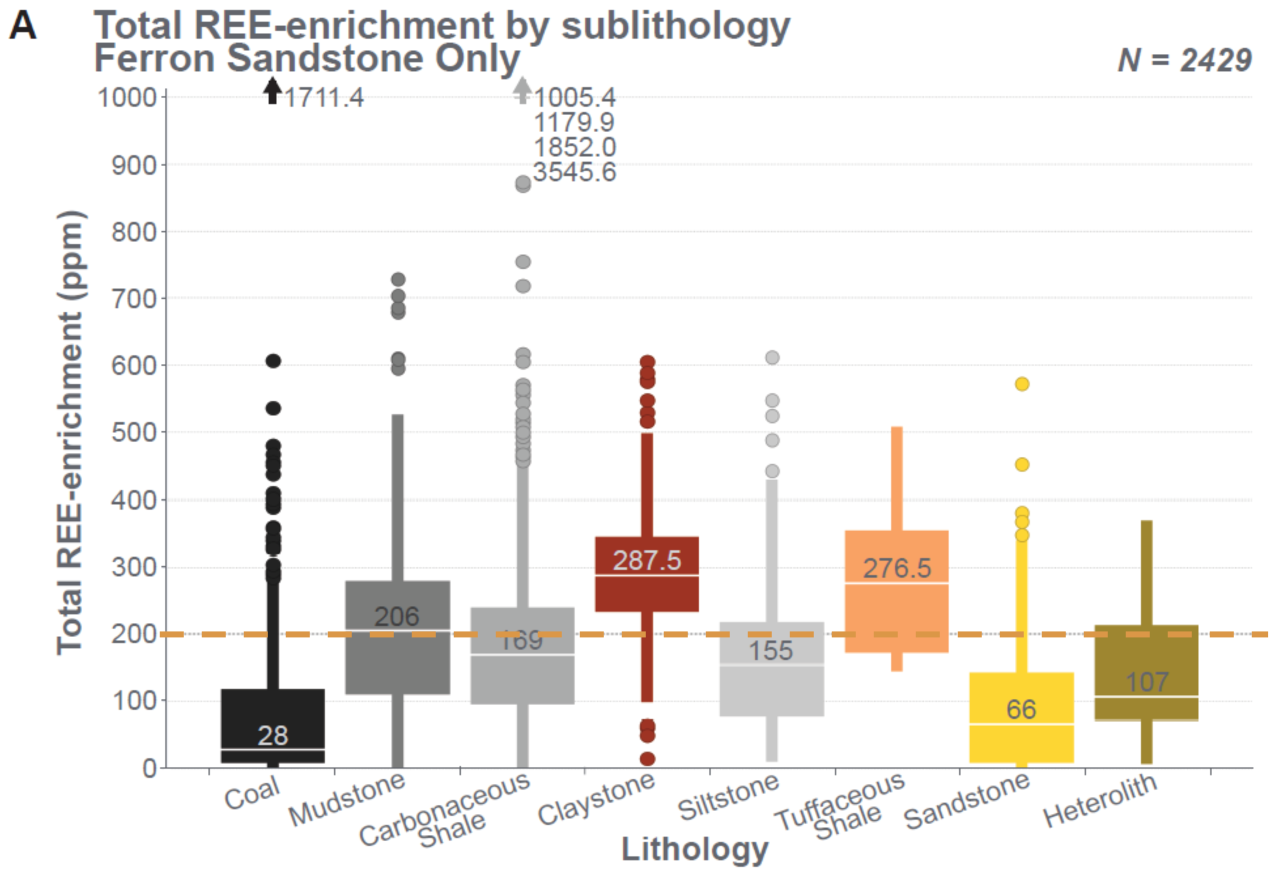
REE-enrichment > 200 ppm

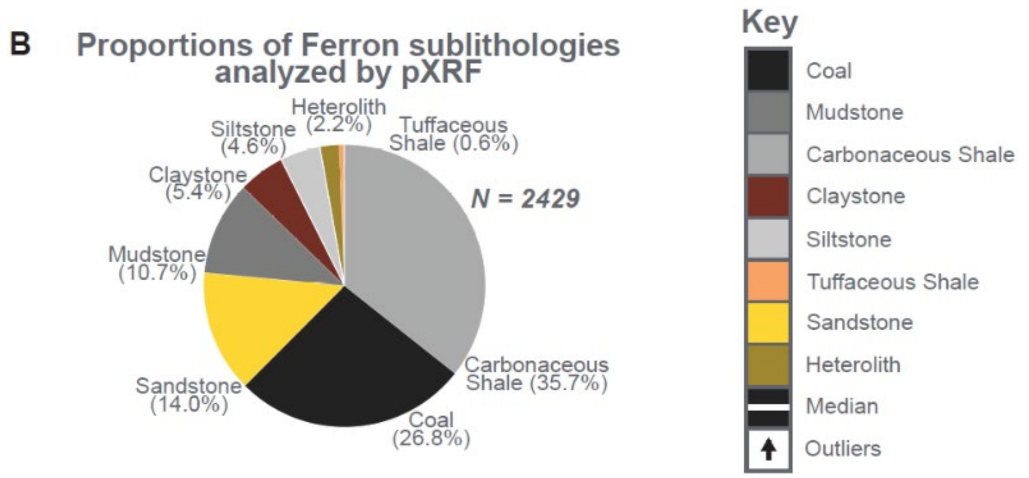
Mudstone most commonly REE-enriched (29 – 39 % of samples)

Coal generally lacks REE-enrichment



Results by sublithologies, Ferron Sandstone only



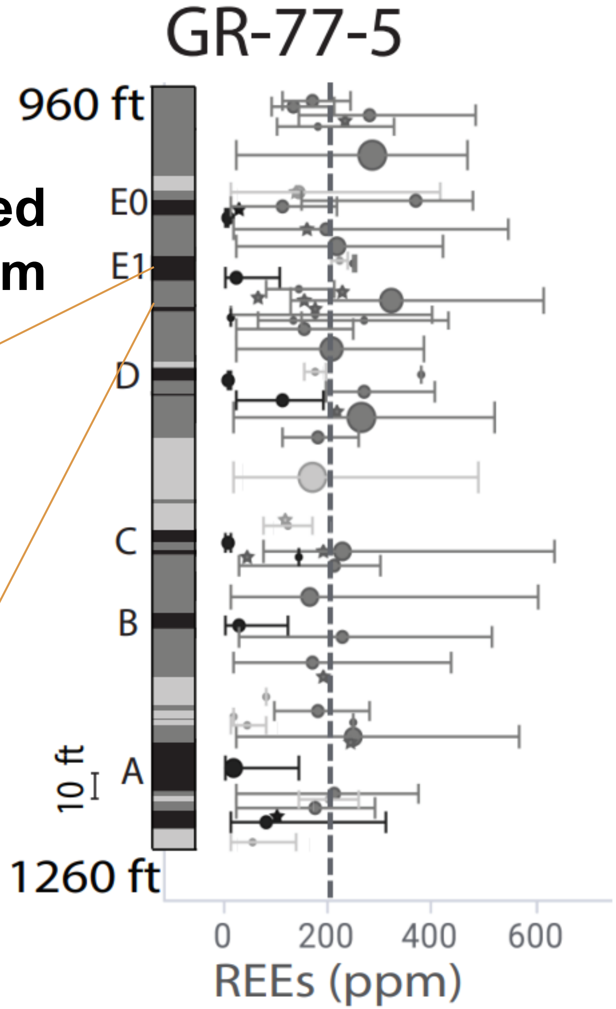


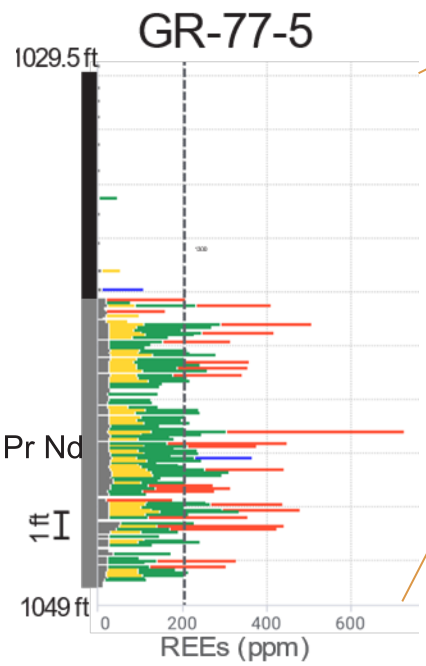
Stratigraphic Trends

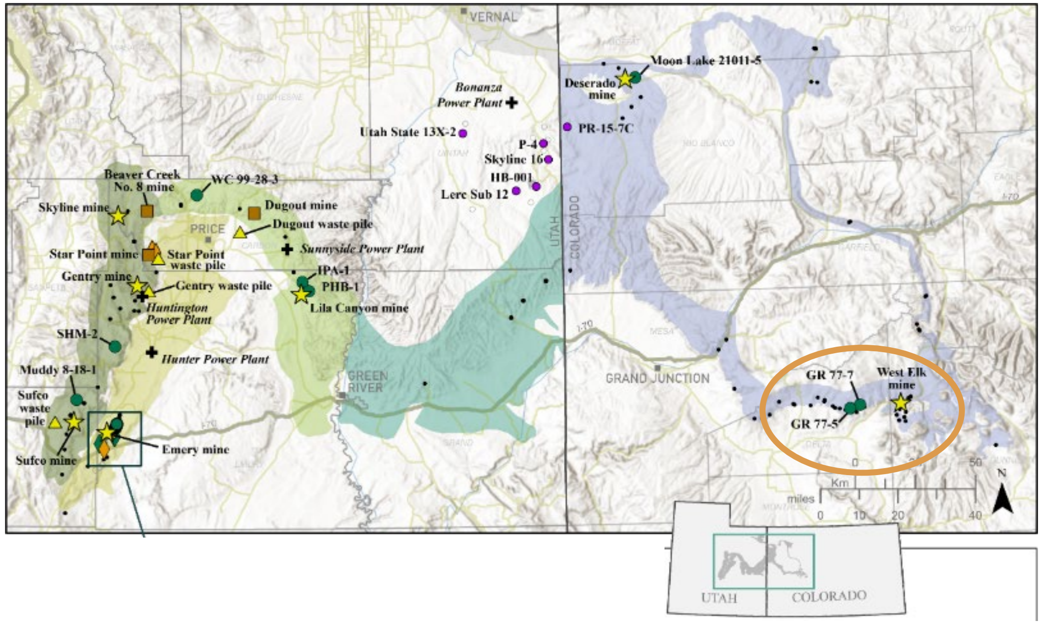
Shale & siltstone beds overlying or underlying coal seams are REE-enriched

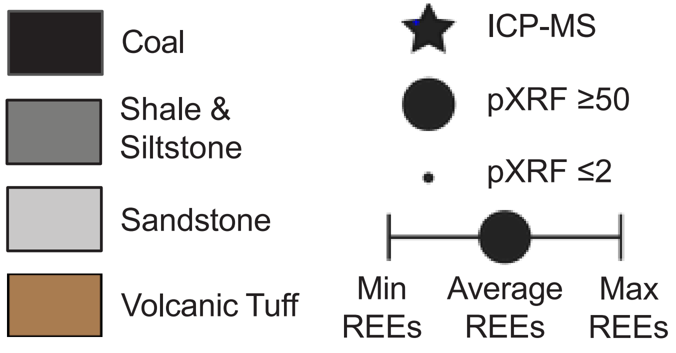
Near West Elk Mine, CO
Mesaverde Grp.

mined seam





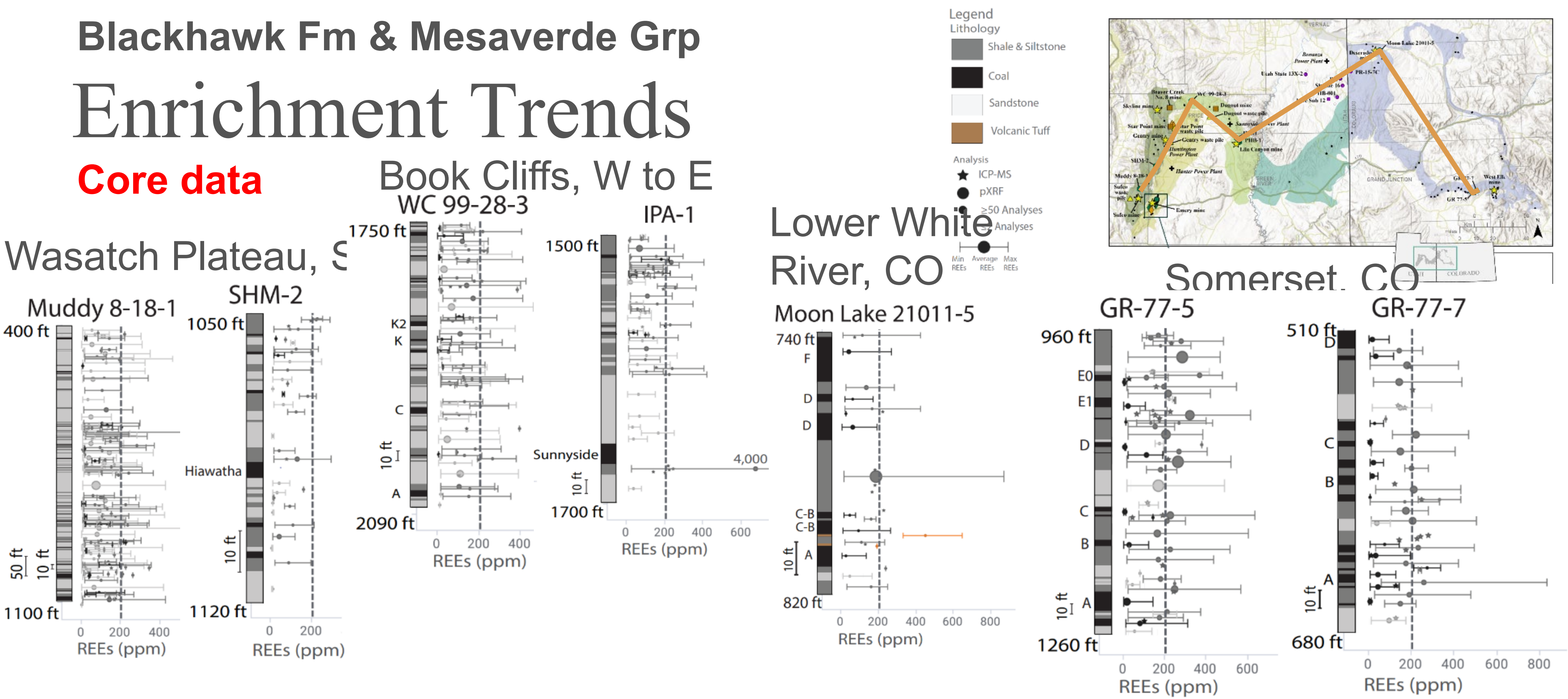




Blackhawk Fm & Mesaverde Grp

Enrichment Trends

Core data



Shale & siltstone beds overlying or underlying coal seams are REE-enriched.

Uinta Region of western CO (Somerset) is most REE-enriched.

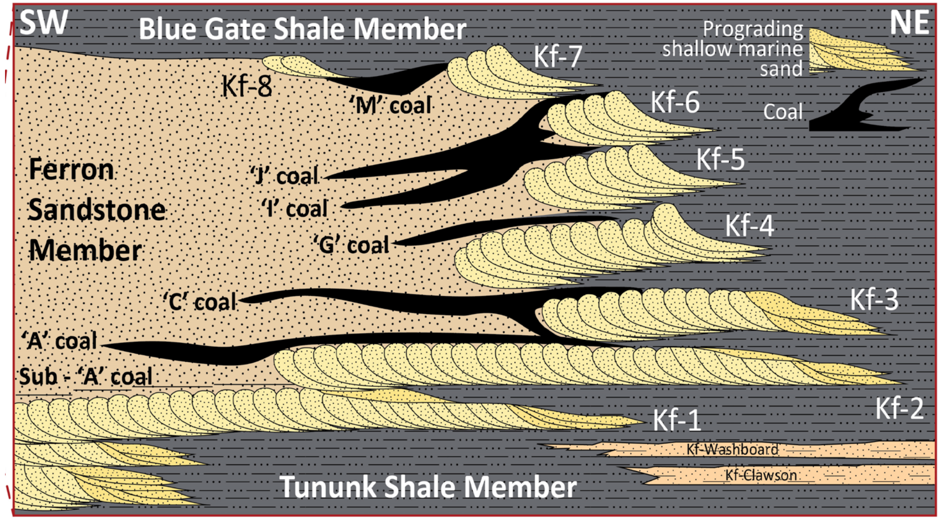
Coe et al. (submitted)

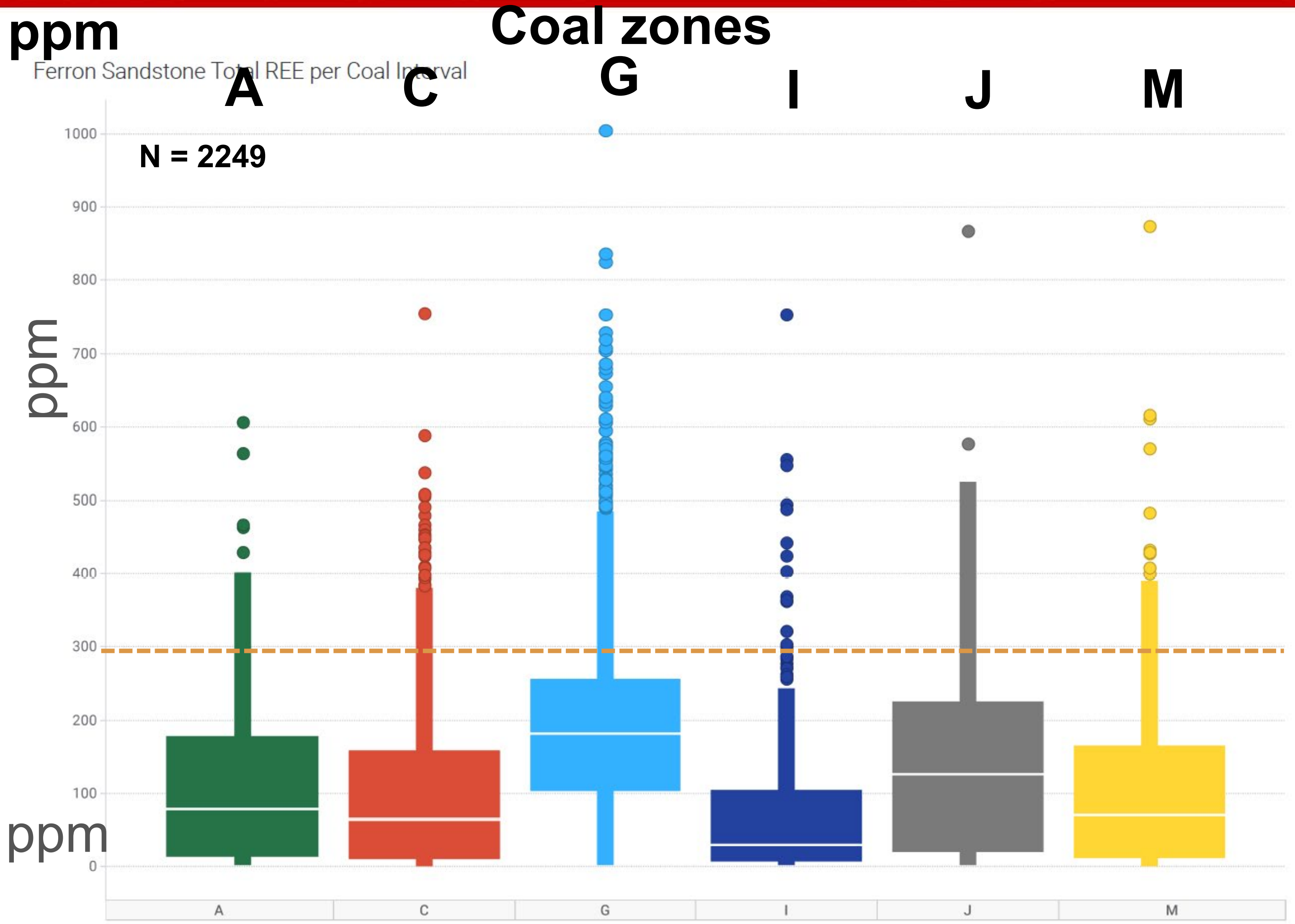
Stratigraphic Trends

Ferron Sst

G coal zone is REE-enriched compared to other coal zones

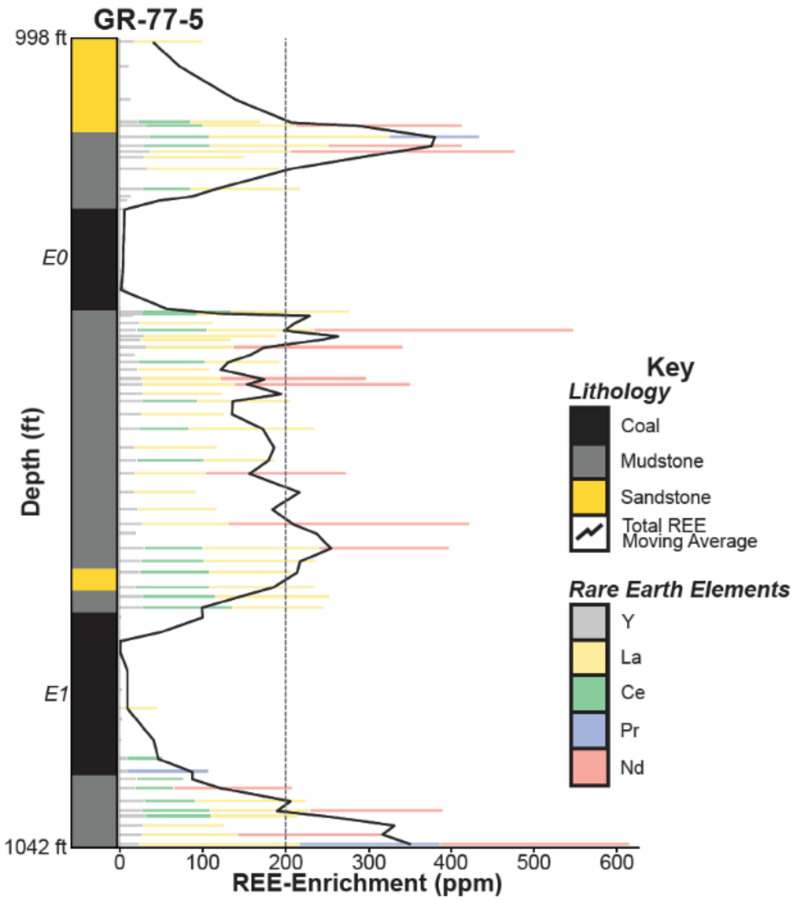
Max value = 4871ppm (C Coal zone)



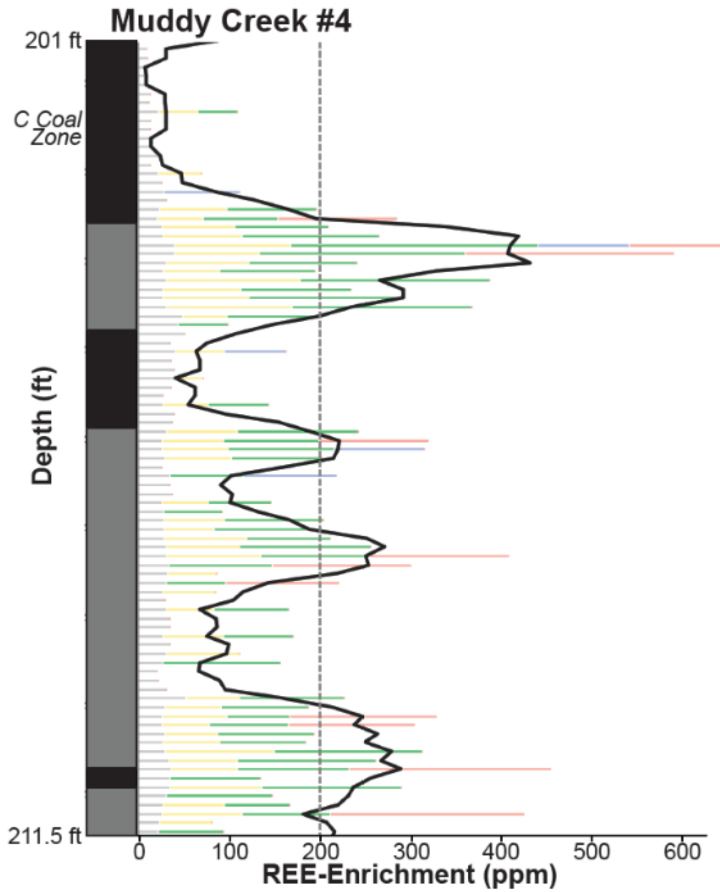


Stratigraphic trends

Mesaverde Grp, CO



Ferron Sst, UT



REE enrichment found in mudstone units overlying or underlying coal seams

Lithologic trends, All Formations

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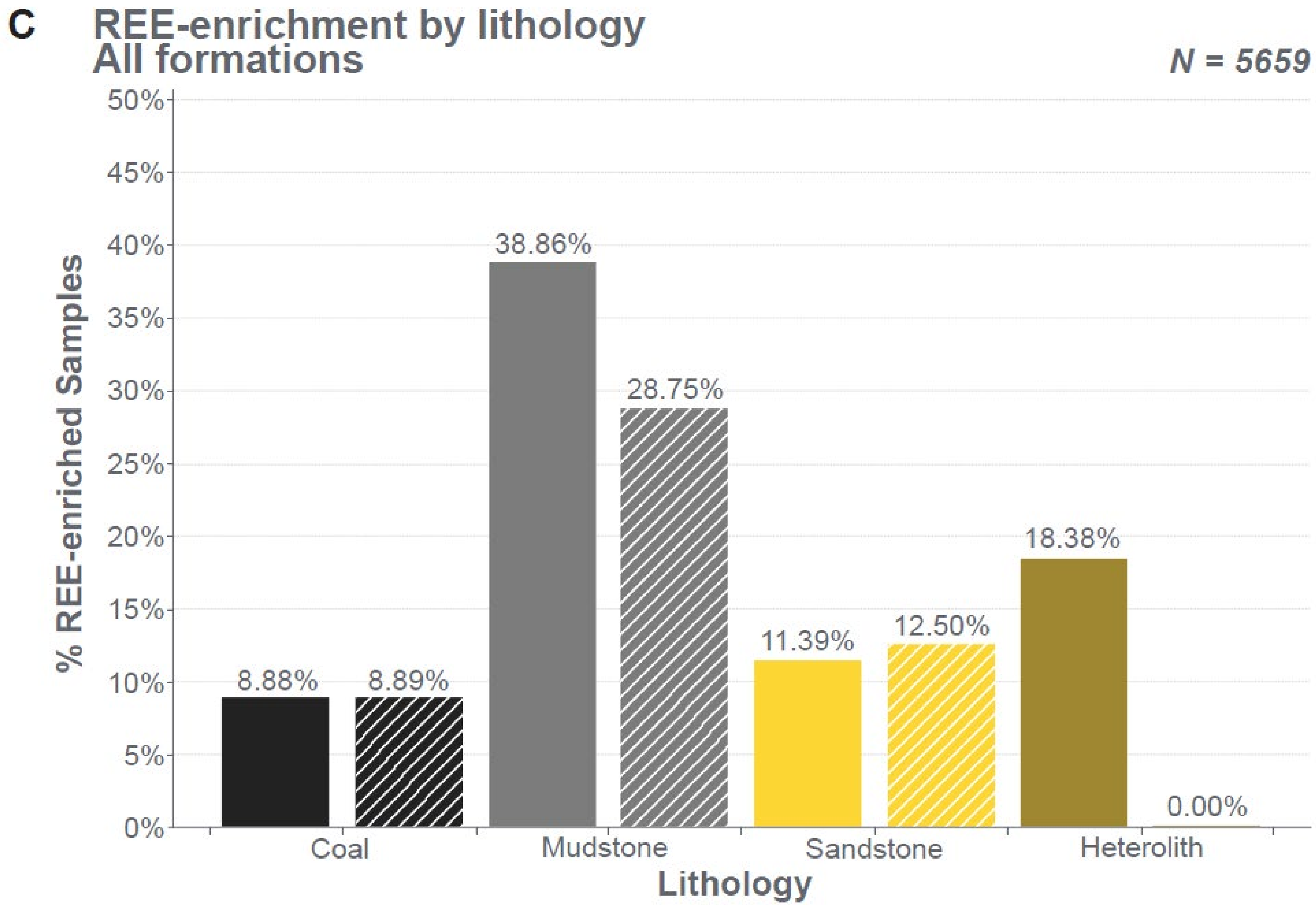
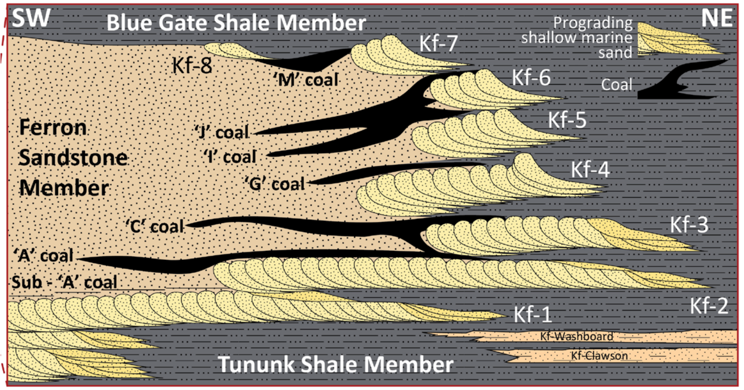
Coal generally lacks REE-enrichment

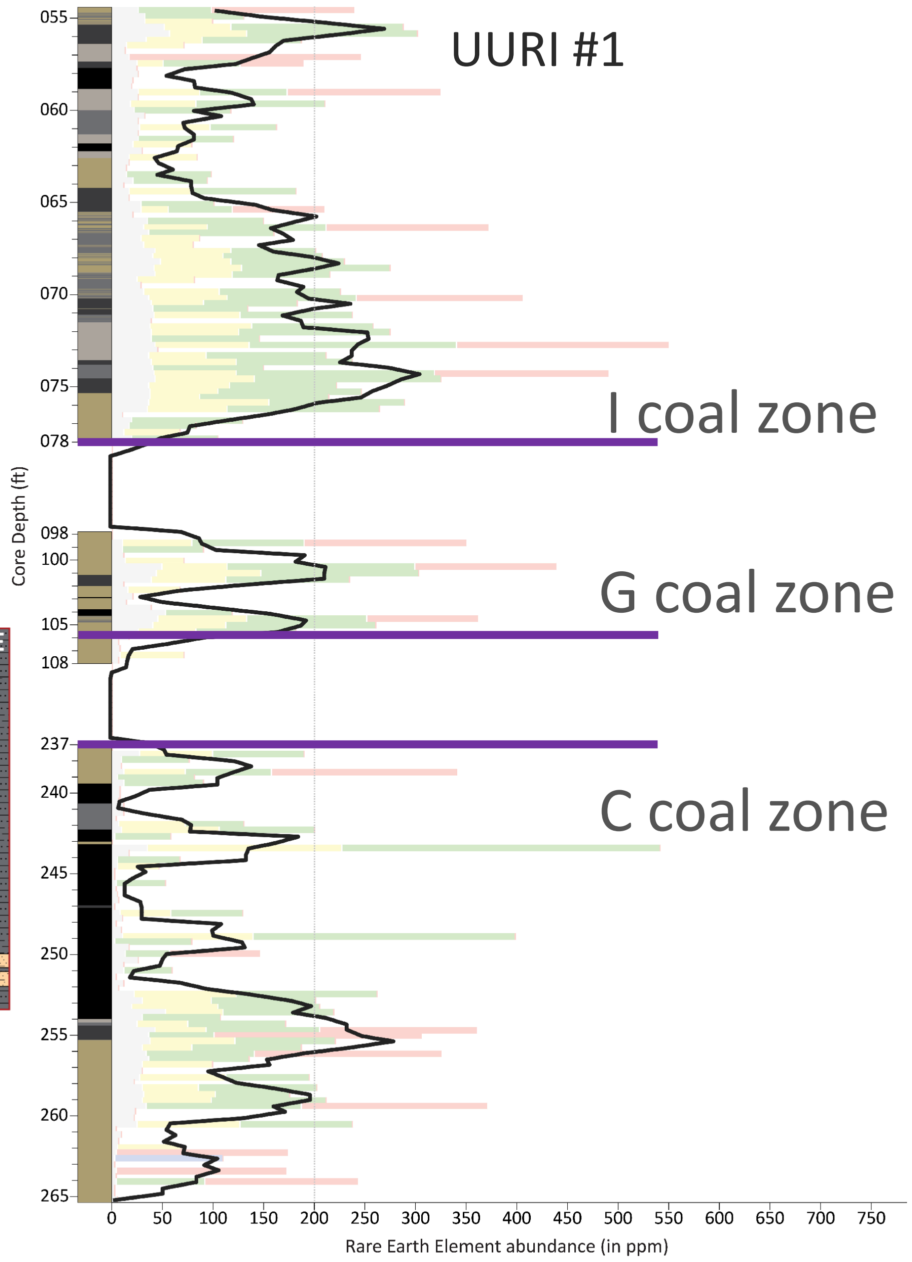


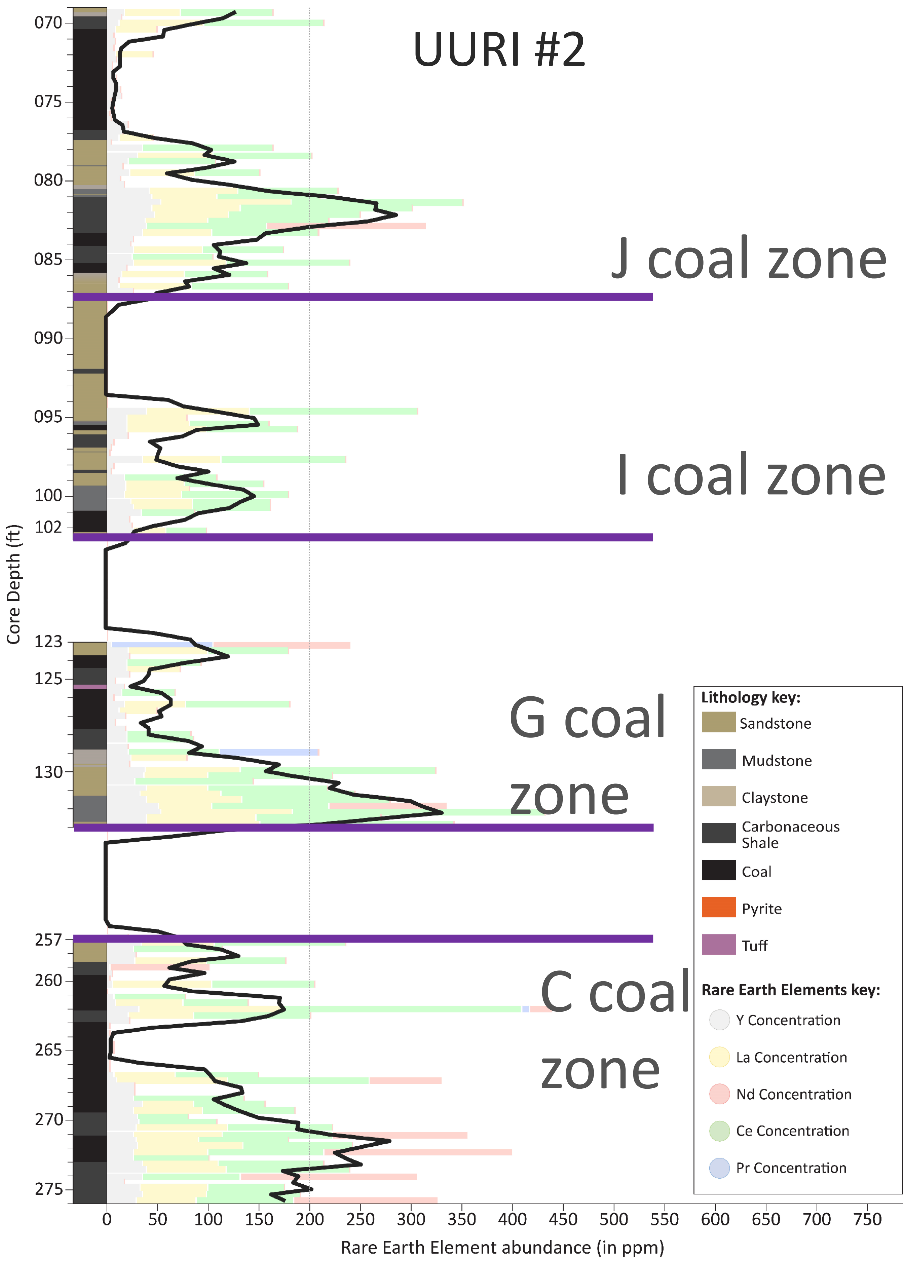
Ferron Sst

Stratigraphic Trends

Carbonaceous shale, claystone & mudstone beds overlying or

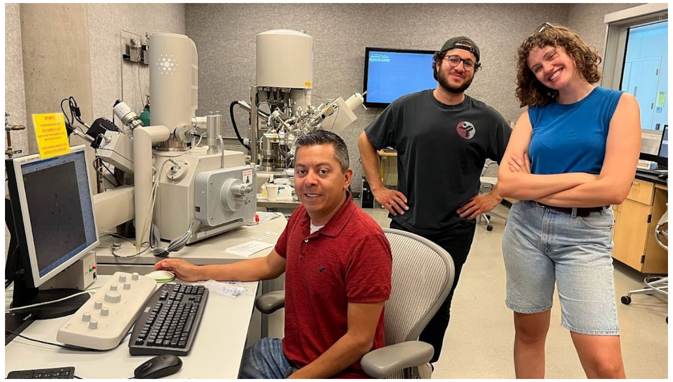


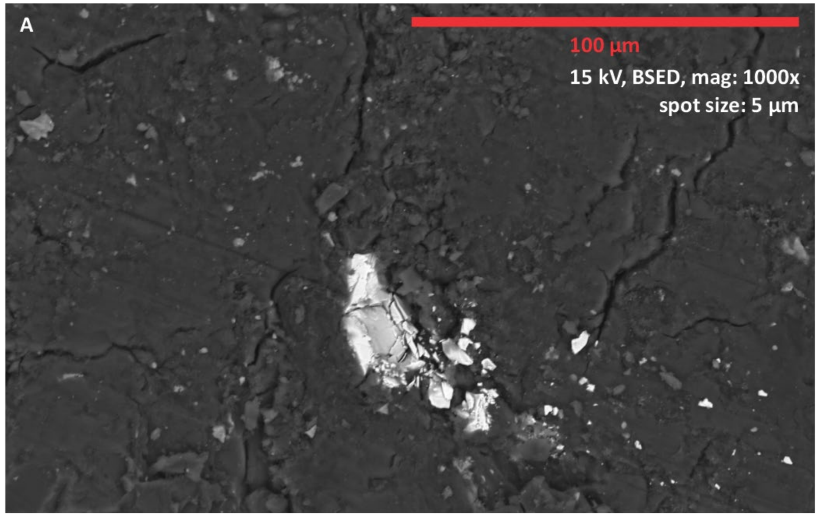




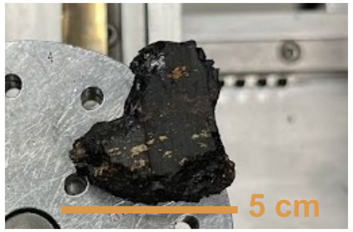
Mechanism of REE-enrichment

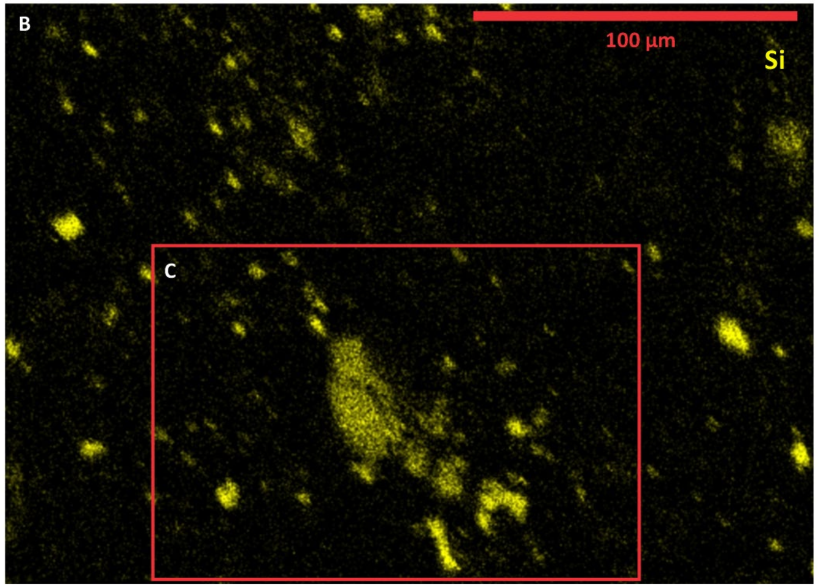
Beaver Creek No. 8 mine, Castlegate A seam
TREEs: 781 ppm – 934 ppm via ICP-MS



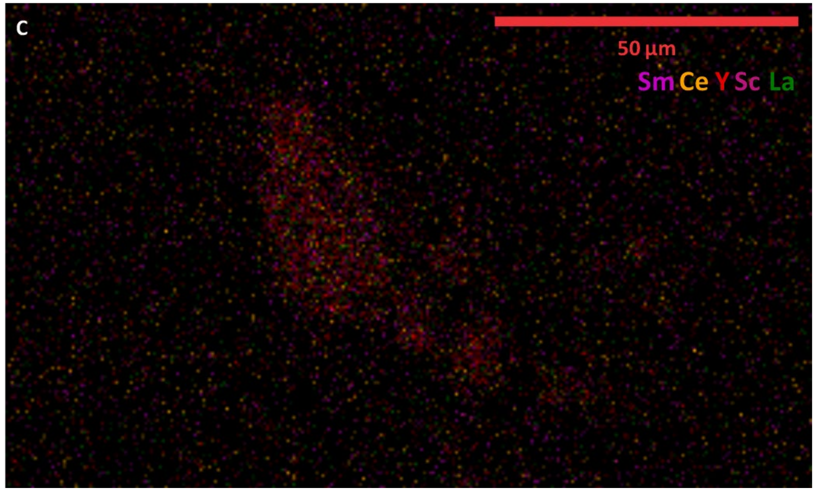


Backscattered electron (BSE) image 1000x





EDS map silica (Si)



EDS map REEs
Sc, Y, La, Ce, Sm

Silicate domains interpreted as volcanic ash and debris transported via air fall

Mechanism of REE-enrichment

Beaver Creek No. 8 mine, Castlegate A seam
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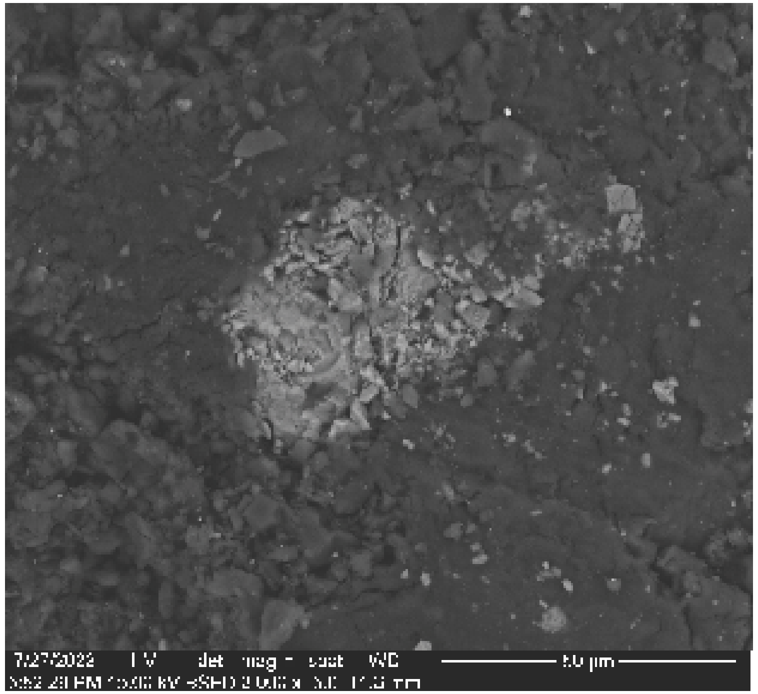

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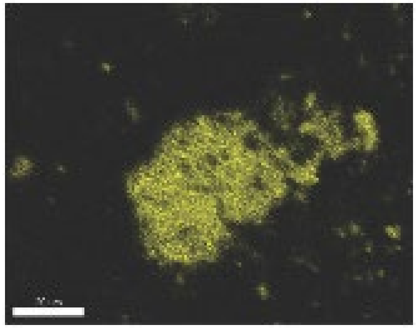

EDS map silica (Si)

EDS map REEs Y, Sc, La, Ce, Sm

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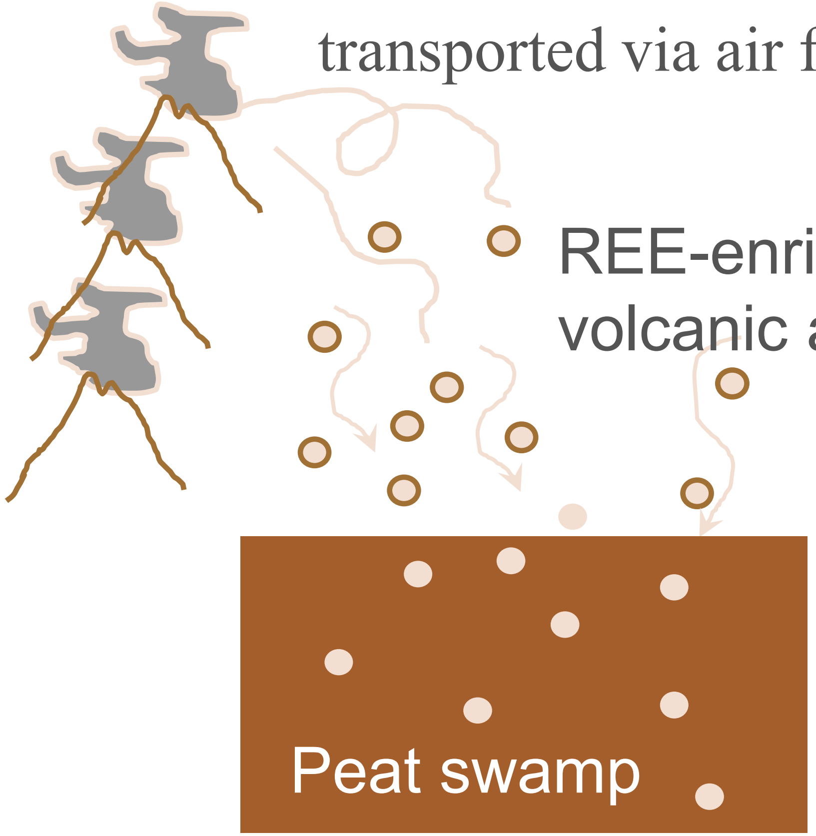


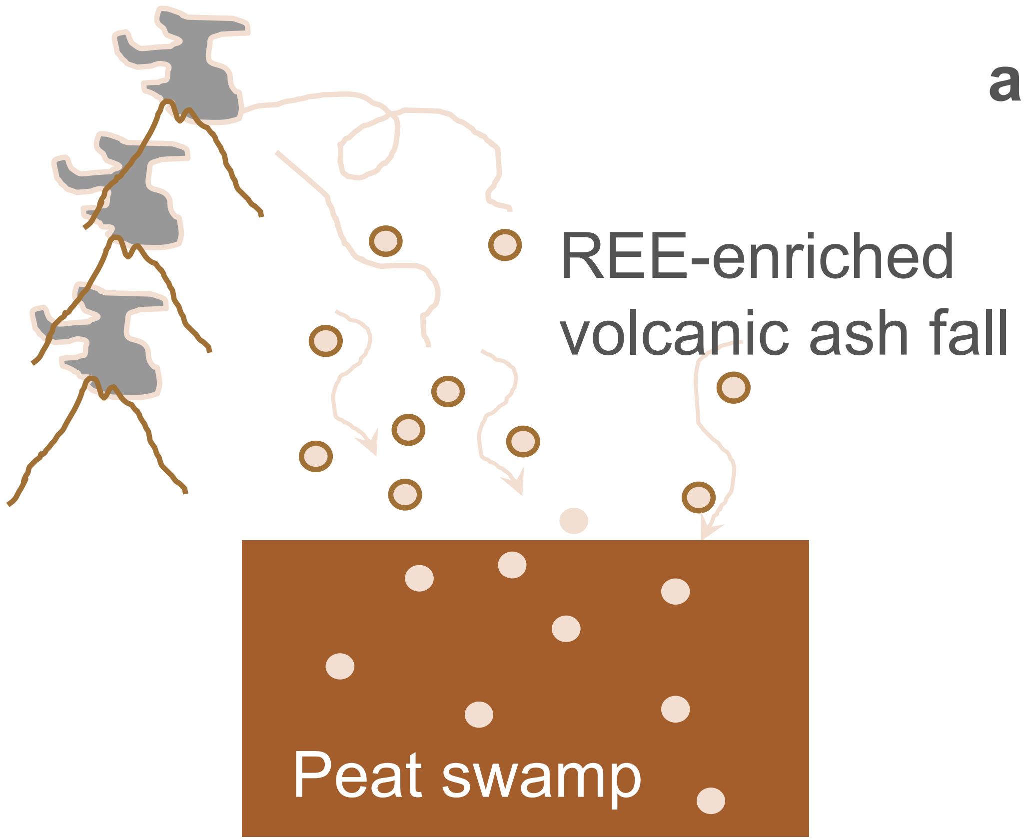
REE-enriched volcanic ash fall

Mechanism of REE-enrichment

Spatial REE-enrichment trends are likely the result of both paleodepositional and diagenetic mechanisms.

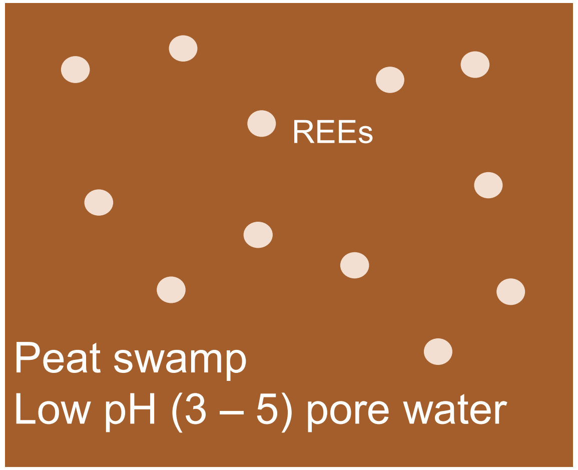
Paleodepositional mechanisms

1) Volcanic ash in peat



and/or

2) Organic matter uptake of REEs



Eskenazy (1998)

HREEs are able to form complexes with organic compounds, particularly under pH 3 – 5 conditions

Cation exchange with Na, K, Ca, and Mg

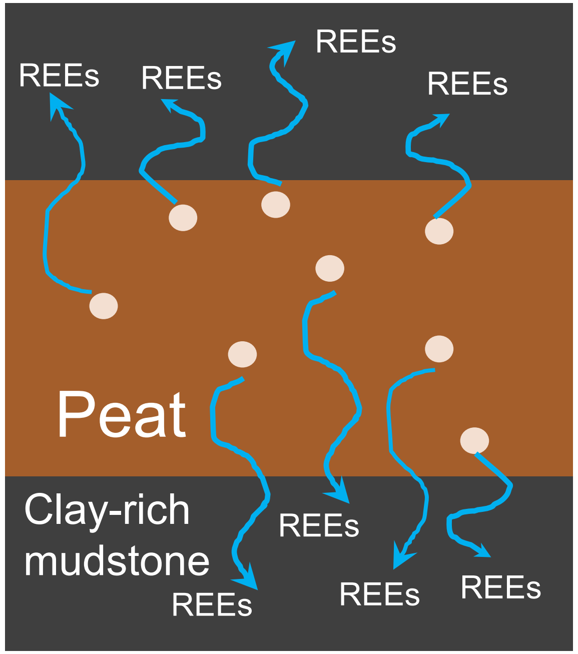
Mechanisms of REE-enrichment

Spatial REE-enrichment trends are likely the result of both paleodepositional and diagenetic mechanisms.

Diagenetic mechanisms

1) **Early diagenesis** (eogenesis)

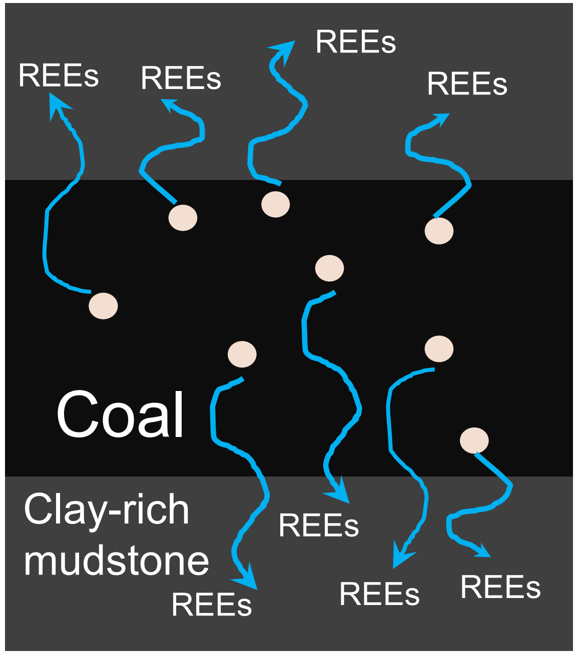
Early movement of REEs in peat pore waters??



2) **Burial diagenesis** (mesogenesis)

Temperature driven REE mobility

REEs fractionate to clays with increased coal rank

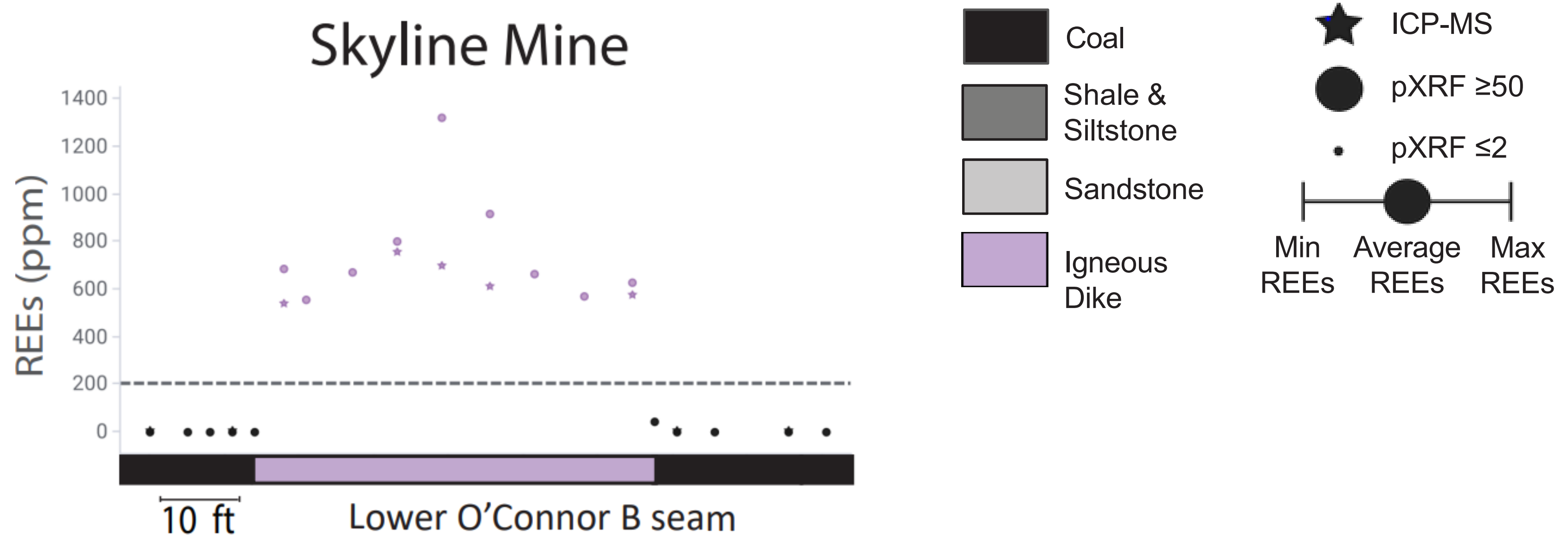


3) **Late diagenesis** (telogenesis)

Meteoric water REE mobility

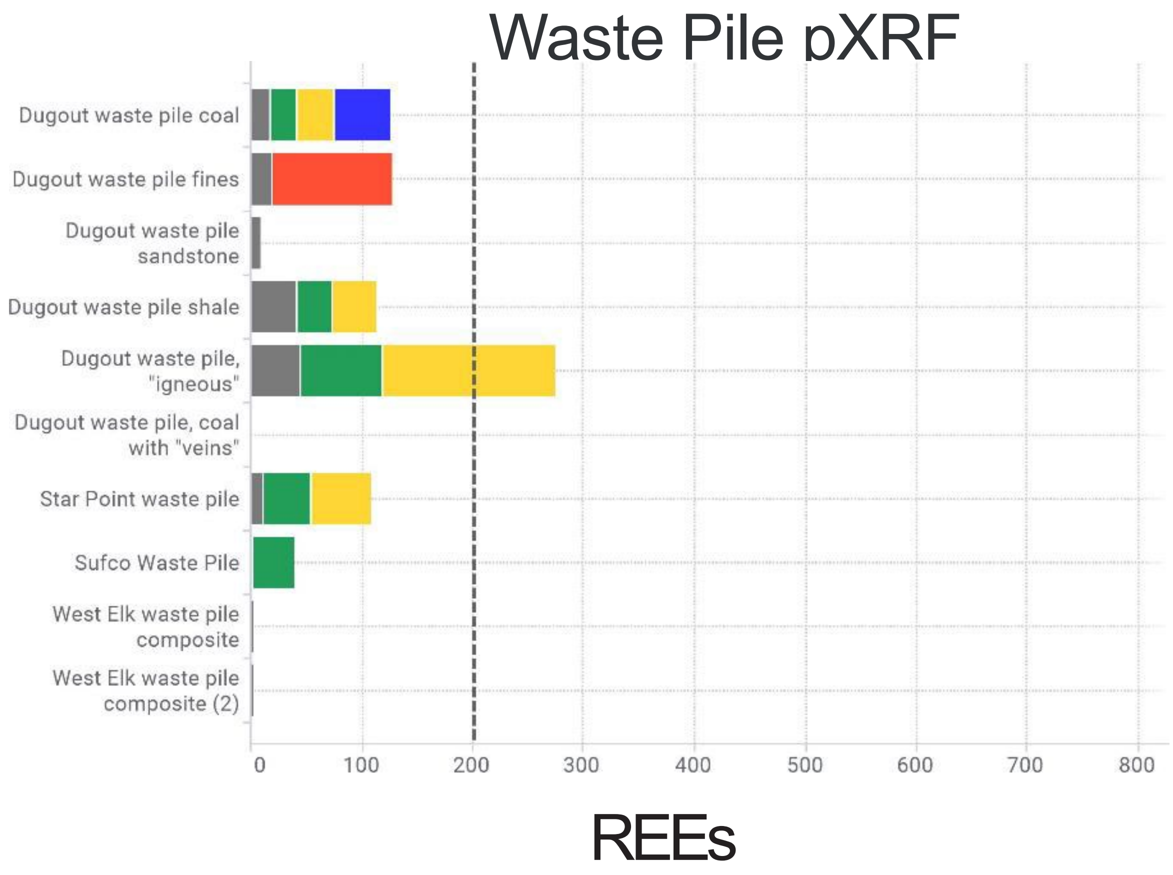
Paleo or modern erosional surface

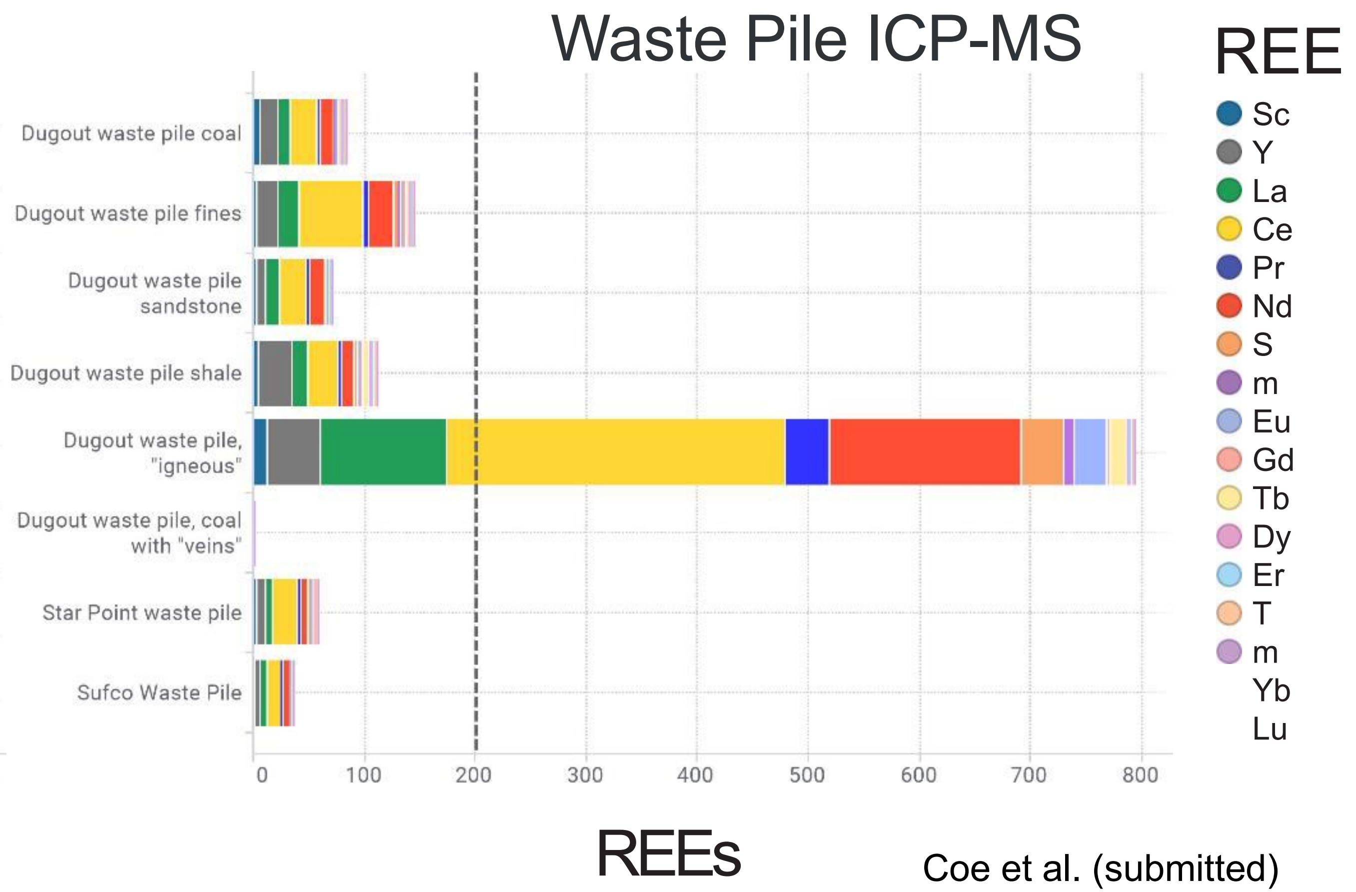
Igneous dikes and waste piles



Igneous dikes that cross cut at least one local underground mine are REE-enriched, and may be very locally significant.

Igneous dikes and waste piles





Coe et al. (submitted)

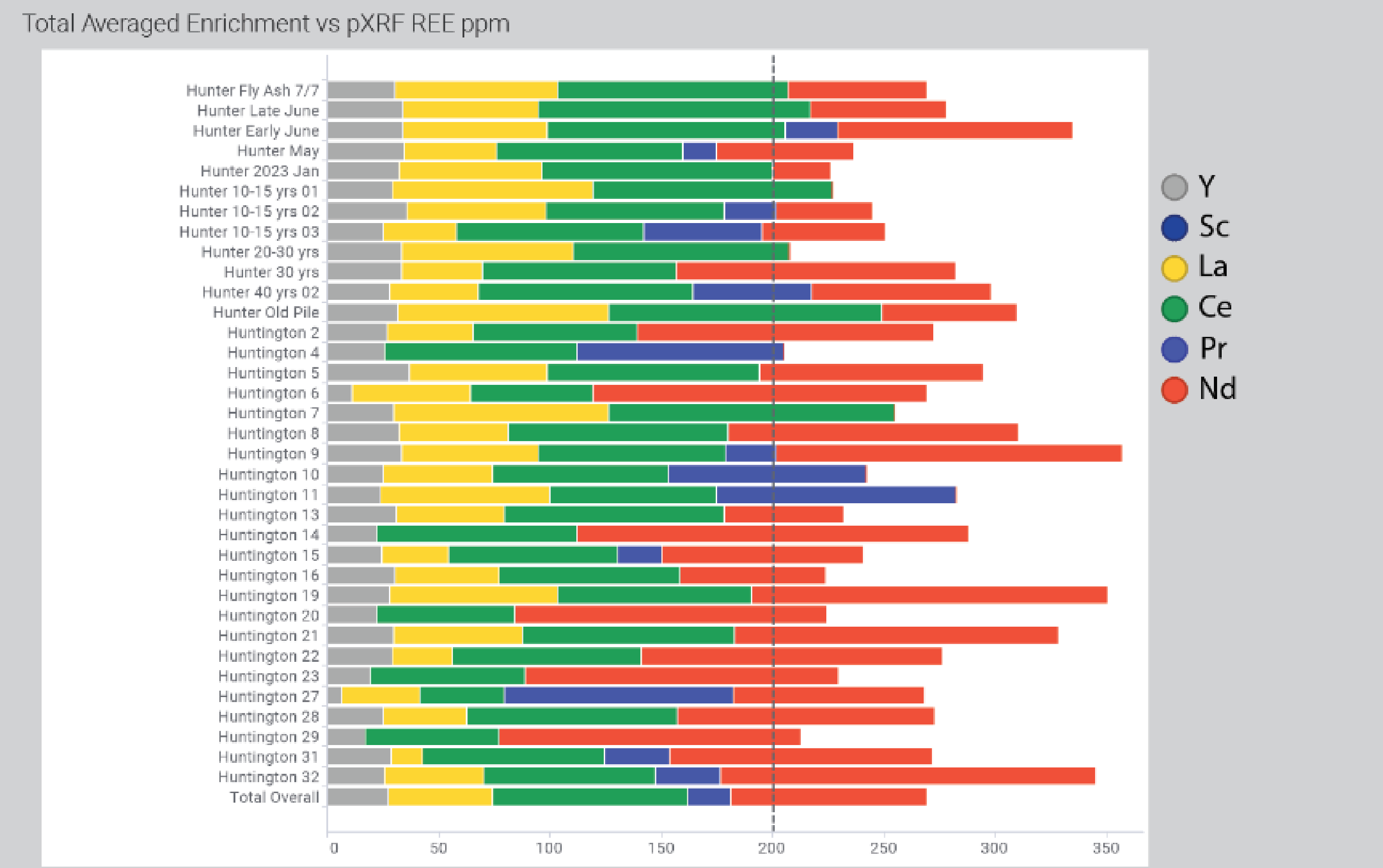
- Waste pile data supports trend of REE-enriched igneous material

Power plant ash piles

- Hunter and Huntington plants
- Subset of samples REE-enriched, total average >250 ppm REEs
- Significant Pr & Nd enrichment

Huntington power plant waste ash pile aerial image, Bing Maps

Hunter power plant ash waste pile aerial image, Bing Maps



All power plant ash pile samples from Hunter and Huntingon, with average REE values from repeated scans shown. The y axis is organized first by power plant and then by depth. At Hunter power plant, depth correlates to age. Total overall average REE enrichment values for all samples is shown in the bottom bar on the y axis. REE enrichment > 200 ppm marked with dotted line.

Geology highlights – Uinta Region

- Collected a powerful geochemical dataset to quantify CM/REE enrichment, in terms of both amount and stratigraphic and geographic context.
- Stratigraphic trend: REE-enrichment (>200 ppm) is found largely adjacent to coals, in carbonaceous siltstones and shales that directly overlie or underlie coal seams.
- Geographic trend: Find consistently highest REE-enrichment in western Colorado, in the Somerset coal field.
- A few percent of coal samples analyzed are REE-enriched, but coals themselves are generally not REE-enriched.
- The lateral variability in REE-enrichment, as well as the mineral association of REEs, remains relatively unconstrained and is the focus of ongoing investigation.

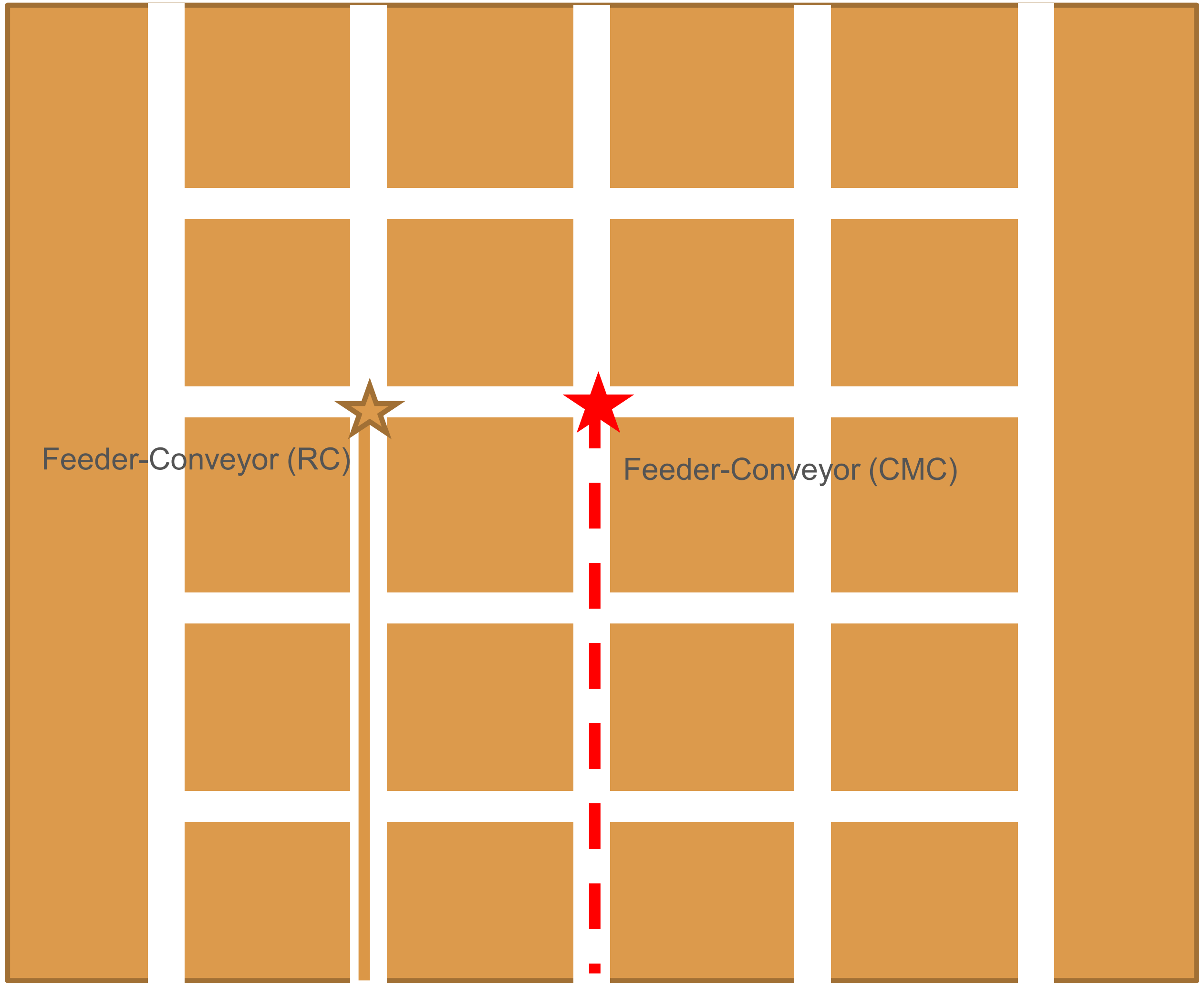
Geology highlights – Uinta Region

- Local igneous dikes that cross-cut Skyline Mine (UT) and are found in waste piles (e.g., Dugout waste pile) are REE-enriched.
- Some samples show relatively high Nd content (~100 ppm or more) – including from ash plant piles, igneous dike samples in waste piles, and volcanic ash beds in the Green River Formation oil shale deposits.

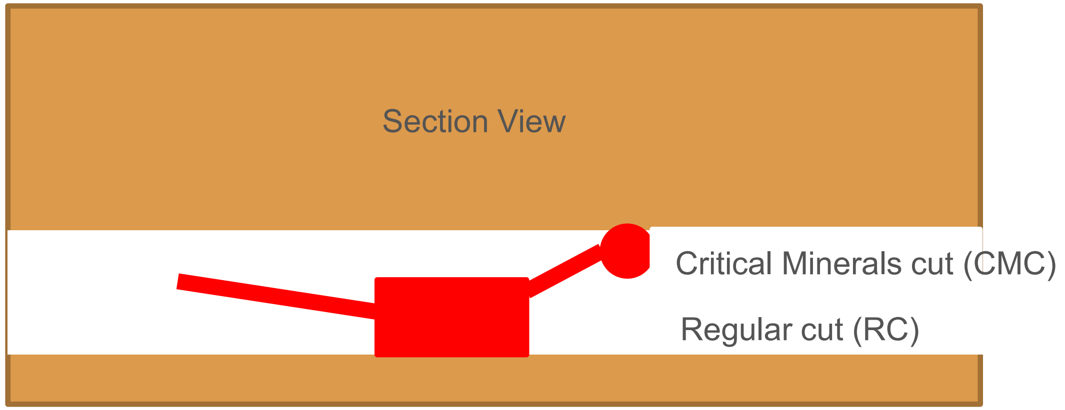
Project highlights – Uinta Region
Mining implications

- Floor and roof material of active underground mines could be REE-enriched, particularly if the floor and roof is shale or siltstone. This should be further explored for quantitative resource assessment, mining engineering feasibility and economic viability.
- Igneous material in at least one active mine and a few waste piles could be of local significance. The volume and regional occurrence is small, but the REE-enrichment is high.
- Nd-rich material should be prioritized and leveraged.

Room and Pillar



Plan View



- Continuous (Room and Pillar)
  - can be applied more readily to mineral deposits that are not uniform
  - coal recovery is typically <~50%

Selective Mining

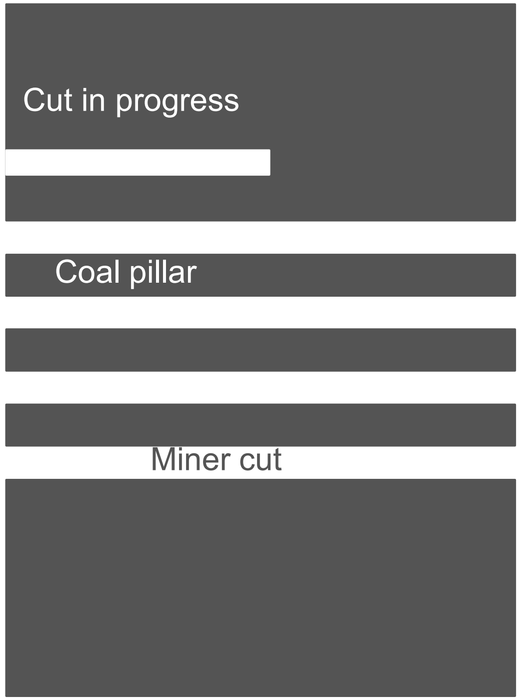
- Extracting non-fuel minerals will require selectivity
  - Within seam
  - Above/below seams

- Highwall miners are used extract narrow bands of coal from the surface
  - They make small cuts (holes) into the seam

youtube.com and caterpillar.com

Resource Loss with Highwall Miners

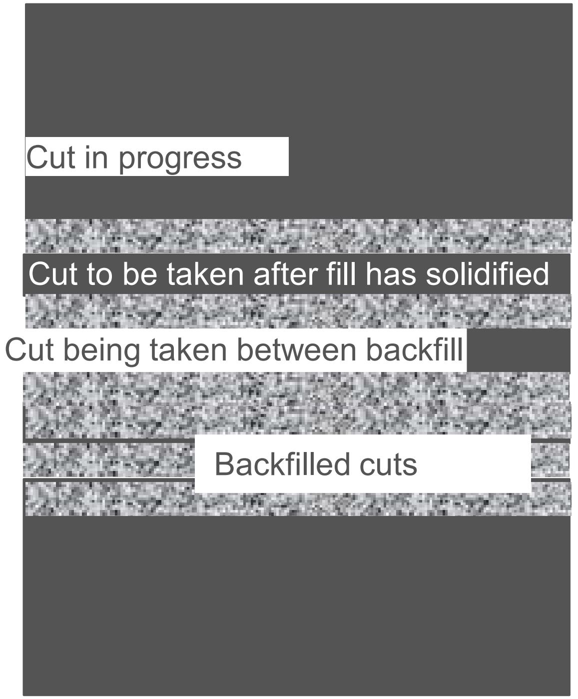
- About half of the resource is lost as pillars are left between cuts
  - If pillars are not left, strata will collapse on the miner as it makes the next series of holes



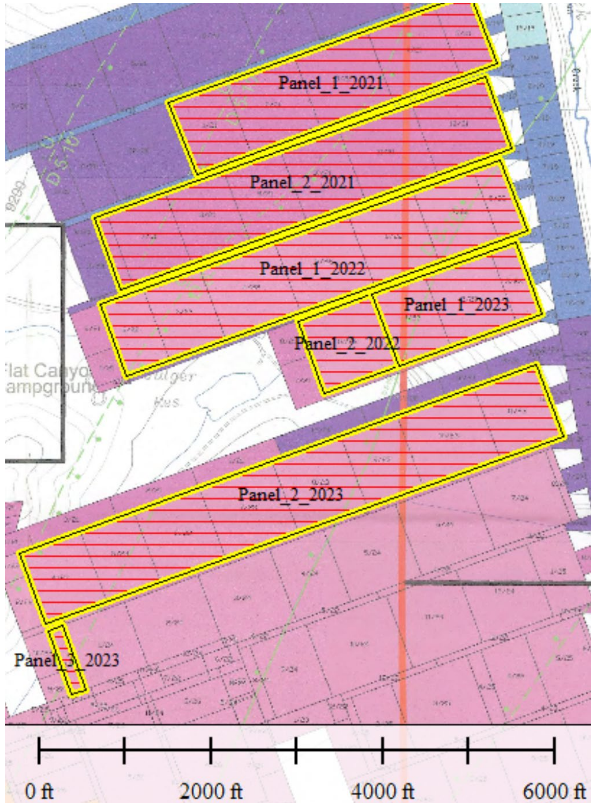
youtube.com and caterpillar.com

Backfilling cuts

- Backfilling is common in metal mines to recover all ore
  - Pillars are left behind initially, but are mined once neighboring backfilled cuts are stable
    - A sequence is followed to ensure that cuts are not made in between unconsolidated backfill
- Same technique can be used with highwall miners to extract the entire resource



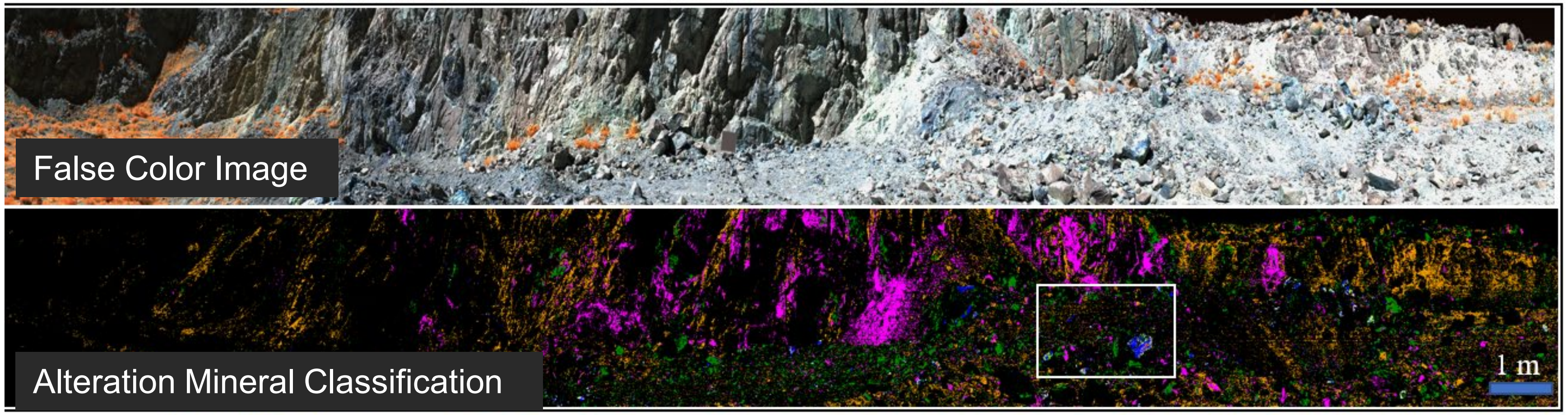
Backfill



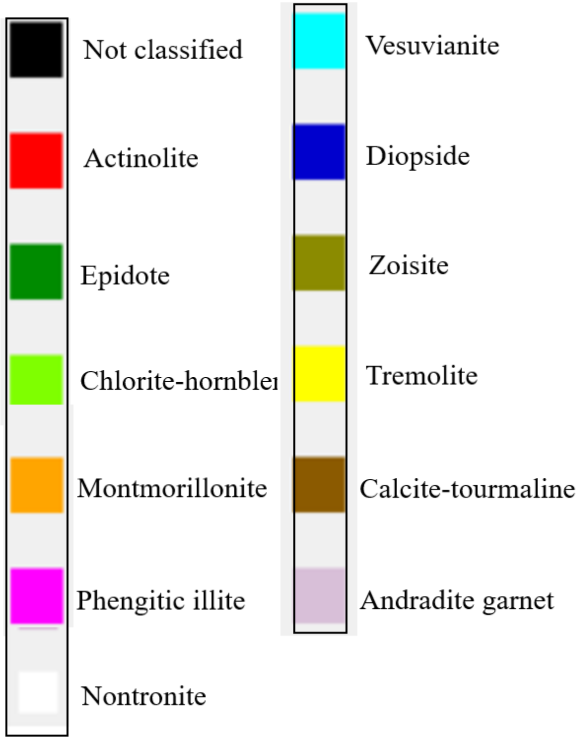
- Highlighted regions show planned mining from 2021 through 2023 at one Utah mine.
- The thickness of the coal ranges from 10 to more than 19 ft.
- This mine opens a volume of ~81,000,000 ft^3 per year; a portion of this volume could be utilized for backfill.
- Backfill is an alternative and productive use for waste material and reduces some environmental impacts.
- Currently, backfilling is not practiced in coal mines in the U.S.; utilizing waste material for backfill is practiced in the coal industry internationally.

Imaging spectroscopy: Gold Hill, Utah

- The Yellow Hammer prospect in the Gold Hill district is a past producer of Tungsten ores.
- The prospect is not associated with Carbon ores, but it demonstrates the variety of critical minerals in Utah.
- The data were acquired at ~30 m from the highwall and have a spatial resolution of ~0.85 cm^2.



Classification Legend

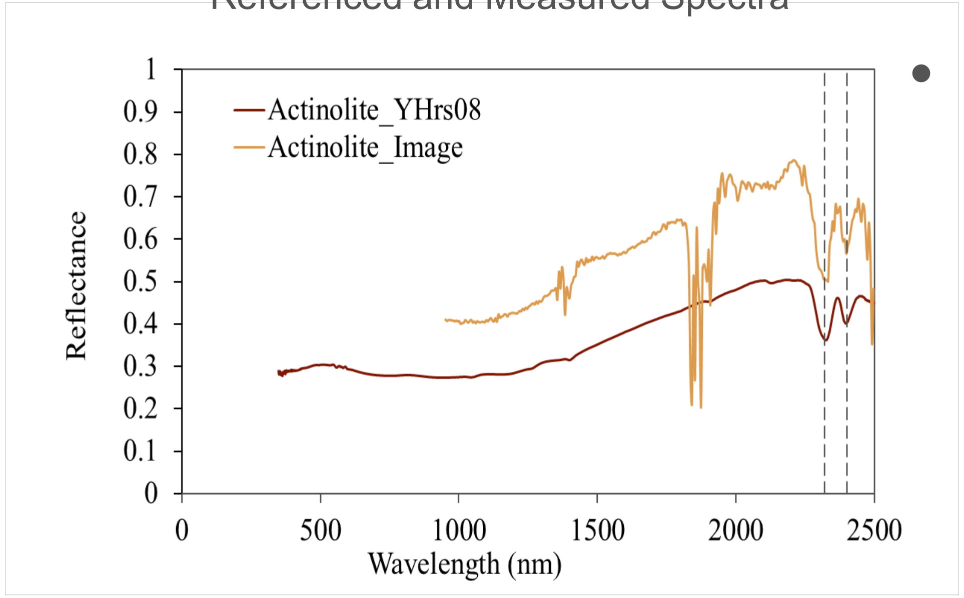


Imaging spectroscopy: Gold Hill, Utah

Classification Statistics

Mineral	Medium Resolution (0.85 cm^2)	
	Number of Pixels	Percent
Epidote	57,596	24.90
Chlorite-hornblende	1,372	0.59
Actinolite_yhrs8	311	0.14
Montmorillonite	99,064	42.83
Phengitic illite	64,493	27.88
Vesuvianite_usgs	319	0.14
Diopside_usgs	5,040	2.18
Zoisite_usgs	75	0.04
Tremolite	21	0.01
Calcite-tourmaline	575	0.25
Andradite-garnet	2	0.00
Nontronite	2,433	1.05

Referenced and Measured Spectra

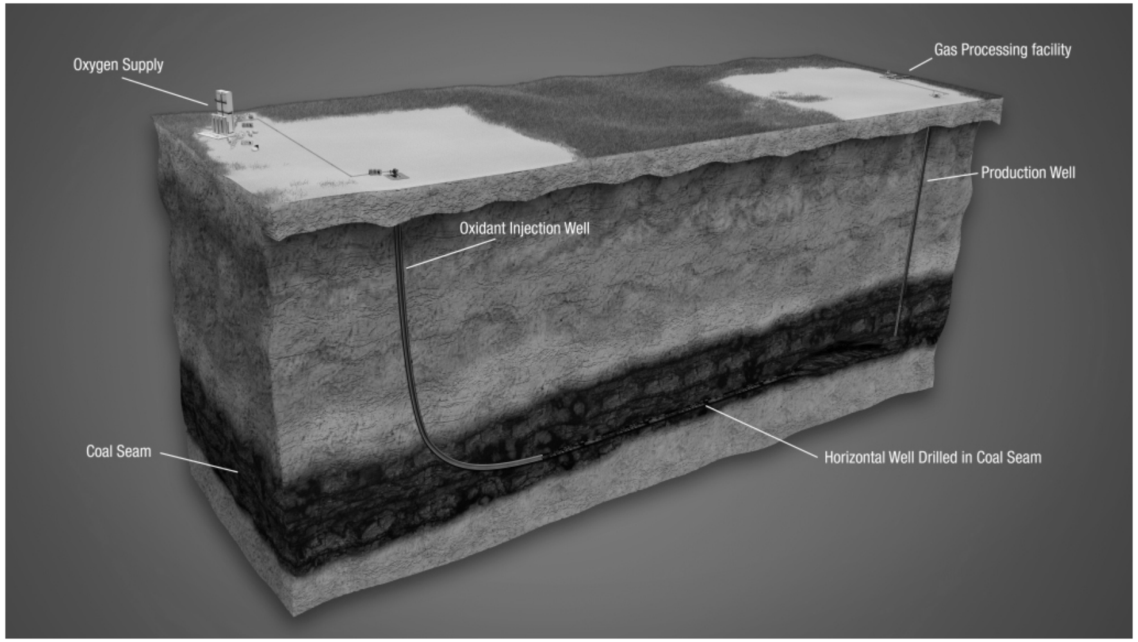


The classification algorithm works by matching absorption features in the spectra.

The comparison above shows the spectrum of actinolite from a reference sample and the spectrum of a pixel classified as actinolite; both spectra have an absorption doublet just below 2,500 nm.

- Imaging spectroscopy is a developing technology and will be useful for
  - Identifying REE and Critical Mineral resources, and
  - ore classification and sorting.

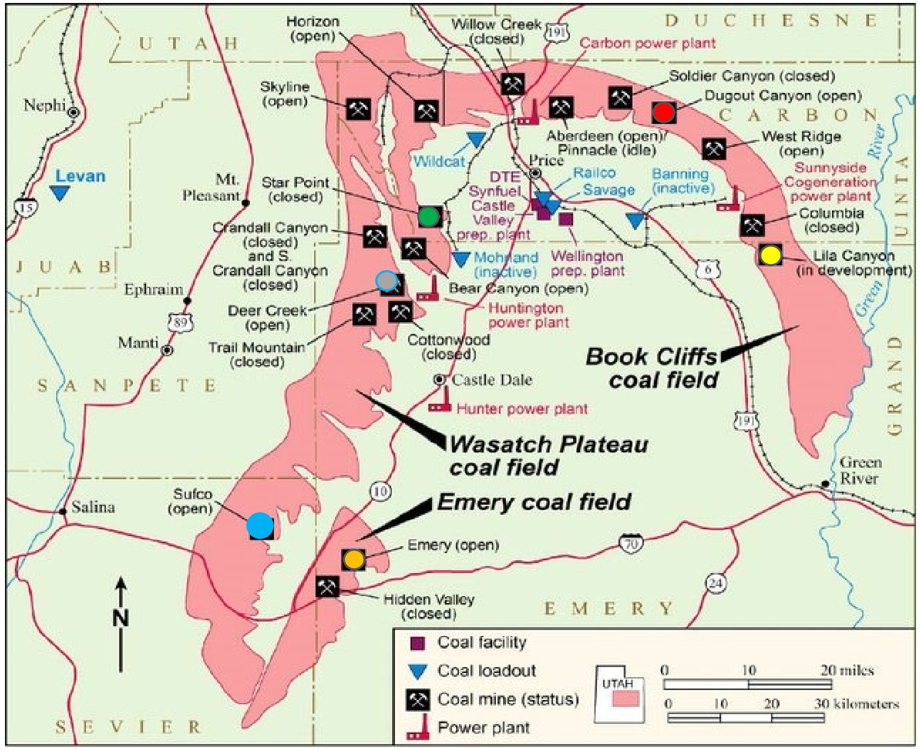
Extraction methods for deep coal seams – Alternative processing for unminable coal – directional drilling



https://onepetro.org/SPEURCE/proceedings/13URCE/All-13URCE/SPE-167025-MS/178351

https://www.rockdrillsales.com/fullpanel/uploads/files/hdd%20product%20catalogue_us-format.pdf

Examination of Coal Resin Resource



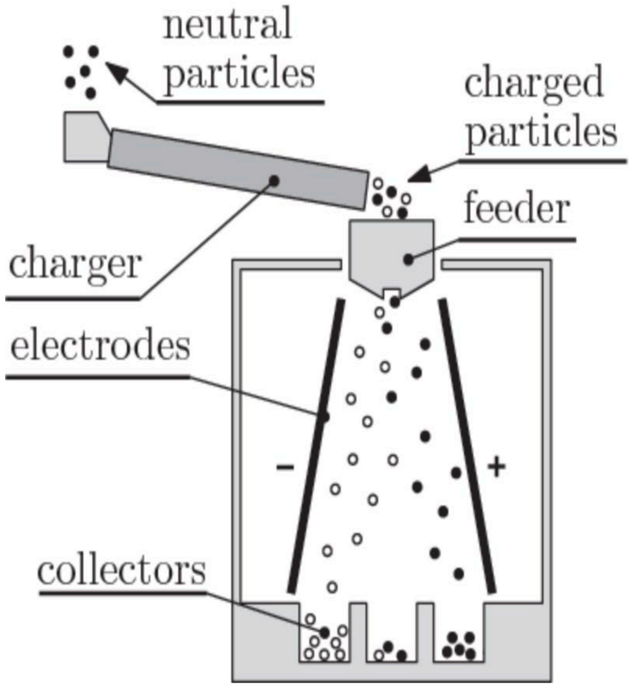
- Nine coal samples from the Uinta basin, expected to contain resin, were received from the geology team. The resin content of the samples were analyzed by Soxhlet extraction.
- The samples from Wasatch Plateau coal field give a higher resin content as high as 10%. The sample from the Book Cliffs coal field has a low resin content (less than 1%).
- Resinite resource is about 19.4 million short tons (17.6 million metric tons).

LCRM(0.95%) DGRM (0.55%) STWT-1 (10.3%), STWT-4 (8.5%)

GMHA (5.5%), GMLA (4.7%), GNLC 6.5%) SFRM (2.4%) EMRM (1.7%)

Evaluation of Process Technology

- **Density separation**: Resinite has a lower density(1.03-1.05 g/cm3) than coal (1.3-1.5 g/cm3) traditional gravity separation can be used to produce resin concentrate
- **Flotation technology**: Advanced selective resinite flotation technologies have been developed at the University of Utah using flotation chemistry control.
- **New technology**: The tribocharging of resin particles and coal particles was evaluated using various tribocharging materials. These results provide a foundation for the development of dry triboelectrostatic separation.

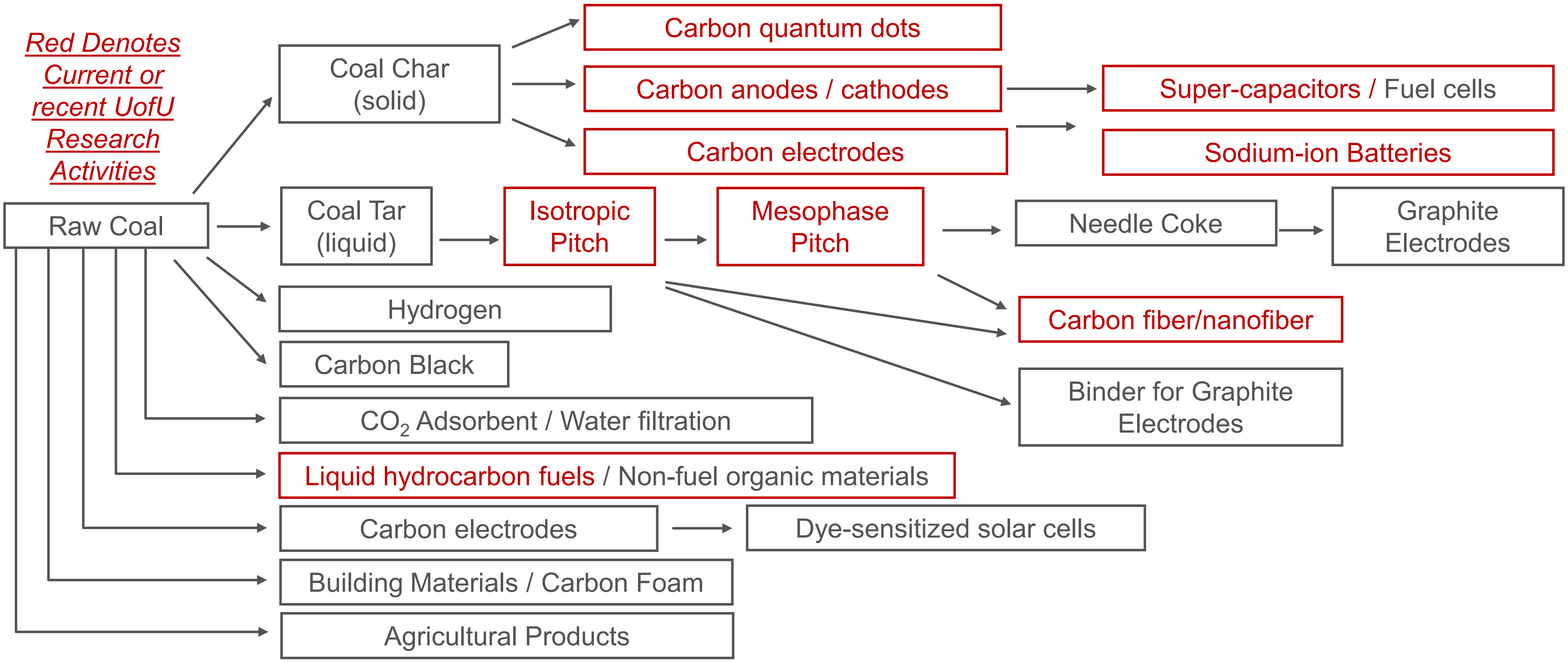


Development of dry triboelectrostatic separation

Review Utilization and Market for the Coal Resin Product

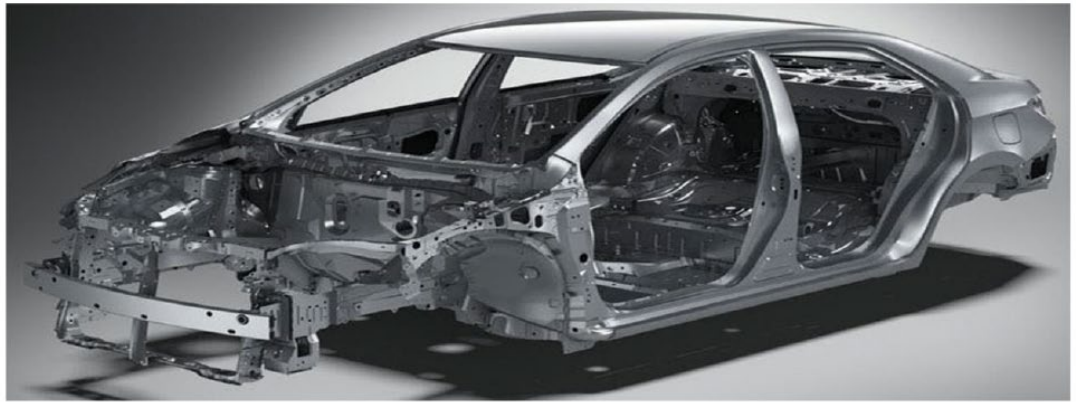
- Resins find wide applications in various industries, including adhesives, binders, plastics, pavement, rubber, varnish, paint, coating, and the ink industry.
- The annual U.S. consumption of various resins in black ink production alone is approximately 750 million pounds (340 million kg) . The coal resin has the potential to capture a portion of this market, with up to 15 percent coal resin being used in black ink production, corresponding to 112.5 million pounds (51 million kg) annually in the U.S.
- The ink resin market is about $3 billion annually [*The 2022 Resin Report, URL: https://www.inkworldmagazine.com/issues/2022-04-01/view_features/the-2022-resin-report/*
- In recent years, there has been a focus on environmentally friendly products, leading to the development of biobased and plant-based resins as alternatives to traditional petroleum-based resins.
- Research on the future use of resin to produce high purity nano-graphite, carbon fibers, and/or carbon nanotubes.

Some Carbon Products from Coal



Carbon Products Literature Survey

- Performed review of studies related to carbon products that can be derived from coal, which have potential for creating a new industry for the Uintah Basin
- A summary of each study with its potential applications is included in the Final Report
- General topics included:
  - Carbon fiber/carbon nanofibers
  - Carbon quantum dots
  - Carbon-anode-based materials/applications, e.g.
    - Supercapacitors
    - Sodium-ion batteries
  - Alternative fuel generation (including hydrogen)
  - Agricultural applications
  - Building materials
  - Carbon foams
  - Environmental applications (e.g., water treatment, gas purification)



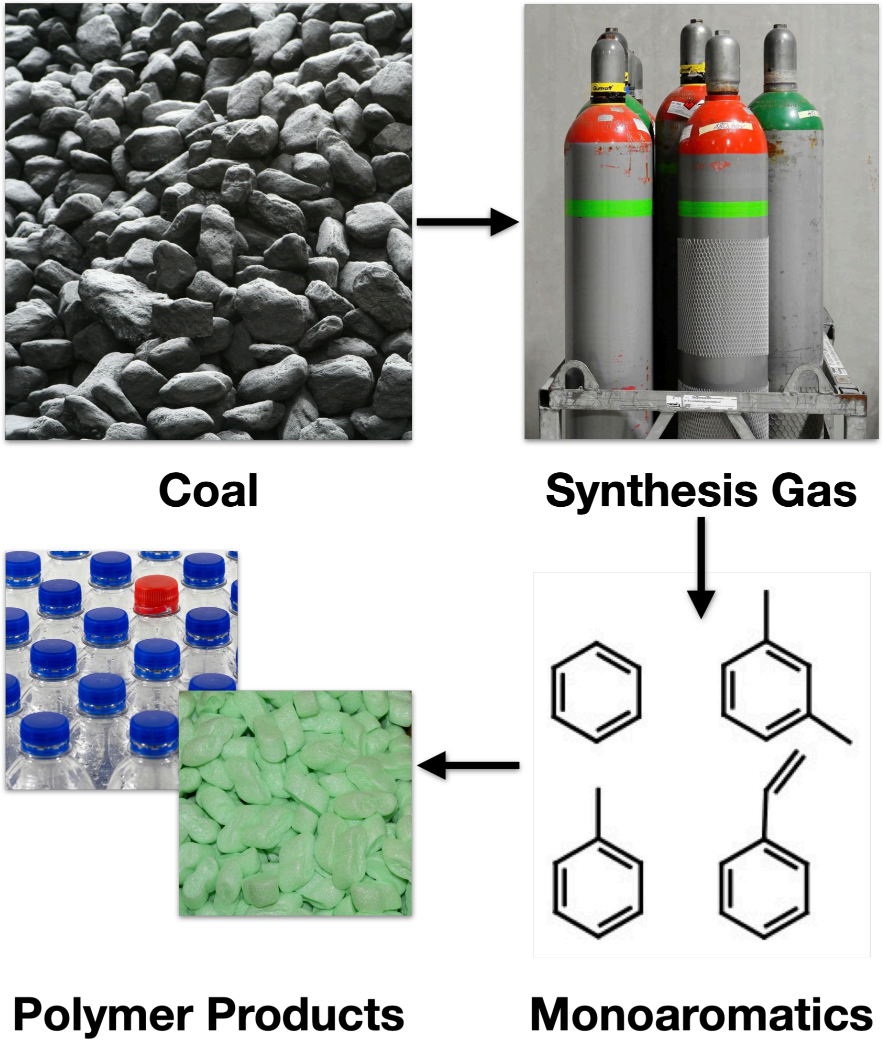
Giraud-Carrier, F., & Barlow, E, "Utah Defense Manufacturing Community C2CF Project Report Coal to Carbon Fiber (C2CF) Business Case Analysis Report," *Utah Defense Manufacturing Community C2CF Project Report,* September 2022.

https://blogs.3ds.com/biovia/wp-content/uploads/sites/27/2021/06/AdobeStock_403833723-scaled.jpeg

https://content.fortune.com/wp-content/uploads/2015/11/vincent-guilly-cea.png

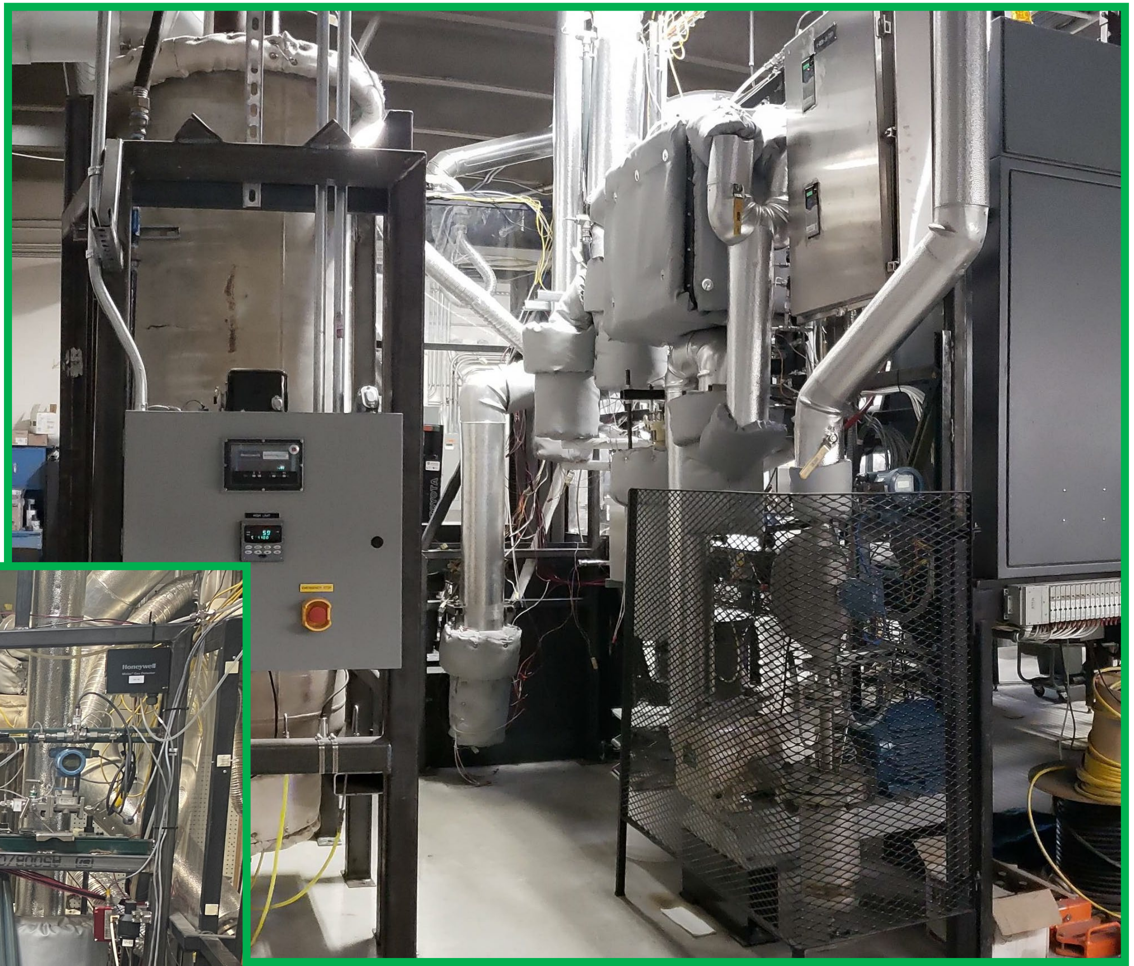
Coal to polymer building blocks—

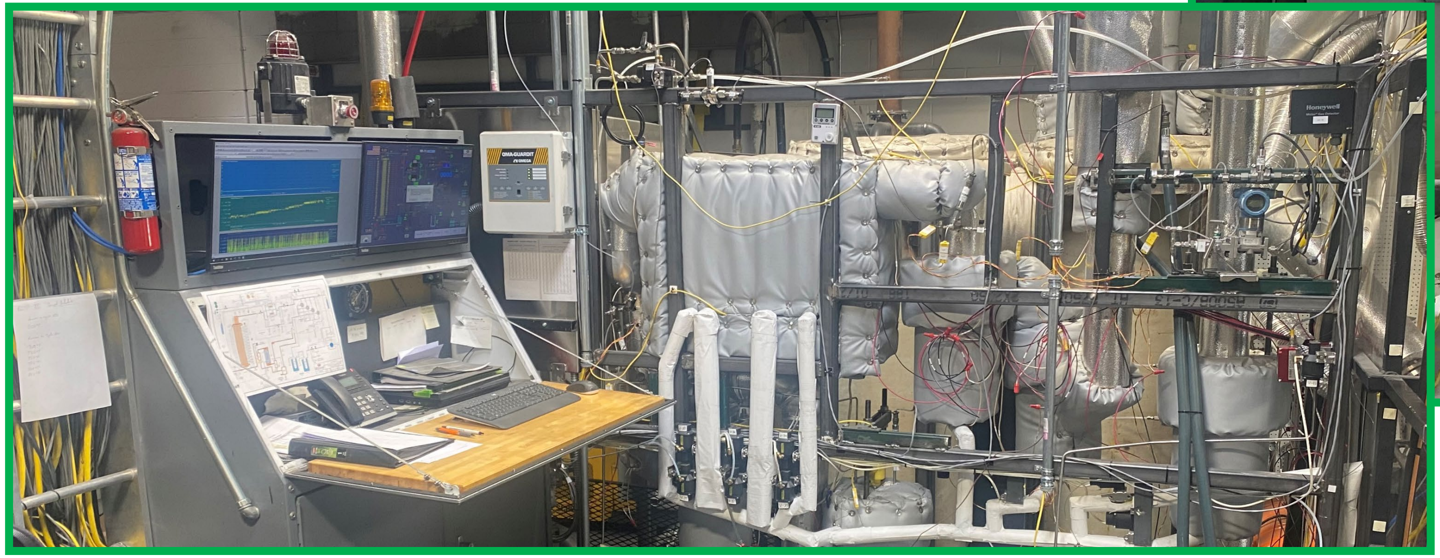
- Coal can be used as a carbon source to produce monoaromatics building blocks for polymer synthesis.
- Fischer-Tropsch synthesis (FTS) and aromatization reactions will produce monoaromatics.
- Opportunities for new bifunctional catalysts which perform both FTS and aromatization reactions.



Carbon Ore Low Temperature Pyrolysis Facility

- Instrumented reactors to test batches from 10 to 500 pounds
- Extensive expertise in fuel-based organic chemistry, reactor-based processes, mathematical modeling and simulation, process engineering and design
- World-leading expertise in oil-shale; recently applied to coal





Green Leaf
CARBON TECHNOLOGIES
A Division of Red Leaf Resources

Large Column Leaching Results

120-day Column Leaching Recoveries (based on solids analyses)

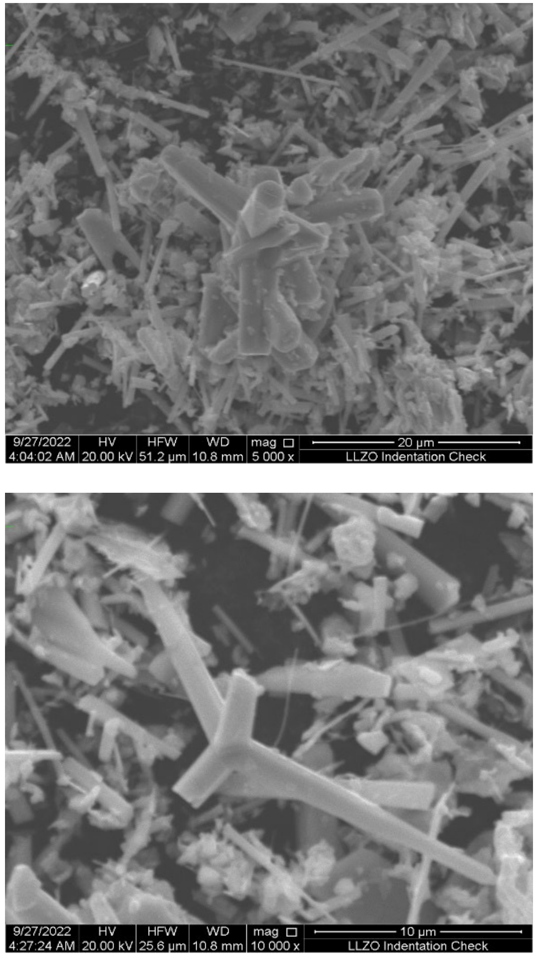
Element	Recirculated Leachate	Ferrous Sulfate	Pyrite Enriched Ore	Control (H_2O_2)
Aluminum	37.9	44.3	49.2	37.8
Barium	36.5	29.1	50.8	51.2
Cerium	47.4	37.3	40.4	26.5
Cesium	36.1	36.3	37.5	36.3
Chromium	34.8	51.4	58.3	49.0
Cobalt	36.9	65.5	51.5	34.7
Dysprosium	29.0	43.4	43.4	29.2
Gadolinium	-36.3	3.7	29.6	-6.5
Gallium	33.7	26.3	52.3	52.9
Iron	16.1	45.1	59.5	56.3
Lanthanum	47.8	40.1	44.2	32.1
Lithium	29.8	41.5	48.0	22.7
Ave 120 Day Recovery	***29.1***	***38.7***	***47.1***	***35.2***

Large Column Leaching Results

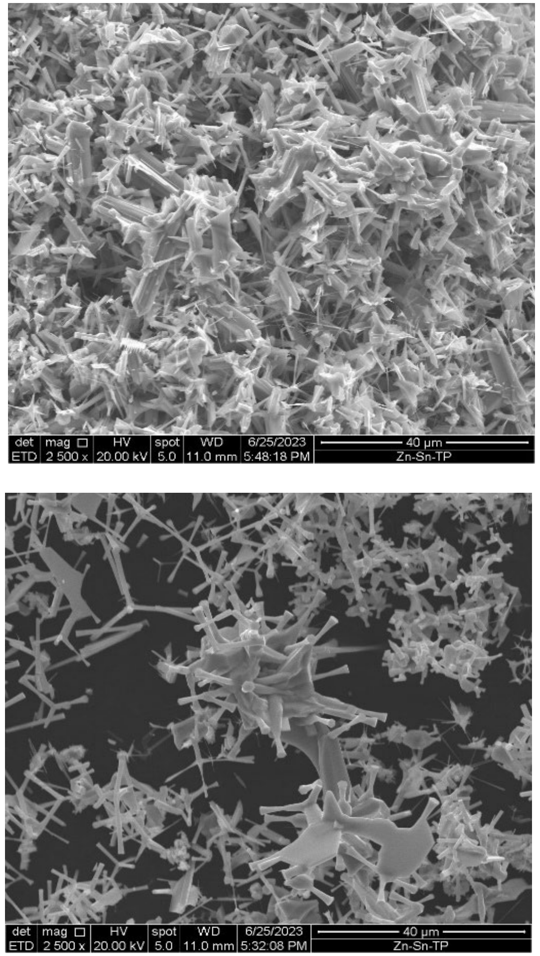
120-day Column Leaching Recoveries (based on solids analyses)

Element	**Recirculated Leachate**	**Ferrous Sulfate**	**Pyrite Enriched Ore**	**Control (H_2O_2)**
Magnesium	18.3	50.4	58.8	40.4
Manganese	47.4	85.9	84.4	78.2
Neodymium	48.3	35.3	42.2	31.3
Praseodymium	33.8	29.6	37.2	25.5
Rubidium	27.2	23.5	18.3	21.1
Samarium	26.9	59.5	30.4	29.1
Scandium	-13.7	50.5	50.5	32.5
Titanium	58.3	20.3	29.0	56.6
Vanadium	32.6	59.0	56.0	46.9
Yttrium	29.8	51.7	48.6	35.1
Zirconium	39.8	43.8	25.9	27.2
Ave 120 Day Recovery	***31.7***	***46.3***	***43.8***	***38.5***

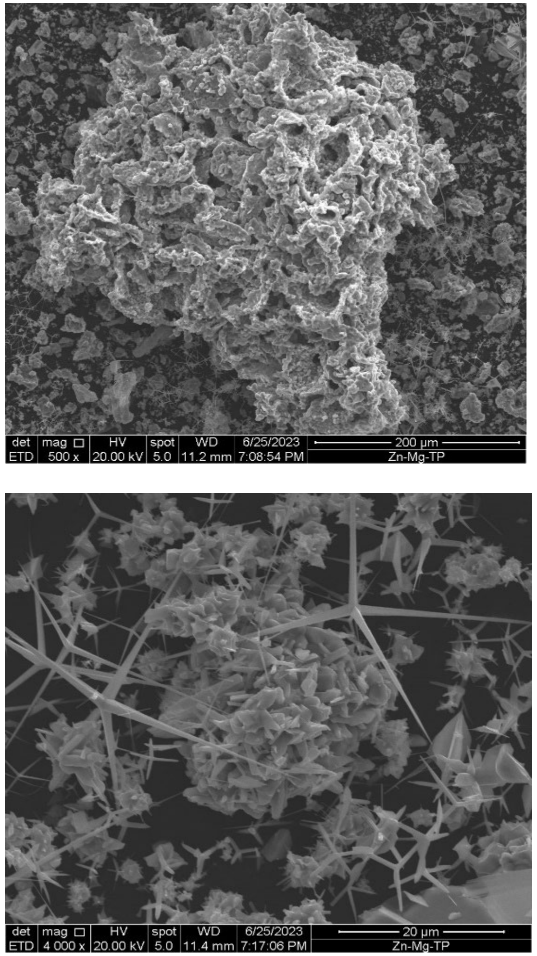
In-House Synthesis of MOF-Coated Nano Metal Oxide Tetrapod Adsorbents



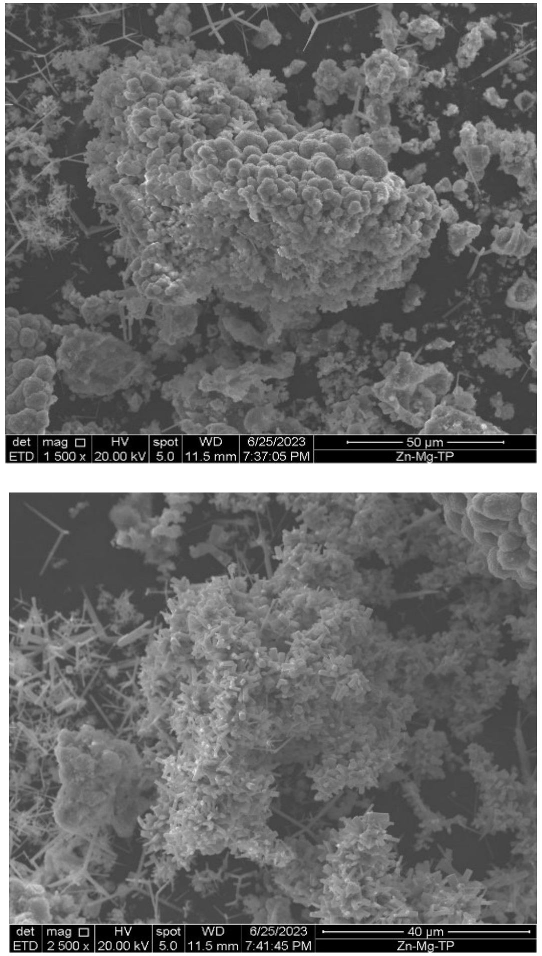
Nanostructures 1



Nanostructures 2

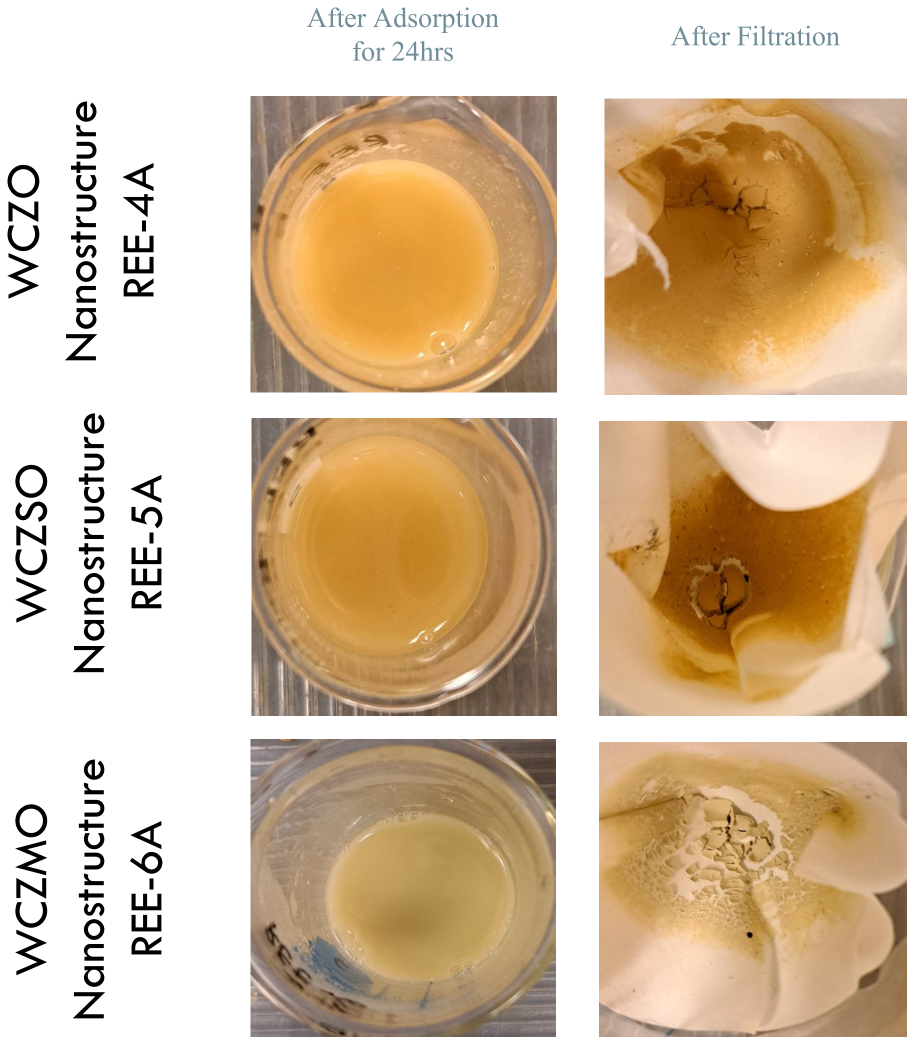


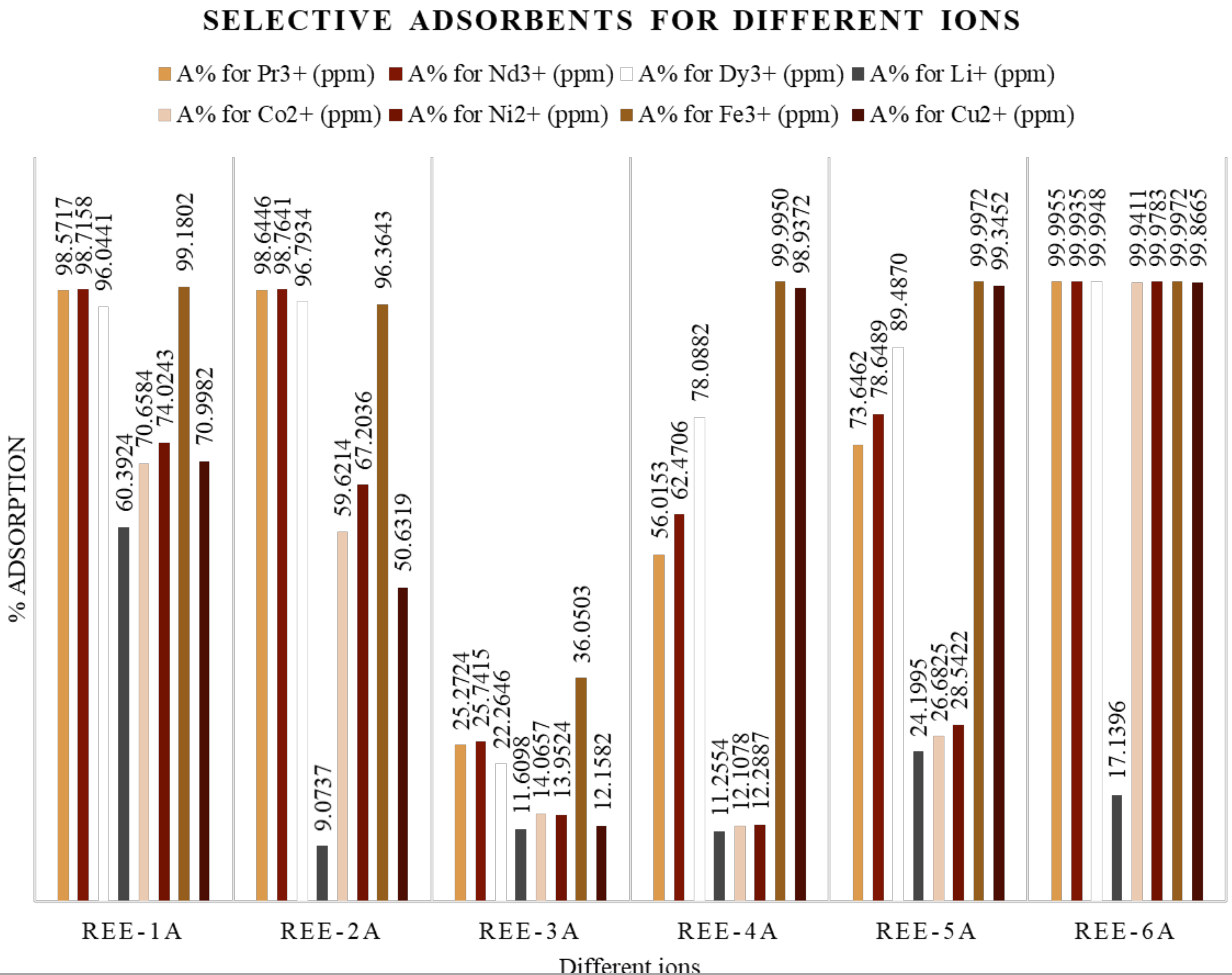
Nanostructures 3



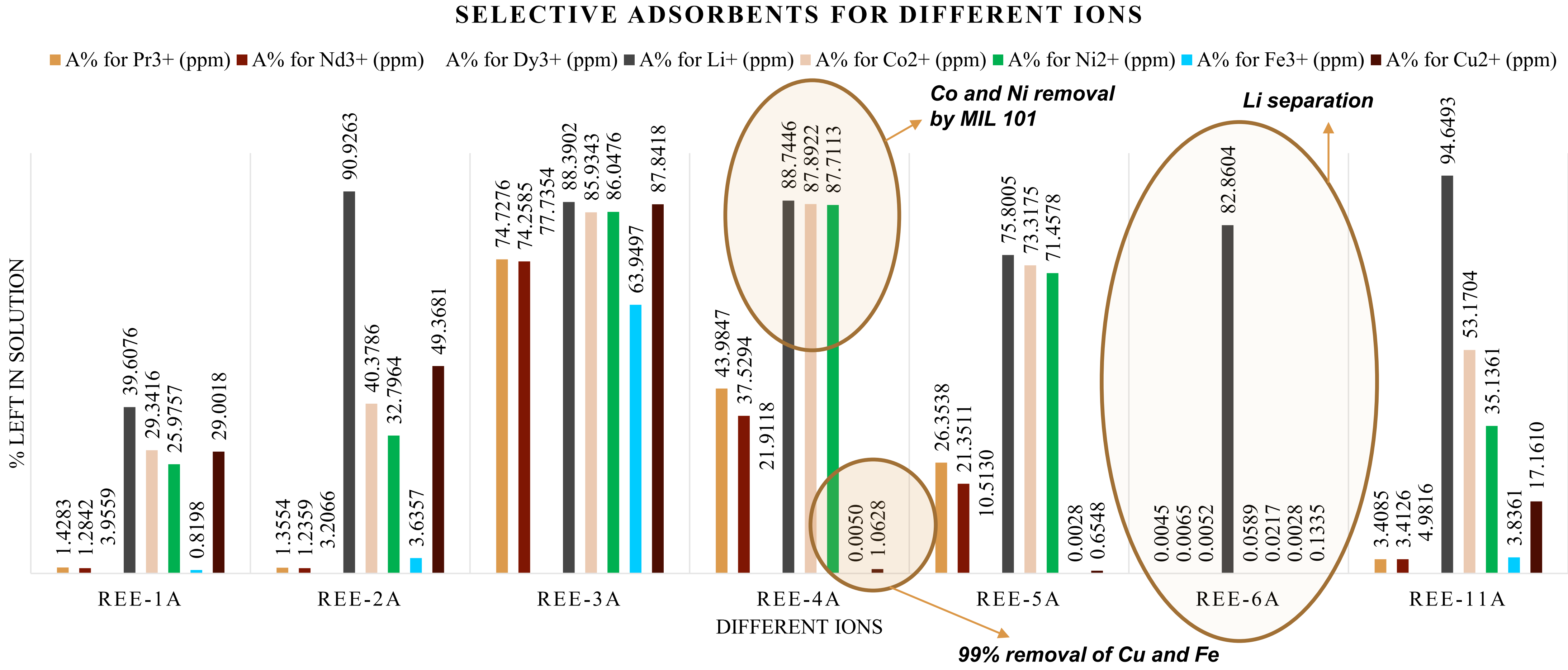
Nanostructures 4

Batch test results for hybrid Nano Adsorbents



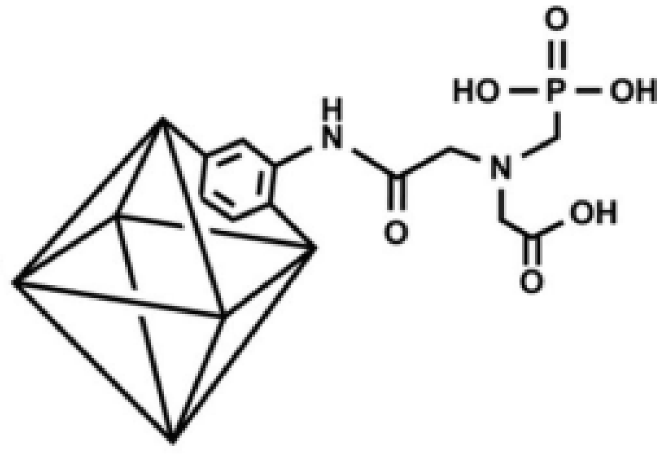


REE-Adsorption Preliminary Tests



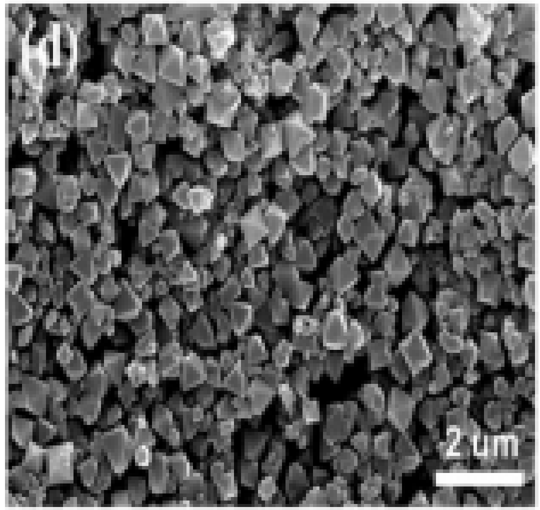
- Data presented here is the % of REEs left in the solution after one round of adsorption test
- From the data, it can be viewed that REE-6A(WCZMO hybrid nanostructure) and REE-11A(ZM hybrid nanostructure with MOF coating) is suitable for separation of Li from the rest

Selective Separation of Gd from Non-REE using MOF type adsorbent[37]



MIL-101-PMIDA

Structure



SEM image

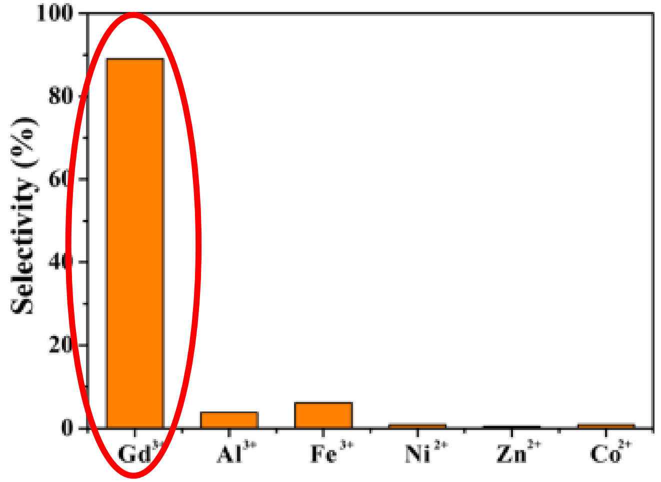


Figure 10. Adsorption selectivity for Gd^{3+} over coexisting transition metal ions on MIL101-PMIDA at pH 5.5.

Selectivity in separation

- This is a Chromium based Metal organic framework type adsorbent with PMIDA (N-(phosphonomethyl)iminodiacetic acid hydrate) embedded in the structure
- The specialty in these type of adsorbent is: it's high affinity for Gd adsorption when compared to other ions and have high separation efficiency for REEs than Non-REEs
- It has nearly 80% regeneration efficiency

Table 2. Adsorption Capacities of the REEs on the Obtained Samples

materials	q_e (mg/g)				
	La^{3+}	Ce^{3+}	Nd^{3+}	Sm^{3+}	Gd^{3+}
MIL-101	14.6	11.3	18.5	17.9	16.5
MIL-101-NH_2	21.6	23.7	28.4	32.1	29.3
MIL-101-PMIDA	37.2	48.3	63.9	69.1	87.7
MIL-101-ED	30.3	36.5	54.0	58.9	66.0
MIL-101-DETA	39.7	52.8	67.5	68.9	73.6

REE/CM separation and recovery technologies Los Alamos National Laboratory (LANL)

- Hydrothermal REE separation Technology based on natural ore-forming processes that concentrate REE using hot water and ligands (phosphate, fluoride)
- Hydrothermal-based technology (with fluorite) extracts from aqueous feedstock M/HREE selectively
- Hydrothermal approach permits to avoid extracting and concentrating U and Th (radioactive contaminants)
- U.S. provisional patent application No. 62/859,428

(LANL) Method

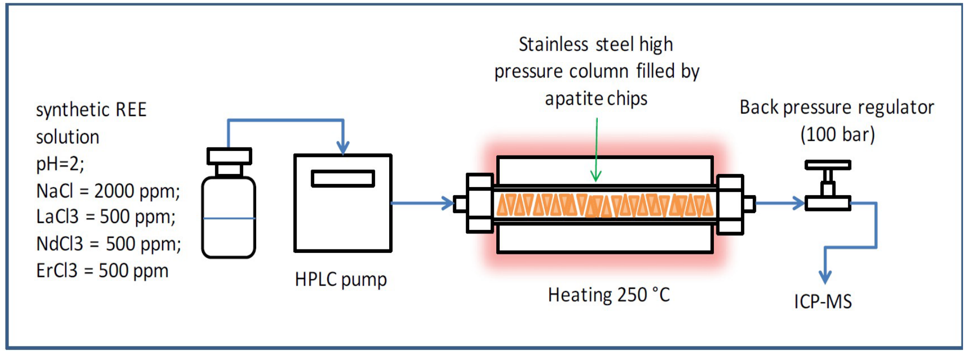
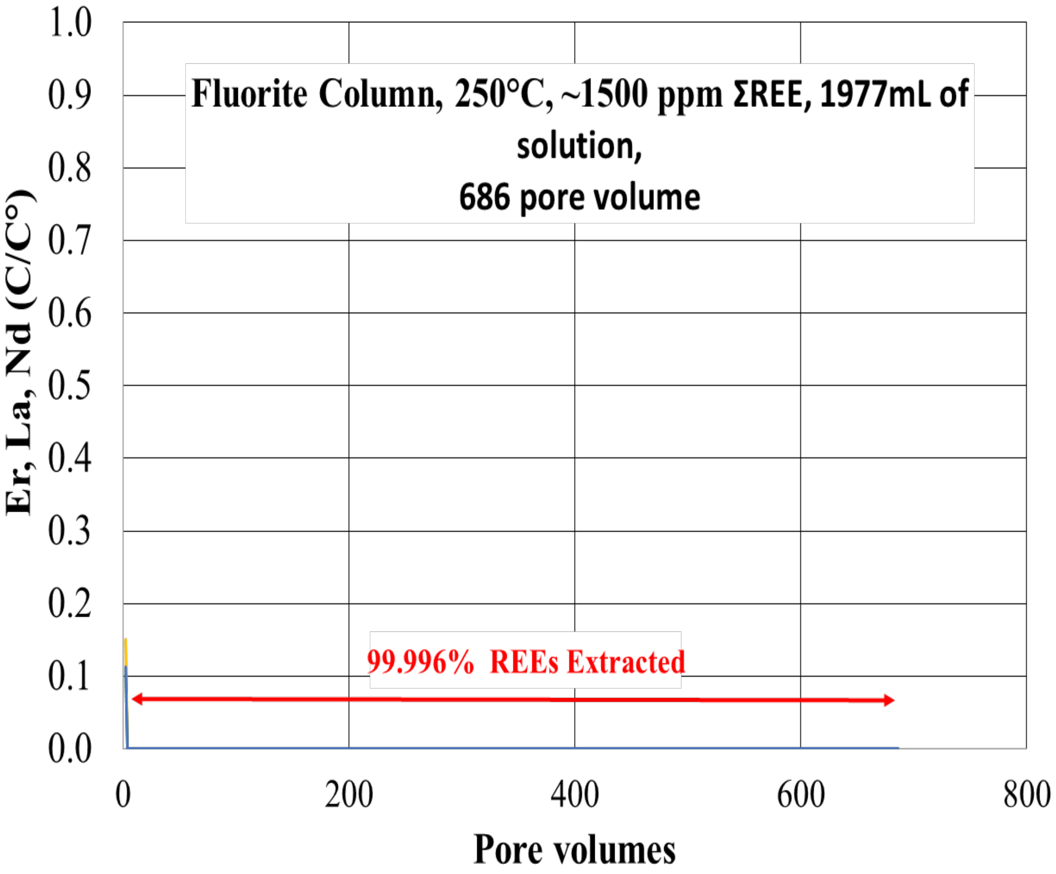
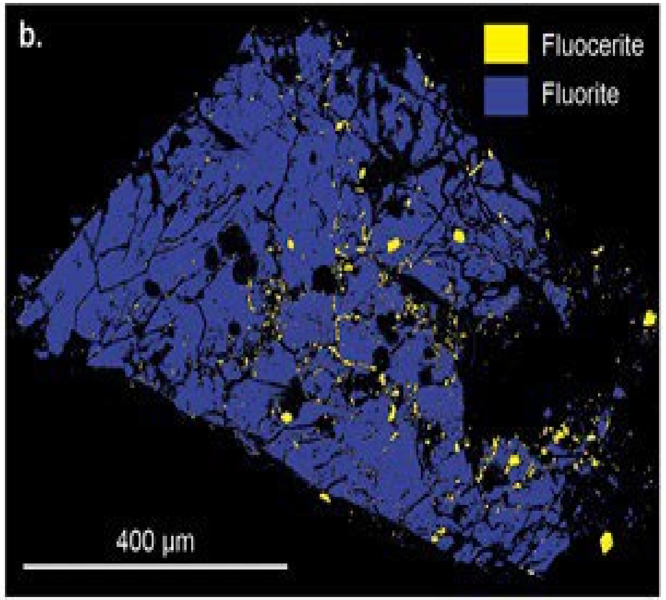


Figure 2. Design of the proof-of-concept experiments mimicking extraction and separation mechanisms illustrated in Figure 1.

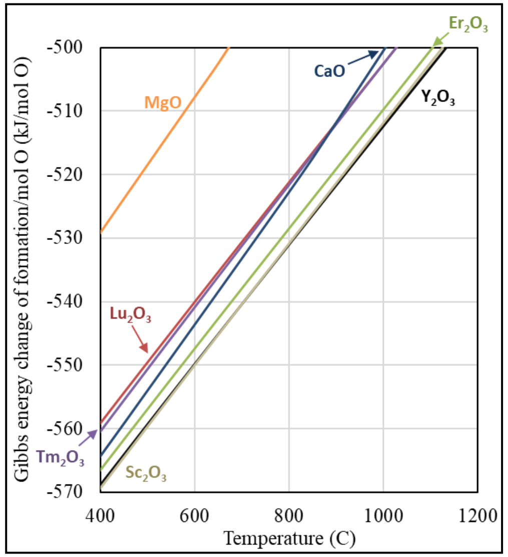
Titanium, stainless steel or monel high

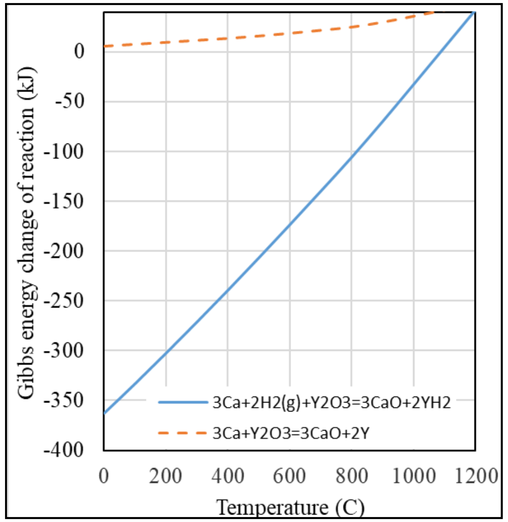
apatite or fluorite

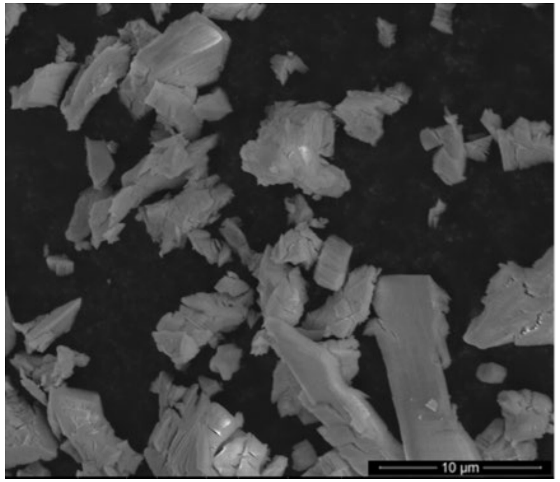


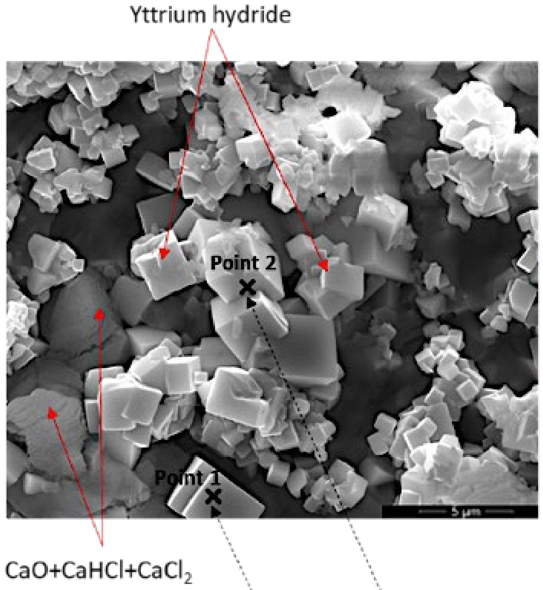


HAMR of Y_2O_3

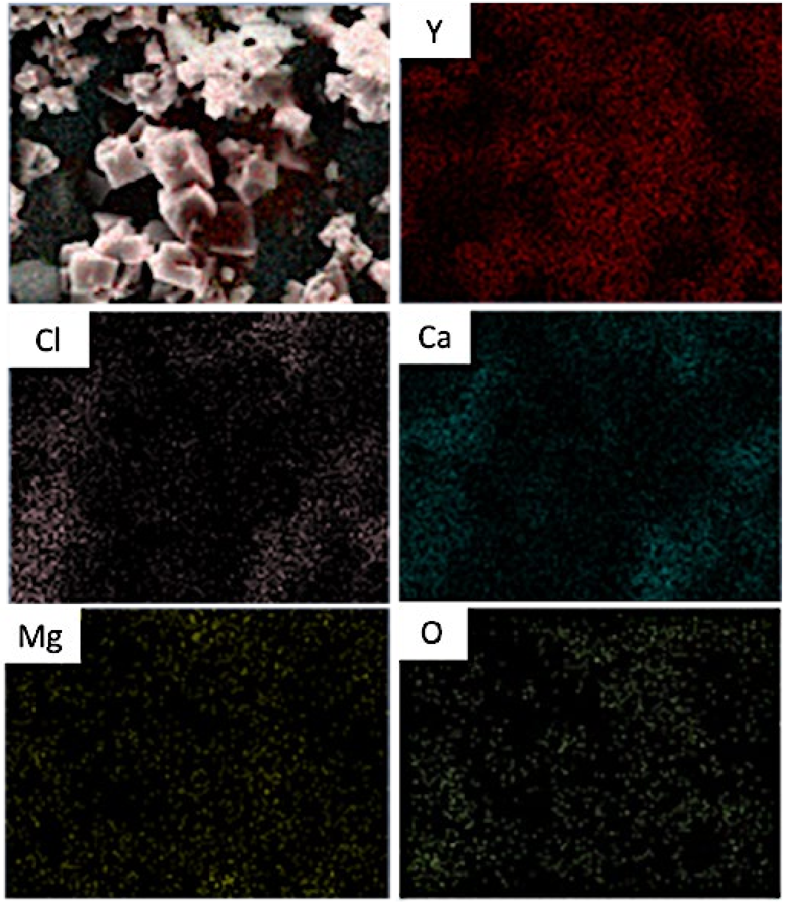




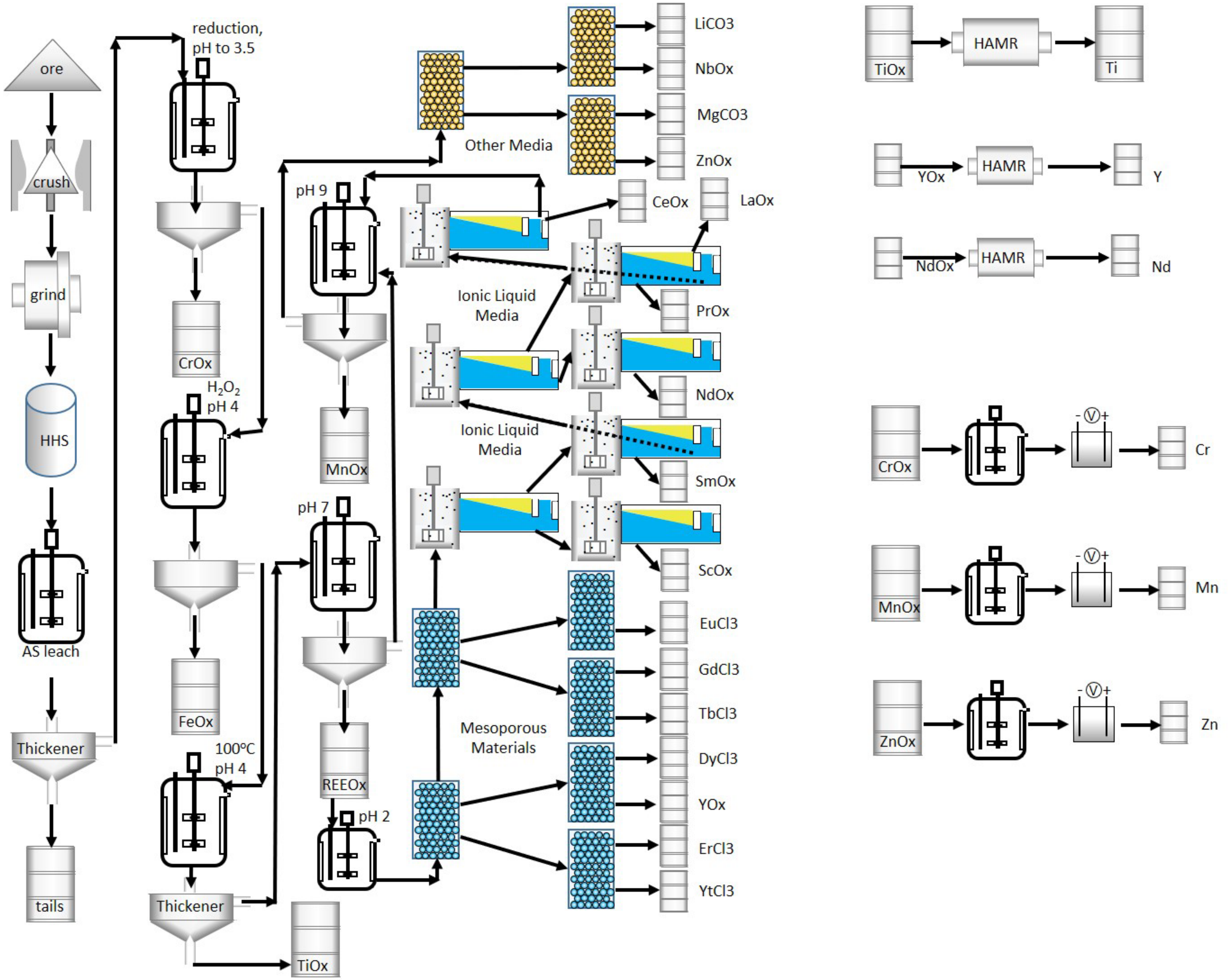




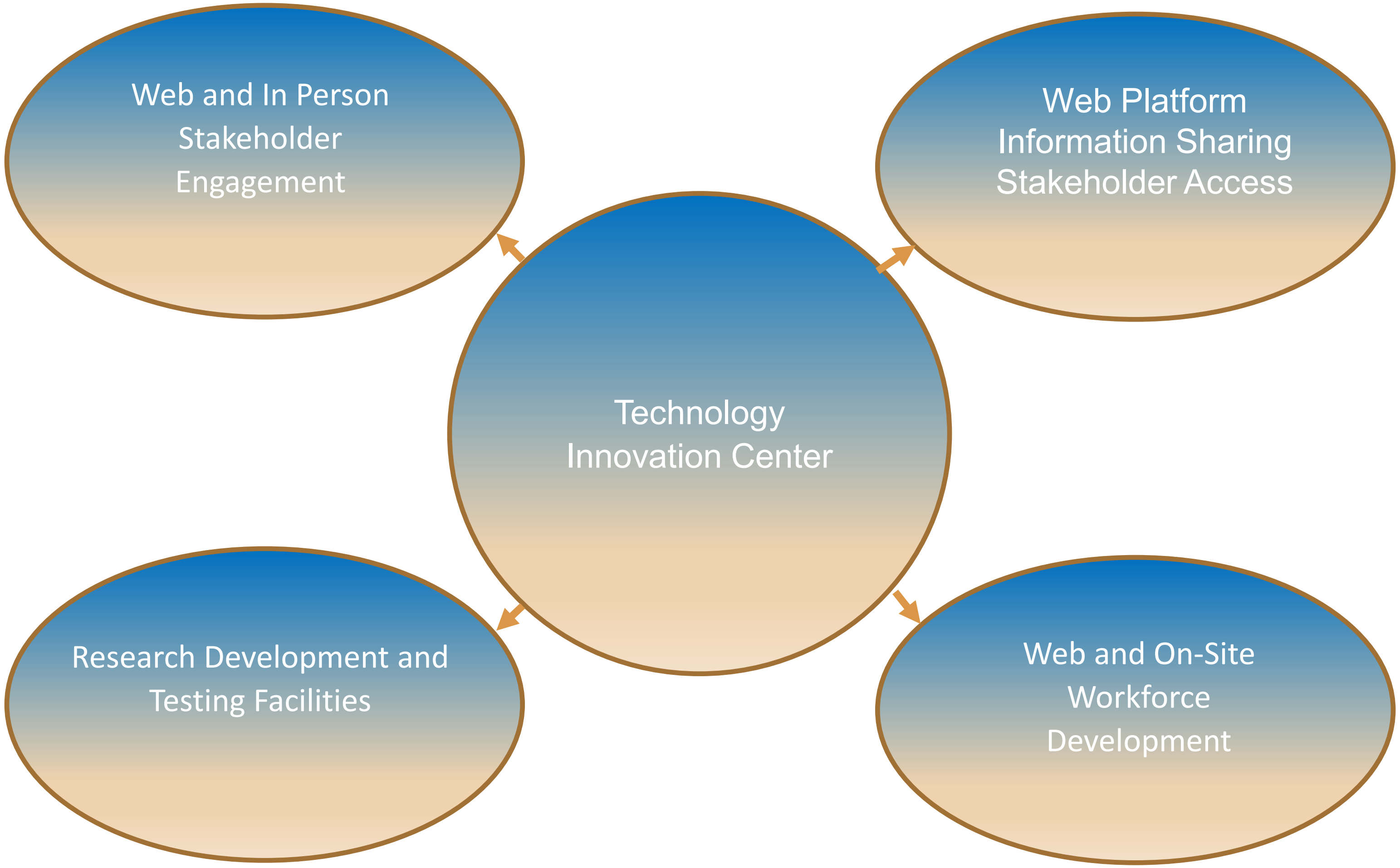
Element	Point 1 Wt.%	Point 2 Wt.%
Y	76.4	85.6
Ca	9.7	6.5
Cl	5.1	1.9
O	7.6	4.8
Mg	1.2	1.2



Draft copy of final flow sheet for producing 20 REE/REO/RES /CM materials from feed material



Our DOE CORE-CM TIC Vision

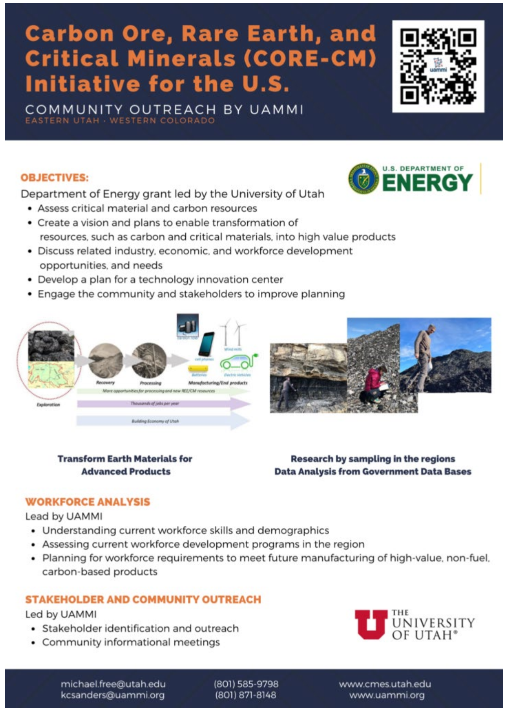


Stakeholder Outreach

- Objective: Engage Stakeholders

	Individuals	Industry	Education	Gov/ Civic	Service Provider	Association	Native American Nations	Community members
1Q2021	77	14	4	7	1	3	0	0
2023	258	26	16	38	10	16	3	45

- UAMMI grew the stakeholder base to 258 individuals representing 154 organizations



Carbon Ore, Rare Earth, and Critical Minerals (CORE-CM) Initiative for the U.S.

COMMUNITY OUTREACH BY UAMMI

EASTERN UTAH · WESTERN COLORADO

U.S. DEPARTMENT OF ENERGY

OBJECTIVES:

Department of Energy grant led by the University of Utah
- Assess critical material and carbon resources
- Create a vision and plans to enable transformation of resources, such as carbon and critical materials, into high value products
- Discuss related industry, economic, and workforce development opportunities, and needs
- Develop a plan for a technology innovation center
- Engage the community and stakeholders to improve planning

Transform Earth Materials for Advanced Products

Research by sampling in the regions Data Analysis from Government Data Bases

WORKFORCE ANALYSIS

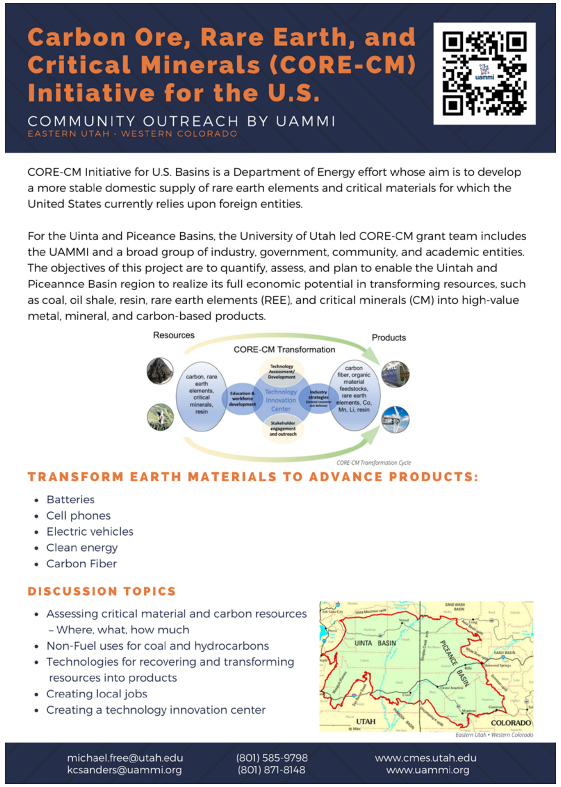
Lead by UAMMI
- Understanding current workforce skills and demographics
- Assessing current workforce development programs in the region
- Planning for workforce requirements to meet future manufacturing of high-value, non-fuel, carbon-based products

STAKEHOLDER AND COMMUNITY OUTREACH

Led by UAMMI
- Stakeholder identification and outreach
- Community informational meetings

THE UNIVERSITY OF UTAH®

michael.free@utah.edu kcsanders@uammi.org (801) 585-9798 (801) 871-8148 www.cmes.utah.edu www.uammi.org



Carbon Ore, Rare Earth, and Critical Minerals (CORE-CM) Initiative for the U.S.

COMMUNITY OUTREACH BY UAMMI

EASTERN UTAH · WESTERN COLORADO

CORE-CM Initiative for U.S. Basins is a Department of Energy effort whose aim is to develop a more stable domestic supply of rare earth elements and critical materials for which the United States currently relies upon foreign entities.

For the Uinta and Piceance Basins, the University of Utah led CORE-CM grant team includes the UAMMI and a broad group of industry, government, community, and academic entities. The objectives of this project are to quantify, assess, and plan to enable the Uintah and Piceannce Basin region to realize its full economic potential in transforming resources, such as coal, oil shale, resin, rare earth elements (REE), and critical minerals (CM) into high-value metal, mineral, and carbon-based products.

CORE-CM Transformation Cycle

TRANSFORM EARTH MATERIALS TO ADVANCE PRODUCTS:
- Batteries
- Cell phones
- Electric vehicles
- Clean energy
- Carbon Fiber

DISCUSSION TOPICS
- Assessing critical material and carbon resources – Where, what, how much
- Non-Fuel uses for coal and hydrocarbons
- Technologies for recovering and transforming resources into products
- Creating local jobs
- Creating a technology innovation center

Eastern Utah • Western Colorado

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Information Sharing & Engagement

- Communication with the Stakeholders was through emails and Eventbrite registration for meetings and events. Additionally, a tutorial on Critical Materials we developed and shared with Stakeholder to further understanding. (See Appendix)
  - Working with the team executing 6.0 – Creation of Innovation Century, UAMMI set up a webpage as a central source of information about the CORE-CM programs. https://www.uammi.org/core-cm

Figure 12 Landing Page for CORE-CM Website

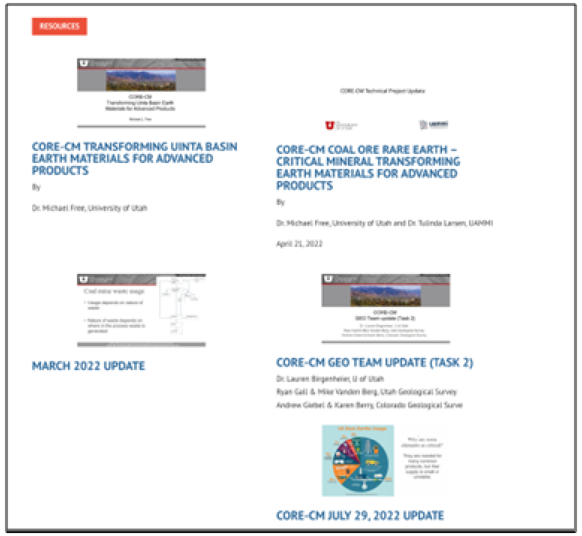

Figure 13 CORE-CM Stakeholder Resources

uammi
UTAH ADVANCED MATERIALS + MANUFACTURING INITIATIVE

Thank You!