NETL REE-SED Assessment Method

Developing a Geo-data Science Driven Approach to Assess REEs in Coal and Related Systems

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August 25, 2020

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Accelerating access to domestic REE resources from sedimentary/coal systems

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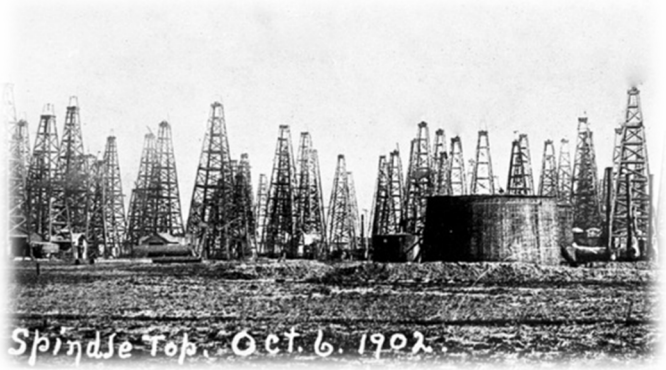
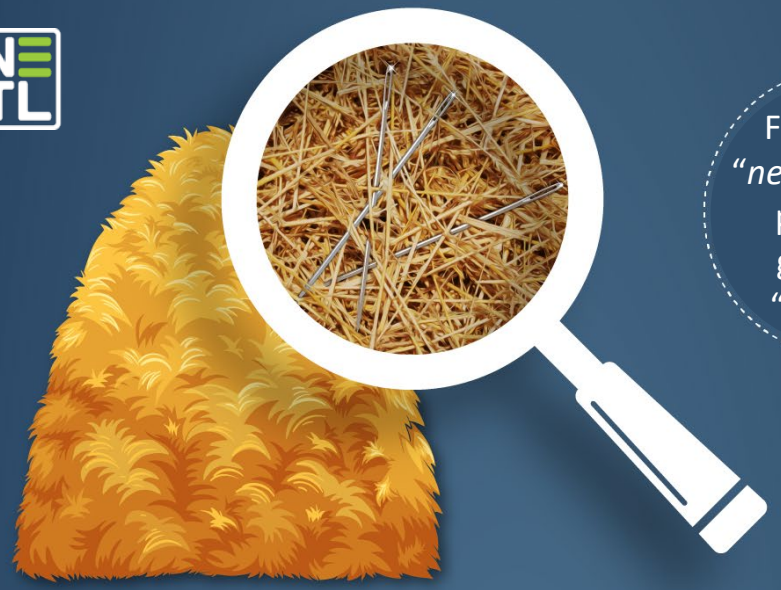
Mineral resources come from geologic media…



Economic deposits are <u>not</u> random…

Systematic, geologic-driven methods <u>improve predictability</u>…

To unlock domestic REE-SED potential, requires data & knowledge informed predictions

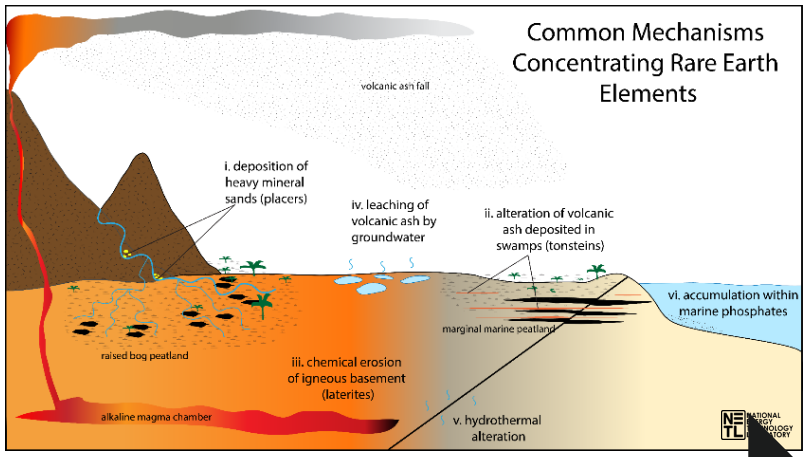


Finding REE *"needles"* in the proverbial geological *"haystack"*

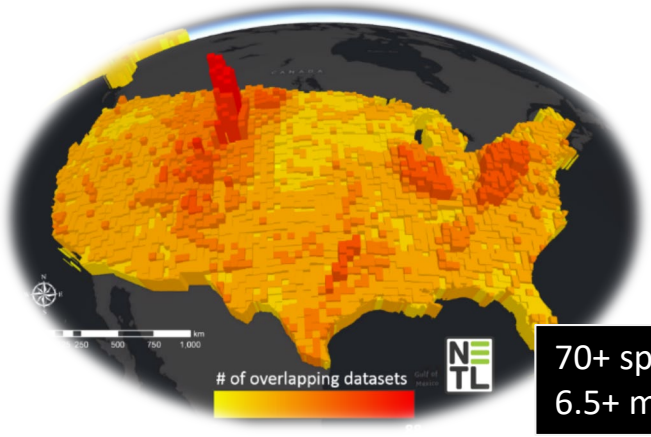
NETL is developing the REE-SED method to identify domestic deposits and unlock the domestic, economic REE supply from coal and sedimentary systems

- **For prediction and ID of high concentration deposits**
- **1st approach for assessing REEs in coal-related sediments**
- **Using a big-data, ML enabled geoscience approach**

Geologic processes + Data underpin REE-SED Method



Distilled knowledge from 100's of geologic studies of REE SED systems combined with millions of data records to the method

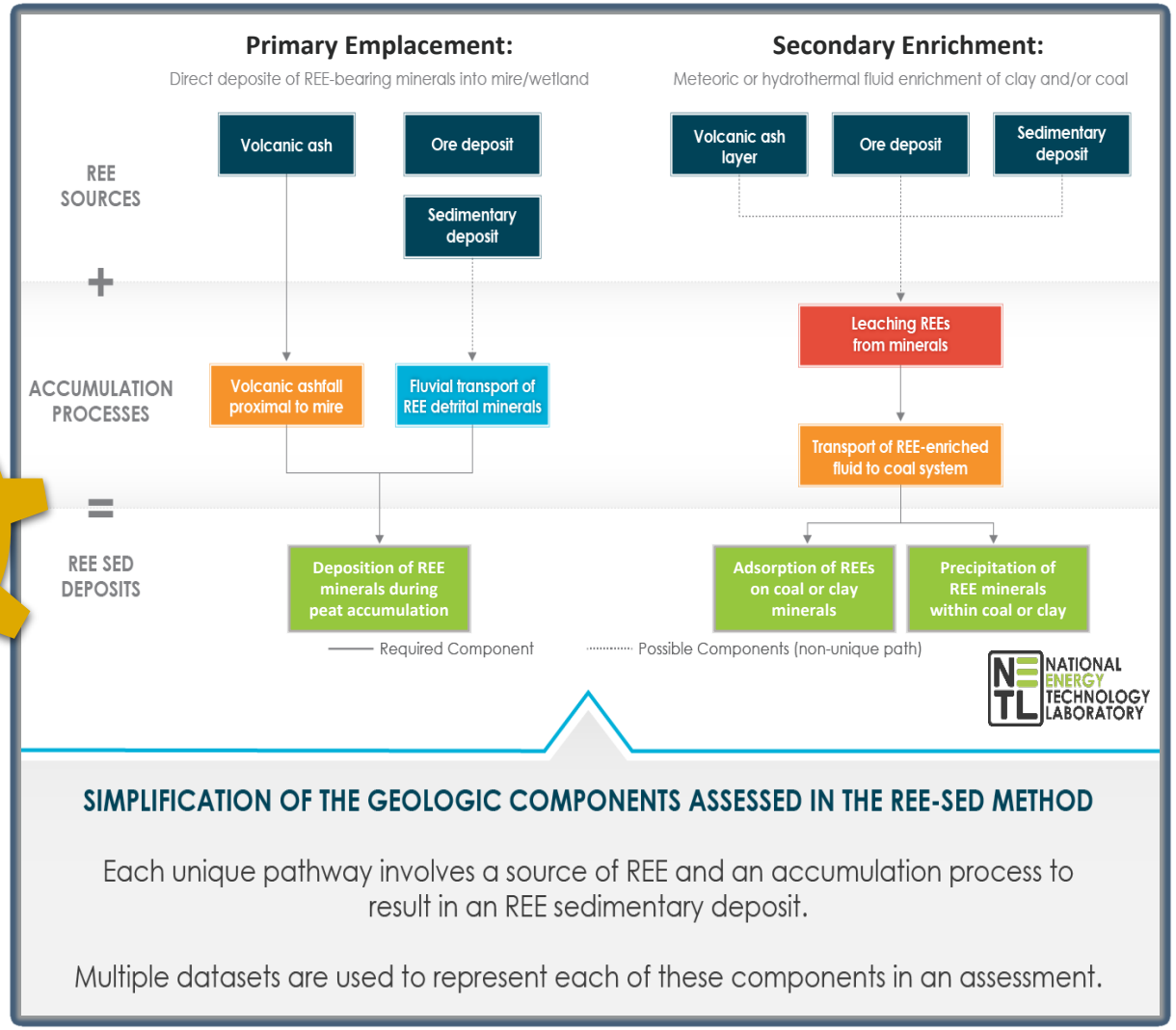


70+ spatial datasets
6.5+ million records

Geologic Processes

REE Sedimentary Assessment

Data



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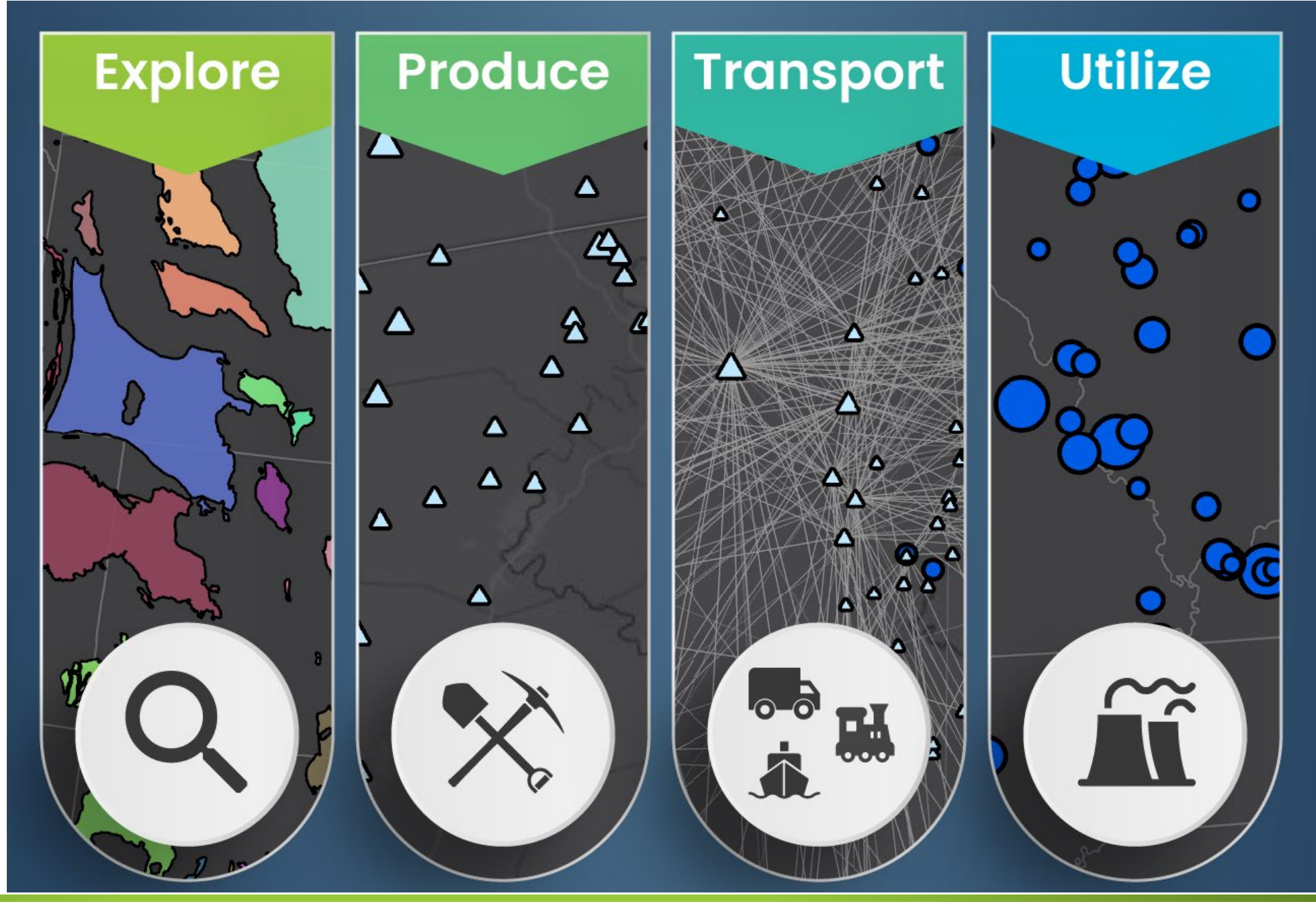
Beyond the Basin

Predicting REE-SED resources from geologic media and byproducts



Predicting REE-resources from coal related sources to byproducts

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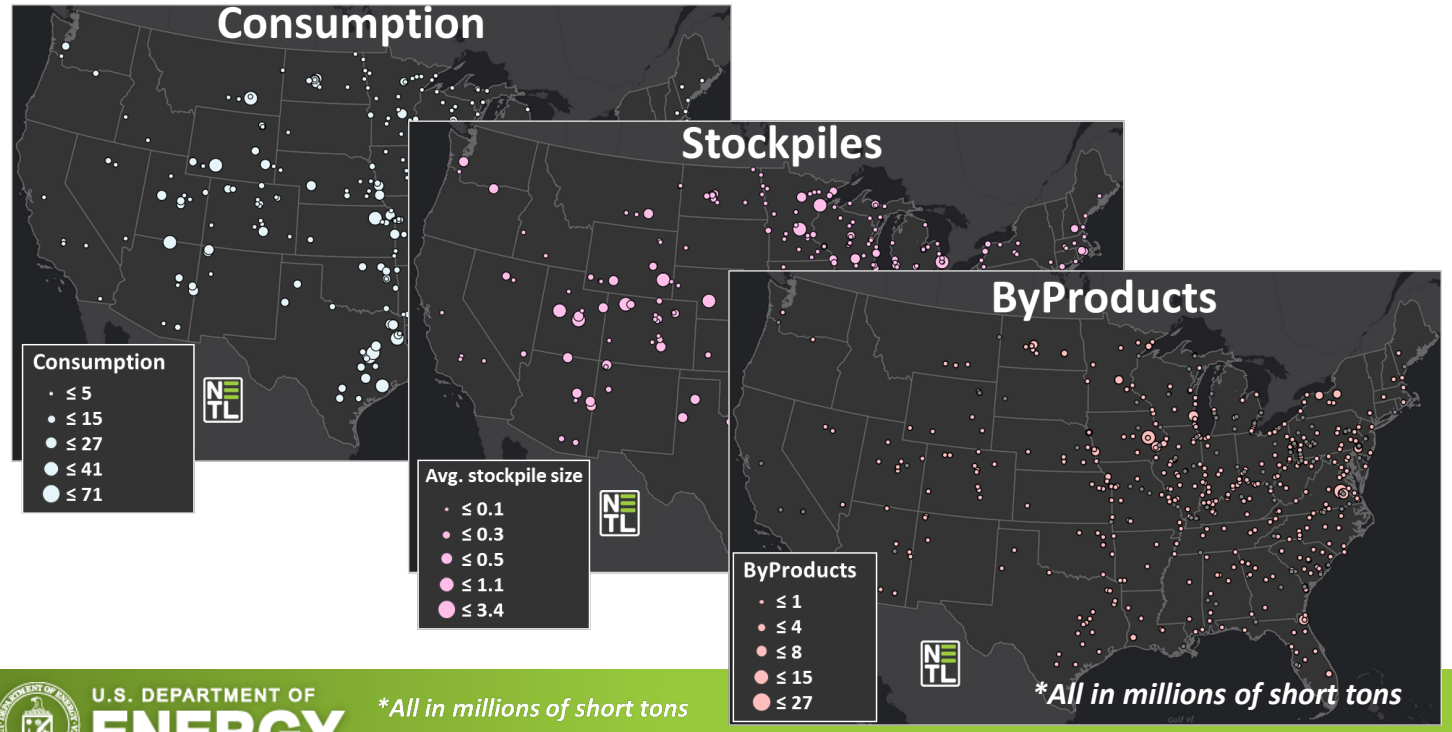
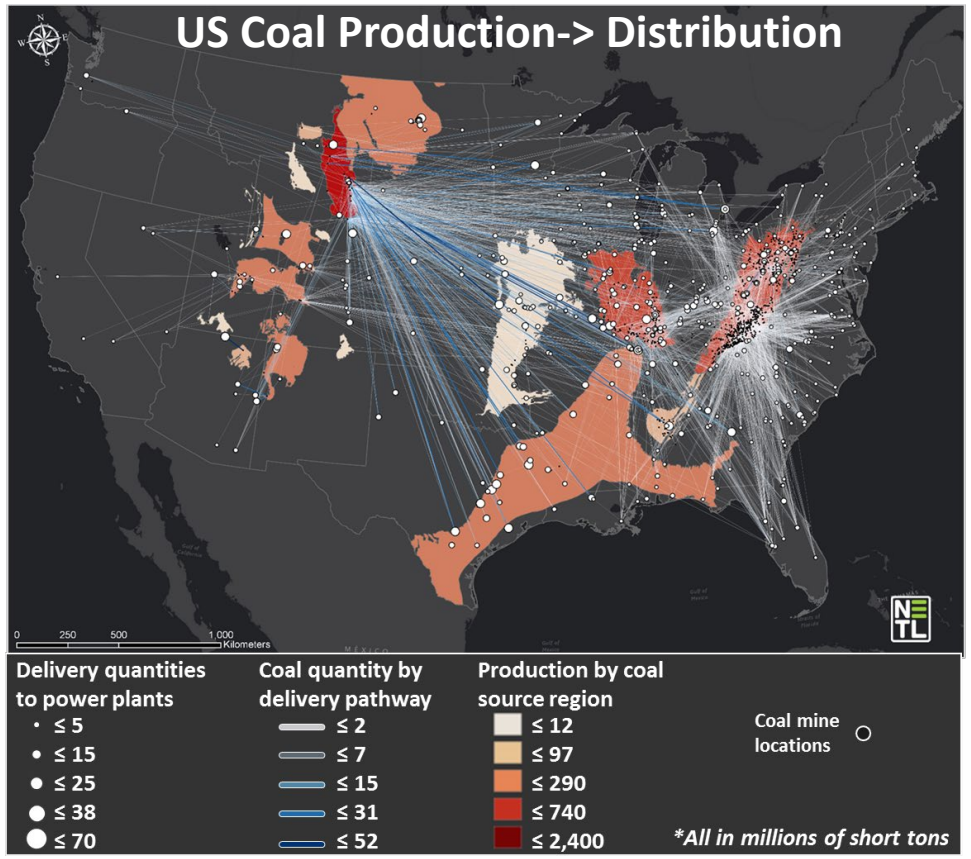
Characterize domestic coal throughout its lifecycle to optimize as a resource:

- Reduce cost of coal ash disposal/recycling
- Increase usage in materials (concrete, drywall, etc.)
- Reduce carbon footprint

Opportunity to use for identifying inefficiencies, vulnerabilities and threats along supply chains

- Natural disasters, economic, environmental, etc.





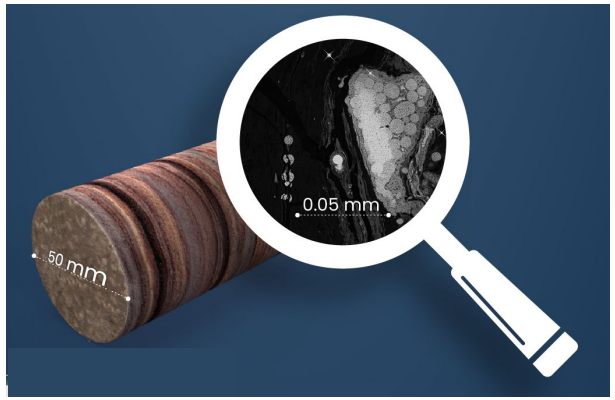
Geodatabase containing over 90,000 records spanning:

- 2168 mines
- 636 power plants
- 85,072 domestic coal deliveries

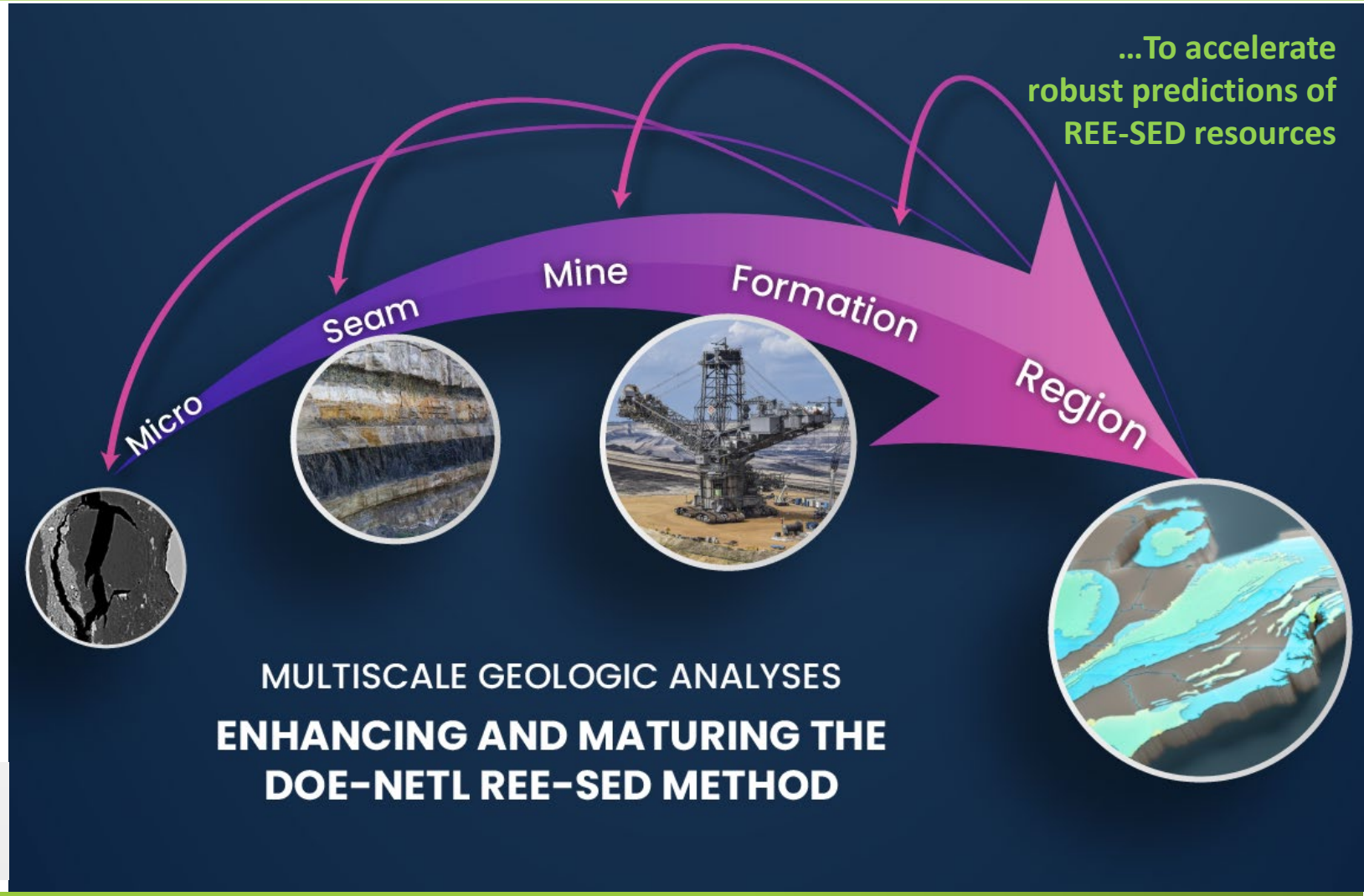
Spatial scale matters – Data collection to improve predictions

Team is working to fill in REE-SED data gaps…

…Strategic sampling & analytics

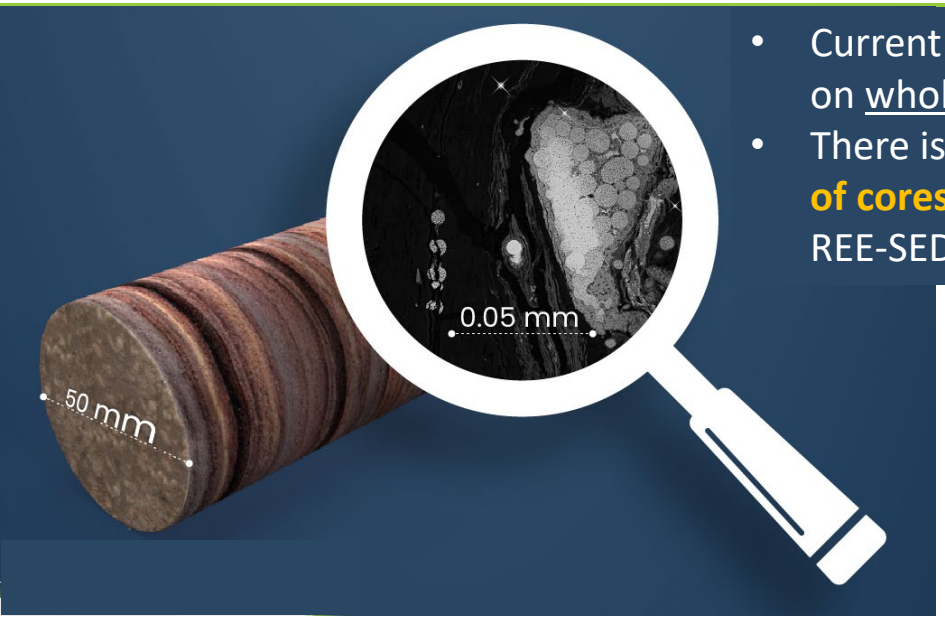


… & key government, industry & academic engagement



Documenting High Concentration Deposits

New measurements show REE concentrations vary with geology



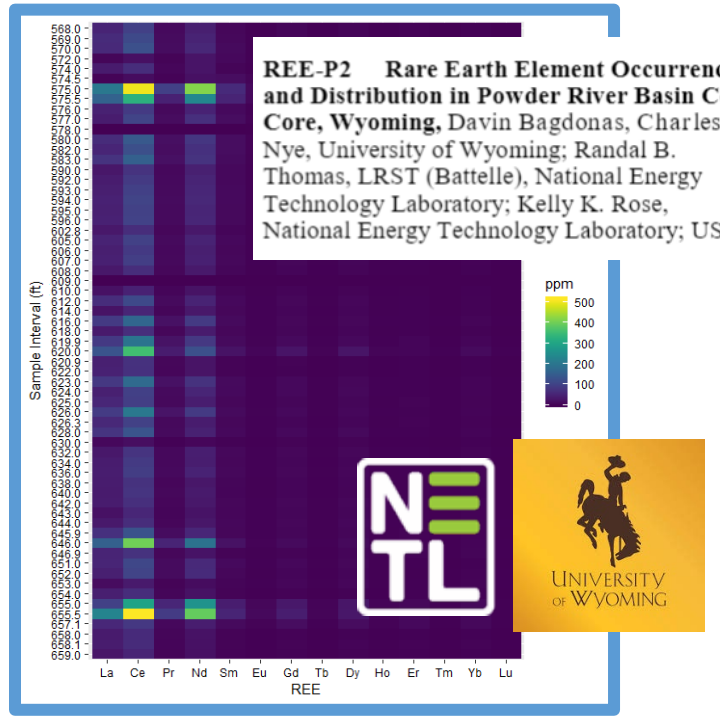
- Current REE databases (e.g. CoalQual) are based on whole sample measurements
- There is a **need for discrete, finer scale sampling of cores,** data to improve prospecting and ID of REE-SED ore quality deposits

NETL and U of Wyoming study **demonstrated vertical, lithologic controls on REE occurrence** (Bagdonas et al., 2019)

Thirty-Sixth Annual INTERNATIONAL PITTSBURGH COAL CONFERENCE

University of Pittsburgh · Swanson School of Engineering

REE-P2 Rare Earth Element Occurrence and Distribution in Powder River Basin Coal Core, Wyoming, Davin Bagdonas, Charles Nye, University of Wyoming; Randal B. Thomas, LRST (Battelle), National Energy Technology Laboratory; Kelly K. Rose, National Energy Technology Laboratory; USA.



- 2nd study with industry cores has also documented geologic variability
  - *Including a **~10' thick ore horizon with REE ranging from 500 to over 2700 ppm***
- New efforts with USGS, WVGES expanding data collection from additional cores

Filling in data gaps, documenting high concentration deposits & improving predictions

Bagdonas, D., Nye, C., Thomas, R., and Rose, K., 2019, Rare Earth Element Occurrence and Distribution in Powder River Basin Coal Core, Wyoming, 2019 Thirty Sixth Proceedings of the International Pittsburgh Coal Conference, September 3 - 6, 2019, 13 pgs.

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Ultimately, this project seeks to improve prediction **of where and how much** REEs exist in domestic sediments

Check EDX® Energy Data eXchange for:

- Datasets
- Publications
- Information
- & future release of the REE-SED tool (~spring 2021)

Contact: Kelly Rose
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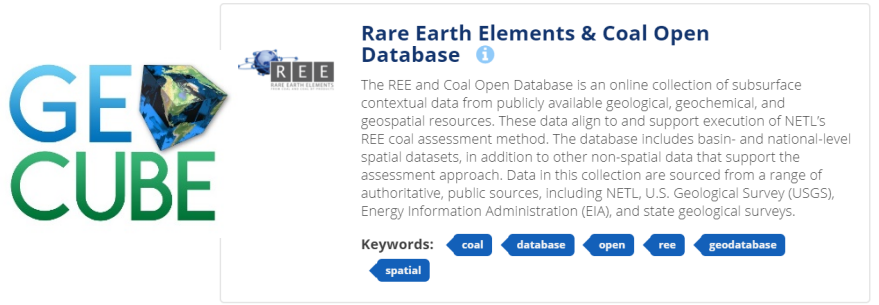
The REE-SED team has assembled an data collection https://edx.netl.doe.gov/geocube/#collections/ree of open-data resources via EDX that may be useful for resource evaluations in the future.



A technical report summarizing the REE enrichment mechanisms published in the literature to date is under review, **forthcoming via EDX (Fall 2020)**

Pubs to Date

Bauer, J., Justman, D., Mark-Moser, M., Romeo, L., and K. Rose. In Press. Exploring beneath the basemap. In D. Wright and C. Harder (Eds) GIS for Science (vol 2). Expected release and publication in Fall 2020.

Bagdonas, D., Nye, C., Thomas, R., and Rose, K., 2019, Rare Earth Element Occurrence and Distribution in Powder River Basin Coal Core, Wyoming, 2019 Thirty Sixth Proceedings of the **International Pittsburgh Coal Conference**, September 3 - 6, 2019, 13 pgs.

Rose, K., Bauer, J.R., and Mark-Moser, M., 2020, A systematic, science-driven approach for predicting subsurface properties, *Interpretation, 8:1, 167-181* https://doi.org/10.1190/INT-2019-0019.1

***Download* the REE-SED Infographic!**

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GAIA Group: Kelly Rose, Gabe Creason, Devin Justman, Scott Montross, R. Burt Thomas, MacKenzie Mark-Moser, Paige Morkner, Nicole Rocco, and Mike Sabbatino

https://www.netl.doe.gov/sites/default/files/2020-08/REE-SED%20Infographic-01.png