Princeton University LIBRARY

Library Research for Energy, Minerals, and Uranium Resources

August 27, 2020

Emily C. Wild, Chemistry, Geosciences and Environmental Studies Librarian

ewild@princeton.edu

"If you can't grow it, you mine it"

PRINCETON UNIVERSITY

My GPO FDLP Webinars

Princeton University – GPO FDLP since 1884

Upcoming webinars

Nov/Dec 2020 : From the Rocks to the Stocks - Library Research with a Geosciences Librarian and a Finance Librarian

November 2020 : Using Art Sources for Chemistry, Geosciences, and Environmental Studies Library Research

October 2020 : Library Research for Natural Hazard Events: Earthquakes, Hurricanes, Volcanoes, and Wildfires

September 10, 2020 : Pharmaceutical Research Sources Available for COVID-19 https://www.fdlp.gov/news-and-events/4630-webinar-pharmaceutical-research-sources-available-for-covid-19

Past webinars, Princeton University

July 2020 : Library Research for Atmospheric and Oceanic Sciences (Including Climate Change) https://www.fdlp.gov/library-research-for-atmospheric-and-oceanic-sciences-including-climate-change

March 2020: Library Research for Water Resources https://www.fdlp.gov/library-research-for-water-resources

January 2020: Introduction to Geosciences Library Research https://www.fdlp.gov/introduction-to-geosciences-library-research

Past webinars, U.S. Geological Survey (USGS)

USGS Library Materials for Natural Hazards https://www.fdlp.gov/usgs-library-materials-for-natural-hazards

USGS Library Materials for Water Resources Information https://www.fdlp.gov/usgs-library-materials-for-water-resources-information

USGS Library Materials for Earth's Age https://www.fdlp.gov/usgs-library-materials-for-earth-s-age

USGS Library: Indexes, catalogs, and other bibliographic tools, a day in the life of a reference librarian https://www.fdlp.gov/usgs-library-indexes-catalogs-and-other-bibliographic-tools-a-day-in-the-life-of-a-reference-librarian

USGS Library: Oil, Gas, Coal, Uranium, and Minerals Maps and Data https://www.fdlp.gov/usgs-library-oil-gas-coal-uranium-and-minerals-maps-and-data

USGS Library: Using USGS Image, Map, and Data Products for Information Inquiries https://www.fdlp.gov/usgs-library-using-usgs-image-map-and-data-products-for-information-inquiries

Energy & Minerals - Who do I help?

"Princeton in the nation's service and the service of humanity"

When working at the U.S. Geological Survey

- General Public
- Teachers, K-12
- College/University Professors
- City, County, State Natural Resource Managers
- Undergraduate & Graduate Students
- New Employees to Geosciences or Post-Docs
- Federal Science Agencies, Scientists & Attorneys
- Private Sector: Scientists & Attorneys
- International Governments & Institutions
- Experienced Library Users that need a refresher

When working at Princeton University

- Undergraduate & Graduate Students
- College/University Professors
- Librarians
- Post-Docs
- Federal Science Agencies, Scientists & Attorneys
- Private Sector: Scientists & Attorneys
- Finance Industry
- International Governments & Institutions
- City, County, State Natural Resource Managers
- Experienced Library Users that need a refresher

Quick Bio

Emily C. Wild

Lewis Science Library, Princeton University

ewild@princeton.edu

Schedule a Research Consultation :
Monday – Friday

Meet Our Specialists – Emily Wild

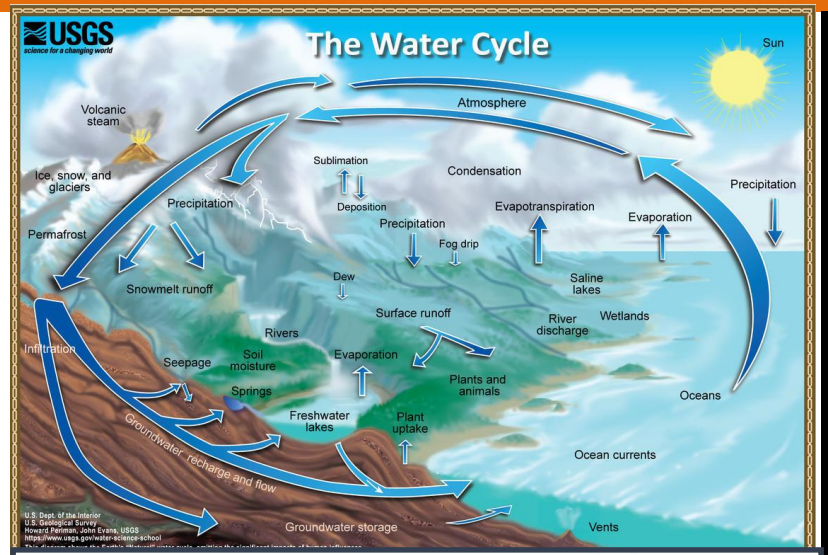
- **Princeton University Library, 2018-Present**

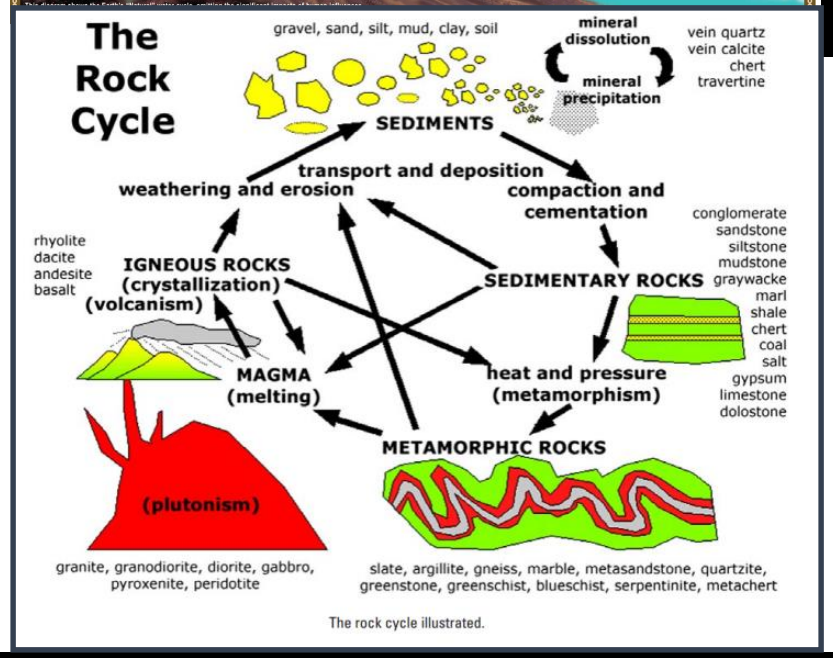
Chemistry, Geosciences and Environmental Studies Librarian
https://library.princeton.edu/staff/ewild
ORCID: https://orcid.org/0000-0001-6157-7629
Exposure Project: https://www.princeton.edu/news/2020/06/08/funding-next-big-idea-new-projects-receive-dean-research-innovation-awards

- **U.S. Geological Survey:** https://www.usgs.gov/staff-profiles/emily-wild
  - **Denver, Colorado : 2008-2018 - Librarian (Physical Scientist)**

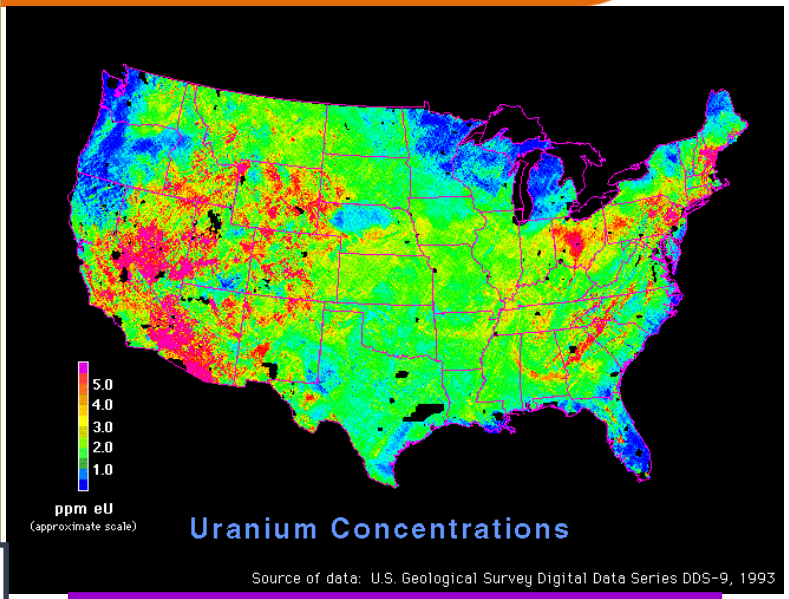
Water: https://www.usgs.gov/mission-areas/water-resources
Energy: https://www.usgs.gov/energy-and-minerals/energy-resources-program/
Minerals: https://www.usgs.gov/energy-and-minerals/mineral-resources-program
Environmental Health: https://www.usgs.gov/mission-areas/environmental-health
Hazards: https://www.usgs.gov/mission-areas/natural-hazards
Publications Warehouse: https://pubs.er.usgs.gov/
Library catalog: https://usgs.primo.exlibrisgroup.com/discovery
Well catalog: https://my.usgs.gov/crcwc/map
Historical Photos: https://library.usgs.gov/photo/
NGMDB: https://ngmdb.usgs.gov/ngmdb/ngmdb_home.html
- NH-VT & MA-RI: 1996-2008 Hydrologist: Water Use, Surface Water, Groundwater, Water Quality, Coastal Waters, Bibliographic Databases
https://www.usgs.gov/centers/new-england-water

Wait, hydrologists know about Energy & Minerals? Yes!





The rock cycle illustrated.



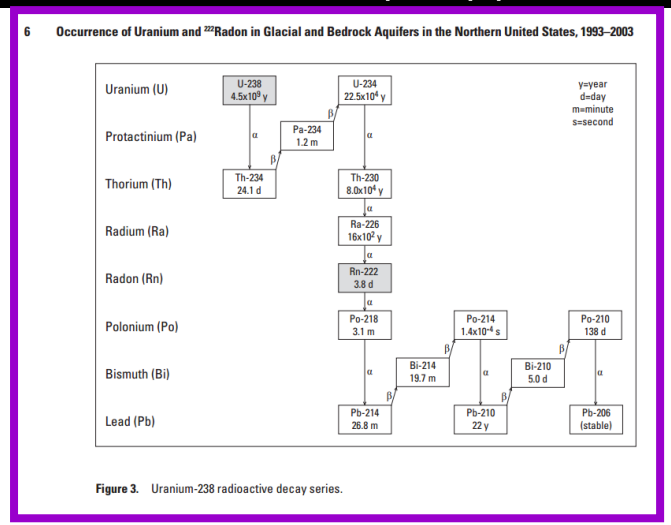
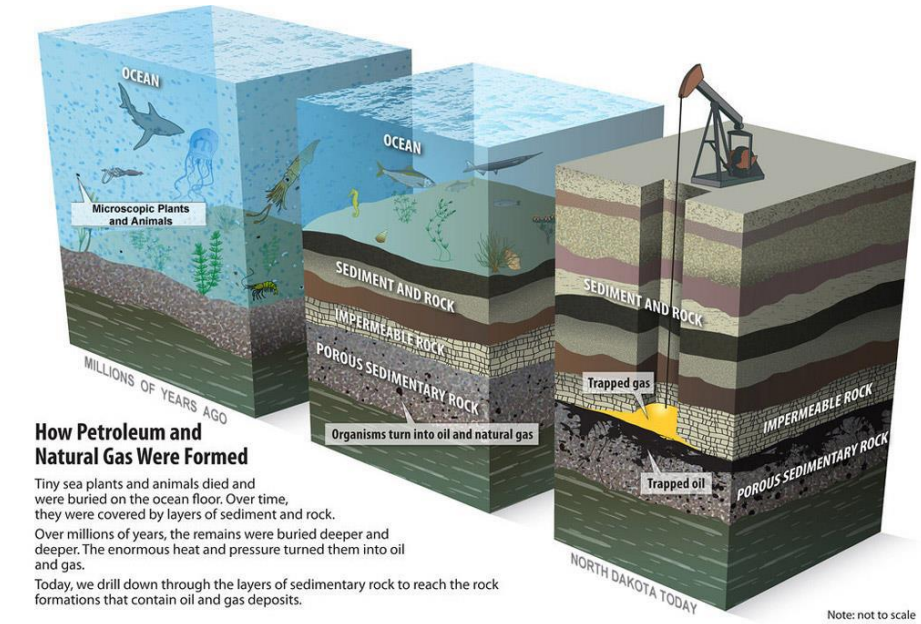

6 Occurrence of Uranium and ^{222}Radon in Glacial and Bedrock Aquifers in the Northern United States, 1993–2003

Figure 3. Uranium-238 radioactive decay series.

[Occurrence of Uranium and ^{222}Radon in Glacial and Bedrock Aquifers in the Northern United States, 1993–2003]

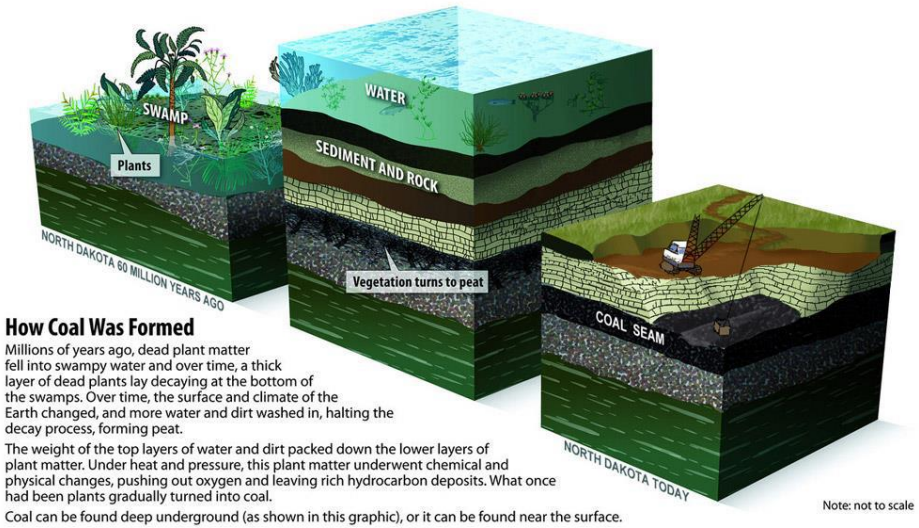


How Petroleum and Natural Gas Were Formed

Tiny sea plants and animals died and were buried on the ocean floor. Over time, they were covered by layers of sediment and rock.

Over millions of years, the remains were buried deeper and deeper. The enormous heat and pressure turned them into oil and gas.

Today, we drill down through the layers of sedimentary rock to reach the rock formations that contain oil and gas deposits.



How Coal Was Formed

Millions of years ago, dead plant matter fell into swampy water and over time, a thick layer of dead plants lay decaying at the bottom of the swamps. Over time, the surface and climate of the Earth changed, and more water and dirt washed in, halting the decay process, forming peat.

The weight of the top layers of water and dirt packed down the lower layers of plant matter. Under heat and pressure, this plant matter underwent chemical and physical changes, pushing out oxygen and leaving rich hydrocarbon deposits. What once had been plants gradually turned into coal.

Coal can be found deep underground (as shown in this graphic), or it can be found near the surface.

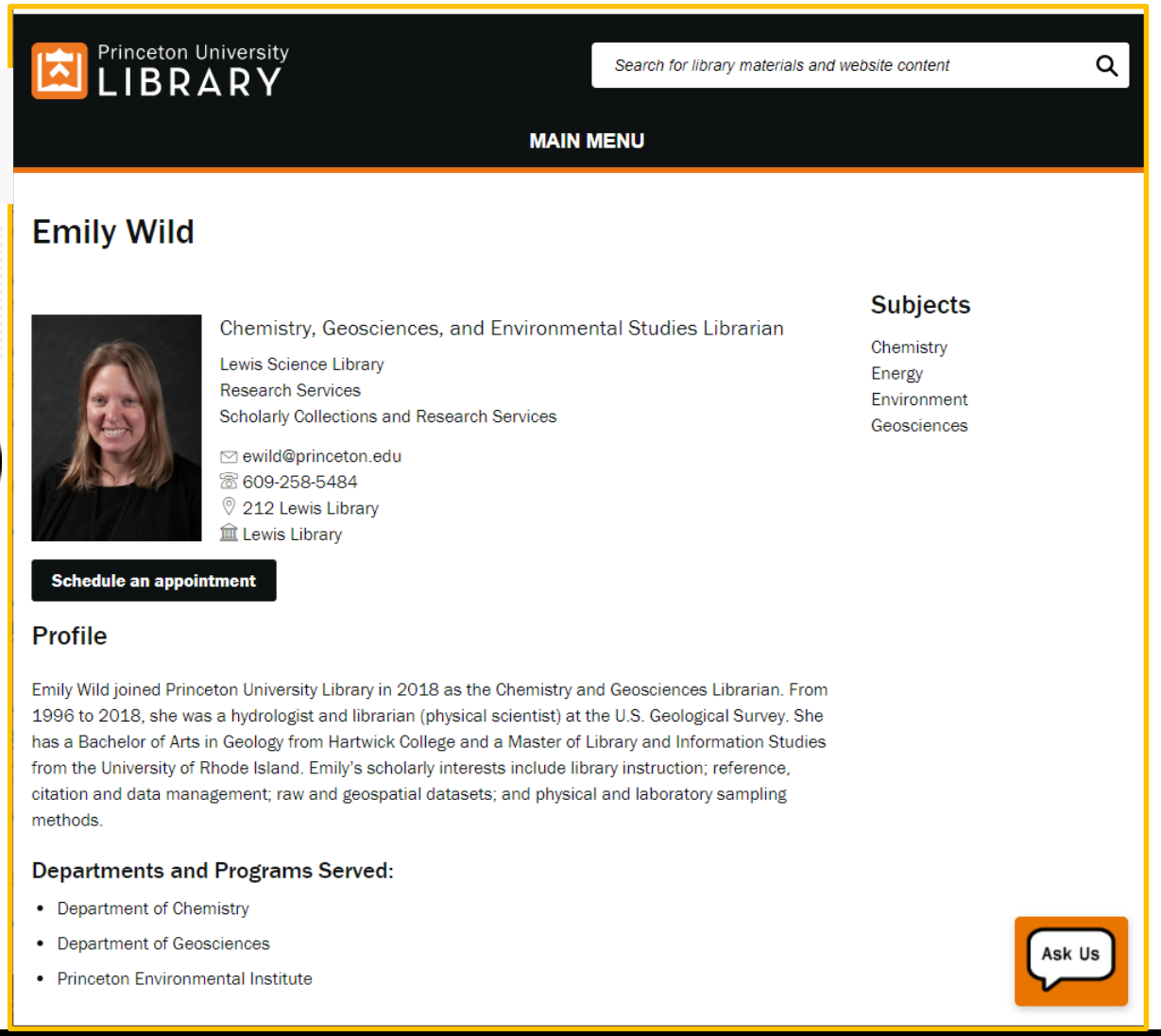
https://www.ndstudies.gov/

Princeton University Library
https://library.princeton.edu/
Department of Chemistry
https://chemistry.princeton.edu/
Department of Geosciences
https://geosciences.princeton.edu/
Princeton Environmental Institute (PEI)
https://environment.princeton.edu/

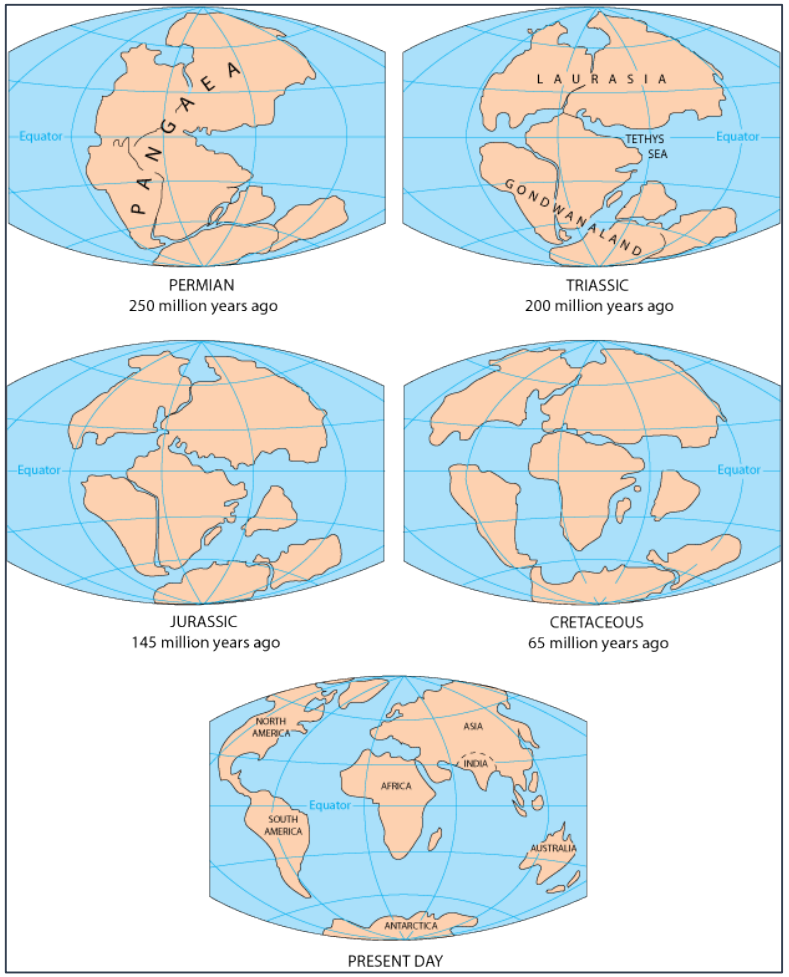
School of Engineering
https://engineering.princeton.edu/
Chemical and Biological Engineering
https://engineering.princeton.edu/departments/chemical-and-biological-engineering
Civil and Environmental Engineering
https://engineering.princeton.edu/departments/civil-and-environmental-engineering
Andlinger Center for Energy and the Environment
https://engineering.princeton.edu/centers/acee

Princeton School of Public and International Affairs
https://spia.princeton.edu/
Bendheim Center for Finance https://bcf.princeton.edu/
Operations Research and Financial Engineering
(ORFE) https://orfe.princeton.edu/home

Exposure Project: Dean for Research Innovation award
Innovation Fund for Research Collaborations between Artists and Scientists or Engineers
https://www.princeton.edu/news/2020/06/08/funding-next-big-idea-new-projects-receive-dean-research-innovation-awards **Fazal Sheikh** https://www.fazalsheikh.org/



Types of Questions for Energy & Mineral Resources



Geologic Time Scale – 2018
https://pubs.usgs.gov/fs/2018/3054/fs20183054.pdf

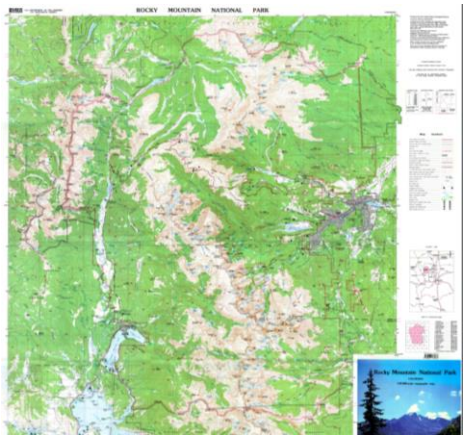
United States, Canada, Worldwide

- Earth processes that create oil, gas, coal, minerals, and uranium
- Location of natural resources
- Making renewable energy
- Land-use history
- Environmental concerns in areas with oil, gas, coal, minerals, and uranium
- Repeat Photography of landscapes

Cretaceous Western Interior Seaway

Information nuggets that astonish students?

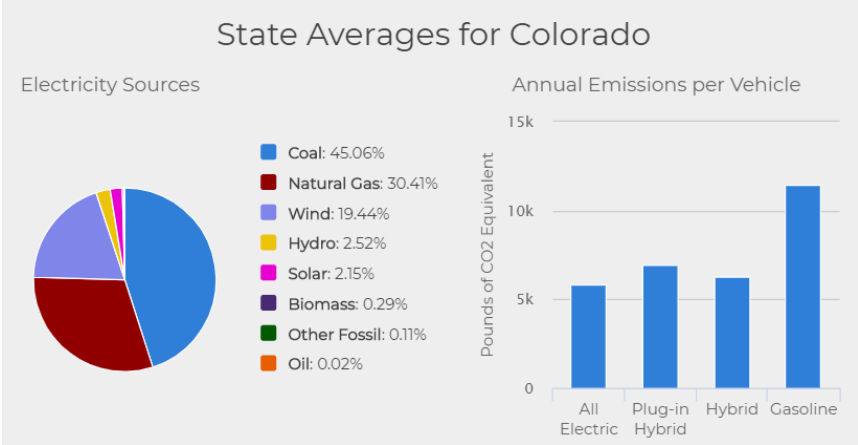
National Park boundaries exist where the rocks are not economically viable
&
Federal land often has mining and oil/gas extraction



Driving an electric or hybrid vehicle does not mean the energy used in the vehicle is renewable

ELECTRIC VEHICLES
Study: EVs 3 times more polluting than gas cars in some states
https://www.eenews.net/energywire/2020/07/08/stories/1063524185

Electricity Sources and Emissions
https://afdc.energy.gov/vehicles/electric_emissions.html

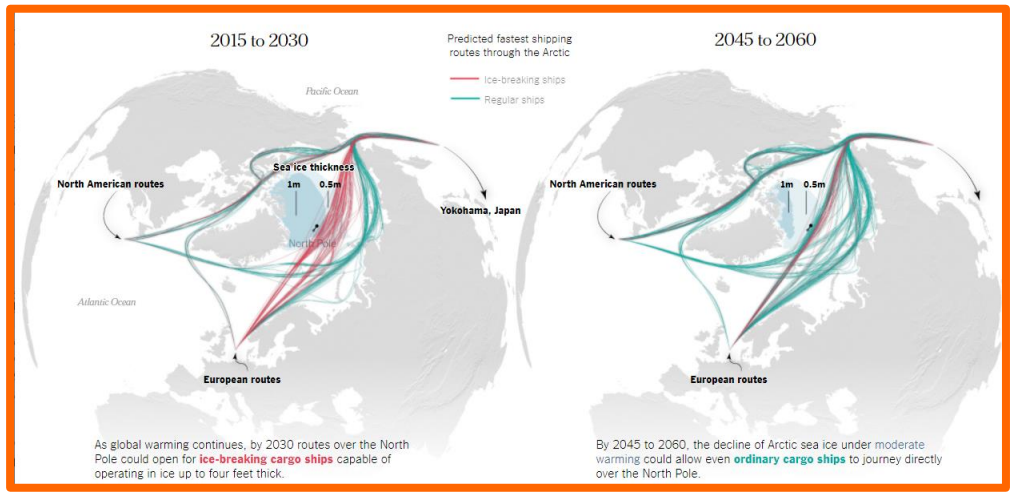


Daily products they use are derived from oil (petroleum products)

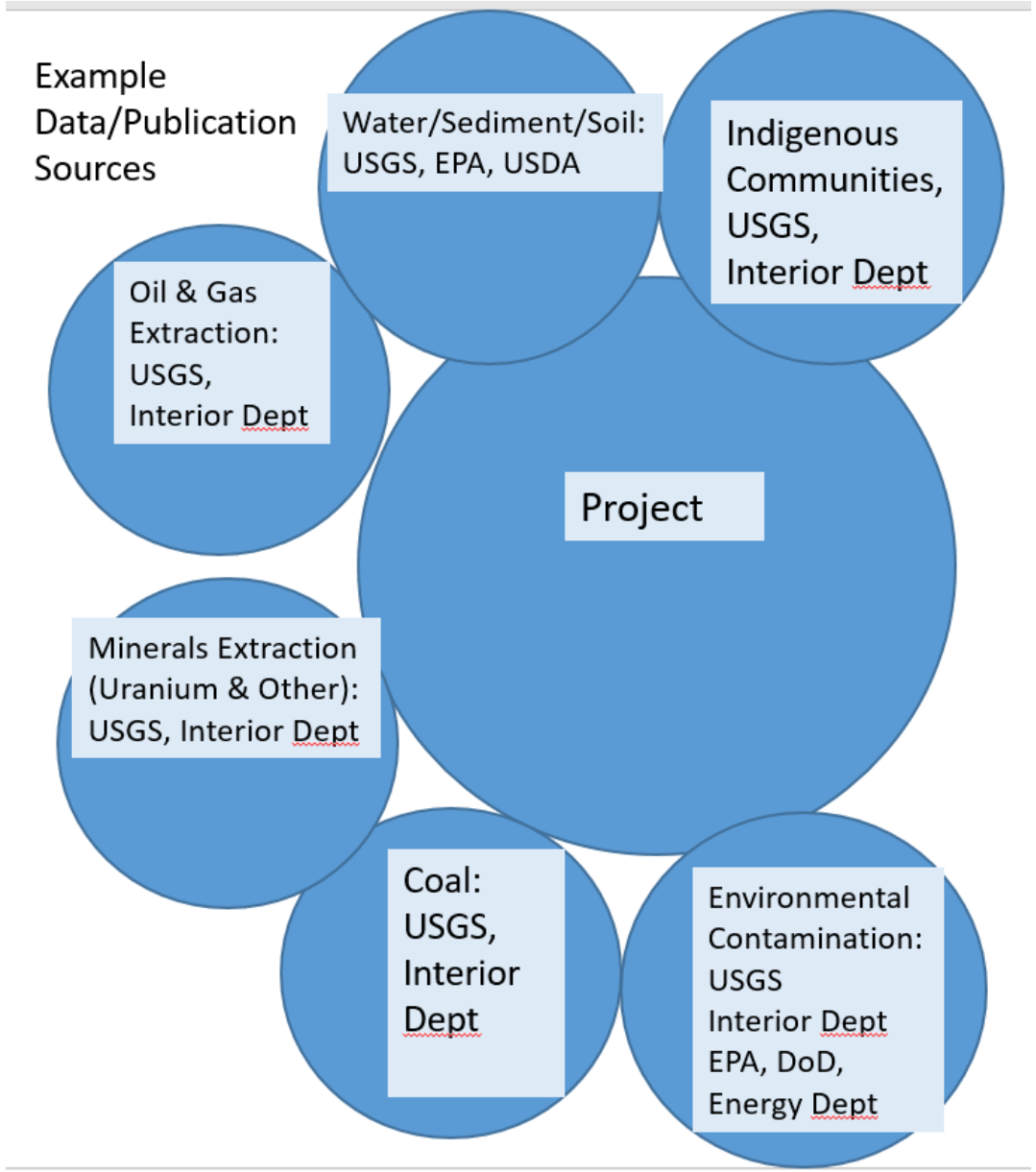
Individuals that are climate-change deniers actually know climate change will happen and the arctic will melt, but as it does:

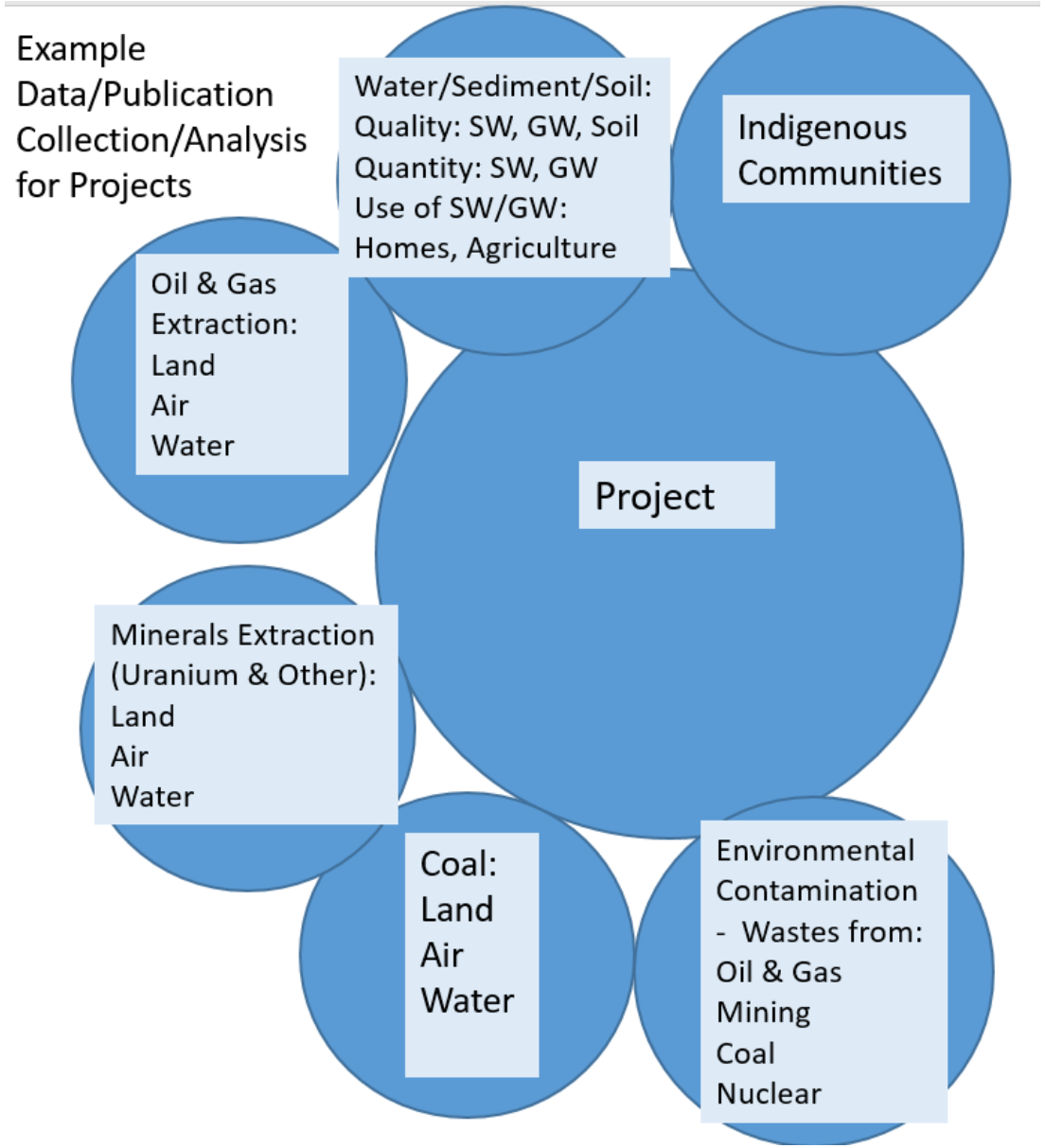
- Arctic ice melting will open up more water for transporting oil and gas from Alaska to Europe

- Arctic ice melting makes it easier to extract oil from ocean i.e. oil platforms on open ocean vs. ice



https://www.nytimes.com/interactive/2017/05/03/science/earth/arctic-shipping.html


Example Data/Publication Sources
Water/Sediment/Soil: USGS, EPA, USDA
Indigenous Communities, USGS, Interior Dept
Oil & Gas Extraction: USGS, Interior Dept
Project
Minerals Extraction (Uranium & Other): USGS, Interior Dept
Coal: USGS, Interior Dept
Environmental Contamination: USGS Interior Dept EPA, DoD, Energy Dept


Example Data/Publication Collection/Analysis for Projects
Water/Sediment/Soil: Quality: SW, GW, Soil Quantity: SW, GW Use of SW/GW: Homes, Agriculture
Indigenous Communities
Oil & Gas Extraction: Land Air Water
Project
Minerals Extraction (Uranium & Other): Land Air Water
Coal: Land Air Water
Environmental Contamination - Wastes from: Oil & Gas Mining Coal Nuclear

Thank you to:

USGS Energy: https://www.usgs.gov/energy-and-minerals/energy-resources-program/

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Timothy S Collett
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Debra K Higley
Michael D Lewan
Paul Lillis
Chris Potter
Tracey Mercier

USGS Minerals: https://www.usgs.gov/energy-and-minerals/mineral-resources-program

Geology, Geophysics, and Geochemistry Science Center https://www.usgs.gov/centers/gggsc

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Anjana K Shah
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Cyrus J Berry
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Celestine Mercer
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William Ridley
Mary Ellen Benson
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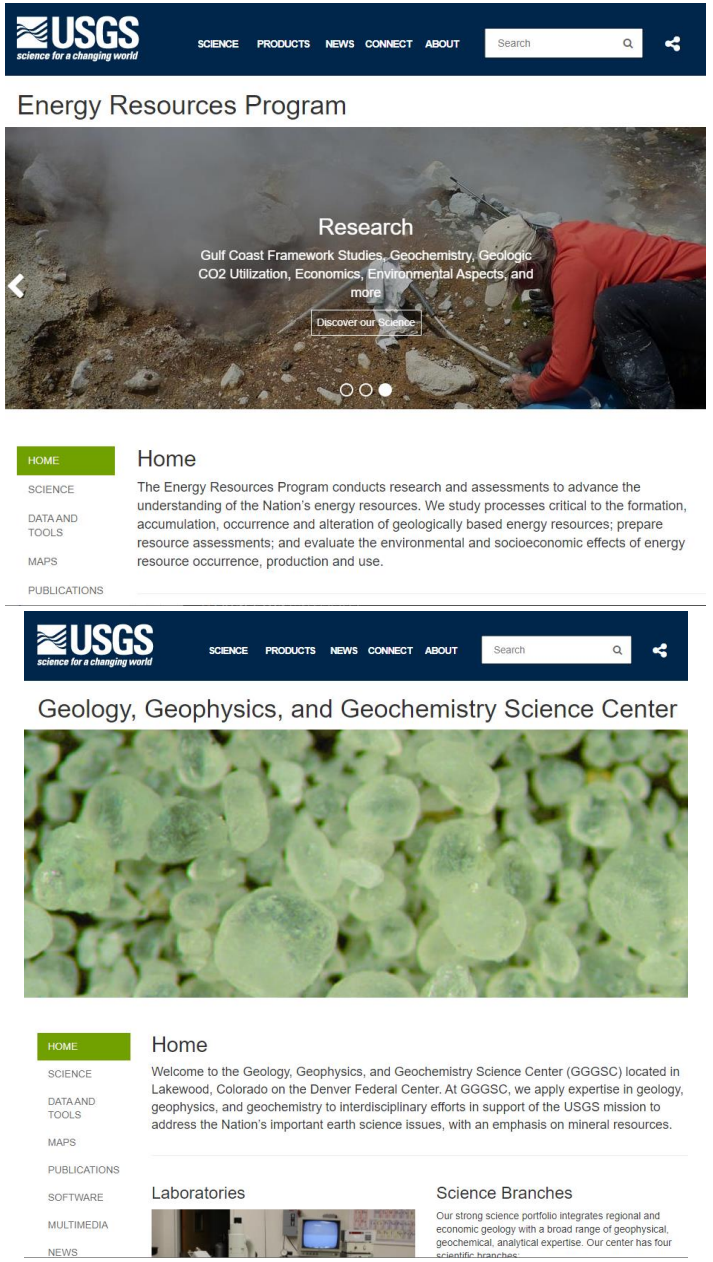
Ryan D Taylor
Russell G Tysdal



Session Overview

https://visibleearth.nasa.gov/

- History of the U.S. Geological Survey
- Princeton University Research
- Energy Resources: Oil, Gas, Coal, Gas Hydrates, Geothermal, Wind, Uranium, Garbage
- Mineral Resources & Commodity Information
- Ocean Mining & Space Mining
- Uranium Resources
- Environmental: Energy/Minerals/Uranium & Extraction/Uses/Wastes

USGS History: the Pre-USGS Map Area the Four Surveys, 1867-1879

[Catalogue and index of the publications of the Hayden, King, Powell, and Wheeler surveys]

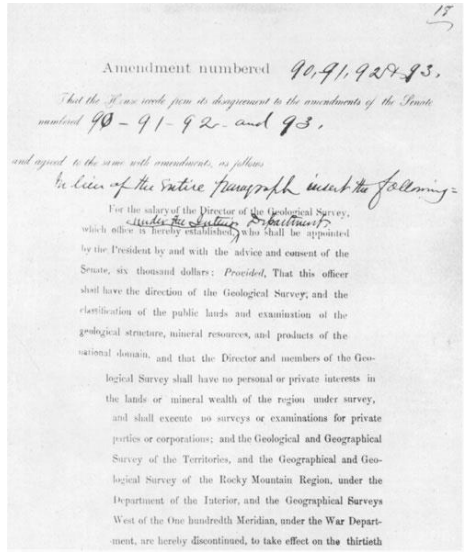
U.S. Geological and Geographical Survey of the Territories (Hayden)

U.S. Geological Exploration of the Fortieth Parallel (King)

U.S. Geographical and Geological Survey of the Rocky Mountain Region (Powell)

U.S. Geographical Surveys West of the One Hundredth Meridian (Wheeler)

[The Four Great Surveys of the West]



Amendment numbered 90, 91, 92 & 93.

That the House recede from its disagreement to the amendments of the Senate numbered 90 - 91 - 92 - and 93,

and agree to the same with amendments, as follows:

In lieu of the matter proposed insert the following:

For the salary of the Director of the Geological Survey, which office is hereby established, under the Interior Department, who shall be appointed by the President by and with the advice and consent of the Senate, six thousand dollars: *Provided*, That this officer shall have the direction of the Geological Survey, and the classification of the public lands and examination of the geological structure, mineral resources, and products of the national domain, and that the Director and members of the Geological Survey shall have no personal or private interests in the lands or mineral wealth of the region under survey, and shall execute no surveys or examinations for private parties or corporations; and the Geological and Geographical Survey of the Territories, and the Geographical and Geological Survey of the Rocky Mountain Region, under the Department of the Interior, and the Geographical Surveys West of the One hundredth Meridian, under the War Department, are hereby discontinued, to take effect on the thirtieth

March 3, 1879: Legislation to rename the Coast and Geodetic Survey and transfer it to the Department of the Interior and to establish the U.S. Geological Survey for "classification of the public lands, and examination of the geological structure, mineral resources, and products of the national domain"

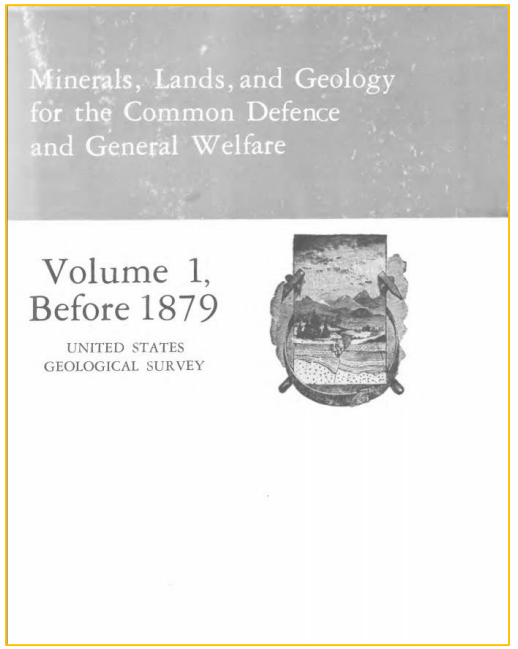
History of the U.S. Geological Survey: “Rabbitt Reports” (by Mary C. Rabbitt)

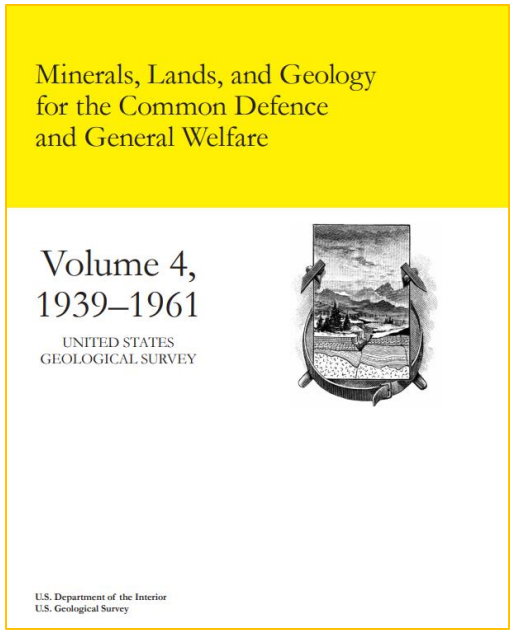
Minerals, lands, and geology for the common defence and general welfare, Volume 1, Before 1879 : A history of public lands, federal science and mapping policy, and development of mineral resources in the United States

Minerals, lands, and geology for the common defence and general welfare, Volume 2, 1879-1904 : A history of geology in relation to the development of public-land, federal-science, and mapping policies and the development of mineral resources in the United States during the first 25 years of the U.S. Geological Survey

Minerals, lands, and geology for the common defence and general welfare, Volume 3, 1904-1939 : A history of geology in relation to the development of public-land, federal-science, and mapping policies and the development of mineral resources in the United States from the 25th to the 60th year of the U.S. Geological Survey

Minerals, Lands, and Geology for the Common Defence and General Welfare—Volume 4, 1939–1961





Folios of the Geologic Atlas (over 200 folios)

https://pubs.er.usgs.gov/browse/Report/USGS%20Numbered%20Series/Folios%20of%20the%20Geologic%20Atlas/

Livingston folio, Montana, 1894, Folios of the Geologic Atlas 1

Ringgold folio, Georgia-Tennessee, 1894, Folios of the Geologic Atlas 2

Placerville folio, California, 1894, Folios of the Geologic Atlas 3

Kingston folio, Tennessee, 1894, Folios of the Geologic Atlas 4

Sacramento folio, California, 1894, Folios of the Geologic Atlas 5

Chattanooga Folio, Tennessee, 1892, Folios of the Geologic Atlas 6

Pikes Peak folio, Colorado, 1894, Folios of the Geologic Atlas 7

Anthracite-Crested Butte folio, Colorado, 1894, Folios of the Geologic Atlas 9

Harpers Ferry folio, Virginia-Maryland-West Virginia, 1894, Folios of the Geologic Atlas 10

Pikes Peak folio, Colorado
Folios of the Geologic Atlas 7
By: Whitman Cross
https://doi.org/10.3133/gf7

More information: **National Geologic Map Database Index Page** (html)
Document: **Document** (3 pdf)
Plates:

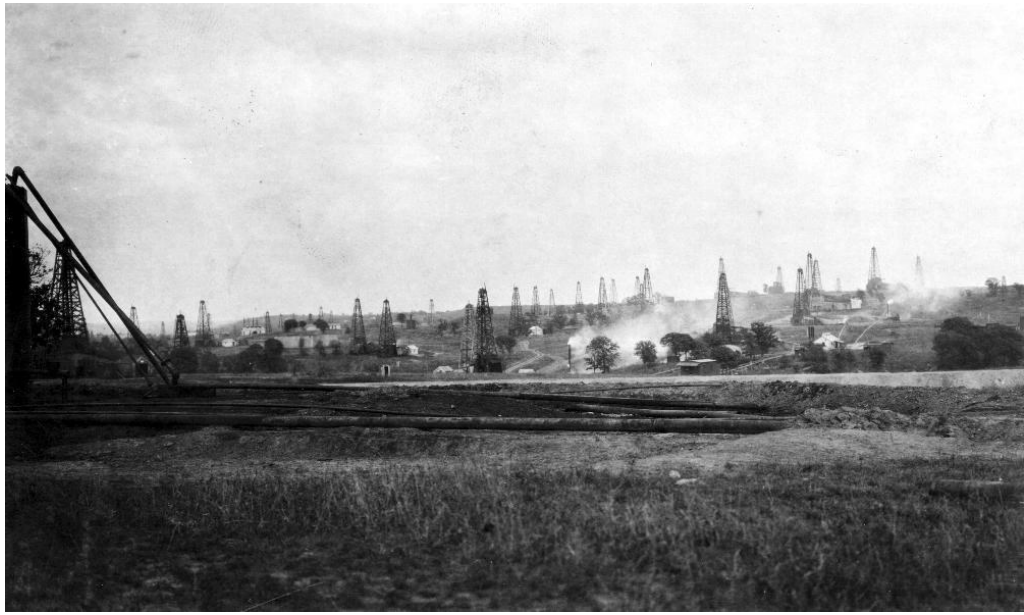
- **Quad Area** (6 pdf)
- **Quad Economic** (6 pdf)
- **Quad Structure** (4 pdf)
- **Quad Topography** (5 pdf)
- **Quad Special** (4313 pdf)

Cover: **Cover** (4 pdf)

USGS Library Historical Photos: https://library.usgs.gov/photo/

four great surveys... (1780)
expeditions (1668)
rocks (1599)
mines (1542)
mineral specimens (1337)
mines, mills, quar... (509)
international (427)
quarries (342)
photomicrographs (241)
mills (224)
indian reservation... (220)
equipment (193)
repeat photography... (161)
specimens (155)
hayden survey (70)
sedimentary (57)
foraminifera (47)
pipelines (28)

Structural relations of formations at Willow mine, Van Houten; north wall of canyon at the mine, showing from top to bottom Raton formation, basal conglomerate of the Raton, unconformity between Vermejo and Raton formations, coal bed within Vermejo and Trinidad sandstone. Colfax County, New Mexico. 1910.



Cushing Oil Field. Creek County, Oklahoma.1915.

“Emily, why do you help us find Interior Department information?”

Today: https://www.doi.gov/bureaus

The U.S. Department of the Interior is a Cabinet-level agency that manages America's vast natural and cultural resources. Our department employs some 70,000 people, including expert scientists and resource-management professionals, in nine technical bureaus:

- Bureau of Indian Affairs
- Bureau of Indian Education
- Bureau of Land Management
- Bureau of Ocean Energy Management
- Bureau of Reclamation
- Bureau of Safety and Environmental Enforcement
- National Park Service
- Office of Surface Mining Reclamation and Enforcement
- U.S. Fish and Wildlife Service
- U.S. Geological Survey

USGS Spin-off agencies/bureaus

U.S. Bureau of Mines: 1910-1996
Back to USGS

Minerals Management Service: 1982-2011
In 2010 after Deepwater Horizon, renamed Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE)

Then split into:

Bureau of Ocean Energy Management

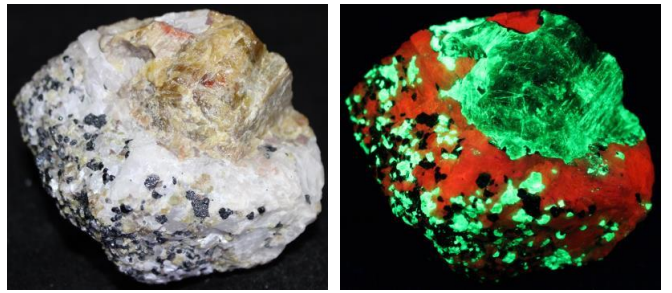
Bureau of Safety and Environmental Enforcement

Office of Natural Resources Revenue

Princeton University Research

Princeton University – GPO FDLP since 1884

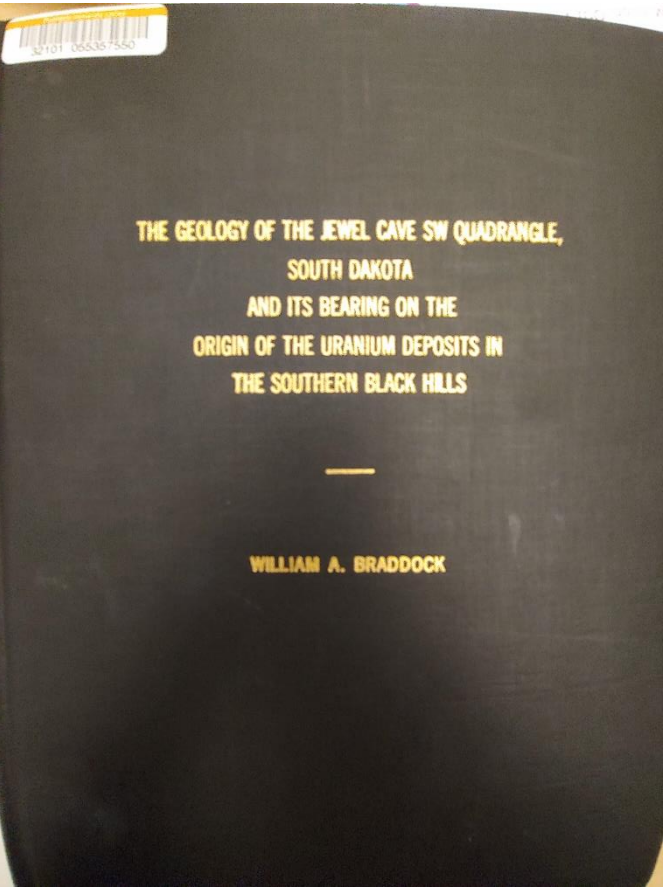
- **Undergraduate Research:** https://geosciences.princeton.edu/undergraduate/undergraduate-research
- **Graduate Research:** https://dataspace.princeton.edu/jspui/handle/88435/dsp01c534fn95t
  - **Mineralogy Research :** https://dataspace.princeton.edu/browse?type=subject&value=Mineralogy
  - **Gem & Mineral Collection:** https://geosciences.princeton.edu/about/mineral-collection
- **Faculty Research:** https://geosciences.princeton.edu/people/faculty
  - **Geology:** https://geosciences.princeton.edu/research/geology
  - **Geochemisty:** https://geosciences.princeton.edu/research/geochemistry
  - **Geophysics:** https://geosciences.princeton.edu/research/geophysics
  - Example: THE DUFFY RESEARCH GROUP AT PRINCETON UNIVERSITY The High-Pressure Mineral Physics Laboratory



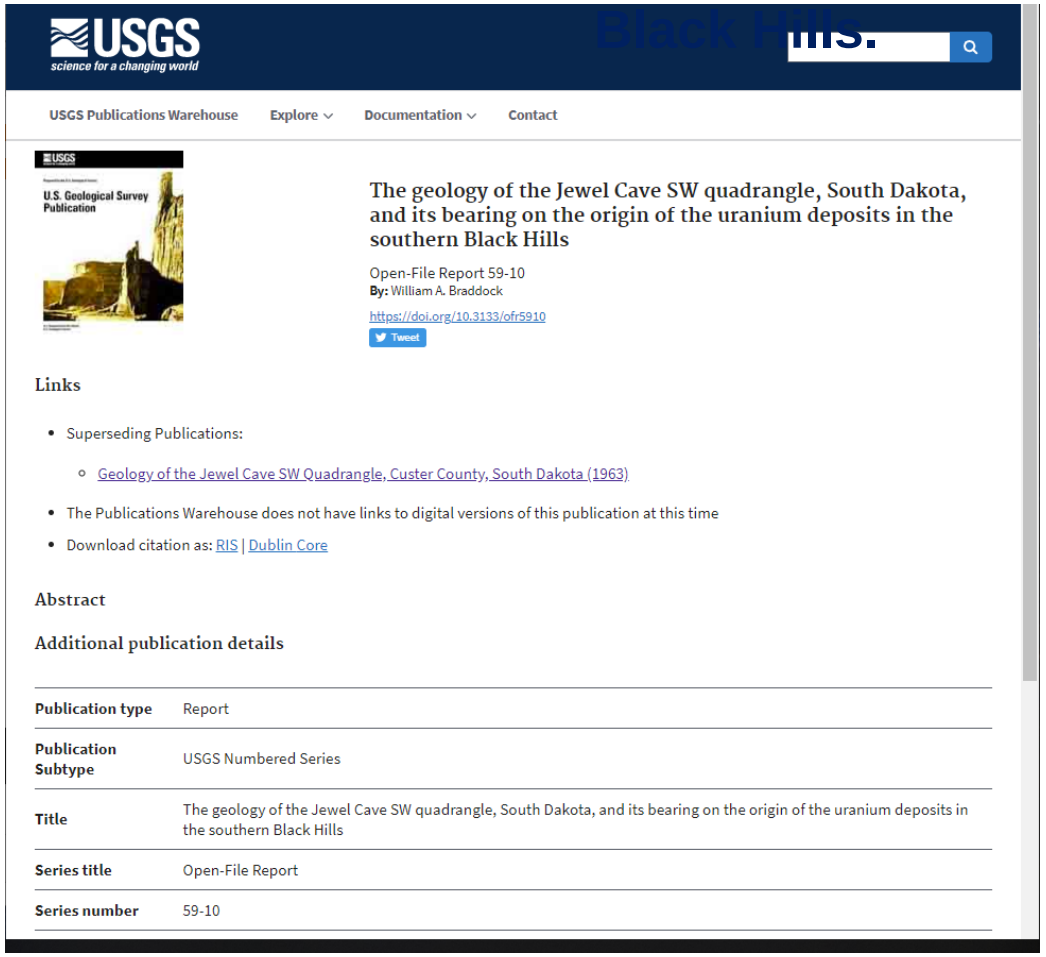
The willemite fluoresces green and the calcite red-orange, franklinite is non-fluorescent. http://www.fomsnj.org/

Princeton University & USGS Collaborations

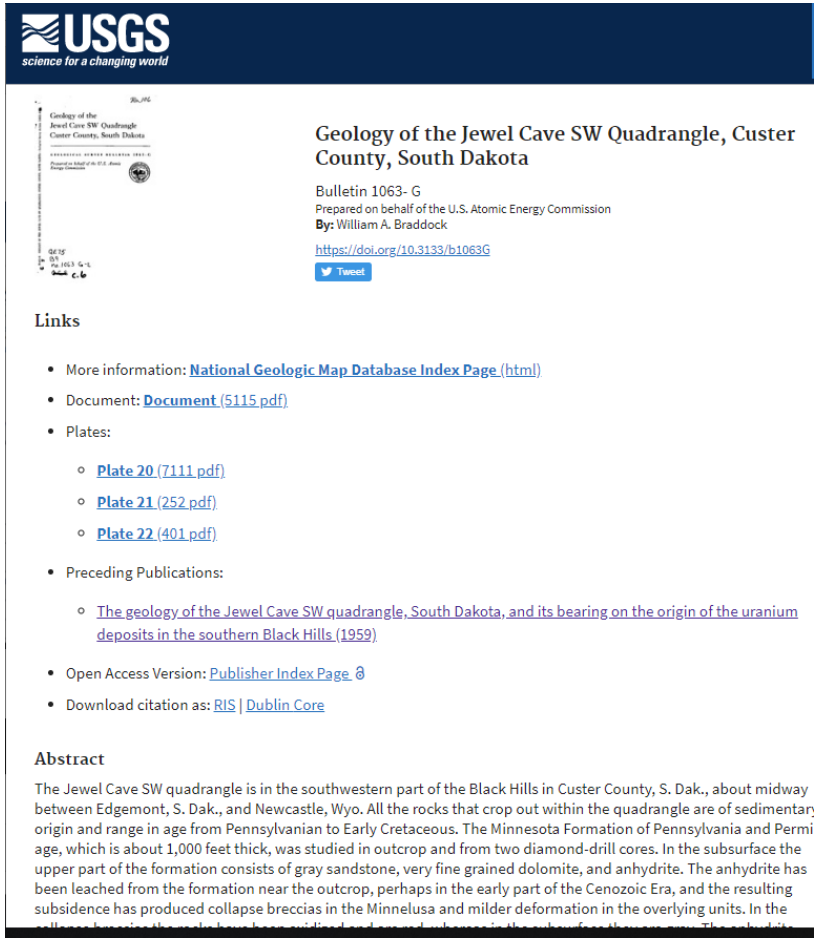
Braddock: The geology of the Jewel Cave SW quadrangle, South Dakota and its bearing on the origin of the uranium deposits in the southern Black Hills.



https://catalog.princeton.edu/catalog/2843663



https://pubs.er.usgs.gov/publication/ofr5910



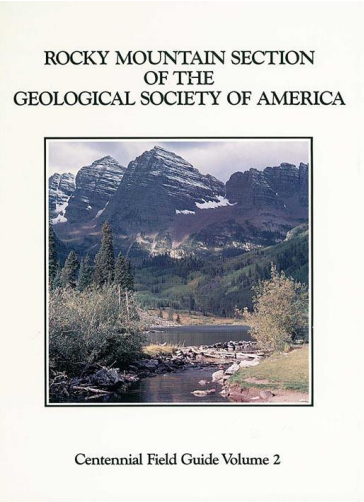
https://pubs.er.usgs.gov/publication/b1063G

William A. Braddock : https://pubs.er.usgs.gov/search?q=William+Braddock

The geology of the Jewel Cave SW quadrangle, South Dakota and its bearing on the origin of the uranium deposits in the southern Black HillsWilliam A. Braddock
1959, Trace Elements Investigations 596
No abstract available....
The geology of the Jewel Cave SW quadrangle, South Dakota, and its bearing on the origin of the uranium deposits in the southern Black HillsWilliam A. Braddock
1959, Open-File Report 59-10
Stratigraphic and structural controls of uranium deposits on Long Mountain, South DakotaWilliam A. Braddock
1957, Bulletin 1063-A
The stratigraphic and structural controls of the uranium deposits on Long Mountain, Fall River County, South DakotaWilliam A. Braddock
1954, Trace Elements Investigations 425
Numerous occurrences of uranium have been found in the Long Mountain area, Fall River County, S. Dak. Correlation diagrams prepared from drill, cores obtained from the U.S. Atomic Energy Commission indicate that the uranium is most abundant in two sandstone units, separated by mudstone in the Lakota sandstone of Early...

BOOK CHAPTER
Precambrian structure, metamorphic mineral zoning, and igneous rocks in the foothills east of Estes Park, Colorado

Decade of North American Geology
DNAG, CENTENNIAL FIELD GUIDES
Rocky Mountain Section of the Geological Society of America

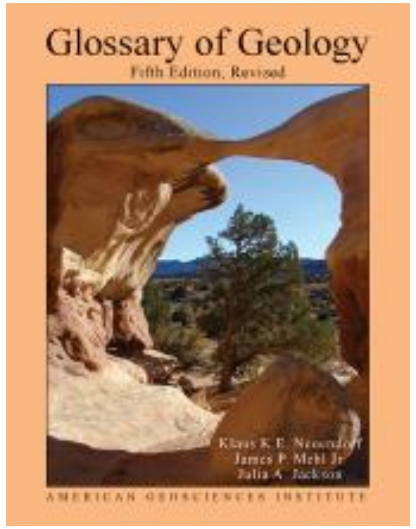


University of Colorado-Boulder
Bill Braddock Geology in the Field Endowment

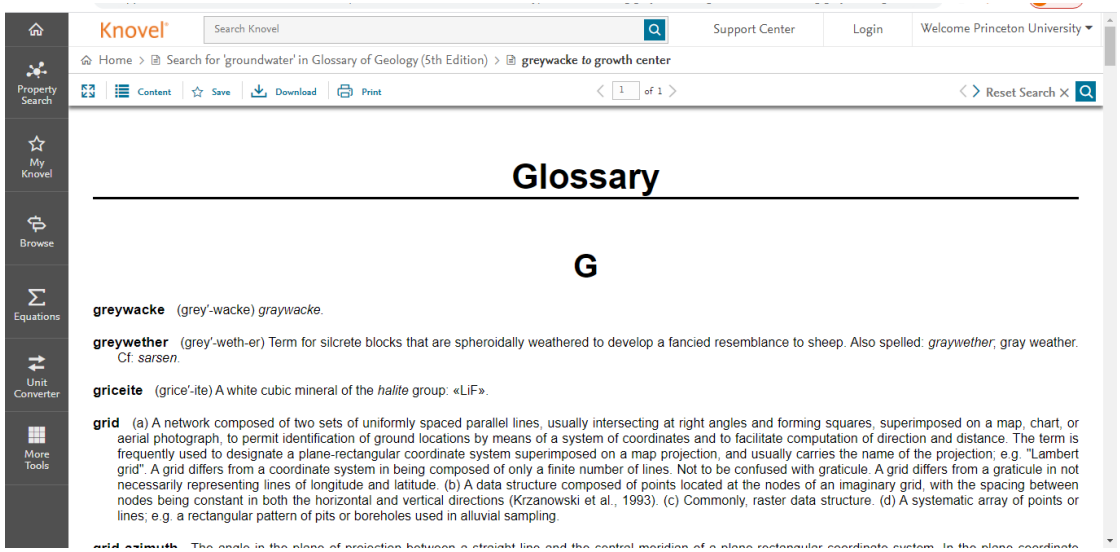
Decade of North American Geology

Essential Books/eBooks

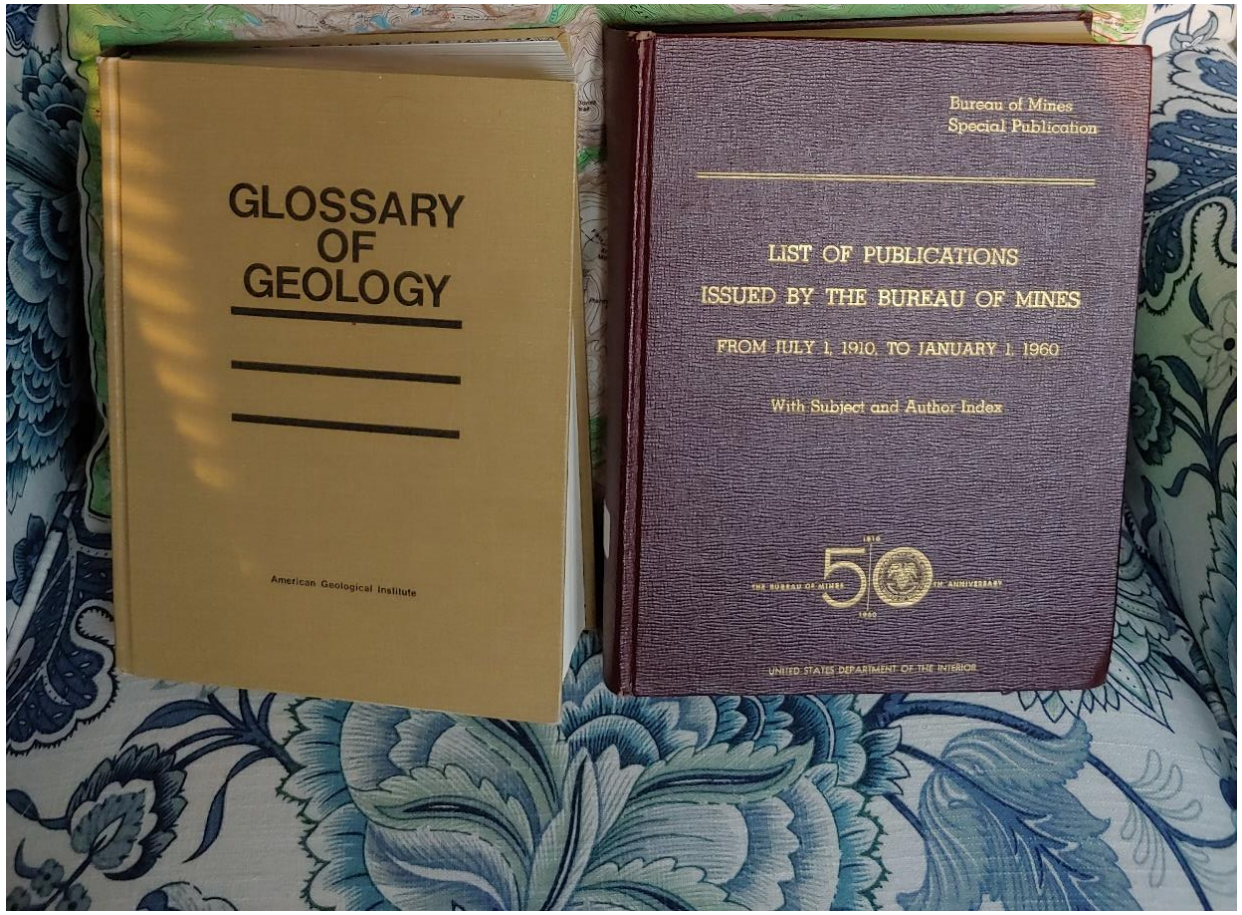
Glossary of Geology
https://www.americangeosciences.org/pubs/glossary



Example:
Glossary of Geology – Online for Princeton University
https://catalog.princeton.edu/catalog/8875615

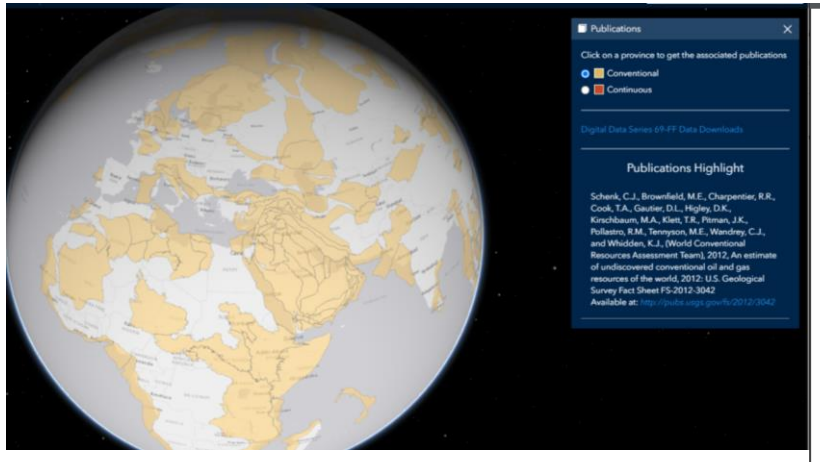


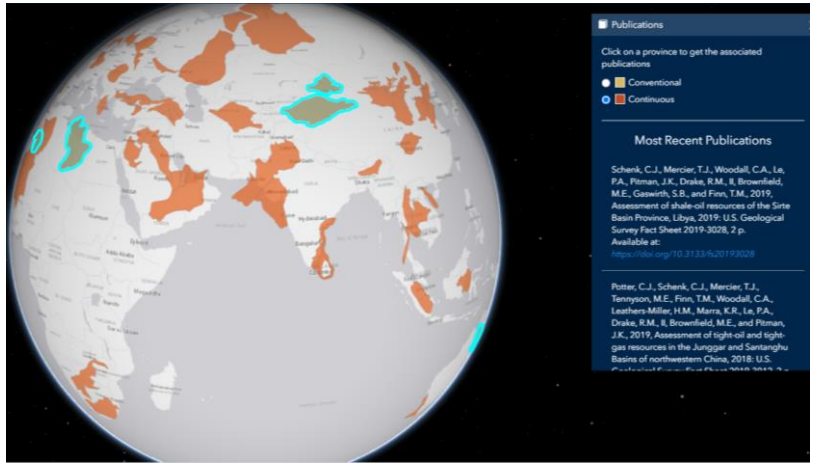
List of journal articles by Bureau of Mines authors published July 1, 1910, to January 1, 1960, with subject index.
https://www.worldcat.org/title/list-of-journal-articles-by-bureau-of-mines-authors-published-july-1-1910-to-january-1-1960-with-subject-index/oclc/4817659&referer=brief_results



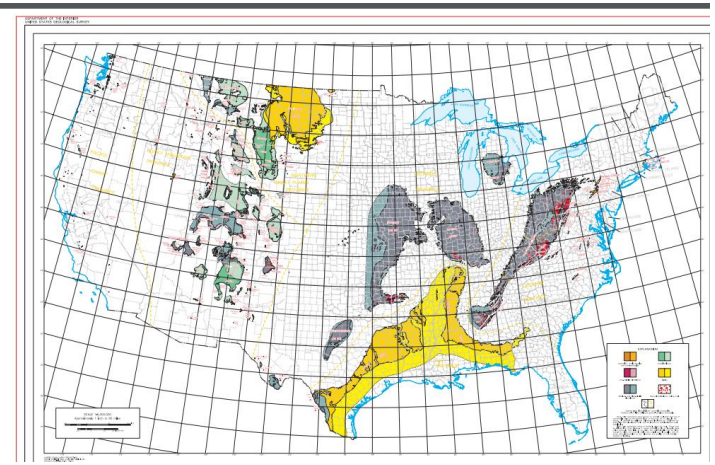
Energy Resources

Oil, Gas, Coal, Gas Hydrates, Geothermal, Wind, Uranium

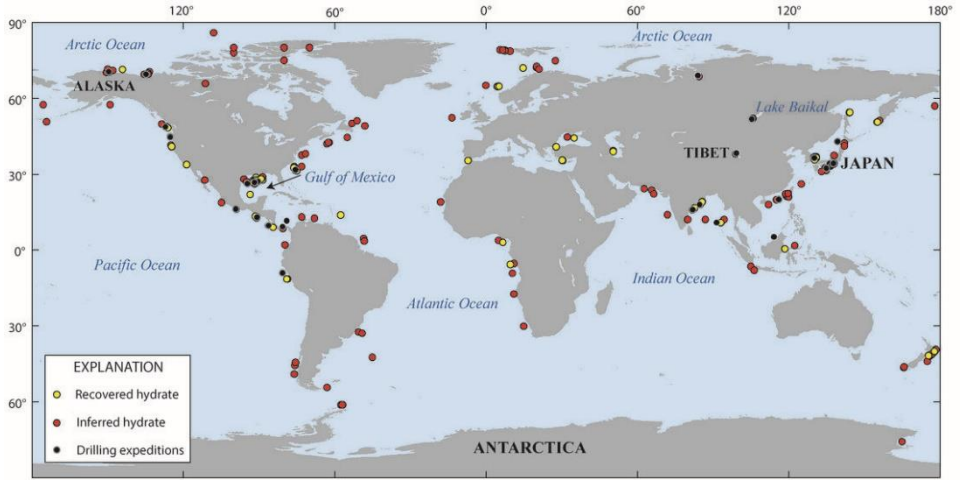




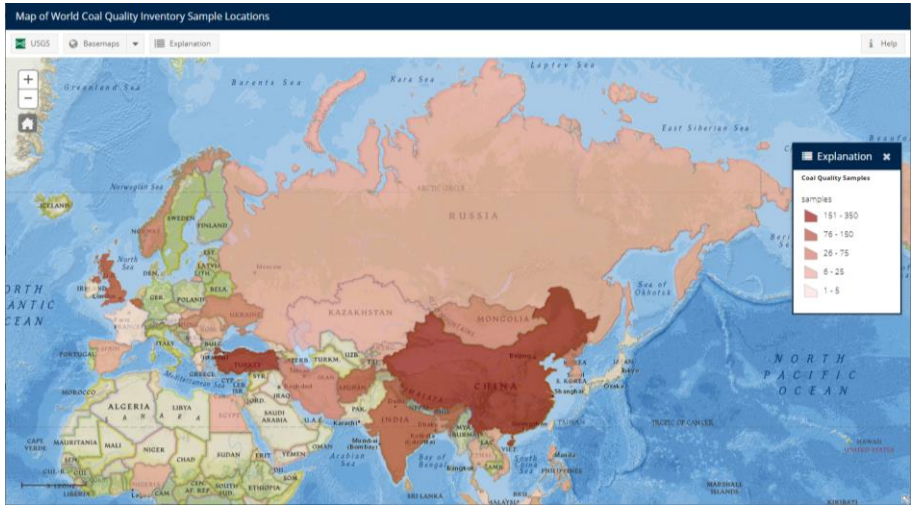
- Conventional Oil and Gas Assessments
- Continuous Oil and Gas Assessments (Unconventional)
https://www.usgs.gov/centers/cersc/science/world-oil-and-gas-resource-assessments



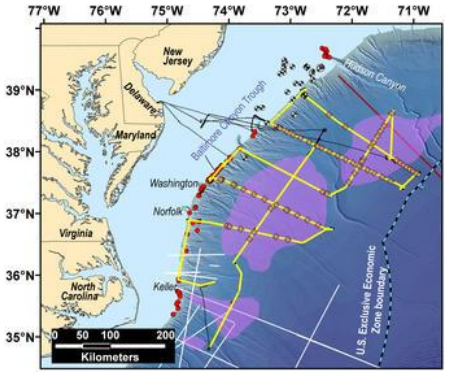
Coal Map, United States



What are gas hydrates?



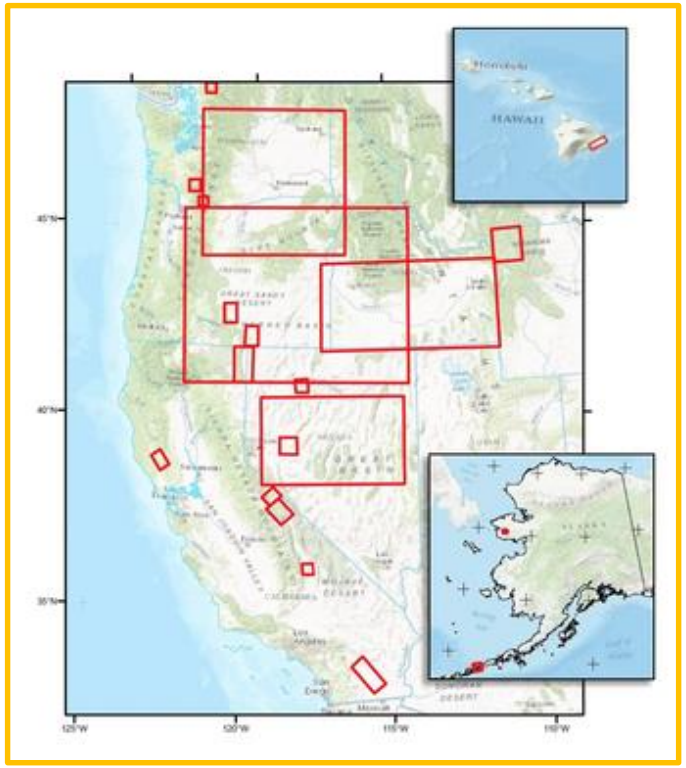
World Coal Quality Inventory Data
http://usgs.gov/centers/eersc/science/world-coal-quality-inventory-data



U.S. Geological Survey Gas Hydrates Project

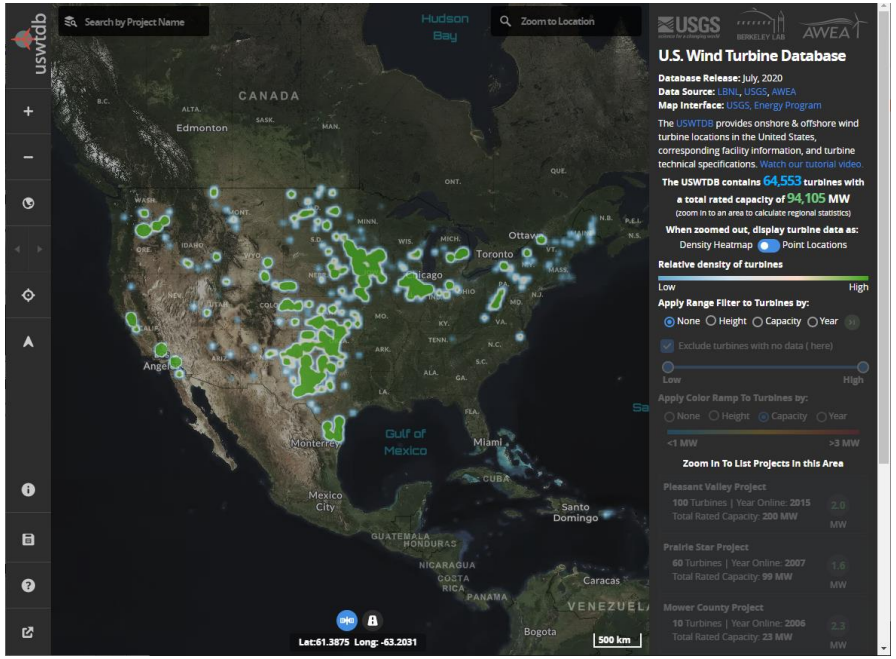
Energy Resources

Oil, Gas, Coal, Gas Hydrates, Geothermal, Wind, Uranium



Geothermal https://www.usgs.gov/energy-and-minerals/energy-resources-program/science/geothermal

Geothermal energy: clean power from the Earth's heat
https://pubs.er.usgs.gov/publication/cir1249

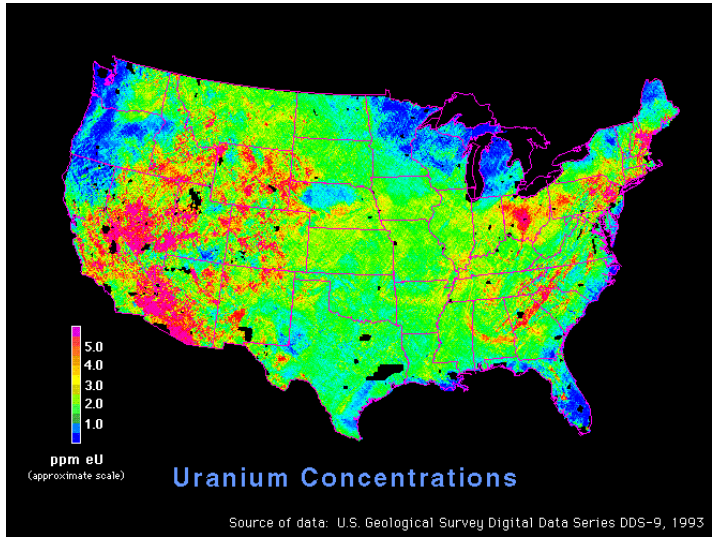


Wind Energy: https://www.usgs.gov/energy-and-minerals/energy-resources-program/science/wind-energy

U.S. Wind Turbine Database
https://eerscmap.usgs.gov/uswtdb/viewer/#3/37.25/-96.25

Wind turbines = Minerals

Critical Mineral Commodities in Renewable Energy



Integrated Uranium Resource and Environmental Assessment

Uranium = a mineral, 1789
Radioactive, 1896
First Atomic Bomb (NM, USA), July 1945
First energy resource, (Idaho), Dec 1951

NREL

https://www.nrel.gov/index.html

https://www.nrel.gov/research/collaborations.html

Joint Institutes
CEMAC – Clean Energy Manufacturing Analysis Center
CRES – Colorado Renewable Energy Collaboratory
ICMC – International Center for Multiscale Characterization
JISEA – Joint Institute for Strategic Energy Analysis
RASEI – Renewable and Sustainable Energy Institute
Energy Frontier Research Centers
BioLEC – Bioinspired Light-Escalated Chemistry
CABES – Center for Alkaline-Based Energy Solutions
CHOISE – Center for Hybrid Organic-Inorganic Semiconductors for Energy
CNGMD – Center for Next Generation of Materials Design
Energy Materials Network Consortia
ChemCatBio – Chemical Catalysis for Bioenergy Consortium
DuraMAT – Durable Module Materials Consortium
ElectroCat – Electrocatalysis Consortium
HydroGEN – Advanced Water Splitting Materials Consortium
HyMARC – The Hydrogen Materials—Advanced Research Consortium
LightMAT – Lightweight Materials Consortium
Other Research Consortia and Collaborations
BESC – BioEnergy Science Center
CAEBAT – Computer-Aided Engineering for Electric-Drive Vehicle Batteries
CCPC – Consortium for Computational Physics and Chemistry
Co-Optima – Co-Optimization of Fuels and Engines
FCIC – Feedstock-Conversion Interface Consortium
IACMI – Institute for Advanced Composites Manufacturing Innovation
iiESI – International Institute for Energy Systems Integration
PVQAT – Photovoltaic Quality Assurance Task Force
ReCell – Lithium Battery Recycling R&D Center
SERIIUS – Solar Energy Research Institute for India and the United States
US-MAP – U.S. Manufacturing of Advanced Perovskites Consortium

https://www.nrel.gov/research/data-tools.html

By Technology


Bioenergy


Buildings


Concentrating Solar Power


Energy Analysis


Grid Modernization


Geothermal


Hydrogen and Fuel Cells


Integrated Energy Solutions


Transportation


Water

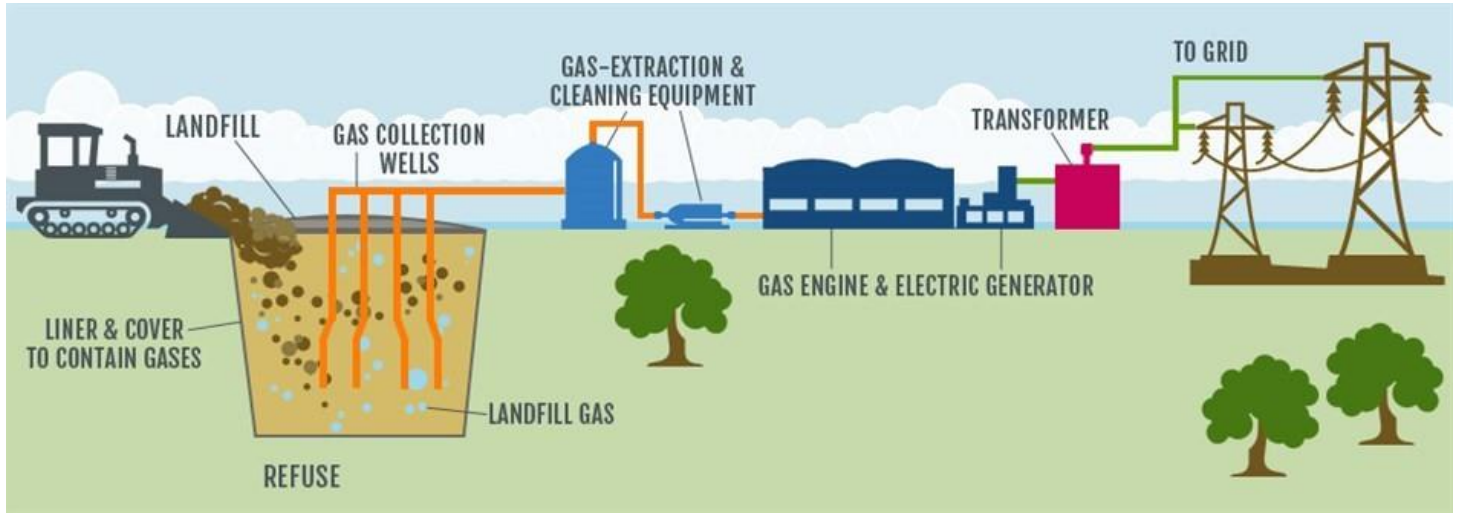

Wind

Wastes – New Jersey

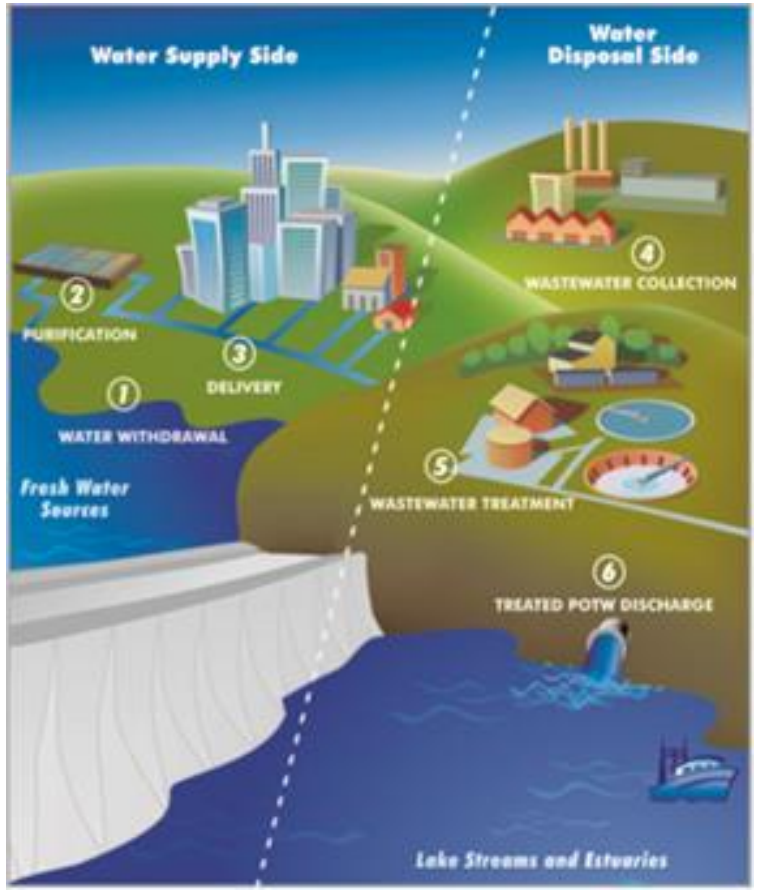
Waste to Energy

https://www.state.nj.us/dep/aqes/bioenergy/

Landfill Gas to Energy



Wastewater to Energy



Oil & Gas

Oil & Gas: Upstream, Mid-Stream, and Downstream – make sure you know what you want

https://www.psac.ca/business/industry-overview/

The **upstream industry** finds and produces crude oil and natural gas. The upstream is sometimes known as the exploration and production (E&P) sector.

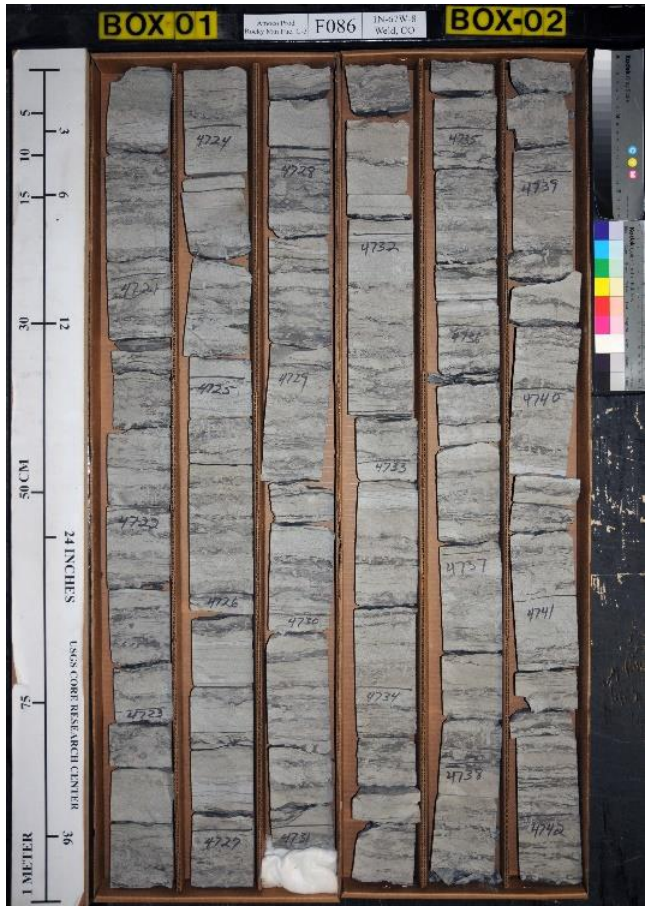
USGS “Finding”

World Oil & Gas Assessments : https://www.usgs.gov/centers/cersc/science/world-oil-and-gas-resource-assessments?qt-science_center_objects=0#qt-science_center_objects

Saudi Arabia: https://pubs.er.usgs.gov/search?q=Saudi+Arabia+&endYear=2000

Afghanistan: https://afghanistan.cr.usgs.gov/oil-and-natural-gas

United States: https://www.usgs.gov/centers/cersc/science/united-states-assessments-undiscovered-oil-and-gas-resources?qt-science_center_objects=0#qt-science_center_objects



https://my.usgs.gov/crcwc/

Weld County, Colorado
AMOCO, Well = ROCKY MTNS FUEL C-3
Core Library Number F086

https://my.usgs.gov/crcwc/core/report/69803

https://my.usgs.gov/crc-data/core/69803/core_photo_70430_box1.jpg

Oil & Gas

Oil & Gas: Upstream, Mid-Stream, and Downstream – make sure you know what you want

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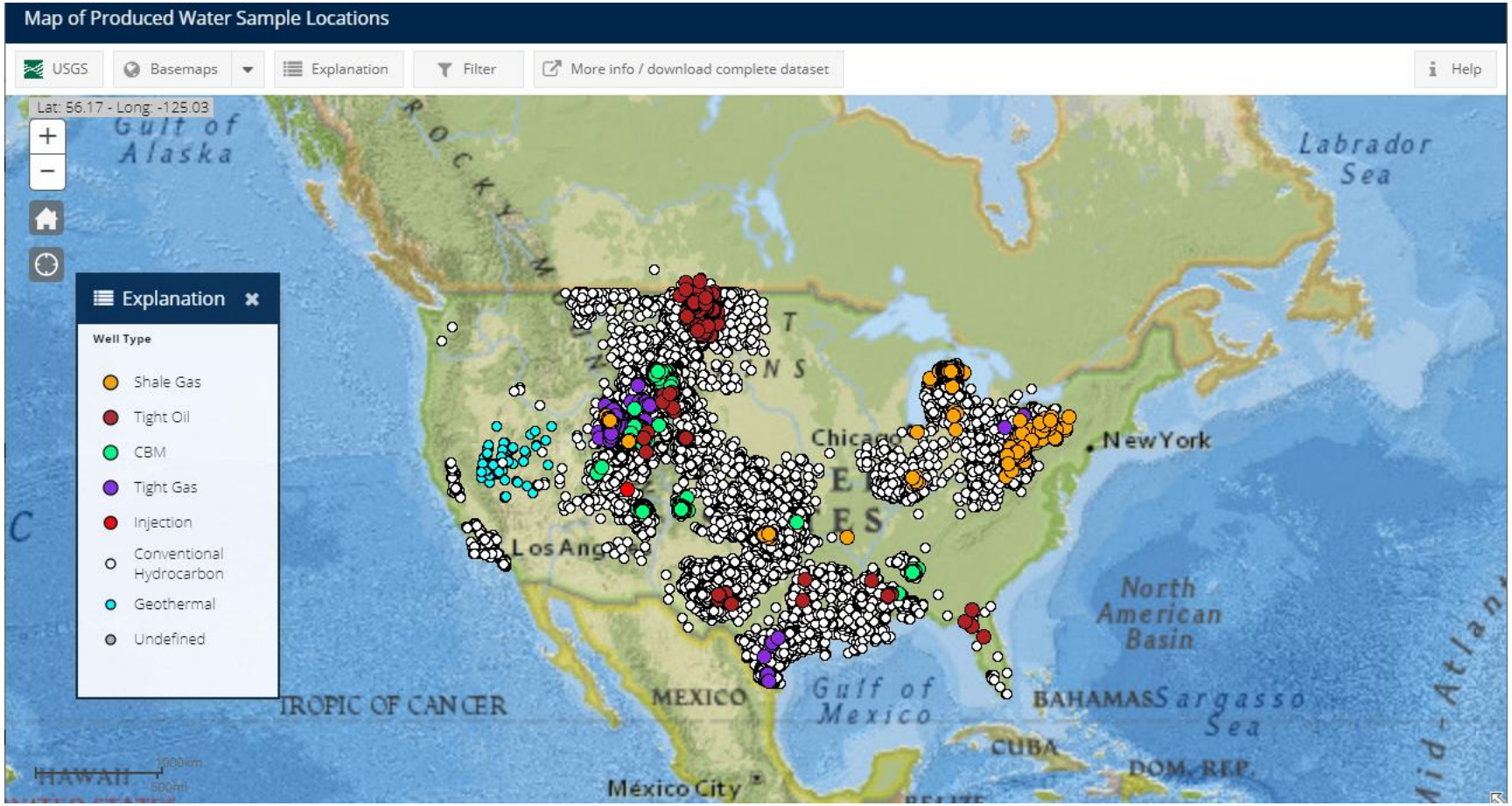
The **upstream industry** finds and produces crude oil and natural gas. The upstream is sometimes known as the exploration and production (E&P) sector.

https://eerscmap.usgs.gov/pwapp/

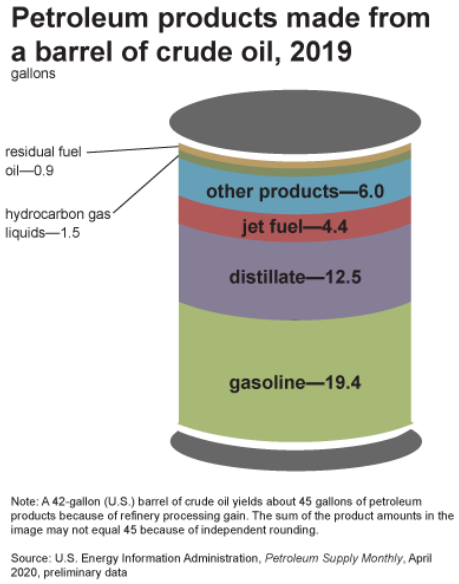


Oil & Gas: Upstream, Mid-Stream, and Downstream – make sure you know what you want

https://www.psac.ca/business/industry-overview/

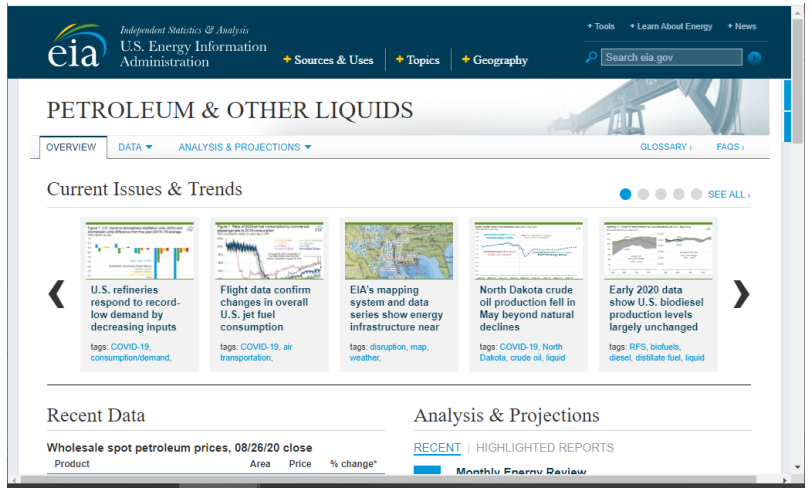
The **midstream industry** processes, stores, markets and transports commodities such as crude oil, natural gas, natural gas liquids (NGLs, mainly ethane, propane and butane) and sulphur.

The **downstream industry** includes oil refineries, petrochemical plants, petroleum products distributors, retail outlets and natural gas distribution companies.

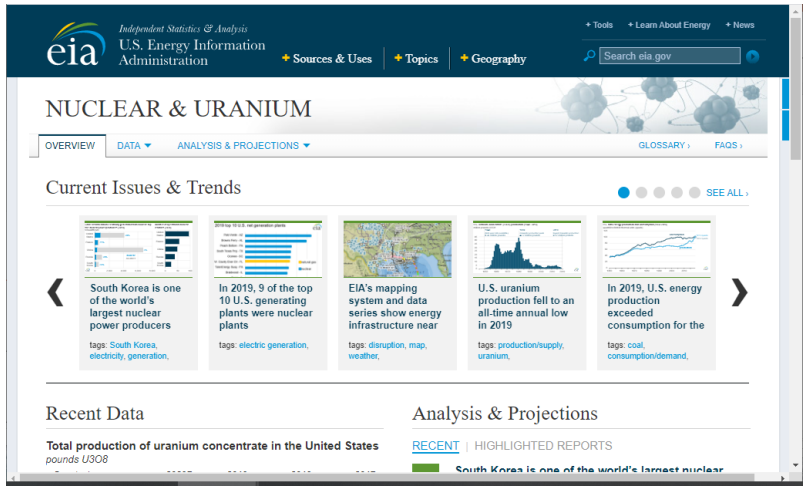


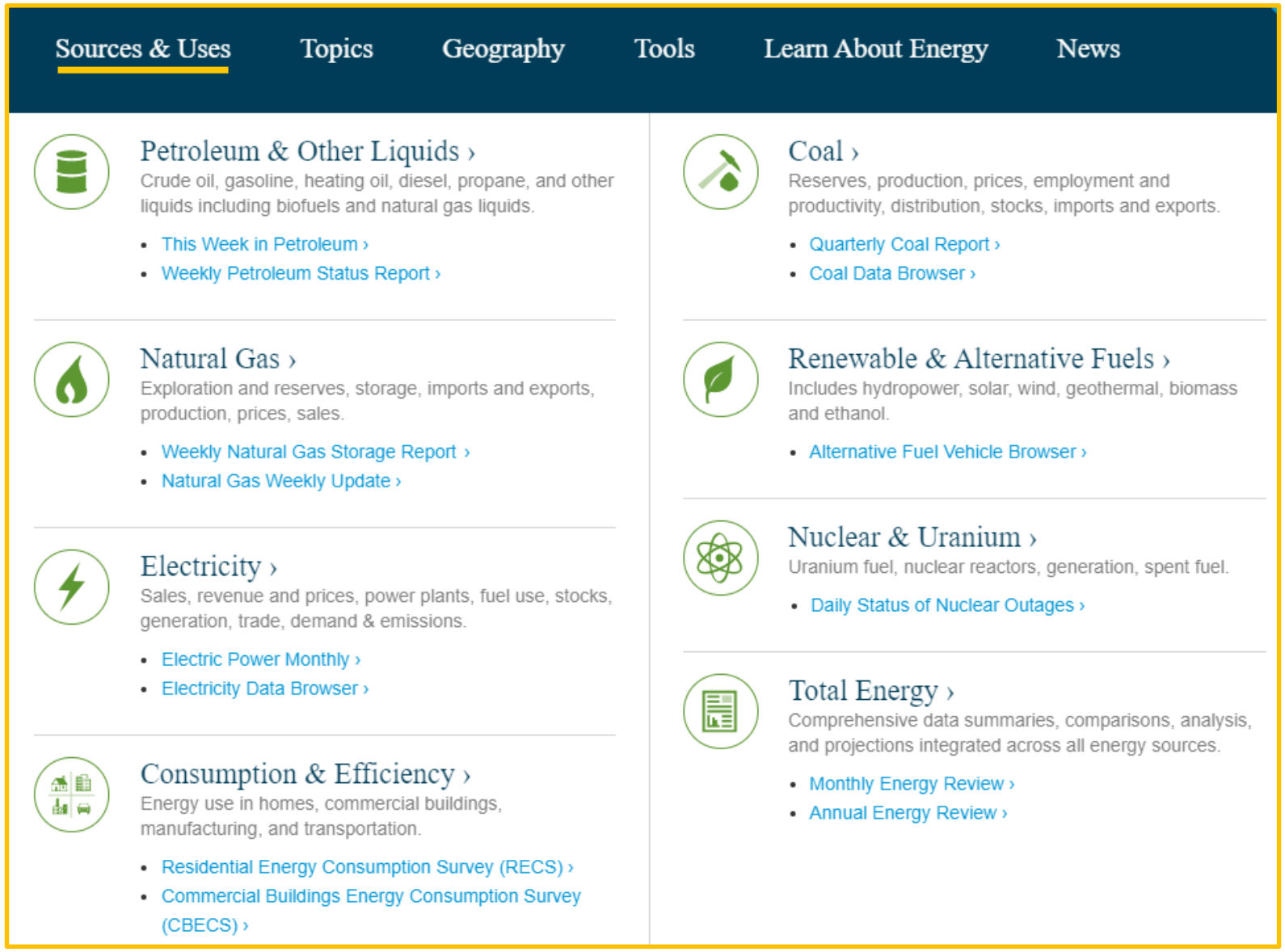
U.S. Energy Information Administration https://www.eia.gov/

https://www.eia.gov/petroleum/



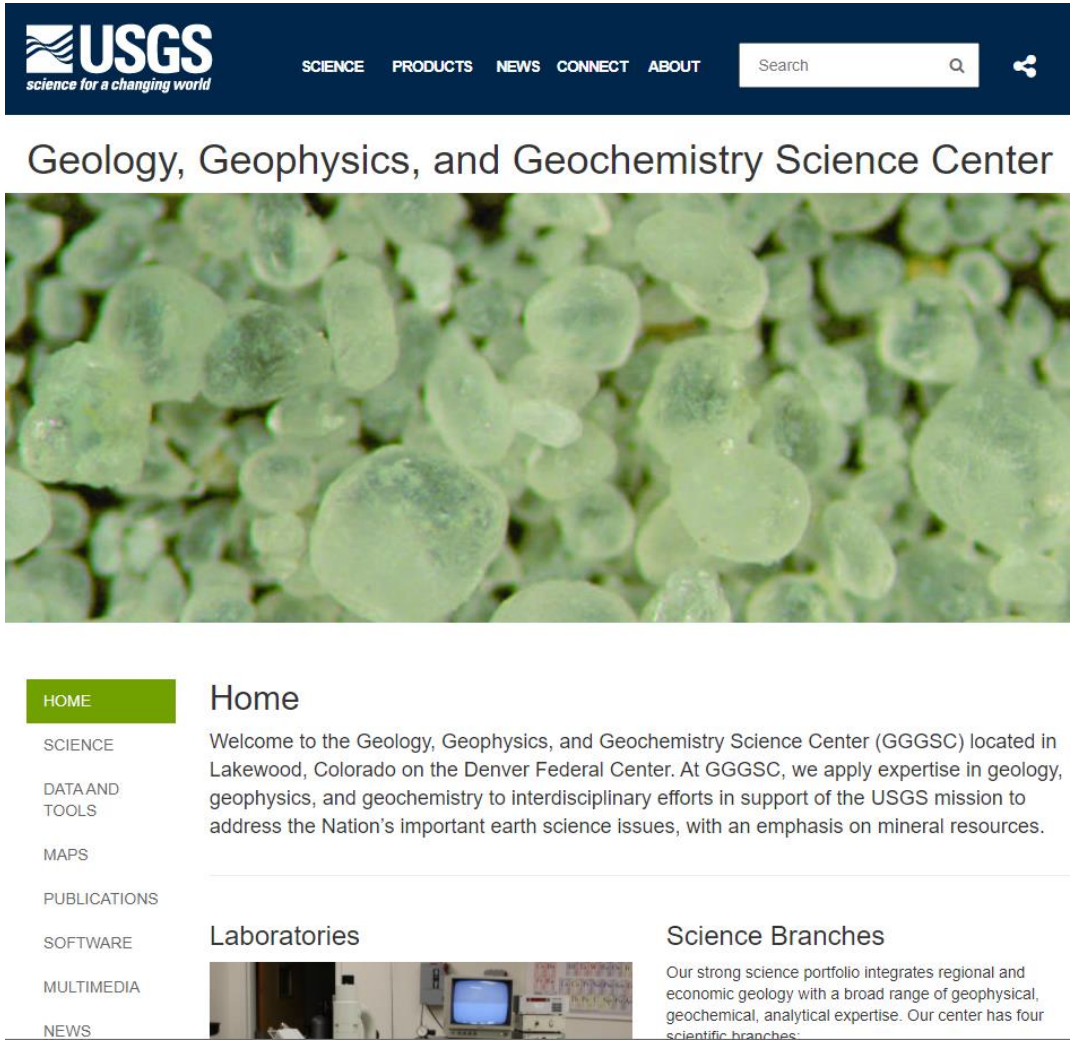
https://www.eia.gov/nuclear/





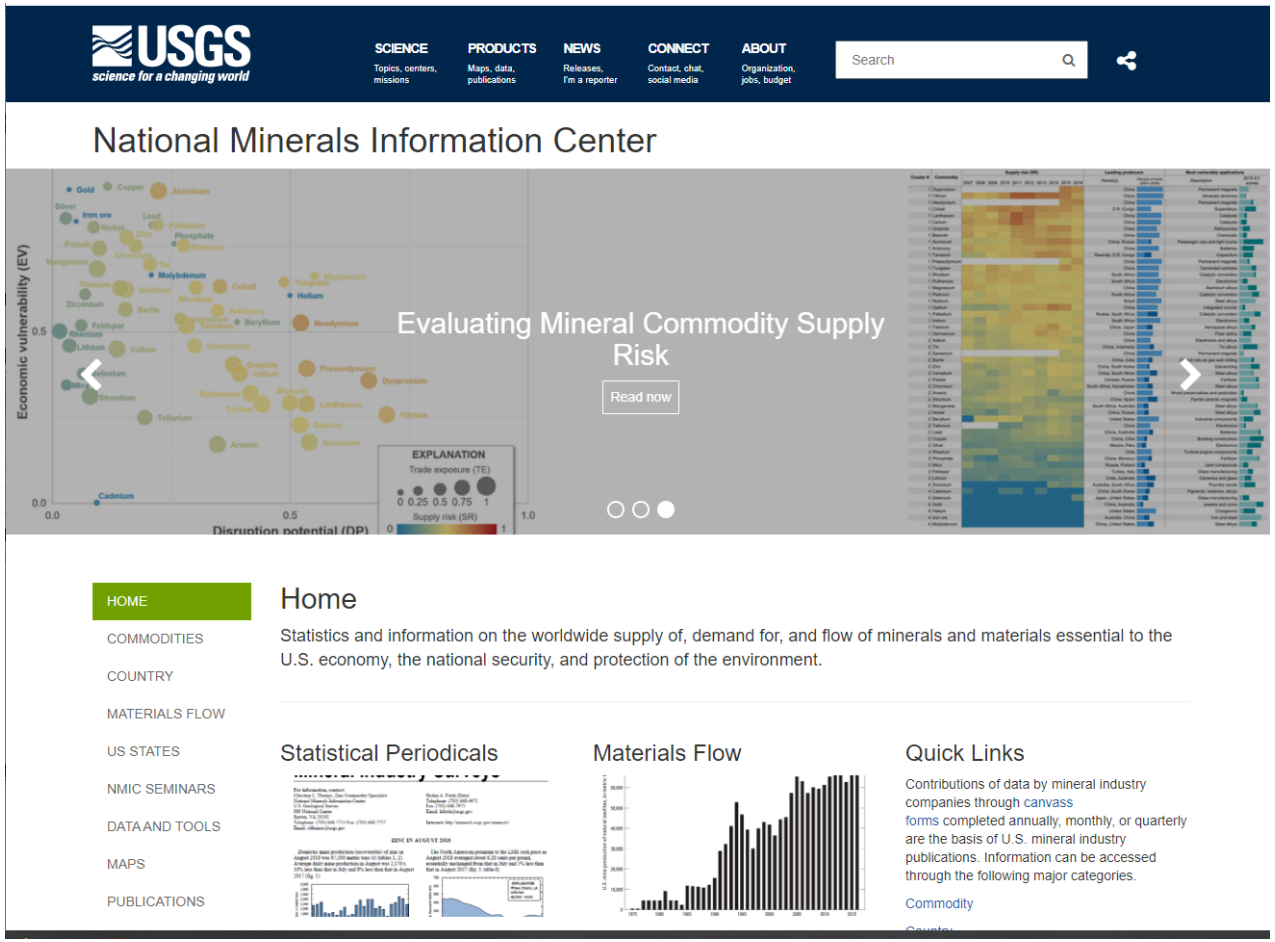
Minerals & “Crustals”

https://www.usgs.gov/energy-and-minerals/mineral-resources-program



https://www.usgs.gov/centers/gggsc

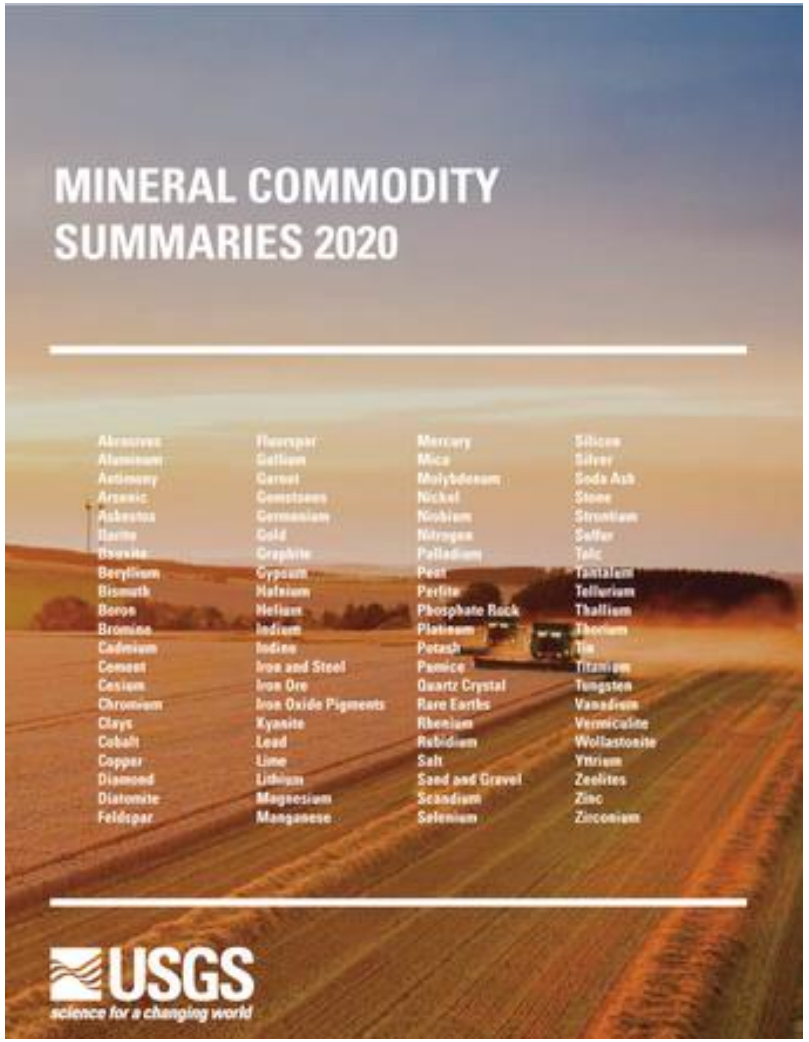
https://www.usgs.gov/centers/nmic



https://www.usgs.gov/centers/nmic/commodity-statistics-and-information

https://www.usgs.gov/centers/nmic/international-minerals-statistics-and-information

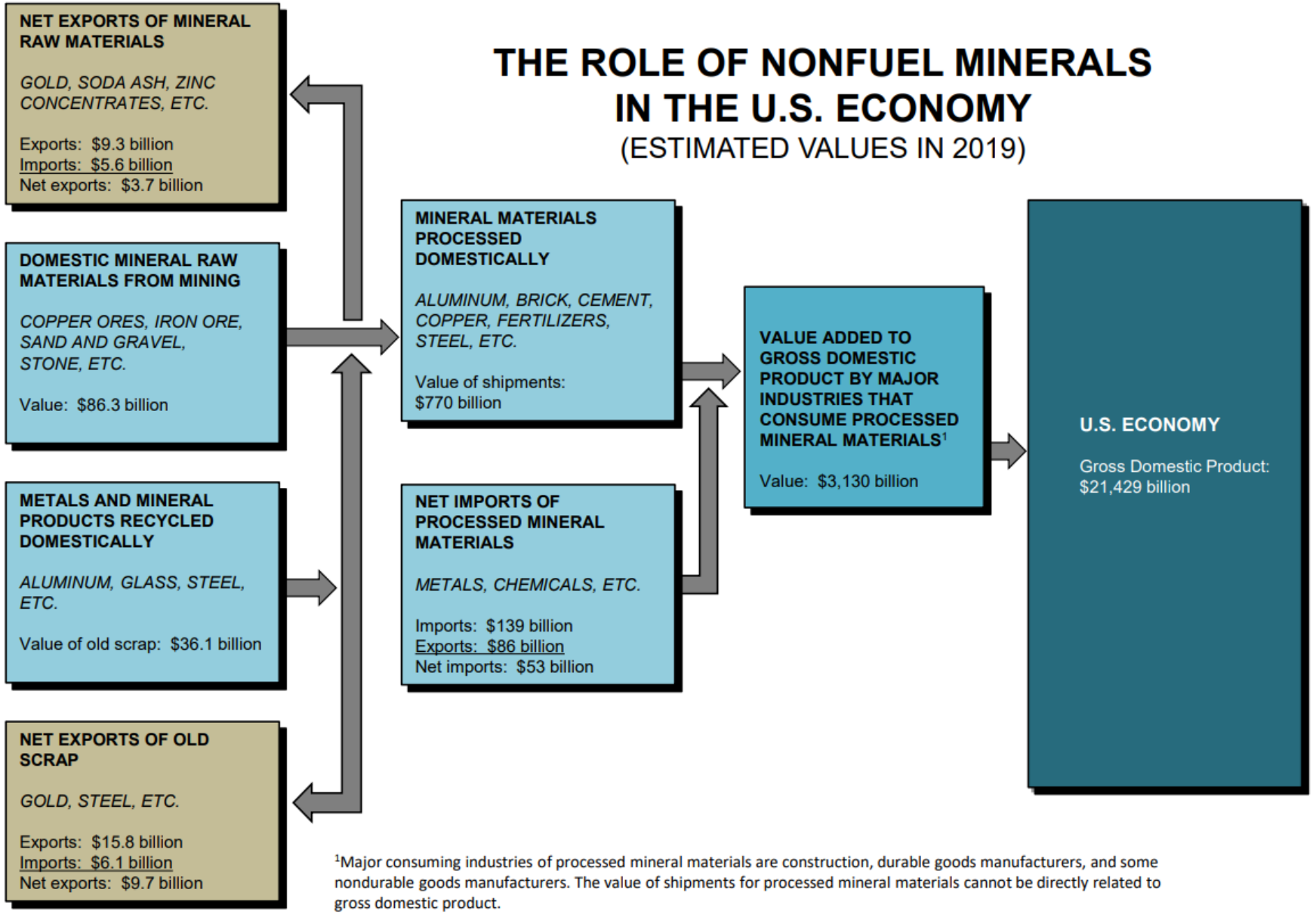
Mineral Commodity Summaries 2020



https://www.usgs.gov/centers/nmic/mineral-commodity-summaries

THE ROLE OF NONFUEL MINERALS IN THE U.S. ECONOMY

(ESTIMATED VALUES IN 2019)



[1]Major consuming industries of processed mineral materials are construction, durable goods manufacturers, and some nondurable goods manufacturers. The value of shipments for processed mineral materials cannot be directly related to gross domestic product.

Sources: U.S. Geological Survey and the U.S. Department of Commerce.

2019 U.S. NET IMPORT RELIANCE[1]

Commodity	Percent	Major import sources (2015–18)[2]
ARSENIC (all forms)	100	China, Morocco, Belgium
ASBESTOS	100	Brazil, Russia
CESIUM	100	Canada
FLUORSPAR	100	Mexico, Vietnam, South Africa, China
GALLIUM	100	China, United Kingdom, Germany, Ukraine
GRAPHITE (natural)	100	China, Mexico, Canada, India
INDIUM	100	China, Canada, Republic of Korea, Taiwan
MANGANESE	100	South Africa, Gabon, Australia, Georgia
MICA, sheet (natural)	100	China, Brazil, Belgium, Austria
NEPHELINE SYENITE	100	Canada
NIOBIUM (columbium)	100	Brazil, Canada, Russia, Germany
RARE EARTHS[3] (compounds and metal)	100	China, Estonia, Japan, Malaysia
RUBIDIUM	100	Canada
SCANDIUM	100	Europe, China, Japan, Russia
STRONTIUM	100	Mexico, Germany, China
TANTALUM	100	Rwanda, Brazil, Australia, Congo (Kinshasa)
YTTRIUM	100	China, Estonia, Republic of Korea, Japan
GEMSTONES	99	India, Israel, Belgium, South Africa
BISMUTH	96	China, Belgium, Mexico, Republic of Korea
TELLURIUM	>95	Canada, China, Germany
VANADIUM	94	Austria, Canada, Russia, Republic of Korea
TITANIUM MINERAL CONCENTRATES	93	South Africa, Australia, Canada, Mozambique
POTASH	91	Canada, Russia, Belarus, Israel
DIAMOND (industrial stones)	88	India, South Africa, Botswana, Australia
BARITE	87	China, India, Morocco, Mexico
ZINC (refined)	87	Canada, Mexico, Australia, Peru
TITANIUM (sponge)	86	Japan, Kazakhstan, Ukraine, China, Russia
ANTIMONY (metal and oxide)	84	China, Thailand, Belgium, India
RHENIUM	82	Chile, Germany, Kazakhstan, Canada
STONE (dimension)	81	China, Brazil, Italy, Turkey
COBALT	78	Norway, Japan, China, Canada
TIN (refined)	77	Indonesia, Malaysia, Peru, Bolivia
ABRASIVES, fused Al oxide (crude)	>75	China, Hong Kong, France, Canada
BAUXITE	>75	Jamaica, Brazil, Guinea, Guyana
CHROMIUM	72	South Africa, Kazakhstan, Russia
PEAT	70	Canada
SILVER	68	Mexico, Canada, Peru, Poland
GARNET (industrial)	64	Australia, India, South Africa, China
PLATINUM	64	South Africa, Germany, Italy, Russia
ALUMINA	54	Brazil, Australia, Jamaica, Canada
MAGNESIUM COMPOUNDS	52	China, Canada, Australia, Hong Kong
ABRASIVES, silicon carbide (crude)	>50	China, South Africa, Netherlands, Hong Kong
GERMANIUM	>50	China, Belgium, Germany, Russia
IODINE	>50	Chile, Japan
IRON OXIDE PIGMENTS (natural and synthetic)	>50	China, Germany, Brazil, Canada
TUNGSTEN	>50	China, Bolivia, Germany, Spain
DIAMOND (industrial dust, grit, and powder)	50	China, Ireland, Republic of Korea, Russia
CADMIUM	<50	China, Australia, Canada, Peru
MAGNESIUM METAL	<50	Israel, Canada, Mexico, United Kingdom
NICKEL	47	Canada, Norway, Australia, Finland
SILICON (metal and ferrosilicon)	41	Russia, Brazil, Canada
MICA, scrap and flake (natural)	37	Canada, China, India, Finland
COPPER (refined)	35	Chile, Canada, Mexico
PALLADIUM	32	South Africa, Russia, Germany, Italy
LEAD (refined)	30	Canada, Mexico, Republic of Korea, India
SALT	29	Chile, Canada, Mexico, Egypt
PERLITE	28	Greece, China, Mexico
LITHIUM	>25	Argentina, Chile, China
BROMINE	<25	Israel, Jordan, China
SELENIUM	<25	China, Philippines, Mexico, Germany
ALUMINUM	22	Canada, Russia, United Arab Emirates, China
IRON and STEEL	21	Canada, Brazil, Republic of Korea

[1]Not all mineral commodities covered in this publication are listed here. Those not shown include mineral commodities for which the United States is a net exporter (abrasives, metallic; boron; clays; diatomite; gold; helium; iron and steel scrap; iron ore; kyanite; molybdenum concentrates; sand and gravel, industrial; soda ash; titanium dioxide pigment; wollastonite; zeolites; and zirconium mineral concentrates) or less than 21% import reliant (beryllium; cement; feldspar; gypsum; iron and steel slag; lime;

MINING [DOT] COM

Rare earths processing facility opens in Colorado

MINING.com Editor | June 11, 2020 | 12:44 pm Intelligence USA Rare Earth

Colorado mountains. Image by David Mark from Pixabay.

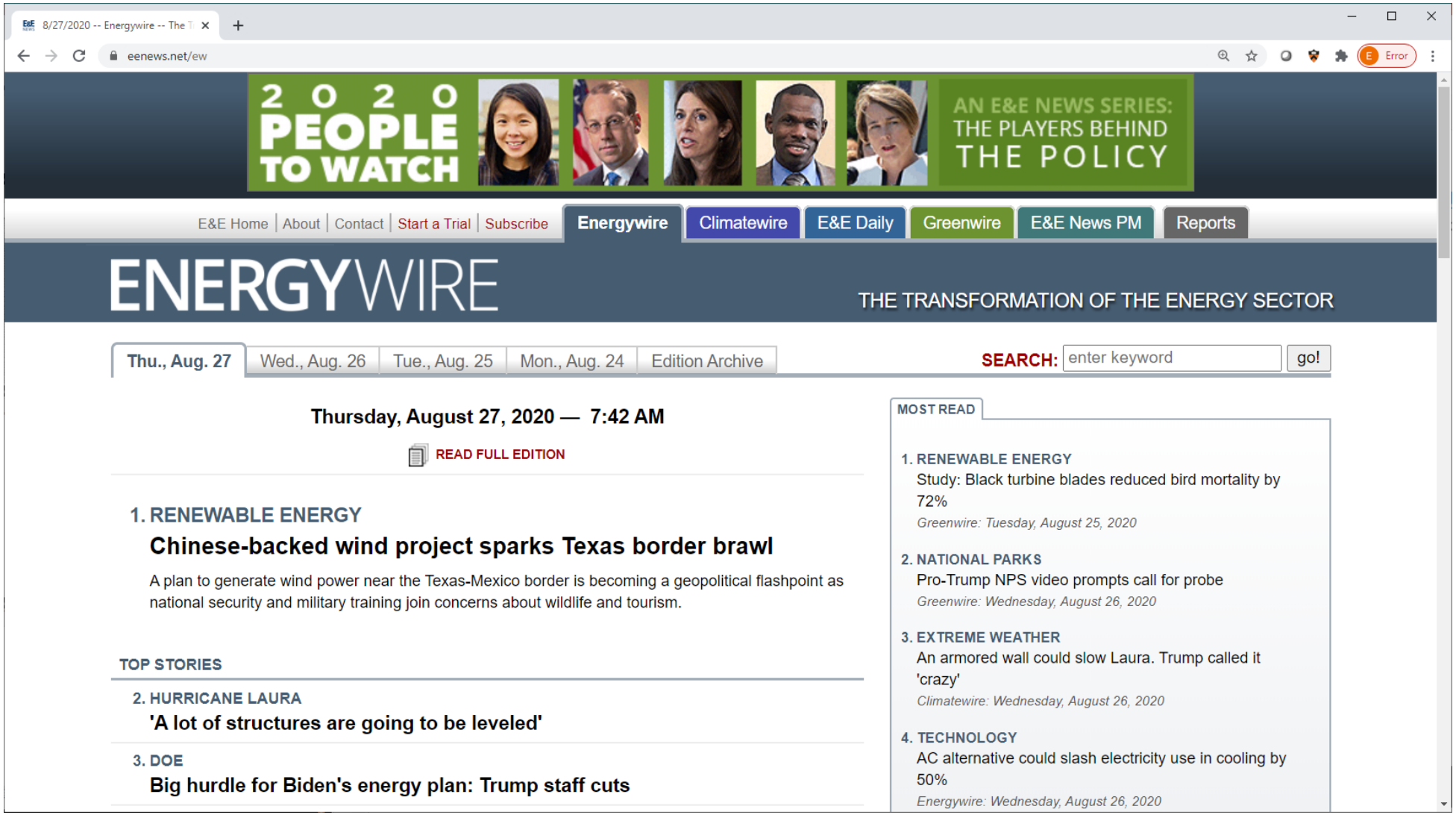
USA Rare Earth, the funding and development partner of the Round Top heavy rare earth project and Texas Mineral Resources announced Thursday that its rare earths pilot plant processing facility in Wheat Ridge, Colorado has received the required permits and officially opened.

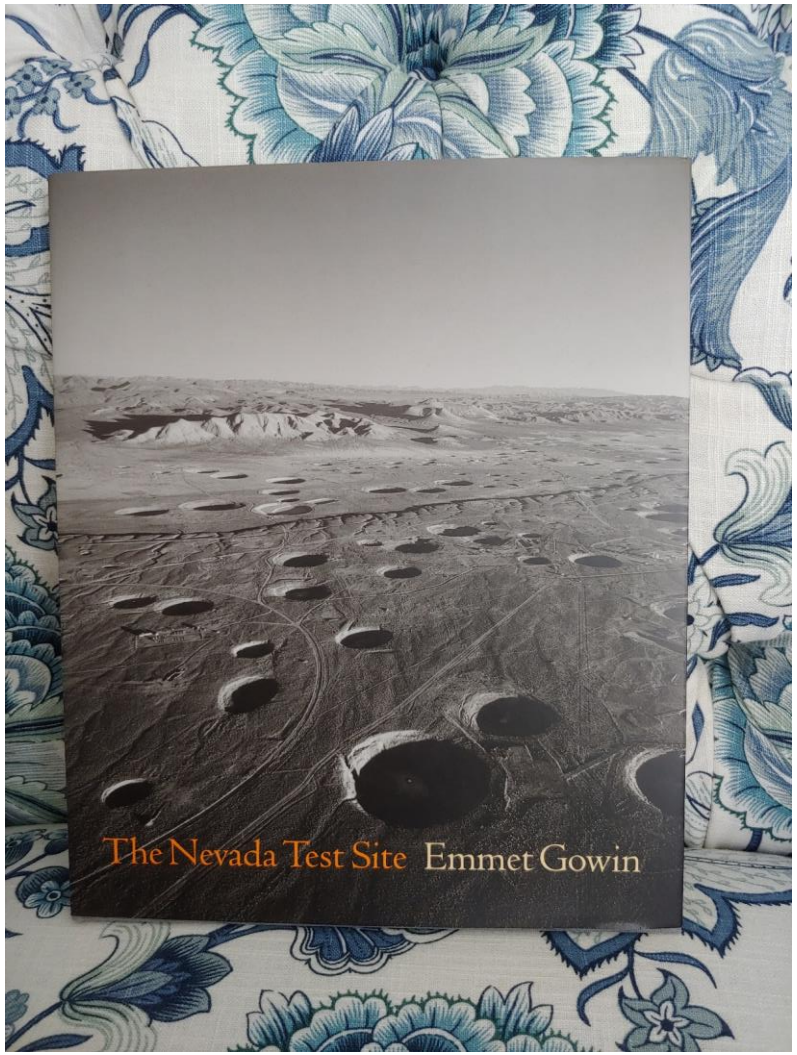
Once fully commissioned, the plant will be focused on group separation of

https://www.mining.com/rare-earths-processing-facility-opens-in-colorado/

https://www.eenews.net/ew

For Princeton University students/faculty/staff
https://www.eenews.net/get_access?site_link=1
(Should also work for USGS/Interior employees)





https://press.princeton.edu/books/hardcover/9780691196039/the-nevada-test-site

Estimation of groundwater flow through Yucca Flat based on a multiple-well aquifer test at well *ER-6–1–2 main*, Nevada National Security Site, southern Nevada Tracie R. Jackson, Keith J. Halford
2019, Scientific Investigations Report 2019-5038
The rate of groundwater flow past underground nuclear testing areas in Yucca Flat at the Nevada National Security Site, southern Nevada, was estimated using results from the ER-6-1-2 main multiple-well aquifer test (MWAT), done during February 5–July 23, 2004. Drawdowns in 13 observation wells were evaluated from pumping in well...

Documentation of single-well aquifer tests and integrated borehole analyses, Pahute Mesa and Vicinity, Nevada Rebecca J. Frus, Keith J. Halford
2018, Scientific Investigations Report 2018-5096
Single-well aquifer testing has been carried out at Pahute Mesa in southern Nevada since 1962. These tests include single-well pumping and slug tests to estimate geologic formation hydraulic properties. Initially, aquifer tests focused on identifying low-permeability rocks suitable for testing large-yield nuclear devices, whereas later hydrologic investigations focused on potential...

Conceptual framework and trend analysis of water-level responses to hydrologic stresses, Pahute Mesa–Oasis Valley groundwater basin, Nevada, 1966-2016 Tracie R. Jackson, Joseph M. Fenelon
2018, Scientific Investigations Report 2018-5064
This report identifies water-level trends in wells and provides a conceptual framework that explains the hydrologic stresses and factors causing the trends in the Pahute Mesa–Oasis Valley (PMOV) groundwater basin, southern Nevada. Water levels in 79 wells were analyzed for trends between 1966 and 2016. The magnitude and duration of...

Hydraulic characterization of volcanic rocks in Pahute Mesa using an integrated analysis of 16 multiple-well aquifer tests, Nevada National Security Site, 2009–14 C. Amanda Garcia, Tracie R. Jackson, Keith J. Halford, Donald S. Sweetkind, Nancy A. Damar, Joseph M. Fenelon, Steven R. Reiner
2017, Scientific Investigations Report 2016-5151
An improved understanding of groundwater flow and radionuclide migration downgradient from underground nuclear-testing areas at Pahute Mesa, Nevada National Security Site, requires accurate subsurface hydraulic characterization. To improve conceptual models of flow and transport in the complex hydrogeologic system beneath Pahute Mesa, the U.S. Geological Survey characterized bulk hydraulic properties...

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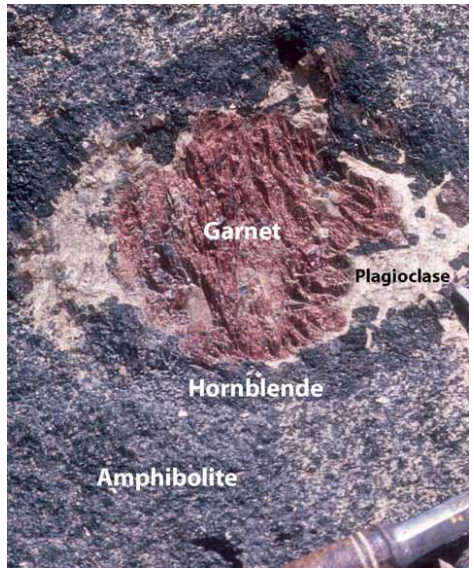
Thank you! Questions?



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