### Geochemistry of Energy Fuels

**Overview**

Project members seek to optimize the efficiency of energy fuel use by understanding the geology, organic and inorganic geochemistry, and microbiology of coal, biomaterials, and related processes that control the accumulation and preservation of fuels, fuel production quality, and the composition of waste products.

**Methods**

Collaboration internally within, and externally with, industries and academic institutions is helping to establish the USGS Science Strategy for the Geochemistry of Energy Fuels Project.

Forecasting and modeling the geochemistry and geology of energy fuels and effects of energy use will benefit USGS assessments and directly relate to the Secretary’s Priority #2 to sustainably develop our energy and natural resources, and the USGS Science Strategy objective Energy and Minerals for America’s Future.

The Geochemistry of Energy Fuels Project supports QMS-approved standard operating procedures for project-operated laboratories for organic geochemistry, trace elements, and radiometric analyses of samples from the United States.

**Task 1: Geochemistry and Physical Controls on Oil and Gas Production**

**Objective:** To map modern and historical oil and gas-producing areas in the United States, and analyze samples of modern coal for chemical, rheological, and petrographic characteristics.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Biogeochemical Database**

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<th>Task</th>
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<td>1</td>
<td>Geochemistry and Physical Controls on Oil and Gas Production</td>
<td>[Ruppert, Barnhart, Rivera, Ruppert, Smith]</td>
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**Task 2: Trace Elements in Energy Fuels (Koehler, A. Scott, C. Scott, Objective:** Reducing mercury and potentially harmful trace elements in U.S. coals. Predict trace elements in major energy resources and coal.

**Methods:** Laser ablation-ICP-MS method for detailed elemental analysis of coals. Use transport equations and increased use of statistics to control sulfur emissions.

**Why:** Understand and predict elements regulated under EPA Mercury and Air Toxics Standards.

**Task 3: Geochemistry of Energy Fuels (Ruppert, Jones, Karacan, Objective:** Investigating the processes that impact fuel quality, quantity, and availability; fluid and steam storage in energy resources; and the use of fluid fuel to inform assessments and land management.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Why:** Map areas in the Permian Basin for subsurface environment sampling.

**Task 4: Maps of Energy Occurrences (Tippin, Park, Ruppert) Objective:** To develop and test historical coal mining occurrences in the United States, and analyze samples of modern coal for chemical, rheological, and petrographic characteristics.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Why:** Mapping of historical and modern coal deposits in the United States, development of a comprehensive database for modern coal sampling.

**Task 5: Methanogenesis (Barnhart, Orem, Ruppert, Varonka) Objective:** Understand biogeochemical processes in hydrocarbon reservoirs to develop methodologies for enhancing microbial natural gas production.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Why:** Understand the distribution of REE in coal and coal ash.

**Task 6: Byproducts of Energy Fuels (Koehler, A. Scott, C. Scott) Objective:** Determine the occurrence and distribution of rare earth elements in coal and coal ash, and the potential for their extraction.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Why:** Understand the distribution of REE in coal and coal ash, and the potential for their extraction.

**Task 7: Methanogenesis (Barnhart, Orem, Ruppert, Varonka) Objective:** Understand biogeochemical processes in hydrocarbon reservoirs to develop methodologies for enhancing microbial natural gas production.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Why:** Understand the distribution of REE in coal and coal ash.

**Task 8: Byproducts of Energy Fuels (Koehler, A. Scott, C. Scott) Objective:** Determine the occurrence and distribution of rare earth elements in coal and coal ash, and the potential for their extraction.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Why:** Understand the distribution of REE in coal and coal ash, and the potential for their extraction.

**Task 9: Naturally Occurring Radioactive Materials (Galadgos, A. Scott) Objective:** Quantity, activity, and potential uses of naturally occurring radioactive materials and activity in national and international trade.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Why:** The NORM library is being prepared to measure uranium-235 and thorium-232 in coal.

**Task 10: Project Data Management (Jones, Trippi) Objective:** Manage data management plans and prepare data for distribution.

**Methods:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Why:** The data management plan is being prepared to distribute data to the public.

**Non-Research Tasks**

- **Trademarks and CVC database:** Store high microstructure coal in a central location.
- **Illustrations:** Visualize the processes that impact fuel quality, quantity, and availability.
- **Technical Writing:** Prepare technical reports and publications.
- **Project Tracking:** Use biogeochemical database to classify such gases and determine if they are biogenic or thermogenic.

**Publication Number:** US2017/0321228

**Project Publications available upon request**