

Geochemical Tracers: Rare Earth Elements

Department of Geology

Designing and Disseminating Better Health and Nutrition Practices

Building and Protecting Global Food Systems

Enhancing Well-Being

Enabling Impactful Technologies

DECODING NATURE

Kansas State University Research, Scholarly, and Creative Activities and Discovery Strengths

Overview

Responsibly acquiring and transporting oil and natural gas to fuel our nation are fundamental to maintaining economic growth and national security. Studying the biogeochemistry of hydrocarbon reservoirs helps us to better evaluate and extract



these precious resources. Conventional methods of fingerprinting crude oils use “molecular fossils,” or biomarkers, which are the remnants of compounds produced by living organisms. This practice overlooks the interactions of organic components with an array of inorganic substances in the environment that affect oil’s composition.

K-State researchers are using rare earth elements as geochemical tracers for the transformation of organic matter into petroleum. The work focuses on **Woodford shale from north central Oklahoma and Chattanooga shale from south central Kansas**. The project compares rare earth element distributions in the shale to that in oils from the same formation.

Impact

Studying unconventional shale reserves helps **decode nature** by enhancing understanding of the process that transforms organic matter into petroleum. Organic matter in shales and crude oils can have distinctive rare earth element characteristics that can be



inherited from the original organic source material. Rare earth elements are one record of the interaction between organic materials, inorganic mineral matrices, and waters during hydrocarbon generation.

K-State researchers and their students are helping to **establish rare earth element geochemistry as a tool to provide new sources of information** on the origin, migration history, accumulation, and alteration of the crude oil in a reservoir.

This **impactful technology** could help identify new oil reserves and extraction methods.

About Kansas State University

Kansas State University was established in 1863 as the nation’s first operational land-grant university. We’ve held firmly to the land-grant philosophy of serving our world through discovery and innovation. Today, the university is on its way to becoming a Top 50 public research university by 2025 through supporting, encouraging, and growing our research efforts.

Important points in time for K-State Research



1887 Agricultural Experiment Station built to analyze horticultural and entomological subjects



1967 Alf Landon Lecture Series on Public Issues established



2015 National Bio and Agro-Defense Facility groundbreaking

1863 Kansas State University founded



1944 First U.S. patent application filed for a plastic container for frozen foods



1997 Hale Library expansion completed



RECENT SUCCESSES: **\$183 million** in FY2013 research expenditures **4 USAID** Feed the Future Innovation Labs
14 patents granted in 2014 **1,000** research grants in FY2014
\$473.9 million in FY2014 endowment **4,493** graduate students