Please join the Pittsburgh Association of Petroleum Geologists as we return to in-person lunch meetings!

This month’s talk is titled “The Upper Devonian Dunkirk Shale of Western New York State: A Natural Laboratory for Understanding the Processes that Enrich Critical Minerals in Shale Dominated Strata.” This talk is authored by Ashley S. B. Douds, David R. Blood, and Scott D. McCallum; the presentation of this talk will be given by Mr. Blood and Mr. McCallum.

**Date:** Thursday, February 17th, 2022  
**Place:** Cefalo’s Restaurant, 428 Washington Ave. Carnegie, PA  
**Time:** 11:15 Social Time, 11:45 Lunch Buffet, 12:00 Speaker  
**Cost:** FREE to PAPG members, $40 for non-members, $10 for non-member virtual attendees

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Abstract

The United States has seen a burgeoning demand for energy derived from renewable resources. Vehicle manufactures are producing electric vehicles, countries and corporations have pledged to achieve net zero carbon emissions, and an increasing amount of electricity is generated from wind and solar. Integral to these technologies is the use of critical minerals (CMs) including Rare Earth Elements (REEs). Indeed, the demand for REEs is expected to grow by 5% - 9% per year over the next 25 years. Such growth in demand has led to a renewed focus on CMs exploration and extraction technologies. Moreover, as occurred in the oil and gas industry with the “shale boom”, rising commodity prices and a lack of domestic high yield deposits may force companies to explore “unconventional” sources of CMs, for example those contained within organic-rich mudstone and associated strata.

Organic-rich mudstones provide a classic example of a high-volume/low-concentration deposit: many CMs of interest are semi-enriched in these deposits, yet they are distributed over vast volumes of rock. However, specific depositional and diagenetic processes, including the formation of erosion-induced pyrite-rich lags, oxygen burndown, and hydrothermal fluid flow may concentrate metals into thinner stratigraphic horizons, or along fluid-flow paths.

Examples of two such processes, erosion-induced pyrite-rich lags, and oxygen burndown are found in Upper Devonian transitional beds of the upper Hanover Shale and basal Dunkirk Shale. These units are well exposed along the Lake Erie shoreline and numerous creeks and ravines across western New York State. Here, the interval between the Upper Kellwasser Bed near the top of the Hanover Shale and the base of the continuous black shale of the Dunkirk Shale expands from approximately 12 cm at Pt. Gratiot in Dunkirk, NY to over 7 meters along Beaver Meadow Creek at Java Village, NY. Grey, bioturbated mudstone dominates the section, interbedded with an eastward-increasing number of thin black shale beds at the centimeter to decimeter scale thickness. Basal contacts are often sharp, scoured, and pyrite-filled while most upper contacts are sharp, and planar to undulatory.

Each exposure was measured, and hand samples, rotary side-wall cores, and vertical continuous cores collected. Hand samples and sidewall cores were disaggregated and powdered. Vertical cores were cut into 1 cm intervals, disaggregated and powdered. Preliminary analysis by both portable and benchtop X-Ray Fluorescence indicate that critical minerals Co, Cu, Ni, and Zn are significantly enriched over background black and grey shale in thin black shale containing pyrite lags. Thin black shale with no pyrite, but sharp upper contacts with overlying strata are moderately enriched in these metals.

This talk will discuss the stratigraphy of the Hanover-Dunkirk transition, the depositional and diagenetic processes occurring within the interval, and the statistics used to understand metal enrichment and occurrence.
Biographies

Ashley Douds is an accomplished Petroleum Geologist with over 20 years experience in US conventional and unconventional plays in the Appalachian, Permian, and Rocky Mountain Basins, South Texas, GOM, as well as international offshore plays in Brazil and Nigeria. Ashley has worked for supermajors (ExxonMobil), government (DOE’s National Energy Technology Laboratory), and small independent operators (EQT Production and Parsley Energy) giving her a diverse background in both technical and managerial assignments. She received her Master of Science in Geology and Bachelor of Science in Geology from West Virginia University.

Ashley formed Core2Core Geologic, a WOSB, in 2020 in order to apply her varied technical expertise to the hunt for new and existing forms of energy. She co-founded Wildlands Research LLC to geologically quantify and predict critical mineral enrichment in fine-grained sediments. Ashley’s background in integrating various types of data allows for a comprehensive understanding of the system under evaluation. Her skills include basin and field scale sequence stratigraphy, geochemistry, geophysics, petrophysics as well as evaluating and assessing new technologies. Ashley is also the Chair of the Critical Minerals Committee for AAPG’s Energy Mineral Division.

Randy Blood is a geologist and petrophysicist based in the greater Pittsburgh area working on various aspects of Paleozoic strata in the Appalachian Basin. He is the founder of DRB Geological Consulting and a co-founder of Wildlands Research. He has worked unconventional organic-rich mudstone and tight gas sand reservoirs for over 15 years. Much of his research focuses on building gas-in-place models, understanding hydrocarbon storage mechanisms, and building holistic geological models to explain the accumulation and distribution of reservoir facies. Most recently he has begun work creating resource assessments of critical minerals in various deposits in North America. Randy leverages his subsurface experience combined with extensive fieldwork to better understand depositional and diagenetic processes which make concentrate critical minerals in sedimentary strata. He has delivered over 50 talks and posters, published full-length journal articles in a number of special publications, lead multiple core workshops, and a number of field trips focusing on the geology of organic-rich mudstones.

Scott McCallum has over 15 years of experience working as a geologist, petrophysicist, and data scientist in the oil and gas industry. He spent 3 years working in a research position at Oak Ridge National Lab with a focus on CO₂ and CH₄ hydrates as well as CO₂ sequestration. He holds a B.S. in Geology from Indiana University of Pennsylvania, an M.S. in Geology from Southern Illinois University, and is currently working towards an M.S. in Computational Mathematics at Duquesne University.

Scott founded McCallum Petrophysics and Data Analytics (MPDA) in 2019 where he has split his time working on applied mathematics problems related to high performance computing and statistical and petrophysical projects within the oil and gas industry. He brings his passions for data science and geology to Wildlands Research where he can work on finding creative solutions within the realm of energy transition.
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