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Turning On the Tap: Unlocking Untapped Critical Minerals in Sedimentary Basins

ELLEN GRACE POLITES[1], YUNTIAN TENG[1], KEJU YAN[1], KEERTHANA KRISHNAN[1], CHARLES HEATH STANFIELD[1], QUIN MILLER[1], NABAJIT LAHIRI[1], RADHA KRISHAN MOTKURI[1], CHRISTOPHER BAGWELL[1], SON THAI DANG[2] AND HERBERT TODD SCHAEF[1]

[1]Pacific Northwest National Laboratory
[2]University of Oklahoma

Sedimentary basins with oil and gas resources may hold the key to future critical mineral production as the world continues to mine dwindling high-grade deposits. The plethora of geochemical data as a byproduct of generations of fossil energy production indicates vast low-grade metal resources like Ti, V, Cr, Mn, U, Y, Li, etc. that are accessible through existing well infrastructure. We estimate that from just 13 unconventional hydrocarbon reservoirs in the United States, the critical resource potential of 5% of the reservoir volumes with a 1% recovery rate would result in 547 million metric tons of critical minerals (as defined by the United States Geological Survey). These large-volume, deep, low-grade resources require an in-situ mining approach rather than pit or tunnel mining. We propose the injection of engineered fluids into existing unconventional oil and gas wells to react and recover critical minerals from reservoirs. Here, we present our findings from a suite of experiments conducted to design and optimize engineered fluids for critical mineral recovery from unconventional reservoir rocks. Our approach allows us to selectively react and recover metals from targeted minerals to aid in downstream separations. These experimental results demonstrate a promising pathway for transforming already accessible hydrocarbon reservoirs into a new source of untapped critical minerals.