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Interfacial, Mineralogical and Microstructural Evolutions in Kerogen-Rich Shale from the Marcellus Formation at Pennsylvania and Shale-like Rocks from the Negev Desert under Thermal Treatments

CODY COCKREHAM[1,2], XIANGHUI ZHANG[1], ANDREW C. STRZELECKI[1], MIU LUN LAU[3], MIN LONG[3], CHRIS J. BENMORE[4], XIAOFENG GUO[1], OFRA KLEIN-BENDAVID[5], PHILIP H STAUFFER[2], GILLES A BUSSOD[2], HONGWU XU[2], HAKIM BOUKHALFA[2] AND **DI WU**[1]

[1]Washington State University

[2]Los Alamos National Laboratory

[3]Boise State University

[4]Argonne National Laboratory

[5]Ben-Gurion University of the Negev

Presenting Author: d.wu@wsu.edu

Shale rocks have complex geochemical and mineralogical properties tightly related to the interplays among water molecules, organic guest species and inorganic mineral matrices that are sensitive to thermal treatments. Here, we present our recent studies on the interfacial, mineralogical and microstructural evolutions of the kerogen-rich shale from Marcellus Formation, Pennsylvania, United States, and the shale-like rocks from Negev Desert, Israel. Specifically, we coupled a set of *in situ* and *ex situ* temperature-programmed characterization methods to elucidate the thermal dehydration pathways, decomposition mechanisms of both inorganic and organic species, and subsequent crack/fracture formation, and/or grain growth for the shale matrix. Major techniques applied include *in situ* X-ray diffraction (XRD), *in situ* diffuse reflectance infrared Fourier transform spectroscopy (DRIFTS), integrated thermogravimetry, differential scanning calorimetry, and mass spectrometry (TG-DSC-MS), and transmission electron microscope (TEM). These two studies lead to new geochemical insights into the thermal behaviors of free and confined water, decomposition of the organic matters, dehydroxylation of clays, decarbonation of carbonates, and kinetic parameters derived from model-independent methods to optimize the pyrolysis process of shale for hydrocarbon recovery with higher efficiency. Further, the thermal dehydration and dehydroxylation processes, and microstructural characteristics of the shale samples may enhance our understanding of the fluid-fluid and fluid-mineral interfacial geochemistry, salt deposition, and channel/fracture formation under geothermal environments with spacial confinement.

[1] C. B. Cockreham, X. Zhang, M. L. Lau, M. Long, X. Guo, H. Xu, D. Wu, *ACS Earth Space Chem*. (2020), 4 (12), 2461-2469.

[2] C. B. Cockreham, X. Zhang, A. C. Strzelecki, C. Benmore, X. Guo, O. Klein-BenDavid, P. H. Stauffer, G. Y. A. Bussod, H. Xu, D. Wu, H. Boukhalfa, (2022), *unpublished.*