

Tongwei Zhang

Professional Summary

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Professional Preparation

Academic Background

Postdoctoral Senior Research Fellow Chemistry, California Institute of Technology, January 2007

Ph.D. Isotope Geochemistry, Chinese Academy of Sciences, 1999

M.S. Petroleum Geochemistry, Chinese Academy of Sciences, 1994

B.S. Petroleum and Natural Gas Geology, Northwest University, 1986

Professional Appointments

Senior Research Scientist, Bureau of Economic Geology, The University of Texas at Austin (September 2020-Present)

As PI or Co-PI for several research projects financially supported by ExxonMobil, Shell, ConocoPhillips, Yanchang Petroleum Group and also as one of key researchers of MSRL (Mudrock System Research Laboratories), Dr. Zhang's research focus is on shale gas and tight oil geochemical characterization. Recently, Dr. Zhang has been developing new research program of Oil Geochemistry in Unconventional Reservoirs at BEG, including Eagle Ford, Austin Chalk, Wolfcamp and Bond Springs plays. Dr. Zhang is developing a new project of Deep Shale Gas Sweet-Spot Evolution and AI Technology for Gas Production Prediction.

Research Scientist/Organic Geochemist, Bureau of Economic Geology, The University of Texas at Austin (August 2015-Present)

As PI or Co-PI for several research projects financially supported by ExxonMobil, Shell, ConocoPhillips, and the Yanchang Petroleum Group, and as one of the key researchers of the Bureau's Mudrock Systems Research Laboratory, my research focus is on shale gas and tight oil geochemical characterization. I am also the director of the Organic Geochemistry Lab at the Bureau of Economic Geology.

Present Position: Research Associate/Organic Chemist, Bureau of Economic Geology, The University of Texas at Austin (April 2008 - Present). As PI or Co-PI for several research projects financially supported by ExxonMobil, Shell, ConocoPhillips, and Yanchang Petroleum Group, and also as a key researchers in the MSRL (Mudrock System Research Laboratories), my research focus is on shale gas and tight oil geochemical characterization and integration with geological elements (lithology and geological facies) and pore characterization to evaluate gas and oil storage, petroleum generation and migration, and oil saturation and fluid properties. I also set up a new gas geochemistry laboratory in the Bureau, utilizing startup funds provided by the Jackson School of Geosciences..

Laboratory Manager and Research Geochemist, Power, Environmental & Energy Research Center (PEER center)
Chemistry and Chemical Engineering Division, California Institute of Technology, Pasadena, CA

(March 2007 - April 2008). Responsible for geological interpretation of petroleum and natural gas origin and accumulation in sedimentary basins worldwide; research-project, annual-report, final-report, and proposal writing; and effective management of PEER chemistry laboratories.

Postdoctoral Scholar, Chemistry and Chemical Engineering Division, California Institute of Technology, Pasadena, CA

Chemistry and Chemical Engineering Division, California Institute of Technology, Pasadena, CA (September 2001 - February 2007). Focus: integrated geological and geochemical tools for petroleum reserves assessment, geochemical methods for petroleum and natural gas exploration, CO₂ origin and accumulation in sedimentary basins, H₂S and CO₂ risk prediction from TSR prior to drilling.

Professor of Geochemistry, State Key Laboratory of Gas Geochemistry, Lanzhou Institute of Geology, Chinese Academy of Sciences (CAS) (November 1998 - August 2001). As PI or Co-PI, focused on integrating geological observations and geochemistry of natural gas and sources; established a method of composition analysis for oil/gas inclusions trapped in reservoirs by means of ultraviolet laser ablation; reconstructed oil- or gas-filling history in reservoirs and identified oil/gas-filling stages of the trap by combining fluid-inclusion microthermometry in the Sichuan sedimentary basin, China; conducted field and laboratory measurement of soil gas (including free phase and absorbed phase), soil secondary carbonate, and mercury; established relationship between enrichment of soil secondary carbonate and microseepage hydrocarbon from deep reservoirs; proposed new mechanism of mineralization in soils resulting from hydrocarbon microseepage; built classification of natural gas origins in a depression on the basis of natural gas geochemistry; evaluated a prospective target for unconventional natural gas accumulation within the depression; conducted N₂, CO₂, Hg gas geochemistry and He and Ar noble gas geochemistry in main gas fields of China; discovered close relationship between helium and argon isotopes and fault activity and volcanic activity; developed geochemical criteria to identify mantle-derived CO₂.

Visiting Scientist, Institute of Petroleum and Organic Geochemistry of Juelich Research Center, Germany (January 1999 - July 1999). Quantitative investigation of cap-rock sealing properties of oil and gas for providing important parameters of basin modeling; conduction of gas migration in diffusion to evaluate extent of carbon-isotope fractionation of methane on experimental and geological time scales; establishment of mathematical procedure by which the extent of isotopic fractionation can be estimated on the geological time scale.

Dissertations

Origins of the natural gases in Huanghua depression, China and carbon isotope fractionation of methane during gas migration, 1999

Areas of Expertise

Areas of Expertise

Expertise in nonhydrocarbon gases (CO₂, H₂S, and N₂) risk prediction prior to drilling, especially H₂S risk prediction from thermochemical sulfate reduction

Expertise in the application of noble gas geochemistry and fluid inclusions to the reconstruction of oil- and gas-filling history in reservoirs

Extensive expertise (15 years) in geological interpretation of petroleum and natural gas origins and accumulation in sedimentary basins by integrating petroleum and natural gas geochemistry, geology, and basin evolution

Hands-on knowledge and experience with high-temperature and high-pressure hydrous pyrolysis and the kinetics of petroleum and gas generation

Skills in laboratory water-chemistry measurement and formation-water chemistry prediction by using thermodynamic model

Strong skills in gas and organic compound quantification and isotopic composition analysis with GC, GC/C/MS (MAT252, MAT251); also experienced with FT-IR/IR, UV, and VG-5400 isotope spectrometer

Awards

Awards and Honorary Societies

2015 Wallace E. Pratt Memorial Award

IAGC Hitchon Award (for Applied Geochemistry 27 [12] paper "Experimental investigation of main controls to methane adsorption in clay-rich rocks"), 2016

Scholarship, Chinese Academy of Science, 1999

Fansuquan Fellowship, 1996

Fellowship, Chinese Academy of Science, 1994

Second Award, Science and Technology Advancement, Chinese Academy of Science, 1994

Fellowship, Graduate School, Chinese Academy of Science, 1993

Service

Proposal Review Panels Participation

Acta Sedimentologica Sinica (China) (Articles), 2013

Chinese Science Natural Foundation (Proposals), 2013

Marine and Petroleum Geology, Organic Geochemistry, Journal of Petroleum Science & Engineering, Energy and Fuels, Geochemica et Cosmochemica Acta, AAPG Bulletin, Geology, Journal of Asian Earth Sciences, Basin Research (Articles), 2013

Presentations

Invited Presentations

Importance of lithofacies cycles on oil expulsion and pore development in organic-rich mudrocks: presented to AEC 2020, presented at Tackle the Issues Session: Success with Deep, Hot Conditions, online Zoom meeting, September 29-October 1, 2020.

Chemical and Carbon Isotopic Gas Compositions from The Wolfcamp in Permian Basin and Their Geological Significance: presented to Goldschmidt Virtual 2020, presented at Unconventional Shale Reservoirs (08o), Virtual conference meeting, June 21-26, 2020.

Facies, Depositional Environments, Chemostratigraphy, and Reservoir Quality of the Middle Devonian Marcellus Formation, Appalachian Basin, Northeastern Pennsylvania: presented to Houston Geological Society, presented at Houston Geological Society Northsiders' Luncheon, Houston, Tex., September 17, 2019.

How Depositional Environment, Diagenesis, and Thermal Maturity Affect the Evolution and Significance of Organic and Mineral Pore Systems in Unconventional Oil and Gas Reservoirs: Current Understanding and Future Research: presented at AAPG Hedberg Conference, Houston, Texas, March 4-May 6, 2019.

Presentations

Organic geochemical characterization of Upper Wolfcamp and 3rd Bone Spring Formation, Delaware Basin: presented to AAPG, presented at International Meeting for Applied Geoscience & Energy (IMAGE), oral presentation, September 27-29, 2021.

Chemical and Carbon Isotopic Gas Compositions from The Wolfcamp in Midland Basin and Their Significance as Geochemical Tracers for Well Completion: presented to AEC 2020, presented at Theme 5: Permian Basin Unconventional Plays In Memory of Stephen C. Ruppel

II, online Zoom meeting, September 29-October 1, 2020.

Pore Size Distributions and Oil Storage Mechanism in The Wolfcamp Mudstone, Midland Basin: presented to AEC 2020, presented at Theme 5: Permian Basin Unconventional Plays In Memory of Stephen C. Ruppel II, online Zoom meeting, September 29-October 1, 2020.

Gas geochemistry and gas adsorption and preservation in shale gas system: invited lecture presented to Unconventional Energy Resources class of Jackson School of Geosciences, The University of Texas at Austin, Austin, Texas, November 4, 2013.

Liquid hydrocarbon characterization and pore characterization of Eagle Ford shales by using N₂ adsorption and desorption isotherms: presented at Shell/UT Unconventional Research Project Meeting, oral presentation of research progress of Task 7, Austin, Texas, October 22, 2013.

Effect of organic matter properties, clay mineral type and thermal maturity on gas adsorption in organic-rich systems: presented at Unconventional Resources Technology Conference (URTeC), oral talk in Theme 13: Source Rock Characterization, Denver, Colorado, August 12-14 2013.

Geochemical controls on gas adsorption and preservation in organic-rich shale systems: presented at American Association of Petroleum Geologists, 2013 Annual Convention, poster presentation in Theme 1: Unconventionals II (EMD/AAPG), Pittsburgh, Pennsylvania, May 2013.

Integrated hydrocarbon geochemical characterization and pore size distribution analysis for Bakken Shales, Williston Basin, USA: presented at American Association of Petroleum Geologists, 2013 Annual Convention, Oral talk in Theme 1: The Bakken Petroleum System (AAPG/EMD), Pittsburgh, Pennsylvania, May 2013.

Hydrocarbon geochemistry and pore characterization of the Bakken Formation and implications for oil migration and oil saturation: oral presentation at 2013 Meeting of Mudrock Systems Research Laboratory, Austin, Texas, March 2013.

Tight oil resources in United States: invited lecture presented to Petrochina Research Center, Beijing, China, December 2012.

Gas adsorption, gas geochemistry and gas generation kinetics: invited lecture presented to Unconventional Energy Resources class of Jackson School of Geosciences, The University of Texas at Austin, Austin, Texas, November 2012.

Main controls on gas adsorption and canister desorption in organic-rich shale system: presented at annual project meeting with ConocoPhillips, Houston, Texas, September 2012.

Shale gas geochemistry and its application to gas preservation and recovery: invited lecture presented to ExxonMobil Exploration Company, Houston, Texas, June 2012.

Geochemical controls on gas adsorption and preservation in organic-rich shale systems: invited lecture presented to Department of Geological Sciences and Engineering, Missouri University of Science and Technology, Rolla, Missouri, March 19, 2012.

Shale gas geochemistry and kinetics of mixed gas adsorption: presented at annual EM/BEG meeting, Austin, Texas, February 14, 2012.

Shale gas development in US and main controls on shale gas chemistry: invited lecture presented to Aachen University, Aachen, Germany, September 22, 2011.

Main controls on gas chemistry in shale gas system: invited oral presentation in Session IB: shale gases and tight gases of AAPG Hedberg Research Conference on Natural Gas Geochemistry: Recent developments, Applications, and Technologies, Beijing, China, May 9-12, 2011.

Experimental gas extraction by rock crushing: Evidence for preservation of methane in core samples from the mudstones of the Eagle Ford Formation: invited oral presentation in Theme 5 (Active and Emerging Plays-Haynesville and Eagle Ford) of AAPG 2011 Annual Convention &

Exhibition, Houston, Texas, April 10-13, 2011.

Geochemical identification of free gas and adsorbed gas and its impact to shale gas production. Presented at EM/BEG Quarterly meeting, Austin, April, 2011: April 2011.

Gas geochemistry and its application in shale gas exploration and production: invited talk to Petrochina Lanfang Institute, Lanfang, China, October 17, 2010.

Gas geochemistry and shale gas reservoir characterization: invited lecture for shale gas workshop, Chengdu, Sichuan, China, October 13-14, 2010.

Gas adsorption and gas storage mechanism in shale: invited talk for 2009 AAPG Unconventional Gas Research Committee Meeting, Denver, Colorado, June 9, 2009.

Geochemical kinetics model for gas generation from sources and hydrocarbon oxidation by TSR: invited lecture to Jackson School of Geosciences, Austin, Texas, April 2009.

Origins of natural gases (CH₄, CO₂, H₂S) and geochemical predictive model: invited talk to ExxonMobil Upstream Company, Houston, Texas, December 11, 2008.

Gas geochemistry in shale gas exploration and production: invited lecture for MRSL/BEG shale gas workshop, Houston, Texas, November 20, 2008.

New experiments of hydrogen sulfide initiation: presented to Thermochemical Sulfate Reduction (TSR), at 2007 JIP/Caltech meeting, Pasadena, California, February 2007.

Natural gas geochemistry in the Tarim Basin, China, and its application to gas filling history: Invited lecture presented at AAPG/SEPM's Petroleum Geochemistry Case Studies--Opportunities for Reducing Risk, 2007.

Natural gas geochemistry in Tarim Basin, China, and its indication of gas filling history: presented at the University of Southern California, Los Angeles, California, September 2006.

Natural gas geochemistry in the Tarim Basin, China, and its indication to gas filling history: Invited lecture presented to Environmental and Civil Engineering Department, University of Southern California, Los Angeles, California, September 2006.

Labile organosulfur species formation in Thermochemical Sulfate Reduction (TSR): presented at JIP/Caltech meeting, Pasadena, California, January 2006.

Effect of TSR on hydrocarbon cracking: presented to CNPC (Chinese National Petroleum Cooperation) visitors, Caltech, Pasadena, California, November 2005.

CO₂ origins and its accumulation in sedimentary basin: presented at the University of Southern California, Los Angeles, California, October 2005.

Origins of CO₂ and its accumulation in sedimentary basins: Invited lecture presented to Environmental and Civil Engineering Department, University of Southern California, Los Angeles, California, October 2005.

Mechanism and kinetics of TSR: presented at 15th Annual V.M. Goldschmidt Conference, University of Idaho, Moscow, Idaho, May 2005.

Organosulfur speciation and effect on TSR: presented at JIP/Caltech meeting, Pasadena, California, January 2005.

Hydrogen sulfide prediction kinetics model: presented at AAPG meeting, Dallas, Texas, May 2004.

Effect of TSR on gas generation and hydrocarbon cracking: presented at Caltech, Pasadena, California, January 2004.

Kinetics and mechanism of thermochemical sulfate reduction: presented at JIP/Caltech meeting, Pasadena, California, January 2003.

Natural gas generation and accumulation in sedimentary basin: presented at PEER Center, Caltech, Pasadena, California, August 2002.

CO₂ origins in Huanghua Depression, Bohai Bay Basin, China: Invited lecture presented to Organic and Isotope Geochemistry Groups in the Federal Institute for Geosciences and Natural Resources, Hanover, Germany, June 1999.

Natural gas origins in Huanghua Depression, Bohai Bay Basin, China: Invited lecture presented at Institute of Geology and Geochemistry of Petroleum and Coal, RWTH Aachen University, Aachen, Germany, March 1999.

Activities of a Professional Nature

Professional Societies

American Association of Petroleum Geologists

Geochemical Society

Geological Society of China

Petroleum Geology Association, Gansu Province, China

Sigma Xi, The Scientific Research Society

Funding

Research Support

Principal Investigator: Spatial Heterogeneity of Bone Spring and Wolfcamp Crude and Key Controls to Crude Properties in the Delaware Basin, ExxonMobil Research and Engineering Co. (July 1, 2019-December 31, 2020; \$748,083.00).

Principal Investigator: GeoChem Lab, Ageron LLC (March 29, 2019-December 30, 2020; \$61,330).

Principal Investigator: Investigation of Oil Generation, Expulsion, Storage, and Migration in Marine Shales by Integrated Geochemistry and Petrography, PetroChina (March 1, 2017-December 30, 2020; \$141,351).

Principal Investigator: Spatial Heterogeneity of Austin Chalk Crude and Key Controls to Crude Properties, Exxon (July 1, 2018-December 30, 2019; \$355,400).

co-PI: Practical Isotopic Analyzer for Subsurface Gases, Mesa Photonics (January 1, 2017-December 30, 2019; \$361,546).

Principle Investigator: Spatial Heterogeneity of Eagle Ford Crude, ExxonMobil (November 16, 2016-June 30, 2018; \$267,000).

PI: Lacustrine shale gas reservoir characterization in the yanchang formation by integrated geological facies, geochemistry, chemostratigraphy, SEM pore imaging, petrography and geophysics, Yanchang Petroleum Group (November 2013 - October 2015, \$1,000,000).

PI: Investigation of the oil storage mechanism and variables for oil saturation in organic-rich shales, ExxonMobil (June 2013 - May 2015, \$200,000).

Key researcher: Mudrock Consortium, 25 industrial members (January 2010 - December 2014).

Co-PI: Investigation of oil storage and migration in the eagle ford formation by integrated geochemistry and petrography, Shell (September 2012 - August 2014, \$300,000).

PI: Gas geochemistry laboratory setup, Jackson School of Geosciences (January 2008 - December 2012, \$260,000).

PI: Shale gas geochemistry, ExxonMobil (July 2011 - April 2012, \$110,000).

PI: Investigation of gas chemicals and isotopic variation in shale, ExxonMobil (December 2009 -

April 2012, \$268,000).

Publications

Peer Reviewed Journal Articles

Luo, H., Zhang, T., Yan, J., and Gong, J., 2022, Rare earth elements and yttrium (REY) distribution pattern of lower Cambrian organic-rich shale in Yichang area, Western Hubei Province, South China, and source of carbonate minerals: *Applied Geochemistry*, v. 136, no. 105173, 21 p., <http://doi.org/10.1016/j.apgeochem.2021.105173>.

Shao, D., Zhang, T., Li, Y., Milliken, K. L., Zhang, Y., and Song, H., 2022, Effects of confining pressure and microscale heterogeneity on hydrocarbon retention and pore evolution from artificial maturation of Eagle Ford Shale: *International Journal of Coal Geology*, v. 260, no. 104057, 18 p., <http://doi.org/10.1016/j.coal.2022.104057>.

Shao, D., Zhang, T., Zhang, L., Li, Y., and Meng, K., 2022, Effects of pressure on gas generation and pore evolution in thermally matured calcareous mudrock--insights from gold-tube pyrolysis of the Eagle Ford Shale using miniature core plugs: *International Journal of Coal Geology*, v. 252, no. 103936, 15 p., <http://doi.org/10.1016/j.coal.2022.103936>.

Sun, X., Zhang, T., and Walters, C. C., 2022, Geochemistry of oils and condensates from the lower Eagle Ford Formation, south Texas. Part 2: Molecular characterization: *Marine and Petroleum Geology*, v. 141, no. 105710, 23 p., <http://doi.org/10.1016/j.marpetgeo.2022.105710>.

Zhang, T., Sun, X., Walters, C. C., Sundaram, A., and Calla, T. J., 2022, Geochemistry of oils and condensates from the lower Eagle Ford formation, south Texas. Part 1: Crude assay measurements and SimDist modeling: *Marine and Petroleum Geology*, v. 139, no. 105576, 16 p., <http://doi.org/10.1016/j.marpetgeo.2022.105576>.

Li, Y., Zhang, T., Shen, B., Li, Z., Shao, D., and Lash, G. G., 2021, Carbon and sulfur isotope variations through the Upper Ordovician and Lower Silurian of South China linked to volcanism: *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 567, no. 110285, 15 p., <http://doi.org/10.1016/j.palaeo.2021.110285>.

Milliken, K. L., Zhang, T., Chen, J., and Ni, Y., 2021, Mineral diagenetic control of expulsion efficiency in organic-rich mudrocks, Bakken Formation (Devonian-Mississippian), Williston Basin, North Dakota, U.S.A.: *Marine and Petroleum Geology*, v. 127, no. 104869, 24 p., <http://doi.org/10.1016/j.marpetgeo.2020.104869>.

Zhang, T., Fu, Q., Sun, X., Hackley, P. C., Ko, L. T., and Shao, D., 2021, Meter-scale lithofacies cycle and controls on variations in oil saturation, Wolfcamp A, Delaware and Midland Basins: *AAPG Bulletin*, v. 105, no. 9, p. 1821-1846, <http://doi.org/10.1306/01152120065>.

Enriquez, D. A., Zhang, T., Sun, X., Meng, D., and Zhang, Y., 2020, Methane resaturation in Barnett Formation core plugs and new approach for determination of post-coring gas loss: *Marine and Petroleum Geology*, v. 118, no. 104430, 15 p., <http://doi.org/10.1016/j.marpetgeo.2020.104430>.

Hackley, P. C., Zhang, T., Jubb, A. M., Valentine, B. J., Dulong, F. T., and Hatcherian, J. J., 2020, Organic petrography of Leonardian (Wolfcamp A) mudrocks and carbonates, Midland Basin, Texas: the fate of oil-prone sedimentary organic matter in the oil window: *Marine and Petroleum Geology*, v. 112, no. 104086, 15 p., <http://doi.org/10.1016/j.marpetgeo.2019.104086>.

Shao, D., Zhang, T., Ko, L. T., Li, Y., Yan, J., Zhang, L., Luo, H., and Qiao, B., 2020, Experimental investigation of oil generation, retention, and expulsion within Type II kerogen-dominated marine shales: insights from gold-tube nonhydrous pyrolysis of Barnett and Woodford Shales using miniature core plugs: *International Journal of Coal Geology*, v. 217, no. 103337, 16 p., <http://doi.org/10.1016/j.coal.2019.103337>.

Tang, X., Zhang, T., Zhang, J., Sun, X., Wu, C., and Jin, Z., 2020, Effect of pore fluids on methane sorption in the Lower Bakken Shales, Williston Basin, USA: *Fuel*, v. 282, no. 118457,

14 p., <http://doi.org/10.1016/j.fuel.2020.118457>.

Wu, C., Zhang, L., Zhang, T., Tuo, J., Song, D., Liu, Y., Zhang, M., and Xing, L., 2020, Reconstruction of paleoceanic redox conditions of the lower Cambrian Niutitang shales in northern Guizhou, Upper Yangtze region: *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 538, no. 109457, 11 p., <http://doi.org/10.1016/j.palaeo.2019.109457>.

Alfi, M., Hosseini, S. A., Enriquez, D., and Zhang, T., 2019, A new technique for permeability calculation of core samples from unconventional gas reservoirs: *Fuel*, v. 235, p. 301-305, <http://doi.org/10.1016/j.fuel.2018.07.114>.

Ellis, G. S., Zhang, T., Kralert, P. G., and Tang, Y., 2019, Kinetics of elemental sulfur reduction by petroleum hydrocarbons and the implications for hydrocarbon thermal chemical alteration: *Geochimica et Cosmochimica Acta*, v. 251, p. 192-216, <http://doi.org/10.1016/j.gca.2019.02.023>.

Lashgari, H. R., Sun, A. Y., Zhang, T., Pope, G. A., and Lake, L. W., 2019, Evaluation of carbon dioxide storage and miscible gas EOR in shale oil reservoirs: *Fuel*, v. 241, p. 1223-1235, <http://doi.org/10.1016/j.fuel.2018.11.076>.

Li, Y., Zhang, T., Shao, D., and Shen, B., 2019, New U-Pb zircon age and carbon isotope records from the Lower Silurian Longmaxi Formation on the Yangtze Platform, South China: implications for stratigraphic correlation and environmental change: *Chemical Geology*, v. 509, p. 249-260, <http://doi.org/10.1016/j.chemgeo.2019.02.003>.

Shao, D., Zhang, T., Ko, L., Luo, H., and Zhang, D., 2019, Empirical plot of gas generation from oil-prone marine shales at different maturity stages and its application to assess gas preservation in organic-rich shale system: *Marine and Petroleum Geology*, v. 102, p. 258-270, <http://doi.org/10.1016/j.marpetgeo.2018.12.044>.

Ko, L., Ruppel, S. C., Loucks, R. G., Hackley, P. C., Zhang, T., and Shao, D., 2018, Pore-types and pore-network evolution in Upper Devonian-Lower Mississippian Woodford and Mississippian Barnett mudstones: insights from laboratory thermal maturation and organic petrology: *International Journal of Coal Geology*, v. 190, p. 3-28, <http://doi.org/10.1016/j.coal.2017.10.001>.

Shao, D., Ellis, G. S., Li, Y., and Zhang, T., 2018, Experimental investigation of the role of rock fabric in gas generation and expulsion during thermal maturation: anhydrous closed-system pyrolysis of a bitumen-rich Eagle Ford Shale: *Organic Geochemistry*, v. 119, p. 22-35, <http://doi.org/10.1016/j.orggeochem.2018.01.012>.

Hackley, P. C., Zhang, L., and Zhang, T., 2017, Organic petrology of peak oil maturity Triassic Yanchang Formation lacustrine mudrocks, Ordos Basin, China: *Interpretation*, v. 5, no. 5, p. SF211-SF223, <http://doi.org/10.1190/INT-2016-0111.1>.

Ko, L. T., Loucks, R. G., Ruppel, S. C., Zhang, T., and Peng, S., 2017, Origin and characterization of Eagle Ford pore networks in the south Texas Upper Cretaceous shelf: *AAPG Bulletin*, v. 101, no. 3, p. 387-418, <http://doi.org/10.1306/08051616035>.

Ko, L., Loucks, R. G., Milliken, K., Liang, Q., Zhang, T., Sun, X., Hackley, P. C., Ruppel, S. C., and Peng, S., 2017, Controls on pore types and pore-size distribution in the Upper Triassic Yanchang Formation, Ordos Basin, China: implications for pore-evolution models of lacustrine mudrocks: *Interpretation*, v. 5, no. 2, p. SF127-SF148, <http://doi.org/10.1190/INT-2016-0115.1>.

Li, Y. F., Zhang, T., Ellis, G. S., and Shao, D., 2017, Depositional environment and organic matter accumulation of Upper Ordovician-Lower Silurian marine shale in the Upper Yangtze Platform, South China: *Palaeogeography, Palaeoclimatology, Palaeoecology*, v. 466, p. 252-264, <http://doi.org/10.1016/j.palaeo.2016.11.037>.

Loucks, R. G., Ruppel, S. C., Wang, X., Ko, L., Peng, S., Zhang, T., Rowe, H. D., and Smith, P. L., 2017, Pore types, pore-network analysis, and pore quantification of the lacustrine

shale-hydrocarbon system in the Late Triassic Yanchang Formation in the southeastern Ordos Basin, China: Interpretation, v. 5, no. 2, p. SF63-SF79, <http://doi.org/10.1190/INT-2016-0094.1>.

Peng, S., Zhang, T., Loucks, R. G., and Shultz, J., 2017, Application of mercury injection capillary pressure to mudrocks: conformance and compression corrections: Marine and Petroleum Geology, v. 88, p. 30-40, <http://doi.org/10.1016/j.marpetgeo.2017.08.006>.

Rowe, H. D., Wang, X., Fa, B., Zhang, T., Ruppel, S. C., Milliken, K., Loucks, R. G., Shen, Y., Zhang, J., Liang, Q., and Sivil, J. E., 2017, Chemostratigraphic insights into fluvio-lacustrine deposition, Yanchang Formation, Upper Triassic, Ordos Basin, China: Interpretation, v. 5, no. 2, p. SF149-FS165, <http://doi.org/10.1190/INT-2016-0121.1>.

Sun, X., Liang, Q., Jiang, C., Enriquez, D., Zhang, T., and Hackley, P., 2017, Liquid hydrocarbon characterization of the lacustrine Yanchang Formation, Ordos Basin, China: organic-matter source variation and thermal maturity: Interpretation, v. 5, no. 2, p. SF225-SF242, <http://doi.org/10.1190/INT-2016-0114.1>.

Zhang, T., Sun, X., Milliken, K., Ruppel, S. C., and Enriquez, D., 2017, Empirical relationship between gas composition and thermal maturity in Eagle Ford Shale, south Texas: AAPG Bulletin, v. 101, no. 8, p. 1277-1307, <http://doi.org/10.1306/09221615209>.

Zhang, T., Wang, X., Zeng, H., Fishman, N., Katz, B. J., Milliken, K., Wei, M., Loucks, R. G., and Ghanizadeh, A., 2017, Introduction to special section: Lacustrine shale characterization and shale resource potential in Ordos Basin, China: Interpretation, v. 5, no. 2, p. SFi-SFii, <http://doi.org/10.1190/INT-2017-0314-SPSEINTRO.1>.

Zhang, T., Wang, X., Zhang, J., Sun, X., Milliken, K., Ruppel, S. C., and Enriquez, D., 2017, Geochemical evidence for oil and gas expulsion in Triassic lacustrine organic-rich mudstone, Ordos Basin, China: Interpretation, v. 5, no. 2, p. SF41-SF61, <http://doi.org/10.1190/INT-2016-0104.1>.

Gilbert, K., Bennett, P. C., Wolfe, W., Zhang, T., and Romanak, K. D., 2016, CO₂ solubility in aqueous solutions containing Na⁺, Ca²⁺, Cl⁻, SO₄²⁻ and HCO₃⁻: the effects of electrostricted water and ion hydration thermodynamics: Applied Geochemistry, v. 67, p. 59-67, <http://doi.org/10.1016/j.apgeochem.2016.02.002>.

Ko, L., Loucks, R. G., Zhang, T., Ruppel, S. C., and Shao, D., 2016, Pore and pore network evolution of Upper Cretaceous Boquillas (Eagle Ford-equivalent) mudrocks: Results from gold tube pyrolysis experiments: AAPG Bulletin, v. 100, no. 11, p. 1693-1722, <http://doi.org/10.1306/04151615092>.

Sun, X., Zhang, T., Sun, Y., Milliken, K., and Sun, D., 2016, Geochemical evidence of organic matter source input and depositional environments in the lower and upper Eagle Ford Formation, south Texas: Organic Geochemistry, v. 98, p. 66-81, <http://doi.org/10.1016/j.orggeochem.2016.05.018>.

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