

Agenda for Annual Meeting of the Mudrock Systems Research Laboratory (MSRL)
April 8-9th, 2020
Bureau of Economic Geology
Web-based viewing

Meeting Highlights

- Focused geologic studies on the Delaware Basin, Midland Basin, Eagle Ford and Austin Chalk Formations in Texas
- Special technical session and core workshop on the Vaca Muerta Fm., Argentina
- Integrated core characterization methods and results that tie to rock and fluid attributes
- Hydrocarbon geochemistry, expulsion, migration and oil saturation studies
- Understanding fluid transport, and permeability and porosity in mudrock systems
- Full day Mudrocks short course and **full day core workshop (postponed)**

Day 1: Wednesday, April 8th, 8:00 AM – 5:00 PM Technical session
(Web-based viewing using Zoom video conferencing)

8:00 - 8:30 Log in, set up, introduction, overview, and highlights – *Toti Larson & Joseph Yeh*

Oral Technical Presentations

Reservoir Architecture and Attributes I: Eagle Ford Shale and Austin Chalk Formation

8:30–9:00 Chemostratigraphy of the Eagle Ford Shale across the San Marcos Arch and Karnes Trough; Data analytics to integrate complex datasets – *Toti Larson and Steve Ruppel*

9:00–9:30 Eagle Ford diagenesis as a function of burial depth and maturity and how it impacts petrophysical and mechanical properties – *Lucy Ko and Robert Loucks*

9:30–10:00 Geochemical evidence of organic matter source and depositional environments of Lower and Upper Eagle Ford – *Xun Sun*

10:00–10:30 **Break with online discussion**

10:30–11:00 Spatial heterogeneity of crude oil in the Eagle Ford Shale and key controls to oil quality – *Tongwei Zhang*

11:00–11:30 Mineralogy trends for the Austin Chalk across south Texas and Louisiana – *Robert Loucks (given by Toti Larson)*

11:30–12:00 A preliminary study of the effects of thin bed layers on hydraulic fracturing – *Farzam Javadpour & Mehran Mehrabi*

12:00–1:00 **Lunch break and online discussion**

Porosity, Permeability, Wettability, and Fluid Flow Modeling

1:00–1:30 The effects of entrapped gas bubbles on liquid flow in shale– *Farzam Javadpour and Hong Zuo*

- 1:30 - 2:00 Pore Connectivity, Porosity, Permeability, and Influence of TOC and Mineralogy in Shale– *Sheng Peng*
- 2:00–2:30 Three Dimensional Digital Shale to Estimate Permeability- *Farzam Javadpour & Tao Zhang*
- 2:30 – 3:00 **Break with online discussion**
- 3:00–3:30 Gas-water relative permeability and implications on optimal production strategies. Examples from the Eagle Ford Shale and Wolfcamp Formation – *Sheng Peng*
- 3:30 – 4:00 Oil recovery by water imbibition and wettability (mostly Wolfcamp) – *Sheng Peng*
- 4:00 – 4:30 Machine learning, convolutional neural network application in pore identification in shale/mudrock SEM images - *Ken Ikeda & Lucy Ko*
- 4:30 – 5:00 Complex roles of calcite in organic-rich mudrocks: using micropetrography to understand grains, fossils, and cements – *Rob Reed & Robert Loucks*

Day 2: Thursday, April 9th, 8:00 AM – 4:00 PM Technical session
(Web-based viewing using Zoom video conferencing)

- 7:30 – 8:00 Sign in, Set up, Introduction, overview, and highlights – *Toti Larson*
- 8:00–8:30 Presentation of “Anatomy of a Paleozoic Basin Volume 2”
and a stratigraphic framework for the Permian Basin – *Charlie Kerans*

Oral Presentations

Reservoir Architecture and Attributes II: Permian Basin

- 8:30–9:00 Wolfcamp A and B lithologic and thermal maturity trends across Reagan County, Midland Basin – *Toti Larson, Lucy Ko, Scott Hamlin, and Steve Ruppel*
- 9:00–9:30 Trace-elemental and petrographic constraints on the severity of hydrographic restriction in the silled Midland Basin during the Late Paleozoic Ice Age – *Junwen Peng & Toti Larson*
- 9:30–10:00 Slope to basin sediment pathways and stratigraphic correlations in the southern Delaware Basin – *Xavier Janson and Buddy Price*
- 10:00–10:30 **Break with online discussion**
- 10:30–11:00 Data analytical tools to integrated lithofacies and geochemical characterizations of Wolfcamp A and B in the Delaware Basin, Reeves County – *Toti Larson, Lucy Ko, Rob Reed, and Steve Ruppel*
- 11:00–11:30 Key controls to oil saturation in Wolfcamp A and timing of oil vertical migration in Delaware basin – *Tongwei Zhang*
- 11:30–12:00 Organic source and deposition conditions of Wolfcamp A, Reeves County, Delaware basin – *Sun Xun*
- 12:00–1:00 **Lunch break and online discussion**

Special Session on the Vaca Muerta

- 1:00–1:30 Depositional Systems of the Vaca Muerta – *Cornel Olariu & Ron Steel*

- 1:30–2:00 Lithofacies and Depositional Environments of Vaca Muerta, Neuquén Basin –
Lucy Ko & Toti Larson
- 2:00–2:30 A critical review of Vaca Muerta pore data with implications in hydraulic
fracturing – *Farzam Javadpour*
- 2:30–3:00 **Break with online discussion**
- 3:00–3:30 Hydrocarbon geochemistry, oil saturation and gas storage in the Vaca Muerta,
Neuquén Basin, Argentina – *Tongwei Zhang*
- 3:30–4:00 Preliminary Pore Systems and SEM Lithologies of a Vaca Muerta Core, Neuquén
Basin, Argentina – *Rob Reed*

4:00 PM Online discussion and questions

MSRL Mudrocks Short course
Thursday, April 16th, 8:00 AM – 4:00 PM
(Web-based viewing using Zoom video conferencing)

Outline: This short course will present best methods of multidisciplinary data collection, and interpretation critical to characterizing unconventional mudrock reservoir systems. The fundamentals of each concept will be introduced. Topics to be covered include facies characterization, chemostratigraphy, hydrocarbon geochemistry, pore systems, porosity/permeability, and fluid flow and their importance in mudrock oil and gas reservoir characterization, hydraulic fracturing and production.

Schedule

- 7:30** Sign in, Set up, Introduction, overview, and highlights – *Toti Larson*
- 8:00 – 9:30 Mudrock depositional processes and deep water turbidites (David Mohrig)**
- Depositional processes and basin controls
 - Defining characteristics and attributes of mudrocks
- 9:30 – 10:30 Geochemistry of mudrock systems (Toti Larson)**
- Importance of trace and major element chemistry in mudrock characterization
 - Applied multivariate statistics to geochemical systems
- 10:30 – 12:00 Diagenesis and pore networks (Robert Loucks)**
- Introduction to mudrock pore types, pore networks, and pore classification
 - Diagenetic processes in mudrocks from deposition through burial
- 12:00 – 1:00 Lunch** (Sandwiches and beverages provided)
- 1:00 – 2:00 Fluid flow in mudrock systems (Farzam Javadpour)**
- Reliable permeability values are critical in hydraulic fracturing design and production forecast
 - NonDarcy gas and liquid flow
- 2:00 – 3:00 Porosity and Permeability measurements (Sheng Peng)**

- Pros and cons of laboratory methods and comparison of GRI vs. pressure decay methods
- Importance of relative permeability and laboratory measurements

3:00 – 4:00

Hydrocarbon geochemistry – (Tongwei Zhang, Xun Sun)

- Defining organic matter type, oil and gas generation and migration
- Biomarkers and their application in source input and thermal maturity

4:00

Online discussion and questions

Core workshop postponed until further notice

Core Workshop: Held at Bureau of Economic Geology, Core Research Center

Core Workshop Agenda

- 8:30–9:15 Short oral presentations of cores to be viewed (BEG VR room)
- 9:15–12:00 Core workshop
- 12:00–1:00 LUNCH (provided)
- 1:00–3:00 Core workshop
- 3:00–4:30 Open core viewing

Cores to be presented

- 1) Delaware Basin - Bone Spring (Leonardian), Reeves County
- 2) Delaware Basin - Wolfcamp A & B, Reeves County
- 3) Midland Basin - Wolfcamp A & B and Dean Fm., Reagan County
- 4) Eagle Ford Shale: Karnes County
- 5) Eagle Ford Shale: Webb and Dimmit Counties (two cores)
- 6) Vaca Muerta Fm., Neuquén Basin, Argentina

Poster Presentations postponed until further notice *Hors d'oeuvres and drinks provided*

The use of neural network to quantify pores and porosity in organic matter - *A. Wang & Farzam Javadpour*

Effective slip length of heterogeneous surface with entrapped bubble - *H. Zuo & Farzam Javadpour*

Petrography of Mudrocks and Their Implications on Source Rock and Seal Properties in the Alaska North Slope: OM Types, Quality, Provenance, Diagenesis, and Depositional Environment – *Lucy Ko*

Bulk and Position-Specific Isotope Geochemistry of Natural Gases from the Eagle Ford Shale, South Texas – *Liu, Horita, & Toti Larson*

Pore Systems and SEM Lithologies for the Permian Wolfcamp Shale from the Delaware Basin, Texas – *R. Reed, S. Peng, S. Ruppel, & E. Sivil*

Carbonate Factory Response and Recovery following OAE-1A in Central Texas *Esben Pedersen*

Geochemical response of Lower Jurassic intervals to magmatic doming of the North Sea – *Kiara Gomez*

Quartz types in the Upper Pennsylvanian organic-rich Cline Shale (Wolfcamp D), Midland Basin, Texas: Implications for silica diagenesis and rock mechanical properties – *J. Peng & Kitty Miliken*

Integrated petrographic, lithologic, and geochemical characterization of the Lower Eagle Ford in Dimmit and Webb Counties – *Lucy Ko*

Geochemical controls of diagenetic limestone concretions in the Lower Eagle Ford Shale – *E. Sivil, Toti Larson, & Lucy Ko*

SEM image automation using machine learning techniques – Building a tool for size-distribution and detection of pyrite framboids in mudrocks – *Artur Davletshin & Ko*

Hydrocarbon geochemistry, thermal maturity and oil saturation in the Vaca Muerta – *Tongwei Zhang*

Tracer-guided characterization of dominant pore network and implication for permeability and wettability in unconventional reservoir rocks *Sheng Peng, Rob Reed, Xianghui Xiao, & Yijin Liu*