

N292: Deepwater Depositional System Stratigraphy for Exploration and Development (Arkansas, USA)

Format and Duration

Field - 5 Days Low Physical Demand

Instructor(s): Lesli Wood and Mac McGilvery

Summary

The Pennsylvanian-age Jackfork Group and the younger overlying Atoka Formation strata of central Arkansas offer a world-class field area to examine the common deepwater architectural elements that constitute many reservoirs worldwide and to compare and contrast deepwater deposits of the structurally passive-to-active basin transition. Participants will gain an understanding of potential reservoir body geometry and its impact on the degree of stratigraphic compartmentalization and internal reservoir flow units. The link is made between depositional facies elements such as channel, levees, channelized sheets, layered or amalgamated sheets, and lateral and vertical reservoir connectivity. We will discuss enigmatic deposits as well, such as mass failures, linked debrites, slurry flows and sand dikes, and the range of deepwater depositional processes that control bed-scale lithologies and related reservoir quality.

Business impact: Application of the learnings of this course will empower participants to get a better understanding of gross reservoir sand and net reservoir which can have significant importance on predicted in-place and recoverable reservoir volumes. This course stresses applications to both exploration and development, examining deposits at all scales (seismic to thin section) and presents 3D geological models of these outcrops that show analog flow character during reservoir performance simulation.

Learning Outcomes

Participants will learn to:

- 1. Recognize and evaluate deepwater architectural elements in outcrop, core, logs (including borehole image logs) and seismic, how they form, and their characteristics.
- 2. Build a sequence stratigraphic framework for deepwater facies and facies associations as a predictive tool for exploration and development.
- 3. Evaluate outcrop-based geological modeling and assess the procedures, constraints, and limitations on building robust geological models of deepwater depositional systems.
- 4. Assess geologic controls on reservoir quality and make predictions in subsurface settings.
- 5. Judge the significance of scale in exploration and development of deepwater depositional systems.
- 6. Appraise deepwater transport and depositional processes and bed-scale products.

Training Method

This is a field course supported by short classroom sessions in an 80:20 ratio in the Little Rock and Hot Springs areas of Arkansas. The classroom sessions include a core workshop, with practical exercises and discussion conducted at the field localities.



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Physical Demand

The physical demands for this class are <u>LOW</u> according to the Tetra Tech RPS field course grading system. The field areas are in central Arkansas where the climate tends to be hot and humid with the possibility of severe thunderstorms in the summer but is quite comfortable in the Spring and Fall. Elevations range from 70-170 m (230-560 ft) above sea level. Hikes rarely exceed 1 km (0.5 miles) and are on relatively flat quarry and spillway floors. Transportation is by minivan or SUV on mostly blacktop roads.

Who Should Attend

Exploration or development geologists, geophysicists, reservoir engineers, reservoir modelers and/or geoscience and engineering managers within companies that are evaluating or exploiting deepwater clastic reservoirs.

Course Content

Day 0: Travel to Little Rock, AR.

Evening lectures will present the goals of the course, a background on deepwater deposits and processes, and an overview of the paleo- and modern settings we will see over the next five days coupled with pizza.

Day 1: McCain Mall, Big Rock Quarry, Pinnacle Mountain

Focus is on proximal deepwater systems, specifically the depositional elements and facies of the middle to upper slope. Stops include channel and levee systems of the Upper Jackfork Gp., canyon fills of the Upper Jackfork Gp., and mass transport deposits and healing phase turbidite reservoirs in the Jackfork Gp. slope.

Day 2: DeGray Spillway and Highway 7

Focus is on the depositional process and resulting lithologies and links to reservoir quality of the lower slope basin floor, with an emphasis on the log and seismic expression of these deposits. We will visit the Lower Jackfork contact with the highstand deposits of the underlying Stanley Shale, and the stacked channel-lobe-mass failure sequences of the Jackfork in the worldclass DeGray Spillway.

Day 3: Hollywood Quarry, Baumgartner Quarry and Dierks Spillway

Focus is on incorporating the observations of the past two days into reservoir models. We will visit more basinward systems of the Jackfork Group in Hollywood Quarry, Baumgartner Quarry and Dierks Spillway and examine the impact of faulting, injectites and sand/shale body architecture on connectivity and fluid flow in these systems.



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Day 4: Wilcox Core Workshop and Distal Systems

A morning core workshop will examine multiple cores taken from the Wilcox-age deepwater depositional system. We will compare facies and facies associations seen in the cores with the outcrop we have observed. Students will practice their ability to interpret facies, facies associations and depositional elements. Morning lectures will set the tectono-stratigraphic framework for tomorrow's Atoka Fm. stops, and discuss the link between sandstone diagenesis and reservoir quality. An afternoon field stop will visit the most distal facies in the deepwater system.

Day 5: Deepwater Deposits of the Subsiding Atoka Foreland

We will visit the deepwater deposits of the Atoka Fm., which overlies the Jackfork Gp. and was deposited as the area transitioned from a passive to compressional margin setting. We will contrast traction-dominated marginal marine deposits with gravity-dominated slope/basin deposits and we will compare an outcrop-calibrated log motif to examples from the Gulf of Mexico and the North Sea Basin.

Day 6: Depart Little Rock, AR