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

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**Format and Duration**

Field - 5 Days
Low Physical Demand

## Summary

**Business Impact:** This has a significant impact on understanding gross reservoir sand and net reservoir which can have significant importance on predicted in-place and recoverable reservoir volumes.

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. 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. 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.

## 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 five-day field course comprised of morning lectures and afternoon field work in the Little Rock and Hot Springs, Arkansas area. The course consists of classroom lectures (15% of the course), a core workshop (5% of the course) and field stops with practical exercises (80% of the course).

## Physical Demand

The physical demands for this class are LOW according to the Nautilus Training Alliance 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 major 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.

## Prerequisites and Linking Courses

Participants should have an understanding of the fundamentals of sedimentology and sequence stratigraphy as taught on the N155 (Introduction to Clastic Depositional Systems: A Petroleum Perspective) and ideally some familiarity and experience with deepwater processes.

There are more than a dozen RPS courses that focus on deepwater clastic topics at the Skilled Application Level. These include field courses such as N514 (Shelf Margin Shallow Marine Deltaics to Deepwater Turbidites: Sedimentology and Sequence Stratigraphy (Wyoming, USA), N315 (Deepwater Slope Canyons and Channel Complexes of Southern and Central California) and N033 (Characterisation, Modelling, Simulation and Development Planning in Deepwater Clastic Reservoirs, Tabernas, Spain); and reservoir modeling as taught on N012 (Reservoir Modelling Field Class, Utah, USA).

## Course Content

The course begins with an overview of deepwater processes, deposits and systems in a classroom lecture preceding the first day of the field course. Several exercises will be done on outcrop to reinforce the deepwater exposures that we visit. Day four begins with a core workshop and lecture on the Wilcox Group, Gulf of Mexico, U.S.A.

### Itinerary

**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.

**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. You will return to Little Rock in the late afternoon to fly home.