

# N670: Fluvial and Coastal Clastic Depositional Environments (*Texas Gulf Coast, USA*)

#### Format and Duration

Field - 4 Days Low Physical Demand

Instructor(s): Anton Wroblewski

## Summary

This course provides hands-on experience with a variety of modern, clastic reservoir geobody types that provide calibration points for accurate facies and reservoir models and allow for more targeted exploration, appraisal, and development wells, ultimately increasing reservoir production potential and overall profitability. Participants will examine underfilled and overfilled incised valley systems, meandering fluvial point bars, microtidal bayhead deltas, barrier islands, spits, tidal inlets, flood tidal deltas, a wave-dominated delta, tidal flats, creeks, and oyster reefs, and proximal-distal vs. strike-fed coastal reservoir bodies. Many of these deposits and locations are the basis for the most commonly used depositional models of coastal and fluvial geobodies. Participants will learn when these are and are not the best analogs to use and how unique features of each system affect its resulting stratigraphy and sedimentology. Geomorphology, stratigraphy, and sedimentology are linked through the use of trenches, outcrop and core images, and log data to provide insights into three-dimensional subsurface interpretations.

## Learning Outcomes

Participants will learn to:

- 1. Identify fluvial, deltaic, tidal inlet, bay margin, and barrier island/shoreface deposits based on grain size profile, sedimentary structures, and ichnofossils.
- 2. Predict reservoir properties of a variety of fluvial and coastal geobodies away from well bore and beyond seismic resolution by using first principle observations and appropriate analogs.
- 3. Recognize and predict the presence of strike-fed and point source sandstone bodies in coastal settings using regional context and physicochemical proxies.
- 4. Construct depositional environment maps constrained and informed by appropriate modern and ancient analogs.
- 5. Recognize that fluvial systems and their associated coastal deposits and incised valleys are primarily driven by sediment supply and climate in the drainage basin and can be decoupled from sea level changes.

## Training Method

This is a field course, supported by classroom sessions in a 70:30 ratio. Classroom sessions will comprise presentations, case studies, exercises, and reviews of the fieldwork.

## Physical Demand

The physical demands for this class are LOW according to the Nautilus Training Alliance field course grading system. The class is conducted in sandy and muddy fluvial, deltaic, and strandplain settings of Texas. Weather can be cool and damp or hot and humid, depending on the time of year. The longest walk in the class is about 1.5 mi (2.4 km) with no elevation gain. Most days are spent in open areas, with



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little shade from the sun. Stray cats, alligators, and insects are prevalent. Participants will dig trenches in some areas and should expect to get wet on most days. Buoyancy aids are provided.

## Who Should Attend

Exploration and production staff working fluvial and shallow marine environments, including integrated asset teams of geologists, geophysicists, and reservoir, petroleum, geothermal, and CCS engineers.

## **Course Content**

#### Day 0: Travel To Houston

- Participants travel to Houston, TX (George Bush International airport).
- Evening lecture on course content and introduction to local and regional geological context, implications for potential analogs, natural history, and wildlife.
- Overnight in Houston, TX.

#### Day 1: Fluvial, Bayhead Delta, and Spit Deposits in an Underfilled Incised Valley

- Trinity River point bar deposits and fluvial processes in the 9 km wide incised valley. We will compare the modern river to the older, mid-Holocene river and a variety of outcrop and subsurface analogs.
- Salt Wedge Barrier: Visit a salt intrusion barrier and review the role of climate and runoff in migration of salt wedges upstream in estuaries and coastal rivers.
- Trinity Bayhead Delta: Examine the fluvial-marine transition in an underfilled valley, with an emphasis on grain size, heterogeneity, and biogenic structures.
- Bolivar Peninsula and Galveston Tidal Inlet: Explore the role of wave energy on open and protected coastlines of a spit and take a ferry ride across the 2.6 km wide tidal inlet.
- Overnight in Galveston, TX.

#### Day 2: Microtidal, Wave-Dominated Barrier Island

- Shoreface, Foreshore, and Backshore deposits: Facies and diagenetic features will be examined in trenches with an emphasis on reservoir quality implications and preservation potential. Salinity comparisons of surface and groundwater across a seaward-landward transect to evaluate surface and groundwater flow patterns. Discuss lateral vs. proximal-distal sediment delivery on open coastlines.
- Back-Barrier Deposits: Sample sediment and biogenic features in washover and bay deposits for comparison to bayhead delta, spit, and shoreface deposits.
- Spit/Tidal Inlet Deposits: Hike 1.5 km to investigate the facies, grain size, and heterogeneity of a laterally migrating spit/tidal inlet. Trenches dug into individual accretion ridges facilitate discussions about potential reservoir plumbing and behavior. Outcrop examples of tidal inlets will be compared



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to the modern system.

• Overnight in Galveston, TX.

### Day 3: Wave-Dominated Delta in an Overfilled Incised Valley

- Beach Accretion Ridges: Cruise seaward down the San Bernard River to investigate the wavereworked mouth bars of the Brazos River, which are now a beach ridge dominated strandplain. Surface observation and trenching facilitates discussion of reservoir properties and the role of local physiographic features on continuity and heterogeneity of depositional elements.
- Wave-Reworked River Mouth: Explore a storm wave modified river mouth to determine the role of autogeneic vs. allogenic processes.
- Abandoned Wave-Skewed River Channel: Sample sediment and ichnites in an abandoned channel that was cutoff by lateral migration of strandplain deposits.
- Overnight in Freeport, TX.

#### Day 4: Transgressive vs. Regressive, River-Dominated Deltas in an Overfilled Incised Valley

- Regressive, Prograding Deltaic Distributary Channel: Cruise down the main, artificial distributary channel of the Colorado River to examine smaller, natural channels and compare them to fluvial channels.
- Prograding Mouth Bars: Compare stable, vegetated mouth bars to younger, evolving mouth bars using trenches, surface observation, and satellite imagery.
- Transgressive, Abandoned Delta Front: Examine wave ravinement and marine flooding of an abandoned delta lobe.
- River Mouth: Discuss the evolution of the Colorado River from a log jammed sediment trap to an active, delta-building system and the rate of progradation in a moderate sized tributary river delta.
- Travel back to Houston for Course Review and final banquet.
- Overnight in Houston, TX.

### Day 5: Travel Day

• Participants depart from Houston, TX (George Bush International Airport).