THE SEDIMENTOLOGY, ICHNOLOGY, AND PRESERVATION POTENTIAL OF FLUVIAL-DELTAIC AND ASSOCIATED CLASTIC SHORELINE DEPOSITIONAL FACIES

A Field Course

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Date: TBA
Location: Begins and ends in Corpus Christi, Texas (arrive at 4 PM on start date at Corpus Christi International Airport and depart from Corpus Christi International Airport at 2 PM on end date) (Transportation to and from Corpus Christi International Airport is provided)
Tuition: $2,500 includes guidebooks, transportation by van and boat during the course, and all lunches during the course.
Enrollment Minimum: 15
Enrollment Maximum: 20

Who Should Attend

Exploration and production/reservoir geologists, geophysicists and engineers working in fluvial-deltaic and related clastic shoreline systems worldwide that need to understand the sedimentological and ichnological processes of clastic shoreline depositional systems and what their preservation potentials are. Understanding the preservation potential of depositional and ichnological facies facilitates the construction of more realistic geological reservoir models.

Course Approach, Content, and Objectives

This is a five-day course, including 4 field days, and 1 day with lectures and core and hand sample examination.

The utility of geometric, architectural, sedimentological, ichnological, and facies data from modern clastic depositional systems in the development of analogs for ancient rock systems in outcrop or in the subsurface is a direct function of the preservation potential of modern depositional and ichnological facies. Not all primary facies within a depositional system are preserved in the rock record. For example, in ancient clastic shoreline successions, it is more common to encounter wave-reworked deltaic sediments, asymmetric deltas, beach sequences without preserved foreshore and/or aeolian back beach facies, shoaling upward deltaic or shoreface sequences truncated by transgressive wave ravinement and overlain by transgressive lag deposits, storm washover fan facies, and flood tidal deltas. All of these examples represent the destruction of primary or secondary clastic shoreline depositional facies and thus a lack of facies preservation. When examining modern depositional facies, in a quest for an analog for a subsurface clastic shoreline system, stratigraphers must continuously question themselves about what facies are most likely to be preserved and does a missing facies necessarily mean

that our models must be revised. Therefore, an analysis of the preservation potential of the individual facies of modern clastic depositional systems is warranted.

The preservation potential of a clastic depositional system is a function of the total kinetic energy of the system. In effect, the preservation potential of a shoreline depositional and ecological system and its ichnological record is a function of the kinetic energy partitioning between the sediment-supplying system and the kinetic energy of the original environment into which the sediment is deposited and/or the system to which the sediment was post-depositionally subjected. The kinetic energy of a modern clastic depositional system can be partitioned into a river-wave-tide-wind quaternary kinetic energy system. The kinetic energy system is controlled by both global and local basin processes. Since the wind component has only a local, short term role and its long term effects are coupled with wave and tidal energy, the system can be collapsed to a ternary energy system that is defined by the relative importance of riverine sedimentation rate, the local persistent wave energy, and the local tidal range. This ternary system can be thought of as being composed of a sediment-supplying energy (riverine) component and a binary redistribution energy system (waves and tides). This approach provides the geoscientist a way of understanding preservation potential and a way of conditioning data from modern depositional systems for use as analogs to ancient preserved outcrop and subsurface clastic systems.

Course set up:

Day 1 – Lectures will provide (1) an introduction to fluvial-deltaic depositional systems and preserved reservoir architecture, (2) an introduction to the depositional sequence stratigraphy of clastic shoreline depositional systems, (3) an introduction to neo-ichnology of the Texas Gulf Coast, (4) an introduction to the ichnology of fluvial-deltaic systems in the rock record, (5) an introduction to clastic shoreline depositional systems, including incised valley estuaries and lagoonal facies, and preserved reservoir architecture, and (6) a practical introduction to the recognition and use of significant stratigraphic surfaces. Examination will be made of outcrop samples, cores, and logs of preserved deltaic and shoreline facies associations highlighting the sedimentology and the ichnology.

Day 2 -- A field examination will be made of the sedimentology and neo-ichnology the modern beach and barrier island depositional systems along North Padre Island and Mustang Island, accompanied by lectures about the preservation of these facies in the ancient rock record.

Day 3 -- A field examination will be made of the sedimentology and neo-ichnology of modern back barrier, abandoned flood tidal delta, and estuarine depositional systems within Corpus Christi and Nueces Bays, accompanied by lectures about the preservation of these facies in the ancient rock record. A field examination of the stranded Ingleside highstand barrier system at Flour Bluff will be made to illustrate preservation scenarios.

Day 4 – A field examination will be made of the sedimentology and neo-ichnology of the modern Brazos River delta to analyze modern deltaic processes, accompanied by lectures about the preservation of these depositional facies and ichnofacies in the ancient rock record. A field examination will be made of an active flood tidal delta at Cedar Lakes downdrift of the Brazos River.

Day 5 – A field excursion will be made to the abandoned old Brazos River delta at Quintana Beach, followed by a field examination of the depositional systems and ichnology of the active flood tidal delta at San Luis Pass.

Principal objectives:

- To be able to understand modern fluvial-deltaic and associated clastic shoreline depositional systems and the ecological systems associated with them.
- To be able to identify and delineate the architecture of fluvial-deltaic and associated shoreline deposits utilizing logs and cores.
- To be able to identify ichnofossils and utilize them as paleoenvironmental and depositional facies indicators.
- To obtain an understanding of concepts of preservation potential of clastic shoreline systems and how to condition modern analog data sets for application to subsurface reservoir systems.

Please note that some of the field trip stops involve some moderate walking. At selected stops, field trip participants will be required to wade into the shoreface surf zone or into lagoonal or bay waters. In addition, there will be travel by boats to selected field trip stops. Sub-tropical weather in the field trip area is generally very warm and sunny; therefore precautions should be taken to minimize the effects of sun and heat.