
N530: Shore to Shelf Edge Depositional Systems (*Virtual Outcrops*)

Instructor(s): Philip Hirst, Stephanie Kape

Format and Duration

Classroom - 3 Days

Virtual - 5 Sessions

Summary

This course is designed to address the fundamentals of shelf sedimentology within a time stratigraphic framework. In addition to 'classic' lowstand, transgressive, and highstand systems, we will also review transgressive highstand deposits and the influence of current and tidal reworking of shelf clastics. The course will cover the seismic scale down to detailed reservoir scale, thus providing an understanding of how to use models in a predictive sense.

Business Impact: Participants on this course will develop a good understanding of **shelf and shallow marine systems within a sequence stratigraphic framework** for both clastic and mixed carbonate-clastic systems

Learning Outcomes

Participants will learn to:

1. Place shallow marine and shelf deposits into a time-stratigraphic framework.
2. Understand the system controls on deposition.
3. Have an understanding of the different deposits produced during low, transgressive, and high stand systems tracts.
4. Understand how these deposits can vary along strike and appreciate the limitations of the '2D' sequence stratigraphic model.
5. Understand how shelf processes rework and reorganise shelf deposits, and how to recognise these.
6. Understand the geometry of carbonates and mixed carbonate-clastic shorelines.
7. Be able to select and use appropriate analogues for different systems.

Training Method

This is a classroom or virtual classroom course comprising a mixture of lectures, discussion, case studies, and practical exercises reviewing 3D outcrop imagery, seismic data, and outcrop photos.

Who Should Attend

The course is designed for geoscientists of all experience levels with an interest in paralic, shallow marine to shelf margin systems. Some prior knowledge of sequence stratigraphy and carbonate sedimentology is assumed.

Course Content

The following summarises the proposed content of this course, which may vary depending on the focus and experience of the participants.

1. Sequence stratigraphic framework

Seminar: An overview of sequence stratigraphic methods, focussing on shallow marine sequences.

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Emphasis will be placed on time gaps, erosion and condensation, as well as understanding the distribution of deposits.

Exercise: Sequences and Parasequences in Algeria.

2. Source to sink

Seminar: Source to Sink Analysis. Understanding the controls on sediment deposition (sea level, sediment source, climate, tectonics), looking at both clastics and carbonates.

Outcrop analogue: Eocene, Storvola, Spitsbergen.

Exercise: Construction of a simple Wheeler diagram to place deposits in a time framework.

3. Carbonates

Seminar: A review of the controls on carbonate deposition, ramp and rimmed margin geometries. Case studies from the Palaeogene of NE Spain, Miocene of Venezuela.

3D analogues: Lluçmayor reef complex, Mallorca, Spain; Cala Figuera Ramp, Menorca, Spain.

4. Lowstand Systems Tract

Seminar: Incised valley geometries and infills with down-tract shelf edge deltas to upper slope deposits.

Outcrop analogue: Eocene shelf edge deltas to base of slope fans, Storvola, Spitsbergen.

Modern analogue: Lagniappe shelf edge delta, Louisiana shelf.

5. Transgressive Systems Tract

Seminar: Introduction to the TST, transgressive surfaces of erosion, Barriered estuaries and tidal estuaries. Case examples from the Chimney Rock Member, Wyoming, English channel.

Outcrop analogues: Tidal sediments Baronia Fm, Pyrenees; Barriered shoreline Pano Fm, Pyrenees.

Exercise: Ness Formation well log correlation.

6. Highstand Systems Tract

Seminar: Highstand deltas. Review the different controls on deltas (wave dominated, tidal and fluvial dominated). Look at the different geometries of sands produced and implications for vertical stacking and correlation. Review the delta top deposits within a sequence stratigraphic framework to understand the architecture and continuity of potential reservoirs.

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Outcrop analogue: Palaeo-Orinoco succession, Mayaro, Trinidad.

7. Transgressive highstand

Seminar: Review of transgressive shorelines occurring during sea level highstands. Barrier systems, lagoons, flood tidal deltas. Case example from the Sego Sandstone, Colorado.

3D analogue: Almond Formation, Wyoming.

Modern analogue: US Atlantic coastline.

8. Mixed carbonate and clastic margins

Seminar: Review mixed systems, both reciprocal and co-existing mixed systems. Case examples from the Tertiary and Quaternary Papua New Guinea, Italy Pleistocene.

Outcrop analogues: Mixed carbonate-clastic shoreline and ramp, Jurassic UK; Mixed deltaic succession, Sobrarbe Fm, Pyrenees.

Exercise: Identification of carbonates from seismic data sets.

9. Shelf processes

Seminar: Reworking of the clastic components on the shelf. Review of tidal and storm processes (winnowed gravels, megaripples, ridges, hardgrounds). The role of along-shelf currents.

Outcrop analogue: Ordovician sand waves exposed in 3D, Algeria.

10. Analogues

Seminar: The use of analogues in geological concept and model building, advantages and pitfalls, field analogues, new techniques and cognitive bias.

Analogues: Spring Canyon member roadcut, Utah; Ainsa, Pyrenees (core vs outcrop).

11. Wrap up and summary