Title:
Seismic Geomorphology of Mixed-Influence Coastal-Deltaic Systems

Summary:
Recognition of mixed processes on coastal-deltaic systems end members (relative power of W-wave, T-tide and F-fluvial processes) is important for both exploration and reservoir characterization. Mixed-influence systems impart asymmetry and heterogeneity that impact prediction of subsurface lithology (facies), static modelling of various connectivity scenarios, and ultimately exploration to development well planning. Numerous detailed studies of these mixed-influence systems from modern analogs, outcrop and core, and log data requires calibration with high resolution seismic visualisation.

Although typical stacking of genetic units (5-25m parasequence-scale) is at or below the resolution limits of most 3D seismic data, focused seismic stratigraphic workflows can image detailed geomorphic plan-forms, which reflect features at the limits of detection (<10m).

A range of seismic stratigraphic workflows are illustrated (single and multiple datums, horizon slicing, flattening, optical stacking, channel/feature chasing, and attribute calculations) with a variety of example seismic datasets. These workflows can produce detailed images of complex facies juxtapositions at or near the detection limit. Specifically, we show examples of varying degrees of wave, fluvial and tidal influence, recognized by characteristic plan-form features at element to complex scales including (but not limited) to the following:

1. High to low reflectivity, continuous elongate arcuate, divergent to subparallel reflections (either convex or concave in a basinward direction), indicative of wave-dominated (W), to wave-dominated, but tide-influenced (Wt) strand-plains and associated down-drift chenier-plains (Tw).

2. High reflectivity, continuous and sinuous channel-form reflection features adjacent to sets of recurved-lineations (convex-basinward), interpreted as the trace of tide-influenced estuarine channels (Tt) or distributary channels (F, Ft).

3. Transparent seismic reflections with internal channel-forms, and dendritic or reticulate planforms, indicative of tide-dominated shorelines including tidal flats and associated tidal creeks (T, Tw, Twf).

4. High to low reflectivity, continuous or discontinuous, low- to high-sinuosity channel-form reflections, either isolated or amalgamated, indicative of fluvial-dominated channel belts, and associated abandoned meander loops (F, Ft), associated with a background of transparent to highly reflective continuous to discontinuous reflections, representing the alluvial or coast-deltaic floodplain.

This approach can assist prediction of reservoir connectivity in wave-dominated systems, with the recognition of internal baffles and local barriers associated with shale-prone parts of the depositional system, both within and between parasequences.