

## **Large Scale Mixed Carbonate-Siliciclastic Clinoform Systems: Three types from the Mesozoic North American Atlantic Offshore**

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The continental shelf off eastern Canada and the United States exhibits seismically-imaged clinoforms with similar morphologies but very different origins. The longest in both time and space is the Mesozoic carbonate giga-platform, beginning in the Jurassic at the Grand Banks and continuing to the present off Florida. Today the margin comprises a siliciclastic slope but since the Jurassic three large-scale progradational clinoform packages were produced by very different mixed siliciclastic-carbonate systems. The large distribution and thickness has them interpreted as smaller, isolated systems. Well control near the shelf margin is available in only two areas - the Nova Scotia Shelf and Baltimore Canyon Trough - but allows identification of representative carbonate and siliciclastic depositional facies and depth relationship.

Typically mixed systems are attributed to reciprocal sedimentation (alternating siliciclastic-carbonate-evaporite deposition) related to a) changes in the sediment supply over time (temporal variation); b) or geographic changes of sediment input e.g., delta lobe switching (spatial variation); or c) climatic variation, from humid to arid and semi-arid. Type I- prograding ramps between the large Late Jurassic-Early Cretaceous paleodelta near Sable Island (Sable Delta) and the Abenaki carbonate platform to the southwest, formed in comparatively shallow shelf and slope waters by oolites-coral/coralline sponge reefs and microbial slope mounds. Type II- examples of the intermediate type, of earliest Cretaceous age, occur off Nova Scotia and in Baltimore Canyon capping the Abenaki or equivalent carbonate platforms. Deltaic clinoforms grade laterally from Sable Delta or up-dip from nearshore small deltas and descend into deeper shelf waters with less argillaceous content and nutrient-rich waters that favour growth of sponge reef mounds and inter-reef beds. Type III- Late Cretaceous to Paleocene, comprise distal Wyandot Chalk with siliciclastic clinoforms of the overlying Banquereau Formation. This very different non-benthic system occurs in deep shelf and upper slope conditions, offshore Nova Scotia, where dilution of the pelagic carbonates is reduced by slower rates of fine siliciclastic sedimentation. Exploration strategies will differ dramatically depending on which system generated the clinoforms. A broader perspective is essential for hydrocarbon exploration of mixed siliciclastic-carbonate depositional systems of this scale.