

Brittle versus Mobile Shale Tectonics in Deltas: Structural Constraints Derived From Regional Seismic Interpretations

P. A. Restrepo-Pace* (Mubadala Oil & Gas)

Many deltas e.g. NW Borneo exhibits extensional growth systems landward and compressional structures at the present day slope and deep-water positions. The link between the extensional and compressional systems is hard to pin down as deep seismic data is of poor quality in these areas. Extension is generally believed to be accommodated by volume changes of a mobile substratum (mobile shale interpretation) Figure 1.

This view has been prevalent primarily due to:

- Poor seismic imaging at depth
- Evidence of overpressure
- Pock marks on the sea floor
- Sandbox and numerical structural models
- Seismic interpretation bias introduced by workstation interpretation i.e. large vertical exaggeration
- Structural geometry similarities between of shallow structures in many regions (Nigeria, Angola, Trinidad, Gulf of Mexico or Brazil salt basins)

- Operational driven interpretation i.e. prospect generation and very few seismically intensive regional studies
- Small amount of shortening at the toe thrust area that cannot account the amount of extension up dip

Careful examination of long cable data offshore Nigeria provides sufficient evidence to indicate that though mobile shale is present, may not be as extensive as currently believed. In the latter view extension and compression are linked via a basal detachment system (brittle interpretation) Figure 2.

The evidence for such interpretation is presented here; seismic examples, concepts and analogue models from sandbox experiments are also utilized. Future improvements on deep penetration long cable seismic imaging should provide better constraints and thus new plays may emerge (many with drilling challenges). In addition, the alternative structural interpretations may lead to improved charge modelling in complexly deformed delta systems.

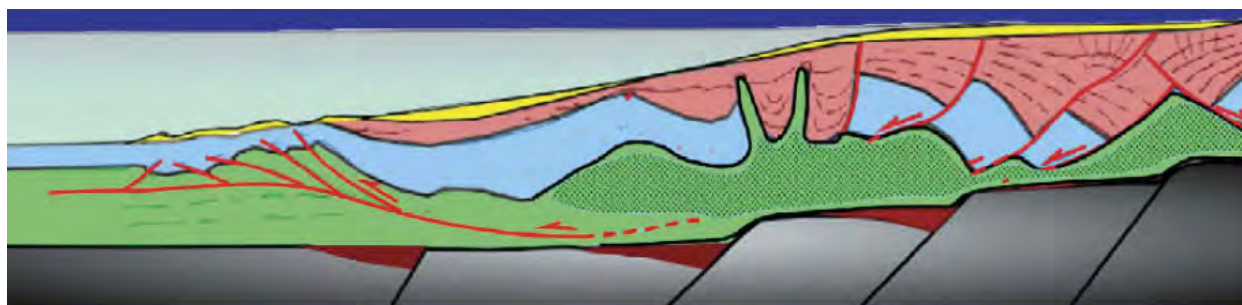


Figure 1: Schematic cross-section depicting the internal structure of a typical delta wedge. Extension/accommodation space of the updip section is accommodated by displacing mobile shale from the overpressured deeper portions of the delta.

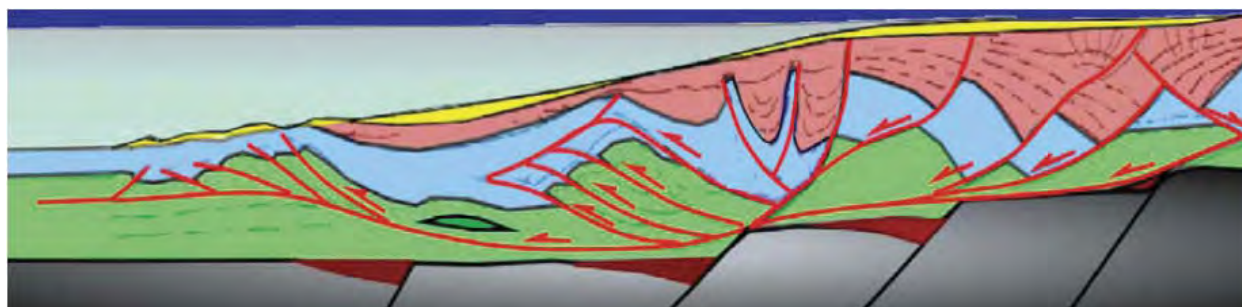


Figure 2: Alternative interpretation for a typical delta wedge. This model links the extensional systems landward with the compressional systems basinward.