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Shortening and Deformation Through Space and Time in the Deep-Water Niger Delta

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ABSTRACT

Previously we have shown that 3 closely spaced, fault- propagation folds in the down-dip toe area of the Niger Delta started to grow at about 12 Ma and that the most active period of structural growth was between 9 and 3.7 Ma with a notable slow-down in the last 4 Myrs. Maximum growth rates range from 200-400 m/Ma. We have now extended this work over a 40 km long dip-section across the toe-thrust domain. We observe that the thrusts started to form earlier in a more landward direction as occurs in many tectonic foreland fold and thrust belts. However, the structures do not stop growing in a similar way; there is no clear, distal migration of a wave of deformation in a simple piggyback fashion. Some thrusts have stopped growing and yet there are other thrusts along the length of the section that are still active forming present day topography and affecting the pathway of sea-floor slope channel systems. The maximum growth rate on any one structure is similar to those reported in our previous work and throughout the entire width of the deforming belt the reduction in shortening rates occurs at similar time. We suggest that the reduction in the Pliocene-Recent fold shortening rate is a response to the slow-down in extension observed in the up-dip extensional domain of the Niger Delta gravitational system in the same time interval and that this is triggered by a reduction of sediment supply to the Nigel delta at about 4 Ma. It would seem that the sediment-loading driver is shutting down and rates of deformation respond accordingly across the entire delta. We have also observed that one of the lateral structures (striking parallel to the thrust transport directions) in the eastern lobe of the Nigeria delta has started to move prior to the main shortening within the section considered to be pre-kinematic. The sub-vertical deforming zone can be mapped for c.50 km along strike and has sinistral transtensional movement throughout the upper Miocene-recent. The timing of deformation along this structure suggests that it is not a tear fault accommodating radial deformation in the toe parts of the delta. Instead it aligns with a buried oceanic transform imaged in the oceanic crust beneath the main Eocene to Recent Niger Delta succession, suggesting older inherited exert structural control on major sectors of the Niger Delta. We also show how this strike-slip zone has constrained the pathway of slope channel-systems throughout the upper Miocene-Pleistocene.