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Controls of sedimentary supply and gravity driven deformation on the eastern Niger delta (Plio-Pleistocene) from the shoreline to the deep sea plain

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We studied the evolution of the gravity flow sedimentary within a large shelf-edge delta (Eastern Niger delta) over the last 2,5Myr taking into account the influence of the contemporaneous gravity driven deformation and sedimentary supply. To do this, we mapped (i) the shoreline geometry and (ii) the associated turbiditic systems for 9 intervals using a classification based on three morphological end-members: erosive, constructive and depositional modes. We characterized the depositional profile of the passive margin delta from the littoral domain to the abyssal plain and its spatial and temporal variability. We showed that, at the scale of the delta, the depositional profile varied from (i) a shelf edge delta profile with a slope break at the location of the shoreline during progradation to (ii) a ramp profile characteristic of a mid-shelf delta during retrogradation. Thus, during a stratigraphic cycle, the delta front evolved from a prograding slope break during the development of the HST, to steepening clinoforms during the development of the LST that progressively flattened out during the TST to reach a ramp profile at the MFS. The turbiditic systems (including MTC) initiate near the shoreline, at the toe of the delta front. Also, they form preferentially down slope synthetic faults or within antithetic fault relays. They are initially erosive, becoming constructive further down slope and eventually depositional. They may become erosive again as they cut through the compressional structures. We showed that the stratigraphic state (progradation/retrogradation) controls the amount of sediment reaching the platform and strongly impacts the density of gravity flow sedimentary systems (low density during progradation and high density during progradation). On the other hand, the gravity driven deformation controls the slope of the sea-floor and, in doing so, their morphology (erosive/constructive/depositional). Within this framework, lateral migrations of the delta impact both the spatial distribution of gravity driven deformation and gravity flow sedimentary systems. We think these results may be extrapolated to many shelf-edge deltas affected by gravity-driven deformation. Also, these results provide us with a tool to predict the spatial distribution of the domains in erosion/transit/sedimentation of the gravity flow sedimentary systems as well as their expected lithologies.