Study of the Pleistocene submarine canyons of the south-eastern Niger delta basin: Tectonostratigraphic evolution and infilling

Using integrated analysis of 3D seismic data and well logs, this study evaluates the tectonosedimentary evolution of Pleistocene submarine canyon systems of the Eastern Niger Delta basin and discusses the controlling factors on canyons formation and development. The study focuses on the head and trunk of a two-branched, long-lived canyon system, the Galabor Canyon. These branches are the eastern and western branches and are separated by a shale ridge that formed contemporaneously to the canyons. The canyon head encroaches the shelf edge, where incised valleys and shelf-edge deltas are localized. The western branch is 3km and 6km wide on the canyon neck and trunk, respectively, and 7km wide at a confluence point where it connects with the eastern branch of the canyon system. The eastern branch contains a 2.5km wide channel belt that displays high amplitude contrast. Such channel belts evolve through lateral accretion of individual channels about 400m wide, increasing sinuosity from straight to meander shapes. Seismic horizons correlating to the top and bottom of the canyon fills were mapped across a regional 3-D seismic volume. They correlate to shelf-margin systems tracts, the stacking pattern of which suggests possible fourth-order sequences. Growth faults dissect shelf-edge deltas, which are correlated to mass-transport deposits in the canyon-head infilling. Mass transport complexes are also observed away from the shelf edge, where the rising shale ridge laterally feeds the canyon. River connection during lowstand stages of canyon activity is suggested by large amounts of sand forming multistorey meander belts confined within the canyon and laterally passing to muddy levees and fallout turbidites. Two stages of canyon incision and infilling are stacked in the Pleistocene. The primary incision that resulted in canyon formation is tied to Marine isotope stage (MIS) 52 at about 1.65Ma during a major regressive event. The second canyon system cut into the first system after a short period of deposition of hemipelagic sediments. The cross-sectional geometry of these canyons is V-shaped on the canyon neck but gradually passes downslope to a U-shape geometry as the canyons widen. However, both canyon geometry reverses into a V-shaped form just as they come close to the downstream confluence point, suggesting an influence of shale ridge uplift on the sudden change in geometry. The data presented in this study provides clues for studying the relationships between submarine canyon heads and sediment sources and the structural controls in the routing of sediments from the shelf environments to the deep basins.