Sedimentological and Petrographic Evidence of Flow Confinement in a Passive Continental Margin Deep-Marine Slope Channel Complex, Isaac Formation, Windermere Supergroup, British Columbia

Tyler Billington, Bill Arnott
University of Ottawa

9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

In both the ancient and modern sedimentary records levee deposits are dominated by sand-rich classical turbidites. However, in levee deposits of the Neoproterozic Windermere Supergroup, in addition to classical Bouma turbidites, strata that superficially resemble turbidites but distinctively are rhythmically interstratified and intercalated with mud-rich sandstone are observed. At its base an idealized succession consists of graded, structureless or planar-stratifed, very coarse- to very fine-grained clayey sandstone equivalent to the Ta or Tb divisions of a classical turbidite. This, then, is overlain sharply by wavy or low-angle (°) cross- or planar-stratified, medium- to very fine-grained, matrix-rich (30-40%) clayey sandstone (heterolithic strata) superficially resembes the Tc division but in which cross-stratification is ubiquitously low angle (°) and sand-rich parts are rhythmically interlayered with a mixture of sand and mud. This is then capped by a succession of matrix-rich (60-70%), planar-laminated, fine- to very fine-grained sandy claystone that ranges up to a few 10s of cm thick. Laminae are sharply bounded and marked by a repetitive alternation of sand/silt-rich and mud-rich layers that can be followed along strike for 10s of meters, which then is overlain sharply by massive or graded structureless claystone. Differences in the lithological and textural characteristics of the heterolithic and capping mud-rich units compared to classical turbidites are interpreted to be a consequence of flow confinement. Here two-way confinement was

provided by an escarpment (erosional levee) that had been sculpted by an older erosional channel complex and growth of a depositional levee associated with a younger, unexposed channel. Flows that overspilled the new channel and flowed down the developing levee eventually encountered the earlier part of the same flow that previously had encountered the escarpment, ran-up (inflated), became gravitationally unstable, and flowed back toward the channel. This set up a complex interaction between the incident flow (channel overspill flow) and the flow from the escarpment (return flow), which stratigraphically is manifest as the heterolithic and thick mud cap. Evidence of confinement is also indicated by stratal tabularity (<1% change over 1 km along strike), paleocurrent reversals and the anamolously thick mudstone cap. With continued deposition, relief of the escarpment became reduced, and as a consequence the strength of the reflected flow diminished. Eventually, the escarpment became buried and the now unobstructed and unconfined overspilling flows deposited a succession of thin-bedded turbidites that more closely resemble turbidites deposited on modern and ancient deep-marine levees.