Architectural Evolution of an Ancient Basin Floor to Slope Transition from the Windermere Turbidite System, Southeastern Canada

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In the Cariboo Mountains, British Columbia, Neoproterozoic strata of the Windermere turbidite system reflect the shift from basin-floor-fan dominated to slope-channel dominated deposition. Although similar architectural transitions have been reported from other outcrops and subsurface deep-water systems, they remain poorly understood. Unlike many ancient deep-water examples, the basin floor to slope transition is here well exposed in a continuous, 500 m-thick section and mapped across a >1.5 km wide outcrop transect. The succession contains a diverse suite of architectural elements, in which lobe and channel deposits dominant in the lower part of the transition, but give way in the upper part to channel and mass-transport deposits. Irrespective of position, fine-grained sheets, composed of layered, thin-bedded turbidites occur sandwiched between these sand-rich strata.

Lobe deposits occur as extensive “sheet-like” elements (up to 30 m thick), but internally comprise a complex architecture of thin- to medium-bedded, layered mudstone-sandstone sheets dissected by numerous broad, low-relief, mostly coarser-grained sandstone channel fills. These elements are interpreted to represent distributary channel-dominated lobes that accumulated on the proximal basin floor to base of slope. In the lower part of the transition interval, channel deposits are up to 15 m thick, several hundred meters wide and are filled with sandstone or heterolithic strata. Locally they incise lobes or fine-grained sheet deposits. In the upper part of the transition interval, on the other hand, channel and channel-levee complexes extend across the study area and consist of two or more vertically-stacked (10-25 m thick), laterally-offset, composite slope channels with conglomerate and coarse sandstone infill. Stratigraphically upward, mass-transport deposits (i.e. debrites and slides) increase in size and abundance, indicating the more frequent emplacement of increasingly larger mass failures on a prograding slope. Fine-grained sheets also increase in thickness, but locally are incised by scours formed during the passage of bypass currents, or eroded by channelized or mass-transport deposits.

Delineating the various stratigraphic patterns and geometries in the Windermere basin floor-slope interval has major implication regarding facies prediction in analogous deep-water reservoirs.