# Transitional Event Deposits (TEDs) of the Cerro Toro Formation: Implications on Deep-Water Exploration and Production in Submarine Channel Systems

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## ABSTRACT

In the Cretaceous Cerro Toro Formation, Magallanes Basin, southern Chile, slope channel complex system deposits of the Lago Sofia Member were examined in the Silla Syncline area, Torres del Paine National Park. Though enveloped in a thick and shale-dominated slope environment, the channel complexes are dominated by conglomerate. The conglomeratic units range widely in terms of fabric such as clast to matrix proportion, and in terms of thickness, but some commonalities are observed. Particularly distinctive beds, known as TEDs (transitional event beds), are up to 20 m thick, are laterally extensive, have prominent fluted bases, and have a vertical fabric starting with a (1) thin inversely-graded clast-supported base; then (2) a normally-graded and clast-supported interval; (3) gradually becoming more sand and clay matrix-supported conglomerate, with (4) a progressive upwards increase in matrix and normally grading, in both floating gravel clast and matrix grain size, towards the top; and (5) a co-genetic sandstone on top. There are at least three different processes that are thought to have generated these deposits: (i) a debris-flow, with a high matrix yield strength, with a long run out that can segregate larger gravel clasts, shearing them at the bottom, generating flutes and traction carpets, progressively depositing more debritic, muddier, less gravelly sediments upwards; (ii) a flow that initiates as a debris-flow, then progressively increases in turbulence, with its turbulent part accelerating and outpacing the debritic part of the flow, generating the flutes and traction carpets, freezing and being overrun by the debritic part of the flow again, depositing the matrix-supported part of the beds; or (iii) retrogressive headwards failure of the toe sets on a steep gravelly delta front, triggering a subaqueous and non-cohesive gravel avalanche downslope onto a muddy slope, that causes the mixing required to produce a cohesive large-volume debris flow that produces the TEDs. The fabric of these spectacular event beds is described in some detail from measured sedimentary logs, combined with petrographic analysis and high-resolution field mapping. The flow rheologies, putative triggering mechanisms and timing of formation of these events and their sequence stratigraphic significance are all discussed in relation to channel complex system development in this topographically irregular and tactically active setting.