Downslope variability in deep-water slope channel fill facies and stacking patterns: implications for hydrocarbon exploration

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Abstract: Lithologic variations in deep-water slope channel systems offer key insight into sedimentary processes on deep-water slopes, and are a primary control on performance and updip stratigraphic trap formation in subsurface reservoirs associated with ancient deep-water systems on numerous continental margins. While many studies have described these variations at outcrop-scale along depositional strike (across-channel), few have focused on deciphering down-depositional-dip changes due to: (1) the paucity of downslope perspectives afforded by outcrops; or (2) limited resolution subsurface data. In this study, characterization of slope channel elements (≤30 m thick; ≤400 m wide) and composite channelform bodies composed of two or more stacked channel elements (channel complexes and channel systems; >30 m thick; >400 m wide) was conducted along a 50-km long depositional-dip-oriented outcrop belt of the Campanian-Maastrichtian Tres Pasos Formation (Chile) to constrain longitudinal changes in slope channel fill character and stacking patterns. Results show that channel elements in updip regions of the system contain abundant siltstone, whereas channel elements in downdip regions are more sandstone-rich. Outcrop observations are supported by channel element net-to-gross ratios (i.e., measures of sandstone proportion), which progressively increase downdip. The proportion of sandstone-rich channel elements within channel complexes and channel systems also increases downdip; however, channel element stacking pattern variability results in a poor correlation between net-to-gross values and paleoslope position when composite channelform bodies are considered. These findings indicate that the longitudinal distribution of coarse-grained detritus in channel systems is fundamentally tied to the degree of coarse-grained sediment bypass and erosion that occurs along a slope. The results of this study provide a uniquely detailed record of changes in channel fill and stacking patterns along deep-water slopes, and help inform various aspects of analogous subsurface reservoirs, including the nature of updip stratigraphic traps, as well as sandstone proportion trends at numerous scales.

Biography: Ben is a Geology Laboratory Instructor in the Department of Earth and Environmental Sciences at Mount Royal University in Calgary. He holds PhD and MSc degrees in Geology and Geophysics from the University of Calgary, and an Honours BSc degree in Earth and Environmental Science from the University of Waterloo. Prior to joining Mount Royal, Ben held a variety of research-oriented roles with the Canadian government, various academic institutions, and the
petroleum industry, and spent time working in various areas across Canada, the United States, Chile, and Argentina. Ben is passionate about all aspects of geology, and is keen to help the next generation of geoscientists find exciting and rewarding employment upon graduation.

Figure 1:

Figure 2: