Downslope Variations in Slope Channel Body Stacking Patterns in Outcrop, Magallanes Foreland Basin, Chile

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Summary

Deep-water channels, which transport large volumes of detritus to the deep ocean, are highly variable along their length as they transect the continental slope. Slope channel systems have been imaged extensively using modern 3-D seismic reflection surveys and bathymetric methods in an attempt to understand their variability along continental slope profiles. While 3-D seismic surveys provide incredible insight into these systems, there is a paucity of detailed sedimentological data available with which to consider variation in formative processes over long distances. The study addresses this lack of fine-scale data through the examination of slope channel deposits along a 10 km-long depositional-dip-oriented slope profile in the Tres Pasos Formation of southern Chile. The Tres Pasos Formation was deposited on the prograding margin of a foreland basin that was characterized by >1000 m of water depth (Hubbard et al., 2010). The foreland basin was developed in response to Andean uplift during the Cretaceous.

Channel strata were documented with 18 measured sections (total of 550 m), as well as channelform surfaces (i.e., tops, bases) that were surveyed using high-resolution differential GPS (dGPS) methods. These data provide the basis for the stratigraphic architectural characterization of the outcrop belt, from which calculations of channel width, thickness and offsets were derived. Intra-channel deposits are divided up into six lithofacies associations, consisting primarily of turbiditic sandstone and siltstone.

Along the 10 km-long downslope transect, several key sedimentological and architectural observations are made. Individual channels are characterized by intra-channel fill showing significant changes downslope, from areas dominated by substantial bypass of sand (i.e., recorded by lags and bypass drapes) to channel segments filled with heterolithic material, including thick units of amalgamated sandstone. Twenty-four individual channels have been identified, and these channels possess widths, thicknesses, and sinuosities which are comparable to other modern and ancient examples (Fig. 1A; cf., McHargue et al., 2011). While the majority of these channels stack systematically eastward, pronounced changes in vertical and lateral offsets between channels occur at numerous stratigraphic levels (Fig. 1B, 1C). These changes contribute to the variations in overall width and stratigraphic thickness observed for the entire succession. In a basinward direction, the width of the composite channel succession decreases from 1696 m to 707 m, and the overall stratigraphic thickness increases from 133 m to 187 m. These associations suggest an increased confinement of the channel system, along with increased aggradation downslope (Fig. 1A-C). Ongoing work is focused on

documentation of systematic changes within the channel strata along the depositional-dip-oriented outcrop exposure, which will aid in the understanding of downslope variation in processes of sediment transfer (i.e., erosion, bypass and deposition), and provide an opportunity to consider variation in large-scale channel stacking patterns that is commonly observed in slope channel systems on the continental margin of Atlantic Canada (cf., Piper et al., 2005).

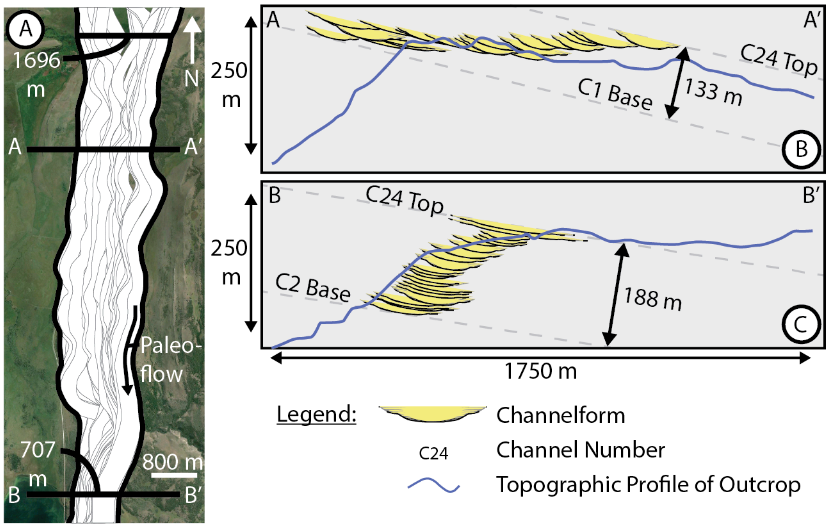

Figure 1. Illustration of the downslope variations in slope channel architecture. (A) Planform expression of the twenty-four channel elements. The width of the composite channel succession narrows considerably from north to south. (B) Depositional-dip-oriented cross-section A-A'. Many of the channels in this cross-section are considerably offset from one another. (C) Depositional-dip-oriented cross-section B-B'. Compared to A-A', channels at this location show stacking that is far more aggradational and apparently confined.

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