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# Deciphering controls on deep-water sediment routing systems along convergent margins: Leveraging basin-wide chronostratigraphic data in the Nanaimo basin.

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## Summary

Sedimentary systems on convergent margins respond to and preserve the record of tectonic processes (e.g., subduction erosion, protracted magmatism). These processes often affect large areas over protracted periods of time and impact the dispersion of sediment across basin depocenters. As such, investigation of thick paleo-continental-margin-scale stratigraphic successions is required to constrain their spatial and temporal characteristics. However, local deformation can make the correlation and interpretation of disparate outcrops within paleo-margin successions difficult. Understanding these controls on sediment-routing systems aids in the prediction of reservoirs and the stratigraphic evolution of basin-fill successions.

The Nanaimo basin represents one of multiple forearc basins that were present along the Pacific margin of North America during the Late Cretaceous. The upper Nanaimo Group, the uppermost portion of the basin fill, is recorded in a ~2000 m thick and 160 km long depositional strike-oriented outcrop belt of the basin margin, which exposes multiple turbidite channel-system deposits. Numerous hinterland sediment sources, including the Coast Mountains Batholith (CMB), the North Cascade thrust system, and sediment sources east of the CMB, supplied the basin with sediment and detailed analysis of these source terranes allows for the evolution of the basin fill to be tied to distinct hinterland events.

We construct a high-resolution chronostratigraphic framework for the upper Nanaimo Group that demonstrates channel sedimentation along the margin using a combined geochronologic-stratigraphic dataset. Stratigraphic data includes the architecture and paleoflow of numerous channel-system deposits (~2000m of measured section; 2226 paleoflow measurements), while geochronologic data includes 38 U-Pb detrital zircon samples (n=7759) that provide both provenance information and the depositional age of the sampled strata. This dataset divides the 20 M.y. of forearc sedimentation into six time intervals that constrain the spatio-temporal evolution of channel systems in reference to changes in sediment provenance and hinterland evolution.

Turbidite channel-system deposits of the upper Nanaimo Group cluster spatially into three long-lived fairways, each with a unique depositional history spanning 8 to 18 M.y. Along-strike variations in channel-system architecture, the timing of channel sedimentation, and major shifts in channel-system orientation are attributed to the segmentation of the basin into localized depocenters due to oblique subduction. Basin-wide introduction of gravel to the basin and along-strike variations in sediment provenance are attributed to deformation within the major sediment source areas. The chronostratigraphic framework enables these tectonostratigraphic processes to be disentangled, making the upper Nanaimo Group an ideal natural laboratory for the study deep-water systems in deep-time and a basin-scale outcrop analog for similar systems globally.