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The recognition and implications of a single composite submarine canyon fill interpretation for Late Cretaceous Nanaimo Group strata on Hornby and Denman Islands, B.C.

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The >4 km thick Late Cretaceous Nanaimo Group that crops out on Vancouver Island and in the Strait of Georgia is a key component of the Insular Superterrane. The geological history of this terrane has been a topic of extensive debate, which motivates paleogeographic investigation of Nanaimo Group strata. Early studies of the Nanaimo Group on Hornby and Denman islands (Fiske, 1977 and Allmaras, 1978) interpreted a fluvial-deltaic environment of deposition; however, Katnick and Mustard (2003) demonstrated a deep-water, submarine fan origin for the deposits. We hone this interpretation and propose that sedimentation of the Nanaimo Group on Hornby and Denman islands took place in a submarine canyon setting. Based on mapping, sedimentary characteristics, and comparison with other canyon systems, we propose that the entire stratigraphic sequence exposed on these islands, was deposited within a single, long-lived canyon system. The composite sedimentary body, comprised of conglomerate, sandstone, thin-bedded turbidites and fine-grained chaotic deposits, is up to 1 km thick and 18 km wide; based on previous biostratigraphic information, it records 8-10 Ma of erosion, sediment bypass and deposition on the paleo-basin margin (Muller and Jeletzky, 1970; Ward, 1970; Sliter, 1973; McGugan, 1979; Haggard, 1991 and 1994).

Previous formation-scale lithostratigraphic correlations have directly linked the Nanaimo Group between Northern (e.g., Hornby and Denman) and Southern (e.g., Gabriola, Saltspring) Gulf islands. However, the composite coarse-grained units are observed locally to on-lap high-relief erosion surfaces towards the edges of the islands. The islands are largely defined by resistant conglomerate and sandstone units at their cores and recessive slope facies at their margins, with evidence for the incisional edges of the composite conduit present in intertidal outcrop exposures at the edges of the Islands. Consequently, the deposits on Hornby and Denman cannot be lithostratigraphy correlated to the deposits of the Southern Gulf islands.

Sedimentological evidence for a submarine canyon interpretation includes: (1) facies transitions from conglomerate axis to finer units finer units at canyon margins; (2) presence of numerous channelform sedimentary bodies within the highly composite canyon fill; (3) indicators of extensive sediment bypass, including imbricated pebble-conglomerates; and (4) presence of mass wasting deposits at canyon margins, including slump blocks. The average paleoflow through the conduit was 227°(southwest); however, the individual components channelforms range from 160° to 300° on average, which is a reflection of the sinuous nature of channels that were focused through the conduit

Submarine canyons of this scale are observed in numerous modern day settings, including the Monterey Canyon offshore California, and the Bengal Canyon in the Bay of Bengal (Figure 1). Similar composite features have also been described from Cretaceous forearc strata of California (e.g., Williams, 1998). The shear magnitude of this canyon and age of the deposits supports a fixed geographic position that facilitated down-slope sediment transfer for millions of years. Future work will focus on the paleogeographic implications of this long-lived fixed submarine canyon.

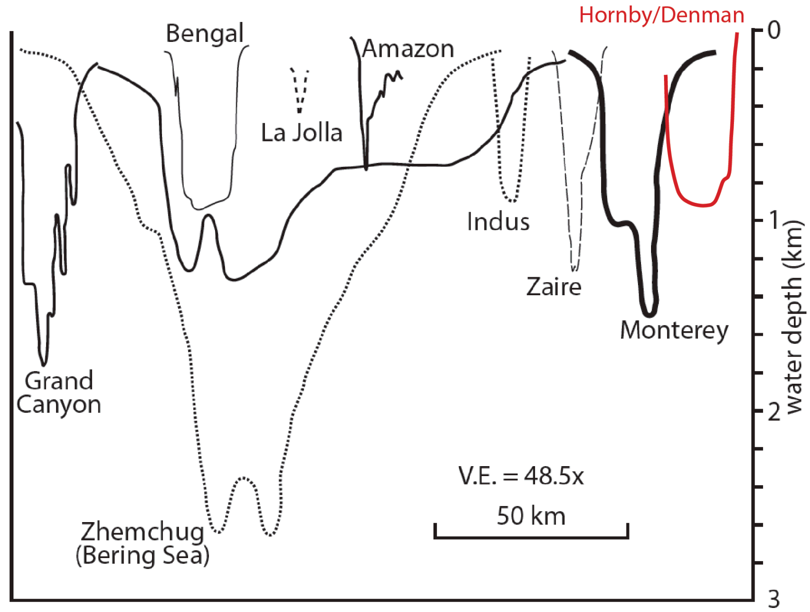

Figure 1: Comparison of canyon cross-sections modified from Normark and Carlson, 2003.

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