



## **Comparing observations and morphodynamic numerical modeling of upper-flow-regime bedforms in fjords and outcrop**

Stephen Hubbard (1), Svetlana Kostic (2), Rebecca Englert (1), Daniel Coutts (1), and Jacob Covault (3)

(1) Department of Geoscience, University of Calgary, Calgary, Canada (shubbard@ucalgary.ca), (2) Computational Science Research Center, San Diego State University, San Diego, USA (skostic@sbcglobal.net), (3) Bureau of Economic Geology, The University of Texas at Austin, Austin, USA (jake.covault@beg.utexas.edu)

Recent bathymetric observations of fjord prodeltas in British Columbia, Canada, reveal evidence for multi-phase channel erosion and deposition. These processes are interpreted to be related to the upstream migration of upper-flow-regime bedforms, namely cyclic steps. We integrate data from high-resolution bathymetric surveys and monitoring to inform morphodynamic numerical models of turbidity currents and associated bedforms in the Squamish prodelta. These models are applied to the interpretation of upper-flow-regime bedforms, including cyclic steps, antidunes, and/or transitional bedforms, in Late Cretaceous submarine conduit strata of the Nanaimo Group at Gabriola Island, British Columbia.

In the Squamish prodelta, as bedforms migrate, >90% of the deposits are reworked, making morphology- and facies-based recognition challenging. Sedimentary bodies are 5-30 m long, 0.5-2 m thick and <30 m wide. The Nanaimo Group comprises scour fills of similar scale composed of structureless sandstone, with laminated siltstone locally overlying basal erosion surfaces. Backset stratification is locally observed; packages of 2-4 backset beds, each of which are up to 60 cm thick and up to 15 m long (along dip), commonly share composite basal erosion surfaces. Numerous scour fills are recognized over thin sections (<4 m), indicating limited aggradation and preservation of the bedforms. Preliminary morphodynamic numerical modeling indicates that Squamish and Nanaimo bedforms could be transitional upper-flow-regime bedforms between cyclic steps and antidunes.

It is likely that cyclic steps and related upper-flow-regime bedforms are common in strata deposited on high gradient submarine slopes. Evidence for updip-migrating cyclic step and related deposits inform a revised interpretation of a high gradient setting dominated by supercritical flow, or alternating supercritical and subcritical flow in the Nanaimo Group. Integrating direct observations, morphodynamic numerical modeling, and outcrop characterization better constrains fundamental processes that operate in deep-water depositional systems; our analyses aims to further deduce the stratigraphy and preservation potential of upper flow-regime bedforms.