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High-resolution seismic images of southeast Alaskan glacial fjords and continental shelf: Is the present the key to the past?

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High-resolution seismic data collected aboard the R/V Maurice Ewing in August-September, 2004 imaged glacial fjords throughout southeast Alaska and the glacially- dominated shelf offshore the largest temperate glaciers in the world. Individual fjords show from 2-10 glacial advance-retreat sequences, whereas the high-resolution and deeper penetrating seismic data show the continental shelf records glacial advance and retreat sequences back to the onset of the Cordilleran Ice Sheet and earlier. Most sequences show erosional bases below a chaotic ice-contact seismic facies, a less chaotic ice-proximal facies, and a stratified ice-distal facies. Disenchantment Bay also shows flood events from the emptying of Russell Fjord following Hubbard Glacier ice-damming events. Sediment accumulation rates in Lisianski Inlet, Lynn Canal, Muir Inlet, Disenchantment Bay and the continental shelves offshore Icy Strait, Malaspina Glacier, and Bering Glacier are being examined based on clear seismic facies boundaries correlated with jumbo piston-cores from the upper sequence of each area. Although preliminary data are simple thicknesses rather than volumes, they suggest accumulation rates may vary by 2 orders of magnitude depending on over how many glacial cycles the rates are calculated. They confirm that glaciers are the dominant erosional agent because once glaciers have retreated from a fjord, accumulation rates dramatically decrease. Thus the variability likely results from differing glacial histories, lengths of glacial occupation and depths of erosion in individual fjords and different shelf regions. Limited age data suggest some fjords had Little Ice Age (LIA) advances whereas others may not have. Older advance-retreat sequences can include "Neoglacial" events and Last Glacial Maximum (LGM), and are locally preserved in a given fjord due to younger glacial erosional events not scouring to bedrock depths. Ages of these older sequences currently remain unconstrained. For example, Lynn Canal contains 2 glacial advance-retreat sequences where the most recent event is not the LIA based on core data. If the lower sequence in that fjord is LGM then the fjord has accumulated ~250 m of sediment in 18 kyr, an average accumulation rate of 1.4 cm/yr. In contrast, Disenchantment Bay may have as many as 5 advance-retreat events since the LIA that have produced ~250-m-thick sediment body. Taken locally as the accumulation rate, the upper portion of Disenchantment Bay has accumulated an incredible 70-100 cm/yr of sediment over the last 250-350 yrs. These variations require detailed histories to be developed for each fjord or glacial system in order to understand the cumulative erosion and/or deposition in this coupled glacial climate-tectonic system.