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Localized deformation zones in the offshore leading edge of the Yakutat microplate, Gulf of Alaska

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The Gulf of Alaska margin is dominated by the collision and subduction of the Yakutat microplate as it travels northwest with respect to North America at near Pacific Plate velocities (\~45 mm/yr). The oblique Yakutat block collision with North America is in transition between convergence to the west and translation along the Queen Charlotte-Fairweather-Denali Fault system to the east and north. Industry seismic reflection and high- resolution seismic reflection data collected by the R/V Maurice Ewing (2004) provides insight into how the Yakutat-North America collision is accommodated by active offshore structures near the leading edge of the Yakutat microplate. A \~200 km wide area bounded by the Ten Fathom Fault, the offshore N. America-Yakutat contact, to the west and the eastern edge of the Pamplona Zone (PZ) to the east has previously been mapped as a continuous deformation zone consisting of NE-SW trending imbricate thrusts and folds. Though this mapping corroborates onshore measurements of active deformation west of the Bering Glacier in the Yakutat block, the relationship between current onshore deformation and the observed offshore structures remains unclear. Our observations indicate that neotectonic deformation is accommodated offshore by highly localized, asynchronous thrusts that, when analyzed in an accretionary context, may be connected by a sub-horizontal decollement. Data from the eastern edge of the PZ, the proposed deformation front, shows surface deformation caused by east-verging thrust faults. Seismic reflection profiles in the western PZ and the Bering Trough show no evidence of active tectonic deformation and up to \~200 m of undisturbed sediments indicating that faulting in this part of the Yakutat block has been inactive since the Last Glacial Maximum or earlier. Farther west, above the Kayak Island fault zone, directly east of the Ten Fathom Fault, the presence of up to \~50 m of undeformed sediments suggests a recent (ca. 14 ka) transition in deformation style, including a possible eastward jump of the deformation front to the eastern PZ. In addition, images of the Khitrov fault zone south of Kayak Island show possible transpressional faulting and associated surface deformation that may indicate a shift in tectonic style in this corner of the microplate as Yakutat material is constricted west of the PZ. Collision in the leading edge of the Yakutat block therefore appears to be accommodated by deformation along localized fault structures as opposed to a broad zone of deformation. These localized deformation zones correlate with the edges of the large temperate glaciers that are the dominant erosional force in the St. Elias orogeny.