

Tectonostratigraphic Evolution of the Mackenzie Delta - Beaufort Sea Fold Belt

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Interpretation of 2D seismic data from the western region of the Mackenzie Delta - Beaufort Sea Fold Belt (MDBSFB) shows that Cenozoic deformation produced low-amplitude, long-wavelength faulted anticlines and folds. Filling of backlimb synclines by convergence packages and uplift-related erosion allow dating phases of deformation in the MDBSFB during the Middle-Late Paleocene, Middle Eocene, Early Oligocene, Late Oligocene and Early Miocene.

Interpretation of the seismic data indicates that pre-existing basement normal faults formed buttresses to a basal detachment (occurring at 11 to 12 sec TWT; ~12-13.5 km depth) in the northern part of the study area resulting in contraction and uplift along north- and south-verging thrust sheets above the normal-faulted footwalls. This contraction and uplift formed the previously undocumented Foreland High resulting in the northern limit of the MDBSFB extending 30 to 40 km farther basinward than noted in previous studies. A topographic low, the Central Region, developed between the hinterland of the study area and the Foreland High. This Central Region became the focal point for deposition from the Oligocene through the Late Miocene. The shelf, slope and toe of slope were structurally controlled during this time with syn-depositional deformation occurring in the Early and Late Oligocene and Miocene.

The MDBSFB rock record is compared to a strain class model for Alaska (Seeley and Spratt, 2006). This strain class model uses convergence rates between the proto-Pacific, Pacific and North American plates to empirically classify the style of strain in Alaska and northward (present day orientation) from the Jurassic to Present. The strain class model demonstrates that high convergence rates from the mid-to-Late Cretaceous through Eocene resulted in the deformation that produced uplift of the Brooks and Northeastern Brooks Ranges with development of the MDBSFB as foreland fold belt. Episodic contraction in the Early Oligocene, Late Oligocene and Early Miocene is likely associated with the interactions between the Pacific and North American plates, but at this time, cannot be tied directly to the convergence rates between the plates.