

Helwig, J. A., Bird, D. E., Kumar, N., Emmet, P. A., and Dinkelman, M., 2012, **Tectonic framework of the Beaufort-Mackenzie margin, Canadian Arctic Ocean, from integrated deep seismic and potential-field studies** (abstract): Eos, Transactions, American Geophysical Union, Fall Meeting Supplement, vol. 93, T34A-05.

A five-year long, ION ArcticSPAN seismic survey program in the Canadian Beaufort Sea expands and elaborates the tectonic framework of the Canada Basin passive margin. The margin is clearly subdivided into three segments of different orientation and structure: 1) the overprinted Cordilleran-Beaufort Foldbelt segment trending west towards Alaska; 2) the transtensional Tuk segment trending northeast off the Tuktoyaktuk Peninsula; and 3) the extensional Banks segment trending north off Banks Island. From nearshore to 2500 m depth, over 20,000 km of 2D long-offset data were acquired and processed into 40 km deep PSDM profiles. The latest lines used special technology for shooting beneath first-year ice-covered areas, and 450 km of OBC data were acquired in the nearshore transition zone. From well control in the Mackenzie Delta area, a geological interpretation is extended into the late Jurassic to Recent passive margin stratigraphy as well as the varying underlying crust of both oceanic affinity, and Ellesmerian and Laurentian continental affinities. Major elements of a tectonic synthesis include: 1) deep profiles show the Tertiary detached Beaufort foldbelt overlies greatly extended continental and/or oceanic crust although the COB is obscured by the overprint; 2) oceanic crust with steep relief is found at the inferred junction of the extinct spreading center of the Canada Basin in the Mackenzie delta; 3) on the Tuk margin, thick Proterozoic and Paleozoic strata flanking the Laurentian craton are terminated at the COB by a transform fault system; and 4) architecture of the Banks segment includes late Jurassic rift structure, and a continent-ocean transition beneath the continental slope prism that includes gravitational folds down-dip of shallower extensional break-away faults and rollover folds in the Tertiary. Our tectonic framework is consistent with a rotational model for opening of the Canada Basin. The free air gravity field is dominated by a high-amplitude continental margin anomaly (CMA) over the southeastern slope to shelf boundary of the Canada Basin, extending approximately 1,000 km from off the Tuktoyaktuk Peninsula to off northern Banks Island. Forward models, that integrate seismic depth images and free air gravity, demonstrate that the CMA is produced, in large part, by the transition from continental crust to oceanic crust. In the central Canada Basin a northwest-trending free air gravity low, interpreted as an extinct late Jurassic to early Cretaceous seafloor spreading center by most workers, extends about 850 km along the basin axis and intersects landward with the CMA at the Oligocene Amauligak Trough. The trough borders the Tuk fossil transform system, and is inferred to be caused by reactivation of the ridge-transform junction due to the loading of the north-propagating Beaufort foldbelt. High quality images in new deep seismic data and integrated gravity models support this interpretation.