Deformable Plate Tectonic Reconstructions Incorporating Interpretations from Newly Acquired Geophysical Data Support a Multi-Phase Plate Tectonic Model for the Origin and Evolution of the Amerasian Basin

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Deformable plate tectonic reconstructions in conjunction with tectono-stratigraphic interpretations of recent deep long-offset seismic and gravity data were used to arrive at a multi-phase model for the origin and evolution of the Amerasian Basin. More than 16,000 km of newly acquired deep (40 km) 2-D seismic PSDM data in the Canadian Beaufort Sea provided input into the model. New acquisitions planned for the summer of 2010 will also be interpreted and used to further enhance the model in other parts of the Basin.

The interpretation of the Canadian margin of the Beaufort Sea supports an anti-clockwise rotational model for development of the Canada Basin, with the addition of an initial stage of oblique separation. The first phase started in the Late Jurassic and was characterized by extension and thinning of continental crust along the Banks Island margin, strike-slip movement or transtension along the Tuktoyaktuk Transform Fault, thought to be due primarily to the geometry of the plate boundaries, and initial sea-floor spreading. The second phase of the opening of this part of the basin began to occur in the Early Cretaceous when the Tuktoyaktuk margin was separated from the Alaska Arctic Terrane by anti-clockwise rotation and inferred asymmetrical fan-shaped sea-floor spreading.

In evaluating the applicability of the anti-clockwise rotational model for the entire Amerasian Basin, it was found that, even with removal of pre-rift extension, a good fit for the remainder of the Amerasian Basin could not be obtained. As a result, we conclude that a different model is required to explain the development of the Amerasian Basin beyond Banks Island to the Lomonosov Ridge. Recent field studies suggest that a later phase of Cretaceous rifting occurred in the Amerasian Basin beyond Banks Island causing Chukotka and the Alaska Arctic Terranes to separate by clockwise rotation from the Lomonosov Ridge. Preliminary modeling using deformable plates seems to support this later phase of Cretaceous rifting. It is anticipated that the acquisition and interpretation of deep seismic and high-resolution gravity and magnetic data beyond Banks Island will help further refine this model leading to a better understanding of the structural development, source rock distribution, depositional setting of reservoir rocks, palaeo-climate and ocean currents.