

## **A Palinspastic Deformable Plate Kinematic Model Offers New Perspectives on Palaeozoic to Cenozoic Circum-Arctic Sedimentary Basin Evolution**

**Bridget E. Ady<sup>1</sup>, Richard C. Whittaker<sup>1</sup>**

<sup>1</sup>GeoArctic Ltd., Calgary, AB, Canada.

### **ABSTRACT**

In recent years, the consensus is that a three-stage opening of the Arctic Ocean is the best fit with existing data and global plate kinematics. A new palinspastic deformable-margin plate kinematic model for the circum-Arctic, constrained by gravity, magnetic and geological data, supports and further refines this three-stage opening: 1) Early Cretaceous "windshield wiper" rotational opening of the Amerasia Basin along the Palaeozoic Ellesmerian suture, 2) mid-Cretaceous to Paleocene opening between the Amerasia Basin and the Lomonosov Ridge orthogonal to the earlier spreading direction, creating the pull-apart Podvodnikov and Makarov basins from Campanian and Maastrichtian times respectively, and 3) latest Paleocene to present day opening of the Eurasia Basin between the Lomonosov Ridge and the Barents-Kara Shelf, also orthogonal to the Amerasia Basin. Palinspastic deformable-margin plate kinematic models quantify the timing, amount and direction of extension, compression and deformation related to strike-slip motion across a margin and are particularly important for hyperextended margins such as the Laptev Shelf, SW Barents Shelf, and NE Greenland margins. Restoring the hyperextended basins of the North Atlantic and Labrador Sea and Baffin Bay is also an essential precursor to development of a plate model for the circum-Arctic. The new plate model sheds light on some of the more enigmatic features of the circum-Arctic such as the pre-rift configuration of Ellesmerian and Caledonian structural lineaments and the Northwind Ridge and Chukchi Plateau. It provides the timing and amount of extension transferred along transform zones into the Arctic from the North Atlantic along the De Geer Megashear in the Early Cretaceous and from Baffin Bay–Labrador Sea in the Late Cretaceous along the Wegener Fault Zone, charting a propagating system of seafloor spreading, hyperextension, rifting, transform and extension from the North Atlantic and Labrador Sea to the Arctic. We use the model to restore basin palaeogeometry through time and to analyse the evolution of the Palaeozoic to Cenozoic circum-Arctic sedimentary basins, including marine connectivity, palaeogeography and the influence of structural inheritance.