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Crustal-scale geological and thermal models of the Beaufort-Mackenzie Basin, Arctic Canada

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The Beaufort-Mackenzie Basin is a petroliferous province in northwest Arctic Canada and one of the best-known segments of the Arctic Ocean margin due to decades of exploration. Our study is part of the programme MOM (Methane On the Move), which aims to quantify the methane contribution from natural petroleum systems to the atmosphere over geological times. Models reflecting the potential of a sedimentary basin to release methane require well-assessed boundary conditions such as the crustal structure and large-scale temperature variation. We focus on the crustal-scale thermal field of the Beaufort-Mackenzie Basin. This Basin has formed on a post-rift, continental margin which, during the Late Cretaceous and Tertiary, developed into the foreland of the North American Cordilleran foldbelt providing space for the accumulation of up to 16 km of foreland deposits. We present a 3D geological model which integrates the present topography, depth maps of Upper Cretaceous and Tertiary horizons (Kroeger et al., 2008, 2009), tops of formations derived from interpreted 2D reflection seismic lines and 284 boreholes (released by the National Energy Board of Canada), and the sequence stratigraphic framework established by previous studies (e.g. Dixon et al., 1996). To determine the position and geometry of the crust-mantle boundary, an isostatic calculation (Airy´s model) is applied to the geological model. We present different crustal-scale models combining isostatic modelling, published deep reflection and refraction seismic lines (e.g. Stephenson et al., 1994; O'Leary et al., 1995), and calculations of the 3D conductive thermal field.

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