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Arctic Plate Reconstructions & Predicted Crustal Thickness from Gravity Inversion

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The plate tectonic history of the Amerasia Basin (High Arctic) and its distribution of oceanic and continental lithosphere is poorly known. A new method of gravity inversion with an embedded lithosphere thermal gravity anomaly correction has been applied to the NGA (U) Arctic Gravity Project data to predict crustal thickness and to test different plate reconstructions within the Arctic region. The inversion of gravity data to map crustal thickness variation within oceanic and rifted continental margin lithosphere requires the incorporation of a lithosphere thermal gravity anomaly correction for both oceanic and continental lithosphere. Oceanic lithosphere and stretched continental margin lithosphere produce a large negative residual thermal gravity anomaly (up to -380 mGal), for which a correction must be made in order to determine realistic Moho depth by gravity anomaly inversion. The lithosphere thermal model used to predict the lithosphere thermal gravity anomaly correction may be conditioned using plate reconstruction models to provide the age and location of oceanic lithosphere. Three plate reconstruction models have been examined for the opening of the Amerasia Basin, two end member models and a hybrid model: in one end member model the Mendeleev Ridge is rifted from the Canadian margin while in the other it is rifted from the Lomonosov Ridge (Eurasia Basin), the hybrid model contains elements of both end member models. A crustal thickness of about 20 km is predicted for an Early to Mid-Cretaceous Makarov Basin which is similar to the value obtained from seismic refraction data. We suggest that this method could be used for discriminating between various plate tectonic scenarios, especially in remote or poorly surveyed regions.