



Crustal thickness and OCT mapping of the Arctic region using gravity inversion incorporating a lithosphere thermal correction

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A new technique of gravity inversion with an embedded lithosphere thermal gravity anomaly correction has been applied to the NGA(U) Arctic Gravity Project data to map crustal thickness within the Arctic region. Satellite gravity data and digital bathymetry provide powerful data sets for investigating the transition from continental to oceanic crust at rifted continental margins. The inversion of satellite gravity data at rifted continental margins to map crustal thickness variation and predict the location of the ocean-continent transition (OCT) 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 Moho depth. The gravity inversion using the thermal gravity correction predicts oceanic crustal thicknesses consistent with seismic observations, while that without the thermal correction predicts much too great oceanic crustal thicknesses. The lithosphere thermal model used to predict the gravity anomaly correction may be conditioned using magnetic isochron data to provide the age of oceanic lithosphere. The resulting crustal thickness determination is however sensitive to errors in the magnetic isochron data. A new method of inverting satellite gravity at rifted continental margins to give crustal thickness, incorporating a lithosphere thermal correction, has been developed which does not use a priori information of the location of the OCT using magnetic isochron data and provides an independent prediction of OCT location. Where oceanic isochrons are believed to be reliable the lithosphere thermal gravity correction may be determined for oceanic lithosphere from ocean lithosphere age, and for the thinned continental margin lithosphere using margin

rift age and beta stretching estimates iteratively derived from crustal basement thickness determined from the gravity inversion. Where ocean isochrons are unknown or unreliable, all lithosphere is assumed to be initially continental and a uniform lithosphere stretching age is used corresponding to the time of continental breakup. The thinning factor produced by the gravity inversion is used to predict the thickness of oceanic crust using an empirical relationship to predict the thickness of oceanic crust from lithosphere thinning factor parameterised by a critical thinning factor for the start of ocean crust production and maximum oceanic crustal thickness. This new modified form of gravity inversion with embedded thermal correction provides an improved estimate of rifted continental margin crustal thinning and an improved (and isochron independent) prediction of OCT location. Preliminary results, from this new gravity inversion method of OCT mapping, are shown for the Arctic region and provide useful insights to OCT location and continental breakup history within the Arctic region.