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The crust and upper mantle of the Eurasia Basin revealed by geophysical data and mantle tomography models

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The present day plate boundary between the Eurasia and North America plates, the Gakkel Ridge, runs through the Eurasia Basin in the High Arctic, and is considered the slowest mid-ocean ridge on Earth (c. 6-13 mm/yr). The Eurasia Basin is floored by oceanic crust c. 57-0 Ma old, which formed initially (<10 myrs) within an intermediate-slow seafloor spreading regime and has subsequently slowed down since the Eocene. Here we present new results regarding the crustal accretion asymmetry inferred from new seismic reflection data, a crustal thickness model derived from gravity inversion, and an analysis of available upper mantle tomographic models.
The new seismic and other available geophysical data reveal the asymmetry of the basement and sedimentary structure of the Eurasia Basin. Asymmetry in oceanic crust accretion occurred both at older and younger seafloor spreading stages in the conjugate Nansen and Amundsen sub-basins, with a general trend of higher spreading rate in the Nansen Basin. Since the Miocene, a dramatic decrease in spreading rate led to the formation of high mid-ocean ridge flank topography and ridge segments with variable crust thickness .
Upper mantle tomographic models consistently image low seismic velocities at both ends of the Gakkel ridge in the upper 50 km and relatively higher velocity under the central Gakkel Ridge, which roughly corresponds with thin crust and sparsely magmatic spreading processes. The AMISvArc tomographic model presents an image of the inflow of hot North Atlantic asthenosphere into the Eurasia Basin, suggesting mantle heterogeneities have a major effect on the character of the seafloor spreading.
The new geophysical data, the updated ISC+EMSC earthquake catalogues from 1960 to 2018, the seamount population, and recent tomographic models reveal, in greater detail, the segmentation of the Gakkel Ridge, and may indicate links between upper mantle heterogeneities and surface processes.