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Deglaciation pattern, glacial isostatic adjustment and heat flow of the Kola region, NW Russia

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During the last glacial maximum time (23-17 ka BP) the ice sheet covered the Kola Peninsula and the adjacent Barents and White (as far as to Kanin Peninsula at east) seas. The ice thickness amounted of 2500 m. At 14.7-13 ka BP the adjacent Barents shelf becomes free of ice (Yevzerov, 2007) and two glacial lobes (Barents one in the northern and Belomorian one in the southern parts) were still active in the Kola Peninsula and in the White Sea. Start from 12.5-11 ka BP the periglacial basin forms in White Sea depression as the continental Kola was still covered by ice. After that time the Barents (more rapidly) and Belomorian lobes degraded from east to west, and at ca. 10 ka BP the Kola region becomes almost free of ice.

Based on the analyses of the relative sea level curves of the Barents and White Seas the postglacial isostatic adjustment was evaluated. During the last 6000 years the postglacial uplift was of the dome-shaped form and was more intensive in the western part of the region, than in the eastern one. From this it is assumed that the surface of ice sheet in region was of convex-concave form (Kolka et al., 2005).

P-T values for peridotitic chrome diopsides recovered from the Quaternary sediments of the Kola region using the single-grain thermobarometer of Nimis & Taylor (2000) imply that the maximum depth of xenocryst sampling varies from up to 200 km in the south-eastern and south-western Kola, to 170 km in central Kola, and down to 140 km in the northern Kola region, assuming possibly the different thickness of lithosphere. The data also suggest significant regional variations in the heat flow (Zozulya et al., 2007). Within the southern part of the Kola, adjacent to the Kandalaksha graben

(White Sea rift system), the chrome diopside data is consistent with the 38-44 mW/m^2 model geotherm of Pollack & Chapman (1977). Importantly, towards east and west, away from Kandalaksha graben to south, the lithosphere appears to become thicker and the heat flow corresponds to the cool cratonic model geotherm of 35-38 mW/m^2. The central Kola, in turn, is characterized by more elevated heat flow of ca. 38-44 mW/m^2. The highest heat flow values (up to 50 mW/m^2) are observed in the northernmost Kola region, adjacent to the Barents rift system.

There is a possible link between the heat flow variations and the ice sheet structure and dynamics. The lobes of the ice sheet with higher velocities of ice-mass transportation are confined mainly to the areas with relatively elevated heat flow values, and the ice divided zones correspond roughly to the areas with lower heat flow values. The one of the reason for formation of the periglacial lake in White Sea basin is the elevated heat flow in area. The thickness of the ice sheet is higher in the western part, where the postglacial uplift is more intensive and cratonic geotherm is cooler.