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Coupling of isostasy with Geological - Geomorphological Observations in Large-Scale Erosion - Accumulation Estimations and Landscape Modeling

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From the Scandinavian post-glacial rebound we have found that the flexural rigidity of the lithosphere is 5·10**23 Nm (effective elastic thickness of 30–40 km). Isostatic adjustment to redistribution of water and sediment loads is rarely considered in regional geomorphological modeling with skyline reconstructions of different surfaces, and estimations of volumes of eroded material. However, not accounting for flexural bending of surfaces and vertical movements, caused by isostasy, may lead to unrealistic results. On the other hand, 3D examination of relevant bending in extensive platform regions confirm validity of rheological properties obtained in models of glacial isostatic adjustment.

The value of the flexural rigidity determined from the post-glacial rebound is not necessarily representative for the past; the effective elastic thickness (flexure effect) could theoretically differ over time, e.g. due to changes in heat flow. Anyway, we show the isostatic effect of on the Cenozoic erosion after the Late Cretaceous/Early Palaeogene planation. In contrast to the strong uplift in the western part, to the east of the Baltic it could be reconstructed as the upper step of plains of Russian platform in the direction of Maanselka - Western-Karelic upland. In some areas it slightly modifies exhumed isostatically flattening sub-Cretaceous surface. Over extensive areas it was probably covered by Eocene marine sediments, but Miocene transgressions could also be extensive laterally.

In our model total Cenozoic erosion in the Baltic region was variable, somewhere exceeding 500 m (and much more in local glacial overdeepenings), with the isostatic uplift exceeding 350 m. If bending of the base Cretaceous is mostly connected with Late Cretaceous–Paleogene erosion, the base of sub-Upper Vendian peneplain (SUV) reflects long exhumation history. The uplift of the SUV in the Aland saddle, which separates the sedimentary cover of the Bothnian Bay and Baltic Proper could be caused by isostasy. So could the SUV undulation between the Bothnian Sea and the Bothnian Bay.