

The Occurrence of a Lower Viscosity Layer in the Crust of Old Cratons as a Cause of the Strongly Differentiated Character of Postglacial Uplift

E. V. Artyushkov, V. V. Kol'ka & P. A. Chekhovich

Doklady Earth Sciences **492**, 351–355(2020) | [Cite this article](#)

[Metrics](#)

Abstract

Rapid glacio-isostatic rebound in Fennoscandia and Canada that is nonuniform in time and space indicates that there is a layer with strongly decreased viscosity at shallow crustal depths. The upper boundary of the layer is near the depth of 15 km, which corresponds to the maximum depth of earthquake hypocenters in the Precambrian cratons of the Kola Peninsula and Karelia. The position of the lower boundary is less distinct; however, most likely it is located near the base of the crust. The formation of such a layer in the Pliocene–Quaternary occurred due to infiltration of a large volume of mantle fluids into the crust. In many regions, this has led to retrograde metamorphism with rock expansion and a strong decrease in rocks viscosity.

This is a preview of subscription content, [log in](#) to check access.

REFERENCES

1 I. M. Artemieva, *The Lithosphere. An Interdisciplinary Approach* (Cambridge Univ. Press, Cambridge, 2011).

2 J. T. Andrews, *Glacier Science and Environmental Change*, Ed. by P. G. Knight (Blackwell Publ., 2006), pp. 201–207.

3 A. P. Stroeven, C. Hättestrand, J. Kleman, et al., *Quat. Sci. Rev.* **147**, 91–121 (2016).
<https://doi.org/10.1016/j.quascirev.2015.09.016>

4 K. Lambeck, C. Smither, and P. Johnston, *Geophys. J. Int.* **134**, 102–144 (1998). <https://doi.org/10.1046/j.1365-246x.1998.00541x>

5 A. Paulson, S. Zhong, and J. Wahr, *Geophys. J. Int.* **163**, 357–371 (2005). <https://doi.org/10.1111/j.1365-246X.2005.02645.x>

6 H. Steffen and P. Wu, *J. Geodyn.* **52** (3–4), 169–204 (2011).
<https://doi.org/10.1016/j.jog.2011.03.002>

7 J. Garai, *Post Glacial Rebounds Measure the Viscosity of the Lithosphere* (2003). <https://arxiv.org/abs/physics/0308002>

8 A. F. Grachev and P. M. Dolukhanov, *Problems on Modern Earth's Crust Motions* (Moscow, 1969), Vol. 3, pp. 173–187 [in Russian].

9 B. Matthews, *Arctic* **20** (3), 176–202 (1967).

10 E. V. Artyushkov, *Izv. Akad. Nauk SSSR, Ser. Geol.*, No. 4, 26–33 (1967).

11 E. V. Artyushkov, *J. Geophys. Res.* **76**, 1376–1390 (1971).

12 V. V. Kol'ka, O. P. Korsakova, A. N. Tolstobrova, D. S. Tolstobrov, and A. A. Vashkov, in *Proc. Fersman Sci. Sess. Geol. Inst. Kola Sci. Center RAS* (Apatity, 2018), Vol. 15, pp. 205–208. <https://doi.org/10.31241/FNS.2018.15.051>

13 E. V. Artyushkov, S. P. Korikovsky, H.-J. Massonne, and P. A. Chekhovich, *Russ. Geol. Geophys.* **59** (11), 1389–1409 (2018).
<https://doi.org/10.1016/j.rgg.2018.10.001>

14 *Neotectonic Map of the Northern Eurasia 1 : 5 000 000*, Ed. by A. F. Grachev (Federal Subsurface Management Agency; Schmidt Inst. Phys. Earth RAS, Moscow, 1997) [in Russian].

15 *Earthquakes and Microseismicity in the Problems of Modern Geodynamics of the East European Platform*, Book 1: *Earthquakes*, Ed. by N. V. Sharov, A. A. Malovichko, and Yu. K. Shchukin (Karelian Research Center RAS, Petrozavodsk, 2007) [in Russian].

[Google Scholar](#)

[Download references](#)

Funding

This study was carried out as part of a State Task, project no. 0144–2019–0002, of the Russian Ministry of Education and Science for the Institute of Physics of the Earth, Russian Academy of Sciences, for 2019–2021.

Author information

Affiliations

Schmidt Institute of Physics of the Earth, Russian Academy of Sciences, 123995, Moscow, Russia

Academician E. V. Artyushkov & P. A. Chekhovich

Geological Institute, Kola Science Center, Russian Academy of Sciences, 184209, Apatity, Russia

V. V. Kol'ka

Moscow State University, 119991, Moscow, Russia

P. A. Chekhovich

Corresponding author

Correspondence to [P. A. Chekhovich](#).

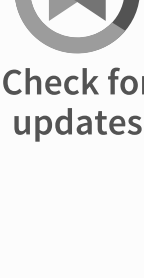
Additional information

Translated by M. Hannibal

Rights and permissions

[Reprints and Permissions](#)

About this article



Check for updates

Cite this article

Artyushkov, E.V., Kol'ka, V.V. & Chekhovich, P.A. The Occurrence of a Lower Viscosity Layer in the Crust of Old Cratons as a Cause of the Strongly Differentiated Character of Postglacial Uplift. *Dokl. Earth Sc.* **492**, 351–355 (2020).
<https://doi.org/10.1134/S1028334X20050037>

[Download citation](#)

Received	Revised	Accepted
10 March 2020	13 March 2020	13 March 2020
Published	Issue Date	
07 July 2020	May 2020	

DOI
<https://doi.org/10.1134/S1028334X20050037>

Keywords:

low viscosity layer

retrograde metamorphism

rock expansion, mantle fluids

glacio-isostatic uplift

cratonic lithosphere

Access options

[Buy article PDF](#)

34,95 €

Price **includes VAT** for Russian Federation

Instant access to the full article PDF.

[Rent this article via DeepDyve.](#)

[Learn more about Institutional subscriptions](#)

Sections

Figures

References

REFERENCES

- Funding
- Author information
- Additional information
- Rights and permissions
- About this article