Composition, temperature, and thickness of the lithosphere of the Kaapvaal craton

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A new model is proposed for the structure of the Kaapvaal craton lithosphere. Based on self-consistent thermodynamic approach, profiles of the chemical composition, temperature, density, and S-wave velocities are constructed for depths of 100–300 km. For the computation of the phase diagram for a given chemical composition (garnet-bearing lherzolite xenoliths and primitive mantle composition, we have used a method of minimization of the total Gibbs free energy combined with the Mie-Grüneisen equation of state. Our forward calculation of phase diagram, seismic velocities and density and inverse calculation of temperature includes anharmonic and anelastic parameters as well as mineral reaction effects, including modes and chemical compositions of coexisting phases. The estimated temperatures depend rather strongly on bulk composition and proportion of phases stable at various depths of the upper mantle. We find that the upper mantle (normal and cratonic) cannot be treated as uniform in terms of bulk composition because a fixed uniform composition leads to a non-physical behaviour of geotherms. The mantle beneath the Kaapvaal craton is chemically stratified: an upper layer at depths between 100 and ~200 km consisting of depleted garnet peridotite and a lower layer (below ~200-220 km) made of a more fertile material [1]. The material composing the cratonic root at a depth of ~275 km does not differ in its physical and chemical characteristics from the composition of the normal mantle, and this allows one to estimate the thickness of the lithosphere at 275 km. The results of this work are compared with data of seismology, thermal investigations, and thermobarometry.

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Reference

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Radiocesium distribution in North-West coast of the Kola Bay

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Introduction

The migration of ^{137}Cs in North territories was investigated to better identify specieshes of its prevalence in tundra landscapes. The territory of interest is located from north-west coast of Kolskiy bay to Norway boader.

Methods

Our method is based on landscape approach developed by A. I. Perelman. Depending on the relief character, the territory was subdivided into four geochemical landscapes. The eluvial landscape is located at the top of nipples, the transit landscape – on the slopes, accumulative and aqual (water) landscapes – on the bottom lands. According to this approach the geochemical map (scale 1:50 000) was created. During the investigation, about 500 samples of soils and lichens (cladonia, cetraria) from 154 points was taken.

Results and Discussion

Data of radiocaesium distribution in soil genetic layers and plants were obtained. Areals with maximum ^{137}Cs concentrations in soils and plants were determined. The highest ^{137}Cs content in soil is 332 Bk/kg, in plant is 194 Bk/kg. The regularities of ^{137}Cs distribution on the territory studied depending on location of supposed sourses is revealed.

The results of investigation of ^{137}Cs vertical in the soil profile are obtained. It was defined that the most polluted components of landscapes are plants and top soil layer. The latter consits of indecomosable organic relics more than one half . This layer sustainibly retains ^{137}Cs.

Conclusion

The detected levels of radiocaesium pollution are much less than 1 ku/km^2, thus it is not dangerous to the people living on territory investigated.