petrology and geophysics. In this study, we discuss the method of estimating temperature, composition, density and thickness of the subcontinental lithospheric mantle beneath the Siberian craton from absolute seismic velocities. The phase composition and physical properties of the lithospheric mantle were modelled within the Na_2O-TiO_2-CaO-FeO-MgO-Al_2O_3-SiO_2 system including the non-ideal solid solution phases. For the computation of the phase diagram for a given chemical composition, we have used a method of minimization of the total Gibbs free energy combined with a 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. Sensitivity of density and velocities to temperature, pressure and composition was studied. Inverse code computes the temperature distribution in the upper mantle from seismic and compositional constraints. The output results contain the self-consistent information on phase assemblages, densities and velocities. The approach used here requires a small number of thermodynamically defined parameters and has important advantages over earlier procedures, which contain no information about entropy, enthalpy and Grüneisen parameter. We inverted for temperature the recent velocity models of the Siberian craton as well as the IASP91 reference Earth model. Several long-range seismic profiles were carried out in Russia with Peaceful Nuclear Explosions (PNE). The velocity models from PNEs recorded along these profiles were used to infer upper mantle temperature profiles beneath the Siberian craton. The seismic profiles were inverted on the basis of low and high temperature xenoliths of garnet peridotites from kimberlite pipes of the cratons in order to gain insights into the temperature sensitivity to variations in the composition and mineralogy of xenoliths. Such a test can provide constraints on the compositional (vertical and lateral) heterogeneity of the upper mantle. 1D and 2D thermal and density profiles of the lithospheric mantle for the Siberian craton are discussed. We derive a lithosphere thickness of roughly 300 km for the Siberian craton by the intersection of the calculated temperature profile in the conductive region with the potential mantle adiabat.

Surface heat flow and thermal structure modelling of the Lithospere in the Black Sea region

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The Black Sea Basin is a deep marginal depression within the Alpine belt. It is surrounded by tectonic features of different ages from pre-Cambrian to Neoalpine whose major elements mainly extend to the Black Sea shelf.

Low heat flow density (20—40 mW/m^2) dominates in the Black Sea. The lowest (< 30 mW/m^2) values have been recorded in central parts of the Western and Eastern Black Sea Basines with maximal sediment thickness. The area of low values occupies the most Western Black Sea Basin, where the "granitic" layer of the crust is absent. The thermal field is slightly differentiated. In the Eastern Black Sea Basin the thermal field is more differentiated. Here several high and low heat flow anomalies are distinguished. Low heat flow covers the most part of the Eastern Black Sea depression, slopes of the Andrusov and Shatsky elevation. A series of limited low (20—30 mW/m^2) heat flow anomalies are identifiable along the Crimea and Caucasian coast. Several high heat flow anomalies are distinguished in the central, northern and southern parts of the depression.

On the periphery of the Black Sea depression the heat flow changes mainly in the range of 20—150 mW/m^2. Abnormal heat flow density tends to occur mainly along the zones of active faults, mud volcano, mud diapirism, fluid and gas fluxes.

On the continental slope and shelf zone of the Black Sea a distribution of heat flow is influenced by land features. Its variation is controlled by geodynamic peculiarities and geological history of adjacent tectonic feature on land. Significant variations in heat flow indicate different ages of tectonic elements and/or repeated tectonic rejuvenations at different time. Heat flows increase from older structure units to younger ones. On the slope of ancient pre-Cambrian Platform the heat flow values are relatively low (35—45 mW/m^2). In the Paleozoic Scythian Plate heat flow increases to 50—65 mW/m^2. A number of geothermal anomaleous zones are distinguished here. High heat flows of some 70—80 mW/m^2 are found in the Karkinit riftogenic trough, Cenozoic Indol-Kuban depression.

The thermal state of the lithosphere depends on two main factors: thermal energy balance and heat transfer conditions. The energy balance is formed by intralitospheric energy sources, mainly radiogenic, and by the amount of heat which is supplied from below (through its basement). Heat transport within the lithosphere is predominantly by conduction. However, in active regions, effective thermal conductivity varies in time. As a result, transient heat flow anomalies are produced, which are complicated by thermal disturbances due to magmatic activity, sedimentation, erosion and horizontal displacement of the lithosphere plates. In constructing a well-grounded thermal model for the lithosphere, the dynamics of the all these processes should be considered. This requires the use of modelling based on complicated physical, mathematical, geophysical and geological phenomena and methods.

In the general case, temperature and heat flow distribution in the inhomogeneous lithosphere dominated by conductive heat transfer satisfies the transient heat conduction equation. The problem may be simplified by its subdivision into two ones: stationary and transient. The stationary problem describes the thermal field of the inhomogeneous lithosphere with thermal conductivity produced by radiogenic heat sources and the mantle heat flow. The transient problem describes temperature and heat flow variations due to short-time changes of temperature, heat generation or heat exchange conditions. The stationary field is taken to be a background (normal field) for the separation of transient anomalies. This problem was solved by finite differences methods.

Transient geothermal anomalies in the studied areas are associated with sedimentation, climate changes, lithosphere extension and astenosphere uplift. The accuracy of the thermal history calculations was checked using the following criteria: thickness and depths of specific lithofocies and basement surface on the present cross-section, thickness of the earth's crust the present values of heat flow and temperatures in the sedimentary rocks.

The modelling results are presented in the form of cross-sections of the lithosphere of temperature and heat flow distribution for two profiles crossing the Western and Eastern Basin of the Black Sea depression. Based on the results of the modeling of the mantle and the earth's crust heat flow components have been determined. Contribution of the sedimentary layer in the central part of the Black Sea Basin is 10—12 mW/m^2, contribution of the whole crust is 13—16 mW/m^2. The contribution of the mantle is 45±4 mW/m^2. It decreases to 30±5 mW/m$_2$ on the Scythian Plate and to 20±3 mW/m$_2$ on the pre-Cambrian Platform. The surface heat flow decrease in Black Sea Basin is mainly due to intensive accumulation of Pliocene-Quaternary sediments. The high mantle component is due to young tectonic activity. Our thermal modelling covers the depth range of the relatively cold thermal layer with temperature below 1300 °C. The 1300 °C temperature level is found at depth between 75—90 km in the central part of the Black Sea Basin, 100—130 km in the Scythian Plate and 160—180 km in the southern slope of the pre-Cambrian Platform area.

Reflection of tectonic structures of platform cover of the North of Russian plate in atmospheric field, character of geomagnetic variations and deep's decontamination

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In 2001—2009 we measurements of atmospheric pressure above fault-crossing were carried out, and the fact of constant "deficiency" of atmospheric pressure was established. These minima have received the working name — "static" and have difficult structure with increase of values in the centre