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ANOMALIES OF TERRESTRIAL TEMPERATURE FIELD OF BELARUS

Zui V.I.

Institute of Geochemistry and Geophysics
National Academy of Sciences of Belarus
7, Kuprievich str., 220141 Minsk, Belarus
e-mail: zui@igs.ac.by

Abstract

Results of regional investigations of the terrestrial temperature field within the territory of Belarus are analyzed. The temperature distribution within the upper part of the platform cover has a contrast pattern both within Paleozoic depressions, and Precambrian units. In addition to already known temperature anomalies in the northern zone of the Pripyat Trough and the Brest Depression, such new anomalies as the Belavezhskaya, Molodechno-Naroch, East-Orsha, Central-Orsha, Belynichi-Rechitsa, Khotimsk-Svetilovichi, Novoyelnya-Lyakhovichi and Grodno were outlined. Temperature distribution maps at a depth of 200 m and a map of its distribution at the so-called quasi-neutral layer were compiled to reveal them. It was shown that the mentioned anomalies are traced identically using the traditional method (temperature distribution at a fixed depth) and the new one (temperature distribution at the "quasi-neutral layer"). But the new approach allowed tracing additional anomalies, for instance, the Belavezhskaya one. Both the traditional method used to distinguish temperature anomalies, and the new one gave comparable results. This paper is devoted to terrestrial temperature field features at shallow depths within the territory of Belarus. It describes the available geothermal anomalies briefly for the first time. A preliminary map of the heat flow density distribution based on a new approach is presented as well.

Introduction

Geological structures of different age, origin and evolution are located within the territory of Belarus. They belong to great lithosphere segments which are Fennoscandia, Sarmatia and Volgo-Uralia (Bogdanova, 1991). The territory of the country was irregularly studied by deep drilling. In turn, it influenced profoundly the quality and results of its studies in terrestrial temperature field. The same concerns the heat flow density data. The Pripyat Trough nowadays belongs to the best-studied tectonic units of Belarus in heat flow, as hundreds of deep boreholes were drilled there in the course of oil prospecting works. At the same time, for instance, the territory of the Orsha Depression and especially its northern part is poorly studied until now. Only a few deep boreholes were drilled to the crystalline basement in its central part.

The very first information on the temperature distribution in deep horizons of the sedimentary cover of the Pripyat Trough was published as early as in the middle fifties of the past century (Belyakov, 1954), and the first data on the temperature pattern of the trough area, as well as the first heat flow density estimates were published later (Protasenya, 1962_1 and 1962_2). Using a very limited number of recorded temperature-depth profiles in deep petroleum survey wells D. Protasenya revealed a positive terrestrial temperature anomaly within the northern part of the Pripyat Trough. Its lateral extent and the more accurate information on its margins were revealed from subsequent investigations (Bogomolov et al., 1972; Atroshchenko, 1975). Geothermal investigations were fragmentary at those time and margins of some of anomalies, especially outside the Pripyat Trough, remained very preliminary.

At present temperature-depth profiles are available practically for all geological structures of the country. But the location of studied wells remains irregular within each of them. Another peculiarity of geothermal data is a small number of studied deep boreholes.

Results of modelling fulfilled by M. Parkhomov (Parkhomov, 1985) showed that there exist not only the lateral, but also pronounced vertical heat flow density variations. Subsequent investigations showed a sufficient heterogeneity of the heat flow pattern within the whole sedimentary cover of the trough (Tsybulya, Levashkevich, 1990; Zhuk et al., 2004). The terrestrial temperature field within the Brest and Orsha depressions remained poorly studied until the recent time, though its heterogeneity was indicated by previous investigations (Tsybulya et. al., 1988; Zhuk et al., 1989; Zui, 2004). Results of detailed investigations of the terrestrial temperature field at shallow depths for the whole territory of the country were absent.

The latest investigations of the temperature field and geothermal anomalies within the whole territory of Belarus including its less studied units are described below. It is necessary to mention that it is still not possible to prepare conditioned terrestrial temperature maps for deep horizons (for instance, 1000 m) using the standard approach for this whole area, as deep boreholes drilled through the whole sedimentary cover still remain very limited in number until now within the northern and northeastern parts of the Belarussian Anteclise, the western slope of the Voronezh

Anteclise, Orsha and Brest Depressions. Consequently, it was not possible to outline reliably geothermal anomalies earlier within the whole territory of Belarus.

We used temperature-depth profiles recorded in a few hundreds of shallow (50-250 m), mostly water wells over the whole territory of the country during the last 20-30 years. Nevertheless, after the detailed analysis it was shown that they could be used to investigate features of the terrestrial temperature field, as well as to outline geothermal anomalies for the whole country. We used both the standard approach of temperature mapping for a fixed depth and a non-traditional approach to outline the terrestrial temperature field features at the surface of the so-called "quasi-neutral layer" as the basis to trace anomalies outlined within the whole territory of the country.

A new approach to trace terrestrial temperature field anomalies

It is known that within a geothermal anomaly the anomalous temperature distribution existing within deep horizons of the platform cover is detectable in every interval of temperature-depth profiles recorded in boreholes right up to the uppermost horizons (see, for instance, Astafiev, Muromtseva, 1973; Astafiev et al., 1975). This temperature exceeding or reducing relative to its background values are reflected in temperature-depth profiles recorded both in deep and shallow boreholes. This difference becomes regularly smaller in absolute magnitude from deeper to shallower depth intervals. Our observations show that this effect is detected up to the so-called "neutral layer", which represents a surface formed from a set of depths for individual boreholes, where annual temperature fluctuations become negligible (Zui V., Vantsevich S., 2002).

For each of individual boreholes the "neutral layer" is observed at such a depth, where amplitude of seasonal temperature fluctuations at the ground surface is attenuated propagating downward along the wellbore and practically disappears. Theoretically, it happens at rather deep horizons (of the order of 500-1000 m). Practically, the "neutral layer" represents such a surface, where the mentioned temperature fluctuations become not detectable by borehole thermometers

(Zui, 2004). For every borehole the temperature at this depth is considered to be stable during at least a year or dozens of years, but it is different for individual boreholes. For the studied holes located in Belarus a depth to the neutral layer ranges, as a rule, from 40 to 60 m and only in a few cases (less than 0.5% of all the studied boreholes) the "neutral layer" was observed at depths up to 110-120 m.

A "quasi-neutral layer" represents a set of depths for all the studied boreholes below that the temperature in a borehole doesn't depend on the season of the year and is growing monotonously. This depth depends on the season, when temperature measurements were undertaken, and is always less than the depth to the real "neutral layer". In other words, for each individual borehole this corresponds to the depth, where the temperature changes from decreasing values to increasing ones with depth and, hence, the geothermal gradient changes its negative value to the positive one when temperature-depth profiles are recorded in the summer time. Above this surface and up to the ground level the temperature fluctuates cyclically during the year, and below this layer it practically doesn't depend on the seasonal temperature variations at the ground surface. This approach allows using temperature profiles recorded even in such shallow water wells as 40-50 m deep only and sometimes even less to trace anomalies of the terrestrial temperature field. . It allows involving into consideration such local areas, where only shallow wells are available for tapping groundwater from the uppermost aquifers. Hence, the more detailed temperature survey becomes possible for the whole studied territory. The considered map is shown in Fig. 2.

The terrestrial temperature field at the surface of the quasi-neutral layer has a contrast pattern. A number of anomalies of low and increased temperature are easily distinguished in the map (Fig. 2). The approach used to trace them is the new one and requires an appropriate validation. The generally recognized method to trace geothermal anomalies is the compilation of temperature map(s) for selected depth(s). The available set of temperature-depth profiles for the territory of Belarus allows compiling a similar map for a depth of 200 m.

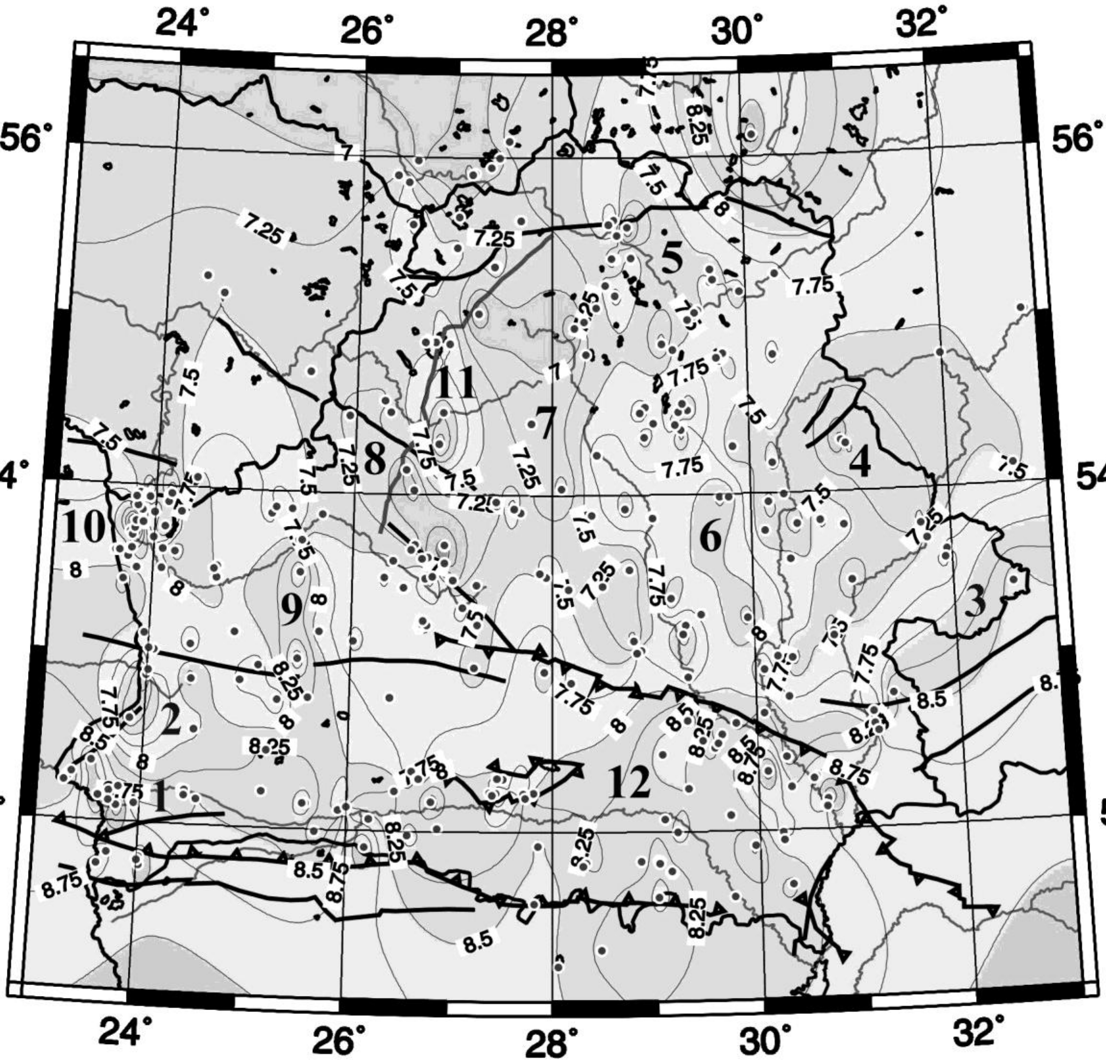

Fig.1. Map of temperature distribution at a depth of the quasi-neutral layer and geothermal anomalies of the terrestrial temperature field within Belarus.

Legend: Anomalies of elevated temperatures: 1 – Podlaska-Brest Depression, 3 – western slope of the Voronezh Anteclise, 6 – Belynichi-Chechevichi (Belynichi-Rechitsa), 9 – Pinsk-Novoyelnya, 10 – Grodno, 11- Molodechno-Naroch, 12 – Pripyat Trough. Anomalies of reduced temperatures: 2 – Belavezhskaya, 4 – East-Orsha, 5 – Chashniki-Polotsk, 7 - eastern slope of the Belarussian Anteclise, 8 – central part of the Belarussian Anteclise.

Рис. 1. Карта распределения температуры на глубине залегания квазинейтрального слоя и аномалии геотемпературного поля Беларуси.

Обозначения: Аномалии повышенных значений температуры: 1 – Брестской впадины, 2 – Припятского прогиба, 3 – западного склона Воронежской антеклизы, 6 – Белыничско-Чечевичская (Белыничско-Речицкая), 9 – Ельнянская, 10 – Гродненская, 11 – Нарочанская. Аномалии нониженных значений температуры: 4 – восточно-Оршанская. 5 – Чашникско-Полоцкая, 7 – восточного склона Белорусской антеклизы, 8 – центральной части Белорусской антеклизы. Распределение температуры на поверхности квазинейтрального слоя в Беларуси.

Temperature distribution map for a depth of 200 m

Around 320 temperature-depth profiles both for shallow and deep boreholes were used to construct a map of the terrestrial temperature distribution at a depth of 200 m. Only around 10 diagrams of the standard logging (3% of the total data) were used among them after the careful selection for those boreholes, where it was believed that enough time was elapsed after drilling had been completed before temperature measurements were undertaken. This time interval is necessary for the thermal field within a rock massif adjoining a wellbore and disturbed during the process of drilling to be able to reach its natural conditions. In other words, the temperature equilibrium between the wellbore fluid and the surrounding rocks massif was reached.

Temperature isolines in Fig.1 were drawn by means of an interpolation within the territory of Belarus. Outside the territory of the country they were extrapolated, therefore their patterns could be considered here as only preliminary ones as no reliable temperature-depth diagrams were available for the territory of Poland and the Ukraine at all. Only a few thermograms (around 10) were used for the adjoining territories of Lithuania, Latvia and Russia. An interval of 0.5 °C was used for isolines, which is acceptable keeping in mind that a thermistor thermometer used for borehole measurements had a precision of temperature readings around ±0.03 °C.

In contrast to much warmer southern and westernmost parts of the considered territory, where temperature ranges from 10 to 14 °C, its central and northeastern parts exhibit temperatures of only 7-9 °C at the same depth of 200 m. The shape of a small positive anomaly over 10 °C shown in the northeastern part of the map is tentatively outlined using only one available temperature diagram recorded in the borehole “Golubiye Ozera” (Blue Lakes) located in the resort of the same name in the adjoining area of Russia.

Validation of the method used and the data reliability

A depth of 200 m was selected to compile the map (Fig. 2) because it allows using more than 300 temperature-depth profiles recorded in boreholes within the country. For deeper horizons temperature maps become less reliable, as the deeper depths we consider the fewer profiles are available, especially within positive geological structures with thin sedimentary cover. Histograms of the temperature distribution for both maps (see Figs.1 and 2) are shown in Fig. 3.

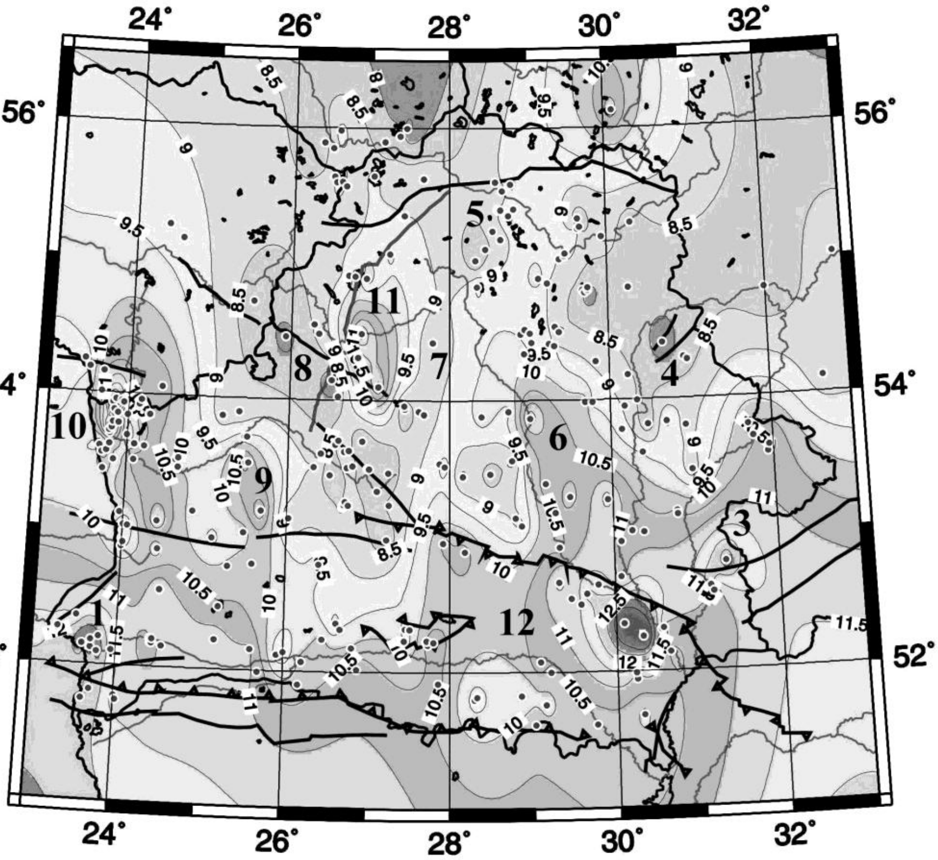

Fig.2. Terrestrial temperature distribution at a depth of 200 m within Belarus. See Fig. 1 for the legend

Рис.2. Распределение температуры на глубине 200 метров в пределах Беларуси. Легенду см. на Рис. 1.

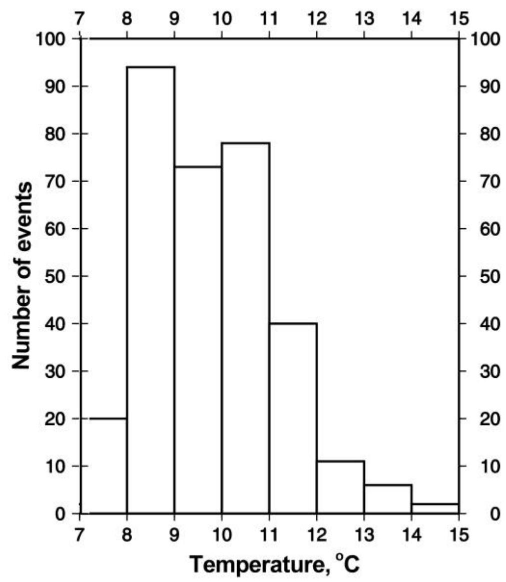

Fig. 3. Histograms of the temperature distribution at the quasi-neutral layer for studied boreholes (left) and for a depth of 200 m (right).

Рис. 3. Гистограммы распределения температуры по изученным скважинам для квазинейтрального слоя (слева) и на глубине 200 метров (справа).

The temperature at the quasi-neutral layer ranges from around 6 to 10 ˚C. The prevailing values are in the range from 7 to 9 ˚C. The maximum number of studied wells (more than 100) exhibits its values confined to an interval of 7.5 – 8 ˚C. Values above 9 ˚C are typical for the northern part of the Pripyat Trough. The temperature at a depth of 200 m ranges from 7.3 to 14 7 ˚C. The prevailing values are from 8 to 11 ˚C with a peak at 8-9 ˚C and the maximum number of studied wells (more than 70). Above 12 ˚C the number of events rapidly decreases.

Temperature measurements in boreholes were fulfilled by the author or with his participation over more than 25 years' period. The overwhelming majority of temperature records were undertaken in boreholes that reached the thermal equilibrium after their drilling was finished; therefore, it is believed that the reliability of the results obtained is high. An error of readings of the absolute temperature values was around ± 0.03 ˚C. Most of boreholes ranged in depth from 100 to 300 m, especially outside the Pripyat Trough. Their drilling was stopped within the fresh water layer.

As it was mentioned above, temperature maps are usually compiled for selected depths or for selected planes (e.g. 500 m below sea level) to reveal both the geothermal field structure, and anomalies of the terrestrial temperature distribution within the studied area. The method to trace geothermal anomalies using the temperature distribution map for the surface of the quasi-neutral layer (a surface, which, in general, is slightly variable during a year) requires some kind of the validation to show that both approaches allow receiving similar results that don't much differ in the sense of tracing terrestrial temperature anomalies and their shapes.

A simple visual comparison of both maps (see Figs. 1 and 2) shows similar behaviour of isotherms in them. They run almost synchronously in both figures. These two maps show that there is no sufficient difference in geothermal anomalies distribution revealed using both the standard and new approaches. The main difference is only in temperature values. Everyone knows the fact that the deeper horizon is considered, the higher temperature it exhibits. In our case a depth of 200 m is far below the quasi-neutral layer position. Results of our measurements show that the depths to the latter one range from around 30 to 60-70 m within the territory of the country, and only in 2 – 3 water wells in the northeastern Belarus drilled near the town of Polotsk within loose sediments in the watershed between the Black and Baltic artesian basins they were observed as deep as 90 - 110 m. The influence of the seasonal temperature variations with the amplitude from around –30 °C in winter to +30 °C in summer at the ground surface are sufficiently attenuated at the quasi-neutral layer and even more so at a depth of 200 meters.

The temperature of the quasi-neutral layer ranges from 6.5 to 9.5 °C (see Fig. 1) within the studied area. Values exceeding 8 °C are typical mostly for the northern part of the Pripyat Trough, where the positive geothermal anomaly was traced during the first years of the regular geothermal studies (Protasenya, 1962_1 and 1962_2), and the western slope of the Voronezh Anteclise stretching into the territory of eastern Belarus. The isotherm 8 °C is extended through the southern part of the Polessian Saddle into the Podlaska-Brest Depression. It is traced further into the northwestern part of the country, continues into southwestern Lithuania and probably joins the positive geothermal anomaly within western Lithuania and the Kaliningrad enclave of Russia. Outside the borders of Belarus observations of the terrestrial temperature field are rather sparse. Within the Orsha Depression the temperature field has a rather contrast pattern with an amplitude of temperature scattering of 2-2.5 °C at the surface of the quasi-neutral layer.

Geothermal anomalies

Temperature distribution maps for the quasi-neutral layer and a depth of 200 meters (see Figs. 1 and 2) reflect contrast patterns with a number of temperature anomalies of its increased and reduced values relative to the background ones. The aim of this paper is to trace them, therefore, their brief description is given below and geological interpretation will be published elsewhere in a separate paper.

Geothermal anomalies of increased temperature within the Pripyat Trough and the eastern part of the Brest Depression are known since the seventies of the past century when systematic geothermal investigations were started in Belarus. The latter represents the easternmost part of the vaster anomaly extended into Poland. It is stretching there to the edge of the East European Platform. Through the Polessian Saddle it joins as a narrow strip within the territory of southern Belarus the geothermal anomaly of the Pripyat Trough described in many publications. According to the results of heat flow studies (Zui et al., 1993), the Polessian Saddle is considered to be a cooled block of the Earth's crust with heat flow density ranging from 30 to 40 mW/m^2. There is a disagreement with elevated temperatures around 8 °C recorded in some boreholes at the quasi-neutral layer. We don't exclude that this is a result of pumping out groundwater for water supply from located nearby water wells. As a result an inflow of water from lower horizons could cause a small convective warming up of studied wells due to water percolation through semipermeable layers separating aquifers. But this assumption requires more detailed consideration.

The anomaly of increased temperature within the western slope of the Voronezh Anteclise is traced within Belarus using temperature measurements in 6 boreholes. Its eastern margin within Russia is unknown because of a lack of data within the Russian part of the anteclise, as well as the Klintsy Graben and the Gremyachi Burried Inlier. Its southern part joins the positive anomaly of the Pripyat Trough.

A vast anomaly of low temperature of 6.5 – 7.5 °C at the quasi-neutral layer in the eastern part of the Orsha Depression was traced in a triangle of towns of Orsha – Smolensk - Cherikov. We named it the East-Orsha Anomaly of reduced temperature. It includes almost the whole area of the Mogilev Minor Trough. Its limits within the Russian territory require subsequent elaboration, as new geothermal data will be accumulated.

The Central-Orsha Anomaly of increased temperature of 7.5 – 8.5 °C at the quasi-neutral layer crosses the whole territory of the Orsha Depression in a meridional direction along the line tracing towns and settlements of Svetlogorsk – Klichev – Belynichi – Vitebsk – Ezerishche - Nevel. Its northern margin within Russia was not reliably traced as only one borehole “Golubye Ozera” was investigated here in its Russian part. At the same time observations close to the border in the Belarussian side are absent as well. Temperature values within this anomaly are increasing above 10 °C at a depth of 200 m as we proceed closer to the Pripyat Trough. This feature is clearly visible at both maps (see Figs. 1 and 2). The Belynichi-Chechevichi positive anomaly with a temperature above 8 °C is traced within this area (see Fig.1) which is outlined using measurements in 3 boreholes. It is transformed into the Belynichi- Rechitsa anomaly at the temperature map for a depth of 200m. The Vitebsk Minor Trough and the Chashniki deep fault (Aizberg et al., 2004) belong to the Central-Orsha Anomaly.

The Chashniki-Polotsk anomaly of reduced temperatures of 7 – 7.5 °C (see Fig. 1) is traced in the northwestern part of the Orsha Depression. It has an extension into the anomaly of reduced temperature values that exists in the eastern slope of the Belarussian Anteclise having a sub-meridian orientation.

The central part of the Belarussian Anteclise represents a cooled crustal block with prevailing temperatures of 7 – 7.5 °C at the surface of the quasi-neutral layer and 8 – 9 °C at a depth of 200 m. Anomalies of the eastern slope of the anteclise and its central part are separated by the Molodechno-Naroch positive anomaly with prevailing temperatures of 9 – 11 °C. It is stretched in a meridian direction from Molodechno town to the Drisvyaty lake. The Naroch fault of the basement is within this anomaly. This zone requires more detailed investigations to be done if the future.

Another local Pinsk – Novoyelnya anomaly of increased temperature of 8-9 °C (see Fig.1) was detected within the area, It also requires more detailed studies. One of possible mechanisms of the platform cover warming up is a convective heat transfer from the cracked crystalline basement. It is confirmed by the radon emanations existing in the vicinity of Novoyelnya town.

The Grodno anomaly of increased temperature values of 10 – 12 °C (see Fig. 2) was outlined using temperature data from around 10 boreholes. Its center corresponds to the Neman river valley to the north of Grodno. Its northern margin within Lithuania was not traced because of lack of reliable data. The same concerns the adjoining territory of Poland.

Finally, the Belavezhskaya anomaly of low temperature of 6-7.5 °C was traced only at the temperature distribution map for the surface of the quasi-neutral layer (see Fig. 1) using 3 boreholes. The boreholes drilled within the vast forest massif – Belavezhskaya Pushcha are too shallow (less than 30 m) to be used for preparing a temperature map for a depth of 200 m.

Preliminary data on heat flow density distribution within the Orsha Depression

As an example to estimate tentatively the heat flow density (HFD) distribution we consider the following approach. It is well known that the HFD is directly proportional to the geothermal gradient (which is a derivative of the temperature) and heat conductivity coefficient within the considered interval. We selected several boreholes with more reliable HFD determinations and temperature data at a depth of 200 m (Dunilovichi18, Grodzyanka 33, Osovo 15, Masyukovshchina G10, Minsk VSK1, Zeleny Bor 138, Myadel 70, Volozhin 1, Rogachev 565, Lakhva 1, Resta 1, Zimnitsa 965, Lettsy, Bogushevsk 1) and compiled a diagram, Fig. 4.

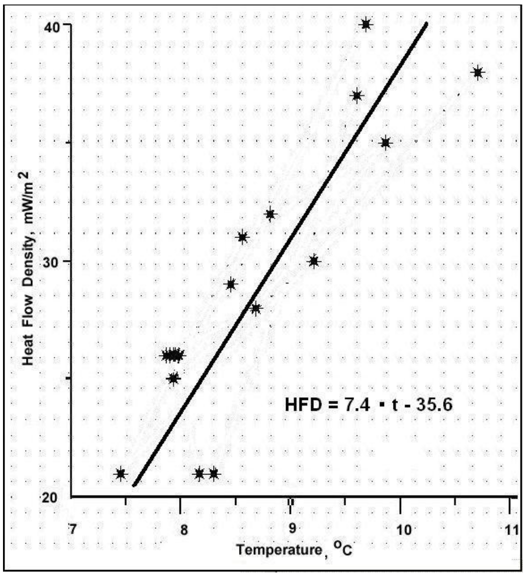

Fig. 4. Preliminary relationship between the observed heat flow density and temperature at a depth of 200 m in selected boreholes of the Orsha Depression and adjoining geologic structures.

Рис. 4. Предварительная связь между наблюдаемой плотностью теплового потока и температурой в отдельных скважинах Оршанской впадины и прилегающих геологических структур.

It was possible to use a relation of the type **HFD = 7.4 • t – 35.6** (mW/m^2), where **t** is the temperature at a depth of 200 m. Thus, together with available heat flow density data, determined in the usual way, it allowed a tentative estimation of the heat flow density for other boreholes of the Orsha Depression and the adjoining geological structures, Fig. 5. The heat flow density isolines are shown as the first preliminary pattern for the studied area. In general, they give an idea of the heterogeneity of the geothermal field of the studied area. The warmer strip with HFD 30-35 and up to 45 mW/m^2 in the southern part crosses the Orsha Depression from the Pripyat Trough through the Mogilev and Vitebsk minor troughs into the Latvian Saddle, which is in good agreement with the temperature distribution patterns shown in Figs. 1 and 2. The eastern slope of the Belarussian Anteclise and the northeastern part of the Orsha Depression represent cold crustal blocks.

Local anomalies of low heat flow of 25-30 mW/m^2 are traced within the Vitebsk Minor Trough, to the east of the Mogilev Minor Trough, as well as within the Osipovichi Uplift. The adjoining Russian territory is still poorly studied and a shape of the HFD isolines can be considered as the preliminary one.

Conclusions

A contrast terrestrial temperature field of the platform cover is characteristic of the territory of Belarus. As new geothermal data were accumulated, it became possible to compile actually the first detailed maps of temperature distribution within the platform cover and to reveal around 10 geothermal anomalies; some of them (the East-Orsha, Central-Orsha, Belynichi-Rechitsa, Pinsk-Novoyelnya, and the Belavezhskaya anomalies) were traced for the first time. A new approach was proposed for this purpose. It is based on an analysis of the temperature distribution map for the quasi-neutral layer.

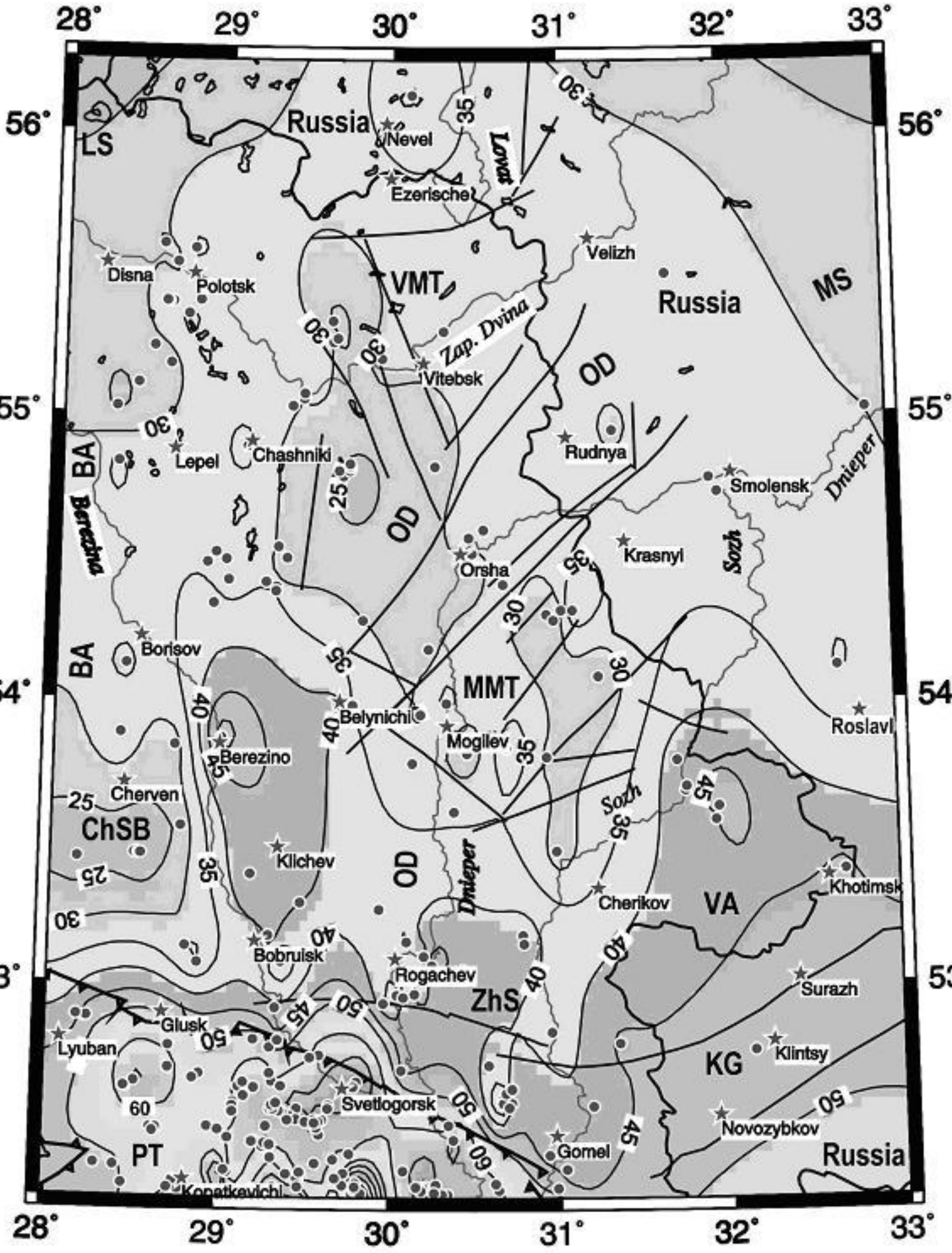

Fig. 5. Provisional map of heat flow density (mW/m^2) distribution within the Orsha Depression and adjoining structures.

Legend: BA – Belarussian Anteclise; ChSB – Cherven Structural Bay; KG – Klintsy Graben; LS – Latvian Saddle; MMT – Mogilev Minor Trough; MS – Moscow Syneclise; OD – Orsha Depression; PT – Pripyat Trough; VA – Voronezh Anteclise; VMT – Vitebsk Minor Trough; ZhS – Zhlobin Saddle.

Рис. 5. Предварительная схема распределения плотности теплового потока (мВт/м^2) в Оршанской впадине и прилегающих структурах.

Обозначения: BA – Белорусская антеклиза; ChSB – Червенский структурный залив; KG – Клинцовский грабен; LS – Латвийская седловина; MM – Могилёвская мульда; MS –

Московская синеклиза; OD – Оршанская впадина; PT – Припятский прогиб; VA – Воронежская антеклиза; VM – Витебская мульда; ZhS – Жлобинская седловина.

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АНОМАЛИИ ГЕОТЕМПЕРАТУРНОГО ПОЛЯ БЕЛАРУСИ

Зуй В.И.

В работе проанализированы результаты регионального изучения геотемпературного поля в пределах территории Беларуси. Поле температуры в в верхней части платформенного чехла имеет контрастный вид как в пределах палеозойских депрессий, так и докембрийских блоков земной коры. В дополнение к ранее выявленным аномалиям распределения температуры в северной зоне Припятского прогиба и в Брестской впадине, были выделены новые аномалии, такие как Белавежская, Молодечно-Нарочанская, Восточно-Оршанская, Центрально-Оршанская, Белыничи-Речицкая, Хотимско-Светиловичская, Новоельня-Ляховичская и Гродненская. Для их оконтуривания была построена карта распределения температуры на глубине 200 метров и соответствующая карта ее распределения на глубине залегания так называемого «квазинейтрального слоя». В работе показано, что выявленные аномалии трассируются как при использовании традиционного подхода (составление карты распределения температуры на фиксированной глубине), так и нового подхода (составление карты ее распределения на глубине «квазинейтрального слоя») дают идентичные результаты. Однако новый подход позволил выделить дополнительные аномалии, например Белавежскую. Оба метода дают сопоставимые результаты при выделении геотермических аномалий. Рассматриваемая статья посвящена изучению особенностей геотемпературного поля неглубоко залегающих горизонтов в пределах территории Беларуси, что позволило впервые дать краткую характеристику имеющихся здесь геотермических аномалий. Предварительная схема распределения плотности теплового потока, основанная на новом подходе, приведена в качестве примера, чтобы показать соответствие в целом аномалий повышенных и пониженных значений температуры соответствующим латеральным вариациям плотности теплового потока.

АНАМАЛІІ ГЕАТЭМПЕРАТУРНАГА ПОЛЯ БЕЛАРУСІ

Зуй У.І.

У артыкуле прыведзены аналіз вынікаў рэгіянальнага вывучэння геатэмпературнага поля ў межах тэрыторыі Беларусі. Поле тэмпературы ў верхняй частцы платформеннага чахла мае кантрасны выгдяд як у межах палеазойскіх дэпрэсій, так і дакембрыйскіх блокаў зямной кары. Дадаткова да вызначаных раней анамалій у паўночнай зоне Прыпяцкага прагіну і ў Падляска-Брэсцкай упадзіне, былі вызначаны такія новыя анамаліі, як Белавежская, Маладзечна-Нарачанская, Усходне-Аршанская, Цэнтральна-Аршанская, Белынічы-Рэчыцкая, Хоцімска-Свяцілавічская, Наваельня-Ляхавіцкая і Гродзенская. Для іх акантурвання была складзена карта раазмеркавання тэмпературы на глыбіні 200 метраў і адпаведная карта яе раазмеркавання на глыбіні залягання так званага «квазінейтральнага слою». У артыкуле паказана, што вызначаныя анамаліі трасіруюцца як пры выкарыстанні традыцыйнага падыходу (складанне карты размеркавання тэмпературы на фіксіраванай глыбіні), так і новага падыходу (складанне карты яе размеркавання на глыбіні «квазінейтральнага слою») даюць аднолькавыя рэзультаты. Аднак новы падыход дазволіў вызначыць дадатковыя анамаліі, напрыклад Белавежскую. Абудва метады даюць сапаставімыя вынікі пры вызначэнні геатэрмічных анамалій. Разглядаемы артыкул прысвечаны вывучэнню асаблівасцяў геатэмпературнага поля неглубокіх гарызонтаў у межах тэрыторыі Беларусі., што дазволіла ўпершыню даць кароткую характэрыстыку наяўных тут геатэрмічных анамалій. Папярэдняя схема размеркавання шчыльнасці цеплавога струменю, заснаваная на новым падыходзе, прыводзіцца ў якасці прыкладу каб

паказаць адпаведнасць у цэлым анамалій павышаных і паніжаных значэнняў тэмпературы адпаведным латэральным варыяцыям шчыльнасці цеплавога струменю.