УДК [552.57:535.3]:551.24/.25+550.36(477) DOI: https://doi.org/10.24028/gj.v44i5.272334

Paleotemperature reconstructions based on vitrinite thermometry data (on the example of the Upper Paleozoic deposits of the Dnieper-Donets depression and the adjacent margins of the Donbas)

A.V. Ivanova, V.B. Gavryltsev, 2022

Institute of Geological Sciences of the National Academy of Sciences of Ukraine, Kyiv, Ukraine

Received 12 June 2022

The article is devoted to paleotemperature reconstructions based on the data on the reflectance of the vitrinite of coal organic matter in the Upper Paleozoic deposits of the Don-Dnieper trough (within the Dnieper-Donets depression and adjacent parts of the Donbas). It is builds on earlier work on reconstructing the paleogeothermal regime by establishing paleogeothermal gradients and amplitudes of vertical displacements of rock massifs. Paleogeothermal indicators are associated with the geodynamic setting of the subsoil, which determines the intensity and nature of the distribution of heat sources, geological development, and features of the tectonic structure of the region. Based on the results, a map of the distribution of paleotemperatures at a depth of 3 km was constructed. An analysis of the changes and patterns in the distribution of paleotemperatures makes it possible to reveal the role of volcanism, deep faults geodynamics, and lithospheric parameters in the thermal history of the region, as well as to evaluate its thermal field evolution. The presented map, along with the previously published maps of the paleogeothermal gradients and amplitudes of vertical displacements of rock massifs, can be used to demonstrate the features and patterns of the regional distribution of the indicated parameters. It could become a powerful tool in the study of the tectonic and geothermal history of the region.

Key words: coal, deep faults, Don-Dnieper trough, gravitational field, lithosphere thickness, paleotemperature, vitrinite thermometry, volcanism.

Introduction. Geothermal data are widely used in solving both scientific geological and applied problems, and they have found particularly wide application in the study of sedimentary basins. Since the thermal regime of the subsoil is one of the main factors governing the structure, composition, and phase state of the organic matter of the stratisphere, geothermal and paleogeothermal studies are widely used in the geology of combustible minerals, in particular coal and petroleum geology. They allow recovering coalification regimes of organic matter and the conditions for the generation of hydrocarbons and the formation of their deposits.

This paper is a continuation and completion of a previous one dedicated to the reconstruction of the paleogeothermal regime of the Upper Paleozoic deposits of the Don-Dnieper trough [Ivanova, Gavryltsev, 2021]. The study aims to determine and analyze the paleotemperatures of the sedimentary cover of the Late Paleozoic stage of the trough's development. Comparing them with the present-day temperatures makes it possible to estimate the thermal history of the region's development from the Paleozoic to the Cenozoic.

Paleogeothermal conditions of the subsoil of the Dnieper-Donets depression (DDD) and Donbas, which were studied using vitrinite thermometry, were covered in the works of A.V. Ivanova [Ivanova, 1975, 1976, 1989, 1991, etc.], A.E. Lukin [Arsiry et al., 1984], N.P. Grechishnikov [Grechishnikov, 1987], V.V. Gordienko et al. [Gordienko, Usenko, 2003; Gordienko et al., 2006, 2015b], V.A. Privalov [Privalov et al., 2004], etc. The history of the study of the Paleogeothermal conditions of the Upper Paleozoic deposits of the Don-Dnieper trough using vitrinite thermometry is covered in more detail in a recently published work [Ivanova, Gavryltsev, 2021].

Methodology of data processing of vitrinite thermometry. The paleogeothermal parameters were determined from the vitrinite reflectance index (VRI) in coal and rock samples with inclusions of Devonian, Carboniferous (mainly), and an insignificant amount of Meso-Cenozoic coal matter [Ivanova, 2012]. VRI measurements in reflected polarized light in air (R_a) and oil (R_o) were carried out by A.V. Ivanova at the Institute of Geological Sciences of the National Academy of Sciences of Ukraine.

The vitrinite thermometry data were processed assuming the leading role of temperature in the process of coalification and the linear dependence of temperature on depth [Ivanova, 1992; Ivanova, Gavryltsev, 2010]. The software algorithm is based on the normalization of many data points from different depths by a function of the VRI dependence on paleotemperature for a selected scale with the resulting array then being approximated by the least squares method. The straight line for the approximation procedure is, in fact, a dependence of the following kind: $t_H = t_0 + \mu(H + \Delta H)$, where t_H is the paleotemperature, t_0 is the temperature of the neutral layer, μ is the paleogeothermal gradient, H is the present depth of the sample, and ΔH is the amplitude of the vertical displacement of the rock massif.

A more detailed description of the methodology and an assessment of the methods for determining paleotemperatures by the Vassoevich coalification scale [Vassoevich, 1986] are given in [Ivanova, Gavryltsev, 2021].

We used VRI data for 2300 samples from over 600 wells in the DDD and Northwestern Donbas [Ivanova, 2012]. To obtain the paleogeothermal parameters of the Southwestern Donbas, we applied the data given by [Levenstein et al., 1991; Privalov, 2004].

Fig. 1 shows the study area. The same factual material is used to reconstruct paleotemperatures as to draw maps of paleogeothermal gradients and amplitudes of vertical displacement of tectonic and salt dome structures reconstructing paleogeothermal and paleotectonic situations of the Don-Dnieper Paleozoic trough [Ivanova, Gavryltsev, 2021]

This paper presents a map of the modeled paleotemperature conditions of Upper Paleozoic sediments 3 km deep (Fig. 2) as there are data on the modern measured and calculated temperatures for this depth. Measurements of the modern temperatures in wells, determination of heat flow and calculated temperatures in the DDD and Donbas are described and summarized in the publications by V.V. Gordienko, I.V. Gordienko, O.V. Zavgorodnyaya, R.I. Kutas and others [Gordienko et al., 2002, 2004; Rudenko, 2007, etc.]. Comparison of paleo- and modern indicators makes it possible to trace the evolution of the thermal field of the studied region

Temperature distribution in sedimentary cover rocks. Results and discussion. The distribution of temperatures in the Earth's crust depends on the magnitude of heat flux, which is closely related to the geodynamic situation of the subsoil, which determines in turn the intensity and nature of heat sources' distribution, geological development, and tectonic features of the region, as well as accompanying distorting effects (convective heat and mass transfer; endothermic and exothermic reactions; inhomogeneities associated with different thermophysical properties of the rocks; energy effects in the event of tectonic disturbances, intrusions, etc.) [Smirnov, 1968; Kutas, 1978; Gordienko et al., 2002; Usenko, 2002; Leonov, 2013 and others].

It is obvious that the configuration of the paleotemperature field naturally repeats the field distribution of paleogeothermal gradients since the same factors are responsible for this distribution [Ivanova, Gavryltsev, 2021, Fig. 5]. A significant increase in paleotemperatures is observed within the Chernihiv segment, in the south-eastern marginal part of the DDD, and in the Donbas segment. The region of minimum paleogeothermal indicators is located in the

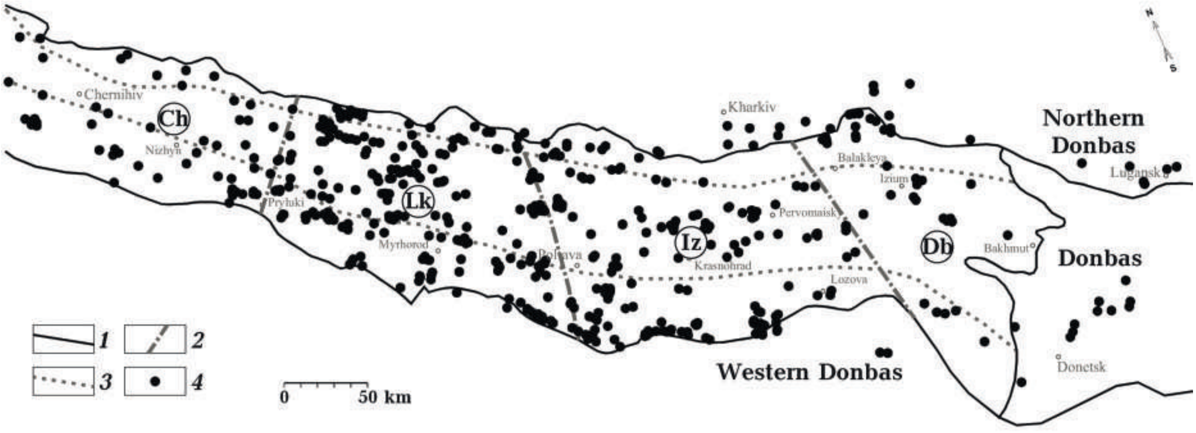

Fig. 1. Map of the vitrinite thermometry data and tectonic zoning scheme of the Don-Dnieper trough within Ukraine: *1* — trough boundary; *2* — boundaries of the transverse division of DDD; *3* — boundaries of the central DDD rift; *4* — wells with VRI data. Letters in circles — the main structural and tectonic segments: Ch — Chernihiv, Lk — Lokhvytsia, Iz — Izium, Db — Donbas [Starostenko et al., 2017a].

central part of the DDD northeast of Poltava.

As shown in [Ivanova, Gavryltsev, 2021, Fig. 6], thermal parameters are in direct correlation with the intensity of the gravitational field caused by the density inhomogeneities of Earth's crust and upper mantle. Paleogeothermal parameters are also associated with the manifestations of Late Devonian volcanism (Chernihiv segment) and the geodynamics of deep faults.

Fig. 3 shows the map of paleotemperatures with added isotherms of the measured and calculated modern temperatures at a similar depth [Gordienko et al., 2004; Rudenko, 2007]. A direct comparison of the paleo- and modern data in the trough area indicates the following.

The **Chernihiv segment** has paleotemperatures from 95—100 to 110—120 °C, modern measured and calculated temperatures range from 70 (southern edge zone) to 80—85 °C.

Paleotemperatures of this segment are noticeably higher. This can be explained by the consequences of the Late Devonian volcanism [Ivanova, Gavryltsev, 2021, Fig. 6], which led to a temporary (for 50—100 Ma) energy accumulation and temperature increase in the accumulating weakly lithified Carboniferous formations by the mechanism described by A.A. Smyslov [Smyslov, 1993] as a non-stationary regime of upper crustal heating. This regime could have persisted and influenced the increase in the degree of maturity of the organic matter of the

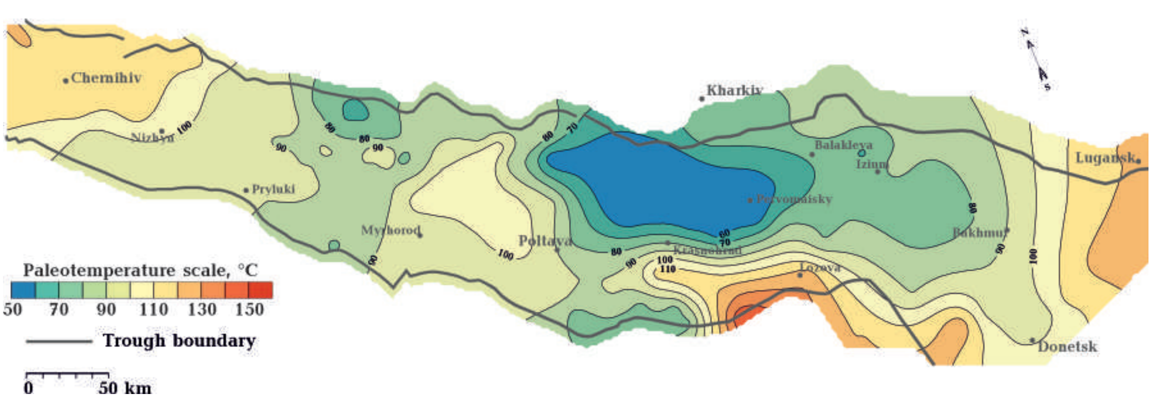

Fig. 2. Map of paleotemperatures at a depth of 3 km.

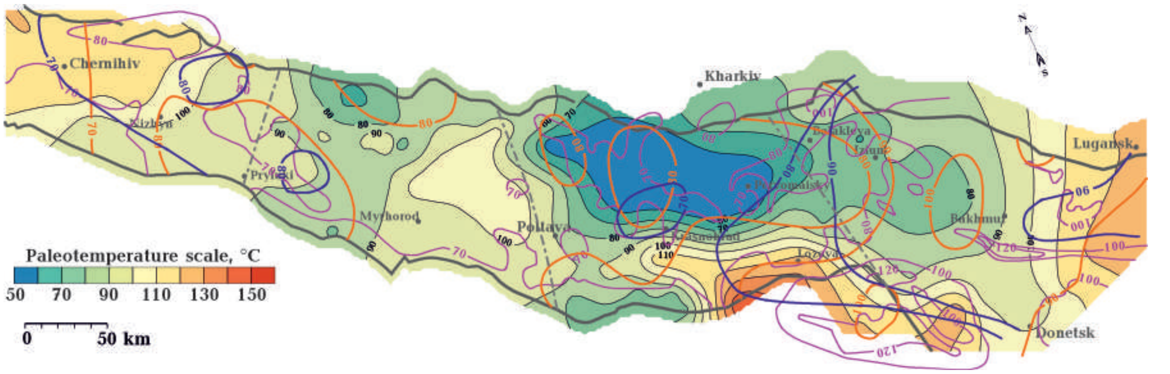

Fig. 3. Map of paleotemperatures with the isotherms of modern temperatures applied to it: blue — measured, pink — calculated [Gordienko et al., 2004], orange — calculated [Rudenko, 2007] (for other markings, see Fig. 1).

Carboniferous deposits during the Carboniferous period and the Early Permian. As noted by R.I. Kutas [Kutas, 1978, p. 28], at present no increase in the intensity of the thermal field is observed in the zones of Paleozoic volcanism.

It should be noted that in the Chernihiv segment (the depth of the asthenosphere base up to 280 km) the highest intensity of the observed gravitational field is noted within the studied territory, reaching +(80—90) mGal [Kuprienko et al., 2010, Starostenko et al., 2017a, b]. It can be assumed that the high values of the gravitational field of the segment are a consequence of Devonian volcanism, with which is associated the saturation of the Earth's crust with dense volcanic formations.

As noted in [Gordienko et al., 2002], in the absence of significant negative anomalies, the positive anomalies of the modern heat flow in this area are local and are associated mainly with the upward movement of deep waters along the faults.

The **Lokhvytsia segment** is characterized by paleotemperatures from 70 to 100 °C. Modern temperatures, both measured and calculated, do not exceed 70—85 °C. In contrast to the modern picture, paleotemperatures are slightly higher in the eastern part of the segment. As shown in [Ivanova, Gavryltsev, 2021, Fig. 6], on this territory, against the background of positive values of the gravitational field, there is a node of the intersection of longitudinal and transverse fault zones with a lithospheric lineament. Apparently, in the Late Paleozoic, this zone was in the stage of activation, which affected the increase in paleotemperatures by 10—15 °C compared to modern ones.

According to [Gordienko et al., 2002], the modern thermal field of the territory under consideration, as well as that of the Chernihiv segment, is characterized by the absence of reliable negative anomalies. Small in area positive anomalies are associated with fault disturbances.

In the **Izium segment**, paleotemperatures vary from 60—80 °C in the north of the segment to 130—140 °C in the southeastern marginal zone. Modern temperatures range from 70—80 in most of the segment to 100—120 °C in its southeastern part (according to the calculated data [Gordienko et al., 2004; Rudenko, 2007]).

The northern half of the Izium segment, with the lowest (up to — 40 mGal) [Kuprienko et al., 2010] intensity of the gravity field and the paleogeothermal gradients [Ivanova, Gavryltsev, 2021, Fig. 5, 6], is also characterized by low paleotemperatures. Paleotemperatures here were 60—70 °C, modern — 70—80 °C.

It should be noted that this territory is distinguished by the widest development of the Lower Permian chemogenic deposits [Arsiry et al., 1984]. Assuming that the maximum heating of the Carboniferous deposits of the graben ended before the pre-Late Permian [Grechishnikov, 1987], the distribution of the Lower Permian chemogenic deposits could influence the values of paleogeothermal parameters. Since halogen formations have high thermal conductivity, they, according to the authors, can be considered as a kind of geothermal heat exchanger that removes heat from the pre-salt rock mass and reduces its thermal parameters.

Gordienko et al. [2002], considering the occurrence of positive thermal anomalies in the post-salt rock complex using the example of the Caspian depression, explain this phenomenon by anomalously high formation pressures exceeding the hydrostatic pressure 1.5 times in the pre-salt stratum, while being close to hydrostatic pressure in the post-salt one. As a result, elisional (or magmatogenic?) waters are filtered upward for a long time through a salt-bearing complex of very low permeability, leading to the appearance of a thermal anomaly in post-salt deposits. According to the measurement data of the heat flow in the pre- and post-salt rock complexes, the correction can reach 20 %.

R.M. Novosiletsky [Arsiry et al.,1984] explains the decrease in thermal parameters in the pre-salt strata by the fact that chemogenic deposits, which are the main aquiclude in the region, deflect ascending flows of hot fluids in the direction of evaporite wedging out.

The increase in paleothermal parameters in the southeastern part of the Izium segment can be associated with the geodynamics of deep faults, which create a node at the intersection of longitudinal and transverse faults with a regional fault that limits the DDD. A comparison of paleo- and modern temperatures indicate the higher activity of this fault zone during the period of the Hercynian tectogenesis. Being the paths of the upward movement of heated deep fluids, the zones of tectonic disturbances caused the appearance of positive thermal anomalies during their activation.

In the **Donbas segment**, according to a very limited amount of data, paleotemperatures vary from 80 to 100—125 °C. Maximum temperatures are observed in the fault zone of the southwestern part of the segment and east of the Bakhmut-Donetsk meridian. Modern measured temperatures vary from 80 to 100 °C [Gordienko et al., 2004; Rudenko, 2007]. According to the calculated data in the segment, the temperature from 80 to 100 °C prevails with anomalies of 100—120 °C in the Donetsk-Makiyivka region, up to 120 °C and more in the southwestern part of the segment and within the Main and Druzhkivka-Kostyantynivka anticlines [Gordienko et al., 2004].

The limited amount of VRI data does not allow one to detect local anomalies. But in general, the paleotemperature indicators of the Donetsk segment are commensurate with modern ones.

The higher paleo- and modern temperature indicators of the Donbas compared to those of the Lokhvytsia and Izium segments may be the result of thinning of the lithosphere within the Donetsk segment (from 120—200 km within the Lokhvytsia and Izium segments to 80—120 km in the Donbas [Starostenko et al., 2017a, b]).

According to V.V. Gordienko et al. [Gordienko et al., 2002, 2006, 2014a, b, 2015a, b etc.], the variations in modern temperature in the DDD and Donbas at a depth of 3 km are mainly due to the variability of the thermal field. Local anomalies are usually associated with fault zones, which is especially clearly manifested in the southwestern part of the Donbas. Positive anomalies of the heat flow are observed during the activation of deep processes, accompanied by the upward movement of deep waters. Negative ones are associated with deep faults, characterized by the downward movement of infiltrating cold waters.

As before [Ivanova, Gavryltsev, 2021], when constructing a paleotemperatures map VRI data from nearby wells, that fit into the general paleogeothermal model, were combined and supplemented with each other. The calculated data array obtained for the construction of the map should be considered as an integral stable solution that reflects the regional distribution features of the studied parameters.

The work was carried out using the structural-tectonic map of the Dnieper-Donets depression [Structural-tectonic ..., 1996] and the tectonic map of Ukraine and Moldova [Tektonic ..., 1988]. The electronic resource "The State Geological Map of Ukraine (Derzhgeolkarta-200)" [State ..., 1998] was used as reference material.

Conclusions. Paleogeothermal indicators are associated with the geodynamic setting of the subsoil, which determines the intensity and nature of the distribution of heat sources, geological development, and features of the tectonic structure of the region. The Hercynian tectogenesis played a leading role in establishing the paleogeothermal regime of the Upper Paleozoic deposits of the Don-Dnieper trough.

A map of paleotemperatures at a depth of 3 km was constructed. The configuration of the paleotemperature field naturally repeats the distribution of the paleogeothermal gradients field, since the same factors are responsible for this distribution [Ivanova, Gavryltsev, 2021, Fig. 5, 6]. Their highest values are observed in the Chernihiv segment, in the southeastern part of the DDD and Donbas. The lowest rates are noted in the central part of the DDD, northeast of Poltava.

Comparison of paleo- and modern temperatures made it possible to estimate the thermal history of the development of the region from the Paleozoic to the Cenozoic.

Elevated paleotemperature values in the Chernihiv segment are explained by the Late Devonian volcanism action no longer manifested in the modern geological period. In the southeastern part of the DDD, high paleotemperatures are associated with the Hercynian activation of deep faults, which is higher compared to the modern one.

The minimum paleotemperatures of the central part of the basin (Izium segment) coincide with the minimum intensity of the observed gravity field and are directly correlated with it.

The Hercynian thermal regime of the Donbas segment generally corresponds to the modern one.

The paleotemperature map of the Upper Paleozoic deposits of the DDD and the adjacent margins of the Donbas, along with the previously published maps of paleogeothermal gradients and amplitudes of vertical displacements of tectonic and salt dome structures, can be used as a tool for studying the tectonic and thermal evolution of the region.

The work was carried out at the Institute of Geological Sciences of NAS of Ukraine as part of the research work on the topic "Evolution of coal-bearing and hydrocarbon-containing formations of Ukraine" 2019—2023 (KPKVK 6541030).

Acknowledgments. The authors express their gratitude to Dr. Geol. Sciences S.O. Machulina and the anonymous reviewer for valuable comments concerning the article's content. Special appreciation addressed to the English editor of the journal, who performed remarkable manuscript polishing, which allowed to significantly improve the presented work.

References

Arsiry, Yu.A.,Vitenko, V.A., Paly, A.M., & Tsypko, A.K. (Eds.). (1984). *Atlas of the geological structure and petroleum potential of the Dnieper-Donets depression*. Kiev: Naukova Dumka, 190 p. (in Russian).

Gordienko, V.V., & Usenko, O.V. (2003). *Deep processes in the Ukrain's tectonosphere*. Kyiv: Publishing House of the National Academy of Sciences of Ukraine, 147 p. (in Russian).

Gordienko, V.V., Gordienko, I.V., & Zavgorodnyaya, O.V. (2014a). Heat field of the north-west part of the Dnieper basin of the Dnieper-Donets depression. *Dopovidi NAN Ukrainy*, *1*, 97—103. https://doi.org/10.15407/dopovidi2014.01.097 (in Russian).

Gordienko, V.V., Gordienko, I.V., & Zavgorodnyaya, O.V. (2014b). Heat field of the south-eastern part of the Dnieper basin of Dnieper-Donets depression. *Dopovidi NAN Ukrainy*, *2*, 98—104. https://doi.org/10.15407/dopovidi2014.02.098 (in Russian).

Gordienko, V.V., Gordienko, I.V., & Zavgorodnyaya, O.V. (2015a). Thermal field of the Donbas. *Geofizicheskiy Zhurnal*, *37*(6), 2—23 (in Russian).

Gordienko, V.V., Gordienko, I.V., Zavgorodnyaya, O.V., Kovachikova, S., Logvinov, I.M., Tarasov, V.N., & Usenko, O.V. (2006). *Dnieper-Donets depression (geophysics, deep processes)*. Kiev: Korvin press, 144 p. (in Russian).

Gordienko, V.V., Gordienko, I.V., Zavgorodnyaya, O.V., Logvinov I.M., Tarasov, V.N., & Usenko, O.V. (2004). *Geothermal atlas of Ukraine*. Kiev: Publ. of the Institute of Geophysics NASU, 60 p. (in Russian).

Gordienko, V.V., Gordienko, I.V., Zavgorodnyaya, O.V., Logvinov, I.M., & Tarasov, V.N. (2015b). *Donbass (geophysics, deep processes)*. Kiev: Logos, 123 p. (in Russian).

Gordienko, V.V., Gordienko, I.V., Zavgorodnyaya, O.V., & Usenko, O.V. (2002). *Thermal field of the territory of Ukraine*. Kiev: Znannya, 168 p. (in Russian).

Grechishnikov, N.P. (1987). Evolution of paleogeothermy of the Don-Dnieper Downwarp. Dnieper-Donets depression. In V.M. Golitsin (Ed.), *Petrology of organic substances in the geology of fossil fuels* (pp. 72—79). Moscow: Nauka (in Russian).

Ivanova, A.V. (1989). *Applications of coal petrography methods oil-and-gas geology*.Working paper № 89.Kiev: IGN AN UkrSSR, 55 p. (in Russian).

Ivanova, A.V. (1991). Application of vitrinite thermometry in oil-and-gas geology. *Sovet. Geologiya*, *3*, 11—15 (in Russian).

Ivanova, A.V. (1976). *Catagenetic zoning of the Carboniferous deposits of the Dnieper-Donets depression according to measurements of the vitrinite reflectance of coal organic matter (in connection with oil-and-gas content)*. Working paper, Kiev: IGFM AN UkrSSR, 70 p. (in Russian).

Ivanova, A.V. (2012). *Catalog of vitrinite reflectance of coal organic matter of Don-Dnieper and Fore-Dobrogea troughs sedimentary deposits with calculated paleogeothermal gradients and vertical displacements amplitudes of tectonic structures*. Kyiv: IGS NASU, 100 p. (in Russian).

Ivanova, A.V. (1975). Study of the catagenetic zoning of the Carboniferous deposits of the Dnieper-Donets depression according to the degree of coal organic matter coalification (in connection with oil-and-gas content). [Author's ref. cand. geol. and min. sci. diss.]. Kiev, 36 p. (in Russian).

Ivanova, A.V. (1992). The technique of vitrinite thermometry data processing for paleogeothermic and paleotectonic reconstructions. *Geologicheskiy Zhurnal*, (6), 32—36 (in Russian).

Ivanova, A.V., & Gavryltsev, V.B. (2010). Method of vitrinite thermometry data processing. *Copyright and Related Rights: Official Bul.*, *21*, 200 p. (in Ukrainian).

Ivanova, A.V., & Gavryltsev, V.B. (2021). Paleogeothermal and paleotectonic reconstructions based on vitrinite thermometry data (on the example of the upper paleozoic deposits of the Dnieper-Donets depression and adjacent areas of Donbass). *Geofizicheskiy Zhurnal*, *43*(3), 82—105. https://doi.org/10.24028/gzh.v43i3.236382 (in Russian).

Kuprienko, P.Ya., Makarenko, I.B., Starostenko, V.I., Legostaeva, O.V., & Savchenko, A.S. (2010). Three-dimensional gravity model of the Earth's crust and upper mantle of the Dnieper-Donets depression and the Donbas. *Geofizicheskiy Zhurnal*, *6*(32), 175—214 (in Russian).

Kutas, R.I. (1978). *Field of heat flows and thermal model of Earth's crust.* Kiev: Naukova Dumka. 148 p. (in Russian).

Leonov, Yu.G. (Ed.). (2013). *Geothermics of the Arctic seas*. Moscow: GEOS, 232 p. (in Russian).

Levenshtein, M.L., Spirina, O.I., Nosova, K.B., & Dedov, V.S. (1991). *Set of maps of Coal Metamorphism in the Donets Basin (on the Paleozoic surface, on the levels: –400 m, –1000 m, –1600 m, and on the structural plans of coal seams c_6^1 and k_5) at 1 : 500 000*. Kiev: Ministry of Geology of the USSR, 14 s. (in Russian).

Privalov, V.A. (2004). *Tectonothermal evolution of the Donets basin* [Dr. geol. sci. diss.]. Donetsk: DNTU Publ. 343 p. (in Russian).

Rudenko, L.H. (Ed.). (2007). The National Atlas of Ukraine. Kyiv: DNVP Kartografiya, 440 p. (in Ukrainian).

Smirnov, Ya.B. (1968). The relationship between the thermal field and the structure and development of Earth's crust and upper mantle. *Geotektonika*, *6*, 3—25 (in Russian).

Smyslov, A.A. (1993). Thermal evolution of the Earth. In *Evolution of geological processes in the Earth's history* (pp. 216—225). Moscow: Nauka (in Russian).

Starostenko, V.I., Pashkevich, I.K., Makarenko, I.B., Kuprienko, P.Ya., & Savchenko, O.S. (2017a). Lithosphere heterogeneity of the Dnieper-Donets basin and its geodynamical consequences. I part. Deep structure. *Heodynamika*, *1*(22), 125—138. https://doi.org/doi.org/10.23939/jgd2017.01.125 (in Russian).

Starostenko, V.I., Pashkevich, I.K., Makarenko, I.B., Kuprienko, P.Ya., & Savchenko, O.S. (2017b). Lithosphere heterogeneity of the Dnieper-Donets basin and its geodynamical consequences. II part. Geodynamics interpretation. *Heodynamika*, *2*(23), 83—103. https://doi.org/doi.org/10.23939/jgd2017.02.083 (in Russian).

State Geological Map of Ukraine at a scale of 1 : 200 000 (Derzhgeolkarta-200). (1998). http://geoinf.kiev.ua/wp/kartograma.htm (in Ukrainian).

Structural-tectonic map of the Dnieper-Donets depression at a scale of 1 : 200 000 (on 6 sheets). (1996). Kyiv: DGP Ukrgeofizika (in Russian).

Tectonic map of the Ukrainian SSR and Moldavian SSR at a scale of 1 : 500 000 (on 20 sheets). (1988). Kyiv: Ukrgeologiya, UkrNIGRI (in Russian).

Usenko, O.V. (2002). Heat flow and modern activation of the Donets basin (according to new data). *Geofizicheskiy Zhurnal*, *24*(5), 102—111 (in Russian).

Vassoevich, N.B. (1986). *Selected Works. Geochemistry of organic matter and the origin of oil*. Moscow: Nauka, 368 p. (in Russian).

Палеотемпературні реконструкції за даними вітринітової термометрії (на прикладі верхньопалеозойських відкладів Дніпровсько-Донецької западини та прилеглих окраїн Донбасу)

А.В. Іванова, В.Б. Гаврильцев, 2022

Інститут геологічних наук НАН України, Київ, Україна

Стаття присвячена палеотемпературним реконструкціям за результатами обробки масиву даних показників відбиття вітриніту вугільної органіки верхньопалеозойських відкладів Доно-Дніпровського прогину (у межах Дніпровсько-Донецької западини та прилеглих частин Донбасу). Вона є продовженням і завершенням раніше опублікованої роботи з реконструкції палеогеотермічного режиму шляхом встановлення палеогеотермічних градієнтів і амплітуд вертикальних переміщень породних масивів. Встановлено, що палеогеотермічні показники пов'язані з геодинамічною обстановкою надр, яка визначає інтенсивність та характер розподілу джерел тепла, геологічний розвиток та особливості тектонічної будови регіону. За результатами виконаної роботи побудовано карту розподілу палеотемператур на глибині 3 км. Аналіз змін та закономірностей розподілу палеотемператур дає можливість виявити роль у термальній історії досліджуваного регіону вулканізму, геодинаміки глибинних розломів, параметрів літосфери, а також оцінити еволюцію його теплового поля. Представлену карту, поряд з раніше опублікованими картами розподілу палеогеотермічних градієнтів та амплітуд вертикальних переміщень породних масивів, слід розглядати як універсальний довідковий матеріал, що може бути використаний з метою демонстрації особливостей і закономірностей регіонального розподілу зазначених параметрів, а також стати важливим інструментом у дослідженні тектонічної та термальної історії розвитку регіону.

Ключові слова: Доно-Дніпровський прогин, вітринітова термометрія, палеотемпература, вугілля, гравітаційне поле, вулканізм, глибинні розломи, потужність літосфери.