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EARTH SCIENCES

THE CONSTRUCTION OF THE MODEL OF THE REGIONAL TRAP OF ABIOGENIC HYDROCARBONS IN THE CRYSTALLINE CRUST OF THE TRANSCARPATIAN DEPRESSION (Ukraine)

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Abstract

It is established thermobaric genesis and the corresponding features of the structure of the LVZs, their places and roles in the structure and geodynamics of the crust of the regions, in particular, Transcarpathia. It makes possible to clarify the geological and structural features of the crust of the region, to adequately interpret distribution of geophysical fields and decipher the peculiarities of local geodynamics and seismic-tectonic process, to clarify the level and nature of geo-ecological hazards, to more effectively predict and investigate deep spatial distribution of mineral resources.

Keywords: The Transcarpathian depression (Ukraine), low seismic velocity and density zones, petrophysical thermobaric modelling, thermobaric hydrocarbon traps.

Introduction. The organization of exploration works based on the organic hypothesis of the origin of oil removed for a long time from the sphere of oil and gas interest significant territories and volumes of the Earth's crust outside the sedimentary cover, where oil and gas deposits can be found. Recognition of the deep genesis of hydrocarbons and the formation of deposits due to their vertical migration along faults has very important practical consequences. Today, it is no longer possible to plan the search for oil and gas deposits without taking into account the possible abiogenic synthesis of hydrocarbons, degassing of the Earth, migration of deep fluids and gases, decompaction of certain horizons of the Earth's crust [11, 15, 16, 18, 26]. Detailed modeling of the deep geological structure of a specific region is necessary to explain the physical nature of velocity local anomalies and related prospects for hydrocarbon exploration and production. In this context, the most effective is the method of petrophysical thermobaric modeling (PTBM), when information on seismic sections of DSS, tectonics, geothermal, and physical properties of rocks is taken into account. Material composition modeling of the lithosphere is based on comparing the materials of the DSS with the data of the experimental study of the physical parameters of rocks at

high *PT* parameters. It confirmed the new hypothesis of decompaction of mineral matter of the Earth's crust of thermobaric origin at depths of 5-25 km, which is recorded by the DSS in the form of low velocity zones (LVZ) – the calculated wave and gravity fields coincide with the observed ones.

Geological interpretation of the PTBM results.

A comprehensive analysis of seismicity, geodynamics, volcanic activity and mineral deposits in the Ukrainian Transcarpathian depression (TD) is mainly based on new information on geological, geophysical, geodesic, structural and geomorphological studies [1, 6, 19, 20, 22, 23, 27].

The TD (Fig. 1) is the part of the Carpathian orogeny where the significant restructuring of the tectonic pattern took place at the turn of the Paleogene and Neogene periods that resulted in a significant difference in the Earth's crust structure of the region. Active post-Alpine tectonic processes caused the formation of both the depression itself and young volcanic features. The depression extends from the NW to the SE and consists of two major units (Fig. 1).

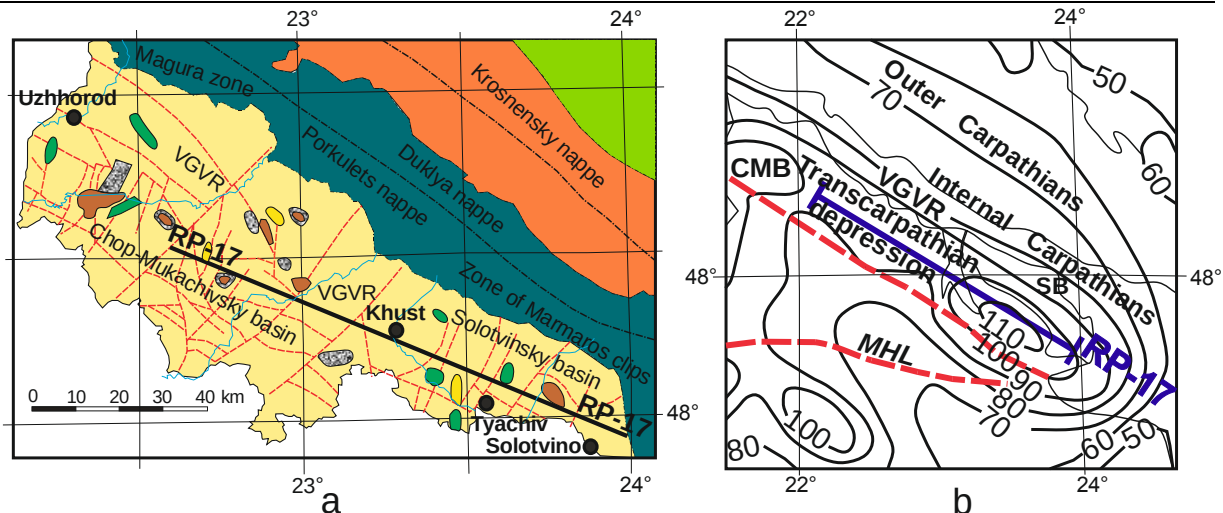


Fig. 1. Schematic maps of the regional tectonic units (a, b), location of the RP-17 seismic profile (a, b) and iso-lines of heat flow (b) [1, 19, 20, 22, 23]. CMB – Chop-Mukachivsky basin, VGVR – Vygortlat-Guta volcanic ridge, SB – Solotvinsky basin, MHL – Mid Hungarian line.

They are the NW Chop-Mukachivsky basin on the Central massifs of the Internal Carpathians and SE Solotvinsky basin superimposed on the flysch zone of the Outer Carpathians. These units are separated from each other by the Vygortlat-Guta volcanic ridge. The Chop-Mukachivsky basin descends, while elevation, horizontal movement and high seismicity are characteristic of the Solotvinsky basin [27]. Drilling data show that the basement of the Transcarpathian depression consists of the Paleozoic metamorphic schists, the Triassic dolomites and dolomitized limestones, the Upper Cretaceous marls and mudstones with sandstones and the Palaeogene sandy-clay formations [22, 23].

The Paleozoic sediments are exposed in the NW depression. The Cretaceous and Paleogene sediments crop out mostly in the south-east, in the Solotvinsky basin. Thus, from the north-west to the south-east the younger sediments gradually comprise the basement of the Transcarpathian depression where numerous faults, clearly registered by both geophysical and geological methods give rise to a complicated block nature of its structure [19, 20, 22, 23].

The block tectonics is a specific characteristic of the Chop-Mukachivsky basin while it is much less expressed in the Solotvinsky depression. Active vertical and horizontal movements and high seismicity can occur here [1, 6, 19, 20, 22, 23, 27]. Along the TD the RP-17 profile [1] revealed the following horizons (1) the sedimentary cover ($V_p=1,7$ to $4,8$ km/s), (2) the Mesozoic basement of the depression ($V_p=5,3$ to $6,0$ km/s) and (3) the Paleozoic basement ($V_p=6,0$ to $6,4$ km/s). Where V_p is elastic longitudinal waves. In the Solotvinsky basin Precambrian rocks (V_p of $6,2$ - $6,5$ km/s) and the Conrad boundary ($V_p=6,6$ to $6,8$ km/s) are also delineated (Fig. 2). The velocities of $V_p=7,5$ - $8,5$ km/s are

registered on the Moho discontinuity. The minimal thickness of the folded basement of the depression is 3 km in the SE Chop-Mukachivsky basin. It increases to 4,0-4,5 km in the Solotvinsky basin. The layer of “granitoids” is determined by the velocity of 6,1-6,4 km/s for the Horizon II at depths from 4,5 to 8 km. The LVZs (Horizon III-LVZ) with the velocity of 6,0-6,1 km/s are below situated below.

The seismic horizon IV (6,2–6,5 km/s) at depths of 6-14 km was earlier believed to be the Conrad boundary (V, K₂). However, is now interpreted to be LVZ of the thermobaric origin located at depths of 6-17,5 km [11]. The Horizon VI is the second LVZ with a velocity of about 6,4 km/s in the crystalline crust of the TD. This layer is located above the Moho discontinuity (Fig. 1, 2). Its velocity values are small for basic rocks. The explanation of the nature of the upper and lower LVZs is possible in analyzing HF in the TD. There are its stationary component and non-stationary anomalies due to geodynamic processes and the distribution of radiogenic heat sources and thermal parameters of the environment [6, 19, 20]. In the depressions of the TD HF varies from 90 to 120 mWt/m². The intensive anomalies (110 mWt/m²) occur along the Central TD. Temperatures are very heterogeneous laterally and vertically: 5 km – 85-150°C, 10 – 180-300, 20 – 300-470, 30 – 450-650, at the M – 600-800°C (Fig. 1, 2).

In order to model the petrophysical structural characteristics of Transcarpathian Depression deep horizons, we proposed petrophysical modeling techniques using experimental data on changes in the physical characteristics of rocks in various PT conditions of experiments corresponding to those for specific geological regions [11, 15].

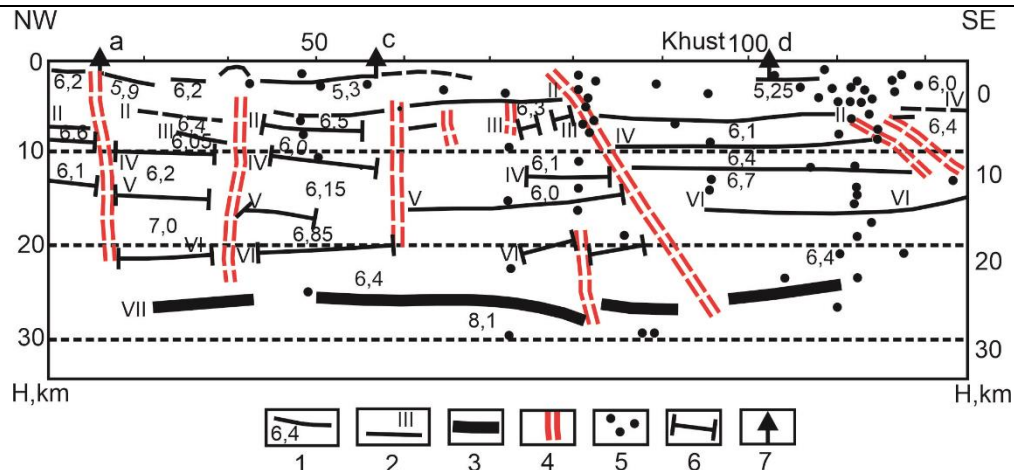


Fig. 2. Seismic section of the Earth's crust and local earthquake hypocentres along the TD [1, 22, 23, 27].
1 – refraction layers and velocities along them; 2 – reflection horizons and their numbers; 3 – Moho discontinuity; 4 – faults; 5 – earthquake focuses; 6 – seismic boundaries; 7 – hydrocarbon exploitation wells.

A sample of the rock in the experiment is like being “submerged” to the definite depth. This technique made it possible to obtain a large amount of information about the change in elastic-density parameters of the mineral substance with depth for specific regions in a

short period of time. Below is an optimal block diagram of small-scale petrophysical deep structural modeling (Fig. 3).

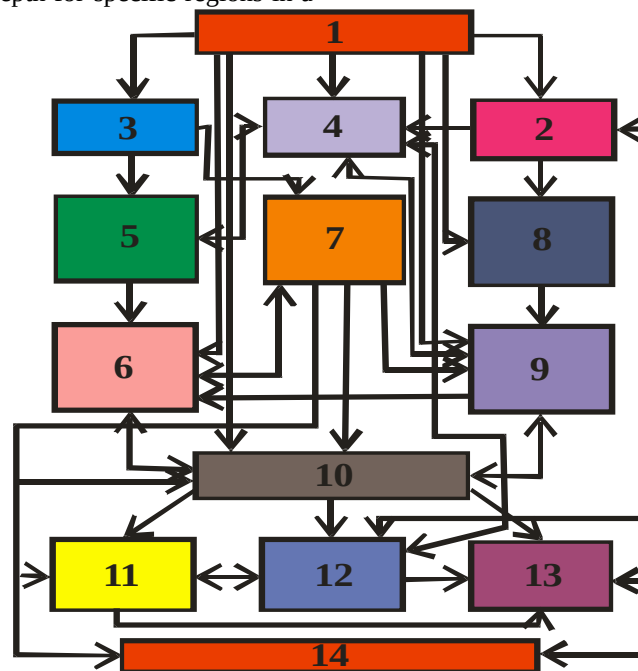


Fig. 3. Block diagram of small-scale petrovelocity deep structural modeling.

1) The study of structural and tectonic features of the region; selection of the main groups of rocks forming the geological environment; its further dismemberment into separate blocks; 2) the analysis of a priori geological and geophysical information, taking into account the data of the deep thermodynamic situation; 3) selection of a collection of rock samples of the studied region, including possible deep analogues (based on the information of blocks 1, 2); 4) the drawing up program variants of experimental study based on the prediction of the distribution with depth of P and T (based on geothermy and gravimetry materials) and their subsequent use in experimental studies of rock samples in high-pressure-temperature apparatus; 5) the study of elastic and density parameters in different thermobaric

conditions based on rock samples collections; 6) statistical processing and analysis of the results of laboratory experiments; 7) complex processing of petrological information and experimental data; the search for correlational dependencies between relevant parameters; drawing up work sheets or tables; 8) the analysis of materials of field geophysical observations (primarily DSS); the construction of high-speed cuts in blocks and layers along the corresponding profile; 9) comparing the results of laboratory petro-velocity PT studies with seismic information; complex primary interpretation; 10) construction of a lithological model of the possible distribution with depth of surface analogues of deep rocks based on a systematic analysis of relevant information (blocks 1, 2, 6, 7 and 9); 11) reconstruction

based on the lithological model (block 10) of petrovelocity sections (V_p , V_s) according to experimental data (blocks 6, 7); 12) construction of a density cross-section with subsequent cyclic correlation of anomalies of the gravity field with velocity and physical cross-sections; 13) creation and analysis of models of distribution with depth of elastic-density (Young's and shear modules, Poisson's ratio, compressibility, etc.) of mineral matter by individual blocks; comparison with primary geophysical information; 14) the construction of complex petrovelocity sections, which are based on the data of experimental PT studies and information accumulated in 10-13 blocks [9].

Influence of PT -regimes on the elastic characteristics and density of rocks. We conducted long-term investigations of the experimental changes in velocities and densities with depth for rocks under PT

conditions relevant to specific regions and at specific depths. The study established the occurrence of the velocity inversion of elastic longitudinal waves and density (ρ) at different depths (H). With increasing depth (that is, with increasing pressure (P) and temperature (T) affecting the specimen of the rock), after some initial increase in V_p and ρ , their decrease is observed. Then the velocities and densities increase again (Fig. 4).

Thus, a low velocity zones are manifested on the $V_p=f(PT)=f(H)$ curves whose configuration and location correlate well with elastic anomalies registered by deep seismic sounding (DSS) information from the Earth's crust at depths of 3-25 km. The changes of $V_p=f(H)$ can also be obtained from measuring the isobars of velocities ($V_p=f(T)$ at $P=\text{const}$) and their isotherms ($V_p=f(P)$ at $T=\text{const}$).

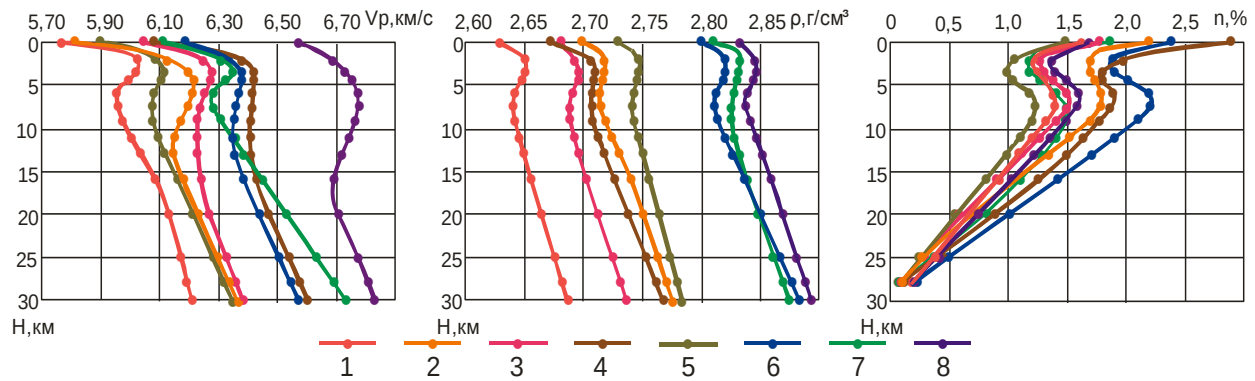


Fig. 4. Changes of elastic longitudinal waves, density and porosity relationships with depth. 1 – evenly granular granites, 2 – porphyroid granites, 3 – trachytoid granites, 4 – rapakivi granites, 5 – plagiogranites, 6 – charnockitoides, 7 – diorites, 8 – anortozites.

Detailed studies showed that both methods of determining $V_p=f(H)$ plots give identical results [9]. Regardless of the methods of determining velocities using several PT programs or calculating the isobars and isotherms there is a threshold value of changes of the temperature with depth ($\partial T / \partial H$) when the anomalous elastic state of mineral matter arises – LVZs. The changes of velocity of elastic waves with depth (V_p) in the rock of constant mineral composition can be calculated by the ratio of $\frac{\partial V}{\partial H} = \left(\frac{\partial V}{\partial P} \right)_T \cdot \frac{\partial P}{\partial H} + \left(\frac{\partial V}{\partial T} \right)_P \cdot \frac{\partial T}{\partial H}$. The LVZs in the Earth's crust are determined by the assumption of $(\partial V / \partial H) < 0$. As far as $(\partial V / \partial P)_T$ $(\partial P / \partial H)_P$ $(\partial T / \partial H)$ are positive, $(\partial V / \partial T)_P < 0$, then to form a zone it is necessary to fulfil the assumption for absolute values:

$$\left| \left(\frac{\partial V}{\partial P} \right)_T \cdot \frac{\partial P}{\partial H} \right| < \left| \left(\frac{\partial V}{\partial T} \right)_P \cdot \frac{\partial T}{\partial H} \right| \quad (1)$$

In most cases, the change of the lithostatic pressure with the depth can be considered as a constant number. Therefore, $(\partial P / \partial H)$ is 0,24÷0,32 kbar/km at depths from 3 to 40 km for ancient shields. The temperature gradient at these depths varies within the wide range (from 5 to 25°C/km) [15]. The relative increase of velocities with pressure under room temperature is

characterized by two intervals: $P=(0\div2)$ kbar is the interval of maximum increase of velocity, $P>2$ kbar where the minimum velocity gradient is observed. As a rule, the velocity change with temperature under atmospheric pressure has three intervals: $T<80\div100^\circ\text{C}$ (minimal changes), $T\approx 80\div250^\circ\text{C}$ (maximal changes).

Further heating within the interval of $T=250\div600^\circ\text{C}$ results in the small decrease of the velocity. The relative changes of velocity under compensating constant pressure (isobars) and constant external temperature (isotherms) are different in absolute values. Within the interval of 20÷70°C under $P<0,7$ kbar the changes of velocity with temperature are negligible, i.e. up to a depth of 2÷3 km the velocities always increase intensively. It is caused by the growth of V_p with pressure due to induration of rocks. The interval $T=100\div250^\circ\text{C}$ is the interval of the most intensive changes of $V_p=f(T)$. Here decrease of velocity by two times is possible because of temperature influence under atmospheric pressure and by about 10-20% under compensating pressure of $P\approx 1,2\div 3,5$ kbar; $T\approx 110\div 250^\circ\text{C}$) that the greatest negative changes of velocity of the elastic waves are observed and zones of low velocities (LVZs) are revealed. The experiments found $(\partial V / \partial T)_P = -2.7\pm 0.5$ ($P\approx 0,5$ kbar); $-0,7\pm 0,3$ ($P=2$ kbar); $-0,33\pm 0,1$ m/s·°C ($P=5$ kbar) and V_p from pressure under different constant temperatures

$(\partial V / \partial P)_T = 0,8 \pm 0,3$ (pressure interval $0 \div 2$ kbar, temperature $20 \div 80^\circ\text{C}$); $0,01 \pm 0,005$ (under $P \approx 2 \div 5$ kbar, $T \approx 20 \div 80^\circ\text{C}$); $0,04 \pm 0,01$ (under $P \approx 2 \div 5$ kbar, $T \approx 265^\circ\text{C}$). Based on these data and experiments under the low and high-temperature regimes and calculations it was revealed that under low-temperature ($(\partial T / \partial H) < 9 - 11^\circ\text{C}/\text{km}$) the zones of the velocity inversion are not reflected on the curves of $V_P = f(PT) = f(H)$. In this case, the condition of (1) is not executed. If the temperature gradient is equal to $(\partial T / \partial H) < 15 - 20^\circ\text{C}/\text{km}$ in pressures interval of $1,8 \div 3,5$ kbar, the relationships of $V_P = f(PT)$ clearly revealed LVZs. The decrease in the velocities of different samples varies from 10 to 250 m/s in these zones.

Similar calculations were also performed according to experimental studies of rocks in various thermodynamic conditions of experiments performed by other authors [3, 4]. However, these data can be used for modelling only at depths more than 10-15 km.

Information on changes density vs. depth was obtained from studies of the volume decrement under PT -experiments and the ultrasonic determinations of the compressibility of the rocks (fig. 4).

The density characteristics of the rocks nonlinearly change with depth similarly to the elastic parameters. The $\rho = f(PT) = f(H)$ relationships demonstrate maximums and minimums. It implies that deep simultaneous influence of P and T on mineral matter results in the formation of zones of density inversion. This mechanism for the origin of the LVZ is corroborated by studies of rock density under programming influence of P and T . As it was expected, under PT relevant to the LVZs density also decreases. The values of $\partial \rho / \partial H$ sometimes are negative reflecting a considerable density decrease of rocks that creates zones of low density in the crust. Under thermodynamics conditions at 5-15 km depth the gradient of the density increment falls to zero or becomes negative (Fig. 2). The additional experiments show that the LVZs depend weakly on a mineral composition of the crust matter. Obviously, the structural transformations and chemical composition play a key role in the variations of rock density.

The low density is very sensitive to the temperature conditions of the Earth's crust similarly to the LVZs. Increasing deep HF decreases rock density, activates capability to decrease the rock density and increase their permeability and hygroscopicity (activates a process of fluid movement) that, for example, causes metamorphic transformation of rocks. In other words, these LVZs are to be the most active horizons of present-day geological-geophysical transformations of the crystalline crust mineral environment [9-11, 15, 13]. A multidisciplinary analysis of DSS data, geothermal and petro- structural modelling showed that the crystal domains of higher temperature gradients are distinguished by more complex character of variations in seismic velocity with depth. Here intensive LVZs occur [11, 15]. In "colder" crystal domains the thickness of the LVZs is negligible or zones are absent at all. In addition, we confirmed that the variations in the mineral composition of the rocks at depths of 5-20 km influence negligibly on position of LVZs and their intensity.

The comprehensive experiments on rocks and minerals under different PT -conditions disclosed an increase in relative deformation of grains and their twinning in the LVZs (5-15 km depth). The density of rocks increases inside the blocks of dislocations and decreases on intergrain boundaries. The defects of minerals packing increase. The intergrain boundaries expand due to their mylonitization, the amount of main micro fissures increases. There is depressurizing or opening of the gas-liquid inclusions in minerals in heating because of excess inner pressure. Moreover, the rocks are characterized the lowered density (Fig. 4) [9, 10, 12].

The petrophysical thermobaric modelling of the crystalline crust on the Ukrainian Shield (USh) demonstrated that characteristics of low velocity zones (LVZs) depend slightly on mineral composition of rocks at relevant depths. They are mainly related to the geothermal regimes of the crystalline crust in study areas [11, 15]. Being large-scale systems of transcrustal deep distortions, zones of low elastic properties and densities are the most permeable for ascending hydrothermal solutions and fluids of the mantle origin during the activation of tectono-magmatic processes accompanied with intensive heat flow (HF). Different processes of metasomatism, formation and localization of mineral resources (e.g. hydrocarbons) most likely occur in these zones. A satisfactory coincidence was obtained between the position of LVZs (decompaction zones) and mineral deposits in the Kirovograd ore region of the USh, on the NW Black Sea shelf, in certain areas of the Caspian Sea [11, 15, 16, 17, 26]. It follows that LVZs of the thermobaric nature serve as the diagnostic indicator of deep mineral deposits.

The LVZs in the crystalline crust as zones of increased porosity of mineral matter. The physical parameters of different types of crystalline (igneous and metamorphic) rocks are mainly controlled by the composition and structural-textural peculiarities of mineral material although a jointing and porosity (n) of the rocks, the state of intergrain boundaries also influence these characteristics. The occurrence of different types of pores and fissures is governed by the conditions of their formation and subsequent processes of transformations. Porosity in the crystalline rocks became the subject of the intensive studies due to examining migration of gas-liquid flows, particularly hydrocarbons, at different depths in the lithosphere [5, 8, 9-11, 28]. Based on the studies of the relationship between porosity and velocity under high PT in the granite samples from the USh, it became possible to characterize more clearly changing porosity and jointing vs. PT environments at different depths. The study also explains some crustal decompaction anomalies of rocks which, in turn, can act as migration pathway for hydrocarbons of the mantle origin. Under atmospheric pressure the clear nonlinear relationship is revealed between the velocity and porosity for 3 groups of the granites which differ in a grain size of rock-forming minerals. The gradients of changing $V_P/f(n)$ increase with increasing the size of grains (Fig. 5).

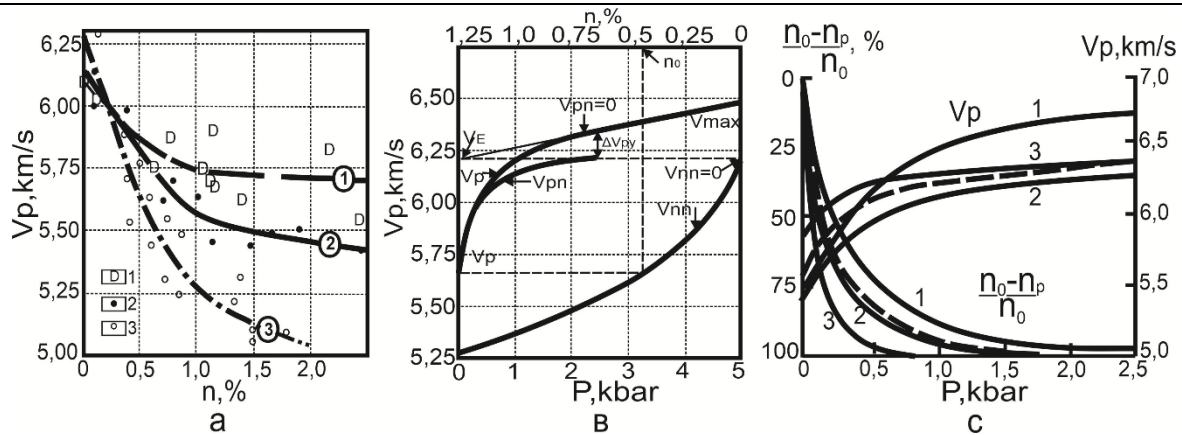


Fig. 5. Changes in velocity and pore space with pressure in granites. a – Change of $V_p=f(n)$ for granites: 1 – fine-grained, 2 – medium-grained, 3 – coarse-grained; b – change of mean values velocity of longitudinal waves for the medium-grained granites vs. pressure ($V_p=f(P)$) and porosity ($V_{pn}=f(n)$); c – relative change of pore space under the increase of pressure in granites: 1 – fine-grained, 2 – medium-grained, 3 – coarse-grained.

The $\frac{n_0 - n_p}{n_0} = \frac{\Delta n}{n_0} = f(P)$ plots characterize the relative change in the pore space (in %) vs. pressure in the granites, where $n = n_0 \left(1 - \sqrt{\frac{V_p - DP - V_0}{V_E - V_0}} \right)$,

D is the relative change in the velocity vs. pressure plot on the linear segment due to the elastic deformation of the rock-forming minerals (Fig. 5, c).

The given ratio makes it possible to estimate changes in the size of the pore space of rocks depending on the applied pressure (depending on the depth) and temperature, based on the data of the measurement of the speed of the propagation of elastic waves in rocks at different depths together with the change in the density of rocks in different PT conditions (fig. 5, c). In the low velocities zone (4–15 km) (the zone of decompaction of rocks, loosening of intergrain boundaries), an increase in porosity is observed.

In the crystalline crust, rocks are subject to compression, heating up, various structural and sometimes material transformations resulting from the action of pressures and temperatures. Heating causes an increase in rocks volume. The coefficient of volumetric thermal expansion of rocks: $2 \cdot 10^{-6}$ – $4 \cdot 10^{-4} \text{ K}^{-1}$; the average $3 \cdot 10^{-5} \text{ K}^{-1}$. When the rocks are heated to 300°C , we observed an increase in the volume of mineral matter by 1–1.5% and a corresponding decrease in density [9, 12, 13]. The action of high pressure, as a rule, leads to compression of the substance, the value of which is determined by compressibility or the coefficient of comprehensive contraction. At a depth of 5–10 km, the

pressure of $P=2,5$ – $3,0$ kbar can increase the crystalline rock densities by no more than $\sim 0,5\%$.

Thus, thermodynamic forces that facilitate the development of local high microstresses will predominate at depths from 3 to 10 km, causing volumetric destruction of structural integrity of the rocks, that results in the formation of deconsolidation of Earth's crust mineral matter at these depths [9, 12, 13]. In this PT interval in the crystalline rocks, a substance decomposes due to the internal multi-oriented stresses, which in local mineral contacts reach values exceeding the strength of individual minerals. This results in a fragile micro-destruction of the environment. The number of main microcracks increases (loosening). At the same time, the migration of free liquid and gas through micro-disruption of minerals and inter-grain contacts activates in the intergranular space, destroying the rock and forming secondary pores and cavities in it. This is a key process for the movement of deep fluids through rocks in the LVZs under natural conditions. In the LVZs, an increase in porosity is observed by 10–25% compared with values at depths of overlying layers (Fig. 6).

Decreasing the velocity of the elastic waves and changing in the density suggests that porosity increases by 10–20% in the LVZs at a depth of 4–15 km in a comparison with that at the 3–5 km depth (horizons of maximum elastic parameters above the LVZs). In the zones of decreased porosity (LVZs) intensive processes of mass transfer, gas-liquid including deep hydrocarbons seem to be the most intensive [9, 25].

Based on the foregoing, graphical presentations and theoretical calculations demonstrate that the rock porosity decreases by 30–50% at a 3–5 km depth (Fig. 6).

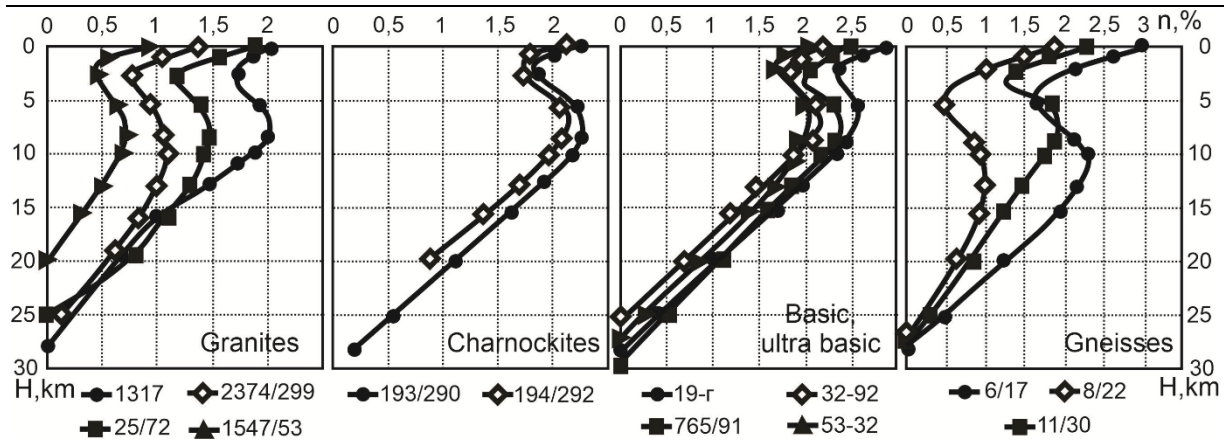


Fig. 6. Change in porosity of the crystalline rocks under thermodynamic conditions at the different depths.

A comparison of experimental data and geophysical observations. The DSS studies revealed anomalies of elastic behaviour of mineral matter in the form of LVZs (Fig. 4). They were also registered during the laboratory experiments on the rock samples simulating thermobaric parameters relevant to 3-25 km depths. A comparison of interdisciplinary experimental and field data allows us to put forward several ideas on the physical nature of elastic zoning mineral matter in the upper layers of the crystalline crust [9, 15].

Model and natural processes or phenomena are considered to be similar if their determining criteria are numerically equal. The theory of dimension and similarity makes it possible to use effective methods of selecting necessary relationships [9].

The criteria of similarity (C) are dimensionless quantities which characterize the given phenomenon or process. The similarity analysis was applied to select the dimensionless quantities which mostly control the velocity of the elastic wave in mineral matter. As the velocity mostly reflects the physical state of matter under different thermobaric conditions, it functionally depends on pressure (P), temperature (T), density (ρ), volume (U), specific heat capacity (C_{ou}) and the Poisson coefficient (σ)

$$V = f(P, T, \rho, U, C_{ou}, \sigma) \quad (2)$$

As objects under study have finite dimensions and are subjected to changing PT environments, it is reasonable to consider depending V on changing PT -regimes with a depth. Substituting T and P by their gradients ($\text{grad } T$ and $\text{grad } P$), we shall get the following dimensions: $[V] = \text{m} \cdot \text{s}^{-1}$; $[\text{grad } P] = \text{kg} \cdot \text{m}^{-2} \cdot \text{s}^{-2}$; $[\text{grad } T] = ^\circ\text{C} \cdot \text{m}^{-1}$; $[\rho] = \text{kg} \cdot \text{m}^{-3}$; $[U] = \text{m}^3$; $[z] = \text{m}$; $[C_{ou}] = \text{m}^2 \cdot \text{s}^{-2} (^\circ\text{C})^{-1}$; $[\sigma]$ - dimensionless.

Solving the matrix of their dimensions we shall obtain the followings criteria of similarity:

$$C_1 = \frac{\text{grad } P \cdot z}{V^2 \cdot \rho} \quad (3)$$

$$C_2 = \frac{\text{grad } T \cdot z \cdot C_{ou}}{V^2} \quad (4)$$

The first (C_1) characterizes the influence of pressure on the velocity of the elastic wave of the object of study within a boundary thickness of z , the second (C_2) characterizes the influence of temperature. Consequently, if a model (m) and its natural (n) affinity consist of the same matter and $\rho_m = \rho_n$ and $C_{oum} = C_{oun}$,

equality of the velocity in the model and natural settings will occur in satisfying the following condition:

$$\text{grad } P \cdot z = \text{inv}, \quad \text{grad } T \cdot z = \text{inv}, \quad (5)$$

where inv is invariant.

Based on these criteria of similarity, equality of mean values of P and T in the model and natural environments is enough to compare the velocity in these both settings. It implies that the V_p/V_s ratio (C_3) must be constant. The mean value of this ratio for the Earth's crust is 1.77 while its laboratory mean value is 1.8 ± 0.1 with 0.95 confidence interval [15]. It follows that the C_3 criterion is the invariant number, e.g., it is numerically equal in nature and models. Therefore, the velocity of elastic wave in the relevant model must not differ from that in natural conditions. Accordingly, the scale coefficients can be taken to be equal to 1. The equations of the relationships between V_p , X_1 , P and T from experiments are invariant and can be applied without changes in simulating natural environments at different depths. Generally, the essence of the petrovelocity thermobaric modelling is the comparability of elastic wave velocity in the lithosphere from DSS method and experimental measurements of this parameter under high PT regimes pressures [9, 15]. From it follows that the LVZs at 3-25 km depth are most likely to be of thermobaric origin.

The nature of LVZ along the DSS profile (RP-17) using the PTBM methodology. The PTBM allows us to explain the origin of the LVZ along the profile [9-12, 13, 14, 18]. For this purpose, the samples are selected of slates, quartzites, metaconglomerates, mylonites, granite-gneisses, diorites, gabbroides and basalts from the USh and Transcarpathia because they seem to form the deep horizons of the TD. Their elastic characteristics were studied in detail at relevant PT conditions [9-12, 13, 14, 18] at low-temperature regime of the Chop-Mukachivsky portion of the profile (Fig. 7, a). In constructing models of other parts of the profile with high-temperature regime (abnormally high for the territory of Ukraine), temperature corrections were made for the values of velocities of the relevant rocks. For depths of 10-35 km relationships of $V_p = f(PT) = f(H)$ were obtained applying isobars and isotherms of velocities obtained by the authors of this study, as well as data on rocks forming the deep horizons of the Earth's crust [3, 4]. As an example of such a modelling, for the area around 105 km of the RP-17 DSS profile, Figs. 7

a, b, c, and d demonstrate the data on temperature regimes, seismic velocities, calculated $V_p=f(PT)=f(H)$. A model is also presented for the distribution of mineral

environments with depth corresponding to these velocities. Having analyzed these materials, we made an assumption about the nature of the LVZs zones in the TD.

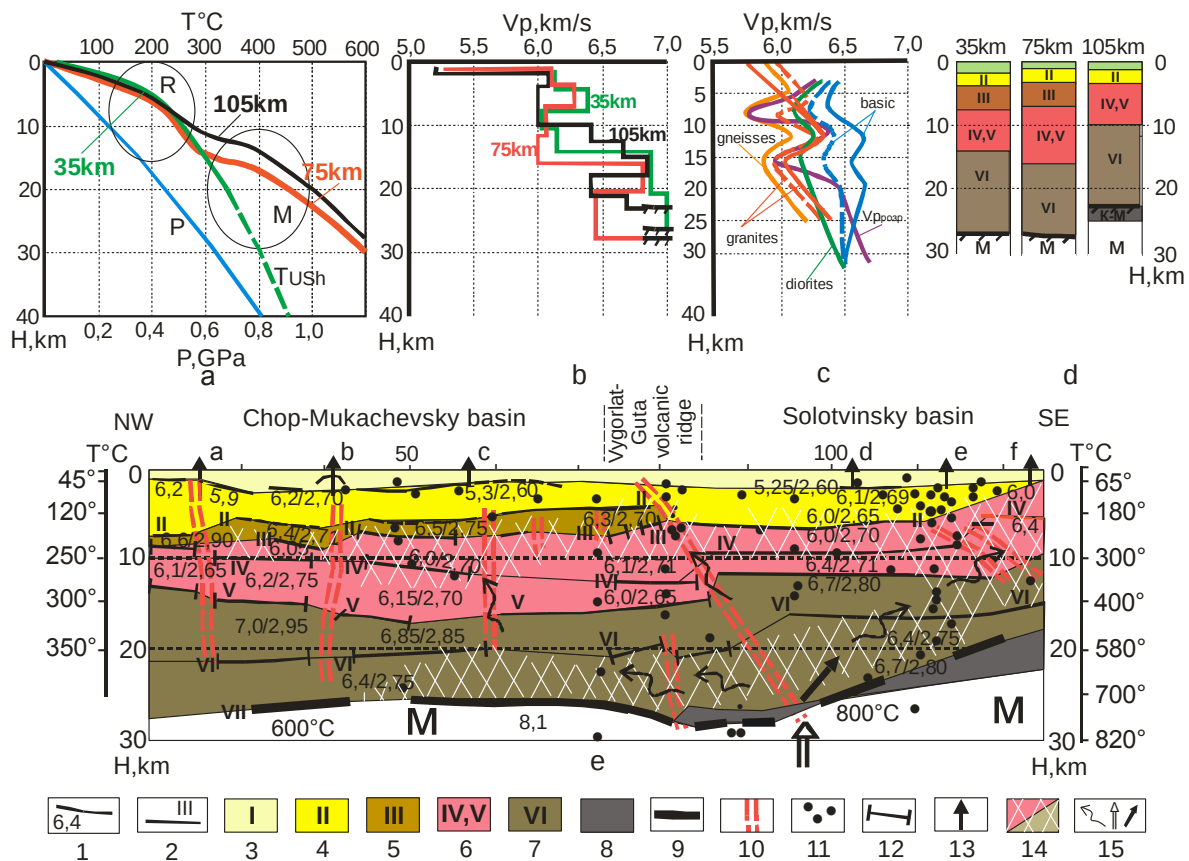


Fig. 7. Elements of PTBM for areas of 35, 75, 105 km of the RP-17 DSS profile (a-d) and the model of rocks distribution with a depth along TD (e) (this study and data from Chekunov et al., 1969; Tretyak et al., 2015; Nazarevich, Nazarevich, 2004; Nazarevich et al, 2002, 2011). a – temperature regimes; b – seismic velocity; c – calculated $V_p=f(PT)=f(H)$ for thermal regime of 105 km; d – distribution models for mineral materials vs. depth according to these velocities. 1 – refraction layers and velocities along them; 2 – reflection horizons and their numbers; 3 – Neogene layer; 4 – folded basement; 5 – Paleozoic amphibolite facies (gneisses); 6 – Proterozoic (Precambrian) gneisses with LVZs; 7 – basic rocks; 8 – crust-mantle mixture; 9 – Moho discontinuity; 10 – faults; 11 – earthquake foci; 12 – seismic boundaries; 13 – hydrocarbon exploitation wells; 14 – LVZs; 15 – fluid flows.

In the TD (Fig. 7, d), the upper LVZ-I resulted from high T in compared with its average values due to radiogenic heat generation of clays, siltstones, sandstones, granite-gneisses and with some contribution of mantle heat [6]. In the LVZ-I the temperature varies from 160 to 260°C, therefore, this zone is of the thermobaric nature [11] and consists of decompaction granite-gneiss with schists which are vulnerable to destructive external influences.

Below the LVZ-I the temperatures are low because of the decrease in radiogenic heat. Besides, the mantle component of HF is controlled by the physical state of the underlying rocks that causes the formation of a layer with high velocity because of the dominance of P over T . This horizon consists of basic rocks. At depth of 18-26 km temperature regimes produced a new LVZ-II. The input of heat from the mantle warms up the rocks up to 600°C at 18-26 km depth (Fig. 7, d). The zone is composed of diorites, gabbroides, basalto-

ides and other products of volcanic activity. The ruptured structure of Moho allows us to suppose the occurrence of crust-mantle mixture here [14].

There are two voluminous domains in the LVZs along the profile. The first occurs in the Vygorlat-Guta volcanic ridge area which is apparently related to an intense inflow of mantle heat along the fault. The second one is located at a 90-120 km depth. The Chop-Mukachivsky basin is localized within the Transcarpathian mantle fault zone where volcanism was widespread. It now descends due to the powerful cooling of volcanogenic formations of low elastic parameters in the lower crust [6, 27]. Additional decompaction of basified formations above the Moho discontinuity and the velocity decrease are associated with shear stresses directed along the TD [27] which causes the dilatant decompaction of rocks [24].

Higher pressure ceases the growth of the zone due to the compensating effect of structural distortions under pressure. Thus, the zone modifies the configuration:

its thickness can be increased due to the increase of intensity of deep HF or the zone can disappear in case of lowering it. Such an instability of the thermodynamics of the LVZs causes their episodic occurrence in the Earth's crust as well as their vertical and horizontal migration depending on of the temperature variations in the deep horizons of Earth [9-11, 15, 28].

The seismic K_2 boundary seems to be thermobaric in origin which results from the intensive increase in V_p above the LVZ. However, it is not excluded that the intensive increase in the velocity above the LVZ can also be associated with occurring of the high velocity rocks instead if low velocity ones. In this case the deep thermobaric conditions facilitate a higher velocity jump.

An intense warming up of the rocks zone is a characteristic of in Solotvinsky basin, which formed a large LVZs above the M discontinuity (in turn, here the latter ascends to 18-21 km). The constant heat inflow from the mantle heats the rocks at depths of 13-18 km and a new LVZ-II zone is formed. Some contribution to the increase in T in the zone is made by the rocks of low thermal conductivity of the LVZ-I above the zone LVZ-II that reduces the outflow of the mantle heat from the LVZ-II.

This is the region of transition from acidic rocks to rocks of intermediate composition, and gabbroids and diorites seem to underlain it. There is the development of LVZs in the Earth's crust in active zones of quite intense stresses. In the process of destruction of the mineral matter at certain depths, the development of LVZs can be associated with the action of the dilatancy effect [21, 24]. Theoretically, it means the linear proportionality of inelastic increases in volume and shear, or in other words the volumetric and shear inelastic deformations are functions of pressure and tangent stress. In crystalline rocks, the effect of the development of microcracks is manifested when the stresses satisfy the criterion for the onset of dilatant pre-destruction or, more simply, the elastic limit. It is assumed that the characteristic changes of types of brittle fractures observed in laboratory experiments on rocks, occur within the crust. On this basis the relevant models are developed for defects of the deep horizons of the crust. A certain disadvantage of our model is the requirement of the presence in the Earth's crust of shear stresses that reach the strength limits of the rocks. However, these phenomena are possible for the territory of Transcarpathia under study. Additional decompaction of basified formations above the M discontinuity and reduction of the velocity are associated with dilatant decompaction of the rocks due to shear stresses directed along the TD and the presence of the mantle Transcarpathian fault [2, 27]. Moreover, earthquakes are concentrated at a shallow depth of the TD (Fig. 8, d), which, in our opinion, is closely associated with the thermobaric zones of the upper crust decompaction. Here, the seismic activity

contributes to the widening of the channels for motion of fluid from the asthenosphere lens below the Carpathian region, which is described in [2, 7].

Elastic characteristics of the mineral substance along the DSS profile (RP-17). The elastic characteristics of a mineral substance in PT conditions are a source of important information about the action of internal stresses in the crust and qualitatively determine the intensity of the development of decompaction and fragile and plastic deformations in it. At depths of 5-15 km of the Earth's crust with increased heat flows, which are not provided with the necessary pressure compensation, destructive temperature stresses occur in the sample. This leads to the decompaction of rocks, a decrease in V_p and, as a result, a of low seismic velocity zone (registered by DSS) and anomalous behavior of rock modules appears at these depths. For isotropic media, modules can be calculated from $V_{p,s}$ and their density. In stationary isotropic conditions, solids can be roughly divided into plastic and fragile. When P and T influence them, their transition from one state to another is possible. Poisson coefficient is an indicator of these processes. Conventionally, for most fragile materials, $0,10 < \sigma < 0,25$, and for ductile materials, $0,25 < \sigma < 0,47$. If it is deformed and heated, inelastic phenomena develop in the substance, then the values can go beyond these limits up to negative values. Inelasticity, as a rule, appear itself in the form of fragile fracture or flow. From these positions, we qualitatively characterized the fragile and plastic state of the rocks of the upper horizons of the Earth's crust on the basis of thermobaric petrophysical modeling, which actually exists in the depths of the TD.

The depression extends from the NW to the SE and consists of two major units (Fig. 8, a).

They are the NW Chop-Mukachivsky basin on the Central massifs of the Internal Carpathians and SE Solotvinsky basin superimposed on the flysch zone of the Outer Carpathians. These units are separated from each other by the Vygorlat-Guta volcanic ridge. The Chop-Mukachivsky basin descends while elevation, horizontal movement and high seismicity are characteristic of the Solotvinsky basin.

According to DSS data (RP-17), PTBM was carried out along the TD. The simulation results are presented for the individual structures of the above-mentioned TD (pickets by profile P-35 CMB, P-75 VGVR, P-115 SB). Fig. 8, b, c, d show the average calculated values according to the V_p , V_s experimental data and density and values of the corresponding modules of rocks (G – shear modulus, σ – Poisson coefficient, β – compressibility).

In the LVZ, the upper horizons are composed of unconsolidated rocks and are homogeneous in terms of elastic parameters. With depth, they become fragile, with high compressibility (Fig. 8).

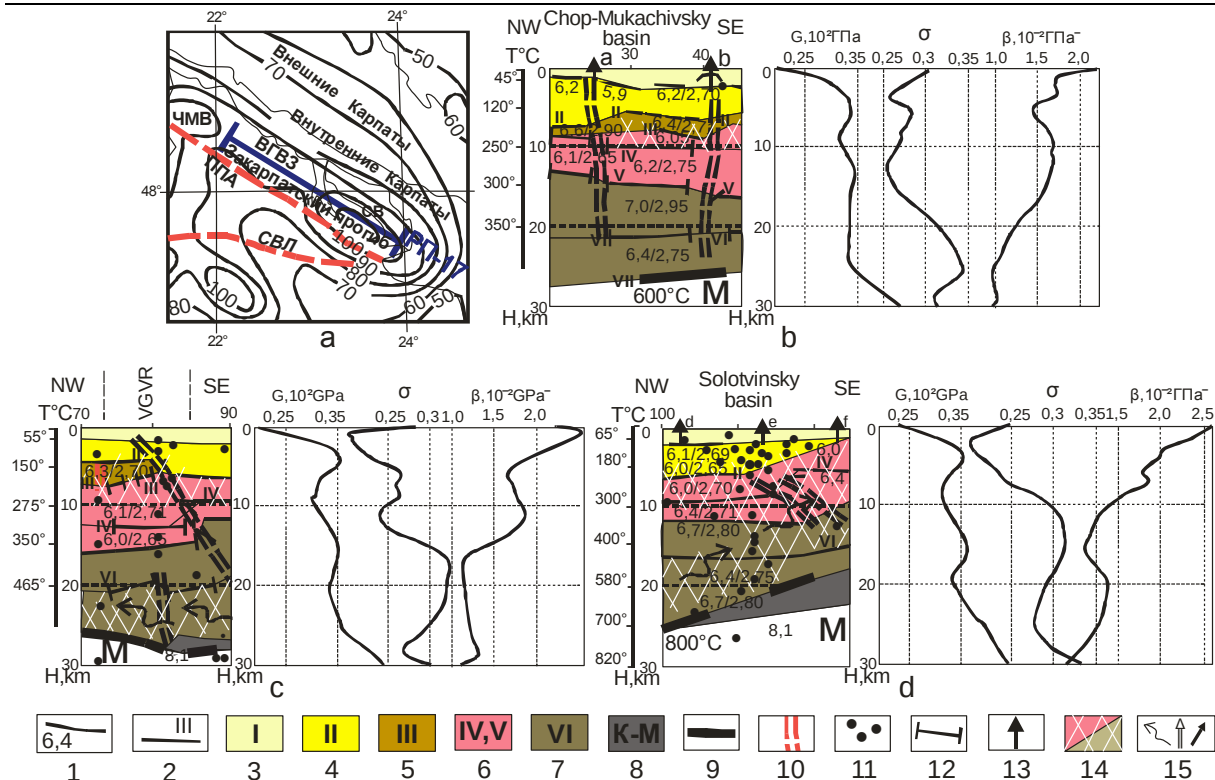


Fig. 8. a – the layout of the seismic profile (RP-17) and heat flows in the Transcarpathian depression;
b, c, d – RP-17 sections (35, 75, 105) – horizons and structures according to the data of DSS and PTBM and corresponding modules (notational designations – see Fig. 7).

Below them, at depths from 4,5 to 8 km, there are layers of “granite-gneiss”. Here, crustal of low seismic velocities zones were discovered, where the temperature varies from 160 to 260°C. Therefore, the zone has a thermobaric nature [9-11] and it is composed of thermally decompacted granito-gneisses and slates, which are exposed to destructive external influences. This is indicated by the calculated modules (Fig. 8 b, c, d). At depths of 6-12 km, E , σ are decrease, G , β are increase slightly, rocks acquire quasi-fragile properties. The seismic horizon at depths from 6 to 17,5 km is composed of rocks of medium composition, and as the depth changes, σ and β acquire increased values in all three sections of the TD. This horizon is composed of rocks in a quasi-plastic state. The second layer is the LVZ in the crust of the TD with a velocity of about 6.4 km/s and located above the M boundary at a depth below 18-26 km and caused by temperature conditions (Fig. 8, c, d). The influx of heat from the mantle heats rocks $H=18-26$ km to 600°C (Fig. 2, 7). The zone is composed of diorites and basaltoids. LVZ-2 along the profile has two volumetric areas – the first in the VGVZ area, associated with an intense influx of mantle heat along the fault [3]. The second area is located in the area of pickets 90-120 km (Fig. 8, d). The SB is characterized by the heating of the rocks that formed the continuous LVZ and intense seismic activity. According to the DSS, the M border has been raised to 15-21 km. However, it is possible that it is not clearly defined enough, perhaps the profile entered the large zone of the Transcarpathian deep fault. The rocks here are of a more fragile state (Fig. 8, d). This is connected with the development here of a system of macrocracks at significant shear stresses that exceed the elastic limit of

rocks at these depths, as evidenced by the low values of σ and G modulus. The appearance of auxetics at these depths is possible. The decompaction of basaltic formations above the M boundary is provoked by the dilatational loosening of the rocks, due to the action of shear stress directed along and across the depression and mantle Transcarpathian deep fault (Fig. 2, 7). Therefore, a mass of earthquake epicenters is concentrated at a shallow depth of the TD (Fig. 7), which, in our opinion, is closely related to the thermobaric zones of decompaction of the upper crust, their low elastic characteristics and σ values. Seismic activity contributes to the effect of expanding the channels of fluid movement [12], under the action of which the disintegration of the mineral substance of the TD is activated. Under thermodynamic conditions, which correspond to the LVZs at depths from 3-5 km to 12-20 km, changes are observed in the rocks, when their cataclastic transformation takes place with an increase in the cracking and porosity of the rocks [9, 11, 14, 18]. The migration of free water and gas through the microcracks of the rock is activated, destroying it, forming secondary cracks and caverns. At the same time, a so-called “degassing pipe” is formed, which is a source for the accumulation of abiogenic hydrocarbons in the crust, which under certain conditions (high pressure, decompression) penetrate into the near-surface horizons of the sedimentary cover, where explosive deposits are formed.

It has been shown for the first time, that the LVZs in the Earth's crust (the region of thermobaric decompression of mineral matter) are its integral part (especially, in areas of the present-day and ancient geodynamic activation, accompanied by the increased deep

heat flows), providing the lithosphere stability. The study showed that the active heating of the Earth's interior inevitably causes the development of the LVZs, as a result of mantle cataclysms and the localization of radioactive elements. The horizons of thermobaric decompression of the rocks, which under the influence of stresses, multidirectional deformations and vibrations acquire the properties of strongly dislocated media, form vast migration channels of fluids, "degassing pipes". In turn, they provide the movement of useful mineral matter to the surface and also provoke intense relaxation of tectonic stresses, in particular, in the form of earthquakes. At present, when interpreting geophysical survey materials, it is necessary to take into account the presence of crustal thermobaric decompression zones (LVZ). In our view, such zones are almost worldwide occurrence in the Earth's crust. This changes outdated ideas on the geological and structural features of the regions under study.

The results of the studies give an opportunity to clarify the geological and structural features of the structure of the Earth's crust of Transcarpathia, to adequately interpret the spatial distribution of geophysical fields and to decipher the features of local geodynamics and seismotectonic process, to clarify the level and nature of geo-ecological hazards, to more effectively predict and study deep regional distribution of mineral resources.

Conclusions. The LVZs are the most active horizons of the present-day transformation of the mineral environment and changes in the structural features of the Earth's crust. The LVZs in the crystalline crust are its integral part stabilizing the lithospheric state. In our opinion, active heating of the Earth's interior, as a result of mantle cataclysms and the localization of radioactive elements, inevitably facilitates the formation of the LVZs which are the horizons of thermobaric decompression of the rocks. Such zones under the influence of fluid migration, stress, multi-directional deformations and vibrations become strongly dislocated media, provoking intense relaxation of tectonic stresses in the form, for example, of earthquakes. In turn, seismic activity causes widening migration channels for the mantle fluids producing the so-called "degassing tubes". Such tubes are the essential elements of the formation of hydrocarbon accumulations.

Based on geological-geophysical data, geodynamic researches and PTBM the TD is considered to be a region of the present-day active geological processes where mineral deposits are formed and earthquakes occur. Among known deep anomalies of the geophysical fields, LVZs are the most accessible to study using different geological-geophysical methods, including superdeep drilling. Taking into consideration the present analysis of the nature and origin of LVZs in the crust of Transcarpathia, it is possible to fulfil the most detailed and perspective study aiming at searching for mineral resources and clarifying the deep structure of the Earth, as well as explaining and predicting crustal earthquakes. Detailed further study of the deep structure of the TD and especially the position of the LVZs can significantly expand the possibilities for hydrocarbons

searching. Moreover, legends in Fig. 8 show hydrocarbon fields.

The LVZs are also domains of intensive relaxation of stresses of tectonically-active processes due to weakened elastic properties of their rocks. Here, act mechanisms for dilatancy destruction of the mineral environment at certain depths of the crystalline crust. Thermobaric LVZs (area of the lowered elasticity, density and increased porosity of rocks) are the trigger mechanism for the origin of earthquake and faults of different orientation in the Earth's crust that is confirmed by the greatest number of focuses of crustal earthquake in the LVZs [12].

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DETERMINATION OF DIRECTIONALITY OF PROCESS DEVELOPMENT IN ECOSYSTEMS OF SMALL RIVERS

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ВИЗНАЧЕННЯ СПРЯМОВАНOSTІ РОЗВИТКУ ПРОЦЕСІВ У ЕКОСИСТЕМАХ МАЛИХ РІЧОК

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Abstract

The paper presents a method of assessing the directionality of process development in ecosystems of small rivers. The revival of small rivers and the rational use of their water resources is of great importance, because in connection with their number, they are not only the main source of water use, but, first of all, it is one of the most important elements of the geographical environment. When developing a set of measures for the revival of small rivers, it is necessary, first of all, to identify river basins with low resistance to anthropogenic load, and then, based on the analysis of the rationality of the economic use of water, land, and forest resources and the peculiarities of the functioning of river systems, to determine a set of environmental protection measures taking into account the assessment of the direction of the processes in their ecosystems.

Аннотація

В роботі представлено метод оцінки спрямованості розвитку процесів у екосистемах малих річок. Відродження малих річок і раціональне використання їх водних ресурсів має величезне значення, тому що в зв'язку з їх численністю вони являються не тільки основним джерелом водокористування, але, насамперед, це - один з найважливіших елементів географічного середовища. При розробці комплексу заходів щодо відродження малих річок необхідно, насамперед, ідентифікувати басейни річок з низькою стійкістю до антропогенного навантаження, а потім на основі аналізу раціональності господарського використання

водних, земельних, лісових ресурсів і особливостей функціонування річкових систем визначити комплекс природоохоронних заходів з урахуванням оцінки спрямованості процесів у їхній екосистемах.

Keywords: ecological state, surface waters, small rivers, water protection

Ключові слова: екологічний стан, поверхневі води, малі річки, захист водних ресурсів

Малі річки, до яких згідно [1], відносяться постійно діючі водотоки довжиною від декількох кілометрів із площею водозбору до 2000 км² чи з витратою води до 5 м³/с, є найбільш розповсюдженим типом водних об'єктів. Так, в Україні 98% стоку формуються в басейнах малих рік. Таким чином, завдяки своїй численності малі річки являють собою найважливішу частину географічного середовища і відіграють велику роль у житті суспільства.

Малі річки на відміну від середніх і великих рік здебільшого знаходяться в безконтрольному розпорядженні місцевих земле-, лісо-, водокористувачів. Значна частина первинної гідрографічної мережі не контролюється органами охорони природи, отже, складно передбачати наслідки природних і антропогенних процесів у басейнах малих річок.

Здійснення господарської діяльності в басейнах малих річок без урахування її впливу на розвиток деградаційних процесів у їх екосистемах привело до виснаження їхніх водних ресурсів і різкому погіршенню якісного стану [2].

Життя малих річок тісно зв'язане з економікою і соціальною структурою прилеглих до них територій і змінюється на тлі їх розвитку, тому що вони особливо чутливі до антропогенного навантаження.

Експлуатація малих річок і земель у їхніх басейнах здійснюється без урахування екологічних закономірностей, які визначають функціонування річкових систем, приводить до їхнього замулення, скороченню стоку й інших негативних явищ. Тому однією з найважливіших і актуальних задач сучасної науки стає комплексне вивчення закономірностей функціонування екологічних систем басейнів малих річок в умовах їхнього інтенсивного використання.

Замулення, виснаження і забруднення малих річок - це прогресуючий процес в умовах господарської діяльності на водозбірній площі, тому що рельєф місцевості є носієм ерозійної енергії території, а активно проведені роботи в басейнах річок визначають інтенсивність розмиву ґрунтів із трансформацією їх у річкові долини.

Нераціональне використання водних об'єктів підприємствами промисловості і комунального господарства, інтенсивне сільськогосподарське використання земель у річкових басейнах, індустріалізація сільського господарства й інших антропогенних факторів є причиною таких руйнівних процесів як яругоутворення, площинна ерозія, заболочуваність і замуленість, що можуть привести до загибелі малих річок [3,4].

Для визначення інтенсивності деградаційних процесів необхідно проаналізувати наступні показники:

- яругоутворення (відсоткове відношення площі земель з процесами яругоутворення до площі басейну річки $O = S_o/S_{bp}$);

- заболочуваність (відсоткове відношення площі земель, зайнятих болотами до площі басейну річки $B = S_b/S_{bp}$);

- еродованість (відсоткове відношення площі земель, підданих площинній ерозії до площі басейну річки $E = S_e/S_{bp}$);

- замуленість басейну річки (відсоткове відношення довжини замуленої річки до загальної довжини річки $I = L_n/L_{bp}$).

Показник інтенсивності деградаційних процесів, що відбуваються в басейні малої річки обчислюється за формулою [5]:

$$S_{np} = 1/2 \times (O + B) \times (E + I) \quad (1)$$

З метою визначення зворотності деградаційних процесів необхідно досліджувати чинники, що на них впливають, і розділити їх на "негативні" фактори, що є причиною чи можуть прискорити процес деградації екосистем, і на "позитивні" фактори, які можуть стабілізувати екологічний стан басейнів малих річок.

До антропогенних чинників, що є причиною деградаційних процесів екосистем малих річок відносяться, насамперед

- розораність (Р);
- урбанізованість (У);
- водозабір підприємств промисловості, комунального і сільського господарства (ВЗ);
- стічні води підприємств промисловості, комунального і сільського господарства (СВ).

У районах інтенсивного землеробства використання орних земель без достатніх ґрунтоохоронних заходів приводить не тільки до зміни водного режиму малих річок, але й до посилення ерозійних процесів, стимулює яругоутворення, що є причиною повної деградації основних природних комплексів і впливає на структуру морфологічної системи, збільшує площу поверхні випаровування. Процес інтенсивної водної ерозії визначає підвищене надходження наносів у малі річки, порушуючи заплавно-русові процеси. Для малих річок у районах інтенсивного землеробства характерно не тільки замулювання заплави, але і зменшення їхньої довжини в зв'язку з дефіцитом енергії водних потоків на переміщення наносів і замулювання місць виклинцювання ґрунтових вод [3,4].

Таким чином, розораність (Р) – є одним з основних "негативних" чинників, що впливають на стан екосистем басейнів малих річок і визначається відношенням площі розораних земель до площі басейну ріки:

$$P = \frac{S_n}{S_{bp}} \quad (2)$$

Урбанізованість (У) являє собою відношення площі селітебної території до площі басейну річки:

$$У = \frac{S_{ct}}{S_{бр}} \quad (3)$$

Урбанізація неминує викликає посилення експлуатації водних ресурсів, а поверхневий стік з урбанізованих територій значно погіршує якісний стан водних об'єктів. На формування якісного складу поверхневого стоку впливає багато факторів. Насамперед, це атмосферні опади, хімічний склад яких залежить від забруднення повітряного басейну, що в умовах великого промислового міста представляє серйозну проблему. Крім цього на формування поверхневого стоку з урбанізованих територій впливають як умови водозбору (ступінь благоустрою і санітарний стан території, щільність забудови і її функціональне призначення, інтенсивність руху транспорту тощо), так і гідрометеорологічні умови (інтенсивність і кількість опадів, інтенсивність процесу сніготанення, період сухої погоди й ін.).

Таким чином, урбанізація (У) також значно впливає на стан екосистем малих річок.

Водозбір підприємств промисловості, комунального і сільського господарства впливає на виснаження водних ресурсів малих річок. Показник впливу водозбору на зменшення стоку малих річок (ВЗ) розраховується як відношення витрат водозбору підприємствами - водокористувачами до витрати річки 95% забезпеченості [5]:

Водовідведення промислових підприємств, а також об'єктів комунального і сільського господарства відноситься до одному з найбільш значних "негативних" чинників негативного впливу на гідрологічний і гідрохімічний режим водних об'єктів. Багато неорганічних і органічних речовин, які надійшли у воду, гальмують процеси самоочищення, що збільшує ризик забруднення водойм і порушення їхньої екологічної стійкості.

Показник впливу скидів стічних вод підприємств промисловості, комунального і сільського господарства на гідрологічний режим малих річок (СВ) визначається відношенням витрат скиду води підприємствами - водокористувачами до витрати річки 95% забезпеченості [5]:

$$СВ = \frac{W_{CB}}{W_{95\%}} \quad (4)$$

Показник ступеня негативного впливу антропогенних факторів на розвиток деградаційних процесів у екосистемах малих річок обчислюється як площа чотирикутника [5]:

$$S_a = 1/2 \times (У + Р) \times (ВЗ + СВ) \quad (5)$$

До "позитивних" чинників стабілізації і поліпшення стану екосистем басейнів малих річок відносяться:

- лісистість (Л);
- залуженість (ЛГ);
- озерність (ПО);
- показник зміни стоку річки (ВІ).

Лісистість (Л) являє собою відношення площі басейну, покритих лісами ($S_{л}$) до загальної площі басейну річки ($S_{бр}$):

$$Л = \frac{S_{л}}{S_{бр}} \quad (6)$$

Для малих річок велике значення має деревна і чагарникова рослинність, яка росте берегами, тому що вона не тільки запобігає ерозії берегів, але й зменшує випаровування і прогрівання, затінюючи водну поверхню. Лісові насадження впливають на якісний склад стоку, поглинаючи з розчину катіони й аніони, поліпшуючи бактеріологічні властивості води, очищаючи їх від зважених твердих часток і впливаючи на температурний режим водних об'єктів, а також забезпечує трансформацію поверхневого стоку в підземний і його рівномірність у часі. Зменшення лісистості водозбірної площі призводить до обміління і навіть загибелі малих річок.

Залуженість (ЛГ) являє собою відношення площі басейну, покритої луками ($S_{лг}$) до загальної площі басейну річки ($S_{бр}$):

$$ЛГ = \frac{S_{лг}}{S_{бр}} \quad (7)$$

На процес замулення великий вплив чинить гідрологічний режим річки. Показник озерності (ПО) являє собою відношення площі водойм ($S_{в}$) до загальної площі басейну річки ($S_{бр}$).

Озерність впливає на рівномірний розподіл стоку в ріці, отже, це позитивний чинник стабілізації екологічного стану малих річок.

Показник зміни гідрологічного стоку річки являє собою відношення (W_{cr}) норми стоку до середньорічного об'єму стоку річки ($W_{бр}$) [5]:

$$ВІ = \frac{W_{cr}}{W_p} \quad (8)$$

Показник впливу позитивних факторів на розвиток процесів в басейнах малих річок розраховується за формулою [5]:

$$S_{ec}^{+} = 1/2 \times (Л + ЛГ) \times (ПО + ВІ) \quad (9)$$

Для кожної природної зони і підзони існують значення лісистості, розораності й інших показників, при яких компоненти природного середовища знаходяться в близьких до оптимальних відношеннях. Відхилення фактичних показників формування гідрологічного і гідрохімічного режимів малих річок від природних (антропогенно-непорушених) дозволяє визначити імовірність (ризик) порушення екологічної стійкості басейнів малих річок і може бути прийнята як міра екологічної небезпеки.

Коефіцієнт спрямованості процесів в басейнах малих річок (K_n) можна визначати відношенням величини негативного впливу антропогенних факторів на розвиток деградаційних процесів (S_a^{-}) до величини позитивного впливу природних факторів (S_{ec}^{+}). [5]:

$$K_n = \frac{S_a^{-}}{S_{ec}^{+}} \quad (10)$$

Показник розвитку процесів (Пнп), що відбуваються в басейнах малих річок під впливом природних і антропогенних факторів визначається за формулою [5]:

$$П_{нп} = K_n \times S_{пр} \quad (11)$$

Визначення спрямованості процесів стану екосистем малих річок має велике значення для ідентифікації проблемних ситуацій і оцінки їхньої гостроти з метою прийняття рішень про першочерговість реалізації водоохоронних заходів у їхніх басейнах.

Малі річки являють собою основу гідрографічної мережі, виконуючи природоутворюючі й екологічні функції, а також є важливим чинником розміщення продуктивних сил і соціально-економічного розвитку суспільства.

Багато досліджень присвячено впливу лісистості, розораності, залуженості на стан водних екосистем, особливо малих річок [6–9].

Господарська діяльність у значній мірі змінює водний режим малих річок, зменшуючи річний і меженевий стік, є причиною розвитку ерозії на водозборах, посилення замулення русел, зменшення здатності самоочищення рік, зміни гідробіологічних умов і заболочування заплавних земель.

Скорочення лісистості водозборів, меліоративні заходи, які проводяться без наукового обґрунтування, оранка річкової долини, надмірний випас худоби на схилах і в заплаві, випрямлення русел приводить до замулення малих річок.

Скидання неочищених і недостатньо очищених стічних вод підприємствами промисловості, комунального і сільського господарства приводить до пригноблення як вищих, так і нижчих біоценозів, значно погіршує якість водних об'єктів, порушується стійкість їх екосистем, річка втрачає своє господарське і рекреаційне значення.

Використання водних ресурсів малих річок у сільському господарстві пов'язане з безповоротними витратами річкової води на зрошення, забрудненню водних об'єктів пестицидами й іншими компонентами поверхневого стоку зі сільгоспугідь, а також органічними речовинами і збудниками інфекційних захворювань – яйцями гельмінтів зі стічними водами тваринницьких комплексів і птахоферм.

Відновлення і формування оптимального режиму малих річок може бути досягнуте шляхом усунення причин їхньої деградації і здійснення комплексу спеціальних організаційних, агротехнічних, лісомеліоративних й інших відбудовних водоохоронних заходів на основі аналізу раціональності господарського використання їх водних ресурсів і земель водозбірної площі.

Відповідно до формули (10) коефіцієнт спрямованості процесів в басейнах малих річок (K_n) визначається відношенням величини негативного впливу антропогенних чинників на розвиток деградаційних процесів у екосистемах малих річок (S_a) до величини позитивного впливу природно-сформованих факторів (S_{ec}).

Якщо $S_a > S_{ec}$, то $K_n > 1$, отже, антропогенні фактори впливають на розвиток деградаційних процесів у екосистемах малих річок, що вимагає визначення комплексу природоохоронних заходів на основі аналізу значимості впливаючих чинників, і оцінки негативних наслідків.

При аналізі раціональності господарського використання водних ресурсів і водозбірної площі малих річок ранжують величини розораності (Р), урбанізованості (У), показники впливу водозбору (ВЗ) і скидання стічних вод підприємств промисловості, сільського і комунального господарства (СВ) на стан малих річок. Показник, що має найбільшу величину вивчається найбільш детально при визначенні комплексу природоохоронних заходів.

З метою визначення причин розвитку деградаційних процесів і визначення заходів щодо їхньої стабілізації і збільшення стійкості малих річок до антропогенного навантаження ранжують показники озерності (ПО), залуженості (ЛГ), лісистості (Л) і показник змінювання стоку річки (ВІ). Показникам з найменшою величиною присвоюється перший ранг і вони ідентифікують проблеми, на які необхідно звернути першочергову увагу при виборі заходів щодо захисту малих річок від забруднення і виснаження.

Для стабілізації процесів формування гідрологічного і гідрохімічного режимів ріки необхідне дотримання умов:

$$(U + P) \times (BZ + CB) < (L + LG) \times (PO + BI) \quad (12)$$

Відродження малих річок може бути досягнуте шляхом усунення причин їхньої деградації і здійснення комплексу спеціальних організаційних, агротехнічних, лісомеліоративних і інших відбудовних водоохоронних заходів на основі аналізу раціональності господарського використання їхніх водних ресурсів і земель водозбірної площі.

Висновки

Малі річки формують водні ресурси, гідрологічний режим і якість води середніх і великих річок, створюють природні ландшафти великих територій, а з іншого боку, функціонування басейнів малих річок визначається станом регіональних ландшафтних комплексів.

Важливою особливістю малих річок є залежність водності, гідрологічного режиму і якості води від параметрів, що характеризують поверхню водозбору (лісистість, заболоченість, еродованість, розораність, зарегульованість, тощо) [9].

Поліпшення сучасного стану водних екосистем передбачає інтеграцію ключових принципів екосистемного підходу у водну політику. З метою досягнення доброго екологічного статусу для всіх водойм Румунії, в роботі [10] представлено інноваційний підхід до моніторингу якості вод і оцінки екологічного стану водних об'єктів. При такому підході річкова система розглядається як сукупність екосистем, який включає в себе не тільки річки, а й прибережні зони з видами рослин і тварин, які населяють цей простір.

З огляду на виклики та загрози, з якими в даний час стикається управління водними ресурсами і посилення невизначеності на зміни клімату, очевидна потреба в гнучкій системі екологічного регулювання. Правильний баланс між гнучкістю в реалізації і надійний у виконанні стандартів має найважливіше значення для зміцнення адаптаційного потенціалу в управлінні водними ресурсами. Але досягнення цих цілей одночасно створює особливі труднощі. Підхід ЄС до управління водними ресурсами спрямований на зміцнення місцевого управління на відповідних рівнях [11].

В цій роботі запропоновано метод оцінювання ризику розвитку деградаційних процесів в річкових басейнах. Цей метод є складовою ієрархічного підходу до оцінювання екологічного ризику погіршення стану поверхневих вод.

Розробка комплексу водоохоронних заходів потребує аналізу причин розвитку деградаційних процесів у водних екосистемах і факторів, що позитивно впливають на екологічний стан річок. Необхідно також проаналізувати раціональність ведення господарської діяльності в річкових басейнах і існуючий стан природоохоронної діяльності [5]. Для вирішення проблеми зміцнення місцевого управління водними ресурсами в статті запропоновано визначення комплексу природоохоронних заходів на основі оцінки раціональності господарського використання водозбірної площі.

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MEDICAL SCIENCES

CHANGES REVEALED BY TRANSMISSION ELECTRON MICROSCOPY (TEM) IN CANDIDA ALBICANS CULTURES INOCULATED WITH OIL OF OREGANO

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Abstract

The study focused on section imaging and electron microscopic structure analysis of *Candida albicans* culture treated with oregano essential oil. In the study we used cultures of *Candida albicans* ATCC pre-treated with essential oil of oregano which were initially left for 72 h at the thermostat, in order to be inhibited by the essential oil of oregano. We took samples from this environment and treated them properly so that they could be viewed and analyzed with the transmission electron microscope.

Keywords: *Candida albicans*, osmium tetroxide, Epon 812, specimen

Abbreviations: h = hour, mm = millimeter, 1 M = molar concentration (expressed in mol/liter), ATCC = standard culture of *Candida albicans*, ATCA = trichloroacetic acid (phosphotungstic acid)

GA = glutaral - dehyde, DDSA = dodecenyl succinic anhydride, NMA = methyl nadic anhydride, DMP30 = 2, 4, 6 – dimethylaminomethyl phenol, TEM = Transmission electron microscope/ transmission electron microscopy

Introduction

Transmission Electron Microscopy (TEM)

Transmission electron microscopy (TEM) is used to produce images of a sample by illuminating the sample with electrons (eg electron beam) in vacuum and detecting the electrons transmitted through the sample. Finally, using TEM we can see the columns of atoms present in crystalline samples.

A typical transmission electron microscope consists of the following components (Figure 1):

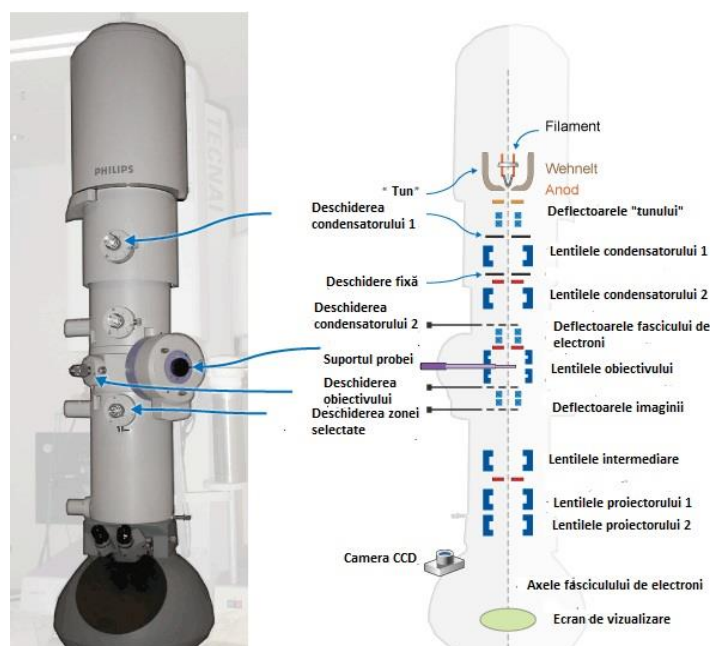


Figure 1. Schematic representation of typical transmission electron microscope components(1)

- **Electron Cannon:** Generates the electron beam. This is usually positioned at the top of the microscope column. The electron emitter is placed in a conical Wehnelt cylinder and the beam exits through the small central hole in the top of the cone.

- **Electron column:** consists of the electron gun assembly at the top, a column filled with a set of electromagnetic lenses, the sample introduction port and pressurization chamber, and a set of apertures that can be moved in and out of the beam path. The column contents are under vacuum.

- **The electromagnetic lens system:** they give the shape of the electron beam, which circulates in a spiral trajectory. Each lens is constructed from a coil of copper wire through which electrical current is passed. There is a hole in the center through which the beam travels.

- **Sample introduction port/pressurization chamber:** is where the sample is introduced into the electron column, into the path of the high voltage electron beam. Before reaching the path of the beam, the sample must pass through the pressurization chamber, which has the role of sealing hermetically to protect the vacuum inside the electronic column.

- **Main control panel and operational controls:** the instrument can be controlled via external panels using buttons, switches and joysticks.

- **Image Capture:** At the base of the column is a viewing chamber with a window and adjustable binoculars. The image is projected on the screen in the viewing room. Binoculars are available to focus the image. The screen in the viewing room is only for producing a temporary image. To collect a permanent image, a CCD camera is inserted into the beam path. This allows the image to be collected in digital form. The exposure time can be adjusted to suit the beam parameters and control the desired image quality.

Current 3D localization **microscopy** approaches are fundamentally limited in their ability to image thick, densely labeled specimens (1).

Due to the increasing popularity of electron cryo-**microscopy** (cryoEM) in the structural analysis of large biological molecules and macro-molecular complexes and the need for simple, rapid and efficient readout, there is a persuasive need for improved detectors (2).

Electronic pneumatic injection (EPI) is a technique for dermal drug delivery, which is increasingly being used in clinical practice. Immediate cutaneous distribution was visualized using ex vivo confocal **microscopy** (EVCM) (3).

To study the immunological features of the secretion of the prostate by electron **microscopy** in patients with chronic recurrent bacterial prostatitis (4).

Conventional two-photon microscopes use photomultiplier tubes, which enable high sensitivity but can detect relatively few photons per second, forcing longer pixel integration times and limiting maximum imaging rates (5).

Understanding the effect of external conditions, temperature in particular, on novel nanomaterials is of great significance. The powerful ability of scanning

tunneling **microscopy** (STM) to characterize topography and **electronic** levels on a single molecule scale is ut (6).

Scanning probe **microscopy** (SPM) is considered one of the most powerful tools for nanoscale studies that are becoming increasingly important, and SPM has shown rapid development. Atomic force **microscopy** (AFM), in particular, is the widely used SPM system (7).

Super-resolution **microscopy** can reveal the subtle biological processes hidden behind the optical diffraction barrier (8).

Material and methods

The study was conducted between July 1, 2019 and May 20, 2020 at the Faculty of Medicine of the "Ovidius" University in Constanța.

For transmission electron microscopy (TEM) we took 2 samples from the Sabouroud medium seeded with *Candida albicans* samples, from a calibrated assortment, called ATCC; the medium was initially treated with oregano essential oil; I inserted the plate into the thermostat, at the standard temperature of 37°C; this was kept for 72 h at the thermostat (10), (11), (12).

After these 72 h in which *Candida albicans* was also inhibited by oregano oil, oil containing carvacrol (13) and thymol (14), we sectioned the necessary TEM material.

The purpose of the study was to obtain images and analyze them.

The samples from the experimental variants were processed by the JASTROW method and analyzed from an ultrastructural point of view by transmission electron microscopy through the following work steps:

- prefixing,
- fixation,
- dehydration,
- inclusion in epoxy resins.

a. Prefixation in 1M cacodylate buffer with 2.7% glutaraldehyde (GA)

The sample is immersed in 2.5% buffered GA + 2% paraformaldehyde in 0.1 M Sørensen buffer, pH 7.4. The resulting sediment is resuspended in prefixing medium consisting of 1M cacodylate buffer, 1M sucrose and 2.7% GA, at a temperature of + 5°C. It is homogenized and kept at a temperature of +4°C for 2 hours. The prefixed homogenate is centrifuged at 800g, which constitutes the second centrifugation for 15 minutes, and another 10 minutes at 1300g. The operation is performed with a centrifuge with cooling. The supernatant is removed by decantation, and the sediment is sufficiently condensed, attached to the bottom of the centrifuge tube. 1M cacodylate buffer and 1M sucrose, without GA, at +4°C is placed in a watch bottle, in which the firmly detached sediment from the tube is placed. It is portioned into small specimens with a side of 0.5 mm. The washing liquid is removed and the second wash is carried out using the same procedures, which has the role of removing excess fixative.

It is very important that after pre-fixation any trace of glutaraldehyde is washed away, the residues of which will prevent the binding of osmium in the post-fixing solution. If traces of aldehydes are not removed

from the tissue, upon postfixation membrane lipids will not fix well with OsO₄ (9).

b. Fixation in 2% osmium tetroxide.

Specimens are placed in small glass tubes containing 2 ml of cold fixative medium consisting of 2% (w/v) osmium tetroxide (OsO₄) dissolved in bidistilled water. The fixing itself is done for 1 hour at +4°C. During this interval the specimens turn black due to their oxidation by the osmium tetroxide, this shows that the fixation has been well done. The fixative is slowly removed by decantation and replaced with cacodylate buffer and cold sucrose to wash and remove excess osmium. The washing operation is done 2 times with cold cacodylate buffer. Each wash takes 5 minutes.

c. Dehydration of specimens

For dehydration, I use serial baths of cold ethyl alcohol, in concentration of 30%, 50% and 70%. In each alcohol bath, the specimens are kept for 10 minutes. In this dehydration phase, the specimens are contrasted in the second bath of 70% ethyl alcohol, which contains 0.5% uranyl acetate and 1% phosphotungstic acid or trichloroacetic acid (ATCA). Contrasting is done at room

temperature for 14 h, after which the specimens are dehydrated at room temperature with ethyl alcohol in a concentration of 90%, 95% followed by 2 baths in 100% ethyl alcohol and 2 baths of propylene oxide. Each bath lasts 10 minutes.

d. Inclusion in epoxy resins

Specimens with *Candida Albicans* culture cells were placed in Epon812 - (consisting of DDSA, NMA and DMP30 as a polymerization agent) mixture 1:1 with propylene oxide. Impregnation is done at room temperature for 16 hours, after which they are taken and placed in transparent capsules. The capsules are filled with pure EPON 812 (epoxy resin), kept for 3h at room temperature and 72h in a thermostat heated to a temperature of 67 °C. At the end of polymerization, the black specimens are at the top of the capsule. The specimens thus prepared are subject to evaluation from the point of view of morphological qualities.

Fine sections were double stained with uranyl acetate and lead acetate, after which they were examined with a Tecnai T12 Microscope produced by FEI, which is located at the Faculty of Medicine of the "Ovidius" University of Constanta.

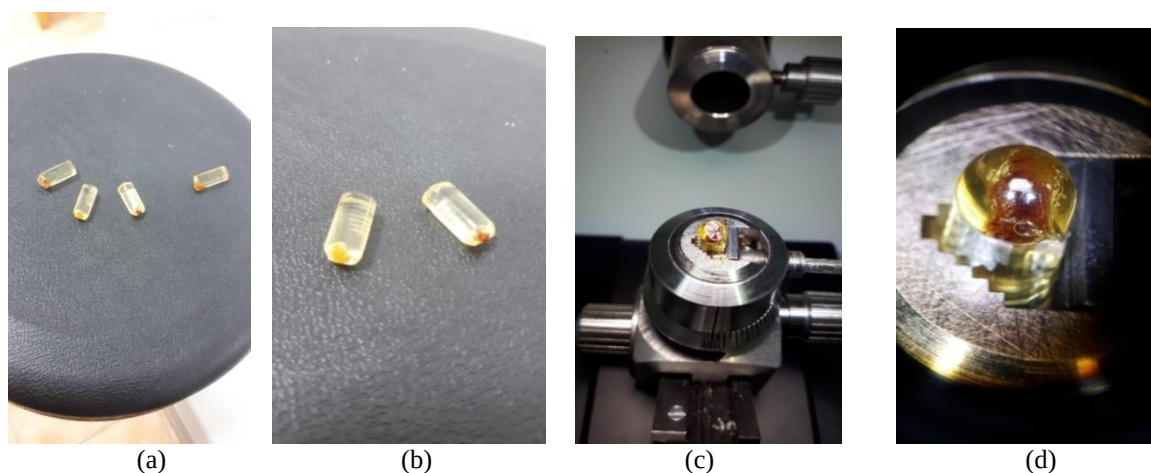


Figure 2 (a, b, c, d). Epoxy resin blocks with *Candida albicans* sample and oregano essential oil analyzed from different angles



Figure 3. Sample preparation for the electron microscope

Discussion and results

Evaluation of sections

Overall characterization was performed using photomicrographs taken at x2900- x30000. From these, I selected some representative images and later interpreted what I obtained.

Caracterizarea în ansamblu s-a efectuat utilizând microfotografii efectuate la mărimi de x2900- x30000. Dintre acestea, am selectat câteva imagini reprezentative și ulterior am interpretat ceea ce am obținut.

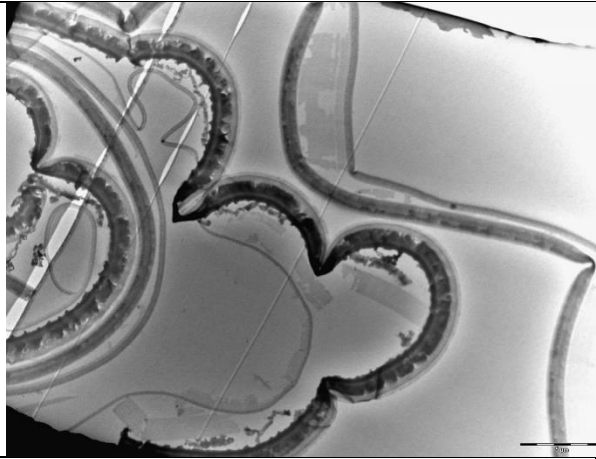


Figure 4. Photomicrograph size x2900, *Candida albicans* culture inoculated with oregano essential oil. The presence of numerous vacuoles and the absence of cell organelles and nucleus can be observed

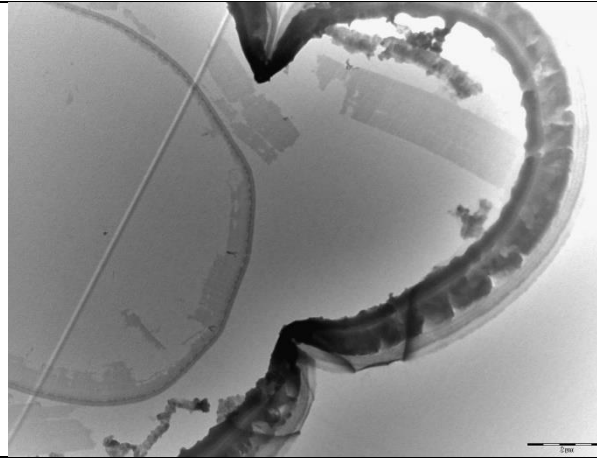


Figure 5. Photomicrograph size x4800, *Candida albicans* culture inoculated with oregano essential oil. It can be seen how the number of cells was drastically reduced following the action of oregano essential oil.

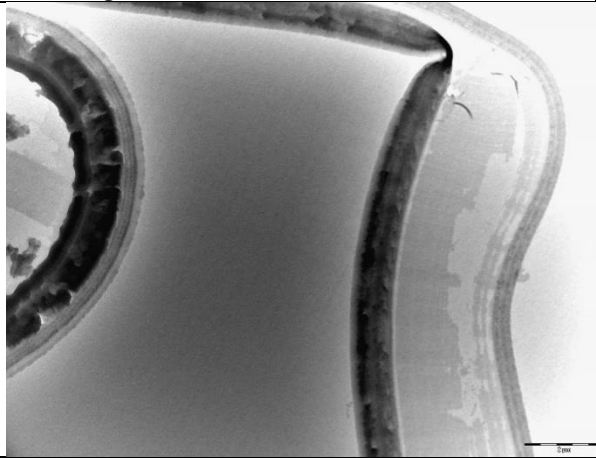


Figure 6. Photomicrograph size x6800, *Candida albicans* culture inoculated with oregano essential oil. Absence of cell organelles and nucleus can be observed.

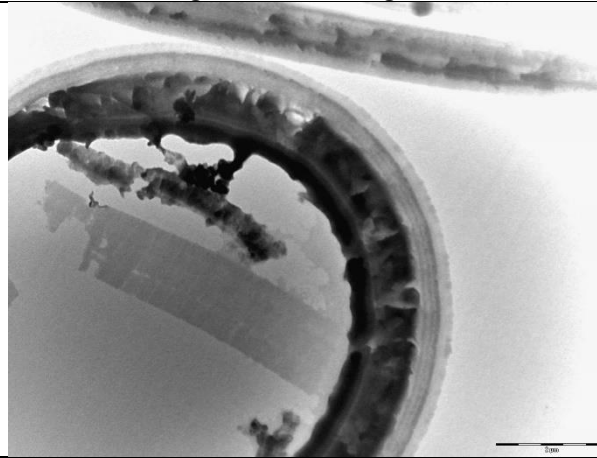


Figure 7. Photomicrograph size x9300, *Candida albicans* culture inoculated with oregano essential oil. Cell wall and cell membrane damage can be seen.



Figure 8. Photomicrograph size x9300, *Candida albicans* culture inoculated with oregano essential oil. Cell wall and cell membrane damage can be seen.

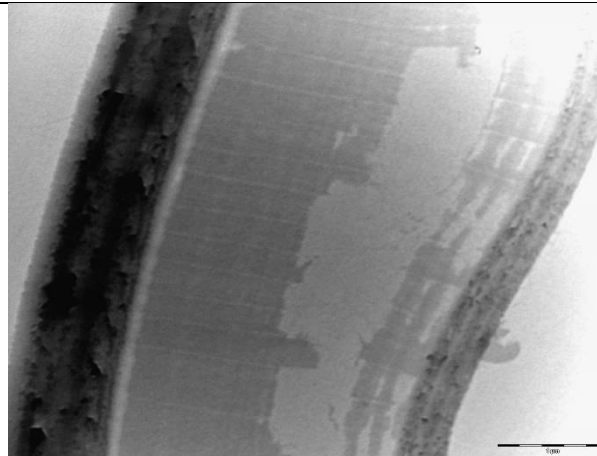


Figure 9. Photomicrograph size x13000, *Candida albicans* culture inoculated with oregano essential oil. Cell wall and cell membrane damage can be seen.

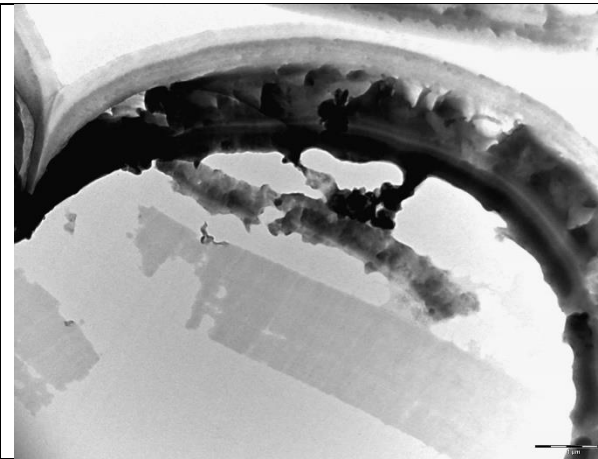


Figure 10. Photomicrograph size x13000, *Candida albicans* culture inoculated with oregano essential oil. Cell wall and cell membrane damage can be seen.

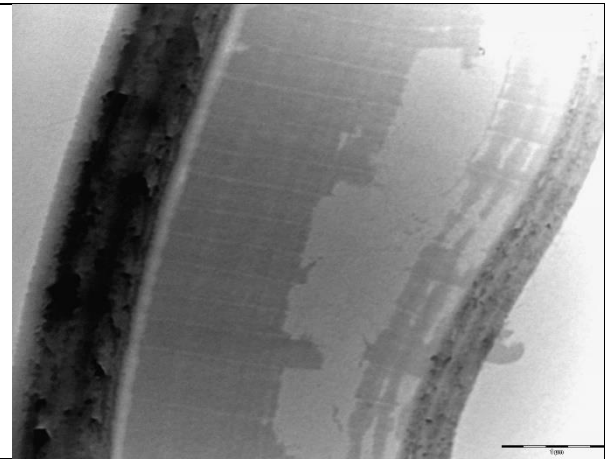


Figure 11. Photomicrograph size x18500, *Candida albicans* culture inoculated with oregano essential oil. Cell wall and cell membrane damage can be seen.

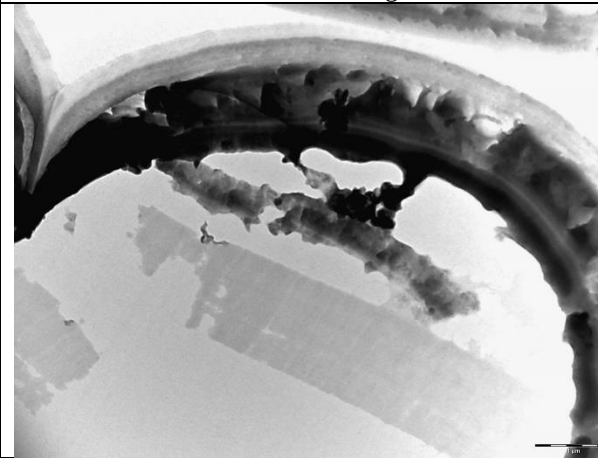


Figure 12. Photomicrograph size x13000, *Candida albicans* culture inoculated with oregano essential oil. Cell wall and cell membrane damage can be seen.

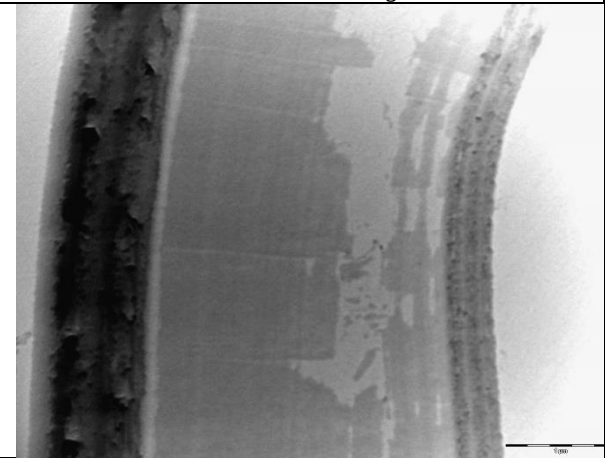


Figure 13. Photomicrograph size x18500, *Candida albicans* culture inoculated with oregano essential oil. Cell wall and cell membrane lesions can be observed.

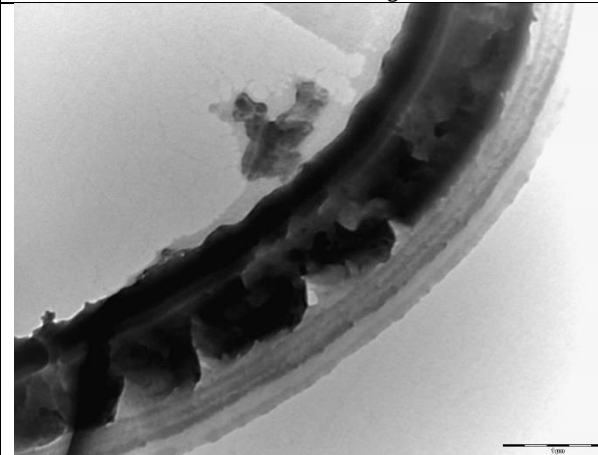


Figure 14. Photomicrograph size x18500, *Candida albicans* culture inoculated with oregano essential oil. Damage to the cell wall and cell membranes can be seen.

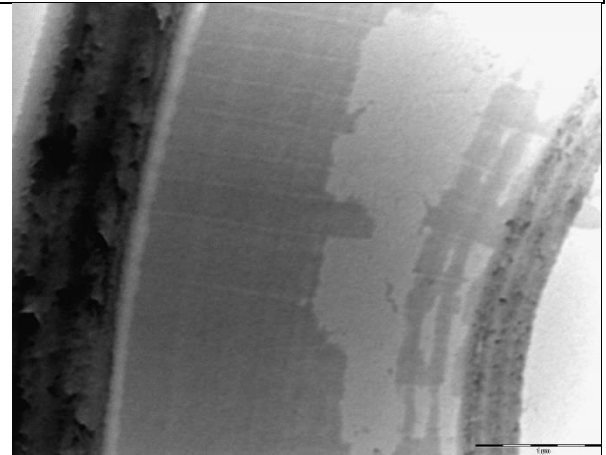


Figure 15. Photomicrograph size x23000, *Candida albicans* culture inoculated with oregano essential oil. Dissociation between the cell wall and the membrane can be seen.

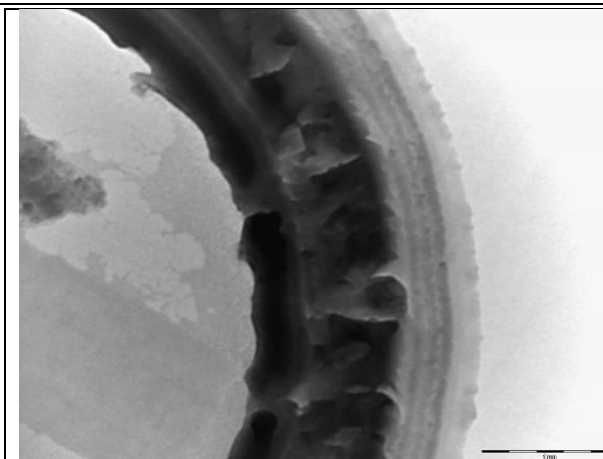


Figure 16. Photomicrograph size x23000, *Candida albicans* culture inoculated with oregano essential oil. Dissociation between the cell wall and the membrane can be observed.

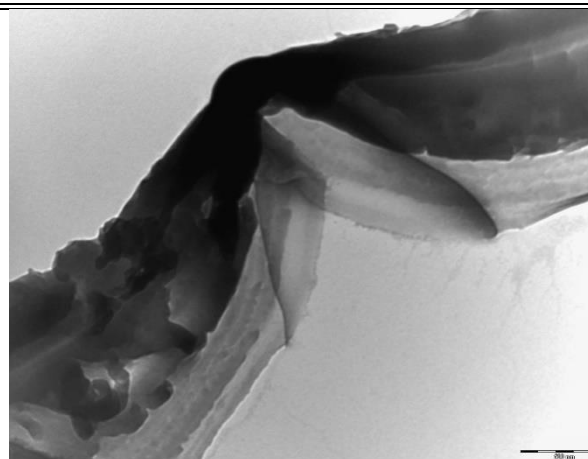


Figure 17. Photomicrograph size x30000, *Candida albicans* culture inoculated with oregano essential oil. Dissociation between the cell wall and the membrane can be seen.

Conclusions

Oregano essential oil can be used successfully as an antifungal for conditions caused by *Candida Albicans*. This antifungal works by dissociating the cell wall and the candida membrane due to the thymol and carvacrol in the composition. The antifungal action of oregano essential oil is irreversible and has a residual effect.

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FEATURES OF THE NOMINATION OF KAZAKH TOPONYMS

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ОСОБЕННОСТИ НОМИНАЦИИ КАЗАХСКИХ ТОПОНИМОВ

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<https://doi.org/10.5281/zenodo.7079596>***Abstract**

The article presents the definition of the concept of "toponymy" in the modern world. Examples of nominations of Kazakh toponyms, and their features in the classification are analyzed. It is noted that the Kazakh people associated toponyms with the life of a nomadic lifestyle, which is reflected in the names of some geographical areas. Toponymy, from this point of view, carries spiritual, cultural information about the language, traditions, customs of the Kazakh people.

Аннотация

В статье представлено определение понятия «топонимика» в современном мире. Разобраны примеры номинаций казахских топонимов, и их особенности в классификации. Отмечено, что казахская народность связывала топонимы с бытом кочевого образа жизни, что отражено в названиях некоторых географических местностей. Топонимия, с такой точки зрения несет в себе духовную, культурную информацию о языке, традициях, обычаях казахского народа.

Keywords: toponymy, nomination, onomastics, oikonymy, geographical area.

Ключевые слова: топонимия, номинация, ономастика, ойконимия, географическая местность.

В современном лексическом наборе не часто можно услышать слово топонимика. В основном она ассоциируется с прикладным характером данного понятия, т.е. применением в переименовании географических пунктов. Что же означает термин «топонимика» на сегодня? «Топонимика» входит в состав учения ономастики и происходит от греческих слов «место и имя». Она изучает географические названия, их происхождение, значение, написание, произношение, а также современное положение. Не только для Казахстана, но и для каждой страны и региона характерны свои географические названия. Известно, что большую роль в составе топонимии страны играет история населяющих определенную территорию народов, расширении и углублении знаний о географии и экономике, местном фольклоре и языковых особенностях [1].

В топонимии Казахстана отсутствуют работы, посвященные современной топонимической ситуации, а также детальные хронологические исследования переименований населенных пунктов в 20 веке. В тоже время значение ее как науки о географических названиях имеет ценность при изучении края, в воспитании культуры и патриотизма населения. Заметно и то, что изучение топонимии привносит ясность в нерешенные наукой проблемы [2].

За последние годы значительные изменения произошли в самых разных областях культуры, в том числе в языке, в специальной именной лексике. Были произведены массовые переименования географических объектов, в результате которых про-

изошли серьезные изменения в топонимии, сформировалось новое представление о месте топонима в общественном сознании. Ввиду особенностей топонимии как науки, важным аспектом ее учения является анализ языковой картины мира на материалах казахской топонимии [1]. Именования, которые отражают особенности географических реальностей, разделяют природные предметы выделением тех его частей, несущих наибольшую информацию и дают конкретную характеристику природной характеристики. Специфические характеристики географической местности выделяют их из числа соответствующих и закрепляют за собой названия.

Многие ученые топонимисты изучали отечественную ономастику и топонимику, особенности номинации географических местностей и их историческое значение [3]. К примеру, известный топонимист А.В. Суперанская в своих трудах выделяет два основных критерия и две линии номинации, по которым обозначают географические объекты:

Критерий:

1. по их физическим свойствам;
2. по их роли в жизни человека и

Номинация:

1. свойства именуемых объектов;
2. характеристика населения, связанная с местностью [3].

Географические наименования могут быть всем известны, однако интерес, который они вызывают своим именем, отраженный на картах или указателях выполняют одну из существенных функций

в нашей ежедневной жизни. Данную функцию отчасти мы принимаем как естественное явление. Ко всему прочему, географические названия – это неотъемлемая часть культурного наследия как язык и рельеф, благодаря которым они сформированы и почти каждое географическое название имеет древнее подлинное значение под своей современной формой [4].

Вопрос о классификации номинации географической местности интересен не только с научной точки зрения, но и с культурной. По характеру объектов выделяют следующие виды топонимии:

1. ойконимия (от греч. *Oikos* – дом, жилище) – названия населенных пунктов;
2. гидронимия (от греч. *Hydor* – вода) – названия водных объектов;
3. оронимия (от греч. *Oros* – гора) – названия особенностей рельефа;
4. космонимия – названия внеземных объектов;
5. фитотопонимы – названия основанные на флоре местности [5].

Подобная систематика связана с особенностями казахских племен и их образом жизни. Казахский народ славится своим кочевым образом жизни, обычно место кочевки было близко к источнику воды. Поэтому подобное деление основывается на культуре поведения казахского народа.

Особое внимание к собственным именам, а именно к топонимам, и их смысловому значению проявляли еще во времена античной древности. По древнегреческим текстам, в которых были отражены географические названия и их классификация, было понятно о возникновении интереса в данном направлении. Вопросы топонимики рассматривались в трудах по истории, географии и языкознанию в далекой древности до наших дней,

хотя сам термин «топонимика» довольно современен [4]. Древний Восток также отличался своими учениями и наукой, Абу Рейхан аль-Бируни ученый-энциклопедист отмечал, что: «Названия изменяются быстро, когда какой-либо местностью овладевают иноплеменники с чужим языком. Их органы речи часто коверкают названия, и в таком виде они переносят их в свой язык, как это в обычае греков. Они берут первоначальное значение, но названия претерпевают изменения». По высказыванию понятно, что произношения иными племенами могли повлиять на истинное название географической местности. Территорию Казахстана населяло множество племен, по территории проходили многие караванные и торговые пути которые оставляли свой след в наименовании [5].

Любая наука формируется за счет спроса во время практики, благодаря которой она развивается. Что касается «топонимики», то она обязана своим выделением из обычного домашнего употребления в специальную отрасль знаний, прежде всего практическим спросом в сфере географии. Первые путешественники давали имена открываемым землям и делали достоянием своего народа неизвестные ранее названия далеких стран и городов. Те люди, были первыми, кто наносил на карту новые страны и новые географические имена. Они же были первыми собирателями географических имен и первыми их потребителями. Вот почему географы являются зачинщиками топонимики как науки. Первопроходцы на новых землях указывали не только особенности местности, но и имели честь дать название, исходя из их особенностей [6].

Разберем особенности номинации казахских географических местностей (табл.1). Ранее мы разобрали особенности классификации.

Таблица 1.

Примеры номинаций топонимики казахского народа

Названия, которые характеризуют рельеф местности (ойконимы, гидронимы)	Тастау, Қапшағай, Тасөткел, Қумдықөл, Каратақыр.
названия, связанные с явлениями погоды, которые не только говорят о том, какие погодные условия в данной местности, но и о том, удобна ли она расположена эта местность для пастбищ, для жилья.	Жайлау, Жылысай, Желторайлы, Қарбасқан, Суықсай.
названия водных объектов (гидронимы), характеризуют температуру воды, цвет, вкус и т.д.	Алакөл, Ащысу, Ақсу, Ащыбұлақ, Тұздыбұлақ, Ақсенгір, Сорбұлақ, Тұздыбастау.
названия, связанные с названиями растений (фитотопонимы)	Алматы, Талдықорған, Шілік, Өленті, Шенгелді, Долаңалы.
топонимы, связанные с названиями животных, птиц (зоотопонимы)	Арқарлы, Текес, Текелі, Құланбасы, Жыланбұлақ, Құланөтпес, Киік, Манғыстау
наименования, в которых присутствует элемент, означающий цвет: ак, кара, кок, сары, кызыл, ала, шубар и т.д. На территории Казахстана таких топонимов, содержащих элемент цвета огромное количество:	Ақтау, Сарыозек, Қызылорда, Көктөбе, Карасу, Алатау
названия, содержащие числа	Тоғызбұлақ, Бескөл, Бесағаш, Үштөбе, Қостанай
названия, несущие информацию о наличии полезных ископаемых	Жезқазған, Кентау, Теміртау, Кенсай

По таблице 1, видно, что казахская народность связывала топонимы с бытом кочевого образа жизни. К примеру, с помощью географических наименований народ показывал то, что где-то природные условия благоприятны для скота, земледелия, жилья, а где-то наоборот постоянно ветрено и холодно. На основе названий местности народ передавал информацию о том, что снег выпадает густой, где больше всего осадков, где хорошо заниматься скотоводством и т.д. [5].

Часть перечисленных наименований не сохранилась в виду того, что происходили перемены в их именовании для придания нового значения местности или водоему. Топонимия казахского народа и любой местности, в некоторой степени, динамична и хаотична.

В исследованиях отечественных ученых имеются учения о топонимии диалектного происхождения. Каждый регион страны отличается своим произношением и говором, что сказывается и на названии местности. Например, южные регионы Казахстана в своем диалекте часто используют звук «ч», что заметно на местных топонимах. Так, выдающийся ученый С. Аманжолов приводил такие примеры: «Чакпак», «Чарын», «Чилик», «Чунжа», «Чолак», «Чамалган», «Чу», «Чардара», которые сохранились в обиходе по сей день.

Для включения в особенности номинации разберем еще один пример. «**Хантенгри**» – это высочайшая вершина на территории Казахстана. Если перевести правильный смысл данного слова, то оно означает «Небесный», «Божественный Властелин». Это связано с его высотой, которое стремится вверх. Так как «небо» в древние языческие времена рассматривалось как «Высшее божество». Оно не имеет хозяина, и никто не может над ним властвовать. В отличие от других высоких гор, название «Хантенгри» резко выделяется своей величественностью, как и с царями, ведь казахские племена называли своих правителей «хан». Ввиду этого, номинация этой вершины в таком ключе вполне себе

логична, так как на территории Казахстана не имеется выше пика [6].

Таким образом, рассмотрев особенности топонимов казахского народа, отражающие особенности географических местностей в данном регионе, можно сделать вывод, что их наименование было связано с бытом племен. Процесс исторического развития связывается с топонимией географических местоположений в стране. Казахские племена обращали внимание на окружающую их местность, что сказывалась на названии места, гор, рек, водоемов.

Топонимия, с такой точки зрения несет в себе духовную, культурную информацию о языке, традициях, обычаях казахского народа. Каждое наименование местности это история народа, в котором заключены быт, культура и особенности жизни.

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PHILOLOGICAL SCIENCES

CONCEPTUAL INTEGRATION, MEANING AND UNDERSTANDING

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Abstract

The present paper presents a synopsis of work on language, form, and meaning in conceptual integration theory. It analyzes that conceptual Integration and provides a potentially powerful model for explaining a wide range of cognitive processes that build connections among different sorts of ideas. The article concludes that *Conceptual blending* refers to a set of cognitive operations for combining words, images, and ideas in a network of "mental spaces" to create meaning.

Keywords: Conceptual meaning, understanding, integration of meaning, artificial intelligence.

There are two main means of structuring knowledge.

- 1) Conceptualization of knowledge,
- 2) Categorization of knowledge.

Conceptual integration theory (also called conceptual fusion theory) developed by Gilles Fauconnier and Mark Turner (see: 5)) in the late 20th century has played an important role in clarifying many controversial issues in linguistics, including comprehension issues, especially text comprehension, in the investigation of problems that have been waiting for a long time to be solved.

The main essence of this theory is that the cognitive operations that take place in the human brain and combine language and thinking can create different meanings. They range from the simplest meanings and concepts to the most complex theories. But such concepts, which seem simple to us at first glance, are actually not so at all. When we speak, think, or even hear, we do not understand the essence of what complex operations are going on in our brains. [5:43]

It is known that language and thinking are connected to each other through 3 types of visualizations (in J. Fauconnier and M. Turner these are explained as "mappings").

The first is a projection image, the second is a pragmatic-functional image, and the third is a schematic image. It was on the basis of the mental field that the Fauconnier-Turner couple determined the emergence of a unique theory in linguistics - the theory of conceptual integration. The essence of this is that conceptualization is the process of understanding information that leads to the creation of concepts. Today, the main cognitive processes in linguistics are understood under the name of the theory of conceptual integration, which has a certain scheme implemented with different levels of abstraction. This scheme includes the output space (Fauconnier-Turner couple calls it "input spaces") and the blended space ("blended space"). [5:172]

All of these represent the "mental field". All of them (of the mental field) are related to conceptual integration.

Then what can be the role of conceptual integration in people's understanding of each other, comprehensive understanding of the information they read and hear? Because our daily life is colorful, the information received during the day is also colorful and has different genres. In artistic texts, scientific texts, political texts, academic-educational texts, we encounter information in an informative, aesthetic, didactic style, while in informative-advertising texts, we encounter all of these from a pragmatic point of view. The new meaning is created as a result of three mental operations - imagination, integration, similarity - performing a complex task together. The difficulty in studying conceptual integration processes is that these processes exceed the boundaries of our consciousness.

As can be seen from this brief information, the role played by the issue of conceptual integration in the comprehension and understanding of the text is irreplaceable. It is precisely because of this importance that the mentioned issue is addressed from time to time, which determines its relevance.

It is known that reading comprehension, writing comprehension, and listening comprehension play an important role in the educational process. All of these processes are mental processes, in which there is an interactive activity between the person performing the action (reading, writing, listening) and the texts. We fully understand the text when we have various skills-habits - to navigate the text, localize information, to feel the spirit of the text, to reconcile events. A reader or listener without such qualities will not be able to get anything other than a superficial understanding of the text. [1: 216]

By participating in the communication process, we sometimes understand what is being said, and sometimes we create the text-speech ourselves. In the first act, our main goal is to understand the ideas expressed in the language. Language is a means of embodying an idea. However, the knowledge used in language coding is not limited to our knowledge of language. Along with our knowledge about the world, the social context of the text, the ability to communicate the information in the memory, plan and manage the discourse and other

aspects also play an important role here. At this time, none of the available forms of knowledge is more important than the other in the process of understanding. None of them is clearly preferred. Only the study of the means of interaction, the mobilization of all knowledge, helps to understand the essence of language communication and conditions the clarification of the nature of the semantic results realized by language practice in everyday life. [3:218]

The study of knowledge during language communication is studied as one of the main directions of cognitive science. Starting from the mid-70s, "cognitive science" began to be developed as the processes of human gathering, using and assimilating information. It is no coincidence that one of the main issues of psychology found its solution in cognitive psychology: human behavior his niche is determined by his knowledge. Knowledge also plays a crucial role in the artificial intelligence system here. Here, the very concept of intelligence is often related to the ability to "use" the necessary knowledge.

In many studies on artificial intelligence, the main goal of the general theory of language is considered to be the explanation of the mechanism of natural language, the mechanism of its understanding. Undoubtedly, the basis of such a model is the interaction of different types of knowledge, and linguistics no longer has "sole authority" in the development of a general model of language. The development of such a general language model can only be solved within the framework of all cognitive sciences.

Although there are various levels of research dedicated to the study of cognitive language aspects, many issues still remain open.

However, two main problems are more discussed in the researches of recent years.

1. The structure of providing different types of knowledge.

2. Means of conceptual organization of knowledge in the process of understanding and construction of language information. [4:59]

Providing certain knowledge during language communication is a very complex and controversial issue. Explicitly expressed knowledge is only a part of the general knowledge base. The storage of information in this knowledge base is not static, on the contrary, it is a self-creating and self-regulating system that constantly moves and changes based on new information.

The knowledge base is based on at least the following components:

- 1) Knowledge of language; a) grammar (together with phonetics and phonology), (supplemented with lexical semantics); b) knowledge of language processing rules; v) knowledge of the principles of speech exchange.

- 2) Foreign language knowledge: a) context and situation, knowledge about the addressee (goals and plans set by the addressee, his perception of the speaker, circumstances; b) general background information (about the world), knowledge about events, situations, actions and processes. [2: 41]

Issues that form the basis of knowledge have been sufficiently explored. The difficulty mainly arises in

clarifying the appropriate structure of the transmission of existing knowledge. For example, what distinguishes the structure intended for the provision of pragmatic information from the structure used for the provision of syntactic information? Or rather, is there a particular level of syntactic representation? What ideas does a person rely on in the process of understanding language?

The order of the waiting list can be extended. For decades, one of the most important results in the theory of cognitive learning has been the idea of the inextricable interaction of the processes occurring in human memory, as well as the clarification of the construction and comprehension of language information. Indeed, the understanding of any new situation leads, first of all, to finding a situation close to it in memory, a little similar to it. In order to analyze and comprehend new information, we have to refer to the previously accumulated experience in our memory. This search is based on the fact that the structure of analyzing and perceiving new information is similar to the structure used to organize memory.

The main importance of past experience in remembering and understanding our information was first researched by F. Bartlett in the 30s of the last century. When he studies the features of understanding texts, he concludes that memory never has a true character. Depending on the social environment, its (text) form often changes in the memory during the re-creation and imagining of texts. He used the concept of "schema" for the purposeful storage of information in memory. By this "schema" he understood the active organization of past experience. [3]

One of the structures for imagining high-level semantic information and the simplest are scenarios. (This is discussed in more detail in A.A. Abdullayev's work entitled "Discourse Analysis and Theme Development". See: A.A. Abdullayev, 2004). A scenario is a set of low-level concepts related to time and cause and effect, which describe the regularization and ordering of stereotyped events over time.

Unlike the theory of artificial thinking, the concept of "frame" rather than the concept of "scenario" is used in linguistics. Ch. Fillmore gave a comprehensive description of the theory of frames and compared the semantics of understanding with the semantics of truth.

With frames, schemes, scenarios, plans, etc. the so-called knowledge structure itself means a package-set of information.[4:159]

This data set is stored in memory, or created as needed from components already present in our memory. It is this set of information that ensures that standard situations fall into a suitable cognitive-thinking form.

These structures play a crucial role in the functioning of natural language. Through them, the relevance of the texts is determined, both at the micro and macro level, and the necessary conclusion is reached; ways of their activation are clarified (eg. etc. some features of giving definiteness - indefiniteness in languages with articles). Finally, they emphasize the importance of context, which allows predicting future events based on structurally similar past events.

"Strategies" are considered to be the best examples of structures intended for imparting pragmatic knowledge. The famous Dutch linguist T. van Dijk, together with B. Kinch, wrote a book called "Strategy for Understanding Related Text" that gives a very good analysis of this issue. The authors emphasize the dynamic aspect of connected text comprehension and write that the comprehension process is strategic in nature. The strategies used in the comprehension of texts are often not pre-programmed, they are beyond the conscious control of the speakers of the language. At the same time, they depend on rapidly changing and cognitive structures (knowledge, plan, instruction, goal). Action strategies are hypothetical and reasonably specific. With their help, the most likely structures are quickly revealed, as well as the importance of receiving the given information. Strategies are also characterized by action on several levels that exist simultaneously, are able to use incomplete information and combine them with inductive and deductive means of analysis.

The authors note that some of the strategies have linguistic features. This includes strategies related to the surface structure of texts during the semantic analysis of texts. Others are mainly about cognitive strategies. The decisive importance for their action is played by the knowledge about the objective entity, the situation and other cognitive information.

Another point of view, which is the exact opposite of the teaching, should be mentioned here. Its supporters believe that knowledge does not play a major role in solving the problems of language analysis. In the event that the analysis process is carried out by specific individuals, then, according to these linguists, features that are not subject to stereotyping and conceptual modeling are of decisive importance. Here, the purposefulness, creation and provision of worldview, hidden (hidden) evidence, emotional states, and needs are understood.

In general, the problems of knowledge organization and the means of their delivery are very closely related to each other within the broader framework of natural language analysis. If the methods of presentation of knowledge have been regularly developed in the works devoted to the problems of artificial thinking in the last two decades, the issues of organization of knowledge have become the focus of attention only in recent years.

In the 80s of the last century, several constructive ideas dedicated to the study of the conceptual organization of knowledge were formed. This includes the assumptions put forward by G. Lakoff and his supporters about the integral nature of language analysis. According to them, the provision of language information is a single - holistic process and takes place simultaneously at all levels of the language - syntactic, semantic and pragmatic. Semantic interpretation is not necessarily required after syntactic analysis. It can be started quickly on the basis of already known information about syntactic structure, and both semantic and pragmatic information can be used during syntactic analysis. [7]

The results of the analysis obtained at any of the language levels are useful for all other levels. There are two possible forms of cross-level relationships. In the first case, the interaction is organized hierarchically. (Unmixed levels interact through intermediate levels). In the second case, "cross-communication" occurs between levels. At this time, each level can be directly connected with all other levels (see: Abdullayev, 1998).

Underlying the ideas of an integral analysis of language is the broader idea of a single level of knowledge transfer. This idea is based on the ability to combine language, sensory and motor information.

We would be wrong if we say that the sum of all the knowledge and ideas available to the speaker and the listener are used during congress speech acts. That's why it is necessary to develop such a conceptual tool that is satisfied with the multitude of existing factors in the interpretation of texts. In this regard, concepts such as "focus" and "relevant" are often mentioned in linguistics literature. (Especially in the works of D. Shperber and D. Wilson, U. Lenart).

M. Minsky suggests applying the system of "cognitive sensors" when talking about the conceptual problems of knowledge. This system prohibits certain forms of speech behavior.

Researches of the famous linguist J. Lakoff cover wider problems in this field. In modern times, a more promising direction, which resonates with the problems of presentation and organization of knowledge, "semantic method" is widespread. Knowledge of dynamic scope is provided here in procedural form rather than in the form of a rulebook. More experts in this kind of research is considered more appropriate for the creation of systems. Here also, as F. Johnson-Laird showed, the means of organizing knowledge in a procedural form also differ.

The cognitive approach to language is such a dynamically developing current that the obtained results are updated quickly. Successful findings obtained during the study of language will undoubtedly be of great importance in the theory and practice of computing systems, machine translation, and search-information systems. However, it should not be forgotten that the study of cognitive aspects of language will only lead to the effective solution of applied tasks, as well as to deepen our understanding of the mysterious mechanisms of language communication. And we are thinking about the problems that have always bothered us for hundreds of years. How should we understand each other better? How accurately and fully does language express our feelings and thoughts? As you can see, we are still far from a complete solution to these or similar problems.

There is a strange proverb: He who knows a lot takes a lot! I wonder why the one who knows so much should take so long. The writer Anar skillfully revealed this in the work "Troule to understand", which tells about the life of Jalil Mammadguluzade. Mirza Jalil, who served his people for many years with his pen, enlightened ideas, and beautiful artistic and publicist works, suffered unimaginable misfortunes! This happened at that time, in the Soviet system. And now, sometimes the "trouble of misunderstanding" is taking place, it makes people nervous and angry. What is this

disease? Why do we not understand, are not understood, or do not want to understand, do not want to understand? When will these reasons decrease?

To conclude, in the epigraph of his novel "Living to Tell", Marquez expresses the idea that, in fact, life is not how one lives, but how one remembers it, but also the ability to tell others. Loneliness, loneliness, and emigration arise from this in all times and in all countries. The main problem of the world: thinking has moved, leading countries seem attractive in this sense and embrace it intelligently.

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THE GENDER APPROACH IN THE CONTEMPORARY LITERATURE

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К ПРОБЛЕМЕ ГЕНДЕРНОГО ПОДХОДА В СОВРЕМЕННОЙ ЛИТЕРАТУРЕ

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Abstract

In modern science there is no consensus on the terminology in the field of literature written by women. The article makes an attempt to investigate the relevance of the gender approach to the study of modern literature.

Аннотация

В современной науке не существует консенсуса относительно терминологии в области литературы, написанной женщинами. В настоящей статье предпринимается попытка рассмотреть актуальность гендерного подхода к изучению современной литературы.

Keywords: modern literature, gender approach, gender, woman's literature, self-identification.

Ключевые слова: современная литература, гендерный подход, гендер, женская проза, самоидентификация.

Современная литература - очень сложное и неоднородное явление. Исследователи, говоря об общей ситуации в русской литературе постсоветского периода, фиксируют ситуацию общего культурного кризиса рубежа веков, усугубленного внутренним кризисом, связанным с распадом Советского Союза. Исследователи разделились на тех, кто видел в новом периоде развития литературы признаки упадка, а также на тех, кто считал литературу 1990-х периодом больших экспериментов, свойственные для культуры переходного периода. Дискуссии вызывали также подходы к исследованию нового периода. В попытках типологизировать современную

литературу исследователи этого явления столкнулись с изрядными трудностями. Главным результатом стало то, что попытки систематизировать литературный процесс 1990-х годов с помощью привычных методик: по жанрам, стилям, направлениям и т.д. — давал приблизительную, а подчас искаженную картину, поэтому ученые заговорили о несовершенстве старых методик. Исследователи искали новые подходы к изучению сложных современных литературных явлений. Говорили о том, что на этом этапе необходимо определять общие, доминантные тенденции развития. Предлагалось изучать индивидуальные поэтики авторов в сочетании с традици-

онными. Выдвигались требования "расширения методологических поисков", "интеграции методологических идей", тесного "взаимодействия теории литературы с другими науками"[2]. Одной из таких попыток типологизации современной русской литературы станет гендерный подход. При этом гендерный подход к изучению литературы является одним из самых дискуссионных и неоднозначных.

Современная женская проза в русской литературе активно заявила о себе в конце 1980-х начале 1990-х гг. В это же время литературоведение стало все чаще обращаться к гендерному подходу: начались академические исследования, проводились научные конференции, стали издаваться монографии, выпускаться многочисленные коллективные сборники ("Женская логика" (1989), "Новые амазонки" (1991), "Чего хочет женщина", "Глазами женщин" (1993). И до сих пор дискуссии о женской литературе не умолкают. Существуют разные точки зрения на вопрос о том, имеют ли право тексты, написанные женщинами, рассматриваться как самостоятельная область словесности.

В литературе конца 1980-х - 1990-х появляется заметное количество писательниц, к творчеству которых привлечено внимание литературоведов, литературных критиков и, конечно, читателей. Современную женскую прозу представляют писательницы разных поколений: "поколения 1980-х" (к которому чаще всего относят Людмилу Петрушевскую, Татьяну Толстую, Марию Арбатову, Дину Рубину, Викторину Токареву), поколения 1990-х (Мария Степанова, Анна Козлова, Майя Кучерская, Линор Горалик), поколения нулевых (Ольга Брейнингер, Гюзель Яхина). Творчество каждой из писательниц внесло свой вклад в своеобразие и самобытность современной литературы и отражает тенденции современной литературы.

Ставя литературу рубежа XX–XXI веков в ряд переходных эпох, С.Тимина подчеркивает, что в ситуации переходности все традиционные подходы могут не дать результата. При этом исследовательница отвергает такие гендерный принцип типологизации, полагая, что творчество Т.Толстой, Л.Улицкой, М.Палей не ограничивается параметрами "женского взгляда" на мир.

Исследователь Челпанова отмечает, что «расцвету женского письма особенно способствуют эпохи кризиса, перехода. В такие эпохи происходит ослабление патриархального "символического порядка" и становится возможным переосмысление женской идентичности; это будет одна из причин, почему в эпоху "лихих 1990-х" в России на первое место выходит тема семьи, быта, традиционно понимаемые в русской культуре как сфера женщин» [7]. Сергей Чупринин [9] в своем авторском проекте "Русская литература сегодня. Жизнь по понятиям" посвятил целую статью гендерному подходу в литературе, дамскому роману, а также феминизму в русской литературе, отмечая, что понятия "секс" и "гендер" - терминологическая проблема совсем недавнего времени. Литературный критик Наталья Иванова тоже полагает, что «литература не бывает

мужской и женской, а только хорошей и плохой»[6]. На что И.Славкина возразит: «... если мы признаем принципиальную разницу между мужской и женщиной, то, вероятно, нужно признать и то, что самопознание, самовыражение женщины в литературе, ее взглядах на мир и на себя в мире в чем-то, (а может, и существенно) отличается от мужского» [5]. М. Абашева на тему женской прозы заметит, что «Женская проза, если отвлечься от ценностных критериев, – факт литературного сегодня, и факт симптоматический, свидетельствующий о начале благотворной дифференциации нашей литературы – жанровой, стилевой, тематической – ее специализации, ранее искусственно сдерживаемой внелитературными факторами» [1].

Авторы пособий, посвященных русской литературе постсоветского периода, М. Черняк в своем учебном пособии по курсу современной русской литературы включает раздел, посвященный женской прозе (творчеству Т.Толстой, Л.Улицкой, Л.Петрушевской, В.Токаревой и др.), тем самым также признавая состоятельность гендерного подхода к изучению литературы.

Еще одна исследовательница современного литературного процесса Татьяна Колядич в своем учебном пособии по современной русской литературе включает в пособие раздел о тенденциях развития современной женской прозы. Однако, если первоначально выделение "женской прозы" проводилось по тематическому признаку, то позже исследовательница делает акцент на необходимости говорить об особом типе ментальности, определяя специфику "женской прозы". И подчеркивает, что необходимо разделять понятия "женская" проза и "дамский роман", хотя оба сосредоточены на изображении "судьбы женщины, описание ее чувств, переживаний", при этом, по мнению исследовательницы, можно говорить об ориентации на разный уровень читательской квалификации. "Дамский роман", безусловно, тяготеет к явлению массовой литературы, прежде всего, из-за излишней сентиментальности, "гламурного эротизма", "формульного письма", предусматривающих использование готовых сюжетных, образных и стилистических блоков). Заметим, что интенсивное развитие массовой литературы в русской литературе XX века тоже начнется с конца 1980-х годов - начала 1990-х. Сам термин "дамский роман" появился в начале XX века, благодаря Корнею Чуковскому, который использовал его в отношении Лидии Чарской и Анастасии Вербицкой, которых считают первопроходцами массовой литературы для женщин. Сергей Чупринин в своем справочном пособии "Русская литература сегодня. Жизнь по понятиям", размышляя о феномене "женской прозы" говорит, что у многих исследователей был соблазн отождествлять дамское с женским, сопоставляя ее уровень сложности и приводит примеры: «Вячеслав Курицын выделяет серьезную "дамскую" прозу и обращается к творчеству Л. Петрушевской и О.Славниковой. А Андрей Немзер творчество Людмилы Улицкой охарактеризовал как "умеренную и аккуратную дамскую прозу с эксплуатацией

дамско-семейных тем, для аккуратности малость приперченную» [1]. Галина Юзефович также соглашается, что термин “женская проза” достаточно легитимен, поскольку “другого определения для текстов, написанных женщинами, о женщинах и преимущественно для женщин, пока не придумано”.

Вопрос гендерного подхода долго оставался болезненным и неоднозначным. Можно наблюдать позиции весьма противоположного толка. Виктор Ерофеев представлял альманах молодой русской прозы 2004-го года “Время рожать”, где он высказал свое отношение к гендерному вопросу в литературе: «В русской литературе открывается бабский век. В небе много шаров и улыбок. Десант спущен. Летит большое количество женщин. Всякое было — такого не было. Из предмета культуры женщины становятся ее субъектом. Раньше ими восторгались, бросали под поезд, все делалось за них. Их роль в русской прозе маргинальна. Ни одна не стала Достоевским. Культовые имена русских поэтесс — при всех их достижениях — невозможно связать с глобальными прозрениями. В лучшем случае поэтессы были внеисторичны. Большой мемуарный суд, который женщины-жены впоследствии сотворили, был судом над мужской историей. Они объявили себя ее жертвами. Это был тоже необходимый внеисторизм, его не хватало России. Но альтернативы, кроме своего курсива, не предложили. Женщины-судьи оказались во многом несправедливы, потому что находились в другом измерении. Мужской взгляд был всегда объемнее, мужчина владел ситуацией. Однако к концу века женщины сохранились лучше» [3].

Рассуждая о литературе начала нулевых, Нина Садур заметит, что: «Отсутствие духовной энергии в обществе отражается на литературе. Понятие “писатель” ушло, вместо него по названию и, что важнее, по сути появились “литераторы”. Помимо этого, удобно и противно вползло в русскую литературу понятие “женская проза”. Она вроде как обособилась, феминизировалась, хотя какой ни с того ни с сего феминизм на нашей почве? Она на фоне остальных разновидностей прозы как-то уж совсем неподражаемо убога. Главная ее тема — беспрерывная сексуальная травма. Она вызывает стойкое чувство неловкости за пишущего. Она почему-то некая женская второсортность. Не оттого, что женщины пишут книги, а оттого, что они сбились в кучу и назвались “женской прозой”. ... Как социальное явление “женская литература” все же отражает некие тяжелые социальные болезни общества. К сожалению, как литература она неоправданна — из-за низкого профессионального уровня. Впрочем, сейчас в литературе (и в культуре вообще) расцвет дилетантства, агрессивного тем более, чем профнепригоднее автор. Вред от такой “литературы” ощущают, я думаю, еще наши внуки» [10].

Отметим, что феминистская проблематика, которая стала весьма заметной в европейской и американской литературе второй половины XX века, в русской литературе постсоветского периода все еще носит редкий и экзотический характер. Марк

Липовецкий по этому поводу заметит «Феминизм, ушел в область чисто академических исследований — довольно узкую и не вполне определенную», так что «в сегодняшней литературе <...> можно назвать только одного постмодернистского автора, последовательно выстраивающего женскую картину мира — это Вера Павлова. У остальных, даже таких заметных, как Л. Улицкая, И. Полянская, М. Вишневская, С. Василенко, О. Славникова, Г. Щербакова, вопрос о том, как конструируется и пересочиняется женская идентичность, как правило, либо решается на уровне сентиментальных стереотипов, либо оттеснен куда-то в дальний угол (а для Толстой он вообще не существует)» [1]. Исследователь отмечал корреляцию между проблемой феминизма и возрастом писательниц, подчеркивая, что в русской литературе для писательниц старшего поколения тема феминизма не актуальна, а насколько она станет востребована у более молодого поколения, пока говорить преждевременно. Действительно, в русской литературе этого периода феминистская проблематика отчетливо проявляется, разве что, в произведениях Марии Арбатовой. Зато в женской прозе постсоветского периода появится христианская проблематика [7]. Исследовательница делает вывод о том, что в 1990-е, «в эпоху кризиса и перехода к новой общественной системе, женская христианская проза ищет путей репрезентации новой, постсоветской женской субъективности (творчество Ю. Вознесенской, М. Кучерской, О. Николаевой)». По мнению исследовательницы, если для одних писательниц, как Т. Толстая, Л. Петрушевская и Л. Улицкая, это станет попыткой не только предложить новые темы, но и обозначить новые способы художественной репрезентации дегуманизирующего, всепоглощающего быта, то для прозы их современниц М. Кучерской, Ю. Вознесенской и О. Николаевой обращение к религиозной проблематике и изображение церковной жизни станет своеобразным эскапизмом, попыткой ухода от исключительно бытовой проблематики, характерной для литературы предыдущего периода. Исследовательница предлагает говорить о новом явлении в русской литературе — новой христианской женской прозе, которой можно трактовать как пути поиска новой идентичности женского письма на постсоветском пространстве. Хочется подчеркнуть, что для постсоветской литературы обращение к религиозной тематике станет ярким явлением, характерной не только женской прозе, христианская тематика активно проявится и у писателей мужчин. Можно вспомнить роман Е. Водолазкина «Лавр».

В нулевые в женской прозе появляются новые имена, новая тематика и новая проблематика. Однако хочется отметить, что явление женской прозы в современном литературном процессе — явление не до конца изученное и неоднозначное, как и терминологический аппарат этой литературоведческой области. Однако гендерный подход к изучению современной литературы имеет свое право на существование. Поскольку пол в этом случае понимается не только как биофизический фактор, а как

фактор социобиокультурный, формирующий определенные стереотипы мужского и женского. И может рассматриваться как попытка возможного переосмысления женской идентичности, вызванного ситуацией переходности культурной эпохи.

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DEVELOPMENT STAGES OF ARABIC

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Abstract

More than 450 million people speak Arabic. This language is a language spread over a wide geographical area and is especially important for Muslims. The article examines the stages of development of the Arabic language and its connection with the Qur'an. The Arabic language is important to understand the Holy Quran and the verses in the Quran correctly. Arabic language belongs to the family of Semitic languages. Unlike other Semitic languages, Arabic was a language that reached the highest level. Before the advent of Islam, the Arabic language was divided into two parts: South Arabic and North Arabic. The article mentions that the Arabic language has been preserved thanks to the Holy Quran and has not become a dead language like some languages.

Keywords: Arabic language, Muslim, Holy Quran, Semitic, Islam

The Arabic language has been one of the Semitic languages known to people since ancient times, and it was the language of Ad, Usmud, Wajdis, and Jurhim, and it reached the peak of maturity when it was scattered in Yemen and Iraq and settled in Hijaz. It reached the peak of its glory when it became the language of the Islamic religion. It should be noted that there are approximately 450 million Muslims in the world who speak Arabic.

With the diverse linguistic and cultural origin of Islam, the positive attitude of people in all walks of life and the most remote parts of the world, the presence of the holy book of Islam had a great impact on the enrichment and development of the Arabic language.

Some Arab scholars, such as Mujtahids, Nahivs, and Saraf scholars, have damaged the structure of the Arabic language. Recitation scholars made serious efforts to prevent its degeneration. They gave rise to different recitations of the Qur'an, in the text of the Qur'an

they tried to punctuate correctly. They put forward reasons and evidence as proofs for their claims. Scholars of jurisprudence interpret the verses and sought to obtain a set of necessary rulings and ijthads based on the Shariah in economic, political and religious matters. For this, they aimed to achieve a better appreciation and understanding. Scholars have tried to linguistically develop the rules and regulations that make up Arabic grammar. To accomplish this, they traveled to many different places in the desert. They collected words and tried to develop Arabic grammar by creating competing schools of syntax.

Modern Arabic literary language has been accepted as the official language in Arab countries, whose population together reaches two hundred million. In addition to the literary language, there are local dialects and dialects spoken by the population. Since they are seriously different from each other and also from the literary language, it is considered common that Arabs of different countries do not understand each other, and Arabs without proper training often do not understand

the literary language. The development of the Arabic language consists of several stages. I will analyze these stages in detail in the main part.

Formation of the Arabic language. Islamic scholars and historians have divided all Arab peoples into two large groups:

1. Qahtani, the southern branch that included the ancient Yemeni people (Me'in and Seba'). al-Yemâme, Najd, Hijaz, Shammar and this includes those who live near the border of Arabia with Syria and Iraq.

2. The Ismaili branch, whose center of gravity is in the north, is translated as North Arabic.

The Arabic language has historically gone through three stages of development: ancient (up to the 5th century), classical (5th - 18th century) and modern (from the 19th century to the present) Arabic language. The first written information about the ancient Arabs was found in the inscription of the Assyrian king Sargon (715 BC). The ancient Arabic language was mainly found in Syria, Lihyān, As-Safa, An-Namara, Zabad, Harraṇ, etc. reflected in the inscriptions.

The Quraish (Mecca) dialect played an important role in the formation of the ancient language, which previously consisted of various local dialects, as a literary language in the later stage of development. This language is identified as the first classical Arabic language with a well-established grammatical structure and a rich vocabulary in the examples of oral poetry created immediately before Islam, in the period called Jahiliyyah by Islamic scholars, as well as in the Qur'an, which is considered a very valuable monument.

In the subsequent process of development, the Arabic language is divided into literary languages and dialects that are more and more different from each other. The literary language replaced Aramaic and Greek, which were still used as written languages in the emerging Arab empire, and became the common written language of the empire and is gaining international importance.

The modern Arabic language, which has been developing on the basis of the classical language since the 19th century until today, differs from its predecessor in that the content of the vocabulary is significantly limited due to the removal of archaisms, the creation of words and expressions reflecting new concepts, and the further stabilization of the grammatical structure.

The Arabic language belongs to the Semitic language family, but the origin of the Arabic language is still not fully understood. Let's take a look at the history of the Arabic language. The development of the Arabic language after the establishment of Islam, the development of the Arabic language during the Umayyad and Abbasid periods, the development of the Arabic language during the Mongol invasions, the Arabic language during the Ottoman conquests, the Arabic language at the end of the 9th century, the Arabic language at the end of the 20th century after the Cold War era. Now let's take a closer look and analyze each of these 6 different periods [5, p.4].

Arabic in the post-Islamic period: Arabic became widespread after the Islamic conquests and after the conversion of many peoples, especially the Copts, Assyrians, Syrians, Berbers, and Romans, to Islam. The

spread of the Arabic language during this period, in addition, foreign peoples began to speak Arabic as a second additional language along with their mother tongue, especially during the period of the Umayyad and Abbasid caliphs, Arabic reached its peak of prosperity as it was the language of literature and science, and the Arabic language was the language of rituals that spread during this period. for example, in the Arab world and in the Syrian, Roman, Catholic and Orthodox churches, the Arabic language was widely spread and developed, not to mention that Jews wrote many intellectual and religious works [4].

Arabic language during the Umayyad and Abbasid period: History testifies that the Arabic language spread widely after the Islamic conquests and was at its peak of prosperity, because the language of literature and science was during the Umayyad and Abbasid caliphates and many peoples were influenced by it, for example: Syrians, Romans, Berbers and after the Copts converted to Islam, because the Arabic language was the language of Islamic law and was not worshiped without it, and this led to its widespread use at that time. As many sciences were converted from their own language to Arabic, non-Arabs began to speak it as a second language as well as their mother tongue, and the use of Arabic was not limited to Muslims, but instead became the language used by other religions at that stage, such as Christians in Roman churches and Jews in the Middle Ages. Many religious works were written in Arabic.

The Ajam language played an important role in the development of the Arabic language, especially during the Umayyad and Abbasid periods, and later they translated the sciences into their native languages, which led to the emergence of many new words and terms that did not exist in ancient times. The Qibbi language used to be, for example, the word Bimaristan is a word of Persian origin, and it should be said that the Arabic language reached the golden age of its highest stages of development and progress, especially after the emergence of a large number of scholars, poets, and writers who expressed their beliefs and ideas in Arabic. Many manuscripts and books were written in Arabic. In all cultural and scientific fields and many other foreign languages were also affected during the Crusade period, French, Spanish, English, German and Italian, due to the mixing and amalgamation that occurred between foreigners and Arabs.

Arabic language during the Mongol invasions: During the Mongol invasion led by Hulaku Khan, the Arabic language declined, Islamic civilization and culture were greatly affected by the destruction, and the Arabic language and European civilization began to emerge. The Mongols invaded the Arab world led by the Hulaku leader and during this period the Arabic language experienced its worst state as the Arabic language suffered a great stagnation and lethargy due to great destruction. The Mongol invasion, in its turn, played a major role in the destruction of Arab civilization and culture. Except for this, during the Mamluk era, Arabs did not pay attention to improving and developing science and language before their occupations. By attempting to reform what had been destroyed in the Arab world by Hulaku Khan and his army, the

Spanish reclaimed their country, which led to a significant decline of the Arabic language, especially after the decline and emergence of Arab scientific inventions and discoveries.

Arabic during the Ottoman Conquests: During the Ottoman conquests, the Arabic language was able to establish itself in the Balkans and Anatolia, especially after the conversion of many inhabitants to Islam. During the Ottoman Empire, Arabic became the second official language, as the Ottomans did not have as much interest in culture and science as they had during the Abbasid period. At the end of the Ottoman period, the Arabic language returned to a state of stagnation for nearly four hundred years, and at the end of the 19th century, it recovered a little in Egypt and the Levant, so the number of literate people increased, newspapers and magazines spread, and many writers' associations were created that revived the classical Arabic language. Among the poets and writers of this period are: Ahmed Shawqi, Gibran Khalil Gibran and Nassif Al-Bazji.

Arabic at the end of the ninth century: The Arabic language fell into a state of stagnation for four hundred years, but then recovered somewhat, and this was after the cultural renaissance of the late nineteenth century, especially in Egypt and Damascus. They also started publishing newspapers in Arabic. In addition, many literary societies were created that contributed to the revival of the classical Arabic language. In this period, there are many well-known writers who contributed to the development and enrichment of the Arabic language, including: Sheikh Nasif Al. - Bazaji and Ahmed Showki. He was nicknamed Prince of Poets, Gibran Khalil Gibran and Boutros al-Sabtani. In their hands, modern Arabic dictionaries appeared, for example: the Dictionary of the Department of Knowledge and the Ocean Dictionary, which are still in use, and the Arabic press, which played an important role in the revival of Arabic thought, was born, but it was not limited to the scientific field, but only to literature, and it should be noted that Arabic language no longer plays as big a role in this field, especially after the Cold War Era at the end of the twentieth century, when English became the most common language in the world, be it Arabic or Western, it became the main language used in business messages and deals.

The stages of the historical development and spread of the Arabic language can be shown in a plan as follows: 1. Ancient Arabic language, 2. Classical Arabic language 3. Middle Arabic language 4. New (Modern) Arabic language 5. Constantly developing local dialects [3].

Old Arabic: Examples of Old Arabic can be found in some inscriptions and are known to have existed before 500 AD. Our information about the Old Arabic language and some ancient writings and their relations with the Arabs is based on the corresponding information with individual and tribal names in the texts of the tribes. About the wars between the Assyrians and the Arabs between 626-853 AD, the forty-name document mentioned in the Assyrian Texts is the oldest today. It is known as a written document in Arabic.

Classical Arabic: What is meant by the term Classical Arabic; Its main backbone, which is considered

supra-dialects like the language of science, literature and poetry in the Qur'an and hadith books, ancient literary texts that exist today, as well as in the places where the Arabic language is spread, remains unchanged. This language, which is called classical Arabic, has also marked its progress and development along with the different dialects that existed in different regions before Islam. As for the texts that represent the classical Arabic language, these texts are as follows [2]:

1. Poems of ancient poets (ignorance, muhadramun and the first poets of the Islamic era)
2. The Koran
3. Official correspondence of the Prophet (pbuh) and the first caliphs
4. Hadiths of the Prophet (pbuh).
5. Prose fragments and examples about Eyyamu'l-Arab

Looking at the characteristics of the classical Arabic language, the old scholar investigated which dialect this Arabic was based on. But late scholars have accepted that the basis of this language is the Quraish dialect.

Middle Arabic: The religion of Islam (from the day it was brought to mankind) has a great influence on the development of the Arabic language. The Qur'an has a great influence in determining the basis of the Arabic language. On the other hand, the spread of Islam beyond the borders of the country with the conquests caused the Arabic language to spread to large areas and interact with the languages of the countries it reached. This interaction means a different way of thinking from the Arabs' old ways and a different way of life from theirs (an urban life separated from all aspects of Bedouin life - material and spiritual). This change in lifestyle is effective in feeling and thinking. As it plays a role in language, it naturally undergoes certain changes. In addition, as a result of the translation activities carried out during the Abbasid era, various words were placed in the Arabic language, some of them were Arabized, and the set of words in the Arabic language changed. The language that emerged as a result of this change and interaction is called Middle Arabic.

New (Modern) Arabic language: The printing of Arabic texts began when Napoleon opened a printing press in Egypt. This has been happening since the beginning of the 19th century. As a result of the rapprochement of the Arab world with European culture and civilization, the Arabic language, the language of art, thought and science, is a new (modern) language. It is called in Arabic. In addition, Napoleon's activities such as an observatory, chemical laboratory, theater and library, the opening of many new schools where the teaching methods and programs of European schools were implemented by the governor of Egypt, Kavalah Mehmet Ali Pasha, made it necessary to express foreign concepts in Arabic. All these (connections and influences) played an active role in the creation and development of the modern Arabic language [1].

Constantly developing local dialects: On the one hand, old dialects, the language used by Arabs who settled in new places; On the other hand, with different Arabic language, many dialects are spoken under the influence of certain conditions and a dialect was

formed. Each of these is called a local dialect. Literary writing of the Modern Arabic and Middle Arabic period, similar to the language, has also developed rapidly in local dialects. Later, some literary texts increased the ratio between the local dialects and modern Arabic and Middle Arabic. For example, drama, novel, story, etc. For this reason, in some countries where Arabic is used as a spoken language, the idea of replacing local dialects with a common written language has arisen.

The role of the Holy Quran in the development of the Arabic language:

Undoubtedly, one of the most important influences of the Holy Quran on the Arabic language was the unity it provided in the language. He gathered all the Arabs on the Quraish dialect and made the Quraish dialect an important part of the Arabic language. However, before the revelation of the Holy Qur'an, the Arabic language was developing and reaching its peak around the Quraish dialect. However, not all dialects were collected yet. With the revelation of the Holy Quran, the leadership of the Quraysh dialect was completed. With this, the so-called unification attempts, which started from the Jahiliyya period, reached their goal and the language was unified.

The Holy Qur'an has ensured the passage of many previously unknown meanings into the Arabic language and has brought many new words to the Arabic language. The Holy Qur'an was used in the Arabic language and gave the terminological meaning to many existing words, and was the first real factor in the emergence of terminological expressions.

The Arabic language was the language of a certain nation that lived in the Arabian Peninsula before the Quran emerged. It was stuck in the framework of the Arabian Peninsula. The revelation of the Holy Qur'an in the Arabic language made it the language of a heavenly religion and gave it the title of a part of worship. Thus, every Muslim used the Arabic language in his prayers, dhikr, takbir and tashahhud. As a result of the conquests and the growth of the caliphate, along with the conversion of groups of people to Islam, the Arabic language began to spread outside the Arabian Peninsula as far as the Muslims could reach. As a result, the Arabic language continued to spread in parallel with the spread of Islam. Among the languages used in the Islamic world, it rose to the first rank and became the first language.

Languages, like people, are born, live for a certain period of time and then die. However, while saying this,

it is necessary to exclude the Arabic language. Because the Arabic language has become a world language thanks to the Holy Quran and the Holy Quran has protected the Arabic language from all kinds of threats. With the encouragement of Islam, Muslims started memorizing the Quran and reading it all the time. This holy book was the source of life for Muslims. Muslims did not allow even one letter of it to be changed. The protection of the Quran, which is the fortress that protects the Arabic language, by memorization in this way, actually meant the protection of the Arabic language. With the backwardness of the Islamic world, it was feared that the Arabic language, like other languages, would disappear or be influenced by other languages. But thanks to the Holy Quran, the Arabic language has eliminated all worries by protecting itself against all kinds of threats. If it were not for the Quran, the Arabic language was expected to disappear like other languages, or at least to be distorted.

The stages of development of the Arabic language represent the history of the development of the Arab people, as it was one of the dominant Semitic languages in the region during the dominance of the Semitic civilization. Some researchers have classified the stages of the historical development and spread of the Arabic language as Old Arabic, Middle Arabic and New Arabic. From the narratives and poems formed during the Jahiliyyah period to the beginning of the Abbasid era, to the Arabic language, Old Arabic; Middle Arabic, the Arabic language used since the beginning of the Abbasids; The Arabic language used today is New Arabic.

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