

ABSTRACTS

GEOLOGY

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GEOLOGICAL FEATURES OF FLUID ZONATION IN MULTILAYER FIELD OF DNEIPER-DONETSK DEPRESSION

Geological conditions of hydrocarbons occurrence in multilayer fields are reviewed to identify prospective underexplored areas on the example of North near-edge zone of Dnieper-Donetsk depression. The main factors of the geological structure multilayer fields as structural-tectonic, stratigraphic, lithofacies, morphological, filtration-capacitive, hydrogeological, thermobaric have been defined. Geological localization features of hydrocarbon deposits of multilayer fields in North near-edge zone of Dnieper-Donetsk depression were analyzed. According to the results of using the parameters of oil-and-gaz-saturation pore the volumes of hydrocarbon deposits were identified as well as features of hydrocarbon fields' vertical zonation. This option more fully describes the internal, discrete structure of each of the fields. As a result of the comparison of effective oil-and-gaz-saturated pore volumes as to the section of each deposit of North near-edge zone of Dnieper-Donetsk depression a baseline horizon has been defined. The baseline horizon is characterized by most effective oil-and-gaz-saturation of pores volume. The features of fluid zoning for each field were identified relative to their base horizons. As the result three types of vertical zoning fluid deposits were identified. First - horizons with less oil-and-gaz-saturation pore volumes of the section lie below and above of the base horizon, second – lie below the base of the horizon; third - above the base horizon. According to the established zoning fluid typing the forecast of new horizons and underexplored areas within opened fields of Dnieper-Donetsk depression were made. In the second type of multilayer fields perspective horizons and underexplored areas were forecasted below the baseline horizons. In the third type of multilayer fields are forecasted above baseline horizons.

Keywords: multilayer fields, fluid zoning, hydrocarbon deposits, oil-and-gas-bearing prospects

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INFLUENCE OF GEOLOGICAL STRUCTURE FEATURES OF GAS CONDENSATE DEPOSITS MATVIIVSKE ON THE CONDITIONS OF THEIR DEVELOPMENT

The article is devoted to the important water-entry problem of the large gas condensate deposits of the eastern region of Ukraine in the process of developing and extracting the residual gas reserves. We present an analysis of influence of geological factors and the rate of extraction of gas on the results of the development of two large Matviivske field's deposits - horizon C-5a1 and C-5g2, which differ from one another by permeability, but are similar in physical size, the pore volume and the presence of the active stratal water.

In this article we briefly discuss the hypothesis of the groundwater genesis. It has been concluded that the fact that the two discussed horizons belong to different zones of katagenesis causes substantial differences in their filtration properties. There is the detailed hydrogeological description of the field, proved reserves of deposits, analysis of their engineering. The problem of the sources of the wells drowning was considered.

It is noted that the permeability of the formation directly causes flooding of gas reservoir characteristics in the process of its development. The authors draw attention to the nature of the gas-condensate reservoir depletion during an initial period - in which case maintenance of gas production high rates may lead to high technological and economic indicators.

Mining the remaining gas reserves of these two deposits, supplying with water, is a complex engineering task. It can be solved in two ways: by allowing the dissolution of lateral coning and the drilling of new wells.

Keywords: groundwater, gas-condensate deposits, wells drowning, gas reserves, development rates, rates of gas production, gas recovery ratio, rock permeability.

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**LITHOLOGY AND FEATURES OF POLYMINERAL ALLUVIUM SEPARATION,
ON THE EXAMPLE OF RIVERS OF UKRAINE**

The river network is part of modern geological environment. It reflects the dynamics of natural processes and the impact of technogenic factors. Changes in the ecological condition of the environment are necessi-

tated by the study and management of alluvium accumulated in the river network in Ukraine. Some 100 samples of alluvium in the rivers Dnieper, Pivdenniy Bug, Ingul, Ingulets and others have been studied. Optical and electron microscopy, lithological and technological researches have been used. Light fraction consists of quartz, carbonates (including organic), feldspar, kaolinite predominates in a fine grade alluvium. Heavy fraction contains almandine, ilmenite, zircon, monazite, to a lesser extent apatite, rutile. Sometimes there is gold, silver, diamonds and other rare minerals. Available particles of metallic iron, bronze, steel sludge, slag, refractories, glass and ore balls are the indicators of the anthropogenic pollution of environment. Dry separation of alluvium has been used in the laboratory. As a result we obtained concentrates of heavy minerals: garnet, ilmenite, monazite, minerals of iron. With the tailings of separation quartz, marshalit, gypsum, carbonates, clay was obtained. Separation methods of natural and contaminated sediments were different, because of the presence of industrial waste in the composition of contaminated alluvium. Researches are confirmed by a polygenic (natural and man-made) formation of high concentrations of heavy minerals in the river alluvium. Extraction of heavy minerals also has ecological significance, since it leads to the clearing of rivers from industrial wastes.

Keywords: alluvium, lithology, mineralogy, electron microscopy, sedimentation, river of Ukraine, deposits, dry concentration.

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QUATERNARY LANDSLIDES OF THE SOUTHERN COAST OF CRIMEA GEOLOGICAL FORMATION CONDITIONS

The number of landslides within the Southern Coast of Crimea is constantly growing. However, the analysis of previous studies indicates that the landslide formation process mainly depends not so much on the impact of anthropogenic factors but on the influence of nature controlled conditions characteristic of the mountainous region. These conditions include geological-lithological, geological-morphological, climatic and hydrogeological. Thus, the analysis of quaternary structural forms and their display in the relief, as well as of the relief evolution resulting from endogenous and exogenous processes should serve as a basis for correct prediction of contemporary landslide activation and landslide-hazard area modeling. The aim of the article is to analyze and identify major regularities of the relief and the geological structure as the cover landslide development environment and substantiate the use of certain geomorphological and geological criteria for the purpose of classification of the study area according to the landslide hazard degree. In the course of the study we used the key provisions of H.S. Zolotariov's historical-geological analysis and V.P. Filosofov's morphometric analysis. As a result, spatial and depth limits of shallow landslide development have been outlined. In addition, the area has been divided into sites according to the potential stability of the geological environment. The obtained results will be further used to build a mapping model and conduct quantitative prediction of landslide-hazard areas of the Southern Slope of the Crimean Mountains.

Keywords: shallow landslides, cartographic modeling, historical-geological method, geomorphological conditions, slope stability.

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PROSPECTS OF INCREASING HYDROCARBON PRODUCTION BY DRILLING SIDE SHAFTS

At the final stage of field development in conditions of limited investment the sidetrack drilling technology is an effective measure of hydrocarbon production intensification in Ukraine.

The problem of sidetracking technology development from cased wells is relevant for several reasons. The main of them is a significant number of inactive or low production wells. After reviewing the current status of gas development, gas condensate and oil fields that belong to PJSC "UkrGasVydobuvannya", after analyzing the dynamics of wells, gas production, and reservoir operating pressures the authors have concluded that the Shebelinske, Zahidno-Hrestischenske, Yefremovske, Melikhovske and Medvedovske fields are most promising as to sidetracking technology application.

The necessity of kickoffs and sidetracking should be technically and economically substantiated.

On the example of West-Hrestischenske field wells the gas-dynamic simulation has been completed which shows what after the positive results of sidetracking additional gas production from the West-Hrestischenske field for 15 years can reach the 48 mln.m³ of gas.

Sidetracking in the inactive and low-rate wells will significantly increase the final recovery factor of reservoirs, restore the well when other methods do not yield a positive result or technical implementation of the recovery is not possible and also reduce the number of projected wells for the infilling in the final stage of the developing.

Keywords: oil and gas fields, development of deposits, technical state of wells, drilling object.

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STRATIGRAPHIC POSITION OF OXFORDIAN DEPOSITS BIVALVE MOLLUSCS IN THE NORTH-WESTERN OUTSKIRTS OF DONBAS

In the north-western outskirts of Donbas, Upper Jurassic deposits consist mainly of various limestone of Oxfordian age. They have cropped out in the limestone quarries and gullies of the right bank of the river S. Donets. Outcrops of Kam'yanka village (Izyum district) and Protopopivka village (Balakleya district) of Kharkiv region are the most complete and informative. The lower (Callovian – Oxfordian) and the upper (Oxfordian – Kimmeridgian) boundaries of Oxfordian deposits can be traced in these outcrops.

Stratigraphical dismembering of Jurassic deposits is based upon cephalopods. Oxfordian deposits contain numerous remains of diverse fauna, including Bivalves mollusks, 103 species of which are defined and described monographically. Stratigraphic position of each pelecypod species is presented.

Close location of outcrops at Kam'yanka and Protopopivka villages gives the composite section of carbonate sediments of the Oxfordian deposits in the outskirts of Donbas. For the Upper Jurassic deposits, the location of the boundaries between different stratones remains unclear, differences relate to certain boundaries between substages and to the names and status of some stratones as well. The lifetime of the species of Pelecypoda is quite durable, so they are of little stratigraphic value.

A large number of different residues of bivalves, including ones in a good state of preservation, and the principle of faunal dissimilarity makes them convenient for morphofunctional, taphonomic, eco-ethological, dimensional, quantitative, paleobiogeochemical analysis, actualistic comparison and other types of analyzes, and therefore the physical reconstruction of geographical parameters of sea basins.

Keywords: Pelecypoda, Oxfordian deposits, north-western outskirts of Donbas, palaeontology, stratigraphy, palaeogeography.

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FORMATION OF LITHOFACIES PRECONDITIONS IN NEWLY FORMED TECHNOGENIC COLLECTORS LVIV-VOLYN COAL-GAS BASIN

The studies conducted have revealed possible litho-facies composition of the man-made reservoirs in the coal seams mined out within the gas-bearing Lviv-Volyn coal basin where sedimentary rocks of the Lower Carboniferous, Tournaisian, Viséan, Serpukhovian and lower part of Middle Carboniferous formations occur. They are represented by crushed shales, siltstones, sandstones, limestones and carbonaceous remains in the of the coal rock sequence.

Conglomerates and gravelstones make only 0.25% of coal-bearing formation to form thin (0.2-1.5, occasionally to 3-4 meters) lenses.

Gravel sandstones have a limited distribution, making lenses and interbeds of 0.5-1.5 m thick.

The sandstones are composed by fine-, medium- and coarse-grained types.

Siltstones are of dark gray color, often caused by clay and carbonaceous minerals.

The most typical shales are composed by finely dispersed material with silty admixture, limited carbonaceous and calcareous varieties. Their dark, mostly gray color is due to the presence of humus or sapropel material.

Limestones are grey, dark grey, sometimes with a brown tint; they are usually fine- or medium crystalline, often with re-crystallized areas.

Coal is mostly of humus type, the sapropel occurs occasionally in the form of interbeds, mainly in the top and bottom humic layers. Coal is dense, viscous, black and black and gray in color.

The core set of the coal rock massif taken from well #7427, located in the northern part of the Lubel coal field, is well represented in the geological section.

The upper alluvial-limnic-swampy-lagoonal coal-bearing sub-formation (middle part) consists of four litho-cycles of the higher order (first one is a lagoon-marine transgressive; the second one is a marine-lagoon regressive; the third one is an uniformly lagoonal, and fourth one is a lagoon-marine transgressive cycle) with one another of lower order, the open marine cycle.

Keywords: industrial collector, coal-gas basin, coal rock mass.

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CALCULATION FEATURES OF UNDERGROUND DRINKABLE WATER RESERVES IN OIL AND GAS INDUSTRY (ON THE EXAMPLE OF TIMOFIIVSKA, MASHIVSKA AND YABLUNIVSKA FIELDS)

In this article, authors provide a technique of geological and economic assessment of groundwater reserves in the oil and gas facilities on the example of Timofiivska, Mashivska and Yablunivska fields. We give a brief description of aquifers operation and their filtration properties, the qualitative composition of water. Some conclusions have been made about the complexity of the geological and hydrogeological conditions of deposit. The chosen method of reserves' calculation and staging of the work has been substantiated. Authors show the results of geophysical researches, outlook modes, experimental-filtration works and experimental-industrial development, which are calculated on the basis of hydrogeological parameters and performed categorization of operational stocks. A perennial positive forecast of chemical composition for a 25 years period has been given. The parameters of the permissible lowering of water for wells in comparison with the decrease achieved in steps by pumping tests and routine observations have been analyzed. The authors substantiate the hydrodynamic method of calculating the reserves of groundwater. The extent of the hydrogeological protection of aquifers and the possibility of a negative impact of oil and gas industry on the

quality of drinkable water has been described. It is proposed to use this technique as the best for the geological and economic evaluation of groundwater resources in the targeted industrial facilities.

Keywords: calculation of exploitational underground drinkable water resources, artesian well, water intake structure, field, mezhigorsko-obyhov groundwater aquifer, buchak groundwater aquifer, experimental-filtration works, experimental-industrial development.

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MICROFAUNAL COMPLEXES AND MICROFACIAL DESCRIPTION OF THE LATE VISEAN CARBONATE ROCKS OF THE SOUTH DONETS BASIN

A detailed study on the microfacies and microfossils of the Upper Viséan carbonate rocks exposed in the South Donets Basin (the Mokra Volnovakha and Calmius rivers) were conducted. The studied material included limestone samples collected from the sections of the Donetsk Suite (the upper part of the Mokra-volnovakha Series) stratotypical area. Special attention in the microscopic study was given to microfauna (foraminifera) and algoflora since foraminifera and algae associations primarily reflect the environments and sedimentation conditions. Two distinguished microfaunal complexes correspond with two subdivisions of the Donetsk Suite. The lower complex included foraminifera *Globoendothyra globula*, *Vissariotaxis exilis*,

Vissariotaxis compressa longa, *Endothyranopsis compressa*. Foraminifera from the upper complex are *Howchinia*, *Omphalotis omphalota*, *Bradyina*, *Palaeotextulariidae*, *Loeblichia*, *Eostaffella ikensis*, *Eostaffella proikensis*, *Archaeodiscus gigas*, *Endotiranopsis crassa*. Correspondingly to Dunham classification were recognized nine carbonate microfacies of limestone. The identified microfacies are bioclastic grainstone, foraminiferal grainstone, oolitic grainstone with bioclasts, foraminifera-algae grainstone, bioclastic packstone, foraminiferal packstone, microbial peloidal packstone, wackstone/packstone and packstone/grainstone. The recognized microfacies associations were correlated with standart microfacies associations (SMA) which were suggested by Wilson and Flügel. This shows that the studied rocks were deposited within the shallow marine environment of the carbonate platform zone. The alternation in sections of the identified facies types reflects cyclic changes of the paleobasin level. Similar conditions are typical for carbonate sedimentation of North of West Europe, Caspian region and Iran carbonate platforms, where Mississippian deposits are composed mainly of carbonate rocks.

Keywords: Late Visean, Donetsk Suite, carbonate rocks, microfacies, microfaunal complexes, foraminifera, carbonate platform, Donets basin.

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TURON NANNOPLANKTON BIOSTRATIGRAPHY OF NORTH-WESTERN DONBASS

A Turonian stage in north-western Donbass is composed of homogeneous chalk and chalk-like marl, in which there are no remains of macrofossils. Several sections of Kharkiv region have been studied.

To show chalk monoliths textures were impregnated with machine oil. Four types of textures were established: numerous cracks, traces of mud-eaters, spotted texture, stains of ferrugination. Three packets were identified (bottom-up): chalky breccias, chalk with interbedded clay and flintstone, chalk with moves of mud-eaters and the remnants of the shells *Inoceramus*.

In the studied range (upper Cenomanian - lower Cognacian) 51 species of calcareous nannoplankton were established. In the nannocomplexes of Turonian north-western Donbass no dominant taxa were found. They were numerous in the southern sections *Watznaueria*, *Cyclagelosphaera*, *Retecapsa*, *Zeughrabdotus*, *Microrhabdulus*, and in the studied deposits they were found in small quantities. But such species as *Kamptnerius magnificus*, *Manivela pentatomidae*, *Quadrum gartneri*, *Gartnerago* spp., are becoming more numerous.

In the lower Turonian zone UC6, UC7; on middle Turonian zone UC8; in the upper Turonian subzone UC9a+b were identified. Boundary of Turonian and Coniacian in sole subzone UC9c conducted. Also, the lower zone of Cognacian UC10 has been installed.

Regional break on the boundary of the lower and middle Turonian not one but a series of closely spaced unconformities were presented. This is due to the non-accumulation of sediment or flushing.

Keywords: calcareous nannoplankton, Turonian, biostratigraphy, north-western Donbass, lithology, ichnites, textures, chalk.

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EVALUATION OF UNDERGROUND DRINKING WATER QUALITY IN CENOMANIAN-LOWER CRETACEOUS AQUIFER COMPLEX IN KHARKIV REGION

The article examined the problem of providing the population of Ukraine with quality underground drinking water. We give general projected groundwater resource in Ukraine. Average supply of forecast resources and production reserves of groundwater per capita has been examined and the place of Kharkiv region among the regions of Ukraine has been shown. The specified area of Kharkiv region has the highest rates of forecast resources. We present the main groundwater aquifers used for water supply within centralized Kharkiv region. The article analyzes the qualitative composition of underground drinking water in the aquifer of Cenomanian-Lower Cretaceous sediments in the water intakes of Kharkiv region. A comparative analysis was made as to the values of the chemical composition indicators of the groundwater aquifer complex Cenomanian-Lower Cretaceous deposits in the period of production intakes with regulations GosSanPiN 383-97 "Drinking Water". Dunn's assessment of macro and micro component in groundwater is under existing water intakes. The chemical composition of underground drinking water within the main fields of Kharkiv region with confirmed reserves of underground water intakes are exploited on groundwater aquifer Cenomanian-Lower Cretaceous sediments. The conclusion regarding the prospects of using underground drinking water is to supply the population with this water that is more qualitative and protected from pollution than surface waters. Today the use of groundwater of Kharkiv region is only 4% of total resources.

Keywords: underground drinking water quality composition, Cenomanian-Lower Cretaceous aquifer system, indicators of chemical composition, groundwater deposits, withdrawals, macro- and micro component composition, Kharkiv region.

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THE PROSPECTS OF OIL AND GAS CONTENT OF THE SINIAN SYSTEM OF THE SICHUAN BASIN OF CHINA

In the article an evaluation of the prospects of oil and gas content of the Sinian system of the Sichuan Basin is given. Two large sedimentary basins in China – the Sichuan Basin in the south and the Tarim Basin in the west are of particular interest. These two basins which include thick mass of shale rich in organic substances cover vast areas and have good reservoir properties for development. An analysis of the importance of previous researches regarding the prospects of this territory with respect to oil and gas content was carried out. In recent years a comprehensive analysis of facies sediments of the Sinian system, the oil-source rock and an analysis of the conditions of the accumulation of oil and gas were conducted in this respect. Conse-

quently, four favourable exploratory promising areas were chosen in an optimal way, including the area of the paleoledge Leshan-Lunnyuisy which is a favourable promising exploratory area of the Sinian system of the Sichuan Basin. As a result of an analysis of the oil and gas content of the Sichuan Basin it was determined that 3 large paleoedges are being developed there: the paleoledge Leshan-Lunnyuisy of the Caledonian period, the paleoledge Luzhou of the Indo-Chinese period and the paleoledge Kaijiang of the Indo-Chinese period. These 3 paleoedges are of great importance for the oil and gas accumulation in the Sichuan Basin. In 90% of areas in the central part of the basin mainly limited platform facies represented by subfacies of internal platform banks and subfacies of dolomitic plateaus are developed.

As a result of the research it was determined that the Sinian system of the Sichuan Basin has the main basic conditions for the formation of large gas fields. A large hereditary paleoledge ensures the conditions for the formation and accumulation of oil and gas of the Sinian system. Persistent sediments in the area laid a foundation for large-scale development of the structure of reservoirs and cap rock and also the oil-source rock.

Keywords: prospects of oil and gas content, China, Sichuan Basin, Sinian system, producing horizons, oil-generating formation, exploratory wells, promising areas, reservoir properties of the rock, structural traps.

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GEOCHEMICAL CRITERIA IN PROSPECTING FOR HYDROCARBONS IN THE EAST OF THE DNIEPER-DONETS DEPRESSION

The article has reviewed hydrocarbon geochemical prospecting criteria in the east of Dnieper-Donets depression among which gas-, hydro-, litho-geochemical and biogeochemical methods are distinguished. These criteria are based on identification of oil and gas halos scattering components and specific associations of items-indicators that show possible presence of oil and gas bowels of the earth.

Natural spatial coincidence of geochemical halos scattering (litho, hydro and atmogeochemical anomalies) in zones of hydrothermal mineralization in rocks with hydrocarbon geochemical anomalies has been discovered. This occurs in the zones of modern thermomasstransferring on fluid dynamically open areas of regional deep faults within anticlinal structures.

During the search for hydrocarbons in the east of DDD contrasting gas geochemical and hydrogeochemical anomalies of deep accumulations of oil and gas have been revealed. They can be formed in overlain sequences regardless of lithological features and rock complexes. This phenomenon is characteristic of neotectonic activation areas and high intensity thermal field, where due to increased energy potential in the rock mass upward migration of fluids is enhanced.

Another indicator of gas and oil accumulates are specific hydrocarbon formations of gas geochemical schemes and hydrogeochemical zoning and hypsometric position of the upper limit of "methane zone."

It has been established that one of the most important search criteria of gas and oil accumulations is space-time correlation and the formation of hydrocarbon and hydrothermal minerals accumulations. If the hydrothermal mineralization in rocks of a geological structure is younger than processes of gas and oil accumulation, prospecting for hydrocarbon deposits in its depths is almost hopeless.

Keywords: Hydrocarbons, geochemical methods, hydrothermal mineralization, petroleum potential, Dnieper-Donetsk basin.

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PATTERN FORMATION OF SALT CONTENT OF NATURAL WATERS IN ACTIVE WATER EXCHANGE ZONE IN UKRAINE

There is a new look offered by the concept of "water zone of active water exchange" as the water flows down from the continents to the oceans. This allows you to uniquely identify its quantitative and qualitative characteristics. Similarly, the term "water zone of active water exchange on land area" is proposed and defined as the total river flow from this area, which includes the flow of atmospheric, surface and groundwater. A general pattern of the formation of the salt composition in the river and underground freshwater of a terrestrial land is considered. A comparison with the standards for drinking water leads to the conclusion that the objective average weighted composition of the water zone of active water exchange of surface and underground is physiologically full for the content of dissolved salt components in the range of total mineralization from 0,1 to 0,6 g/dm³. Living beings are evolutionarily adapted to such water. In this regard, the author raises the question of the need to expand the list of indicators of physiological usefulness of drinking water in addition to the nine indicators regulated by the operating rules of Ukraine – DerzhSaNPiN 2.2.4-171-10. First of all, it is necessary to do this for biophilic microelements, the minimum content of which in drinking water can usefully be measured based on their content in natural waters indicated mineralization. It is shown that the patterns of formation of the salt composition of natural waters in active water exchange zone of the Earth's land and territory of Ukraine are similar. On the basis of long-term hydrological observations it is calculated that the average composition of the water flowing from the territory of Ukraine meets sulfate-hydrocarbonate mixed cationic composition of fresh water with mineralization of 0.45 g/dm³ and is nearly identical to the estimated average composition of water of the same mineralized zone of active water exchange of terrestrial land in general.

Keywords: ionic composition of the water, the water zone of active water exchange, the formation of the composition of the water, quality standards for drinking water, river flow, groundwater flow.

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TOURIST IMAGE OF SUMY REGION (BASED ON SOCIOLOGICAL RESEARCH)

Topical issue in tourism development of Sumy region is the problem of tourist image formation as a source of regional competitiveness.

The purpose of the article was to determine the tourist attractiveness of Sumy region as the result of the poll, which was attended by residents of different regions of Ukraine. It was found out that of about 3,000 respondents only 20% visited Sumy region with the purpose of tourism. The most visited areas are Sumy, Akhtyrka, Konotop, Trostyanets and Putivl. Promising types of tourism in the Sumy region is guided tourism, water, religious and rural tourism.

Sumy region, according to respondents, in general, is attractive to tourists, and the main problems of tourism development are: insufficient funding for tourism, low availability of tourist infrastructure, poor road surfaces in the region, lack of advertising of tourist facilities and so on.

Most of these problems, unfortunately, are systemic in nature and are inherent in most regions of the country. At the regional level, local authorities should pay attention to providing more information on tourist resources of Sumy region, as well as the availability of such information for most population.

In addressing issues Sumy region has prospects for being a competitive region on the tourist market of Ukraine.

Keywords: tourist attraction, tourist image, Sumy region, sociological research.

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IMPORTANT DETERMINANT TERRITORIAL ORGANIZATION OF THE HOTEL INDUSTRY IN LVIV REGION IS URBANIZATION

The aim of this article is to analyze the features of the territorial organization of the hotel industry in L'viv Region with the impact of such factor as urbanization. Territorial organization of the hotel industry is dependent on the systems of settling.

This article explores the impact of urbanization on the territorial organization of the hotel industry attractive for tourism in Lviv region. Application one of mathematical methods in the study confirms the direct impact of the territorial concentration of population in cities on the location of accommodation facilities. However, the observed impact of urbanization and poor geography companies hotel industry in major cities and peripheral districts.

The places with the biggest demand for the accommodation services are big cities and recreational-tourist destinations. The tendencies of the allocation of the hotel complexes are highlighted. Functions of the hotels greatly influence their allocation in the planning structure of the city.

As the result of the conducted centro-graphic analysis the inter-impact of the urbanization level and geography of the accommodation sites was revealed. In L'viv region the mono-centric L'viv agglomeration was formed and multi-centric Drohobych and Truskavets agglomeration is being formed.

The rational allocation of the chain of hotels provides comfort for people and enhance the effectiveness of the enterprises.

Keywords: hotel industry, territorial organization, accommodation facilities, urbanization, mathematical method.

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UKRAINIAN DIASPORA IN TRANSCAUCASIAN REGION: DYNAMICS OF NUMBER, FEATURES OF RESETTLEMENT

The article analyzes the causes of creation, dynamics of population and characteristics of settlement of the Ukrainian diaspora in Armenia, Azerbaijan and Georgia.

The results of population census in Armenia, Azerbaijan and Georgia at the beginning of 2010s are the informational base of research. The number of the Ukrainian diaspora is established according to ethnic criteria in programs of censuses. According to the results of population censuses it was established that from the end of 80th years of XX century the Ukrainian diaspora had significantly decreased. Thus, in the structure of the Ukrainian diaspora the share of region increased by more than half: from 0.95% (in 1989) to 0.41 (XXI cen.). The average annual number decrease of the Ukrainian diaspora is higher in comparison with the countries of the former Soviet Union. The Ukrainian diaspora in the region is highly urbanized, the Ukrainians mainly living in the capital. Such settlement of the Ukrainian diaspora causes reasons of its appearance; the Ukrainians and the Russians constituted the so-called "Technological elite" and concentrated in large industrial and research centers in these countries. At the present stage of urbanization the Ukrainian diaspora seek work in cities, study and so on.

It is noted that the Ukrainian diaspora live in complicated ethnic, linguistic and religious environments, that lead to isolation of the Ukrainian diaspora. Thus, it can be argued that the Ukrainian diasporas in this region form the hub of the diaspora. However, on the basis of differences with ethnos title the Ukrainians integrate in the more numerous environment of the Russian diaspora. The collapse of the Soviet Union has led to significant geopolitical changes in the region, embodied in military conflicts, the decline of the economy and as a result re-emigration to Ukraine or other countries.

Keywords: assimilation, diaspora node, immigration, integration, census title ethnos, Ukrainian diaspora, the share of Ukrainian.

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SPATIAL GROUPING OF THE POPULATION TRADE SERVICE OBJECTS IN KHARKIV REGION

The article analyzes spatial and temporal aspects of the population trade service development in Kharkiv region using cluster analysis. The definition of cluster analysis is given to be a method of the multi-dimensional classification of objects for defining groups of objects having similarity by certain features and differing from each other. For the clusters joining the Ward's method was selected based on the analysis of variance, and the Euclidian distance was chosen to define the measure of cluster similarity. For the research implementation 123 indicators were selected characterizing trade activity and restaurant business institutions per 2007-2013 by districts and cities of regional subordination. Based on the results of cluster the analysis of grouping was conducted separately for districts and cities of regional subordination per each year of the studied period. Four groups of districts were identified in 2013. These groups are selected based on a number of trade objects, population, urbanization level. During 2007-2013 Kharkiv and a number of depressive, rural districts were not changing their place in groups, other ones were moved from one group into another one during the different years. The districts were identified to be the most unique (Kharkivsky, Dergachivsky, Chuguyvsky districts) and the most associated (Shevchekivsky, Barvinkivsky, Bluznukivsky districts).

Keywords: trade service, retail trade, cluster analysis, Ward's method, Euclidian distance, social infrastructure, associating, uniqueness.

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AGROLANDSCAPES OF THE MIDDLE POBUZHCHYA: MODERN CONDITIONS AND PROBLEMS OF THE USE

The wide-ranging extensive land use, excessive plowing of territories without their taking into account the landscape features, the saturation of crop rotation by cultivated crops, lack of organic manure and other adverse factors have led to the development of soil erosion and degradation of agricultural landscapes. The

landscapes of the Middle Pobuzhzhya are the most eroded in Vinnytsya region because the northern region's soils are the most generous. But now they have 6 - 8% less organic matter than their natural analogues. One of the first anthropogenic pressures was experienced by the floodplains. The fertile floodplain provides a rich harvest, therefore they are ploughed and heavily used. The prolonged economic development and natural floodplain of natural resources has led to the complete replacement of natural landscapes by man-made. According to the scientists, it is the transfer of arable land in layers that ensure their protection and preservation for future generations. The perennial grasses protect the soil from erosion better. The organization of agriculture on the basis of landscape involves the study and consideration of natural and anthropogenic resources of a certain territory and its differentiation by lands soil - landscape, hydro- logical and other conditions. Practical implementation of environmentally sustainable land use will only be possible after the creation of an appropriate legislative framework. There are some requirements for immediate adoption in the new edition of the law on payment for land, money and their growth of class assessment, the withdrawal of dangerous erosion of arable land and degraded lands, protection of soil and the corresponding state program that will determine the sources of financing of these measures.

Keywords: Middle Pobuzhzhya, agricultural production, phytosanitary state, dehumification of soils, mono culture, erosion, culture of agriculture, landscapes.

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ANALYSIS OF TERRITORIAL RESOURCES IN TERRITORIAL PLANNING AND ADMINISTRATIVE REGIONALIZATION PRACTICE

The key elements of management practices on the use of their territories are planning, administrative regionalization and the formation of a regional development strategy. The article shows the features of territorial resources analysis, territory integral potential as guidelines for the schemes development of territorial planning regions, strategy of regional development, administrative regionalization. Specific social and geographical characteristics and features of using the territory as a resource have been analyzed: 1) a geospatial base area of human activity, localization of all kinds of natural resources and space for the resettlement of the population and placement of any kinds of business people; 2) any component-sectoral environmental spatially coordinated, should necessarily be bound to a specific area to specific places, locations habitats; 3) assessment area determines the presence of four major characteristics: resource potential location area; the potential of natural and socioeconomic resources of the territory; capacity-building areas for settlement and major types of economic activity; capacity-building area depending on the level of economic development and land use intensity. The author determined the analysis problems of existing environmental management in the region, suggested the options for compatibility and incompatibility analysis of various nature types at the regional level (Kherson region as an example). General distribution levels of regionalization – one-factor (one-component), multi-factors (multi-functional), complex (integrated) regions in the theory and practice of administrative regionalization have been proposed: 1) higher levels of regions were viewed as comprehensive (integral) territorial units with a characteristic combination of key factors of territorial regionalization - historical and geographic, natural geographic, geo-economic, geopolitical; 2) average levels of regions were mainly seen as territorial units that include an original set of features (regionalization criterion should be functional zoning of the country that determines the most efficient and economic use of appropriate specialization); 3) lower levels of regionalization in most cases is the one-component, micro regions are distinguished by characteristics that determine their function in economic complex of mezoregions. It has been proved that the distinction between historical and geographical regions is a strong Ukrainian factor in favor of its regionalization, understanding them as the most integrated formation of the country's regionalization higher levels.

Keywords: territory, territorial resources, regional development, environmental management, territorial planning, administrative regionalization.

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STATISTICAL PARAMETERS OF THE ENERGY CHARACTERISTICS OF BLOCKING ANTICYCLONES

Results obtained in the paper rely on the use of classical and modern methods of energetic properties research in weather scale storms on the basis of standard hydrometeorological databases. First of all, it allowed to improve scientific comprehension of dynamic processes which take place during interaction of blocking anticyclone and cyclone. Blocking as a large-scale steady atmospheric process is a main reason of weather anomalies existing at weekly and seasonal time scales. On the other hand, through a comparatively long period of evolution of the blocking anticyclone, the comprehension can allow to improve the medium range and long range weather forecast, especially, forecast of the extreme weather events, related to the process of blocking, such as droughts, heat waves, anticyclone periphery thundershowers etc. It is very interesting to study these processes in view of medium and long-term weather forecasts, atmospheric processes modelling and climate monitoring. There are presently a large number of papers considering climatic features of atmospheric blocking. However, the methodological differences in methods of blocking processes detection, lack of common methods, and differences in the length of studied periods make difficulties for a climatic general-

ization of blockings. This article aims, on the one hand, to review the existing methods suitable for the recognition of blocking processes and, on the other hand, to offer an approach which uses the dynamic nature of blocking as basis.

Keywords: blocking anticyclones, energy of atmosphere, available potential energy, kinetic energy.

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INNOVATIVE-INVESTMENT ACTIVITY IN KHARKIV REGION AS A FORM OF ITS POTENTIAL REALIZATION

Focusing on Kharkiv region as the whole, nine main cluster structures that have the potential to develop have been identified. A number of industrial enterprises engaged in innovative activity in 2013 in Kharkov region have the highest value among the regions of Ukraine. In percentage share of enterprises engaged in innovative activities amounted to 23.2% in 2013. Innovation and investment infrastructure of Kharkiv region includes about half a dozen of independent organizations and several dozens of specialized units that are part of the scientific and industrial organizations and enterprises. In the territorial structure of innovation and investment activity in Kharkov region there are only two technologic parks and business incubators, free industrial zones, innovative clusters exist only in the long term. The structure of the work volume performed on their own enterprises in Kharkov region differs from the structure in Ukraine, because of predominance of the scientific and technical developments. Feature of financing innovation in Kharkiv region is the high share of financing enterprises' own funds. Grouping of certain economic activities for innovative activity has showed that the most similar in terms of innovation and investment industries are engaged in wood pro-

cessing and metallurgy. Food, rubber and plastics industries are industries that make a significant number of innovation active enterprises, significant amounts of expenditure on innovation and private innovation visible results that are first in sales volumes of innovative products. It should be noted that food industry has significant investment attractiveness (given the quick return of products and provision of domestic raw materials). Among the regions of Ukraine Kharkiv region has a high level of innovation and investment potential, its implementation requires rational investment, updating of capital, financial restructuring and investment areas and other factors promoting the investment climate in the industry.

Keywords: investment, innovation, innovation and investment potential, innovation and investment infrastructure, cluster analysis.

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HISTORY OF SUSTAINABLE DEVELOPMENT STRATEGIES CREATION AND THEIR CLASSIFICATION

Sustainable development is an approach that meets the needs of the present without compromising the ability of future generations to meet their own needs. The history of sustainable development began in 1972, when The United Nations Conference on the Human Environment took place. In 1992 the United Nations Organization recommended that each country introduced its own national sustainable development strategy (NSDS). Since that time many countries have created and implemented their strategies.

The authors emphasize 4 stages in the history of sustainable development strategies creation for the period 1972-2015: the stage of creating sustainable development concept (1972-1992), the stage of primary sustainable development strategies creation (1992-1997), the stage of mass sustainable development strategies creation (1997-2005), the stage of sustainable development strategies revision in the developed countries and strategies creation in the developing countries (2005-2015). It can be assumed that the world countries' interest in creation and implementation of sustainable development strategies will only increase in the future.

Sustainable development strategies can be classified according to the territorial scope (supranational, national, regional strategies), the structure (frame strategies, action plans and mixed strategies) and the approach to the planning process (comprehensive, multi-dimensional strategies; cross-sectoral strategies relating to specific dimensions of sustainable development; sectoral strategies; strategies integrated into existing national development strategies).

Keywords: sustainable development, strategy, history, classification of sustainable development strategies, providing for sustainable development.

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CHANGES OF TEMPERATURE REGIME IN THE TERRITORY OF KHARKIV REGION

The results of changes in air temperature at meteorological stations in Kharkiv region within year and seasons during 2001-2013 have been studied. It is shown, that climatic changes of air temperature parameters in the cities are higher than regional ones. Global warming is characterized by air temperature increasing near the earth surface and is the main line of climate of the 20th - 21 centuries. As a result of the analysis it was defined that for the last decade of the 20th century the number of the abnormal atmospheric phenomena had increased. The authors assume that with air temperature augmentation, there will be changes in atmospheric precipitation mode, air temperatures, sea level that will lead to serious consequences. On the example of Kharkiv region it has been defined that air temperature at meteorological stations grew during 2001-2013. In recent years abnormally high air temperatures have been recorded both in the winter, and in the summer. The augmentation of air temperature amplitude on the territories of Kharkiv region can be considered as the sign of continentality. It is set that the most influence of the urbanized processes on the territorial climatic terms appears in the increase of air temperature. Its tendency depends on the regional territorial structure, thermophysical properties of surfaces. Different atmospheric processes above outskirts territories are determined by weather terms conditioned by the radiation mode. The most contrasts of air temperatures appear in clear weather terms. Difference in the values of maximal and minimal air temperatures is becoming less obvious.

Keywords: temperature regimen, air temperature, climatic norm, tendency, global warming, climate change, regional temperature.

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SOCIAL AND GEOGRAPHIC ASPECTS IN THE RESEARCH OF AGRIBUSINESS TERRITORIAL ORGANIZATION

During Soviet times, the territorial system of agribusiness (agrarian and industrial complex) consisted of large state agricultural and processing companies, agricultural associations. The main integrators and system-forming units at that time were processing plants. In modern terms integrators are not only and not so much processing enterprises as investment companies, large farms with their own processing base and integrated formation that accumulate different stages of agricultural production. Modern agriculture development is characterized by diverse forms of ownership and economic structure shapes farms also as particularly important departure from traditional sectoral management to complex territorial and functional principle of functioning and development.

The article proposes a scheme of territorial and functional structure of agriculture, the basis of which we combined as consolidated taxonomy forms of territorial organization and levels of territorial organization. By levels of territorial organization of agribusiness we identify the national level – within the state; regional – the level of the oblast, region; sub-regional – level large parts of the region (seaside of Kherson region); mezo-regional – the level of administrative units, including city councils; micro-regional – within town and village councils and local – within certain villages. In some cases, the presence information database can be continued differentiation territorial levels to a point level – based on individual businesses and business units.

The forms of territorial organization include: specialized agricultural areas (zones, districts, sub-districts, areas), agro-industrial system (APS) and agro-industrial clusters. APS is formed based on a type of agro-industrial integration, according to form following systems: agricultural (without specialization); agrarian and industrial, agrarian and financial system. In the formation of any system the main role belongs to the existing links between the main elements (subsystems). By these we mean: organizational and economic relations (organizational, managerial, marketing, agri-service) and technological ties.

A new phenomenon in the structure of AIC (primarily within regional AIC) is an agro-industrial clusters. An agricultural cluster is understood by us as a combination of different spatial orientation of the sector companies, organizations and institutions that may be involved in the agro-industrial production and located

in geographical proximity to each other. Among them are: agriculture, processing enterprises, research and educational institutions, market infrastructure, etc.

Keywords: agribusiness (agrarian and industrial complex), territorial organization, agribusiness integration, agrarian cluster, development, structural changes.

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GEODEMOGRAPHIC FORECAST OF KHARKIV REGION (USING THE EXTRAPOLATION METHOD)

Demographic forecast is the necessary precondition for elaboration and implementation of programs of social and economic direction, social infrastructure development, increase in the level and quality of population life, competitiveness and investment attractiveness.

Kharkiv region's population decreased by 360 thousand people during 1995-2013, it corresponded to the state trend. The population dynamics corresponds to the linear trend for the general population of Kharkiv region, so the extrapolation method application is expedient.

Extrapolation methods application for the future population estimation is based on assumption that identified births, death trends will be unchanged during the predictable period of time. The population data base for 15 previous years was constructed for a 5 year - forecast, a coincidence to the linear distribution was confirmed. The population forecast (in general and separately for male and female population) till 2020 for the region and districts' population was developed based on the initial data (population in 2001-2014). The approximation value for the whole population is high (0.96), therefore the forecast is reliable. Besides general number of population the pessimistic and optimistic values were determined by means of standard deviation calculation. The developed forecasts for all districts of Kharkiv region, according to our calculations, can be divided into 3 groups by the value of approximation reliability: districts with the low level of the approximation value ($R^2 < 0,8$) – this includes 2 districts: Kharkivsky and Dergachivsky; districts with the high level of the approximation value ($0,8 < R^2 < 0,97$) – most districts; districts with the very high level of the approximation value ($R^2 > 0,97$) – this is Pechenizsky, Pervomaysky, Lozivsky, Kup'ansky, Krasnogradsky, Kolomaksky, Kegichivsky, Izumsky, Borivsky, Barvinkivsky.

According to the calculated data, if the trends of the population decrease continues, it is necessary to apply measures of demographic policy to improve the demographic situation and approximate optimistic values of the population.

Keywords: Kharkiv region population, demographic situation, demographic development, geodemographic forecast, extrapolation method.

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TOURIST BRANDING PROJECT OF KHARKIV REGION DISTRICTS: ETHNO-CULTURAL ASPECT

Ethno-cultural peculiarities of particular area residents play an important role in the development of tourism. Ethnic heritage of Eastern Ukraine is of particular interest. Due to the development of tourism in Eastern Ukraine an urgent issue in creating brand of Kharkiv region as a whole and its separate parts has appeared. Each Kharkiv region district, undoubtedly, has interesting features that could be used in tourism industry development.

The purpose of the study it is to analyze ethno-cultural tourism resources and tourism brands to determine districts of Kharkiv region.

The article describes the main resources of the ethnic and cultural tourism, their classification according to the internal structure. A group of single ethno-cultural resources, including legends, songs, dances, place names and others has been determined as well as complex ethnic and cultural resources, including language, religion and beliefs, traditions, local cuisine, etc. It analyzes the activities of organizations involved in supporting development of ethnic and cultural tourism in Kharkiv regions and the city of Kharkiv. Ethnocultural characteristics of Kharkiv region districts have been analyzed. Event-defined resources, objects or places associated with the activity of well-known etnofors may become tourist brand districts of Kharkiv region.

Among the districts of Kharkiv region there are presumed territorial brands associated with monuments and places where well-known etnofors lived or worked. A large number of brands belonging to groups of festivals, fairs and historical monuments have been studied.

Ethnocultural tourism potential in Kharkiv region is significant and diverse, but the actual practice of the local representatives of the tourist business is still focused on the stereotypical types of services and the direction of travels.

Keywords: tourism development, ethno-cultural tourism, districts of Kharkiv region, Kharkiv city, brand of district.

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ECOLOGY

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**ASSESSMENT OF IMPACT OF RIVNO NPP ON THE RADIOECOLOGICAL CONDITIONS
OF THE STYR RIVER IN TRANSBOUNDARY CONTEXT**

The problem of tritium contamination of the Styr River as a result of RNPP operation has been considered in this article. Rivno nuclear power plant does not have its own cooling pond, so it discharges debalance waters directly into the Styr, which can lead to changes in the radioecological condition of the river. Debalance waters contain a wide range of radionuclides, such as ^3H , ^{137}Cs , ^{134}Cs , ^{60}Co , ^{54}Mn , ^{60}Sr , etc. Tritium radionuclide (^3H) is especially interesting for the study, as it is not delayed by water purification systems on the station and therefore with debalance waters gets to the Styr River.

In 2010 in the Styr river volume activity of tritium ranged from 6.7 Bq/l to 11.4 Bq/l. The content of ^3H in the river varies depending on the time of year, as well as non-uniformity of radionuclide discharges from RNPP during the year. The maximum content of tritium in the Styr was recorded in March 1993, when the volumetric activity of the nuclide was 6 610 Bq/l, which may indicate the alarm discharge of tritium from RNPP. Considering water consumption, we can assume that downstream the dilution of the discharge is approximately 130 times. With this discharge the activity of tritium will exceed 50 Bq/l. In case of normal operation of NPP 2 times increase in background activities of tritium should be expected at the border with Belorussia.

Keywords: transboundary impact, tritium volume activity, nuclear power plant, radionuclides.

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RESEARCH OF THE CHARACTERISTICS OF HEAVY AND RARE METALS MIGRATION IN THE SOIL IN THE ZONE OF THE SLAG WASTE OF COAL-FIRED THERMAL POWER PLANTS IN UKRAINE

The article describes the characteristics of heavy and rare metals migration in the soil in the zone of the slag waste of coal-fired thermal power plants in Ukraine. Different types of fuel in Ukraine were analysed by the method of statistical information. The principles of slag waste treatment in the European Union have been studied. Approaches to ash waste in the United States, Ukraine and Russia have been compared. It has been determined that to use slag waste as a source of valuable components, we need to know their chemical and mineralogical composition phase. It has been revealed that they are determined by the mineral composition of the fuel source and method of burning it. Basic properties of solid slag wastes from thermal power plants, the ways of heavy compounds and rare metals migration in soils in the areas, where slag waste forms, have been analyzed as a result of original research. Different types of the absorptive capacity of the soil have been identified and the main migration routes of compounds and heavy metals from the waste heap of rare slag waste into the soil have been described. Information on the chemical and mineralogical composition of slag waste should be taken into account with the view of considering them as enriched raw materials for various industries. As a result of using blast furnace slag, fuel ash waste and coal waste are considered as man-made materials that can be used as additives and fillers in the production of a wide range of building materials: cement, concrete, mortar, brick, ceramics and so on. They have proved themselves during installation in the subgrade of roads and other industries.

Keywords: waste of solid propellant thermal power plants, slag, migration of elements in soils, heavy and rare metals, solid fuel, coal.

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THE USE OF PETROCHEMICAL WASTE IN CEMENT PRODUCTION

Use of waste from processing of gas condensate in production of cement is one of the directions to increase the production efficiency, to decrease the amount of material - and power consumption. Besides, it is recycling of the gas industry, reduction in costs of dumps and stores of waste construction, preservation of land grounds, decrease in air basin pollution. All this will allow to solve a very important environmental problem of industrial regions of Ukraine.

As a working hypothesis we can assume that when heating waste of gas processing, interaction reactions begin between mineral and organic components of waste, products of the reaction intensify the effect from this reaction of calcium carbonate decomposition creating conditions for the course of reactions of two-calcic silicate formation at lower temperatures, than in usual technology.

On the basis of the conducted pilot studies the following conclusions are drawn: waste of gas processing are raw materials which mineral component is presented generally by NaCl, Fe₂O₃, SiO₂, CaMg(SiO₃)₂ and

CaSO₄, and the organic part of waste is presented by solid components of oil products that burn at temperatures up to 600 °C.

It is established that waste of gas processing can be used as one of components of raw mix of Portland cement.

It has been established by the conducted research that addition of 5% of solid slime of gas condensate processing to the Portland cement improves its best physicomechanical properties. Besides, the temperature of roasting clinker of such cement is 1200 °C, unlike Portland cement clinker without additive (1400 °C.).

Keywords: industry, waste, Portland cement, kiln, technology, properties, intensifier, energy saving.

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THE INNOVATION POTENTIAL OF THE EARTH SCIENCES IN THE HIGHER GEOGRAPHICAL AND ENVIRONMENTAL EDUCATION

Training at geographical departments in universities begins with a course on "Earth science". Its object of study is a holistic self-organizing natural system – landscape geosphere, which is the global environment of human society. In the formation of ideas about the landscape geosphere a large contribution was made by B. Varenius, A. Humboldt, K. Ritter, P. I. Brounov, A. N. Krasnov, V. I. Vernadsky, A. A. Grigoriev. Modern understanding of earth sciences, as the science of landscape geosphere, is associated with S. V. Kalesnik (40-50-ies of XX century).

A new stage in the development of Geosciences began in the 70-ies, when the use of space vehicles, research vessels and polar stations intensified the study of the Earth's surface, especially oceans and polar regions.

The main task of the earth science is to give a holistic view of the shell surface of the globe on the basis of modern ideas of self-organization of the earth's systems. The training course includes the following topics: 1. Sources of knowledge and methods of the Geosciences. 2. The Earth in Space. 3. The composition and structure of the landscape geosphere. 4. Dynamics of the landscape sphere. 5. Development of the landscape sphere. 6. People in a landscape geosphere. 7 Global change. Earth science and noosphere's development.

The course focuses on respect for earth's nature, demonstrates the dangers of careless destruction of delicate mechanisms of geosystem connections. In some respects, the Earth science discharges the functions of natural philosophy, laying in the minds of students skills of understanding the nature of the earth's surface as an integral part of the evolving Cosmos. The course fulfills the philosophical, natural-scientific and socio-humanistic functions:

- philosophical: Earth is our common home — is a complex self-organizing system, established and functioning according to its own laws; violation of these laws is fraught with the destruction of the system;

- natural science: the revelation of the totality interactions of physical, chemical, biological and geological processes, their integration with the processes of formation and functioning of human society, a description of the processes of integration objects, diverse in space - time and substance and energy characteristics;

- socio-humanistic: to contribute through knowledge of the basic regularities of structure and functioning of the landscape sphere to preserve and improve the living conditions of mankind.

Earth science serves as methodological basis of component courses: geomorphology, climatology and meteorology, hydrology, oceanography, soil science, biogeography.

It gives the possibility to consider these subjects, first, from the point of view of understanding close interactions of all parts of the earth's surface, secondly, understanding of geosystems as self-developing sites where insufficient use of simple causal relations need analysis of circular interactions with positive and negative feedbacks. This, in turn, poses a challenge to improving geographical and environmental education through the development of mathematical apparatus of synergetics. Training course leads geographers to use mathematical modeling and GIS technologies, understanding the laws of self-organization of the earth's systems.

Keywords: earth science, landscape geosphere, geographical education, self-organization of geosystems, global changes, structure, dynamics and development of landscape geosphere, self-organization geosystems, humanity in the landscape geosphere, global changes.

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