

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/364308743>

# HISTORICAL DEVELOPMENT OF THE TERRITORY OF SOUTHERN UKRAINE IN THE EARLY AND MIDDLE MESOZOIC

Conference Paper · September 2022

CITATIONS

0

READS

16

3 authors, including:



**Leonid Yakushyn**

IGS NAS Ukraine

10 PUBLICATIONS 5 CITATIONS

[SEE PROFILE](#)



**Olena Shevchuk**

Stockholm University

100 PUBLICATIONS 66 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



КРЕЙДОВА СИСТЕМА [View project](#)

**Київський національний університет  
імені Тараса Шевченка**  
Навчально-науковий інститут  
«Інститут геології»  
Кафедра мінералогії, геохімії та петрографії



**Від Мінералогії і Геогнозії до Геохімії,  
Петрології, Геології та Геофізики:  
фундаментальні і прикладні тренди  
XXI століття**



**Матеріали конференції**

**28-30 вересня 2022 року  
Київ, Україна**

**HISTORICAL DEVELOPMENT OF THE TERRITORY OF SOUTHERN UKRAINE  
IN THE EARLY AND MIDDLE MESOZOIC**

*Ischenko I.I.<sup>1</sup>, Yakushyn L.M.<sup>2</sup>, Shevchuk O.A.<sup>2</sup>*

<sup>1</sup> *Ukrainian Research Institute for Natural Gases,  
Kharkiv, tarakot2016@gmail.com*

<sup>2</sup> *Institute of Geological Sciences of the National Academy of Sciences of Ukraine,  
Kyiv, yakushin@ukr.net; hshevchuk@ukr.net*

*The main geological events that played an important role in the formation of the territory of Southern Ukraine, as well as the development of sedimentation paleobasins during the Triassic-Jurassic period, are listed in historical sequence.*

**ІСТОРИЧНИЙ РОЗВИТОК ТЕРИТОРІЇ ПІВДНЯ УКРАЇНИ В РАННЬОМУ ТА  
СЕРЕДНЬОМУ МЕЗОЗОЇ**

*Ищенко И.И., Якушин Л.М., Шевчук О.А.*

**Introduction.** Triassic-Jurassic sediments play an important role in the geological structure of the sedimentary cover of Southern Ukraine. These geological formations are still poorly researched due to the significant depths of their occurrence. Data on their geological structure, historical development, and sedimentation conditions are still insufficient, which makes it difficult to solve a number of geological issues, in particular, the oil and gas potential of this promising, but at the same time, poorly studied and insufficiently researched rock complex of the Southern oil and gas region of Ukraine.

**Analysis of previous studies, formulation of the problem and its solution.** Among the key unsolved problems of the geology of the Mesozoic formations of the South of Ukraine, the main ones today are the clarification of the features of the geological structure, the reconstruction of the historical development of the territory, and the paleogeographic reconstruction of the sedimentary basins.

Information about the Triassic-Jurassic stage of the region's development is presented in a number of publications (*Geology ...*, 1969; *Explanatory ...*, 1972; *Pavlyuk, Bogaets*, 1978; *Geology ...*, 1984; *Geology ...*, 1987; *Plachotny*, 1990; *Geological ...*, 1993; *Leshchukh et al.*, 1999; *Gozyk et al.*, 2006; *Khryashchevskaya et al.*, 2007; *Solovyov*, 2011; *Gozhyk et al.*, 2013; *Ischenko*, 2017; *et al.*).

The analysis of printed literature, stock materials and the results of own research shows that the complex geological structure of the South of Ukraine had a long geological history of development, the detailed course of which has not been fully elucidated to date and requires further research.

Currently, we consider it necessary to outline in historical sequence the main stages of development that played an important role in the creation and formation of this territory and its constituent elements, as well as a brief paleogeographical description of the Triassic-Jurassic sedimentation basins.

**Actual material.** The authors used all the available results of exploratory, coal, and structural mapping drilling in the territory of Southern Ukraine, as well as the results of marine regional seismic exploration works in the waters of the Black and Azov Seas and their reinterpretation, performed by the State Enterprise "Naukanaftogaz" during 2006-2014. The authors personally carried out the stratigraphic dissection and correlation of Mesozoic sediments in the sections of more than 500 deep wells of the South Ukrainian and Azov

**Від Мінералогії і Геогнозії до Геохімії, Петрології, Геології та Геофізики:  
фундаментальні і прикладні тренди XXI століття**

monoclinals, the Pre-Dobrudzky trough, the northwestern shelf of the Black Sea, the waters of the Sea of Azov, the Crimean Plain, and the Kerch Peninsula. A facies-lithological analysis of deposits and paleogeographic reconstructions of the Mesozoic have been carried out. The results of previous studies contained in stock materials and published in numerous printed literature are also taken into account.

**Obtained results and their discussion.** In the late Paleozoic, at the end of the Hercynian tectonic cycle, on the southwestern and southern edges of the Eastern European Platform (EEP), the formation of folded structures was completed, which expanded the territory of the latter in a wide strand, among which was the Scythian Plate (*Geological...*, 1993). The orogenic stage of the Hercynian tectonic cycle in the studied area was accompanied by the establishment and development of two marginal (riftogenic) trough at the end of the Paleozoic. The first is the northern one, which extended from the Carpathians to the east along the southern edge of the SEP, the probable relic of which is the Pre-Dobrudzky trough, visible against the background of a younger superimposed tectonic structure. The second is the southern one, which extended from Dobrudja to the east along the southern edge of the Scythian plate to the modern Caucasus, and possibly to the modern Caspian (the presence of Paleozoic marine sediments in it is confirmed by finds in the Himalayan Crimea in the sediments of the Lias of olistostromes with globules and pebbles of Permian-Carboniferous limestones (*Geology...*, 1969)).

At the beginning of the Mesozoic, in the zone of articulation of the SEP and the young folded structure, which by this time had already been peneplenized and transformed into the Epipaleozoic Scythian Plate, the formation of graben-like depressions began - in the north of the Pre-Dobrudzky and Karkinitzko-Berezansky (under another name, Tarkhankutsko-Berezansky) trough (*Plahotny*, 1990), and in its south - Crimean-Caucasian. It is worth noting that according to the modern tectonic map (*Explanatory...*, 1972) on the territory of Ukraine, the Scythian epiorogenic zone, in addition to several secondary structures of the Plain Crimea, also includes the Nizhnyprutsky protrusion of Dobrudja and the Pre-Dobrudzky trough.

The Triassic stage of development of the study area is characterized by the predominance of continental development conditions on the territory of the Scythian plate, in the Pre-Dobrudzky and in the newly formed Karkinitzko-Berezansky (modern Karkinitzky and North Crimean troughs, Azov and Kanevsko-Berezansky shafts) troughs. In the southern part of the Scythian plate, within the Crimean-Caucasian riftogenic trough, there is a powerful marine accumulation of terrigenous flysch formations in a bathymetrically differentiated (from shallow to deep-water) basin. A clear cyclicity of marine sedimentogenesis is observed, which is correlated with tectonic events (rift and orogenic stages).

Phases of rifting and post-rift submergence in the study area probably occurred in the Early-Middle Triassic also in Dobrudja and the Karkinitzko-Berezansky riftogenic trough.

A significant eventful aspect in the history of the region's development in the Triassic period is the formation and further development of a subduction volcanic belt within the Crimean-Caucasian rift system on the border of the Scythian plate and the Black Sea depression and an active continental margin with a deep-sea gutter. This is confirmed by the presence of volcanic material in the rocks of the Upper Triassic and the presence of limestone-alkaline intrusions in the Crimea (*Geology ...*, 1984; *Geology ...*, 1987).

The mountainous part of Dobrudja was actively eroded at the end of the Permian and the beginning of the Triassic. Green slates of the Lower Paleozoic, Ordovician and Devonian quartzites, igneous rocks formed the cores of the ridges. All this material was actively carried by rivers and temporary watercourses into the Pre-Dobrudzky trough, forming alluvial-deluvial deposits and other genetic types of subcontinental deposits. In the Middle Triassic, marine transgression extends over the entire Dobruja.

## ***Від Мінералогії і Геогнозії до Геохімії, Петрології, Геології та Геофізики: фундаментальні і прикладні тренди XXI століття***

At the end of the Carnian age and during the Norian age, active tectonic processes took place in the region with the activation of volcanic activity, as indicated by tests of acid lava and pyroclastic material in sections of the Crimean Mountains and wells in the north of the Crimean Peninsula. In the Rhaetian age, the studied territory becomes a dry land.

At the border between the Triassic and the Jurassic, the Karkinitzko-Berezansky and Crimean-Caucasian paleo- troughs were covered by inversion and folding (Salhirian phase of tectogenesis). Within the boundaries of the Karkinitzko-Berezansky trough, this phase manifested itself more intensively and was accompanied by synorogenic granitoid and effusive magmatism. As a result of these movements, the Tarkhankut uplift was formed (*Plahotny, 1990*).

At the beginning of the Jurassic period, most of the South of Ukraine was a dry land where subcontinental sediments accumulated. Marine formations are established only on the territory of Plain and Mountain Crimea, where sandy-clay deposits continue to accumulate, but compared to the Triassic, they lose their rhythmic nature.

A new stage of tectonic development begins with the Late Lias on the Scythian plate. There is a marine transgression in the northern direction. In the conditions of a shallow marine basin, low-thickness (up to 100 m) marine sand-clay sediments of the Toarcian age accumulate in the Pre-Dobrudzky, Karkinitzko-Berezansky, and Crimean-Caucasian troughs. The Toarcian Sea shallow water basin does not have clear borders and outlines.

In the Middle Jurassic, the area of sea basins increased significantly due to intensive subsidence of a number of areas of the region. In the accumulation zone, a thick layer of conglomerates was accumulated, and in calmer places - subcontinental sandy-clay, often coal-bearing sediments. In the Pre-Dobrudzky trough, after the Middle Jurassic regression, sand-conglomerate deposits were first formed, and later - reefogenic deposits. The Kimmeridgian and Tithonian are characterized by a lagoon-evaporite formation composed of a layering of variegated argillites, gypsum, and rock salt up to 400 m thick.

The maximum activation of volcanic activity in the region occurs during the Middle Jurassic period. This is especially evident in the Crimea, where volcanic facies are common - lavas, tuffs, tuffites and tuff sandstones of the spilito-keratophyte composition. Most spills were underwater in nature.

At the end of the Middle Jurassic era, mainly during the Callovian age, active tectonic processes took place, which caused a number of uplifts. On the territory east of the Odesa fault, marine sediment accumulation stopped, continental deposits accumulated everywhere.

A sharp change in sedimentation and paleogeographic conditions, caused by the manifestations of the Yailin tectonic phase of the Cimmerian orogeny ( $165 \pm 2$  million years ago) (*Ishchenko, 2017; Solovyov, 2011*), occurs at the border of the middle and late Callovian. Most of the region becomes land, with the exception of the territories west of the Odesa fault (the Pre-Dobrudzky trough and the southern part of the Moldavian monocline).

In the Late Jurassic era, the territory east of the Odesa fault was a land area raised above sea level. The Black Sea orogen was located further south. From the late Callovian time, a marginal trough arose between the landmass of the study area and the Black Sea orogen. During the Oxfordian age, carbonate sediments accumulated in the western part of the depression, among which reefogenic structures play a significant role. Similar formations of the same age are known on the coast of Turkey and Bulgaria. During the Oxfordian age, the study area was a dry land and a source of terrigenous material that was eroded into a shallow shelf located to the south. In the Late Jurassic, carbonate sediments accumulated on the shallow shelf. Probably at this time, the Pre-Dobrudzky trough was separated from the southern basin by the Kiliyske uplift.

The Neo-Cimmerian tectonic phase of the Cimmerian orogeny, approximately  $143 \pm 2$  million years ago (*Ishchenko, 2017; Solovyov, 2011*), led to the movement of the zone of

***Від Мінералогії і Геогнозії до Геохімії, Петрології, Геології та Геофізики:  
фундаментальні і прикладні тренди XXI століття***

active subsidence at the beginning of the Early Cretaceous from the Crimean-Caucasian rift system to the Scythian Plate and the southwestern margin of the SEP and initiates the slow transgression of the sea and the new Valanginian-Early Aptian stage of development of the territory.

**Conclusions.** In the historical sequence, the main stages of the development of the territory of Southern Ukraine in the early and middle Mesozoic are given. The correlation between tectonic events and the historical development of the territory and its separate structural and tectonic elements is revealed. Structural and geological changes in the study area are associated with the Salgir, Yailin, and New Kimmerian phases of the Cimmerian tectogenesis, which determined the sedimentation and paleogeographic conditions of the sea basin. The peculiarities of sediment accumulation on land and in sea basins of the early and late Mesozoic in the study area were established.

**References:**

- Explanatory note to the 1:1,000,000 scale tectonic map of the Ukrainian SSR and the MSSR / Chief editor M.V. Muratov [1972]. Kyiv. – 120 p. (in Russian).
- Geological history of the territory of Ukraine. Paleozoic. [1993] Kyiv.: Naukova dumka. – P. 7-11. (in Russian).
- Geology of the shelf of Ukraine. Tectonics / Sologub V.B. et al. [1987]. K.: Naukova dumka. – 152 p. (in Russian).
- Geology of the Ukrainian SSR shelf. Stratigraphy (shelf and coast of the Black Sea) / T.V. Astakhova, S.V. Horak, E.Ya. Kraeva et al. [1984]. K.: Naukova dumka. – 182 p. (in Russian).
- Geology of the USSR. Tectonics. T. 8. Crimea [1969]. // Edited by V.M. Muratov. M.: Nedra. – 575 p. (in Russian).
- Gozhik P.F., Semenenko V.M., Maslun N.V., Poletaeov V.I., Ivanik M.M., Mikhmitska T.M., Velikanov V.Ya., Melnychuk V.G., Konstantinenko L.I., Kiryanov V.V., Tsegelnyuk P.D., Kotlyar O.Yu., Berchenko O.I., Vdovenko M.V., Shulga V.F., Nemyrovska T.I., Shchegolev O.K., Boyarina N.I., Pyatkova D.M., Plotnikova L.F., Leschuh R.Y., Zhabina N.M., Shevchuk O.A., Yakushin L.M. etc. [2013]. Stratigraphy of the Upper Proterozoic and Phanerozoic of Ukraine. Vol.1. Stratigraphy of the Upper Proterozoic, Paleozoic and Mesozoic of Ukraine. National Academy of Sciences of the National Academy of Sciences of Ukraine. Logos. Kyiv. 637 p. (in Ukrainian).
- Gozyk P.F., Maslun N.V., Plotnikova L.F., Ivanik M.M., Yakushyn L.M., Ishchenko I.I. [2006]. Stratigraphy of Meso-Cenozoic sediments of the northwestern shelf of the Black Sea. - K., Logos. – 171 p. (in Ukrainian).
- Ishchenko I.I. [2017]. Stratigraphy and conditions of accumulation of Cretaceous deposits of the Ukrainian sector of the junction zone of the East European platform and the Scythian plate in connection with oil and gas potential: Dissertation of the Doctor of Geological Sciences, specialty 04.00.09 / I.I. Ishchenko. – Kyiv, IGN NAS of Ukraine – 364 p. (in Ukrainian).
- Khryashchevskaya O.I., Stovba S.N., Stephenson R.A. [2007]. One-dimensional modeling of the history of tectonic subsidence of the Black (northwestern shelf) and Azov Seas in the Cretaceous-Neogene // Geophysical Journal. V. 29, No. 5. – P. 28-49. (in Russian).
- Leshchuh R.Y., Permyakov V.V., Polukhtovych B.M. [1999]. Jurassic sediments of southern Ukraine. Lviv: Evrosvit. – 336 p. (in Ukrainian).
- Pavlyuk M.I., Bogaets O.T. [1978]. Tectonics and formations of the region of the junction of the East European platform and the Scythian plate. – K.: Naukova dumka – 146 p. (in Russian).
- Plakhotny L.G. [1990]. Early Kimmerian structures of the Crimea and their relationship with the Alpine and pre-Kimmerian / Geotectonics. – No. 2. – P. 54-62. (in Russian).

**Від Мінералогії і Геогнозії до Геохімії, Петрології, Геології та Геофізики:  
фундаментальні і прикладні тренди XXI століття**

Solovyov V.O. [2011] Chronology of tectonic movements: Phases, epochs, cycles of tectogenesis / V.O. Solovyov – Kharkiv. – 112 p. (in Ukrainian).

**ДО МЕТОДОЛОГІЇ ПІЗНАВАЛЬНОГО ПРОЦЕСУ В ГЕОЛОГІЇ**

**Кирилюк В.П.**

*Львівський національний університет імені Івана Франка,  
Львів, Kyrylyuk.V@u.ua*

*The report considers the main achievements in the field of methodology of geological sciences. Their role in the formation of the doctrine of geological formations and the study of shields of ancient platforms is emphasized. A geogenetic scheme for the formation of geological body systems and a scheme for constructing retrospective geohistorical and geoevolutionary models are proposed.*

**TO THE METHODOLOGY OF THE COGNITIVE PROCESS IN GEOLOGY**

**Kyrylyuk V.P.**

Методологія геологічних наук є одним з важливих аспектів теоретичної підготовки кваліфікованих фахівців. Питання методології геологічних наук активно розроблялися і обговорювалися у 60–70-х роках минулого сторіччя. Вони знайшли відображення в численних статтях, монографіях, збірниках праць конференцій та семінарів на цю тему і, нарешті, у введенні в програми підготовки фахівців вищих навчальних закладів курсу "Історія та методологія геологічних наук". Підвищений інтерес до методологічних аспектів геології виник серед науковців тектонічного спрямування, але згодом поширився і на інші геологічні науки. Увага до методології геологічних наук збіглася, або стала частиною, розвитку в цей же час теорії систем та системного підходу як загальнонаукової методології. І у підсумку більшість вчених зійшлася на тому, що системний підхід може слугувати надійною методологічною основою геологічних досліджень будь якого спрямування. Його застосування призвело до обґрунтування вже наприкінці 70-х – на початку 80-х років минулого сторіччя низки важливих теоретичних засад геології. Серед них основоположними є:

- уявлення про ієрархічну, рівневу організацію геологічних тіл, як носіїв геологічної матерії. Визначені такі рівні геологічних тіл: мінеральний (мінерали), гірськопорідний (гірські породи), геотектонічний (геологічні формації), геоконструкційний (геологічні комплекси), геоструктурний (геоструктури – платформи, складчасті системи, щити тощо), геоболонковий (оболонки земної кори). В ідеалі, кожному рівню організації мала б відповідати окрема геологічна наука. Але поки що такими окремими науками є: а) мінералогія, б) петрографія та літологія, в) вчення про геологічні формації (геоформаціологія), яке все ще знаходиться на стадії свого становлення. Тіла інших рівнів організації є предметом тектоніки, яка широко використовує для їхнього дослідження геологічні формації;

- тіла кожного з рівнів організації являють собою окрему систему і одночасно геологічні тіла нижчого рівня організації є елементами тіл наступного рівня. Їхня сукупність утворює внутрішню структуру (конституцію) цих тіл. Перехід від одного рівня організації до іншого є чітко впорядкованим і відбувається не хаотично, а