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O. V. NIKITENKO[1], O. G. CHERNYSH[2]

[1] Donetsk National Technical University, Artem str. 58, Donetsk, Ukraine, 83001, tel. +38(062)3010964, e-mail paleontologist@yandex.ua
[2] Far Eastern Federal University, School of Engineering, Sukhanov str. 8, Vladivostok, Russia, 690650, tel. +7(914)0712799, e-mail xanfia@yandex.ua

USE OF THE KINEMATIC METHOD FOR RECONSTRUCTION OF STRESS FIELDS AND MECHANISMS OF THE STRUCTURE DEVELOPMENT IN DONBAS (ON AN EXAMPLE OF THE WESTERN CLOSURE OF THE HORLOVKA ANTICLINE)

Purpose. This study focuses on the analysis of structures and kinematics of the western closure of the Horlovka anticline to present a general development mechanism and to determine whether the structural complexity of the study area is consistent with a single regional stress field or not. **Methodology.** The kinematic and structural data available for the study zone have been studied. Further, fault data, including both the fault plane and slickenline orientations, and the sense of movement, have been studied by the kinematic analysis method of O. Gushchenko to estimate characteristics of the mesoregional stress field. Local stress data have been processed by the method for determination of general stress fields provide for reconstruction of main normal stresses which are arbitrarily considered as regional stresses. **Results.** Strike-slip faults (NW-trending, dextral; N–S and NE-trending, sinistral) prevail among the other faults. Mesoregional stress field characterized by subhorizontal NW–SE maximum and NE–SW minimum principal axes, and apparently originated in Laramide time of Alpine orogeny is shear type and the youngest for the Donets Basin. The pattern of a single structural paragenesis of deformation elements of the study area, including a conjugate strike-slip fault system, dome-shaped fold and longitudinal thrusts in its limbs, was developed due to the right-lateral displacements along the longitudinal strike-slip fault system within the Main anticline paraxial part. **Originality.** Strike-slip faults and large shear zone are revealed in the structure of the study area, and characterized its morphology, development, and interaction of structural elements in zone of distributed shear deformation. The primary characteristics of the stress fields of local and mesoregional level are reconstructed. **Practical significance.** Taking importance of the results obtained by the kinematic method into account, applying of the methods based on reconstruction of primary tectonophysical characteristics and restoration of deformation mechanisms will allow better prediction of the small-scale faulting and outburstable zones.

Key words: stress field; kinematic method; slickenlines; strike-slip fault; shear zone; structural paragenesis.

Introduction

Any kinds of geological forecast on various stages of mining sequence should be based on explanation of deformation mechanisms and history of the crust part development. Key issues concerning its reconstruction are: (1) what were the main directions of active tectonic forces the geological structure at different stages over geological time was formed under; (2) which stress fields were active while the geological structure were forming; and (3) what deformation and dislocation distribution within the structure are?

Tectonophysical study is the one of the effective way to objectively estimate it by determination of regularities of the stress distribution and development of tectonic deformation, appearing within the crust. In spite of having various kinds of modeling to solve tectonophysical problems now, field tectonophysics data may make an essential addition to the final results. It should be noted that the surface and underground mining used in layered sedimentary deposits creates very favorable conditions for that. For instance, application of longwall mining method in thick coal seams, together with geological mapping and documentation of underground workings in detail, allows to study geological structures on a true scale, and to record morphology changes both all over the planar surface and cross section.

The Main anticline of the Donets Basin is of great interest as a subject of tectonophysical study not only because of its structural complexity and development mechanism, but also their effect on the safe high-efficient exploitation of coal.

As one of the major segments of the Main anticline, the Horlovka anticline is known, first and foremost, for Nikitovka ore field occurred in the crest part of the fold. Structures of the Nikitovka ore field were investigated and mapped in detail by members of the Department of Mineral Survey of Donetsk Polytechnic Institute, and V. Korchemagin in particular, for a long time. Various massif deformation elements were geometrized there, determined its morphology and kinematics, and reconstructed stress fields for many localities, mine fields, deposits and the region as a whole.

After analyzing mapped structural forms of the Nikitovka ore field he [Korchemagin, 1970] came to the conclusion that they are elements of the deformation field with the certain hierarchy. Longitudinal and diagonal faults, transversal fracture zones, and dome-shaped folds complicated the crest part of the anticline, as low structural order elements after the Horlovka anticline, follow certain regularities related to their an en echelon arrangement which is clearly marked in the structure of the ore field in contrast to randomly distributed tectonic jointing (lower structural order).

Illustrative example of this kind of arrangement is a left-stepping en echelon of dome-shaped folds. Dimensions of the folds depend on width of the crest part of the anticline bounded by two opposite-dipping faults in the central part of the ore field and by the areas of sharp bedding curving towards the limbs. In the horizontal plane they are located in the crest of the anticline in places of maximum curving of its hinge. It was observed that centers of uplifts shift from the east to the west.

Besides dome-shaped folds, an en echelon arrangement in structure was established for NW-trending high-angle longitudinal faults (Secuschy, Sophievsky-Novy, etc.) resulted in undulation of morphology of their planes which are divided into right-stepping linear fragments. Maximum stratigraphic throws of these faults were observed within the areas of their conjunction with dome-shaped folds of the anticline crest. Striking along the crest of the Horlovka anticline, these opposite-dipping faults showed right-lateral strike-slip displacements from structural and kinematic standpoints. Diagonal E–W-trending high-angle faults with the reverse-fault type maximum stratigraphic throws within the areas of their conjunction with domes and minimum ones within the anticline limbs also showed right-lateral strike-slip displacements.

Submeridional transversal fracture zones, as fine jointing bundles near one or two large ones, were observed within the thick ore-bearing sandstones in the southern limbs of dome-shaped folds and interdome spaces. These fracture zones are arranged in a right-stepping en echelon within the oblong crest part of the anticline. Large transversal fractures showed left-lateral strike-slip displacements. It should be noted that the largest zones cross the crest part and attenuate near longitudinal faults in the central part of the crest or through obtuse pinching out in the southern limb on the eastern part of the ore field.

The stress field reconstructed for Nikitovka ore field is characterized by a subhorizontal NW-plunging (330^o) maximum principal stress axis σ_3 (maximum compression) and a subhorizontal SW-plunging (245^o) minimum principal stress axis σ_1 (maximum tension). The stress field axes are oriented in directions diagonal to the Horlovka anticline, a major ore-controlling structure, and symmetric to second-order dome-shaped folds complicated the crest of the Horlovka anticline [Korchemagin et al., 1987; Sim et al., 1999; Gintov, 2005; Saintot et al., 2003; Privalov et al., 2008]. Moreover, a σ_3 axis is invariably perpendicular to the dome-shaped fold axes. The ore field structure was developed under conditions of a special pulsating type of the massif stress state, changing from uniaxial compression to uniaxial tension and vice versa. This stress field that apparently originated in Laramide time of Alpine orogeny is the youngest for the Donets Basin [Korchemagin et al., 1987].

According to the reconstructed stress field characteristics, fault kinematics and orientation of structural deformation elements, the Main anticline are interpreted as over-fault fold, developed in the Carboniferous ductile sedimentary series due to the right-lateral displacements along the zone of the Central Donets deep-seated fault, that also resulted in the development of the structure of the crest of the Horlovka anticline and Nikitovka ore field [Korchemagin et al., 1987; Smishko, 2004]. Reflection of the Central Donets fault in present geological structure of the study area is the Osevoy thrust, traced along the whole length of the Main anticline axis [Stovba et al., 2000; Maystrenko et al., 2003; Saintot et al., 2003]. Those studies have shown that all known deformation elements of the ore field, such as morphology and kinematics of the faults, position and orientation of the dome-shaped folds, systems of transverse fissured veins, straightness of segments of the longitudinal Sekuschy fault, are parts of the structural paragenesis for right-lateral faulting, and are consistent with a single regional stress field.

Purpose

Although the problems of deformation element structural paragenesis, stress fields of local and regional level, and also mechanism of the development of the Main anticline western part, especially the area on the east from Chernobugorskaya brachyanticline, were well studied it should be pointed out that area of the western periclinal closure of the Horlovka anticline is studied not as well as Nikitovka ore field. Now it seems to be possible to do because of new facts of the regional geological structure, fault kinematics and stress field characteristics, obtained through the structural and tectonophysical works within Novodzerzhinskaya coal mine field.

This study focuses on the analysis of structures and kinematics of the western closure of the Horlovka anticline to present a general development mechanism and to determine whether the structural complexity of the study area is consistent with a single regional stress field or not.

The tasks necessary to reach that objectives are: (1) to study kinematics, morphology, and age relations of the faults; (2) to define structural pattern of the massif deformation elements, and determine a mechanism of its development; (3) to reconstruct basic characteristics of stress-and-strain fields of local and mesoregional level; and (4) to analyse an interaction between geological factors and various tectonic structures, and basic characteristics of stress-and-strain fields.

Methodology

Tectonic stresses have been studied by the O. Gushchenko's kinematic method [Gushchenko, 1979; Sim, 2013]. The method used principles of plasticity mechanics, in particular the Batdorf–Budiansky's plasticity theory, and postulated the coincidence of the fault side slip direction with the shear stress direction on the fracture plane. Graphic algorithm for calculating the principal stresses and evaluating the Lode–Nadai coefficient, determining the shape of the stress ellipsoid and the ratio of deviatoric components of principal stresses were developed on this assumption. The input for the study were field-measured orientation data for faults and slickenlines from mine workings within Novodzerzhinskaya mine field (more over 900 measurements), consisted of the orientations of the fault planes and slickenlines, including the sense of movement. Mesoregional level stress field characteristics have been reconstructed by statistical processing of local stereographical solutions. Local stress data processed by the method for determination of general stress fields provide for reconstruction of main normal stresses which are arbitrarily considered as regional stresses [Sim, 2000].

Results

The Main anticline, a major WNW–ESE-trending (290-305°) symmetrical fold, extends 300 km throughout the Donets Basin (Fig. 1).

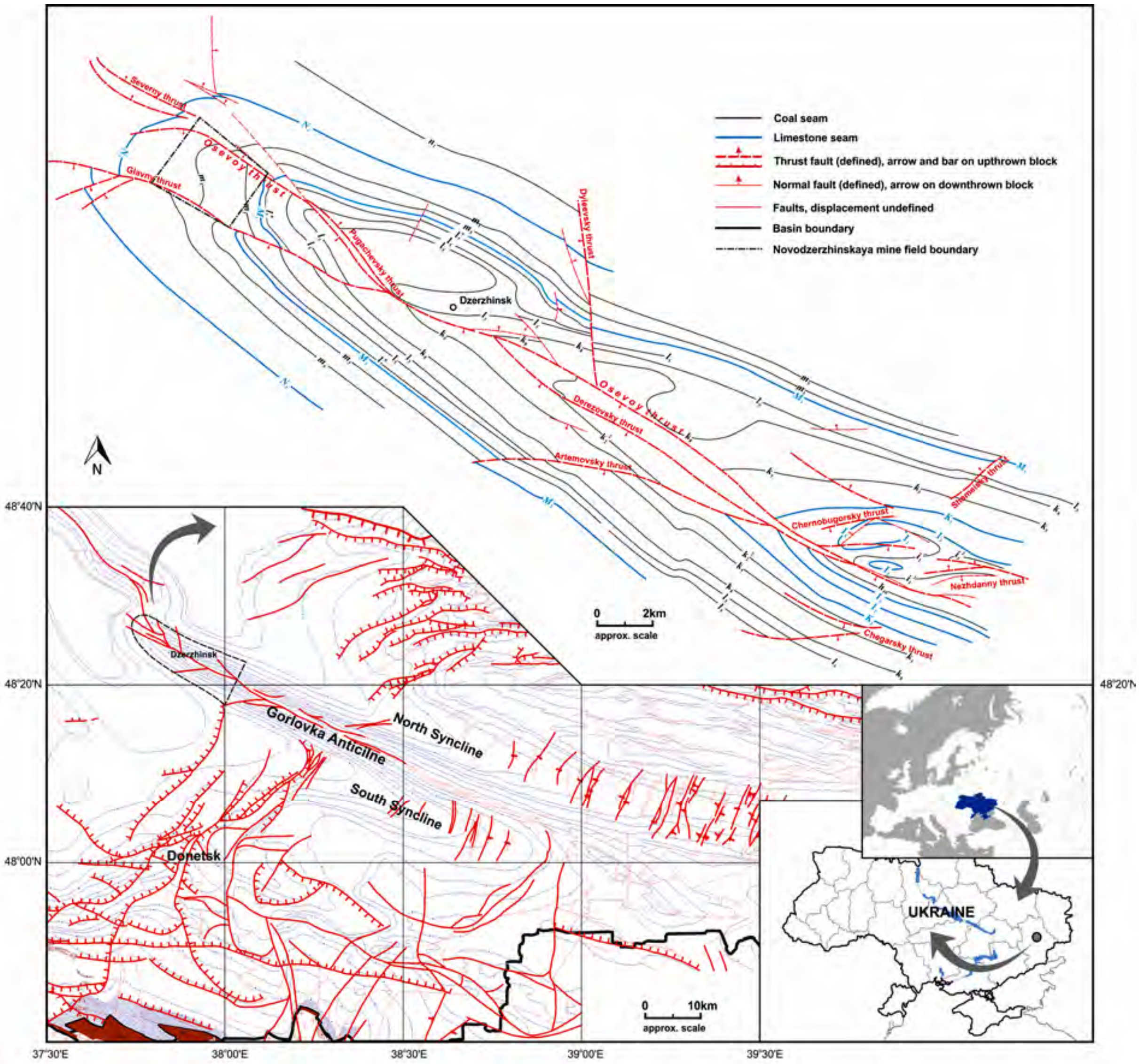

Fig. 1. Location of the study area and Premesozoic sediment geological sketch map of the Donets Basin (modified after Ministry of Ecology and Natural Resources of Ukraine, 2001). Lower right: location map of Ukraine. The study area is pointed out by the square

Towards the west of the Nagolny Ridge, it divides into three right-stepping en echelon fold segments: Olkhovatka-Volyntsevo and Horlovka anticlines, Druzhkovka-Konstantinovka brachyanticline. Both limbs of the fold dip generally steeply (60–65^o), and the crest of the fold, wide on the west and narrow on the east, is faulted by reverse and strike-slip faults, which trend parallel to the fold axis. The Horlovka anticline is the most studied segment of the Main anticline where lots of coal mines [Zabigailo et al., 1994; Lukinov et al., 2008] and Nikitovka ore field are situated. Nikitovka ore field is related to five similar dome-shaped folds, 1 km length and 0.4 km width, exposed in roughly equal intervals (1.4 km) within the crest of the anticline.

The fold axes appear rotated at an acute angle, typically 15–30^o anticlockwise towards the Horlovka anticline axis. Longitudinal faults of the Osevoy thrust system separate these folds to the north and south of the anticline crest part. Four larger dome-shaped folds expose in roughly equal intervals (3–3.5 km) to the east and to the west of fold set of Nikitovka ore field.

The Novodzerzhinskaya coal mine is the westernmost one in the area of the western periclinal closure of the Horlovka anticline. The Middle Carboniferous (suites K to M) seams over the mine field have been basically mined. In the study area, the beds dip away from the crest of the anticline at an angle of 30–35^o on the periphery, which decreases to 10–15^o near the crest. In strike, they vary from a little west through a little north to south of east. The whole region is traversed by an immense number of small-scale faults. Their strikes have such a varying directions, but the great number appear to follow the three trends of sublatitudinal, submeridional, and northwest. Two major faults divide mine field from the anticline limbs: Almazny fault, NW-trending high-angle fault with dip to the north, on the north, and Glavny thrust, latitudinal fault with moderate southward dip, on the south. Both of the faults show displacements with a strong component of right-lateral strike-slip.

The study area was divided into two domains based on its structural complexity along the Osevoj thrust: the first (D_1), to the north, and the second (D_2), to the southwest (Fig. 2). D_2 domain geological structure is relatively simple. Beds dip to the southwest, and the amount of the displacement or deformation is comparatively insignificant. In strike, the beds are bounded by the Osevoy and Glavny thrust planes on the west–northwest and south, respectively.

On the contrary, D_1 domain structural pattern is more complex. It is characterized by the plicative dislocation structure severely complicated by the faults. In their orientation, faults follow the three trends of the northwest, west–northwest, and longitudinal (N–S). NW– and N–S-trending high-angle (75–80^o) faults with dip to the northeast and west, respectively, while the dip of WNW-trending faults is about 40^o to the south–southwest (Fig. 3a).

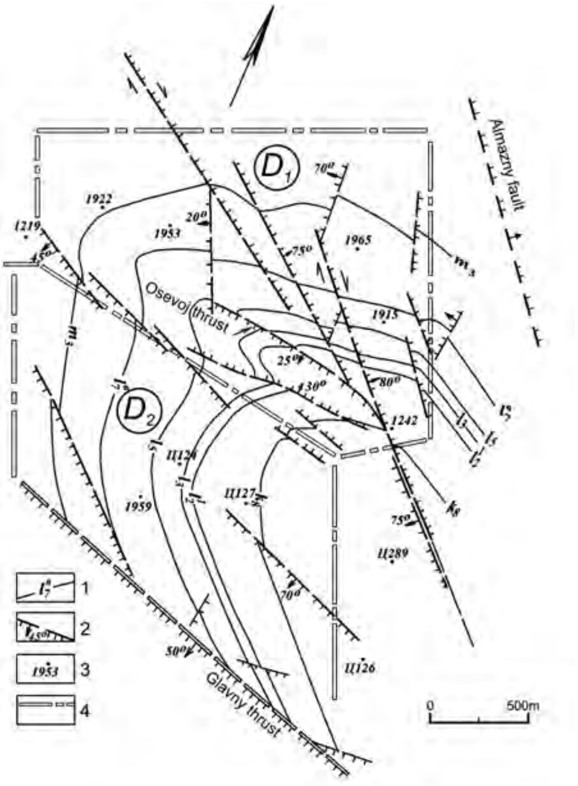

Fig. 2. Simplified geological and structural map of Novodzerzhinskaya mine field (plan of level -502 m modified after the Novodzerzhinskaya Geological Survey)

1 – major coal seams; 2 – faults with attitude of dip; 3 – prospecting drills; 4 – structural domain boundaries

To form a better view of D_1 domain structural pattern it was also subdivided into two subdomains: the eastern (D_{1E}), and western (D_{1W}). The most important fault system in the D_{1E} subdomain is the large shear zone 300 m width, a NW-trending set of faults consisting of several parallel high-angle (70–80^o) fault planes with dip to the northeast that can be followed for 500–800 m over the domain area (Fig. 4). It is traced to the east into the crest of the Horlovka anticline where it merges into the Osevoj thrust. The en echelon NW faults are composed of right-stepping segments that imply a right sense of movement. The segment set has regular spacing of 100–150 m. The slickenlines plunge gently to the southeast, giving predominantly dextral-normal oblique-slip faults.

The area between the NW-trending faults is traversed by the NNE-trending set of sinistral-normal oblique-slip faults consisting of several parallel high-angle fault planes with 5-7 m of stratigraphic throw. In strike, they can be followed for 400 m, and are commonly bounded by the former fault planes.

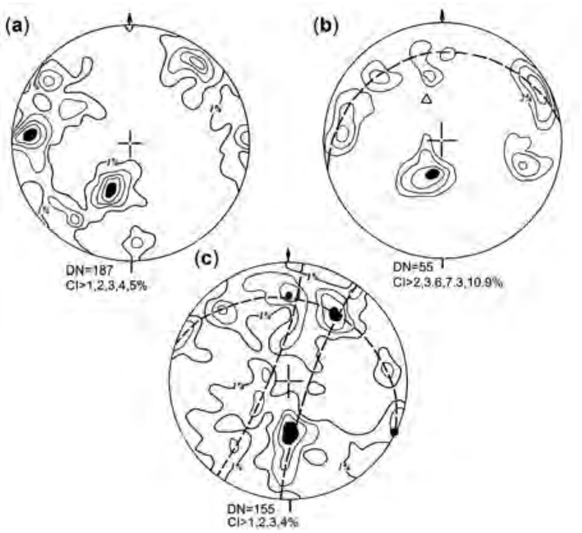

Fig. 3. D_1 domain structural data (all stereographic plots in this paper are upper-hemisphere projections):

(a) contouring of poles to faults; Osevoj thrust zone: (b) contouring of poles to faults, (c) contouring of poles to slickenlines and grooves. Arcs of great and small circles shown by dashed lines. Poles to those circles shown by solid circles. DN, data number; CI, contouring interval

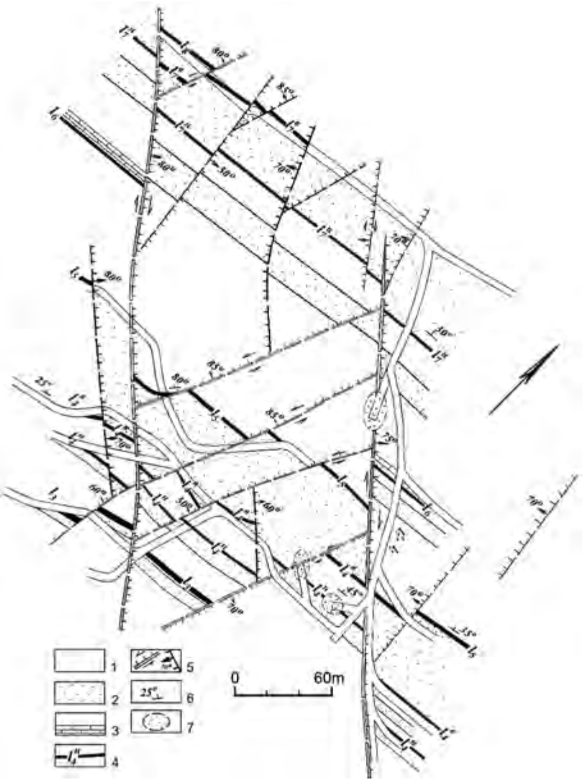

Fig. 4. A structural pattern of the D_1 domain shear zone (copy from a plan of level -502 m according to the Novodzerzhinskaya Geological Survey data)

1 – argillites and aleurolites; 2 – sandstones; 3 – limestones; 4 – coal seams; 5 – faults with sense of slip, dip direction and dip angle of the fault; 6 – attitude of bedding; 7 – inrushes

From kinematic and structural standpoints, these two fault sets, NW (dextral normal-oblique) and NE (sinistral-normal oblique), may be inferred as a conjugate strike-slip fault system.

An important point in the context of geological structure of the D_{1W} domain is dome-shaped fold which is not observed on the present topography and becomes readily apparent at more than 450 m depth below the surface. Periclinal closure and the north limb of the fold are best exposed on the current mining level and its south limb cuts by set of low-angle faults of the Osevoj thrust system.

The fold has gently plunging (20^o) hinge-line which plunges to the west and south-dipping nearly upright (82^o) axial plane. The south limb of the fold dips 18^o to the west, and the north limb dips steeper (35^o) than the south one to the north–northwest. According to dimensions, geometry and spatial orientation, the observed fold is similar to those of Nikitovka ore field.

In contrast to the shear zone, the D_{1E} domain faulting style is mainly defined by WNW-trending faults of the Osevoj thrust system, parallel to the dome-shaped fold axis. Two sets of WNW-trending, N- and SSW-dipping, low-angle (20–30^o) thrust faults with the stratigraphic throw of up to 20 m on some of them have been observed there. Slickenlines are elongated parallel to the dip direction. In addition to the low-angle thrusts, network of numerous secondary high-angle faults is developed on both the hanging and footwalls of the thrusts. Relatively large and extensive of those are: NW-trending high-angle (75^o) faults with 3–4 m of stratigraphic throw. The two sets of small high-angle (55–70^o) faults with the stratigraphic throws of a few decimeters to a couple of meters are mainly developed within the footwalls of the main NW-trending faults. In strike, they appear to follow the two trends of N–S and NE. These faults of comparatively small extent in strike, developing as fractures a few decimeters to a couple of meters away from the plane of the main fault, reach a maximum stratigraphic throw in some meters, and then attenuate completely in 20–30 m in strike. Although these thrust-related faults have different kinematics, one with normal movement and the other with a strike–slip movement, along NW- and NE-trending faults, lateral displacement prevails, and right-lateral slip along the former faults and left-lateral slip along the latter is the rule.

On equal-area plot, as shown in figure 3b, poles to the fault planes, clustering around several distinct maxima, distribute along a great circle which corresponds to the Osevoj thrust plane. A slickenline analysis also shows the symmetry of the linear elements relatively to the Osevoj thrust plane (Fig. 3c). There are three circles on equal-area plot, where one, great circle, corresponds to the trace of the main fault plane, and two other, small circles, have a common axis, lying in the thrust plane.

According to the foregoing data, movements on all of these faults at the D_{1E} domain most likely would have existed due to general displacement of the massif along the main fault plane.

Tectonic stresses in the massif localities have been studied by the kinematic method [Gushchenko, 1979; Sim, 2013]. The input for the study were field-measured orientation data for faults and slickenlines from mine workings within Novodzerzhinskaya mine field, consisted of the orientations of the fault planes and slickenlines, including the sense of movement. Mesoregional level stress field characteristics have been reconstructed by statistical processing of local stereographical solutions. Local stress data processed by the method for determination of general stress fields provide for reconstruction of main normal stresses which are arbitrarily considered as regional stresses [Sim, 2000].

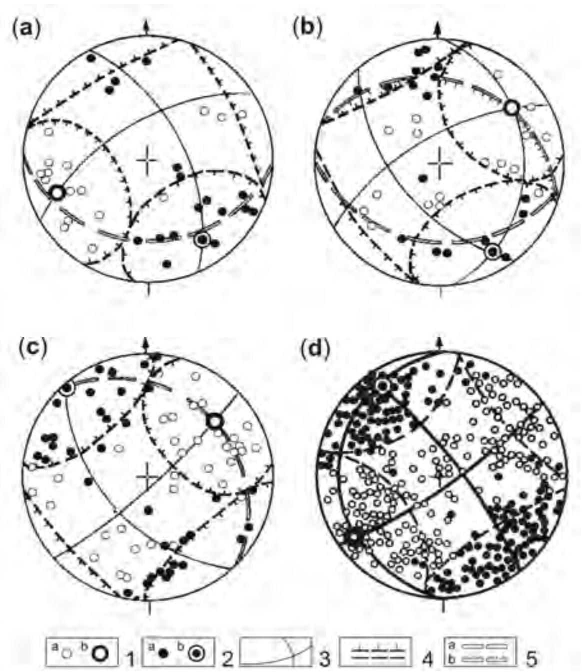

Fig. 5. Stress fields of Novodzerzhinskaya mine (a to c) and Nikitovka ore field (d)

1 – minimum principal stress axis of local (a) and mesoregional (b) level; 2 – maximum principal stress axis of local (a) and mesoregional (b) level; 3 – planes of principal stress axes; 4 – boundaries of compression and extension cones; 5 – planes of bedding (a) and Osevoj thrust (b)

There have been determined that maximum stress axes are concentrated in upper left (NW) and in diagonally opposite (SE) sector of the stereogram, and minimum stress axes, on the contrary, concentrated in upper right (NE) and lower left (SW) sectors (Fig. 5). On mesoregional level, the reconstructed stress field is shear type and characterized by a NW–SE, 320–330^{o} and 140–150^{o}, subhorizontal principal compression axis and subhorizontal NE–SW, 50–60 and 230^{o}–240^{o}, principal extension axis.

However, despite the persistent general orientation of the principal stress axes, some differences in its orientation within the domains have been revealed. For example, in the D_2 domain, as shown in figure 5c, σ_1 plunges at a low angle southwestward (322^{o}, 30^{o}SW) and σ_3 is northeast and horizontal (50^{o}, 5^{o}SE), lying at average bedding plane of this domain. In the D_{1W} subdomain, σ_1 and σ_3 plunge moderately to the northeast (155^{o}, 24^{o}NE) and northwest (60^{o}, 20^{o}NW), respectively, also lying at nearly average bedding plane of this subdomain (Fig. 5a). In the D_{1E} subdomain, σ_1 and σ_3 plunge moderately to the southwest (320^{o}, 28^{o}SW) and northwest (60^{o}, 18^{o}NW), respectively, but the σ_3 axis is located near to bedding plane and σ_1 is lying at the plane of the Osevoj thrust fault (Fig. 5b).

The close agreement of the stress field reconstructed for the study area and Nikitovka ore field strongly suggests one origin and one stress field that resulted in present-day structural pattern (Fig. 5d). This stress field that apparently originated in Laramide time of Alpine orogeny is the youngest for the Donets Basin.

The above data suggest the shear zone revealed in the D_{1W} subdomain is the direct extension of the regional right-lateral displacement within the Main anticline paraxial part. Conjugate strike-slip fault system was formed due to the right-lateral displacements that originated in final stages of Alpine orogeny. Horizontal displacements of the sediment masses to the west at the south limb of the anticline were accompanied by a compression in near-horizontal plane. It resulted in the longitudinal bending of the sediment masses accompanied by formation of the dome-shaped fold and sublatitudinal thrust faults developed at the limbs of the fold. Horizontal displacements at the walls of thrust faults resulted in formation of normal oblique-slip faults which might have developed as normal faults subsequently.

A structural pattern of the deformation elements of the Main anticline western closure indicated above may be interpreted as a single pattern of structural paragenesis developed due to the right-lateral displacements along the longtitidinal strike-slip fault system within the Main anticline paraxial part.

Thus, the right-lateral fault system and the whole right-lateral fault-related paragenesis of dislocations are traced outside the Nikitovka ore field limits into the Main anticline periclinal closure area. There was no polymetallic ore mineralization except few shows of ore, but taking into account the young age of these dislocations, it cannot be eliminated that their geodynamic activity will be shown as rock bursts, gas blowers, and roof falls under deep mining conditions.

Originality

Strike-slip faults and large shear zone are revealed in the structure of the study area, and characterized its morphology, development, and interaction of structural elements in zone of distributed shear deformation. The primary characteristics of the stress fields of local and mesoregional level are reconstructed.

Practical significance

Analysis of characteristics of horizontal stress distribution under shear dislocations is of primary importance for safe and efficient organization of underground deep mining where horizontal stresses can exceed vertical ones related to geostatic pressure in some regions of upper part of the Earth's crust at a depth of 2 km, and therefore it is of importance in outburst zones initiation. The results obtained by the kinematic method based on reconstruction of primary tectonophysical characteristics and restoration of deformation mechanisms will allow better prediction of highly outburstable zones related to the local massif volumes with strike-slip faulting or unstable transitional (oblique-slip faulting) type fields, where the deformation had been going under conditions of a special pulsating type of the massif stress state, changing from uniaxial compression to uniaxial tension and vice versa [Korchemagin et al., 2006; Beseda et al., 2007]. In addition to that it makes the prediction of the small-scale faulting more accessible, owing to the numerous well-known facts about strike-slip systems, their morphology and structural paragenesis, according to modeling and in-situ observations data, that allow to definitely identify and single out them among the other fault types.

Conclusions

Strike-slip faults (NW-trending, dextral; N–S and NE-trending, sinistral) prevail among the other faults within the study area. Mesoregional stress field, characterized by subhorizontal position of NW–SE-oriented maximum principal stress axis and NE–SW-oriented minimum principal axis is shear type. This one that apparently originated in Laramide time of Alpine orogeny is the youngest for the Donets Basin. The pattern of a single structural paragenesis of deformation elements of the study area, including a conjugate strike-slip fault system, dome-shaped fold and longitudinal thrusts in its limbs, was developed due to the right-lateral displacements along the longitudinal strike-slip fault system within the Main anticline paraxial part.

These results which have just been explained briefly, may allow forecasting to be made of structural patterns of deformation structures that forms in right-lateral shear zones at deeper mine levels.

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О. В. НІКІТЕНКО[1], О. Г. ЧЕРНИШ[2]

[1] Донецький національний технічний університет, вул. Артема, 58, Донецьк, Україна, 83001, тел. +38(062)3010964, електронна пошта paleontologist@yandex.ua
[2] Далекосхідний федеральний університет, Інженерна школа, вул. Суханова, 8, Владивосток, Росія, 690650, тел. +7(914)0712799, електронна пошта xanfia@yandex.ua

ЗАСТОСУВАННЯ КІНЕМАТИЧНОГО МЕТОДУ ДЛЯ РЕКОНСТРУКЦІЇ ПОЛІВ НАПРУЖЕНЬ ТА МЕХАНІЗМІВ СТРУКТУРОУТВОРЕННЯ У ДОНБАСІ (НА ПРИКЛАДІ ЗАХІДНОГО ЗМИКАННЯ ГОРЛІВСЬКОЇ АНТИКЛІНАЛІ)

Мета. Визначення умов та механізму розвитку геологічної структури західного змикання Горлівської антикліналі. **Методика.** Детальне картування з елементами структурно-морфологічного аналізу усіх відомих тектонічних елементів району та тектонофізичні методи аналізу тріщинно-розривних структур. **Результати.** Встановлено, що серед розривів різного структурного рівня домінують зсуви (північно-західні – праві, північно-східні та субмеридіональні – ліві). Виділено правозсувовий структурний парагенезис деформаційних елементів структури західного змикання Горлівської антикліналі, що містить у собі комплекс спряжених північно-західних та меридіональних розривів, брахіантиклінальну складку другого порядку, крила якої ускладнені насувами, що орієнтовані повздовж осі головної складчастої структури першого порядку. Встановлено, що за просторовою орієнтацією осі головних нормальних напружень відновлене поле напружень є зсувовим та наймолодшим для Донецького басейну, датованим ларамійською фазою альпійського тектогенезу. **Новизна.** Виявлено зсуви та зсувові зони, охарактеризовано їх морфологію, супутні деформації та механізм їх формування. Відновлено головні характеристики поля напружень локального та мезорегіонального рівня. **Практична значущість.** Впровадження у практику геологорозвідувальних та геолого-експлуатаційних робіт наукових методів прогнозу гірничо-геологічних умов, що засновані на реконструкції головних тектонофізичних параметрів та відтворенні механізмів деформаційного процесу, дасть змогу ефективніше прогнозувати зони дрібноамплітудної тектонічної порушеності та викидонебезпечні зони.

Ключові слова: поле напружень; кінематичний метод; штрихи ковзання; зсувна зона; зсув; структурний парагенезис.

А. В. НИКИТЕНКО[1], О. Г. ЧЕРНЫШ[2]

[1] Донецкий национальный технический университет, ул. Артема, 58, Донецк, Украина, 83001, тел. +38(062)3010964, электронная почта paleontologist@yandex.ua
[2] Дальневосточный федеральный университет, Инженерная школа, ул. Суханова, 8, Владивосток, Россия, 690650, тел. +7(914)0712799, электронная почта xanfia@yandex.ua

ПРИМЕНЕНИЕ КИНЕМАТИЧЕСКОГО МЕТОДА ДЛЯ РЕКОНСТРУКЦИИ ПОЛЕЙ НАПРЯЖЕНИЙ И МЕХАНИЗМОВ СТРУКТУРООБРАЗОВАНИЯ В ДОНБАССЕ (НА ПРИМЕРЕ ЗАПАДНОГО ЗАМЫКАНИЯ ГОРЛОВСКОЙ АНТИКЛИНАЛИ)

Цель. Определение условий и механизма развития геологической структуры западного замыкания Горловской антиклинали. **Методика.** Детальное картирование с элементами структурно-морфологического анализа всех известных тектонических элементов района и тектонофизические методы анализа трещинно-разрывных структур. **Результаты.** Установлено, что среди разрывов различного структурного уровня здесь доминируют сдвиги (северо-западные – правые сдвиги, северо-восточные и субмеридиональные – левые). Выделен правосдвиговый структурный парагенезис деформационных элементов структуры западного периклинального замыкания Горловской антиклинали, включающий в себя комплекс сопряженных северо-западных и меридиональных разрывов, брахиантиклинальную структуру второго порядка, крылья которой осложнены надвиговыми структурами, ориентированными продольно оси главной складчатой структуры первого порядка. Установлено, что по пространственной ориентировке осей главных нормальных напряжений восстановленное поле напряжений является сдвиговым и самым молодым для Донецкого бассейна, датирующимся ларамийской фазой альпийского тектогенеза. **Научная новизна.** Выделены в геологической структуре изучаемого района сдвиги и сдвиговые зоны, описана их морфология, сопутствующие деформации и механизм их образования. Восстановлены основные характеристики поля напряжений локального и мезорегионального уровня. **Практическая значимость**. Внедрение в практику геологоразведочных и горно-эксплуатационных работ научных методов прогноза горно-геологических условий, основанных на реконструкции основных тектонофизических параметров и восстановлении механизмов деформационного процесса, позволит более эффективно прогнозировать зоны мелкоамлитудной тектонической нарушенности и выбросоопасные зоны.

Ключевые слова: поле напряжений; кинематический метод; зеркала скольжения; сдвиговая зона; сдвиг; структурный парагенезис.

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