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COMPARATIVE ANALYSIS OF SPATIAL REGULIARITIES OF THE DEVELOPMENT OF HIGH-ORDER BREAKING FAILURES WITHIN THE AREAL FRAGMENTS OF SREDNEPRIDNEPROVSKII AND INGULSKII MEGABLOCKS OF UKRAINIAN SHIELD

Results of comparing trend azimuths of basic high-order breaking failures within Ukrainian shield in terms of Srednepridneprovskii and Ingulskii megablocks are given.

Изложены результаты сравнения азимутов простирания основных разрывных нарушений высоких порядков в пределах Украинского щита на примере Среднеприднепровского и Ингульского мегаблоков.

Викладено результати порівняння азимутів простягання основних розривних порушень високих порядків в межах Українського щита на прикладі Середньопридніпровського та Інгульського мегаблоків.

Introduction. Srednepridneprovskii (SPMB) and Ingulskii (IMB) megablocks are located within central part of Ukrainian shield covering about half of its area. Both megablocks being rich in mineral deposits have been studied in detail. Mineral and raw material base of Srednepridneprovskii and Ingulskii megablocks is one of the richest ones in nomenclature not only within Ukraine but also worldwide. It is represented by iron, nickel, manganese, gold, silver, titanium, uranium, chromium, molybdenum, and other minerals.

As it has been mentioned before [1, 5] basic mineral deposits tend to develop breaking failures of different orders as well as their intersection nodes.

The objective of the research is to determine and compare spatial regularities of the development of tectonic failures within Srednepridneprovskii and Ingulskii megablocks as well as on the fragments of their separate areas.

Statement of basic research material.

SPMB is the fragment of typical granite-greenstone area within which there are three clear structural levels: pre-greenstone (Lower-Archaean), greenstons (Upper-Archaean), and post-greenstone (Lower-Proterozoic).

Orekhovo-Pavlograskaia seam area consisting of two fragments with 17° and 347° trend azimuths is the eastern border of the megablock.

On the west, SPMB is limited by Krivorozhsko-Kremenchugskii 12° – 17° and Zapadnoinguletskii 357° – 0° (Fig.1). Internal block failures of deep occurrence are represented by latiduninal-meridian and diagonal and orthogonal systems.

High-order breaking failures were studied in detail in terms of fragments of Solonianskii ore field located near Devladovskii fault – within the area of Sergeievskoie deposit and Solnechnoie ore occurrence. High-order breaking failures were singled out according to the results of observation of natural impulse electromagnetic Earth's field (NIEMEF) [3]. Fig. 1 shows positions of the areas.

IMB is a submeridional structure limited by submeridional Golovanevskaia seam area on the west and Krivorozhsko-Kremenchugskii fault on the east (Fig.1). IMB geological structure is complicated by syncline and anticlinal structures being divided by faults of different order developing orthogonal systems as well.

Regularities of the development of high-order breaking failures within IMB were studied in terms of the areal fragment of Rodionovskoie ore occurrence according to NIEMEF results performed by M.M. Dovbnich.

Rodionovskoie ore occurrence is located on IMB within the effect of Krivorozhsko-Kremenchugskii fault.

C Fig.1 represents the position of Rodionovskii area fragment.

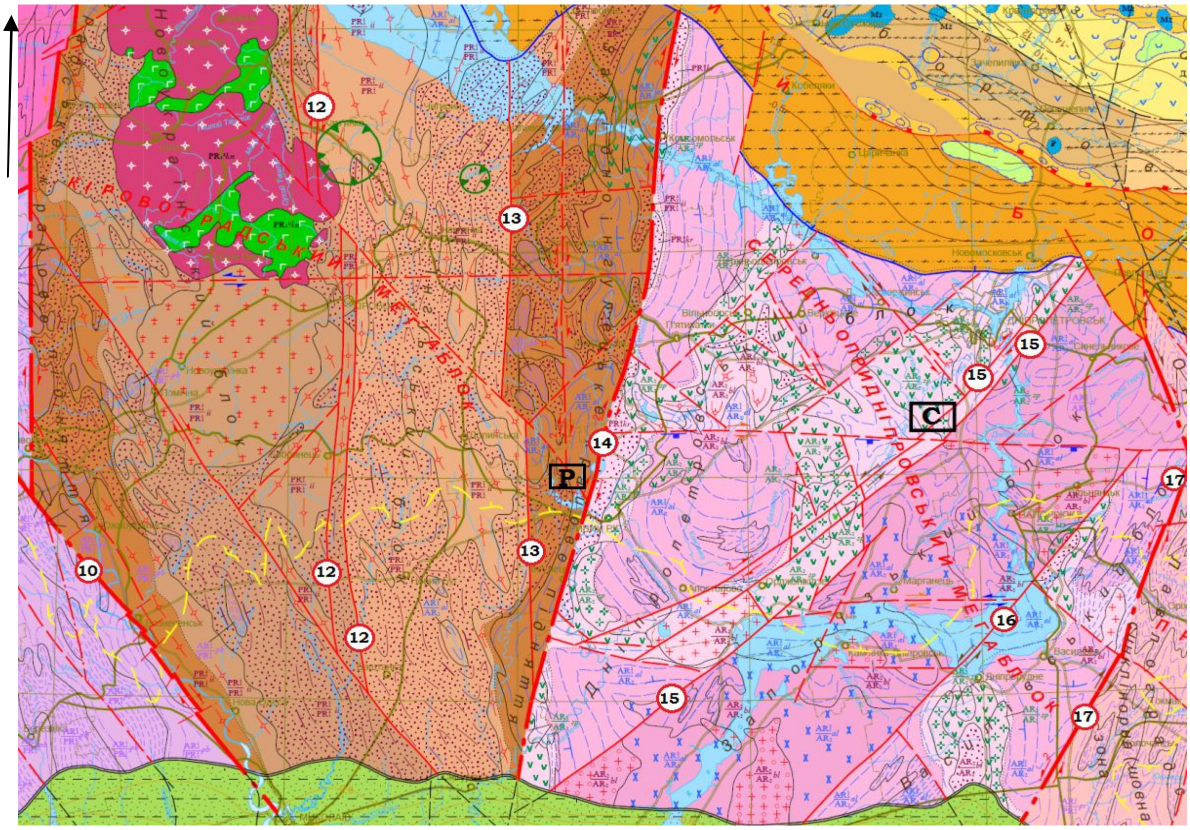

Figure 1. Scheme of tectonic structure of Srednepridneprovskii and Ingulskii megablocks of Ukrainian shield M 1: 1 000 000 [2]

ppLegend:

Circled figures indicate following faults: 10 – Pervomaiskii, 12 – Kirovogradskii; 13– Zapadnoinguletskii; 14 – Krivorozhsko-Kremenchugskii; 15– Derezovatskii; 16 – Maloekaterinovskii, 17– Orekhovo-Pavlogradskii.

Higher-order breaking failures

Second-order breaking failures

P Study area within Rodionovskoie ore occurrence

C Study area within Sergeievskoie deposit and Solnechnoie ore occurrence

Both SPMB and IMB shows all the morphological types of breaking failures: faulting, fissure displacements, overlap faults, and overlap folds.

Spatial position of tectonic failures within SPMB and IMB were studied according to various geological and geophysical research [2, 3]. Table 1 shows the results.

Table 1

Trend azimuths of basic tectonic structures of Srednepridneprovskii and Ingulskii megablocks and their separate fragments (in terms of Sergeievskoie deposit, Solnechnoie ore occurrence, and Rodionovskoie ore occurrence) singled out according to the data of tectonic map of Ukraine [2] and geophysical research [3] as well as according to NIEMEF survey results

Srednepridneprovskii megablock (according to the [2] map data)	Sergeievskoie deposit (according to NIEMEF data)	Solnechnoie ore occurrence (according to NIEMEF data)	Ingulskii megablock (according to the [2] map data)	Rodionovskoie deposit (according to NIEMEF data)
0°	***0°***	–	***0°***	***0°***
–	–	–	7°	7°
12°–17°	***10°–12°***	***10°–12°***	***12°–17°***	***10°–12°***
–	–	20°–25°	–	–
25°–30°	***27°–30°***	***30°***	***30°***	***27° –30°***
35°	–	–	–	–
40°	***40°***	***40–45°***	***42°***	–
45°	***45°***	–	***45°–47°***	–
50°	***50°***	–	55°	–
–	**60° –62°**	–	–	–
–	–	***70°***	–	**67°**
–	–	80°	–	–
85° –90° (270°)	***90° (270°)***	***90–95°(270°)***	***85–90° (270°)***	***90° (270°)***
–	–	–	–	**280°**
290°	***290°***	–	–	–
300°–305°	***300°–305°***	–	–	–
310°	***310°***	–	–	–
315° –320°	***320°***	***320°***	***320°***	–
330° –335°	***332°***	–	–	***330°–335°***
340°	–	***340°***	***345°***	***345°–347°***
350°	–	**350°**	**355°**	***350°***

As Table 1 shows the direction of Krivorozhsko-Kremenchugskii (12°–17°) and latitudinal- meridional (0°–90°) border fault is the dominant ones for the development of breaking failures on both megablocks.

Following diagonal systems are developed within each megablock – 12° –17° and 290°, 40° and 310°, 50° and 320° (on SPMB) and 45° – 47° and 320° (on IMB).

Separate faults have individual trend azimuths not being within the system 25°–30°, 300°–305°, 330°–335°, 340°–345°, 350°–355° their amount being minor.

Sublatitudinal and submeridional systems of tectonic failures as well as failures of Krivorozhsko-Kremenchugskii direction are general for both blocks.

As Table 1 indicates basic directions of high-order breaking failures within the fragments of Sergeievskoie deposit, Solnechnoie and Rodionovskoie ore occurrence are as follows: 0, 90–270°, 12°–17°, and 280° –290°. Moreover, there can be found such fault systems characteristic for both SPMB and IMB as 27° –30° and 300° –305°, 40° –47° and 310°, 50° and 320°.

Further, data of geophysical studies carried out by A.K. Malinovskii within the fragments of Solonianskii ore field and Rodionovskii area were used [6]. Table 2 gives trend azimuths of breaking failures being measured.

Table 2

Trend azimuths of breaking failures according to the results of geophysical studies carried out by A.K. Malinovskii [6] within the fragments of Solonianskii ore field and Rodionovskii [4] area

Trend azimuths singled out according to isoresistivity map, $\rho_к$	**Trend azimuths singled out according to the map of residual anomalies, ΔGост.**	**Trend azimuths singled out according to the map of anomalous magnetic field, ΔTα**	**Trend azimuths singled out according to the map of residual anomalies of magnetic field, $\Delta T_{ост.}$**	**Trend azimuths singled out according to the map of anomalous magnetic field, ΔTα**	**Trend azimuths singled out according to the map of residual anomalies of gravitational field, $\Delta G_{ост}$**
Sergeievskii area, SPMB			**Rodionovskii area, IMB**		
0°	***0°***	***0°***	***0°***	***0°***	***0°***
–	–	–	5°	–	5°
–	–	–	7°–8°	–	7°–8°
12°–17°	***12°–17°***	***12°***	***12°–15°***	***12°***	***12°***
–	–		22°	20° –25°	25°
35°	–	***30° –35°***	–	***30° –35°***	***35°***
–	–	–	42°–45°	40°	40°–45°
–	–	***60°–62°***	***60°–65°***	***60°***	***64°–65°***
90°(270°)	***90° (270°)***	***90° (270°)***	***90° (270°)***	***90° (270°)***	**90° (270°)**
–	–	***287°–290°***	***290°–292°***	–	***290°***
305°	–	***300°–305°***	***300°***	***300° –305°***	–
–	***310°–315°***	***315°***	***310° –320°***	***315° –320°***	***315°–320°***
332°	***332°***	–	***330°–335°***	***330°–335°***	***330°–337°***
–	***340°***	–	***340°***	***340°***	***340°***
–	***350–355°***	–	***350°***	***350°***	***350°***

While comparing trend azimuths given in Tables 1, 2 it is possible to conclude that latitudinal-meridional direction (0°–90°), direction of Krivorozhsko-Kremenchugskii fault (12°–17°) as well as 30°–35° and 300°–305°, 60°–65° and 330°–335°, 310°–320°, 340°, 350°–355° directions are general trend azimuths of both areas.

Conclusions. Directions of border fault – Krivorozhsko-Kremenchugskii 12° – 17° and its orthogonal 280° –290°, latitudinal-meridional directions 0° and 90° as well as 40°–45° and 315°–320° directions are general ones for the failures of different orders on both megablocks.

Both SPMB and IMB demonstrate their individual trend azimuths of tectonic failures of deep occurrence observed within megablocks in general and on its separate areas being singled out according to high-order failures.

Basic fault systems characteristic for SPMB and IMB (0°–90°, 12°–17°) and its orthogonal (280° –290°) as well as 40°–45° and 315°–320° directions can be seen within the fragments of Sergeievskoie deposit, Solnechnoie and Rodionovskoie ore occurrences one which high-order breaking failures have been studied.

According to the results of geophysical survey (residual gravitational anomalies, anomalous magnetic field, residual magnetic field, isoresistivity map, and NIEMEF) 0°–90°, 12°–17°, 40°–47° and 310°–320° are the most general within Sergeievskoie deposit and Rodionovskoie ore occurrence.

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