ANALYSIS OF THE SPATIAL DISTRIBUTION OF GERMANIUM IN THE COAL SEAM C_8^H OF DNIPROVSKA MINE FIELD (UKRAINE)

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The actuality of research of the studying the germanium content in coal seams is due to the possibility of its industrial extraction and use as a valuable accompanying component.

The purpose of the work: to establish a relationship between the germanium content and the thickness and ash content of the coal seam $c_8^н$ of the "Dniprovska" mine field.

Recent achievements. Earlier [1-22], the peculiarities of the distribution of "small elements" that belong to the group of "toxic and potentially toxic elements" in coal seams of some mines of the Pavlohrad-Petropavlivka, Donetsk-Makiivka [24-25] and Krasnoarmiysk [26-40] geological and industrial regions of Donbas and some oil deposits [41-49] were investigated. At the same time, the analysis of germanium distribution in coal seam $c_8^н$ of "Dniprovska" mine field had not been performed before.

Research results. The concentration of this element varies in the range from 0.14 to 23.63 g/t in the $c_8^н$ seam of the "Dniprovska" mine on the constructed isoconcentrate map (Fig. 1) of normalized germanium content. There are five zones of abnormally high content of mine coal on the area. The first zone of increased germanium content with a maximum concentration of up to 19.22 g/t is located between wells No H34102,

No H32729 and No H32914 in the western part of the mine field; the second large area within which the germanium content values reach their maximum of 23.63 g/t is near wells No 12498, No H32355, No H32560, No H32578 and No H32348 in the southwestern part of the field; another relatively small zone of increased germanium content, the values within which reach 16.65 g/t, is located near wells No 13168 and No H3240 and is located in the northwestern part of the mine field; another small location with increased concentrations up to 15.05 g/t is located in the central part of the field near well No H32612; the fifth zone of increased concentrations of germanium occupies the entire eastern part of the mine field (about 34% of the total area of the mine seam) and is characterized, unlike other areas, by a relatively sustained increase in values above the average concentration over a significant area, the maximum content of germanium within the zone reaches 21.95 g/ t.

It should be noted that in the center of this zone there are northeast-trending discontinuous faults, which are accompanied by fairly significant areas of increased fracturing, with which, on the one hand, a significant number of samples with epigenetic sulphide mineralization are associated, and on the other hand, it is not characteristic of the general sampling of samples positive statistically significant correlation between total sulfur and germanium content in the coal seam. The western boundaries of this zone extend in the southeast direction near wells No H3215, No 12406, No H32640, No H32858 and No H32668, the eastern borders are limited by the borders of the mine field.

The minimum value of germanium content in the coal seam $c_8^н$ of 0.14 g/t on the area of the mine field was noted in the sample from the core of the well No H32621, which is located in the northern part of the mine field.

In our opinion, the fact that the general extension of the zones with anomalous increased content of germanium in the coal seam coincides with the extension of northeast-trending discontinuities, which are usually accompanied by areas of increased fracturing, deserves special attention. As is well known, these areas are zones of increased permeability and migration of various genesis and composition of fluids in the coal-bearing stratum. In our opinion, consideration of this issue requires further research.

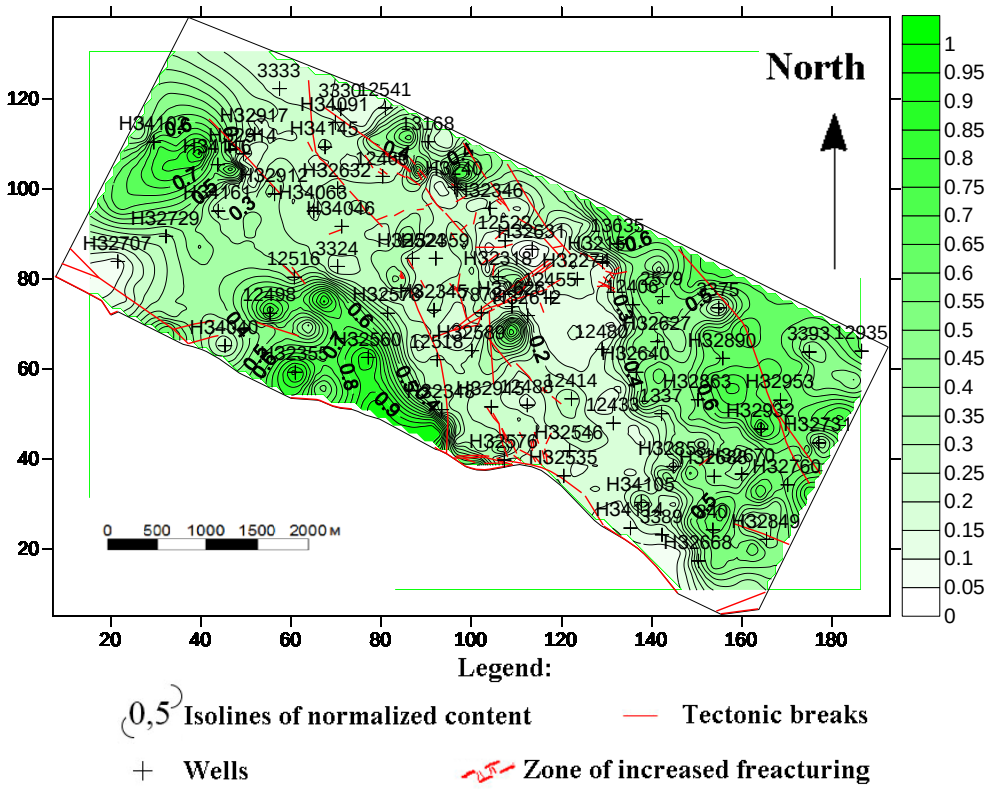

Fig. 1 Map of isoconcentrates of the normalized germanium content in the coal seam $c_8^н$ (Dniprovska mine)

The regional component of the germanium content in the coal of seam $c_8^н$ of the Dniprovska mine (Fig. 2) increases in the southeast direction from 0.27 to 0.43 of this normalized indicator, which corresponds to concentrations of 6.48 g/t and 10.24 g/t.

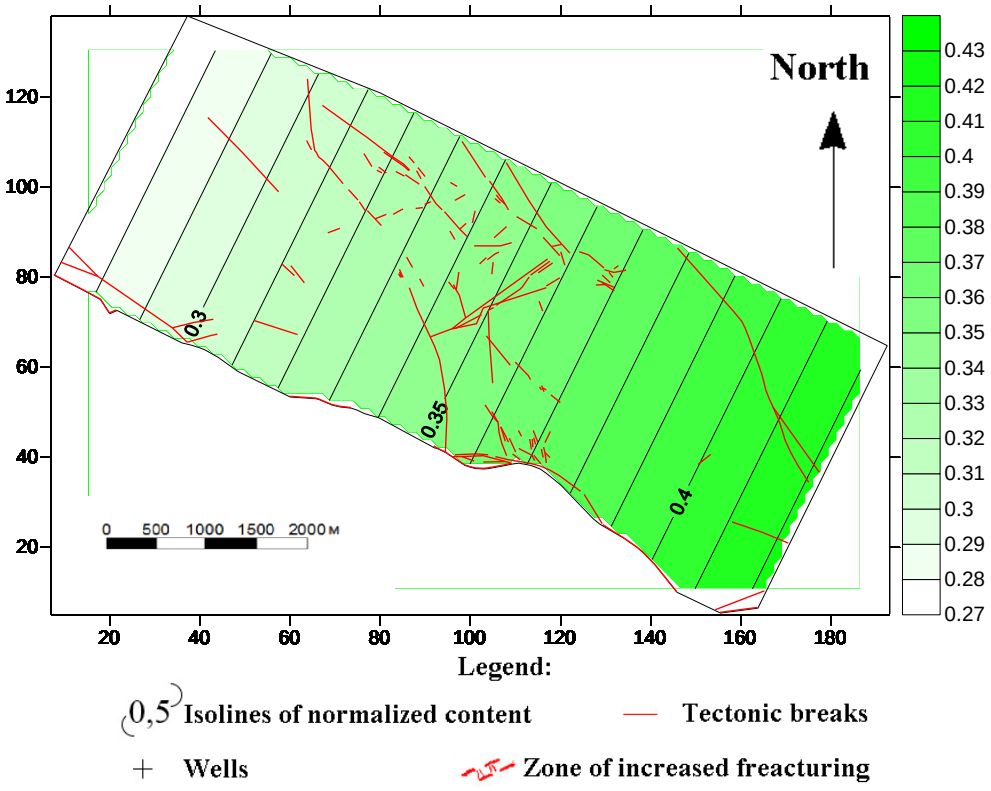

Fig. 2 Map of regional component of change of the normalized germanium content in the coal seam $c_8^н$ (Dniprovska mine)

Local deviations of the normalized content (Fig. 3) of germanium vary in the range from -0.3 to 0.65 in the $c_8^н$ seam of the Dniprovska mine. On the map (Fig. 3), five zones of positive deviation can be distinguished, of which three large ones occupy an area of more than 1 km^2, and two small ones characterized by an area of no more than 500 thousand m^2. The first large zone of local deviation of normalized content with values greater than 0.3 is located in the western part of the mine field near wells No H34102, No H34116, No H32914 and No H32917; the second large area is located in the southwestern part of the field between wells No 12498, No H32355, No H32560, No H32578 and No H32348 in which a significant area is characterized by a significant increase in the indicator (0.5 and more); the third zone of local positive deviations of the indicator is located in the eastern part of the mine field and is characterized by relatively stable values from 0.1 to 0.4, and extends in the southeast direction near wells No H3215, No 12406, No H32640, No H32858 and No H32668, has a sub-parallel spread of discontinuous faults in the center; in the north-western part of the mine field there is a small zone of positive local deviation of the content increase, within its limits the values of the deviation from the regional component vary from 0 to 0.25, and it is associated with the influence of samples from the core of wells No 13168 and No H3240; another small location of positive values of local deviations is located in the central part of the field near well No H32612. The maximum negative values of the local deviation of the normalized content of germanium were noted in the area near well No H32621, which is located 600 meters north of the center of the mine field. It should be noted that the main zone of negative local deviations from the regional component of the germanium content in the coal of seam $c_8^н$ of the Dniprovska mine is located in the central part of the mine field and extends from the southeast to the northwest in the area of the development of relatively small discontinuous faults extending from the southwest to the northeast.

Along the $c_8^н$ seam of the Dniprovska mine (Fig. 4), the gradient of normalized germanium content varies in the interval from 0 to 0.18. Four zones with the highest values of this indicator can be distinguished, each of which occupies an area of no more than 230,000 m^2. The first area of anomalous gradient increase with values greater than 0.13 is located in the western part of the mine field near wells No H34116 and No H32912; another place of increased values is located in the northern, northwestern part of the mine field in the area of wells No 32346 and No 32346, discontinuous disturbances are also located near this area; another area is located in the center of the mine field near well No N32612 and No N32026, in this area there is a whole network of discontinuous faults; the last area of anomalous increase in values originates in the south of the mine field and extends in the north-west direction, the peak of values falls on the place near the well No H32348 where this zone is crossed by a submeridional discontinuity.

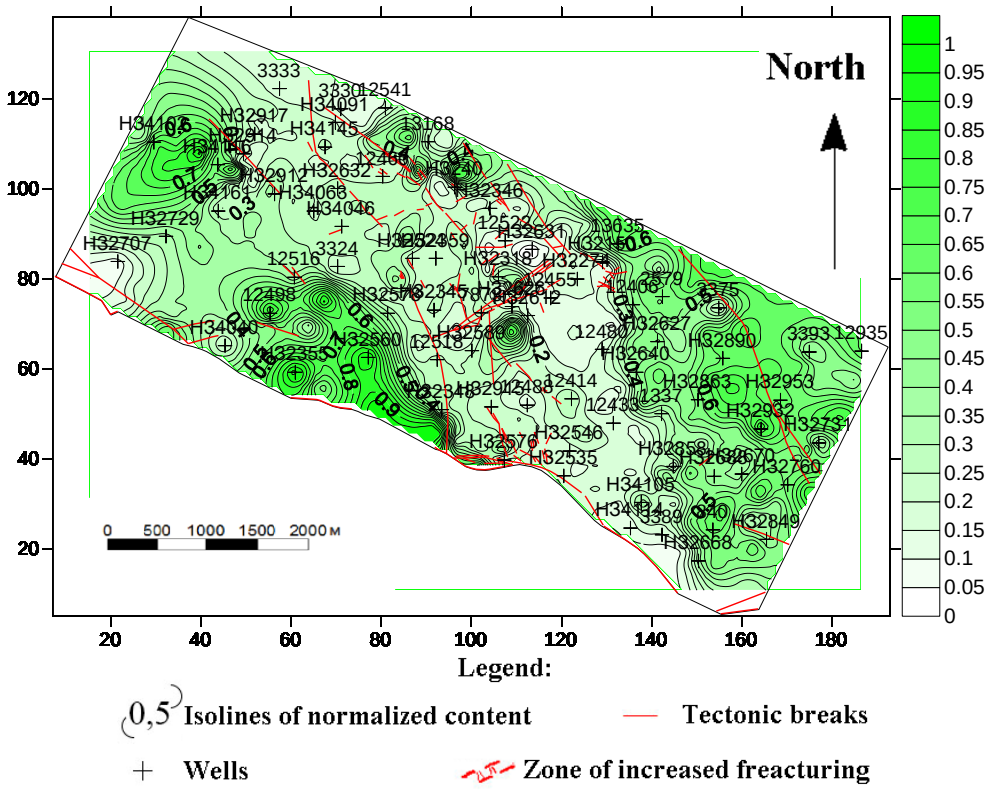

Fig. 3 Local deviations of the normalized germanium content in the coal seam $c_8^н$ (Dniprovska mine)

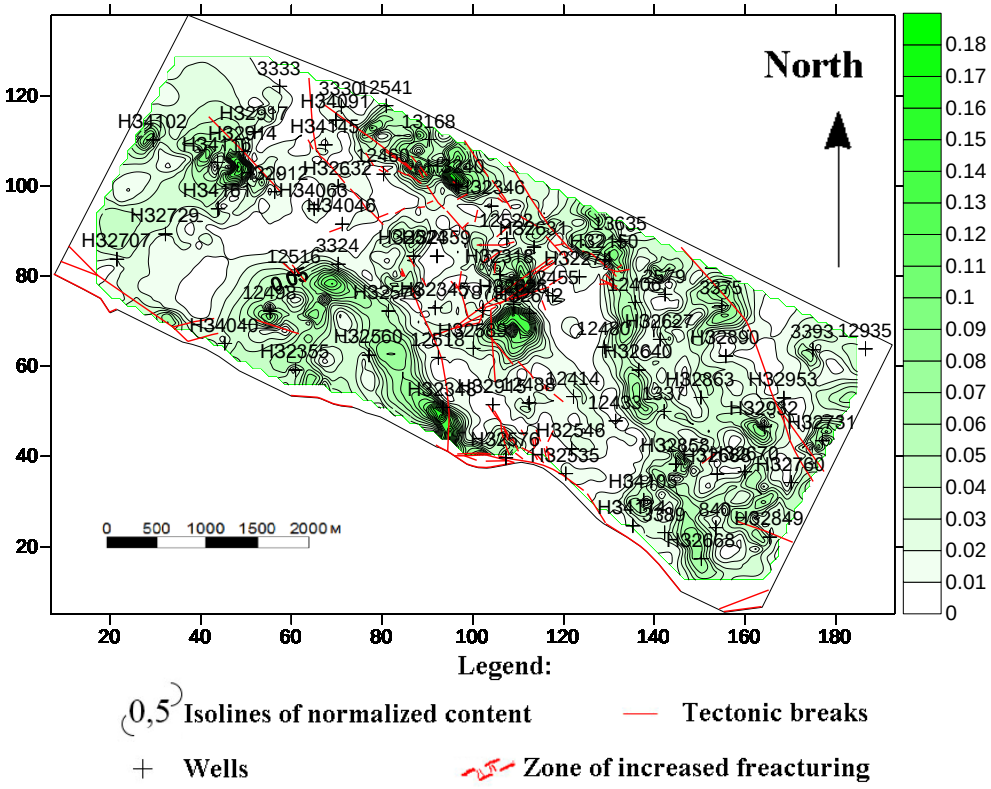

Fig. 4 Local deviations of the normalized germanium content in the coal seam $c_8^н$ (Dniprovska mine)

It is worth noting that when interpreting the zones of high gradients in geochemical concepts as areas of location of geochemical barriers, the general plan of their location

almost everywhere coincides with the extension of discontinuous faults in the northwest direction, indicating the possible significant influence of tectonic factors on the accumulation of abnormal concentrations of germanium in the coal seam. In our opinion, this question needs further research.

Conclusions: 1) The general extent of the zones with anomalous increased content of germanium in the coal of the seam coincides with the extent of discontinuous faults of the northeast trend, which are usually accompanied by areas of increased fracturing. 2) The regional component of the germanium content in the coal of the $c_8^н$ seam of the Dniprovska mine increases in the southeast direction. 3) The main zone of negative local deviations from the regional component of the germanium content in the coal of the $c_8^н$ seam of the Dniprovska mine is located in the central part of the mine field and extends from the southeast to the northwest in the area of development of relatively small discontinuous faults extending from the southwest to the northeast. 4) When interpreting zones of increased gradients in geochemical concepts as areas of location of geochemical barriers, the general plan of their location almost everywhere coincides with the extension of discontinuous faults in the northwest direction, indicating the possible significant influence of tectonic factors on the accumulation of abnormal concentrations of germanium in the coal seam.

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