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APPLICATION OF GIS TECHNOLOGIES FOR STUDYING THE SPATIAL DISTRIBUTION OF THE QUALITY PARAMETERS OF KAOLINS ON THE EXAMPLE OF THE VERBIVSKE DEPOSIT

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Based on the analysis and generalization of the material of the production reports, a database was created for cartographic constructions and the study of the spatial distribution in kaolin's of the average content of TiO_2, Al_2O_3, Fe_2O_3 and the whiteness index, which determine the quality of raw materials. It was found that the content of titanium oxide and trivalent iron in kaolins is insignificant. The whiteness index of kaolin's is determined by the content of titanium oxide in them and, only in some areas, by the content of trivalent iron oxide. The highest-quality kaolin's occur in the form of a southeast-northwest trending band.
Key words: Mykolaiv region, Verbivske deposit, primary kaolin's, spatial distribution of the average TiO_2, Al_2O_3, Fe_2O_3 content and whiteness index.

ЗАСТОСУВАННЯ ГІС-ТЕХНОЛОГІЙ ДЛЯ ДОСЛІДЖЕННЯ ПРОСТОРОВОГО РОЗПОДІЛУ ЯКІСНИХ ПАРАМЕТРІВ КАОЛІНУ НА ПРИКЛАДІ ВЕРБІВСЬКОГО РОДОВИЩА

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На основі аналізу та узагальнення матеріалу виробничих звітів створено базу даних для картографічних побудов та дослідження просторового розподілу в каолінах середнього вмісту TiO_2, Al_2O_3, Fe_2O_3 та показника білизни, які визначають якість сировини. З'ясовано, що вміст в каолінах оксиду титану і тривалентного заліза незначний. Показник білизни каолінів визначаються вмістом в них оксиду титану і лише на окремих ділянках – вмістом оксиду тривалентного заліза. Найбільш якісні каоліни залягають у вигляді смуги південно-східного – північно-західного простягання.
Ключові слова: Миколаївська область, Вербівське родовище, первинні каоліни, просторове поширення середнього вмісту TiO_2, Al_2O_3, Fe_2O_3 та показника білизни.

Entry. Kaolins are included in the list of minerals of national importance. Ukraine ranks first in the world in terms of the number of explored and pre-estimated kaolin reserves. The identified prospective resources amount to 4.5 billion cubic meters. tons, forecast up to 40 billion tons. tons, while in Western Europe it is 3.5 billion. tons. The province of primary kaolin of the Ukrainian Shield stretches for 950 km from Polissya to the Sea of Azov with a width of 350 km [2]. According to the conditions of formation, the depth of occurrence of primary kaolin and

the preservation of deposits, the province of kaolin of the Ukrainian Shield is divided into five subprovinces: Volyn, Podolsk, Central, Dnieper and Azov [2]. According to the genesis, kaolin deposits are divided into eluvial and alluvial. Eluvial kaolins often have high purity, whiteness, and few harmful impurities. Sometimes, due to the significant content of iron hydroxides, kaolin has a yellow color, which forces them to be bleached. In this regard, the study of the spatial distribution of kaolin's with different content of TiO_2, Al_2O_3, Fe_2O_3 and the whiteness index are of great importance.

History of the study of the Verbivske deposit of eluvial kaolin's. Systematic work on the study of the geology of the Middle Pobuzhye region began in 1950 with a complex geological and hydrogeological survey at a scale of 1:200000 sheets M-36-XXXI (Pervomaisk). In 1951, the Black Sea expedition carried out prospecting and exploration for kaolin in the area of the city of Pervomaisk, Odessa (now Mykolaiv) region. At the Verbivske field during this period there were samples 8 wells with a maximum drilling depth of 15 m were drilled. In 1963-1967. On the territory of the district, the Pobuzhsky expedition carried out (Vinogradov G.G. and others) a geological survey at a scale of 1:50000. Kaolin, which was discovered by wells, was investigated for the possibility of their use in the paper and ceramic industries. In this regard, the quality of kaolin was determined, promising areas were allocated, on one of which the Verbivske deposit of primary kaolin is located. In 1970, the Kyiv expedition (Luzhanska L.L., Bondarchuk M.M.) carried out revision and search work to check the occurrence of high-quality kaolin on the territory of sheet L-36-1. One of the objects of the study was the Myhia kaolin occurrence, which, according to the results of the work, was recognized as unpromising, due to the insignificant thickness of kaolin's, their low quality, and significant thickness of overburden. In the period 1984-1990 yrs within the "Pervomaisk" sheet, SGM-200 was carried out. As a result, new data on the geological structure and minerals, 51 occurrences and 47 points of mineralization of various minerals were revealed. In 1991-1992. The Kirovgeologiya expedition carried out exploration work at the Verbynske field by drilling wells [1].

Geological structure of the Verbivske deposit. The Verbivske deposit of primary kaolin is located in the Pervomaisk district of the Mykolaiv region, 4 km north of the village of Myhiya, on the right slope of the Malo-Tashlytska ravine. The area of the deposit is 20.3 hectares. Geomorphological, the area where the deposit is located is a plateau with a general slope in the south-western direction. Orographically, it is a hilly plain dissected by a network of river valleys belonging to the basin of the Southern Bug River. The deposit is confined to the southern axial part of the Pidhorodnyanska syncline, composed of granites, gneisses and migmatites. Accordingly, the kaolin deposit is characterized by inconsistency,

thickness and quality of raw materials. The field is linearly elongated from northwest to southeast. A layer-like deposit of kaolin up to 900 m long is wedged in the eastern, southeastern and southwestern directions. The maximum width of the kaolin deposit is 320 m; minimum is 160 meters. The thickness of the kaolin deposit is heterogeneous, which is associated with uplifts and depressions in the roof of the crystalline basement, which create sharp (up to 10-25 m) fluctuations in the thickness of kaolin. The minimum thickness of primary kaolin (zone of complete kaolinization) is present in wells 30174 – 2.6 m, 30226 – 4.8 m, 30172 – 3.9 m. The maximum thickness of the kaolin deposit is available in wells 30152 – 24.4 m, 30143 – 35.4 m, 30148 – 22.5 m. The average thickness of the kaolin deposit is 10.7 m. Kaolins are represented by two varieties: normal and alkaline.

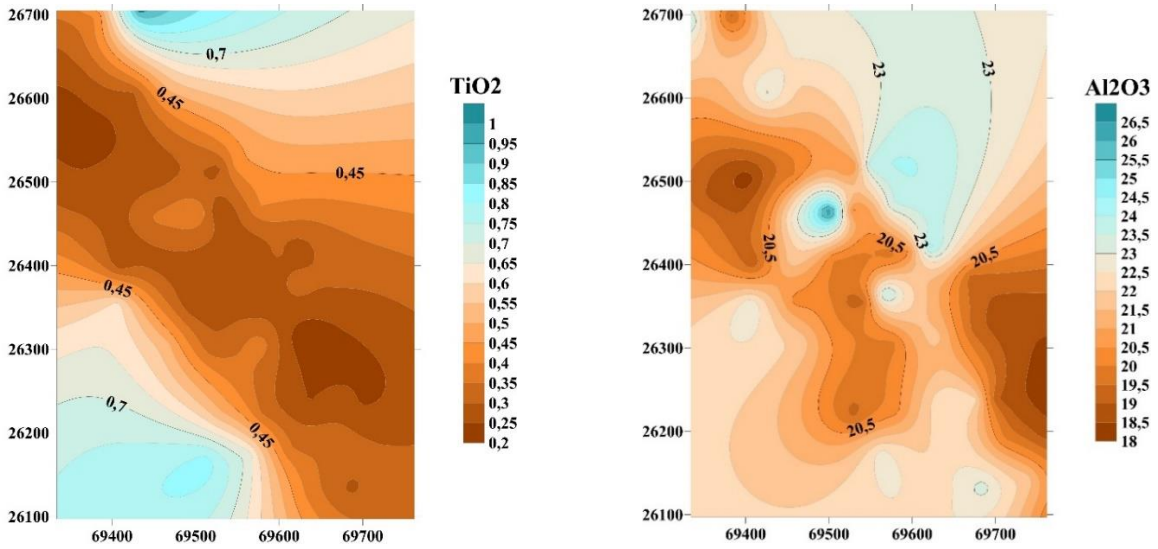
The main useful minerals of kaolin are kaolinite, feldspars, mica. Feldspars are represented by kalispar, the proportion of which in the sandy residues of alkaline kaolins is much higher than in normal ones. In the sandy residues of normal kaolin, the content of kaolinite ranges from signs to 0.5%, in alkaline – from 3 to 6.74%. Mica is represented mainly by muscovite, in the amount of up to 0.68%. Accessory minerals are represented by rutile, zircon, anatase, distene, pyrite, ilmenite, tourmaline, monazite, xenotime, garnet. Of these, anatase (from signs to 0.18%), monazite (from signs to 0.17%), zircon (from signs to 0.01%) are quantitatively significant. Kaolins with medium and high mechanical strength are concentrated in the central part of the deposit.

To study the spatial distribution in kaolins of the average content of TiO_2, Al_2O_3, Fe_2O_3 and the whiteness index, a database was created, which contains the coordinates of wells and the results of the study of the whiteness of kaolin and the content of these oxides in them. With the help of Golden Surfer constructed maps of the lateral distribution of kaolins with different average content ofTiO2, Al2O3, Fe2O3 and whiteness, as well as maps of the roof, sole, and thickness of overlying kaolin of Neogene sediments.

We present some of these constructions, which determine the qualitative indicators of kaolin (Figs. 1, 2). The average content (in %) of oxides in kaolins is as follows: TiO_2 – 0.21-0.97; Al_2O_3 – 18,22-26,8; Fe_2O_3 – 0.2 to 1.43. The whiteness index of kaolin has a wide range of fluctuations from 26.2% to 90.2%. About 65% of the samples are conditioned in terms of linen values.

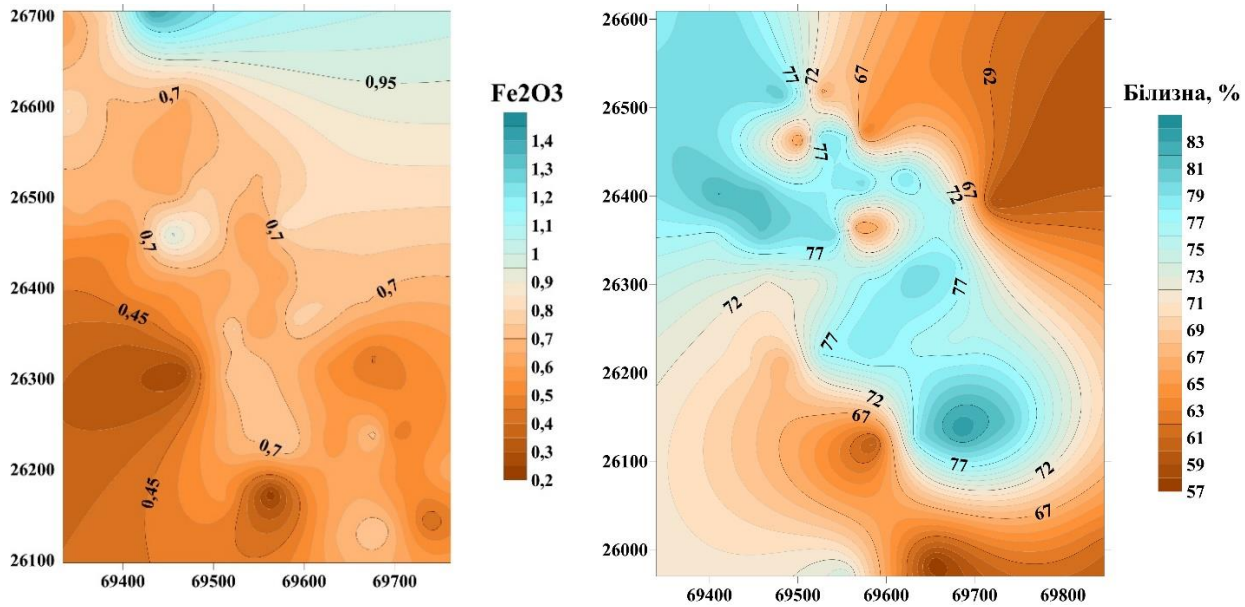
Analysis of cartographic constructions showed that kaolins with a minimum content of$_{TiO2}$ are distributed in the form of a strip of south-eastern – north-western strike, and the maximum content of titanium oxide is inherent in the northern and southwestern parts of the site (see Fig. 1, *a*). The peculiarity of the chemical composition is the low content of titanium oxide, the fine forms of which are almost

completely concentrated in the clay fraction. Distribution of kaolin with minimum Al2O_3 content partially repeats the distribution of kaolins with a low content of titanium oxide (see Fig. 1, *b*). Within the study area, kaolin is characterized by a low content of Fe_2O_3. Kaolin's with a Fe_2O_3 content of more than 1.0% are common in the northern part of the site (see Fig. 2, *a*). Kaolins with a high whiteness index are distributed in the form of a strip of south-eastern – north-western strike with separate areas of a low index within its boundaries (Fig. 2 *b*). Thus, the whiteness index of kaolin's is determined mainly by the content of titanium oxide in them and only partially (in the northeastern part) by the content of ferric oxide.



a *b*

Fig. 1. Maps of lateral distribution of the mean content of TiO_2 (a) and Al_2O_3 (b) in kaolin's



a *b*

Fig. 2. Maps of lateral distribution of the mean content of Fe_2O_3 (a) in kaolins and indicators of whiteness (b)

Conclusions. The highest quality kaolins occur in the form of a strip of south-eastern – north-western strike.

REFERENCES

1. Ozerko V. Exploration of the Verbivske deposit of primary kaolin in the Pervomaisk district of the Mykolaiv region. "Northgeologia". 2005
2. Paranko I.S., Yarkov S.V. Minerals of Ukraine. training manual. Kryvyi Rih: Publishing House, 2011. 364 p.