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Interboundary natural state medium on the Baltic-Black Sea waterways of Western Bug-Dniester segment

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## **INTERBOUNDARY NATURAL STATE MEDIUM ON THE BALTIC-BLACK SEA WATERWAYS OF WESTERN BUG-DNISTER SEGMENT**

**Interboundary natural state medium on the Baltic-Black sea waterways of Western Bug-Dnister segment.** Complex ecology geophysical study on the territory of the proposed Baltic-Black-Baltic Sea channel in Eastern Poland – Western Ukraine border segment is presented. Two possible ways of water connections are proposed. Advantages of the future constructed channel connecting Baltic and Black seas are formulated.

**Key words:** water channel, Dniester, Western Bug, Vyshnya  
Granica między średnim stanem naturalnym w Bałtyk-Czarnomorska śródlądowych zachodniego odcinka Bug-Dniestr.

**Miedzygraniczny stan środowiska naturalnego na terenach Bałtyk-Czarnomorskich wodnych dróg w segmencie Zachodniego Bugu-Dniestra.** Zaproponowano kompleks badawczy na terytoriach, oferowanych na budowę kanału Bałtyk-Czarne Morze. Dwa możliwe sposoby połączenia wody są proponowane. Korzyści kanału zbudowanego w przyszłości łączący Morze Bałtyckie i Czarne sformułowane.

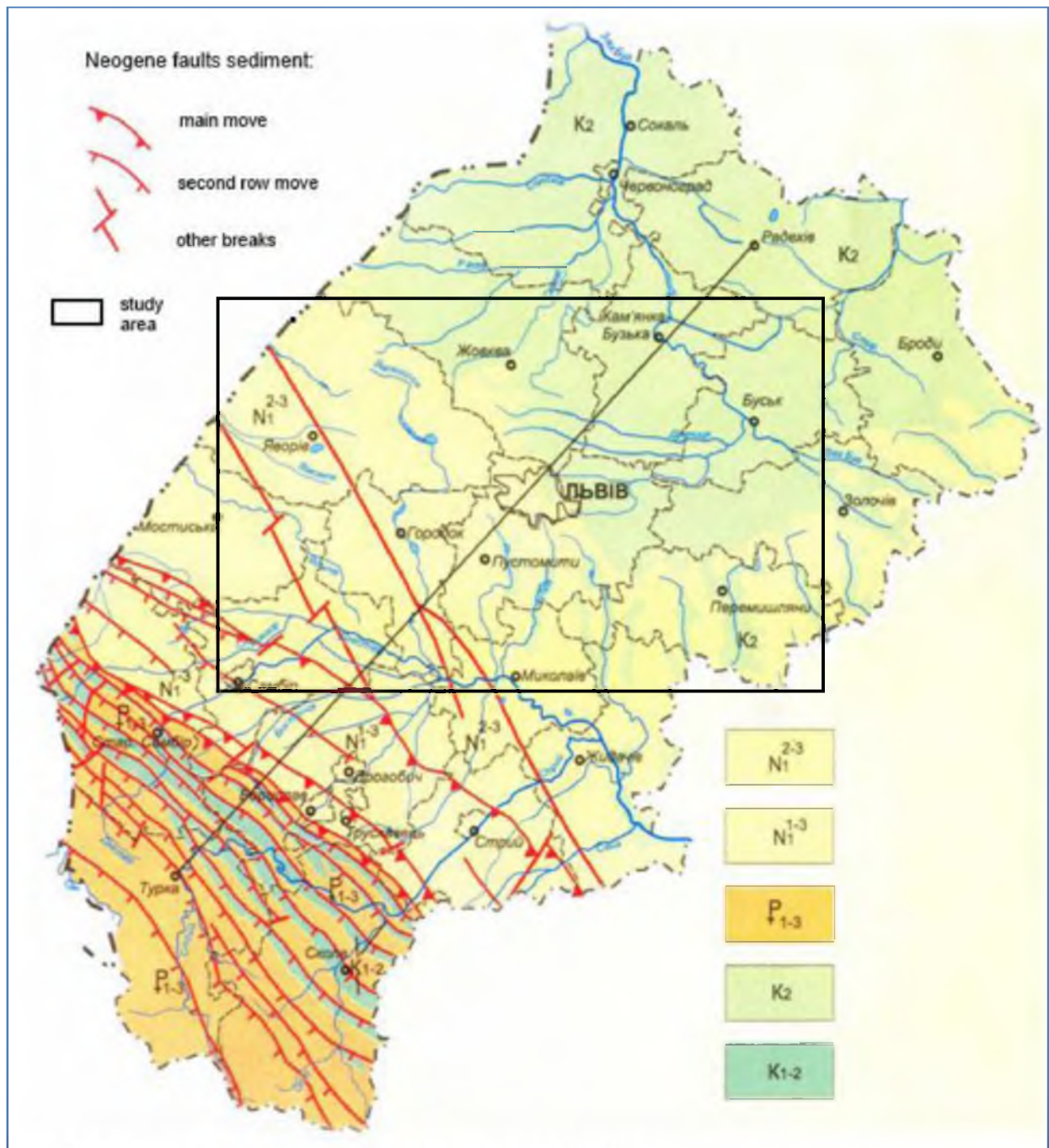
**Słowa kluczowe:** wodny kanał, Dniester, Zachodni Bug, Vyshnja

Waterways in the up today modern technology world leave water transport effective especially in ecology economic aspects. Integration of ecology geological and geophysical investigations including the new members of European Union (EU)– the countries of Central and Eastern Europe, associated countries among them Ukraine must be carried out to obtain the new knowledge in the inter boundary medium natural state on the Baltic-Black seas waterways also in the Western Bug-Dnister segment.

It gives the new jobs in EU, diminish trade costs through use of water transport, reduces environmental pollutions due to the replacement of road transport by water transport, develop new technologies in producing advanced materials, and renovate water infrastructure and technology of ship building strengthening experienced scientists cooperation due to participation in the projects, solve simple mentation challenges in EU.

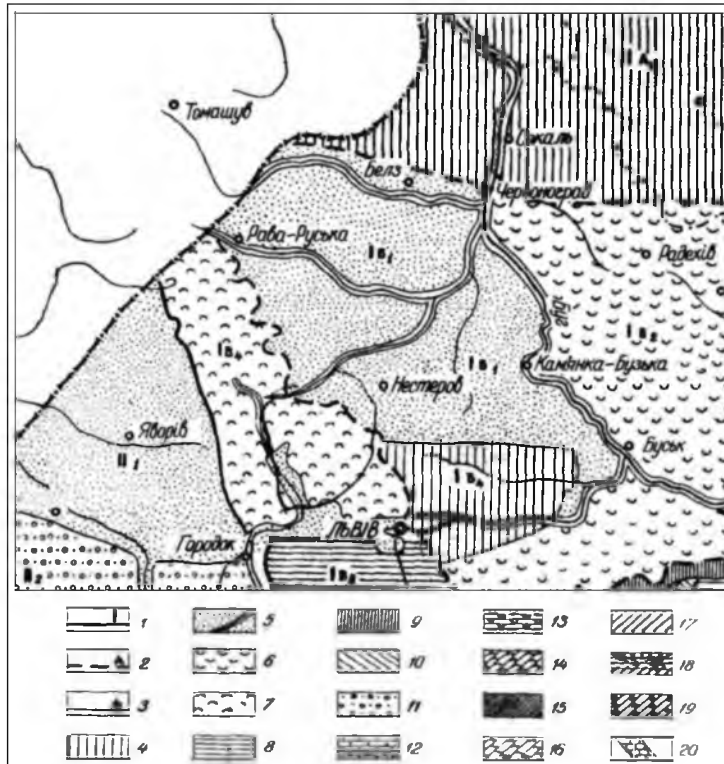
One of the tasks of Baltic – Black Sea waterways construction will be building of the virtual Central – Eastern Europe water transport system model with the connection to extension of West – East on going works including the entire life cycle of the "canals" from their start until end use.

**Investigation of geological structure and relief.** Territories of future channel in geological aspect relevance belong to North-East part of Paleozoic fordip and South-West Ukrainian crystalline plate (Fig. 1). Sediment of the rock here lay on Precambrian basement, which consists of granites and other magmatic and metamorphic rocks. According to geophysical explorations in the vicinity of Lviv region sinking of sediments layers equals 6-7 kilometres. This sink consist the upper Proterozoic, Palaeozoic (Cambrian, Ordovician, Silurian, Devonian, Carboniferous), Jurassic and Cretaceous.



**Fig. 1.** Geological Map of the Lviv region of Ukraine

With aims building of the channels study in details it is necessary to investigate this rocks in the body of which specified ways are structured. Mainly these are Cretaceous and Quaternary sediments. In the base of sink, which consists of senoman sediments, coarse-grained sandstone and sandy marl, upper layer sediments of criterions systems are constructed mainly of light-grey, white soft marl, limestone, what significantly helps in channel building. In the Southern part of the research sedimentary deposits of Neogene age are disseminated. Quaternary sediments consist fluvio-glacial loses and alluvial complex rocks with a thickness of 0.5 to 36 meters. The geological structure is reflected in relief (fig. 2). Territories of investigation found itself in Volyn-Podilla and Lviv Paleozoic Foredeep [1]. The main peculiarities of the territories are that the channel will cross main European water section, which will cause certain engineering dipping in a channel, maybe also – engineering solution to fill the channel with water in the higher spoils. Specifically similar problems exist in France utilizing systems pumping water through the mounting ridge which are solved there.



**Fig. 2.** Geomorphologic scheme of the Northern part of the Lviv region [4]: 1 – border indices and geo-morphological regions; 2 – border subregion sand indices; 3 – border sand morphological districts, orographic terrain elements; 4 – strand loess hills; 5 – outwash sands, alluvial plains and river valleys; 6 – denudation plains; 7 – hilly loess hills; 8 – structural plateau; 9 – hill relief platform; 10 - hilly loess-ridged hills; 11 - moraine, fluvioglacial, alluvial plains dissected; 12 – accumulative terraced foot hills watershed; 13 – structural and erosional hills; 14 - lowland-hilly terrain; 15 – ridges monoclinal; 16 – lowland terrain; 17 - lowland erosion-anticlinal ridges; 18 – medium upland terrain; 19 -high erosion-anticlinal ridges; 20 – Tovtry relief

**Hydrology.** Authors consider two variants of the river junctions for the Baltic and Black sea waters. First variant: channel structuring, which connect Dniester and Western Bug river. The second variant is channel structuring, that will join Dniester river and San river on Polish territories through Vyshnya river. Those variants have their advantages and drawbacks, which needs detailing of research.

In this paper we consider appropriate to write the information about data upon mentioned rivers.

**Dniester river.** River fitting – mixed: rain and underground waters. Spring water arise start in the end of February, in the first days of March. Spring flood on Dniester river is maintain with several ways. During flooding water arise from 8 to 166 cm and in distinct years up to 5 meters. In summer-autumn period it is observed in average up to 5 flooding. Average duration of flooding is 10-25 days. River ice regime is not stable. Average sick of ice suffers area 25 cm [1].

**Western Bug** – right Vistula tributary. Width of the channel in low water is 25-70 m, depth – 1.1-1.7 m, average velocity – 0.45-0.65 m/s. Relief basin of Western Bug is characterized as embedded in erosion-developed and flat plane-cavity formations [1, 2]. Swamping of the river achieves 3.7% [3]. In addition, in areas close to the surface occurrences of carbonate rocks distributed at karst landforms are disseminated. River is owing to plain type of rivers. River feeding is mixed: rainy, snowy and underground. Exist three times of water arising: spring flooding,

summer freshet and winter rising as a result of winter melting. Spring flooding starts freezing in the middle of May. Highest level in the year is observed in March, 13 – March, 18 and may exist all over the average line [1].

Vyshnya river – right tributary of San river lies in lands – 79 kilometres. The river Vyshnya is only 0.3-0.5 meters, the width is 2.6 meters in upper river and 20-30 meters in down river, that is while building the channel it will need its deepening and widening in the upper river [1]. The river Vyshnya srteems through San – Dniester watershed plain. Vyshnya river flow to San river, Radymno town in Poland.

On the following we show the map, where the distinct part of the territories (Lviv region) with Vyshnya water stream is presented.

The area of research is of great human impacts [2, 5-9]. This will require additional studies to assess the possible impact of both man-made objects on the chemical composition of the water channel and the impact of canal on ecological environment.

### **Conclusions:**

1. Territories of future channel in geological aspect relevant belong to North-East and South-West Ukrainian crystalline plate. This thick consist of upper Palaeozoic, Palaeozoic (Cambrian, Ordovician, Silurian, Devonian, Carboniferous), Jurassic and Cretaceous.
2. There are two variants of river junction for the Baltic and Black sea waters. First variant – channel structuring, which should connect Dniester and Western Bug River. The second variant is channel structuring that will join Dniester river and San river on Polish territories through Vyshnya river.
3. River areas studied are with mixed supply (rain, snow, underground). They are characterized by high spring flooding, which can occur in several waves and summer freshet.

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