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## Geological mapping of Lithuanian marine areas of the Baltic Sea – reactivated

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Geological-geophysical investigations of Lithuanian marine areas of the Baltic Sea began in the beginning of the 1960s. Although they contain a lot of geological information, the most effective way for the synthesis of basic geological knowledge which is needed for the assessment of various geological conditions and the rational utilization of natural resources is based on the complex geological mapping of the Baltic Sea coast and the marine areas.

In 1986–1989 geological mapping of part of the Baltic Sea shelf (sheets N-34-II, N-34-III and N-34-IV) was carried out at a scale of 1:200 000 (Fig. 1). Based on the collected geological materials, the set of thematic maps was prepared: bathymetric, sea bottom geological and lithological, Quaternary geological, geomorphological, bottom sediment geochemical, scheme of mineralization of the near-bottom water and vertical changes of the mineralization in the water column.

Geological mapping of marine areas at a scale of 1:50 000 was started in 1992. At that time Lithuanian Geological Survey (LGS) was implementing the part of the “Geology for Society” program – geological mapping of Lithuanian marine areas of the Baltic Sea. Geological mapping of the seabed was planned until 2019. Under this program, the specialists of the former Institute of Geology carried out the geological mapping during 1993–1996. The first mapping stage was carried out at a scale of 1:50 000 in Klaipėda–Šventoji area (sheets N-34-6-A, B, V, G, N-34-7-A, V, O-34-138-V, O-34-139-V, area of 1630 sq. km) (Fig. 1). The geological structure, geomorphology and bottom morphology, geochemical composition of the bottom sediments, their physical and mechanical properties, distribution of biota in bottom sediments, seabed mineral resources, ecological bottom assessment and charac-

teristics of the bottom landscapes have been analysed. The maps of factual data, pre-Quaternary geological, Quaternary geological, geomorphological, lithological, and bottom landscapes (1:50 000), sub-Quaternary surface, thickness of the Quaternary deposits (1:100 000) were carried out. The set of seismostratigraphic sections (1:50 000) and the scheme of interpreted sonograms (1:100 000) were prepared as well. Geological mapping was also continued in the southern part of the Lithuania’s Baltic Sea area – Klaipėda–Nida zone (second stage of the program implementation), but due to the lack of financial resources these works were discontinued, geological maps for the southern part of the marine area were not compiled.



Fig. 1 Geological mapping of the Baltic Sea: 1 – scale 1:200 000 (1989), 2 – scale 1:50 000 (1997), 3 – scale 1:50 000 (2017–2018)

When Klaipėda University research vessel MINTIS was built (in 2014), continuation of the geological mapping become technically possible. The Lithuanian Geological Survey has prepared a project for the complex geological mapping of the Preila zone of the Baltic Sea (territorial sea and exclusive economic zone) at the scale of 1:50 000. Project area – 770 sq. km. During the implementation of the project there was a plan to carry out geological mapping of the Quaternary thickness and compile a set of geological maps at a scale of 1:50 000. The set of maps and schemes should include: bathymetric, Quaternary geological, lithological, geomorphological, bottom sediment geochemical, underwater landscapes, ecological, physical properties of sediments, mineral resources, etc. In addition, the explanatory note of the entire study has to be compiled.

Team of professional researchers from LGS, Klaipėda University and JSC “Geobaltic” have been involved in the implementation of these goals. During the field works on the R/V MINTIS, hydrographic, geophysical and geological surveys were carried out. The sea depth and morphology of the seabed were investigated using multi-beam echo-sounder Reson Sea Bat 7125 (motion sensor – Octans 3000, positioning system – Hemisphere). Sediment distribution and the objects on the sea floor were identified using side-scan sonar Klein 3000. The upper part of the bottom – up to 50 m depth – was investigated using the parametric seismic system INNOMAR SES2000 and the low-frequency seismic device – SIG BOOMER. The total length of profiles of complex investigations (multi-beam echo sounding, side-scan sonar, low-fre-

quency seismic system) – 2525 km; total length of parametric seismic survey profiles – 1784 km. Preliminary evaluation of the information obtained during the complex geophysical studies has led to the selection of the sites for sampling and vibro-coring of bottom sediments. As a result, 228 grab samples using Van Veen grab and 11 vibro-cores (until 5 meters long, using VGK 3/6 vibrocorer) have been collected and prepared for laboratory testing.

Based on the collected data the preliminary bathymetric, lithological and Quaternary sediments thickness maps have been compiled (scale 1:50 000). This is a preliminary evaluation of the performed geological and geophysical investigations only. Detailed results will be presented when all collected data is properly analyzed, laboratory tests performed and integrated geophysical data interpretation is made.

Project team hopes that restarted geological mapping of the Lithuanian marine areas of the Baltic Sea will not terminate with the Preila zone. It is important to continue the same scale and complexity geological mapping in remaining – unmapped marine areas of Lithuania. Using modern techniques and complex approach allows to evaluate the natural resources at the sea, answer many issues related to the utilization of the Baltic Sea area for practical use (construction of wind energy parks, exploration of mineral deposits, etc.). Obtained geological information contributes to the better understanding of value and nature of Lithuanian marine areas, assess the suitability and potential for different developments at the sea, and mitigate the ecological problems related to the contamination of the bottom sediments and threats posed by buried chemical weapon.