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PECULIARITIES OF SEDIMENTARY ENVIRONMENT OF MOST POLLUTED BOTTOM SEDIMENTS IN THE LITHUANIAN WATERS OF CURONIAN LAGOON

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Introduction

The lithological composition and geochemical properties of bottom sediments of Curonian lagoon depend on sedimentary conditions. Water and particulate material circulation patterns are the most important ones. Bottom sediments of Curonian lagoon were rather thoroughly investigated in the last ten years (Gudelis, 1958; Repečka, Pustelnikov, Červinskas, 1980; Biogeochemistry..., 1983; Gulbinskas, 1994–1995; Galkus, Jokšas, 1997; Jokšas, Galkus, Stakėnienė, 1998; Pustelnikovas, 1998; Jokšas, Galkus, Stakėnienė, 2003). Yet due to the lack of field data the notion of general circulation system was based mainly on theoretical speculations.

New investigations of currents and some other water indices in the Lithuanian waters of Curonian lagoon (Galkus, Jokšas, 2002; Chubarenko, Lund-Hansen, Beloshitskii, 2002; Galkus, 2003a; Galkus, 2003b) provided data allowing a new insight into the processes taking place in the lagoon. The aim of the present article is to distinguish the areas of most highly polluted bottom sediments on the basis of certain parameters and to determine the specific features of their sedimentary environment on the basis of analysis of new and previously obtained data about spatial changes of characteristic indices.

1. Material and methods

The article deals with the Lithuanian waters (Klaipėda strait exclusive) of Curonian lagoon. The evaluation of granular and geochemical composition of bottom sediments are based on the archival material of the Institute of Geology and Geography, Department of Marine Research, Marine Environmental team, and published data (the list is given in the introductory part). The spread boundaries of the main lithological types of sediments were specified using the newest published data (Kuršių marios, 2002). The distribution pattern of analysed geochemical indices in the surface layer (0–3 cm) of sediments – organic carbon (C_{org}), hydrocarbons (HC) and metals (Fe, Mn, Zn, Cu, Pb, Cd) – and investigation methods were described in detail in the article by Jokšas, Galkus, Stakėnienė, 1998. Analysis of particulate material and concentrations of $CaCO_3$ in the sediments was described in the monograph (Galkus, Jokšas, 1997).

Comparative analysis of spatial distribution of indices is the chosen method of investigation.

2. Results

2.1. Distinguishing of polluted areas of bottom sediments

Analysis of the distribution patterns of geochemical index values (during expeditional examinations and through generalization of obtained results) allowed distinguishing 6 sediment regions marked by highest sediment saturation with hydrocarbons, assemblages of certain metals or individual elements (Fig. 1).

The 1st region includes the northern part of the deepest area of lagoon, extending from its southern part till the central part, and slope section of Curonian spit at Nida settlement. The depth ranges from 3.7 to 5.8 m. The lagoon bottom closer to the spit is covered by coarse-grained (the size of mineral particles ranges from 0.1 to 0.05 mm and fine-grained (0.05–0.01 mm) silt mud. The mineral frame of one third of mud sediments at a depth of 4.5–5 m is composed of >0.01 mm particles (clay or pelite fraction). This kind of mud is referred to as silt–clay mud.

The 2nd region covers the central part of bottom depression near Preila settlement (the depth exceeds 4 m) and spit slope till the depth of about 3.7 m. The bottom is covered by silt. The variation of granular composition of its minerals particles follows similar pattern as in the 1st region. As the depth of the 2nd region is smaller it has no well developed area of fine-grained silt–clay mud. This kind of mud occurs only locally.

The 3d region is extending north of Žirgų Ragas cape along the Panerija deep towards the Agilos Ragas cape in the north. The boundary of this region approaches the spit coast in the west (50–100 m) and is striking till the 2 m isobath in the east. The surface layer of bottom sediments is composed of silt mud. The proportion of sand in the silt sediments is appreciably higher in the eastern periphery of the region.

The 4th region represents a continuation of the deep in front of Skirvytė mouth (Fig. 1). The depth in the central part of the region exceeds 4 m and in the periphery it reaches about 2 m. The bottom is covered by mud. The particles of its mineral frame grow finer with an increasing depth. Silt–clay mud is accumulating in its deepest part.

The small 5th region is distinguished immediately next to the Atmata branch mouth (Fig. 1). The depth ranges from 5–4 m near the mouth to 1.5 m in the periphery. The surface sediments of the 5th region are composed of fine-grained sand. Its composition is diversified by alluvium, coarser sand and silt admixtures.

The 6th region occupies the area near the eastern lagoon coast in front of Dreverna and Klišupė small rivers mouths and north of them. The bottom is covered by fine-grained sand of more variable granular composition than in the 5th region. The depth does not exceed 2.2 m. The eastern nearshore is overgrown with macrophytes.

The surface bottom sediments of the 1st–4th region stand out for the highest concentrations of biogenic components in the Lithuanian waters of Curonian lagoon. C_{org} amounts to 0.5–0.7% in the dominant fine-grained sand sediments. The content of C_{org} often exceeds 5 % (sometimes even 10 %) in the 1st–3rd region. It is slightly lower in the 4th region, where it ranges within 1–5%. The concentration of $CaCO_3$ is not exceptionally high in the 1st region (1–8%) but it increases considerably (>20%) in the southern periphery. The values of $CaCO_3$ increase up to 5–9% in the 2nd region, 10–19% in the 4th region and reach their maximum (>20%) in the 3d region. The concentrations of $CaCO_3$ reduce in the 5th–6th region (to 1–4% and <1% respectively) where mud sediments are not accumulating. In majority of cases the sharp rise of the proportion of mud and concentrations of biogenic

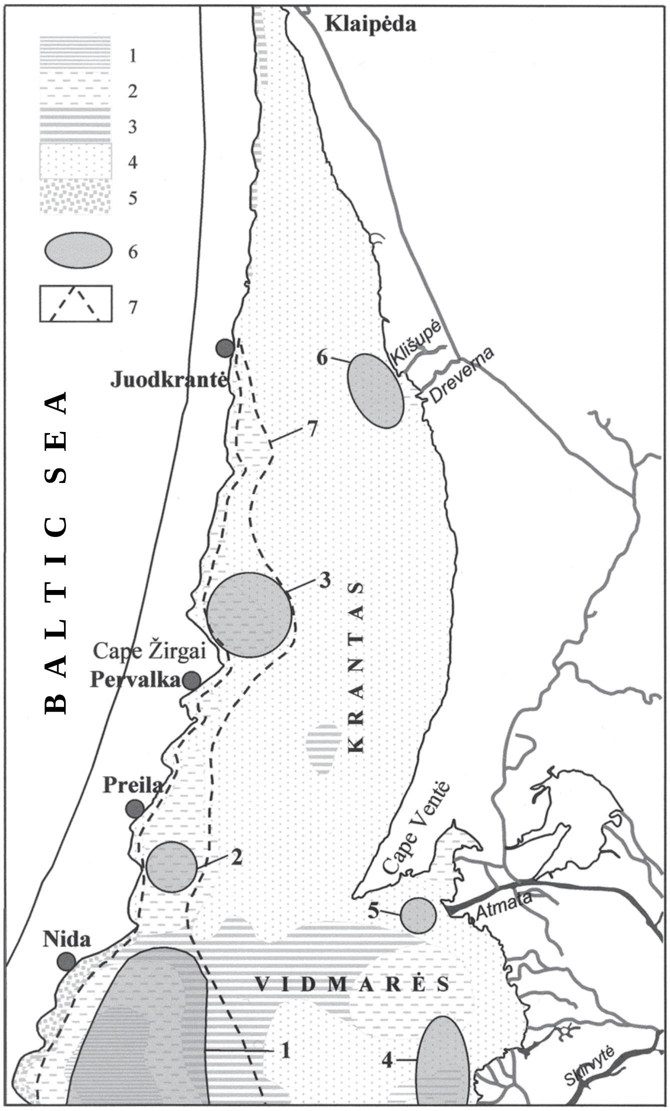

Fig. 1. Most highly polluted areas of surface (0–10 cm) bottom sediments in the Lithuanian sector of Curonian lagoon. Bottom sediments: 1 – mud silty-clayey, 2 – mud silty, 3 – sand silty–silt sandy, 4 – fine grained sand, 5 – medium-grained sand, 6 – most highly polluted areas of surface bottom sediments, 7 – zone of direct impact of dissolved and particulate matter runnoff from the southern part of Curonian lagoon.

1 pav. *Labiausiai užterštų paviršinių (0–10 cm) dugno nuosėdų rajonai Kuršių marių Lietuvos akvatorijoje. Dugno nuosėdos: 1 – aleurito–pelito dumblas, 2 – aleurito dumblas, 3 – aleuritingas smėlis–smėlingas aleuritas, 4 – smulkiagrūdis smėlis, 5 – vidutingrūdis smėlis, 6 – labiausiai užteršti paviršinių dugno nuosėdų rajonai, 7 – iš Kuršių marių pietinės dalies atsklindančios skendinčiosios ir ištirpusios vandenyje medžiagos didžiausio poveikio zona.*

material (organic carbon in particular) is associated with the growing content of planktonogenic organic detritus (sometimes up to 40%) (Jokšas, Galkus, Stakėnienė, 1998).

The average concentration of C_{org} in the bottom sediments of the 5th region in front of Atmata mouth is small (<0.5%) in comparison with the concentration of carbon in the mud and with the concentrations characteristic of the greater part of fine-grained sand. The average concentration of C_{org} in the sediments of the 6th region is higher – about 1%.

Previous investigations revealed that the concentrations of metals are greater in the mud sediments (Jokšas, Galkus, Stakėnienė, 1998). While distinguishing the most highly polluted areas of lagoon bottom we confined to the zones where the concentrations of analysed metals assemblages are appreciably higher than in the surrounding areas.

The 1st, 2nd and 3rd regions are most comparable among themselves according to the spectrum of chemical ingredients. They are characterized by elevated concentrations of metals and hydrocarbons. The mean concentrations of hydrocarbons are gradually increasing moving in the northern direction: the 1st region – 40 µg/g, the 2nd region – 60 µg/g and the 3rd region – 80 µg/g. The concentration of Zn in the mentioned three regions exceeds 70 µg/g (in the greater part of Lithuanian waters of Curonian lagoon it does not exceed 30 µg/g). The same can be said about Cu, whose concentration in the sediments of the 1st–3rd region exceeds 20 µg/g and is appreciably smaller in all other parts (Galkus, Jokšas, 1997). The zones of maximal Pb concentrations (>25 µg/g) are the mentioned three regions and the fourth one. The concentrations of Pb in the sediments of the latter increase moving south and reach their maximum values at the boundary of the investigation area. The concentration of Pb in the Curonian lagoon in the majority of cases equals to 10–15 µg/g but north of Dreverna (till the Klaipėda strait) it is <10 µg/g (Jokšas, Galkus, Stakėnienė, 1998).

The first three regions stand out also for maximal concentrations of Fe (3% on the average) and Mn (0.1%). The average concentrations of these metals in the 4th region are about half as low and they are by 6–10 times lower in the 5th and 6th regions. The 4th region is distinguished for especially high concentrations of Cd (about 2 µg/g).

The concentration of hydrocarbons in the 5th and 6th regions is similar as in the 3rd region. The same concentration in the 5th region (which stands out for the pollution with hydrocarbons) can be regarded as a serious signal of permanent pollution of bottom sediments because the dominant sand sediments are usually characterized by smaller concentrations of hydrocarbons (<6 µg/g). The region in front of Atmata mouth is ascribed to the zones of petroleum hydrocarbon pollution also by other authors (Pustelnikovas, 1998).

The concentrations of organic material and hydrocarbons slightly increase in the 6th region which is under strong impact of wave action. Yet this region is distinguished first of all for pronouncedly elevated concentrations of Cd. The average concentration of Cd exceeds the values occurring in mud sediments and equals 1.5 µg/g (the typical value for the sediments of this granular composition in northern Curonian lagoon is 0.5 µg/g).

2.2. Analysis of the specific features of sedimentary environment

The surface layer of Curonian lagoon bottom sediments has developed during a comparatively short time span and under the impact of similar factors. The environmental factors and, concomitantly, sedimentation processes are subject to certain seasonal variations yet in their total they remain rather stable. This relative stability is supported by the terrestrial runoff which always acts in one direction and plays a decisive role in the natural processes of Curonian lagoon. Human economic activity produces today a considerable influence on the formation of bottom sediments. It may change the features of the shoreline, the depths and the composition of water and drift. We are not going to focus on the composition of bottom sediments as this issue has been discussed in detail in literary sources named in the introductory part.

Water circulation. According to our newest data northern streams are dominant under the settled spring hydrometeorological regime in the section of the first three regions

(Galkus, 2003a) (Fig. 2). It is typical for all three regions that the strongest streams occur in deeper horizons: in the 3 m horizon of the 1st (10–20 cm/s) and 2nd (about 10 cm/s) regions and in the 2 m horizon of the 3rd region (10–20 cm/s). In the summer time, when the terrestrial runoff reduces to the minimum, the general direction of water transport does not change. Yet slowly moving toward the Klaipėda strait the water generates smaller or greater vortices, whose rotation depends on the changing hydrometeorological situation and local geomorphological features (Galkus, 2003b). The ring movement of the water streams is marked by episodic increase of velocities (>30 cm/s) at subaqual slopes. The highest stream velocities occur nearest to the water surface. The best conditions for settling of particulate solids occur when the water stream velocity reduces (both perpendicularly and horizontally to the bottom).

The streams strike south (Galkus, 2003a) or west (Galkus, 2003b) in the 4th region (Fig. 2). The greatest stream velocities (up to 20 cm/s) occur in the surface horizons and reduce in deeper horizons (in the near-bottom layer it is about 5 cm/s).

The region in front of Atmata mouth (No 5) can serve as the best example of transit water area. The little changed river water surges into it in the southwestern direction (Fig. 2). The water stream velocities slow down in this region (from >30 cm/s to 10–20 cm/s in spring and from 10–20 cm/s to <10 cm/s in summer). The ring water circulation, or at least signs of its formation, has been observed north-west of the 5th region (Galkus, 2003a; Galkus, 2003b).

The water of the 6th region in front of Klišupė and Dreverna small rivers is slowly moving towards the Klaipėda strait (Fig. 2). The increase of runoff from these rivers and a favourable hydrometeorological situation create good conditions for formation of closed water circulation rings in the 6th region (Galkus, 2003a). The stream velocity in this region is low: most often 10 cm/s; it rarely exceeds 20 cm/s. The depth in this area is too small to display the relationship of water stream velocities versus depth.

Water turbidity. The all distinguished most highly polluted regions of sediments (the 4th region – only partly) are included in the dispersion zone of terrestrial spring runoff (Fig. 3). The water turbidity in this zone is not lower than in the rivers. Extreme values of water turbidity at the settled spring hydrometeorological regime occur in the 6th region, where they are by 4–5 times higher than the minimal values in the eastern nearshore (Galkus, 2003a). The water turbidity of other distinguished regions does not stand out on the background of the surrounding areas.

The measured summer values of water turbidity are four times as high as the spring values (Galkus, 2003b). The approximately thrice as turbid water as in the Atmata branch is widely dispersed in the studied water area, especially in its central part. In summer the turbid water spreads northward from the southern part of Curonian lagoon. Extreme rise of turbidity values in the 6th region occur in July as also in spring. The water turbidity of other regions does not stand out on the background of the surrounding regions.

Water transparency is opposite to water turbidity index. According to the data of our newest investigations the water transparency in spring is appreciably higher than in summer (up to 1.5 m). It decreases approaching the Curonian spit coast (Fig. 3). The lowest values (<1 m) occur at the mainland coast north of Klišupė river mouth (Galkus, 2003a). The regions of highest sediment pollution (the 3rd region exclusive) belong to the zones of lower transparency than in the surrounding areas.

According to the data collected in July the water transparency values become especially low (up to 0.3–0.2 m) in the narrow nearshore of Curonian spit between Preila

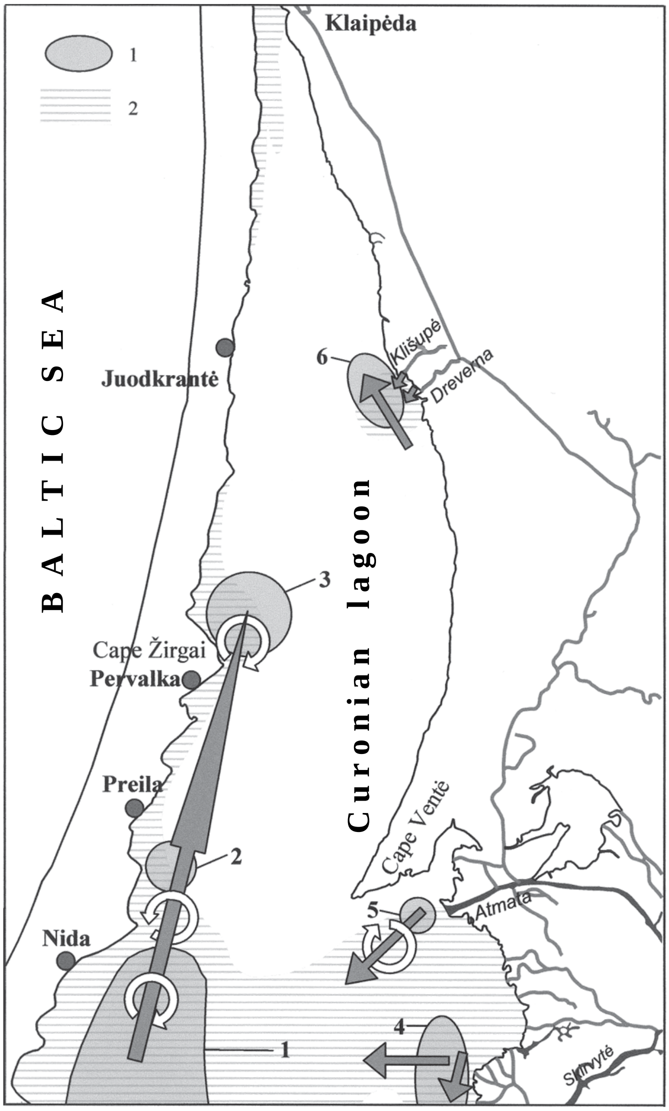

Fig. 2. Directions of main water streams (arrows) in the areas of most highly polluted bottom sediments (1) and zone of positive values of particulate matter sedimentation activity coefficient C_a in the surface bottom sediments (2).

2 pav. *Vyraujančių vandens tėkmių kryptys (pažymėtos rodyklėmis) labiausiai užterštų dugno nuosėdų rajonuose (1) ir vandenyje skendinčiosios medžiagos sedimentacijos aktyvumo koeficiento* (C_a) *teigiamų reikšmių zona paviršinėse dugno nuosėdose (2).*

and Pervalka (the 2nd and the 3rd regions belong to the periphery of the lowest water transparency zone). The low transparency water zone north of Pervalka extends across the lagoon till the mainland coast (Galkus, 2003b). The lowest water transparency values (about 0.1 m) at this time of the year are recorded in the 6th region, where the water is rich in plankton. The water trasparency in the greater part of lagoon in August is more even than in July but the interface zones river–lagoon and lagoon–sea become more prominent (Galkus, 2003b). The sharp decrease of Atmata river water transparency in the 5th region becomes especially visible. This is the region where the development of microorganisms and sedimentation of thindispersed material intensify under the conditions of low stream velocities and mixing of marine and lagoon water.

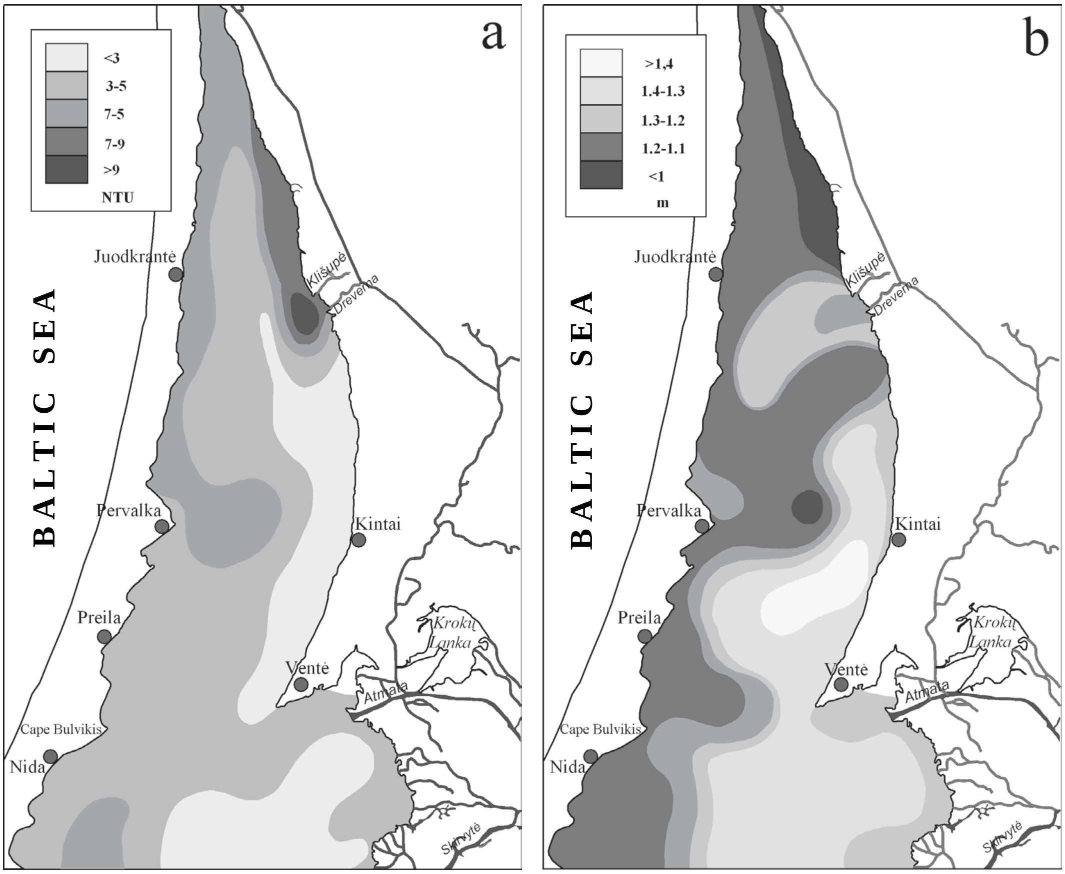

Fig. 3. Water turbidity (a) and transparency (b) in the Lithuanian water area of Curonian lagoon in April, 2002 (Galkus, 2003a). NTU – Nephelometric Turbidity Unit.
3 pav. *Vandens drumstumas (a) ir skaidrumas (b) Kuršių marių Lietuvos akvatorijoje 2002 m. balandį (Galkus, 2003a). NTU – nefetometrinis drumstumo vienetas.*

Particulate material. The thindispersed material transported in particulate form and settled on the bottom accumulates from 70% to 98% of soil pollutants (Galkus, Jokšas, 1997). The greatest amount of this material gets into the lagoon in spring. The greatest amount of organic material is produced in the lagoon water in summer. The indices of particulate material are discussed on the basis of individual long-term data.

The average spring concentration of particulate material is about 20 mg/l. This season is marked by the NW near-bottom water flow in which the concentrations of suspensions are higher than the mean values. This water flow reaches the Curonian spit and disperses in the nearshore (Fig. 3). Main water flow meets on its way all distinguished sediment regions except the 6th region. An especially high proportion (in the surface water layer – 62–85%, in the near-bottom layer – 50–70%) of planktonogenic silicon particles in the total of particulate material is a distinctive feature of the water area between the Atmata mouth and the wide sector of the western nearshore (Nida–Pervalka). The spread zone of this type of water includes the 1st, 2nd, 3rd, and 5th regions. It should be noted that the content of planktonogenic particles in the water suspensions of the 6th region is also appreciably higher (up to 41% in the surface water layer) than in the surrounding areas.

The average spring concentration of particulate material is about 32 mg/l. The flow of water saturated with particulate material from the Nemunas delta, which is typical for spring, takes place in the whole water column in summer. The concentration of suspensions in the near-bottom water layer especially increases (50–60 mg/l) in the western nearshore between Nida and Pervalka (regions 1, 2 and 3) and at the 4th region (50 mg/l). The greater part of particulate material in suspensions is composed of biogenic particles.

The abundance of biogenic material in particulate material in the water column of the Nemunas delta front in warm season has been recorded also by other authors. Generalized results of C_{org} measuring in particulate material revealed that the zone of higher concentrations (2–5 mg/l) of organic carbon is extending from the Nemunas delta till the spit coast and further to the north (Biogeochemistry, 1983). This zone includes regions 1–5. Investigations of organic carbon in the eastern nearshore (the 6th region) have not then been carried out.

The autumn mean concentration of suspensions (26 mg/l) is slightly lower than the summer value. The distribution of particulate material is rather even. The 4th region stands out for the abundance of this material in autumn when it reaches 40–50 mg/l. The greater part of particulate material is composed of mineral particles.

The mean winter concentration of suspensions is only 4 mg/l. The migrating thindispersed material (mostly composed of allochthonous biogenic and mineral particles) produces in this season no greater influence on sedimentation processes in the most highly polluted bottom areas. Especially fine mineral particles dominate in winter suspensions in the 1st –3rd regions near the spit (60–80%) and allochthonous organic material – in the 5th and 6th regions (5–60%).

Sedimentation intensity of thindispersed material depends on its composition and abundance in the water column, water stream velocity, depth, wave action and other factors. This material absorbs the greater part of migrating pollutants. Its sedimentation intensity coefficient (C_a) was calculated for different lagoon bottom areas (Fig. 2). The calculation was based on the average interrelation of median diameter (D_{50}) of sediment fractions versus content of thindispersed fraction (<0.05 mm) using all available data on granulometric composition of different sands. C_a represents the difference between the actual content of thindispersed material in a sediment sample and the content determined by the average interrelation curve determined according to D_{50} of the sample. Positive values indicate the areas of more intensive sedimentation and greater content of settled thindispersed material than the average in the sediments of respective granular composition (Galkus, 1996). The intensity of thindispersed material sedimentation is maximal in the areas of mud sediments (with a very high content of finest fractions). Such areas include the 1st and the 2d regions of high pollution. The sedimentation intensity in the greater part of the 3rd and the 4th regions is maximal. In other parts the C_a values are positive (up to C_a=5 in the 3rd region). The thindispersed material sedimentation intensity in the 4th region is close to the average value: C_a in the sediments of the northern part of the region is close to 0. This value is increasing in the southern direction (up to C_a=1). The 6th region stands out among the surrounding areas (C_a varies from -0.8 to -0.6) for the positive K_a values (up to 3.2) in the sediments.

The variation patterns of the concentrations of silicon particles in the thindispersed material of distinguished regions generally correspond with the pattern of sedimentation intensity of microorganism products and planktonic organic material. The greatest portion of silicon patrticles was recorded in the 1st region (from 30% to 50% of the total of thindispersed material). It becomes especially high in the southern part of the region – the peripheral part of the Lithuanian waters – (often exceeds 50%) and gradually decreases in the northern direction. The concentration reduces to 30 % in the 2d region and to 25%–30% in the 3rd region. The content of silicon particles in the 4th region is 5% and in the 6th region only <0.1%.

It is interesting to note that the distribution pattern of the typical terrigenous element Ti in the bottom sediments is comparable with the distribution pattern of silicon particles in the thindispersed material. The concentrations of Ti become especially high near the coast of Curonian spit (regions 1–3) and in the mud sediments of the 4th region (Pustelnikovas, 1998). The comparability of sedimentation intensity indices of genetically different materials can be accounted for by their close link with the thindispersed material.

Conclusions

1. Six regions of surface bottom sediments (Fig. 1) have been distinguished in the Lithuanian waters of Curonian lagoon. They stand out among the surrounding areas for high values of sediment saturation with organic material, hydrocarbons, certain assemblages of metals and individual elements: organic material, HC, Zn, Cu, Pb, Fe, and Mn – in regions 1–4, HC – in the 5th region and Cd – in the 6th region.

2. The supply and movement of sedimentary material in the regions 1–3 are predetermined by turbulent N–NE streams, abundance of biogenic particulate material and high sedimentation intensity. These regions belong to the dispersion zone of terrestrial runoff where the vital activity of plankton and sedimentation of planktonogenic particles highly intensify in spring. The surge of the water saturated with organic detritus from the southern part of lagoon plays a decisive role in summer sedimentation and composition of bottom sediments. Sedimentation of silt and clay mineral particles is very intensive in regions 1–3.

3. The formation and geochemical composition of recent bottom sediments in the 4th region are predetermined by the general SW water transport and the input of sedimentary mineral material from the Nemunas delta whose thindispersed portion intensively settles in the delta front deep of Ežia shoal. The participation of biogenic material in the processes of sedimentation of the 4th region is not as intensive as in regions 1–3.

4. The 5th region in front of Atmata mouth is in the zone of the most intensive water transit. The almost unchanged river water flows across it in the SW general direction. The slowing down of water stream velocities is responsible for intensifying sedimentation of thindispersed material and accumulation of river pollutants in the bottom sediments.

5. The 6th region in front of Klišupė and Dreverna mouths is marked by low water transparency values and slow NW streams. The sedimentation of thindispersed material in this region is more intensive than in the surrounding areas. The portion of planktonogenic particles in its particulate material increases in warm season and the content of alloshthonous organic material – in winter.

6. The high sedimentation intensity of thindispersed material is the unifying feature for the all distinguished regions. The concentrations of chemical components in the surface bottom sediments tend to grow in the areas of most intensive accumulation of biogenic material. The spectrum of pollutants is predetermined by the position of sedimentation region with respect to the dominant water streams and distance from the river mouths and other sources of pollution.

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Kuršių marių Lietuvos akvatorijos labiausiai užterštų dugno nuosėdų arealų sedimentacinės aplinkos ypatybės

Santrauka

Kuršių marių dugno nuosėdų litologinė sudėtis ir geocheminės savybės priklauso nuo sedimentacijos sąlygų, kurių viena svarbiausių yra vandens ir skendinčios jame nuosėdinės medžiagos cirkuliacijos ypatybės. Atlikus tėkmių bei kai kurių kitų vandens rodiklių naujus tyrimus Kuršių marių Lietuvos akvatorijoje (Galkus, Jokšas, 2002; Galkus, 2003a; Galkus, 2003b), sukaupta vertingų duomenų, naujai nušviečiančių Kuršių mariose vykstančius procesus. Šio straipsnio tikslas – išskirti labiausiai užterštus Kuršių marių Lietuvos akvatorijos dugno nuosėdų arealus ir nustatyti jų sedimentacinės aplinkos rodiklių ypatybes, analizuojant naujų bei ankstesnių sedimentacinę aplinką apibūdinančių rodiklių erdvinę kaitą.

Straipsnyje analizuojama Kuršių marių (be Klaipėdos sąsiaurio) Lietuvos akvatorija. Dugno nuosėdų granulinė ir geocheminė sudėtis įvertinta naudojantis Geologijos ir geografijos instituto

Jūros tyrimų skyriaus Aplinkotyros teminės grupės archyvine medžiaga bei jau spaudoje skelbtais duomenimis. Pagrindinis tyrimo metodas – rodiklių erdvinio pasiskirstymo lyginamoji analizė.

Išanalizavus Kuršių marių Lietuvos akvatorijos paviršinių dugno nuosėdų geocheminių rodiklių reikšmių pasiskirstymą išskirti 6 rajonai (1 pav.), kuriuose nuosėdų prisotinimo organine medžiaga, angliavandeniliais ir tam tikru metalų komleksu ar atskirais elementais laipsnis ryškiai padidėjęs aplinkinių arealų fone: 1–4 rajonuose – organika, HC, Zn, Cu, Pb, Fe, Mn; 5 rajone – HC; 6 rajone – Cd. Nustatyta, kad 1–3 rajonų ruože smulkiadispersės nuosėdinės medžiagos patekimą ir nusėdimą ant dugno lemia sūkuringos Š–ŠR krypties tėkmės ir vandenyje esančios biogeninės medžiagos gausa bei sedimentacijos aktyvumas. 4 rajono dabartinių dugno nuosėdų formavimuisi ir geocheminei sudėčiai reikšmingiausia yra iš Nemuno deltos plūstanti nuosėdinė mineralinė medžiaga ir pietvakarių krypties vandens pernaša. Šiame rajone biogeninė medžiaga į sedimentacijos procesus įtraukiama ne taip intensyviai, kaip 1–3 rajonuose. Priešais Atmatos žiotis esantis 5 rajonas yra intensyvaus upės vandens plūsmo į Kuršių marias tranzito zonoje. Mariose sumažėjus vandens tėkmės greičiui, priešžiotiniame rajone smulkiadispersės nuosėdinės medžiagos sedimentacija ir iš Nemuno baseino atplūstančių teršalų kaupimasis dugno nuosėdose suintensyvėja. Priešais Klišupės ir Drevernos upelių žiotis esantis 6 didesnio užterštumo rajonas pasižymi mažu vandens skaidrumu ir lėtomis ŠV tėkmėmis. Palyginus su aplinkiniais vandens plotais, smulkiadispersės nuosėdinės medžiagos sedimentacija ten yra intensyvesnė, skendinčiojoje medžiagoje šiltuoju metų tarpsniu padaugėja planktonogeninių dalelių, žiemą – alochtoninės organikos kiekis.

Svarbiausias visų išskirtų labiau užterštų Kuršių marių rajonų bendras bruožas yra smulkiadispersės nuosėdinės medžiagos sedimentacijos intensyvumo išaugimas. Cheminių ingredientų koncentracijos paviršinėse dugno nuosėdose turi tendenciją padidėti ten, kur intensyviau kaupiasi biogeninė medžiaga. Teršiančių medžiagų spektro ypatybę lemia dugno nuosėdų arealo padėtis vyraujančių vandens tėkmių atžvilgiu, atstumas nuo upių žiočių ir kitų taršos šaltinių.