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SHORT COMMUNICATIONS

Mercury Content in the Soil-Vegetation Cover of Russky and Shkot Islands (Peter the Great Bay, Primorsky Territory)

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Abstract—The ecological situation on Shkot Island and the adjacent part of Russky Island in terms of mercury content in soils and leaves of tree and shrubbery vegetation has been analyzed. The main sources of mercury input into geosystems have been revealed. To determine its content in soils and vegetation, 3 and 16 plots have been sampled on Russky and Shkot islands, respectively. It is shown that the soil cover of Russky and Shkot islands is represented by typical and dark brown burozems (brown forest soils) and their pyrogenic analogues. Mercury distribution depends on soil properties in a soil cover and on plant species in vegetation. The results of laboratory research of mercury content in geosystems are presented. Using interpolation method, maps of mercury content in the soil cover and oak leaves (*Quercus mongolica)* have been compiled for Shkot Island. The average mercury content in the soil cover of Shkot Island and the adjacent part of Russky Island is 81.2 ng/g. The average contents in various plant species are as follows: 26.3 ng/g for *Carpinus cordata*, 24.5 ng/g for *Quercus mongolica*, 9.1 ng/g for *Artemisia gmelinii*. Such variations are caused by different mercury accumulation ability of the plant species. It is assumed that the high mercury content in the soil and vegetation in the eastern part of Shkot Island is due to tectonic features. The maximum soil mercury content on Shkot Island is confined to the Dotovaya Bay coast, which is the island's main recreation area in summer. Numerous campfires and wood and household waste (first of all, polyethylene) combustion lead to mercury redistribution in the adjoining territories. In terms of mercury content, the ecological setting in the soil-vegetation cover of Russky and Shkot islands is viewed as favorable. The mercury content in soil is much below maximum permissible concentration. Since maximum permissible concentration of mercury in plants is not available, the comparison has been carried out for Clarke values. The mercury content exceeds Clarke values for *Carpinus cordata* and *Quercus mongolica,* which can be attributed to natural regional specifics. The obtained data can be used as background indicators.

Keywords: mercury, soil, vegetation, Russky Island, Shkot Island

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INTRODUCTION

Mercury is one of the most toxic heavy metals. In terms of toxic influence on biota, this element along with lead, cadmium, and zinc is assigned hazard class 1 rating (GOST 17.4.1.02-83, 2008). Even at low concentrations, mercury is a supertoxic and super pathologic element of high biodestructive activity.

Geochemically, mercury tends to form organomineral compounds and strong bonds with sulfur, and has high fugacity. Fugacity of mercury and some of its compounds facilitates its redistribution between all the components of the biosphere. Owing to atmospheric transfer, mercury is widespread in natural ecosystems (Gordeeva et al., 2012). Atmospheric mercury is supplied to soils with precipitation as well as in gaseous and aerosol forms. The study of mercury migration in the atmosphere—plant—soil system showed that atmospheric mercury supplied as vapor is absorbed and retained by conifer needles (Granovsky et al., 2001). Mercury is easily absorbed by plants from feeding solutions, and the resultant increase of mercury in soil causes its increase in plants. In addition, plants can directly absorb mercury vapor. Young plants, unlike old ones, are more sensitive to air saturated mercury vapor (Kabata-Pendias and Pendias, 2001). Plant mercury poisoning occurs at mercury concentration in soil above 1000 mg/kg, while 50 mg/kg cause growth disturbance. Most plants have mercury concentrations between 0.01 and 0.2 mg/kg (Kloke, 1980). Plants usually have lower mercury levels than soils, as plant litter mineralization can lead to mercury accumulation in the upper soil horizons. Mercury content in soil profile is inherited mainly from source rock (Kabata-Pen-

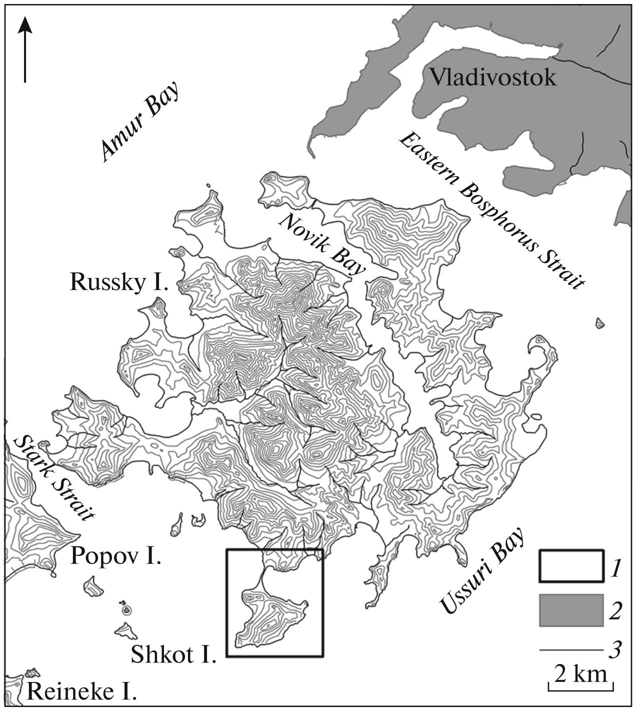

Fig. 1. Map of Russky and Shkot islands with adjacent territories. Symbols: (*1*) studied area, (*2*) Muraviev-Amursky Peninsula; (*3*) water streams.

dias and Pendias, 2001). Therefore, mercury concentration in soil cover varies strongly even within one region. For instance, its contents in the Siberian soils vary within 0.005–1.275 mg/kg (Granovsky et al., 2001). At present, background mercury content in soils is rising considerably due to increasing anthropogenic pollution. Thus, according to the data obtained at the end of 20th century, average mercury concentrations in the surface layer of different soils around the world were no higher than 400 μg/kg (Kabata-Pendias and Pendias, 2001). It is pertinent to mention that mercury found in soil can form particularly toxic compounds : methyl- and dimethylmercury (Il'in, 1991). The highest toxicity level of methylmercury is caused by its high solubility in lipids, where it enters cell and interacts with protein. This results in mutagenic and genotoxic transformations in organisms (Motuzova, 2013).

No integrated study of mercury content in the soil-vegetation cover on the islands of the Primorsky Territory has been carried out up to date. Detailed studies of mercury content in the Peter the Great Bay were conducted by researchers from the V.I. Il'ichev Pacific Oceanological Institute of the Far Eastern Branch, Russian Academy of Sciences. The highest mercury contents were found in the above-water layer of the Amur Bay (4.0, average—2.6 ng/m^3) and the Eastern Bosphorus Strait (3.1, average—2.4 ng/m^3), while the lowest content was registered in the Ussuri Bay (1.1, average—1.8 ng/m^3) (Kalinchuk et al., 2012). The mercury content varied from 0.5 to 0.7 ng/L in the surface seawater layer and from 0.5 to 2.8 ng/L in the bottom layer. The maximum mercury content in bottom sediments (289 ng/L) was found in the Eastern Bosphorus Strait, while sediments from the remaining area of the Peter the Great Bay contained less than 1.5 ng/L (Aksentov, 2015). The highest mercury content in the bottom sediments was noted in the Eastern Bosphorus Strait, where it reached 200–400 ng/g. The mercury content in the bottom sediments of the Amur and Ussuri bays was 100 ng/g, and no more than 25 ng/g in the central part of the Ussuri Bay and in the open part of the Peter the Great Bay (Aksentov and Astakhov, 2009).

At present, the islands of the Peter the Great Bay are one of the development centers of the Primorsky Territory. This is, first of all, the case of Russky Island, and, to lesser extent, Shkot, Popov, and Reineke islands. Due to high hazard of mercury to both natural geosystems and human beings, mercury content monitoring is a necessary condition for stable functioning of natural-territorial complexes and for establishing favorable living and economic development conditions. The high influx of mercury from natural and industrial sources as well as from household waste combustion poses great hazard. In this relation, the study of mercury migration in the atmosphere–plant–soil system and mercury biological accumulation by geosystems acquires critical importance.

The aim of this research is to analyze the ecological environment on Russky and Shkot islands in terms of mercury content in soil and leaves of tree and shrubbery vegetation and to determine the main sources of mercury input in the geosystems.

To this aim, we (1) analyzed physical and geographical conditions of the studied area; (2) carried out field geobotanical, soil, and landscape studies; (3) determined physicochemical properties of soils and mercury content in soil and vegetation; and (4) compiled a series of maps of spatial mercury distribution in soil and vegetation.

OBJECT AND METHODS

Russky and Shkot islands have an area of 9972.05 and 251.83 ha, respectively, and belong to the Empress Eugenie Archipelago, the Frunzenskii district of the city of Vladivostok (Fig. 1).

The islands are mainly made up of granites and granitoids, and abundant pebbled conglomerates, sandstones, and siltstones (Prelovsky et al., 1996). They are characterized by a low-mountain topography, with small terraced and lowland landscapes in the coastal parts and isthmuses. Their water stream system is poorly developed and frequently dries during the rain-free periods. The climate is monsoon, with the average precipitation amount around 800 mm/yr, 85% of which occur in summer. The mean annual temperature is around +6°C (*Scientific-applied*..., 1988). The soils are characterized by "insular" pedogenesis determined by the geochemical influence of the sea, altitude, steepness, slope exposure, and diversity of vegetation. The soil cover is mainly represented by burozems (brown forest soils) (Pshenichnikov and Pshenichnkova, 2013). The vegetation cover is dominated by polydominant broad-leaved shrubbymixed forests with liana consisting of Mongolian oak (*Quercus mongolica* Fisch. ex Ledeb.), hearthleaf hornbeam (*Carpinus cordata* Blume), Amur linden (*Tilia amurensis* Rupr.) and Take linden (*T. taquetii* C.K. Schneid), Korean maple (*Acer pseudosiboldianum* (Pax) Kom.), prickly castor-oil tree (*Kalopanax septemlobus* (Thunb. ex Murray) Koidz.), rhynofolious ash (*Fraxinus rhynchophylla* Hance), Japanese angelica tree (*Aralia elata* (Miq.) Seem.), and others. There are also anthropogenically transformed shrubby–suffruticous–mixed herb communities consisting of *Lespedeza bicolor* Turcz., Gmelin's wormwood (*Artemisia gmelinii* Web. ex Stechm.), sward grass (*Miscanthus sinensis* Anderss.), and others. The islands are dominated by landscapes of gentle and moderately steep slopes on granites and granitoids, and basalts, with the predominance of the highly closed polydominant broad-leaved forests on dark and typical burozems (Ganzei et al., 2016). At present, the geosystems are subjected to intense anthropogenic impact, which is well illustrated by the state of vegetation cover.

Field studies in 2009, 2017, and 2018 in different types of landscapes involved geobotanical descriptions, morphological description of soils, and herbarial sampling of vascular plants. To determine mercury contents in the soils and vegetation, we collected samples of soils from humus horizons, and of leaves of trees and shrubs from 3 and 16 plots on Russky and Shkot islands, respectively (Fig. 1).

Soil samples were stirred, purified from inclusions (plant roots, stones, and others), and dried to air-dry state, and then to an absolutely dry state (in oven at t = 30°C). Then, soil was powdered in a mortar by pestle and sieved through a 1-mm sieve (GOST 17.4.4.02-84, 2008). Biogeochemical samples (leaves) were dried to an air-dry state and ground in order to perform a homogenous sample.

Mass concentration of total mercury in samples was measured by flameless atomic absorption using a RA-915M mercury analyzer with a Zeeman correction of non-selective absorption on a PIRO-915+ pyrolytic device without preliminary decomposition of sample. The PIRO-915+ device transforms bound mercury in atomic state by pyrolysis with its subsequent transfer from atomizer into analytical cuvette with gas carrier (air). Technical facilities of the analyzer make it possible to reach the detection limit of 0.5 mg/kg. The accuracy of analytical measurements of mercury concentrations was controlled by the measurement of the reference soil sample SCHT-3 GSO 2509-83 (NPO Taifun, Obninsk, Russia).

RESULTS AND DISCUSSION

Physicochemical Properties of Soils

The soil cover of Russky and Shkot islands is represented by typical and dark brown burozem and their pyrogenic analogues (*Field...*, 2008). The mercury distribution in soil cover depends on the soil properties. Organic matters have a great influence on the mercury retention in soil (Table 1).

The soils of Russky and Shkot islands are formed under conditions of free intra-soil drainage, which is caused by the light loamy mechanical composition of surficial horizons and elevated gritty consistency (from 40 to 80% vol % of soil mass) of the lower part of the profile. Accumulative-humus horizons of soils are usually characterized by light loamy composition.

Data on the physicochemical properties of soils of Russky Island indicate an active influence of pyrogenic factor on the soil–vegetation cover. The influence of ground fire is expressed in the partial or complete burning out of forest litter and mat under Gmelin's wormwood, and sometimes, in burning of trunks to a height of 1–1.5 m. In the accumulative-humus horizons, the pyrogenic influence is expressed in the presence of coal particles to a depth of 5–10 cm and a change of acid-base indicators. The postpyrogenic transformation of surficial organogenic horizons serves as the main indicator for the fire damage to soil. The most prominent fact of the postpyrogenic soil state is the medium acidity. The salt pH value of horizon AYpir of section 2-17 formed beneath forest is 4.9, which could be attributed to the recent wildfire and influx of litter burning products, in particular, water-soluble ash compounds in soil. These compounds saturate soil-absorbing complex in alkali earth elements and cause a decrease of acidity compared to the background values (Maksimova et al., 2014; Tsibrat and Gennadiev, 2008; Krasnoshchekov and Cherednikova, 2012). Thereby, the obtained data on the content of exchange calcium and magnesium, as well as totals of absorbed bases, and the value of hydrolytic acidity are consistent with this assumption. Similar situation is observed in section 6-17 on Shkot Island, which contains coal particles. This horizon has pH value up to 4.9 and, respectively, the higher content of exchange calcium (13.2 mmol/100 g soil), the total of absorbed bases (25.2 mmol/100 g soil) and mobile potassium (330 mg/kg) compared to other soils under study, which were formed beneath forest massifs showing no traces of pyrogenic impact (sections 4-17, 5-17, 8-17, 12-17).

The content of organic matter in the accumulative–humus horizons beneath the polydominant broad-leaved forests varies within 10.40–12.96 wt %. The higher parameters were found beneath the brushwood of Gmelin's wormwood with Lespedeza (13.21–13.36 wt %). Compared to the forest vegetation, these vegetation communities show the higher total of absorbed bases (25.6–26.0 against 10.0–24.4 mol/100 g)

Table 1. Physicochemical properties of burozems of Russky and Shkot islands

Characteristics			Russky Island			Shkot Island							
Vegetation			Polydominant broad-leaved forest								*Artemisia gmelinii* with *Lespedeza*		
Section no.			1-17	2-17	3-17	4-17	5-17	6-17	8-17	12-17	9-17	11-17	7-17
Horizon			AUpir	AYpir	AYpir	AY	AY	AYpir	AY	AY	AU	AU	AY
Depth, cm			0–20	0–11 (13)	0.5–6 (9)	3–13 (14)	3–9 (12)	4–15	6–20	4–10 (19)	2–15	5–18	1.5–18
Salt pH			4.5	4.9	4.5	4.4	4.6	4.9	3.9	4.5	4.8	4.7	4.4
Organic matter, wt %			12.87	12.84	12.04	12.96	11.62	12.54	11.52	10.4	13.21	13.36	11.62
Mmol/100g soil	Exchange acidity		0.22	0.24	0.3	0.28	0.24	0.24	0.96	0.22	0.24	0.24	0.24
	Hydrolytic acidity		11.0	9.04	9.84	12.0	7.11	7.59	13.6	10.8	7.28	9.23	10.1
	Exchange cations,	Ca^{2+}	10.5	12.0	9.0	10	8.7	13.2	6.5	12.2	10.0	11.5	10.7
		Mg^{2+}	5.5	6.5	4.0	7.5	4.7	5.2	4.5	6.7	7.2	5.5	5.0
		Na^{+}	0.3	0.4	0.2	0.7	0.4	0.4	0.4	0.4	0.6	0.6	0.4
	Total of absorbed bases		20.0	28.0	16.4	20.4	16.0	25.2	10.0	24.4	26.0	25.6	20.0
mg/kg	P_2O_5		47	36	30	22	20	28	–	20	32	30	19
	K_2O		300	275	295	217	124	330	168	185	192	300	249

and mobile potassium forms (192–300 against 124–217 mg/kg). In all soils, the content of mobile phosphorus is extremely low and corresponds to the gradation "unprovided" (Arinushkina, 1970). This parameter for the brushwood of Gmelin's wormwood also exceeds similar data on soils beneath forest (30–32 against 20–28 mg/kg). The content of exchange sodium in soils beneath Gmelin's wormwood is higher compared to that of soils beneath forest (0.6 soil against 0.4 mmol/100 g soil), which is connected not only with the composition of vegetation, but also with proximity to the sea basin and periodical influx of sodium cations with marine precipitation into this territory. The highest content of exchange sodium (0.7) was found in horizon AY of section 4-17 formed beneath forest vegetation. This value is likely related to the position of the section near the coast (6 m) and sea salt impulverization.

Areas at stage of postpyrogenic reduction are characterized by the "elevated availability" of mobile potassium (275–300 mg/kg) in soils (Arinushkina, 1970), which, with allowance for conclusions of other authors (Krasnoshchekov and Cherednikova, 2012), could be considered as the positive influence of pyrogenic factor on soils.

Mercury Content in Soil–Vegetation Cover

Field and laboratory studies of soil and leaf samples revealed the main tendencies in the spatial distribution of mercury on Shkot Island and the adjacent part of Russky Island. The mercury content in soil cover varies within 35.9–158.6 ng/g on Shkot Island and 59–104 ng/g on the adjacent part of Russky Island (Table 2). The analysis of spatial differentiation of the considered element represents a major point of interest in the study. Using interpolation method, the corresponding maps were compiled in ArcMap software package 10.1 (Fig. 2). The highest mercury content was found in plot 4-17 located in the Dotovaya Bay. As distance from this zone increases, the mercury content in soil cover decreases to 60.6–85.0 ng/g, and the central part of the island is characterized by the lowest values of 35.9–60.5 ng/g. The elevated mercury content in soil up to 108.9 ng/g was found in plot 4-18. This value falls practically on the boundary with the next interval of mercury contents, shown in Fig. 2.

The obtained data allowed us to map the mercury content in the vegetation cover only for the Mongolian oak. Compiling the maps for heartleaf hornbeam and wormwood is impossible due to insufficient data array. The mercury content in leaves of the Mongolian oak varies within 14.6–41.5 ng/g, reaching maximum values in plot 4-18 (41.5 ng/g), and minimum, in plot 2-18 (17.9 ng/g). The elevated mercury content was found in plot 6-18 (33.3 ng/g) (Table 2). The spatial distribution of mercury in the vegetation cover differs from that of the soil cover. At the same time, there is some similarity – the elevated mercury content in plot 4-18 with a gentle decrease inward the island. Plot 4-17 is characterized by the maximum mercury content in soil (158.6 ng/g) and the low content in leaves of the Mongolian oak (20.72 ng/g) with the increase up to 28.8 ng/g in plot 1-18 (Table 2, Fig. 2).

The average mercury content in the soil cover on Shkot Island and the adjacent part of Russky Island is

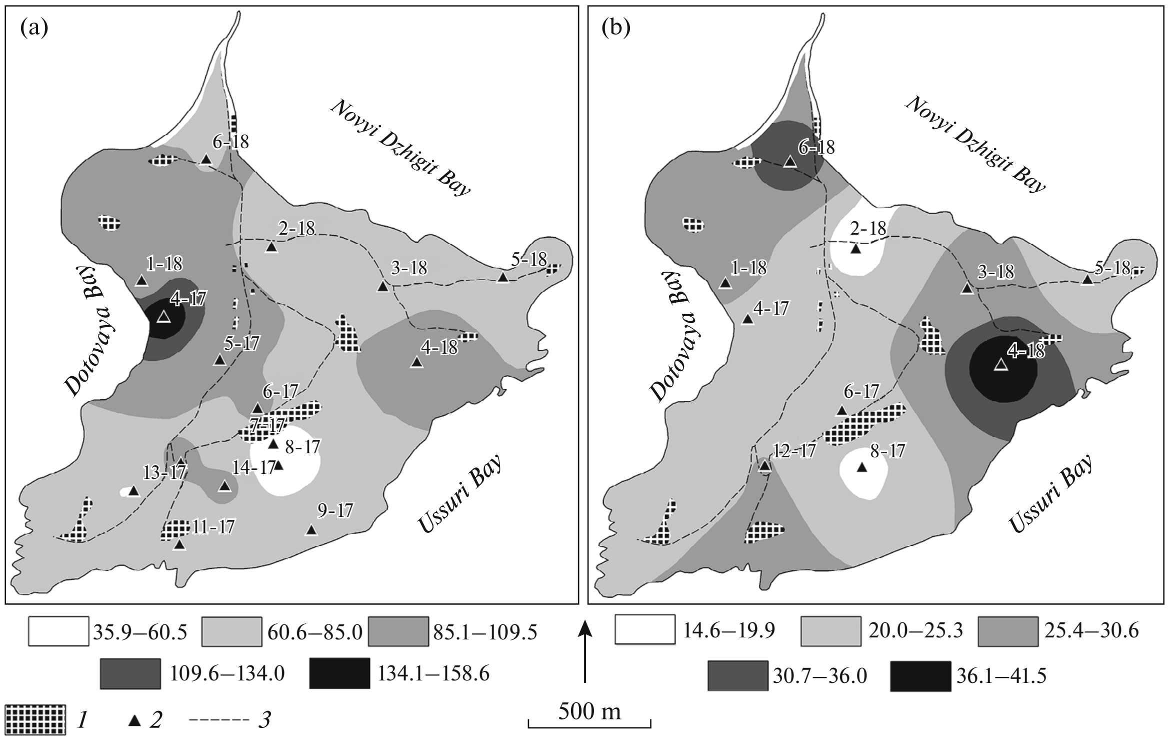

Fig. 2. Mercury content in the accumulative–humus horizons (a) and leaves of the Mongolian oak (b) on Shkot Island (ng/g). Symbols: (*1*) anthropogenic (abandoned) territories, (*2*) observation plots and their numeral designations; (*3*) ground roads.

Table 2. Mercury content in the geosystems of Russky and Shkot islands

Island	Plot no.	Soil			Vegetation		Accumulation coefficient
		sampling depth, cm	horizon	mercury, ng/g	species	mercury (leaves), ng/g	
Russky	1-17	0–20	AUpir	60.3	Sagebrush	13.7	0.23
	2-17	0–11(13)	AYpir	58.6	Mongolian oak	14.6	0.25
	3-17	0.5–6(9)	AYpir	104.0		22.3	0.21
Shkot	4-17	3–13(14)	AY	158.6		20.7	0.13
	5-17	3–9(12)	AY	86.9	Heartleaf hornbeam	28.2	0.32
	6-17	4–15	AYpir	94.1	Mongolian oak	24.8	0.26
	7-17	1.5–18	AY	43.2	Gmelin's wormwood	6.6	0.15
	8-17	6–20	AY	35.9	Mongolian oak	18.3	0.51
	9-17	2–15	AU	78.3	Gmelin's wormwood	10.8	0.14
	11-17	5–18	AU	77.3		10.1	0.13
	12-17	4–10(19)	AY	89.8	Mongolian oak	25.4	0.28
	1-18	5–7(10)	AY	91.2	Mongolian oak	28.8	0.32
					Heartleaf hornbeam	25.7	0.28
	2-18	4–13	AY	76.0	Mongolian oak	17.9	0.24
					Heartleaf hornbeam	24.9	0.33
	3-18	5–15(16)	AY	68.7	Mongolian oak	25.8	0.38
					Heartleaf hornbeam	26.4	0.38
	4-18	3–13	AY	108.9	Mongolian oak	41.5	0.38
	5-18	2–9	AY	74.6	Mongolian oak	20.6	0.28
	6-18	5–11	AY	84.7	Mongolian oak	33.3	0.39
	13-17	6–16	AY	60.3	n.d.	n.d.	n.d.
	14-17	2.5–14	AU	91.6	n.d.	n.d.	n.d.

n.d.—not determined.

Table 3. Average mercury contents in the soil–vegetation cover and accumulation coefficients in the leaves of different plants

Plant	Average mercury content in soil, ng/g	Average mercury content in leaves, ng/g	Accumulation coefficient
Heartleaf hornbeam	81.2	26.3	0.33
Mongolian oak		24.5	0.30
Gmelin's wormwood		9.1	0.14

81.21 ng/g. The average values for different species are given in Table 3. The highest value is registered for heartleaf hornbeam, and the lowest, for Gmelin's wormwood. These variations are caused by different ability of plants to accumulate mercury. This peculiarity was noted by some authors (Perelman, 1975; Skugoreva and Nizovtsev, 2012; Mineev et al., 1983). Species ability for mercury accumulation is revealed by calculation of the accumulation coefficient (AC), which reflects the ratio of mercury content in plant to its content in soil (Skugoreva and Nizovtsev, 2012). Heartleaf hornbeam has the highest AC, which exceeds that of Mongolian oak, and the lowest AC is registered for Gmelin's wormwood.

A principally important question is to establish mercury sources in the soil–vegetation cover. There are natural and anthropogenic sources. The natural sources on the islands of the Peter the Great Bay are, first of all, faults running along the Amur Bay and the Eastern Bosphorus Strait. The Alekseev Bay in Popov Island is characterized by elevated mercury content. This bay is located in the near-contact zone of a granitic intrusion, where mercury can reach surface along tectonic dislocations. In addition, the elevated mercury content was found in atmosphere in the open part of the Peter the Great Bay, which is related to its influx through crustal faults (Kalinchuk et al., 2012). We believe that these tectonic features caused the elevated mercury content in soil (108.9 ng/g) and the highest content in the Mongolian oak (41.5 ng/g) in plot 4-18. However, this conclusion requires additional confirmation by detailed geological survey.

At present, the anthropogenic source provides the most significant mercury influx in the geosystems of the southern Primorsky Territory. As mentioned in (Aksentov and Astakhov, 2009), the Peter the Great Bay is located in a zone with elevated content of anthropogenic mercury in the ground air. A regional source is the urbanized regions of Northeastern China. The transboundary transfer of polluted air masses results in elevated mercury content in the atmosphere. The point source is the city of Vladivostok, the neighboring waters of which are characterized by its maximum values (Kalinchuk et al., 2012, Aksentov, 2015; Aksentov and Astakhov, 2009). The lichen indication studies record the constant influence of regional and transboundary transfer of pollutants. Areas subjected to strong anthropogenic impact are dominated by lichens resistant to the influence of anthropogenic factors. The lichens show traces of pyrogenic damage on thallomes. In areas unaffected by direct anthropogenic activity, lichens show suppression, which indicates air pollution (Rodnikova and Skirina, 2014).

A local anthropogenic mercury source is the domestic activity within the island geosystems. The territory of Shkot Island is devoid of settlements and other economic objects. Anthropogenic territories distinguished in Fig. 2 are anthropogenically transformed areas of the former military presence on the island, which show no relation with the present-day mercury distribution. In summer, the island is used for recreation purposes. The largest camping area is the Dotovaya Bay coast. The active recreation use of this territory causes the highest mercury content in soil cover. Unrestricted use of campfires and wood and household waste (first of all, polyethylene) combustion lead to mercury redistribution in the adjacent territories. In addition to the highest mercury content in soil, this territory also demonstrates the highest heavy metal contents, which exceed some approximate permissible concentrations, also resulting from domestic waste burning (Kiseleva et al., 2018). The low mercury contents in the Mongolian oak leaves for this territory (plot 4-17) is explained by sampling in the beginning of July, prior to recreation season. Mercury accumulation in soil cover reflects a years-long trend for recreational use of the Dotovaya Bay coast area.

It is necessary to consider the ecological state of soil–vegetation cover of Shkot Island and the adjacent part of Russky Island in terms of mercury content focusing on its negative influence on natural geosystems and on human health. Maximum permissible concentrations recorded in GOST (National State Standart), SanPiN (Sanitary Rules and Norms) and other normative documents are available for soil, air, and some food products. In the Russian Federation, the maximum permissible concentration (MPC) of mercury in soil is set at 2100 ng/g (*Maximum...*, 2006). Other components of geosystems have no MPC and can be characterized only by average contents. In particular, the average mercury content in the Earth's crust is 45 ng/g (Saukov et al., 1972), and that in plants is 15 ng/g (Kovalevsky, 1974). The presented data and results of laboratory analyses allowed us to draw the following conclusions:

(1) The mercury content in soil accounts for only an insignificant part of MPC (maximum values are 158.6 ng/g (plot 4-17) or 7.6% of MPC);

(2) The mercury concentrations in plants exceed Clarke values, which could be natural regional specifics;

(3) The obtained data reflect mainly the state of geosystems weakly affected by domestic activity, with the integrated influence of natural and anthropogenic factors, and could be used further as background indicators.

CONCLUSIONS

The results of geoecological studies on Shkot Island and the adjacent part of Russky Island show that the geosystems operate under intermittent influence of pyrogenic factor. This significantly modifies the physicochemical properties of soils and leads to the transformation of vegetation.

The average mercury content is 81.2 ng/g in soil, and varies in the vegetation cover depending on plant species: 26.3 ng/g for heartleaf hornbeam, 24.5 ng/g for Mongolian oak, and 9.1 ng/g for Gmelin's wormwood. Similar distribution was obtained by calculating the accumulation coefficient. The high mercury content in the soil–vegetation cover of the eastern termination of Shkot Island is likely related to the peculiarities of tectonic structure. A detailed geological survey is required to obtain final conclusion. The highest mercury contents in the soil cover in the Dotovaya Bay coast is due to the recreational activity: burning of domestic wastes and redistribution of released mercury. The adjacent territories also demonstrate a long-term mercury accumulation. It spite of this fact, the mercury content in soil accounts for only an insignificant fraction of MPC. The average mercury content in leaves of the analyzed trees exceeds Clarke values for plants, which could be regional specifics.

These studies are of special importance in relation with planned further economic development of the territory. The conception of Russky Island and adjacent territories development implies the formation of educational, scientific, cultural, touristic–recreational, and exhibition clusters. Ecological monitoring should be organized to provide stable functioning of the island geosystems and planned territorial–domestic structures. The obtained data on mercury distribution on Shkot Island and the adjacent part of Russky Island reflect the background values and could serve as the basis for organizing such monitoring.

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