RADIOECOLOGICAL AND RADIOBIOGEOCHEMICAL SITUATION IN THE POOL OF RIVER MAILUU-SUU (KYRGYZSTAN)

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Introduction

In the end of XX c. in connection with increased texnogenium of biosphere accompanying wide application of mineral fertilizers, couse accumulation in environment wastes of a mining industry, household wastes and other, technogenium biogeochemical provinces and new associations of chemical elements arise. It is known that sharp deficiency or the surplus in environment of biologically active elements results in diseases of animals, plants and men. On the territory of Kyrgyzstan and other countries biogeochemical provinces with deficiency and surplus I, F, Cu, V, Ca, Sr, Se, U and Hg are investigated. The doctrine about biogeochemical provinces finds practical realization in medicine and agriculture (preventive maintenance of endemical diseases, synthesis of medicines, manufacture of microfertilizers etc.)(1,3,4,6,7,8,9).

The ecology of coast ecosistems and river Mailuu-Suu (ground, water, plants) is investigated for the first time in uranium-technogenius area.

Materials and methods

Selection of samples of soil, natural waters and plants carried out by a way of platforms on the certain routes with the account of landscape-geochemical and meteorological conditions. Processing of samples carried out in biogeochemistry laboratory of an environment GEOCHI of RAS and Biology-soil institute NAS of KR with use of soil and geological cards at an advice of the geologists and soil scientists of Kyrgyzstan. Concentration of trace elementis was measured by AAS luorimetrical and etc. methods.

Results

During operation of a uranium deposit Mailuu-Suu (1946-1968 years) more than 10 thousand tons of uranium were extracted. According to the scientific geologists and geochemists, radioactive wastes in the given site, are quantitatively equivalent to size of the extracted uranium. In tail-depository the huge amounts of residual uranium and its ong-lived of isotopes (Th-230, Ra-226 etc.), hence, radio-activity tail-depositories will be kept for a long time (Fig. 1.) (2, 5).

Now these damps and storehouses are in pitiable condition, that radioactive wastes, heavy metals and the toxic substances pollute the environment. And, most dangerous sites is now in landslide-dangerous zones where food are possibly contaminated by waters of the river Mailuu-Suu. In pool of the river mud-torrents are often accumulated. For example, in 1958 as a result of failure on tail-depository №7 on the river has passed radioactive mud-torrent with the charge more than 200 m^3/s and 1996, 2000, ect.

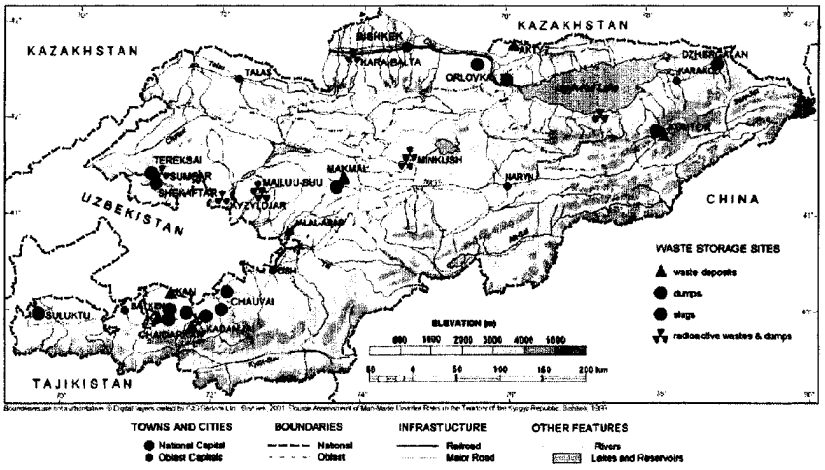


Fig 1. Uranium tail-depositories and dumps (Kyrgyzstan)

According to the scientific geochemists, the chemical structure of a firm part of tails is close to initial ore, from which the basic quantity (90 %) of uranium is discharged (2). We have surveyed the sites of the river Mailuu-Suu starting from the top point of waterfence (conditionally controlled zone) up to a dam (up to the border with Uzbekistan) in 5 points. The preliminary survey was carried out on 8 points, for more detailed research only 5 points are left. The general characteristic of water according to the seasons of the year is given below in the Tables 1. In the whole Mailuu-Suu river on our received data is unsuitable for drinking and cultural - household usage. The highest concentration after the attitude LPC (limit-permissible-consentration) are characteristic for Se (up to 20 times), and the level does not change in all extent of the river. Fe accumulated up to 8 times more, is especial 2 and 5 points, and Hg, Cd and Al up to 2 times. It is necessary especially to note, that in Kulmen-Sai river inflow Mailuu-Suu river are marked the increased contents of uranium up to 5 times, where the inhabitants use water for watering and economic needs.

The concentration of other investigated microelements in the river at a level or are lower LPC. Till current of the river the level of concentration Hg, Cd and Se does not vary almost, it is constant, on other elements of the certain laws is not revealed ($P < 0,05$) (3, 7).

Ground:

In the whole the average meanings specified in the Table 2, show rather low levels of soil cover pollution by microelements under the attitude to a background and LPC. Little increase of concentration is revealed for Al, Mn, Se and U (in 2 - 3 times) in autumn-spring time and Zn up to 6 times.

Table 1. Microelement structure of water in Mailuu-Suu river (average annual mg/l)

Element	LPC	Points of selection and average meaning					
		1	2	3	4	5	∑
1. Al	0,5	0,55	1,076	0,94	1,026	1,086	0,935±0,22
2. Ba	4,0	0,068	0,009	0,024	0,088	0,102	0,074±0,38
3. Co	1,0	0,005	0,0073	0,005	0,006	0,005	0,005±0,001
4. Cu	1,0	0,004	0,007	0,005	0,008	0,008	0,006±0,001
5. Fe	0,5	0,248	0,46	0,34	2,54	3,209	2,601±2,01
6. Hg	0,005	0,01	0,01	0,01	0,01	0,01	0,01±0,001
7. Mn	0,1	0,07	0,225	0,081	0,181	0,192	0,101±0,03
8. Co	0,5	0,005	0,004	0,010	0,003	0,010	0,006±0,004
9. Ni	0,1	0,026	0,032	0,025	0,028	0,025	0,22±0,14
10. Pb	0,1	0,02	0,035	0,02	0,02	0,02	0,023±0,002
11. Se	0,001	0,023	0,02	0,023	0,02	0,023	0,021±0,001
12. V	0,1	0,007	0,011	0,006	0,008	0,006	0,007±0,001
13. Zn	1,0	0,005	0,011	0,003	0,142	0,077	0,047±0,043
14. U	0,037	0,004	0,04	0,19	0,04	0,04	0,04±0,01
15. Cd	0,001	0,002	0,002	0,002	0,002	0,002	0,002±0,0002

Plants:

Conditionally areas of research are divided into three fields:

1) Conditionally pure sites is upper reaches of the river above waterfence, where vegetation is submitted by highgrassy, differentgrassy (Artemisia ferganensis, Tanacetum vulgare L., Astragalus lasiosemius)

2) Average current of the river, where the basic tail-depository – cereal differentgrassy are located (Achillea bibersteinii Afan., Tanacetum vulgare L., Astragalus lasiosemius).

Table 2.The average contents of trace elements in the soil of Mailuu-Suu river pool (mg/kg dry matter)

Elements	LPC	Background	Points of selection and average meaning					
			1	2	3	4	5	∑
1. Al	70	2,36	2,75	1,96	5,48	9,16	8,95	5,66±1,2
2. As	0,6	0,4	0,51	0,49	0,74	1,68	0,72	0,82±0,13
3. Ba	0,4	0,25	0,34	0,39	0,64	0,81	0,64	0,56±2,1
4. Be	0,4	0,025	0,32	0,07	0,93	0,76	0,62	0,54±0,11
5. Cd	0,5	0,02	0,181	0,36	0,54	0,91	0,66	0,53±0,10
6. Co	5,0	0,04	0,04	0,06	0,14	0,15	0,91	0,26±0,02
7. Cr	6,0	0,08	0,09	0,23	0,48	0,29	0,17	0,25±0,05
8. Cu	3,0	0,19	0,20	0,29	1,12	0,87	0,72	0,64±0,14
9. Fe	40	2,66	2,28	4,98	9,25	6,25	4,15	5,38±1,3
10. Hg	0,06	0,1	0,13	0,25	0,39	0,29	0,36	0,21±0,02
11. Mn	2,1	0,12	0,13	0,31	0,57	0,23	0,35	0,32±0,06
12. Mo	1,2	0,04	0,07	0,13	0,08	0,71	0,59	0,32±0,10
13. Ni	4,0	0,09	0,12	0,23	0,44	0,34	0,27	0,28±0,05
14. Pb	6,0	0,2	0,34	0,74	0,99	1,03	0,82	0,78±0,16
15. Se	0,2	0,16	0,22	0,51	0,62	0,76	0,97	0,62±012
16. V	0,9	0,07	0,10	0,09	0,12	0,14	0,09	0,11±0,09
17. Zn	23,0	0,16	0,22	0,65	1,32	0,87	0,43	0,70±0,11
18. U	0,02	0,4	0,46	0,76	0,89	0,73	0,61	0,69±0,14

3) The bottom current of the river up to border with Uzbekistan, with the vegetation in the pool of the river - cereal-wormwood differentgrassy (Phragmites communis Trin, Bromus tectorum, B. Oxyodon, Centaurea squarrosa Willd.), and further agricultural cultures.
The vegetative cover inspection of the investigated area (1999-2003 yy). allowed to reveal a number of features of microelements concentration by plants and morphological changes in extreme geochemical conditions.

From the table it can be seen, that as a whole in a vegetative cover of pool Mailuu-Suu river the level of the majority of the investigated microelements is at a level of control sites or lower. However there are microelements, which are several times bigger than background sites. For example, Al - up to 6 times (predominantly in spring time), As - up to 3 times (spring-summer period), Pb - 2 times (autumn period), Se - up to 24 times (spring period) and U - up to 3 times (spring period).

On the large scale the increasement of concentration is observed in the average and bottom currents of the river pool. Also the separate kinds of plants are investigated. According to species and average test (middle trial of plants) in lower and average zones the level of the investigated elements is high.

Conclusion

The level of radionuclides and line of microelements in a soil-vegetative cover and water are established. According to our received data, on the whole soil-vegetative cover of coast of the Mailuu-Suu river is satisfactory.

Naturally, the soil cover in tail-depository area up to 5 kms is not suitable for the agricultural purposes. In area of coast Mailuu-Suu river (tail-depository and dumps) there is a line of geomorphological (landslips and flood) and radioecological problems which must be solved in national and regional scale.
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Table 3. Microelements in a vegetative cover (middle trial of plants) of biosphere in Mailuu-Suu subregion (mg/kg of dry matter)

Elements	LPC (Klark)	Background	Points of selection and average meaning					
			1	2	3	4	5	∑
1. Al	71	2,36	2,75	1,96	5,48	9,16	8,95	5,66
2. As	2,0	0,4	0,51	0,49	0,74	1,68	0,72	0,82
3. Ba	-	0,25	0,34	0,39	0,64	0,81	0,64	0,56
4. Be	-	0,025	0,32	0,072	0,93	0,76	0,62	0,54
5. Cd	0,5	0,02	0,181	0,36	0,54	0,91	0,66	0,53
6. Co	5,0	0,04	0,04	0,06	0,14	0,15	0,91	0,26
7. Cr	0,5	0,08	0,09	0,23	0,48	0,29	0,17	0,25
8. Cu	3,0	0,19	0,20	0,29	1,12	0,87	0,72	0,64
9. Fe	40	2,66	2,28	4,98	9,25	6,25	4,15	5,38
10. Hg	2,1	0,1	0,13	0,25	0,39	0,29	0,36	0,21
11. Mn	4,0	0,12	0,13	0,31	0,57	0,23	0,35	0,32
12. Mo	1,2	0,04	0,07	0,13	0,08	0,71	0,59	0,32
13. Ni	4,0	0,09	0,12	0,23	0,44	0,34	0,27	0,28
14. Pb	6,0	0,2	0,34	0,74	0,99	1,03	0,82	0,78
15. Se	0,4	0,16	0,22	0,51	0,62	0,76	0,97	0,62
16. V	15,0	0,07	0,10	0,09	0,12	0,14	0,09	0,11
17. Zn	2,3	0,16	0,22	0,65	1,32	0,87	0,43	0,70
18. U	2	0,4	0,46	0,76	0,89	0,73	0,61	0,69

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