CENTRAL ASIAN JOURNAL OF INNOVATIONS ON TOURISM MANAGEMENT AND FINANCE

Volume: 03 Issue: 05 | May 2022 ISSN: 2660-454X

http://cajitmf.centralasianstudies.org/index.php/CAJITMF

Assessment of the Quality of Pollution in Kvemo Kartli Region (Georgia) Soils

[1] **Lali U. Shavliashvili**

[2] **Ekaterina Sh. Shubladze**

[3] **Elina M. Bakradze**

[4] **Gulchina P. Kuchava**

Received 16th Mar 2022,
Accepted 19th Apr 2022,
Online 21st May 2022

[1, 2] Hydrometeorological Institute of Georgian Technical University David Aghmashenebeli aven.150a, Tbilisi, Georgia
Shavliashvililali09@gmail.com
ekaterineshubladze7@gmail.com

[3, 4] National Environmental Agency of Ministry of Environmental protection and Agriculture of Georgian David Aghmashenebeli aven.150, Tbilisi, Georgia
h.bakradze@gmail.com
gkuchava08@gmail.com

Abstract: The expedition works were conducted on urban soils on the territory and adjacent to the Madneuli enterprise of Kvemo Kartli region. Taken from the soil samples 0-10 cm depth. In them determined heavy metals - Cu, Zn, Pb, Mn, Cd, Co and Ni by plasma-emission spectrometer-ICP-OES. The quality of some heavy metal contamination of soil is revealed in connection with Clark; The quality of pollution of urban soils is studied: the risk of pollution, the contamination concentration coefficient, the total characteristic of pollution and the contamination index. Bolnisi municipality urban soils are contaminated with heavy metals cadmium etc in Kazreti. These pollution in accordance with ecological-hygienic categories meets with heavy metals total pollution ZC<16 "allowable", ZC=16-32 "moderately dangerous" categories.

Keywords: Soil, heavy metals, contamination, concentration, pollution quality.

Introduction. Mining-mining enterprises may perform a negative role in the environmental pollution process.

A good example of pollution in Georgia is in Kvemo Kartli, in the Bolnisi municipality, the polymetal mining enterprise of the Kazreti Program in the Bolnisi Municipality and the licensing territories that are located in the south-east of Tbilisi. Madneuli sulfide deposit is presented mainly in three types of ores - gold-copper-colachal, gold-barit-polymetal and gold-quartzita, which will be processed by the flotation method [1].

The deposit is processed in an open career. Priority contaminants of Madneuli enterprise are heavy metals - Cu, Zn, Pb, Mn, Cd, Ni, and others, increased amounts of heavy metals in the environmental facilities in the natural waters [2,3] in the soils [3-8] and therefore in the food products, Poses not only the nature of the region but also the health of the region and certain cities.

Materials and Methods. Brown soils are widespread in study areas [9]. In order to study the pollution of soil with heavy metals, in 2015-2020years sampling of soil samples were made from urban soils 0-10 cm depth in different points: background, in order to determine soil pollution in two points of Bolnisi. In the soil samples were determined the overall forms of heavy metals [10]. Chemical analyzes were conducted in the accredited Laboratory of atmospheric air, water and soil analysis of the Environmental Pollution Monitoring Department of the National Environmental Agensy of the Ministry of Environment Protection and Agriculture of Georgia. For analysis, high standards tools are used (soil digestion-Milestone - Start D Microwave System; pH meters-Milwaukee-mi 150; Plasma-emission spectrometer-ICP-OES and others). All stages of the monitoring are underway in accordance with the standards of the International Organization for International Standards (ISO).

Discussion.

The following indicators are used to describe the contamination of heavy metals of urban soils [11]: The main criterion of pollution assessment of soil heavy metals is used as:

$$K_k = C/K \qquad (1)$$

where K_k – Clark koeficient

C- chemical compunds concentracions

K – chemical element Clark

The coefficient of pollution concentration is calculated by the formula:

$$K_C = C_I/C_{FI} \qquad (2)$$

where, K_C - coefficient of pollution concentration;

C_I - Actual content in heavy metal soil;

C_{FI} - heavy metal background value in the soil.

To calculate the total feature of pollution (Z_C), we need to use no less than 7 chemical elements.

$$Zc = SUM (Kc_1 + \ldots\ldots Kcn) - (n-1) \qquad (3)$$

where, n – chemical elements amount

Kc – pollution koeficient .

Soil pollution index $\alpha = (Ko)/n \qquad (4)$

where, $Ko = C /MPC$

Table 1. Average number of heavy metals (2015-2020) content of soil 0-10 cm depth

#	point		Cu	Zn	Pb	Mn	Cd	Co	Ni	pH
			mg/kg							
1	Mashavera-Dmanisi-background	0-10 cm	17.84	48.67	12.84	365.81	0.41/3.2	7.43	4.23	7.20
2	Kazreti-Mashavera upper	0-10 cm	58.96/1.3	154.26/1.9	20.82/1.3	429.57	1.03/7.9	6.19	10.65	7.19
3	Kazreti-Kazretula confluence with Mashavera	0-10 cm	118.44/2.5	111.84/1.4	30.07/1.9	759.42	2.40/18.5	9.50	14.89	7.49
4	Bolnisi - Near Meteostation	0-10 cm	45.23/1.0	128.80/1.6	24.77/1.6	700.20	1.80/13.9	13.08	9.50	7.32
5	Bolnisi- Exit	0-10 cm	82.71/1.8	98.44/1.2	30.95/1.9	867.53	1.34/10.3	14.13	16.72	7.39
Clarks-Earth Certificate of Clark Elements According to Vinogradov			**47**	**83**	**16**	**1000**	**0.13**	**18**	**58**	

Table 1. is given the background concentrations of heavy metals defined in the soil samples taken from Mashaveri-Dmanisi in the soil samples taken as a etalone, compared to the results of our results. It turned out that the background concentrations of metals are much less compared to the soil samples taken in Kazreti and Bolnisi.

Table 1. and Fig. From 1-4, 0-10 cm depth after joining Kazreti-Mashavera, pollution is more than Kazreti-Mashavera. While in Bolnisi, soil pollution is more high than in a meteorological station.

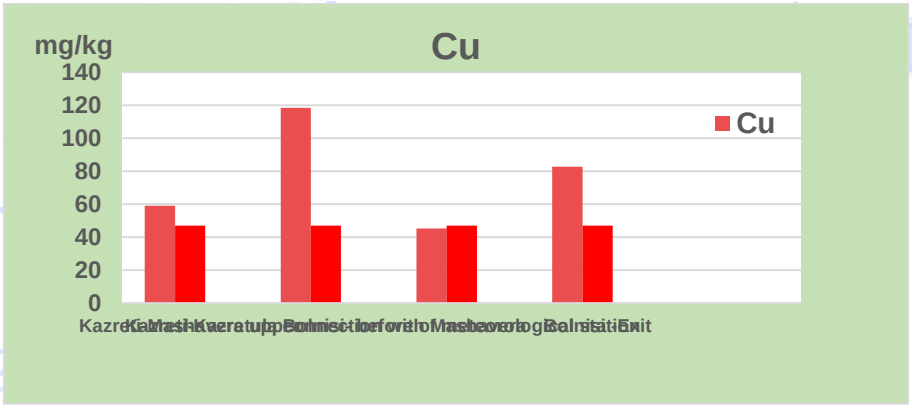

Figure 1. Copper's average multi-year content in Soil 0-10 cm depth, 2015-2020

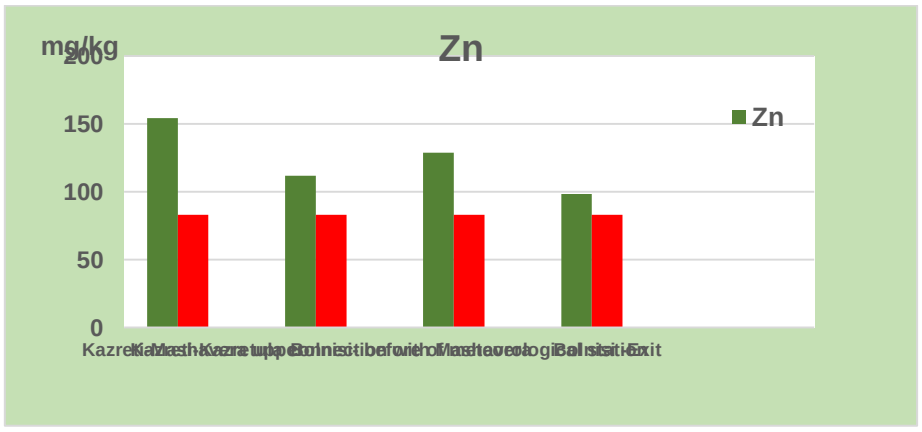

Figure 2. Zinc average multi-annual content in Soil 0-10 cm depth, 2015-2020

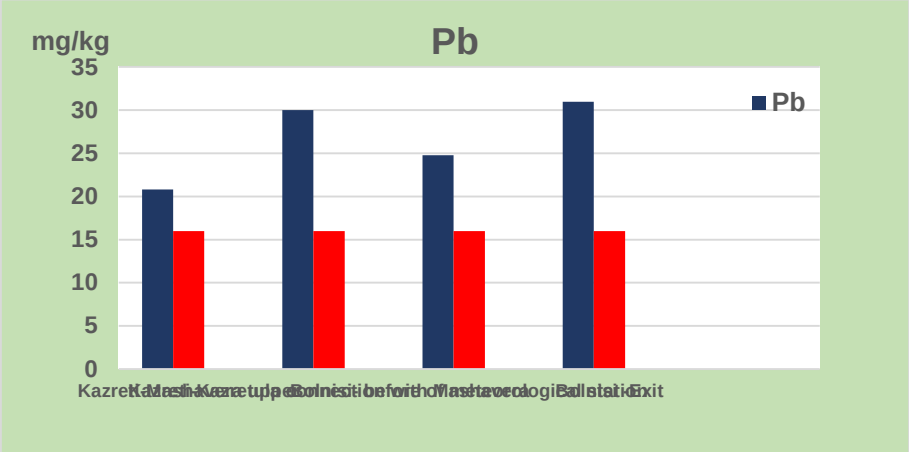

Figure 3. Lead average multi-annual content in Soil 0-10 cm depth, 2015-2020

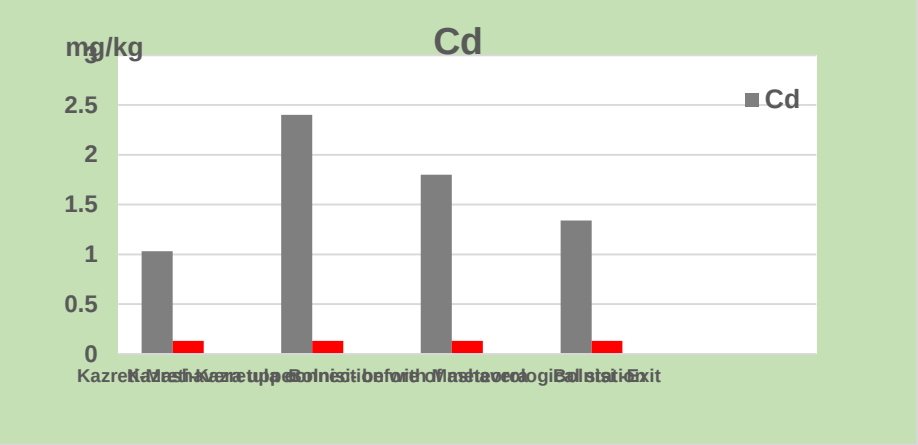

Figure 4. Cadmium average multi-annual content in soil 0-10 cm depth, 2015-2020

As the figures shows copper, zinc, lead and cadmium concentrations exceeds the relevant Clark's values. It is especially high in cadmium, and manganese, cobalt and nickel content in no case does not exceed the importance of Clark.

According to the average multi-annual (2015-2020) of heavy metals (2015-2020), we calculated the quality of pollution of soil with heavy metals from Kazreti and Bolnisi territories (Table 2-5).

Table 2. Indicators of soil pollution Kazreti, Mashavera at the top 0-10 cm

#	Heavy metal, mg/kg	Danger class	C_a,	Clarks	Kc – Concentration coefficient	Ko	Zc Total characteristic of pollution	α Soil Contamination
1	Copper-Cu	II	17.84	47	3.30	1.3	9.29	0.19
2	Zinc-Zn	I	48.67	83	3.17	1.9		0.27
3	Lead-Pb	I	12.84	16	1.62	1.3		0.19
4	Manganese -Mn	III	365.81	1000	1.17	0.4		0.06
5	Cobalt-Co	II	7.43	18	1,00	0.3		0.04
6	Cadmium-Cd	I	0.41	0.13	2.51	7.9		1.13
7	Nickel-Ni	II	4.23	58	2.52	0.2		0.03

Z_C-pollution rate 9.29 <10 i.e. the soil is slightly contaminated. According to the soil pollution index, soil is slightly contaminated with cadmium. The rest of the metals - "clean" categories.

Table 3. Quality of the chemical contamination of soil Kazreti, joining Kazretula, 0-10 cm

#	Heavy metal, mg/kg	Danger class	C_B,	Clarks	Kc – Concentration coefficient	K_0	Zc Total characteristic of pollution	α Soil Contamination
1	Copper-Cu	II	17.84	47	6,64	2.5	17.30	0.36
2	Zinc-Zn	I	48.67	83	2,30	1.4		0.20
3	Lead-Pb	I	12.84	16	1,63	1.9		0.27
4	Manganese -Mn	III	365.81	1000	2.08	0.8		0.11
5	Cobalt-Co	II	7.43	18	1.28	0.5		0.07
6	Cadmium-Cd	I	0.41	0.13	5.85	18.5		2.64
7	Nickel-Ni	II	4.23	58	3,52	0.3		0.04

Z_C-pollution is 17.30 varies from 10-25 and soil is contaminated and meets in "moderately dangerous" category. According to the soil contamination index, soil is contaminated with only cadmium, the rest of the metals are in the category of "clean".

Table 4. Soil pollution quality indicators with Bolnisi-meteorological station, 0-10 cm

#	Heavy metal, mg/kg	Danger class	C_B,	Clarks	Kc – Concentration coefficient	K_0	Zc Total characteristic of pollution	α Soil Contamination
1	Copper-Cu	II	17.84	47	2.54	1.0	11.42	0.14
2	Zinc-Zn	I	48.67	83	2.65	1.6		0.23
3	Lead-Pb	I	12.84	16	1.93	1.6		0.23
4	Manganese -Mn	III	365.81	1000	1.91	0.7		0.10
5	Cobalt-Co	II	7.43	18	1.75	0.7		0.10
6	Cadmium-Cd	I	0.41	0.13	4.39	13.9		1.99
7	Nickel-Ni	II	4.23	58	2.25	0.2		0.03

Z_C-pollution total feature of 11.42> 10 i.e. the soil is contaminated on average and meets the "eligible" category.

Soil Pollution Index α <0.75 - "clean" i.e Cu, Zn, Pb, Mn, Co, Ni are not pollution and only cadmium meets α> 1 - "contaminated" category.

Table 5. Soil pollution quality indicators from Bolnisi, 0-10 cm

#	Heavy metal, mg/kg	Danger class	C_B,	Clarks	Kc – Concentration coefficient	K_0	Zc Total characteristic of pollution	α Soil Contamination
1	Copper-Cu	II	17.84	47	4.64	1.8	13.78	0.26
2	Zinc-Zn	I	48.67	83	2.02	1.2		0.17
3	Lead-Pb	I	12.84	16	1.63	1.9		0.27
4	Manganese -Mn	III	365.81	1000	2.37	0.9		0.13
5	Cobalt-Co	II	7.43	18	1.90	0.8		0.11
6	Cadmium-Cd	I	0.41	0.13	3.27	10.3		1.50
7	Nickel-Ni	II	4.23	58	3.95	0.3		0.04

Z_C-pollution is in the scope of 13,78 10-25, ie the soil is contaminated on average and meets the "eligible" category.

According to the soil contamination index, soil is contaminated only by cadmium and meets the "contaminated" category; The rest of the metals - "clean" category.

Conclusion

1. The average number of heavy metals (2015-2020) is established on the depth of 0-10 cm of urban soils. The main pollutant metals of the Bolnisi municipality are identified and more polluted places.
2. Evaluated the quality of the soil with heavy metals. Copper, zinc, lead and cadmium are revealed in urban soils;
3. The final 0-10 cm layer of soil is contaminated with cadmium. More pollution is worth mentioning at Bolnisi Exit (Z_C =13.78) compared to the meteorological station (Z_C= 11.42);
4. Joining Kazretula with Mashvera is more contaminated (Z_C=17.03) compared to Mashavera (Z_C =9.29).
5. Bolnisi municipality urban soils are contaminated with cadmium most in Kazzeti. These pollution in accordance with ecological-hygienic categories, meets with heavy metals, Z_C<16 "permissible", Z_C = 16 -32 "moderately dangerous" categories.

References:

1. V.Gavrandashvili, R. Chagelishvili and others. - Recycling of Madneuli baritous orte-containing ores - Georgian Academy of Sciences, Chemistry Series, 2004;
2. V.Gvakharia, G.Samarguliani, N.Machitadze - Influence of Anthropogenic Factors on the Distribution of Heavy Metals in Waters and Soils of Bolnisi Region - Bull of Georgian Academy of Sciences, 156, #1, p.81-85, 1997;
3. Shavliashvili L., Bakradze E., Arabidze M. and Kuchava G. - Arsenic pollution study of the rivers and soils in some of the regions of Georgia" - International Journal of Current Research Vol.9, Issue, 02, pp.47002-47008, February, 2017;
4. Yu N. Vodyanitsky - Pollution of Soils with Metals and Metalloids - MSU, Moscow, 2017 (in Russian);
5. T. Urushadze, G. Ghambashidze, W. Blum, A. Mentler - Soil contamination with heavy metals in Imereti region (Georgia) - Bulletin of the Georgian National Academy of Sciences 175, pp. 122-130, 2007;
6. Elina Bakradze, Yuri Vodyanitskii, TengizUrushadze, Zaur Chankseliani, Marine Arabidze - Annals of Agrarian Science ''About rationing of the heavy metals in soils of Georgia'' pp.1-6, 2018; https://www.sciencedirect.com/science/article/pii/S1512188718300162;
7. N.Vodyanitskii Yu - Contamination of soils with heavy metals and metalloids and its ecological hazard (analytic review) - Eurasian Soil Sci. 46 (7) (2013) 793-801 (analytical review), Soil Science, 7, pp.872-881, 2013 (in Russian);
8. Khubutia C. - Distribution of heavy metals in the soils of Bolnisi district. - A.Janelidze Geoloical Institute, Proceeding, 1998 New Series, Vol. 119, pp. 861-864, 2004;
9. Urushadze T. - Soils of Georgia - Tbilisi, Agricultural University Press, 186 pp., 2009;
10. Фомин Г.С. Фомин А.Г. - Почва, контроль качества и экологические безопасности по междуна родным стандартам. - Москва ВНИИ стандарт, 300 ст, 2001;
11. Order of the Minister of Labor, Health and Social Affairs of Georgia # 297 / N August 16, 2001, August 16, 2001;
12. Кларки элементов в земной коре согласно разным авторам. https:/ru.vikipedia.org/viki/ ;
13. G.Supatashvili - Environmental Chemistry (ECOCCIAN) - Tbilisi, University publishing house, 187 p., 2009.