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RADON CONCENTRATION IN WATER ON THE SEVERAL REGIONS OF GEORGIA

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Summary: *A quantitative assessment of radon (^{222}Rn) distribution in the surface, shallow and deep layer waters in several regions of Georgia has been carried out. In total, about 600 samples were measured by a portable AlphaGUARD radon monitor. The radon concentration ranged from 0.1 to 222 Bq/l.*

Key words: *Rn mapping, out-door radon.*

Introduction

The works [1-3] present the results of our early studies of radon content in soil and water in various regions of Western Georgia.

According to GNSF project FN-19-22022, “Radon mapping and radon risk assessment in Georgia”, during 2020–2021, the authors carried out fieldwork to quantify the radon distribution, ascertain geological factors influencing the radon concentrations in water in some geographical areas in Georgia.

Method

The field study was conducted by the mobile group of researchers who measured ^{222}Rn concentration in various water sources (boreholes, wells and springs) in several regions of Georgia. In total, about 600 water samples were analyzed by a portable radon monitor AlphaGUARD (Bertin Instruments). All observation sites were marked by GPS position.

The key method for fulfilling the project requirement is radon mapping based on the application of geochemical methods. Results of analyses on radon concentration were marked on topographic and geological maps. After that, the field data were digitized and transferred into the GIS system. The connection of radon anomalies to geological and hydro-geological structures is analyzed using GIS technology.

Data

From the tectonic point of view, the Northern of the tested territory belong to the Grate Caucasus folded system, Southern Adjara-Trialeti folded system and the territory between them to the Georgian plate. Lithology and geological structures of the region, presence of many tectonic faults, radioactive elements in rocks, various hydrogeological, geomorphological structures and soil characteristics determine the complexity of the territory. Based on all the above parameters, the map of ^{222}Rn concentration in waters was compiled using the GIS technique. Sampling points are shown in Fig. 1.

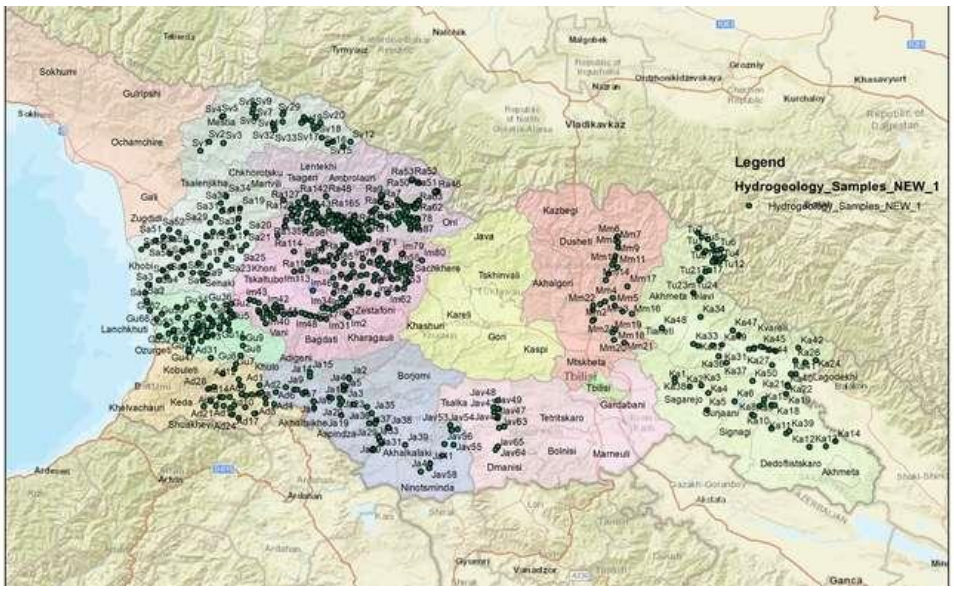

Fig. 1. Sampling points location on the territory.

Testing was carried out at selected areas in almost all tectonic regions. “Svaneti” and “Tusheti” regions were tested on the territory of the Central part Great Caucasus system. The distribution of radon concentrations in waters is presented in Fig. 2.

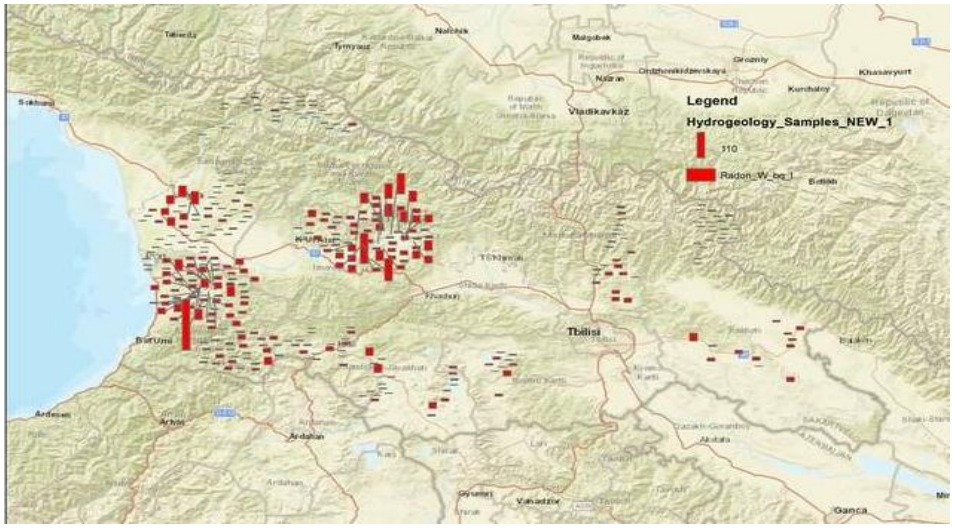

Fig. 2. Distribution of radon concentrations in waters on the territory.

In these areas, there are mainly developed spring waters that have been analyzed in almost all areas. In these surface waters, radon background levels are low. For example, in the “Svaneti” region, the radon concentration in springs varies between 0.8–2.2 Bq/l. In the mineral springs of deeper genesis, radon concentration grows up to 7–10 Bq/l (mineral springs “Shavghele”, “Becho”, etc.). In the “Tusheri” region, the background radon concentration in springs is lower, between 0.5–3.4 Bq/l.

Sampling was conducted on the territory of the West part of Georgian Plate on the territory of Western Georgia, in particular in the “Samegrelo”, “Guria”, and “Imereti” region. In the territory of “Samegrelo”, were mainly tested the boreholes, both types of waters, shallow and deep thermal. Radon concentrations, observed in surface water of shallow wells, vary between 0.2–6.7 Bq/l. In deep thermal wells, their values reach 25–34 Bq/l (“Tsaishi” and “Zugdidi”).

On the territory of the "Guria" region, the background radon concentration in shallow water reaches 2.9–10 Bq/l. In deep groundwater and mineral waters, radon concentrations are higher, such as in the village "Meria" with 24.4 Bq/l in a borehole and the village "Shemoqmedi spring" with 222 Bq/l.

The territory of the "Imereti" region is characterized by high levels of radon in waters. The background value in the shallow groundwater varies between 1.9–6.2 Bq/l. In the deep groundwater layer, the values increase. For example, on the North territory, there are Lower Cretaceous age rocks, which contain fissure and fissure-karstic type of pressurized groundwater (regions of "Tskaltubo" and "Kutaisi"); the characteristic example is the low-radioactive thermal water of "Tskaltubo Resort" (50–70 Bq/l). Here the springs have a large debit (200–220 l/s).

On the East part of the Georgian plate was tested territory of the "Tianeti" region, where a low concentration of radon in water, about 0.1–5.3 Bq/l, was found. Only in two springs (mm N19-20) it does increase till 13.8–18.5 Bq/l.

In South Georgia, the territory of Adjara-Trialeti folded system, and Javakheti Plate were sampled. In general, both parts dominate by the spring type of shallow groundwater. There is a law background radon concentration in water 0.6–7.2 Bq/l for the "Adjara" region and 0.87–6.7 Bq/l for the "Javakheti" region found. In the several mineral springs, radon value increases till 11.9–13.1 Bq/l for "Adjara" and 22.4–36.1 Bq/l for "Javakheti".

Conclusions

Peculiarities of distribution of radon concentration in selected surface, shallow and deep layer waters on some territory of Georgia were studied, such background and anomalous areas were outlined. The elevated radon concentration is related to the tectonic faults and hydrogeological "windows".

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