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EFFECT OF INDUSTRIAL–URBANIZED LANDSCAPES ON UNDERGROUND WATERS

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ABSTRACT

Theoretical and empiric problems of the chemical composition of subsoil waters in industrial-urbanized landscapes of the intermediale zone of the European part of the USSR are generalized. Data characteristic of the most common chemical components in subsoil waters and their changeability regularities dependent on the increase in their formation under geological-hydrogeological conditions both in depth and latitudional extention are considered. Precise dependence of chemical composition and subsoil water quality on the geomorphological situation, lythology of soil and growth of city construction was established.

INTRODUCTION

In most cities of the world industrial–urbanized areas cover 5 to 15% of the territory. In future the regions of the above type are certain to be expanding. The scope of contamination sources passes on from local to regional. The necessity arises to evaluate the dependence of the above localities on the formation of the quality of subsoil waters with a view to futher predicting anol governing the quality.

Industrial-urbanized landscapes are under maximal anthropogenic effect, on the one hand, and the most advanced technological approaches of neutralization of undesirable effects are being used, on the other hand. In this case, an ideal model of solving the problem of interrelationship between the environmental medium and humanactivities can be found. Subsoil qaters can be taken as one constituent part in the model, the reasonable utilization and protection of which, is of primary importance for economic development of the country.

RESULTS

It is known by experience that the main part is played in the formation of chemical composition of subsoil waters under industrial-urbanization conditions by contamination caused by every-day life in the eities. Weth the growth of city construction there arise differences in the distribution of anthropogenic factor effects against time. The peripherical parts of cities are under conditions close to the natural ones. The centre of the city is, as usual age-old. The analysis of hydrochemical data shows the sequential growth of mineratization of subsoil waters downtown with the increase in the growfn of new constructions (ref. 1). Sharp differences can be seen, when considering the pattern of pure subsoil waters in remote territories not affected by city life, in the relatine growth in mineralization by percentage. In city territories the factor of contamination is several times in excess of that in the natural ones by its significance in the formation of

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chemical composition of subsoil waters (ref. 2). Lythology of the aeration zone permeable to contaminants is of secondary importance being responsible for merely a small range of mineralization variations and ionic composition in city regions. This can be accounted for by shallow bedding level of underground waters. As a result in the increase of subsoil water mineralization, there occurs the shift of ionic composition along the direction of relative increase in ions in strong acids and their decrease in the low ones. Entirely newtype of water ensues which is not typical of that in natural regions. It is a firmly established fact for the intermediate zone of the European part of the country that water mineralization in the immediate sublayer under the soil gets increased in winter and summer seasons under natural conditions and diminishes during the periods of snow melting in spring and autumm when the rainfalls continue. Under contamination conditions in the cities the seasonal changes in the chemical composition of subsoil waters become different; the least mineralization occurs in winter time, while the most considetable one is observed during spring and autumn periods. Furthermore, the highest dispersion of mineratization values is noted in spring and autumn, while the lowest one is seen in winter. This phenomenon may, probably, be accounted for by the fact that under the conditions of air pollution by dust particles and other atmospheric pollutants in the cities the maximal supply of contaminants provided by rainfall flows and other sources in the above season enters the subsoil waters in a conventional way (ref. 3). In winter the contamination content sharply decreases and sort of sub-soil water purification occurs. The greatest seasonal fluctuations are shown by mineralization of subsoil waters, the content of sulphate-ion chloride and nitrates. The content of sulphate-ions gets increased by more than twice in summer time as compared to that in the season of winter both in the suburbs and city centre. This phenomenon is of great importance for the construction of cities as well as engineering-geological research, since subsoil waters with no dangerous implications for research, in the winter season may become sulphate-aggressive in summer time. Increase in the content of sulphates in the subsoil waters towards the warmer dust-abundant period of the year leads to the assumption that the main source of sulphate formation is the air--borne dust particles in the cities. This is in good agreement with the data of chemical composition of sedimentary dust particle test samples in different cities. Prevalent salts in the city dust particle structure were those of sulphates; making up 30–35% of the total content, while chlorides amounting to 1–3% only. In engineering-geological research in the cities the seasonal variations of chemism in subsoil waters should be taken into account as well as the powerful source of subsoil water, such as dust particles, should not be neglected. Changes in mineralization of subsoil waters plotted against time graphically show that disregarding the large-scale scattering of separate contaminants the whole of the analyses shows the gradual growth in mineralization which is in excess by 1,5 to 2 orders of magnitude as compared to that in peripherical regions. As a result of city life, the increase occurs in every constituent part of the subsoil water chemical composition, the most marked ones being sulphates, nitrates, potassium, ammonium, when expressed by ratios in per cent. Under city life conditions the mineralization of subsoil waters decreases with depth. It is common knowledge that in nature the decrease in contamination with depth occurs both as a result of water self-purification and their diminishing in quantity in the whole of subsoil waters. Establishment of stable hydrochemical zone cross-sectionally is of great significance in practice. The most considerable effect of field contamination is found in the range of 0 to 4 m depth, i. e. in the area of sewage channel networks, cesspools and all sorts of other sedimentary contaminant. sources. In the depth of 12 to 20 m. the effect of field contamination on the chemical composition of subsoil waters is actually not observed. Not only the decrease in total mineralization is observed with depth, but also that in its dispersion. It was found that with depth the amplitude of fluctuations of anion concentrations was slowing down more rapidly than that of cations. This phenomenon is of great importance for hydrochemical testing of subsoil waters since a great quantity of analyses is needed for attaining the given accuracy of testing under considerable dispersion. The results obtained

demonstrale the advanlages of calculating the changeability of hydrochemical field of subsol waters as regards the depth of their bedding level under correct arrangement of hydrochemical testing of subsoil waters under the conditions of industrial-urbanized landscapes.

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