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The two-layer geochemical structure of modern biogeochemical provinces and its significance for spatially adequate ecological evaluations and decisions

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Contamination of the environment has reached such a scale that ecogeochemical situation in any area can be interpreted now as a result of the combined effect of natural and anthropogenic factors. The areas that appear uncomfortable for a long stay can have natural and anthropogenic genesis, but the spatial structure of such biogeochemical provinces is in any case formed of a combination of natural and technogenic fields of chemical elements. Features of structural organization and the difference in factors and specific time of their formation allow their separation on one hand and help in identification of areas with different ecological risks due to overlay of the two structures on the other.

Geochemistry of soil cover reflects the long-term result of the naturally balanced biogeochemical cycles, therefore the soil geochemical maps of the undisturbed areas may serve the basis for evaluation of the natural geochemical background with due regard to the main factors of geochemical differentiation in biosphere. Purposeful and incidental technogenic concentrations and dispersions of chemical elements of specific (mainly mono- or polycentric) structure are also fixed in soils that serve as secondary sources of contamination of the vegetation cover and local food chains. Overlay of the two structures forms specific heterogeneity of modern biogeochemical provinces with different risk for particular groups of people, animals and plants adapted to specific natural geochemical background within particular concentration interval.

The developed approach is believed to be helpful for biogeochemical regionalizing of modern biosphere (noosphere) and for spatially adequate ecogeochemical evaluation of the environment and landuse decisions. It allows production of a set of applied geochemical maps such as: 1) health risk due to chemical elements deficiency and technogenic contamination accounting of possible additive effects; 2) adequate soil fertilization and melioration with due regard to secondary redistribution of chemical elements; 3) selection of areas adequate for the short- and long-term ecogeochemical monitoring; 4) selection of areas as global and regional biogeochemical standards. The approach was used to evaluate contribution of stable iodine deficiency and radioactive iodine fallout to distribution of thyroid diseases among population of the Bryansk region [1], to evaluate natural transformation of the initially uniform spatial structure of N, P, K in agricultural fields [2] and radiocesium in forest and flood plain landscapes [3].

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