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Abstract: Forms of gold and arsenic, as one of the main pathfinders, were researched in eluvial, illuvial and parent material horizons of podzol soil at the Novye Peski gold deposit. Forms of gold and arsenic were studied with sequential extraction method. Results of this study showed that main forms of gold are water-soluble, bound to organic matter and “insoluble”, for arsenic: bound to Fe and Mn-(oxy)hydroxides and bound to organic matter. The form bound to organic matter was considered in detail and gold and arsenic were analyzed in humic and fulvic acids solutions extracted from podzolic soil. It was determined that gold is mainly bound to humic acid (HA), arsenic – to fulvic acid. Due to the prevalence of form of gold bound to humic acid, the modelling process of different gold and arsenic (III) contents sorption on solid humic acid were observed and data on quantity of adsorbed ions per unit mass of HA and recovery ratio were obtained. More than 90 % gold recovery rate was observed for concentrations less 10 μg/cm3 and for arsenic it was in a range 8 – 15 %.

Keywords: gold; arsenic; humic acid; soil

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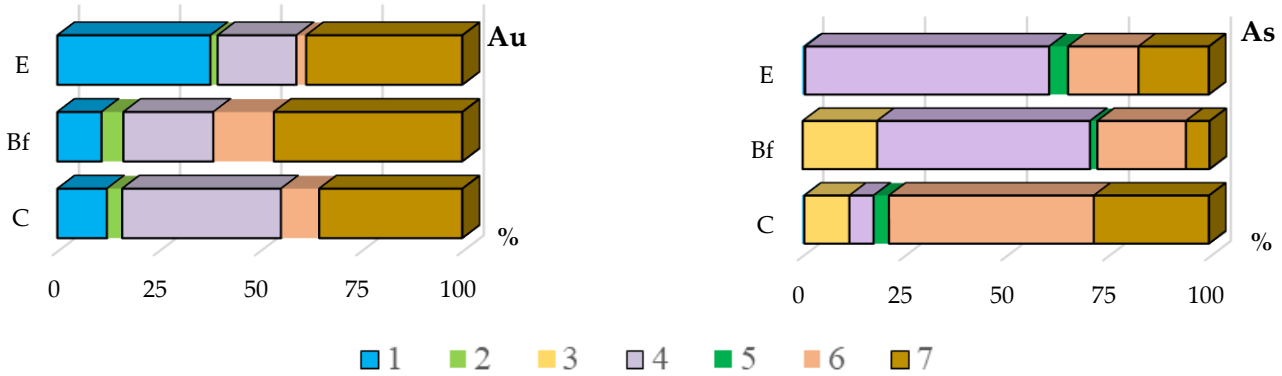
Results and Discussion

Forms of gold and arsenic in loose sediment (mean percentage)



1 – water-soluble; 2 –loosely adsorbed; 3 – strongly adsorbed; 4 – bound to organic matter; 5 – bound to carbonates; 6 – bound to Fe-Mn (hydr-)oxides; 7 – residue ("insoluble").

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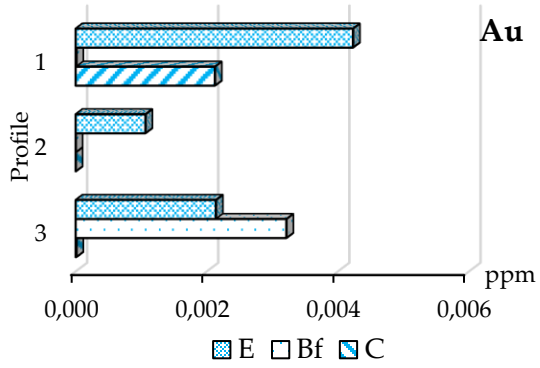
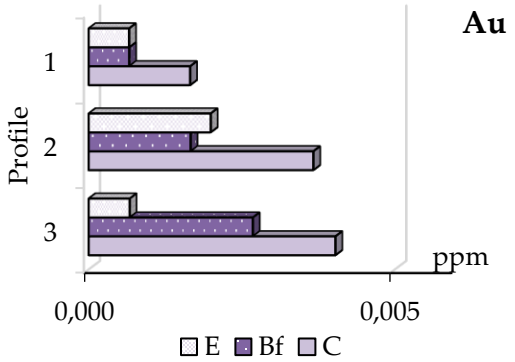
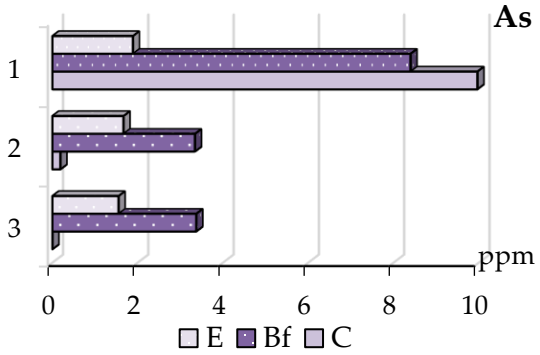
Distribution pattern of gold and arsenic in different forms within the soil profiles

Water-soluble

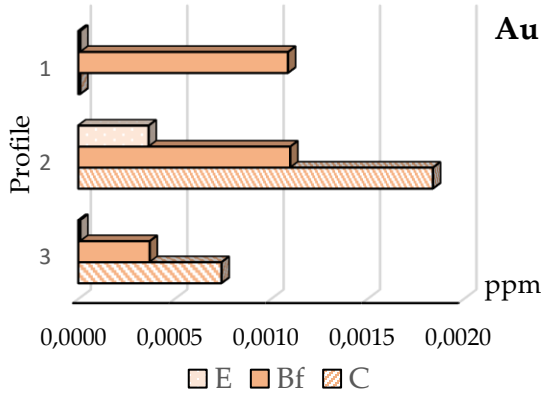


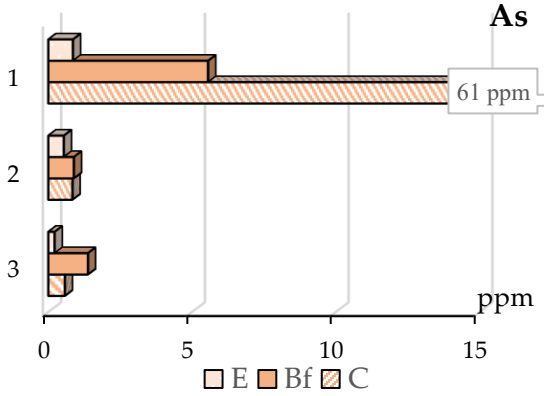
Bound to organic matter





Bound to Fe-Mn (hydr-)oxides





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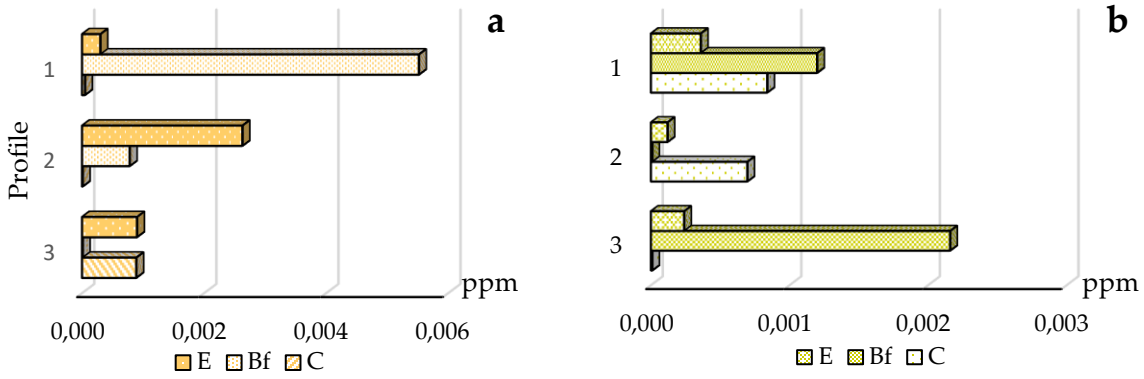
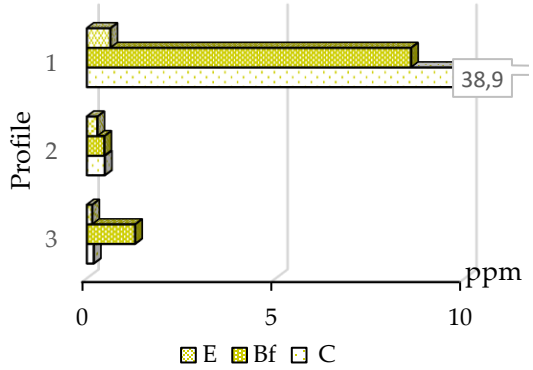
Distribution pattern of gold and arsenic bound to humic and fulvic acids within the soil profiles

Distribution of gold bound to humic acid (a) and fulvic acid (b) in soil horizons



Distribution of arsenic bound to fulvic acid in soil horizons



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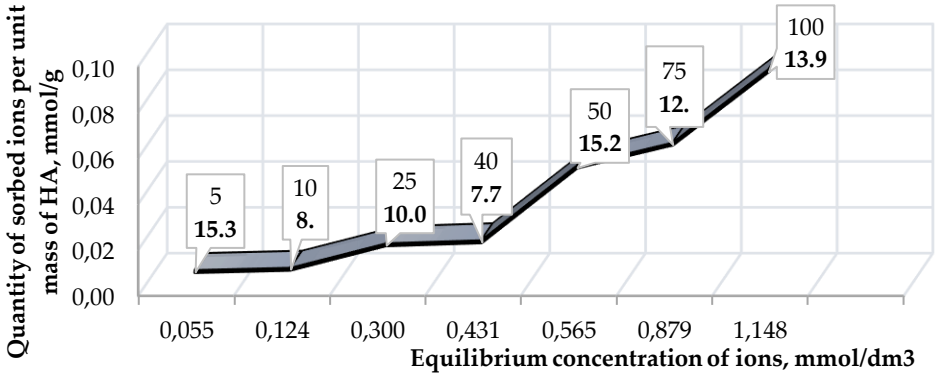
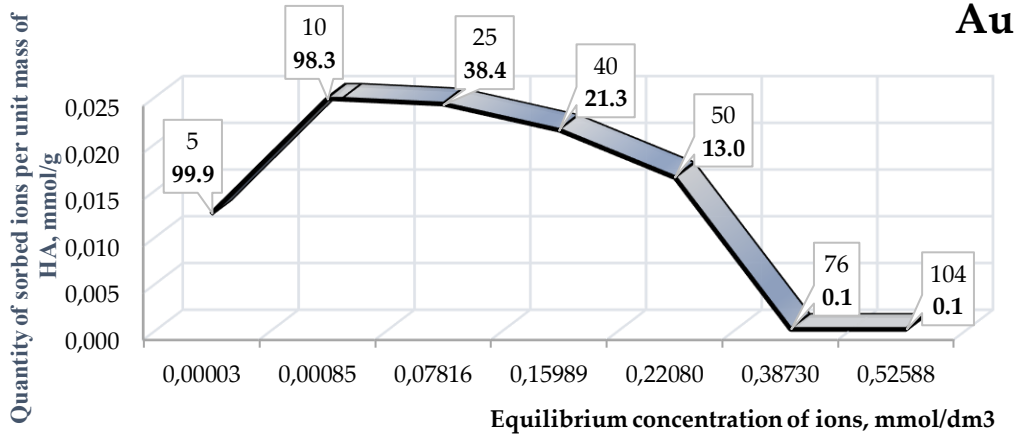
Gold and arsenic sorption by the solid humic acid

Isotherms of arsenic and gold ions sorption on humic acid.

As



Au



The footnotes indicate the initial concentrations of the element in solutions and recovery rate (in bold type).

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Conclusions

1. The main forms of arsenic in the loose sediments in Novye Peski area are bound to oxides and hydroxides of iron and manganese and bound to organic matter. For gold, it is water-soluble, bound to organic matter and “insoluble”

2. Water-soluble gold and bound to HA can point the mineralized zone at Novye Peski while for arsenic those forms are bound to organic matter, to Fe-Mn (hydr-)oxides and to FA, thus these two elements have different concentration media.

3. Solid humic acid is quite active concentrator of low gold concentrations in hydrochloric solutions and recovery degree can exceed 90%, which is opposite to arsenic, for which recovery degree does not exceed 15%.

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Supplementary Materials

Links:

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Thanks for your attention

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