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Micromapping of uranium and phosphorus in the lake Baikal sediments (Academicheskiy Ridge, St8; St11)

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The chemical elements local distribution data, particularly uranium and phosphorous, in the lake Baikal benthal sediments reflects the conditions of those sediments formation. These forming conditions directly associated with climate change in the past and could be used for the palaeoclimatic reconstructions. A microorganism, such as diatomic weeds, has a considerable influence to not only the silicon concentration increase, but also concentrations increase for phosphorous, uranium, precious metals and trace elements. Furthermore, diagenetic alterations lead to the considerable matter redistribution in the sediments and to the formation of new minerals, aggregates and micro-layers. Time estimation of climate change periodicity depends on the locality of utilized analysis methods and on the ability of the methods to determine an element presence form in the sediments.

The purpose of this research is determination of mineralogical, geochemical, physical and chemical conditions of concentration and dispersal as well as evaluation of distribution patterns and periodicities (due to paleoclimatic conditions of sedimentation) for uranium and phosphorus in the benthal sediments of the Baikal Lake. Fragments of the lake sediment columns taken from the axial part of the Akademicheskiy Ridge in Lake Baikal (stations coordinates St8-107^{o}56'25N; 53^{o}32'15E and St11 – 108^{o}00'05N; 53^{o}33'51E) were studied using complex of local analysis methods, such as: n, f - and n, β-autoradiography, SR-XFA, EMP, SEM and TEM. The specific feature of the examined sediments is the presence of phosphorus-iron-manganese formations with stratified, concretionary and flocculation structures in them. An integrated approach has allowed a detailed investigation of the distribution of U and P, as well as a number of related elements (U, Y, As, Sr, Ca, Fe, Mn, Ti, etc.) in the fragments of the bottom sediments columns. The distributions of U and P in the authigenic component of sediments along the whole columns length (with the step of 12 micron) have been studied by the autoradiography method. Layer-by-layer sediment columns scanning with the step of 100-200 microns were performed using SR-XFA which also allowed to determine the concentration of such elements as: Y, As, Sr, Ca, Fe, Mn, Ti and others.

Three main types (groups) of concentrators were established for U and P: 1) - terrigenous (clastogenic) - thorite, monazite, apatite, ilmenite, magnetite; 2) - authigenic - clay minerals, diatoms, phosphorus "flakes", iron-manganese-phosphatic layers; 3) - diagenetic - iron-manganese-phosphatic nodules, area enriched by Fe and Mn (evidence of the redox conditions variation). The same three groups of concentrators have been also identified for the most of major, minor and trace elements. In addition, the mineralogical evidences of gold and silver accumulation in the process of sedimentation and diagenesis were established. The regular periodicity in the distribution of authigenic uranium and phosphorus in the sediment column were identified by statistical methods (Fourier, wavelet analysis). These uranium and phosphorous concentrations oscillations periodicities are determined by oscillations in the sedimentation conditions and primarily by the climatic environment changes.

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