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Parametrization of environment by geochemistry of the varved clastic and bio- chemogenic lake sediments

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As it well known, recent quantitative estimations of high-resolution environmental variability are based on geochemical records in lake sediments. Naturally, annually laminated sediments (varves) are the best objects for paleoclimatic study, because they allow to investigate seasonal variability for understanding long-term environmental pattern. Also, varved sediments seem to be applied as the model for identification of element-indicators for non-laminated sediments.

The XRF scanner on Synchrotron Radiation provides big geochemical dataset for next mathematic treatment, including time series construction. XRF scanning realizes rapid and non-destructive determinations more than 30 trace elements in a range of concentration from 1 up to 10000 ppm in annual layers. That makes sedimentary cores comparable with tree-rings. Geochemical and physicochemical investigation of lake sediments provides basic information to identify geochemical signals with paleoclimate.

In general, sediment consists of mineral component, organics and carbonates. The proportions between these components are affected by environmental parameters, because measured element content or their combinations show correlation with meteodata on instrumental time interval. That allows applying geochemical variability to reconstruct the environmental parameters in the form of time series.

The proportions between main components are controlled by temperature, atmospheric precipitation, water salinity and other external forcings. So, layered structure of lake bottom sediments and detectable elements content variability both represent a continuous record of environmental history.

Element composition and it's climatic response. Bottom sediments represent conditions of physical weathering, temperate bioproductivity and aridity, which concern to mountain lakes within extra tropical zone. The numerical values of the parameters can be computed by software of physical-chemical modeling for gas+water+rock multisystems.

Mineral matter responses to runoff. Mineral clastic part is correlated with x-ray density. It includes "clastic" rock-forming - Si, Al , Ti, Fe, Mg, Ca, K and trace elements such as Sr, Rb, Y, Zr, REE etc. Organic component of sediment more reflects temperature by means of productivity in the catchment and waterbody. Organophillic elements are Br, I, U and others soluble elements correlated with organic Carbon or LOI<500oC. Bio-chemogenic component is more characteristic for saline lakes, where Ca-, Mg- and Sr- carbonates precipitated in dependence of temperature, aridity and water salinity.

Separate geochemical indicators are directly used for paleo- environmental evaluation. For example, elements with changing valency may be a proxy of outer conditions. Fe is strictly connected with sulfur in sulphide under anoxic conditions. And also Fe forms siderite in carbonate ion saturated, but calcium poor, water in the sedimentation system. Mn-enriched layers, crusts and nodules mark usually a long – term pauses of sedimentation in oxic systems. Mo/Mn ratio is good correlated with anoxic atmosphere. And so on.

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