Analysis of the individual annual layers elemental composition in the Lake Kucherlinskoe (Altai) varves sediments with submicron spatial resolution by scanning micro_XRF-SR with x-ray optics (poly capillary lenses).

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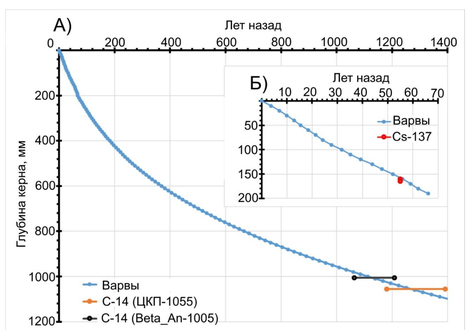
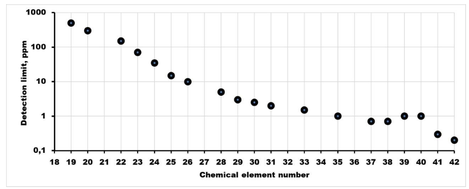
Samples for analysis (optical thin section) were prepared for several core intervals of Lake Kucherlinskoe bottom sediments with well visually distinguished separate annual layers (varves). The annual nature of the layers was previously confirmed by the coincidence of varvechronology (layer counting) with isotopic dating (Cs-137, Pb-210, C-14). The thickness of the annual layers ranged from <1 to 3-4 mm. To study the internal structure of annual layers, we used the scanning micro_XRF-SR with focusing x-ray optics (poly capillary lenses).



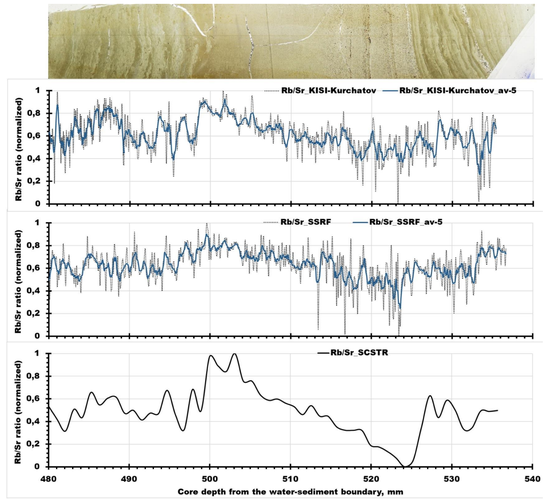
Age model (core depth - age of the sediment layer)



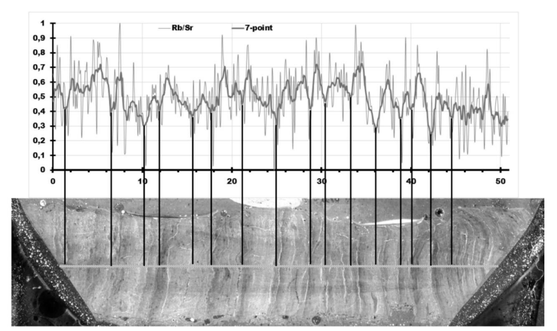
Detection limits of analyzed elements

The experiments were carried out at the Siberian Center for Synchrotron and Terahertz Research (INP SB RAS, Novosibirsk) and the Kurchatov Complex of Synchrotron-Neutron Research (KISI, Moscow) using a confocal X-ray microscope, as well as at the Shanghai Synchrotron Center at the micro_XRF-SR station. The excitation energy in all cases was 22 keV. The size of the scanning spot was determined by the used focusing poly capillary lenses and amounted to 15-25 microns. The scanning step coincided with the exciting radiation spot size on the sample. The measurement time was determined by the counting rate and ranged from 10 to 100 seconds per point.

Scanning profiles were superimposed on the optical images of the thin section obtained with a high-resolution scanner. Given that the thickness of the thin section is less than 20 µm, a change in elemental composition reflects visual changes in the structure of the bottom sediment. Thus, while tracking visual changes in the structure and elemental composition of individual annual layers, seasonal geochemical features and boundaries between the layers can be distinguished. The obtained changes in the elemental composition made it possible to calculate the annual layers by the found lithological and geochemical indicators of the layer boundaries (Rb / Sr ratio).



Rb/Sr ratio marking the traces of the Great Mongolian earthquake 1871, measured at three SR centers (Novosibirsk, Moscow, Shanghai)



Graph of changes in the Rb / Sr ratio in thin sections of Lake Kucherlinskoe bottom sediments