Evaluation of atmospheric flows of mineral substances in the south-eastern coast of Baikal Lake during the last 200 years

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Oligotrophic bogs are capable to maintain in its peat deposits the mineral substance of atmospheric aerosol. The study of microelement composition of the stratified horizons allows us to determine the changes in chemical content of atmospheric aerosol under the influence of natural and anthropogenic factors in the historical time.

Dulihinskoe bog, located in the territory of the Baikal State Biosphere Reserve, took our attention as an object for retrospective geochemical monitoring. In the center of the bog (N 51°31', E 105°00') there were selected the top 47 cm of the 4-meter peat packs of 11000 years old [1] in the form of the monolith with square 22 * 13 cm^2. There was defined naturally radioactive (^{210}Pb, ^{226}Ra, ^{232}Th, ^{238}U, ^{40}K) and anthropogenic (^{137}Cs, ^{241}Am) elements in ash samples and held AAS determination of 19 chemical elements.

^{210}Pb permanently come from the atmosphere and disintegrated over the time in peat horizons, whereas ^{137}Cs, ^{241}Am supply was only in 1953- 1963 years [2]. Distribution of ^{210}Pb and ^{241}Am allowed us to allocate layers, formed in the 19-20th centuries, for which we calculated the rates of accumulation of mineral matter [3] (see table).

Table1: The average annual speed of substance inflows.

The obtained values of the elements proceedings on the earth surface for the second half of the XX century are commensurate the values for the Western Siberia, subjected to anthropogenic impact. Flows of mineral substances remain rather high and in the middle ages, that we explain by the proximity of mountain systems (Khamar-Daban) [3], in contrast to the Western Siberia with its arid environments.

[1] Bezrukova et al (2000) *The problem of the environment, climate reconstruction of the Holocene and Pleistocene* of *Siberia* **2**, 36-47. [2] Gavshin et al (2004) Reports of the RAS **396**, 804-807. [3] Bobrov et al (2012) *Heavy metals and radionuclides in the environment* **1**, 82-90.

Evaluation of the Lu-Hf-in-lawsonite geochronometer

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We present an evaluation of the recently established Lu-Hf-in-lawsonite geochronometer [1, 2] including a reliable separation procedure for lawsonite. For this purpose, four blueschist-facies rocks from the island of Syros (Greece) and the Tavşanlı Zone (Turkey) were investigated, covering a wide range of different lawsonite occurrences, as well as pseudomorphs after lawsonite.

The developed mineral separation procedure involves magnetic and density separation as well as hand-picking and yields almost pure lawsonite concentrates. Lutetium and hafnium concentrations as well as Hf isotope ratios were obtained by using a selective digestion technique for mineral separates [3], a single-column separation procedure for element purification by ion exchange [4], and high-precision isotope ratio measurements by MC-ICP-MS.

Lawsonite showed elevated Lu concentrations of 0.4-1.4 ppm and very low Hf contents of <0.1 ppm. The $^{176}Lu/^{177}Hf$ values of 0.6-4.4 are comparable to other minerals used for Lu-Hf geochronology and allow obtaining well-defined isochrons and precise ages. However, bulk pseudomorphs after lawsonite do not preserve the Lu and Hf concentrations or Hf isotope ratios of the former lawsonite after its prograde breakdown. The obtained Lws-WR age (50.3±1.2 Ma) of the HP-LT metamorphism on Syros is in excellent agreement with previously published geochronological and geothermobarometric studies [e.g., 3]. The Lws-WR ages (87.5±1.1 Ma, 89.3±1.8 Ma) of two metabasites from the Tavşanlı Zone provide the first tight constraints on the onset of HP-LT metamorphism in this region [e.g., 5].

Due to its relatively small P-T stability range and elevated Lu/Hf values, lawsonite is well suited for Lu-Hf geochronology and has proven to be a powerful tool to date high pressure-low temperature metamorphic events. This geochronometer allows dating lawsonite growth in rocks of the lawsonite-blueschist subfacies and offers numerous prospects for investigating different subduction zone processes.

[1] Mulcahy *et al.* (2009), *Geology* **37**, 987-990. [2] Vitale Brovarone & Herwartz (2013), *Lithos*, in press. [3] Lagos *et al.* (2007), *Chem. Geol.* **243**, 16-35. [4] Münker *et al.* (2001), *G^3* **2**, 1064. [5] Okay & Whitney (2010), *Ofioliti* **35**, 131-172.

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