



A rapid transgression of suburban lake: anthropogenic or natural causes?

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There are about 3200 lakes in Chelyabinsk region (South Ural) having total area 2200 square km. On the eastern mountainside of South Ural the depths of large tectonic lakes as Uvildy, Turgojak, Irtyash reach 40 metres. These lakes are not only principal turistic objects but major storage of fresh water in the region. For example during the period of 70th years, about 30% of one billion cubic metres of water from Uvildy was used to compensate the empty of reservoir for needs of the Chelyabinsk city and its industry. The scale of ecological impact of that management was considerable. Such lakes as Uvildy and Turgojak approximate its levels of 60th only in 2003-2005. Contrary to deep and low mineralized mountain lakes, the water of plain steppe shallow lakes of Zaural'e is sometimes salty. Lake Smolino, on the southeast suburban of Chelyabinsk, was one of such lakes 70 years ago. The rapid increase of its volume, from 20 to 100 million of cubic meters, and diminishing of salinity from 9 g/l (1936) to 1 g/l on last decades, caused the succession of ecological and socioeconomic changes. On the one hand, these changes are positive for the city: the ichthyofauna on fresh water was developed rapidly with different kinds of fish, various pretty sandy beaches arised there. On the other hand, continuous growing of lake level (2,5 m from 1960 to final of last century) inundated several southern municipalities. In the middle of 90th years waters from Smolino were pumping to the neighbouring lake Sineglazovo, but it was rapidly led to its critical volume. Actually various expensive projects are proposed to extract "superfluous" water to the Miass river basin. A cause of lake growth is still not clear. Initially, one suspects industry that on 50th years was added to lake about 3 mil cubic meters per year, and last twenty five years this water has been transferred to other localities. Meanwhile the Smolino continues its advance. There are some hypotheses about water infiltration from Shershni reservoir through clefts in the western five kilometers granite border of lake, or about amplification of superficial

run-off coefficient and ragged water-pipes, that are accompanied the evidence of lake rising level. On our viewpoint the principal factor of modern growth of lake volume is natural decadal climate variability of precipitation, with more pronounced impact on landscape zone boundaries, in case of Smolino there is the forest / steppe boundary. Why these natural reasons did not on researches scope? From text above it is clear that water balance of South Urais lakes significantly modified. Traditionally, as etalon of non-modified lake, many of the authors consider Argaiash lake, 50 km to north-west from Chelyabinsk. Really, if one visually compare of inter-annual variations of Smolino and Argaiash, he adopt visual effects as a fact. After that it is easy put on the mind, that 0,3 cm/year linear trend of Argaiash is natural, but 4 cm/year linear trend of Smolino due to anthropogenic cause. Firstly, comparison with "analog" is not adequate without detailed calculation of balance, consideration of isobaths curve and etc. For example, the most southern of mointaneous lakes, Kundravinskoe (90 km to south-west of town) have positive trend of 0,7 cm/yr, also. After subtraction of trends, were observed that value of correlation between oscillation of Argaiash and Kundravinskoe is more than 0,7, but with Smolino only 0,35-0,5. Definitively, the analogue of "natural" oscillation of Smolino and its western neighbors is lame. Adequate estimation of growth western and eastern lake on South Ural is not possible because of strong longitudinal and latitudinal gradients of precipitation. In spite of visual similarity of curves, correlation between annual sums on northern border of steppe (Shadrinsk, station 180 km north-east from lake), and station on forestry hills (Zlatoust 120 km to west) is less than 0,5. The same comparison between each of these station and precipitation near lake give correlation more than 0,7. It is important that precipitation trend on east to lake is positive, but western trends negative. Smoothed curve of eastern precipitation and Smolino level correlated positively +0,6, when Argaiash and Kundravinskoe correlated negatively with small degree of significance. The sign of connection change to opposite when western precipitation took in place, with major degree of confidence for Kundravinskoe (+0,6). Preliminary conclusion: the choosing of lake-analogs on limits of landscape zones is complicated tasks, involving detailed inspection of precipitation regime. The origins for growth of suburban lake, seemly, are in "natural" variability of precipitation (and possible changes in evaporation rate). Some archeological finds give evidence that lake have large oscillations in past. At the same time urban climate effects on evaporation is possible source of additional acceleration. More studies need to quantify contribution of various factors to Smolino growth.