



Isotopic variability in the deepest Vostok (East Antarctica) ice core suggests not perfect mixing of Lake Vostok water

A.A. Ekaykin and V.Ya. Lipenkov

Arctic and Antarctic Research Institute, Polar Region Geography, St. Petersburg, Russian Federation (ekaykin@aari.nw.ru, 7-812-3521057)

One of the key questions about subglacial Antarctic Lake Vostok (LV) hydrological system is whether the water of the lake is well mixed or not. Not complete mixing of water from the sources feeding the lake (glacier melt and hydrothermal water) with the water of main lake body would have several important consequences: 1) lake ice retrieved from 5G-1 borehole at Vostok Station is likely formed from a water layer which is not fully representative for the entire lake; 2) effective residence time of water in the main lake body is likely significantly longer than that deduced from simple mass balance estimations; 3) and, likely most important, not perfect mixing of lake water would suggest the existence of ecological niches where micro-biota can hide from lethal influence of high oxygen concentration likely typical for the lake.

A powerful and promising tool for studying hydrological regime of LV is analyses of lake ice isotope content variability. Up to now, isotopic data from the lake ice have been only used to roughly estimate the components of the lake's mass balance. However, closer view to the lake ice isotopic signal may provide with a range of valuable information about processes taking place just beneath the glacier sole.

Here we present new isotopic data from the deepest part of Vostok ice core (3611-3650 m), as well as revisit the previously published data from the 3538-3611 m interval. It is shown that the lake ice isotope content experiences small-scale variability which is related to the changes of the isotopic composition of the freezing water. Since the time-scale of these oscillations is much less than the expected LV residence time, it suggests that lake water is not perfectly mixed. Most likely it is due to not complete mixing of melt water and/or hydrothermal water with lake resident water on their way to the freezing site.

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