



New look at the “accretion ice” of the subglacial Lake Vostok, Antarctica

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Modern understanding of the genesis of the subglacial Lake Vostok is based on GPS measurements of horizontal and vertical ice sheet movement and isotopic, geochemical, gas content and microbiotic characteristics of ice cores. The results of sounding of the glacier bed allow assuming the groove origin of the lake basin. The isotopic and gas contents analyses showed that the ice below 3539 m depth formed by water freezing (“accretion ice” as referred in literature) and considerably differs from the upper glacier ice. In addition, mathematical modeling suggests a different character of the phase change process at the bottom surface of the ice cover in shallow and deep parts of the lake. At present there is a single point of instrumental measurements (borehole) over the Lake Vostok area where the ice cover thickness is determined. The borehole is positioned over the deep part of the lake where the water freezing at the bottom of ice cover is expected. The “accretion ice” layer thickness at this point is about 220 m. It is also assumed that the thickness of the “accretion ice” is increasing from the West to the East coast of the lake owing to glacier flow trajectory over the lake. The lurch of Earth glaciations due to the continental drift has evidently led to freezing of Antarctic lakes. For this reason the formation of “accretion ice” can be caused by gradual freezing of the lake due to climate change linked to the ice cap growth, i.e. this process could be started about 30 Ma ago. Provided the Lake Vostok existed before the start of glaciations, here we show that the ice at the lake surface can be formed in the first tens-hundreds kyr of initial strong enough glacial periods. Thus, the observed characteristics of the “accretion ice” can reflect the lake’s environment of nearly 30 Ma ago (making this ice as ancient as possible) and may not be relevant to the rather recent lake water, climate and ice cap conditions. It means that anything found in the “accretion ice” may not belong to the contemporary lake water while reflects almost

the whole history of the Antarctic ice cap. It should be added that an absence of horizontal and vertical movement within the “accretion ice” trapped between steep shores of the lake is an important assumption for such a statement and have to be checked by extra measurements.