Geophysical Research Abstracts
Vol. 16, EGU2014-1467, 2014
EGU General Assembly 2014

Geoethical Approach to Antarctic Subglacial Lakes Exploration

Pavel Talalay, Alexey Markov, and Mikhail Sysoev
Jilin University, Polar Research Center, Changchun, China (ptalalay@yahoo.com)

Antarctic subglacial aquatic environment have become of great interest to the science community because they may provide unique information about microbial evolution, the past climate of the Earth, and the formation of the Antarctic ice sheet. Nowadays it is generally recognized that a vast network of lakes, rivers, and streams exists thousands of meters beneath Antarctic Ice Sheets. Up to date only four boreholes accessed subglacial aquatic system but three of them were filled with high-toxic drilling fluid, and the subglacial water was contaminated. Two recent exploration programs proposed by UK and USA science communities anticipated direct access down to the lakes Ellsworth and Whillans, respectively, in the 2012/2013 Antarctic season. A team of British scientists and engineers engaged in the first attempt to drill into Lake Ellsworth but failed. US research team has successfully drilled through 800 m of Antarctic ice to reach a subglacial lake Whillans and retrieve water and sediment samples. Both activities used hot-water drilling technology to access lakes. Hot water is considered by the world science community as the most clean drilling fluid medium from the present point of view but it cannot solve environmental problems in total because hot-water even when heated to 90 °C, filtered to 0.2 μm, and UV treated at the surface could pick up microorganisms from near-surface snow and circulate them in great volume through the borehole. Another negative impact of hot-water circulation medium is thermal pollution of subglacial water. The new approach to Antarctic subglacial lakes exploration is presented by sampling technology with recoverable autonomous sonde which is equipped by two hot-points with heating elements located on the bottom and top sides of the sonde. All down-hole sonde components will be sterilized by combination of chemical wash, HPV and UV sterilization prior using. At the beginning of the summer season sonde is installed on the surface of the Antarctic ice sheet above subglacial lake. All equipment is got into working trim, the bottom hot-point is powered, and the sonde starts to melt down to the ice sheet bed. The personnel leave the site, and all further operations are going on in semi-automatic mode. The melted water does not recover from the hole and refreezes behind the sonde. Electric line for power supply and communication with down-hole sensors is released from the coil installed inside the sonde. Since the sonde enters into the subglacial lake, it samples the water and examines subglacial conditions. After sampling, the motor connected with coil is switched on, and the top hot-point is put into action. The sonde begins to recover itself to the surface by spooling the cable and melting overlying ice with the help of the upper hot-point. Since 8–9 months from starting, the sonde reaches the surface and waits the personnel for servicing and moving to the next site. The big advantage of the proposed technology is that subglacial lake would be measured and sampled while subglacial water is reliably isolated from surface environment.