Fluorescence and amino acids measurements in water column of Antarctic subglacial lakes

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The Dry Valleys in Antarctica could be used as a good model for testing of life detection systems for Solar system exploration. All planets and their satellites from Earth outward are cold environments. Surface of Dry Valley could be used for modeling conditions on Mars, and Dry valley lakes covered with ice all year around could be a nice test place for systems designed to study lake Vostok and Europa. One of these lakes –Bonney Lake – is a stratified saline lake. The salt concentration in this lake monotonically increases from the surface to the bottom. This lake is permanently covered with 4 m thick ice. Short light period and negative temperatures on the surface almost all year around makes *in situ* studies in this lake a very challenging enterprise. Salinity of the lake adds additional difficulties for analysis of distribution of amino acids through water column of this lake.

Our preliminary data showed that there is a very strong correlation between concentration of amino acid measured by HPLC method (this method requires a lot of preliminary treatments – desalting procedure, tagging with fluorescent sonds, etc.) and intensity of fluorescence induced by 224 nm laser measured at different wavebands with a system of photo-multiplier tubes (PMT).

Such a self-contained instrument capable of measuring intensity of fluorescence in real time as it goes down through the water column in such lakes could serve as a good proxy to distinguish between lakes harboring or harbored life and sterile environment. Such an instrument could be used not only to measure and monitor the content of amino acid in Dry Valley lakes, but in the future could be used for remote studies of Lake Vostok. And of course when time comes to study the ocean underneath the ice on Europa, such experience and autonomous instrument will be the first one to be put in action.

NASA applications for the technology we are developing include miniature, low power, and autonomous, *in situ* sensors for detection of a wide range of organic molecules on Europa, Titan and elsewhere in our solar system. In addition, this sensor technology is suitable for search and monitoring the general microbial environment of the terrestrial lakes and other water bodies.

The significance of this instrument is its ability to detect minute quantities of chemicals related to life and polyaromatic hydrocarbons (PAH) in a small, robust, self-contained, submersible package capable of a wide variety of NASA applications including Antarctic missions and missions to Europa, Titan and elsewhere. We believe our approach offers the best trade-off of information capture to size, weight and power consumption of any instrumental combination for in situ detection of life.

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