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SUBGLACIAL LAKES HAVE CHANGED OUR VIEW OF ANTARCTICA

Captain Robert F. Scott made numerous diary entries referring to the paucity of life on the Antarctic continent. Little did Scott realize that life surrounded him in the form of microorganisms. Life within the interior ice sheet was only recognized with the recent reports of bacteria in Lake Vostok, an enormous lake (~14,000 km², >1000m deep) beneath Vostok Station. Though ice cores at Vostok Station were originally collected for paleoclimate research, the basal portion (3,539 to 3,623 m) of the core had a chemistry and crystallography distinctly different from the overlying stratified glacial ice. The properties of this basal ice, in concert with radar data, revealed that it formed by the refreezing (accretion) of lake water to the underside of the ice sheet. Using ice-water partitioning coefficients, it was estimated that Lake Vostok itself could contain up to 10⁶ bacterial cells ml⁻¹, similar to that in the open ocean. Recent data from Russian scientists studying DNA in accretion ice have indicated that thermophilic bacteria may exist within the lake. Evidence for the presence of thermophiles is supported by the recent interpretation by French scientists of He³/He⁴ data from accretion ice. This interpretation now implies that there may be geothermal plumes entering the bottom of the lake. If this emerging picture is correct, Lake Vostok could harbor a unique assemblage of organisms fueled by chemical energy.

The recent evidence for the presence of microbes in Lake Vostok has changed our view of the extent of Earth's biosphere. Important new information based on airborne radar surveys has shown that at least 100 more subglacial lakes exist beneath the ice sheet. These lakes, though not nearly as large as Vostok, are still substantial with at least one exceeding 800 km² in surface area. The high density of lakes near Dome C implies that a hydrologically interconnected lake district may exist in this region of Antarctica. These lakes provide many new environments that presumably contain life in what was once thought to be an inhospitable environment.

What is the future of subglacial lake research? A formal Subglacial Antarctic Lake Group of Specialists (SALEGOS) was organized by SCAR in July 2000. The charter for the group and their actions on subglacial lake exploration can be found on their website (<http://salegos-scar.montana.edu/>). The SCAR SALEGOS outlined a detailed plan for eventual lake entry and sample return. This plan calls for the establishment of a network of lake observatories within the next 3-6 years. These observatories will consist of a string of instruments lowered into each lake that collect data continuously and send it in real time to the surface. Such information can be used to plan the next stage of lake exploration outlined by the Group, which includes actual return of water samples to the surface within 6-9 years. The final stage involves the return of deep sediment cores that can be used to reconstruct paleoclimate and geological records for Antarctica. The Group emphasizes that the plan, while phased-in, is not a linear progression of steps, one leading to the next, but must be a complex interplay of parallel developments that converge at critical milestones to achieve the programmatic goals and objectives. Overriding this entire plan, of course, are environmental concerns. All members of the SALEGOS realize that environmental stewardship precedes all scientific endeavors. The next 5-10 years should prove to be an interesting time of discovery for Antarctic science, one that follows the Antarctic tradition of melding interdisciplinary and international science. We can expect subglacial lakes to be at the forefront of such discovery since they remain one of the last unexplored frontiers on our planet.

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