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Physical, chemical and biological processes in Lake Vostok and other Antarctic subglacial lakes

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Abstract

Over 70 lakes have now been identified beneath the Antarctic ice sheet. Although water from none of the lakes has been sampled directly, analysis of lake ice frozen (accreted) to the underside of the ice sheet above Lake Vostok, the largest of these lakes, has allowed inferences to be made on lake water chemistry and has revealed small quantities of microbes. These findings suggest that Lake Vostok is an extreme, yet viable, environment for life. All subglacial lakes are subject to high pressure (~350 atmospheres), low temperatures (about -3 °C) and permanent darkness. Any microbes present must therefore use chemical sources to power biological processes. Importantly, dissolved oxygen is available at least at the lake surface, from equilibration with air hydrates released from melting basal glacier ice. Microbes found in Lake Vostok's accreted ice are relatively modern, but the probability of ancient lake-floor sediments leads to a possibility of a very old biota at the base of subglacial lakes.

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