

Noble gas radioisotope constraints on age of ice cover of West Lake Bonney, Taylor Valley, Antarctica

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Noble gas radionuclide profiles were measured in West Lake Bonney to constrain the formation time of its perennial ice cover. Large-volume water samples were pumped from four depths in the center of the lake, and bulk gas extraction from lake water was done using a semipermeable hydrophobic membrane. Argon and krypton were then separated for measurements of ³⁹Ar, ⁸¹Kr, and ⁸⁵Kr by low-level counting (³⁹Ar) and atom-trap trace analysis (⁸¹Kr and ⁸⁵Kr). A simple diffusion model incorporating elevated dissolved Ar concentration at the ice cover-lake water interface (caused by Ar exclusion during freezing of air-saturated water) and initially air-saturated water throughout the lake, with a small flux of basement rock-derived Ar, yields lower-limit ice formation times of about 100 to 300 years. In contrast, previous ice-cover dating efforts using dissolved radiogenic ⁴He profile [Poreda et al., 2004] and ³⁶Cl [Lyons et al., 2008] have generally indicated much longer duration of perennial ice cover. These new data are consistent with historical field observations and provide a strong new temporal constraint on the formation of the perennial ice cover of West Lake Bonney.

REFERENCES

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