

The two Newberry crater lakes, OR: subaqueous sources of Hg and As

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Lake Paulina and East Lake are adjacent crater lakes in the Newberry caldera South of Bend (OR). The lakes are ~ 8000 years old and have carbonate-rich, Cl-poor waters, and small hot springs dot their margins. East Lake has subaqueous inputs of Hg-rich CO₂-H₂S gas, and the water has up to 140 ppm bicarbonate at pH 6.5. Paulina Lake is carbonate-rich (three times seawater alkalinity), at a pH of ~ 8.5 and high dissolved silica, the result of hot fluid injections at the lake bottom. The sediment in both lakes largely consists of diatom frustules and ash. Paulina Lake sediment has hydrothermal components (up to 15% Fe₂O₃ with P, Si) and up to 250 ppm As, but no Hg. East Lake sediment has low As levels, but up to 4 ppm Hg. Sedimentation rates are 1-2 mm/year, with up to 8% organic carbon in East Lake. Fish in East Lake are Hg-rich. Stable isotope data of lake waters plot on a local evaporation line, with the East Lake fluids more evolved than the Paulina Lake fluids. The water balance derived from the isotopic mass balance demands hydrothermal inputs into Paulina Lake on the order of 2-12 million m³/yr. Organic matter in East Lake sediment has relatively heavy carbon isotope values (-20 to -24‰) as does DIC (up to +4‰); DIC is lighter in Paulina Lake. The nutrient cycle is partially fed by photosynthetic cyanobacteria (*Nostoc* balls). The aqueous carbon isotope balance is influenced by CO₂ inputs, photosynthesis, and escape of isotopically light CO₂ through diffusion at the surface.