

Pinatubo lake chemistry and degassing 1991-2010

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Pinatubo volcano erupted violently in 1991, emitting about 1.7×10^{10} t SO₂ during its June 15th Plinian eruption of VEI 6, leaving a caldera of approx. 2.5km diameter and 600m depth. Subsequent phreatic events and dome growth continued through 1992. A first small crater lake began to form in 1991. Water samples were collected and in-situ measurements of pH and temperature) made in 1991, 1992, 1994, 1996, 1999, 2000, 2001, and in 2010. We here summarize the data obtained during these surveys, and the current (2010) state of degassing, bathymetry and water chemistry of Lake Pinatubo.

In late 1992, the initial small lake had a significant acid-sulfate component from a possible hydrothermal component during ongoing dome growth, and anhydrite dissolution. Subsequently, this component was "drowned" and quickly overwhelmed by rainfall (2-4 m/y), groundwater draining from the crater walls into the lake, and a few neutral chloride crater wall springs. Prevalent bubbling of a predominantly CO₂ gas phase persists throughout the lakes history, indicating ongoing degassing of a remnant shallow magma related to the 1991 eruption.

Degassing was tracked by sonic bathymetry in 2010 throughout the lake, and appears to occur along linear features, at the 1992 dome, and diffusely along the entire shallow lake margin. Bubble trails in the deep portions of the lake lessen toward the surface, reflecting a process of ongoing dissolution. Dissolved CO₂ was measured in deep water samples taken in situ by two methods, a Niskin sampler, and samples from a hose lowered to depth and pumped from aboard the operators vessel into a closed evacuated vessel. CTD measurements in August 2000 found a strong inverted thermal stratification below 20m depth, reaching over 70°C at 50m depth above the submerged 1992 dome. By January 2001 the lake had homogenized and was much cooler (27°C at all depths), and it was again well-mixed and cool when re-surveyed in 2010. Crater wall fumaroles emit boiling-point hydrothermal gases dominated by water and CO₂.