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Stable isotopic records of lake sediments from Taal Lake in central Philippines during the past 60 years

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Taal Lake is located in Batangas Province of central Philippines (14°0.01'N, 120° 59.1'E), with a surface area of 267 km2, a maximum depth of 176 m and an elevation of 3 m above sea level. The lake occupies the famous Taal Volcano system which consists of a 15 [U+F0B4] 22-km prehistoric caldera. The 5-km-wide Taal Volcano Island which has 47 craters and 4 maars, lies in the north-central Taal Lake. With 34 recorded eruptions, Taal Volcano is one of the 16 monitored volcanoes by the Global Volcanism Network.
A 120-cm long gravity core was retrieved from 15-m water depth of Taal volcanic lake located in the central Philippines. Dated by the nuclear bomb introduced-14C curve, the core reveals a detailed sedimentary history of Taal Lake during the past 60 years. [U+F064] 18O and [U+F064] 13C analyses on bulk carbonates and [U+F064] 13C measurements on organic carbon in the sediments were carried out for 56 samples. The annual resolution [U+F064] 18O and [U+F064] 13C records provide us the detailed variations of the lake's hydrological, biological and sedimentary history. Carbonate was precipitated in isotopic equilibrium with the lake water at ~30oC which is close to the measured water temperature. The [U+F064] 18O and [U+F064] 13C of the carbonates co-vary in the core, exhibiting the feature of a closed lake. In general, when there is more input surface water, the [U+F064] 18O and [U+F064] 13C of the lake goes lighter due to dilution effect. The lake productivity at this time will be lower, and carbonate precipitation is less. When the lake experiences less surface water input and/or more evaporation, the [U+F064] 18O and [U+F064] 13C of the lake goes heavier due to the hydrological balance and increased lake productivity. However, when the volcanic activity increases, significant amount of hydrothermal input and deep CO2 input will lead to increase of lake's [U+F064] 18O and [U+F064] 13C. Both carbonate and organic carbon will decrease due to the influence of volcanic input. This situation was occurred around 1991. However, if a volcanic eruption causes significant amount of dead carbon from vegetation and organism in and around the lake, the lake's [U+F064] 13C will be depleted. At the time, the [U+F064] 18O and [U+F064] 13C of the lake goes the opposite way. The 1965 eruption may be an example of such a case. With the detailed geochemical profiles, we are able to reconstruct climatic, environmental and volcanic history of Taal Lake area.