Water quality characteristics of Lake Nyos, Cameroon

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In 1986, Lake Nyos in Cameroon released a large amount of CO_2 and killed more than 1700 residents. Subsequent investigation revealed that the CO_2 is originated in degassing magma and is ascending from the bottom of the lake with thermal water (e.g., Kusakabe et al., 1989; Ohba et al. 2012). Although controlled degassing started at Lake Nyos in 2001 and have resulted in reducing CO_2 content of the lake (e.g., Kusakabe et al. 2008), investigations regarding chemical components except CO_2 content is also important to ensure gas disaster prevention.
In this study, chemical compositions of the water samples collected from various depths in the lake Nyos and volcanic rocks collected from lake rim were analyzed. TDS of the lake increases with depth. The ionic dominance pattern for cations is $Fe^{2+} > Mg^{2+} > Ca^{2+} > Na^{+} > K^{+}$ at the bottom of the lake, whereas the anion is dominated mainly by HCO_3^{-} with only a very small amount of Cl^{-} and SO_4^{2-}. Except for HCO_3^{-} derived from CO_2, whose origin has already been described, the concentration of dissolved components are 40 ~ 380 mg/L and Na/(Na+Ca) weight ratios are about 0.3 ~ 0.4, indicating that the water quality of the lake is affected by water-rock interaction. Good correlation was observed between chemical compositions of lake water and whole-rock compositions of the rock samples, supporting this inference. Assuming that the chemical components of the lake water are derived from rock dissolution, the solubility of the elements seem to be basically controlled by the ionic potential (Z/r), elution rate of elements of large Z/r (e.g., Al, Ti and Cr) were small compared to elements of small Z/r (e.g., Na, K, Ca, Mg, and Mn). Additional study in consideration of pH condition and equilibrium state of minerals is important to determine the water-rock interaction processes that affect the water quality.

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