

Climate conditions of the past 200 years recorded in a tufa from Tokunoshima, Kagoshima Prefecture

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Tufa, a carbonate deposit developed in a stream setting in a limestone area, is potential for a paleoclimate archive. Annual layering and high growth rate of several mm/year of the tufa enable high-resolution analysis. A problem is that the tufas at stream settings hardly grow continuously over a period of 20 years. On the other hand, a longer continuous record can be expected from tufas at a cascade setting where the tufas grow from the bottom of waterfall. A cascade tufa is rare in Japan but developed at Obaru beach in Tokunoshima, Kagoshima Prefecture. This study analyzed a 49.2 cm long tufa in order to reconstruct climatic conditions.

The cascade tufa exhibits irregular growth surfaces, and analyses for the clear annual lamination indicates a growth rate of 2.35 mm/year. Applying this rate, the 49.2 cm long specimen corresponds to 209 years. While counting of densely-calcified summer bands evaluates the depositional period 187 years.

Comparing isotopic records of the tufa from other sites, the Obaru beach tufa has a relatively high $\delta^{18}\text{O}$ due to the high value of rainwater, and has very high $\delta^{13}\text{C}$ reflected from the cultivation of sugar cane. Our analyses provide some insights into the potential of the tufa record. First, decreasing trend of $\delta^{13}\text{C}$ since the 1960's is the Suess Effect by combustion of fossil fuels. While high $\delta^{13}\text{C}$ extended back to the bottom of the sample indicates that sugar cane cultivation has sustained from the 1840's. $\delta^{18}\text{O}$ values can be correlated to rainfall amount rather than air temperature. This relation infers amount of rainfall for the period before meteorological observation; low rainfall in 1840-1870 and high rainfall in 1870-1890. In addition, a conglomeratic texture in the 1960's most likely corresponds to a tsunami by Chile Earthquake in 1960. This study presents the longest climatic record from the modern tufa. Finding more appropriate samples will further improve the length and resolution of the tufa records.

Andrews, J. E. (2005). Palaeoclimatic records from stable isotopes in riverine tufas: Synthesis and review. *Earth-Science Reviews*, 75(1-4), 85-104.

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