

Centurial-scale cycle observed in oxygen isotope of Holocene stalagmites from central Gifu Prefecture, Japan

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We report the Holocene oxygen isotope profiles successfully obtained from two stalagmites in Gujo City, Gifu Prefecture, where meteoric oxygen isotope appear distinct seasonal pattern (low in winter and high in summer). Holocene sections of stalagmite OT02 (5.3 cm thick) and OT03 (15.3 cm) from exhibit more than 10 cyclic changes in its oxygen isotopic values in a period of 11-2 ka. Estimated ~650-yr wave length broadly conforms with that of solar activity reconstructed based on radio carbon anomaly. The periodicity is also conformable with historical climatic periods, such as Little Ice Age and Medieval Warm Period. Temperature change was unlikely responsible for the stalagmite isotope because the phase unmatched with the solar activity. The stalagmite oxygen isotope was low during the cold phases of lower solar activity, and likely records the change in average isotopic composition of the meteoric water. Meteoric water samples collected at a reference site (Ogaki City) clearly indicate seasonality in the oxygen isotope values. Meteoric waters in winter generally record low isotopic values, likely owing to the Rayleigh distillation that occurs in water vapor mass from the Japan Sea. The stalagmite records at Gujo can be the change in the winter proportion of meteoric water. This would have increased the stalagmite oxygen isotope during colder periods. Similar centurial-scale cycles appear in the Holocene stalagmite from Mie Prefecture. We suggest that such cyclic change can be extended back to Yanger Dryas.

Keywords: stalagmite, Holocene, oxygen isotope