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Coinciding Late Holocene δ^{13}C and δ^{18}O Time Series in Stalagmites from different Caves in Belgium.

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Three stalagmites, taken from three Belgian caves, were dated and analyzed for stable C and O isotopic compositions. External reproducibility at the 2σ level of δ^{13}C and δ^{18}O, measured on a dual inlet IRMS Finnigan Delta E or Thermoquest XLPlus, were better than 0.07‰ and 0.1‰ respectively. Six U/Th datings were carried out on the 32 cm long 'La Timide' stalagmite from the Han-sur-Lesse cave which indicated deposition 5.380 ($\pm$ 93) ka BP and 9 ($\pm$ 14) a BP. In the mid 90-ies, U/Th dating of the 68 cm long Hotton and the 79 cm long Vilaine Source stalagmite produced ambiguous results, either due to detrital ^{232}Th contamination (Hotton) or due to a too low U content (Vilaine Source). Radiocarbon dating was carried out on the Hotton and the Vilaine Source stalagmites (resp. 10 and 7 samples) and corrected for a dead carbon proportion (dcp) of an estimated 12%. While a new U/Th dating programme is in progress on the Vilaine Source stalagmite, the best geochronological estimate at present points to the deposition of the Vilaine Source stalagmite between 6.369 ($\pm$ 110) ka BP and 514 ($\pm$ 61) a BP and between 10.808 ($\pm$ 273) ka BP and 2.831 ($\pm$ 88) ka BP for the Hotton stalagmite. Low resolution time series (a dental drilled sample every 5 mm) of δ^{18}O and δ^{13}C display very similar patterns in all three stalagmites and a strong co-variation of δ^{18}O and δ^{13}C is seen in each stalagmite. The δ^{18}O values evolve in a narrow range from -6.4‰ to -4.9‰ and have similar means between -5.5‰ and -5.8‰. The fluctuations of the δ^{13}C values in each stalagmite are about 2 to 3 times larger than those of the δ^{18}O values, but they are also similar in all three stalagmites. δ^{13}C varies in a range between -11.8‰ and -6.6‰. The mean δ^{13}C is -8.7‰ for 'La Timide', -10.4‰ for the Hotton and -10.1‰ for the Vilaine Source stalagmite. The δ^{18}O and δ^{13}C values are too high compared to what would be expected for calcite

deposition in isotopic equilibrium, based on a presumed mean temperature of about 12˚C as it is today, a meteoric water δ^{18}O close to today's value of about -7.0‰ and the assumption that there was a 100% C3 vegetation in the area throughout the Holocene. This is supported by too positive δ^{18}O and δ^{13}C values, respectively 1.8‰ and 5.5‰ too high, measured on calcite deposited on glass slabs placed in the Han-sur-Lesse cave. We think that kinetic effects bound to evaporation accompanied by CO_2-degassing set off the δ^{18}O and δ^{13}C values from equilibrium to more positive ones and that this mechanism quantitatively varied through time as cave air humidity and temperature varied. Consequently we think that the δ^{18}O and δ^{13}C time-series do not directly reflect fluctuations in temperature and soil CO_2-composition respectively, but indirectly follow, both together, variations of colder and wetter versus warmer and drier climates. In this respect the Little Ice Age and the Medieval Warm Period can be recognised. A high resolution δ^{18}O- and δ^{13}C-time series (a micro-drilled sample every 50 μm) of the 'La Timide' stalagmite over the last 190 ($\pm$19) a BP reveals a significant decrease in both δ^{18}O and δ^{13}C, from -4.5‰ to -5.5‰ and from -7.0‰ to -9.5‰ respectively. The decrease of δ^{18}O over the past ca. 200 years is in disagreement with the observed temperature increase of about 1.5˚C during the same period. The δ^{18}O and δ^{13}C decrease might tentatively be related to a tendency of the calcite deposition towards equilibrium, caused by a slight increase in cave air humidity, which would be in agreement with an observed slight increase in precipitation in Belgium.