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Discontinuous Holocene stalagmite growth from a shallow Alpine cave (Cogola di Giazzera, NE Italy): temperature sensitivity and hydrology control

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Cogola di Giazzera located in NE Italy (Long. 11˚10' E; Lat. 45˚59' N; elevation 1025 m a.s.l.), is a small shallow cave developed in pure Jurassic limestone. In the terminal chamber, temperature and drip water δ^{18}O are constant throughout the year. Drip discharges, which are mainly controlled by fissure flow, fluctuate depending on the season and several drips stop during prolonged dryness. Here we present an isotopic and petrographic study of a 57 cm-long actively growing candle-shaped stalagmite (GZ1) that it is characterized by three distinct hiati in its central part. Eleven MC-ICP-MS U/Th age determinations allow to detect three different growth phases: the first from 4.5 to 3.7 ka, a second, very short, from 1.4 to 1.3 ka, and the last one from 1 ka to present-day. GZ1 mostly consists of dendritic calcite texture, and its relatively fast axial growth rate (0.1 to 0.5 mm/year) allows a good time resolution also at the 2-mm sampling interval we utilised for stable isotopes.

In the topmost 20 cm, corresponding to the last 1000 years, we observed a positive correlation between $\delta^{18}O_c$and mean annual Alpine air temperature, and d$\delta^{18}O_c$/dT of about +1.1‰ /˚C. This temperature dependence of $\delta^{18}O_c$ was observed in other stalagmites from NE Italy, although the d$\delta^{18}O_c$/dT in GZ1 is much higher. This value probably reflect the enhanced sensitivity of Cogola di Giazzera with respect to deeper caves.

In the older portion there is a clear co-variance between oxygen and carbon isotopes indicating kinetic effect i.e. non-equilibrium deposition. Nevertheless it is still possible to observe a positive correlation between calcite stable isotopes (both oxygen and

carbon) and C-14 production rates, which reflect solar influence on evapotanspiration. The discontinuous stalagmite growth reflect both regional climate events and hydrology which can be related to tectonic events. The most recent growth phase, in fact, seems to correlate with an historical earthquake that triggered also some landslide in the region dated around 950 cal. years BP.