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Detailed analysis of the lamination and the geochemical varibility of the speleothem Zerolin to study the paleoclimate of SE Spain.

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This work reports an exhaustive analysis of geochemistry and lamination in the paleoclimate study of Málaga using an actively stalagmite called Zerolín, collected in 2007 in the Cave of Ardales. U-Th dates indicate that the spleothem began forming 1000 years ago.
The older portion of the stalagmite presents a very marked lamination with an alternation of white and porous layers and denser dark layers. Lamination is absent in the younger portion of the stalagmite, which features darker calcite and slower growth rates. In the laminated part of the speleothem, a comparison of layer counting and U/Th dates indicates that light and dark couplets are annual.
A detailed age model was then produced for the laminated part of the stalagmite based on layer counting anchored to a precise U/Th age. For the non-laminated portion of the stalagmite, U/Th dates were used in Bchron software to produce an age model. Periods of higher growth rate coincide with a greater thickness of white layers. In nonlaminated sections, U/Th dates confirm important depositional gaps.
In the geochemical analysis it was discovered that the relationship and behavior of trace elements and stable isotopes is different in the upper zone than in the lower annually laminated zone. Over annual laminae cycles, trace elements such as Sr and d13C covary and may be driven by prior calcite precipitation, however Mg is out of phase with Sr. In nonlaminated segments, the correlations are not as systematic.
The trace element and d13C indicate two periods of drier conditions in the stalagmite (1100-1200/1600-1800 AD) .These coincide with periods when there was an increase in the frequency of prayers for rainfall in historical documents from the Toledo Cathedral (F.Dominguez Castro et.al 2008), suggesting that the stalagmite is reflecting regionally significant humidity changes.