

SPELEOTHEM ARCHITECTURAL ANALYSIS: TOWARDS A STANDARDIZED STRATIGRAPHY IN STALAGMITE-BASED PALEOCLIMATE RESEARCH

JAVIER MARTÍN-CHIVELET^{1,2}, M. BELÉN MUÑOZ-GARCÍA¹, JUNCAL CRUZ^{1,2}, ANA I. ORTEGA³, MARÍA J. TURRERO⁴, MAIALEN LOPEZ-ELORZA^{1,2}

¹ Dpt. of Stratigraphy, Faculty of Geological Sciences, Complutense University of Madrid, 28040 Madrid, Spain

² Institute of Geosciences (CSIC-UCM), c/ José Antonio Nováis 12, 28040 Madrid, Spain

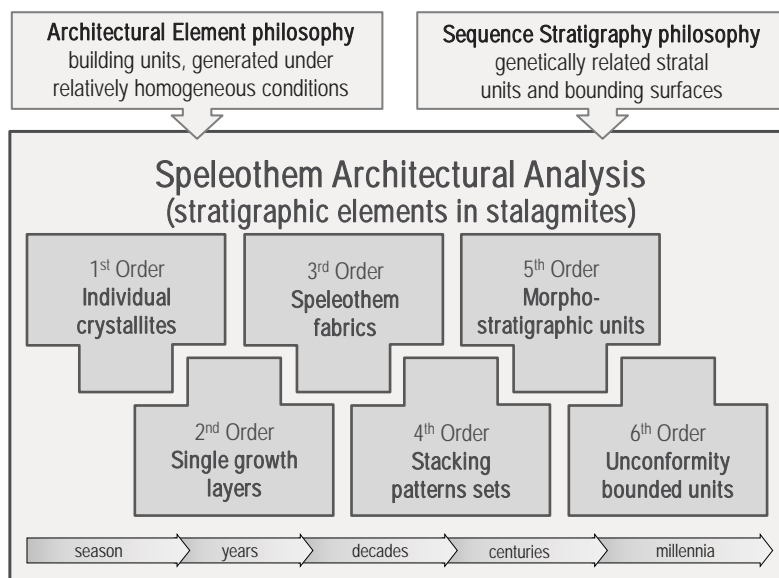
³ CENIEH. Paseo Sierra de Atapuerca s/n, 09002 Burgos, Spain

⁴ Ciemat, Departamento de Medioambiente. Avda. Complutense 22, 28040 Madrid, Spain

* j.m.chivelet@geo.ucm.es

Reliable paleoclimate time series based in stalagmites require the precise characterization of speleothem internal micro-stratigraphy, a task too often poorly accomplished despite the recent advances in speleothem research. This weakness is probably due to the lack of a robust integrative methodological framework capable of integrating the wide range of petrographic and micro-stratigraphic methods currently used in speleothem characterization.

For covering this need, we propose the Speleothem Architectural Analysis (SAA), a holistic approach inspired in well-established stratigraphic procedures such as the



architectural element analysis and the sequence stratigraphy, commonly used by geoscientists for categorizing the stratigraphy of sedimentary deposits. The SAA approach establishes a six-fold hierarchy of speleothem architectural elements and their bounding surfaces: individual crystallites (1st order), single growth layers (2nd order), speleothem

fabrics (3rd order), stacking patterns sets (4th order), morphostratigraphic units (5th order), unconformity-bounded units and major unconformities (6th order). Each category of architectural element is formed in a different range of time, from seasons or years to centuries or millennia. The method provides an open and versatile tool for unravelling the complexities of speleothem growth. It generates a standardized stratigraphic framework for each stalagmite, which can be the basis for its genetic interpretation in a multi-temporal scale. This stratigraphic analysis must precede and accompany any geochemical work directed to the construction of paleoclimate series.