



## **Speleothem fabrics and carbonate inhibiting ions as proxies for climate reconstruction in SW Sardinia.**

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Santa Barbara karst system (Iglesiente, Sardinia, Italy) is world renown for the hosted speleothem sequence, ranging from Cambrian-Ordovician up to present. It is a classical “mine cave” without any natural entrance, which was intersected by mining activities about 50 years ago.

The aim of the present paper is to present the first results of a textural and geochemical study of the uppermost part (Quaternary) of the speleothem sequence and to try to relate these variations to changes in the climate of the cave area.

The analyzed portion of the core drilled in a flowstone starts from the top of the speleothem (which was still active at the time of sampling (2003)) and it has a thickness of 90 cm. According to the few already available U/Th dates the studied sequence corresponds to a period of 240 ka.

The analyzed portion of speleothem consists of an alternation of calcite and aragonite layers with different fabrics and it presents also clear re-dissolution periods.

The presence of widespread poly-sulphides ore bodies hosted in the karstified sequence, which were remobilized during Oligocene thanks to a thermal water uplift, allowed the speleothem to trap inside its structure several metallic ions. Geochemical analyses (performed by EDAX) put in evidence a distribution pattern for Fe, Ba, Zn, Pb, Sr e Mg ions which controlled the mechanisms of growth of the two polymorphs.

Normally aragonite displays acicular fabric, and its crystal lattice contains relative

high amount of Ba, Pb, Sr ions while Fe-Zn-oxide are trapped in the infra-crystalline porosity:  $\text{Ba}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Sr}^{2+}$  substitute  $\text{Ca}^{2+}$  in aragonite, for its large ion ray, forbidding calcite deposition;  $\text{Fe}^{2+}$  and  $\text{Zn}^{2+}$  can't enter in the aragonite crystal lattice; so, sometimes they substitute  $\text{Ca}^{2+}$  in calcite polygonal crystals co-precipitated with aragonite, sometimes they are trapped like oxides in aragonite porosity;  $\text{Mg}^{2+}$  substitutes  $\text{Ca}^{2+}$  in calcite crystals that displays elongate columnar fabric.

Relative abundance of these ions as well as the deposition of calcite and/or aragonite with different fabrics seems to be controlled by climate oscillations. Ion mobilization from rock results from two factors: a) temperature of percolation waters (high temperature increases speed of chemical reactions); and b) contact time between rock and solutions (a long contact time favours ions mobilization). The first depends on external temperature, the latter on hydraulic pressure of percolation waters, depending on rain. So, according to authors, dry periods with high temperature have favoured remobilization of all ions and consequently aragonite deposition with them, while rainy periods with lower temperature favoured karstification of host rock, and consequently calcite deposition with magnesium ion.

LLMZA luminescence analysis identified a proxy record for paleotemperature of a calcite level from this speleothem ( $12^\circ\text{C}$ ?). This technique cannot be applied in aragonite layers; therefore, fluid inclusions as well as C and O stable isotope analysis will be used to complete relative chronology of cyclic variations of rainfall and temperature proxy records. Finally, complimentary U/Th analyses will lead to date the relative chronology of the observed climatic oscillations.