



Speleothem Shape and Natural Remanent Magnetization

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Speleothems might be of interest for high-resolution reconstruction of the Earth's magnetic field. However, little is known about the influence of speleothem morphologies on their Natural Remanent Magnetization (NRM). Here we report on a high-resolution and detailed paleomagnetic and anisotropy of magnetic susceptibility (AMS) study of a dome-shaped stalagmite of Middle Holocene age (6.52 ± 0.19 to 5.08 ± 0.24 ka; $\pm 2\sigma$) from Southern Portugal. In order to assess the potential influence of calcite growth dip on the recorded remanent magnetization, magnetic and AMS directions from sub-horizontal to gradually sub-vertical calcite growth collected in a transversal cross-section of the stalagmite are compared. A striking linear correlation is observed between magnetic inclinations, calcite laminae dipping angles and k_3 inclination, whereas magnetic declinations are independent of the stalagmite's morphology. Magnetic inclinations recorded in oblique and vertical calcite growth layers are underestimated when compared to a global paleosecular variation model, and better fit the model when considering extrapolated magnetic inclinations from hypothetical horizontal layers. Therefore, we suggest that stalagmite's morphology exerts a critical role on the recorded magnetic inclinations, probably resulting from particle rolling with dripwater flow along the sloping surfaces. Such a new evidence has critical implications for reconstructing high-resolution paleomagnetic records in speleothems, and opens new perspectives to better understand their mechanisms of remanent magnetization acquisition.

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