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Paleomagnetism in speleothems: Influence of calcite growth dip on the natural remanent magnetization

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Recent studies recognized speleothems as excellent recorders of the Earth's magnetic field. However, some questions remain about the origin of the natural remanent magnetization and about the influence of the speleothem shape on the recorded magnetic directions. Preliminary paleomagnetic data acquired in a Portuguese speleothem (cubic samples with 8 cm³), dated in the Holocene period (5000-6500 yrs BP), showed that the values of the remanent magnetic inclination vary in function of the orientation (dip) of the calcite growth and of the orientation of the K₃ axis measured by Anisotropy of Magnetic Susceptibility (AMS) techniques. In counterpart, declination does not exhibit significant variations. On this basis, we suggested that the recorded remanent magnetic directions are affected by the shape of the stalagmite. Here, we duplicated the paleomagnetic analysis by using smaller cylindrical samples with 2 cm³ in volume in order to check for possible artifact due to sampling technique and to improve our temporal resolution. Our new results confirmed a good correlation between the inclination values of the natural remanent magnetization and the dip of the calcite growth. Once compared with paleosecular variation models, our data fit the expected declination and inclination values at 5000-6500 yrs BP. These new findings highlight the importance of the influence of the stalagmite shape on the recorded remanent magnetization and provides us new clues to improve the quality of the high-resolution geomagnetic records in speleothems.

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