Editorial: Advances in Speleothem Research

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"For paleoclimate, the past two decades have been the age of the ice core. The next two may be the age of the speleothem". This recent statement by Gideon Henderson (*Science*, 313: 620-22, 2006) suggests that speleothems (i.e., stalagmites, stalactites and flowstones) have the potential to provide ice core-like records of past climatic and environmental changes.

The marked rise in publications on speleothems over the last decade (see Fig. 1) is therefore not surprising and reveals the growing interest among paleoclimatologists in this fairly novel climate archive. Speleothems have several advantages in comparison to other paleoclimate archives (e.g., ice cores, tree rings, ocean and lake sediments). Firstly, caves containing speleothems can be found in almost all parts of the world. Secondly, uranium-series dating permits the dating of speleothems with exceptionally high precision back to ~600 kyr BP. In contrast to radiocarbon dates, uranium-series dates are absolute ages and no calibration is needed. Therefore, precisely dated speleothem records play a key role in dating climatic events and transitions, such as Dansgaard-Oeschger cycles or glacial inceptions and terminations. Thirdly, speleothems grow continuously over long time intervals (10^3–10^5 years) and thus long and highly resolved time series covering several glacial-interglacial cycles can be developed. Fourthly, facilitated by recent analytical and technical advances, a number of geochemical and physical parameters, such as stable isotope ratios, trace elements and annual band thickness, can be routinely measured at decadal- to sub-annual-resolution. These parameters bear information about the world above the cave, including rainfall, temperature, vegetation, soil productivity and glacier extent.

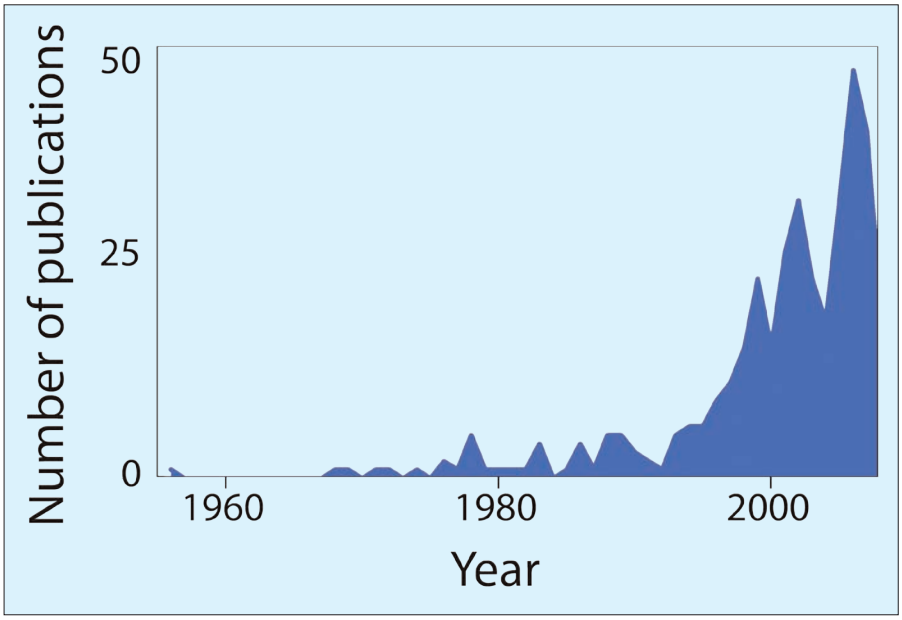

Figure 1: Plot of the number of published papers on speleothems and stalagmites (source ISI's Web of Science, 2008 publications included up to June).

Thus at first glance, speleothems appear to be a perfect climate archive. Yet, with more studies being performed on these deposits, the community is beginning to realize that a variety of climatic, environmental and hydrologic parameters influence the geochemical and physical properties of speleothems and their interpretation as climate proxies is rarely straightforward in a quantitative sense. Each cave has its unique geological and environmental setting, which needs to be understood before stable isotopes, trace elements, annual bands or other proxies can be used with confidence for paleoclimatic and paleoenvironmental reconstructions.

Long-term cave monitoring programs and experimental studies are thus mandatory for caves from which speleothems are collected. Monitoring caves is logistically and technically demanding and few research groups currently have the resources to operate such programs, yet in order to firmly establish (calibrated) speleothem proxy data in the future, comprehensive monitoring is imperative. In conjunction with advanced statistical techniques (e.g., those used in tree-ring studies), these monitoring studies are an important step in advancing this field towards more quantitative climate reconstructions.

This PAGES newsletter focuses on several important aspects of speleothem-based paleoclimate research ranging from cave monitoring and studies of established and novel geochemical and physical proxy indicators, to dating issues and the development of long time series. We hope that these examples enlighten the reader on the current status of speleothem research and the strength and further potential of this archive in paleoclimatic and environmental reconstructions.

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