Geophysical Research Abstracts
Vol. 14, EGU2012-9293, 2012
EGU General Assembly 2012

Speleothems as sensitive recorders of volcanic eruptions – the Bronze Age Minoan eruption recorded in a stalagmite from Turkey

D. Fleitmann (1,2), A. Borsato (3), S. Frisia (4), S. Badertscher (1,2), H. Cheng (5,6), R.L. Edwards (6), and O Tüysüz (7)

(1) Institute of Geological Sciences, Bern, Switzerland (fleitmann@geo.unibe.ch), (2) Oeschger Centre for Climate Change Research, Bern, Switzerland (fleitmann@geo.unibe.ch), (3) Museo delle Scienze, Trento, Italy, (4) School of Environmental and Life Sciences, University of Newcastle, Australia, (5) Institute of Global Environmental Change, Xi'an Jiaotong University, Xi'an, Shaanxi, China, (6) Department of Geology and Geophysics, University of Minnesota, Minneapolis, USA, (7) Eurasia Institute of Earth Sciences, Istanbul Technical University, Turkey

Tephra layers in marine and lacustrine sediments are crucial for chronostratigraphic dating. However, tephrachronologies based on marine and lake sediments suffer from age uncertainties due to low sedimentation rates, biturbation and inherent problems associated with radiocarbon dating (e.g. hardwater effect, varying marine reservoir ages). A potential, but still underexploited, archive of local to regional paleovolcanism are precisely-dated speleothems, as changes in their sulphur concentration (incorporated as sulphate into speleothem calcite) seem to be closely related to fluctuations in atmospheric sulphur loads. The strong dependency of sulphur on soil pH and ecosystem storage, however, can result in a delay of several years to decades in the registration of volcanic eruptions and anthropogenic emissions by stalagmites.

Here we present synchrotron-radiation based trace element analysis performed on a precisely-dated section of a stalagmite from Sofular Cave in Northern Turkey. As this section covers the time interval of the intensively studied Minoan volcanic eruption between 1600 and 1650 BC, we can test whether this vigorous eruption can be traced in a stalagmite. Of all measured trace elements, only bromine shows a clear short-lived peak at 1621 $\pm$ 25 BC, whereas sulphur and molybdenum peak later at 1617 $\pm$ 25 and 1589 $\pm$ 25 respectively. We suggest that all trace element peaks are related to the Minoan eruption, whereas the observed phasing of bromine, molybdenum and sulphur is related to differences in their retention rates in the soil above Sofular Cave. For the first time, we can show that bromine appears to be an ideal volcanic tracer in stalagmites, as it is a prominent volatile component in volcanic eruptions, can be easily leached in soils and rapidly transferred from the atmosphere through the soil and bedrock into the cave and stalagmite respectively. Overall, our case study reveals that sulphur and bromine contents in precisely-dated speleothems can help to improve existing tephrachronologies significantly.