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Impact of wildfires on subsurface volcanic environments: New insights into speleothem chemistry

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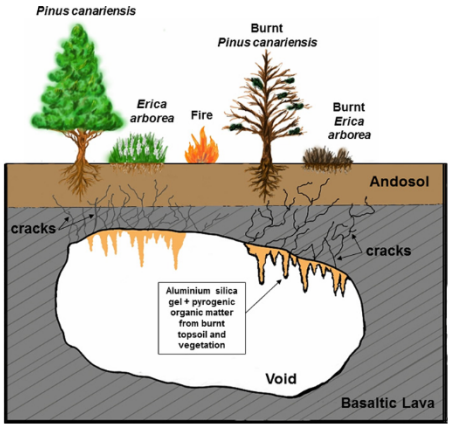
HIGHLIGHTS

- Cave speleothems represent one of the most important climate archives.
- Jelly-like speleothems are composed of hydrous gels of amorphous aluminum silicates.
- Stable isotopes identify plant-derived organic matter from overlying laurel forest.
- Biomarkers of *Erica arborea* are recorded in speleothems by analytical pyrolysis.
- Speleothems are archives of pyrogenic OM from the overlying burnt biomass.

GRAPHICAL ABSTRACT



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ABSTRACT

Siliceous speleothems frequently reported in volcanic caves have been traditionally interpreted as resulting from basalt weathering combined with the activity of microbial communities. A characteristic feature in lava tubes from Hawaii, Azores and Canary Islands is the occurrence of black jelly-like speleothems. Here we describe the formation process of siliceous black speleothems found in a lava tube from La Palma, Canary Islands, Spain, based on mineralogy, microscopy, light stable isotopes, analytical pyrolysis, NMR spectroscopy and chemometric analyses. The data indicate that the black speleothems are composed of a hydrated gel matrix of amorphous aluminum silicate materials containing charred vegetation and thermally degraded resins from pines or triterpenoids from *Erica arborea*, characteristic of the overlying laurel forest. This is the first observation of a connection between fire and speleothem chemistry from volcanic caves. We conclude that wildfires and organic matter from the surface area overlying caves may play an important role in the formation of speleothems found in La Palma and demonstrate that siliceous speleothems are potential archives for past fires.

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