

Gypsum speleothems in lava tubes from Lanzarote, Canary Islands. Did you say gypsum?

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Lanzarote is the easternmost island of the volcanic Canary archipelago considered together with Fuerteventura the low relief islands of the archipelago. These island receive less rain than 300 mm/year. Basaltic lava flows preserves lava tubes formed during cooling and solidification of external parts of lava, while internal parts were still hot and flowing. When lava flow stopped the lava abandoned the tubes, and the tubes preserved empty. These tubes actuate as caves and some of them develop speleothems. Pardelas/El Covón, and Chifletera lava tubes occur within Middle Pleistocene lava flows which are surrounded by Holocene lavas from the 1730-1736 eruption. Pardelas/El Covón main entrance is located very close the western coast sea cliffs while Chifletera is 400 m inland.

Although carbonate is abundant in calcretes and in the aeolian sand deposits of the island, the speleothems observed in Pardelas/El Covón, and Chifletera lava tubes are constituted mainly by gypsum and minor halite. The speleothems observed are 1) sugar-like powder accumulation on the walls and floors; 2) claw-like stalactites; 3) desert rose formations on the walls; 4) fracture filling speleothems; 5) cotton-like crystal aggregates and 6) micrometric whisker crystals. The mineralogy of these speleothems varies from 100% gypsum in the case of stalactites and desert roses, to a mixture of gypsum and halite in small concentrations in the aggregates and powder. The microtexture of these speleothems is varied, being the most common the lenticular formed by packed small ($\approx 150 \mu\text{m}$) crystals arranged heterogeneously. In other cases lenticles are organised in a feather-like arrangement. Microcrystalline gypsum, with no preferred orientation and disperse halite crystals is found in the cotton-like and powder speleothems. In the case of the desert roses, stalactites and fracture fillings, the speleothems are composed of gypsum macro crystals reaching 5 cm long.

The $\delta^{34}\text{S}_{\text{CDT}}$ values of the gypsum speleothems ranges from 18.2‰ to 19.2‰, being the present day sea water values of 20.9‰. The $^{87}\text{Sr}/^{86}\text{Sr}$ ratio for Pardelas/El Covón (0.708930-0.708976) is slightly lower than sea water values (0.70916) while for Chifletera (0.708618-0.708671) the values are closer to those described as the aeolian dust input ratios.

Sulphur isotopes and cave setting suggest that the sea spray could be the main source of sulphur for the sulphate speleothems although a slight contribution of volcanic SO_2 , could have decreased the $\delta^{34}\text{S}_{\text{CDT}}$ signal. The $^{87}\text{Sr}/^{86}\text{Sr}$ ratio also supports the sea spray contribution although 400 m inland, in Chifletera the contribution of aeolian dust input could be more important.