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Salt Bubbles of Atacama: curious, small and ephemeral morphologies

J. De Waele (1) and P. Forti (1)

(1) Italian Institute of Speleology, University of Bologna, Italy (jo.dewaele@unibo.it)

During a field trip in November at San Pedro de Atacama (Chile), organized in the framework of a Strategic Project funded by the University of Bologna, several centimeter-scale white bubbles were observed on the salt crust floor in the famous Valle de la Luna (moon valley). These bubbles are composed entirely of pure white salt and have been encountered in a limited area of about 15,000 square meters. A total of 36 of these small structures, named here “salt bubbles”, have been located and measured. Their maximum diameters range between 1,5 and 15 cm (average 6.3 cm), their minimum between 1 and 12 cm (average 5.4 cm), their original height (some are broken to the floor) is comprised between 1 and 8 cm (average 3.5 cm). Almost 60% of the salt bubbles have an opening on top, sometimes on their flanks, in average somewhat smaller than their diameters. The biggest always have an opening, being the closed bubbles normally less than 3 cm wide.

When the inside of the salt bubble is visible, a tube-like opening is clearly visible and projects into the underground for at least a decimeter, mostly deeper than 20 cm. The bubbles perfectly match the edges of these holes. In some cases salt crystals grow on the inside of the bubbles forming curving filaments.

The salt bubbles are very similar to cave rims and form by evaporation processes after very occasional rainy episodes. Concentrated rainfall (average annual rainfall is 5 mm), occurs very rarely and enables infiltration of salty water through openings in the salt crusts. This water is conveyed underneath the impervious salt crust presumably in a network of interconnected fissures and underground cavities in which moist air flows, and can escape under the form of vapor only through cracks or openings.

Evaporation processes occur when the vapor exits the holes leading to the formation of a salt rim on the side. Salt bubbles are generally seasonal features that are doomed to dissolve by rain, but some appear to be able to survive several years building up a thick salt crust that can reach almost 1 cm.