Geophysical Research Abstracts
Vol. 17, EGU2015-6878-1, 2015
EGU General Assembly 2015

Crystallization processes derived from the interaction of urine and dolostone

Beatriz Cámara, Monica Alvarez de Buergo, and Rafael Fort
Instituto de Geociencias (CSIC,UCM), Madrid, Spain (alvarezm@geo.ucm.es)

The increase in the number of pets (mostly dogs), homeless people and the more recent open-air drinking sessions organized by young people in historical centers of European cities, derive on the augmentation of urinations on stone façades of the built cultural heritage. Up to now this process has been considered only under an undesirable aesthetical point of view and the insalubrious conditions it creates, together with the cleaning costs that the local governments have to assume.

This study aims to confirm urine as a real source of soluble salts that can trigger the decay of building materials, especially of those of built cultural heritage of the historical centers of the cities, which are suffering the new social scenario described above.

For this purpose, an experimental setup was designed and performed in the laboratory to simulate this process. 5 cm side cubic specimens of dolostone were subjected to 100 testing cycles of urine absorption by capillarity. The necessary amount of urine was collected by donors and stored following clinical protocol conditions. Each cycle consisted of imbibitions of the specimens in 3 mm high urine sheet for 3 hours, drying at 40ºC in an oven for 20 hours and 1 hour cooling in a dessicator.

At the end of the 100 cycles, small pieces of the specimens were cut, observed and analyzed with the aid of an environmental scanning electron microscope, which presents the advantage of no sample preparation. The sampled pieces were selected considering there were different sections in height in the specimens: a) a bottom section that corresponds to the section that has been immersed in the urine solution (3 mm); b) an interface section, immediately above the immersed area, which is the area most affected by the urine capillarity process, characterized by a strong yellowish color; c) the section that we have named as section of influence, which is subjected to the capillary absorption, although not so strongly than the interface section (these 3 sections, a) b) c) represent the first one centimeter of the specimen from the bottom); d) and the fourth and top section, which shows no influence by the effect of urine capillary absorption.

The obtained results showed, from bottom to top, the following crystallized salts: a) abundant prismatic crystals enriched in P and Ca (calcium phosphate); b) amorphous round-shaped potassium sulfate crystals and cubic sodium chloride crystals embedded in an organic matrix; d) cubic sodium chloride crystals are dominant. In the unaffected area, no other crystals were detected different from the carbonate minerals forming the rock.

These results are in accordance to which has already been published by the authors in granitic materials (Cámara et al 2014).

Acknowledgements: to Geomateriales 2 programme (S2013/MIT-2914) funded by the Community of Madrid.

Cámara B., Alvarez de Buergo, M.; Fort, R.; Ascaso, C. de los Rios, A.; Gomez-Heras, M. 2014. Another source of soluble salts in urban environments due to recent social behaviour pattern in historical centres. In: Science, Technology and Cultural Heritage (edited by M.A. Rogerio-Candelera), 89-94. CRC Press-Balkema, Taylor and Francis. ISBN 9781138027442 - CAT# K25502