Burning experiments on calcareous nannofossils – contribution to a better understanding of historic mortar production

Janina Falkenberg

Institute of Geology, Mineralogy and Geophysics, Ruhr-Universität Bochum, Universitätsstraße 150, 44801 Bochum, Germany.
janina.falkenberg@rub.de

Joerg Mutterlose

Institute of Geology, Mineralogy and Geophysics, Ruhr-Universität Bochum, Universitätsstraße 150, 44801 Bochum, Germany

Lime-based mortars consists of lime, which is produced by burning naturally occurring limestones. The limestones are heated approx. up to 900°C. The burning causes the thermal decomposition of $CaCO_3$ into CaO (=quicklime) and CO_2. The very reactive quicklime is slaked with water, producing $Ca(OH)_2$ (=lime). In a last step, lime reacts with CO_2 of the atmosphere, forming again solid $CaCO_3$. Calcareous nanno- and microfossils are not expected to be present in lime binders of mortars due to the high heating temperature. Unexpectedly, we have encountered remains of calcareous nannofossils in historic mortars and mortar-based materials.

To gain a better understanding of the behaviour of calcareous nannofossils during the burning procedure, four samples were heated to nine temperature levels (100°C, 300°C, 500°C, 600°C, 700°C, 750°C, 800°C, 850°C, 900°C). Both, original and heated, samples were analysed with respect to their nannofossil content and preservation by using settling slides. Our results show a decrease of absolute numbers and preservation from 500°C onwards, nannofossils are preserved up to 900°C. Changes in the relative abundance of individual species show that some taxa are more heat resistant than others. This pattern is best explained by different crystal sizes and forms as well as surface area. The abundance of calcareous nannofossil, their preservation and the presence / absence of different nannofossil taxa can therefore be used for estimating the burning temperature during the quicklime production.

Our study helps to gain a better understanding of historic mortar production. It will also supply information for the preservation of monuments, because new mortars can be made with the same material and under the same conditions like those in the past.