Provenance analysis of historic mortars and mortar based materials – a micropalaeontological approach

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Mortar has been the essential construction agent of buildings for more than 9000 years, with lime as the most widely used mortar-binder in historic buildings. For producing lime mortars, naturally occurring limestone is heated to > 800°C, causing a thermal decomposition into quicklime (CaO). Post-Triassic limestones often contain calcareous nannofossils. These calcitic, single-celled, marine photoautotrophic algae (< 30 μm) are significant components of the Earth's biogeochemical cycle since the Jurassic and are as such well-studied in the fields of oceanography, marine biology, micropalaeontology and geology. Here, we focus on the neglected application of these algae in archaeology and related fields.

We analysed 28 mortar samples from six, archaeologically well-dated medieval churches (800 – 1510 AD) from the Münsterland Basin (northern Germany) for their calcareous nannofossil content. Notwithstanding substantial heating most samples yielded low diversity assemblages which provided in some cases reliable biostratigraphic ages of the limestone mined. In all examples locally outcropping limestones were used; in one case the lime was transported over a distance of 20 km. The medieval builders preferred limestones over marly limestones, even if the later are exposed nearer to the former building site. In the case of the Paderborn Cathedral, different limestone resources have been used over the 500 years of construction, suggesting that socioeconomic factors (e.g. ownership of land) partly controlled the source area of the mined material.

The general lesson of the current study is that calcareous nannofossils are i) present in mortar and mortar-based materials (render, colour version) of historic buildings; ii) a good tool for the provenance analysis of mortars (even a few nannofossil findings can suffice).