On the occurrence of magnesium bearing phases in Baroque mortars from post-Cistercian Abbeys in SW Poland

W. Bartz1, J. Kierczak2 and M. Gąsiór3

1University of Wrocław, Cybulskiego 30, 50-205 Wrocław, Poland (correspondence: wojciech.bartz@ing.uni.wroc.pl).
2University of Wrocław, Cybulskiego 30, 50-205 Wrocław, Poland.
3Laboratory for Technological and Conservation Research, Faculty of Architecture, Wrocław University of Technology, Poland.

This study presents the results of mineralogical characterization of crystalline phases, occurring in binder of Baroque mortars. They were sampled from the post-cistercian churches in Kamieniec Ząbkowicki and Lubiąż, both located in the Lower Silesia (SW Poland). Mortar samples were analyzed by means of optical microscopy, thermal analysis (DSC-TG), X-ray diffraction (XRD) and scanning electron microscopy (SEM-EDS).

The Baroque mortars have binder composed of calcium carbonate phases (calcite) and numerous magnesium carbonate phases. The latter are mainly represented by magnesite [MgCO3], however various hydrous magnesium carbonates occur as well, in different proportions. Typical is hydromagnesite [4MgCO3•Mg(OH)2•4H2O], generally considered as intermediate phase to formation of thermodynamically stable magnesite. Similar phase i.e. nesquehonite [MgCO3•3H2O] is uncommon. Its occurrence is limited to few samples.

The presence of magnesium-bearing phases indicates that the magnesian lime mortars were employed. It is known, that they are susceptible to weathering due to formation of secondary sulphates. In fact, all of mortar samples contain small amounts of secondary gypsum [CaSO4•2H2O]. On the other hand, no traces of typical weathering product i.e. epsomite [MgSO4•7H2O] or hexahydrite [MgSO4•6H2O] were found. Previous studies revealed that formation of hydrous magnesium carbonates is related to restricted contact of fresh magnesian lime mortar with atmospheric CO2, thus inner parts of plasters, renders or joint mortars. However our observations showed that in studied materials there is no interdependence between amount of hydrous magnesium carbonates and the exact location of sample in the masonry structure.

The research was supported by the National Science Centre Project, Grant UMO-2012/07/B/ST10/03820