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

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This study presents the results of mineralogical characterization of crystalline phases, occuring 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 [$MgCO_3$], however various hydrous magnesium carbonates occur as well, in different proportions. Typical is hydromagnesite [$4MgCO_3 \bullet Mg(OH)_2 \bullet 4H_2O$], generally considered as intermediate phase to formation of thermodynamically stable magnesite. Similar phase i.e. nesquehonite [$MgCO_3 \bullet 3H_2O$] is uncommon. Its occurence 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 [$CaSO_4 \bullet 2H_2O$]. On the other hand, no traces of typical weathering product i.e. epsomite [$MgSO_4 \bullet 7H_2O$] or hexahydrite [$MgSO_4 \bullet 6H_2O$] were found. Previous studies revealed that formation of hydrous magnesium carbonates is related to restricted contact of fresh magnesian lime mortar with atmospheric CO_2, 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.

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