



Influence of mineralogical, petrographical, and geochemical characteristics of impure limestones on the composition of fired hydraulic lime: a case study on Lower Palaeozoic limestones from the Prague Basin (Barrandian area, Czech Republic)

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Prague Basin, making part of the Barrandian area (Bohemian Massif, Czech Republic), is a rift-like depression filled with non-metamorphosed sedimentary series of Upper Proterozoic – Lower Palaeozoic age. Among other sedimentary rocks, different types of limestones are present. These limestone were historically exploited and used for various purposes including natural and decorative stone, common construction material, and also a raw material for firing of inorganic binders: aerial lime, hydraulic lime and/or, more recently, Ordinary Portland Cement (OPC). Lithotypes with higher amount of silica and/or clay component were of special interest due to the hydraulicity of fired product known as “pasta di Praga” in Baroque. However, our recent knowledge of these limestones is incomplete in terms of the contribution of mineralogical, geochemical, and petrographical characteristics on the properties of fired hydraulic lime. In the recent study, representative samples of 4 facies of the Lower Devonian limestone (Kosoř ls., Řeporyje ls., Dvorce-Prokop ls., and Zlíčov ls.) were subjected to a detailed mineralogical and petrographic study of raw material by means of polarizing microscopy, cathodoluminescence of thin sections and scanning electron microscopy with an energy dispersive spectrometer (SEM-EDS). X-ray diffraction (XRD) of insoluble residues obtained by treatment with both the hydrochloric acid and the acetic acid solution was used. Wet silicate analysis provided data on the content of major elements from which standard cement and lime indexes and modules were calculated. Laboratory firing experiments of these limestone were performed by a calcination at temperature ranging from 850 to 1200°C (after 50°C). XRD of fired products shows that limestones with high content of silica (some of the Dvorce-Prokop ls.) produced binder with high amount of newly formed calcium silicates (larnite). Gehlenite and others calcium aluminates and aluminosilicates are typical for firing of limestones with higher content of clay minerals (illite and kaolinite) which are common in Kosoř ls., Řeporyje ls., and Dvorce-Prokop ls. Brownmillerite was formed in limestones exhibiting higher proportion of Fe-oxihydroxides (specifically Řeporyje ls). Presence of free lime and portlandite correlates with decreasing content of non-carbonate material (some varieties of the Dvorce-Prokop ls. from Bráník Rocks).