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# Identification of the carbonate sources and quarries for historical lime-mortars in Teplá

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For the restoration of historical buildings there is an essential need to know the source of the building materials for the replacement and reconstruction with the same or similar material. Natural stones can often be identified by optical comparisons, which can be verified by further investigations. The identification of the raw material of lime mortars and lime plasters is much more difficult because the carbonates are not available in their original constitution. Nevertheless relictic features such as fabric or not calcinated carbonate grains allow the tracing back of the mortar to the carbonate rocks in the field. In the case of ancient buildings lime has often been not properly burned due to the simple kiln technology. That means that there can be unburned relics or not calcified quicklime in slaked plasters and mortars. These “mistakes” are important for searching the quarries of the carbonates for the mortars.

Samples of mortars of mediaeval buildings in Karlovy Vary and Loket and their surroundings as well as samples of mainly baroque age mortars of the monastery of Teplá were available for examination. While the plasters and mortars from Karlovy Vary and Loket contained relics of layered and “coral shaped” carbonates, in Teplá coarse grained carbonate rocks were identified. These observations were of high significance because Western Bohemia is quite poor in carbonate rocks. Therefore, all available carbonate sources were used for lime production.

Based on geological and on regional historical books, journals and maps some small carbonate deposits of very different genetic types were localized. Five of those carbonate rocks were chosen for further investigations: sweet-water limestone of the Eger-

Franzensbad basin, the “Sprudelstein” (a carbonate sinter) of Karlovy Vary and the crystalline marbles of Mýto (west of Tachov), of Háj (southwest of Lázně Kynžvart) and from the Lazurový Vrch (southeast of Mariánské Lázně).

Calcination experiments show not only the loss in mass, but also changes in color and structure. Surprisingly typical fabric features of the unburned mineral grains and the rocks themselves still were recognizable after the experiments. These observations were applied to the interpretation of the lime of historical mortars and allowed to trace them back to their natural sources.

In samples from Karlovy Vary and Loket there can be clearly identified remnants of the Karlsbader Sprudelstein by macroscopic inspection. The typical structures are shown in pieces up to several centimeters. Pictures from the scanning electron microscope support the former results. They can be clearly related to the reports on former quarrying and calcination in the Teplá valley at the site, where today the main spa zone of Karlovy Vary is located. The carbonate sinters of the hot springs can be regarded a major source of carbonate for lime production in this zone.

The raw material for the mortars of the monastery of Teplá can be limited to marbles by the examination of thin sections. The unburned relics present the grain size and the characteristic twin lamellas of coarse marbles. Now the three marbles are under consideration. They have nearly the same grain size but they vary in the color. The carbonate from Mýto is bright white with a touch of green, the one from Háj is grey and the last one from the Lazurový Vrch is pink. But after burning they all show nearly the same color, which does not help to determine their provenances. An exact identification of the used quarries was only possible by a document from 1920 found in the archive of the monastery of Teplá. According to a mine map underground galleries and a lime kiln existed on the slopes of the Lazurový Vrch, which belonged to the monastery.