

## CHARACTERISATION OF HISTORIC MORTARS AND PLASTERS

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In the course of an EU-Interreg project, the composition and preservation state of Romanesque and Gothic plasters and mortars from several buildings in Northern Tyrol, Austria, and Southern Tyrol, Italy, were studied to obtain information on the remarkable durability of these materials compared to modern lime plasters and mortars (DIEKAMP et al., 2004). The approach in this study is exemplified using the inventory of Gothic mortars from the main tower of the Finstermünz fortress in the upper Inn valley, Northern Tyrol, Austria. The fortress is situated 995 m above sea level directly next to the Inn river in the centre of the Eastern Alps and is therefore exposed to extreme weather conditions.

Aside from documenting the general state of preservation in terms of local environmental conditions (detailed mapping of building materials and their preservation state) samples were selected and taken for laboratory work. The materials were analysed with respect to composition, fabric, load of salts and decay features by wet chemical analysis (WISSER & KNÖFEL, 1987), optical microscopy, X-ray diffraction, electron microprobe, differential thermal analysis, BET, Hg-porosimetry and salt elution.

Considering the extreme climatic conditions at the Finstermünz site, the Gothic plasters, mortars and lime finishes are in an amazingly pristine state of preservation. It is only in the socle area where massive damage can be observed due to humidity and soluble salt.

Typical features of the mortars are numerous limepops in the binder, originating from dry slaking of the fired limestone, and a very dense texture containing only few macroscopic pores. The binder-to-aggregate ratios are in the range between 1.71 and 2.94. The fraction of hydraulic components based on wet chemical analysis varies between 1.7 and 3.1 %. Optical microscopic and electron microprobe examination revealed the presence in both binder and limepops of hydraulic phases and vitreous aggregates. The latter are thought to have formed during the firing process. Differential thermal analysis to determine nature and amount of hydrate phases are in progress.

The preliminary results show that a combination of i) historic manufacturing techniques, ii) a high ratio of binder-to-aggregate and iii) the presence in the binder of hydraulic components is essential for the outstanding durability of these materials.

### References

- DIEKAMP, A., BIDNER, T. & MIRWALD, P.-W. (2004): Historische Putze und Mörtel in Tirol – Umgang mit historischem Materialbestand, Berichte der Deutschen Mineralogischen Gesellschaft, No. 1, 2004, p. 31.
- WISSER, S. & KNÖFEL, D. (1987): Untersuchungen an historischen Putz- und Mauermörteln. Teil 1: Analysegang. Teil 2: Untersuchungen und Ergebnisse - Zeitschrift „Bautenschutz und Bausanierung“ 10 (1987), p. 124-126 und p. 163-171.