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Compatibility study and adaption of stone repair mortars for the Lede stone (Belgium)

T. De Kock (1,2), D. Vandevoorde (1,3), M.A. Boone (1,2), J. Dewanckele (1,2), W. De Boever (1,2), M. Lanzón (4), G. De Schutter (5), L. Van Hoorebeke (2,6), P. Jacobs (1,2), V. Cnudde (1,2)

(1) Research Group Sedimentary Geology and Engineering Geology, Department of Geology and Soil Science, Faculty of Sciences, Ghent University, Belgium, (2) Centre for X-ray Tomography (UGCT), Ghent University, Belgium, (3) Department of Conservation and Restoration, Artesis University College of Antwerp, Belgium, (4) Departamento de Arquitectura y Tecnología de la Edificación. Escuela de Arquitectura e Ingeniería de Edificación ARQ&IDE, Universidad Politécnica de Cartagena, Spain, (5) Magnel Laboratory for Concrete Research, Department of Structural Engineering, Faculty of Engineering, Ghent University, Belgium, (6) Department of Subatomic and Radiation Physics, Faculty of Sciences, Ghent University, Belgium

One of the main historic building materials in northern Belgium is the Lede stone. This arenaceous limestone from Lutetian age was excavated in the region of Ghent and Brussels and was transported northwards by main rivers such as the Scheldt and Zenne. Thanks to this natural transport route, the stone in also found in many cities which lie abroad the excavation area, such as Antwerp (Belgium) and various cities in the Netherlands (Breda, Zierikzee, ...). Due to its dominant occurrence in our cultural heritage, it is frequently subjected to restoration and renovation works. Depending on the degree of decay, most frequent stone operations are cleaning, healing with mortar or replacing it by (often exotic) fresh blocks.

Originally, this limestone has a greenish-gray colour, but when being exposed to atmospheric conditions it acquires a yellowish to rusty coloured patina. The origin of the latter is most likely the oxidation of glauconite minerals which are present in a few percent in the stone. In addition, the stone often demonstrates black crust formation due to sulphation. Cleaning of the stone often results in an excess removal of this black gypsum crusts and patina, thus exposing deeper parts of the stone which appear more greenish-gray again. When the stone is subsequently healed by adding repair mortar to damaged parts, the question rises which mortar colour is more appropriate.

The choice of repair mortar is greatly depending on commercial aspects. When handling entire facades on monuments, a mineral mortar based on ZnCl is most often applied in Belgium. The big advantage of this mortar is its fast curing. Three colour types have been developed for the Lede stone in specific. However, the hardness of this mortar is sometimes in conflict with reversibility. For the handling of individual sculptures some conservators choose for the application of (hydraulic) lime mortars. The advantage of using such mortars is their high compatibility and reversibility. The disadvantage, besides being more labour intensive than mineral mortars based on ZnCl, is that no specific recipes are yet developed for Lede stone and the result is thus dependent on the knowledge of the restorer. Both of the repair mortars have the problem that Lede stone changes its colour due to ageing while the mortar itself remains colour stable. This means that if the mortar colour was adapted for a resemblance at the moment of application, the colour difference between stone and mortar will increase in time.

In this study, the compatibility of the different stone repair mortars with the Lede stone are tested. Further, a study was made whether the mortar recipes can be adapted for a better compatibility. In addition, the effect of glauconite addition in the mortar is studied to resolve the possibility of ageing of the mortar similar to the stone.