Laser cleaning on archaeological metal finds compared to micro sandblasting

Susanne Heimel¹, Wolfgang Kautek², Gabriela Krist³, Hans Nimmrichter³, Bernhard Pichler⁴, Kathrin Schmidt¹

¹ University of Applied Arts Vienna, Institute of Conservation
² University of Vienna, Department of Physical Chemistry
³ Federal Office for Protection of Monuments Austria
⁴ Department of Archaeometry
⁵ University of Applied Arts Vienna, Department of Archaeometry

Archeological Background

In the year 2010 rescue excavations in Gemeindebahn (Lower Austria) unearthed the grave of a Celtic warrior that could be dated back to the 5th century BC, corresponding to the local archeological period Latène A. Part of the burial equipment was an iron sword and its scabbard (Fig. 1). Such excavations are problematic to remove, since most of the methods lead to destruction or alteration of original surface and substance. One of the main tasks was the reconnection of all fragments. For providing a stable bonding it was necessary to completely remove the Calcite from the breaking edges, but preserve every topographic detail at the same time. Second requirement was a general cleaning of the surface, which was disturbed by corrosion products and covered with dry earth as well as sinter crusts (Fig. 4). The required cleaning method should therefore be able to remove hard deposits, without harming the thin malachite layer on the copper-based parts and the texture structures, which mainly consisted of amorphous iron oxides.

Challenge in Conservation

Due to the brittleness of the totally corroded iron, the scabbard was broken into numerous pieces whose breaking edges where covered with a dense layer of calcareous sinter (Fig. 3). Such excavations are problematic to remove, since most of the methods lead to destruction or alteration of original surface and substance. One of the main tasks was the reconnection of all fragments.

Micro Sandblasting vs. Laser Cleaning

An approved way for cleaning of archaeological material is the use of micro sandblasting machines. But in case of the scabbard, the non-selective abrasion through the grit material would have rounded the sinter crusts on the breaking edges were removed through laser ablation. After gluing of the fragments, the calcite on the inner face of the two scabbard pieces was firstly reduced by micro sandblasting and then totally taken off by laser (Fig. 19).

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Contact Information

Mag. S. Heimel
sus.heimel@gmail.com, +43 650 8787 966
Univ.-Prof. Dr. Ing. W. Kautek
wolfgang.kautek@ceu.ac.at, +43 664 60277 52470

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