Improving the storage conditions for composite historical objects: do oxygen-free conditions keep their promise?

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The collection of the "Museum of Carriages and Department of Court Uniforms" holds a big variety of historic objects connected to the court of the former Emperors of Austria. Only a small part of these objects is on view, the rest is kept in storage areas mainly located in historic buildings without air-conditioning. The objects enclosed in this study – sleigh harnesses and pad blankets – are kept in a historic storage area located within Schoenbrunn Castle.

The variety of materials present in these objects, i.e. leather, textile, wood, metals,...results in a high susceptibility to climatic changes and air pollution. Therefore, the decision concerning the best storage conditions is quite complex. Often the metallic parts of the objects already show corrosion, e.g. green corrosion on copper and copper alloys or black corrosion on silver, and the leather and the textile fibres are brittle due to their beginning decomposition. Climatic changes and air pollution are mainly responsible for these undesirable changes.

In the framework of a two years research project ten pad blankets and eight sets of selected parts of sleigh harnesses were partially cleaned from corrosion and were packed in different types of locally available transparent plastic foils (polyethylene, polyamide/polyethylene, EVOH, and aluminium oxide coated) to improve their storage conditions in June 2002. To further prevent the corrosion of metal parts and the decomposition of organic materials ten of these plastic bags were either filled with pure nitrogen or ATCO 2000 FTM oxygen scavengers were added to reach a nearly oxygen free environment (controlled by Ageless-Eye indicators and oxygen measurements). For stabilising their relative humidity and to control the effectiveness of this method half of the bags were also equipped with preconditioned Silica Gel. During the storage duration of one and a half years (up to January 2004) the relative humidity and temperature inside the bags were checked by data loggers and thermo/hygrometers, the level of pollution was monitored by pieces of lead, copper, brass, and silver as well as passive samplers, and the condition of the objects was observed by the restorers in regular intervals.

Comparing the results of storing the group of objects selected in plastic bags under ambient conditions and under nitrogen, no significant difference could be detected for their state of preservation after reopening the bags. It was also possible with both methods to considerably stabilise the relative humidity inside the bags compared to the annual fluctuations within the storage area. At the same time the relative humidity detected for the oxygen-free conditions was often higher – and, therefore, more unfavourable – than for the ambient conditions.

Furthermore, some unexpected problems occurred with the storage under nitrogen. Against all expectation the corrosion of metals was not prevented, but – especially for the copper plates – was enhanced. Reddish, bluish, brownish and silvery discolorations could be observed on the copper plates kept under nitrogen. For certain bags also discolorations of the Ageless-Eye indicators could be observed although the oxygen content within the bags remained below 0,1%. First suggestions for the reasons for these observations will be presented and discussed together with the detailed results of the project.