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# X-RAY MICROTOMOGRAPHY AS AN IMAGING TOOL IN CULTURAL HERITAGE STUDIES

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X-ray microtomography is a powerful imaging technique used for visualizing an object's internal microstructure without physical cut. It was introduced in the '80s and is nowadays commonly used in several different research areas. In this study we would like to introduce microtomography in the world of cultural heritage studies.

A tomographic reconstruction is made from a series of Röntgen photos taken with a fixed rotation step over 180 or 360 degrees around the sample. As a consequence the diameter of the object will determine the magnification and thus the resolution. The first type of examples is related with the conservation of building materials. E.g. Lecce stones are typical construction materials which have been used for long-time in historical buildings in the South of Italy. Their high porosity results in a readily uptake of rainwater containing a lot of atmospheric pollutants which causes the stones to decay. Different kind of organic hydrophobic products are often applied as protectives with the aim to reduce the corrosion of the materials. Another related example is the conservation treatment of wood. Old ships such as the Viking ships (now in the museum of Roskilde after treatment) or the Roman ships (found in the ancient harbour of Pisa) are discovered under water where they were lying for centuries. The ship's structures are well preserved however the wooden elements became spongy. These waterlogged wood fragments need to be treated in order to preserve the ships outside the water. With micro-CT we studied the inside structure of the archeological Quercus wood: with and without consolidants and studied the differences with a recent Quercus sample. The purpose of these studies is to investigate how the protective products fill the pores of the stone or the wood. Since microtomography allows 3D investigation it is possible to study the morphology of the samples before and after treatment. Parameters such as: total porosity, pore size distribution, structure thickness and thickness distribution can be calculated. As a last example we had a look at a piece of painted enamel from the 16$^{th}$

century. We scanned a small plaquet from the Museum Boijmans Van Beuningen (Rotterdam – The Netherlands). After CT scanning we made a maximum intensity projection image from the 3D dataset which clearly showed the places and layers where lead-white was used by the artist. With these different examples microtomography proves to be an interesting tool for visualization and quantification of the internal micro-structures of the object by calculation of 3D morphological parameters.