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Microstructural characterization of European historical swords through neutron imaging

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It is evident from several analyses performed on steel samples that the production of arms and armor used cutting edge technology of that time so a study of such artefacts can give fundamental details about the technological skills of a specific area or period. In order to correlate similar samples of a specific age or provenance, it is important to build trustworthy classification parameters. Neutron imaging techniques allow us to determine the morphology and microstructure of composite steel artefacts thus allowing us to characterize the composition, the steel quality, the welds and thermal treatment.

We started a systematic study to characterize the production methods of European swords from the early Middle Ages to the 17th century. On this purpose we started analyzing three swords of great importance now belonging to the Bayerisches Nationalmuseum.

-Longsword, produced in Tyrol in the late 15th century, inv. W872.

-Hunting sword, produced by M. Diefstetter (bladesmith), Munich, c. 1550 (blade) (grip), inv. W579.

-Sword, produced in Northern Italy, possibly Milan, c. 1560, inv. W587.

White beam tomography allowed detecting the presence of several features in the bulk of the blades as multi-layered structures, cracks and defects, and determining the width and the shape of the martensitic hardened edges. Energy selective analysis allowed determining details of the steel composition and microstructure as well as mapping the different low and high carbon areas.

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