a diffraction scan has been performed dividing the blade into three different sections: the edge, the core and the ridge, thus determining the inner phase distribution and confirming the highly differentiate specialization of the single parts of this kind of swords. The shape of the ferrite peak has also been studied in order to semiquantitatively determine the texture level, the strain level and the domain size of the grains to gain knowledge about the several forging methods used by the different schools and traditions.

An energy resolved neutron imaging study has also been performed using the ICON beamline at the spallation neutron source SINQ in Switzerland [3]. A sword fragment has been analysed in order to map the ferrite density by exploiting the enhancement of contrast induced by the selection of two different neutron wavelengths to be used for imaging, thanks to the Bragg edges [4]. We have performed two tomographic reconstruction using two different neutron wavelengths at values immediately before and after the 110 ferrite Bragg edge. The two tomographic reconstructions have been combined together in order to maximize the ferrite phase contrast compared with all the others and evidencing into the tomography the distribution of the ferrite phase inside the sample.

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Keywords: japanese swords, neutron diffraction, bragg edge neutron imaging

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Estimation of iron valencies of Prussian blue pigment by anomalous X-ray diffraction

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Prussian blue (PB, iron(III)hexacyanoferrate(II) [1]) is a pigment that has been widely used in Europe in the 18th and 19th centuries. Exposed to light or to anoxic treatments, some PB-containing artifacts discolor due to a photoreduction of iron(III) into iron(II). Although several experiments on light induced degradation of PB have been done in the past, the oxidoreduction process related to the fading and particularly the role of the substrate remains poorly understood.

Anomalous diffraction experiments at the Fe K-edge have been performed on different synthesized PB powders and PB laid on paper. Following the previous literature [2-3], the Fe(III) / Fe(II) ratio could be quantified and related to the state of discoloration of the pigment. In addition to XANES spectra and X-ray diffraction data, the present study aims at better understanding the chemical and structural variations observed on faded PB artefacts.

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Keywords: anomalous diffraction, iron, prussian blue

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XRPD studies of the objects of cultural heritage made of copper or its alloys

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Bronze disease is a dangerous phenomenon which can totally destroy an archeological or art object in a short time. Archaeological metallic objects are susceptible to quick corrosion reactions when excavated and exposed to environmental conditions. Archaeological artifacts can also be contaminated (e.g. chloride contamination) with salts from the burial environment. Bronze disease happens when an artifact containing copper is exposed to humidity and acidity - a condition in which cuprous chloride can be formed. When it is exposed to water, hydrochloric acid forms along with cuprous oxide according to the reaction:

$CuCl_2 + H_2O = 2\ HCl + CuO$

HCl in oxidizing atmosphere reacts with metallic copper giving CuCl, which in contact with moisture, oxygen from air or cuprous oxide turns into $CuCl_2$, which subsequently reacts with water producing dangerous HCl. The information provided above indicates that a systematic description of individual copper phases in artworks and explanation of their origin and transformations are very desirable and the knowledge concerning the solution of these problems in the best museums will be valuable for our research.

In the presented study we have investigated a painting executed on a copper plate which was partially corroded. The samples were taken from both sides of the painting. The identified compounds are presented in the table below:

Name of identified compound	Chemical Formula	PDF number
cuprite	Cu_2O	04-006-6514
tenorite	CuO	00-003-0884
cerussite	$Pb(CO_3)$	04-002-0438
hydrocerussite	$2PbCO_3Pb(OH)_2$	00-001-0687
gypsum	$CaSO_4{\cdot}2H_2O$	00-036-0432
brochantite	$CuSO_4{\cdot}3Cu(OH)_2$	00-013-0398
Quartz	SiO_2	01-085-0865
copper	Cu	00-004-0836

As it is shown above we have not detected the signs of bronze disease. Details of this study as well as the usefulness of powder diffraction technique in the investigations of the deterioration processes of metal objects will be presented.

Keywords: corrosion, XRPD technique, cultural heritage

MS.47.1

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Structure and elasticity of single-crystals by phonon imaging at high pressure

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