

Investigation of two paintings from the collection of the Kröller-Müller Museum by scanning macro-XRF at Beamline L

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The Kröller-Müller Museum is one of the most important museums of the Netherlands, famous for its sculpture garden and its collection of paintings by Vincent van Gogh (1853-1890). Two paintings of the museum's collection, Vincent van Gogh's "Birds' nests" (KM109.945, F 108/JH 940) and "Still life with flowers" (KM 100.067, anon. Germany/France, formerly attributed to Vincent Van Gogh (until 2003)) were brought to DESY for investigation.

From X-ray radiographs of both paintings, it is known that under their surface, hidden paint layers, constituting different, hidden paintings, are present. While in case of the "Still life with flowers" the hidden painting's motive could be identified as two wrestlers, the motive of the painting under the "Birds' nests" remained unclear.

Radiographs generally only give a very rough impression of a hidden painting's motive, as they are basically density distribution images. To reveal further details of the hidden motives, that possibly might allow an identification of the painting under "Birds' nests", it was decided to investigate them by scanning macro-XRF at Beamline L of HASYLAB.

At Beamline L the paintings were mounted on a motor stage and moved through a primary beam of 38.5 keV. The primary beam was obtained from the white beam emitted from a bending magnet of the DORIS III synchrotron storage ring by means of a Ni/C monochromator and collimated to a beam size of 1 mm. The fluorescence radiation emitted by the painting was collected by four energy dispersive Silicon-Drift-Detectors (SDDs) that were positioned around the painting in different angles and so allowed to collect radiation emitted from front- and backside simultaneously.

The better part of both paintings' surface was scanned with a dwell time between 0.25 and 0.5 s per pixel and a step size of 1 mm. These investigations provided elemental distribution images of both paintings that give detailed insight in the hidden paintings and, albeit the art historical interpretation of the results is yet not finished, allowed for a tentative identification of the hidden painting under "Birds' nests".

As was confirmed in a close inspection of the paintings after the measurement, no damage was done to them.

In Figure 1 an exemplary excerpt of the results obtained on "Still life with flowers" is shown. While the X-ray radiograph in Figure 1b allows to vaguely sense the arms of the wrestlers on the hidden painting, no details can be seen, as the radiography is dominated by the strong absorbing lead white used in the flowers of the surface painting. In contrast to this, the hand, gripping the other wrestler's arm is clearly visible in the Barium distribution image, shown in Figure 1c, that was obtained by means of synchrotron based scanning macro-XRF. The presence of Barium indicates the use of Barium sulfate as an extender for other, possibly organic, pigments.

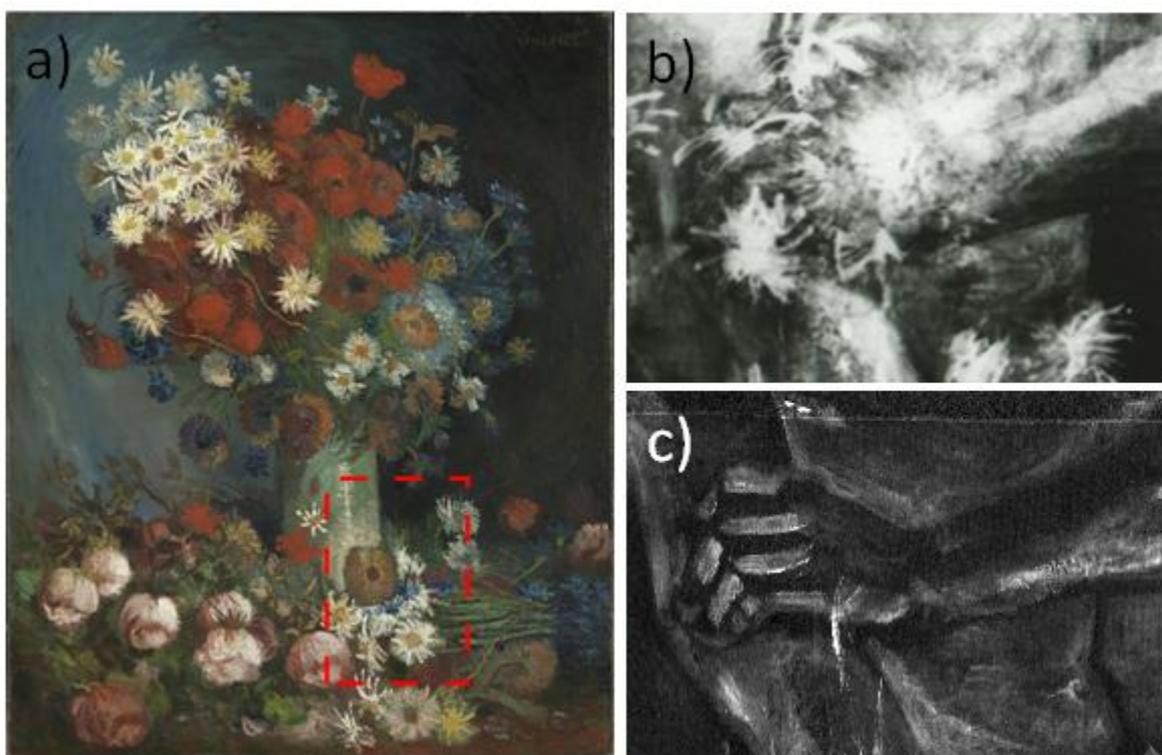


Figure 1: a) "Still life with flowers" as photograph. The exemplary area is indicated by the red square. b) X-ray radiograph of the exemplary area. c) Ba-K α intensity distribution image. The images b) and c) were rotated by 90 degrees clockwise.