

Thermovision investigation of frescos in Cistercian monastery in Łąd (Poland)

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Abstract

Complex non-destructive testing of Gothic wall paintings in the richly decorated oratory of the Cistercian Cloister in Łąd were undertaken in 2007. The objective was searching for the oldest painting workout. Thermographic tests were performed with an Inframetrics PM 290 camera using a 4000 W lamp as a source of radiation in static and dynamic technique, i.e. by heat wave method. The same fragments of wall paintings were examined by UV fluorescence and UV reflectography, with the use of 4000W halogen lamps and a 320-360 nm filter. The paintings were also investigated in near infrared using the above mentioned lamps and an 870 nm filter. A comparison of all photographs recorded by the above methods allowed to indicate the areas where Gothic polychromy was present and to reveal the changes of composition introduced in course of restoration works.

1. Introduction

Recent discoveries of ancient wall paintings were possible mainly thanks to modern non-destructive research methods. They allow penetrating in-depth of a multi-layer structure of painting decoration without interfering with the monument's structure. Much hope is connected with thermographic methods [1]. Field works provide verification of these methods and their development in the field of monuments restoration. Every mediaeval wall painting has its own history. Its material traces as over-painting and repairs or other treatment are carefully analysed. The lack of proper documentation makes it necessary to reconstruct the history of an object by means of laborious analysis of subsequent layers by means of physical and chemical methods.

An example of such a valuable but still unrecognised historical construction is the Cistercian monastery in Łąd where wall paintings were subject to complex non-destructive testing. The aim of these works was to find the earliest polychromy dating from before the second half of the 14th c. and to determine the form and contents of Gothic painting ornamentation in St. Jacob's Chapel figure 1. The wall paintings rich in form and content are here partly covered with over-painting. Polychromy, as it is seen today dates probably from the sixties of the 14th cc. and was uncovered and partly reconstructed in the years 90-ties. However, we cannot evaluate to what extent it lost its original character due to numerous restoration works [2, 7,9, 10].

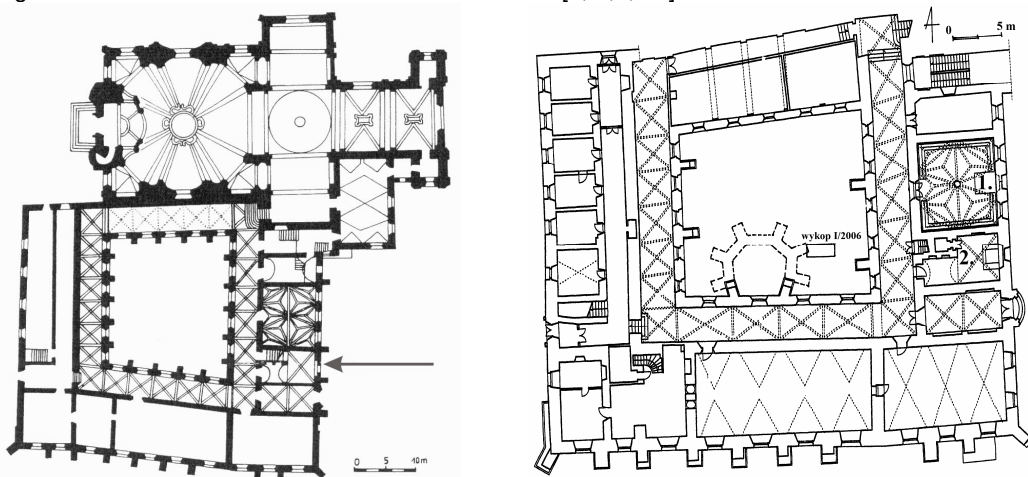


Fig. 1. Scheme of the post-Cistercian cloister in Łąd with St. Jacob's Chapel marked [2]

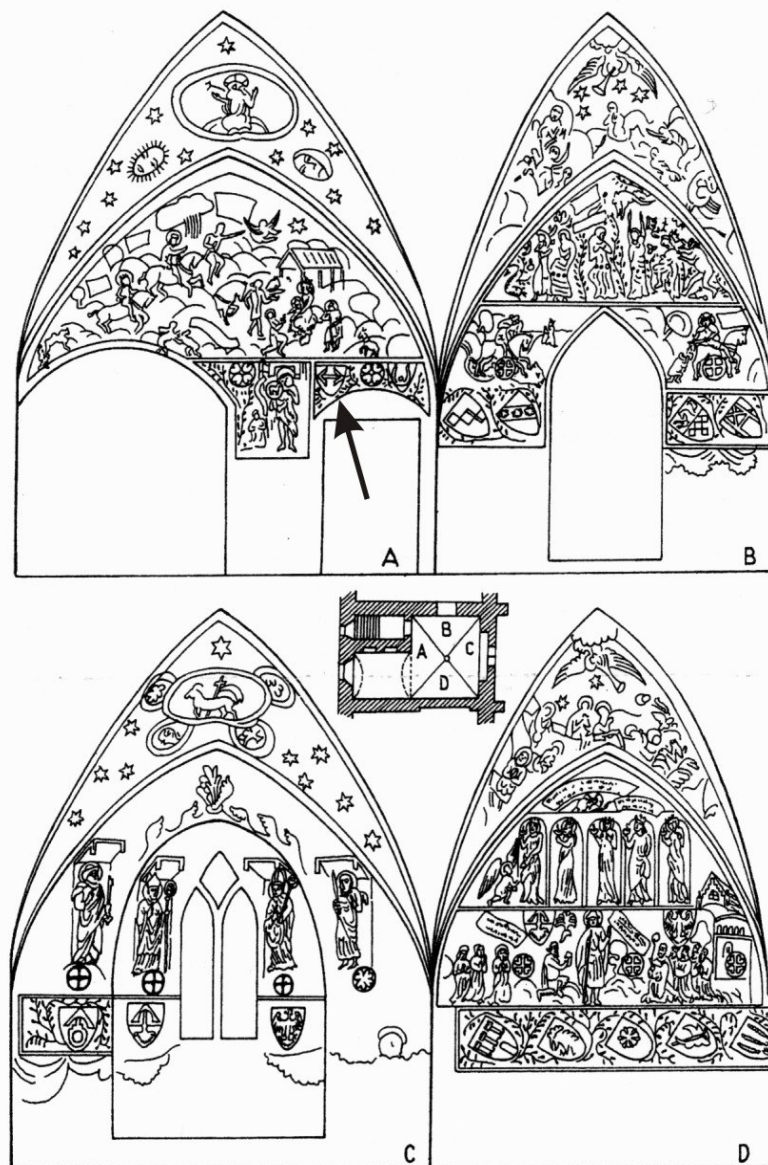


Fig. 2. Location of paintings inside the Chapel [2]

2. Historical outline

The history of the Cistercian abbey is not clear. Cisters, coming from nearby Łekno were settled at this location in the second half of the 12th cc. [3]. In the 13th cc. Łąd was a significant political and cultural centre. The history of the cloister in the 14th and 15th cc. were turbulent, which left traces on the construction and its decoration. In mid-14th cc. as results from heraldic research, wall paintings were executed in St. Jacob's Chapel, dated from 1352 to 1369 [2].

The chapel and its decoration belong to the most precious monuments of this type on the territory of Poland figure 2.

The painting programme had to express a private political manifesto in order to glorify king Kazimierz the Great's party and the supporting families. The frieze of painted escutcheons runs around the chapel. The foundation scene represented on the southern wall (figure 3) is the only one of this kind in Great and central Poland [4].

This indicates how important is a careful examination of the authentic fragments of the painting for the sake of the history of arts, which is mentioned in several publications [2, 3, 4 9, 10].

Identification of original parts is not an easy task as in course of changing political situation the paintings experienced deterioration, renovation and over-painting according to the requirements of the epoch. However, no mentions have preserved in archives. All that we know is that construction works were commissioned by the abbots in the church and cloister on the break of 15th and 16th cc., at the end of the 17th c. and in the 20-ties of the 18th c. After the abolishment of the monastery the construction was devastated., after 1841 it housed grain stores, cow barns and hen-house.

In mid-19th c. a restoration programme was undertaken, the next stage was inaugurated in 1915 and the next one in 1925-27. Restoration works were also performed in the 70-ties of the 20th cc. [2]. However, it is not evident which treatment concerned St. Jacob's Chapel and its wall paintings. What we know is that conservation was carried out in the 20-ties and comprised cleaning and cavity refilling of plasters and polychromy as well as removal of previous over-painting.



Fig. 3. An example of painting on the southern wall, representing the scene of handing in a symbolic effigy of the Chapel by the founder Wierzbięta to the Cisters' abbot in the presence of St. Jacob. Photo by A. Wyrwa

To sum up – although nowadays the paintings do not show major loss of form and its contents can be interpreted without obstacles, it remains uncertain how they were influenced and changed by renovation works.

Final solution as for the original form under the remaining deposits was expected from complex non-destructive testing, among which thermography played a key role.

3. Non-destructive testing

Investigation of wall paintings in St. Jacob's Chapel in Łąd was performed with the use of non-invasive electromagnetic measurements from UV to IR 3-5 μ m. The chosen fragments were examined by 4 research methods: thermography, UV reflectography, UV fluorescence and near IR analysis [5]. Static and dynamic (the method of heat wave) thermography were applied with the use of an Inframetrics PM 290 camera. Four 375 W lamps were used as a source of heat and ThermalScope software elaborated at the Institute of Electronics, Technical University of Łódź. This package gives a possibility of marking the investigated area, calculating average temperature and standard deviation, calculating a histogram and temperature distribution along a chosen line. Single images or their sequences can be recorded. Special software was prepared for frequency analysis for a sequence of thermograms [6].

In St. Jacob's Chapel in Łąd the same fragments of painting were registered in UV range by means of reflectography and fluorescence methods.

UV fluorescence was recorded using a 360nm mercury fluorescent lamp and a 415-700nm filter.

For UV reflectography 4000W lamps were used and a 320-360nm filter.

The research cycle was completed with recording in visible light and near IR. The object was heated with 4000 W lamps and 870 nm filter was applied.

The results were registered digitally with a Cannon 350 D camera and appropriate filters for the given radiation ranges. The results for chosen fragments of the painting were out together and the digital results were compared. This allowed for interpretation of the noticed differences and correlate them with the object's history. As a result, information was received on the state of preservation of the painting and the places where the original paint layer was lost and replaced with plaster and colour. The range of this treatment is not unequal. Next to well preserved areas most deteriorated fragments are present. The thermographic method allowed to identify such

effect among others within the foundation scene on the southern wall. It also registered the type of substrate and brick plot but no rebuilding traces under the painting.

The images received by UV reflectography and fluorescence and in near IR together with visible light photography showed certain changes in the composition, e.g. in the area of coat of arms figure 4.

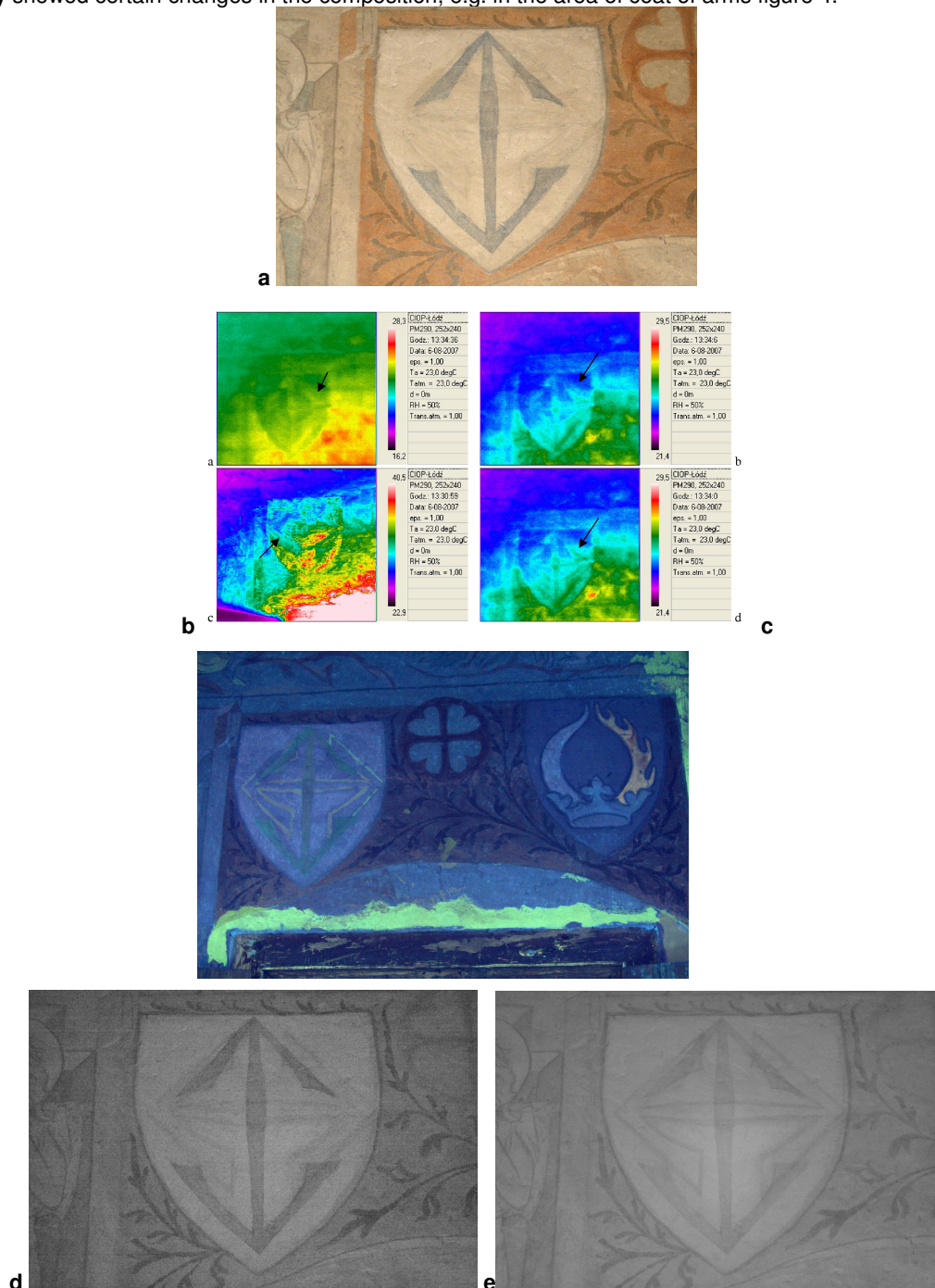


Fig. 4. Exemplary results of non-destructive testing on a fragment of wall painting recorded in different ranges of electromagnetic radiation, a. Photography in visible light, b. thermograms, c. UV fluorescence, . d. UV reflectography, e. Photography in near IR

4. Resume

The investigation fully confirmed the usefulness of the choice and combination of the four presented methods in different ranges of electromagnetic radiation to the examination of wall paintings in St. Jacob's Chapel in Ląd. Without any interference with the matter, information on the location of the 14th cc. polychromy and its authenticity was obtained. However, it was not successful to identify any other earlier painting workout under the plaster. Further development of the methodology of thermographic testing and joining other non-destructive methods should allow to solve this problem in the future.

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