Working Buildings: The Effect of Building Use on the Conservation of Wall Paintings and other Sensitive Polychrome Surfaces

TOBIT CURTEIS

Abstract

Although our medieval churches and cathedrals are primarily working buildings, their ancient fabric is highly vulnerable to deterioration, as are the historic artefacts contained within them. Often, the requirements of those using historic buildings are significantly different from those whose role it is to maintain and conserve them.

The expectations of modern congregations and visitors are very different from those of only a generation ago, and often place an enormous strain on both the building fabric and its historic contents. In particular, the impact of heating and ventilation on sensitive surfaces, such as wall paintings, is an area that is little understood by many charged with the care of such buildings and, as a result, damage can often be caused by actions intended to alleviate it.

In order for church buildings to maintain their proper function, it is essential that the historic fabric remains in good condition. Equally, for the building to remain relevant, visited, and funded, it is important that the conditions within it are conducive to its working nature. It is the role of the conservator to advise on the ways in which conditions can be achieved that are acceptable to the people using the building, as well as being suitable for the conservation of the building fabric and the objects displayed within it.

Introduction

It is an often-quoted maxim of Paolo Mora, the eminent Italian restorer, that the two things that cause damage to wall paintings are *man* and *moisture*. While conservators and building professionals can often control moisture through technical means, to control man, and the effect that he has on the historic environment, is a rather more complex task.

It is this aspect of conservation – the effect that people have on the historic buildings in which they live and work – that is to be addressed here. Although this paper focuses on the effects of building use on the structural fabric and internal surfaces, in particular wall paintings and architectural polychromy, of churches and cathedrals, many of the principles involved are relevant to all manner of historic buildings.

The problem

Churches exist for the worship of God and, in many cases today, they have a secondary function as a social hub for the community. Although this may seem obvious, it is a fact that often appears to be forgotten when considering the conservation of the historic fabric or objects within the churches. (How many conservation plans, for instance, mention the word ‘God’?) However, understanding this fact is critical to successful long-term conservation.

The requirements of the people using these buildings are often at odds with those of the conservation community whose role it is to maintain and conserve the building fabric. The expectations of modern congregations and visitors, in particular the levels of comfort heating that are now considered desirable, are very different from those of only a generation ago, and can place an enormous strain on both the building fabric and its historic contents.

In the view of the author, the job of the conservator is to bring the historic building to the next generation in a stable and sustainable condition. We often forget that in the history of the buildings that we treat, conservators are a tiny irregularity. The day-to-day, or rather decade-to-decade, care is provided by the people who own or maintain the building. Therefore, in order to ensure that the building is properly conserved, it is essential that we persuade these people of the validity of our advice. Because, if once our collective backs are turned, they do not feel inclined to implement our advice, then what use is it? As a profession, this is an area in which we are extremely weak. How many conservation courses, for instance, have a module entitled ‘dealing with the client’?

It is certainly true that there has been a considerable development in preventative conservation over the past decade. In this context, preventative conservation means the identification and treatment of causes of deterioration, before severe damage develops, rather than the treatment of the symptoms after the damage has already taken place (an approach that has characterized so much historic conservation and restoration). A key to this change of focus has been the fact that a preventative approach has been recognized as worthwhile by some, although by no means all, of the funding bodies. However, despite these positive developments, the basic problem remains. People wish to use historic buildings in a way that they have never been used in the past, and this often comes into direct conflict with the requirement to conserve the historic fabric and contents in their present state.

Specific issues

In order to explore this dichotomy, and to look at the ways in which these problems can be overcome, some of the specific issues that commonly cause difficulties in historic churches are addressed below.

Modern heating

Perhaps the most widespread problem is that of the internal environment and, in particular, the effects of modern heating systems. In general, people who use churches would like them to be warm and dry during services, but, for reasons of cost, they do

not wish to maintain these conditions at other times. As a result, heating is turned on for two or three hours on a Sunday morning and turned off for the rest of the week. Although this approach is now widely understood to be damaging to the building fabric, it is one that is still maintained in thousands of churches across the country. As this is still so widespread, the microclimatic effects that such heating patterns cause, as well as some of the more common misconceptions associated with them, may usefully be reviewed.

The sudden increase in air temperature that takes place when heating is turned on, will usually cause the relative humidity (RH) to drop. Typically, in medieval churches, the change in RH will be in the order of at least 10% or 20%, and will cross the band of deliquescence of numerous salts and salt mixtures that are found in original and added building materials. This causes movement and crystallization of the salts and resultant damage to the building fabric and, in particular, to the most sensitive surfaces such as wall paintings and architectural polychromy. The reduction in air temperature, when the heating is turned off, allows the RH to increase and the salts go back into solution. Each cycle of heating repeats this process, causing damage to the fabric on every occasion.[1] Although this is a huge over simplification, the mechanism it describes is widely known about by historic building professionals.

What is less widely appreciated is the effect of an increase in temperature on the absolute humidity, that is the actual volume of water in the air. The fabric of most medieval churches acts like a sponge and absorbs high levels of moisture from both water vapour in the air and liquid water in the building structure. When the air temperature is raised, some of this moisture desorbs or evaporates, increasing the actual moisture content in the air. This increase in the volume of water in the air means that when the heating is turned off, causing reduction in air temperature, the RH will increase to a higher level than before the heating was turned on. This is usually exacerbated by the fact that the heating has been turned on for a service, when additional water vapour will have been created by the breathing and perspiring of the congregation, as well as evaporation from wet coats and umbrellas.

Although air heats up and cools down relatively swiftly, many building materials have a higher thermal lag and react more slowly. The warm wet air created during the service comes into contact with the cool surfaces, reducing the air temperature sharply. The cool air can no longer support the high level of water vapour causing it to condense on to the cold surface. In churches, much of the resultant condensation is invisible as it is absorbed directly into the porous walls, but the effect on the dissolution and movement of soluble salts is none the less dramatic.

So here, in a nutshell, we have the problem caused by short-term heating. We understand it, and we understand its long-term implications for the building fabric, but does the parish? Usually not. What is more worrying is that many building professionals appear not to understand it either. As a result, new heating systems are regularly installed in churches, which exacerbate rather than reduce this problem.

How then do we overcome these problems? The first thing is to recognize our lack of control over the long-term management of the buildings in question. In general, the situation for churches is very different from, say, National Trust properties, where there are recognized protocols and the need for environmental control (often in the form of conservation heating) is widely understood. If the congregation in a church feel cold,

they will simply override any heating controls in order to make themselves feel warm. If the price of oil goes up, or the pensions market goes down, the money will not be available in the parish to pay for, what is often perceived as, 'unnecessary heating' and our conservation heating system will be turned off. We should also not ignore the financial implications of falling attendance figures in churches that will inevitably reduce parish incomes, placing further stress on funds for conservation heating, and other control systems, which are often regarded as luxuries. These are real issues and, as responsible conservators, we cannot afford to ignore them when we are designing conservation strategies. This is not to suggest that active environmental controls such as 'stabilizing' heating have no place in churches. Simply, we should recognize that, in many cases, such systems would not be used in the way that we intended.

In looking at heating strategies that will work, we should first address the clients' perception of what they think they need. The lowest impact on the environmental conditions can often be achieved with carefully thought-out localized heating. However, people generally expect the conditions in their church to be as similar as possible to their living room. So, when they enter a church and the air temperature in the aisle is low, they insist that the church is cold, never mind the fact that the temperature in the pews, where a carefully-designed localized heating system is in operation, may be entirely acceptable. In addition, there is the question of how people distribute themselves around a church. When working in churches, it is common to see a congregation of 20 people spread themselves around a church built for 200. The implications for heating (and heating costs) are obvious.

Many of the technical problems associated with different heating systems have been addressed and information is readily available on such matters. *Heating Your Church* by Bill Bordass and Colin Bemrose is a particularly good introduction to the technician and the layman alike.[2] However, in reality, the problems are not simply technical, but ones of perception. It is the job of the conservation professional to overcome these issues just as we would any other technical conservation matter.

So, making people warm in church, without damaging the historic fabric, involves a very wide range of issues that are not the domain of any one professional advisor. In some cases, one does see imaginative and well-thought-through solutions to the problems, but in many more cases the discussion is largely about flow temperatures and thermostats. If we are to persuade our clients of the importance of conservation issues involved with heating, we must ourselves have a unified approach to the issues involved. This, in turn, means that conservators should be involved in the initial design of any project in just the same way as the architect, heating engineer, and planning officer.

Ventilation

Heating is one of the principal artificial factors affecting the internal microclimate in churches. The other is ventilation. Ventilation is both cheap and easy to implement and, therefore, it is recommended by church architects on a regular basis. The reason usually given for increasing ventilation is to 'dry out' a church. But is this desirable and is this what will be achieved?

Let us first consider the question of desirability. A significant reduction in the water content within the building fabric will inevitably lead to the crystallization of hygroscopic

salts, resulting in damage to the fabric. If this is a single event, followed by a stable dry environment, then it might be regarded as worthwhile. However, drying caused by ventilation is usually short term and intermittent and, as a result, repeated cycles of the dissolution/crystallization process take place causing continual damage. Also, recent research has shown that even a mild increase in the level of air movement over the surface of a wet porous object (such as a plastered wall) causes a huge increase in the level of evaporation and, by implication, salt crystallization.[3]

More significantly, if there is water in the building fabric, is ventilation and surface drying the way to treat the problem? Why is the water there in the first place? Often it is as a result of a failure in the building envelope or rainwater disposal system. If this is the case, then a reduction in moisture content through ventilation will be of questionable value. Rather, it will be necessary to repair the damage to the fabric; in other words, treating the source of the problem and not the symptom.

So, the question of the desirability of ventilation is less straightforward than might at first appear to be the case. Certainly, for the building fabric, while long-term stable drying may have certain benefits, short-term drying is likely to cause further damage.

The question of whether ventilation achieves an overall reduction in humidity levels is also far from straightforward. Ventilation, in this context, means the exchange of internal and external air. In historic churches, a high level of what could be termed ‘natural ventilation’ occurs as a result of building porosity (i.e. gaps in the building fabric that allow air exchange to take place). Deliberate ventilation, on the other hand, involves the encouragement of air exchange via doors, windows, or other openings that are constructed for this purpose.

On average, in Northern Europe, it is wetter outside than it is inside. It therefore seems remarkable that the idea has developed that the uncontrolled importation of external air will somehow make things drier. What actually happens is that, when it is drier outside (i.e. absolute humidity is lower), the imported air will usually reduce the level of water vapour in the internal microclimate. However, if the external absolute humidity is higher than inside (and in Northern Europe, it generally is), it will make the air wetter. There are, of course, sophisticated mechanical systems that will assess and compare the internal and external conditions and allow controlled ventilation accordingly. But this is not what happens in parish churches, where windows and doors are left open or closed for weeks or months at a time.

Even when a more careful approach is taken, the results are rarely much better. Human beings are notoriously bad at judging minor changes in RH, being far more sensitive to fluctuations in temperature than in moisture. As a result of this inability to judge moisture levels, and the very common misconception that warm means dry, controlled manual ventilation tends to consist of throwing open the windows on an occasional warm winter day. On such a day, although the external air temperature may have increased, the absolute humidity will often be high, as a result of moisture evaporating from the ground. This warm wet external air then enters the church and comes into contact with the cold walls, causing water vapour to condense.

This is not just a theoretical model. Environmental monitoring of churches, where a high level of deliberate uncontrolled ventilation is employed, has regularly shown incidents of condensation associated with ventilation. Indeed, in many cases, incidents

of what can be termed ‘ventilation condensation’ outweigh those of condensation resulting from the inappropriate use of the heating system.

This appears to fly in the face of the extensive anecdotal evidence of ventilation causing a building to dry (this is something that the author has often found puzzling). However, it is often the case that ventilation is implemented as part of a wider programme of building fabric repairs, which address damage to the building envelope and the rainwater disposal system. Therefore, it is possible that the perceived drying caused by ventilation has in fact been caused by the control of liquid water entering the building fabric.

However, giving advice that appears to go against people’s intuitive beliefs is extremely difficult, particularly if another building advisor is saying that ventilation is so obviously a good thing. Perhaps ventilation should be considered in the same way as heating. Both are powerful tools for environmental control that, if used carefully, can be beneficial. However, if they are used without adequate control, both can cause considerable damage. Therefore, before either ventilation or heating is recommended, the actual effect that they might have should be considered far more carefully than is currently the case. When a new heating system costing £20,000 is proposed, the advisor thinks about it very carefully, weighing up the pros and cons before recommending it. If it were necessary to pay a similar amount for ventilation, and one had to consider the pros and cons to the same degree, would it be recommended as widely? Probably not.

Alterations to the building fabric

Although these effects can be serious, deterioration resulting from changes in the microclimate is generally fairly slow. Far more immediate is the damage often caused by work on the building fabric, including re-decoration, re-organizing the internal fittings, or the installation of kitchens and lavatories. With certain exceptions, all these changes can be achieved with minimal impact on the historic fabric. However, this relies on careful consideration of potentially sensitive areas of the building at the initial design stage of any project. This is particularly relevant for large projects, such as the addition of lavatories, kitchen facilities, or meeting rooms within the existing church building, where the risk of damage to the original fabric is extremely high. It is therefore essential that the project manager, usually the church architect, recognizes the potential risks at the outset and takes advice from the relevant expert (be that a wall painting conservator or an archaeologist).

With the redecoration of medieval churches, it is now a common recommendation by the Council for the Care of Churches, English Heritage, or the Diocesan Advisory Committee that a preliminary examination is undertaken by a conservator, in order to establish if any wall paintings survive and to recommend strategies to prevent damage during the building work. While this is not yet a universal approach, it is an extremely positive step and should be actively encouraged. As well as protecting wall paintings from inadvertent damage, it can also be very cost effective when one considers the expense that is incurred if wall paintings are discovered in the middle of a building project.

Day-to-day maintenance

Although it tends to be very serious when it occurs, the number of incidents of large-scale damage caused by decoration or structural alterations is limited due to the planning regulations and faculty requirements. Far more common is the non-malicious damage that is caused on a day-to-day basis due to simple ignorance of the historic fabric. Despite the extensive material published by the Council for the Care of Churches, unnecessary damage of this type continues to occur.

A typical example is found on a very fine thirteenth-century painting of St Thomas Becket in a small church near Cambridge. Located in a niche on the east wall of the nave, the painting showed signs of deterioration and paint loss on its lower half, only some of which appeared to be associated with the moisture patterns observed elsewhere on the wall. It was only when the church was visited at Christmas and a vase of holly was found sitting in the niche, pushed hard up against the painting, that the cause of deterioration became clear.

A similar case is that of a very important and unusual sixteenth-century painted stone screen in a church in Cheshire. The screen separates the chapel, dedicated to the patron, from the chancel. While the chapel side of the screen is finely painted with grotesques and polychrome decoration, the chancel side, which was originally very simply painted, had lost much of its polychromy, in particular on the upper tracery. During the initial survey a number of complex theories were examined as to why this pattern of preferential deterioration had developed. It was only some years layer, while carrying out a follow-up survey, that one of the well-meaning church cleaners was found scrubbing down the chancel side of the screen with a big broom ‘to get rid of all that dust’.

Far more worrying was the fate of the west end of the screen, which retained much of its very fine painting. Because the screen forms a tight space by the organ, it had become used for storing brooms, vacuum cleaners, bits of old wood, and various other implements, which chipped away at the paintings whenever they were moved. This was pointed out to the church wardens and it was recommended in the report that the practice was stopped. On returning several years later for the follow-up survey, it was found that not only had the advice been ignored, but further material had been jambed in and the damage had worsened. When this was brought to the attention of the church warden, he explained that there was no other convenient place for storage.

The particularly depressing aspect to this case was that considerable time, effort, and money had been spent on behalf of the parish, and recommendations that would have cost no money at all to implement were deliberately ignored. As a result, further irreversible damage has occurred to a highly important work of art. Were this a health and safety issue, where professional advice had been willfully disregarded and injury had occurred to visitors, legal proceedings would follow. In conservation, such things are almost unheard of and as a result this sort of thing regularly happens with no consequence.

Maintaining historic contents will always have risks attached and the simplest actions can cause significant long-term damage. Scrubbing medieval floor tiles, polishing brass plaques on painted walls, cleaning stained glass windows, chipping candle wax off alabaster monuments, even sweeping the floor next to pieces of medieval sculpture all

have risks attached to them. The job of conservation advisors is not to stop housekeeping functions from happening, but simply to direct them in a way that will not cause unnecessary harm to the historic material involved.

Building maintenance

Although incorrect housekeeping measures can cause damage, this is rarely as serious as that which can be caused by a lack of, or incorrect, building maintenance. At one end of the scale are the major problems affecting the building fabric. Structural instability, failure of the roof, damage to windows, and large-scale deterioration of pointing are among the most serious issues that tend to be encountered. The system of quinquennial inspections by the church architect or surveyor means, however, that in many cases the problems are identified and acted on before significant damage takes place. Neverthless, in many other cases, a lack of will or funds means that the advice of the architect or surveyor is ignored or acted on far later than has been recommended and further damage occurs.

At the other end of the scale are the minor maintenance issues that take little time or money to implement, but are often ignored, sometimes with disastrous consequences. Perhaps the most common problem that results in the most serious damage is the failure to maintain the rainwater disposal system. Blockages of gutters, downpipes, and drains result in more damage to wall paintings than almost any other single cause. The cost of commissioning a local builder to undertake a regular programme of gutter maintenance might be a couple of hundred pounds per year. The cost of the conservation of seriously damaged wall paintings or wet rot in the roof timbers might well run into tens of thousands of pounds.

Conclusions

How, then, does the conservation profession ensure that the buildings with which it is involved are successfully conserved, without preventing them being used for their correct working function?

In fact, most of the requirements of a working church can be achieved without damage to the historic fabric. What are the reasons for serious damage continuing to take place on so regular a basis? Generally, such damage falls into two categories – wilful damage and inadvertent damage. Willful damage, in this context, means damage that takes place as a result of a deliberate refusal to seek, listen to, or act on expert advice. Inadvertent damage, on the other hand, tends to occur as a result of incorrect expert advice or simple ignorance. Fortunately, most of the damage encountered falls into the second category, although there are still a significant minority of cases where this is not the case.

If we are to attempt to reduce the level of inadvertent damage, the first stage must be to make sure that the expert advice provided to parishes is as accurate as possible and that they do not receive conflicting advice from different advisors. This demands a level of co-ordination between professional advisors that is, at present, uncommon. If, for instance, a church architect is asked to advise on installing or changing a heating system in a church where wall paintings are present, then it is essential that advice is sought from a wall paintings conservator on the impact that this will have on the paintings. Similarly, if a wall-painting problem relates to the building structure, then the

conservator should liaise closely with the architect or surveyor. Only in this way will suitable and co-ordinated advice be available to the client, who has no choice but to rely on the accuracy of the information provided by the professional advisors.

The second part of the solution is to ensure that the custodians of the building, in the case of churches this generally means the parochial church council (PCC), have the information about how to care for their building without causing damage. Members of PCCs are usually volunteers and, understandably, do not take kindly to being instructed by 'experts' on how to sweep floors or carry out other basic housekeeping tasks. However, most members of PCCs care very much about the church buildings for which they are responsible and are happy to take advice if it is offered with some tact.

How, then, is such information to be provided? This, in the opinion of the author, is the key to solving much of the problem. Although there is a great deal of extremely good advice available, it often fails to reach those who are actually undertaking the day-to-day care and management of the building. How many volunteer church cleaners, for example, have had any instruction on how to carry out their tasks without causing damage to the historic objects? What is needed is a system by which advice on good practice can be provided to a person within the parish, who can then disseminate it more widely. After all, volunteer archaeologists expect basic instruction before being allowed to participate in a project. Should not similar information be offered to church volunteers?

There remains the difficulty of dealing with damage caused by willful disregard of advice. In theory, there is a legal framework that provides sanctions when serious damage has been caused, but in practice prosecutions are rare. In cases where minor damage is caused, there appears to be little or nothing that can be done and it is left to the conservation advisors to persuade the parish to implement their advice. Regrettably, given that follow-up surveys are rare, this often has little or no effect.

Although it is often difficult to bring together the working needs of the building and its conservation requirements, we should bear in mind the consequences of failure. If churches ceased to be working buildings, they would loose their purpose and become merely museums. As a consequence, they would lose the people who, at present, freely give their time as custodians and who provide much of the funding for their care. No amount of state aid would make up for this and, in conservation terms, the resulting lack of day-to-day care and maintenance would be disastrous. Therefore, while it is our responsibility to ensure that the historic fabric is properly conserved, it is also our responsibility – wherever possible – to do so in a way that will allow those who use the building to achieve their requirements. Of course, there will always be some cases where the changes that a parish wishes to make will be in direct conflict with the protection of the historic fabric, and in such cases the changes should be blocked. Nevertheless, in the majority of cases, with correct and co-ordinated advice from their professional advisors and careful implementation of the work, most of the building use requirements can be met with an acceptably low level of impact on the fabric.

Biography

Tobit Curteis BA (Hons), Dip Conservation (Courtauld Institute)
Tobit Curteis holds a BA in history of art (University of Warwick, 1988), a postgraduate diploma in the conservation of wall paintings, Courtauld Institute of Art/Getty Conservation Institute (1991), a post-diploma internship in Rome and Florence for the Courtauld Institute of Art (1992), and has been a private conservator in the United Kingdom since 1992.

Notes

1 In recent years there has been extensive research into the behaviour of salt mixtures in historic building materials, and this has shown that the situation is far more complex than has hitherto been understood. However, the basic principles of fluctuations in heating, causing salts to go in and out of solution, remain the same.

2 Bordass, B. and Bemrose, C., *Heating Your Church*, Church House Publishing, London, 1996.
3 Pender, R. 'Towards Monitoring Moisture Movement in Support Materials of Wall Paintings', *Proceedings of the 6th International Conference on Non-Destructive Testing and Microanalysis for Diagnostics and Conservation of the Cultural and Environmental Heritage*, Rome 1999, pp.831-841

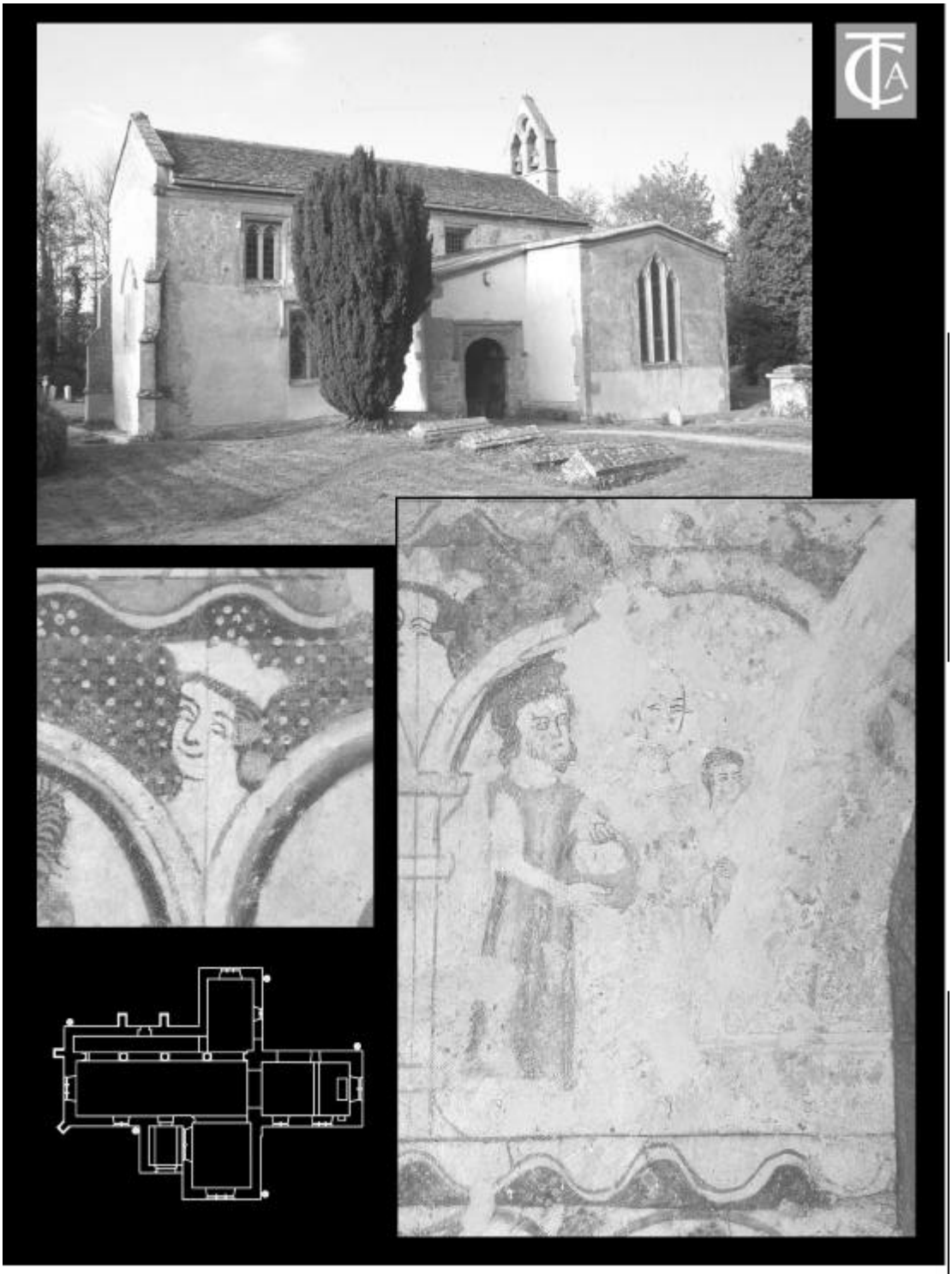

Figure 1. The 14th Century wall paintings at St George's Church Kelmscott, Oxfordshire

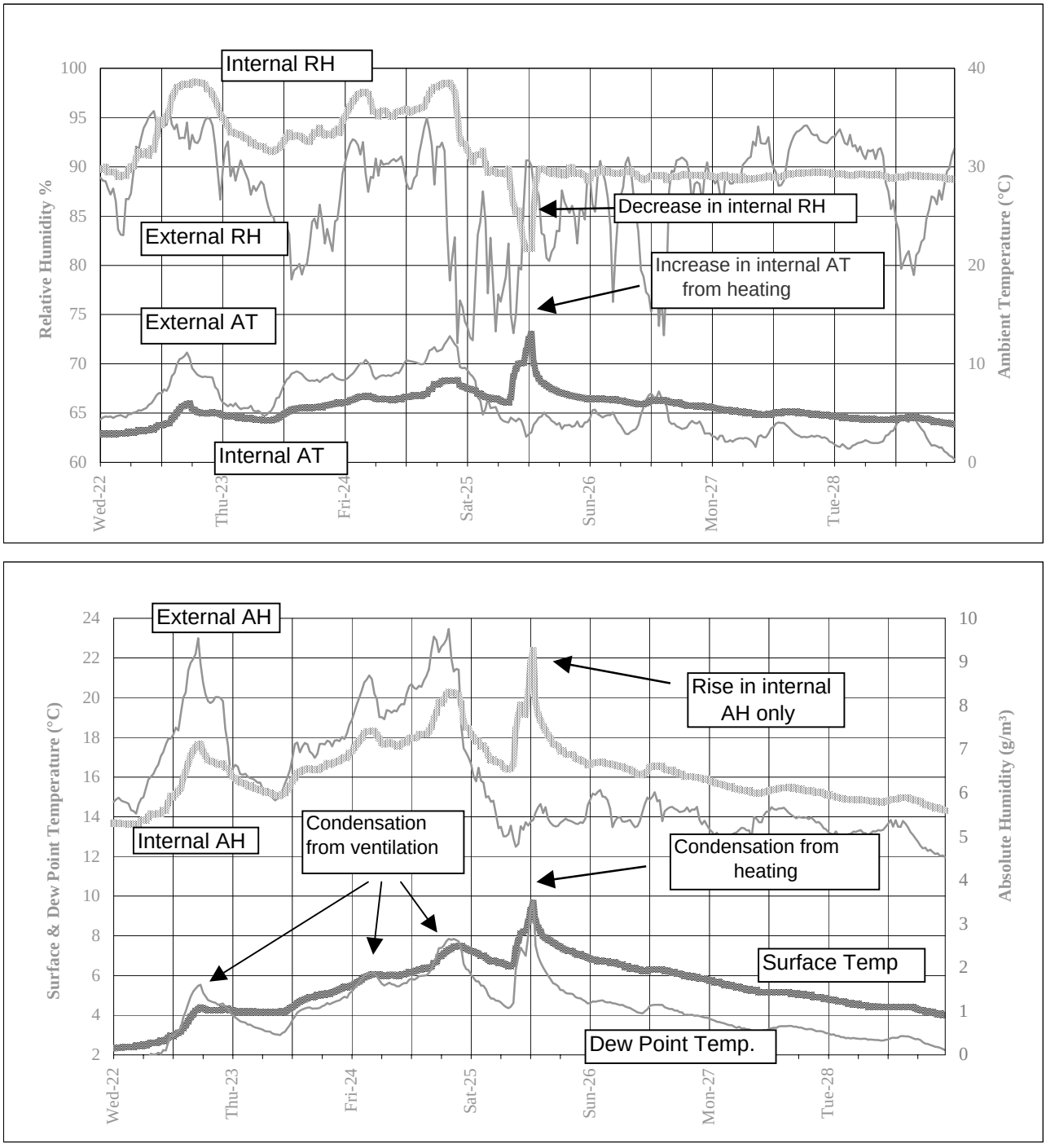

Figure 2. Microclimatic conditions in December 1999, showing condensation taking place as a result of external ventilation in the period before Christmas and as a result of heating on Christmas day.