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Tree-ring growth shows that the significant population decline in Norway began decades before the Black Death

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ABSTRACT

The Black Death (1349–1350 in Norway) is often cited as the cause of a severe population decline and building hiatus in the middle of the 14th century. This paper analyses this hypothesis by matching the Black Death with human and environmental impacts on tree-ring growth. The number of buildings dated by dendrochronology in Norway shows a dramatic decline several decades before the plague. In Norway, the building hiatus, which has parallels in several other places in Europe, dates from the late-13th century almost to the 16th century. The first dated houses built after the plague date from the 15th century and many of the logs have exceptionally wide tree rings compared to timber from other periods. Assuming the rapid growth was because of an open landscape, the trees are likely to have grown on infields of farms abandoned due to the 14th century population decline. Since many of these fast-growing trees germinated in the early-14th century and the number of dated buildings drops dramatically several decades before the plague, the Black Death can hardly be the only reason for the population decline in Norway and one plausible explanation is that some environmental impact occurred decades earlier. The dendroclimatological evidence of cold and wet summers in the years before the plague is suggestive, but historical sources also pinpoint famine due to crop failure. They also tell of farms being abandoned several decades before the plague and mention periods of heavy rainfall and famine in the early-14th century.

1. Introduction

Reduced availability of timber felled during the 14th century has been experienced in several places when constructing tree-ring chronologies (Bartholin and Landstrøm, 1983; Baillie, 1995; Thun, 2009). This has been explained by a pause in the erection of new buildings associated with a population decline following outbreaks of the plague known as the Black Death (Berg, 1997: 95). The Black Death (1349–1350 in Norway) was the first in a series of outbreaks of an epidemic disease that had widespread consequences for politics, culture, economy and demography. Based on more than 100 studies of the Black Death, Benedictow (2004) estimated that as much as 60% of the population in Norway died due to the plague between the spring of 1349 and the winter of 1350, and that it caused a dramatic population decline in Asia and Europe in the mid-14th century.

Many Norwegian historians have argued that the Black Death in 1349–1350 was the sole cause of the population decline and the abandonment of farms in the late Middle Ages (Hasund, 1919; Lunden, 2002; Moseng, 2006). However, Dybdahl (2010, 2012) argued that climate was an important factor explaining the increased mortality. Plagues were common during the Middle Ages, and the added effect of climatic deterioration may explain why the consequences of specifically the Black Death became so severe. He also directed attention to the abandoned farms mentioned in *Diplomatarium Norvegicum* (DN), a collection of Norwegian letters and documents that are central for studies of the medieval period. One letter from 1340 tells of a private person leasing a farm outside Bergen (Fig. 1) that had been abandoned 10 years earlier. The letter also mentions several farms in Trøndelag (the region surrounding Trondheim) being abandoned in 1334, 1338 and 1342, showing that crises were emerging decades before the plague in 1349–1350 (Dybdahl, 2010: 206).

Eckstein (2007) gave examples of how dendrochronological data can be used to investigate past human behaviour and showed that human impact on tree-ring growth can provide knowledge about the timing of events and living conditions. In many countries, dendrochronologically dated buildings go more than a millennium back in time. In Norway, this has also enabled studies of variations in building techniques after the building hiatus in the 14th century, notably corner-timbering (Berg, 1989: 36–40; Thun, 2002; Stornes and Thun, 2012: 144) and splash whittling (Berg, 1989: 21–24; Thun, 2002: 257; Thun and Storsletten, 2011). The long pause likely meant that knowledge and traditional building techniques failed to be handed down from one

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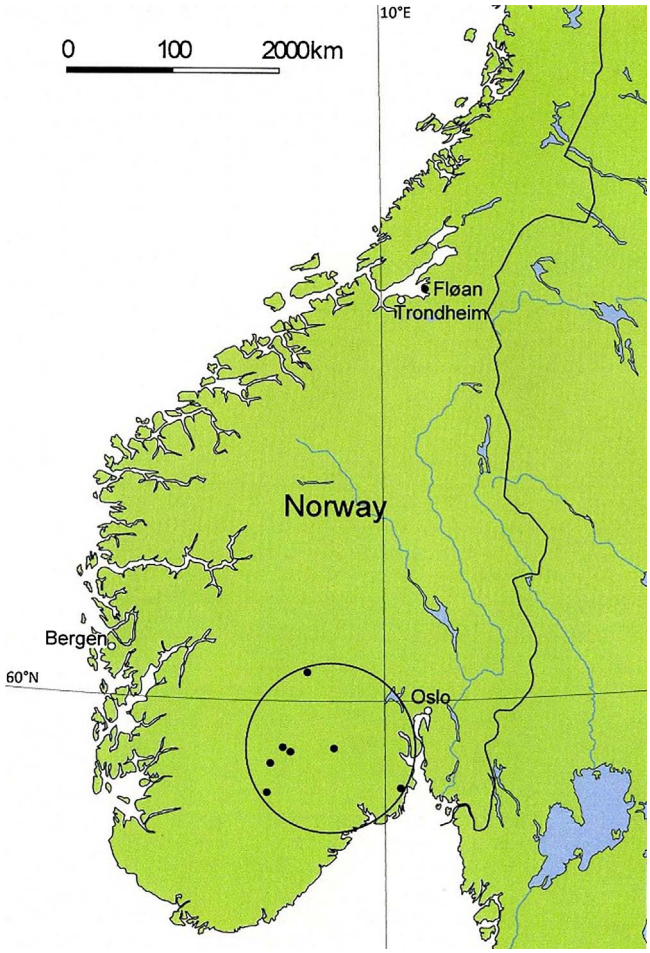

Fig. 1. Map showing the location of Trondheim, Bergen, Oslo and the eight 15th century timber buildings dated by dendrochronology in southern Norway as dots.

generation to the next, and new techniques more easily gained a foothold when work recommenced.

Many decades of dendrochronological studies in Norway and more than 1000 dated buildings indicate that the building hiatus began before the plague in 1349–1350. There also seems to be a difference in the type of forests used for timber in the early-15th century compared to other centuries. Dendrochronological samples cored from logs of Scots pine (*Pinus sylvestris* L.), hereafter referred to as pine, felled in the beginning of the 15th century show surprisingly broad tree rings, indicating that these trees grew in an environment different from that of other periods. This unusually fast-growing timber coincide in time with the building hiatus and historical descriptions of population decline. This makes it reasonable to presume that these trees grew on abandoned farmsteads. A more detailed study of the dendrochronological material from this period should therefore provide valuable information on events in the decades before the Black Death.

More specifically, the aims of this paper are:

- To estimate when the trees began to grow on infields so that farm abandonment in the 14th century in Norway can be more precisely dated.
- To refine understanding of the length and date of the Norwegian building hiatus in the 14th century.
- To investigate whether environmental conditions can explain the dramatic consequences of the plagues in the second half of the 14th century.

2. Data and Methods

The material in Norway dated with dendrochronology to the 15th century comes from three different sources. Logs from eight standing buildings (Fig. 1) in southern Norway (75 samples), samples from wooden objects excavated at the Archbishop's Palace in Trondheim (62 samples) and archaeological material from Oslo (79 samples).

To investigate differences between the material from the 15th century and other periods, the average tree-ring widths and the number of tree-rings in the 75 samples from building timber dated to the 15th century (eight houses) are compared with samples taken from building timber dated before 1350 (200 logs) and logs felled between 1500 and 1750 (170 logs). This provides an estimate of the growth increase on abandoned infields compared to the natural growth in a forest. All the samples originate from buildings in different parts of southern Norway and are described by Thun (2002, 2005).

The archaeological material is very heterogeneous and originates from a variety of artefacts. Several samples from the 15th century excavated in Trondheim are from wells and 58 samples from Oslo derive from cog boxes (i.e. corner-connected logs filled with stones and used to stabilise waterfronts, described by Stornes and Thun (2012)). Some of these artefacts are made from exceptionally fast-growing trees, and several samples contain fewer than 50 tree rings. Tree-ring widths in archaeological material may therefore not be suitable for comparison with logs used in timber houses prior to 1300 and after 1500, because the selection of fast-growing, slender trees might have been deliberate. The variation in tree-ring widths from different periods is therefore best suited in building timber only.

Dybdahl (2010: 206) mentioned farms abandoned decades before the Black Death in 1349–1350. Tree rings could provide more information because the germination and growth of the trees on abandoned fields can be dated. These trees provided mature timber for buildings when the infields were cleared and building started again in the early-15th century. Their felling would also have cleared such fields for renewed arable farming (Fig. 2). Dendrochronology can provide the latest possible year for germination of trees that grew on the infields of abandoned farmsteads.

The core samples were taken at the lowest possible point on the logs to provide a maximum number of tree rings. However, even if the pith is present, the dating of the innermost tree ring will never be anything other than a *terminus ante quem,* the latest possible date for the germination of the tree. In such fast-growing trees, there is probably a very low number of tree rings down to the germination year. Very little material from northern Norway, here defined as the area north of Trondheimfjord (Fig. 1), has been dated to the medieval period (Thun and Storsletten, 2011). Material from northern Norway is therefore not included in this study.

To investigate the climatic conditions in the late-13th and early-14th centuries, the results presented here are compared with written reports of crop failure and famine, records of volcanic forcing and reconstructed summer temperatures from several places in Europe.

3. Results

3.1. The length of the building hiatus

More than 1000 buildings have so far been dated with dendrochronology in Norway and several hundred are from before 1300 and after 1500. In contrast, only four standing buildings date from the last decades before the Black Death, between 1300 and 1350, have been dated with dendrochronology (Table 1), and building activity declined already during the second half of the 13th century. These four buildings consist of excellent material and one of them is a stave church (Reinli Stave Church). No buildings in southern Norway are dated to the second half of the 14th century and only eight to the 15th century (Table 2). A histogram along a timescale shows the number of buildings