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Wood use in a growing medieval city. The overexploitation of woody resources in Ghent (Belgium) between the 10th and 12th century AD

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ABSTRACT

The analyses of wood and charcoal recovered from a medieval refuse layer provided information on the use of woody resources between the 10th and 12th century A.D. in the city of Ghent (northern Belgium). During this period, Ghent evolved from a small settlement to a large urban centre. The results show that in the 10th century, the best suited woody taxa were used for both timber and firewood, *Quercus* sp. being the major wood type in the assemblage of the waterlogged timber remains and *Betula* sp., *Carpinus betulus*, *Quercus* sp. and *Fagus sylvatica* dominating the charcoal assemblages. By the 11th century, the somewhat less suited wood of *Fraxinus excelsior* is the most frequently used timber and fuel wood, indicating that the better quality wood taxa had become scarce. During the 12th century, *Alnus* sp. is the mayor wood type exploited both for fuel wood and construction wood, though this tree provides only very poor quality fuel and timber wood. The evolution in the taxa that have been used for both timber and fuel wood thus shows the overexploitation of woody resources, leading to the shortage of first high quality wood taxa and later also of other tree species that provide medium and low quality timber and fuel wood.

1. Introduction

Evidence for the overexploitation of woody resources by former societies mostly comes from environments that are very sensitive to disturbance such as island ecosystems or regions characterized by an (semi-)arid climate (e.g. Köhler-Rollefson and Rollefson, 1990; Miller, 1990; Engel and Frey, 1996; Hayashida, 2005; Rull et al., 2015). Population growth and high demand for wood also led to the overexploitation of woody resources in areas with optimal growing conditions and with a wide range of available tree species, such as some regions of northwestern Europe however. This was the case for example during the Middle Ages in Flanders (northern Belgium). During this period, the region witnessed an important increase of the population and the emergence of several large urban centers such as Ghent, Bruges, Courtrai, Ypres and Antwerp, and became, together with N-Italy, the highest urbanized region of Europe (Bairoch, 1988; Verhulst, 1999; Pounds, 2005).

Although fuel supply is seen as one of the most critical constrains upon the growth of pre-industrial cities (Bairoch, 1988; Galloway et al., 1996), apart from a few studies in Central Europe (e.g. Kočár et al., 2010), little is known on fuel and wood consumption and its environmental impact during this demographic evolution as most studies focus on social and economic aspects or on food supply (e.g. Pirenne, 1937, 1970; Verhulst, 1999). These studies are also mostly restricted to the late medieval period as for earlier times there are hardly any historic documents available (e.g. Galloway et al., 1996).

This paper now presents the results of the study of wood and charcoal remains recovered from a thick layer of refuse that gradually accumulated between the 10th and 12th century AD in the city of Ghent. These results show for the first time the important impact of the medieval population growth and urbanisation in northern Belgium on woodland composition and wood availability during this period.

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2. Material and methods

2.1. Site

2.1.1. Natural conditions

The study site (51°03′13″N, 3°43′28″E, 8 m a.s.l.) (Fig. 1a) is located on the Emile Braun-place in the city of Ghent. This city is situated in northern Belgium in a broad alluvial plain at the confluence of the rivers Scheldt and Lys. Most of the region around Ghent is low and flat terrain (Fig. 1b), characterised by wet, sandy and clayey soils, with some slightly higher areas to the southeast of the city that are characterised by sand-loam soils. The climate is Atlantic with a mean annual precipitation of 800 mm. The mean annual temperature is 10 °C; mean maximum and minimum temperatures for January are 5.5 °C and 0.5 °C respectively, and for July 22.5 °C and 12.5 °C (Poncelet and Martin, 1947). The potential natural vegetation in northern Belgium is black alder carr (Alnion glutinosae) on waterlogged soil, alluvial forest with black alder and European ash (Alno-Padion) on moderate wet alluvial soil, beech-dominated (Fagion sylvaticae) or oak-hornbeam forest (Carpinion betuli) on dryer soils with high silt loam content and woodland with English and sessile oak (Quercion robori-petraeaea) on sandy soils (De Keersmaeker et al., 2013).

2.1.2. Historical background

The formation of Medieval Ghent was initiated by the foundation of two abbeys during the 7th century, St-Bavo's abbey and St-Pieters abbey. A first settlement, that was situated next to St-Bavo's abbey, was destroyed in 879 A.D. by the Vikings. Shortly after, a new portus, i.e. a small commercial center with a harbor, was formed on the West bank of the river Scheldt and which was surrounded by a semicircular moat (Declercq and Verhulst, 1992; Verhulst, 1999) (Fig. 2). In the first half of the 10th century, this settlement had expanded westwards, outside the defensive moat, towards the river Lys (Caenegem and Geens, 1989; Verhulst, 1999). At the start of the 12th century, the city had expanded further and completely covered the area between both rivers and also areas on the other banks of these two rivers (Fig. 2). By the end of the 12th century, Ghent had become the second highest populated city north of the Alps, only Paris being bigger. Within the city walls lived up to 65,000 people (Caenegem and Geens, 1989; Verhulst, 1999).

2.2. Sampling and analysis

During an archaeological rescue excavation in 1996 in the historic centre of the city of Ghent, a c. 110 cm thick medieval deposit was found which contained mainly organic material such as wood fragments and animal bones, and which seemed to represent a gradual accumulation of waste and debris (Ervynck and Laleman, 1999). Within this refuse deposit, there were several levels with the remains of wooden street paving indicating that the street level rose as a consequence of the accumulating refuse. As there were no clear stratigraphic units visible within the refuse deposit, the deposit was artificially subdivided in 11 layers of 10 cm each and bulk samples of c. 90 l were taken from every layer. These samples were wet sieved over 4 mm, 2 mm and 0.5 mm meshes. Fragments of waterlogged wood were sorted from the 4 mm residues and charcoal fragments from both the 4 mm and 2 mm residues. The waterlogged wood in the residues consisted mainly of wood chips and bark. From each layer, a minimum of 100 of these waterlogged wood chips and a minimum of 200 charcoal fragments have been identified. Bark fragments have not been studied. For the identification of the waterlogged wood, transversal, radial and tangential thin sections were cut using a razor blade, mounted in a glycerol/water solution (50%) and studied using a transmitted light microscope. Charcoal fragments were broken in transversal, radial and tangential planes and were studied using an incident-light microscope with dark field illumination. Identifications are based on wood anatomy atlases and identification keys (Schweingruber, 1990; Gale and Cutler, 2000; Grosser, 2003; Schoch et al., 2004) and on a reference collection of modern wood and charcoal samples.

2.3. Chronology

Four radiocarbon dates have been obtained from the refuse deposit (Table 1), i.e. from a wood fragment and an animal bone from the lowest level of the deposit and from fragments of the wooden street levels from the middle and upper part of the deposit. Only *Alnus* sp. wood fragments have been selected for dating to reduce the risk for a possible old wood effect. The results indicate that the accumulation of waste at the site started between the 8th and 10th century A.D. and continued until the 11th or 12th century A.D.

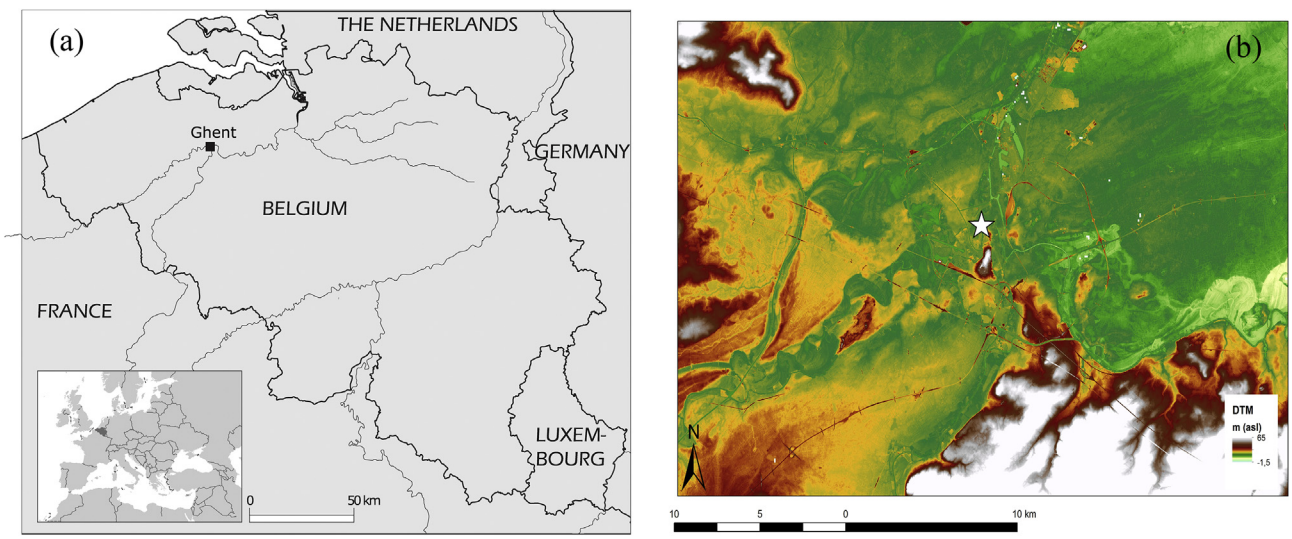

Fig. 1. Location of Ghent (a) and DEM of the region around Ghent (b). The location of the study site is marked with a white star.

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