



# People and fire management in South Norway during the Lateglacial

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## ABSTRACT

The aim of this paper is to interpret the occurrence of microscopic charcoal in pollen diagrams in the Lateglacial in South Norway. The methods used are palynology, radiocarbon dates and ethnographical analogy with charcoal as possible proxy data for anthropogenic activity. The possible origins of the charcoal are natural lightning-ignited fire, secondary deposition, long-distance transport and anthropogenic activities. The sixteen sites are discussed compared to their specific location. Based on the changes in nature and a discussion of the early peoples' northward migrations after the last ice age, my conclusion is that people most probably strategically used intentional fire not only at the settlement sites but also for other purposes to preserve their basis of existence. These may have included regular vegetation fire management for improving hunting and gathering, visibility and travel. Local and restricted burning of woody plants (dwarf shrubs, shrubs and trees) and herbs resulted in increased productivity and species diversity, an increase in the biomass and productivity of the animal populations. The northward-expanding trees and the more or less open forest became denser at the Continent and later in South Norway. This may have led the foragers to broaden its application to develop seasonal burning to manage the vegetation as a hunting and gathering strategy. Smoke signal fires for communication may also have been important for people living without neighbours.

## 1. Introduction

The occurrence of microscopic charcoal in the pre-Holocene deposits is evidence of fires in the Lateglacial period. Charcoal from archaeological sites has an anthropogenic origin, but charcoal in pollen samples from peat and lake sediments could have other origins, such as natural lightning-ignited fires. This paper investigates the hypothesis that hunter-gatherers dependent on harvesting natural resources during the Lateglacial in Northern Europe had a culture of environmental management, which developed as a strategic, intentional and controlled use of fire in vegetation to improve their lifestyle. I propose that foragers who controlled fire for many purposes widened its application to preserve their basis of existence by the intentional burning of vegetation. My hypothesis is that fire management may have been increasingly important for concentrating resources in selected areas, when the trees and more or less open forest in the Lateglacial became denser and advanced at the Continent—and later in South Norway. The aim of the study is to investigate the origin of the charcoal and to describe how fire management may have been an integrated part of the hunter-gatherers' cultural strategies.

People needed fire in many contexts: at the settlement sites, for signalling, for preparing raw materials and especially for burning vegetation to provide browse for animals and to enhance food production (Rick et al., 2012). Fire generates a vegetation with increased

productivity and species diversity in the early phases of ecosystem development, resulting in an increase in the total biomass and net productivity of the animal populations (e.g. Marlon et al., 2013). In addition, fire recycles nutrients in the soil and improves conditions for seedlings. Recently burnt areas are covered by lush vegetation, primarily herbs, because fire reduces the need for plants to compete for moisture (Ahlgren, 1960; Loope and Gruell, 1973). Herbivores move from resource-poor towards resource-rich environments as a self-reinforcing mechanism (Gaustad and Mysterud, 2013). Fire may also increase the mobility of people and animals by improving networks of trails (Brody, 2002a [1981]; Davies et al., 2005).

The ecological effects of hunter-gatherers' systematic, controlled and deliberate burning of vegetation are sometimes far more substantial than the ecological effects of farmers' clearance and cultivation (Woodburn, 1980). The practice of burning by foragers is a neglected topic in Scandinavian paleoecology, compared to post-Mesolithic farmers' forest clearing (e.g. Fredskild, 1975; Morales-Molino and García-Antón, 2014; Paus, 1982; Prösch-Danielsen, 1993). By contrast, Høeg (1995, 1999) concluded for six sites in South Norway (included in the present study) that the charcoal indicated anthropogenic burning. An obvious reason for not commenting on Lateglacial charcoal occurrence may be that it is often not or only weakly correlated with other changes in the pollen diagrams that could be related to people. Another reason for ignoring charcoal occurrences in Lateglacial pollen records is

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the Northern European settlement record with scarce—however recently increasing—evidence of early records of pioneer settlements, showing a sporadic presence of people after c. 15,500 cal BP (e.g. Ballin et al., 2010; Barton, 1997; Eriksen, 2002; Mithen et al., 2015). Furthermore, even if the population density during the Lateglacial was very low, it was a period characterised by the migrations of mobile hunter-gatherers (Selsing, 2012). Being highly adaptive and generally opportunistic hunters using flexible subsistence strategies, their main strategy may have been to move to places where their resources were present—terrestrial as well as marine (Eriksen, 1996; Nordqvist, 2009). The aim of moving was to make life safe. The routes were primarily cyclic and access to resources must have been satisfied from a broad region along the route.

## 2. The geographical setting and hunter-gatherers' relationship to nature

It is unique that, during the last glacial termination, people for the first time inhabited all the continents (except from Antarctica) and occupied the northern regions of Europe (Straus and Goebel, 2011).

### 2.1. Changes in nature

The deglaciation of Northern Europe since the Last Glacial Maximum was characterised by a retreat interspersed with standstills and re-advances (Hughes et al., 2016). The deglaciation of South Norway started before 15,500 cal BP and the coastal areas were progressively deglaciated during the Lateglacial (Stroeven et al., 2015). In West Norway, the Older Dryas ice margin was located close to the Younger Dryas ice margin, in some places inside and in other places outside (Mangerud et al., 2017). There is evidence for ice-marginal positions during the Allerød in South Norway (chronology and age, see Table 2) and the estimated minimum retreat of the ice margin implies large ice-free coastal areas in western and southwestern Norway (Lohne et al., 2007; Mangerud, 1977, 1980). About 12,700 cal BP, the ice sheet readvanced during the Younger Dryas, in the southwest by approx. 40–50 km. In the southeast, the outer coastal areas were deglaciated 14,200–13,600 cal BP and were characterised by ice-front oscillations that resulted in ice-marginal deposits far inland with a marine limit up to 221 m asl (Bargel, 2005; Bergström, 1999; Sørensen, 1983). The early traces of people therefore may be located high above the present sea level (e.g. Johansen, 1964; Jonsson, 2014; Åhrberg, 2012). A changing archipelago characterised this coast with a calving ice margin since 13,100 cal BP (Bargel, 2005; Sørensen, 1983). The interior was covered by inland ice during the Lateglacial (Vorren and Mangerud, 2006); although this statement has been questioned in recent years (e.g. Kolstrup and Olsen, 2012; Kullman, 2002, 2013; Parducci et al., 2012a, 2012b).

A mosaic of landscape elements with large variations in vegetation over short distances dominated and changed due to the Lateglacial climate (Krzywinski and Stabell, 1984; Kristiansen et al., 1988; see also references in Table 1). Herbs dominated the pioneer vegetation during the pre-Bølling period before a shrub consolidation phase took over with e.g. willow (*Salix*), juniper (*Juniperus*), dwarf birch (*Betula nana*) and Ericales in the early Interstadial phase. Following Paus (1995) tree birch may have arrived locally delayed 200–300 years compared to the Bølling warming and formed a birch tree/shrub vegetation in Rogaland, southwest Norway. The mid-Bølling Arctic treeline may have crossed north Rogaland. During the Allerød, closed birch forest probably did not develop north of Rogaland when tree birch migrated as far north as Møre and Romsdal in northwest Norway. Herb vegetation with dwarf shrubs took over in the Younger Dryas with tree birch only at sheltered sites in south Rogaland. During the late Younger Dryas, vegetation with shrubs and dwarf shrubs developed. The short climatic deteriorations (about 14,200 cal BP, 13,500 cal BP and 13,100 cal BP) were unfavourable to forest (e.g. Paus, 1989). Studies on plant macrofossils do

not indicate the presence of birch at two investigated sites in South Norway during the Allerød (Birks, 1993), supported by the evidence from Denmark (Mortensen et al., 2014). Birks' (1993) studies inferred a summer temperature 2–6 °C lower in the Allerød than has been proposed from pollen alone.

The distribution of the fauna was determined by the changes in the distribution of land, sea and ice (Aaris-Sørensen, 2009). The only widespread terrestrial prey during the Lateglacial was reindeer. Other big game was wild horse, and mammoth lived at the Continent, in addition to smaller mammals and birds (Eriksen, 1996). Important prey such as elk, deer, wild boar, bear and beaver, immigrated to Scandinavia after the transition to the Holocene (Aaris-Sørensen, 1998; Aaris-Sørensen et al., 2007; Kindgren, 1995; Lie, 1986, 1988, 1990). The coastal zone was rich in resources with access to both terrestrial and marine resources. Marine resources were important when staying at the coast and included seal, whale, fish and many different sea birds, as recorded at Blomvåg, western Norway, the richest Lateglacial bone fauna in Norway dated to the Bølling-Allerød (14,800–13,300 cal BP) (Lie, 1986; Hufthammer, 2001; Mangerud et al., 2017).

The ice-free area available for habitation was the coastal rim, which broadened during the Lateglacial and was delimited by sea-level changes, different from region to region (Hafsten, 1983; Hamborg, 1983; Helle et al., 1997, 2000; Mangerud, 2000; Svendsen and Mangerud, 1987). When the ice cap receded, people were able to enter further into the landscape. The changes in climate, landscape, vegetation and fauna would have influenced the foragers' land use pattern (Eriksen, 2002).

The Inuit in the Canadian Arctic have made systematic use of the environment as a whole—including the sea ice (Aporta, 2002, 2009; Aporta et al., 2011). Hunter-gatherers use and relation to sea ice could—at least theoretically—have been the same in South Norway during the Lateglacial. The presence of sea ice in the Nordic seas retreated abruptly at the start of warm interstadials and spread rapidly during cooling phases, indicating a good correlation between climate and sea ice cover for the last 30,000 years (Hoff et al., 2016).

The people, who used South Norway during the Lateglacial, may have originated from the continuous land area of the British Isles, the North Sea Plain, Denmark, southwest Sweden and the North European Plain, collectively named the Continent (Selsing, 2012). This is in contrast to Glørstad (2016), who proposed the Swedish west coast for the first colonisation in the early Holocene—even if the landscape was habitable earlier.

South Norway has a varying nature today, with many islands along the coast and deep, long fjords, especially in the west. The interior is mountainous, with peaks below 2500 m asl. The climate is maritime in the west and more continental in the east.

### 2.2. Pre-Holocene colonisation and settlement in northern Europe

The earliest settlement of South Norway is an on-going interdisciplinary discussion (Selsing, 2012). Because of the high mobility and flexibility of hunter-gatherers, the migration routes are not important because the Continent was the origin of the people. The immigration can be seen as a historical social process in two steps, limited by environmental and resource factors, defined as the pioneer phase and the residential camp phase by Housley et al. (1997) and used by Selsing (2012) for the immigration to South Norway.

## 3. Methods

### 3.1. Palynological analysis

Laboratory technique followed Fægri and Iversen (1975, 1989). Charcoal counts were carried out along with pollen in standard preparations and counted on the pollen slides in the same size range as pollen (cf. Tolonen, 1985). The percentage of microscopic charcoal is

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