

A preboreal elk (*Alces alces* L., 1758) antler from south-eastern Norway

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Grøndahl FA, Hufthammer AK, Dahl SO and Rosvold J. 2010. A Preboreal elk antler from south-eastern Norway. *Fauna norvegica* 30: 9-12.

In 1895 a shed elk antler was found in a mire on a farm near Fluberg, in Søndre Land municipality in south-eastern Norway. The antler was first radiocarbon dated in 2008 and yielded the age $9,100 \pm 50$ BP (8,340 – 8,250 BC), which is the oldest dated elk remain from Norway. Elk (*Alces alces* L., 1758) are a pioneer colonising species; they were already established south of the ice front in Denmark and southern Sweden in the Late Glacial period.

This antler shows that the species had arrived in south-eastern Norway in the late Preboreal period. This could tie in with the earliest arrival of elk once the colonizing routes from southern Sweden were established 9,300-9,200 BP. The antler is clearly of the palmate morph, and strongly resembles elk antlers found in Denmark and southern Sweden from the Late Glacial and Early Holocene periods. This find also reveals that the vegetation at the end of the Preboreal period suited large herbivores such as elk.

Keywords: *Alces alces*, elk, preboreal, immigration, antler morphology, south-eastern Norway

doi: 10.5324/fn.v30i0.629. Received: 2010-03-09. Accepted: 2010-07-02. Published online: 2010-12-21.

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INTRODUCTION

Sub-fossil remains of vertebrates, in particular bones, have been found in large parts of Norway. Isolated finds are however rare, and most derive from archaeological excavations of human dwelling sites. Such finds are primary evidence for faunal immigration history, and may provide important information about how the landscape and vegetation have developed.

Little is known about Norwegian vertebrate fauna during the Preboreal, the first millennia of the Holocene. Elk (*Alces alces* L., 1758) were however one of the first new mammal species to migrate into Norway as the ice receded. A shed antler found in a drained bog in Hov in Løten municipality, Hedmark county, was ^{14}C -dated to $8,520 \pm 140$ BP (Henningsmoen 1975), and has until now been the oldest dated find of the species. Burnt bones

of elk together with beaver (*Castor fiber* L., 1758) and wild boar (*Sus scrofa* L., 1758) have also been found in a coastal human dwelling site at Tørkop, in Halden municipality in Østfold county. This site has been ^{14}C dated by charcoal to between 8,800 and 7,000 BP (Mikkelsen et al. 1999; Hufthammer 2006).

In this article we report a new ^{14}C dating of an isolated find of an elk antler, pushing back its arrival to Norway by several hundred years. We provide a description of its morphological characteristics, and discuss the ecological implications of the find.

MATERIAL AND METHODS

The antler was found in 1895 by workers digging a ditch in a bog near Fluberg (UTM 32 north 6738500 east 570300) 420 m.a.s.l. in Søndre Land municipality in Oppland county (Figure 1), and the find has been kept on the farm ever since. It was located at a depth of about 1 m, but the exact find site is unknown. The find was briefly described by Collett (1912) who indicated that

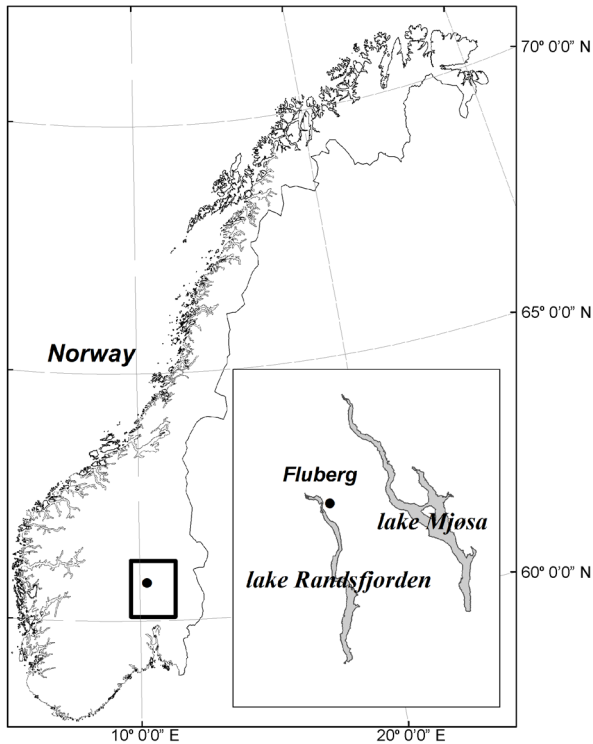


Figure 1. The map shows the site of the antler find north-east of the lake Randsfjorden (© Norge digitalt).



Figure 2. The elk antler from Fluberg, Søndre Land municipality in south-eastern Norway. Photo: Finn Audun Grøndahl.

it might be of Late Glacial age. A 1.4 gram section of the antler by the pedicle was sent for ^{14}C dating by accelerator mass spectrometry (AMS) at the Poznan Radiocarbon Laboratory in Poland. The ^{14}C date was calibrated using CALIB 5.0.1 (Stuiver & Reimer 1993) with the calibration curve Intcal04 (Reimer et al. 2004), using 1 standard deviation ranges. If not specified, all the reported ages are in ^{14}C years before present (BP).

RESULTS

The elk antler from Fluberg has been dated to $9,100 \pm 50$ BP (Poz-22238) which corresponds to 8,340-8,250 BC. This is the oldest dated elk remain from Norway.

The antler, which has been shed, is clearly of the palmate morph with 13 tines and no apparent form of division (Figure 2). All the tines are short, measuring between 5-175 mm, with two being so small that they are barely measurable. The length of the beam is unknown as it had been sawn off upon mounting. The antler has been evaluated according to the C.I.C. standard, and was awarded 283 points, which meets the requirement for a silver medal. Morphologically the antler shows strong resemblance to antlers found in southern Sweden and Denmark from the Late Glacial and Early Holocene periods (Liljeborg 1874; Liljegen & Lagerås 1993; Aaris-Sørensen 2009).

DISCUSSION

Reindeer (*Rangifer tarandus* L., 1758), polar bear (*Ursus maritimus* Phipps, 1774) and stoat (*Mustela erminea* L., 1758) are known from the Late Glacial period in Norway (Fjellberg 1978; Blystad et al. 1983; Lie 1986; Hufthammer 2001). The elk antler from Fluberg is the oldest Holocene find of a terrestrial mammal in Norway, with the exception of a reindeer

antler from Egersund in Rogaland county that has been dated to $10,255 \pm 80$ BP (T-8821) (Osteological Archive, Natural History Collections, University of Bergen). The Fluberg antler is also one of the very few mammal remains from inland south-eastern Norway. The shed antler is almost intact, which is rare as almost all prehistoric Holocene bone finds from eastern Norway are small burnt fragments (Hufthammer 2006). The find confirms the elk as a pioneer species in Norway.

At the start of the Holocene most of the Scandinavian peninsula was covered by ice (Andersen & Borns 1997). Southern Sweden however was free of ice before 14,000 BP (Lagerlund & Houmark-Nielsen 1993), and elk bones from this area have been dated to about $11,345 \pm 70$ BP (LuS-7685) (Aaris-Sørensen 2009). Until about 9,300-9,200 BP southern Sweden was separated from the rest of the peninsula by the Närke Strait (Björck, fig 14, 1995). The northward immigration of mammals probably occurred as soon as colonizing routes were established. The Fluberg antler thus shows that elk were among the first mammals to colonize south-eastern Norway. This is not surprising since elk, and especially young bulls, have a strong dispersal propensity. Young bulls have been recorded dispersing several hundred km (Hoffman et al. 2006). They are able to move through alpine areas, over ice covered lakes, and have no problems with crossing open waters (Collett 1912). Elk are also adapted to exploit vegetation in early stages of succession where willows (*Salix* spp.), birch (*Betula* spp.) and Scots pine (*Pinus sylvestris*) are important browse (Andersen & Sæther 1996).

The Fluberg antler is very large compared to the average size of those of modern Norwegian elk (Solberg et al. 2006). Elk remains from Late Pleistocene and Early Holocene times in Europe suggest that the species had a larger body and considerably larger antlers than modern elk (Kurtén 1968). The landscape south of the glaciers at the end of the Last Ice Age was characterized by open steppe tundra vegetation (Andersen 2000), and antler mass of ungulates is generally larger in open as opposed to forest landscapes (Geist 1999). The frequency of palmate antlers increase to the north and with increasing body size (Sæther & Haagenrud 1985; Engan 2001). The largest antlers are in general found among six year olds which, in modern Norwegian populations, have an average of 10-12 antler tines in total (Solberg et al. 2006). The antler therefore represents a prime-aged bull in very good condition.

The ecological context

At the beginning of the Holocene the ice sheet extended to the Oslo area (Andersen 1980). During the following centuries a dramatic climate improvement caused the rapid withdrawal of the ice from large parts of eastern Norway, and at about 9,000 BP the ice margins in south-eastern Norway were situated just

north of the find (Sørensen 1983).

The Fluberg antler shows that the area was ice free, and that the vegetation was able to sustain elk. Pollen analytical examinations have been done in several sites not far from Fluberg (Figure 3). A pollen sample from the lowest layer in a bog (9,000-8,700 BP), in Østsinni in Nordre Land municipality, 545 m.a.s.l. and 9 km north of Fluberg, shows that pioneer species such as sea-buckthorn (*Hippóphaë rhamnoides* L., 1758), dwarf birch (*Betula nana* L., 1758), willow (*Salix* spp.) and birch (*Betula* spp.) dominated (Høeg 1990). The lowest layers of the Skonnord bog (9,100-8,100 BP) in Gjøvik municipality, 436 m.a.s.l. and 15 km east of Fluberg, show the same type of vegetation with the addition of juniper (*Juniperus communis* L., 1758) (Høeg 2007). This is further confirmed by a pollen diagram from a bog near Engelaug in Løten municipality, 184 m.a.s.l. and 60 km east of Fluberg, where a pioneer shrub vegetation dominated in the lowest layer (9,700-9,350 BP) followed by open birch forest (9,350-9,050 BP) (Høeg 1996).

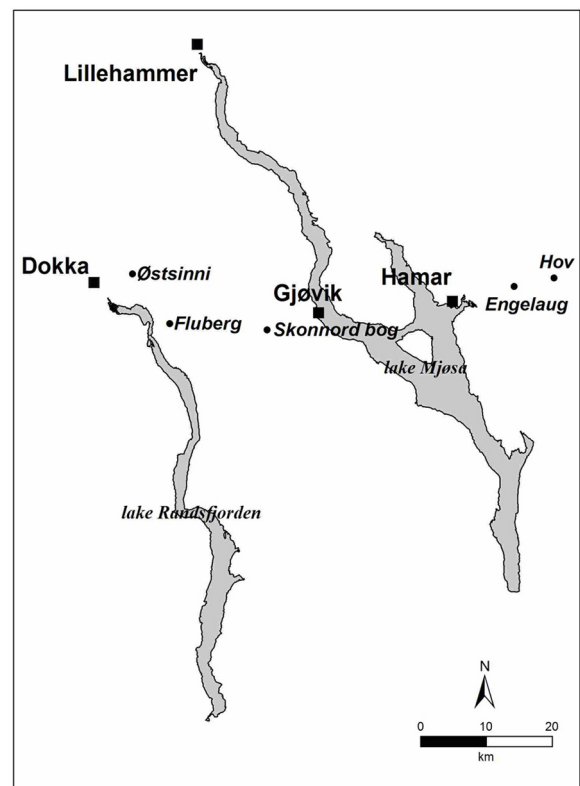


Figure 3. The map shows pollen analytical examination sites close to the find site of the Fluberg antler. Hov is the find site of the elk antler from Løten municipality, Hedmark county (© Norge digitalt).

CONCLUSIONS

The Fluberg antler confirms the elk as a pioneer species in the inland of south-eastern Norway at the end of the Preboreal. Elk colonized southern Norway as soon as it was physically possible, and when the area could provide sufficient browse for the species. The antler shows a prime-aged bull in very good condition.

ACKNOWLEDGEMENTS

The Frøtheim family in Fluberg has been very helpful, and allowed samples to be taken from the antler for dating. Geir Høitomt gave useful assistance. Kim Aaris-Sørensen, Thijs van Kolfsochten, Helge Irgens Høeg, Mona Henriksen, Reidar Andersen and Vidar Holthe read the manuscript and supplied with important information. Ola Hellerud must be specially thanked for the maps he produced. Alastair Brown assisted with the English translation.

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