Available online at www.sciencedirect.com
ScienceDirect
Review of Palaeobotany and Palynology 141 (2006) 189–201
Review of Palaeobotany & Palynology
www.elsevier.com/locate/revpalbo

# Mid-Holocene environmental change at Black Ridge Brook, Dartmoor, SW England: A new appraisal based on fungal spore analysis

J.J. Blackford [a,*], J.B. Innes [b], J.J. Hatton [c], C.J. Caseldine [c]

[a] *Geography, School of Environment and Development, The University of Manchester, Oxford Road, Manchester M13 9PL, UK*
[b] *Department of Geography, University of Durham, Science Laboratories, South Rd. Durham DH1 3LE, UK*
[c] *Department of Geography, University of Exeter, Amory Building, Rennes Drive, Exeter EX4 4RJ, UK*

Received 31 January 2005; accepted 20 March 2006
Available online 16 June 2006

**Abstract**

Black Ridge Brook is an upland peat site in a high rainfall area of SW England. Pollen evidence has shown that it was once wooded, with *Betula* and *Corylus* dominant, before periods of change to more open ground and the spread of mire vegetation. Previous palaeoecological work at the site inferred a history of burning based on microscopic charcoal levels, with the burning periods reducing *Betula* cover. These changes occurred between 9000 and 6300 BP (radiocarbon years) during the Mesolithic archaeological period, and have been linked to the impacts of hunter–gatherers using fire, as suggested elsewhere in upland Britain.

In this paper, hypotheses of deliberate burning, grazing and the reasons for using fire are tested using non-pollen palynomorphs in addition to the microcharcoal and pollen data. While indicators of dung are present, the frequencies are low, and not always in the levels expected on the basis of vegetation change, although some correlation of disturbance indicators is seen in the earlier Holocene before woodland cover reached a maximum. There is evidence for increased and sustained growth of *Corylus* following increases in inferred fire frequency. Statistical analysis of the combined data set shows the association of some non-pollen types with specific stages in the development, and then recession, of woodland. Other types show the presence of on-site burning or host plants, and help distinguish between local and regional vegetation changes. The nature of the depositional environment is both shown by, but also affects, the non-pollen microfossil record.


*Keywords:* Mesolithic; charcoal; fungal spores; pollen; NPPs; fire; Dartmoor

## 1. Introduction

The Mesolithic period in upland Britain, as elsewhere in northern Europe, is thought to have been characterised by a system of land use by hunter–gatherer communities (Innes and Simmons, 1988; Edwards, 1990; Caseldine and Hatton, 1993). This regime is thought to have involved the deliberate burning of woodland vegetation to improve the livelihoods of people through a number of mechanisms — improving browse or grazing for wild animals, increasing hunting success, increasing the production of *Corylus avellana* nuts or *Quercus* acorns, or driving game animals as a hunting technique. There is a large and varied literature that deals with this issue,

* Corresponding author.
*E-mail address:* Jeff.Blackford@Manchester.ac.uk (J.J. Blackford).

0034-6667/$ - see front matter © 2006 Elsevier B.V. All rights reserved.
doi:10.1016/j.revpalbo.2006.03.009

showing a range of disturbance types from fire-related canopy manipulation, disturbance without fire, increases in grassland (Poaceae) and increases in *Corylus avellana*-type pollen frequencies. At the most convincing locations, multiple-cores and high-resolution analyses have been used to reconstruct the spatial scale of fire events (Innes and Simmons, 2000), the duration of forest disturbances (Simmons and Innes, 1996; Edwards, 1996) and the relationship to the 'artefactual' Mesolithic (Edwards, 1990). Predominantly through the use of fire, Mesolithic activity has been suggested as a cause of blanket peat formation (Simmons and Innes, 1985; Smith and Cloutman, 1988; Innes and Simmons, 1988; Moore, 1993), and the beginning, in patches at least, of the open landscapes that now dominate the uplands of the British Isles.

Despite this research, there remain doubts as to the importance of human actions on the vegetation changes recorded. While at or near some palaeoecological sites there are records of Mesolithic flint scatters, at others these are absent, distant or undated. Woodland disturbance and changes in the tree–non tree ratio, and even fires, are expected elements of natural forest dynamics. The initial status of untouched closed woodland in the mid-Holocene has also been questioned (Vera, 2000). Hence, while the Mesolithic impacts model is, on balance, the favoured explanation for the palynological record of the period, there remain serious doubts (Tipping, 1996; Edwards, 1996; Brown, 1997), particularly in distinguishing between natural and anthropogenic events.

In a discussion of the evidence for Mesolithic burning, Caseldine and Hatton (1993: 120) referred to: "...something of an inferential approach, as there is rarely any direct evidence for the purpose of the fire." Further data are required, ideally of a different type from those previously presented, in order to resolve these issues.

Fungal spores have increasingly been used alongside more commonly counted microfossils in palaeoecological studies (for example van Geel et al., 2003; Innes and Blackford, 2003; various authors in this volume). They include types likely to represent the presence of decaying wood, dung, fire or specific host plant species and add to the overall reconstruction of both depositional context and surrounding environment (van Geel et al., 2003). Phases of on-site burning during the later Mesolithic at North Gill, north-east England (Innes and Blackford, 2003), were followed by an increased presence of animals as shown by significant peaks in frequencies of dung fungi. There is no reason to suppose that fresh dung was transported to this site in any other way, and so these data to an extent confirmed the model of 'manipulation' to improve resources for hunter–gatherers. In the context of earlier inferred Mesolithic disturbance, therefore, it seems likely that additional evidence can be gained that may enhance the current understanding of events through this period and further test the hypothesis of significant Mesolithic impacts. In this paper a site where significant, fire-related environmental changes have been inferred from the Mesolithic period, is re-examined using fungal spores and other non-pollen microfossils.

## 2. Materials and methods

### *2.1. The study area*

Dartmoor, in south west England (Fig. 1a) is one of several upland areas dominated by heathland or acid-grassland vegetation in the British Isles. The area has been the subject of several previous palynological studies (reviewed by Caseldine, 1999) and was one of the first areas that yielded data interpreted as showing pre-agricultural impacts on deforestation and peat inception (Simmons, 1964). The vegetation changes and linked fire history shown in this initial work were confirmed by later re-examination of the site analysed initially by Simmons et al. (1983) and at further sites from elsewhere in the upland peat-covered areas (Caseldine and Maguire, 1986; Caseldine and Hatton, 1993). Overall, Mesolithic communities probably played a part in landscape change, promoting peat growth and open vegetation (Caseldine and Hatton, 1996a,b). As part of a wider examination of the Mesolithic palaeoecological record using fungal spores and other non-pollen palynomorphs, Black Ridge Brook was selected due to the age, charcoal record and structure in the existing palynological record and the presence of a later-Mesolithic microlith site within 3 km (Jacobi, 1979). The site, close to a small stream in a peat-filled river valley at 447 m altitude (Fig. 1b) showed a sequence of tree recession episodes associated with high charcoal frequencies. This sequence eventually resulted in peatland expansion, a modified *Quercus*-dominated woodland and, on higher ground, open or scrubby vegetation. The 'Black Ridge Brook model' (Caseldine and Hatton, 1993), proposed that this period of very frequent burning, shown by consistently high microcharcoal values between 7700 and 6300 BP (radiocarbon years) was probably anthropogenic. This paper re-examines the Black Ridge Brook (BRB) data with the addition of fungal spores and other remains from the original samples prepared by Hatton (1991). This negates any potential problems of correlation between sampled profiles and enables a direct comparison of pollen, charcoal and fungal data. In addition to the period of highest charcoal counts, periods