
Mesozoic and Tertiary palaeobotany of Great Britain

C.J. Cleal Department of Biodiversity and Systematic Biology, National Museums and Galleries of Wales, Cardiff, UK

B.A. Thomas Welsh Institute of Rural Studies, University of Wales Aberystwyth, Aberystwyth, UK

D.J. Batten Institute of Geography and Earth Sciences University of Wales Aberystwyth, Aberystwyth, UK

and M.E. Collinson Geology Department, Royal Holloway University of London, Egham, UK

GCR Editor: D. Palmer

Published by the Joint Nature Conservation Committee, Monkstone House, City Road, Peterborough, PE1 1JY, UK

First edition 2001

©2001 Joint Nature Conservation Committee

Typeset in 10/12pt Garamond ITC by JNCC

Printed in Great Britain by CLE Print Limited on Huntsman Velvet 100 gsm.

ISBN 1 86107 489 1.

A catalogue record for this book is available from the British Library.

Apart from any fair dealing for the purposes of research or private study, or criticism or review, as permitted under the UK Copyright Designs and Patents Act, 1988, this publication may not be reproduced, stored, or transmitted, in any form or by any means, without the prior permission in writing of the publishers, or in the case of reprographic reproduction only in accordance with the terms of the licences issued by the Copyright Licensing Agency in the UK, or in accordance with the terms and licences issued by the appropriate Reproduction Rights Organization outside the UK. Enquiries concerning reproduction outside the terms stated here should be sent to the GCR Team, JNCC.

The publisher makes no representation, express or implied, with regard to the accuracy of the information contained in this book and cannot accept any legal responsibility or liability for any errors or omissions that may be made.

British Geological Survey and Ordnance Survey copyright protected materials

1. The copyright of materials derived from the British Geological Survey's work is vested in the Natural Environment Research Council. No part of these materials (geological maps, charts, plans, diagrams, graphs, cross-sections, figures, sketch maps, tables, photographs) may be reproduced or transmitted in any form or by any means, or stored in a retrieval system of any nature, without the written permission of the copyright holder, in advance.
2. To ensure that copyright infringements do not arise, permission has to be obtained from the copyright owner. In the case of BGS maps this includes both BGS and the Ordnance Survey. Most BGS geological maps make use of Ordnance Survey topography (Crown Copyright), and this is acknowledged on BGS maps. Reproduction of Ordnance Survey materials may be independently permitted by the licences issued by Ordnance Survey to many users. Users who do not have an Ordnance Survey licence to reproduce the topography must make their own arrangements with the Ordnance Survey, Copyright Branch, Romsey Road, Southampton SO9 4DH (Tel. 01703 792913).
3. Permission to reproduce BGS materials must be sought in writing from the Intellectual Property Rights Manager, British Geological Survey Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG (Tel. 0115 936 3331).

4. The National Grid is used on diagrams with the permission of the Controller of Her Majesty's Stationery Office, Crown copyright licence no. GD 27254X/01/00.

Recommended example citations

Cleal, C.T., Thomas, B.A., Batten, D.J. and Collinson, M.E. (2001) *Mesozoic and Tertiary Palaeobotany of Great Britain*, Geological Conservation Review Series, No. 22, Joint Nature Conservation Committee, Peterborough.

Collinson, M.E. and Cleal, C.J. (2001) Paddy's Gap. In *Mesozoic and Tertiary Palaeobotany of Great Britain*, Geological Conservation Review Series, No. 22, (C.J. Cleal, B.A. Thomas, D.J. Batten, and M.E. Collinson), Joint Nature Conservation Committee, Peterborough, pp. 245–47.

Contents

Acknowledgements

Access to the countryside

Conserving our fossil heritage — JNCC policy statement

Preface N.V Ellis

1 Introduction to the Mesozoic and Tertiary palaeobotany of Great Britain C.J. Cleal and B.A. Thomas

Overview

Introduction

Mesozoic–Tertiary vegetational history

Palaeobotanical problems

The systematics of the Plant Kingdom

The selection of Mesozoic–Tertiary palaeobotany GCR sites

2 The Triassic palaeobotany of Great Britain B.A. Thomas and D.J. Batten

Introduction

History of research

Palaeogeographical and stratigraphical setting

Triassic vegetation

Triassic palaeobotanical sites in Britain

Hapsford Bridge

Cnap Twt

3 The Jurassic palaeobotany of Yorkshire B.A. Thomas and D.J. Batten

Introduction

History of research

Palaeogeographical setting

Stratigraphical background

Yorkshire Jurassic vegetation

Palaeobotanical sites in the Yorkshire Jurassic succession

Whitby–Saltwick

Runswick Bay

Roseberry Topping

Broughton Bank (Hasty Bank)

Hillhouse Nab

Hayburn Wyke

Botton Head

Beast Cliff (Robin Hood's Bay)

Maw Wyke (Hawsker Bottoms)

Red Cliff (Gristhorpe Bay/Cayton Bay)

Cloughton Wyke

Scalby Ness

4 The Jurassic palaeobotany of southern England C.J. Cleat, B.A. Thomas and D.J. Batten

Introduction

History of research

Palaeogeographical setting

Stratigraphical background

Jurassic vegetation in southern England

Palaeobotanical sites in the Jurassic rocks of southern England

Stonesfield

Huntsman's Quarry

Maggot, Kingbarrow and Waycroft quarries

5 The Jurassic palaeobotany of Scotland B.A. Thomas and D.J. Batten

Introduction

History of research

Palaeogeographical setting

Stratigraphical background

Jurassic vegetation in Scotland

Palaeobotanical sites in the Jurassic rocks of Scotland

Brora

Culgower Bay

Lothbeg Point

Eathie Fishing Station

Bearreraig

6 The Cretaceous palaeobotany of Great Britain B.A. Thomas and D.J. Batten

Introduction

History of research

Palaeogeographical setting

Stratigraphical background

Early Cretaceous vegetation

Cretaceous palaeobotanical sites in Britain

Covehurst

Hanover Point

Luccombe Chine

Cliff End

7 The palaeobotany of the Palaeocene and Palaeocene–Eocene transitional strata in Great Britain M.E. Collinson and C.J. Cleal

Introduction

History of research

Palaeogeographical setting

Stratigraphical background

Palaeocene and Palaeocene–Eocene transitional vegetation

Palaeobotanical sites in the Palaeocene and Palaeocene–Eocene transition of Britain

Herne Bay

Felpham

Cold Ash

Pincent's Kiln

Harefield

Harwich

Walton-on-the-Naze

Ardtun

8 Early and early–middle Eocene (Ypresian–Lutetian) palaeobotany of Great Britain M.E. Collinson and C.J. Cleal

Introduction

History of research

Palaeogeographical setting

Stratigraphical background

Early and early middle Eocene vegetation

Early and early middle Eocene palaeobotanical sites in Britain

Sheppey

Herne Bay

Wrabness

Bognor Regis

Lake

Arne

Bracklesham

Whitecliff Bay

9 Late middle Eocene–early Oligocene (Bartonian–Rupelian) and Miocene palaeobotany of Great Britain M.E. Collinson and C.J. Cleal

Introduction

History of research

Palaeogeographical setting

Stratigraphical background

Post-Lutetian vegetation

Post-Lutetian palaeobotanical sites in Britain

Highcliffe

Barton

Hordle-Beacon Cliffs

Paddy's Gap

Headon Hill and Totland Bay

Colwell Bay

Chapel Corner

Thorness Bay

Hamstead Ledge

Bouldnor Cliff

Bees Nest

References

Glossary

Fossil index

General index

Acknowledgements

Work on this volume was initiated by the Nature Conservancy Council and has been seen to completion by the Joint Nature Conservation Committee on behalf of the three country agencies, English Nature, Scottish Natural Heritage and the Countryside Council for Wales. The late Dr George Black, then Head of the Geology and Physiography Section of the Nature Conservancy Council, initiated the project in 1977. C. Cleal is grateful to him for the invitation to participate in the project; also to Dr Bill Wimbleton (then Head of the GCR Unit) for his help and support during the site selection.

Many specialists in addition to the authors have been involved in the assessment and selection of sites; this vital work is gratefully acknowledged. In particular, we thank Dr Richard Bateman (now at the Natural History Museum, London), Professor Peter Crane (now at the Royal Botanic Gardens, Kew), Dr Chris Hill (formerly at the Natural History Museum, London), Mr Cedric Shute (formerly at the Natural History Museum, London), Dr Joan Watson (University of Manchester) and Mr R. Williams (Redcar, Teeside) and Dr Bill Wimbleton (Countryside Council for Wales, Cardiff).

Thanks are also due to the GCR Publication Production Team: Mr Neil Ellis, Publications Manager, and Miss Anita Carter, Production Editor. The diagrams were produced by Xipress IT Solutions of Newmarket by Drs Susanne White and Chris Pamplin.

Where the content of illustrations has been replicated or modified from the work of others appropriate acknowledgements are given in the captions. The National Grid is used on diagrams with the permission of the Controller of Her Majesty's Stationery Office, © Crown copyright licence no. GD 27254X/01/00. Photographs are accredited in the captions.

Finally, we acknowledge the contribution to this work by the late Miss Morag Jones, who did much of the selection of the Yorkshire Jurassic sites. Morag died shortly after leaving the GCR Unit, in a tragic accident while on a palaeontological expedition to North Africa. We dedicate this volume to her.

Access to the countryside

This volume is not intended for use as a field guide. The description or mention of any site should not be taken as an indication that access to a site is open. Most sites described are in private ownership, and their inclusion herein is solely for the purpose of justifying their conservation. Their description or appearance on a map in this work should not be construed as an invitation to visit. Prior consent for visits should always be obtained from the landowner and/or occupier.

Information on conservation matters, including site ownership, relating to Sites of Special Scientific Interest (SSSIs) or National Nature Reserves (NNRs) in particular counties or districts may be obtained from the relevant country conservation agency headquarters listed below:

Countryside Council for Wales, Plas Penrhos, Ffordd Penrhos, Bangor, Gwynedd LL57 2LQ.

English Nature, Northminster House, Peterborough PE1 1UA.

Scottish Natural Heritage, 12 Hope Terrace, Edinburgh EH9 2AS.

Conserving our fossil heritage — JNCC policy statement

Fossils are a key part of our natural heritage and form a major scientific, educational and cultural resource. They are fundamental to understanding the evolution of life and the character of ancient environments. Fossils also provide a basis for comparing the ages of rocks the world over.

The discovery, collection and study of the fossilized remains of ancient life can be enjoyable and stimulating activities that give people a fascinating insight into the geological and biological history of the Earth. However, the available fossil resource is finite. It is only through maintaining a prudent approach to the management of important fossil sites that future generations will be able to experience, study and enjoy this resource.

Responsible fossil collecting

In most circumstances, responsible fossil collecting is not harmful to the conservation of fossil sites. It can actually benefit our understanding of geology. This is particularly true where the fossils are relatively common or the sites in which they are found are subject to high levels of natural or artificial degradation, such as coastal cliffs that are being eroded or quarries that are being actively worked. In such situations collecting fossil specimens that might otherwise be destroyed can be beneficial to science, provided that they are properly documented and made available for study. Responsible fossil collecting can therefore be a valuable activity in the sustainable management and safeguard of our fossil heritage.

Irresponsible fossil collecting

Irresponsible collecting provides no scientific or educational gain and is therefore an unacceptable activity resulting in irreparable damage to our fossil heritage. It will pose a clear threat where fossils are rare or the fossil source is limited in extent, for example in a cave or a river channel deposit. Collecting without proper recording and curation, inexperienced collecting, over-collecting and inappropriate use of power tools and heavy machinery are likely to reduce or even destroy the scientific value of such sites. Unless the activity is undertaken in an appropriate manner, the statutory nature conservation agencies, the Countryside Council for Wales, English Nature, Environment and Heritage Service and Scottish Natural Heritage, will oppose fossil collecting on the small number of Sites of Special Scientific Interest /Areas of Special Scientific Interest where this activity would cause significant damage to the features of special interest.

Code of good practice

Adopting a responsible approach to collecting is essential for conserving our fossil heritage. The basic principles set out below should be followed by all those intending to collect fossils.

Access and ownership — permission to enter private land and collect fossils must always be gained and local bylaws should be obeyed. A clear agreement should be made over the future ownership of any fossils collected.

Collecting — in general, collect only a few representative specimens and obtain these from fallen or loose material. Detailed scientific study will require collection of fossils *in situ*.

Site management — avoid disturbance to wildlife. Many invertebrates and lower plants live on or under loose rocks that should be replaced in their original positions whenever possible. Do not leave the site in an untidy or dangerous condition for those who follow.

Recording and curation — always record precisely the locality at which fossils are found and, if collected *in situ*, record relevant details of the position of the rock layer from where the fossil was collected. Ensure that these records can be directly related to the relevant specimens. Where necessary, seek specialist advice on specimen identification and care. Fossils of prime scientific importance should be placed in a suitable repository, normally a museum with adequate curatorial and storage facilities.

Achieving positive management

In order to achieve the successful management of the fossil heritage of the United Kingdom, the statutory nature conservation agencies will:

- Promote the responsible approach outlined in the *Code of Good Practice*, above.
- Encourage the placement of scientifically important fossils into a suitable repository (such as a museum) in order to ensure their proper curation, long-term security and accessibility
- Recognize the contribution that responsible fossil collectors can make to geological and palaeontological study.
- Encourage collaboration within the geological community to ensure that maximum educational and scientific gain is made from our fossil resource.
- Support and encourage initiatives that increase awareness and understanding of the value of our fossil resource and the need to conserve it.
- Increase awareness and understanding of the differing management needs of fossil sites. In particular, encourage landowners and occupiers to become advocates for conservation of the fossil resource.
- Review the need for export and import controls on the international trade in fossil specimens.

Preface

There is such a diversity of rocks, minerals, fossils and landforms packed into the piece of the Earth's crust we call 'Britain' that it is difficult not to be impressed by the long, complex history of geological change to which they are testimony. But if we are to improve our understanding of the nature of the geological forces that have shaped our islands, further unravel their history in 'deep time' and learn more of the history of life on Earth, we must ensure that the most scientifically important of Britain's geological localities are conserved for future generations to study, research and enjoy. Moreover, as an educational field resource and as training grounds for new generations of geologists on which to hone their skills, it is essential that such sites continue to remain available for study. The first step in achieving this goal is to identify the key sites. This is the aim of the Geological Conservation Review.

The GCR, launched in 1977, is a world-first in the systematic selection and documentation of a country's best Earth science sites. No other country has attempted such a comprehensive and systematic review of its Earth science sites on anything near the same scale. After over two decades of site evaluation and documentation, we now have an inventory of over 3000 GCR sites, selected for 100 categories covering the entire range of the geological and geomorphological features of Britain.

This volume, detailing the Mesozoic and Tertiary Palaeobotany GCR sites, is the 22nd to be published in the intended 42 volume GCR series. Not only does it contain the descriptions of key localities that will be conserved for their contribution to our understanding of the palaeontology and palaeobiology of plants, but also provides an excellent summary of the floral realms in Britain and the considerable research that has been undertaken on it. The book will be invaluable as an essential reference book to those engaged in the study of these rocks and will provide a stimulus for further investigation. It will also be helpful to teachers and lecturers and for those people who, in one way or another, have a vested interest in the GCR sites: owners, occupiers, planners, those concerned with the practicalities of site conservation and indeed the local people for whom such sites are an environmental asset. The conservation value of the sites is mostly based on a specialist understanding of the stratigraphical, palaeontological and sedimentological features present and is therefore, of a technical nature. The account of each site ends, however, with a brief summary of the geological interest, framed in less technical language, in order to help the non-specialist. The first chapter of the volume, used in conjunction with the glossary, is also aimed at a less specialist audience. This volume is not intended to be a field guide to the sites, nor does it cover the practical problems of their ongoing conservation. Its remit is to put on record the scientific justification for conserving the sites.

This volume deals with the state of knowledge of the sites available at the time of writing, in 1998–2000, and must be seen in this context. Palaeontology, like any other science, is an ever-developing pursuit with new discoveries being made, and existing models are subject to continual testing and modification as new data come to light. Increased or hitherto unrecognized significance may be seen in new sites. Indeed, during the progress of writing this book, new sites have been proposed for the Palaeobotany GCR lists, and it is possible that further sites worthy of conservation will be identified in future years. Nevertheless, there is still much more to learn and the sites described in this volume are as important today as they have ever been in increasing our knowledge and understanding of the palaeobotany of Britain. This account clearly demonstrates the value of these sites for research, and their important place in Britain's scientific and natural heritage. This, after all, is the *raison d'être* of the GCR Series of publications.

N.V. Ellis, GCR Publications Manager December 2000

[References](#)