

---

# Palaeozoic Palaeobotany of Great Britain

C.J. Cleal and B.A. Thomas

Department of Botany, National Museum of Wales, Cardiff, UK.

GCR Editor: W.A. Wimbledon and D. Palmer

Chapman & Hall London, Glasgow, New York, Tokyo, Melbourne, Madras

Published by Chapman & Hall, 2–6 Boundary Row, London SE1 8HN, UK

Chapman & Hall, 2–6 Boundary Row, London SE1 8HN, UK

Mackie Academic & Professional, Wester Cleddens Road, Bishopbriggs, Glasgow G64 2NZ, UK

Chapman & Hall GmbH, Pappelallee 3, 69469 Weinheim, Germany

Chapman & Hall USA, One Penn Plaza, 41st Floor, New York NY10119, USA

Chapman & Hall Japan, ITP-Japan, Kyoto Building, 3F, 2–2-1 Hirakawacho, Chiyoda-ku, Tokyo 102, Japan

Chapman & Hall Australia, Thomas Nelson Australia, 102 Dodds Street, South Melbourne, Victoria 3205, Australia

Chapman & Hall India, R. Seshadri, 32 Second Main Road, CIT East, Madras 600 035, India

First edition 1995

© 1995 Joint Nature Conservation Committee

Printed in Great Britain at the University Press, Cambridge

ISBN 0 412 61090 6

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 of licences issued by the appropriate Reproduction Rights Organization outside the UK. Enquiries concerning reproduction outside the terms stated here should be sent to the publishers at the London address printed on this page.

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.

A catalogue record for this book is available from the British Library Library of Congress Catalog Card Number: 94–70931

Printed on permanent acid-free text paper, manufactured in accordance with ANSI/NISO Z39.48:1992 and ANSI/NISO Z39.48–1984 (Permanence of Paper).

## Contents

## Acknowledgements

## **Access to the countryside**

## **Preface**

## **1 Introduction**

Palaeozoic vegetational history

Palaeobotanical problems

The systematics of the Plant Kingdom

The choice of GCR sites

## **2 History of research on British plant fossils**

Silurian

Devonian

Lower Carboniferous

Upper Carboniferous

Permian

## **3 Silurian**

Palaeogeographical setting

Stratigraphical background

Evidence of pre-Silurian vegetation

Silurian vegetation

Silurian plant fossils in Britain

Pen-y-Glog Quarry

Llangammarch Wells Quarry

Rockhall Quarry

Cwm Craig Ddu Quarry

Capel Horeb Quarry

Perton Lane

Freshwater East

## **4 Devonian**

Palaeogeographical setting

Stratigraphical background

Devonian vegetation

Devonian plant fossils in Britain

Targrove Quarry

Turin Hill

Llanover Quarry

Craig-y-Fro Quarry

Ballanucater Farm (R J. Rayner)

Auchensail Quarry (R.J. Rayner)

Rhynie

Bay of Skail

Sloagar

Plaistow Quarry

## **5 Lower Carboniferous**

Palaeogeographical setting

Stratigraphical background

Early Carboniferous vegetation

Lower Carboniferous plant fossils in Britain

Lennel Braes

Whiteadder

Oxroad Bay (R.M. Bateman, G.W. Rothwell and C.J. Cleal)

Weak Law

Kingwater

Pettycur

Kingswood End

Laggan

Loch Humphrey Burn (R.M. Bateman and C.J. Cleal)

Glenarbuck (R.M. Bateman and C.J. Cleal)

Puddlebrook Quarry

Moel Hiraddug

Teilia Quarry

Wardie Shore

Glencartholm

Victoria Park

## **6 Upper Carboniferous**

Palaeogeographical setting

Stratigraphical background

Late Carboniferous vegetation

Upper Carboniferous plant fossils in Britain

Nant Llech

Wadsley Fossil Forest

Cattybrook Claypit

Nostell Priory Brickpit

Llanbradach Quarry

Jockie's Syke

## **7 Permian**

Palaeogeographical setting

Stratigraphical background

Permian vegetation

The Palaeophytic-Mesophytic transition

Permian plant fossils in Britain

Stairhill

Middridge Quarry

Kimberley Railway Cutting

## **References**

## **Glossary**

## **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. Since the Geological Conservation Review was initiated in 1977 by Dr G.P. Black, then Head of the Geology and Physiography Section of the Nature Conservancy Council, many specialists in addition to the authors have been involved in the assessment and selection of sites; this vital work is gratefully acknowledged.

This volume represents the fruits of a 12-year review of Britain's Palaeozoic palaeobotany sites. It was done in collaboration with most of those palaeobotanists who have an interest in these sites, and who were consulted at both the site-selection and writing-up phases of the project. We recognize that without this collaboration, the project would be effectively meaningless, and we thank all those who have given their advice and suggestions. Certain people have provided particularly valuable input, however, and merit specific mention: Dr Dianne Edwards (University of Wales College of Cardiff) and Mr Peter Tarrant (Morville, Shropshire) for help on the Silurian and Devonian; Dr Albert Long (Berwick-on-Tweed), Dr Nick Rowe (Royal Holloway, University of London), the late Dr John Holmes (Universite des Sciences et Techniques, Montpellier) and Mr Stan Wood (Edinburgh) for help on the Lower Carboniferous; Mr Cedric Shute (Natural History Museum, London) and Ms Gaynor Boon (Sheffield City Museum) for help on the Upper Carboniferous; and Professor Bob Wagner (Jardin Botanico de Cordoba) and Mr Tim Pettigrew (Tyne & Wear Museums Service) for help on the Permian. Most of the photographic illustrations were prepared by the photographic studios of the National Museum of Wales (Cardiff) and the Natural History Museum (London), to whom we are very grateful. Special thanks must go to Mr Cedric Shute of the Natural History Museum, for taking some of the photomicrographs. Line drawings for the volume were prepared by Ian Foulis Associates (Saltash).

Finally, we would like to thank Dr George Black for inviting us to participate in the project, Dr Bill Wimbledon, for his help and support during site-selection and for his patient editing of the early text, and the GCR publication production team — Dr Des O'Halloran, Neil Ellis (Publications Manager); Valerie Wyld (Text Officer); Nicholas D.W. Davey (Scientific Officer/Editorial Assistant).

## **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 or that a right of way exists. 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 in no way 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:

English Nature, Northminster House, Peterborough PE1 1UA.

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

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

## **Preface**

This volume summarizes the results of a survey of British Palaeozoic palaeobotany sites, undertaken between 1978 and 1990 as part of the Geological Conservation Review (GCR). The GCR was the first attempt to assess the scientific significance of all Britain's geological sites and has proved a landmark in the development of a coherent geological conservation strategy in this country. To ensure that the assessments were based on a firm logical and scientific foundation, the range of scientific interest was divided into ninety-seven discrete blocks, reflecting the natural divisions of stratigraphy, palaeogeography and geological process; Palaeozoic palaeobotany was one of these blocks.

The first stage in the survey was a review of the literature, to establish a comprehensive database of sites. From this, a provisional list of potentially significant sites was made and this was circulated to all relevant specialists in this country and abroad. At the same time, the sites were visited to assess their physical condition and whether the interest was still extant. In some cases, this excavation (so-called 'site-cleaning') was carried out to see if the interest of a site could be resurrected or enhanced. The comments made by the specialists and the field observations were then used to produce a second site list, which again was circulated for comment. This process of consultation continued until a consensus was reached among the specialists about which Palaeozoic sites were of sufficient palaeobotanical interest to justify conservation. The minimum criterion was that it was the best in Britain for yielding a particular assemblage of plant fossils. The resulting GCR sites were thus, at the very least, of national scientific importance, although many, such as Craig-y-Fro Quarry, Rhynie and the various Lower Carboniferous petrification sites, were also of international importance.

These GCR sites have been used as building-blocks for establishing a new set of Sites of Special Scientific Interest (SSSIs). If there was no other significant interest at or adjacent to the site, a proposal was made to establish it as an SSSI on the palaeobotanical interest alone. In many cases, however, a site showed other potentially significant features, or it adjoined another site of significance. In these cases, a composite proposed SSSI would be constructed from a set of GCR sites. Despite the heterogeneous nature of such sites, it is important to remember that the palaeobotanical interest is sufficient on its own to justify the conservation of the part of the site yielding the plant fossils. The SSSI proposals that have arisen out of this survey have been sent to the appropriate country conservation agencies (English Nature, Countryside Council for Wales, Scottish Natural Heritage), whose governing Councils are responsible for the final decision to notify them.

This volume is not intended to be a field guide to these sites, nor does it cover the practical problems of their future conservation. Its remit is to put on record the scientific justification for conserving the sites, discussing the interest of the fossils found there, and placing them in a wider palaeobotanical context. Each site is dealt within a self-contained account, consisting of highlights (a précis of its special scientific interest), a general introduction (with a brief historical review of research carried out there), a brief statement as to the stratigraphical context, and a list of all reported plant macrofossil species (including a statement about preservation-types). A detailed interpretation of the significance of the site then follows. This interpretive section has unavoidably had to be couched in technical language, because the conservation value is mostly based on a specialist understanding of the fossils present. The account of each site ends, however, with a brief summary of the interest framed in less technical language, in order to help the non-specialist.

The inclusion of a site in this volume should not be taken as an indication of rights of access, nor should it be taken as an invitation to visit. The majority of the sites are in private ownership and prior permission to visit must always be obtained from the landowner and/or occupier. In many cases the sites are vulnerable to over-exploitation, and it is hoped that those that do visit them will treat them with the respect that should be given to any other part of our unique national heritage.

Finally, it must be emphasized that this volume does not provide a fixed list of the important Palaeozoic palaeobotany sites in Britain. Palaeobotany, like any other science, is an ever-developing pursuit with new discoveries being made continually. During the progress of this very survey, findings at three sites raised them from being of little apparent interest to being of national importance (Targrove Quarry, Kingswood End, Wadsley Fossil Forest). It is inevitable, therefore, that further sites worthy of conservation will be discovered in future years. There is also the problem of potential site loss, with at least one location having come under threat during the time of the survey (Nostell Priory Brickpit). This volume deals with our knowledge of the sites available at the time of the GCR survey (mainly during the 1980s) and must be seen in this context. Nevertheless, the account clearly demonstrates the value of British sites for Palaeozoic palaeobotany, and their important place in Britain's scientific and natural heritage.

## [References](#)