Quaternary of Wales

Geological Conservation Review

S Campbell and D Q Bowen

W A Wimbledon Editor in Chief

NCC catalogue number A4.1

Contents

The Elan Valley Bog

Tregaron Bog (Cors Tregaron)

Cors y Llyn

Chapter 7 — Quaternary stratigraphy: northwest Wales

Lleiniog

Red Wharf Bay

Hen Borth

Moel Tryfan

Dinas Dinlle

Gwydir Bay

Porth Oer

Porth Neigwl

Porth Ceiriad

Glanllynnau

Morannedd

Chapter 8 — The Quaternary of North Wales

Pontnewydd Cave

Cefn and Galltfaenan Caves

Tremeirchion (Cae Gwyn, Ffynnon Beuno) Caves

Vicarage Moss

Snowdon (Yr Wyddfa)

Y Glyderau

Y Carneddau

Llyn Peris

Cwm Dwythwch

Clogwynygarreg

Cons Geuallt

Y Llethr

Rhinog Fawr

Preface

General preface to the Geological Conservation Review series

The British Isles, a comparatively small land area, contains an unrivalled sequence of rocks, rich and varied mineral andlossil deposits, and landforms spanning much of the Earth's long history, including most of that since the appearance of life. Well documented ancient volcanic episodes, famous fossil sites, and sedimentary rock sections used as comparative standards around the world, have given these islands an importance out of all proportion to their small size. The fact that these long sequences of strata and their organic and inorganic contents, evidencing enormous periods of time, have been studied by generations of leading geologists gives Britain a unique status in the development of the science. Many of the divisions of geological time used throughout the world are named after British sites or areas, for instance the Cambrian, Devonian, and Ordovician systems, the Ludlow Series or the Kimmeridgian and Portlandian stages.

The Geological Conservation Review (GCR) was initiated in late 1977 to assess, document and ultimately publish descriptions of the most important parts of this rich heritage. The GCR is intended as a review of the current state of knowledge of the key earth-science sites in Great Britain. It provides a firm factual basis on which site conservation will be founded in coming years. Each of the volumes of the GCR series describes and assesses key sites in the context of a portion of the geological column, or a geological, palaeontological or mineralogical topic. Each site description and assessment is a justification of a particular scientific interest at a locality, of its importance in a British or international setting, and ultimately, by implication, of its worthiness for conservation.

The aim of the Geological Conservation Review series is to inform landowners and occupiers of land, geologists and other scientists, planners and members of a wider public of special features of interest in sites being considered for notification as Sites of Special Scientific Interest (SSSIs). It is written to the highest scientific standards but in such a way that the assessment and conservation value of the sites is clear. It is a public statement of the value set on our geological heritage by the earth-science community which has participated in its production, and it will be used by the Nature Conservancy Council (NCC) in carrying out its conservation functions.

All the sites described in this volume have been proposed for notification as SSSIs by NCC staff, the final decision to notify or renotify is made by the Council itself.

Preface to the Quaternary of Wales

This volume, the first in the Geological Conservation Review series, describes the Quaternary rocks and landforms of Wales. It covers the evidence in the rock record for Pleistocene glaciations, fluctuating sea-levels during and between these catastrophic cold phases, and the presence of ancient flora and fauna, including early Man. The severe climatic decline that characterises the last part of the Cenozoic Era ends with the present (Holocene) interglacial, a period of rapid vegetational change reflecting the climatic improvement which has come with the last ten thousand years of geological time (West 1968).

British geologists were relatively slow to accept the full glacial origins of landscapes and deposits as they had been expounded by Alpine workers such as Venetz and Charpentier in the 1820s and 1830s (North 1943). As late as 1852, Ramsay was systematically documenting and interpreting the evidence for the land-based nature of Britain's ice-masses (Ramsay 1852, 1860; Zittel 1901). The spectacularly glaciated terrain of Wales, particularly Snowdonia, was of the

greatest importance in the establishment and acceptance of the Glacial Theory. It was in Wales and the Welsh borderlands that it was for the first time demonstrated that the 'Ice Age' was in fact not a single event, but a sequence of cold events separated by temperate phases. The ice-carved Welsh uplands still form classic ground for the student of Pleistocene glacial history and geomorphology. They and the coastal fringe have been at the forefront of research in recent years (Lowe and Walker 1984).

The layout of this volume reflects a dual need: to demonstrate adequately the scientific and conservation interest of the localities it describes, and to elucidate the significance of sites in the context of the volume and of the Quaternary of Britain. The first chapter, written by Professor D Q Bowen, is a general account of the Quaternary, and this combined with the simplified conclusion section of each site description is intended for the less specialist reader. Chapter 2 and all other descriptive and interpretive material in the volume is written in language consistent with that in publications on the Pleistocene and Holocene, and is intended for a readership in the earth-sciences and related fields.

Each account of a site in this volume is given in the context of an area, the geology and geomorphology of which is described in a chapter introduction. Each locality is described in detail in a self-contained account, consisting of highlights (a précis of the specific interest of the site), an introduction (with a concise history of previous work), a description, an interpretation (assessing the fundamentals of the site's scientific interest and importance), and a conclusion (written in simpler terms for the non-specialist).

The terminology employed in the text is conservative; we do not attempt any radical refinement of what is in some cases a confused nomenclature. The Pleistocene Series/Epoch has had a basal stratotype defined, and this has received international recognition — we follow this usage. The Holocene is variously regarded as a sub-division of the Pleistocene (very reasonably because it includes the present interglacial) which would give it a status equivalent to a stage, or as a series separate from the Pleistocene. The Pleistocene Series is widely regarded by geologists as a series of the Neogene System, along with the earlier Miocene and Pliocene series. Quaternary is here used in a somewhat loose sense, following its traditional usage for the last part of Cenozoic time, and as a less precise alternative to a combined Pleistocene and Holocene. The final decision on whether Quaternary is to be retained and what its hierarchical status and definition will then be, are matters presently being considered by the International Commission on Stratigraphy.

Special note

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 ownership of particular sites may be available from the appropriate NCC regional office — see next page.

Acknowledgements

Work started on this volume with the preliminary compilation of a site coverage by Dr Wishart Mitchell. This early work was incorporated into a final list, and documentation and draft writing was undertaken by Dr Stewart Campbell between 1983 and 1986. A full first draft of this volume was completed by him in May 1988. Drafts of the first two chapters were completed in January 1989 by Professor D Q Bowen, who jointly edited the remainder of the volume.

We would like to acknowledge the many colleagues who have made an invaluable contribution to the production of this volume and the site coverage which it describes. In particular, we thank the following for detailed discussion and information: Dr M J C Walker, Dr P D Moore, Dr J M Gray, Dr D F Ball, Dr A J Sutcliffe, Dr F M Chambers, Dr B S John, Dr G E Saunders, Professor J A Taylor, Professor J Rose, Dr Y Battiau-Queney, Dr A J Stuart, Dr H S Green, Mr J G Rutter, Mr M Davies, Dr N F MacMillan and Dr R C Preece.

Further useful information was provided by Professor A G Smith, Dr K Simpkins, Professor J B Whittow, Dr C Harris, Dr I D Ellis-Gruffydd, Dr C A Lewis, Dr R A Shakesby, Mr I C Thompson, Mr M D Wright, Dr R Donnelly, Mr P S Wright, Dr G S P Thomas and Brother J van Nedervelde. S Campbell thanks Dr G P Black and Dr J E Gordon for their enthusiastic encouragement in the early stages of the project.

Professor N Stephens kindly provided facilities in the Department of Geography at University College, Swansea during the field assessment phase of the project.

It is also a pleasure to acknowledge the contribution made to this work by Mrs Shirley Drake, who typed early versions of the text, by Miss Kathleen Harrison, who typed the final draft, and by Mr Paul Butler who drafted the figures. The work on the volume bibliography and on bibliographic searching by Mr Peter Cann and Mr Kevin Hayward is also acknowledged with thanks.

Lastly, we would like to acknowledge Professor Nicholas Stephens for his constructive comments on the typescript in his capacity as referee.

Information

Information on conservation matters relating to Sites of Special Scientific Interest (SSSIs) or National Nature Reserves (NNRs) in particular counties or districts may be obtained from the relevant Nature Conservancy Council Regional Officer as listed below:

Regional Officer, Dyfed — Powys Region, Plas Gogerddan Aberystwyth, Dyfed. SY23 3EE

Regional Officer North Region Plas Penrhos, Ffordd Penrhos, Bangor. Gwynedd. LL57 2LQ

Regional Officer South Region 43 The Parade Roath, Cardiff. CF2 3UH

References