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# Marine Permian of England

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## **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.

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

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

## Preface

This book is concerned almost wholly with a diverse suite of carbonate rocks that were formed near the margins of shallow tropical seas during the last 5–7 million years of the Permian period (300–251 Ma). These unique rocks, collectively known as the Magnesian Limestone, have been studied for more than 160 years and the names of some of the early workers — Geinitz, Murchison, Phillips, Sedgwick, Sorby — would grace any geological hall of fame. Despite this formidable assault, and the efforts of a host of later workers, the Magnesian Limestone still retains many of its secrets.

Permian marine rocks crop out on both sides of the Pennines, but those of the Zechstein Sea to the east are by far the thicker and more varied, and in these lie all but one of the sites selected for special protection. Detailed accounts of the rocks in 26 such sites form about half of this book and the normal and special features of these sites are compared, contrasted and placed in their mutual context in the remainder of the book. The sites were selected according to a range of criteria, including uniqueness, representativeness, historical importance and suitability for teaching purposes and research; most are inland quarries but a few are in the unrivalled coastal cliffs of classical County Durham where the main difficulty lies in deciding what not to select. Some sites, especially the coastal cliffs at Blackhalls Rocks, Seaham and between South Shields and Sunderland are worthy aspirants to World Heritage status.

The rocks at the sites selected for protection, in conjunction with those at other exposures and with information from boreholes, reveal much of the dynamic history of the late Permian seas in northern England. They suggest initial creation of the seas by catastrophic flooding of sub-sea-level inland drainage basins (themselves perhaps the product of differential subsidence accompanying post-Variscan crustal cooling and attenuation) and a subsequent complex history of basin filling against a background of ?glacially-triggered sea-level oscillation. Evidence of at least four major sea-level changes is fundamental to the widespread recognition of four main cyclic rock sequences in each basin, the first two of which together filled much of the original basin whereas the others were formed mainly in space created by continuing episodic subsidence. In north-east England, especially, the late Permian rocks of the first and second cycles display clear evidence of formation in a wide variety of nearshore tropical environments including sea-marginal subaqueous slopes, shelves, lagoons and reefs. They have, in addition, been altered both chemically and physically during deep burial and re-emergence, the most spectacular effects being the creation of a bewildering and unique range of calcite concretions that are famous world-wide. Finally, almost all the carbonate rocks at almost all the listed sites bear evidence of the former presence of calcium sulphate crystals and patches, and many of the coastal cliffs vividly demonstrate the disruptive dislocation caused by the dissolution of formerly interbedded thick anhydrite (and probably some halite) deposits.

## [References](#)