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# The coast of Caernarfon Bay (Newborough Warren and Morfa Dinlle)

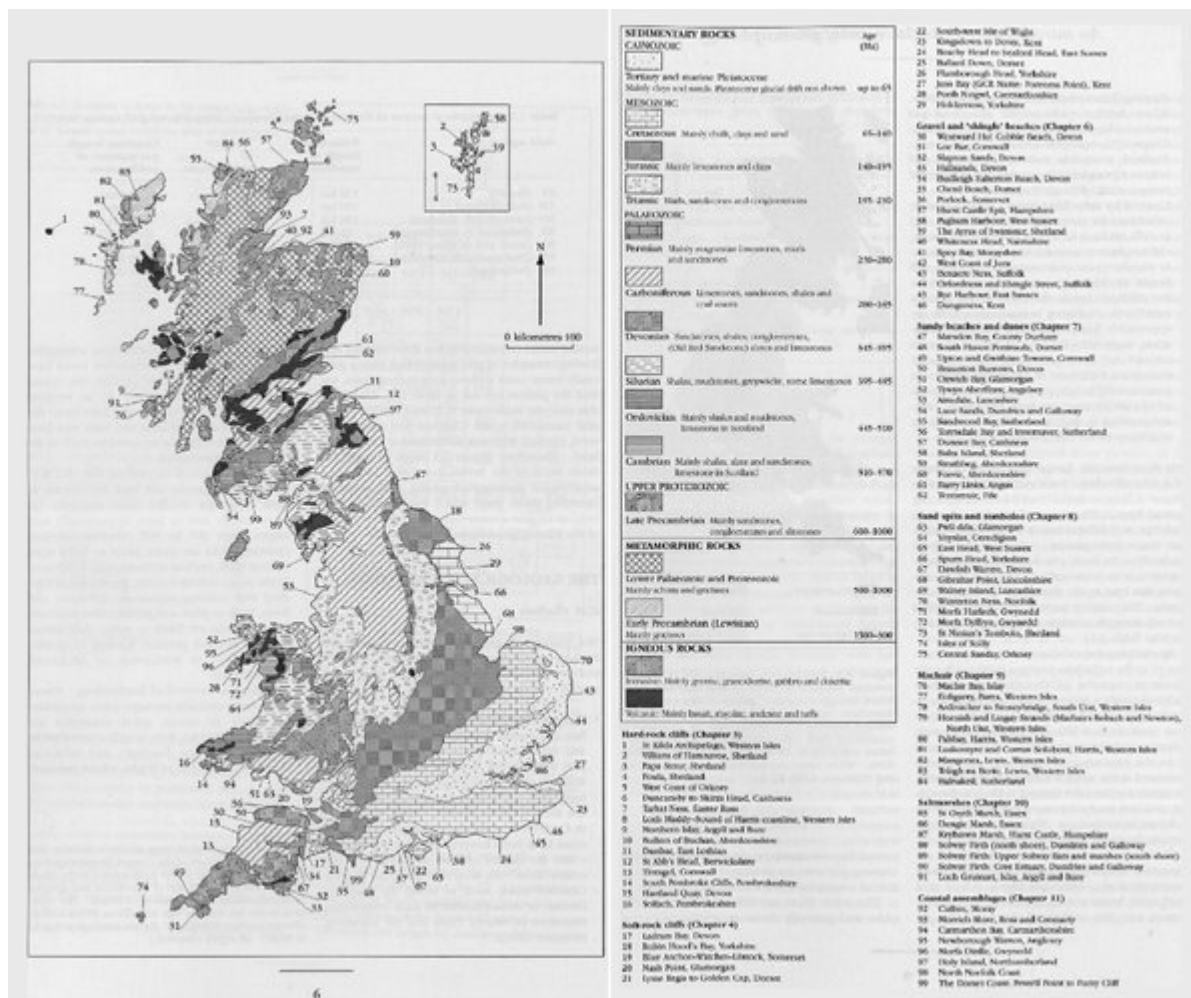
V.J. May

## Introduction

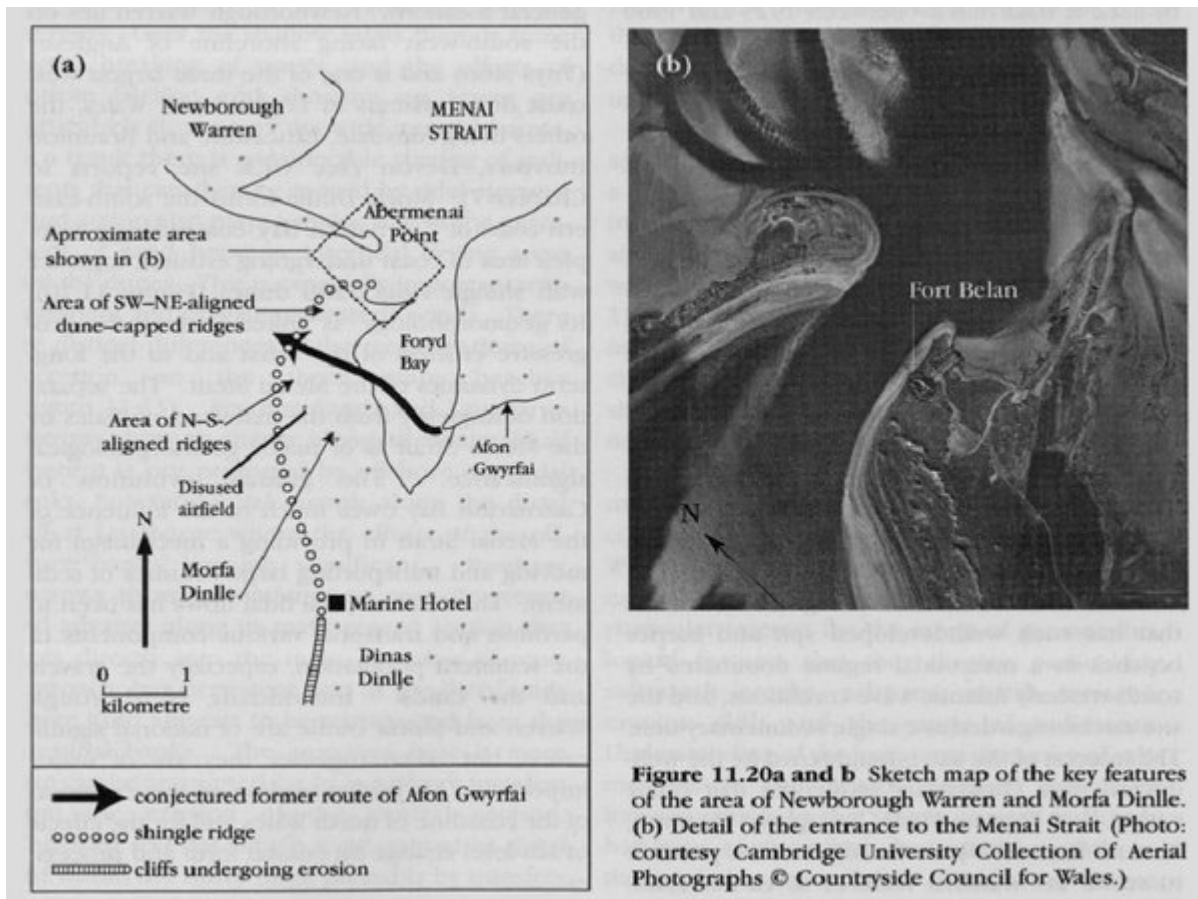
Newborough Warren and Morfa Dinlle are major dune areas on opposite sides of the western mouth of the Menai Strait (see (Figure 1.2) for general location). Newborough Warren lies on the south-west facing shoreline of Anglesey (Ynys Mon) and is one of the three largest west coast dune systems in England and Wales, the others being Ainsdale, Lancashire and Braunton Burrows, Devon (see GCR site reports in Chapter 7). Morfa Dinlle forms the south-eastern coast of Caernarfon Bay, comprising a complex area of coast undergoing erosion, together with shingle ridges and dunes (Figure 11.20). Its geomorphology is linked both to the progressive erosion of the coast and to the longterm dynamics of the Menai Strait. The separation of Anglesey from the mainland of Wales by the Menai Strait is of major geomorphological significance. The gradual evolution of Caernarfon Bay owes much to the influence of the Menai Strait in providing a mechanism for moving and transporting large volumes of sediment. The action of the tidal flows has been to partition and transport various components of the sediment population, especially the gravels and the sands. Individually, Newborough Warren and Morfa Dinlle are of national significance, but taken together they are of major importance for understanding of the evolution of the coastline of north Wales and for the effects of sea-level change on coastal form and processes.

## The Menai Strait

The double estuary that formed in the Menai Strait in the early postglacial period (see, for example, Greenly, 1919; Embleton, 1964) changed as sea level rose around 6500 years BP into the present-day complex tidal system that floods from both the east and the west. There is a residual flow towards the south-west (Harvey, 1967, 1968) owing to a combination of a higher tidal range at the north-eastern end and the relative phase of the tides. High water at Fort Belan (opposite Abermenai Point) is 1 hour prior to high water at Beaumaris (at the eastern end of the Menai Strait) and is 3 m lower. The resulting hydraulic gradient means that tidal flow in the western entrance to the Menai Strait is markedly ebb-dominated, leading to a pronounced ebb-tide delta whose outer ramparts are known as the 'Caernarfon Bar'. The flood tide in the Irish Sea sets from south to north and a flood-tide rampart has developed to the south of the entrance to the Strait, i.e. immediately west of Morfa Dinlle. Within the Strait, east of Fort Belan and Abermenai Point, flood-tide deltaic deposits have also developed, less extensive than the ebb-tide delta but nevertheless extremely important in their control of the estuarine dynamics. As the tidal delta deposits within the Strait developed during the Holocene Epoch, so the tidal prism in the estuary decreased. In response, the tidal flow velocities decreased in the entrance to the Strait and this allowed sedimentation to proceed, so reducing the entrance cross-sectional area (Pethick, 1997). Holocene infill of the Strait reduced the width from more than 3 km to less than 2 km and mean depth from 20 m to the present-day 10 m, with extensive sandflats across both east and west entrances. It is suggested by Pethick (1997) that the gravel ridges of Morfa Dinlle and the Abermenai spit are direct results of this gradual decrease in the tidal prism of the Menai Strait during the later part of the Holocene Epoch. As deposition proceeded in the Strait, so the cross-sectional area of the mouth decreased, and the Morfa Dinlle gravel ridges extended 1. northwards to define an increasingly narrow mouth (now less than 400 m) between Abermenai Point and Fort Belan.



(Figure 1.2) Geological map of Great Britain, also showing the locations of the Coastal Geomorphology GCR Sites. The map shows sedimentary rocks classified according to their age of deposition and igneous rocks according to their mode of origin. The numbers in the key indicate age in millions of years (Ma). (Permit number IPR/26-45C British Geological Survey. (NERC. All rights reserved.)



**Figure 11.20a and b** Sketch map of the key features of the area of Newborough Warren and Morfa Dinlle. (b) Detail of the entrance to the Menai Strait (Photo: courtesy Cambridge University Collection of Aerial Photographs Countryside Council for Wales.)

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