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# Tywyn Aberffraw, Anglesey

[SH 362 685]

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## Introduction

Many of the structurally aligned valleys that cross Anglesey (Ynys M6n) form shallow estuaries on the south coast, including the largest, the Mon Cefni, which lies within the Newborough Warren GCR site (see site report in Chapter 11). Tywyn Aberffraw comprises a small beach and area of dunes, which lie to the west of the much larger dunes of Newborough Warren, and occupy a confined valley site (see (Figure 7.1) for general location). Because of the physical constraints of the locality, there is little possibility of sand entering or leaving the bay alongshore, and the bounding cliffs supply very little sediment to the beach (Robinson, 1980b). Tywyn Aberffraw provides an excellent opportunity for the study of beach and dune relationships within an area of restricted sediment supply. The site is also distinguished by the relative isolation of individual fixed parabolic dunes upon a sand plain (Steers, 1946a; Ranwell, 1955; Robinson and Milward, 1983). This landform assemblage has few comparable equivalents in Britain.

## Description

Tywyn Aberffraw is a small site, with a beach only 700 m wide between hard-rock headlands, but the sand plain and dunes extend about 2.5 km inland (Figure 7.14). The site fills the western end of Traeth Mawr, one of several low-lying basins that cross Anglesey from south-west to north-east and cut here into the Precambrian grits, shales and lavas of the Gwna and Fydlyn groups. The valley is filled at its south-western end by sand, almost all lying within the rocky confines of the valley, but there has been very little migration of sand on to the higher rocky surfaces on either side. Broadly, the site falls into four morphological units: the cliffs, the beach (swell-aligned towards the south-west) the active dunes, which form a triangular area less than 250 m wide at the western end of the beach but widening to about 1 km along the eastern boundary of the site, and the sand plain and mainly fixed dunes that form most of the site.

The cliffs form low (rarely more than 7 m) vertical features cut into the Precambrian rocks, above which there are more extensive slopes rising to about 40 m OD. These slopes bound the site on both sides, with a small stream, the Mon Ffraw, flowing at the base of the western slope. Although the slopes are not included within the site, they have confined sand to the valley floor and provide some shelter from winds from the west and east. The beach is about 300 m wide at low water and is composed almost entirely of sand. Waves can only approach the beach from a very narrow range of directions (south to WSW). Waves approaching from the south-west undergo no refraction and fetch to the south-west exceeds 4000 km. The beach appears to have undergone only limited retreat in recent decades. The active dunes are affected by some recreational trampling and are eroded periodically by wave action. Wind action carries sand along the eastern side of the site, while on the western side the Mon Ffraw it prevents accumulation along the foot of the bounding slope. The western slope is, however, also sheltered from the strongest winds. As a result, along the eastern edge of the site the active zone extends almost 1 km inland. The main part of the site is dominated by a sand plain that slopes from over 14 m OD in the east to about 8 m OD in the west. Several isolated vegetated parabolic dunes rise above the sand plain, one of the best examples being at [SH 367 694].

## Interpretation

This site occupies a similar position on the coast to that which Ranwell (1955) identified at Newborough Warren, a few kilometres to the east, as being an ideal location for maximum sand movement by wind and therefore a prime site for the study of dune development and migration. Unlike Newborough Warren, the beach at Tywyn Aberffraw is extremely restricted laterally with limited sand removal by longshore drift. The beach retains an almost constant orientation because the adjacent headlands restrict the direction of wave approach. As a result, this can be described as 'an almost perfect

bay-head beach' (Robinson, 1980b, p. 42) for which the offshore zone is the most likely source of sediment for the accumulating beach. In turn the dunes rely entirely on the supply of sand from the narrow beach and some recycling by the stream. The restriction of the site between higher ground has also affected the patterns of wind transport because the western side is more sheltered from westerly winds and the valley widens away from the beach. The sand available for maintenance of dunes, which are migrating inland, is therefore limited both in quantity and in its spatial distribution. However, the site is grazed by sheep, cattle and rabbits (Ashall *et al.*, 1995; Potter and Hosie, 2001), which may affect sand mobility locally. Unlike Newborough Warren, where there is a tendency for linear dunes to migrate inland (Ranwell, 1955), dunes at Tywyn Aberffraw tend to be isolated and lower. This is almost certainly a result of a limited sediment input and a minimal long-shore supply. Parabolic dunes stand in isolation above the plain in a landform assemblage that is uncommon in England and Wales.

The internal structure of one of the largest parabolic dunes consists mainly of landward-dipping accretion surface, both on the windward (foreslope) and the leeward (rearslope) of the dune (Bristow and Bailey, 2001). A large area of trough cut-and-fill identified by ground-penetrating radar on both the windward slope and the dune crest indicates that sediment is being moved from the windward side and transported to the leeward side. As the dunes migrate landwards, they preserve some of the older landward-dipping surfaces of earlier phases of accretion.

Apart from Newborough Warren, probably the best comparable coastal sites are the Sands of Forvie and Barry Links on the north-east coast of Scotland, where a number of parabolic dunes stand above a sand plain (see GCR site reports, this chapter).

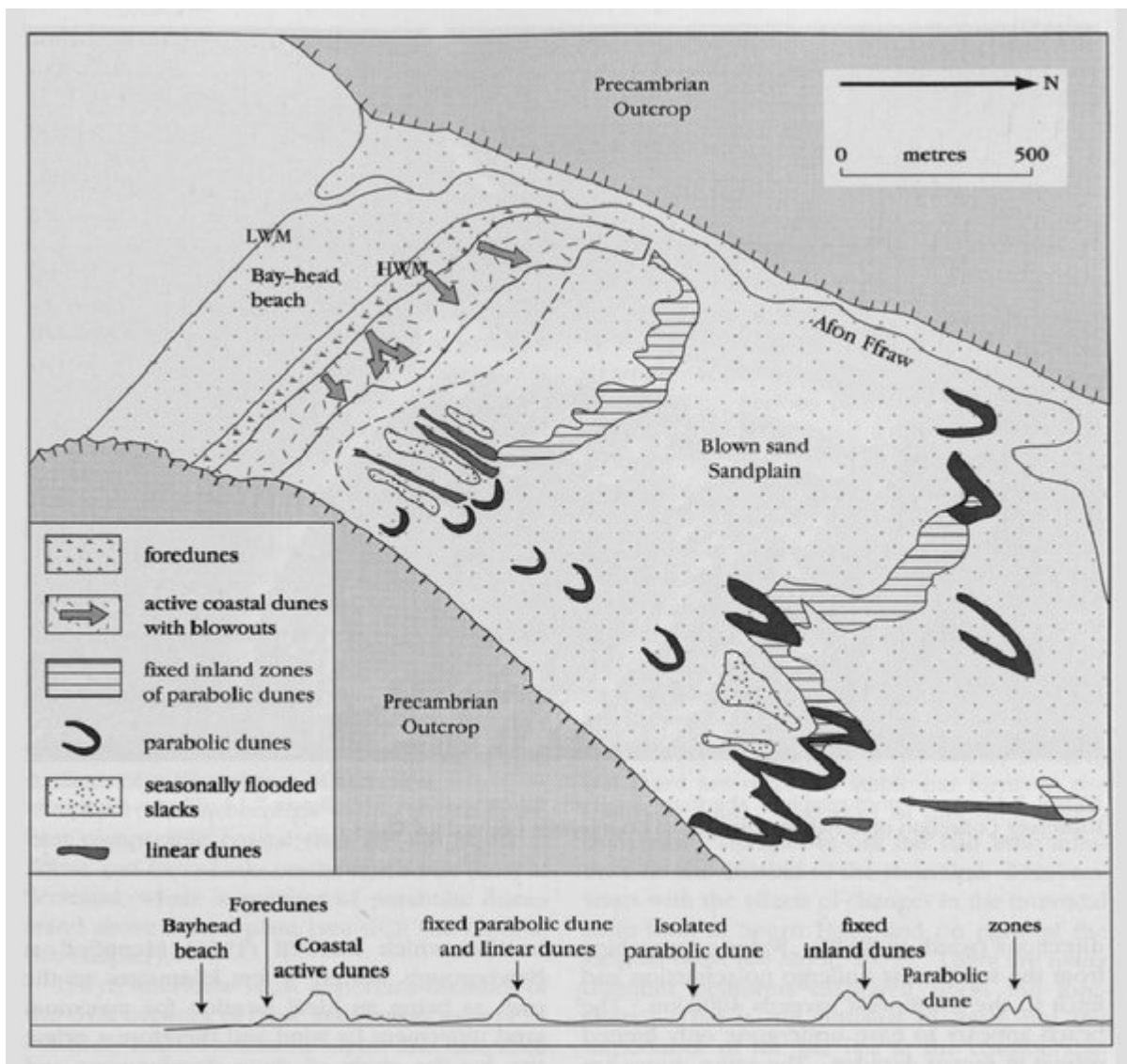
Tywyn Aberffraw is an important member of the GCR network of dune systems because of its relatively limited sediment supply and restricted development of dunes. In this respect it contrasts especially strongly with its neighbour at Newborough Warren.

## **Conclusions**

Tywyn Aberffraw is an almost perfect geomorphological exemplar of a bay-head beach that is backed by dunes that include probably the best example of a sand plain with isolated parabolic dunes in England and Wales. The site combines the unusual attributes of a near-perfect sandy bay-head beach and a sand plain with isolated parabolic dunes. Furthermore, its continued development can be shown to depend almost exclusively upon offshore sand sources and fluvial recycling rather than any longshore sediment transport.



(Figure 7.1) Great Britain sandy beaches and coastal dunes, also indicating the location of GCR machair–dune sites (see chapter 9) and other coastal geomorphology GCR sites that contain dunes in the assemblage.



(Figure 7.14) Key geomorphological features and profile of the Tywyn Aberffraw GCR site. (After Robinson and Milward, 1983.)