

LOE BAR

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Introduction

Loe Bar lies about 4 km SSW of Helston, Cornwall (see Figure 6.2 for general location). It encloses a lagoon occupying part of a former ria and forms an integral part of a beach system extending from Porthleven (SW 627 254) to Gunwalloe (SW 653 223; Figure 6.4). The site is important to coastal geomorphology on two counts. First, Loe Bar is a rare example (in England and Wales) of a bay–bar, and second, it is a key member of a suite of major beaches formed and maintained by predominantly south-westerly wave regimes. The beach is formed of rounded, fine shingle and coarse sand predominantly comprising flint or chert for which there is no local source on land. Present-day inputs of sediment from the adjacent cliffs are small, and overall the beach is in deficit. The bar itself is washed over during periods of high wave-energy and a series of washover fans occurs behind the bar. The periodic breaching of the bar has been described in the literature (Ward, 1922; Toy, 1934; Steers, 1946a; Goudie and Gardner, 1985), but the origin of the bar has attracted less attention (Toy, 1934; Goudie and Gardner, 1985).

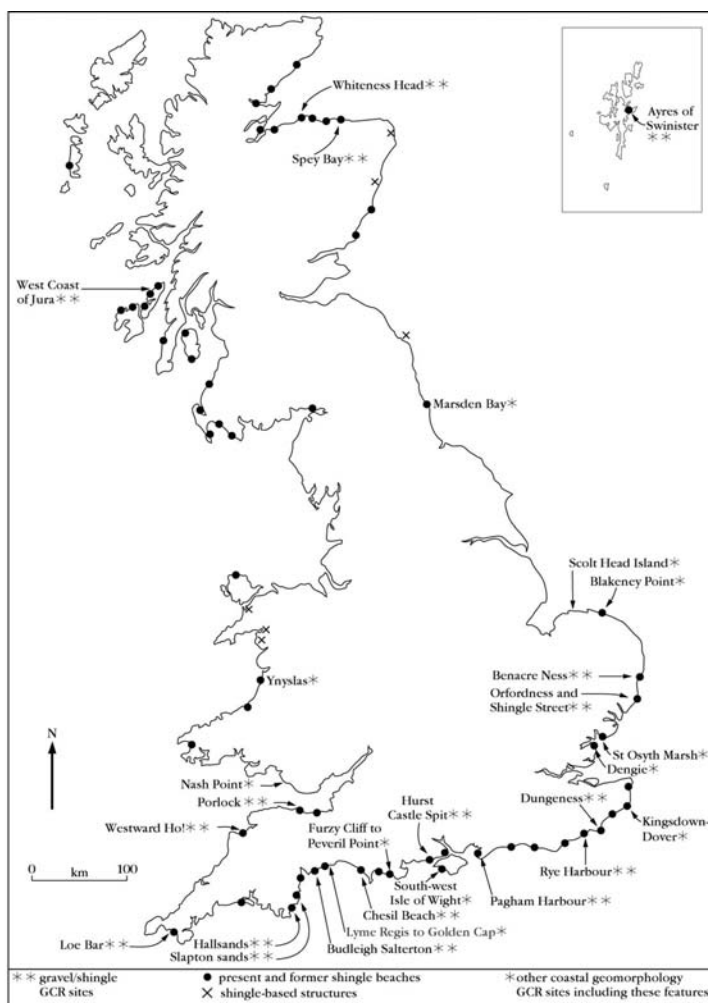


Figure 6.2: Coastal shingle and gravel structures around Britain, showing the location of the sites selected for the GCR specifically for gravel/shingle coast features, and some of the other larger gravel structures.

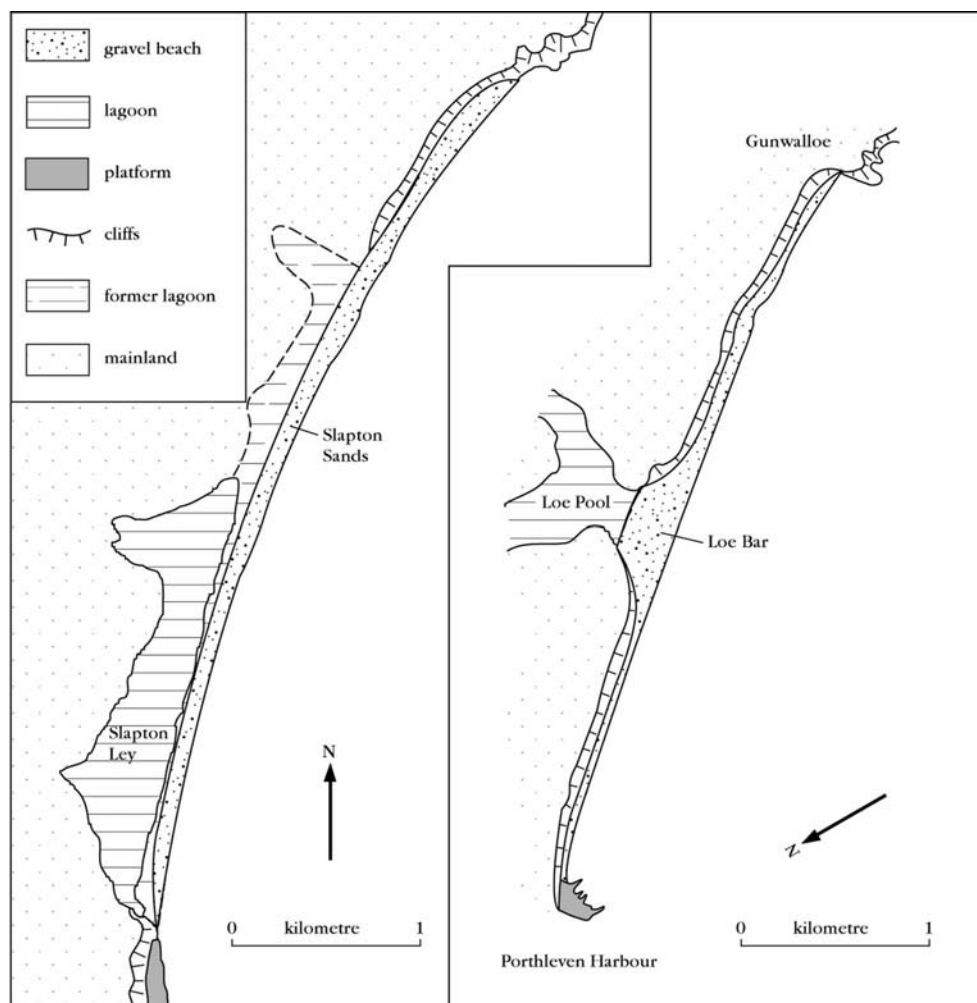


Figure 6.4: Comparison of geomorphological form between Slapton Sands and Loe Bar. Slapton Sands encloses a large lagoon, part of which has been infilled by sediment and become a brackish wetland. At Loe Bar, a cliff-foot beach confined between headlands has blocked off a narrow estuary.

Description

The site extends for 4.3 km south-eastwards from Porthleven, but the Loe Bar itself forms only 400 m of this beach. The site is divided into three parts: the cliffs and beach known as 'Porthleven Sands', the bar itself, and the cliffs and beach known as 'Gunwalloe Fishing Cove Beach'.

The beach throughout the site forms a single sediment cell that can neither gain nor lose sediment from alongshore because of confinement by the harbour arm and rocky headland at Porthleven in the north, and the headlands to the south-east at Gunwalloe (Figure 6.5). Most of the sediment (over 90%) that forms the beach is flint, which falls into two size classes: medium to very coarse sand (between +0.5 and -1.0 phi) and small pebbles (above -4.0 phi). Towards the eastern end of the beach, the proportion of quartz and serpentine increases slightly. The cliffs are cut mainly in Devonian Mylor Beds (mainly grey slates) west of the Bar, and Lower Gramscatho Beds (which weather more readily than the Mylor Beds) to its east, but supply only small quantities of material to the beach. Both clifflines have a 'slope-over-wall' or bevelled form, the lower 'wall' being cut both into the very resistant schist and quartz that crop out at the foot of the cliff, and the much less resistant solifluction material that forms much of the cliff either side of the Bar, but especially towards Porthleven. There the local erosion has been retarded by the construction of a wall and gabions. Gabions have also been used to protect the foot of the cliff below Bar Lodge just to the west of the bar.



Figure 6.5: Loe Bar, looking approximately south-east, showing the bar and its washover features. (Photo: V.J. May.)

The Bar was described by Leland during the 16th century as having a tendency to be regularly breached by the River Cober. Borlase described the bar in 1758 as forced up against the mouth of the valley by south-west winds. From time to time, the people of Helston excavated a channel through the bar in order to reduce the risk of flooding from the lake. The cost for this activity, according to Borlase, was three halfpence! The last known artificial breaching of the bar took place in the winter of 1867–1868 after which an overflow adit was cut at the north-western end of the bar. The bar has moved inland since the mid-19th century and may have increased in height (according to Goudie and Gardner, 1985, although no details are given). Washover features can be seen on its landward side, the result of overtopping. However, because of its steep front and gentle upper and back slopes, such overtopping occurs at the extreme of the swash phase and so only limited amounts of sediment are transferred over the crest. The crest itself is only a few centimetres higher than the Loe Pool behind it. The level of water in the Loe Pool does not appear to be affected by tides and so may be perched in a similar way to that at Slapton (see GCR site report, this chapter). The orientation of the beach, and the limited amount of sediment in the beach and the bar are such that sediment tends to move towards the centre of the bay at present. This process depletes the north-western and south-eastern parts of the bay, but maintains the sand and shingle supply to the bar. The accumulation of shingle blocking the Pool appears to be considerable, for Rogers (1859) describes a boring made in 1834 that reached 22 m (just over 9 m below low-water mark) without reaching bedrock.

Interpretation

Although the Loe Bar has frequently been cited as a textbook example of the comparatively rare British case of a bar completely blocking a lake (e.g. Wooldridge and Morgan, 1937; Steers, 1946a; Monkhouse, 1965; Barnes, 1977), its formation has never been satisfactorily explained (Steers, 1981). Curiously, it is quoted more often than Slapton Ley, which has similar characteristics (Figure 6.4). King (1972a) regarded it as exemplifying the closure of an estuary that only occurs where discharge is very low or there is a very permeable barrier. The latter suggests general seepage through the bar, but this does not appear to be the case. Toy (1934) suggested that two spits had developed from east and west across the valley. In this model, tidal action would move sand and shingle eastwards from Porthleven towards the bar, but strong south-easterly winds would bring about a reverse movement from the east. Eddies

set up by the flow of the river and tidal scour would keep the channel clear, but would encourage the growth of spits on opposite sides of the valley mouth. The bar would be completed when the gap was closed by either gradual processes, or severe waves, perhaps during storms. The so-called 'tidal wave' reported by Toy appears to have been an example of particularly large swell which pushed large quantities of sand and shingle up and over the bar. Although the occurrence of tsunamis in the North Atlantic Ocean has been considered as a possible mechanism for the formation of some beaches, there is no evidence for the influence of tsunamis here. The height of the bar is such that it would only be possible for very large run-up to carry material to the top of the bar. Steers (1946a) was convinced that the development of the bar was more likely to have resulted from wave action than from tidal action. He noted later (1981) that its position relative to wave action is comparable with Chesil Beach, i.e. it is only the relatively infrequent, largest waves that can carry material on to the top of the bar to build it up or even to move its crest inland.

Explaining the presence of a high proportion of flint in the beach is a problem as indeed it is at Slapton Sands. Bird and Schwartz (1985, p. 364) described the Loe Bar as a beach of flint shingle 'washed up from the sea floor (there being no flint sources in the adjacent cliffs or hinterland areas)'. King (1972a, p. 519) described the Loe Bar as made up of 'unusual material', intermediate between sand and shingle in size. Other flint-dominated shingle beaches along the southern coast of England are also found isolated from present-day sources of flint. The most likely origin for such beaches is their development as barrier beaches that were gradually moved onshore as Holocene sea level rose, the flint coming from drowned terraces of the former river flowing down the English Channel. During its movement across the sea floor in front of the cliffs the beach could have been breached and re-formed, and might even have been more spit-like. The outline of the bay is such that longshore movements could carry shingle towards the bar, and maintaining its form. Thus the beach tends to maintain an equilibrium form with the dominant and prevailing waves that means a more or less smooth curve throughout its length. The bar itself is thus a sediment sink as far as the overall beach budget is concerned. It remains unclear why the beach has such a strongly bimodal size distribution.

Conclusions

Loe Bar is a rare and excellent British example of a shingle bay–bar, and it is one that has international renown as a type example of this form. The site has additional interest because the bar blocks a ria, and the sediments in the adjacent cliffs suggest that the beach occupies an interglacial embayment. The beach is in overall deficit, but the bar is likely to survive as long as shingle remains within the main beach to maintain it. Breaching may occur from time to time, although that has not been recorded since the 1830s. The continued existence of the bar is dependent upon the maintenance of sediment supply from the wider area. As sediment is transported and, in effect, trapped in the bar, it can be replaced by sediment moving in from the main beach. As a result, the stability of the bar depends on natural and unimpeded sediment supply and transport from the wider beach system. In turn the ecological interest of the Loe Pool depends upon the unimpeded natural evolution of the geomorphological processes operating at the site.

Comparable bay–bars with a lagoon occur at Slapton and at the western end of Chesil Beach. At one time the beach at Pagham Harbour also formed a bay–bar with a lagoon, but this was breached and insufficient shingle has been supplied to it for the bar to redevelop. The differences between Loe Bar and Pagham Harbour are, first, their oceanographic context, Loe Bar being directly exposed to south-westerly Atlantic swell, whereas Pagham Harbour is affected by refracted swell, and second the tendency for the Loe Bar to rebuild after breaching, from both natural and anthropogenic causes. The evolution of Loe Bar most likely relates to migration of barrier beaches across the present-day seabed to more-or-less their present position with changes in the present-day beach mainly associated with overtopping. It is also evident that the outline of much of this coastline pre-dates present-day sea level and the Loe Bar is probably reoccupying an interglacial embayment.

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