



Aspen Burrow Cröcker

**Council of the Isles of Scilly  
Shoreline Management Plan**

## **SECTION 3**

# **COASTAL EVOLUTION AND PROCESSES**

### 3 COASTAL EVOLUTION AND PROCESSES

#### 3.1 Historical Evolution

The following text is a synthesis of a detailed report on physical processes at play in the Isles of Scilly<sup>(1)</sup>. The interested reader is referred to this document, a copy of which is held by the Council of the Isles of Scilly.

Scilly is a geologically defined archipelago, the weathered remnants of a granite boss or **batholith** which intruded into the Devonian **killas** during **Permo-Carboniferous** times, some 270 million years ago<sup>(2)</sup>. The boss rises sharply from a flat seabed plain at about 70 m below sea level, to a highest point of +50 mAOD on St Mary's.

The single rock-type has resulted in a uniform morphology. The detailed form of the archipelago is controlled by:

- crystalline variation within the granite. The central, later, so-called G2 intrusion<sup>(3)</sup> is finer and would appear to be more susceptible to weathering and erosion;
- fault patterns. Shatter-belts created by faulting are weak areas and dictate the alignment of much of the coastline;
- exposure. The eastern part of the batholith, more sheltered from the rigours of the Atlantic wave climate, are less denuded.

During the past two million years major climatic fluctuations have resulted in periodic advances of the polar ice caps. In the United Kingdom this produced a cover of southward advancing ice-sheets on at least three occasions. During the penultimate glaciation ice extended as far south as Scilly, as indicated by minor boulder-clay deposits on the northernmost islands<sup>(3)</sup>.

---

(1) *Isles of Scilly Shoreline Management Plan: A Review of Physical Processes, Sea Sediments Ltd, Chard, October 1995*

(2) *The Geology of the Isles of Scilly, G. Barrow, Memoirs of the Geological Survey 3571360, 1906*

(3) *The Pleistocene Deposits of the Isles of Scilly, G.F. Mitchell & A.R. Orme, Quarterly Journal Geological Society, 123, 59-92, 1967*

With each glacial period global sea levels fell, at times being 100 m below the present level. During the interglacial periods the sea returned to levels thought to be little different from those of today. During these long periods of regressing and transgressing sea levels, the presently sub-tidal slopes of the Scilly batholith would have been subject to intense erosion and sediment redistribution as a result of shoreline wave action. These processes produced peripheral slopes dominated by massive granite exposure and boulder deposits, passing into sand and gravel deposits of the seabed plain surrounding the archipelago.

The **tundra-type** climate imposed during glaciations had a marked effect on weathering and erosion processes active in the islands. Freeze-thaw, so-called **solifluction**, processes resulted in the sliding of soils and granite rubble from high to low areas, leaving the upland granite areas bare, and creating a mantle of **head** (or what is locally termed **ram**) deposits on the lower slopes.

The rise of global sea-levels over the last 10,000 years since the ultimate glaciation is known as the Flandrian transgression. Due to its "recent" nature the phenomenon is well-studied from many locations throughout the world<sup>(4)</sup>. At a given location, the detailed form of this rise in sea level is dictated by global (**eustatic**) water level change and local (isostatic) changes in landmass height. These issues are discussed in Section 2.

The last 5,000 years of the transgression has been studied in Scilly by Thomas<sup>(5)</sup>, (see Section 5.4.5) using drowned archaeological sites to construct a sea level curve which shows that mean sea level 4,000 years ago was about 7 mACD or around 10 m lower than at present indicating an average rise in sea level of the order of 2.5 mm/yr.

Initial evidence from examination of intertidal peat deposits suggests that the rate of increase of sea level indicated by Thomas may be somewhat **high**<sup>(6)</sup> and that a lower rate of increase of the order of 0.7 mm/yr would be more appropriate. With the sea at the level proposed by Thomas the major islands of present Scilly formed a single unit (see Figure 3.1). The subsequent invasion of the sea and the

---

(4) *Sea-Level Movements during the Last Deglacial Hemicycle; Final Report of the UK Working Group, IGCP Project 61, J.T. Greensmith & M.J. Tooley (Eds.), Proceedings of the Geologists Association, 93 i, 1982*

(5) *Exploration of a Drowned Landscape. Archaeology and History of the Isles of Scilly, A.C. Thomas, B.T. Batsford Ltd., London, 1985*

(6) *The Early Environment of Scilly - Palaeoenvironmental Assessment of Cliff Face and Intertidal Deposits, 1989-1993, J. Ratcliffe and V. Straker, Cornwall Archaeological Unit, Truro, 1996*

---

reworking of the deposits of the environment over the past 4,000 years is the backdrop to present coastline stability issues in Scilly.

## 3.2 Coastal Sediments and Sediment Transport Mechanisms

### 3.2.1 Sediment Deposits

The three major active sources of intertidal and subtidal sediments in Scilly are:

- breakdown of the granite under present-day wave action and weathering processes;
- reworking and redistribution of deposits formed during the Pleistocene and Flandrian periods, notably ram, alluvium, marine and wind-blown sands;
- shell material, generated by the vast population of shell-forming organisms that inhabit the Scilly intertidal and sub-tidal zones.

A map of the sediment deposits within the archipelago is presented in Drawing 1 the detail of which was compiled from aerial photographs<sup>(7),(8)</sup>, local knowledge, British Admiralty chart notations and some survey work<sup>(9),(10)</sup>. It should be regarded as a preliminary charting to which future information should be added in order to refine it.

Much of the archipelago is floored by rock and so-called residual granite rubble, boulder and cobble deposits which have been winnowed free of finer sediments. Most of this substrate is overgrown with brown algae and, in the clear waters of Scilly, is readily identifiable in aerial photographs. The intertidal and subtidal areas are thought to be predominantly of this substrate type (see Drawing 1).

---

(7) *Black and White Aerial Photographs of the Isles of Scilly, Ordnance Survey, 1976*

(8) *Oblique Aerial Photographs for Survey of Eel Grass Beds, Coral Cay Conservation Sub-Aqua Club, 1995*

(9) *South Western Electricity Board - Isles of Scilly Off-Islands Cable Routes Hydrographic Survey, Report Nr C6621, Wimpol Ltd, London, 1984*

(10) *A Survey of Foreshore Erosion at Bar Point, St Mary's, R.S. Nunny, Isles of Scilly Expedition Report, Coral Cay Conservation Sub-Aqua Club, 1992*

## Council of the Isles of Scilly Shoreline Management Plan

A large percentage of the seabed is covered by a sedimentary layer - sands, sandy gravels and gravels, deposited by marine processes. Eel grass (*Zostera spp.*) communities are extensive on this substrate in many parts of the islands. Sub-bottom profiling by the South Western Electricity Board<sup>(5)</sup> along cable routeways has shown that in many areas this sedimentary layer is very thin, usually less than a metre in depth, although **localised** basins of deeper deposits do occur. This sediment layer has the appearance of normally being stable, although it may be subject to movement under storm conditions.

In contrast are areas of well-sorted medium and coarse sands, which look to be regularly mobile under tide or wave currents. These deposits are readily identifiable in shallow water from aerial photographs<sup>(7),(8)</sup> and side-scan sonar traces", and are mapped in Drawing 1. A few particle-size analyses are available from intertidal and **subtidal sediments**<sup>(9),(10)</sup>. They show that sand deposits are dominated by coarse and medium sands and that fine sand or silt is seldom encountered which is consistent with the high-energy nature of the environment.

Above the High Water Mark there are **localised** zones of alluvium, and extensive dune deposits of windblown sand (see Drawing 1).

### 3.2.2 Asymmetry of *Tidal* Velocities

Due to the effects of flow deflection through the island channels, asymmetry commonly occurs between flood and ebb velocities. In situations where the flow exceeds the critical threshold for sand transport, an asymmetric distribution of velocities commonly results in the preferential transport of sand in the direction of strongest flow. The apparent residual sand transport direction is shown at the locations of current meter recordings in Drawing 1.

### 3.2.3 Wave Penetration

Through processes of refraction the island system is a focus for wave energy. With short wavelengths there is less efficient refraction on shoaling, and much of this wave energy is lost as waves break against or reflect from the outward facing coasts, leaving the inner waters of the archipelago relatively calm. The longest wavelengths however are more able to deform to the tortuous nature of the major inlets, and more efficiently penetrate the inner waters, particularly at high tide. This phenomenon is easily seen when the (locally so-called) ground seas progress along the channels to the centre of the island group. Appletree Point is one location known to suffer from

the ability of the longer period waves to travel more easily along the channels.

### **3.2.3 Sediment Transport by Tides**

Sand transport by tides or under combined tidelwave action is evident from the nature of the deposits in several parts of the archipelago. In the Crow Bar area, in the channels between Tresco, Tean and St Martin's and in the channel between Bryher and Tresco and Samson and Tresco (Hulman area), megaripples and sand ribbons have been identified in side-scan sonar records<sup>19</sup> and aerial photos.

In these areas peak velocities 0.5 m above the bed have been predicted to attain a maximum of 0.5 m/s<sup>19</sup> which is competent to transport sands and fine gravels in saltation (a rolling/bouncing movement close to the bed), consistent with observations that bedload transport of sands regularly occurs.

The apparent direction of residual transport of sand resulting from flow asymmetries is shown in Drawing 1 and Figure 3.2. Caution has to be observed in attempting to define regional sand transport patterns from these data, as a single current meter in the centre of a channel may not reflect transport in the channel section as a whole and divergence of flood- and ebb-dominated transport zones is a well established phenomena in coastal and estuarine systems.

Observations made in Scilly appear to indicate that the residual flow is landward in the centre of the channels between Bryher, Tresco and St Martin's. This observation gives some confidence to the assumption that the data available reflects sectionally-average sand transport.

Observation of the overall pattern of residual sand transport (see Drawing 1) indicates a movement of sand from the north of the archipelago to the south (see Figure 3.2). In the Bryher-Tresco-St Martin's Flats there appears to be a consistent southward movement of sand which splits in the Crow Bar area to pass east and west of St Mary's. Current meter data confirms, by inference, a southward movement of sand between St Mary's and St Agnes. There appears to be a balance between east and west going transport at the southern end of Crow Bar, which may explain the accumulation of sand in this area as a function of longer-term residence. If tidal currents are not competent to transport sand in the St Mary's Sound and Crow Sound areas (there are no data available) these zones may be sink sites for sand.

Council of the **Isles of Scilly**  
Shoreline Management **Plan**

### 3.2.4 *Sediment Transport by Waves*

- ***Onshore-Offshore Transport***

The passage of a wave produces an orbital motion in the water column beneath the wave which impinges upon the seabed in shoaling water where it is compressed to a simple to-and-fro movement. Two characteristics of this flow produce the well-observed model of transport of sand under wave action:

- flow duration is short (<20 s) and little turbulence is developed except at and inshore of the breaker line where there is extreme turbulence and intense transport in suspension;

the deformation of the shape of a wave as it begins to shoal produces stronger shorter landward flow under the wave crest and a weaker longer seaward flow under the trough.

These two factors combine to produce a situation where waves move coarse material onto beaches and trap it there, at the same time winnowing fine material from the beach cell and depositing it seawards of the breaker line.

The definition of coarse and fine in this respect depends upon the local wave energy. There are graded beaches on **Scilly** composed of cobbles and boulders where wave energy is occasionally sufficient to move this material onshore and to erode all sands from the beach and disperse it offshore. Other beaches are composed of medium sand where peak wave energies are lower. There will however be recycling of sand between the upper and lower beach areas in response to the seasonal variation in incident wave energy. Sand is often removed from dunes during winter storms only to be replaced during summer swells.

Sand finer than about 200  $\mu\text{m}$  tends to be dispersed into suspension once the threshold of movement is exceeded and is usually found only in the most sheltered of localities. Only localised deposits of this nature (water depths of 10 m or more) have been identified in the sub-littoral zone in **Scilly**<sup>(9),(10)</sup> attesting to the high-energy characteristics of the environment. Material of this size appears therefore to be largely lost from the local sedimentary system into deeper water.

Within the archipelago, wave action will therefore tend to move medium sands and coarse material towards the High Water Marks. It will also be interacting with tidal transport. At Crow Bar, for example, wave action will

tend to push sand onto the Bar from both the west and east, counteracting the projected tidal dispersion of sand to the **SW** and **SE**.

- **Longshore Transport**

Once medium-coarse sands, gravels and cobbles reach the shoreline under wave action, longshore drift (driven by the oblique approach of waves to the shore) moulds the deposits into equilibrium positions. Two types of deposit can be identified:

- Trapped Bay Beaches, where headland configuration inhibits transport out of the bay (e.g. Porth Cressa on St Mary's);
- Spits and Tombolas, where deposits reflect a balance between wave energies approaching from opposing directions (e.g. Pelistry on St Mary's, The Bar between St Agnes and Gugh).

Both types of deposit are well represented in Scilly. Both can be expected to undergo considerable locational fluctuation in plan form as a result of seasonal and long-term variation in wave climate. There is no identifiable regional or prevailing drift direction because of the island formations and 360° exposure to wave approach.

### **3.2.5 Back-Beach Sediment Transport**

Extensive sand deposits exist in Scilly landward of the High Water Mark which may be formed in two ways, often interacting.

- **Wind (or Aeolian) Transport**

Where the beach is extensive and does not remain wet at low tide, wind action can carry medium sands inland to form dunes and sand sheets. These are best developed on the southwestern shores of Tresco and St Martin's, where the prevailing (**SW**) winds can act upon extensive intertidal sand flats. Dynamic strand-lines of this nature, exhibiting long-term stability, are identified in Drawing 1.

- **Overtopping**

Where the high water mark is a ridge backed by lower-lying land, overtopping can displace large quantities of sand, gravel and cobbles landward, so building up the hinterland. It is thought that this is or has been an active process at many locations within the islands. The Pools on Bryher and St Agnes are believed to have been dammed off in historical times as a result of this type of accumulation.

### 3.3 shoreline Stability

#### 3.3.1 High Water Mark Advance and Retreat

The identification of changes due to coastal erosion and deposition is more liable to be identified in a study of High Water as opposed to Low Water Marks because:

- surveyors a century ago would have had easier access to the HWM than the LWM both of which are easily mapped nowadays by aerial photography;
- changes due to erosion and deposition (as opposed to sea-level variation) would be more apparent at the HWM than at the LWM except at major sand deposits (notably Crow Bar). Inundation effects should be most noticeable on the very gently sloping Flats between Bryher, Samson, Tresco and St Martin's.

A comparison of raw data of drying banks between **1792** and **1992** derived from increasingly accurate and periodically updated issues of British Admiralty Chart 34 is shown in Drawing 2. Furthermore, the more accurate **1880** Ordnance Survey (c.f. the **1792** Graeme Spence Admiralty Chart) and **1980** Admiralty HWM maps digitized and it was found that, in many areas, the fit was not good but corrections were made as appropriate". Drawing 3 highlights suspected erosion sites derived from the **1880** and **1980** surveys; erosion sites reported by local observers are also included in this mapping.

#### 3.3.2 Changes in Cross-Section

Shoreline types identified in Scilly, seen in cross-section, are illustrated in Figure 3.3, with type locations identified in Drawing 3 (A = St Agnes, B = Bryher, M = St Mary's, N = St Martin's; each island having its own number series).

##### A HIGHLY-EXPOSED HILLSLOPE SHORES

There are many cliffed coastlines of this type on **Scilly**<sup>(11)</sup>. The intense wave energy has notched the granite, and washed away all but the boulders from the platform. Run-up and spray effects have tapered away any ram

---

(11)

*A Short Guide to the Geology of the Isles of Scilly, Anonymous, Isles of Scilly Museum Publication Nr 11, undated*

Council of the **Isles of Scilly**  
Shoreline Management Plan

deposits overlying the granite. Erosion will be on a geomorphological timescale and not noticeable. The exception to this will be infrequently occurring cliff-falls, as have been observed to take place historically.

**B MODERATELY-EXPOSED, BEACH-FREE HILLSLOPE SHORES**

Ram cliffs are a common feature of the **Scilly** coastline. They are rarely more than 3-4 m high. Wave energy is competent to scour away ram, rotten granite, sand and gravel leaving a sloping weed-covered ledge with a boulder and cobble foreshore backed by a small sandy gravelly beach and a vertical ram cliff, only reached by the sea on the highest tides. When undercut, these cliffs tend to develop vertical cracks a metre or so back from the cliff edge, collapsing catastrophically and maintaining a vertical face. The debris from falls is soon washed away.

**C MODERATELY-EXPOSED HILLSLOPE SHORES WITH BEACH**

A spectrum of conditions exist within this category. At one extreme (illustrated in Figure 3.3) the beach completely protects the underlying granite and quaternary deposits, the thickness of water- and wind-deposited sand being sufficient to absorb the effects of changing wave energies. Examples free of erosion problems may be seen (e.g. the duned sector of St Martin's Bay) but the more common situation is where a modest beach fronts the hillslope checking erosion of the ram, permitting the cliffs to become weathered back and overgrown. Where the beach is thin, however, erosion is reported as a problem.

The shoreline east of Bar Point on St Mary's is an example of where once a fully beach-protected situation may have existed, but subsequent loss of the beach as a result of the eastward migration of Bar Point<sup>(10)</sup> has left eroding cliffs of ram overlain by sands, fronted by a very poor beach, thus a Type B shore.

**D HIGHLY-EXPOSED FLAT-LYING SHORES**

In low-lying situations between island hills the sea has usually penetrated well landward and has formed graded beaches of cobbles and boulders, pushed up in a ridge at the High Water Mark to a level often above that of the hinterland. Long period waves during storm periods can frequently overtop these beaches, pushing sand, gravel and cobbles into deposits reinforcing the back slope of the ridge (e.g. Stinking Porth on Bryher). Observations of such processes indicate that effects are primarily constructive, although, in the short-term, deposits are not evenly laid along the beach front, and local lowering of the back beach ridge can be

## Council of the Isles of Scilly Shoreline Management Plan

detrimental to security as has been reported on Scilly<sup>(12),(13)</sup>. Shores of this nature are likely only to retreat with time.

### E MODERATELY-EXPOSED FLAT-LYING SHORES

This is a situation very similar to that described (Type D) above but with sandier beaches. Sand is however in short-supply, and dunes have not developed behind the beach (see Type F shores described below). In contrast to the Type D shore, this can undergo advance or retreat with time, as a function to the supply of sand to the foreshore. The potential for overtopping is seen as a threat.

### F SAND DUNE SHORES

Many of the low-lying inward-facing shores of Scilly are backed by dunes, usually providing a stable but dynamic High Water Mark. There is map and anecdotal evidence that some of these areas may be eroding possibly related to a long-term reduction of sand supply, the mechanisms for which are not evident. Many beaches are accreting, although some are still perceived as being vulnerable (e.g. Porth Mellon, St Mary's) possibly due to human effects such as trampling of stabilising marram grass or the construction of access ways.

### 3.3.3 Changes in Plan

The stability of shore model types C, E and F described above is dependent to a large extent on the supply of sand to the foreshore. As well as being affected by shore-normal, wave driven processes, this supply can also be affected by shore-parallel longshore drift and/or tidal transport of sand, evident in plan form.

Sand within trapped bay beaches may undergo longshore displacement, for example as a result of the changed frequency of storm occurrence from critical directions. This was evident during the winter 1995/1996 following a prolonged run of south-east gales which shifted sand along many south-facing beaches from the east to the west.

---

(12)

*High Energy Coastal Sedimentary Deposits: An Evaluation of Depositional Processes in South-West England, I.D.L. Foster, Geography Department, Coventry Polytechnic, Internal Report, 1991*

(13)

*Engineer's Report for Coast Protection Works on St Agnes, DHV (UK) Ltd., Bristol, 1995*

---

Council of the Isles of **Scilly**  
Shoreline Management Plan

Appletree beach on Tresco appears to have undergone a southward displacement of sand over the past century, possibly exacerbating or possibly as a result of the erosion problems identified at the site.

The sand spits at Bar on Bryher and Bar Point on St Mary's have markedly changed in form over the past century. This may be due to short-term variability in the occurrence of storm wind directions. At Bar Point on St Mary's there is also evidence of a longer-term persistent eastward migration of the spit<sup>(10)</sup>. Both sites are, or have been, local extraction points for building aggregates.

One of the most marked changes in shore plan identified from the comparison of High Water Marks is at Stony Porth/Rushy Bay on Bryher. Map evidence clearly indicates that a century ago Stony Porth was a trapped bay beach (Type D, see above). The bastion of the southernmost headland was the Inner Colvel Rock, connected to the main island by the narrow isthmus of the cobble beach which has been breached during the last century enabling the "untied" southern end of Stony Porth to migrate to lie more parallel to the incident wave energy.

### 3.3.4 Low Water Mark Advance and Retreat

The earliest reliable survey of the islands' low water marks was undertaken by Graeme Spence<sup>(14)</sup>. The mark surveyed is believed (but not known definitively) by the present day Hydrographic Office in Taunton to be the lowest water of spring tides, which is liable to be slightly higher than the Lowest Astronomic Tide (LAT) of current chart datum. These two marks are compared in Drawing 2. The 1792 chart is obviously not surveyed to a level of accuracy comparable with that of the modern day, and small-scale changes cannot be identified. However, two clear changes are observable:

- on the low-lying flats between Samson and Tresco and between Tresco and St Martin's the 1792 LWM is comparable to the 0.6 m isobath today, indicating a general 0.6 m submergence in 200 years, consistent with the 3.3 mm per year identified from the Newlyn tide records. Such inundation must be enhancing wave penetration and exacerbating HWM erosion on inward-facing shores;
- the drying Crow Bar marked on the 1792 chart occupies depths of 0.3 to 1.4 m on the modern chart, and would therefore appear to

---

(14)

*A Survey of the Scilly Isles, Chart 34, Graeme Spence, Surveyor, Hydrographical Office, 1792*

---

## Council of the Isles of Scilly Shoreline Management Plan

have undergone erosion in areas. However, the position of the drying crest of the modern Crow Bar is some 200 m further east than that of 1792 (confidence in the 1792 position-fixing is high since Crow Bar is so close inshore), and extends considerably further south, a change which can only be attributed to the accumulation of 1 m or more of sand in this area. Such local deposition is consistent with both the predicted tidal transport of sands, and the inward movement of sand under shoaling waves approaching from the south-west and south-east of St Mary's. The overall eastward migration of the Bar may reflect the dominance of westerly waves in local sand transport processes.

### 3.3.5 Biological Effects

Kelp-rafting is probably an important mechanism whereby cobbles and boulders are transported into littoral areas from deeper waters, as reported by local observers.

Extensive eel grass (*Zostera* spp.) beds occur on sand flats in many parts of the islands<sup>(15)</sup>. The beds do not appear to grow in areas of strong tidal currents, but may be important stabilising agents as far as wave-induced scour is concerned.

Marram grass plays an important role throughout the islands in stabilising dune deposits. The effects of trampling are extensive, as noted from aerial photographs.

### 3.3.6 Anthropogenic Effects

Quays and coast protection structures have been constructed on many coasts of the main islands (see Drawing 1). They require constant attention. Most appear to have had minimal effect on beach regimes. Exceptions are in Popplestones on Bryher and Appletree Point on Tresco where vertical seawall construction seems to have created wave-breaking conditions immediately in front of the walls that has led to the thinning or total removal of the beach to the detriment of the foundations of the structures. The structure at Popplestones has recently been replaced by a rubble-mound structure that should improve stability and discourage further beach erosion. The construction and partial removal of the lifeboat slip on St Agnes has been noted from map evidence to have changed the planform of Periglis.

---

(15)

*Isles of Scilly Expedition Report, Coral Cay Conservation Sub-Aqua Club, 1993*

## Council of the Isles of Scilly Shoreline Management Plan

A general malaise throughout the islands is the practice of small-scale private works to exclude run-up during storms in areas where land has been put to use very close to the waters edge. This protection takes the form of rubble and rubbish dumping. Small lengths of concrete block wall have also been constructed. In many areas this practice probably converts the constructive depositional action of overtopping by long period waves into destructive turbulence along the upper beach, leading to localised depletion of beach sediments and the more vigorous attack of the zone at and immediately above High Water.

The extraction of sand and gravel for building purposes has been traditionally carried out intertidally in Scilly. At Bar on Bryher and Bar Point on St Mary's extraction occurs in areas immediately adjacent to those where marked retreat of the High Water Mark is evident from map evidence.

A study carried out at Bar Point in 1992<sup>(11)</sup> postulated a natural clockwise circulation of sands around the headland, involving both longshore drift and aeolian transport phases, superimposed on a slow natural eastwards translocation of the headland feature. Map evidence also showed that current rates of retreat on the western shore of the headland are higher than earlier this century. The study concluded that aggregate erosion at the tip of the spit is altering the plan form of the high water mark in such a way as to enhance longshore drift, thus increasing sand transport rates within the east-going part of the cycle of sand around the headland, and hence increasing the rate of eastward migration of the spit. The study also concluded that there was no obvious onshore movement of sand at this locality to replenish extraction losses".

### 3.4 Future Trends

There are many areas within the islands that are stable in the long-term (100 years) as has been shown from examination of map evidence. Areas that can be shown from map evidence or local knowledge to be eroding are identified in Drawing 3. The general rate of erosion measurable from OS data seems to be fairly consistent at 10 m per 100 years although there are locally higher and lower rates of erosion. These areas may be expected to continue to erode at generally similar rates to today.

Some beaches will erode beyond the isolated hard points which presently anchor them (as Stony Porth on Bryher is presently in the process of doing) with the eventual isolation of the anchoring hard point as an offshore rock. The combination of separate adjacent beaches into one whole which is smaller in overall length than the sum of its previously independent component parts will be

Council of the **Isles of Scilly**  
Shoreline Management Plan

the result. On a global scale across the islands, this can be seen to have happened in reducing the one original island (4,000 years ago) into several islands and rocks (see Figure 3.1).

In the very long term horizon (a time horizon much greater than 100 years), the areas vulnerable to erosion will extend beyond those stretches of coast which are presently affected as water levels increase due to global warming. It is noticeable that St Martin's is relatively unaffected by the process of global warming and coastal erosion since its dwellings are all constructed at a high level. The most vulnerable area historically has been Hugh Town on St Mary's which has been built on the sand bar connecting the high land of Garrison Hill and Buzza Hill.