

COASTAL EROSION SURVEY  
ABERDARON BAY TO GREAT ORME

REPORT NO. 79

Ymddiriedolaeth Archaeolegol Gwynedd  
Gwynedd Archaeological Trust

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**Gwynedd Archaeological Trust Report No. 79**

## **Coastal Erosion Survey, Project GAT 39**

### **Objectives**

To carry out a desk and field study of the coastline of Gwynedd from the southern tip of the Llŷn Peninsula to the northern tip of the Great Orme, to assess and map the scale of erosion, record the condition of known archaeological sites and features and to identify new sites.

In general terms the study aims to provide an environmental assessment of the coastline, to identify the effects of past and future erosion and suggest management strategies for particular archaeological sites and areas of potential. This will be a direct aid to management in balancing the archaeological resource against threats, extending the known record and aiding development control.

### **Summary**

Much of the coastline was shown to be either stable or suffering only slight erosion being composed of resistant rock or with man-made protection. Serious erosion of immediate significance was confined to quite small areas. However, much of the coast is both low lying and composed of soft glacial sediments and here documentary evidence shows that there has been slow continuous retreat of the land-edge. Areas are identified which are liable to be inundated with the impact of rising sea levels due to global warming. Much of these are reclaimed marshland which have considerable archaeological potential as 'wetland' and thus merit survey and assessment. A considerable number of new archaeological features were recorded, the larger proportion being medieval or post-medieval. Along most of the coast post-medieval cultivation extends virtually to the cliff edge. The few remaining areas of land not under modern cultivation are therefore identified for their future field work potential. Survey of the known sites shows that most are in sheep pasture and stable but a few are in poor condition and need attention. While there are few new sites where deterioration will continue without conservation measures being taken, most require at least survey and a suggested response for each is listed in the summary gazetteer (Appendix 2).

In terms of general academic and management goals the project identified three main themes for future work: first, evaluation of the earlier prehistoric exploitation of Llŷn; second, evaluation of Dinas Dinlle wetland environs; third, recording of post-medieval industrial features and complexes.

### **Research Design**

The area of study was defined to include not just the coast edge itself but in addition part of the dry land edge, taken as a strip 150m wide (from the coast edge) and the intertidal zone (fore shore).

The work falls into two fields of scientific interest: First the study of physical erosion and second the study of the archaeology. Contact with the Marine Studies Department of University College of North Wales, Bangor, (UCNW), shows that there has been no overall study of coast erosion in this area. Research seems to take place only in relation to specific areas of interest or management problems. Archaeological knowledge, deriving originally from work by the Ordnance Survey and the Royal Commission on Historic Monuments (Wales), has never been specifically related to the effects of erosion. Additionally, parts of the coast, due to their scenic nature, have received more attention than others from amateur field walkers and the public, producing a probable bias in the known record in terms of the distribution of sites.

The work was seen as filling a gap in knowledge particularly in identifying those archaeological sites which are eroding and which require attention. It was also seen as a requirement for resource planning in the face of widespread concern about rising sea-levels with global warming and of increasing amenity use of the coast as a result of the encouragement of tourism and the provision of better information, access and long-distance paths.

The archive of survey records will be retained by Gwynedd Archaeological Trust (GAT) while this synthesis with reference maps and gazetteers will be made more widely available.

No previous comparable archaeological survey is known although a similar study is at present underway in Northumberland (Hardy, 1991). Coast edges have always received greater than average study because of their attractiveness for amenity use and the frequent presence of soil exposures. On the other hand, the project can be regarded as just a study of a particular landscape type, comparable in aims to studies of other rather different landscapes, such as the North West Wetlands or Bodmin Moor in England.

The survey was designed as a rapid study of an extensive piece of landscape (139 km) to aid general management rather than to produce detailed surveys of individual sites. The work entailed looking for and recording earthworks, structures or artifacts within the coastal edge strip or eroding from soil exposures, recording the types of coast edge, fore shore or land edge use, quantifying erosion and assessing the condition of previously recorded features. The results will assist in the survey of comparable areas and will also be of relevance to other related disciplines such as geology and natural history as well as to planning authorities and to commercial firms involved in environmental assessments, coastal protection consultancy and engineering work.

### **General description of the survey area**

Most of this length of coast is generally north-western facing except for localised areas, the tip of Llŷn, the area between Clynog and Morfa Dinlle and the west coast of the Great Orme. Only limited areas are therefore affected by the main wave action from the prevailing south westerly winds. The Menai Straits are narrow, shallow, sheltered and little more than a tidal estuary.

The coast from Aberdaron Bay around to Yr Eifl, Trefor consists largely of cliffs, up to 30 metres high, of mainly hard, resistant, igneous rocks. Rocky cliffs of igneous and, in small part, carboniferous limestone also outcrop along the southern shore of the Menai Straits between Caernarfon and Bangor. There are small areas of igneous cliffs on the north coast at Penmaen Mawr and Penmaen Bach and of limestone cliffs on the Great Orme peninsula. The rest of the coast is mainly of low cliffs of glacial sediments, silty sands or clays incorporating some pebbles and larger boulders. These sediments cover much of the land area and rocky cliffs are in most cases overlaid by depths of glacial deposit, producing complicated weathering profiles. In addition, glacial sediments have filled ancient bays and channels in the bedrock often to below sea level so that there are localised occurrences of deep, soft sediment within larger areas of rocky cliffs (Steers, 1964, 122).

The whole coast consists of a raised 'plain', an ancient sea-platform (Smith and George, 1961, 2, 78) and fragments of ancient beach platform have been identified at various points around Llŷn (Whittow, 1960, 31).

Some lengths of the coast edge have man-made protection, particularly around the towns of Caernarfon, Bangor, Llanfairfechan, Penmaenmawr, Conwy, Deganwy and Llandudno and where large estates such as those of Vaynol and Penrhyn border the sea. There are also some areas of low lying land between Clynog and Morfa Dinlle which have been reclaimed by drainage and sea-walling.



## Methods

The survey was carried out by two persons walking the coast edge simultaneously. Features, coast types and erosion classes were noted directly onto 1:10000 maps backed up by detailed descriptions on GAT survey forms and by photographs or sketch plans where necessary. Often where the coast edge consisted of a considerable depth of drift there were two components, the land plateau edge at the head of a sloping cliff and the actively eroding coast edge at the foot of the drift slope, just above the fore shore. Soil exposures were searched for artifacts but not comprehensively since some drift slopes had many sheep trample/soil creep terracettes while other places were inaccessible and dangerous.

In general the rocky coast of western Llŷn was very slow to survey because of its indented and inaccessible nature. Other areas were easier because of the presence of coastal paths or of very low coast edge allowing survey from the fore shore. Large parts of the Menai Straits are walled but apart from a few private areas most was surveyed because of the possibility of features occurring in the coast edge strip.

## Survey Recording

### a. Description of Coast and extent of erosion.

The type of coast and erosion were described in textual description but to facilitate analysis were also recorded in coded categories which were entered on a record form (Fig. 1). A separate record form was completed for each length of coast which appeared to be of a similar general physical type. Minor changes such as where a stream cuts a channel through the cliff were incorporated in the same record whereas a cove within a length of cliff would have a separate record number. A series of similar adjoining coves on the other hand would also have just a single record number.

The coast was thus recorded as a linear landscape and records could describe as short or long a length as required. As the descriptions were coded the information can be plotted and displayed in map form allowing easy access to the data. In addition, the information could, if required in future, be entered onto a computer database with the ability to plot two dimensional graphic data.

One hundred and fifty two record sheets were used to describe the 139 km of coast. The records used three descriptive types: coast edge, land edge and fore shore. Coast edge type described the actual interface between the land and the tidal zone. The land edge type described the land-use of the land immediately adjoining the coast edge. The fore shore type described the intertidal area up to highest storm tide height at the coast edge.

#### Coast Edge Type This includes 12 categories:

- |    |                                    |
|----|------------------------------------|
| 1  | Man-made wall                      |
| 2  | " " bank                           |
| 3  | " " mixed rubble dump              |
| 4  | " " boulder dump                   |
| 5  | " " other                          |
| 6  | Mainly rock                        |
| 7  | Rock with drift cover              |
| 8  | Rock to tide line with drift cover |
| 9  | Drift, boulder clay                |
| 10 | Drift, sand/blown sand             |
| 11 | Alluvial/marine mud                |
| 12 | Other                              |

To facilitate display the man-made types were merged into one category on the accompanying maps (below). Not all man-made coast edges were designed specifically for coastal protection e.g. some estate walls but where these have been monitored and maintained erosion is

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## Gwynedd Archaeological Trust

Project 39 Coastal Erosion Survey

OS 1:10000 Map No.	Record No.
Project Maplet No.	OS Grid Refs
Place Name Description	
Coast Length (km)	Direction (Facing)
Coast Edge Type	Land Edge Type
Foreshore Type	Geology
Erosion class	Soil
Associated PRNs	
Associated Project Record Nos	
Description	
Date Walked	Recorded by

effectively controlled. Apart from man-made coast edges the main distinction is between 'hard' i.e. of rock and 'soft' coasts i.e. of glacial or alluvial material. As all of the survey area has been glaciated then glacial deposits are very widespread and often very deep. Much of the coastline is dominated by cliffs eroding in this glacial drift which produces a characteristic sloping coast edge generally partly grassed over. There is some variation in appearance of these drift cliffs depending on the height of the underlying rock strata, the depth of the drift and on the local constituents of the drift. The two typical coast edge types are one where the underlying rock surface is above highest tide level (Type 7). Here all the wave erosion is of the rock and so slow that the overlying drift is well grassed and stable. The other type is one where the surface of the underlying rock is at around highest tide level (Type 8). This results in direct storm erosion of the drift which is grassed but subject to soil creep and slumping, above a rocky fore shore. The depth of the drift also varies from a few centimetres to over 30m and the constituents of the drift vary. The majority is 'boulder clay' which is fairly cohesive but there are more localised areas of sandy drift such as under-glacier fluvial deposits or outwash channels and even ancient beach deposits. The drift, being uncemented, has a low angle of rest at the coast edge caused by soil creep and slumping. This may be a very slow process but continues even though the surface may be well grassed over. The areas of more sandy drift have a lower angle of rest and slumping and soil creep are much more active. It is the steeper cliffs in drift which are most actively eroding i.e. they have not been able to achieve an angle of rest. This in turn means that even if coast edge erosion ceased the cliffs would continue to erode back until their angle of rest was reached. This is very significant for features which are already on the (drift) cliff edge.

The bedrock underlying the drift often has a plateau-like top, the result of geologically earlier wave platforms or glacial planing. However, there are some localised features in the top of the bedrock, for instance glacial channels and it seems to be these which create local erosion features such as coves, rather than that these are where weaknesses in the rock have produced greater erosion. The constituents of the drift are difficult to assess for the non-specialist and the differentiation was only general.

Alluvial deposits would be very sensitive to erosion but are generally the result of aggradation of the coast by river silts rather than erosion. The only other type of coast encountered was shingle storm bank, little different to man-made shingle sea walls but a result of natural aggradation.

**Land Edge Type** relates to land-use rather than physical type, ordered in terms of the extent of human interference.

- 1 Man-made structures
- 2 Arable
- 3 Improved pasture
- 4 Scrub/heath/rough pasture
- 5 Coppice/woodland
- 6 Other

Man-made structures can be any kind of building, road etc. Arable use is infrequent and spasmodic and for the area investigated pasture is the major land-use by far. It is difficult to differentiate by eye between improved pasture (i.e. ploughed and re-seeded) and unimproved as experience of the Blackdown Hills Survey Project by the Exeter Museums Archaeological Field Unit has shown (P. Weddell. pers. comm.). Pasture that has never been ploughed in recent memory can still be 'improved' by good management and be of better appearance than poorly managed fields which have been ploughed and re-seeded just as scrub/heath can be old pasture or arable that has been neglected or abandoned. However, observation in many pasture fields of slight lynchets, headlands or fieldstone dumps shows arable use in the past and it can be suggested that very few if any of the fields in modern use along the coast have not been ploughed. Coppice or woodland is very limited in extent but is important as the type of land-use most likely to preserve earthworks.

**Foreshore Type** This was recorded because it gives some clues as to the state of erosion e.g. a mud foreshore shows a lack of erosion. It also shows the effect of post-glacial rising sea-levels. A steep rocky coast will change little as sea-level rises while a very shallow foreshore will change considerably and lacking erosion is likely to preserve organic remains such as peat beds or tree stumps. A marshy foreshore may be the result of submergence or of transgression from open water to dry land by silting and organic growth. The following are the types used:

- 1 Rock
- 2 Boulder
- 3 Shingle
- 4 Sand
- 5 Mud
- 6 Marsh
- 7 Mixed
- 8 Other

**Erosion class** depended on a visual assessment of the condition of the coast edge not a strict quantification. This, if possible, would have to be based on a measurement of the retreating coast edge over a long period and this is obviously outside the scope of the project. The alternative is a comparison of the present coast with that shown on early maps which will be included in the general discussion. The survey looked for immediately evident signs of erosion such as soil exposures, slumps, the presence and type of covering vegetation and the condition of land edge field boundaries.

The following are the classes used:

- |   |        |   |   |
|---|--------|---|---|
| 1 | Stable | - | No erosion, aggrading or man-made protection.   |
| 2 | Slight | - | Some soil exposure but well vegetated and post-medieval boundaries largely intact.        |
| 3 | Medium | - | Widespread soil exposure, intermittent slumping. Post-medieval boundaries largely gone.   |
| 4 | Major  | - | General soil exposure, frequent slumping, little vegetation, no post-medieval boundaries. |
| 5 | Severe | - | Widespread slumping, no vegetation, recent boundaries undercut.                           |

A drift cliff covered by trees shows that it has been stable in the past but if the coast edge tree roots are being undercut then this would be classified as slight erosion. If there are recent tree falls at the coast edge then this would be classified as medium erosion.

There are few features which can give precise indications of erosion. Field boundaries provide perhaps the best markers that might also be identified on early tithe maps or estate maps although even these are unlikely to be accurate enough to allow measurement of changes. Occasionally stone gate-posts are found on the beach presumably very close to where they originally stood. Also there are numerous beach access tracks for fishing or for collection of sea-weed/sand for improvement of fields. These are generally washed away at their seaward end and show that some erosion has taken place since their abandonment probably earlier this century.

The type of erosion being identified here is the immediate, evident erosion which is on quite a different scale to the longer term geological erosion or aggradation of the coast controlled by wind direction, currents, geology, changes in sea-level and climatic changes. Some dramatic changes can take place in rare storm conditions, even on a generally stable coast and management of endangered archaeology should take these into account, in addition to continual slow erosion, just as would an engineer in planning new structures such as bridges etc.

There are other erosion factors besides wave action which particularly affect the coast. Visitor and animal trampling tends to be more intense than inland as are the effects of ensuing wind and rain. Coasts are also attractive for development whether for tourism, housing or amenity.



## **b. Archaeological Survey**

This consisted of two parts. First of visiting those sites, features or find spots already known and recorded on the Gwynedd Sites and Monuments Record (SMR) and second the recording of any new features, sites or finds. Features or finds within 150m of the coast edge were included and the potential of any wider areas actually adjoining this coastal strip considered. Forty five known sites or features lay within the survey area and eighty five new ones were recorded. The recording was done on standard GAT survey forms which include a detailed description, a record of threats and assessment of condition. Because of the extent and variety of the surveyed area the discussion will be set out in eight geographical areas each covering 10 x 13km, matching the OS 10km longitudinal grid lines, numbered from the south west (Fig. 2).






The archaeological sites, features or find spots are described on their individual records and summarised in the gazetteer (Appendix 2). To allow display here they have been put into simplified categories with their project record numbers to allow further reference. The category symbols for previously known sites are numbered in italics (records *401-445*) and new sites are numbered in plain type (records 201-285). The same figures show the areas of unimproved land where more comprehensive survey may be useful as well as land below about five metres above highest tide level which may be prone to future submergence.

# COASTAL EROSION SURVEY - KEYS TO MAPS 1-8

## COAST EDGE TYPE

	Man-made barrier
	Rock
	Rock & drift cover
	Low rock & drift cover
	Drift, boulder clay
	Drift, sand/blown sand
	Alluvial/marine mud
	Shingle storm bank
	Human disturbance

## EROSION CLASS

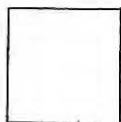
	Stable
	Slight
	Medium
	Major
	Severe

## NEW RECORDED SITES

+	Lithic scatter/flint bed
▲	Cairn/standing stone
●	Settlement feature- prehistoric - early med.
■	Settlement feature- med.- post med.
△	Agricultural/fish/forestry
□	Industrial/military
○	Transport



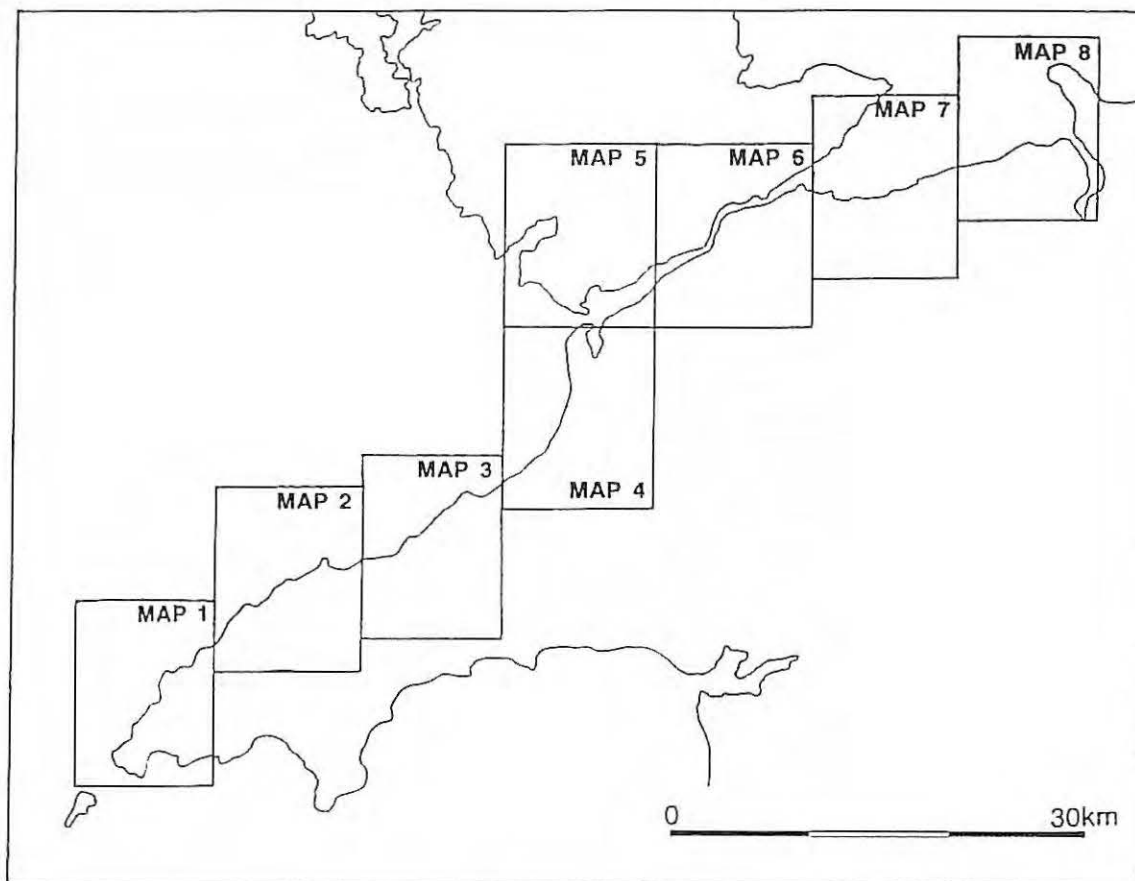
Coastal areas of unimproved heath, scrub, or woodland deserving field survey



Land in survey area below 10m OD

201 - 281	New record
401 - 445	SMR record





## Survey Results

### Map 1, Porth Cloch, Aberdaron Bay to Traeth Penllech, Llangwnnadi (Coast Records 1-14, Figs. 3-5).

#### a) Coast Type and Erosion Assessment (Figs. 3-4).

The southern part of this area is of relatively high cliffs (c. 40m OD) largely of exposed rock, although with some drift cover in units 1 and 2. The northern part, units 7-14 is also mainly of rock with drift cover but somewhat lower (c. 15-20m OD). The bedrock of hard schist and gneiss is resistant to erosion so that despite being exposed to prevailing winds and waves erosion is only slight. Where the coast edge is of exposed rock it is steep or very steep sloping and very difficult of access but for the same reason unlikely to contain archaeological features. Where there is drift cover the coast edge consists of sheer or steep rock capped by medium sloping drift, mainly well grassed. The exceptions are the more indented coves of Porth Oer (unit 8) and Porth Iago (unit 10). These coves seem to be the result not of increased erosion of softer bedrock but because the surface of the bedrock is locally much lower here, replaced by drift. These may be surface indications of former river channels or glacial channels in the bedrock. In any case the drift is much softer than the bedrock on either side and so erodes further producing medium sloping cliffs, partly grassed and subject to gradual slumping and soil creep. In one place at Porth Oer there is an exposure of glacial sand, possibly fossil beach, below the boulder clay (McCarroll, 1990) and this is subject to major erosion. At Porth Iago the cliff is of sand much of which is exposed by visitor trampling for access which has resulted in extensive weathering and slumping.

#### b) Archaeology (Fig. 5).

The southern headland of Llŷn has the greatest concentration of recorded sites of the whole study area. This seems surprising since it is the most remote and most marginal agricultural land. The explanation is that being so marginal it has been little used in modern times so that features have survived as has occurred in other upland areas of Britain. In addition, as a scenic and unenclosed area (largely in National Trust ownership), it receives extra attention from casual visits, increasing the likelihood of chance finds.

Of the previously recorded sites visited (401-421) those of prehistoric and later settlement and field features are in well grassed heath land and in good condition. These would produce additional information if surveyed in detail. One site is an offshore find of a Roman anchor (411) and the nearby cliffs are inaccessible but as the probable site of an ancient shipwreck a visit could be productive. Another site (414) is a rock-cut medieval holy well just above highest tide level. Although on the extreme coast edge it is in good condition and shows that erosion of the rock cliffs is minimal. A standing stone (415) is in only fair condition, its setting being eroded by sheep trampling and weathering. Five lithic surface scatters have already been recorded (401, 402, 404, 408 and 416). Two of them were only seen in the first place because of exposures in ploughed fields and are hidden from view because the fields are now in permanent pasture. The others were recorded in eroding cliff soil exposures and are in only fair condition with artifacts continuing to erode out. One of them (404) is in very poor condition on a completely denuded and weathered cliff top and is of particular interest because it includes large blades of stone similar to that from the Neolithic axe factory site on Mynydd Rhiw, the largest discovery of such material away from the source site and therefore worthy of further investigation.

Around Mynydd Anelog is another area of heath land in which are some agricultural features, small embanked fields (417) and 'cross-contour' banks (ie oriented at right angles to the contours), possible early land boundaries (419 and 420). These are in only fair condition because of sheep trample and weathering in the exposed conditions. An extensive hut group (421) further inland is well vegetated and in good condition as is an unclassified oval platform (418).

# COAST EDGE TYPE

## MAP 1

0 5km

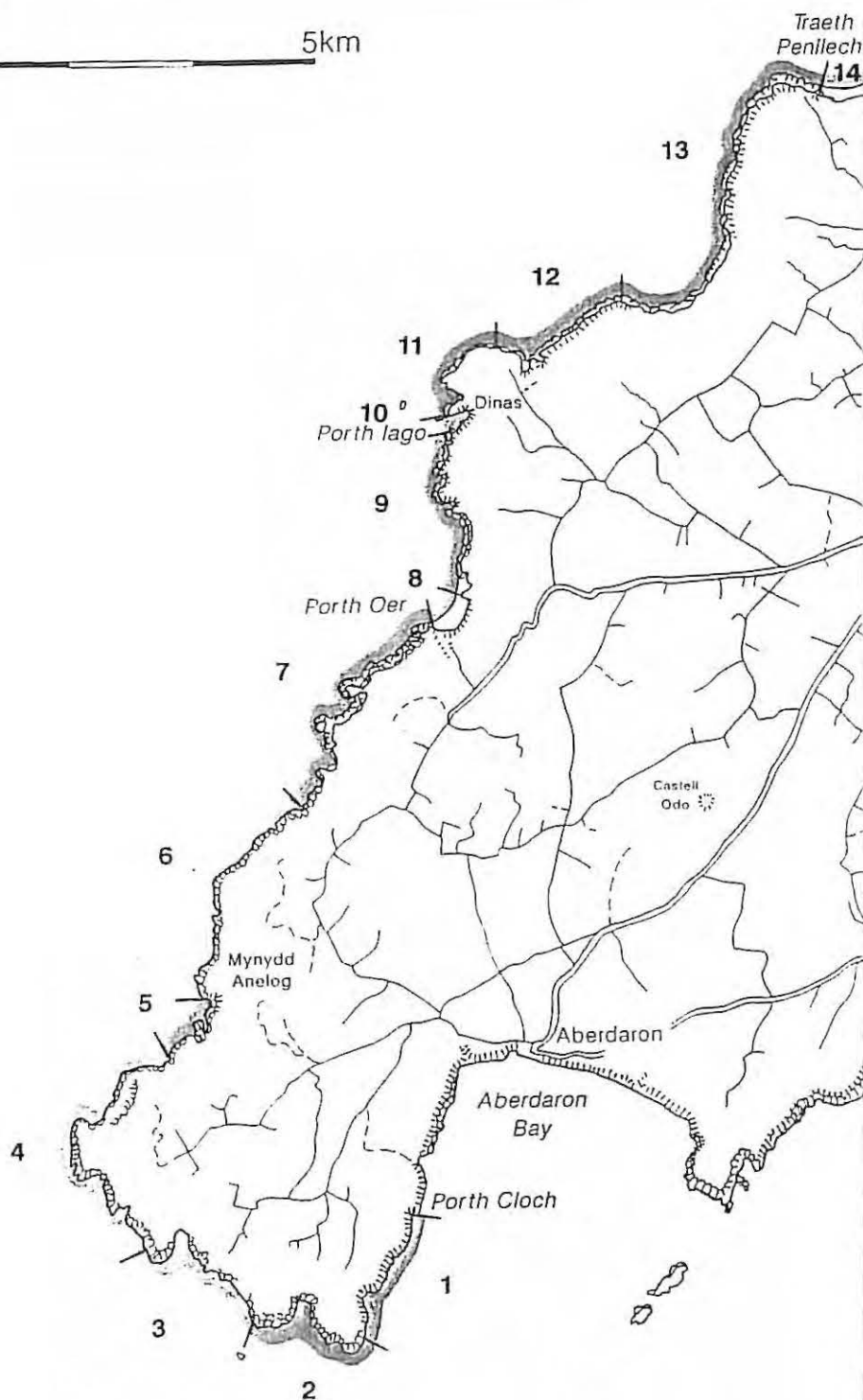


Fig. 3

EROSION CLASS

MAP 1

0 5km

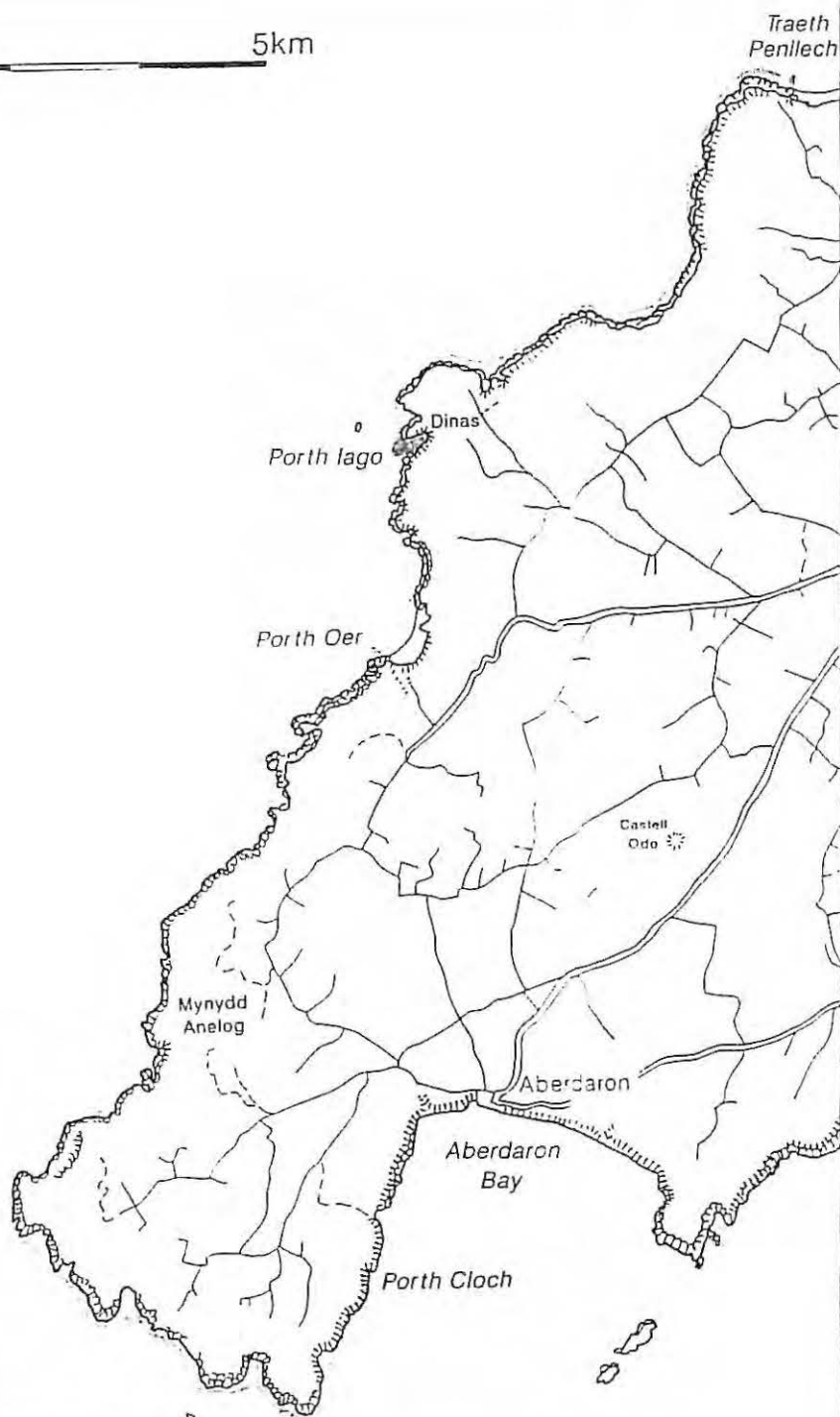


Fig. 4

# RECORDED SITES

# MAP 1

0 5km

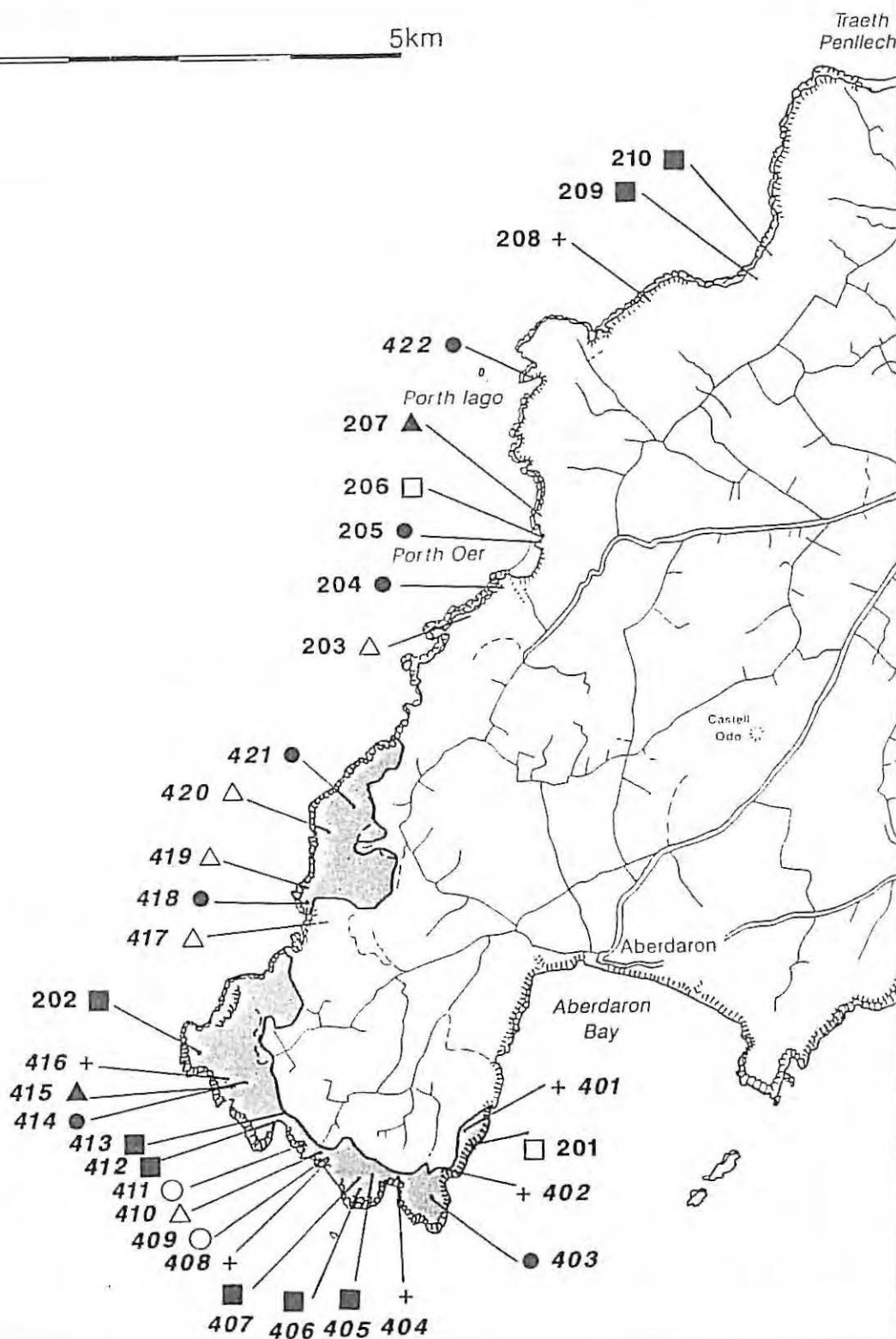


Fig. 5

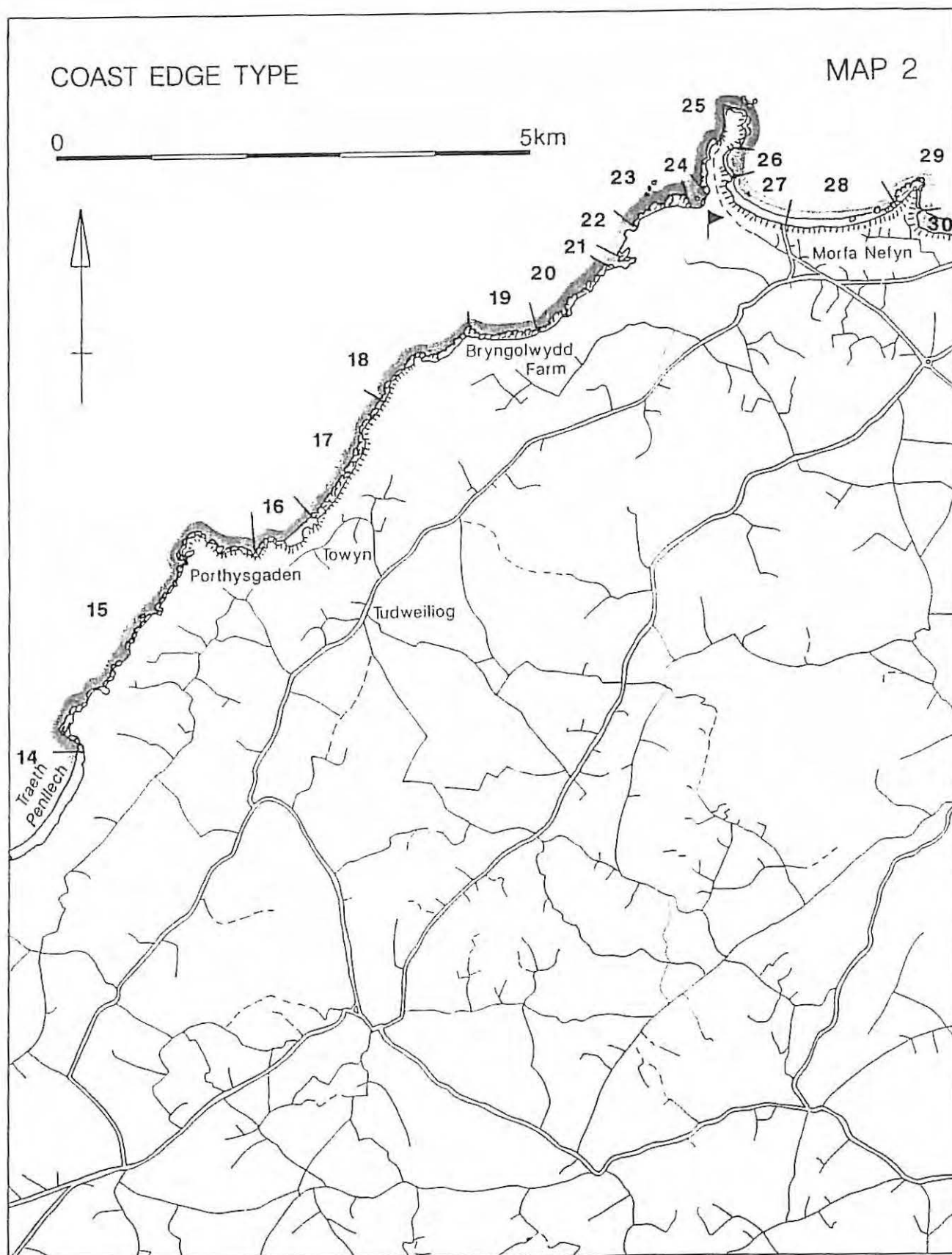


Fig. 6



EROSION CLASS

MAP 2

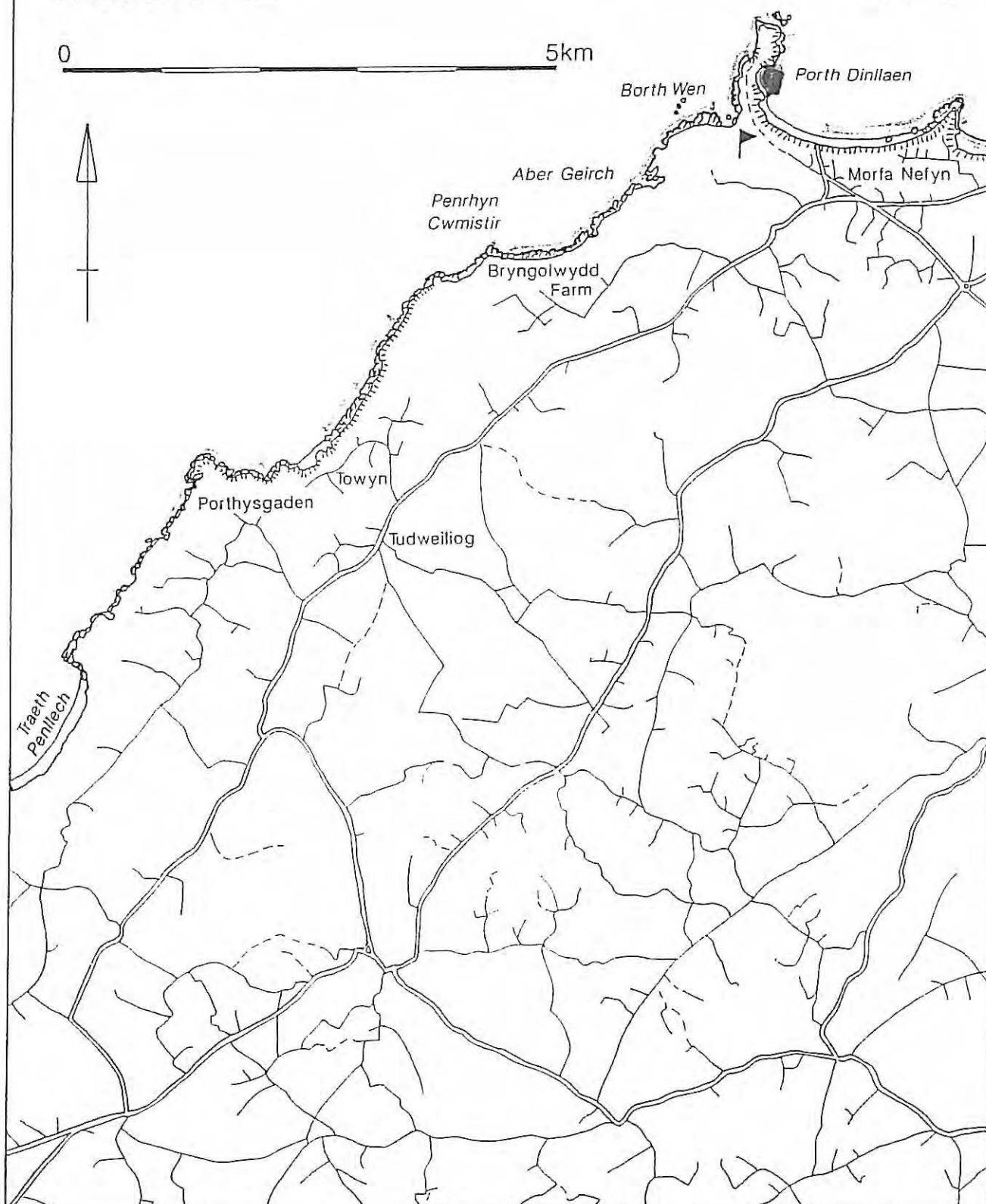


Fig. 7

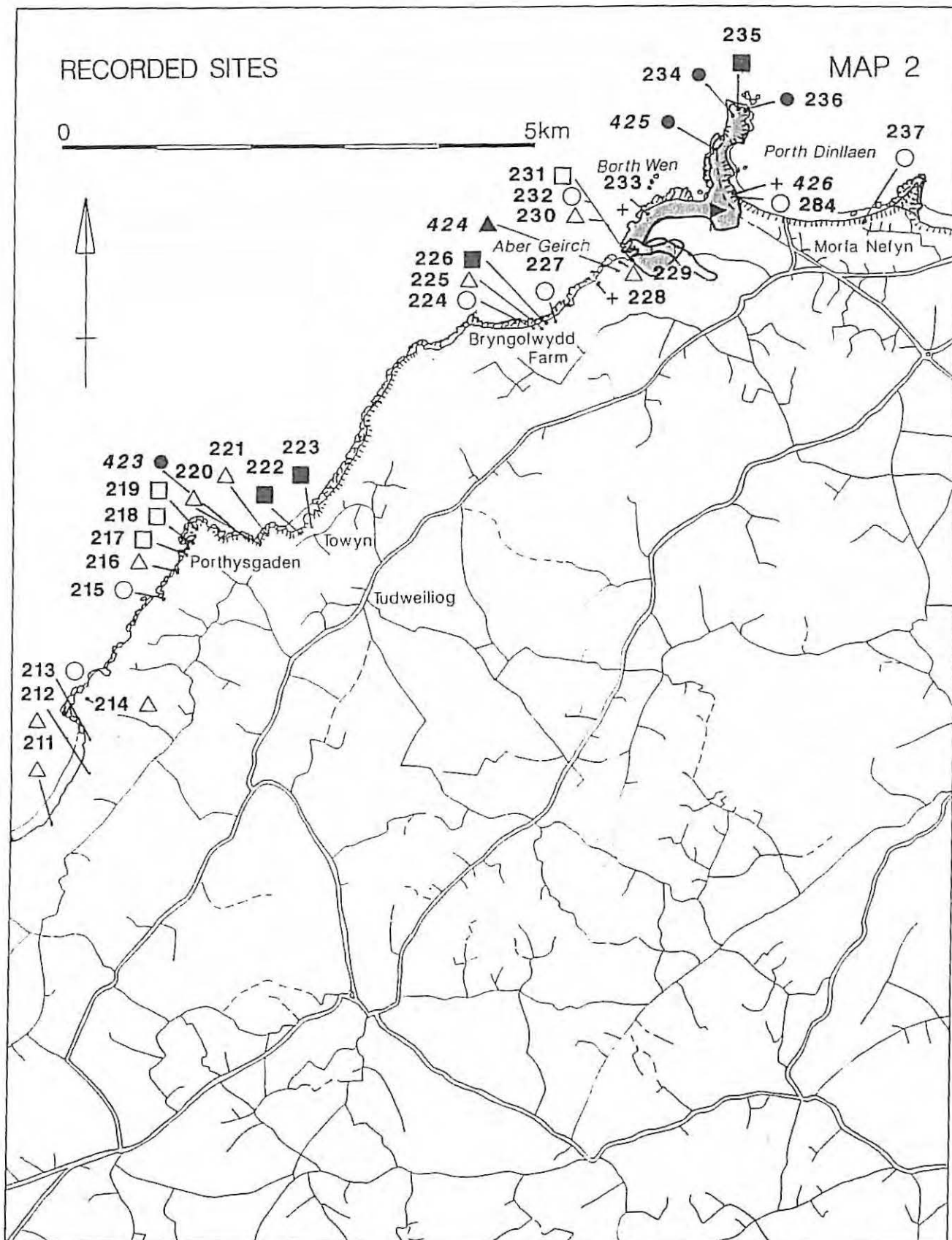


Fig. 8

Only two new features were noted in this area, both post medieval. 201 is a stone quay with remains of machinery but no obvious sign of function and in poor condition as a result of wave erosion. 202 is a small rectangular embanked platform possibly for a fishery look-out hut.

The northern part of this area, record units 7-14, has only one previously recorded site, the small promontory fort of Dinas at Porth Iago (422). While not suffering from wave erosion the condition of the ramparts are only fair, being slighted by a recent farm track and susceptible to further damage, therefore meriting a survey.

The new features recorded are: 203, a series of cross-contour banks similar to 419 and 420, 204 a series of possible circular hut platforms, 205 a possible small promontory fort, 206 a lime kiln, 207 a standing stone, 208 a possible flint working site represented by a single flint core and 209/210, two small embanked rectangular hut platforms associated with small rectangular fields. All these are well grassed and in fair to good condition although meriting ground survey.

In general this length of coast is encroached on closely by farmland which is all pasture but shows signs of occasional ploughing. Such archaeological features as there are survive only in the very narrow strip between the fields and the cliff edge showing that much may have been lost due to ploughing.

## **Map 2. Traeth Penllech to Nefyn (Record units 14-30, Figs 6-8)**

### **a) Coast type and Erosion Assessment (Figs. 6-7).**

The greater part of this length of coast as far as Porth Dinllaen is of steep rocky cliffs with a drift cover. The drift is medium sloping but generally well grassed with little erosion as the rocky part of the cliff absorbs the wave impact. There are two exceptions where there is medium erosion around Penrhyn Cwmistir (units 18-19) and Borth Wen (unit 24) where the bedrock top is low, at about highest tide level. This results in more erosion at the foot of the drift slope with active slumping and soil creep.

To the east of Porth Dinllaen the cliffs are not of rock but entirely of drift which in this area is sandy rather than boulder clay. At the west end of Porth Dinllaen there is active slumping and soil creep. To the east the slopes are well grassed and erosion is slight.

### **b) Archaeology (Fig. 8)**

Few features have previously been recorded on this part of the coast except for the promontory fort of Porth Dinllaen (425), single chance finds (423 and 426) and a probably natural feature (424). The reason is the almost complete absence of unimproved areas with modern fields coming virtually to the cliff edge, presumably eradicating any early features.

A number of new features were recorded, mainly field boundary banks, ridge and furrow cultivation, beach access tracks, quarries or buildings. In addition an exposure of larger than normal flint pebbles was seen in a cove south of Aber Geirch (228). A new flint working site was also recorded on Nefyn Golf Course (233) eroding from redeposited soil from construction of a nearby golf tee. Earthworks of house or building platforms of possible prehistoric date were recorded near Bryngolwydd Farm (226) and of post-medieval date at Towyn (222). Also at Towyn is an unusual small stone building incorporated in or enclosed by a mound, probably a turnip or potato store. Similar features are found in Cornwall, called 'hulls' which may be the post-medieval successors of the souterrain (Tangye, 1973; Christie, 1979). Within the promontory port of Porth Dinllaen remains of a possible inner enclosure were noted (234) as well as possible round house platforms (236) and a turf-built rectangular building (235).

As this length of coast is suffering only slight erosion there is little threat to any features from the sea. The upstanding remains of post-medieval industrial buildings at Porthysgaden (217-219) have been privately consolidated. The greatest threat of erosion is from human activities on Nefyn golf course. The flint site (233) has been exposed by construction there of a tee, the ramparts of the promontory fort have been cut away and left exposed by construction of paths while the interior of the fort has been landscaped and further tees and greens built. The possible hut platforms (236) are simply small terraces on the rocky north eastern point but with no trace of walling. Otherwise, if there were any internal features upstanding within the fort they have now been obliterated by golf course landscaping.

Just east of the Porth Dinllaen settlement is an isolated house on the edge of the shore, 'Hen Blas'. This was recorded as 'Custom House' on an Admiralty map 'Port Dyn Lleyrn Survey' 1837 (UCNW Bangor Archives, Misc 6/104).

There is only one area of unimproved land here, around the valley of Aber Geirch and a number of post-medieval features were seen - ridge and furrow cultivation (229), boundary banks of small rectangular fields (230), a trackway (232) and a series of small stone quarries (231). This area has a dense gorse and heath cover and could well produce more results with a fuller survey.

### **Map 3. Nefyn to Gyrn Goch (Record units 30-44, Figs, 9-11)**

#### **a. Coast Type and Erosion Assessment (Figs. 9-10).**

This is a much more varied coast than that already described as it has a number of rocky headlands interspersed by coast edges of drift some of which are suffering medium erosion through wave action, slumping and soil creep. At Porth y Nant (unit 34), however, the slopes are fairly stable with growth of scrub woodland probably because of low grazing pressure compared to elsewhere. Another part of the Porth y Nant shore (unit 35) is completely disrupted by quarrying activity and at Trefor part of the shore is man-made, the bed of the former quarry tram-way (unit 41).

#### **b. Archaeology (Fig. 11).**

Previously recorded sites include crop-mark 'circles' at Pistyll (427), recorded from aerial photographs not observable on the ground. These have not been identified but might be Early Christian burials associated with the nearby church. These features are now within a caravan park and are susceptible to damage by cutting of service trenches which would merit at least observation.

South of Carreg y Llam is a previously recorded, possibly AD 3rd- 4th century settlement complex (428), regarded as of regional importance. This is close to the cliffs but not threatened at present. However, it is now almost secured from grazing and reverting to scrub. It deserves management of the vegetation or survey before features become hidden.

On the rocky headland of Carreg y Llam itself was once a hillfort (430) previously excavated in advance of quarrying (Hogg, 1957). Nothing remains of this now and no associated features were seen. Nearby is rectangular 'long house' (429) which is in stable condition.

Close to the 'old' quarry pier at Trefor is a previously recorded undated flint/chert working site (431). A number of worked flints were collected in a short period and it is clear that this is a fairly rich site and subject to continuing erosion. Some flints are eroding out of the topsoil close to the cliff edge where trampling and weathering of a footpath are destroying the turf cover. Others are eroding out of an exposed section face on the sides of an old adit cutting. This section shows that more of the site exists with possibly a preserved horizon buried under colluvium. This is unusual for a coastal site and shows that it has potential for recovery of a



# COAST EDGE TYPE

MAP 3

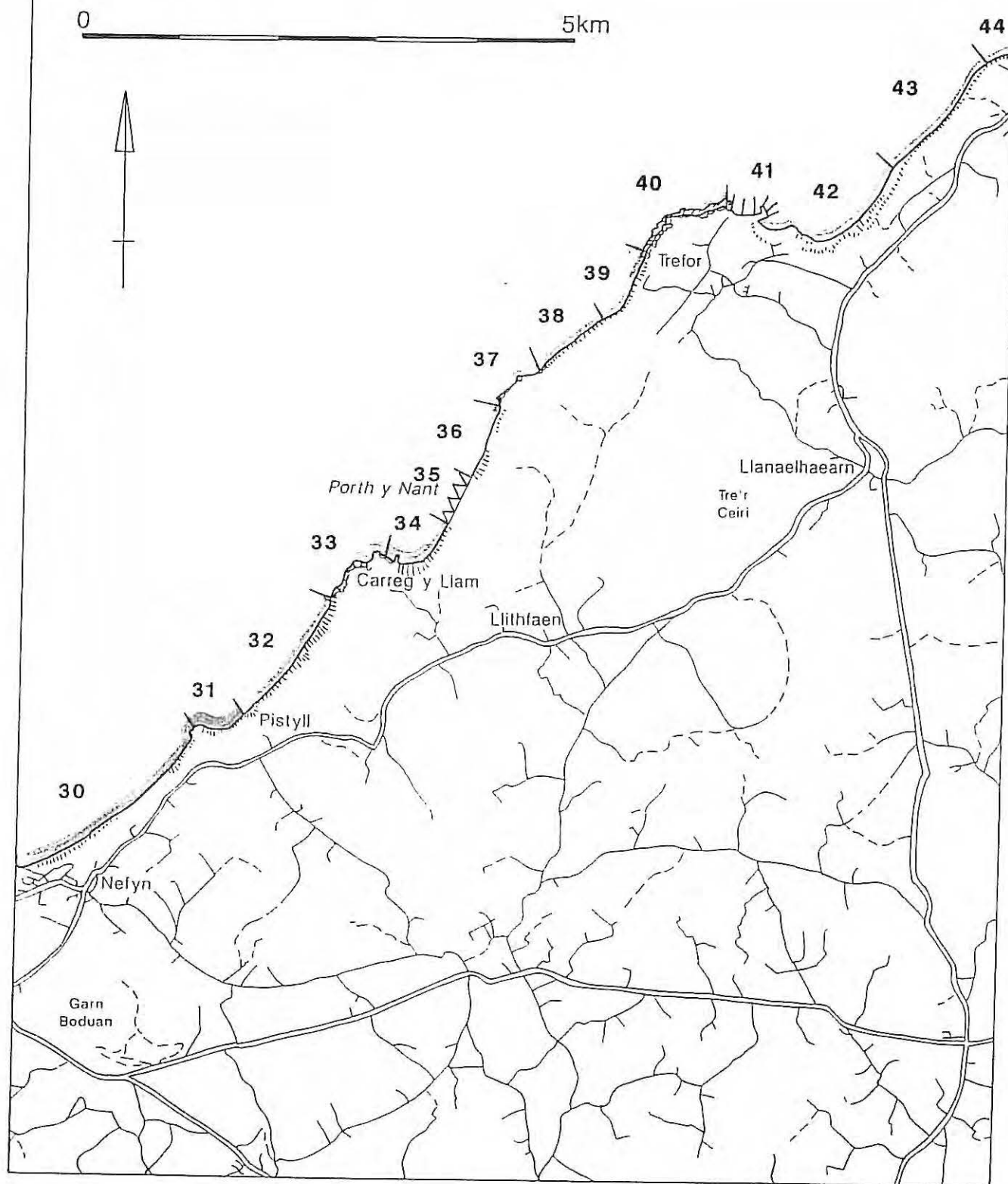


Fig. 9

EROSION CLASS

MAP 3

0 5km

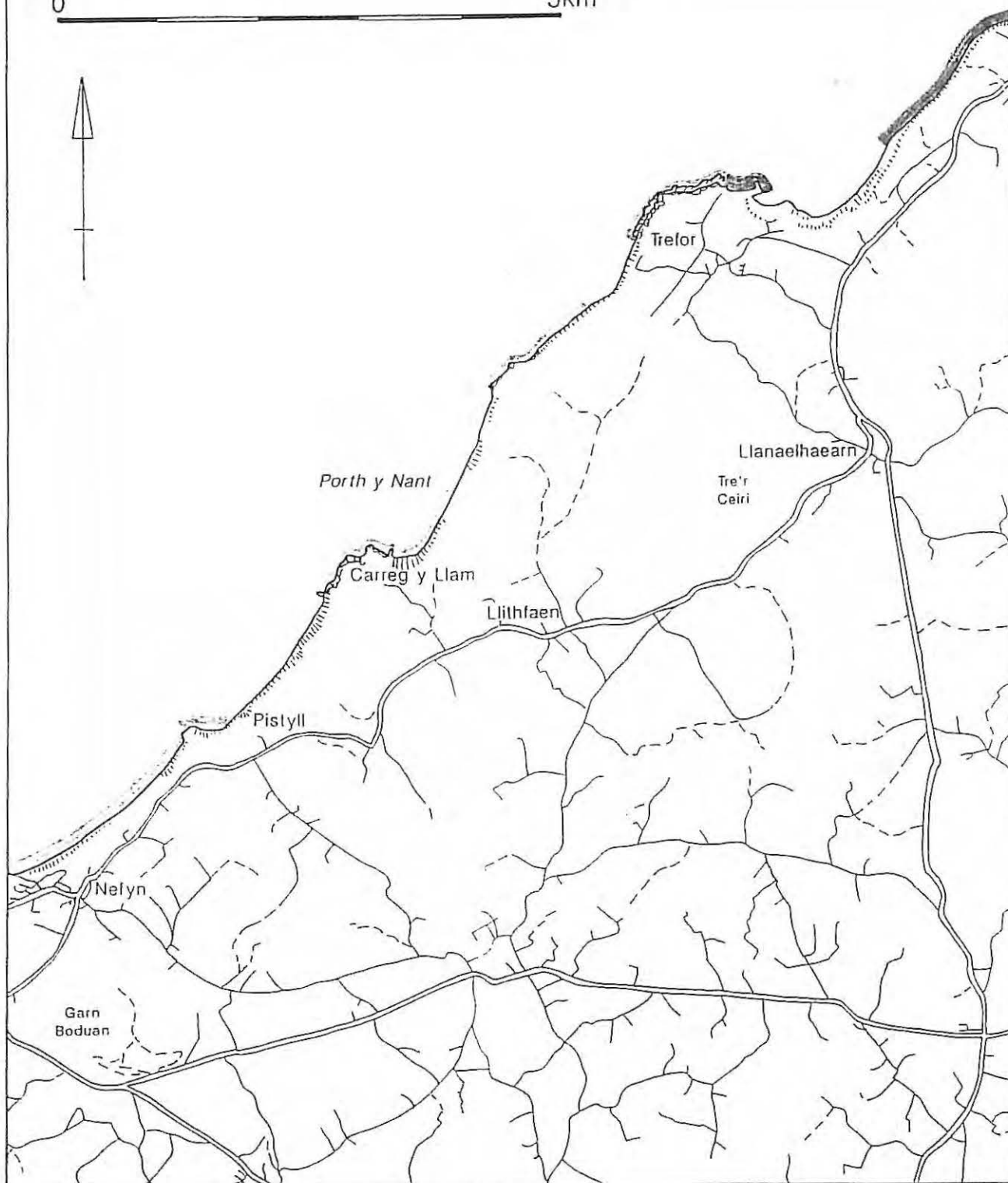


Fig. 10



# RECORDED SITES

MAP 3

0 5km

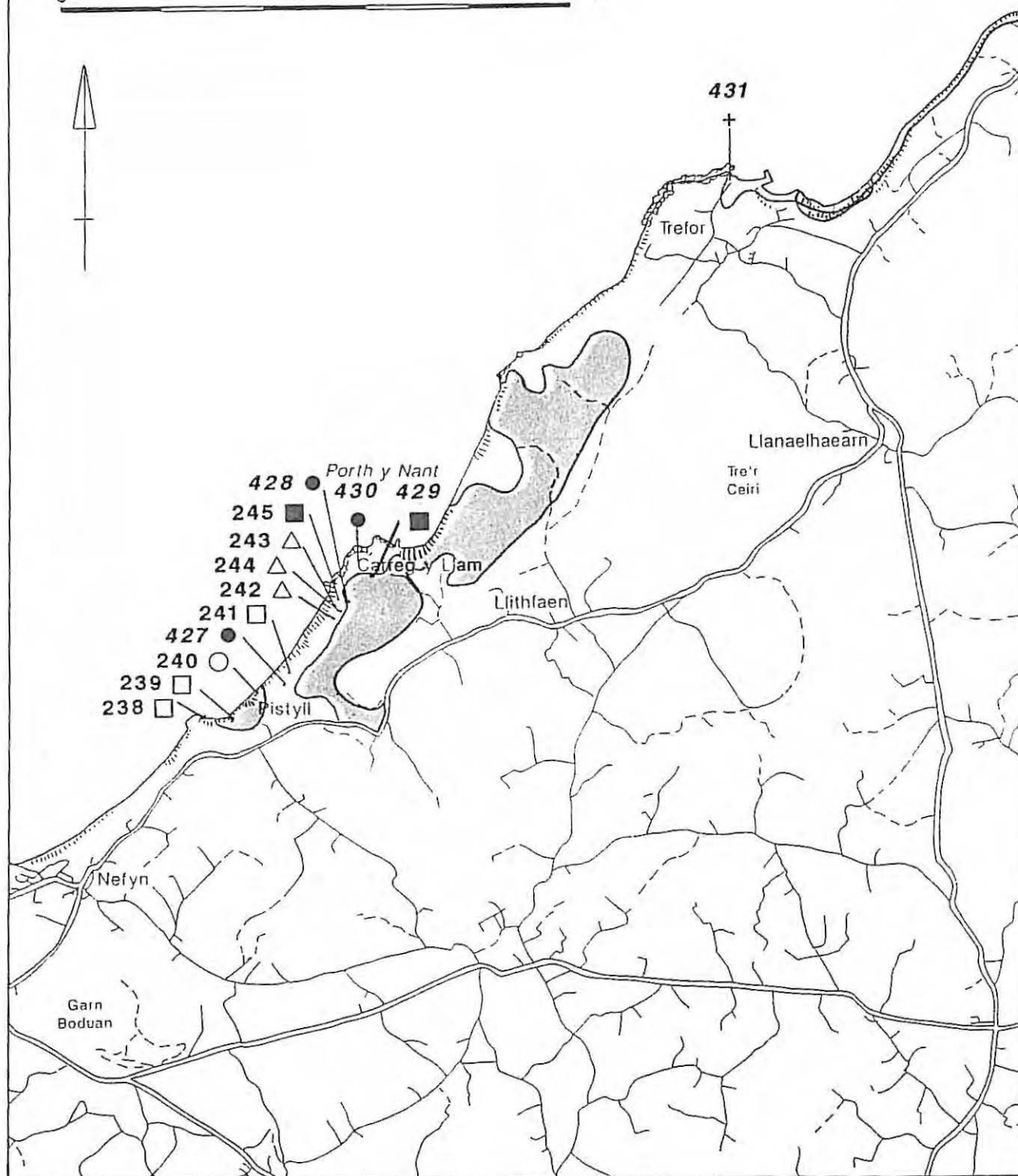


Fig. 11

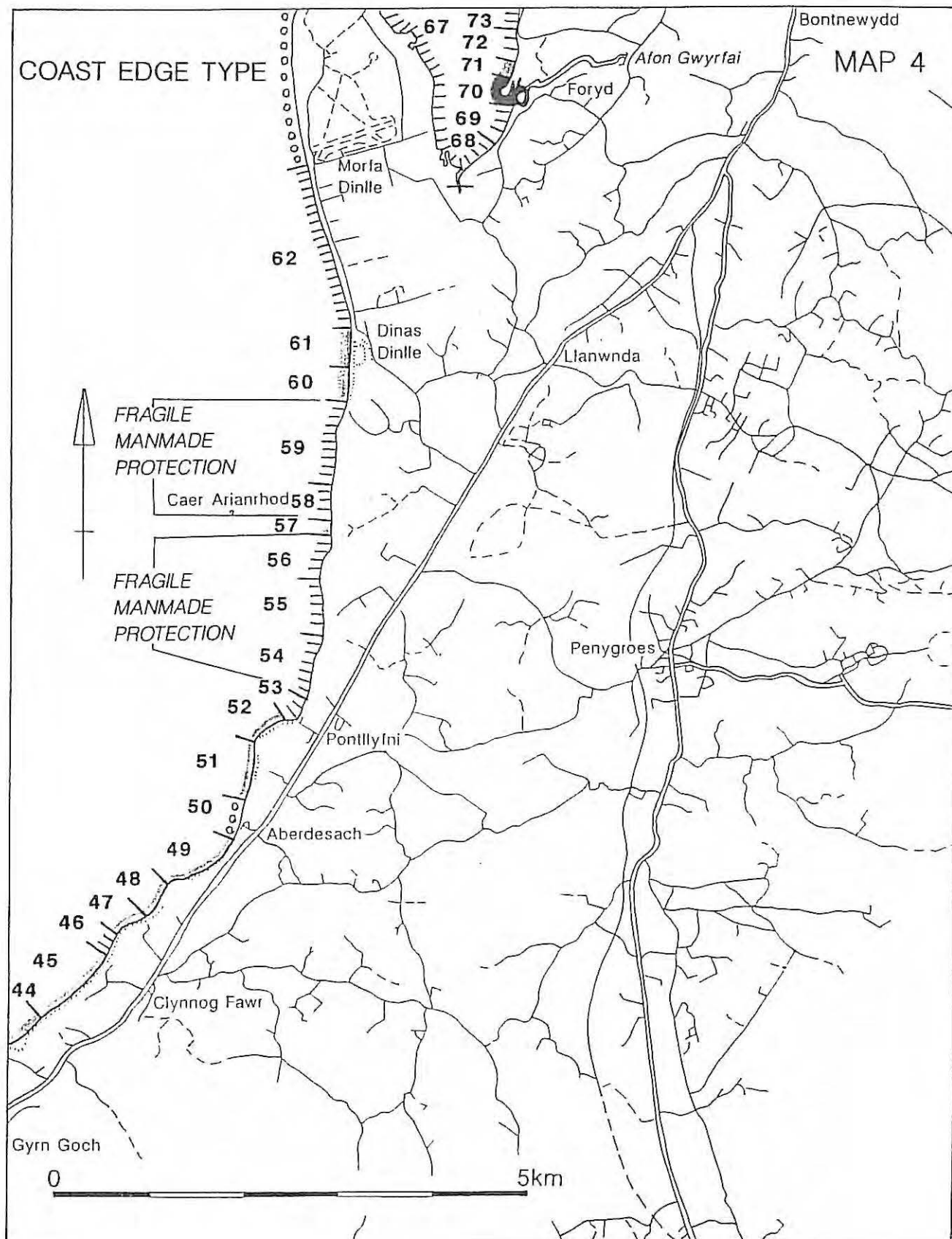


Fig. 12

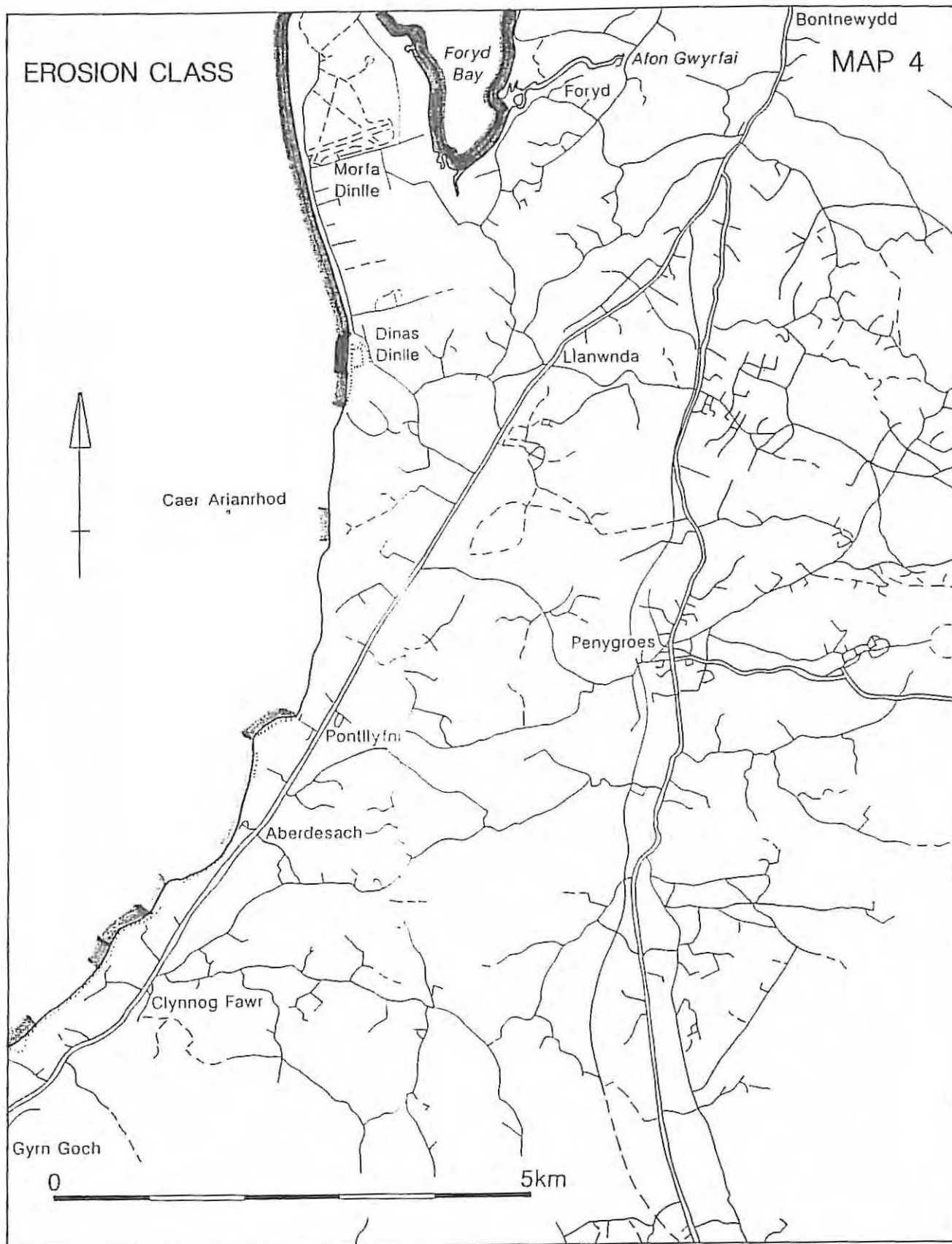


Fig. 13

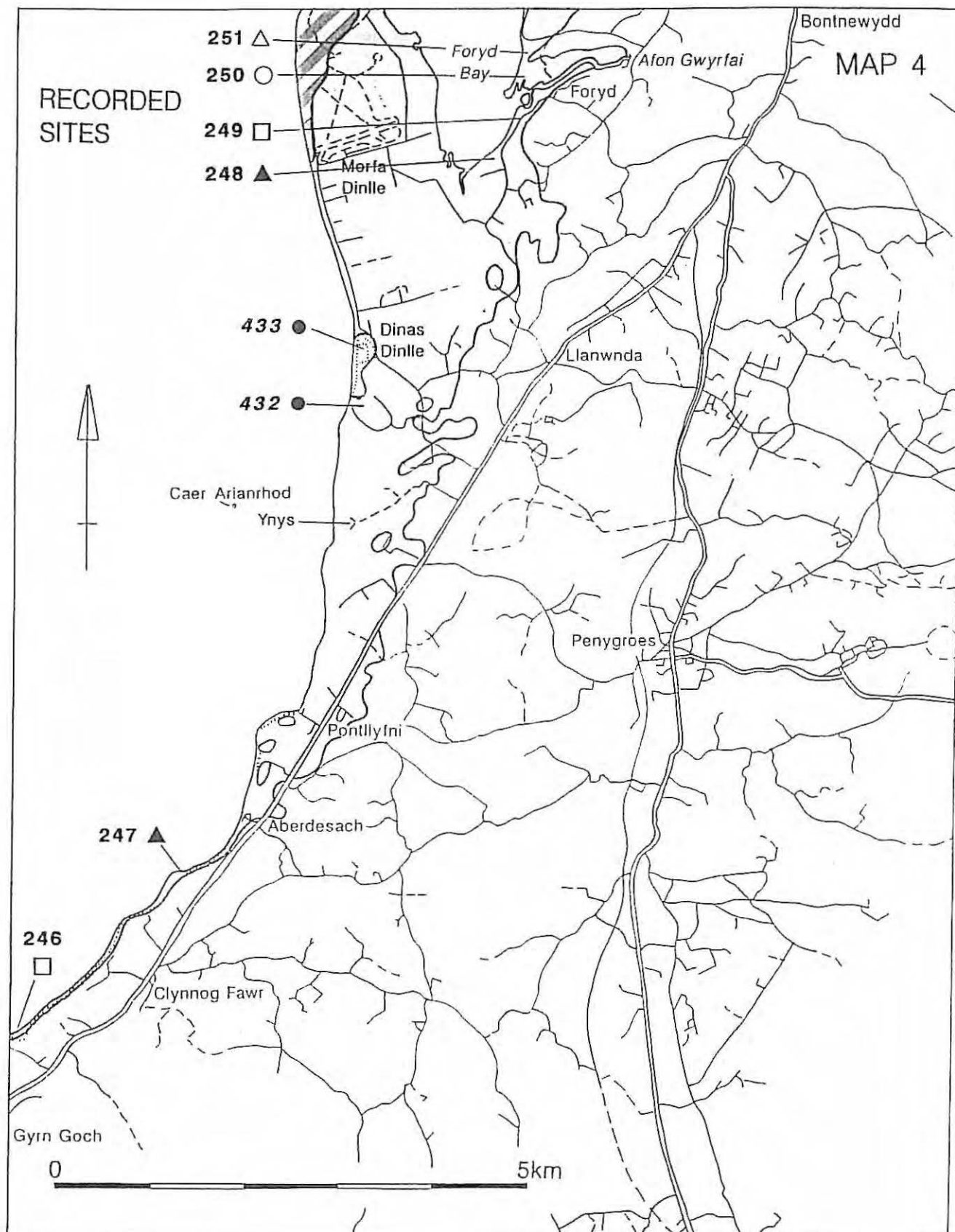


Fig. 14

good diagnostic assemblage and of dating material, possibly even of other settlement evidence. In terms of its potential, scarcity and condition it deserves further attention, evaluation, recording or protection and so a more detailed description has been included (Appendix 3).

This area is rich in post-medieval, chiefly industrial remains. There are three major abandoned quarry complexes at Carreg y Llam, Porth y Nant and Trefor. That at Trefor includes some spectacular buildings which deserve photographic record since they may be at risk from the small scale exploitation which has re-started there. At Pistyll is a small, well preserved, stone-working complex (239) with buildings and cobble-stone working floors fairly intact. Nearby is a small quay (238) probably part of the same complex, working and shipping stone from the extensive quarries on the hill slopes above Pistyll.

In the valley north of Pistyll is a small turbine generator house (241) with parts of the machinery surviving in situ with casting dates of 1906 and 1908. Close to the Carreg y Llam settlement (428) a number of field features were recorded including positive lynchets, fragments of earlier field walls, two clearance cairns and a small rectangular building platform (242-5). These show that the area around the settlement, now sheep pasture, has been arable in the past. This arable phase cannot be assumed to be directly associated with the 3rd-4th century settlement (described above) as there is also nearby the remains of a rectangular medieval? farmhouse. The features are all fairly stable although deserving survey since the settlement is accepted as of regional importance. A brief survey of this area has recently been carried out after acquisition by the National Trust (Dillon, 1992).

There is a considerable area of unimproved land between Pistyll and Trefor quarry in which there may be new features of early settlement to discover, perhaps from aerial or ground survey should the vegetation cover be burnt off. North east of Trefor is a narrow coastal strip of hazel woodland which is of interest as a rare surviving area of coppice, an early origin probably demonstrated by its appearance in the settlement name, 'Cappas lwyd' (grey coppice).

#### **Map 4. Gyrn Goch to Cefn-ynysoedd, Llanfaglan. (Record units 44-73, Figs. 12-14).**

##### **a. Coast Type and Erosion Assessment (Figs. 12-13)**

The majority of this length of coast edge is protected by artificial barriers. A large area of land behind units 53-59 is reclaimed marshland with a network of drainage dykes and the sea-edge protected by a large shingle bank and tidal gate. Similarly, the Morfa Dinlle peninsula has been drained and protected by a sea wall on the west and around most of Foryd Bay. The northern part of the peninsula is an aggrading coast due to longshore drift with a massive natural shingle bank and the build up of sand around the western end of the Menai Straits.

The southern part of this coast (units 44-52) is mainly of low cliffs of drift, vulnerable and suffering considerable erosion. The hillfort of Dinas Dinlle (433) is built on an isolated knoll of glacial sands (Hart, 1990) which are very vulnerable and erosion is major to severe, possibly exaggerated by the artificially protected coast to north and south. Even an area of the sea-wall to the south of Dinas Dinlle has been washed out in the last winter's storms putting the whole of the reclaimed farmland behind it at risk.

A small area around the mouth of the Afon Gwyrfa (units 70-71) is unprotected but there is no erosion as the river mouth is silting up and the shallow Foryd bay is gradually changing to salt-marsh.

##### **b. Archaeology (Fig. 14)**

The immediate hinterland here is of favoured farmland suitable for arable and could therefore be expected to have attracted early settlement. In fact relatively few archaeological features



have been recorded. This may simply mean that they have been destroyed or at least concealed by modern cultivation. The two recorded sites are first, a large oval field enclosure (432) and second, the hillfort of Dinas Dinlle (433). The oval enclosure comes close to the coast edge but is not threatened. It was recorded from aerial photographs but observation on the ground, of the part closest to the coast edge, shows no evidence of any earthwork preceding the existing modern field wall. Further fieldwork is needed to date the origins of the enclosure. It seems likely that the original enclosure was oval because the wall enclosed a low oval-shaped area of slightly elevated ground which was in effect a slight 'island' or peninsula within an area of wetland/marsh prior to drainage as was the case with some settlement a little to the south, (with the place name Ynys, 'island'). After drainage the surrounding area was laid out with a different field pattern, rectilinear rather than curving to the contours. This reclamation most probably was carried out during the eighteenth century 'agricultural revolution'.

Newly recorded features were also few. A possible prehistoric feature was an unusual gatepost (247), a large tapering dressed stone, perhaps a re-used Bronze Age standing stone, washed out on the beach near Aberdesach. Later features comprise lime-kilns at Gyrn Goch (246) and Foryd (249), a nearby trackway and field wall fragment (250 and 251) and a clearance cairn near Llanwnda (248).

In general there is little threat to archaeology except at Dinas Dinlle which because of its site value and the severity of the erosion is worthy of survey and protection and is the subject of a more detailed management study (Appendix 4).

Despite the sparsity of recorded archaeology there is some potential. The offshore reef here (Fig. 14) is the, probably fanciful, location of the mythical 'Caer Arianrhod' of the 'Four Branches of the Mabinogi'. Dinas Dinlle, however, is mentioned in the tales and the adjacent former marshland both to north and south must hold considerable research value particularly for wetland archaeology. Any assessment of the hillfort should look at its setting in the landscape not just as an isolated feature. The Morfa Dinlle peninsula is naturally aggraded on the west side by a series of shingle storm beaches. The ridges of earlier beach lines can be seen in places inland on the peninsula although largely covered by blown sand. These former beach lines represent a chronological series and there is the possibility of shell middens or flint working sites being discovered by sand blows. A few areas of exposure were searched but without result.

The rest of the coast is agricultural with no areas of good archaeological preservation likely. However, the presence just inland of standing stones and burial chambers as well as the Dinas Dinlle hillfort suggests that there are early landscape features such as settlements and field systems awaiting discovery.

#### **Map 5. Morfa Dinlle (Record units 63-66) and Cefn-ynnysoedd, Llanfaglan to St Mary's Church, Llanfairisgaer (Record units 73-79) Figs. 15-17**

##### **a. Coast Type and Erosion Assessment (Figs. 15-16)**

The tip of Morfa Dinlle is naturally aggrading and stable on the west side, artificially protected around the northern tip at Fort Belan and of naturally aggraded mud and blown sand on the east side. The rest of the coast is entirely sea-walled except for a small piece by Ferodo factory north of Caernarfon which is of fairly soft eroding shale cliffs and another area south of St. Mary's church which is low unprotected alluvial material and subject to slight erosion (unit 78).



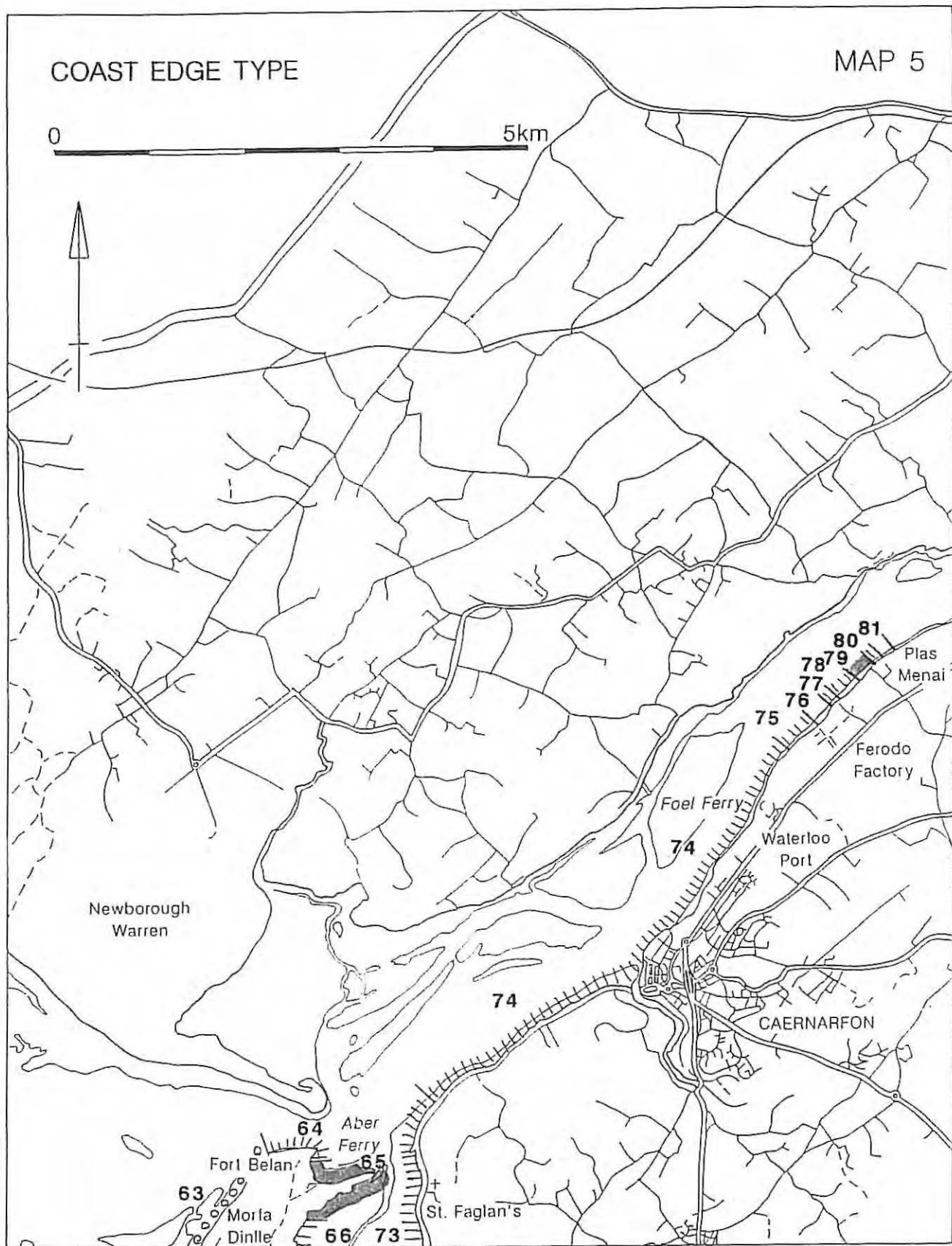


Fig. 15

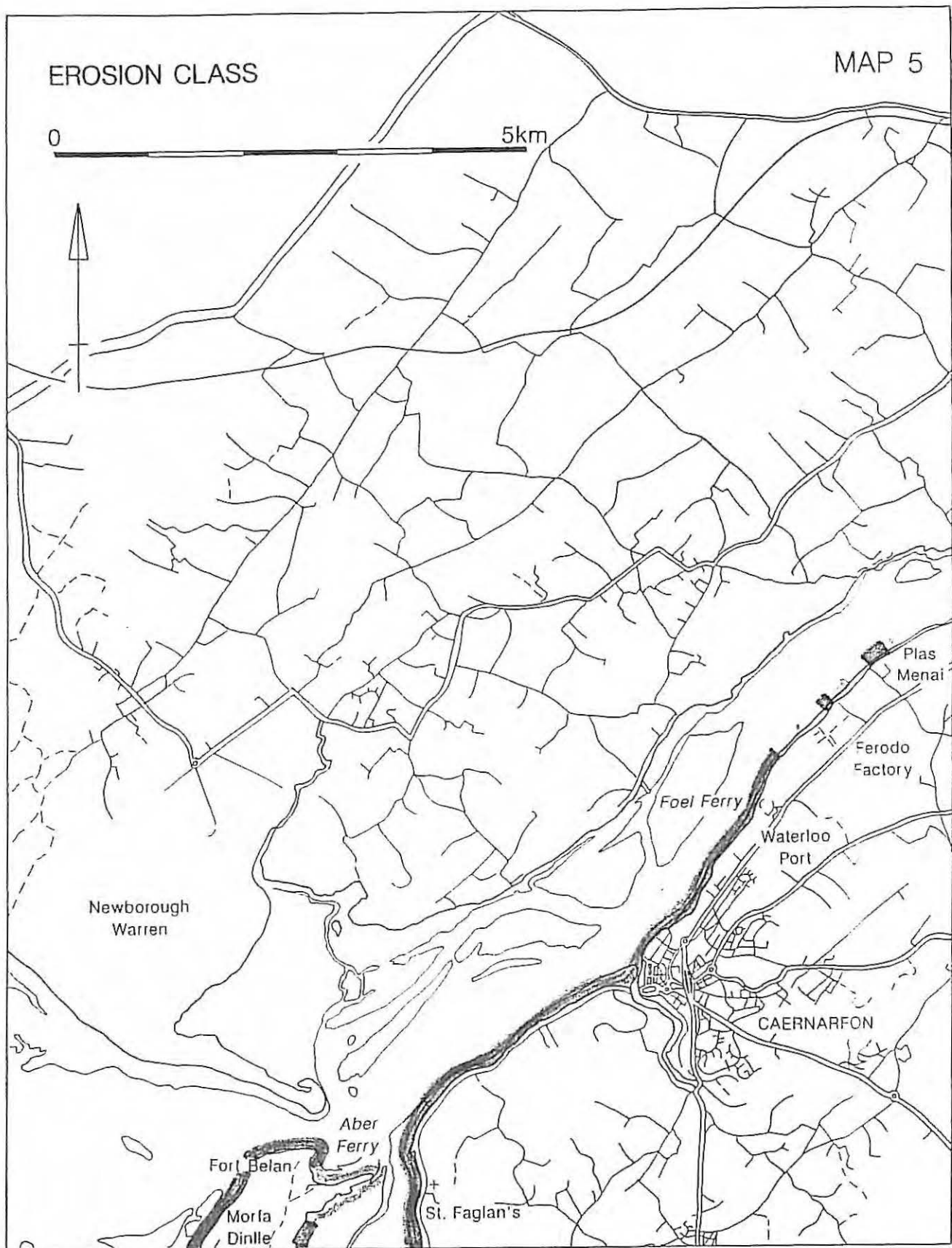


Fig. 16

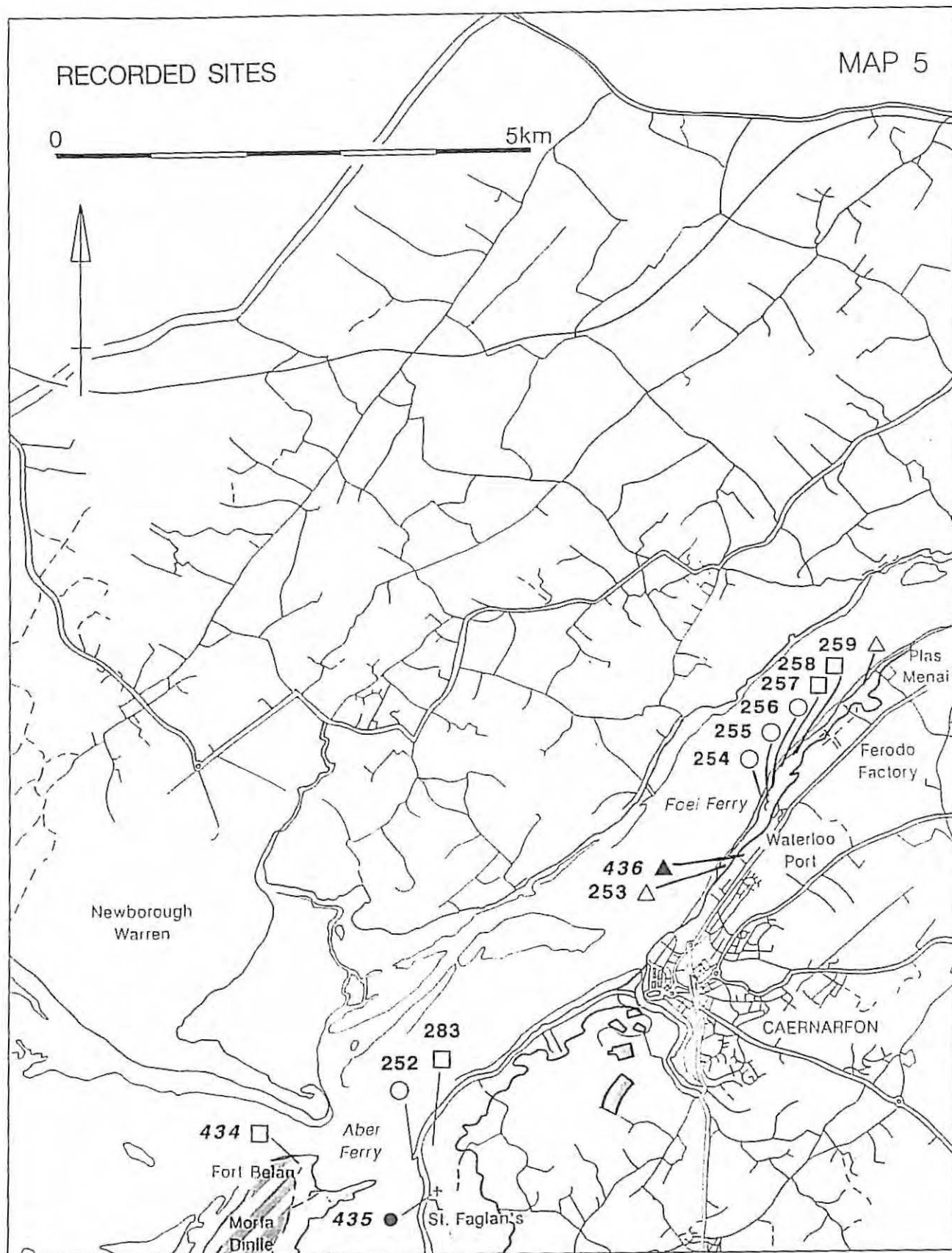


Fig. 17

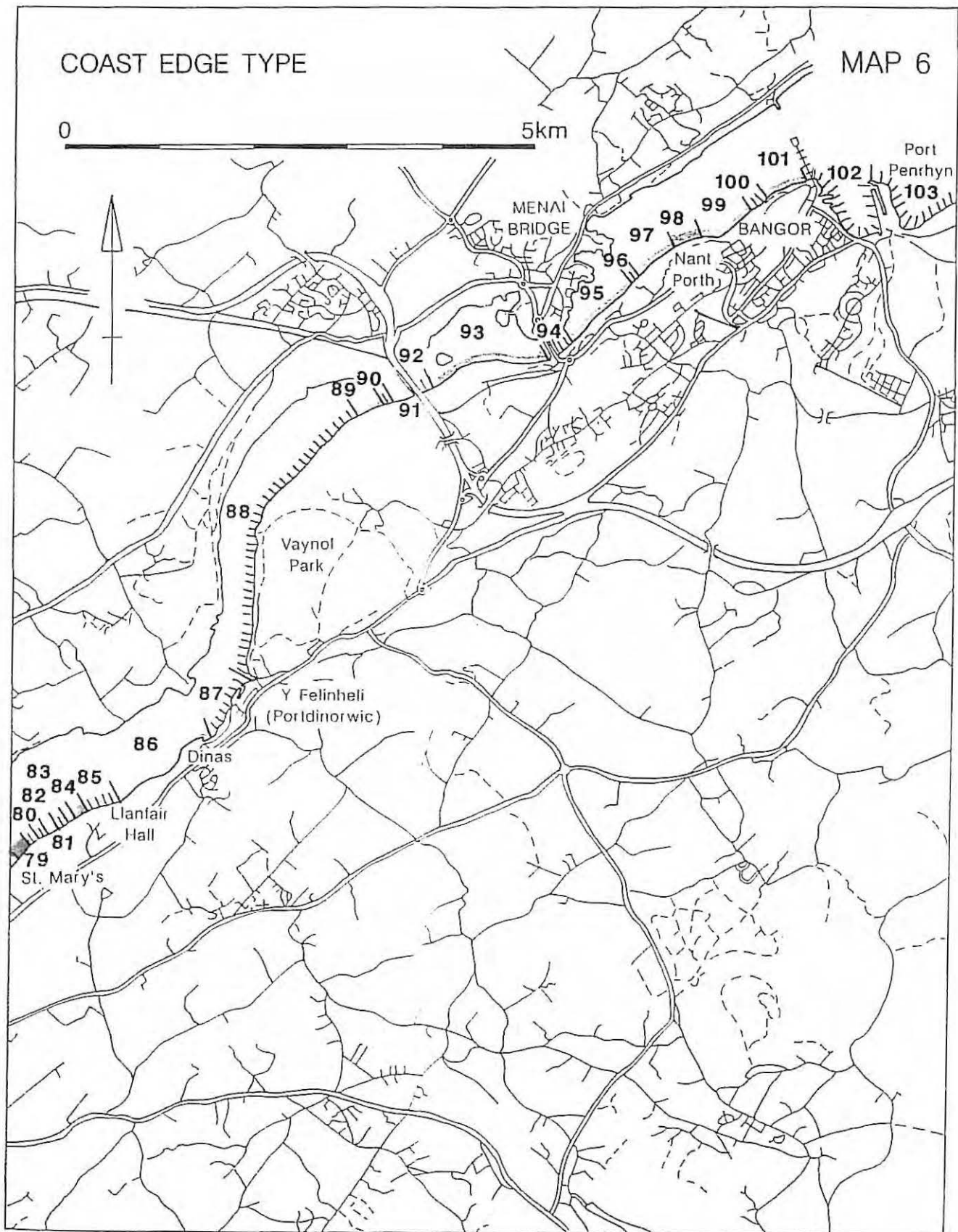


Fig. 18



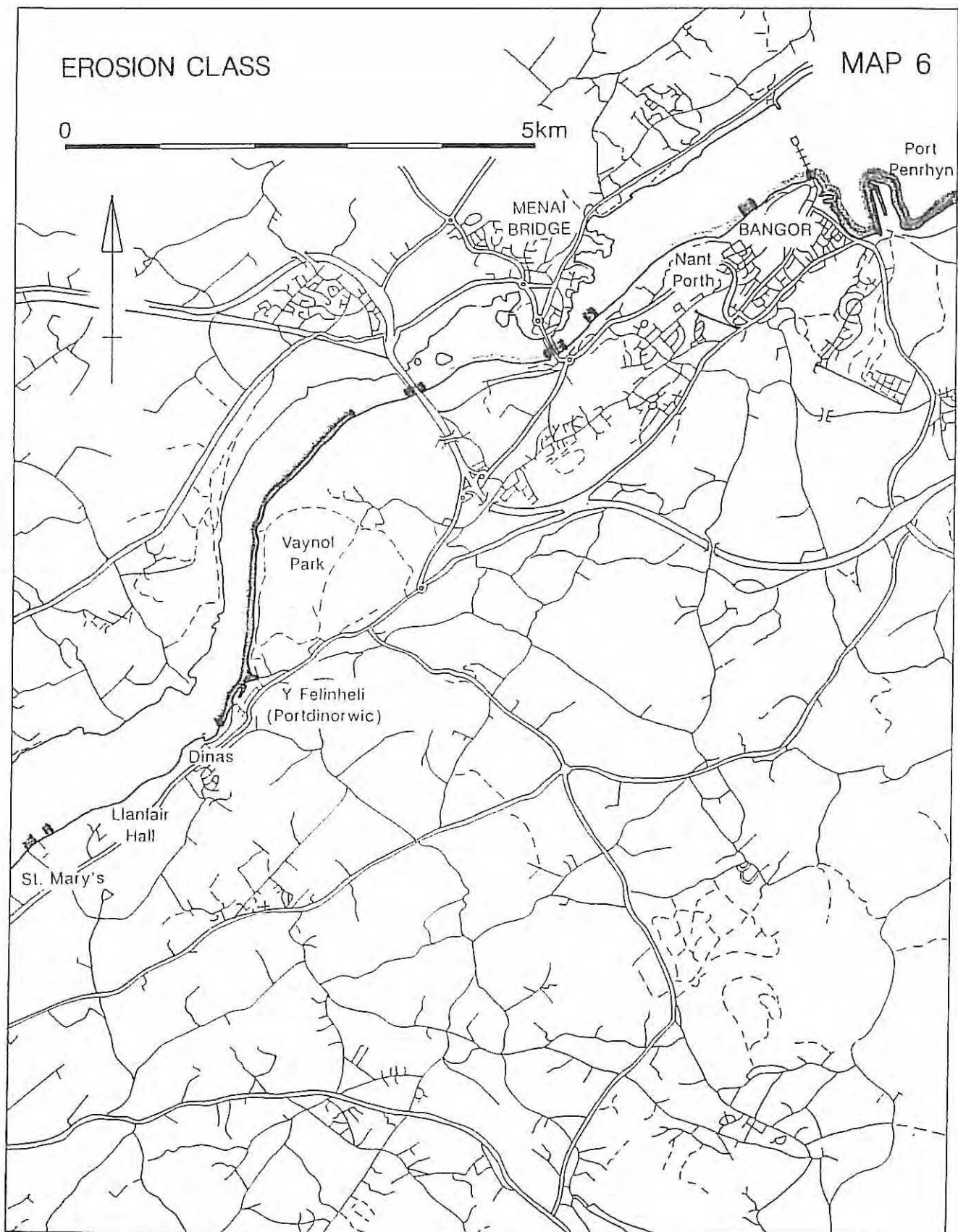


Fig. 19

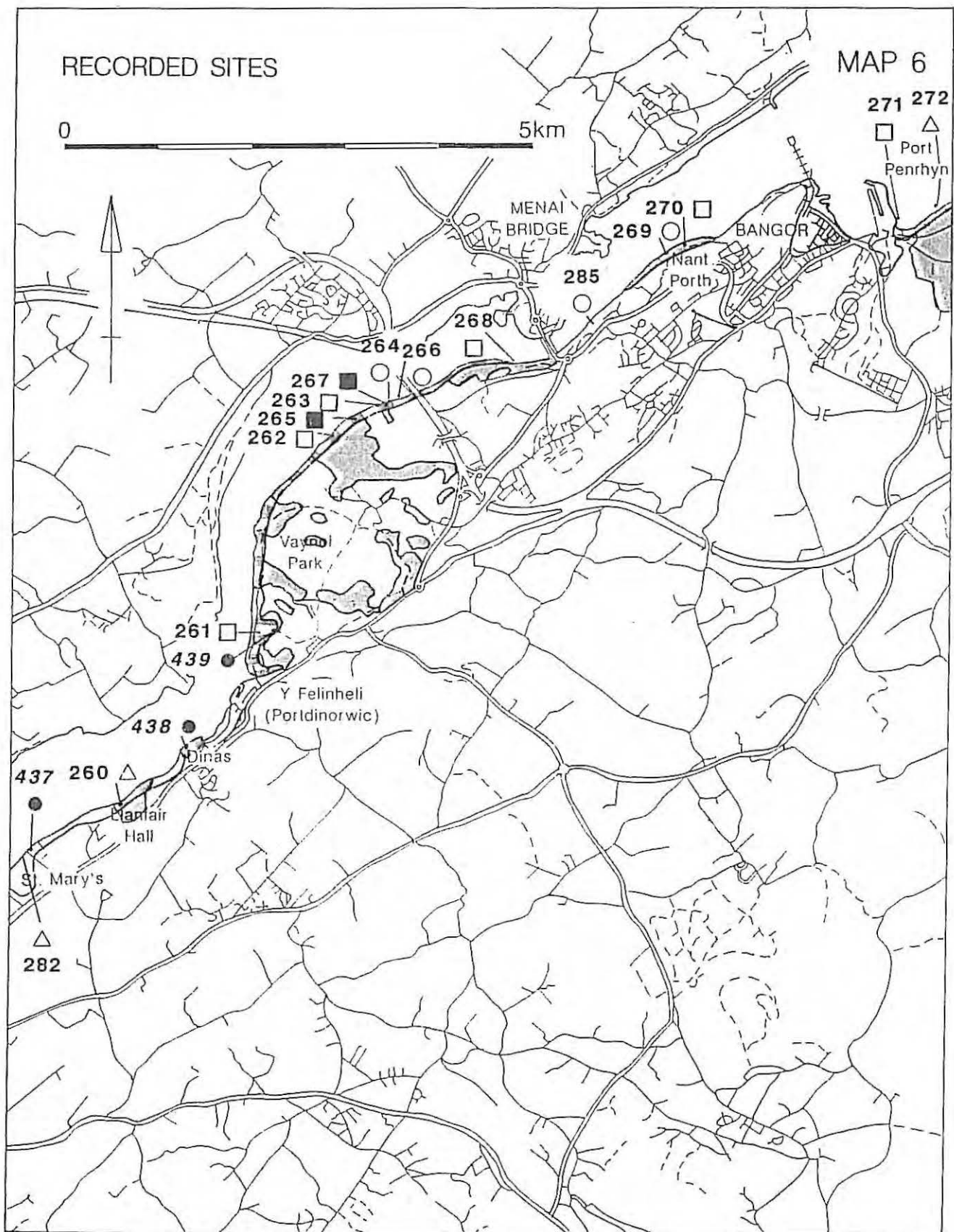


Fig. 20



## **b. Archaeology**

Of previously recorded features only one is possibly prehistoric, the site of a presumed barrow where human bones were found at Waterloo Port during 19th century gravel quarrying (436). The site is a pasture field where a slight depression probably marks the position of the gravel pit. There is no erosion threat to the site but the field could be suitable for building development when a watching brief would be desirable.

Fort Belan (434) a Napoleonic era fort is in a good state of preservation and with no erosion threat. The adjoining dock however should be fully recorded as it is at present undergoing renovation for leisure use. St. Faglan's church (435) is stable and actively conserved.

Newly recorded features are all post-medieval. Two are stone quays of probable ferry crossings to Anglesey, one the Aber ferry (252) and the other the Foel ferry (254). Close to the latter is a ruinous probable ferry-keeper's cottage (255). Both the latter features were extant on the OS 25 inch 2nd Edition, 1900, although the ferry itself had closed earlier in the 19th century. Close to the quay 252 is an impressively built limekiln (283), of probably the same as one marked here on Lewis Morris's map of 1748. Near Waterloo Port is a fragment of ridge and furrow (253) preserved by chance in the paddock of a private house. On the edge of the fields adjoining the shore north of Waterloo Port are two separate buildings, one of stone (257) and one of brick (258). The purpose of these is unclear but they may be warehouses/barns for the transfer of agricultural products from ship to shore or vice versa. None of these features are in immediate danger from erosion. Just south of St Mary's church is a slate gate-post (259) on the beach eroded out of a former field boundary and showing that the coast edge has retracted slightly in recent years. Wave effect on the Straits is so slight that erosion here is mainly a matter of neglect of boundaries. Nearby, on the foreshore, are the remains of a rectangular tank, one of two marked as 'oyster beds' on the OS 25 inch 1917 Edition.

## **Map 6. St Mary's church, Llanfairisgaer to Penrhyn Castle (Record units 80-103) Figs. 18-20**

### **a. Coast Type and Erosion Assessment Figs. 18-19.**

Much of this coast is walled and stable. Most of the rest is rocky cliffs and suffering only slight erosion except in one place, near Llanfair Hall. (unit 83) where the cliffs are a poorly cemented conglomerate and at Nant Porth, where the cliffs are of drift, slumping in places (unit 98).

### **b. Archaeology (Fig. 20)**

The only previously recorded sites are St. Mary's Church, Llanfairisgaer (437), walled and stable, and the promontory fort of Dinas, Y Felinheli (438) on a rocky outcrop within a private garden and stable. At the south end of Y Felinheli waterfront was a boat-building yard with associated features including a saw-pit, extant on the OS 25 inch 1916 Edition, now all cleared, concreted over and rebuilt, apart from the slipways.

In Vaynol Park is the findspot of a Roman coin hoard (439) although the exact location is not known. It seems likely that it may have been found during construction of a limekiln (261) or associated quarrying. This site was until recently overgrown but is in process of being cleared by the National Trust as a 'historic' feature for a leisure trail revealing associated features such as quarries, tram track-bed and kiln-keepers cottage. These need to be recorded as improved access is likely to create erosion. The kiln and associated buildings appear to have been extant at the time of the OS 25 inch 1916 Edition.

In Llanfair Wood is a wood boundary bank (260). On the foreshore adjoining the north end of Vaynol Park are a series of long oval scoops, some with associated fragments of walling (262). These are man-made features thought to be former laying-up places for small coastal vessels (Cecil Jones, pers. comm.) and deserve survey. They were in existence by 1872 as they are marked on an Admiralty Chart of that date together with two others, not noted on the present survey, closer to the Britannia Bridge (Menai Strait, 1872, Sheet 2 of 4, Dept. of Ocean Sciences, UCNW, Bangor).

In the woods on the coast edge between Vaynol Park and Britannia Bridge (Coed y Mor and Coed Mair) are two previously unrecorded groups of sub-rectangular building platforms (265 and 267) which are fairly certainly the remains of short-lived workshops or navy settlements used during construction of the Britannia Bridge. Fifteen hundred men were employed in the work. The main settlements, however, built by the company, were below each end of the bridge probably making use of land already purchased for the construction work. These settlements accommodated 500 men with their families and included wooden houses, shops and a school (Clark, 1849, 30). Most of the rest of the work force must have had makeshift dwellings. The sections of the bridge were built on stone and timber staging on the foreshore to the west of the bridge site and had accompanying workshops. Apart from the possible house platforms the other apparent remains are of a trackway (264) and the brick-built rectangular foundation (266) for the company site office (Clark, 1849, Plate 1). All record of these massive works had gone by the time of the Admiralty chart of 1872 described above. Although not suffering from sea erosion these features are a very fortunate survival in this area of neglected woodland/rough pasture. Any change in use such as an increase in grazing pressure or visitor access would affect the presently well preserved remains. The nearby coastal part of Vaynol Park is in process of being up rated as a pedestrian trail by the National Trust and features such as these could in themselves have potential for visitor presentation. They therefore deserve detailed survey and possibly small scale evaluation excavation.

Another 19th-century feature (268) is on the cliff-top partly in the grounds of the University Botanic Gardens and partly of the Ceris Nursing Home, 400m west of the Menai Bridge. It consists of a number of related features, groups of decaying massive timber beams, a mound, ironwork, cables and chains with more ironwork on the beach below. The function of these has not yet been documented but may be the remains of a hoist of some kind for lifting material from the beach perhaps in connection with construction of the nearby Bangor to Holyhead railway (1850).

About 500m north east of the Menai Bridge is the quay formerly of the Porthaethwy ferry, extant on John Evans' 'Map of North Wales', 1795, and in use until 1826, supplanted by the opening of the Menai road bridge.

On the cliffs at Nant Porth, Upper Bangor are a whole series of quarries (270) which discharged down chutes to the beach where there is a probably associated stone quay (269).

The whole of Port Penrhyn, including its associated buildings, is of historic interest and sensitive to development and change. On the foreshore of the artificial mole making up the main quay were noted quantities of iron making waste, perhaps imported as ballast or deliberate land-fill, 'Ballast' was marked here on an early Admiralty chart, 'Holyhead to Liverpool', 1872, surveyed 1835 (UCNW, Bangor, Archives, Misc 6/116).

Off the west shore of Penrhyn Castle is the remains of a wooden stake fish weir (272) fragile and much eroded deserving surveying and perhaps radiocarbon dating.

# COAST EDGE TYPE

MAP 7

0 5km

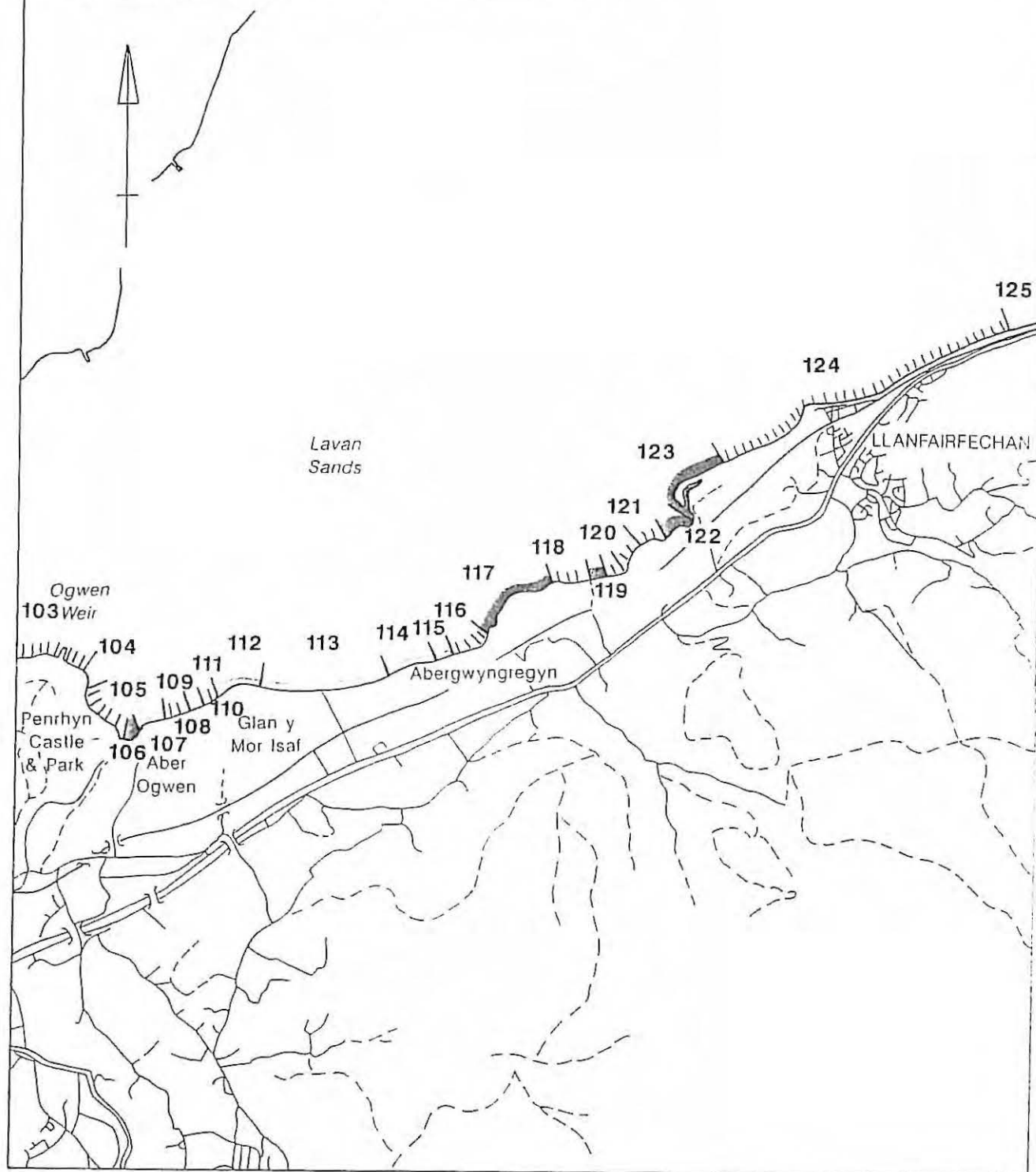


Fig. 21

EROSION CLASS

MAP 7

0 5km

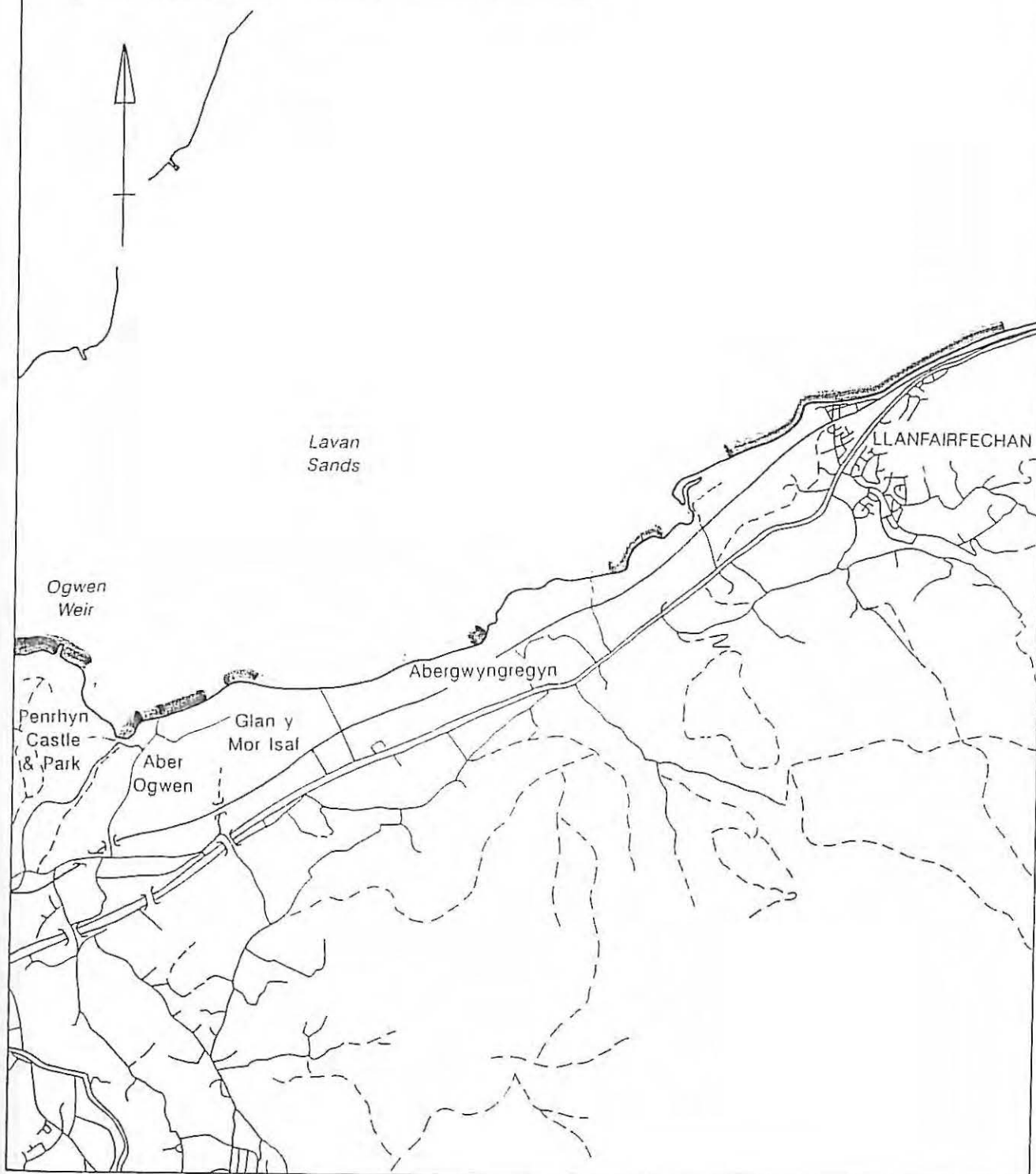


Fig. 22

# RECORDED SITES

MAP 7

0 5km



Lavan  
Sands

LLANFAIRFECHAN

273



Ogwen  
Weir

274

276

275



Abergwyngregyn

Glan y  
Mor Isaf

Aber  
Ogwen

Penrhyn  
Castle  
& Park

Fig. 23



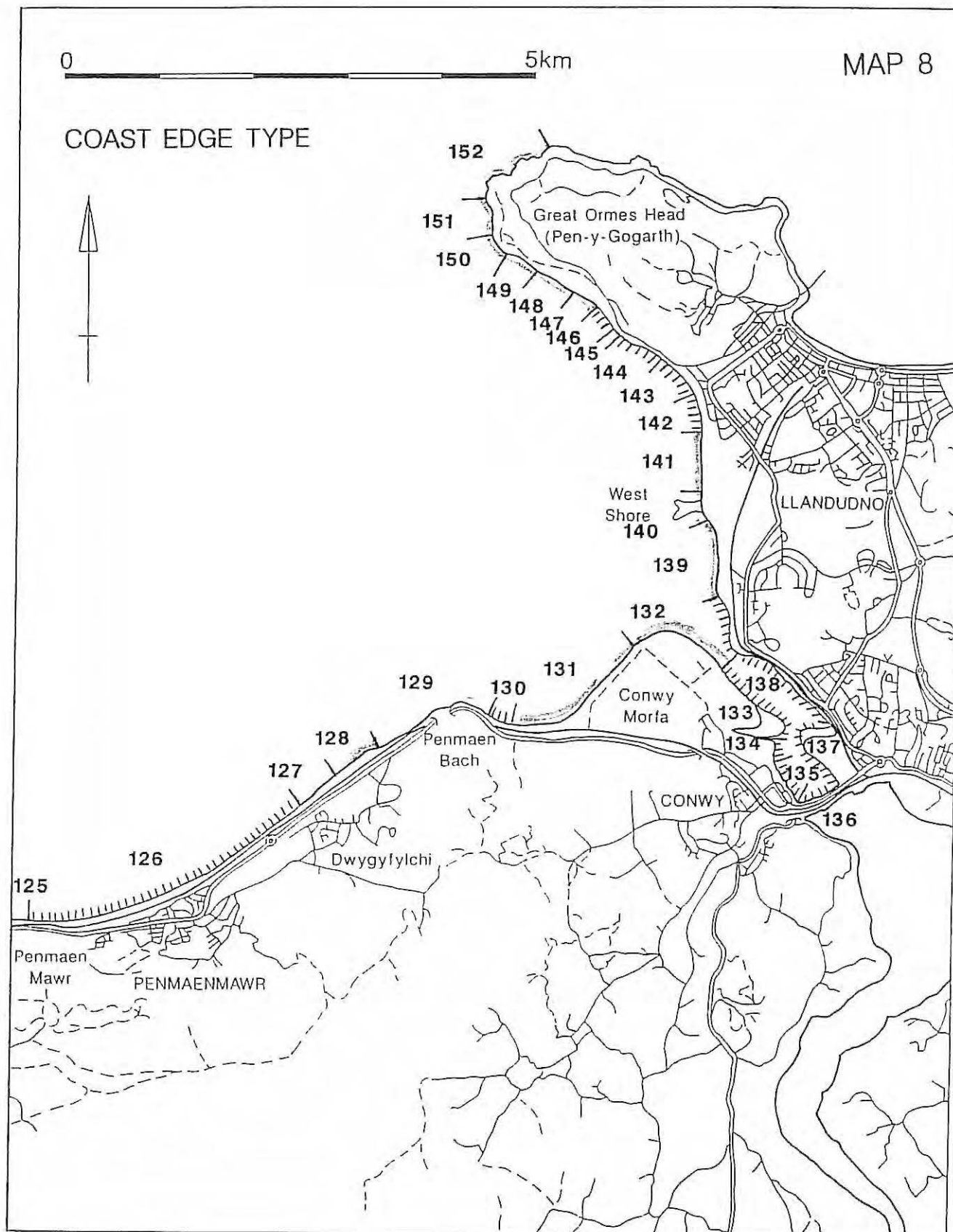


Fig. 24

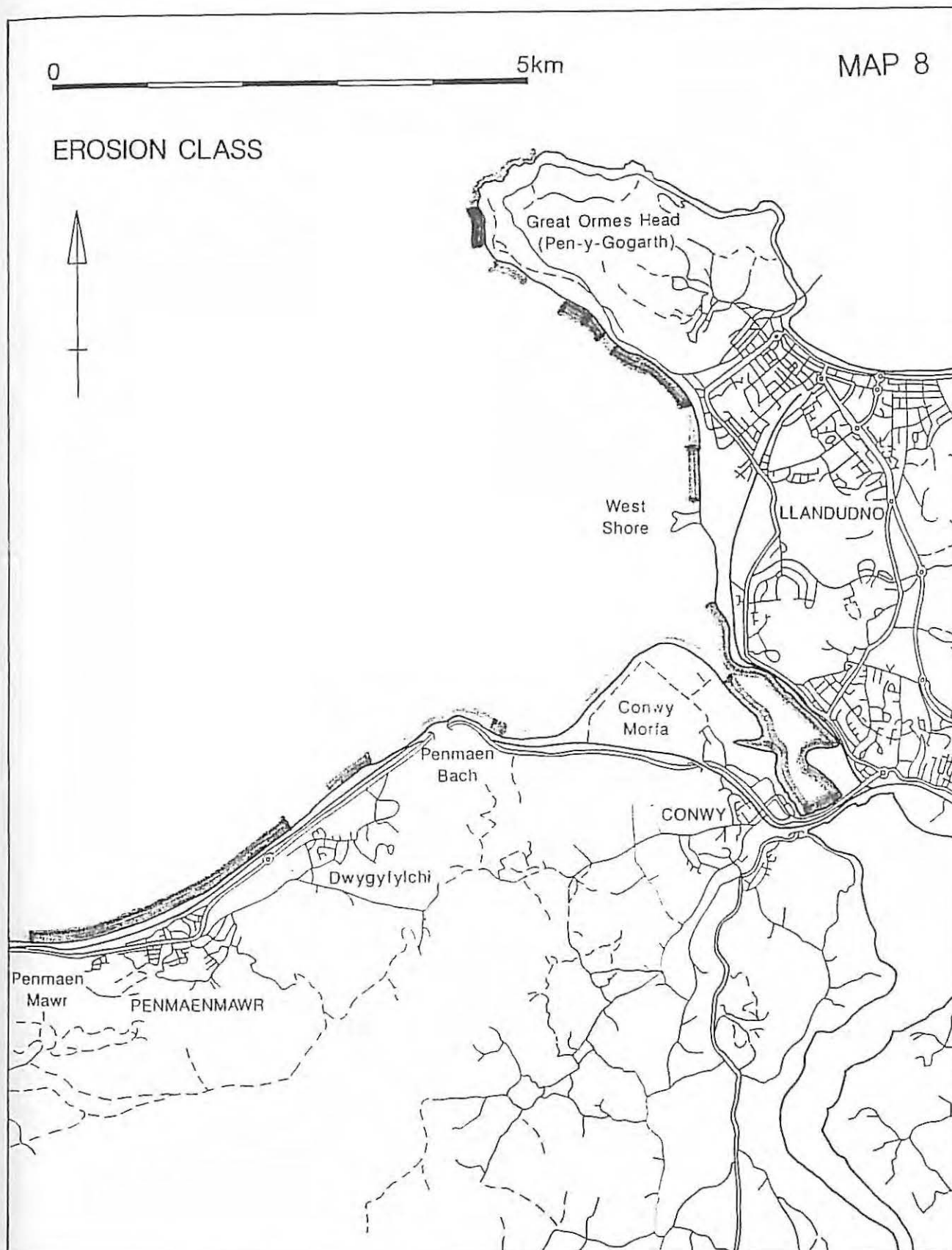


Fig. 25

0 5km

MAP 8

RECORDED SITES

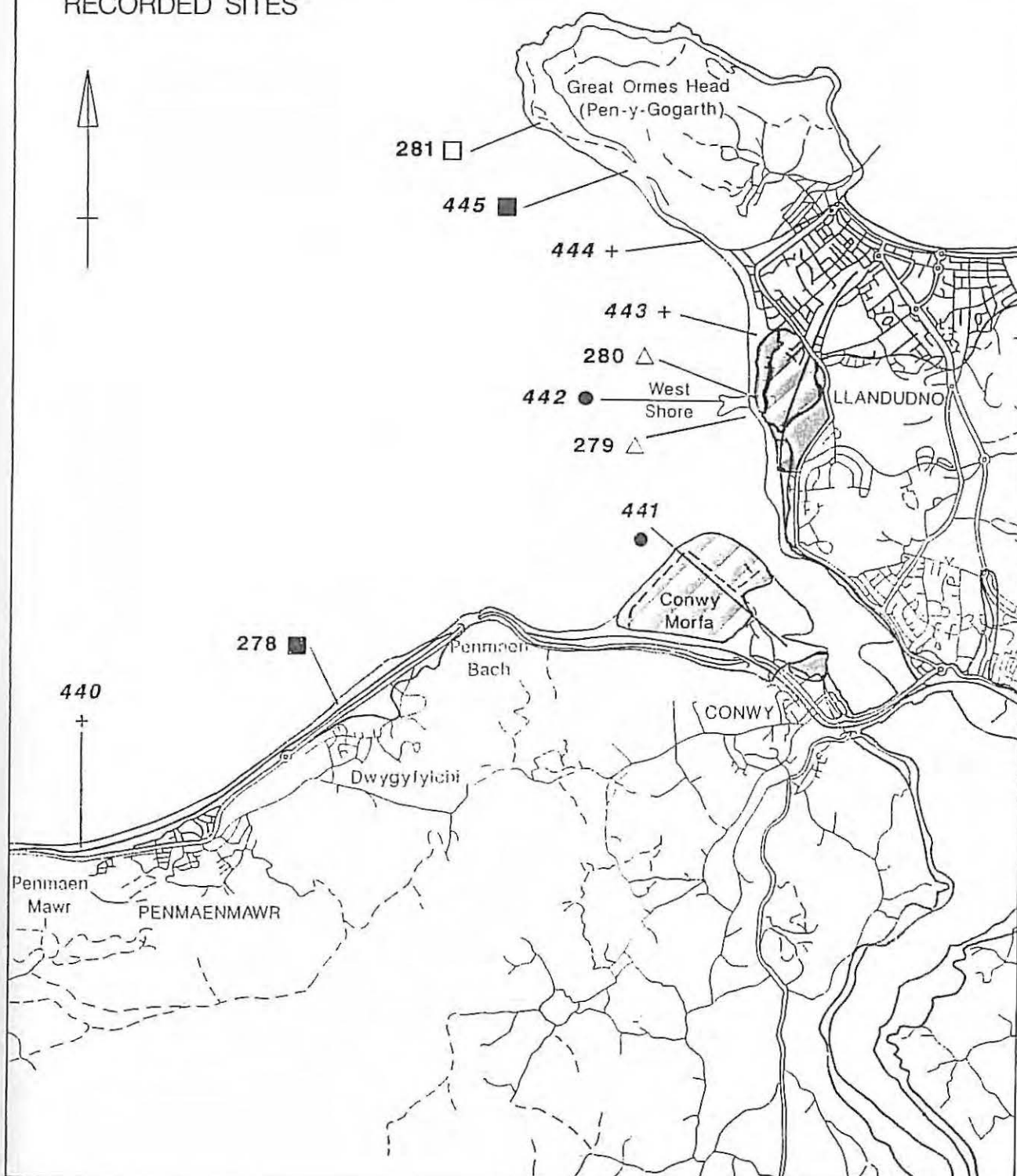


Fig. 26

## **Map 7. Penrhyn Castle to Penmaenmawr headland (Record units 108-125), Figs. 21-3**

### **a. Coast Type and Erosion Assessment (Figs. 21-2)**

This coast is varied in type but generally fairly stable, protected from the prevailing winds and currents by Anglesey. Approximately half is protected by man-made features particularly that around Penrhyn Park and Llanfairfechan sea front. This is stable except for part of the east side of Penrhyn Park where the estate wall has been washed away (unit 104). The rest of the coast comprises either alluvial delta deposits which are slightly aggrading (units 105, 117 and 122-3) or very low drift cliffs (units 107-115) which are in general fairly stable but eroding where there are slight promontories (units 107, 112 and 114).

### **b. Archaeology (Fig. 23)**

There are no previously recorded features. On the foreshore off the point of Penrhyn Park is the Ogwen Weir (273) with stakes of slate and wood surviving although eroding badly. The unusual and formerly magnificent sea-bathing house (274) of Penrhyn Castle is severely eroded, so far without record. On the foreshore at the west side of the Aber Ogwen is an area of old tree-stumps (275) of unknown age although possibly woodland lost when the Ogwen was canalised (during construction of the park). A similar area of tree stumps (277), occurs on the fore-shore just west of Llanfairfechan.

Saxton's map of 1578 marks 'Ogwen Chap.' and John Evans' 'Map of North Wales', 1795, marks 'Capel Ogwen' near what is now Aber Ogwen farm although there is no known evidence of a chapel here.

On the shore north of Glan-y-mor-isaf is a ruined cottage (276) protected by a slight sea-wall. In the terrace behind the latter are layers of mussel and cockle shells suggesting that shell-fishing was the livelihood as is still carried out commercially on the Lavan Sands today.

The general absence of archaeological features along what is an agriculturally productive part of the coast can be put down to two factors. First, because of the shallow fore-shore any sites of late post glacial coastal exploitation will have been lost to rising sea-levels. Second, arable farming has eliminated all upstanding earlier features. Nevertheless the area still has archaeological potential. The Lavan Sands may still preserve buried submerged land surfaces and other features such as fish weirs. Penrhyn Park, relatively unexplored and undamaged may preserve other features. Finally the discovery of the major complex of neolithic and later features nearby at Llandegai (Houlder, 1969) by aerial photography suggests that this was a population centre of some importance and there are thus likely to be other archaeological features in the area. Any such features are likely to be discovered only as crop marks from aerial survey.

## **Map 8. Penmaenmawr Headland to Great Ormes Head (Record units 125-151) Figs. 24-26.**

### **a. Coast Type and Erosion Assessment (Figs. 24-25)**

Approximately half of this coast is protected by sea walls along the developed sea front of Penmaenmawr, Conwy and Llandudno as well as along the estuary land recently reclaimed for the Conwy tunnel. The rocky headlands of Penmaen Mawr, Penmaen Bach and Great Ormes Head are relatively stable. There are three areas of sandy shore, Dwygyfylchi (units 127-8), Conwy Morfa (units 131-2) and Llandudno West Shore (units 139-41). Dwygyfylchi is composed of low sandy cliffs suffering some major erosion but recently being stabilised by rubble dumping. Conwy Morfa is an aggraded coast, a large shingle bank overlain by blown sand and suffering little erosion. Llandudno West Shore however, which faces the prevailing



wind, is suffering medium erosion and some coastal protection work has been carried out. The only other area is the west side of Great Ormes Head, around Gogarth, facing the prevailing wind, composed of sandy drift and suffering major to severe erosion.

#### **b. Archaeology (Fig. 25)**

Of the previously recorded features four are just isolated single findspots (440, 441, 443 and 444) of which only 441, a spindle whorl, is of a domestic nature and likely to show the presence of nearby settlement. 442 is the site of a presumed former monument recorded on a maritime chart of 1748 (Morris). This chart shows an apparently defensive oval or circular enclosure named 'Castell Tremlyd' no trace of which exists today, apparently destroyed by coastal erosion. The name was attached to a farm existing there and shown on a mid-nineteenth century estate survey (Gloddaeth Estate, 1849). The name 'Tremlyd' means 'observation' suggesting a possible use for a fortification here, with commanding views over the entrance to Conwy harbour. Otherwise this would not be a good natural defensive position and so if it did exist was perhaps a medieval or later lookout, rather than a prehistoric enclosure. At Gogarth is the remains of the medieval Bishop's Palace (445) the structure of which is being encroached on by cliff erosion (see Appendix 5).

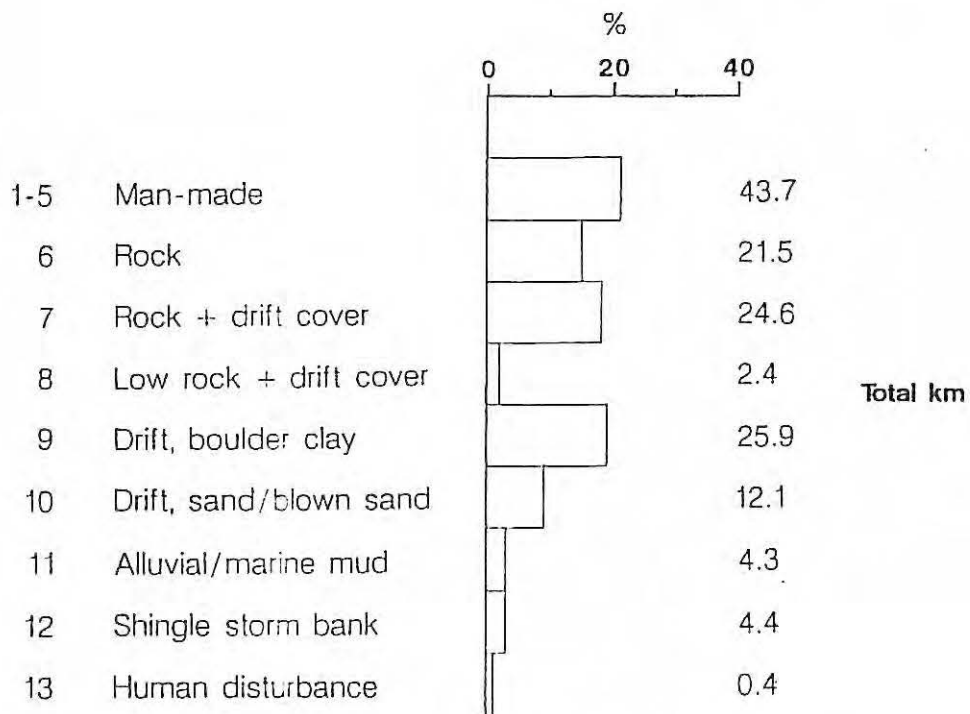
New features are few. In the low sandy drift cliff at Dwygyfylchi is a buried soil in which is a small shell and bone midden (278) which may be associated with nearby 18th-century wine bottles. Of more interest, off Llandudno west shore, is a boulder-made fish trap (279) apparently the same as one marked on Lewis Morris chart of 1748 and named 'Cored Faelgrun'. On the cliff-top nearby are traces of ridge and furrow cultivation (280) remnants of the former farmland (Castle Tremlyd farm, see above) eliminated by golf course construction. On the north end of Great Orme is a battery of second world war gun emplacements (281) perhaps not of historic value but proving the extent of recent erosion as they are now collapsing down the cliff face.

The major erosion threat to archaeology is that to the Bishop's Palace at Gogarth. One of the enclosure walls is undermined and beyond recovery, most of one of the secondary buildings has already eroded away and in the cliff face is exposed a shell and animal bone midden. There have been attempts to stabilise some parts of this coast but that below the palace itself is unprotected. The buildings were planned in detail for the Royal Commission Inventory (1956) so there is a reference point to assess erosion for further survey. Results of a rapid survey and recommendations are included here as Appendix 5. Any protection measures will have to stabilise the whole cliff fronting the monument while there may need to be smaller scale recording of areas which cannot be saved.

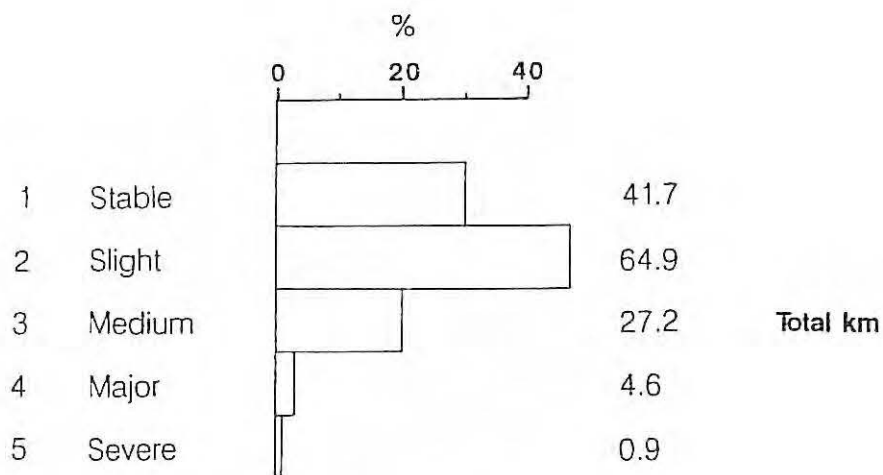
The sites of the find-spots of 440, a perforated stone mace-head and of 443, a possible hand axe, are not threatened by erosion but their discovery suggests that there may be some depth of stratigraphy which merits monitoring of any construction work. The fish weir (279) deserves survey, first because a large boulder breakwater has recently been built very close to it which will change the erosion pattern and could destroy or bury the weir. Secondly, the weir as marked on the Lewis Morris chart of 1748 adjoins the former site of 'Castell Tremlyd'. The position of the landward end of the weir should therefore show where the coast edge was in 1748.

Areas of some archaeological potential are the relatively undeveloped areas of Conwy Morfa, Aberconwy School/Bodlondeb Wood and Llandudno Golf Course.

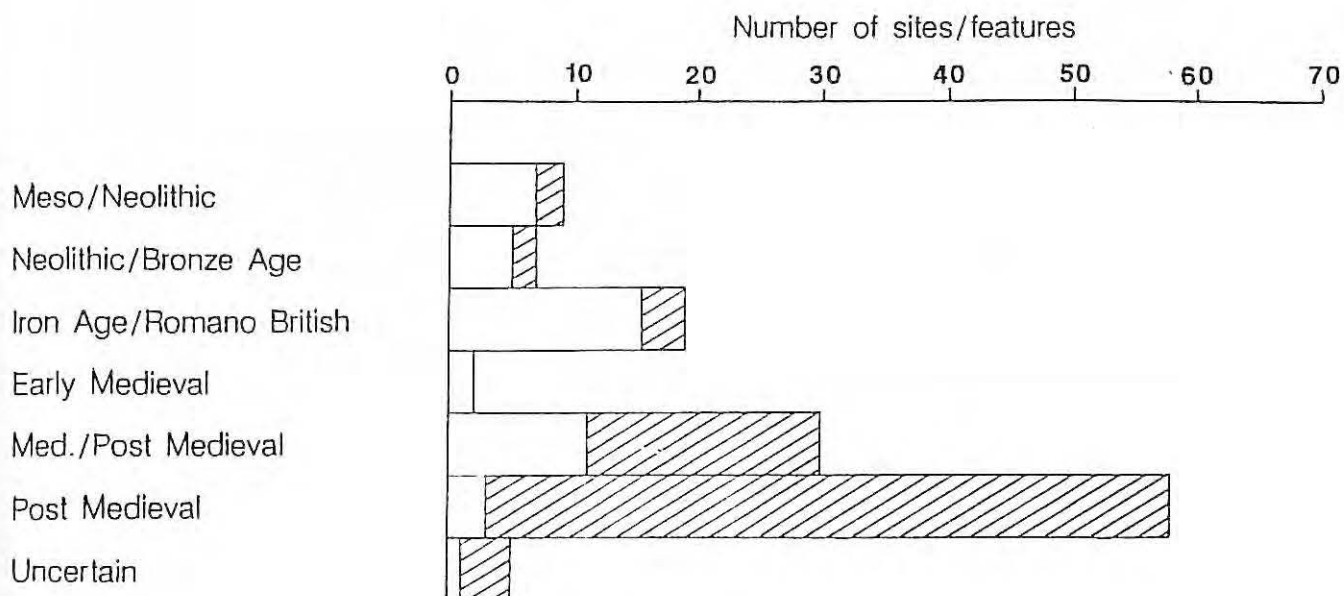




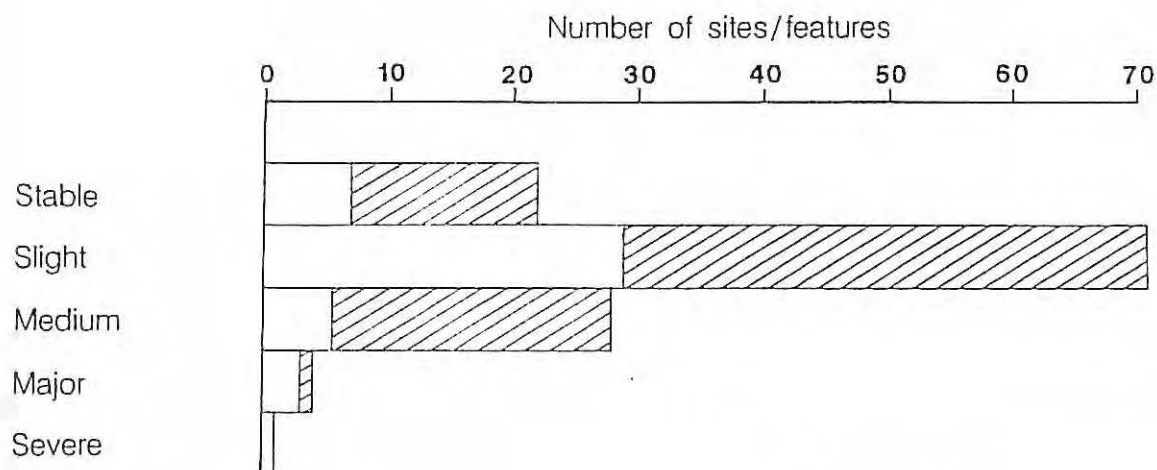
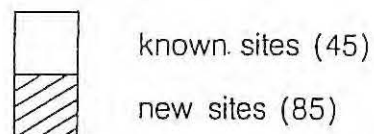
a) Proportion + total length of coast of different coast types.



b) Proportion + total length of coast of different erosion classes.



a) Total of sites/features by period



b) Total of sites/features by erosion class



## Conclusions and Recommendations

### 1. Summary of results

The total length of coast of different coast edge types is summarised in Fig. 27a. The largest single category is of man-made coast, 44km, 31%, while coasts of rock or rock with drift cover together comprise 46km, 33% of the total. These are all likely to be stable or relatively stable coasts. The remainder, however, 50km, 36%, are all of coastal types sensitive to erosion and show the possibility of management problems. This accords closely with the identified classification of areas of erosion (Fig. 27b) with 107km, 76% stable or of only slight erosion, 27km, 20% of medium erosion and 6km, 4% of major or severe erosion.

The survey has approximately tripled the number of recorded sites in the coastal strip, from 45 to 130, and the totals are summarised by period in Fig. 28a. New prehistoric sites are few, partly because of the lack of suitable exposures. For instance some of the known flint sites from west Llŷn are from collections of ploughed fields whereas no ploughed areas were seen in the present survey. The larger number of new sites comprise mainly medieval/post medieval features such as field boundary banks or associated building platforms or of post medieval industrial or transport features such as quarries, buildings, quays or trackways. Fig 28b summarises the erosion threat to the sites recorded. The greater proportion, 72%, are stable or in areas suffering only slight erosion. The remainder, comprising 33 sites or features, merit some response. There are also a number of sites which are suffering from erosion unrelated to that of the coast edge, for instance those already lying off-shore, like fish-weirs, or those being trampled by visitors or animals. There are also those, which being previously unrecorded, deserve survey in their own right.

### 2. Assessment of Erosion

Recording of erosion has been descriptive and qualitative rather than strictly quantitative. This is because of the lack of specific markers against which to measure erosion. Comparison with early maps is ideal but the earliest maps are not sufficiently precise except where specific features are referred to actually on the (former) coast edge. Thus the record of an enclosure 'Castell Tremlyd' by Lewis Morris in 1748 (Fig. 29a) is very useful as the position of the adjacent fish trap, which still survives in part, shows that the headland on which Castell Tremlyd stood has retreated by some 100-200m (Fig. 29b) and this estimate can be improved by survey. No trace of an enclosure survives although the name was attached to a farm existing here at the time of a mid-nineteenth century estate survey (Gloddaeth Estate, 1849). Comparison of this survey with present day maps suggests that the coast edge has retreated by 5-10 metres in the last 150 years ie c. 3.5 to 6.5 metres per century.

The earliest editions of the Ordnance Survey 25 inch maps, towards the end of the nineteenth century, do show the coast in sufficient detail to allow comparison with recent editions and therefore changes can be measured. For the area between Aberdesach and Pontllyfni (Map 4) the coast edge retreated by about 15m (50ft) between 1918 and 1973 which would be a loss of about 27m in a century. Around the mouth of the Afon Llyfni however comparison with an early estate survey (Survey of the Bodaden and Plastyrian Estates, 1814) shows that the immediate coast has actually extended slightly, probably due to river silting and dyke building. Slightly further north the coast edge of the slight peninsula on which stands the farm of Ynys retreated by 30m between 1917 and 1973. Further to the south near Clynog is an ancient fish trap (a curving stone wall) on the lower foreshore which has been the subject of a detailed examination (Momber, 1991). It is now too far below sea level to be functional and its position suggests that sea level has risen by c. 2.84m since its construction and that the coast edge has retreated by about 118m. Estimate of the rate of erosion depends on the date of the fish trap. Nearby is an offshore reef which is traditionally known as Gorad Beuno, 'the fish trap of Beuno', Beuno being the founder of the Clynog church in c. AD 615-635. However, Momber suggests that the fish trap would not have survived in such good condition if it was seventh century in date and suggests instead that it was part of the new works carried out when Clynog was re-established as a religious centre between AD 1130-1230. If true this

demonstrates a rate of erosion of c. 13.7-15.5m per century. The dating and the estimate of erosion was supported by comparison of the 1889 and 1973 editions of the OS 25 inch maps which showed that the coast edge had retreated by c. 12m over that period.

Ashton (1920), in his study of the coast quotes the Royal Commission on Coastal Erosion of 1907 which reported a 'a wastage of only 13 inches in 7 years' (ie c. 4.7m per century) on the Llanfairfechan side of Penmaenmawr mountain (*ibid*, 221), presumably the low lying silty coast, not the rocky headland. There were also 'local reports of an average wastage of 8 inches a year for the last 50 years with frequent land slips in Nevin Bay' (ie c. 20.3m per century). Ashton also quotes Leland as saying that 'near Abermenai the sea hath eaten up a small village on the Caernarfon side' (*ibid*, 223). However, the coast around Abermenai is fairly stable, for instance a limekiln marked on the coast edge near St Faglan's church by Morris in 1748 still survives (Map 5, Site 283). Morfa Dinlle is a peninsula created by longshore drift of sand and shingle and is still growing. Comparison of the OS 25 inch 1918 Edition with that of 1973 in the northern part of the peninsula shows the coast edge to have advanced by c. 25m. If Leland's statement is true then the lost village must have been further south, perhaps a small fishing settlement, possibly at Borth ('port') south of Aberdesach, where there are the ruins of one medieval cottage.

The details and condition of the 13th/14th century Bishop's Palace at Gogarth have been recorded by Hughes and North (1924) and the structure described and planned by the Royal Commission (1956) when the condition of the southern building was already only fragmentary, described as 'much overgrown with ivy and being destroyed by erosion'. The present rapid survey (Appendix 5) showed that erosion is still active and further parts of the monument have been lost since 1956. While the fragmentary southern building has only minor value in terms of record or display the main building complex around the hall is still complete. However, it is less than three metres from the cliff edge and requires urgent attention. The monument was one of the few in Caernarfonshire on the list compiled by the 1956 Royal Commission Survey as 'Especially worthy of preservation'. Protection must be part of the local coastal management strategy as the settlement of Gogarth is also at risk and erosion patterns may be related to those of Llandudno West Shore where coastal protection works have already been completed.

Identification of a number of trackways to coves and beaches on the rocky north coast of Llŷn provides some measure of recent erosion as in most cases the seaward end of the tracks has been eroded away. However, the date of construction and use of the tracks is uncertain. They clearly link up with the surviving systems of fields associated with largely 19th century farmhouses so the antiquity may not be great. The tracks were most likely built to provide access for small scale fishing or for collection of seaweed and sand for land improvement. Both these activities probably came to an end in the early 20th century so the indication is of a loss of perhaps five metres of coast since that time. Where presently used roads give access to beaches as at Nefyn and Morfa Nefyn the seaward ends have been protected.

Observation of coast edge footpaths and field boundaries shows that the coast edge is retreating in many places. Footpaths and stiles have had to be relocated inland e.g. above Porth Dinllaen and east of Aber Ogwen on the north coast and earlier stone walls have been replaced by post and wire fences. In places even the latter have been washed out where there has been recent major erosion as around Dinas Dinlle. In two places gate-posts were seen on the beach where earlier boundaries had eroded away. That at Borth, (247), Aberdesach shows that at least ten metres of cliffs have gone in the last century or two. That at St Mary's church, Llanfairisgaer (259) shows that perhaps only a couple of metres has gone.

Other buildings of any antiquity actually on the sea-edge are few. One is St. Mary's Church, Llanfairisgaer, where the original 'llan' enclosure wall is still intact although modern reinforcement of the foundations has taken place along the sea edge. Estate sea walls that have not been maintained have been eroded at Llanfair Hall, Llanfairisgaer, and at Penrhyn Castle. Gogarth Palace was recorded on a large scale survey of 1849 (Gloddaeth Estate, 1849) which showed its main range as c. 38m from the cliff edge whereas it is now only 8 metres away.



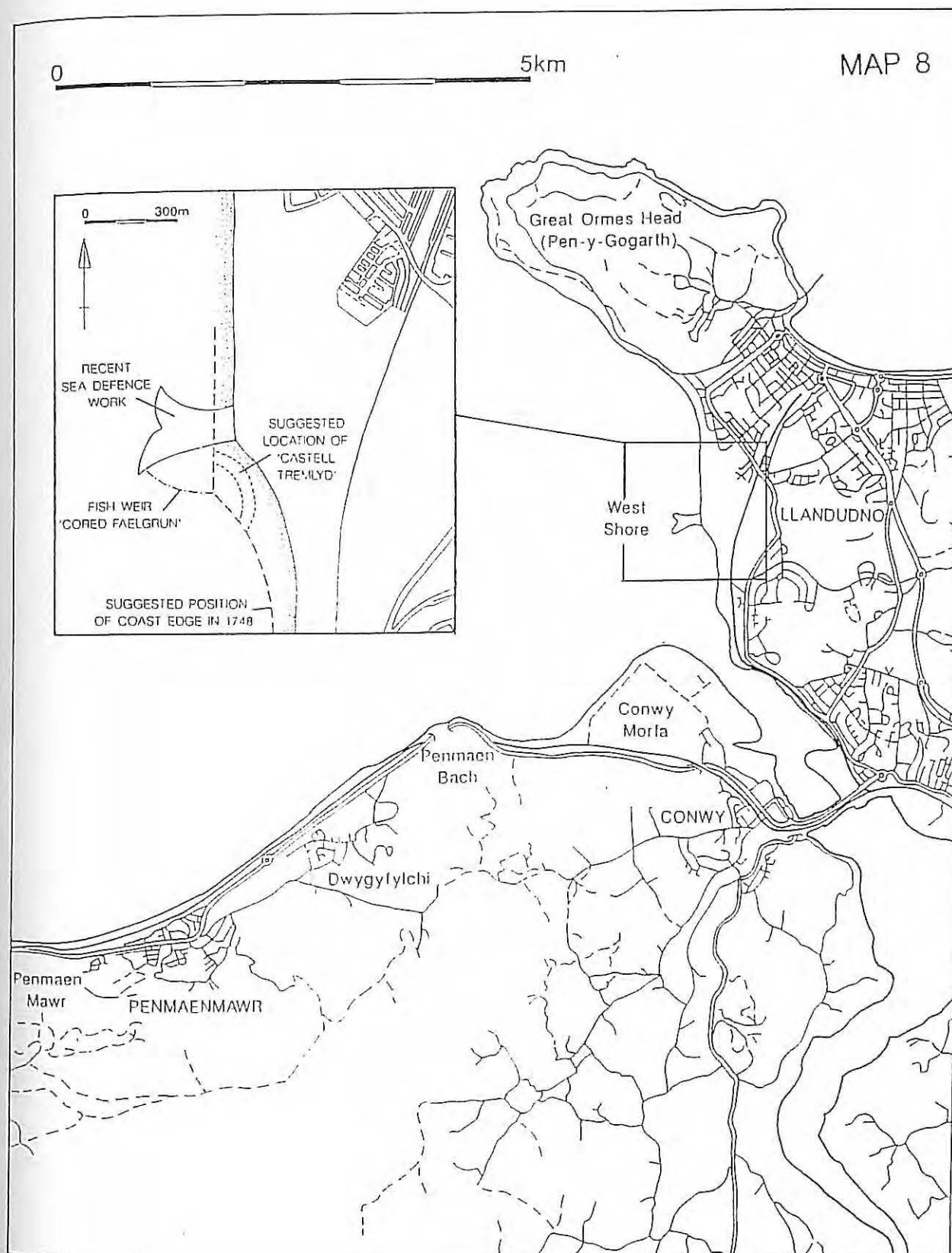


Fig. 29





Fig. 30

### 3. Long term erosion cycles and changing sea-levels.

Normal wave action may have little erosive power. Real change is the result of storms on annual and longer cycles when astronomical coincidences can cause exceptional tides and winds. Some of these are historically documented such as the sand-blows which buried the medieval church of St. Piran, Perranporth, Cornwall in the 18th century or which buried a large area of farmland at Newborough, Anglesey in 1330 (Carr, 1982, 23).

Another factor to be considered is that erosion may be less significant than changes in sea-level. Sea-level rose steadily in most places in Britain from the end of the last glacial period *c.* 10000 BP to the early Neolithic *c.* 5700 BP (Tooley, 1974). This involved a change in sea-level from about 40m below OD during the glacial maximum to the present level. During the early Mesolithic (*c.* 6500 BC) sea levels were about 20m below OD while during the later Mesolithic they were at about 10m below OD. Plotting the sea-bed contours at these levels gives a reasonably accurate picture of the coast edge during these periods (Fig. 30). Large areas of low-lying land around Gwynedd have therefore been submerged, including any coastal exploitation sites situated thereon. This argument has been used to explain the complete absence of earlier mesolithic sites from the coast of Cornwall despite a profusion of later mesolithic sites. Where the coast edge is elevated as on Western Llŷn the coast edge was not submerged so mesolithic sites have survived. Other more gradually sloping and low-lying coasts have retreated substantially and so sites of this period are not found on the coast edge as it is at present. This includes most of the survey area apart from western Llŷn and the Great Orme. Evidence of the latest phase of submergence survives as remains of forests and peat beds at several offshore locations around Anglesey and others are reported from Dinas Dinlle and Trefor (Cecil Jones, pers. comm.). The North Wales Marine Study Group hope to radiocarbon date some tree remains to fix the time of submergence and samples from tree stumps from the shore off Dinas Dinlle are currently being dated (J Scourse, pers comm). This post-glacial submergence may also have led to the legends of lost cities off the north coast and traditions that the Lavan Sands were once farmland ('Llys Helig') drowned in a great flood (Roscoe, 1836, Ashton, 1920, North, 1957). From about the beginning of the Neolithic period sea-levels are calculated to have fluctuated within about 5m of the present level, for instance with a temporary recession of the sea during the Neolithic period (Tooley, 1974), so local changes and erosion must have taken place on sensitive i.e. low lying and geologically 'soft' coasts. These minor fluctuations are difficult to document but require consideration. The general rise in sea level is illustrated by the Menai Straits as they average only *c.* 6m in depth and were formed by submergence of two adjoining glacial channels during the course of the post glacial just as the English Channel was not complete until the 6th millennium BC. The Menai Straits were probably marshy inlets until at least the Neolithic while they seem to have been shallower than at present during the Roman invasion since Tacitus reports that the Agricola invasion of Anglesey was achieved without the need for boats using local auxiliaries who knew the fords. Comparison with early features noted on the survey has been discussed. As described above, some work has already been done in considering the coast south of Dinas Dinlle where there is a potentially useful early feature, a historically documented (12th century?) fish trap, Gorad Beuno, near Clynog Fawr. There are other known fish traps (Jones, 1982) and there are still others historically documented, on the Gwyrfa and Seiont (The Record of Caernarfon, 1461-83) which are yet to be located. Further survey work therefore may produce more details about past sea levels.

The effects of the documented changes in sea-level need to be assessed in the face of the expected rise in sea-levels in the next century from global warming with mean sea-levels expected to rise by about two metres (Clark and Primus, 1987). Much depends on how tidal ranges (the difference between highest and lowest water) change but areas within about five metres of present high tide will be prone to flooding. The maximum present tidal range around North Wales is about 10 metres. Ordnance Survey heights are plotted above **mean** sea-level and so the 10m OD contour effectively shows areas within about 5m of highest tide level and which therefore need assessment. These areas are shown in general terms on Fig. 31 and in more detail on Figs. 5, 8, 11, 14, 17, 20, 23 and 26. Sites which are already eroding such as Dinas Dinlle and the Bishop's Palace, Gogarth will be eroded at a greater rate. The low

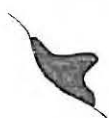
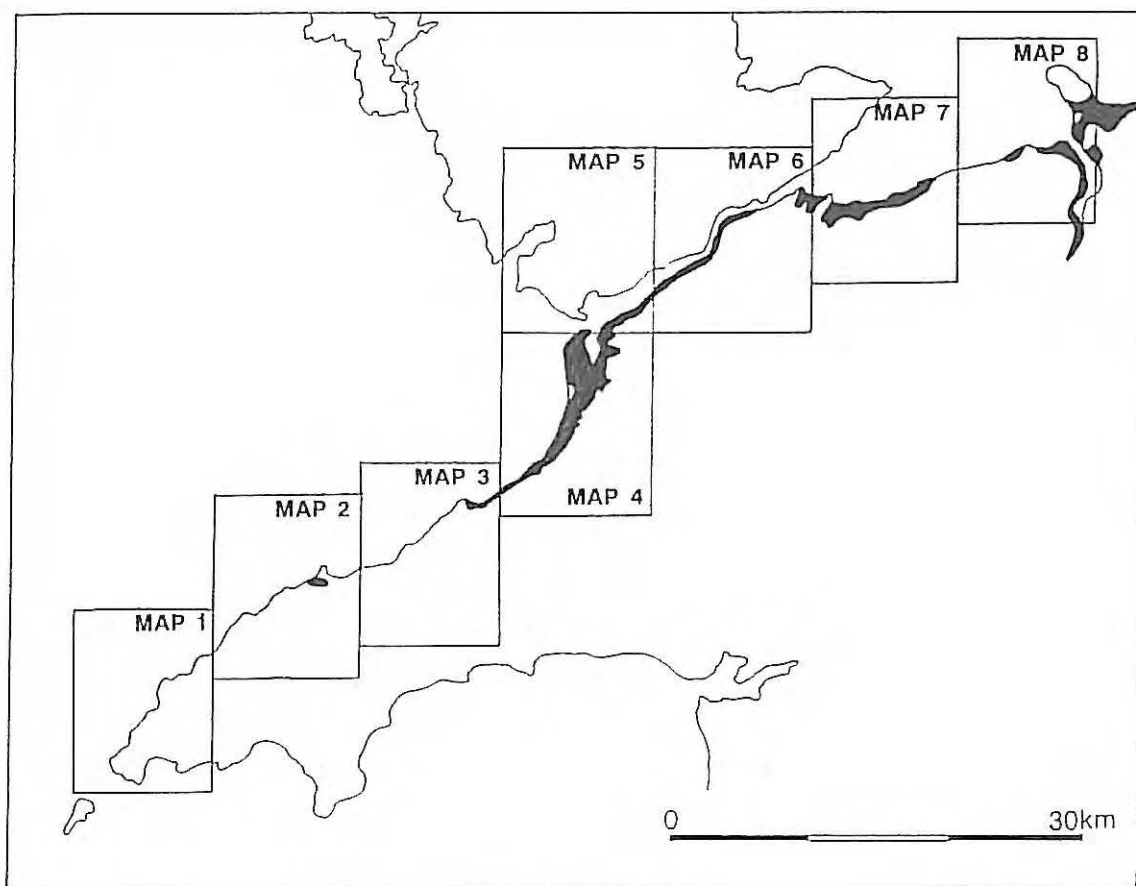
lying areas will be threatened with flooding and the drained and reclaimed marshland around Pontllyfni and Morfa Dinlle may be difficult or uneconomic to maintain whereas more valuable areas of settlement such as Llandudno will have to be protected at high cost. There are relatively few known archaeological features which might be threatened by their imminent inundation, for instance the burial chamber at Clynog Fawr (PRN 101) and the possible enclosure south of Dinas Dinlle (432, PRN 3593). New survey features threatened are a lime-kiln at Gyrn Goch (246) and fish weirs at Port Penrhyn (272 and 273) and Llandudno (279).

#### **4. Other coastal influences affecting archaeology**

The coast is an area of particular attraction for leisure pursuits, tourism and settlement. Thus footpaths, marinas, golf courses, caravan parks and housing can all be considered as coastal erosion features. For instance, the golf courses at Nefyn and Llandudno have both demonstrated how archaeological features can be erased by landscaping. At Nefyn the works have damaged the upstanding remains of a monument of at least regional importance, the fort which gives its name to the commote (viz 'Dinas Llŷn') and have erased any minor associated features. At Llandudno most of the remains of the previous historic landscape have been erased, perhaps including features associated with the enclosure of Castell Tremlyd noted by Morris in 1748.

Of the total length of coast studied about 50% is designated as Heritage Coast and/or AONB while about 45% of the remainder is classified as landscape conservation area within district plans (Fig 32). A small part of the north coast is in the Snowdonia National Park and the whole of Llŷn is an Environmentally Sensitive Area. Other parts of the coast attain protection as property of the National Trust (most of Western Llŷn) and about 10% of the coast consists of designated Sites of Special Scientific Interest (SSSI) or local nature reserves. The main relevant SSSI's are the western tip of Llŷn (Map 1), Porth Dinllaen (Map 2), Pistyll and Nant Gwtheryn (Map 3), Dinas Dinlle (Map 4), Foryd Bay (Maps 4 and 5) and Nant Porth, Bangor (Map 6). Relevant local nature reserves are The Lavan Sands (Map 7) and The Great Orme (Map 8). Locally, much of the Llŷn coast is being managed as a leisure and tourist resource by the District Council. In some respects this will protect the coast by, for instance, maintaining footpaths but it will also increase pressure by promotion, advertising and signboarding and perhaps creation of a continuous coastal footpath which could become prone to overuse as is happening nationally with long distance footpaths. Similarly, the good preservation of the various settlement sites on Western Llŷn is largely due to their obscurity which could be changed by improved public information. A balanced and general management policy is required.

The impact of any construction or other development on archaeology is taken account of in the draft PPG on Coastal Planning (1992) and other PPG's are relevant, those on Nature Conservation (in draft), Archaeology (PPG16), Countryside, including National Parks and AONBs (PPG7), Sport and Recreation (PPG17) and guidance notes on physical restraints to development in relation to coastal erosion e.g. flooding (DOE Circular 17/82) and unstable land (PPG14). The problem with the effects of erosion on archaeology is that it is not an item covered by development controls and, for instance, erosion was not considered as a threat to archaeology in the Gwynedd Structure Plan (Gwynedd County Council, 1986, 11.11). Any assessment will therefore only come through specially commissioned studies such as the present project. Erosion is however recognised as a threat in terms of existing settlement and in terms of strategic planning in Wales the Association of Welsh Counties is already assessing the issues likely to be significant in the next 10-15 years and has formed a Coastal Strategy Working Group. The Coastal Planning Draft PPG suggests that coastal areas within 5m of sea level (presumably meaning within 5m of mean high tide) could be vulnerable to flooding and that therefore any proposed development in those areas should be considered carefully. The impact of rising sea-levels with global warming has been brought to public attention with recent flooding at Towyn, Clwyd and as a result the Welsh Office re-issued earlier advice note 15/82. This was then incorporated in the Gwynedd Structure Plan (Gwynedd County Council, 1991), perhaps belatedly, since major flooding occurred in Llandudno in 1992. New, costly protection measures are in progress there and at Dinas Dinlle while local concern has been



Land within survey area  
below 10m OD

Fig. 31

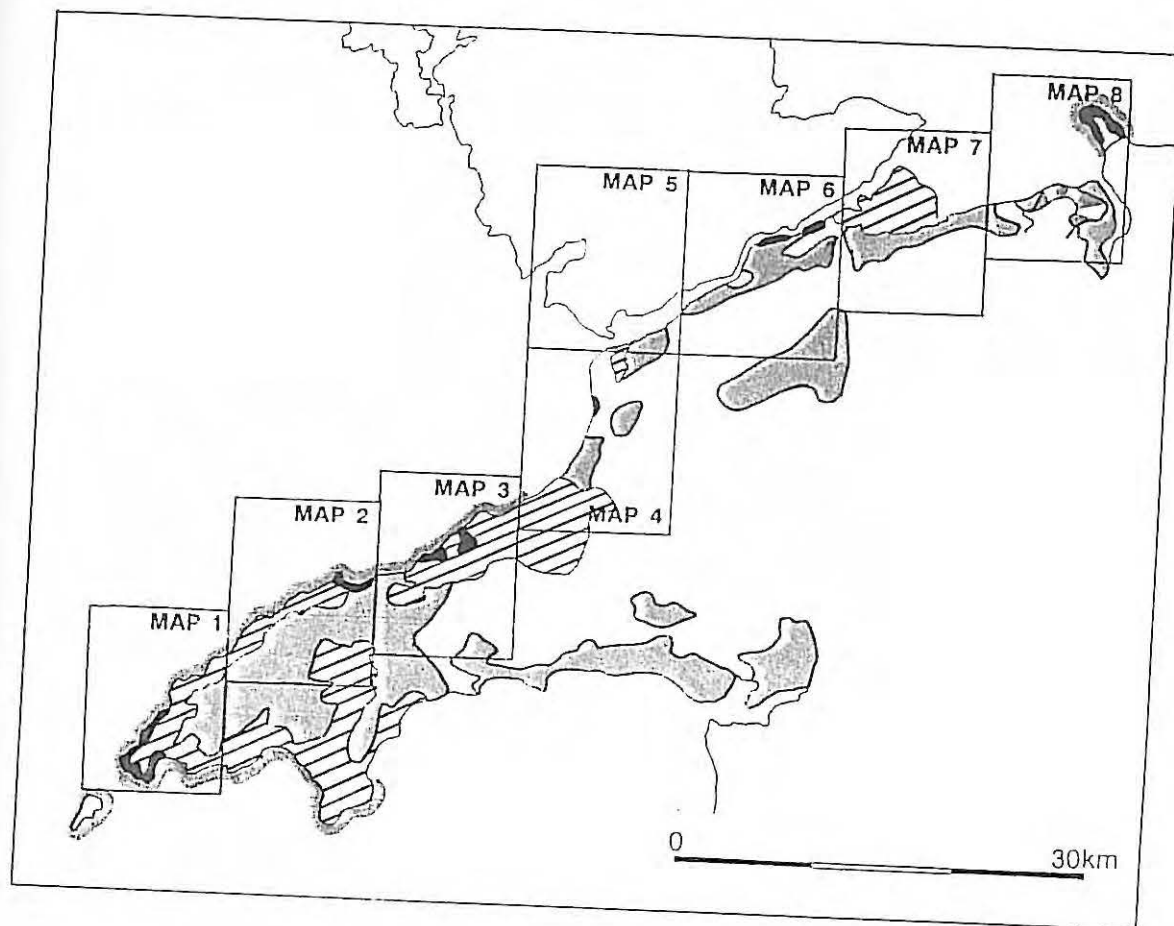


Fig. 32



expressed after suggestions that funds may not be available to protect the area around Pontllyfni. Such protection measures could in themselves affect archaeological remains, both during actual construction and through changes in the natural erosion pattern. It is therefore vital that archaeology is taken into consideration at the design phase. On the other hand, while a rising sea-level may have a local impact on archaeology there may also be some beneficial effects if development in coastal areas is restricted. Many of the new features noted on the present survey are post-medieval which by their construction are often more resistant to coastal erosion than prehistoric features. In one respect they are not however, and that is in the remit of local planning authorities to regenerate and restore run-down areas and reclaim derelict land, for which purposes grants are available. This can mean extensive changes to historic port landscapes, such as those at Caernarfon and Port Dinorwic, landscapes which merit the highest level of recording.

While it is possible to produce summary maps of erosion showing areas affected it necessary to assess sites individually and for those visited in the survey a summary gazetteer is provided (Appendix 2) with a note on present condition and suggested priorities for action as an aid to management. More detailed case studies are provided of three of the sites considered as being under particular threat.

The survey has been productive in providing a record of the archaeology and its condition and has provided a general assessment of erosion of value in the long term. It has shown that there are some localised areas of significant erosion threat but that a large part of this particular length of coast is relatively stable because it consists of high cliffs of resistant rock. In addition, most erosion results from exposure to the wave action from the prevailing south west winds and much of this coast either faces away from the prevailing winds or is otherwise sheltered. It follows from this that survey of the rest of the Gwynedd coast would be valuable, particularly of the coasts of south Anglesey, south Llŷn and Cardigan Bay where, because of their orientation, erosion can be expected to be more severe. In addition, Morfa Harlech is a low lying area endangered by rising sea levels.

## APPENDIX 1

### Coastal Erosion Survey Gazetteer: Coast Types and Erosion Assessment

Record No.	Grid Refs	Coast length	Coast edge type	Land edge type	Foreshore type	Erosion class
1	163250-159241	1.2	7	4;3	1;3	2
2	159241-150243	1.7	7	4	1;3	2
3	150243-141250	1.7	6	4	1;2	2
4	141250-143263	2.6	6	4	1	2
5	143263-147268	1.2	7	3	1	2
6	143263-154284	2.2	6	4	1	2
7	154284-165297	2.7	7	3	1/2/3	2
8	165297-168302	6.6	9	3	4	3
9	168302-169316	1.9	7	3	1;2	2
10	169316-168317	0.12	10	3	4	4
11	168317-172319	1.2	7	3	1	2
12	172319-181323	1.3	7	3	1	2
13	181323-198341	3.0	7	3	1	2
14	198341-208352	1.9	9	3	4	3
15	208352-220374	3.2	7	3	1	2
16	220374-233378	1.5	7	3	4	3
17	233378-240391	1.5	7	3	1	2
18	240391-249397	1.1	8	3	1	3
19	249397-256397	0.8	8	3	1	3
20	256397-265404	1.2	7	3	1	2
21	265404-265405	0.3	11	4	3	2
22	265405-267409	0.8	6	3	1	2
23	267409-273410	0.6	7	6	1	2
24	273410-274412	0.3	8	6	3,2,1	3
25	274412-276416	1.6	7	6	1	2
26	276416-277413	0.3	10	6	4	5
27	277413-282408	1.2	10,9	6	4	3
28	282408-295410	1.4	10,9,4	3,2	4,3	2
29	295410-296409	0.4	9	4,2	1	2
30	296409-318421	3.0	10	3,2,1	3,4	2/3
31	318421-322421	0.8	7	3	1,2	2
32	322421-332435	1.5	9	3	3	3
33	332435-338438	0.8	6	4,6	1	2
34	338438-344443	0.9	9	4,5	3	2
35	344443-346447	0.4	12	6	3	2
36	346447-349455	0.9	9	4,6	3	2
37	349455-353458	0.4	6	4	1	2
38	353458-360464	0.9	9	4	3	2
39	360464-364470	0.8	9	3	3	3
40	364470-372475	1.0	6	3	1	2
41	372475-375474	0.3	3,1	1	2	1
42	375474-389479	2.0	9	3,4,5	3,4	3
43	389479-398489	1.4	9	3	3	4
44	398489-403493	0.6	9	3	3	1
45	403493-410500	1.0	9	3	3	3
46	410500-411501	0.1	4,9,11	3	3	1
47	411501-415504	0.5	9	3	3	4
48	415504-417507	0.4	12	3	3,4	2
49	417507-423511	0.8	9	3	3,4	3
50	423511-425515	0.5	12	3	3,4	2

51	425515-426523	0.7	10,9	3	3,4	2
52	426523-429525	0.3	9	3	3	4
53	429525-431526	0.3	1	1	4,3	1
54	431526-432530	0.5	2	3	3,4	1
55	432530-433539	1.0	2	3	3	1
56	433539-434544	0.5	2	3	4,3	1
57	434544-435546	0.2	9	3	3	2
58	435546-435549	0.6	2	3	4,3	1
59	435549-436558	1.0	2	3	3	1
60	436558-436562	0.4	9	3	3,4	4
61	436562-436565	0.3	10	3	3,4	5
62	436565-432583	1.8	1	1,3	3,4	1
63	432583-438610	3.1	12	6	3	1
64	438610-442609	0.5	4	1,6	3	1
65	442609-441603	0.9	11	6	3,5	2
66	441603-439600	0.4	3	6	5,6	1
67	439600-448577	2.5	2	3	5,6	1
68	448577-451584	0.8	4	3	6	1
69	451584-453589	0.6	3	1,3	5,6	1
70	453589-453592	0.5	11	1,3	5	1
71	453592-454594	0.2	9	3	3,5	1
72	454594-454597	0.3	1	3	3,5	1
73	454597-455615	1.9	3	3	3,5	1
74	455615-493652	5.5	1	3,1	3,5	1
75	493652-495654	0.4	13	1	3	2
76	495654-497656	0.3	6	1	3	3
77	497656-498657	0.1	1	1	3	1
78	498657-499657	0.2	2	3	3	2
79	499657-501660	0.3	11	3	3	3
80	501660-502661	0.1	1	1	3	1
81	502661-503661	0.1	6	3	3	2
82	503661-504662	0.1	1	1	3	1
83	504662-505663	0.1	6	3	3	3
84	505663-507664	0.2	8	3	3,5	2
85	507664-511665	0.5	1	3	3,5	2
86	511665-520672	1.1	6	5	3,5	2
87	520672-522674	0.3	3	1	3,5	2
88	522674-53557065	3.8	1	1,5	3,5	1
89	53557065-53807077	3.0	6	5	3,5	2
90	53807077-53847078	0.03	1	5	3,5	2
91	53847078-54137087	0.3	6	5	3,5	2
92	54137087-54277090	0.15	1	4	3,5	1
93	54277090-55677127	1.5	6	5,4,1	3,5	2
94	55677127-55837135	0.18	1	1	3,5	1
95	55837135-56247181	0.6	6	3,5	1	2
96	56247181-56277183	0.03	1	1	3,5	1
97	56277183-56827236	0.77	6	1,5	3,5	2
98	56827236-57177253	0.4	9	5	3,5	2
99	57177253-57787280	0.8	6	3,5	3,5	2
100	57787280-57937291	0.2	1	1	3,5	1
101	57937291-58377318	0.55	6	5	3,5	2
102	58377318-59467267	1.5	1,3	1	3,5	1
103	59467267-60607288	1.23	1	5	1,3,5	1
104	60607288-60747275	0.2	6	5	3,5	3
105	60747275-61067216	0.8	1	5	3,5	2
106	61067216-61257225	0.2	11	4	3	1
107	61257225-61507237	0.3	9	3	3	4

108	61507237-61707243	0.2	2	3	3,5	1
109	61707243-61767245	0.06	1	3	3,5	1
110	61767245-61947253	0.1	9	3	3,5	2
111	61947253-62047280	0.1	1,9	4,5	3,5	2
112	62047280-62407267	0.36	9	3	3,5	4
113	62407267-63537276	0.66	9	3	3,5	2
114	63637276-64117295	0.56	9	3	3,5	3
115	64117295-64347302	0.24	9	3	3,5	2
116	64347302-64747312	0.42	3	3	5	1
117	64747312-65347373	0.95	11	4	5	2
118	65347373-65687376	0.35	2	3	3,4,5	2
119	65687376-65847378	0.16	1,11	3	3,4,5	3
120	65847378-66007382	0.17	1	3	3,4	1
121	66007382-66377414	0.5	4	1	3,5	1
122	66377414-66727430	0.4	11	3	5,6	2
123	66727430-66977490	0.80	11,2	6	3,5	2
124	66977490-69857620	3.3	1	3,5,1	3,4	1
125	69857620-70257626	0.41	6	6	3,4	2
126	70267626-73107747	3.1	1	1	3,4	1
127	73107747-73477784	0.55	10	6	3,4	3
128	73477784-73957809	0.54	10,3	1	3,4	4
129	73957809-75007845	1.2	6	6	3,4	2
130	75007845-75257834	0.26	1	1	3,4	1
131	75257834-76627920	1.8	10	6	3,4	2
132	76627920-77527896	1.06	10	6	3,4,5	2
133	77527896-77577828	0.9	2	1	3	1
134	77577828-77867823	0.3	1	1	5	1
135	77867823-78117784	0.6	1,6	5,1	3,5	1
136	78117784-78427752	0.43	1	1	3,5	1
137	78907780-78687840	1.1	2	1	5	1
138	78687840-77527974	1.9	1	1	3,4,5	1
139	77527974-77397055	0.45	10	6	3,4	3
140	77398055-77308075	0.21	9,10	6	3,4	3
141	77308075-77308146	0.70	10	1,6	5	4
142	77308146-77248175	0.55	5	1	3,4	2
143	77248175-76898220	0.60	1,5	1	3,4	1
144	76898220-76388250	0.6	1	1	1,3	1
145	76388250-76328255	0.08	6	4	1,3	2
146	76328255-76168276	0.28	1	1	1,3	1
147	76168276-75978292	0.25	9	1	3,2	3,4,5
148	75978292-75488316	0.54	9,4	6	3,2	3
149	75488316-75178333	0.34	9	4	2,3	2
150	75178333-75028355	0.28	9	4	2,3,4	3
151	75028355-74958388	0.34	9	4	2,3,4	5
152	74958388-75698450	1.0	6	4,6	1	2

## APPENDIX 2

### Coastal Erosion Survey Summary Gazetteer: Archaeology

#### Introduction

The gazetteer provides a brief summary of each site/feature. Further details can be obtained by referring back to the individual record sheets. The record number is unique to the project, taken from a series allocated as follows: 1-200, Erosion records; 201-400, New archaeological features; 401-500, GAT SMR features. The PRN is the SMR primary record number. Co-ordinates are all preceded by SH. 'A' after the co-ordinate means approximate only. Abbreviations used: Coll, Collection; Neo, Neolithic, BA, Bronze Age; IA, Iron Age; Med, Medieval.

#### Map 1

##### A. Known Archaeological Features

Record No.	PRN No.	Co-ords	Site Descrip	Site Type	Period	Condition	Action
401	3297	161-249-A	Worked flint	Surface coll	Mesolithic?	Good	Surface coll
402	4349	1590-2455	Worked flint	Surface coll	Mesolithic?	Good	Surface coll
403	1674	1585-2419	Hut group	Earthwork	BA/IA?	Good	Survey
404	3296	154-244-A	Worked stone	Surface coll	Neolithic?	Poor	Surface coll Exc?
405	1664	154-2446	Hut circle	Earthwork	BA/IA?	Good	Survey
406	773	1516-2437	Hut circle & field system	Earthwork	BA/IA?	Good	Survey
407	1228	1513-2413	Hut circle & field system	Earthwork	BA/IA?	Good	Survey
408	1224	1477-2463	Worked flint	Surface coll	Mesolithic	Fair	Nil
409	1665	1473-2459	Trackway	Earthwork	Post med	Good	Nil
410	1666	1475-2462	Mound	Earthwork	Post med?	Good	Nil
411	2759	145-247-A	Anchor	Sea-bed find	Roman	-	Visit
412	780	1429-2499	Hut square	Earthwork	Medieval?	Good	Survey
413	1668	1436-2507	House? platforms	Earthwork	Medieval?	Good	Survey/monitor
414	3632	1392-2518	Holy well	Rock-cut	Medieval	Good	Nil
415	1669	1384-2520	Standing Stone	Stone	Neo/BA	Fair	Monitor
416	4350	1383-2525	Worked flint	Surface coll	Mesolithic?	Fair	Surface coll
417	1657	1472-2672	Field system	Earthwork	Med/post med	Fair/poor	Survey
418	1659	1461-2696	Circular platform	Earthwork	Med/post med	Good	Survey
419	1658	1460-2700	Boundary bank	Earthwork	Med/post med	Fair	Survey
420	1656	1485-2753	Boundary bank	Earthwork	Med/post med	Fair	Monitor
421	768	150-276	Hut group/ field system	Earthwork	BA/IA	Good	Survey
422	407	1670-3170	Promontory fort	Earthwork	IA?	Fair	Survey

##### B. New Archaeological Features

201	-	1615-2477	Stone quay	Stone structure	Post med	Poor	Survey
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202	-	1363-2553	Rectangular platform	Earthwork	Post med?	Good	Nil
203	-	1590-2920	Boundary banks	Earthwork	Natural?	Good	Survey?
204	-	1630-2960	Circular platforms	Earthwork	Natural?	Good	Survey?
205	-	1675-3015	Promontory fort?	Earthwork	IA?	Fair	Survey
206	-	1676-3018	Lime kiln?	Stone structure	Med/post med	Good	Nil
207	-	1669-3036	Standing Stone	Stone structure	Prehistoric	Good	Nil
208	-	1768-3231	Worked flint	Surface coll	Mesolithic?	Fair	Monitor
209	-	1866-3252	Rectangular hut platform	Earthwork	Med/post med	Good	Survey
210	-	1880-3270	Rectangular hut and field	Earthwork	Med/post med	Good	Survey

## Map 2

### A. Known Archaeological Features

423	5226	226-374-A	Bronze palstave	Isolated find	BA	-	Nil
424	2211	2638-4024	Pseudo feature	Natural	-	-	Nil
425	421	2744-4155	Promontory fort	Earthwork	IA	Fair/poor	Survey
426	2210	2764-4113	Stone weight	Isolated find	IA?	-	Nil

### B. New Archaeological Features

211	-	2050-3430	Lynchet	Earthwork	Post med?	Good	Nil
212	-	2090-3498	Embanked field	Earthwork	Med/post med	Good	Nil
213	-	2080-3534	Trackway	Earthwork	Med/Post med?	Fair	Nil
214	-	2076-3534	Clearance cairn	Earthwork	Post med	Good	Nil
215	-	2161-3675	Trackway	Earthwork	Post med	Fair	Nil
216	-	2175-3700	Ridge & furrow	Earthwork	Post med	Fair	Nil
217	-	2194-3732	Industrial? platform	Earthwork	Post med	Good	Nil
218	-	2196-3740	Industrial building	Stone structure	Post med	Good	Nil
219	-	2194-3750	Industrial building	Stone structure	Post med	Good	Nil
220	-	2272-3740	Boundary banks	Earthwork	Med/post med	Fair	Nil
221	-	2275-3744	Ridge & furrow & field banks	Earthwork	Med/post med?	Fair	Survey
222	-	2315-3745	Settlement? banks & mounds	Earthwork	Med/post med?	Fair	Survey
223	-	2324-3747	Vegetable store?	Stone structure	Med/post med?	Good	Local research
224	-	2557-3969	Trackway	Earthwork	Post med?	Fair	Nil

225	-	2962-3968	Field banks	Earthwork	Post med	Fair	Nil
226	-	2567-3971	Circular building? platform	Earthwork	Post med	Fair	Survey
227	-	2574-3975	Trackway	Earthwork	Post med	Fair	Nil
228	-	2620-4016	Flint pebble exposure	Surface coll	Natural	-	Nil
229	-	2635-4035	Ridge & furrow	Earthwork	Med/post med	Fair	Nil
230	-	2658-4040	Field system	Earthwork	Med/post med	Good	Survey
231	-	2664-4040	Quarry	Earthwork	Post med	Good	Nil
232	-	2667-4040	Trackway	Earthwork	Post med	Good	Nil
233	-	2682-4092	Worked flint	Surface coll	Mesolithic?	Fair	Survey
234	-	2765-4192	Defensive bank?	Earthwork	IA?	Poor	Survey
235	-	2774-4200	Rectangular building	Earthwork	Med/post med	Fair	Survey
236	-	2778-4200	Hut? terraces	Earthwork	IA?	Good	Nil
237	-	2925-4090	Trackway	Earthwork	Post med	Fair	Nil
284	-	2765-4114	Custom House	Building	Post med	Good	Nil

### Map 3

#### A. Known Archaeological Features

427	5217	3272-4242	Hut? circles	Cropmark	IA?	Fair	Monitor
428	2220	3332-4335	Hut circle settlement	Earthwork	IA?	Fair	Survey
429	1268	3346-4359	Long hut	Earthwork	Med?	Good	Nil
430	1261	3340-4365	Hill-fort	Site of	Early med	-	Nil
431	1477	3716-4748	Worked flint	Surface coll	Mesolithic	Poor	Survey & evaluation

#### B. New archaeological features

238	-	3144-4218	Stone quay	Stone structure	Post med	Good	Nil
239	-	3230-4213	Stone factory complex	Stone structures	Post med	Fair	Survey
240	-	3233-4228	Trackway	Earthwork	Post med	Fair	Nil
241	-	3274-4260	Turbine house	Stone structure	Post med	Fair	Nil
242	-	3233-4312	Clearance cairn	Earthwork	Med/post med	Good	Nil
243	-	3330-4322	Lynchet	Earthwork	Med/post med	Good	Nil
244	-	3325-4325	Clearance cairn	Earthwork	Med/post med	Good	Nil
245	-	3323-4329	Building platform	Earthwork	Med/post med	Fair	Survey

### Map 4

#### A. Known Archaeological Features

432	3593	4357-5572	Oval enclosure	Earthwork	IA/RB?	Fair	Survey?
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433	1570	4370-5635	Hillfort	Earthwork	IA/RB	Very poor	Eval/Survey
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#### B. New Archaeological Features

246	-	4002-4901	Lime kiln	Stone structure	Post med	Fair	Survey
247	-	4185-5080	Menhir/ gate post	Stone structure	Prehistoric/ Post med	Very poor	Survey
248	-	4497-5834	Clearance cairn	Stone structure	Med/post med	Fair	Survey
249	-	4532-5880	Lime kiln	Stone structure	Post med	Fair	Nil
250	-	5922-4536	Trackway	Earthwork	Post med	Good	Nil
251	-	4538-5940	Field wall	Stone structure	Post med	Fair	Nil

### Map 5

#### A. Known Archaeological Features

434	3082	4405-6095	Artillery fort	Stone structure	Post med	Good	Nil
435	3102	4554-6068	Church	Stone structure	Medieval	Good	Nil
436	3116	487-641-A	Barrow	(Site of) earthwork	BA	Poor	Monitor

#### B. New Archaeological Features

252	-	4530-6102	Quay	Stone structure	Post med	Poor	Survey
253	-	4854-6400	Ridge & furrow	Earthwork	Post med	Good	Nil
254	-	4893-6465	Quay	Stone structure	Post med	Fair	Nil
255	-	4898-6464	Ferry? house	Stone structure	Post med	Poor	Survey
256	-	4900-6470	Trackway	Earthwork	Post med	Poor	Nil
257	-	4915-6502	Store? building	Stone structure	Post med	Good	Nil
258	-	4927-6514	Store? building	Brick structure	Post med	Good	Nil
259	-	4998-6585	Gate post	Stone structure	Post med	Poor	Nil
283	-	4544-6132	Lime kiln	Stone structure	Post med	Poor	Survey

### Map 6

#### A. Known Archaeological Features

437	3681	5017-6602	Church	Stone structure	Medieval	Good	Nil
438	3682	5190-6710	Promontory fort	Earthwork	Early med?	Good	Survey

439	793	5263-6836	Coin hoard	Isolated find	Roman	-	Nil
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#### B. New Archaeological Features

260	-	5120-6655	Wood bank	Earthwork	Post med	Good	Nil
261	-	5263-6834	Limekiln complex	Stone structure	Post med	Fair	Survey
262	-	5330-7045	Boat anchorages	Earthwork	Post med	Fair	Survey
263	-	5383-7078	Sea-wall	stone structure	Post med	Good	Nil
264	-	5392-7081	Quay?	Stone/brick structure	Post med	Fair	Survey
265	-	5362-7064	Rectangular hut settlement	Earthwork	Post med?	Good	Survey
266	-	5389-7078	Trackway	Earthwork	Post med?	Good	Survey
267	-	5400-7080	Rectangular hut settlement	Earthwork	Post med?	Good	Survey
268	-	5530-7117	Industrial complex	Mound & timber structures	Post med?	Poor	Survey
269	-	5682-7237	Quay	Stone structure	Post med?	Fair	Nil
270	-	5686-7232	Quarry complex	Earthwork	Post med?	Good	Nil
271	-	5939-7280	Industrial dump	Earthwork	Post med?	Good	Nil
272	-	5973-7290	Fish weir	Wood structure	Med/post med	Poor	Survey
282	-	5001-6590	Oyster bed	Stone structure	Post med	Poor	Nil
285	-	5609-7162	Ferry quay	Stone structure	Post med	Fair	Nil

#### Map 7

##### A. Known Archaeological Features

Nil

##### B. New Archaeological Features

273	-	6026-7314	Fish wier	Wood/stone structure	Med/post med	Poor	Survey
274	-	6053-7310	Sea-bath house	Stone structure	Post med	Poor	Survey
275	-	6100-7235	Submerged forest	Environmental feature	Post med?	Poor	Nil
276	-	6203-7258	House	Stone structure	Post med	Poor	Nil
277	-	6663-7430	Submerged forest	Environmental feature	Post med?	Poor	Nil

## Map 8

### A. Known Archaeological Features

440	2880	707-762-A	Stone axe-hammer	Isolated find	Beaker/ Early BA	-	Nil
441	2823	7762-7824	Pottery? spindle whorl	Isolated find	IA?	-	Nil
442	4594	7735-8056	Promontory fort?	Site of	IA?	-	Nil
443	5030	773-813-A	Hand axe?	Isolated find	Palaeolithic	-	Nil
444	4589	767-882-A	Stone axe	Isolated find	Neolithic	-	Nil
445	813	7605-8290	Bishops Palace	Stone structure	Medieval	Very poor	Survey

### B. New Archaeological Features

278	-	7328-7767	Shell midden	Earthwork	Post med?	Fair	Nil
279	-	7715-8039	Fish weir	Stone structure	Medieval?	Fair	Survey
280	-	7740-8067	Ridge & furrow	Earthwork	Post med	Poor	Nil
281	-	7500-8385	Gun battery	Stone structure.	Post med	Very poor	Nil



### APPENDIX 3

#### Erosion case study - Mesolithic flint-working site, Trefor, PRN 1477, Project record no. 431

This site was discovered by GAT in 1990. It lies on the cliff edge of a narrow, rounded ridge which runs close to the cliffs adjacent to a small valley, where a stream debouches to the sea (Fig. 33a). Worked flint and occasional chert pieces were collected from the cliff edge where the rock surface is exposed by trampling and weathering. In 1993 further pieces were collected here but, in addition, a buried soil was seen in the side of a nearby small quarry in which were more artifacts but this time in situ. The quarry cuts into a sloping ridge of rock which has a smooth surface, the result of glacial planing. Above the rock surface is an area of stratified sediments which appear to consist of an old humic land surface buried by a layer of gravelly colluvium (Fig. 33b). The soil horizon is so clear that it fairly certainly cannot simply be redeposited during excavation of the adjacent (19th century) quarry. Similarly, the gravelly layer above is not as mixed as would be expected if it was quarry dump. Worked flint and chert pieces occur in the buried soil and in smaller numbers in the lower part of the gravel layer. The worked pieces are all waste but include small conical cores, small blades (< 10mm width) and one small microburin which suggests that the assemblage is of later mesolithic date.

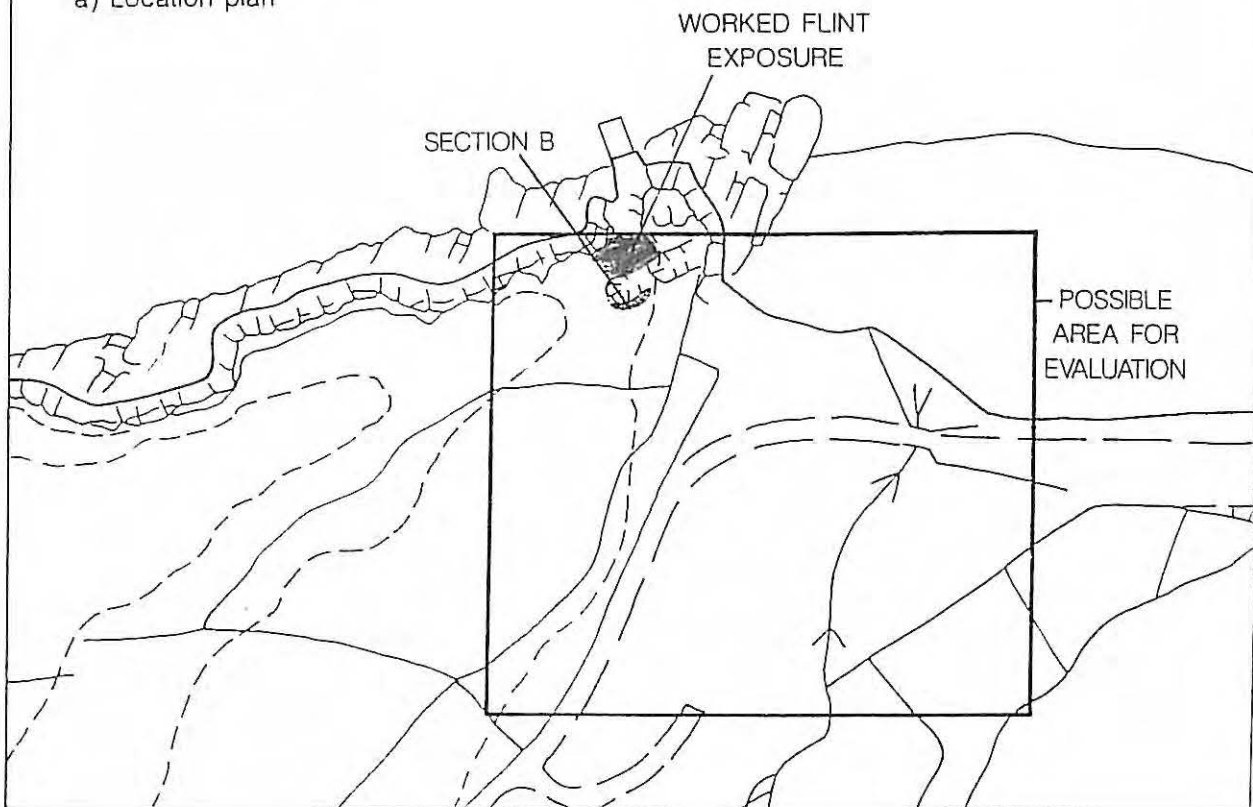
It seems likely that here there is a buried mesolithic land surface. It lies on such a slope however, that the surface is unlikely to be the working floor itself. This was probably situated further up the slope on the top of the knoll where it may survive in good condition. Even if the buried soil is simply that existing at the time the quarry was dug the flint still derives from further up the slope, beyond the quarry, and should still survive. The sea level at the time of the mesolithic occupation would have been about 5m below the present and the coast edge would therefore have been further away. The adjoining small valley floor would have been similarly lower and it is therefore likely to contain sediments accumulated since the mesolithic occupation and have considerable potential for preserved environmental and cultural evidence.

#### Recommendations

In terms of the quantity of material present from what is only a minor exposure of the whole this is clearly a major activity area with over 150 pieces collected in 1990 and a similar number in 1993. Considering the rarity of sites of the later mesolithic period in North Wales, the only published examples from Prestatyn and Brenig, Trefor has the potential to be the type for the area and as it is suffering from continuing erosion it deserves to be properly evaluated. Two small trenches of an archaeological nature have been dug into the deposits in recent years although there is no record of who carried this out. An evaluation could consist of small scale but widespread test-pitting. This would define the area of activity, produce a large enough assemblage for analysis, evaluate the potential for structural, industrial and environmental evidence and perhaps produce material for radiocarbon dating.

TREFOR FLINT SITE PRN 1477

a) Location plan



b) Schematic section

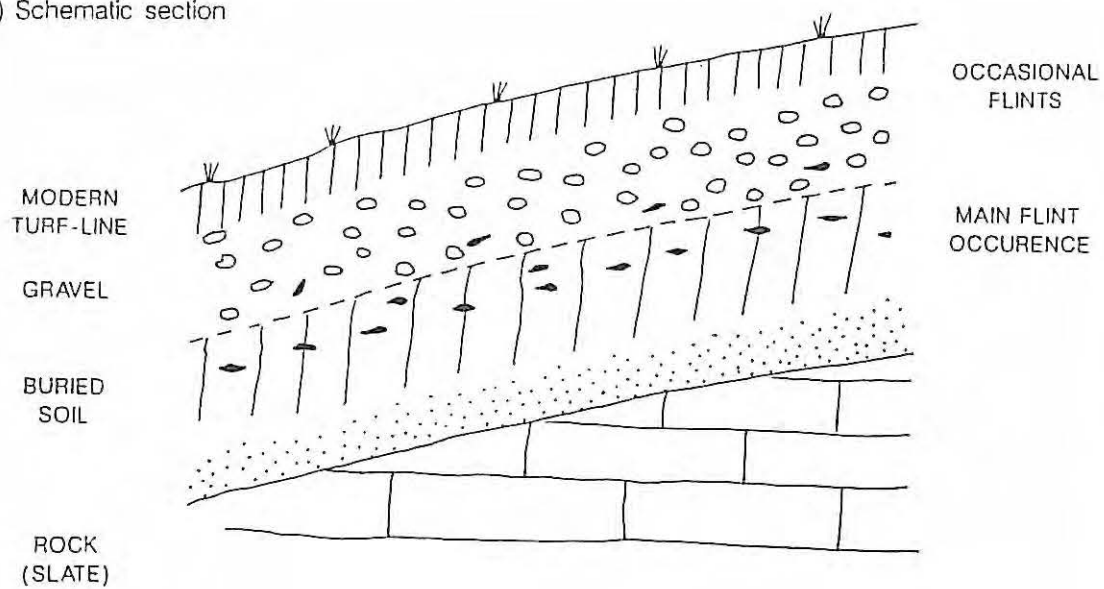


Fig. 33

## APPENDIX 4

### Erosion Case Study - Dinas Dinlle, PRN 1570, Project Record no, 433

This hill-fort is built on a small isolated hill of deformed glacial sediments. The precise geological reason for the hill's origin is not yet understood (Hart, 1990, 63-70) and the exposed cliff-face section is of great interest for glacial studies and so is designated as a site of Special Scientific Interest (SSSI).

The hill-fort is regarded as of national importance and is a Scheduled Ancient Monument (CAR 48). The site has never been excavated although there are some chance finds, these suggest occupation in the 2nd-3rd centuries AD but its construction is likely to be considerably earlier. The fort is bi-vallate with a simple entrance on the south east and similar in construction to other hill forts in the region which must have been local strongholds in the Iron Age, for instance Dinas Dinorwig, Llanddeiniolen and Craig-y-dinas, Llanllyfni. Its situation on a hill of soft glacial sediments on the sea edge has led to erosion which can be documented and assessed to some extent. The curve of the defences, together with what is known from early maps suggests that the fort was once a continuous enclosure i.e it was not just a defended promontory. This in turn suggests that at one time there was a similar gradual slope to lower ground on the west as there is today on the east side. It appears then that a considerable area of land has been lost to sea erosion. The earliest illustration is a maritime chart of 1748 by Lewis Morris (Fig. 34a) is only a stylised sketch but was obviously intended to show that the defences were already partly eroded. A more detailed plan of 1871 (BM Add. MS 28860) shows a very similar situation with evidently little change (Fig. 34b). More precise appreciation of the changes is possible by comparison of the first edition of the OS 1:2500 survey of 1888 with the most recent survey of 1975. This shows a retreat of the cliff edge of up to 20m not only of the hill of Dinas Dinlle itself but of this whole part of the coast. Observation during the GAT project showed several very recent land slips, presumably during the winter of 1992-3 and a survey of the cliff edge showed that up to 20m of the hill-fort had been lost since 1975 with several areas of land subsidence (Fig. 35).

#### Assessment of Erosion

It is clear that further monitoring of the monument will only show that erosion is continuing. Since 1975 approximately 1100 sq.m of the interior has been lost, perhaps double that if the area of the defences is included, approximately as much as was lost in the previous 90 years. If this rate of erosion continues it can be estimated that the whole of the interior of the monument will be lost in the course of the next century. Apart from the loss of the monument itself it is doubly unfortunate in that because of lack of research, there is still no understanding of the monument's date or function. It might be argued that the cost of coastal protection outweighs the value of the archaeological resource but it will be argued that there are other grounds on which protection is warranted, first in providing greater security to the modern coastal settlement of Dinas Dinlle, secondly in making the coast edge safe for visitors and thirdly in preserving the monument as a suitable case for public interpretation.

#### Interpretation of the Erosion Process

Although it is the cliff-top edge which is most important as regards erosion of the monument it is the angle of the cliff which is most significant as the sea is only eroding the foot of the cliff. It is the natural movement towards an angle of rest which is actually causing collapse of the cliff top. The angle of the cliff face at present is about  $65^{\circ}$  (from the horizontal) whereas the natural angle of rest for such unconsolidated material would be about  $30^{\circ}$  from the horizontal (Young, 1972, 165). This is very similar to the angle of the cliff, of  $32.5^{\circ}$ , in similar material, found at Clynnog, 6km to the south (Momber, 1991, 100-1). Such a low angle would probably never be reached because the cliff face would become naturally stabilised by the growth of vegetation. Nevertheless, even if all sea erosion could be halted, some 20 to 25m of the monument would still be lost before the cliff reached a natural angle of stability. Fig. 36 shows a diagrammatic cross section of the monument, A-B as on the plan Fig. 35, with the

observed retreat of the cliff face and the effect of the movement towards a natural angle of rest.

### Responses to Erosion

If, as currently proposed, the erosion is merely slowed then the cliff face will achieve a lower angle and will become partly vegetated. This may provide insufficient exposed section for the purpose of geological study in which case full protection would be preferable. Whatever course of action is adopted at least 20 to 25m of the monument will be lost and it seems unacceptable that a sizable portion of the interior of such a well-known and unresearched monument should be destroyed without at least evaluation. This area corresponds roughly to all that west of the present fence-line. It is fortunate that the presently known internal features of the fort identified from ground survey in 1956 (RCHM, Caerns, Vol.II Central), house sites, enclosures and a possible burial mound are all on the eastern side of the site, the least threatened (Fig. 37). However, the rest of the interior is an unknown quantity. Preservation of features may be good because of the presence of a covering layer of blown sand but this in turn may mask features from geophysical survey. Excavation may therefore be the only productive means of evaluation. If this approach is adopted then it should be carried out on a small scale sampling basis and carefully restored to avoid further erosion.

### Summary

1. Although valuable to geological study, mainly for educational purposes, it is not acceptable on safety grounds to leave the cliff as it is at present, a danger to visitors at both beach and cliff top level.
2. The monument is valuable because a) it is a nationally important site with considerable potential for study and b) Like Maiden Castle or Danebury it is in a tourist area and a prominent landscape feature, frequently visited, with great potential for interpretation.
3. For the reasons outlined above it would be desirable to begin a programme of stabilisation and archaeological evaluation.



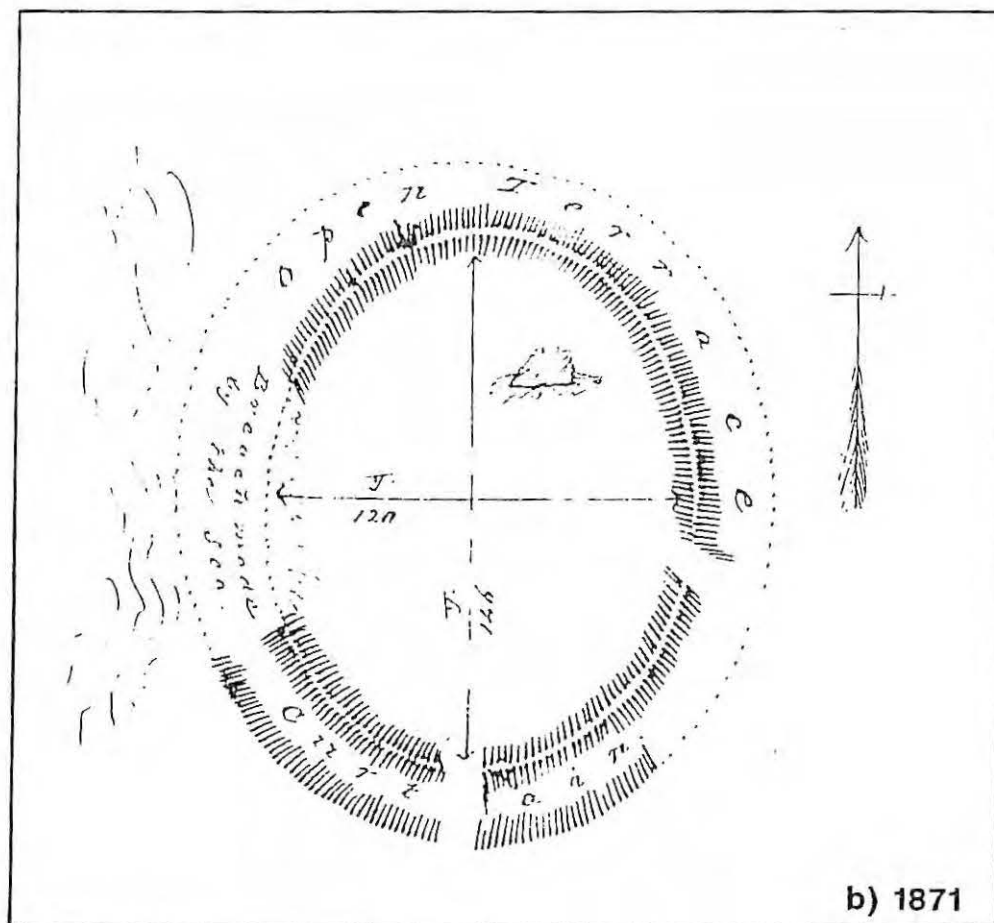
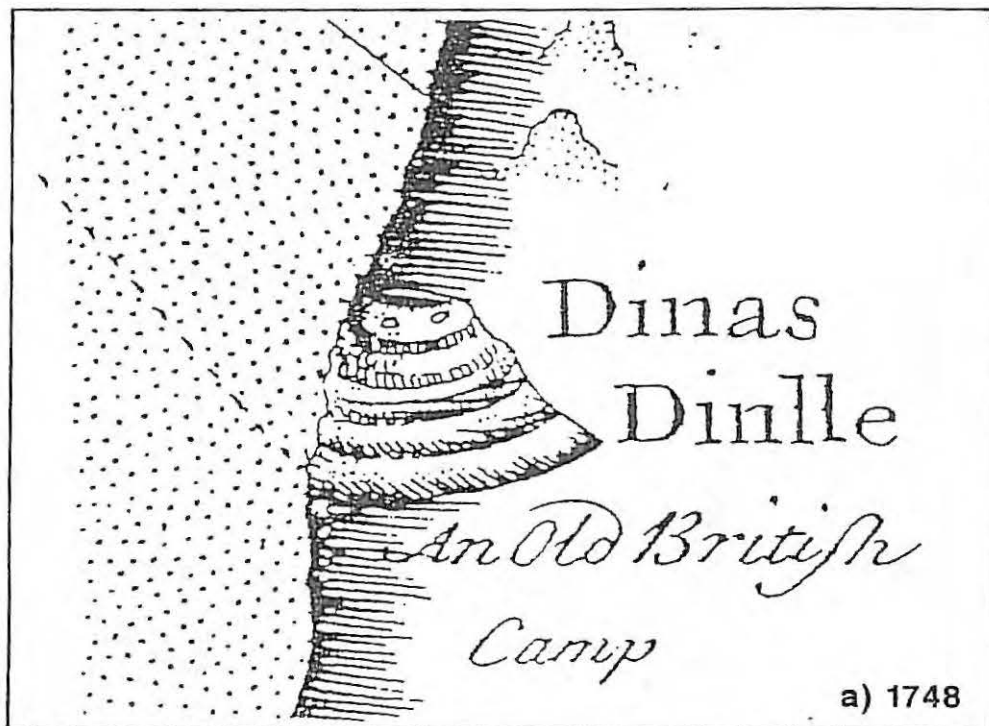


Fig. 34



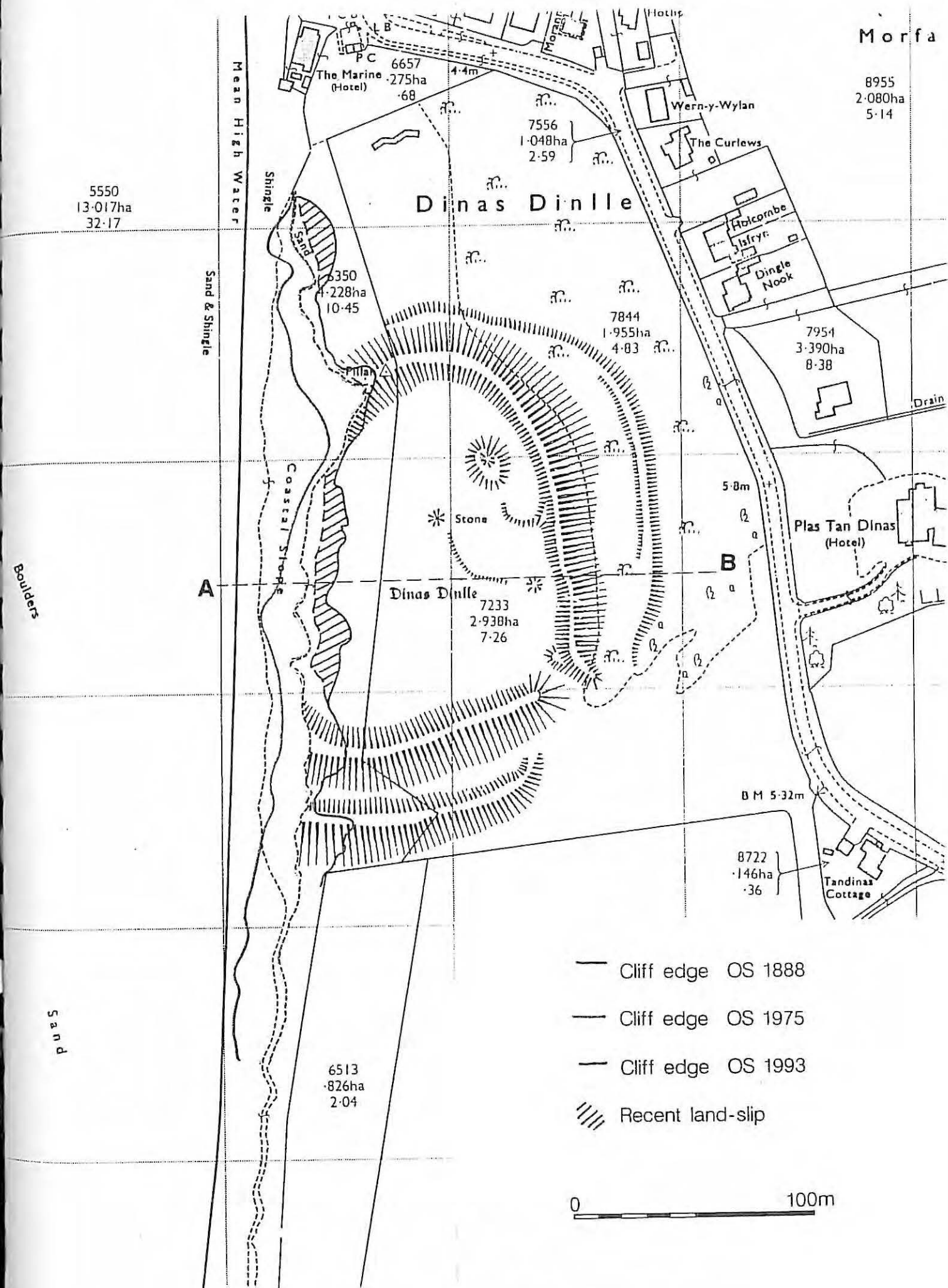


Fig. 35

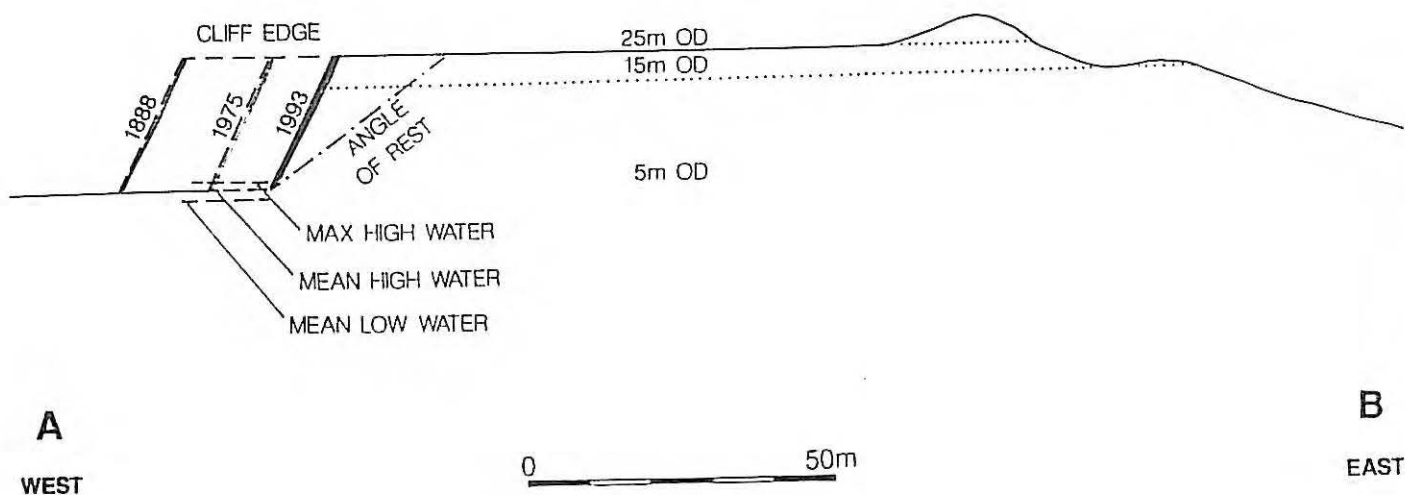


Fig. 36

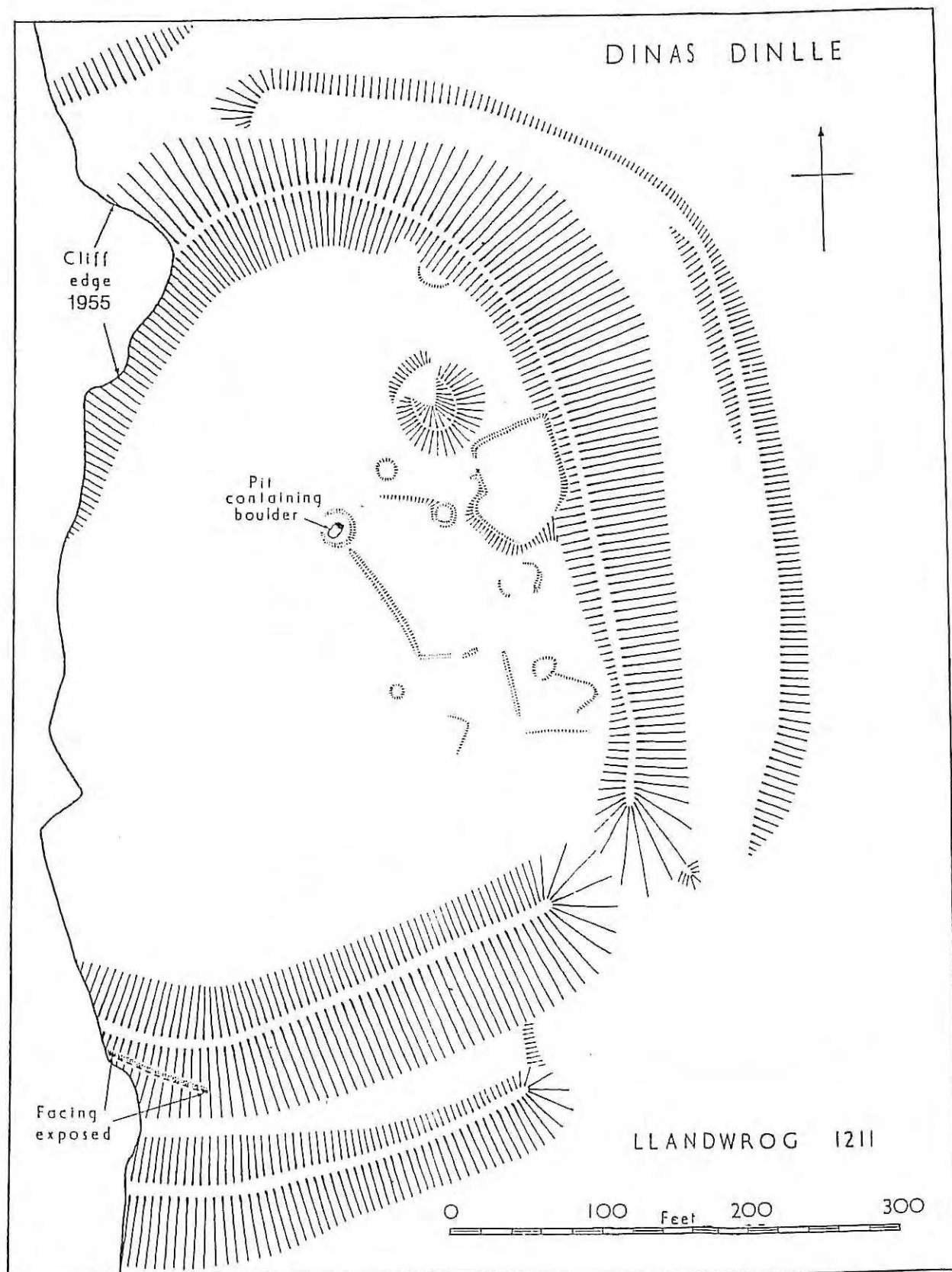


Fig. 37

## APPENDIX 5

### Erosion case study - The Bishop's Palace, Gogarth, Llandudno, SAM CAR 93, GAT PRN 813, Project record no. 445

Gogarth lies on a length of coast consisting of a narrow raised plateau, at c. 30m OD, of sandy glacial till overlying the limestone bedrock of the Great Orme. The coast edge is soft with little structural strength and as it faces the prevailing winds suffers considerably from wave erosion. The degree of erosion varies depending on the amount of coastal protection works carried out as some areas are now stabilised by construction of sea-walls. In the area of the medieval Bishop's Palace which is a scheduled ancient monument, a site of national importance, there has been no protection work and the present survey classifies the erosion as medium to major. Erosion has evidently been a long continuing process since the western building of the palace complex (Fig. 38), tentatively identified as of 13th century date by previous excavations (Hague, 1956), survives as only a fragment, the eastern gable, on the cliff edge. Presuming that the western building consisted of at minimum a simple hall of similar dimensions to that in the surviving main range of buildings, that is a hall of about 18 metres in length, then at very least the coast has retreated by about 20 metres. This suggests that the coast has retreated here by at least one metre per 30 years on average (ie 20 metres in 600 years). In fact erosion has probably been considerably greater than this as Ashton (1920, 191) reports an oral record of fields being ploughed between Gogarth and the sea about 1800. However, an estate survey of 1849 (Gloddaeth Estate, 1849) shows a small field between the main range and the cliff edge which is at about 38m distance whereas it is now at about 8m, a loss of about 30m in 150 years or about 20m per century.

The prospect of continuing erosion led to the 1955 excavation of the fragment of the western building (Hague, 1956). After 40 years this actually still survives little altered. Much of the area of the cliff below the monument is covered in vegetation and therefore apparently fairly stable. However, the cliff to north and south of the building has an open exposed face and has eroded back by several feet since 1955 (Fig. 38). The one metre deep foundations of the building are in fact acting as a harder baulk which is not eroding as quickly as the surrounding area. However, the north wall of the building is undercut and a large part of the structure could fall at any time. The 1955 excavations, left open although since grown over, may have contributed to the problem.

There are also two other areas of recent erosion which occurred during the June 1993 storm (Fig. 38). These resulted not from sea erosion but from excessive surface water run-off when over four inches of rain fell on the area within a few hours. The first area is to the south of the palace buildings near the boundary of the house grounds where a wide front has been stripped of vegetation cover and gulleying has occurred. No further structures are exposed. The second is within the scheduled area north of the palace building where storm-water gulleying has caused a massive slip of the cliff face, removing the beach access steps and causing the cliff edge to retreat by seven metres. The cliff edge is now only one metre from the north west corner of the palace building. As the cliff is of unsupported sandy material it will soon erode back further. The area has been fenced off as part of the garden path has fallen away, producing a danger to residents. The cliff edge in this area needs to be stabilised urgently by temporary means while more effective and permanent works are designed.

#### Recommendations

1. As far as can be seen the recent erosion has not revealed any new structural features or occupation surfaces. However, the area of fresh erosion needs to be studied more closely before any restoration or consolidation is carried out. This might involve limited excavation depending on the measures to be adopted. As the erosion occurred because of very exceptional surface run-off it need not recur if the drainage is suitably altered.
2. The area of the western building has changed little since 1955 but the gradual general retreat of the coast edge is gradually isolating the building fragment which will eventually

collapse down the slope. Since it is openly accessible from the beach it is dangerous and consideration should be given to reducing the exposed masonry to a safe angle. The cliff immediately to the north of the building is eroding quickly, exposing occupation rubbish deposits, floor levels and a fragment of associated wall. This appears to be the floor of a room adjoining the main hall but was not excavated in 1955 so would be worthy of excavation prior to any conservation works.

3. The general retreat of the cliff can be treated in only one way if the main range of the palace is to be preserved. This would involve stabilisation of the cliff foot and face. The latter would require an archaeological input although the exposures at present suggest this input would not be great as no further structures have so far been exposed.



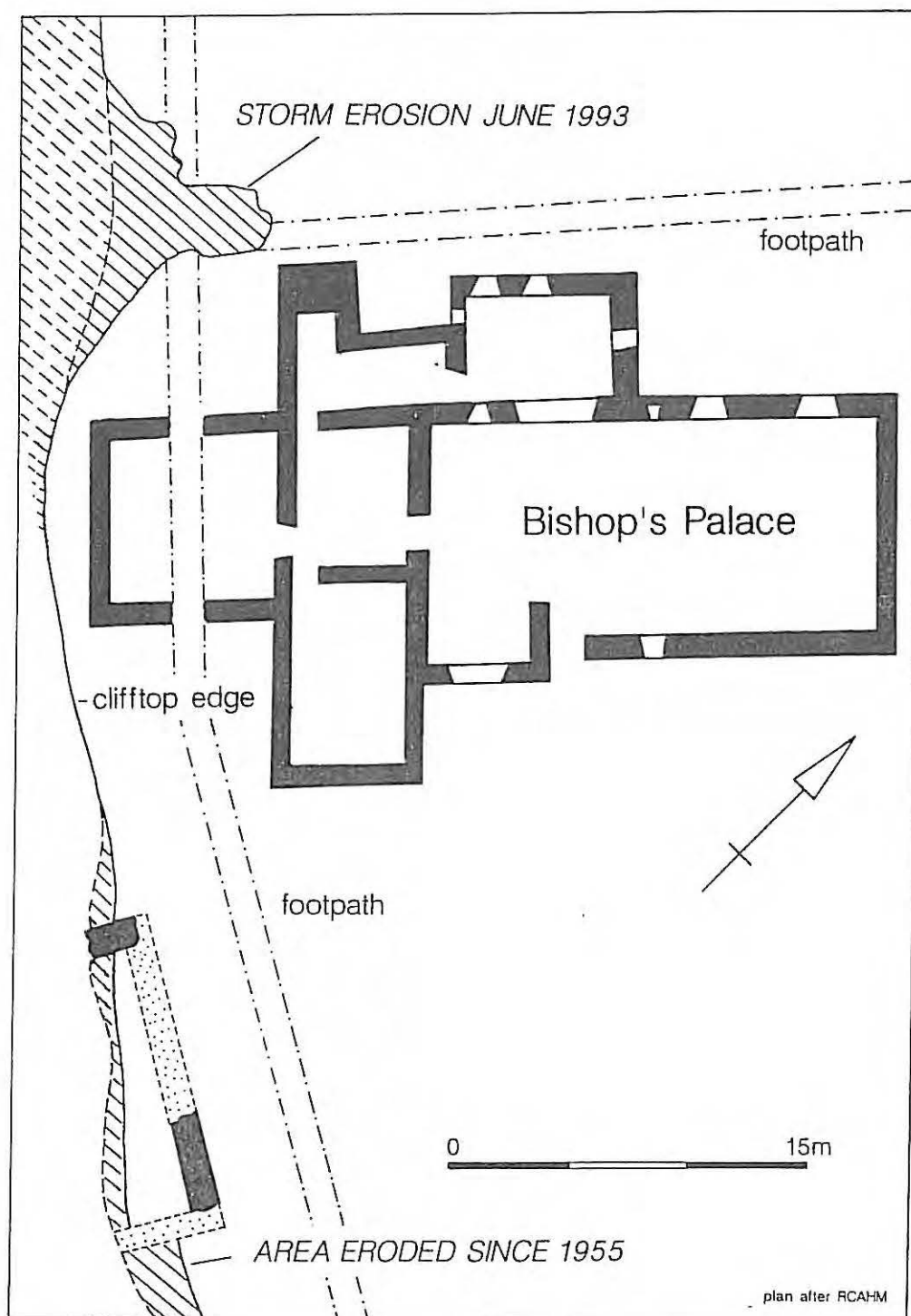


Fig. 38

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## COASTAL EROSION SURVEY, G39

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