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A walkover survey of the Oxwich Bay landslide

Land Use and Development Programme

Open Report OR/10/001

BRITISH GEOLOGICAL SURVEY

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G O Jenkins

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National Grid Reference

SW corner 250000,185000
Centre point 250638,185944
NE corner 252000,187000

Map

Sheet 247, 1:50 000 scale, Swansea

Front cover

Oxwich Bay landslide (photo P. M. Williams with permission)

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Foreword

This report is the published product of a study by the British Geological Survey (BGS) in response to a rockfall in Oxwich Bay on the weekend of the 19th and 20th December 2009. A walkover survey was carried out on 1st January 2010 to establish the cause of the landslide and to obtain a photographic record of the event.

Acknowledgements

The author would like to thank Mr Mark Williams of Slade, Oxwich, for information and photographs of the landslide.

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FIGURES

Summary

A walk over survey was carried out on the 1st January 2010 on a landslide that occurred within a disused quarry at Oxwich Bay on the Gower Peninsula, South Wales.

The landslide was classified as a rock fall, approximately 50 metres in length and 30 metres in width. The slide material consisted of large (up to 6 metres x 6 metres) blocks of limestone from the Oxwich Head Limestone Formation.

The cause of the slope failure was probably due to water penetrating fractures in the limestone cliff. During periods of cold weather, this water has frozen and then thawed and expanded, increasing the in situ stress acting in the fracture and causing the rock to fail.

1 Introduction

1.1 BACKGROUND

On the weekend of the 19th and 20th December 2009 a rockfall occurred in Oxwich Bay on the Gower Peninsula, South Wales. A walk over survey of the landslide was carried out by Gareth Jenkins on 1st January 2010. The rockfall occurred after a prolonged period of freezing temperatures and high rainfall levels in the preceding months.

1.2 LOCATION

The Oxwich Bay Landslide lies on the northern slope of Oxwich Point in Oxwich Bay on the southern coast of the Gower Peninsula, 12 miles to the west of Swansea. The northern slope of the headland is covered in ancient broadleaf woodland.

Figure 1. Location map of Oxwich Bay landslide, Gower Peninsula, South Wales.

1.3 GROUND SURVEY & DATA COLLECTION

The fieldwork involved a rapid walk over survey of the landslide to acquire data for entry into the BGS National Landslide Database, along with the collection of a photographic and video record of the slide. All fieldwork was carried out in accordance with the British Geological Survey's Health and Safety Guidelines.

2 Geology

The Oxwich Bay landslide lies within the Swansea 1:50:000 geological map sheet (247). The area is underlain by the Oxwich Head Limestone Formation, which consists of thickly bedded, fine to coarse-grained, recrystallised, grey mottled, skeletal packstones (Howells, 2007), with distinctive pale-dark grey pseudobrecciation (Waters & Davies, 2006). The limestone contains conspicuous hummocky and pitted palaeokarstic surfaces overlain by thin, red and grey mottled clay beds, interpreted as palaeosols. At the site of the rockfall the beds dip at approximately 20 degrees towards the north east. Oxwich Point forms the southern limb of the Oxwich syncline. The Oxwich Head Limestone was extensively quarried along Oxwich Point and exported from the old port of Oxwich to Devon (where it was burnt and used as agricultural lime) up until the end of the 19th Century. Many of the cottages in the village used to house the quarry men.

There are no superficial deposits mapped in the vicinity of the landslide.

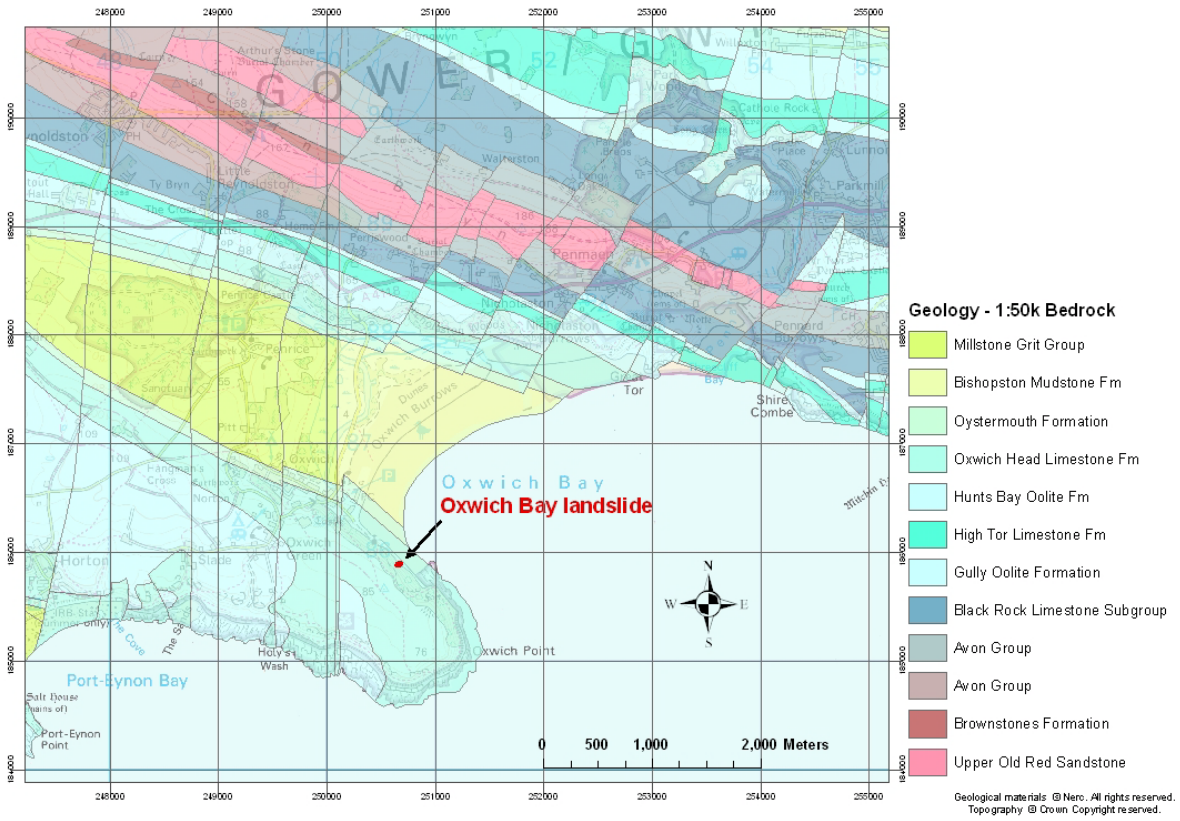

Figure 2. Map of the bedrock geology in the area of the Oxwich Bay landslide.

3 Nature of Landslide

The Oxwich Bay landslide has occurred within a disused quarry, with blocks of limestone dislodged from the old working face at the back of the quarry. The structural and lithological characteristics of the Oxwich Head Limestone Formation provide the ideal mechanism for rock falls, similar to those observed in Tertiary basalts in Northern Ireland (Prior *et al.*, 1971, Douglas, 1980, Wilson & Cunningham, 2002) and more recently in Utah (Elliot & Giraud, 2009). Observation of the rock fall during the walk over survey showed it to be approximately 30 metres in width (across slope) and 50 metres in length (downslope). Large blocks (up to 6 metres by 6 metres) have been dislodged from the cliff face and tumbled 50 metres down the dip slope

of underlying beds onto the rocky foreshore. Run out from the landslide has been limited by the craggy nature of the foreshore, where beds of the Oxwich Head Limestone Formation dip at approximately 20 degrees towards the north-east, forming a jagged profile of ridges and rock pools. Failure of the blocks has occurred along fractures within the limestone. It is most likely that water has penetrated into the fractures which during periods of cold weather has frozen and expanded (by approximately 9%, Matsuoka, 1990), increasing in situ stress acting on the fracture and causing the rock to fail. Matsuoka (1990) also states that water migration, caused by adsorptive suction, also plays a large role in frost shattering. It appears that the failed section probably formed in a feature that was proud of the surrounding cliff face as the newly exposed face is now concordant with the older surrounding faces (i.e. the failure has not cut back into the cliff face). Figures 3 and 4 show large weathered boulders of limestone (known locally as "The Dices") that have been deposited during a previous rock fall (date unknown). A large volume of water was observed flowing from the middle to lower sections of the landslide during the walk over survey.

This landslide is National Landslide Database ID 17649/1. The National Landslide Database also contains a landslide located approximately 200 metres to the south of the Oxwich Bay landslide at NGR 250669 185694 which has been named the Oxwich Wood landslide (ID 11793/1).

Figure 3. Oxwich Bay landslide. Photograph taken from NGR 250657 185944 looking south.

Figure 4. Close-up view of the Oxwich Bay landslide. Photograph taken from NGR 250692 185923 looking south-west.

Figure 5. Close-up view of the Oxwich Bay landslide. Photograph taken from NGR 250710 185896 looking west.

Figure 6. Close-up view of the Oxwich Bay landslide. Photograph taken from NGR 250710 185887 looking west.

Figure 7. Close up of the back wall of the landslide. Red iron-oxide weathering caused by water percolation into former fracture. (Photograph courtesy of Mr P. M. Williams).

Figure 8. Wide angle view of the Oxwich Bay landslide showing its position within a disused limestone quarry. Photograph taken from NGR 250782 185968 looking west.

4 Conclusions

The landslide in Oxwich Bay is a small rockfall in the Oxwich Head Limestone Formation. The limestone has failed along fracture planes, with blocks up to 6 metres x 6 metres being dislodged from the cliff. The rockfall has occurred in the site of a disused quarry and has probably involved the failure of material that was previously proud of the surrounding cliff line.

The cause of the failure is likely to have been due to freeze thaw. It is most likely that water has penetrated into the fractures which during periods of cold weather has frozen and expanded, increasing the in situ stress acting in the fracture and causing the rock to fail.

Evidence of a previous rockfall activity is present in the form of weathered boulders of limestone (known locally as “The Dices”) on the foreshore in the immediate vicinity of the December 2009 landslide (Figures 3 and 4).

References

British Geological Survey holds most of the references listed below, and copies may be obtained via the library service subject to copyright legislation (contact libuser@bgs.ac.uk for details). The library catalogue is available at: http://geolib.bgs.ac.uk.

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