South Wales RIGS Group Site Record
RIGS Description

SECTION A

General	South Wales
Site Name: Gaen Quarry, South Cornelly	**File Number:** Site_RAW_JRD_46
RIGS Number: 620	**Surveyed by:** RA Waters & JR Davies
Grid Reference: SS 8215 8065	**Date of Visit:** December 2010
RIGS Category: Scientific	**Date Registered:**
Earth Science Category: Stratigraphy	**Owner:** Mr T S Rees **Planning Authority:** Bridgend County Borough Council
Site Nature: Dormant quarry face	**Documentation prepared by:** Jerry Davies
Unitary Authority: Bridgend County Borough Council	**Documentation last revised:** 22nd February 2012
OS 1:50,000 Sheet: 170	**Photographic Record:**
OS 1:25,000 Explorer Sheet: 151	
BGS 1:50,000 Sheet: E262	

RIGS Statement of Interest: This forms part of a network of key sites (RIGS & GCR) which collectively allow the evolution and facies development of the lower Carboniferous (Dinantian) carbonate ramp/platform in South Wales to be studied and which also includes sites of historical and educational interest. Gaen Quarry (also known as Gaen's Quarry) forms part of a sub-network of sites located to the south of the South Wales Coalfield, the so called south crop.

Gaen Quarry, alongside Lock's Common, Porthcawl, are important sites within the Oxwich Head Limestone Formation of the Vale of Glamorgan in providing clear evidence of penecontemporaneous subaerial exposure, karstic dissolution and soil accumulation on the local carbonate platform during the Asbian Stage. Moreover, the deep, red mudstone palaeosol-filled depressions and pipes that occur at several levels within the Gaen Quarry succession were the first such features to be described and illustrated in detail from the Vale of Glamorgan; and those exposed in the currently dormant northern face of the quarry remain the largest recorded in the region. More recent re-assessment has confirmed that these palaeokarstic features occur at a level, one of many within the cyclical local Asbian succession, which also displays textures and fabrics typical of calcretes, including calcified fossil rootlets (rhizocretions).

Gaen Quarry is important as a site where large-scale palaeokarstic features within the the Oxwich Head Limestone can be observed and which, in providing evidence of the dimensions and lateral variability of such features, allows the processes associated with subaerial exposure, karstic dissolution and soil formation to be assessed.

Geological setting/context:

The late Dinantian Oxwich Head Limestone Formation of Gower also crops out extensively in the Porthcawl and South Cornelly area of the Vale of Glamorgan. At the time of its deposition tropical limestone accumulation in South Wales had evolved a shallow-water, low gradient, equatorial platform (Wilson et al., 1990). It was during the Geological Survey's early mapping of the formation's eastern succession that Tiddeman (in Stahan & Cantrill, 1904) was the first to recognise that distinctive hummocky surfaces with associated red clay seams and rubbly zones were the product of penecontemporaneous emergence followed by soil and karst formation. The number of such surfaces showed that limestone accumulation was frequently interrupted. Following work in South Wales and elsewhere (e.g. Vaughan, 1905; Dixon & Vaughan, 1912; George, 1933, 1974) such surfaces were shown to be widespread within strata then referred to as *Dibunophyllum* Zone age and at other key levels in the regional Carboniferous Limestone succession. Subsequent research showed that these 'palaeokarstic' levels record periods when global Dinantian sea level fell; limestone deposition only resuming when sea levels rose again and the platform surface was re-submerged (Ramsbottom, 1973). The late lower Carboniferous succession in South Wales, subsequently labelled Asbian in age (George et al., 1976), was thus shown to be cyclical in nature. Systematic variations in the limestone facies confirm that each cycle, between its defining palaeokarstic surfaces, records an upwards shallowing.

Gaen (also known as Gaen's) Quarry has worked a flat-lying succession that extends from the Holkerian Stormy Limestone Formation into the pale grey Oxwich Head Limestone Formation of Asbian age. It is significant as a site where the palaeokarstic surfaces within the cyclical Asbian strata display exceptionally large dissolution features. These 'pipes' were first described by Thomas (1953) and the largest he recognised remains visible today in the currently dormant northern face of the quarry (Photographs 1 & 2; Figure 1). Here a c. 30m-wide and c. 8 m deep depression is filled with red mudstone interpreted as fossil soil. The underlying limestone is extensively stained and impregnated with haematite. The sharp, convex-upwards base of the overlying limestone displays irregularities and minor faulting consistent with post-depositional, differential compaction of the mudstone unit and accommodation settling and fracturing of the overlying, more ridged, limestone beds (Photograph 2; Figure 1). When traced laterally away from the mudstone filled pit, the underlying and overlying limestone units converge and the red mudstone fill material is reduced to an impersistent mudstone seam overlying an irregular surface. Here the underlying limestone displays dark grey mottling, laminated micrite coatings and small (1-2 mm diameter) tubular structures which comprise a concentric dark grey, micrite outer sheath and calcite spar-filled centre. The later are now widely acknowledged to represent calcified fossil rootlets collectively termed rhizocretions and provide compelling evidence of subaerial exposure of the limestone bed shortly after its deposition, the colonisation of its upper surface by plants and the associated development of soil-related alteration effects (pedogenesis) typical of calcretes.

The features exposed in Gaen Quarry contributed to Davies' (1991) study of the evolution and lateral variability of late Dinantian platformal palaeokarst and calcrete features and the mudstone-filled depression exposed in the quarry can be interpreted in line with his model. Following emergence and an initial phase of plant colonisation,

the upper surface of the newly exposed carbonate platform is rapidly lithified. At the same time wind-blown dust accumulates and is stabilised as a clay soil by plants. The lithified limestone beneath this soil cover is then prone to pedogenic alteration and the formation of calcrete textures and fabrics including rhizocretions. Dissolution by downward percolating rain waters within the vadose zone (karstification) also takes place. Locally, minor irregularities in the surface of the limestone can become sites of enhanced dissolution; soil material preferentially builds up within these developing depressions which, as a consequence, develop into sites of accelerated dissolution and soil accumulation. The resulting broad, soil-filled depressions, a form of covered karst, closely resemble modern dolines. The maximum depth of the soil-filled, Gaen Quarry 'pipes' provides a minimum depth for the fossil vadose zone at the time of their formation as dissolution slows once the underlying water table is intersected. The sharp base of the limestone bed that overlies the depression's mudstone fill records a rapid marine transgression and a return to carbonate deposition across the local platform surface.

The limestones underlying and overlying the mudstone-filled depression in Gaen Quarry are otherwise typical of the Oxwich Head Limestone and comprise pale to medium grey skeletal and peloidal packstones and grainstones. Diagenetic effects such as pseudobrecciation and mottling, that are a feature of Asbian limestones, are also well seen.

References:

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STRAHAN, A AND CANTRILL, TC. 1904. The geology of the South Wales Coalfield. Part VI. The country around Bridgend. *Memoir of the Geological Survey of Great Britain*, Sheet 262.

THOMAS, TM. 1953. New evidence of intra-formational piping at two separate horizons in the Carboniferous Limestone (Dibunophyllum Zone) at South Cornelly, Glamorgan.

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WILSON, D, DAVIES, JR, FLETCHER, CJN AND SMITH, M. 1990. The geology of the South Wales Coalfield, Part VI, the country around Bridgend. *Memoir of the British Geological Survey*, Sheet 261 and 262 (England and Wales).

VAUGHAN, A. 1905. The palaeontological sequence in the carboniferous Limestone of the Bristol area. *Quarterly Journal of the Geological Society of London*, 61, 181-305.

SECTION B

PRACTICAL CONSIDERATIONS:
Please score Accessibility and Safety Red Amber or Green

Accessibility:		X	

Comment: Active limestone quarry accessible via quarry roads; private owner may be reluctant to allow access

Safety:		X	

Comment: Section is a steep, currently dormant quarry face, but attention needs to be taken of operations elsewhere in the quarry and in particular the movements of haulage vehicles and plant. At the site itself, quarry spoil tips and vegetation provide physical obstructions which need to be negotiated with care

Conservation status:

There are no known conservation designations of this RIGS

OWNERSHIP/PLANNING CONTROL:

Owner/tenant: Mr T S Rees

Planning Authority: Bridgend County Borough Council

Planning status/constraints/opportunities:

There are no known planning constraints or opportunities

CONDITION, USE & MANAGEMENT:

Present use: Dormant face of limestone quarry

Site condition: Generally good, but partially obscured by scree and superficial vegetation

Potential threats: Continued degradation and growth of trees and shrubs; resumption of working in this part of Gaen Quarry

Site Management: Need to refresh exposures by clearing scree and vegetation; monitor quarry activity to ensure that any resumption of working in this area does not affect the critical area of the face

SITE DEVELOPMENT:

Potential use (general):

Potential use (educational):

Other comments:

Photographic Record

Photograph 1. Access to Gaen Quarry; northern face to right

Photograph 2. Currently dormant northern face of Gaen Quarry showing deep, red mudstone-filled palaeokarstic depression and haematite-stained underlying, and the convex base and locally foundered overlying Oxwich Head Limestone (quarry face is c. 15m high)

Annotated Sketch

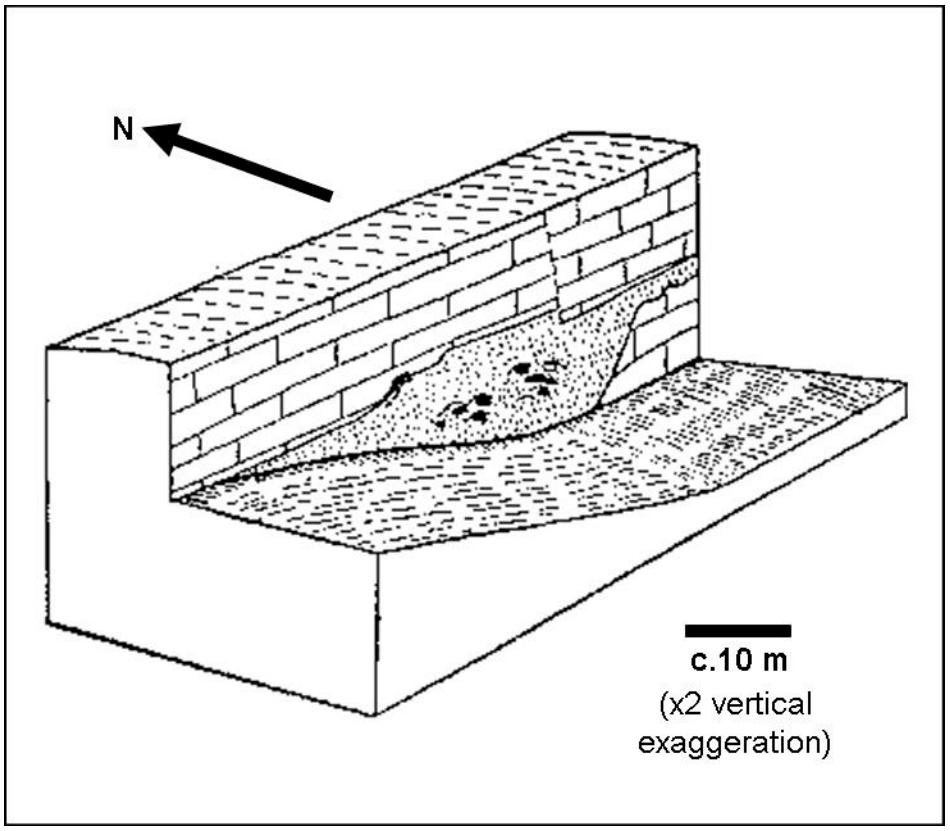

Figure 1. Red mudstone-filled palaeokarstic depression (stippled) exposed in the northern face of Gaen Quarry as sketched by Thomas (1953) (subsequent quarry operations have exposed the western (left hand) edge of the feature; compare with Photograph 2)